

# ENGINEERS' REPORT

FOR THE

YEAR 1846-47.

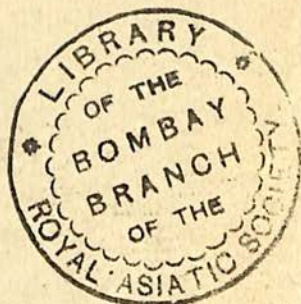


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Bombay:

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No. 420 OF 1847.

MILITARY DEPARTMENT.

*Garrison Engineer's Office.*

*Bombay, 24th July 1847.*

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SIR,

1. Agreeably to the instructions contained in your circular letters No. 4395 of the 11th November 1843, and No. 3316 of the 18th August 1845, I have the honor to enclose a statement of the expenditure of my Department during the past official year, drawn up in the prescribed form.

2. In the return shewing the expense of Engineering and Superintendence, I have charged the staff allowances of the Garrison Engineer and his Assistant, with the cost of Establishment of every kind; this shews the charge for Engineering to be  $8\frac{1}{2}$  per cent. on the outlay on account of Public Works, but if the sums expended on account of artificers and materials supplied to distant stations, such as Aden and Scinde, are to be added, the charge for Engineering will be reduced to  $6\frac{1}{2}$  per cent. on the outlay.

3. As almost the whole of the works are executed by contract, I am unable to afford any data deduced from actual experience regarding the expense of labour or materials of any portion of a work.

I have the honor to be,

Sir,

Your most obedient Servant,

(Signed) H. J. WILLOUGHBY, Capt.

*Acting Garrison Engineer at the Presidency.*

*Bombay, 24th July 1847.*

TO THE SECRETARY TO THE MILITARY BOARD,

BOMBAY.

Account of the Expenditure in the Garrison Engineer's Department  
for the year 1846 | 47.

Bombay, 1st May 1847.

NAME OF WORKS.	AMOUNT.			TOTAL.		
	Rs.	a.	p.	Rs.	a.	p.
<b>ANNUAL AND SPECIAL REPAIRS.</b>						
Making annual and special repairs to the public buildings occupied by troops &c. in the Castle, Fort George, Garrison, Esplanade, Colabah and at out-posts. ....	.....	.....	.....	23,946	10	2
<b>CERTAIN WORKS.</b>						
Repairing the Jetty at Mahim. ....	443	5	10			
Tools for the office of the Garrison Engineer, and oil for the Chowkies and Offices. ....	95	5	7			
Contingencies, additional temporary assistance required in the Garrison Engineer's Office. ....	830	0	0			
Cowdunging clay floors of the Barracks &c. at Colaba. ....	41	7	11			
Cleaning out the Fort ditches. ....	2,474	3	7			
Making alterations &c. in the Laboratory. ....	81	6	0			
Making alterations and repairs in the Hospital of the 2nd Battalion Artillery in Fort George. ....	90	0	0			
Making alterations to the Quarter Master General's Office at the Presidency. ....	200	0	0			
Constructing two private staircases and bathing rooms to two of the Officers' Quarters in Fort George. ....	1,280	0	0			
Constructing two windows in the dead wall in the North of the Military Pay Master's Quarters at the Presidency. ..	225	0	0			
White-washing the Pendalls, Native Officers' Quarters, Store-room, Quarter Guard, Serjeant Major's Quarters, Qr. Master Serjeant's Quarters, and School room, of the Marine Battalion Lines on the Esplanade. ....	388	3	3			
White-washing the Pendalls of the 20th Regiment Native Infantry on the Esplanade. ....	349	4	4			
White, grey, yellow and pink washing inside the Hospitals, out-houses, and Assistant's Quarters at the Presidency. ..	674	8	0			
Constructing mat frames and making repairs to the Barracks at Colaba. ....	713	12	0			
Repairing the stays, fastenings &c. of the different flag-staffs at the Presidency. ....	136	9	2			
Repairing the bamboo-wall &c. of the depôt privy at Colabah. ....	23	0	0			
Putting up the mat frames, repairing the ceiling &c. of the Quarters of the Adjutant, 23rd Regiment N. L. I. at Boreebunder. ....	17	8	0			
Making necessary repairs to the buildings in the Grand Arsenal. ....	50	1	5			
Repairing the dungaree ceiling of the quarters formerly occupied by the Surgeon of the Native General Hospital on the Esplanade. ....	4	0	0			
Making tatta wall and repairing a post of the Cooperage sheds on the Esplanade. ....	16	0	0			
Repairing a portion of a wall in the lines of the 23rd Regiment N. L. I. on the Esplanade. ....	20	0	0			
Carried forward Rs. ..	7,603	5	1	23,946	10	2

## Expenditure.—(Continued.)

NAME OF WORKS.	AMOUNT.			TOTAL.		
	Rs.	a.	p.	Rs.	a.	p.
Brought over Rs....	7,603	5	1	23,946	10	2
Repairing dungaree ceiling of three Officers' Quarters and part of the bamboo wall in the Sanatorium on the Esplanade.....	40	0	0			
Repairing the Ordnance Bunder.....	87	0	0			
Repairing the drain passage through the compound of the Adjutant of the Marine Battalion.....	59	0	0			
Repairing the outer tattas of the necessaries used by the women of the 20th Regiment Native Infantry.....	3	0	0			
Constructing drains to the compound and foot-paths to the out-offices of the Brigade Hospital on the Esplanade.....	250	4	0			
White-washing the Barracks at Colaba.....	106	0	0			
Making minor improvements and alterations to the Hospitals at the Presidency.....	7,200	0	0			
Rebuilding the wall on both sides of the entrance to the packing room in the Grand Arsenal.....	750	0	0			
Fitting up the places at the entrance of the offices and new Quarters both in the Town Barracks and Fort George.....	92	0	0			
Repairing the Godowns in the Mandavee Lunette, in charge of the Deputy Commissary General.....	32	0	0			
Making mat veranda and glass casement to the South and West verandas of the Adjutant's Quarters, 23rd Regiment N. L. I. at Bore Bunder.....	260	0	0			
Repairing a wooden trough of the European General Hospital.....	9	5	0			
Repairing the wall round the compound of No. 32 Bungalow at Colaba.....	5	12	0			
Making four additional windows to the packing room in the Arsenal &c.....	136	0	0			
Renewing the ceiling of the bedroom of No. 56 Quarters at Colaba.....	24	0	0			
Putting a railing round the Ditch from the outer Gate to the Officers' Mess House in Fort George.....	290	0	0			
Filling in the space of ground in the Gun Carriage yard at Colaba.....	240	0	0			
Substituting Pore Bunder stone floor for the present one of chunam in the Billiard Table Veranda in the Mess House, and rebuilding the privy and fitting it up with a water-closet at Colaba.....	265	0	0			
Preserving the mat frames removed from the Barracks at Colaba.....	18	6	10			
Repairing the gates of the Fire Engine shed.....	5	4	6			
Repairing the railing and gates &c. of the Lines of the 24th Regiment Native Infantry.....	109	0	0			
Constructing additional cook-house accommodation for the Hospital used by the regiment quartered at Colaba, and the Depot Queen's Troops.....	1,360	0	0			
Making alterations in the Gun Carriage Manufactory at Colaba.....	87	0	0			
Repairing the gate leading to the Town Barrack, and replacing to top stone of the drain in the square &c.....	13	0	0			
Carried forward Rs....	19,045	5	5	23,946	10	2

## Expenditure.—(Continued.)

NAME OF WORKS.	AMOUNT.		TOTAL.	
	Rs.	a. p.	Rs.	a. p.
Brought over Rs....	19,045	5 5	23,946	10 2
Making a weather frame to the Town Major's office... ..	20	0 0		
Making repairs to Bungalw No. 106 at Colabah... ..	2	8 0		
Replacing the wooden post of veranda of the Gun Shed } in Fort George.....	12	0 0		
Converting the Northern end of the veranda of the Town } Major's office into a small room by trellis work. ....	87	0 0		
Making repairs to the railings and one of the Gateways } of the Marine Battalion Lines.....	21	0 0		
Repairing the Door of the Sally Port leading from Fort } George towards Boree Bunder.....	6	0 0		
Making alterations and additions to the Commissariat } shed for Bullocks and Carts in Mody Bay.....	301	0 0		
Putting up a punkah in the office of the Deputy Adjutant } General, Her Majesty's Forces.....	23	0 0		
			19,515	13 5
<b>BUILDINGS.</b>				
Putting an upper story on the petty store room in the } Grand Arsenal.....	2,906	8 0		
Erecting a Guard room in the Church Gate Ravelin ....	530	0 0		
Erecting a work shed and store room in the Cooperage, } making an office &c.....	1,422	0 0		
Constructing a carriage road from the Castle Gate to the } Mint Tank.....	266	0 0		
Erecting a Privy for the use of the Serjeant at the Salu- } ting Battery.....	28	8 0		
Enclosing and recovering from the Sea a portion of } ground adjoining the Gun Carriage premises on Colaba }	2,475	0 0		
Erecting solitary cells for the European troops in Gar- } rison.....	4,740	0 0		
Erecting solitary cells for the European troops at Colaba..	4,980	0 0		
Erecting three pendalls for 2nd class servants to the Na- } tive Infantry Hospital on the Esplanade.....	697	0 0		
Erecting a pendall for the servants of the Hospital for the } European Regiment at Colaba.....	1,800	0 0		
Erecting a shed for the reception of the Commissariat } Bullocks and Carts, near the Town Barracks.....	2,080	0 0		
Constructing a wall of rubble masoury round the tank } in Fort George.....	296	0 0		
Purchasing kutchu sag planks required to form a road-way } for a bridge of Boats for the Engineer Department in } Scinde.....	780	2 4		
Erecting a Guard-room outside the Gate of the camp- } equipment yard in the Grand Arsenal.....	295	0 0		
Purchasing rafters for Barracks to be erected at Hydra- } bad in Scinde.....	559	2 6		
Erecting a shed on the Esplanade for giving cover to the } wood work for the Hyderabad Barracks.....	269	0 0		
Purchasing Bamboos required for the Ex-Engineer's De- } partment at Aden.....	1,075	2 4		
Repairing doors, teakwood, for the completion of the Hos- } pital and out-houses of the new European Barracks at } Hydrabad in Scinde.....	1,931	0 0		
Carried forward Rs..	27,130	7 2	43,462	7 7

*Expenditure:—(Continued.)*

NAME OF WORKS.	AMOUNT.			TOTAL.		
	Rs.	a.	p.	Rs.	a.	p.
Brought over Rs....	27,130	7	2	43,462	7	7
Hammallage and boat hire for conveying doors to Kur- rachee, for the completion of the Hospital and out- houses of the new European Barracks at Hyderabad in Scinde.....	46	15	9			
Supplying wood and iron works for ten Barracks to be erected at Hyderabad in Scinde.....	62,316	0	0			
Erecting a Guard room and privy in the Gun Carriage Manufactory at Colaba.....	1,950	0	0			
Hammallage and boat hire &c. for conveying the wood and iron works of the Barracks to Hyderabad in Scinde.	2,998	3	8			
Removing the Warrant Officer's Quarters at Colaba, and erecting new Quarters in their stead.....	4,400	0	0			
				98,849	10	7
Levelling the Esplanade, constructing flat rooms &c. for Dhobees, and the Establishment for collecting the Esplanade fees.....				9,330	1	4
Grand Total, Rupees one Lac, fifty one thousand, six hundred and forty two, annas three, and pies six.....				1,51,642	3	6

*Statement of the sums expended by the Garrison Engineer at the Presidency, from 1st May 1846 to 30th April 1847.*

NAME OF OFFICER.	Annual and special re- pairs.			Certain Works.		Building.		Expended from Espla- nade Fund.		Total.	
	Rs.	a.	p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.
Captain T. M. B. Turner, Garrison Engineer.....	23,940	10	2	19,515	18 5	98,849	10 7	9,330	1 4	1,51,642	3 6

*Statement shewing the cost of Engineering and General Superintendence of the Garrison Engineer's Department for the above period.*

NAME OF OFFICER.	Expense of Es- tablishment per annum.		Expenditure.		Rate per cent.
	Rs.	a. p.	Rs.	a. p.	
Captain T. M. B. Turner, Garrison Engineer at the Presidency.....	13,263	12 9	1,51,642	3 6	8½

*Statement of sums expended, not included in the above statement, on account of workmen and materials forwarded to Out-Stations.*

	Amount.		Total.	
	Rs.	a. p.	Rs.	a. p.
To amount paid to artificers proceeding to, or returning } from, out-stations &c. .... }.	41,503	7 9		
To amount paid for materials forwarded to Seinde.....	2500	0 0		
<b>Total, Rupees forty-four thousand and three, annas seven, and pies nine..</b>			<b>44,003</b>	<b>7 9</b>

(Signed) H. J. WILLOUGHBY, Capt.  
*Acting Garrison Engineer at the Presidency.*





No. 218 of 1847.

GENERAL DEPARTMENT.

*Civil Architect's Office.*

*Bombay 24th July 1847.*

SIR,

1. Agreeably to the instructions contained in your circular letters No. 4395 of the 11th November 1843, and No. 3316 of the 18th August 1845, I have the honor to enclose a statement of the expenditure of my Department during the past official year, drawn up in the prescribed form.

2. In the statement shewing the expense of Engineering and Superintendence I have entered the staff allowances of the Civil Architect and the cost of Establishment of every kind, which shews the charge for Engineering &c. to be 12 per cent. on the outlay.

3. As almost the whole of the works are executed by contract, I am unable to afford any data deduced from actual experience regarding the expense of labour or materials of any portion of a work.

I have the honor to be, &c.

(Signed) H. J. WILLOUGHBY, Capt.

*Acting Civil Architect at the Presidency.*

(True Copy.)

(Signed) N. H. THORNBURY, Capt.

*Secretary Military Board.*

TO THE SECRETARY TO THE MILITARY BOARD,

BOMBAY.

Account of the Expenditure in the Civil Architect's Department for  
the year 1846 | 47.

Bombay, 1st May 1847.

NAME OF WORKS.	AMOUNT.		TOTAL.	
	Rs.	a. p.	Rs.	a. p.
<b>GENERAL DEPARTMENT.</b>				
<i>Annual and Special Repairs.</i>				
Annual and special repairs to the buildings in the General Department for 1846.....	14,809	10 9	14,809	10 9
<b>CERTAIN WORKS.</b>				
Substituting plank ceiling for the present one of cloth in the Roman Catholic Church at Colaba.....	274	0 0		
Making alterations to the Lunatic Asylum at Colaba.....	7,775	0 0		
Making alterations to the General Post Office.....	470	0 0		
Putting glass casements to the veranda and windows of the office of the Hon'ble Company's Solicitor.....	400	0 0		
Cleaning out the Phansi Tank on the Esplanade.....	185	0 0		
Putting up a water-closet in Mr. Secretary Escombe's office..	349	8 0		
Cleaning out the Town Hall enclosure.....	24	0 0		
Cow-dunging the floors of the Post Office.....	16	0 0		
Repairing wooden posts and iron chain on the Bombay Green.....	0	13 10		
Making four openings within the railing between the Church and Apollo Gate.....	295	0 0		
Removing the remains of the old ramps of Phansi Tank on the Esplanade.....	900	0 0		
Putting up a new ceiling in the office of the Hon'ble Company's Solicitor.....	104	0 0		
Executing certain repairs to the different wells on the Esplanade.....	126	0 0		
Putting up a temporary dam to prevent the sea water flowing into the spring in the Colaba channel.....	97	13 10		
Adjusting the displaced stones of the Apollo Pier and Colaba Causeway.....	31	11 2		
Securing from further damage the wall of the Burial ground at Back Bay.....	328	1 5		
Rebuilding portion of the wall of the compound of Parell Government House, which has been thrown down by the rain water.....	73	0 0		
Repairing the out-houses of the Observatory, damaged by the Monsoon.....	9	0 0		
Repairing two side slopes of the Colaba Causeway.....	65	0 0		
Repairing a venetian window in the office of Superintendent of Stationery.....	9	0 0		
Making additions and repairs required to the Burial Ground at Back Bay.....	3,864	0 0		
Fixing a weather board to a window of a room on the ground floor of Parell Government House, appropriated as an office, for the purpose of keeping out the rain....	50	0 0		
Repairing the roof of the Cow House and Buffaloes' shed at Parell.....	48	0 0		
Carried forward Rs....	15,482	0 3	14,809	10 9

## Expenditure.—(Continued.)

NAME OF WORKS.	AMOUNT.			TOTAL.		
	Rs.	a.	p.	Rs.	a.	p.
Brought over Rs....	15,482	0	3	14,809	10	9
Repairing broken panes of glass in the Serjeant's Quarters and chowkey attached to the Pound.....	10	11	0			
Making the necessary repairs to the Southern Veranda of the sleeping Bungalow at Malabar Point, damaged by the late high winds.....	13	8	0			
Repairing the weather frames of the Secretariate Premises, blown down by the late high winds.....	8	0	0			
Exchanging the brass bolts at present fastening the several doors of the basement room of the Town Hall, as also two door locks.....	9	8	0			
Putting up a plank ceiling to and paving the floors of the General Post Office.....	4,470	0	0			
Repairing posts and iron chain on the Bombay Green....	17	6	0			
Removing the stuccoed ceiling of the large Hall of the Secretariate and substituting a cloth one.....	221	0	0			
Lessening the depth of the bathing pool at the Lunatic Asylum at Colaba.....	10	0	0			
Reconstructing a portion of the front wall of the office of the Hon'ble Company's Solicitor.....	91	0	0			
Making the venetian window in the Hon'ble the Governor's bathing room at Parell.....	27	0	0			
Putting up two plank screens in the Lunatic Asylum at Colaba.....	20	0	0			
Making three punkahs, two bathing places, and a new mouthpiece for the principal fountain in front of Government House at Parell.....	263	0	0			
Repairing two lamp posts at the Government House at Parell.....	19	0	0			
Raising the lintil of a door and converting the five stalls into loose boxes of the principal stable at Parell.....	337	7	6			
Making alterations and additions to the Jamsetjee Jeejeebhoy Hospital.....	500	0	0			
White-washing inside the Jamsetjee Jeejeebhoy Hospital.....	112	0	0			
Watchman in the Civil Architect's yard, and behind the Town Barracks.....	84	12	5			
Conveyance for Maistree to superintend the civil works....	240	0	0			
Additional temporary assistance required in the Civil Architect's Office.....	411	8	0			
				22,360	13	2
<b>BUILDINGS.</b>						
Erecting a Dhurmsalla for the use of the destitute poor of the Island of Bombay, in connexion with the District Benevolent Society.....	32,247	0	0			
Improving the communication between the Fort and Esplanade at the Apollo Gate.....	13,373	12	0			
Excavating four old additional wells on the Esplanade....	100	0	0			
Constructing a road from the Boree Bunder Custom House Chowkey to the main road.....	590	0	0			
Carried forward Rs.....	46,310	12	0	37,170	7	11

*Expenditure.—(Continued.)*

NAME OF WORKS.	AMOUNT.		TOTAL.	
	Rs.	a. p.	Rs.	a. p.
Brought over Rs....	46,310	12 0	37,170	7 11
Constructing right portion of Jamsetjee Jeejeebhoy Hospital....	126	0 0		
Constructing compound gates, enclosure wall, and railing for Jamsetjee Jeejeebhoy Hospital....	500	0 0		
Making roads within the compound of the Grant Medical College and Jamsetjee Jeejeebhoy Hospital....	240	0 0		
Making fittings &c. for the Grant Medical College....	117	13 0		
Making up two carts for removing the sweepings &c. of the Jamsetjee Jeejeebhoy Hospital....	274	15 1		
Levelling the ground generally within the compound of Grant Medical College and Jamsetjee Jeejeebhoy Hospital....	522	5 11		
Erecting two Pendalls for the thirty-nine second class Hospital servants attached to the Jamsetjee Jeejeebhoy Hospital....	1,225	0 0		
			49,316	14 0
<b>JUDICIAL DEPARTMENT.</b>				
<i>Annual and Special Repairs.</i>				
Annual and special repairs to the buildings in the Judicial Department for 1846....	3,450	7 10		
			3,450	7 10
<b>CERTAIN WORKS.</b>				
Making certain improvements and alterations in the House of Correction....	3,193	0 0		
Making alterations and improvements in the House of Correction....	800	0 0		
White painting the Chambers of the Hon'ble Sir Erskine Perry in the Supreme Court....	163	0 0		
Cleaning and oiling the ceiling of the trial wards in the Jail.	40	0 10		
Preparing a scaffold and all other things, for a native named Ragoonath Muddon, sentenced by the Supreme Court to be executed....	12	10 10		
Putting a screen over a portion of the new Tread Mill in the County Jail....	198	0 0		
Boxing in the ends of the Tread Mill now in use at the County Jail....	30	0 6		
Repairing a broken wheel of the Tread Mill in the County Jail....	9	4 9		
Half yearly white and grey-washing the interior of the County Jail....	130	0 0		
Preparing a scaffold and all other things, for a native named Pestonjee Jamsetjee, sentenced by the Supreme Court to be executed....	11	3 2		
			4,587	4 1
<b>BUILDINGS.</b>				
Erecting an Iron Tread Mill in the County Jail....	100	0 0		
Constructing a cart with Iron Tank for the use of the House of Correction, similar to those in use at the By-culla Schools....	136	13 0		
Carried forward Rs....	236	13 0	94,525	1 10

## Expenditure.—(Continued.)

NAME OF WORKS.	AMOUNT.			TOTAL.	
	Rs.	a.	p.	Rs.	a. p.
Brought over Rs.....	236	13	0	94,525	1 10
Erecting an iron Tread Mill in the House of Correction } at Byculla.....	1,823	0	0	2,059	13 0
<b>TERRITORIAL DEPARTMENT.</b>					
<i>Annual and Special Repairs.</i>					
Annual and special repairs to the buildings in the Ter- } ritorial Department for 1846.....	7,631	10	0	7,631	10 0
<b>CERTAIN WORKS.</b>					
Making one new iron-barred window, and lengthening } the lower part of the two present windows, and white- washing walls and ceiling in the Inspectors' office of the Custom House in the Fort.....	50	0	0		
Making repairs to a Bungalow and 5 Chowkies lately } made over by the farmer of salt pans to the Depart- ment of the Collector of Land Revenue.....	162	0	0		
Repairing the dry stone retaining wall at the Boree Bun- } der, and the Masonry wall near Cooly Bunder, injured by the late gale and high tides.....	94	0	0		
Levelling and draining of the Town Custom House wharf } and inner Court yard.....	20	0	0		
Making certain alterations to the General Treasury... }	200	0	0		
Making additions to the wall and constructing a gate at } Cooly Bunder.....	474	0	0		
Removing and re-constructing the Custom Chowkey at } Mazagon Bunder.....	226	0	0		
Removing certain posts and rails in the Town Custom } House wharf, and making and fixing new rails in other places.....	770	0	0		
Removing and re-erecting the Custom Chowkey at Coolee } Bunder, and for securing from the effect of the Sea the Custom House Chowkey at Sonapoor.....	370	0	0	2,366	0 0
<b>BUILDINGS.</b>					
Erecting a covered pathway across the open Court yard } between the office of the Collector of Land Revenue and the Custom House; and for drawing off the water that usually collects there during the Monsoon.....	455	0	0	455	0 0
Carried forward Rs.....				1,07,037	8 10

*Expenditure.—(Continued.)*

NAME OF WORKS.	AMOUNT.			TOTAL.		
	Rs.	a.	p.	Rs.	a.	p.
Brought over Rs.....				1,07,037	8	10
<b>MARINE DEPARTMENT.</b>						
<i>Annual and Special Repairs.</i>						
Annual and special repairs to the Buildings in the Marine } Department for 1846.....	3,039	0	0	3,039	0	0
<b>CERTAIN WORKS.</b>						
Raising the drain which runs between the two ranges of } Carpenters' Barracks in Tod Lane, to the level of the } drain running down Tod Street.....	52	0	0			
Executing repairs to the cooking places of the Admiral's } establishment.....	19	0	0			
Pulling down the Naval Captains' Bungalow with comp- } ound and out-offices on the Esplanade, and re-erecting } them after the rains.....	1,100	0	0			
Removing the Admiral's Bungalow with compound and } out-houses on the Esplanade.....	129	0	0			
Making repairs to the Colaba coal shed.....	15	0	0			
Repairing pulleys and other parts of the dropping board } in the Astronomical Observatory at Colaba.....	9	12	6			
Paving certain passages adjoining the Artificers' Barracks } in Tod Lane.....	151	15	5			
Repairing the wall of the Coal shed at Upper Colaba....	30	0	0			
Re-erecting the Admiral's Bungalow on the Esplanade....	1,541	0	0			
Replacing the large stones at the lower part of Colaba } Pilot station Bunder.....	34	0	0			
Making repairs to the dropping board apparatus at the } Observatory.....	6	0	0			
Placing a post under one of the flooring beams in the } Artificers' Barracks in Tod Lane.....	2	0	0			
Repairing the cock of the water pipe lately broken on the } Commercial Bunder pier, and cleaning and repairing } the drain.....	71	12	8			
Making repairs to the Mazagon Bunder.....	189	2	1			
Conveyance for maistree to superintend the Marine works..	240	0	0			
Additional temporary assistance required in the Civil } Architect's office.....	180	0	0			
				3,770	10	8
<b>BUILDINGS.</b>						
Constructing the buildings for a residence for the Naval } Dubash, on the Esplanade.....	847	0	0			
				847	0	0
Grand Total, Rupees one Lac, fourteen thousand, six } hundred and ninety-four, annas three, and pies six....				1,14,694	3	6

*Statement of the sums expended by the Civil Architect at the Presidency, from 1st May 1846 to 30th April 1847.*

NAME OF OFFICER.	Annual and special repairs.		Certain Works.		Buildings.		Total.	
	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.
CAPTAIN T. M. B. TURNER, CIVIL ARCHITECT.								
General Department.....	14,800	20 0	22,360	13 2	40,316	14 0	86,487	5 11
Judicial Department.....	3,450	7 10	4,587	4 6	2,050	13 0	10,097	8 11
Territorial Department.....	7,631	10 0	2,306	0 0	455	0 0	10,452	10 0
Marine Department.....	3,030	0 9	3,770	10 8	847	0 0	7,650	10 8
Grand Total....	28,030	12 7	33,084	11 11	52,678	11 0	1,14,004	3 6

*Statement shewing the cost of Engineering and General Superintendance of the Civil Architect's Department for the above period.*

NAME OF OFFICER.	Expense of Establishment per annum.		Expenditure.		Rate per cent.
	Rs.	a. p.	Rs.	a. p.	
Captain T. M. B. Turner, Civil Architect at the Presidency.....	13,786	0 0	1,14,694	0 0	12

(Signed) H. J. WILLOUGHBY, Capt.  
Acting Civil Architect at the Presidency.



No. 86 of 1847.

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MARINE DEPARTMENT.

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To

THE SECRETARY TO THE MILITARY BOARD.

SIR,

1. I have the honor now to lay before you the Transactions of this Department during the past official year.

2. The annexed statement No. I. shews the works which were in hand, and the expenditure upon each.

3. The charge for Engineering has amounted to 13½ per cent. upon the outlay.

4. The only works of importance which I shall notice, are the widening the entrance of the Stern Duncan Dock, and the improvement to the Apollo Pier.

5. The Duncan Dock was completed shortly before the commencement of the monsoon, and every exertion was made to remove the Cofferdam to admit of the large steamers being docked, if necessary, as soon after the commencement of the monsoon as possible. The removal of the Cofferdam was effected in the following manner: previous to the admission of any water through it, the Cofferdam was supported inside by extra shores, which could easily be taken up, and every portion of the clay puddling between it and the gates excavated up to the gate piles—the Dock gates being closed to prevent any water entering the Dock. The two lower wale-pieces of the Dam were then cut out, as well as all the lower bolts, and a considerable portion of the puddling both inside and outside the Dam cleared out. The Dam now began to leak so much that I directed its penstock to



be opened to admit the water through it, and its functions as a Dam here ceased. During the ensuing two spring tides the excavation of the clay puddling was continued, and all the wales and bolts were removed. The piles were now ready to be drawn, and I started the first by means of two screw-jacks, applied on either side of a wooden frame, bolted to the top of the pile, which after great exertion was drawn. I also extracted some others by this means, as well as by means of a long heavy spar used as a lever, the fulcrum being within two feet of the pile. These means however were found too slow, and the Master Attendant's Department put up for me two pairs of large shears, the falls of which were led to the capstans on either side of the Dock, by which means the piles were easily and rapidly drawn within a very few days. The Dredging Boat was then set to work, and all the accumulation of mud which had taken place in the channel since the Docks were closed, speedily removed. The Docks were now ready for the admission of vessels, and the P. & O. Company's Steamer "Braganza" was the first vessel docked.

6. The Dock gates have been found to work easily and well, and to be quite water tight.

7. The new penstocks have likewise been found to answer well, having this advantage over the old scuttles, that the water can be admitted rapidly into the Dock at any time, and as much or as little as may be required.

8. The "improvements to the Apollo Pier" were commenced in the month of September last, and completed in June.

9. This work was called for in consequence of the old rubble stone slope at the end of the pier being nearly every monsoon so damaged, as to render it impassable till repaired. The present work has been built upon the base of the old rubble stone slope, commencing from low water mark spring tides. This slope, which has been built for years, it was considered would bear the additional weight of the new work without much settlement; to have weighted it would have put the public to so much inconvenience, that it was out of the question. When the new work, which from its base has been carefully brought up in complete courses (including the filling in), had reached the height of about ten feet, a slight settlement was apparent; this increased till the work reached a height of about eighteen feet, when it began to diminish, and by the time the work had reached its full height it had very nearly ceased alto-

gether. Since the completion of the work, the settlement has been so trifling as to be scarcely worthy of notice, and I feel satisfied now, that if it settles at all, half an inch will be its utmost extent.

10. I have alluded to the above solely as a guide in the construction of similar works in future. The settlement does not in any way affect the stability of the work, and would only be apparent to the careful scrutiny of a professional eye. When it is practicable to avoid settlement, the bases of works of this description should always be well weighted previous to the superstructure being commenced; as where substratum is compressible, the additional weight of the superstructure must cause it to yield in some degree.

11. In the Board's letters No. 5717 and 202, dated respectively 8th December and 16th January last, I was called on to make experiments in cements, with a view to obtain a cheap water cement, and to report upon the Aden pumice with regard to its quality as an ingredient for the same. The result of my experiments is shewn in the annexed statement No. II. By this it will be seen, that all the different clays, brick and tile earth and moorum, found in the vicinity of Bombay when calcined, pulverized, and mixed either with Bombay or Poona lime, form an excellent water cement, either in fresh or salt water. The Aden pumice used in a similar way forms a cement superior to any of the above, and is I conceive a most valuable ingredient.

12. The best proportion for use with any of the above ingredients appeared to me to be two parts lime, one part sand, one part pulverized cement. The term cement I have applied to the different clays &c. when calcined and pulverized.

13. The cheapest mode of working the cement on a large scale appears to me to be to appropriate a Ganee (Mill) entirely to its use, close to the chunam Ganees, with two sifting frames attached, one for every two of the latter, the larger particles in the sieve being constantly thrown back into the Ganee and a fresh supply added as quickly as possible; by this method the cost of the cement will be about one half the cost of chunam, and sand worked up ready for use, or in other words, the usual cost of chunam ready for use increased by one half, will be the cost of the water cement ready for use.

14. Both the Bombay and Poona limes are hydraulic, though slow setting below water, but when used above the surface of the water they set quickly enough for almost any purpose. I would not therefore

recommend the cement being used except under water, or where it would not be allowed to dry, as I found that when this was the case, after long immersion it cracked for three or four feet above low tide mark: in damp situations it may be used with great advantage.

I have the honor to be,

Sir,

Your most obedient servant,

(Signed) J. ESTRIDGE, Captain,

*Engineer to the Dock Yard.*

*Bombay, Dock Yard Engineer's Office,  
6th August 1847.*

## No. I.

Statement shewing the Actual Expenditure upon Works carrying on under the Engineer to the Dock Yard, for the official year from 1st May 1846 to 30th April 1847.

No.	NAME OF WORKS.	AMOUNT.			TOTAL.		
		Rs.	a.	p.	Rs.	a.	p.
1	Constructing a Building Yard to the South East of the Dock Yard and Saluting Battery, comprising three slips for building ships of war, of the 1st class, of Her Majesty's Navy.....	2,995	14	8			
2	Erecting a Coal Depôt on the East side of Colaba Causeway, between the Merchants' Ground and Apollo Pier.....	5,209	10	2			
3	Erecting a new Smithy on the New Ground and converting the old Smithy into a store for machinery for the Factory.....	5,257	15	6			
4	Erecting a teak palisading enclosing the ground proposed to be made over to the Dock Yard, and removing the coal and mast-sheds, and erecting in lieu two double tiled sheds with a cook-room for the boat crews.....	1,700	0	6			
5	Making additions and alterations to the offices of the Superintendent of the Indian Navy in the Dock Yard.....	4,835	14	4			
6	Making a channel along the Southern wall of the New Ground.....	93	4	4			
7	Placing fender posts along the face of the wharf wall under the large crane near the Factory.....	815	1	6			
8	Erecting a shed at the head of the Dock.....	3,713	0	0			
9	Furnishing stones for the benches of the new Saw Mill, and backing up the footing wall of the shed with rubble masonry.....	27	8	0			
10	Erecting a gun-shed in the Dock Yard.....	6,315	0	0	30,963	4	6
<i>Repairs to Fortifications and Buildings.</i>							
1	Widening the entrance of the Stern Duncan Dock.....	13,642	14	5			
2	Widening the upper Duncan Dock and constructing grooves for a Caissoon.....	11	14	0			
3	Erecting a cadjan shed over H. M. Ship Meanee.....	4,080	0	0			
4	Covering with cadjans the Brigs Zenobia and Goshawk.....	850	0	0			
5	Erecting a cadjan shed over the new Steam Packet under construction in the upper Duncan Dock....	1,057	0	0			
6	Special repairs to the buildings in the Dock and Building Yards for 1846.....	420	0	0			
7	Securing the blocks for the Satellite to be hauled upon...	124	2	10			
8	Annual repairs to the Buildings in the Dock and Building Yards for 1846.....	2,483	0	0			
		22,668	15	3	30,963	4	6

## Statement:—(Continued.)

No.	NAME OF WORKS.	AMOUNT.			TOTAL.		
		Rs.	a.	p.	Rs.	a.	p.
	Brought over Rs....	22,668	15	3	30,963	4	6
9	Repairing store room and removing the chains for the } water contractor.....	245	10	8			
10	Repairing the Boiler-makers' shed on the New Ground... }	379	0	0			
11	Constructing masonry work for the Boiler of the Dock } Yard Steam Kiln.....	49	2	3			
12	Improving the ventilation of the Smithy attached to } the Factory in the Dock Yard.....	84	0	0			
13	Improving the Apollo Pier.....	28,032	5	7			
14	Putting up a revolving light in the Light House.....	277	8	9			
15	Experiments for water cement.....	100	5	10			
16	Making alterations to the Lanthorn of the Light } House at Colaba.....	51	0	0			
17	Annual repairs to the public buildings in the Dock } and Building Yards for 1847.....	400	0	0			
					52,288	0	4
					Rupoes....	83,251	4 10

ERRORS EXCEPTED.

(Signed) J. ESTRIDGE, Captain,

*Engineer to the Dock Yard.*

*Bombay, Dock Yard Engineer's Office,  
6th August 1847.*

## No. II.

## SCHEDULE OF EXPERIMENTS IN WATER CEMENT.

Months and dates.	Number of experiment.	PROPORTIONS.	REMARKS.
1847. January	30th	1 One part Poona lime fresh calcined and slaked, one part calcined white clay pulverized.....	This began to set almost immediately, and in 48 hours was quite hard.
		2 One part Bombay lime sifted and ground, one part calcined white clay pulverized.....	This after 48 hours had set firmly, but not so hard as the above—has since become quite hard.
February	1st	3 Common Bombay lime and sand taken from the Gar, worked up and placed into water.....	Set slowly and gradually hardened;—on the 8th July it was taken out and found to have hardened so much as to require some force to break it.
		4 One part Bombay lime sifted, one part calcined white clay pulverized.....	This mixture has also set well.
		5 Two parts Bombay lime sifted, one part calcined white clay pulverized.....	This has set very hard.
		6 One part Bombay lime sifted, one part calcined white clay pulverized, one part Sea sand.....	This has set firmly, but not so hard as the above.
		7 One part Poona lime fresh slaked, one part calcined white clay pulverized.....	This has set very hard.
		8 Two parts Poona lime fresh slaked, one part calcined white clay pulverized.....	Ditto.....ditto.
		9 One part Poona lime fresh slaked, one part calcined white clay pulverized, one part Sea sand.....	Ditto.....ditto.
,,	3rd	10 One part Bombay lime sifted, one part calcined white clay pulverized.....	This has set very well.
		11 Two parts Bombay lime sifted, one part calcined white clay pulverized.....	This better than the above; very good.
		12 One part Bombay lime sifted, one part calcined white clay pulverized, one part Sea sand.....	Has set firmly, but inferior to the above.
		13 One part Bombay lime sifted and ground, one part calcined white clay pulverized.....	This is very good.
		14 One part Poona lime slaked, one part calcined white clay pulverized.....	Very good.
		15 Two parts Poona lime slaked, one part calcined white clay pulverized.....	Ditto.

## Schedule—(Continued.)

Months and dates.	Number of experiment.	PROPORTIONS.	REMARKS.
1847.			
February	3rd	16 One part Poona lime slaked, one part calcined white clay pulverized, one part Sea sand. . . . .	Very good.
"	4th	17 One part Bombay lime sifted, one part calcined red clay pulverized. . . . .	Ditto.
		18 One part Bombay lime sifted and ground, one part calcined red clay pulverized. . . . .	Ditto.
"	5th	19 One part Poona lime fresh slaked and sifted, one part calcined red clay pulverized. . . . .	Ditto.
"	23rd	20 One part Poona fresh slaked, one part calcined Aden pumice pulverized, one part Sea sand. . . . .	Ditto.
		21 Poona lime alone pulverized. . . . .	{ Sets firmly, and hardened in three or four days.
		22 Aden pumice alone pulverized. . . . .	Will not harden.
		23 One part Poona lime fresh slaked, one part calcined Aden pumice pulverized. . . . .	Very good.
		24 One part Bombay lime sifted and ground, one part calcined Aden pumice pulverized. . . . .	Set slowly, but very hard.
"	24th	25 One part Poona lime, one part Sea sand pulverized. . . . .	Set well and firmly.
		26 One part Poona lime, one part calcined Aden pumice pulverized with salt water. . . . .	Set very hard.
"	25th	27 One part Bombay lime sifted and ground, one part calcined Aden pumice pulverized with salt water.	Set slowly, but very hard.
March	9th	28 One part Poona lime, one part calcined brick earth pulverized. . . . .	Set in 24 hours, and in a week very hard.
		29 One part Bombay lime sifted and ground, one part calcined brick earth pulverized. . . . .	Ditto. . . . . ditto.
"	11th	30 One part lime Tarapooree fresh slaked, one part calcined brick earth pulverized. . . . .	Ditto. . . . . ditto.
		31 Tarapooree lime fresh slaked by itself.	{ Set very slowly, but gradually hardened.
"	12th	32 Poona lime first sort fresh slaked by itself. . . . .	Set slowly, but gradually hardened.
		33 One part Poona lime fresh slaked, one part calcined brick earth pulverized. . . . .	Set in 24 hours and hardened.
"	16th	34 One part Poona lime, one part calcined brick earth pulverized. . . . .	Ditto. . . . . ditto.
		35 One part Bombay lime sifted and ground, one part calcined tile earth pulverized. . . . .	Ditto. . . . . ditto.

## Schedule—(Continued.)

Months and dates.	Number of experiment.	PROPORTIONS.	REMARKS.		
1847. March	18th	36	Two parts Bombay lime with sand as taken from the Gar, one part calcined clay pulverized and sifted.....	Ground together in the common chunam Gannees.	A piece of rubble masonry about 2 feet cube was built in the harbour at the low tide mark spring tides when they were going off, and on being inspected the next springs, was found to have set very hard.
"	20th	37	Two parts Bombay lime with sand as taken from the Gar, one part calcined Aden pumice pulverized and sifted.....		
"	24th	38	One part Poona lime first sort, one part tile earth without being fresh calcined, pulverized.....	Set in 24 hours and hardened.	
"	26th	39	One part Poona lime first sort fresh slaked, one part calcined red moorum pulverized.....		Ditto.....ditto.
"		40	One part Poona lime first sort fresh slaked, one part calcined yellow moorum pulverized.....	Ditto.....ditto.	
"	29th	41	One part clay lime fresh slaked by itself.....		Set well and quickly, and hardened well.
"	30th	42	One part clay lime fresh slaked, one part calcined yellow moorum pulverized.....	Ditto.....ditto.	
April	1st	43	Surat lime fresh slaked by itself.....		This has not set at all.
February	5th	44	One part Bombay lime, one part sand as taken from the Gar.....	This was allowed to remain under water 5 months, and when taken out was quite hard.	

(Signed) J. ESTRIDGE, Captain,

*Engineer to the Dock Yard.**Bombay, Dock Yard Engineer's Office,  
6th August 1847.*



No. 1444 OF 1847.

To

THE SECRETARY TO THE MILITARY BOARD,

*Bombay.*

SIR,

I have the honor to lay before the Military Board a Statement, drawn up in the prescribed form, of the Expenditure in the Public Work Department of the Province of Scinde, during the year 1846 | 47, and to be, &c.

(Signed) A. C. PEAT, Major,

*Superintending Engineer,*

*Scinde.*

*Kurrachee, 9th August 1847.*

(True copy,)

(Signed) N. H. THORNBURRY, Captain,

*Secretary Military Board.*

Account of the Expenditure in the Public Work Department in the Province of Scinde, during the year 1846 | 47.

NAMES OF WORKS.	AMOUNT.			TOTAL.		
	Rs.	a.	p.	Rs.	a.	p.
LOWER SINDHE DIVISION.						
<i>Kurrachee.</i>						
Annual and special repairs to the Buildings in the Military Department.....	4,161	7	8	4,161	7	8
Watering and preserving trees both round the European Infantry Barracks, and on the sides of the road between the Kurrachee Bunder and Cantonment.....	483	5	0			
Repairing wells and water-wheels.....	98	1	7			
White-washing Hospitals, &c.....	793	8	8			
Cow-dunging the whole of the Military Buildings occupied by the European Troops.....	1,615	4	8			
Fixing panes of glass to different buildings in place of those broken by storms.....	82	3	4			
Petty supplies for purifying European necessaries.....	71	0	5			
Repairing and keeping in order the boring apparatus.....	55	4	6			
Constructing the railings for the Engineer's Store Yard.....	71	10	8			
Repairing the General Hospital.....	76	10	7			
Repairing cracks of the Chunam floor of the European Infantry Barracks water-room.....	0	15	6			
Removing the railings of the Engineer Store Yard.....	14	11	9			
Skittle alleys, 60th Royal Rifle Barracks.....	105	2	8			
Repairing doors and windows of the 12th Regiment Native Infantry Hospital.....						
Repairing the ridge pole of the European Sappers and Miners' Chuppers.....	15	13	1			
Cleaning the drains that feed the Ram Bany Tank.....	12	12	0			
Sprinkling quicklime, &c. over the graves of all the cholera cases.....	106	8	9			
Repairing the European Sappers and Miners' Chuppers.....	61	3	1			
Skittle alleys in 1st Fusiliers Barracks.....	62	14	11			
Making a large press for the Executive Engineer.....	37	6	2			
Repairing the Office Theodolite.....	10	0	0			
Cleaning the lines of His Excellency the Governor's escort..	6	6	0			
Removing the two necessaries in the Old Artillery lines....	21	10	10			
Repairing the doors and windows of the European Infantry patcheries.....	94	10	5			
Making a box for the Executive Engineer's Office.....	9	4	2			
Building fire-places in the cook-rooms of the Artillery pendalls on the heights.....	33	1	10			
Carried forward Rs....	3,930	10	7	4,161	7	8

## Lower Scinde Division.—(Continued.)

NAMES OF WORKS.	AMOUNT.		TOTAL.	
	Rs.	a. p.	Rs.	a. p.
Brought over Rs....	3,939	10 7	4,161	7 8
Constructing gate-ways in the paling of the Engineer's } Store Yard..... }	6	6 6		
Piling stones at Ram Bang..... }	85	8 3		
Repairing doors and windows of the Horse Artillery Pat- } cheries..... }	4	8 0		
Plastering the walls of the old Necessary and Cook-house } of the European Infantry Hospital..... }	24	5 6		
Removing the rubbish of the old Quarter Guard in the } European Infantry lines..... }	11	4 0		
Raising the portion of the ground upon which the butts } of the Rifles rest in the arm racks of the European In- } fantry Barracks..... }	89	13 1		
Levelling the ground at the extreme left of the European } Infantry Barracks..... }	97	6 0		
Supplying copper basins for the use of the solitary cells..	19	8 0		
Repairing the 3rd Regiment Native Infantry Hospital } Cook-room..... }	21	7 0		
Repairing the windows of the Secretary's Office.....	4	2 4		
Disbursed for the damages sustained by the brick contrac- } tor during the rain storm..... }	42	0 0		
Making iron tent pegs for Her Majesty's 86th Regt..	86	4 0		
Removing the temporary Cook-room and Necessary near } the General Hospital..... }	7	8 0		
Removing the anchor from Clifton to the Engineer } Store Yard..... }	7	9 0		
Repairing the beacon of the Menora Port Light House...	86	6 5		
Excavating wells in the Belooch Battalion lines .....	51	1 8		
Enlarging windows in the lock-up room of the Horse Ar- } tillery Quarter Guard..... }	29	4 6		
Turning Tiles of the No. 3 Horse Artillery Barracks ve- } randah..... }	40	12 4		
Constructing a semi-circular wall at the end of, and dis- } tant a few feet from, the troughs of 4   1 s. o. Artillery } wall .....	145	8 5		
Removing and re-building the temporary Cook-room and } Necessaries of Her Majesty's 86th Regiment and 1st } Bombay Fusiliers..... }	157	8 3		
Repairing verandah of the European Infantry Barracks...	219	2 8		
Repairing the Ordnance Workshop.....	105	12 1		
Additions to the old well in the Horse Artillery lines.....	98	15 11		
Removing an old shed from the Artillery lines.....	8	3 10		
Repairing the temporary Cook-room attached to the 2nd } Troop Horse Artillery Barracks..... }	16	14 5		
Levelling the new Parade ground.....	127	7 9		
Making a press for Government House.....	144	3 6		
Digging drains about the Engineer's Artificers' lines.....	45	10 3		
Supplying two lamps and one new reflector, and re-silver- } ing an old reflector, for the use of the Light House at } Menora..... }	15	0 0		
Carried forward Rs.....	5,738	4 3	4,161	7 8

## Lower Scinde Division.—(Continued.)

NAMES OF WORKS.	AMOUNT.		TOTAL.	
	Rs.	a. p.	Rs.	a. p.
Brought over Rs.....	5,738	4 3	4,161	7 8
Making a press for the Assistant Quarter-Master General's Office.....	74	5 10		
Repairing the sentry boxes in the Ordnance Department.....	2	12 3		
Cleaning the drains of No. 2 Barrack of Her Majesty's 60th Rifles.....	5	7 0		
Repairing the 3rd Regiment Native Infantry Hospital doors, windows, &c.....	30	10 3		
Repairing the 2d Troop Horse Artillery temporary Hospital.....	82	5 4		
Repairing the trusses of the Church Bungalow.....	118	15 4		
Partitioning the European New Pendalls, for the accommodation of the families of the 1st Bombay European Fusiliers.....	348	13 1		
Cleaning the pendalls of the Belooch Battalion.....	9	0 0		
Building eight fire-places in four of the European New Pendalls.....	58	7 0		
Partitioning No. 10 European New Pendall for a guard room for the 60th Royal Rifles.....	92	5 5		
Placing a rafter in order to support the corner of the house occupied by the Jemadar of the 4th or Rifle Corps.....	1	7 4		
Renewing a broken post plate, &c. of the Hospital occupied by the 60th Royal Rifles.....	6	2 0		
Plastering with mud, the roof of the Hospital Guard-room of the 60th Royal Rifles.....	22	12 7		
Oiling the trunks of the Fire-engine.....	3	10 0		
Repairing Horse Artillery Patcheries.....	8	12 8		
Replacing Tiles on a portion of the Church Bungalow.....	4	12 0		
Repairing the drains leading from the wash-house to the Cess Pools at No. 7 Barrack-room occupied by Her Majesty's 60th Royal Rifles.....	1	8 10		
Partitioning the European New Pendalls for eight married men, of the 1st Bombay European Regiment Fusiliers.....	46	7 10		
Replacing a broken principal in one of the verandahs of the European Barracks, occupied by Her Majesty's 60th Royal Rifles.....	1	5 0		
Fencing the Secretary's Office compound with mangrove..	136	6 5		
Re-building an old well in the Horse Artillery Lines.....	358	7 2		
Excavating drains round the 25th Native Infantry Lines.	800	0 0		
Ditto..... ditto, European New Pendalls.....	363	10 3		
Ditto wells for three Companies of Artillery.....	262	14 10		
Punkering the Pendalls on the heights.....	3,254	8 7		
Repairing and making good the road between Cantonment and Bunder.....	49	1 2		
Placing covers over the cess-pools of the European Infantry Barracks.....	95	13 8		
Fixing arm-racks, shelves, and pegs to the Artillery Pendalls on the heights.....	1,029	0 0		
Ditto..... ditto..... ditto, to the European New Pendalls.....	5,580	11 2		
Carried forward Rs....	18,577	19 0	4,161	7 8

## Lower Scinde Division.—(Continued.)

NAMES OF WORKS.	AMOUNT.			TOTAL.		
	Rs.	a.	p.	Rs.	a.	p.
Brought over Rs....	18,577	13	9	4,161	7	8
Planting a milk bush hedge inside, and a prickly thorn } hedge outside, the old grave yard.....	218	0	0			
Draining the cantonment.....	33	9	6			
Making and fixing new glass windows to the Serjeant's } rooms in the Barraeks occupied by the 60th Royal } Rifles.....	332	5	9			
Chimneying the eaves of the roofs of the 9th Barrack oc- } cupied by the 60th Royal Rifles.....	686	1	7			
Building a stone pillar, and replacing another of the grave } yard gate-way.....	11	3	2			
Additions and alterations to the Artillery Pendalls on the } heights.....	5,640	0	0			
Enclosing the Burial-ground with rubble stone, and mud } pointed with lime masonry wall.....	200	0	0			
Building well for the 2nd Troop H. A.....	218	12	0			
Armourer's shed in the E. I. Lines.....	84	5	7			
Building three Urinaries, one to the Rear-guard, and two } to the School-rooms of Her Majesty's 60th Rifles.. }	196	14	3			
European New Pendalls for 1800 Europeans.....	93,533.	5	4			
Temporary Bathing-sheds, Cook-rooms, and Necessaries } to European New Pendalls.....	2,555	0	0			
Government House additions, out-offices, &c.....	34,342	4	9			
Metalling a portion of the road between Camp and Kur- } rachee Bunder.....	809	2	6			
Mole at the Kurrachee Bunder.....	30,721	0	11			
Additional Cook-room in the E. I. Lines.....	561	11	7			
Additional Necessary in the European Infantry Lines..	528	15	6			
25th Native Infantry Lines.....	38,310	4	5			
Horse Artillery Barracks.....	22,924	10	6			
Horse Artillery Hospital.....	2,298	9	4			
Ditto Urinaries.....	54	8	0			
Ditto Sick horse stable.....	96	12	9			
Ditto Hospital male Cook-rooms.....	112	10	6			
Ditto Ditto female Ditto.....	77	6	0			
Ditto Ditto Necessary and Urinaries.....	37	2	0			
Building 28 Fire-places under the verandahs of the Euro- } pean New Pendalls.....	140	0	0			
Guard-room Necessary, and Sentry walls at the Ordnance } Stores.....	444	4	7			
Building temporary Necessary to the Horse Artillery } Patcheries, and temporary Cook-room to the Horse Ar- } tillery Hospital.....	57	13	7			
Ditto Workshop for the 1   1 s. o. or Captain Bailey's } Company of Artillery.....	64	11	4			
Ditto Ditto for the 1   2 s. o. or Captain Forster's } Company of Artillery.....	64	11	4			
Ditto Ditto for the 3   2 s. o. or Captain Turnbull's } Company of Artillery..	64	11	4			
Ditto Ditto for the Artillery Farriers.....	64	11	4			
Carried forward Rs....	2,54,003	9	2	4,161	7	8

## Lower Scinde Division.—(Continued.)

NAMES OF WORKS.	AMOUNT.			TOTAL.	
	Rs.	a.	p.	Rs.	a. p.
Brought over Rs....	2,54,003	9	2	4,161	7 8
Building an Office for the Ordnance.....	80	0	0		
Ditto three temporary Cook-rooms for the 1st Bombay } European Regiment Fusiliers..... }	218	0	0		
Ditto two temporary Necessaries for Ditto.....	148	0	0		
Ditto two temporary Cook-rooms and two Necessaries } for H. M.'s 86th Regiment..... }	293	0	0		
Building two temporary Cook-rooms, one Necessary, and } one Bathing-shed for the families of the 1st Bombay } European Regiment of Fusiliers..... }	120	0	0		
Building one temporary Cook-room for the families of the } 1st Fusiliers in place of the one destroyed by fire..... }	26	8	5		
Building one temporary Cook-room and one Necessary } to the General Hospital..... }	61	4	2		
Total Company's Rupees....				2,54,950	5 9
<b>GARRAH.</b>					
Repairing the 10th Regiment Native Infantry Lines at } Garrah..... }	1,498	2	10		
Total Company's Rupees..				1,498	2 10
<b>BARRACK DEPARTMENT</b>					
Supplying Barrack Furniture.....	679	8	0		
Ditto Charpoys.....	343	0	0		
Ditto Copper ware for European Troops. ....	2,038	0	0		
Securing the ends of Cotboards (100).....	25	14	11		
Supplying empty water casks for European Troops.....	112	0	0		
Removing, arranging, and repairing Barrack furniture...	629	12	7		
Supplying Oil and Cotton Wicks for the European Troops..	1,219	1	6		
Total Company's Rupees..				5,047	5 0
Total Lower Scinde Division....				2,65,657	5 3

## CENTRAL SCINDE DIVISION.

## Hydrabad.

NAMES OF WORKS.	Rs.		
		a.	p.
New European Infantry Barracks.....	74,208	10	2
New Line of Road from Entrenched Camp to Port of Hy- } drabad..... }	4,028	11	4
Metalling 600 feet of road.....	347	5	7
Carried forward Rs....	78,584	11	1

## Central Scinde Division.—(Continued.)

NAMES OF WORKS.	AMOUNT.			TOTAL.		
	Rs.	a.	p.	Rs.	a.	p.
Brought over Rs....	78,584	11	1			
Making two Treasure Chests for Collector of Hyderabad....	167	1	9			
Building a wall round the office Bungalow of the Deputy Collector Hyderabad.....	21	15	8			
Alterations to the Deputy Collector's Bungalow at Hyderabad.....	124	15	7			
Repairs to the Artillery Hospital in the Entrenched Camp..	326	2	7			
Making Shot Terraces.....	125	13	8			
Petty Repairs.....	2,947	11	10			
Total Company's Rupees...				82,488	8	2
<i>Mahmed Khans Sanda.</i>						
Repairs to the Deputy Collector's Bungalow at Mahmed Khans Sanda.....	295	10	1			
Total Company's Rupees...				295	10	11
<i>Kolree.</i>						
Amount expended on the works at Kolree.....	1,106	13	0			
Total Company's Rupees..				1,106	13	0
Total Central Scinde Division...				83,891	0	1

## UPPER SCINDE DIVISION.

*Sukkur.*

NAMES OF WORKS.	Rs.	a.	p.
Alteration to old European Barracks.....	4	9	0
Constructing European Hospital.....	129	0	0
Additions and alterations to Medical Store-room G. Hospital.....	10	14	0
Constructing Gun-sheds in Fort Bukkur.....	1,526	15	3
Repairing Huts of the 7th Regiment Native Infantry Lines.	4,164	12	8
Constructing Arm-racks for H. M's. 17th Foot.....	1,217	3	8
Making up jewassa tatties and watering them.....	4,774	12	6
Repairing pontoons.....	300	15	10
Clearing out Fort Bukkur.....	66	8	0
Filling water-casks.....	37	1	0
Repairing Hospital 11th Regiment Native Infantry.....	3	3	0
Repairing Verandah and Chicks Hospital 11th Native Infantry.....	20	8	0
White-washing 11th Regiment Native Infantry Hospital....	11	11	0
Carried forward Rs....	12,268	2	0

## Upper Scinde Division.—(Continued.)

NAMES OF WORKS.	AMOUNT.		TOTAL.	
	Rs.	a. p.	Rs.	a. p.
Brought over Rs.....	12,268	2 0		
Repairing filth cart.....	5	6 0		
Removing Barrack furniture.....	3	8 0		
Repairing and putting up Chicks European Barracks.....	23	10 11		
Removing Field park to the Fort.....	8	2 0		
Constructing Sentry Box.....	1	8 0		
Levelling old Tombs about Cantonment.....	284	2 0		
Repairing General Hospital.....	25	0 5		
Cleaning out well in front of European Barracks.....	3	7 0		
Cleaning and deepening well in the Horse Lines of the 4   1 s. o. Artillery.....	1	4 0		
White-washing New European Barracks.....	109	5 3		
Putting up Chicks 4   1 s. o. Artillery.....	0	15 5		
Clearing out 2 wells in rear of H. M's 17th Regiment Bazar.	4	5 0		
Constructing temporary partition between the sick Euro- peans and Natives of the 4   1 s. o. Artillery.....	7	5 9		
Constructing temporary Verandah to H. M's 17th Regi- ment.....	871	10 7½		
Making up Targets.....	334	8 0		
Repairing Residency buildings.....	10	12 9½		
Constructing quarter guard 4   1 s. o. Artillery.....	979	14 2		
Cowdunging Barracks 4   1 s. o. Artillery.....	5	12 0		
Repairing doors and windows 4   1 s. o. Artillery.....	3	10 4		
Repairing a beam in a hut of the 11th Native Infantry....	1	0 0		
Constructing solitary cells 4   1 s. o. Artillery.....	827	0 11		
Repairing Sepoys' Lines 11th Regiment Native Infantry....	3	13 10		
White-washing Hospital 4   1 s. o. Artillery.....	14	12 0		
Cleaning out Fort Bukkur.....	21	14 11		
Blasting Rocks on the high roads.....	29	15 7		
Repairing Sepoys' Lines 11th Regiment Native Infantry..	7	15 0		
Repairing Collector's Cutcherry.....	10	9 10		
White-washing Hospital 11th Regiment Native Infantry..	10	2 6		
White-washing Hospital Baggage Corps, and Dooly } Bearers.....	6	12 0		
Constructing Lascar Lines in Fort Bukkur.....	4,507	10 3½		
Painting a pontoon train....	278	8 0		
Constructing huts at Meerpoor.....	119	4 0		
Ditto.... do. at Moolarickpoor..	119	0 0		
Ditto Infantry Lines at Shahpoor.....	1,709	12 6		
Repairing Hospital at Shahpoor.....	75	14 9		
Constructing godown at Shahpoor....	84	15 3		
Constructing godown at Meerpoor....	30	1 8		
Packing Medical Stores.....	1	8 0		
Making up mining frames....	208	15 0		
Repairing a hut 11th Regiment Native Infantry.....	0	8 0		
Removing Barrack furniture....	28	7 9		
Hanging up Chicks Hospital 7th Regiment Native Infantry.	4	12 2		
White-washing General Hospital... ..	6	10 0		
Making chicks for ditto.....	81	4 0		
Repairing privy seats in Hospital of the Camel Baggage } Corps.. ..	10	14 4		
Carried forward Rs.....	23,154	7 11½		



## Upper Scinde Division.—(Continued.)

NAMES OF WORKS.	AMOUNT.		TOTAL.	
	Rs.	a. p.	Rs.	a. p.
Brought over Rs....	23,154	7 11½		
Clearing the open space of ground on the right of the } Golundauz Lines.....	2	4 0		
White-washing Hospital 7th Regiment Native Infantry..	4	6 7		
White-washing Hospital 11th Regiment Native Infantry..	5	0 0		
White-washing Officers' Qrs. in Fort Bukkur.....	3	8 0		
Making up chicks for doors and windows, Hospital Camel } Baggage Corps.....	42	11 6		
Repairing Collector's Kutcherry.....	9	4 4		
Repairing a hut in the Lines of the 11th Regt. N. Infantry.	11	1 0		
Repairing Barracks and Ordnance Store-rooms in Fort } Bukkur.....	33	1 3		
Repairing Commissariat godown.....	12	10 1		
<b>Total Company's Rupees..</b>			<b>23,272</b>	<b>6 8½</b>
<i>Shikarpoor.</i>				
Repairing and cleaning wells.....	95	10 4½		
Re-roofing Infantry Hospital and Medical Store-room, } and repairing and replacing Hamps.....	256	6 8		
Re-roofing Commissariat Store-room, and constructing } a drain in the New Fort.....	162	9 6		
Re-pairing wells in the Lines of the 3rd Cavalry.....	90	3 0		
Re-roofing Residency Bungalow.....	133	6 6		
Re-roofing Cavalry Barracks.....	178	0 3		
Re-roofing Cavalry Saddle-room.....	102	2 3		
Repairing a well in the Artillery Lines.....	50	13 0		
Replacing and repairing hamps to the Hospital 3rd Light } Cavalry.....	53	3 10¼		
Constructing a wall in front of the entrance of the New } Fort.....	16	14 0		
Repairing Infantry Barracks.....	44	0 5½		
Repairing a well in the Infantry Lines.....	8	13 1		
Repairing two Cavalry wells.....	97	8 5½		
Repairing Cavalry Barracks.....	6	0 6		
Re-roofing Infantry Barracks.....	89	2 5½		
Re-roofing Cavalry Lines.....	123	11 4½		
Repairing and cleaning wells in the Golundauze Lines....	45	15 4		
White-washing Hospital 3rd Cavalry.....	26	4 ½		
Cleaning wells in the Artillery Lines.....	11	11 0		
Repairing three wells in the Lines of the 3rd Light Cavalry.	30	15 6		
Repairing well and godown in Commissariat Fort.....	10	14 0		
Repairing Infantry Lines.....	44	15 1		
Repairing the Riding Master and Quarter Master Serjeant's } Bungalows 3rd Light Cavalry.....	11	13 0		
Repairing a well in the Artillery Lines.....	1	13 6		
Repairing verandah in the Commissariat Fort, and two } Barracks in the Irregular Cavalry Lines.....	23	8 7		
<b>Carried forward Rs...</b>	<b>1,716</b>	<b>7 9½</b>	<b>23,272</b>	<b>6 8½</b>

## Upper Scinde Division.—(Continued.)

NAMES OF WORKS.	AMOUNT.			TOTAL.		
	Rs.	a.	p.	Rs.	a.	p.
Brought over Rs....	1,716	7	0½	23,272	6	8½
White-washing Hospital 4th Rifles.....	19	2	10			
Repairing a well in the Cavalry Lines.....	64	9	11½			
White-washing Artillery Staff Serjeant's Bungalow.....	3	9	5			
Repairing Quarter Guard 3rd Light Cavalry.....	18	8	11			
Repairing saddle-room 3rd Light Cavalry. . . . .	21	11	5			
Repairing six Barracks 3rd Light Cavalry.....	199	10	3			
Repairing Collector's Bungalow..	241	12	10			
Repairing two Barracks 4th Regiment Rifles....	54	8	9			
Repairing well in the Artillery Lines.....	8	1	10			
Repairing a well in the 3rd Light Cavalry Lines....	1	14	0			
Repairing a well in the Commissariat Department.....	3	5	0			
Repairing a well in the Lines of the 3rd Light Cavalry..	1	13	0			
Repairing Barrack 4th Regiment Rifles....	2	14	10			
Repairing two wells 3rd Light Cavalry..	0	12	6			
Removing Barrack Furniture..	1	8	0			
Repairing Acting Serjeant Major's Bungalow 7th Regi- } ment Native Infantry....	6	5	3			
Repairing the Residency out-offices.....	102	7	5			
Repairing Huts 7th Regiment Native Infantry..	21	10	0			
White-washing Staff Non-commissioned Officers' Quar- } ters 7th Regiment Native Infantry. . . . .	4	9	0			
White-washing Staff Non-commissioned Officers' Quar- } ters 18th Regiment Native Infantry. . . . .	6	9	2			
Repairing a well in the Commissariat godown..	5	3	7			
Repairing Hamps Artillery Hospital.....	12	0	4			
Repairing Hams Hospital 7th Native Infantry....	11	13	7			
White-washing and repairing Hospital 18th Regiment } Native Infantry.....	16	8	4			
Repairing two wells in the Lines of the 18th Regiment } Native Infantry.....	18	13	9			
White-washing and repairing Artillery Staff Serjeant's } Quarters..	8	10	3			
White-washing and repairing Artillery Barracks..	92	5	0			
White-washing and repairing Artillery Quarter guard..	14	14	5			
White-washing Artillery Hospital..	60	7	5			
Repairing Lines of the 7th Regiment Native Infantry. . . . .	21	15	6			
Repairing Artillery Gun-sheds....	49	14	6			
Repairing Commissariat godown..	129	3	11			
Ditto..two Artillery Necessaries..	1	9	5			
Ditto.. Artillery workshop....	3	2	0			
Ditto..two Artillery wells....	8	14	0			
Total Company's Rupees.....				3,047	8	2½
Carried forward Rs.....				26,319	14	10½

## Upper Scinde Division.—(Continued.)

NAMES OF WORKS.	AMOUNT.			TOTAL.		
	Rs.	a.	p.	Rs.	a.	p.
Brought over Rs.....				26,319	14	10½
<i>Larkhana.</i>						
Making and hanging up Chicks Hospital Camel Corps....	193	4	8			
White-washing Hospital Scinde Camel Corps....	80	8	8			
Repairing ten Barracks for Scinde Camel Corps.....	32	11	0			
Repairing one Barrack for twenty Sepoys....	2	0	2			
Repairing out-offices attached to the Collector's Bungalow..	34	13	5			
Repairing upper story Scinde Camel Corps Hospital.....	15	11	8			
Repairing Collector's Bungalow.....	7	7	4			
Repairing one Line for Suwars.....	65	8	2			
Total Company's Rupees.....				422	1	1
Total Upper Scinde Division.....				26,741	15	11½

*Statement shewing the amount of Engineering and Superintendence, with reference to actual outlay.*

DIVISIONS AND NAMES OF OFFICERS.	Total Expended on Public Works.	Amount of Establishment charged on Works.	Expenditure on Public Works not including Establishment.	Total of Establishment, including Military Pay and Allowance of Officers and Establishments charged to the Works.	Per centage upon the works for Engineering and Establishment.
<b>LOWER SCINDE DIVISION.</b>					
Lieutenant Maxwell, Bengal Engineers, and Lieutenant Hill, Bombay Engineers.....	2,65,657 $\frac{2}{100}$	4,994 0 0	2,60,663 $\frac{2}{100}$	22,794 $\frac{2}{100}$	8 $\frac{2}{100}$
<b>CENTRAL SCINDE DIVISION.</b>					
Lieutenant Adams, Bombay Infantry, Lieutenant Dellsie, Bombay Engineers, Brevet Captain Weller, Bengal Engineers, and Lieutenant Burke, Bombay Engineers.....	83,890 $\frac{1}{100}$	2,218 $\frac{5}{100}$	81,671 $\frac{6}{100}$	17,079 $\frac{2}{100}$	20 $\frac{0}{100}$
<b>UPPER SCINDE DIVISION.</b>					
Lieutenant Frazer, Bengal Infantry, Lieutenants Hill and Walker, Bombay Engineers.....	26,741 $\frac{2}{100}$		26,741 $\frac{2}{100}$	12,911 $\frac{2}{100}$	48 $\frac{2}{100}$

*General Statement of Expenditure.*

DIVISION.	Amount Ex- pended on Public Works.			Engineering and Establishment.			TOTAL.		
	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.
Lower Scinde.....	2,60,663	0	0	22,794	0	0	2,83,457	0	0
Central Scinde.....	81,671	0	0	17,079	0	0	98,750	0	0
Upper Scinde.....	26,741	0	0	12,911	0	0	39,652	0	0
Grand Total....	3,69,075	0	0	52,784	0	0	4,21,857	0	0

(Signed) A. C. PEAT, *Major,*  
*Superintending Engineer Scinde.*



No. 938 OF 1847 | 48.

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To,

THE SECRETARY MILITARY BOARD,

*Bombay.*

Sir,

I have the honor to forward the Annual Report of Works in the Northern Provinces, for the year ending 30th April 1847.

*Statement of the Sums Expended by each Officer under the Superintending Engineer Northern Provinces, from 1st May 1846 to 30th April 1847.*

NAMES OF OFFICERS.	In the Military Department.		In the General Department.		In the Judicial Department.		In the Revenue Department.		In the Territorial Department.		In the Political Department.		TOTAL.	
	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.
Captain Hart and Brevet Major Goodfellow, Acting and Executive Engineers Surat and Broach.....	11,018	2 10	9,780	3 9	5,088	5 3	397	15 6	477	14 0			26,712	9 4
Captain Morse and Lieutenant Dickin-son, Acting and Executive Engineers of Ahmedabad.....	8,997	6	4,35,820	6 8	6,579	8 11	3,194	0 2	216	0 0	1,207	12 11	56,015	3 0
Lieutenants Hoolcombe and Robertson, Acting Executive Engineers at Deesa. } Lieutenant Peacocke, in charge of Pub- } lic Works at Rajcote..... } Lieutenants Davison and Moyle, in } charge of Public Works at Bhoof..... }	17,007	14 11	108	8 11									17,110	7 10
	371	15 2									1,559	9 4	1,931	8 6
	1,509	9 0									419	0 0	1,928	9 0
Grand Total....	38,905	0	3,45,709	3 4	11,617	14 2	3,591	15 8	693	14 0	3,186	6 3	1,03,704	5 8

*Statement shewing the cost of Engineering and General Superintendence of each Officer under the Superintending Engineer Northern Provinces, from 1st May 1846 to 30th April 1847.*

NAMES OF OFFICERS.	Expense of Establishment per annum.		Expenditure		Rate per cent.
	Rs.	a. p.	Rs.	a. p.	
Captain Hart and Brevet Major Goodfellow, Acting Executive Engineers at Surat and Broach.....	10,952	3 9	26,712	9 4	41
Captain Morse and Lieutenant Dickinson, Acting and Executive Engineers of Ahmedabad..	8,984	2 9	36,015	3 0	16 $\frac{2}{3}$
Lieutenants Hoolcombe and Robertson, Acting Executive Engineers at Deesa.....	5,516	8 0	17,116	7 10	31 $\frac{1}{3}$
Lieutenant Peacocke, in charge of Public Works at Rajcote.....	326	0 0	1,931	8 6	16 $\frac{2}{3}$
Lieutenants Davison and Moyle, in charge of Public Works at Bhooj.....	300	0 0	1,928	9 0	15 $\frac{2}{3}$
Total Rs....	25,878	14 0	1,03,704	5 8	25 $\frac{2}{3}$

During last year, no Works of general or permanent professional interest have been executed, and there do not appear to have been any facts recorded worthy of publication.

I have the honor to be,

Sir,

Your most obedient servant,

(Signed) W. B. GOODFELLOW, Bt. Major,

*Acting Superintending Engineer, N. P.*

*Superintending Engineer's Office, N. P. }  
Surat, 5th November 1847. }*



No. 3176 OF 1847.

## GENERAL DEPARTMENT.

To,

THE SECRETARY TO THE MILITARY BOARD,

*Bombay.*

SIR,

I have the honor to forward the Annual General Report of the proceedings of the Department of Public Works in the Southern Provinces, during the official year 1846 | 47.

2. The total Expenditure from the 1st May 1846 to the 30th April 1847, in the Military and Civil Departments, is as follows:—

*Total Expenditure in the Military and Civil Departments of the Several Executive Officers of the Public Work Department in the Southern Provinces.*

NAMES OF DIVISIONS OR STATIONS.	Amount Ex- pended on each.		Amount of Superintend- ence.		Superintend- ence per centage.
	Rs.	a. p.	Rs.	a. p.	
<b>POONAH.</b>					
<b>MILITARY DEPARTMENT.</b>					
Repairs.....	12,740	10 6			
Annual Repairs.....	10,608	4 0			
Special Repairs.....	6,197	10 0			
New Works.....	22,917	10 7			
Military Department Total....	51,864	3 1			
Civil Department Total....	35,668	6 7			
Grand Total....	87,472	9 8	13,661	13 2	15½
<b>CIVIL DEPARTMENT.</b>					
Repairs.....	8,910	5 3			
Annual Repairs.....	4,167	4 6			
Special Repairs.....	563	11 6			
New Works.....	21,987	1 4			
Civil Department Total....	35,608	6 7			

NAMES OF DIVISIONS OR STATIONS.	Amount Ex- pended on each.		Amount of Superintend- ence.		Superintend- ence per centage.
<b>AHMEDNUGGUR.</b>					
<b>MILITARY DEPARTMENT.</b>					
	Rs.	a. p.	Rs.	a. p.	
Repairs.. .. .	1,655	13 6			
Annual Repairs.... ..	6,659	14 3			
Special Repairs.. .. .	850	4 3			
New Works.. .. .	11,462	7 2			
<b>Military Department Total.....</b>	<b>20,628</b>	<b>7 2</b>			
<b>Civil Department Total.....</b>	<b>14,664</b>	<b>6 9</b>			
<b>Grand Total.....</b>	<b>35,292</b>	<b>13 11</b>	<b>11,909</b>	<b>11 1</b>	<b>33½</b>
<b>CIVIL DEPARTMENT.</b>					
Repairs..... .. .	5,429	1 0			
Annual Repairs.. .. .	1,096	3 11			
Special Repairs.. .. .	456	15 5			
New Works.. .. .	7,742	2 5			
<b>Civil Department Total.....</b>	<b>14,664</b>	<b>6 9</b>			
<b>BELGAUM.</b>					
<b>MILITARY DEPARTMENT.</b>					
Repairs.. .. .	787	5 6			
Annual Repairs.. .. .	5,884	7 3			
Special Repairs.. .. .	975	15 6			
New Works.. .. .	6,800	4 8			
<b>Military Department Total.....</b>	<b>14,448</b>	<b>0 11</b>			
<b>Civil Department Total.....</b>	<b>33,856</b>	<b>13 8</b>			
<b>Grand Total.....</b>	<b>48,304</b>	<b>14 7</b>	<b>12,524</b>	<b>6 8</b>	
<b>Deduct for Extra Establishment.....</b>	<b>1,450</b>	<b>13 4</b>			
	<b>46,854</b>	<b>1 3</b>			<b>26½</b>
<b>CIVIL DEPARTMENT.</b>					
Repairs.. .. .	269	13 6			
Annual Repairs.. .. .	13,708	2 2			
Special Repairs.. .. .	10,883	14 10			
New Works.. .. .	8,004	15 2			
<b>Civil Department Total.....</b>	<b>33,856</b>	<b>13 8</b>			

NAMES OF DIVISIONS OR STATIONS.	Amount Expended on each.		Amount of Superintendence.		Superintendence per centage.
	Rs.	a. p.	Rs.	a. p.	
<b>DHARWAR.</b>					
<b>MILITARY DEPARTMENT.</b>					
Repairs.. .. .	229	8 6			
Annual Repairs.. .. .	111	5 2			
Special Repairs.. .. .					
New Works.. .. .	161	2 2			
Military Department Total.....	495	15 10			
Civil Department Total.....	26,607	12 4			
Grand Total.....	27,103	12 2	15,387	6 8	56½
<b>CIVIL DEPARTMENT.</b>					
Repairs.... .. .	15,692	15 7			
Annual Repairs.. .. .	3,314	2 10			
Special Repairs.... .. .	2,555	7 3			
New Works.... .. .	5,045	2 8			
Civil Department Total.....	26,607	12 4			
<b>KOLAPOOR.</b>					
<b>MILITARY DEPARTMENT.</b>					
Repairs.... .. .					
Annual Repairs.. .. .	8,602	2 11			
Special Repairs.. .. .					
New Works.. .. .	1,937	5 4			
Military Department Total.....	10,539	8 3			
Civil Department Total.....	842	1 9			
Grand Total.....	11,381	10 0	3,395	15 1	29½
<b>CIVIL DEPARTMENT.</b>					
Repairs.. .. .					
Annual Repairs.... .. .					
Special Repairs.. .. .					
New Works.. .. .	842	1 9			
Civil Department Total.....	842	1 9			

NAMES OF DIVISIONS OR STATIONS.	Amount Ex- pended on each.			Amount of Superintend- ence.			Superintend- ence per centage.
	Rs.	a.	p.	Rs.	a.	p.	
<b>SHOLAPOOR.</b>							
<b>MILITARY DEPARTMENT.</b>							
Repairs....							
Annual Repairs.....	2,302	0	0				
Special Repairs..	376	0	0				
New Works....	2,669	8	0				
Military Department Total.....	5,347	8	0				
Civil Department Total.....	139	14	6				
Grand Total.....	5,487	6	6	1,148	0	0	21
<b>CIVIL DEPARTMENT.</b>							
Repairs..							
Annual Repairs..	59	12	3				
Special Repairs..	80	2	3				
New Works....							
Civil Department Total.....	139	14	6				
<b>KHANDEISH.</b>							
<b>MILITARY DEPARTMENT.</b>							
Repairs.....	1,290	4	0				
Annual Repairs....	587	1	7				
Special Repairs..	33	0	0				
New Works....							
Military Department Total.....	1,910	5	7				
Civil Department Total.....	53,272	6	11				
Grand Total.....	55,182	12	6	25,110	13	5	45½
<b>CIVIL DEPARTMENT.</b>							
Repairs....	14,646	7	1				
Annual Repairs..	1,472	2	3				
Special Repairs..	106	0	0				
New Works....	37,047	13	7				
Civil Department Total.....	53,272	6	11				

NAMES OF DIVISIONS OR STATIONS.	Amount Ex- pended on each.			Amount of Superintend- ence.			Superintend- ence per centage.
<b>ASSEERGHUR.</b>							
<b>MILITARY DEPARTMENT.</b>							
	Rs.	a.	p.	Rs.	a.	p.	
Repairs.. .. .	284	0	3	•			
Annual Repairs....	545	0	0				
Special Repairs..							
New Works.. .. .							
Military Department Total.....	829	0	3				
Civil Department Total.....							
Grand Total.....	829	0	3				
<b>CIVIL DEPARTMENT.</b>							
None.							
<b>DAPOOLEE.</b>							
<b>MILITARY DEPARTMENT.</b>							
Repairs. .. .. .	17	12	0				
Annual Repairs..	1,055	0	0				
Special Repairs..	749	6	0				
New Works.. .. .	145	0	0				
Military Department Total.....	1,967	2	0				
Civil Department Total.....							
Grand Total.....	1,967	2	0	200	0	0	10
<b>CIVIL DEPARTMENT.</b>							
None.							
Grand Total amount of Expenditure.....	2,71,571	4	3				

3. The works during the last year have not been of such a nature as to afford opportunity for any remarks not already offered in the last report.

4. But I would beg to forward for the information of the Board, the accompanying Annual Reports, in the General and Territorial Departments; and the Civil Engineer in Candeish, which are most detailed and clear, and on which great labor has been bestowed by Lieutenant Hart.

I have the honor to be,

Sir,

Your most obedient servant,

(Signed) W. HARRIS, Major,

*Acting Superintending Engineer, S. P.*

*Superintending Engineer's Office, S. P. }*  
*Poona, 30th December 1847. }*



No. 703 of 1847.

## GENERAL DEPARTMENT.

To,

THE SUPERINTENDING ENGINEER SOUTHERN PROVINCES,

Poona.

SIR,

1. I have the honor to submit my Report for the official year 1846 | 47, of the proceedings of the Civil Engineer's Department in Khandeish.

2. The account of the Expenditure is as follows :—

NAMES OF WORKS.	AMOUNT.			TOTAL.	
<i>Works connected with the communications of the Provinces.</i>	Rs.	a.	p.		
Annual repairs to the Agra road, between the foot of the Chandore Ghaut and Scindwa.....	9,600	6	10		
Annual repairs to the road between Rawere and Dhurungam.....	2,222	1	2		
Annual repairs to the road between Joregah and Nussocera-bad.....	2,425	8	0		
Agra road, Chandore Ghaut, to Scindwa (monthly sanction of 1,000 Rupees).....	19,078	5	9		
Humla Causeway.....	22	7	2		
Carried forward Rs.....		33,348	12	11	

NAMES OF WORKS.	AMOUNT.			TOTAL.	
	Rs.	a.	p.	Rs.	a. p.
Brought over Rs. ....				33,348	12 11
<i>Bhundarras and Tanks.</i>					
Lone Kheira Bhundarra.....	239	11	0		
Cunassee Bhundarra....	7,338	4	9		
Patonde Bhundarra... ..	398	7	1		
	7,976	6	10	7,976	6 10
<i>Buildings.</i>					
Cotton gin house Dhurungaum.. ..	379	11	11		
Annual and Special repairs, Territorial Department Col- } lector's.. ..	466	11	2		
Kutcheries, &c. at Dhoolia, Special repairs to the Col- } lector's Dwelling-house at Dhoolia....	106	0	0		
Constructing ventilators in the Dhoolia Jail....	957	0	6		
Annual and special repairs Judicial Department to Jail } Adawlut &c. at Dhoolia.. ..	392	0	0		
Annual repairs to the temporary Buildings in the Fort of } Malligaum....	176	10	11		
Altering the Centre Guard-room to the Dhoolia Jail.....	1,376	7	8		
Constructing Urinaries to the Jail at Dhoolia.....	549	0	0		
Constructing a Bungalow for the W. Bheel Agent Nun- } doorbar....	1,078	12	5		
Building six Wells, Agra road, between Scindwa and } Ackberpoor.. ..	827	0	5		
Constructing three travellers' Bungalows, Agra road, in } Nimar.. ..	867	10	3		
Planting Trees between Malligaum and Chandore Ghaut... ..	99	10	0		
Constructing three Wells, Agra road, in the vicinity of } the Scindwa Ghaut....	180	8	2		
Annual and special repairs to travellers' Bungalows.....	436	12	2		
Constructing a Church at Malligaum.. ..	2,778	3	7		
Constructing a Store-room and Work-shed (Civil En- } gineer's) at Malligaum....	405	2	8		
Constructing a Ferry Boat for crossing the Mails over } the Taptee River....	681	4	6		
Fords and Ghauts.....	170	8	10		
Annual repairs Military Department.. ..	15	11	1		
Emergent repairs to the Military Lines at Dhoolia.....	1,140	9	2		
Blue-washing the Military Detachment Hospital at Dhoolia...	11	0	0	13,114	7 5
Grand Total, Rupees Fifty-four thousand, four hundred and thirty-nine, } Annas eleven, and Pies two.....				54,439	11 2



*Abstract of the amount Expended during the official year 1846 | 47.*

	Rs.	a.	p.
Works connected with the communications of the Province.....	33,348	12	11
Buildings.....	13,114	7	5
Bhundarras.. .. .	7,976	6	10
Grand Total as above Rs.,...	54,439	11	2

*Statement shewing the Expense of Engineering and Superintendence with reference to actual outlay.*

NAMES OF OFFICERS, &c.	Expense of Establishment	Expenditure	Rate per cent.
	Rs.		
1st Lieutenant P. L. Hart, Civil Engineer in Khandeish.....	8,351		
2nd Lieutenant M. Kennedy, Assistant Civil Engineer (appointed on Special duty at Asseerghur, left 31st December 1846)..	3,402		
2nd Lieutenant Jones, Assistant Civil Engineer, joined 13th January 1847....	1,522		
2nd Lieutenant Boddan, joined as Acting Assistant Civil Engineer 9th January 1847...}	643		
Mr. Assistant Surveyor and Builder T. Price, in charge Assistant Civil Engineer's Office Dhoolia, from 1st May 1846 to 13th January 1847..	1,448		
Four Assistant Surveyors and Builders, including Mr. Price..	4,218		
Detachment Sappers and Miners, their Batta and Working Pay..	634		
Office Establishment from 1st May to 30th November 1846..	4,681		
Total Rs....	24,899	54,439	Nearly 46 Rs.

Rs.  
 Expenditure during the official year 1846 | 47..... 54,439  
 Expense of Civil Engineer's Establishment, including }  
 all charges. . . . . } 24,899  
 Rate per cen. =  $45\frac{2}{3} + \frac{1}{3}$  nearly 46 per cent.

Rupees 20,000 increase of per centage over former year.

Reason of increase.

The necessity of having sanctioned works always in hand to fall back upon.

Average strength of Khandeish working parties.

Rupees 1,80,276

3. The Expenditure is less this year than that of the former, by upwards of twenty thousand Rupees; the per centage has consequently increased about fifteen per cent. The want of sanctioned works this year has been much felt, and is the principal cause of increase in the per centage; it has also tended, in conjunction with considerable sickness experienced by those engaged on the Cunasse Bhundarra, to partially disorganize the working parties. It is scarcely necessary to mention, that the inhabitants of Khandeish, generally speaking, are somewhat averse to labour, and that almost the whole of the works in the Province are executed by the lower casts of Hindoos from the Deccan. To sustain the efficiency of the working parties, composed of these people, it is necessary to give them constant employment, to have sanctioned works in advance of those that may be in progress, to fall back upon when the others are completed. The average strength of the work-people is about fourteen hundred; it has fallen to about nine hundred, from the causes above-mentioned.

4. The amount of Estimates submitted to the Superintending Engineer S. P. for Works connected with the Province, is Rupees one Lac, eighty-nine thousand, two hundred and seventy-six.

Constructing a House for the reception of Saw Gins at Dhurungaum. . . . .	Rs. 1,834
Special repairs to the Collector's Bungalow at Dhoolia . . . . .	240
Emergent repairs to the Military Lines Dhoolia . . . . .	1,272
Repairing the Datoortee Bhundarra. . . . .	8,811
Supplimentary estimate Work-shed and Store-room . . . . .	405
Ditto Dunnair Bhundarra. . . . .	52
Military Pendalls, Dhoolia . . . . .	16,393
Bheel Lines various parts of Khandeish. . . . .	15,052

Carried forward Rs. . . . . 44,059

Brought over Rs....	41,050
Cotton Press House at Dhurrungaum. . . .	2,463
Chowdana Bhundarra. . . . .	1,502
Kundana Bhundarra. . . . .	1,190
Much Mull Bhundarra. . . . .	4,192
Solitary Cells, two Native Regiments. . . .	2,326
Supplimentary Estimate Sultana Kutcherry.	568
Bungalow W. Bheel Agent, Nundoorbar...	2,000
Record-room, Chaleesgaum... . . . .	903
Remedying insecurity of Cells, Dhoolia Jail.	4,335
Erecting weather frames Dhoolia Jail. . .	654
Bridging and draining the Nimar Line, that portion of the Agra road between Scindwa and the Nerbudda. . . . .	46,465
Supplimentary Estimate alterations to Centre Guard-room of the Dhoolia Jail. . . . .	273
Ditto travellers' Bungalow at (in Nimar) Koorvunpoora.. . . . .	746
Defences of Pimpulnair Kutcherry.. . . .	13,845
Agra Road Kanoolee Nulla Bridge. . . . .	4,710
Annual repairs Territorial Department.. . .	686
Ditto..... Judicial.... ditto.. . . .	666
Ditto..... General.... ditto.. . . .	618
Ditto made Roads and Bridges.. . . .	13,910
Ditto..... Military Department.. . . .	44
Annual and Special repairs Judicial Depart- } ment.. . . . . } 511	155
Malkurries Kutcheries..... . . . .	4,313
Supplimentary Estimate Cunasse Bhundarra	5,152
Wall to surround Work-sheds, &c. Dhoolia Jail	4,505
Dhabarree Patna Bhundarra.. . . . .	3,748
Modee..... ditto..... . . . . .	2,628
Mandul..... ditto..... . . . . .	1,804
New Court House Dhoolia Jail.. . . . .	19,332
Doosana Bhundarra..... . . . . .	184
Alterations Malligaum Kutcherry.....	789
Total....	<u>1,89,276</u>

*Abstract of the above Description of Work executed.*

Summary of work performed.

Estimates prepared. ....	52
Plans prepared .....	37
Number of miles travelled by the Civil Engineer as per written Journal.. ..	1549

Original Duties of the Civil Engineer's Department in Khandeish.

5. The Civil Engineer's Department was, I have generally understood, formed more particularly for the repairs of the numerous valuable works of Irrigation in the Western Districts of the Province. The following Statement will shew, to what extent the expenditure has amounted on the different heads of,—1st, Works connected with the communications of the Province;—2nd, Buildings;—and 3rd, Bhundarras, since its formation in 1836 | 37 to the close of the present year 1846 | 47, and whether the original intentions of Government have been carried out or not.

To what extent carried out?

YEAR.	Works connected with the communications of the Province.	Bhundarras.	Buildings.
	Rs.	Rs.	Rs.
From 1836   37	1,29,070	68,361	18,608
to 1842   1843			
1843   1844			
1844   1845			
1845   1846			
1846   1847			
Total 11 years....	2,77,393	1,14,687	63,113

Proportion of time occupied in  
1st—Buildings,  
2d—Bhundarras,  
3d—Roads &c.

Taking, then, Buildings at..... 1·0  
Bhundarras will be..... .. 1·81  
Works of communication..... .. 4·39  
and supposing nine hours daily. to be devoted,

	H. M.
Buildings will engage.....	1 15
Bhundarras.....	2 15½
Works of communication..	5 29½

6. The Superintendence and attention of the Department, as a general rule, has been and must be directed where the greatest expenditure is; and it is on this general supposition, the foregoing calculation has been based. There can be no doubt of the value of the Irrigation Works: and if this Department was originally formed principally for the purpose of their repairs, by increasing or sustaining the Irrigation, and only (2 n. 15 m.) one quarter of its time devoted to them, it is very clear its use has been somewhat subverted.

7. In several of Captain Scott's (late Civil Engineer) communications, the employment of his time on such miscellaneous Works, to the detriment of the Revenue Works, formed a subject of regret. I beg to express mine on the same account. The value and importance of these Works, I am most fully impressed with, and also with the necessity of some division of labour with regard to them.

8. Of all the miscellaneous Works in Khandeish which engages an unusual portion of time, is the Dhoolia Jail. There appears to me to be no termination to the alterations, additions, and repeated calls for fresh works. Independent of annual repairs, these have amounted, between the years 1844 | 45, 1846 | 47, to the large sum of Rupees twelve thousand seven hundred and sixty-four, viz.

As a general rule, most time and attention will be required in those branches of the work where the greatest expenditure is.

Of the works of Irrigation formed; the principal cause of the formation of the Department; and only one-fourth of its time is engaged on them: its use has been somewhat subverted.

Employment of the late Civil Engineer's time on miscellaneous work to the detriment of Revenue Works &c: some division of labour necessary.

The Dhoolia Jail requiring much time.

Large amount expended in alterations to this building, Rs. 12,764.

	Rs.	a.	p.
New Drains, Dhoolia Jail.... ..	79	0	0
Work-shed, Dhoolia Jail.... ..	2,040	0	0
Hospital over Guard-room, Dhoolia Jail.. .. .	1,888	7	1
Stair and Court House Privy, Dhoolia Jail..... ..	258	14	0
12 Solitary Cells, Dhoolia Jail.....	5,087	0	0

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Carried forward Rs.... 9,353 5 1

Brought over Rs....	9,353	5	1
Emergent Repairs temporary Buildings Fort of Malligaum (Prisoners removed out of Dhoolia Jail) ....	351	14	5
Constructing Ventilators, Dhoolia Jail.	957	0	6
Annual Repairs temporary Buildings Malligaum Fort, (Prisoners remained there)....	176	10	11
Altering centre Guard-room, Dhoolia Jail.....	1,376	7	8
Constructing Urinaries, Dhoolia Jail	549	0	0

Total Rupees... 12,764 6 7

And with the periodical repairs, the amount will be thirteen thousand five hundred and fifty Rupees, annas thirteen, and pie one, viz.

Annual Repairs	1844		45..	330	14	1
Ditto	1845		46..	63	8	5
Ditto	1846		47.	392	0	0

786 6 6

Expense of alteration as detailed above.. 12,764 6 7

Total Rupees.... 13,550 13 1

Rupees 13,550.

Nothing further should be done to the Dhoolia Jail beyond the necessary periodical repairs.

There are several fresh calls for new works besides the above. It appears to me, that the expenditure of Rupees thirteen thousand five hundred and fifty (13,550) in the course of three years on a finished building, is a very large one; and as due attention has been paid to all sanitary measures in many of these alterations, I would most strongly recommend that nothing further be done to this building not actually and bonâ fide absolutely necessary. I am free myself to confess, that with the unfinished state of the principal line of communication running through the Province, the Agra Road, and the ruinous state of many of the works of Irrigation, it will be a subject of deep regret to me to see

one single Rupee more expended on this building, containing five or six hundred well-fed human beings, supported entirely by the "State," and contributing nothing whatever towards it than in the usual necessary periodical repairs. I scarcely ever enter this Jail without envying the amount of human power available, which might be made so, for the numerous useful works in this fine Province, and sincerely hope some means may shortly be devised of cheaply working it, and really carrying out a sentence of "Imprisonment with hard labour." Five hundred of these prisoners properly worked on the road, would make it a beautiful line in two or three years.

A pity the Prisoners cannot be made available for the public works of the Province, particularly the Agra line of road.

9. I will now proceed to make a few remarks on the

#### WORKS CONNECTED WITH THE COMMUNICATIONS

##### OF THE PROVINCE.

##### I. AGRA ROAD.

	M.	F.	Y.
Chandore Ghaut to Scindwa....	116	6	214
Scindwa to the Nerbudda.....	37	0	162
To the Khull Ford of the Nerbudda	3	0	0
	<u>156</u>	<u>7</u>	<u>156</u>

*Chandore Ghaut to Malligaum.*—156M. 7F. 156Ys.

During the past official year, the Wakee Nulla Bridge, commenced the former year, has been completed. It consists of a semi-elliptical rubble masonry arch, of 30 feet span, and 8 feet rise, with two side semi-circular arches of 5 feet span each. The work throughout is constructed of rubble masonry, on a pitched foundation of the same. A second bridge has been constructed across a branch of the same large nulla, called the second Wakee Bridge. It is composed of two wooden trusses, each 54 feet in length, firmly fixed in rubble masonry abutments, the road being laid on the lower beams of the trusses. It has a waterway of 46 feet in the clear, the

No. 1. Wakee Nulla Bridge.

No. 2. Wakee Nulla Bridge.

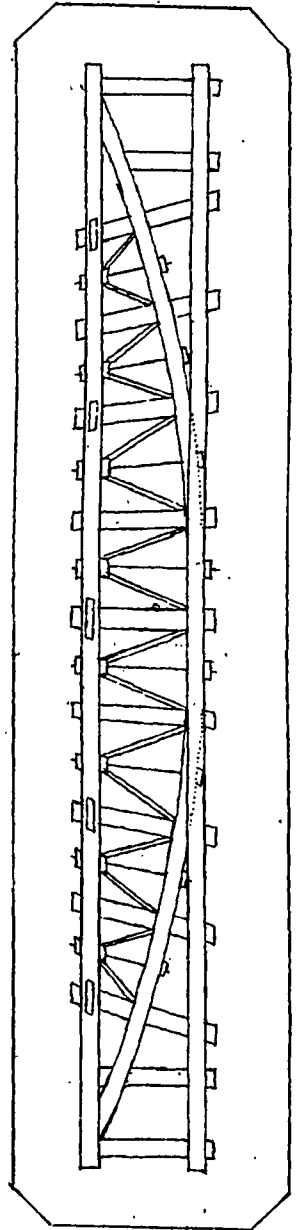
road crossing the nulla somewhat obliquely. The trusses are composed of pieces of teak, none exceeding 10 feet in length, taken out of the ruinous buildings in the Fort of Malligaum. The subjoined figure will give an idea of one of the trusses, and I hope to be able to give a more detailed account of this work in the Appendix annexed to this Report.

*Between Malligaum and Dhoolia.*

10. A rubble masonry bridge has also been constructed over a bad nulla (Wulwarree Nulla,) between the Town of Malligaum and the Village of Dherryghaum, consisting of two semi-elliptical arches of 18 feet span, and a rise of 1 foot each, constructed on a pitched rubble masonry bottom. An oblique or skew bridge has been commenced, to cross the Kanolee Nulla near Chickulwall, of two semi-elliptical arches, 24 feet span, and a rise of 7 feet each, also on a pitched rubble masonry foundation. The arches have been constructed and centering struck, and the work about two-thirds finished.

Wulwarree Nulla  
Bridge.

Kanolee Nulla  
Bridge.



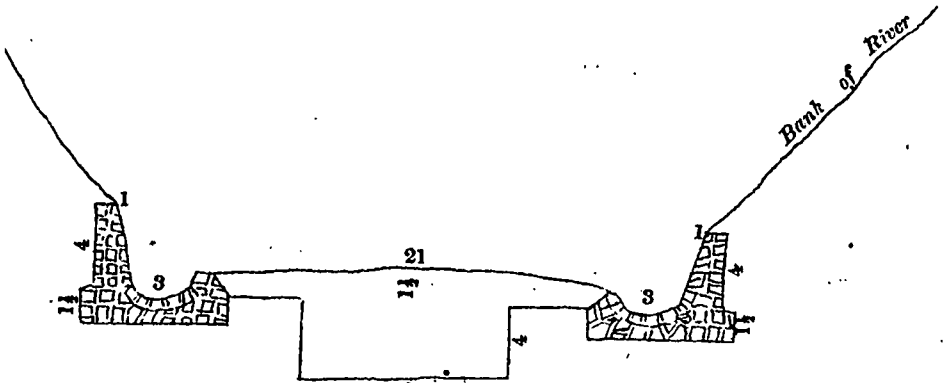


*Between Dhoolia and Sirpoor.*

11. The approach on the north bank of the Taptee has been completed. The approach on the south side, of a similar description, is very nearly finished. The section below will give some idea of the section of this road carried to the bed of the river through very high banks. I fear I shall not be able, with this Report, to give an account of this work; I will, however, endeavour to do so, and should I be able, it will be found in the Appendix annexed.

Approach of north bank of the Taptee River.

Approach of south bank of the Taptee River.



*Between Sirpoor and Scindwa.*

12. Nothing has been done to this portion, beyond the usual periodical repairs.

*Between Scindwa and the Nerbudda.*

13. This portion of the Agra road, called the Nimar Line, has not been touched since it was cleared by Captain Otley, a large balance remaining unexpended of the original sanction. Plans and Estimates have been submitted for bridging and draining the line, with a viewing of appropriating such, as far as it will go, to so useful an end.

Nimar Line.

Plans and Estimates submitted for bridging the Nimar Line.

*General State.*

General state of the Agra road.

14. As regards the general state of this highly important line, extending from the Chandore Ghaut to the Nerbudda, 156 m. 7 f. and 156 ys. from this ghaut, Soangeer may be pronounced a good moorum road. From Soangeer to the Nerbudda, as a whole, may be considered as very little better than a cleared track, of course varying in quality. There are no impediments in any part of the line to fair weather traffic; the slopes of all the ghauts are good, and the banks of the nullas cut down. I am now engaged in gradually overcoming the smaller impediments, such as constructing nullas and bridges of a small description where most required, in regular succession, and generally improving the road level; this once effected, the road can be made either moorum or metalled, as may be required.

II. *Rawere and Dhurungaum Road.—54 Miles.*

Rawere and Dhurungaum road.

Bridges and drains required to this line.

15. This is a fair weather road, passing mostly over black soil: it crosses the Taptée and Geerna, both large rivers, with very high banks. During the fair weather, the road is as good as could be desired for fair weather traffic, and all that it at present requires are a few bridges and drains.

III. *Joregah and Nusseerabad Road.—63 Miles.*

Joregah and Nusseerabad road.

Bridges and drains very much required to this line.

Have been under reference a year and a half.

16. This is also a fair weather road, and running somewhat parallel to the Boree and Geerna rivers, crosses in a measure the drainage of the Country. Without bridges and drains, it is in many parts quite useless; long detours have to be made to avoid the numerous nullas. Plans and Estimates, prepared by Captain Ottley, were submitted by me, and a reference was made on the subject of sanctioning them about a year and a half ago.

#### IV. *Malligaum and Surat Road.*

17. This line of road never appears to have received any regular repairs by this Department, as a line of road. Captain Scott repaired one or two small Ghauts on it. It was made by the Pioneer Corps upwards of twenty years ago. The slopes of the ghauts are all bad, and the largest ghaut on the line, the Koondaibharree, between Dhywell and Beesurwarree, is in some parts 1 in 5. A detailed report on this line, and some others, to Surat, was made by me in July 1846. The sickness of the Surveyor employed on the survey of the Koondaibharree ghaut, which compelled him to proceed to the coast on medical certificate, has much delayed this project, which, however, I hope will be shortly ready. A new line down this ghaut is very much required.

Malligaum and Surat road.

No repairs executed by this Department to it.

Greatest impediment on the line the Koondaibharree ghaut, slope 1 in 5.

Reason of delay in the survey of this ghaut.

#### V. *Observations on the principal Lines of Communication in Khandeish.*

18. A sketch Map of the present lines of road in Khandeish, and those most required, accompanies this Report. The principal expenditure on these works has been on the Agra Road. I think the junction of the Rawere and Dhurungaum Road with Dhoolia would be very beneficial, and complete the communication with the Eastern Districts. From Dhoolia the road might be taken with much benefit by Keir, Neir, and Sawkay, to Goreda, and there cut into the Malligaum and Surat Road, a few miles from Dhywell. The Koondaibharree Ghaut being at the same time put in an efficient state, would render the communication between the Eastern Districts of the Province and the coast complete. The Koondaibharree Ghaut Road has been surveyed, and the plan and estimate will be shortly submitted; it should be constructed in a permanent manner—the other lines might merely be cleared. With respect to the roads in the Western Districts, many of the barrees or passes are scarcely traversable for carts. The direct road from the

Lines of communication in Khandiesh generally.

Communication between the coast and Eastern Districts.

Roads in the Western Districts. The Barrees or passes in very bad order.

Barrees requiring to be put in efficient order.

Road between Dhywell and Nundoorbar very bad. Do. between Sankay and Zeytana.

richest parts of these districts is by the Kunchunbarree Ghaut to Nassick. This ghaut was put in repair by Captain Scott, and the following barrees intercepting the various lines of communication between the valleys of the Geerna-Arrum and tributaries, Moosin Panjur Kace and Borai Rivers, require to be put in an efficient state to complete the lines. A good cart road running North and South through the Western Districts, including the easy passages of all these barrees in its line, would be of great utility. The road at present between Dhywell and Nundoorbar is particularly painful, while the one between Sankay and Zeytana, by the Gutbarree, is terrible.

1. Between Baze and Suttana—Hutroa Barree.
2. Between Suttana and Zeykheira—Doll Barree.
3. Between Zeykheira and Pimpulnair—Sail Barree.
4. Between Sankay and Zeytana—Gut Barree.

Sail Barree very bad.

There is also another one between Zeykheira and Pimpulnair, which I am not acquainted with,—the Pesol Barree, repaired by Captain Scott. The above, I think, are the ones which first require attention. The first is in very good order, but the others, particularly the Sail Barree, one of the most used, is particularly bad.

Roads over these hills require to be constructed in a permanent manner.

100 Rupees allowance quite inadequate.

19. The roads over these passes generally follow the water-courses over sheet rock and up steep rocky banks, and require to be constructed in the most permanent way, and great attention paid to the drainage. The allowance of 100 Rupees for each ghaut and ford is totally inadequate for works of such magnitude. If merely cleared, in the worst places, of detached stones and baidars, the next season after heavy rain finds the work in as bad a state as before. The lines over these hills require to be most judiciously chosen; and as detailed Plans and Surveys would be required, and such documents occupy much time, putting these works in an efficient state must be a work of time. My attention, however, should leisure permit, shall be directed

to the Sail Barree, the worst and most used, over which a new line would be required.

### VI. *Bhundarras.*

20. A separate Report on these works accompanies this, agreeably to the 11th para. of Mr. Pringle's Letter, No. 1817 of 1847, to the Revenue Commissioner, bearing his endorsement, No. 801 of 1847.

Bhundarras.

### VII. *Buildings.*

21. With respect to the works constructed under this head, nothing worthy of remark has been executed. However, while on the subject of Buildings, I beg to submit a few remarks on the subject of day-labour, particularly relating to artificers, such as Goundies, Carpenters, Stone-cutters, and others. Task-work, to a certain extent, is in use amongst the common labourers. The system of paying artificers by the day, instead of the work performed, abounds with defects, encouraging uncompromising idleness on the part of the artificers, and with fraud to the employer. It is productive of much evil, placing the Engineer completely at the mercy of his work-people, and reducing his estimated amount of labour to a nullity. In all countries, and amongst the Natives themselves, a system of day-labour is never followed, and all are paid by some local standard measurement; and where measurement cannot be applied, in very few instances, by job work. There can be no doubt, to a hard working man, pay by work and not by day is as great a benefit as to his employers. In this Province especially, where living is generally so cheap,—one day's work keeping a man for four, the evil is particularly felt—continual employment is no object; and during a month, I have scarcely ever found either an artificer or common labourer work twenty days out: on Sundays there is, of course, no work done, and they are not counted.

Buildings.

Remarks on day-labour.

The introduction of a system of payment for work performed instead of per day quite impossible to the Engineer.

Assistance of Government required.

Under the present system of day-labour, impossible to obtain a proper portion of work from the artificers.

22. To introduce a system of payment to artificers for measured works, would be quite impossible to the Engineer Officer with common labourers. As I before mentioned, task-work, to a certain extent, is in force; but to the former, the incitement to irresponsible idleness is too great: if done at all, the assistance of Government would be required; to what extent it might be considered expedient to give such assistance, if at all, I cannot say, but very probably it might be left still to competition, which generally (as far as my experience goes) resolves itself into combination. I merely introduce the subject, as the Engineer whose duty it is to exact a proper degree of work from all work-people in Government employ under him, and I see no other system but of payment for work performed. If a certain number of artificers are employed who are idle half the day, Government is swindled half the amount: supposing their pay to be cut, they leave the work. I must confess myself, under the present system of day-labour, it is most difficult, I may add almost impossible, to obtain a proper degree of work. There is, of course, but one remedy at present, which is the contract system: however, in this Province such a system does not obtain, and no one comes forward. On one or two occasions, common Banians have taken contracts for repairs, and of course, such people being perfectly unacquainted with such work, the result has always been most unsatisfactory. Even supposing high rates at first to prevail for measured work, the benefits resulting would be incalculable; at any rate, you would know exactly what you would get for your money, which at present you are perfectly ignorant of.

#### VIII. *Establishments.*

23. The following alterations have taken place in the Department since last Report.

On Lieutenant Hill, Assistant Civil Engineer, leaving in February 1846, Mr. Price, Assistant Surveyor and

Builder, took charge of his duties, which he performed very satisfactorily to the 13th January 1847, when Second Lieut. Jones being appointed, relieved Mr. Price. Lieut. Kennedy, Assistant Civil Engineer, was detached to Asseerghur on special duty, 1st January 1847, and Lieut. Boddam joined as Acting Assistant Civil Engineer, 9th January 1847. Such changes are, of course, very detrimental. The two young officers lately joined—Lieuts. Jones and Boddam,—having been out only a few months in the country when they were appointed, could have had no experience whatever, having to learn their duty before they could be of any material service. I have every reason to be pleased with their efforts.

*Native Surveyors.*

24. During the last season, I have had every reason to be pleased with these subordinates, particularly Luximon Ramchunder, No. 71, who was entrusted with the execution of a very difficult and important work—the Cunassee Bhundarra, which he did much to my satisfaction. Since Mr. Thomas Price, No. 46, joined my Office from being in charge of Lieut. Hill's duties, I cannot say he has exhibited his usual zeal and industry. Narrayen Witul, No. 45, having caught a bad fever in the Survey of the Koondaibharree Ghaut, was obliged to proceed to the Coast for his health on medical certificate; I was therefore deprived of his services during some of the most important months of the working season.

I have the honor to be,

Sir,

Your most obedient servant,

(Signed) R. HART, Lieut.

*Civil Engineer.*

*Malligaum, Civil Engineer's  
Office, 17th August 1847.*





# APPENDIX

TO

## ANNUAL REPORT

IN THE

### GENERAL DEPARTMENT,

FOR THE YEAR 1846 | 47.

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#### TOOLS.

Most of the tools generally procurable from the Arsenal at the Presidency or out-stations, being particularly unfit for large Works in which there are deep cuttings through Moorum or Rock, and other descriptions of heavy work, I have annexed a rough sketch of nine different sorts of the most useful tools, with a short description of each attached.

Musters have been made up, which I shall be happy to submit, should the subject be deemed of sufficient importance.

Tools generally procurable from the Arsenal not well adapted to heavy works.

Musters have been made up by the Civil Engineer.

The Pick-axes usually supplied invariably break at the eye, when the other parts of the tool are in excellent order. I think, were the Kodallee No. 4 more generally substituted for this tool, with a strong circular eye for the handle, it would be attended with much advantage to the laborer and his work, and also be found in point of breakages and repairs much more economical.

Something very defective in the Pick-axes.

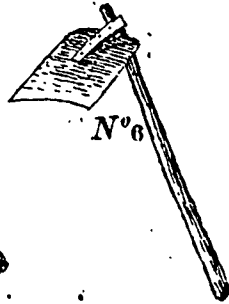
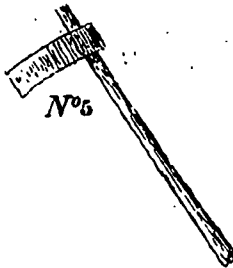
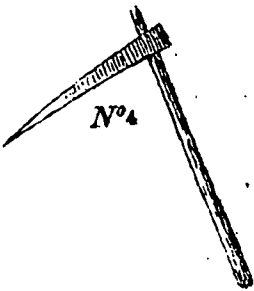
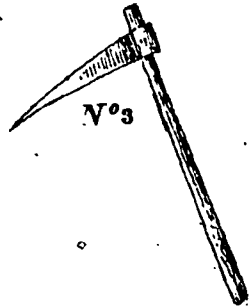
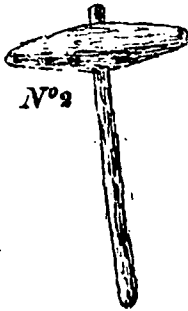
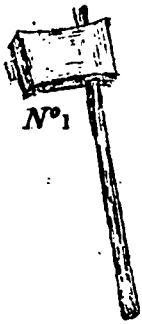
Better substitute for the Pick-axe generally the Koodalee.

Numbers 1, 2, 3, and 7, are particularly useful tools.

The common Phaora is No. 6. I think those issued generally too heavy. I have seen but two sorts—the large and small; the former is far too heavy a tool altogether, and the latter is too heavy and long in the blade for its size. A strong eye and shank is required, with a somewhat light, broad, and shallow blade riveted on.

Phaoras issued too heavy.

No.	NAMES.	DESCRIPTION.
1	Sootkee.....	This is a large heavy description of Sledge Hammer, with a steel Tongue (Butt) for squaring large stones in the Quarry, and reducing them to a tolerably square form for the stone-cutter. Its weight is lbs.17½.
2	Do. or Gun.....	A description of Sledge Hammer of an oblong form for breaking stones in the Quarry; particularly useful in detaching pavements loosened by blasts, very useful in cuttings in rock, in excavating wells, &c. Its weight is lbs.19½.
3	Soomba.....	A thick round heavy species of Kodalee; very useful in excavating in rock and hard moorum, loosening stone cracked by blasts, &c. Its weight is lbs.12½.
4	Kodalee.....	The common native Pick-axe,—a very useful tool in excavations of all sorts; a much stronger and more economical tool than the Pick-axe—not so liable to break. Its weight is lbs.7.
5	Felling axe or Koorar.	Narrower and thicker than the English one—more adapted to the strength of a Native. The eye, in which the handle is fixed in, is round, very easy to re-handle; the English one is very difficult to re-handle, and is too heavy for this country. The eye being triangular, is a great objection unless a carpenter is at hand. Its weight is lbs. 6.
6	Phaora.....	This is the common Phaora; broader in the blade, shallower, and not so heavy as those usually supplied. Its weight is lbs.7½.
7	Small Sootkee.....	This is a small Sootkee (See No. 1), or Goundies Hammer, with the steel Butt for dressing stones: in all rubble masonry work this is a most useful tool, and one much required. Its weight is lbs.3½.
8	Hammer.....	A Hand-hammer for breaking metal for roads. Its weight is lbs.2½.
9	Hand Hatchet or Phursee.....	A small Hatchet for clearing low jungles: a very useful tool. Its weight is lbs.3.



	WEIGHT.
No. 1. Sootkee, or Sledge Hammer.....	17½ lbs.
No. 2. Ditto... or Gun... do.....	19½
No. 3. Soomba, or another description of Hammer.....	12½
No. 4. Kodalee, or Native Pick-axe.....	7
No. 5. Koorar, or Felling-axe.....	6
No. 6. Phaora, or Native Hoe.....	7½
No. 7. Small Sootkee, or Goundees Hammer.....	3½
No. 8. Hammer.....	2½
No. 9. Hand Hatchet.....	3

## BRIDGES.

In the hope that detailed Plans and cost of this useful description of Works, Road Bridges, actually executed, may prove generally useful, I beg to transmit, with the Annual Report in the General Department for 1846 | 47, the following Plans of Bridges executed on the Agra Road, with a short description of each.

Plan No. 19, 1847 | 48. Details of the Trussed Wooden Bridge constructed across the Wakee Nulla, No. 2, S. of Malligaum.

Plan No. 20, 1847 | 48. Details of the Rubble Masonry Bridge constructed across the Wakee Nulla, No. 1, S. of Malligaum.

Plan No. 21, 1847 | 48. Details of the Rubble Masonry Bridge constructed across the Moongsa Nulla, S. of Malligaum.

Plan No. 22, 1847 | 48. Details of the Rubble Masonry Bridge constructed across the Wulwarree Nulla, N. of Malligaum.

Plan No. 23, 1847 | 48. Details of the Rubble Masonry Bridge constructed across the Choukey Nulla, N. of Malligaum.

Plan No. 24, 1847 | 48. Details of a small Viaduct erected near Sirpoor, N. of Malligaum.

## PLAN NO. 19 OF 1847 | 48.

DESCRIPTION OF THE TRUSSED BRIDGE ACROSS  
WAKEE NULLA, No. 2.

This Bridge is composed of two vertical trussed frames, formed of pieces of teak, none exceeding 10 feet in length. Wakee Nulla  
Bridge No. 2.

The general scantling of the principal timbers is 10" x 4". These frames rest 4' on each end of the abutments of the bridge, and are supported at the ends by a wooden corbal and shut, projecting 2' beyond the face of the abutment, leaving a clear waterway of 46 feet. The timbers of which these frames are composed, were carefully fitted together at the workshop, taken to pieces and carted to the spot a few paces from where the bridge was building, again fitted together about sixty paces from the Nulla across which a good scaffolding had previously been erected, and there brought into close contact, and securely bolted and stopped together. The truss being completed, was lifted by one hundred Bigarries, carried to the scaffolding, and laid on its side, from which it was raised to a vertical position in its proper place. The same process was pursued with the other trussed frame. No bolt was driven or fixed after it had been placed in its position, nor even on the scaffolding before raising it to the vertical position. Composed of ver-  
tical trussed frames

The roadway joists or floor timbers were placed as nearly at right angles as possible to the sides of the trusses; the road crossing the Nulla obliquely at each end, they partly rest on the abutment and partly on the stringer. These joists were only slightly knotted down in some places, and laid without any fastening on the upper side of the string pieces. They are teak logs in the rough, about 14' long x 7½" x 8", laid at about 2 feet apart. Trussed frames  
completed.

How placed in  
position.

Roadway joists.

Not fastened to  
stringers.

- Wooden arches.** This trussed frame is composed of a pair of string pieces, with a pair of wooden arches (rod 70), each arch being composed of five pieces of teak 10" x 4". The ends of the arches are knotted down to the ends of the stringer, and fastened there by two iron straps at each end, and one screw-bolt to each framing between the two straps. These straps embrace the ends of both stringers, there being a screw-bolt, as before remarked, to each framing.
- Radiating posts.** To each truss, composed of a pair of framings, there are eleven radiating posts passing between the two framings, and each bolted through the stringers and arches by eight screw-bolts, four through the stringers, and four through the arches. The posts are single, and the stringers and arches of the framings are fastened in pairs upon their sides by the screw-bolts, as before mentioned. These posts project four inches below the under side of the stringers.
- Railing.** The radiating posts are carried up to a level with the top of the arches, and firmly kept in their places by horizontal pieces in pairs bolted through the heads of the posts. Besides the eleven radiating posts, there are ten other vertical ones, one at each end of the framing in the masonry.
- Vertical posts.**
- The pieces of teak being only 10 feet in length, scarfing was necessary, which was effected by bringing the squared end of the timbers together, and bolting iron bars along their sides, a block of wood, the thickness of the radiating posts, being inserted at the places of scarfing. By transposing the position of the timbers of one of the framings, no two joints come in the same place—both those of the string pieces and arches are broken. There is not a mortise or tenon in the trussed framing.
- Joints of framing broken.**
- Bolting blocks.** Bolting-blocks were also inserted between the ends of the stringers forming solid masses to bolt through.
- Stiffening the framing.** To stiffen the trussed framing when the string pieces, arches, and radiating posts were all bolted together,

short transverse blocks of wood, of a triangular shape, were let into the upper side of the stringers, extending over both to the depth of about half an inch; on the sides of these blocks, small struts, each 3" x 3", were fitted on (no tenon), the upper ends of these struts being let into the radiating posts near the lower edge of the arches. A similar block, of a more oblong shape, was also fitted on to the upper sides of the arches extending over the pair of framings, and a corresponding one on the lower side of the string-pieces through these three. Round iron 1½" suspending bolts were passed and screwed up on the lower end by a nut and washer to the lowermost block. The whole framing is much stiffened and strengthened by these suspending bolts and struts, at an expense of a comparatively small quantity of materials. In 54 feet, the string pieces were cambered 6".

How?

The truss frames are separated by a distance of 12 feet. The flooring of the bridge is composed of round teak rafters (goals) about 3" diameter each, placed close to one another, and well nailed down to the flooring beams or roadway joists. There is also a side plank, to retain the road material, nailed on the inside of each truss to the radiating posts.

Distance between truss frame.

Flooring.

Side planks.

The timber used in this bridge is teak throughout, rescued from rotting in the ruinous native buildings in the Fort of Malligaum. The roadway joists were furnished from the Work-yard. The flooring was also procured from the Fort, and appears to have been used for flat roofs of the native buildings. The wood is very brittle from its great age, supposed to be about one hundred years old, or I should have reduced the scantling from 10" x 4" to 10" x 2½" or 3".

Timber.

Scantling of timber.

The general construction of this work is as follows: viz.

*Foundation*—Filled in of uncoursed rubble masonry.

No pitched foundation.

*Abutments*—Sides and ends of coursed rubble masonry.

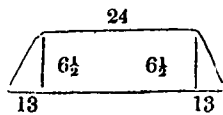
*Parapet wall*—Of coursed rubble masonry coped with single stones laid transversely across the wall. Third sort cutting.

*Embankment*—Of stiff clay and moorum with sand.

**Embankment.** The embankment on the S. approach is about 530 feet long, filled in to an average height of  $6\frac{1}{2}$  feet: that in the N. approach is 500 feet long, filled in to an average height of  $6\frac{1}{2}$  feet.

**Cost.** The total cost of this work, including embanking, was Rupees four thousand one hundred and twenty; and the cost of the different portions of the work may be roughly taken as follows, viz.

		Rs.	a.	p.
	Total expense of trusses and road-way, including Carpenters' work, nails, iron, &c. &c.....	750	3	7
<b>Cost of different portions.</b>	15,959 cubic feet of rubble masonry, including every thing at 12 Rs. per 100 cubic feet.....	1,915	1	3
	1030 running feet of embankment = 2477.15, at eight annas per 100 cubic feet*	1,238	9	2
	Sundries, including scaffolding, excavating foundation, &c.....	216	2	0
	<b>Total Rs....</b>	<b>4,120</b>	<b>0</b>	<b>0</b>



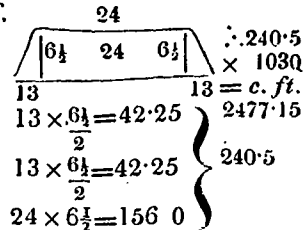
\*Running ft. of abutment=80'—then  $80 \times 2 = 160$  running ft.

Then  $160' \times 19' \times 4\frac{1}{2} = 12920$  c.f.

Wall protecting road  $48' \times 3\frac{1}{2} \times 14\frac{1}{2} = 2436$

Parapet Wall  $138' \times 1\frac{1}{2} \times 3\frac{1}{2} = \dots \dots \dots 603$

15959



**Tarring.**

All the wood-work received three coats of tar. The moorum at the sides of the road is 4" deep, and 2" of good broken metal over it; and in the centre of the road, 8" moorum, and 4" metal.



No. 20 OF 1847-48.

DESCRIPTION OF THE RUBBLE MASONRY BRIDGE  
CONSTRUCTED ACROSS THE

WAKEE NULLA, No. 1.

This bridge consists of a semi-elliptical arch, of 30 feet span, with a rise of 8 feet, and two side semi-circular arches, of 5 feet span each. The breadth of the roadway between the parapets is 18 feet. The roadway is embanked on the N. side 250 feet in length, and on the S. side 450 feet, at an average height of  $5\frac{1}{2}$  or 6 feet. Dry rubble stone walls retain this embankment the whole of the above distance.

Wakee Nulla  
No. 1.

The foundation of this bridge, composed of uncoursed rubble masonry, is carried down 2 feet to hard moorum and rock. The arch is of hammer-dressed rubble masonry throughout, and the other portions of the work are of coursed rubble masonry. The parapet wall is  $3\frac{1}{2}$  feet high, and the length of parapet, from end to end, 71 feet: the top is coped with choonam plaster. The waterway of the large arch was afterwards paved with rubble stone and choonam, the original foundation being carried under the side arches.

The details of this bridge are most clearly shewn on the Plan accompanying.

Total cost, including the approaches, was Rupees Rs. 3,744 5 6.  
three thousand seven hundred and forty-four, annas five,  
and pies six.

No. 21 of 1847-48.

DESCRIPTION OF THE RUBBLE MASONRY BRIDGE  
CONSTRUCTED OVER THE

MOONGSA NULLA.

Moongsa Nulla. This bridge has two segmental arches of 15 feet span each, and rise five feet. Throughout, the construction is of rubble masonry, with a coping of choonan plaster to the parapet wall. The waterways are roughly paved with dry rubble.

This bridge was constructed about the middle of an embanked portion of the Agra Road, near Moongsa. The walls shewn in the Plan adjoining the wings, were found necessary, to preserve a closer connection with the raised portion of the road. The approaches were filled in, about 60' in length at each end of the bridge, to an average depth of  $5\frac{1}{2}$  or 6 feet.

The whole drainage of this part of the country finds its vent through this bridge. In the heavy falls of rain at the commencement of the monsoon, the embankment has hitherto been always injured more or less; this bridge is, therefore, not a sufficient outlet for the water, and two or three large drains through the embankment, with a low wall on the exposed side, are required to give a more free outlet to the water, and to protect the foot of it.

Rs. 1,232	13	10	The actual cost of this work was Rupees one thousand two hundred and thirty-two, annas thirteen, and pies ten,
Rs. 1,300	0	0	and the estimated amount Rupees thirteen hundred.

No. 22 OF 1847-48.

DESCRIPTION OF THE RUBBLE MASONRY BRIDGE  
CONSTRUCTED ACROSS THE  
WULWARREE NULLA.

This bridge is composed of two semi-elliptical arches, Wulwarree Nulla. of 13 feet span each, and 6 feet rise. The breadth of the roadway between the parapets is 18 feet, and length of the parapet, from end to end, 60 feet. The roadway is 22 feet broad, and embanked on the N. side of the bridge 420 feet in length, and on the S. side 530 feet, and an average height of  $5\frac{1}{2}$  feet. There is no dry stone retaining wall. On the up-stream side are two dwarf walls, about 6 feet high, to protect the junction of the embankment with the bridge in heavy floods.

This work throughout is constructed on a pitched foundation of uncoursed rubble masonry to a depth of 4 feet. The remaining portions of the work are of coursed rubble masonry arches, of hammer-dressed rubble masonry. The parapet wall is coped with cut stone, 3rd sort.

The cost of this work was Rupees three thousand and Rs. 3,004 10 8 four, annas ten, and pies eight, including the approaches.

No. 23 OF 1847-48.

DESCRIPTION OF THE RUBBLE MASONRY BRIDGE  
ACROSS THE  
CHOWKEY NULLA.

**Chowkey Nulla.** This bridge has two semi-elliptical arches, of fifteen feet span each, and 6 feet rise. The breadth between the parapets is 18 feet, and length of parapet, from end to end, about 50 feet. The superstructure rests on a pitched rubble masonry foundation, with inverted arches extending from the abutments to the pier. The approaches are scarcely of any length, the banks of the nulla being rather steep. The foundation is of uncoursed rubble masonry, arches of hammer-dressed and other portions of coursed rubble masonry. The parapet is coped with choonam plaster.

Rs. 1,142	4	3	<p>The cost of this bridge was Rupees one thousand one hundred and forty-two, annas four, and pies three, and the estimated amount Rupees one thousand nine hundred and fifty-nine. The principal cause of this great difference was a quantity of rubble stone on the spot, which appeared to have belonged to a former structure: the approaches also being well raised, but little filling in was required.</p>
Rs. 1,959	0	0	

No. 24 OF 1847-48.

## DESCRIPTION OF A SMALL VIADUCT CONSTRUCTED

NEAR

## SIRPOOR.

This little viaduct is constructed over a deep gullee, crossing the Agra Road near Sirpoor, along which a road runs to an adjacent village. It consists of one segmental arch, 14 feet span, having a rise of four feet, It is 14 feet between the parapets. Almost the whole of this work is constructed of brick, excepting a small portion of the filling in of the abutment and wing walls, which is composed of a sort of coarse concrete, made by mixing up large pebbles procured from a neighbouring nulla with choonam. Stone is not procurable for miles round.

Sirpoor viaduct.

The cost was Rupees five hundred and twenty-six, annas eleven, and pies nine, the estimated amount being six hundred and twenty-nine.

Rs. 526 11 9

Rs. 629 0 0

(Signed) P. L. HART, Lieut.

*Civil Engineer Khandeish.*

No. 704 OF 1847.

To,

THE COLLECTOR OF KHANDEISH,  
DHOOLIA.

SIR,

1. I have the honor to submit my Annual Report in the Territorial Department, for the official year 1846 | 47.

2. The Works executed or in hand during the past year are as follows :—

NAMES OF WORKS.	Amount.		
	Rs.	A.	P.
Lenekheira Bhundarra.....	329	11	0
Cunassee Ditto .....	7338	4	9
Patoonde Ditto .....	398	7	1
Total amount expended.....	7976	6	10

*Lenekheira Bhundarra.*

Rs. 239 11 0      3. The amount expended on this work has gone towards the improvement of the water-course which, running along the banks of the River for some distance, is very liable to injury in the heavy floods during the monsoon.

*Cunassee Bhundarra.*

Rs. 7,338 4 9      This amount nearly completed one of the largest works of the sort yet executed in Khandeish. It will pay Government from ten to twelve per cent.

*Patoonde Bhundarra.*

Rs. 398 7 1

The amount expended on this work was for some slight repairs. No return may be expected from the outlay, as from the usual want of water in the River and the extent to which deposit has accumulated behind the Bhundarra, no great benefit can ever be expected from this dam in its present state.

4. It will be seen from the foregoing, that the portion of work executed in this Department is very small, alone arising from a want of sanctioned works: and I beg to call your particular attention to the 5th para. of my Annual Report in the General Department which shews, that under the supposition of the Engineer Department in Khandeish having been originally formed for the repairs of the Revenue works, taking the expenditure for the last eleven years from the formation of the Department, the following proportion of expenditure on the Public Works of the Province has existed. The time and attention of the Department has of course been relative to the expenditure.

Supposing building taken at . . . .	1
Bhundarra will be . . . . .	1.81
and works of communication . . . .	4.39

5. During the period I have held the appointment of Civil Engineer in Khandeish, I have been very dubious of the actual advantages derived from the repairs of many of these works. There can be no doubt of the old works having paid themselves over and over again; but of several large expenditures for repairs and improvements, although present revenue may have been sustained, still the extra revenue derived has been in some cases rather unsatisfactory, and in such results I have been inclined to look for other causes than a want of attention and exertion as relate to these works in the Engineer Department. My predecessor, Captain Scott, received high testimonials of his assiduity and exertion; and

the Hon'ble the Governor in Council was pleased to state, that the quantity of work performed by me was highly creditable.

6. With a wish of obtaining all the information in my power relating to these works in connection with the assessment, &c. of the irrigated land, I requested you would do me the favor of sending me any Records for perusal bearing on the subject; to which you replied, "you regretted you could not comply with my request." I then addressed you a letter containing fifteen or twenty queries relative to the subjects on which I wished to acquire information, to which I received no answer. Your time and attention, I have no doubt, must have been taken up with weightier matters connected with the Collectorate. I trust, therefore, in perusing this Report, you will make due allowances for any want of knowledge likely to betray itself, as far as details go, if not generally of a subject on which I am about to offer a few remarks.

7. It appears to any one who has traversed the Western Districts of the Province, that the cultivation of Sugar Cane is the all in all of the koonbee, in fact that it is pushed to extremes. I suppose because it is cultivated under favorable terms of assessment, and is the commodity of the highest commercial value, that the cultivation of Sugar Cane in these districts has wonderfully increased of late years; there can be no doubt the same remarks may apply also to Rice: the steady fall of the prices of both almost attest the fact, that both crops must have been pushed to extremes. Formerly I believe the crops, or the land according to the crop, were assessed, and the rates on Sugar Cane more than averaged thirty Rupees (30 Rs.) a beega: Rice yielded somewhere about fifteen (15 Rs.), there being two or three rates. The rates now are all equalized on the land, and no matter how much water the crop consumes, whether Sugar Cane, Rice, or Wheat and Kirkool, they all average somewhere about eleven Rupees (11 Rs.) per beega.



8. The subject of assessing the *land* instead of the *crop* (the land according to the species of the crop), has of course been determined, after long experience, by the District Officers, who have brought much knowledge to bear on the subject; however, it does not appear clear to me, that such should obtain with reference to this description of irrigation: as an owner of a Bhundarra, it would appear to me a fairer measure assessing the land according to the quantity of water I supplied it with. In the consideration of this subject the land does not appear to me to be the first object of consideration. If I, as a private individual, make a large outlay by erecting a dam across a river, and have always a large supply of water on hand ready for agricultural purposes, the person who uses most of my water should pay the most. Whether this case at all applies as far as Government is concerned, I leave to you. But as regards the effects on the Engineer Department more particularly, my present objections would certainly apply, if their efforts are to be at all measured by the number of beegas irrigated.

9. I conceive all the Engineer's labors in connection with these Works should finally tend to produce an ample supply of water throughout the year for irrigation. When the lands reverted to Government (formerly, in all probability, given in *enam* to those who built or repaired these Works) the most water-consuming crops, as Sugar Cane, paid the highest rate of assessment, and the other crops in proportion. No doubt all the rates were unusually high, but as long as the most time and water-consuming crops are pushed into extremes, which they are by the fixed rates, so long will the exertions of the Engineer Department in the repairs and improvements of these works appear in an unfavourable light.

10. With reference to the subject (and a very important one it appears to me) of the great decrease of irrigated land (see Mr. Pringle's Jumma Bunde Report, dated 31st October 1841, No. 433) in connection with these

works having fallen off by about one half in extent, from 22,277 beegas to 11,875, there are various reasons to be assigned, amongst which is a very prominent one, that so much rain does not now fall as formerly : and without the necessity of any meteorological observations to prove this, one can scarcely travel over any part of the Province without meeting with ruined Bhundarras frequently across inconsiderable looking streams which now never have a drop of water in them ; there are other reasons no doubt for this decrease of cultivated bagayet land, but it appears to me, whether water be abundant or not, it must go on decreasing in extent as long as time and water-consuming crops are pushed to extremes in a thinly-populated district, and neither the liberal sanctions of Government on these works nor the exertions of the Engineer Department will stop it.

11. In conclusion, I should have much wished had I remained in Khandeish to have mastered this subject of assessment, so far as it concerned the Engineer in the repairs and improvements of the works of irrigation ; and my present conviction is, that if the utility of the Department is to be measured by the number of beegas under irrigation, the value of it must appear in any but a favourable light. All the efforts of the Engineer should tend to produce an unfailling supply of water ; and if a water-consuming crop is assessed at the same rate as others, while requiring five times the amount of water, his exertions are to a great extent gone, and the cultivation of an article forced while the decrease of irrigated land will progress. Until I can obtain better information on the subject, it certainly appears to me, unless a crop is so far taxed with reference to the quantity of water it consumes, not the quantity of the land, the Bhundarra which supplies the water is not done justice to. To repeat this subject :—if a beega of A, requiring five times as much water as a beega of B, C, or D, pays only the same rate of assessment, a fair return is not made to the work supplying the water ; the irrigation by so large

an expenditure of water on one description of beega A must decrease, and the commodity A forced to extremes, which I humbly conceive to be the existing case in Khandeish with respect to Sugar Cane and Rice, particularly the former.

I have the honor to be,

Sir,

Your most obedient servant,

(Signed) P. L. HART, Lieut.

*Civil Engineer Khandeish.*

*Malligaum, Civil Engineer's*

*Office, 17th August 1847.*

“True copy.”

(Signed) P. L. HART, Lieut.

*Civil Engineer Khandeish.*

No. 969 OF 1847.

To,

E. H. TOWNSEND, Esq.,

REVENUE COMMISSIONER, S. D.

Poona.

SIR,

Handing up Report of Expenditure.

Rs. 3,14,795.

Rs. 18 and five-eighths.

Cost of Superintendence.

Mode of calculating cost of Superintendence.

I have the honor to submit the following Report of the Proceedings of the Road and Tank Department for the official year 1846 | 47, with a Statement appended of Works performed, shewing a total expenditure of Rupees three lacks, fourteen thousand, seven hundred and ninety-five, and an average charge for Superintendence of Rupees eighteen and five-eighths.

2. The mode of calculating the cost of Superintendence is the same that was adopted by Major Peat, and is also similar, I believe, to the practice pursued in other branches of the Public Work Department; but as the per centage varies so widely, a word or two of explanation may here be appropriately introduced in order to render the causes intelligible.

3. In addition to the consolidated Staff pay and tentage of the Executive Officer, the pay and allowance of the "permanent establishment" are alone admitted into the calculations from which the per centage is derived: the cost of maintaining any "temporary establishment" that may be required, is not taken into account. Now when there is no permanent establishment whatever under the executive Officer, or when it is inadequate for the duties required, there is no alternative but to make up for the deficiency by the temporary employment of the best qualified maistrees and carevons procurable, and the pay of these men is not taken into account in calculating the per centage.

4. In the case of Mr. Armitstead, I do not mean to say, that even were the pay of the temporary establishment he has been thus compelled to employ included in the calculation, it would materially increase the rate for Superintendence, or cause it to exceed  $2\frac{1}{2}$  per cent. The rates at which his karkoons and other temporary *employés* are paid have been so low, and the number of labourers so unusually great, that the total charge of the former is the merest trifle when compared with the expenditure incurred in labor and materials on such an extensive line of works; but under different circumstances, and with works scattered over the country and of greater variety, the addition of the pay of the temporary establishment might very perceptibly affect the charge for Superintendence; and this I mention, for the purpose of shewing that rates deduced as at present are not to be considered undeviatingly correct.

Mode of calculating cost of Superintendence.

5. I have mentioned that the whole of the Staff pay of the executive Officer is included in the charge for Superintendence; and although it would be impossible perhaps to do otherwise, still it cannot be doubted that the practice is calculated to convey erroneous impressions. The duties of the executive Officer are as much those of a designer and estimator and accountant, as of an actual supervisor of work; and in truth it may be asserted as a general rule, that a far greater proportion of his time is passed in the varied labours of his Office, than in personally watching the progress of the buildings and other public works he may have in hand. To debit the whole of his pay to the charge of "Superintendence," when probably two-thirds of it ought to be allowed to other items, is clearly, therefore, a mistaken principle.

6. In my Report for 1845 | 46, I stated that Captain Jacob had finished a survey of the proposed new terminus to the Mail Road, and was then employed in designing and estimating for the works required thereon. These estimates were duly completed in October, and

Performances of 1st Assistants.

Captain Jacob.  
New Terminus to  
Mail Road on Hog  
Island.

together with the several designs for bridges, drains, causeways, and pier, were submitted to the Military Board on the 12th of that month. As the depth of the creek which separates Hog Island from the reclaimed flats had not been tested however with sufficient accuracy, instructions were received from the Board to probe it to the bottom; and it was at the same time requested, that the slopes over the hilly ground on other parts of the proposed line might be reduced to a maximum of 1 in 20, instead of 1 in 18, as designed by Captain Jacob.

7. The bed of the creek was accordingly probed in various places, and as a rocky stratum was invariably met with within 15 feet of the surface, it was found unnecessary to make any alteration in the estimate for the causeway, which already allowed for a foundation of that average depth, but provision was made for the improved slopes recommended by the Board; and the estimate for the entire line of works, thus corrected, amounted to Rupees two lacs, sixty-five thousand, five hundred and thirty-nine. In this estimate the construction of the road across the flats reclaimed from the sea was incomparably the heaviest item, amounting to no less than forty thousand Rupees a mile, while the rest of the line, inclusive of pier and bridges, barely averaged seventeen thousand.

Rs. 2,65,539.

Rs. 40,000.

Rs. 17,000.

8. A discovery was made in regard to the nature of the flats, however, while the bed of the creek was being examined, which materially interfered with the mode of construction proposed by Captain Jacob; for it was ascertained, on removal of the surface crust or layer, which extended only to the depth of a foot or little more, that the substratum was soft enough to admit of its being penetrated to the very bottom, with almost as much facility as the mud in the creek. Under these circumstances, as wooden piles would not answer, and a loose stone foundation would have been inordinately and almost incalculably expensive, it was proposed to construct the road on the undisturbed surface of the soil, with an under

layer of hurdles to diffuse the pressure and prevent sinking. It was further intended, that this road should have been protected from the encroachments of the sea, by putting the reclaiming lands into a state of efficiency.

9. The mode of construction, just described would doubtless have been much less costly than the one Captain Jacob had originally estimated for, under the supposition that he could cut trenches in the soil, and build masonry retaining walls for the support of the roadway; but as it was impossible, in the absence of any data, to calculate the cost with any approximation to accuracy, the estimate was left unaltered.

10. Manifold and undeniable as would have been the advantages of this new line, which would have placed an always accessible terminus some 12 miles nearer Bombay than the present inconvenient and unapproachable one, its probable cost was yet so great, that, until the prospect of a connection between the Presidency and the Deccan at some future day by means of a rail-road, the Government declined sanctioning it: and Mr. Secretary Escombe, in his letter to the Military Board of the 4th June last, No. 1552, stated that certain arrangements with the Bombay Steam Navigation Company, which Government had under consideration, for the conveyance of the Mail to Panwell, would obviate, if carried out, any further necessity for the consideration of the subject of a new terminus.

Reasons for abandonment of the proposed new Terminus.

11. On the completion of the duty just described, Captain Jacob undertook the survey of the Kating Tank and its environs, in compliance with a wish expressed by the Hon'ble Court of Directors in their Letter to the Bombay Government of the 21st May 1844, and with a view to determine on the best way of preventing a further accumulation of mud in its bed; but as I shall shortly have occasion to describe how this duty was performed, in another Section of my Report, I will not now dwell upon the subject.

Kating Tank.

Captain Jacob withdrawn from the Department, and appointed to Superintend the Jamsetjee Bund.

12. It merely remains for me to add, in allusion to Captain Jacob, that as soon as all the designs and estimates connected with the improvement of the Kating Tank had been submitted to higher authority, the interests of Government and the urgency of the occasion rendered it advisable that that Officer should be removed from the Road and Tank Department, to take charge of the Jamsetjee Bund at Poona, which till then had been under the Department of the Superintending Engineer S. P. Independently of losing the services of an Officer whose established reputation would be but little enhanced by any praise from me, and who possesses the rare merit of being just as hardworking as he is talented and able, Captain Jacob's removal, unavoidable as it probably was, afforded further matter of regret to myself, in consequence of its incapacitating the Department from undertaking several projects for the extension of irrigation which it otherwise might have done. The vacancy occasioned by his withdrawal is yet unfilled.

Lieut. Bruce's performances. Wangoolie new line.

13. Lieut. Bruce, at the date of my last Report, was engaged, as therein mentioned, in preparing designs and estimates for a proposed new line of road between Poona and Wangoolie; but these documents, instead of being ready for transmission to the Military Board by the month of October, as I had anticipated, and as they undoubtedly ought to have been, were not received from Lieut. Bruce till the 12th of January following. The estimate for  $8\frac{1}{2}$  miles of bridged and finished road, which was minutely worked out and tolerably accurate, amounted after correction to Rupees eighty-eight thousand, nine hundred and eighty-six, and the designs for all the works required on the line were very creditably done. The delay, however, which had occurred in their preparation, was unsatisfactorily accounted for by Lieut. Bruce, and he was consequently remanded to his regiment by Government on the 19th May last, since which date the Department has been without a 1st Assistant,

Rs. 88,986.

Lieut. Bruce remanded to his Regiment.



14. Before leaving the Department, however, Lieut. Bruce had contrived to make a survey of the Jehoor Ghaut on the much traversed road between Nuggur and Aurungabad, which had been represented to be in a dangerous state, and a serious impediment to cart traffic. A sketch survey, remarkably well drawn, and accompanied by a Report, was accordingly despatched to the Military Board's Office on the 25th February last; and had Lieut. Bruce but shown as much alacrity in the previous performance of his duty as he did on this occasion, it is possible that he might have escaped the censure of the Military Board and the displeasure of Government.

Jehoor Ghaut.

15. In recounting the performances of the 2nd Assistants, it may be as well to adhere to the practice introduced by Major Peat, and hitherto observed by me, of classing them under distinct headings in connection with the lines of road respectively under their charge; but for the sake of perspicuity, and also with the view of shewing the greater importance that has been attached of late to works for the extension of irrigation and for supplying water to towns and villages, that part of my Report which relates to tanks, bunds, and wells, will appear under a separate head.

Performances of  
2nd Assistants.

### I. THE AGRA ROAD.

16. Lieutenant Scott still remains in charge of that portion of the line which lies between Colsette Bunder and the Thull Ghaut; and the expenditure during the past year has been Rupees nine thousand and seventy. The state of the road appeared to me to have been much improved since my inspection of the previous year; most of it was really good, and considering the inequalities of the ground between Kurdee and Kusara, the immense traffic on the road, and the rough treatment it experiences at the hands of cart-drivers, it might afford matter for surprise how a moorum surface lasts so well.

Between Colsetta  
Bunder and Thull  
Ghaut.

State and ex-  
penditure.

Unfair treatment  
of Road.

17. When the opium traffic is at its height, strings of unwieldy and greatly over-loaded carts may be seen descending the steep dips below the ghaut, their wheels locked, and acting like ploughs on the surface of the road; and as if they were not sufficient to destroy it, trunks of trees are frequently attached to the rear of the carts, and with men seated thereon, are trailed after them as drags or make-weights. Such treatment as this is surely sufficient to damage the best of roads: that it should injure a moorum road needs not to be explained.

Proposed new  
line between Kus-  
sara and Kurdee.

18. The survey of Lieut. North's proposed new line of road between Kurdee and Kussara was sent in to the Military Board on the 22nd October last, and the probable cost, roughly estimated by that Officer at Rupees one lack, thirty-three thousand, three hundred and ninety-one, was sanctioned by the Supreme Government, as communicated in Mr. Secretary Escombe's Letter of the 18th March last, No. 712. The new line only deviates from the old one where the dips are at present too steep for traffic, and no slope is to exceed one in nineteen.

Proposed means  
of carrying it on.

19. The preparation of the several designs for the works required on the new line, as well as the actual commencement of the road itself, have been temporarily postponed till arrangements could be made for rendering an Officer available for the duty. At the date of receiving the intimation of sanction, Lieut. Scott was too much occupied with other work to admit of my recommending him for the performance of this important duty; but on the opening of the season, I am of opinion that he might be advantageously employed thereon, the more especially as the proposed new line is conveniently situated for the purpose, and as the experience which that Officer has now had in the duties of the Road and Tank Department will prove of some service in the performance of this.

Thull Ghaut new  
Road. Expendi-  
ture.

20. The portion of the new road at the bottom of the Thull Ghaut, which in my last Report was stated to have

been commenced in the month of December 1845, was completed by Lieutenant Chapman on the 27th of December last, when, in conjunction with the portion previously finished, it was opened to the public, and has since been in constant use. The expenditure on the entire completed piece of road, which is in length a mile and a half, amounted to Rupees seventy thousand, two hundred, and fifty-six.

Rs. 70,256.

21. The portion of road which was first completed was formed with an inward slope, the outer edge having been made a foot higher than the inner, and the surface a plane instead of a curve. The road at the bottom of the ghaut has been constructed with the usual slight convexity of surface, and will not only therefore be much easier for draft, but will also, I think, be more evenly used throughout its entire breadth than the other, and will consequently suffer less from the heavy traffic that passes over it.

22. On the completion of the lower portion, the encampment of labourers, with store-house and work-shop, were removed with all expedition to the top of the ghaut, the cuttings on which were commenced in the month of January, and carried on with as much celerity as the paucity of labourers in that neighbourhood would admit of. Up to the 30th April last, 4,200 running feet of side cutting had been completed to the full width of roadway, and 1157 feet completed to average widths of 10, 12, and 18 feet respectively.

23. The estimates for the completion of the road over the ghaut were despatched from this Office, after examination and amendment, in the month of September last, the total amount being Rupees one lack, forty-eight thousand, three hundred and ninety-one, which was sanctioned by Government on the 12th of the following month. The parapet wall which has been built along the edge of certain portions of the roadway already completed, and which was described in the 18th para. of my Report for

Ghaut estimate  
and plans.

Rs. 148,391.

1845 | 46, having been considered unnecessarily expensive by the Military Board, a more simple style of construction has been provided for in the estimate, viz. dry rubble.

Road between Thull Ghaut and Nassick, and between Nassick and Chandore. State and expenditure.

24 The road from the top of the Thull Ghaut to Nassick is in much the same state as it was last year, slightly improved in some places, a little fallen off in others; but from Nassick to Chandore, a very decided change for the better was observable at the date of my last visit, and it would have been difficult to find a half mile in any portion of its length that could have been justly characterized as in bad, or even in indifferent, order. Considering the state that I found it in on my first inspection, this improvement is very creditable to the Officer in charge. The expenditure on the whole during the past year, from the top of the Thull Ghaut to the bottom of the Chandore Ghaut, has amounted to Rupees twelve thousand nine hundred and thirty-six.

Rs. 12,936.

Flying Bridge at Kokungaom.

25. The ferry boat on the Radwa river at Kokungaom has been converted into a flying bridge by the addition of standards and ropes: ramps have also been cut through the banks for landing places, and approaches from the main road have been constructed, the whole at a cost of Rupees five hundred and sixty-five.

Rs. 565.

Proposed Bridge at Pimpulgaom. Lieut. Cowper, of the Engineers, appointed to the Department and engaged in estimating for other improvements required on the line.

26. A Bridge of 60 feet span has been designed by Lieutenant Chapman for the Pharasherry river at Pimpulgaom, where the Post is occasionally delayed as much as 8 hours, and an estimate has been laid before the Military Board; but as some modification in the centering appeared desirable, with a view to diminish the cost, a month or two will probably elapse before the proposed work can receive the sanction of Government. The small rivers at Wozur and Argaum require also to be bridged as recommended in my Report of last year, and the requisite plans and estimates are under preparation by Lieutenant Cowper of the Engineers, who has been attached to this Department for the purpose of estimating for these and

other improvements between Egutpoora and Chandore, which the Post Master General has in a late report to Government represented to be advisable.

## II. MAIL ROAD.

27. Captain Pruett and Lieutenant Cowper still retain charge of the portions below and above the ghaut respectively; the expenditure for repairs under the former having amounted to Rupees five thousand nine hundred and seventy-three, and under the latter to Rupees fifteen thousand five hundred and forty. The three years' contract with Venkuttish Narrain for the repair of the mail road under Lieutenant Cowper having terminated on the 30th April last, fresh tenders were invited for the performance of the repairs for the ensuing season, and the lowest tender having come from Nunderam Soonderjee, a man of character and substance, has been approved of and accepted.

Below the Bhoore Ghaut.  
Above do.  
Expenditure.  
Rs. 5,973.  
Rs. 15,540.

28. The raising of the Panwell Bunder, as well as the construction of masonry rivetments to protect it from the tide, have been carried on during the past season, and are now completed at a contract cost of Rupees five thousand seven hundred and twenty-five; but I regret to say, that the contractor, Govind bin Hurry, has given a deal of trouble, by frequent attempts to introduce bad work, and that it has been necessary to resort to the most stringent remedies the terms of the agreement allowed of in order to prevent his succeeding in these fraudulent practices.

Panwell Bunder.  
...  
Rs. 5,725.

29. The sum required for bridging and metalling the New Akoordie line, amounting in the aggregate to Rupees twenty-eight thousand four hundred and twenty-six, was sanctioned by the Court of Directors under date the 25th November last, and the works are now in progress by contract under the orders of Lieutenant Cowper. The entire cost of this piece of road, which is  $8\frac{1}{2}$  miles in length, will on completion have amounted to Rupees

Completion of new Akoordie line sanctioned by the Hon'ble Court.  
Rs. 28,426.

Rs. 46,858.  
Rs. 5,512.

forty-six thousand eight hundred and fifty-eight, or five thousand five hundred and twelve Rupees per mile, which may be accounted a rather moderate rate than otherwise for a metalled and perfect road in the Deccan, considering that the country is almost always either undulating, and intersected by numerous watercourses, or else composed of black soil where the foundations of a road are an unavoidably expensive item.

Probable date of completion and saving in annual expenditure for repairs.

30. The contractor is not bound to finish the work before the 31st July 1848, but it is an object of importance to have the new line open by the commencement of the monsoon, every exertion is being made, and will continue to be made, to prevent any work remaining on hand after the beginning of June. As the Ounde and Panowlie and Bhojapoor lines will be abandoned on the completion of the Akoordie road, the saving in road repairs will amount to no less than Rupees four thousand eight hundred per annum.

Rs. 4800.

Junction line with Seeroor road by Holkar bridge.

31. A short line of junction between the Dapoorie and the Holkar Bridge was at the same time sanctioned by the Hon'ble Court at an estimated cost of Rupees seven thousand eight hundred and twenty-seven; but as it appeared likely that a contractor might be found to do the work for a smaller amount, tenders were invited, and the lowest, amounting to Rupees six thousand three hundred and fifty, has been accepted. This short piece of road is intended to perfect the communication between Bombay and Nuggur, when the Bhojapoor line shall have been abandoned; but it is believed, that during the fair season the greater portion of the traffic between those places will proceed by Poona and Kurradee.

Rs. 7827.

Rs. 6350.

Culverts and drains required between Poona and Khundalla.

32. The plans and estimates which were alluded to in my last Report as being under preparation by Lieutenant Cowper for a number of small bridges and drains required on the Mail road between the Western extremity of the Akoordie new road and Khundalla, were despatched to the Military Board Office on the

31st of May last, the aggregate of the estimate amounting to Rupees thirty-one thousand two hundred and twenty-four, and the number of works provided for being fifty-three. A few of the streams for which culverts or drains of several water-ways have been designed, are from four to two feet deep in the monsoon, and form an occasional obstruction to the Post, but the generality are small, and are chiefly to be objected to as being injurious to the road.

Rs. 31224.

33. Plans and estimates prepared by the same Officer have also been sent in for widening that part of the Mail road which lies between Dapoorie Bridge and the point of junction with the Seeroor road, and the maximum width of which is at present only 17 feet. These estimates were originally called for by Major Peat, who foresaw the necessity that would exist for making this portion of road of a convenient width as soon as the completion of the Akoordie road should have thrown it open to all the traffic between Bombay and Poona. The length to be widened is 2 miles and 581 yards, and the estimated cost of making it uniformly 25 feet broad, inclusive of the cost of drains, amounts to Rupees ten thousand five hundred and sixty-seven.

Widening the road through Kirkee.

### III. ROAD BETWEEN POONA AND NUGGUR.

34. Mr. Scott is still in charge of this line of road, and the expenditure on repairs during the past year has amounted to Rupees eight thousand two hundred and twenty-three. On the whole it may be said to have been generally improved by the trouble that was bestowed on it last monsoon; and in some places, especially near Soopa, where the moorum is of first-rate quality, it is equal in smoothness of surface and almost in hardness to the best parts of the Mail road.

State of the road and expenditure.

Rs. 8223.

35. The two bridges of stone and chunam masonry which in my last Report were stated to have been sanctioned by Government for the nullahs at Kondapoor

Two new stone bridges.

Failure of mud centering.

Rs. 8995.

Rs. 4305.

and Wusudwadee, the one at a contract cost of Rupees six thousand nine hundred and ninety-five, and the other at a contract cost of Rupees four thousand three hundred and five, were commenced in the month of October last under the orders of Mr. Scott. The progress of both works was very satisfactory up to the month of May last, when an unseasonable and totally unexpected fall of rain caused a sudden rise in the nullah at Kondapoor, which produced a slight sinking in the mud centerings, and thus caused the arches of the bridge then being turned to shew cracks between their haunches and the skewbacks of the pier. No alternative presented itself but to pull down the damaged arches and the incorrect centerings, and as the monsoon was at hand to postpone further operations till the re-opening of the fair season. Of course the contractor was in no wise to blame, as the accident was one over which he had no control, and which could not have been foreseen. The nullah at Wusudwadee, though distant only 3 miles from Kondapoor, was neither flooded nor in any way affected by the fall of rain alluded to, and the progress of the bridge advanced therefore without interruption.

Shikarpoor bridge.

Rs. 309.

36. The retaining walls of the Eastern approach of the Shikarpoor Bridge, which are constructed of dry stone squared and coursed, and which, adjoining the abutments, are no less than 25 feet in height, began to bulge and give way in the latter end of 1845. A portion which had actually tumbled down was re-built by Mr. Scott in the month of July of last year, at an outlay of Rupees three hundred and nine, but a much larger expenditure will be requisite before the security of the entire approach can be ensured. The bridge was built in the year 1842 | 43, under the orders of Lieutenant Hart of the Engineers, and the fault of construction in the retaining walls appears to lie in want of bearing in the facing stones, and in the looseness of the backing.

Seena river.  
Best way of bridging it.

37. Having very attentively examined the bed of the Seena river when last at Nuggur, it appeared to me that



if piles could be forced to penetrate the hard stratum below the gravel of which the bed consists to the depth of a couple of feet or so, the style of bridge best suited to the locality, and incomparably the cheapest, would be a wooden one, and the Military Board have sanctioned an experiment being made to ascertain this point. Though styled a river, and in point of breadth almost deserving of the name, being 333 feet across, the extreme height of its banks does not exceed 4 feet, and as the layer of gravel which forms its bed is 12 or 13 feet in depth, a masonry bridge, with foundations springing from the rocky stratum, would be enormously expensive, considering the ordinary shallowness and insignificance of the stream. Were the river freshes confined indeed within its proper channel, it might be almost doubted whether a bridge of any sort would be absolutely required, but flooded as the banks occasionally are to a considerable distance, the stream is at times impassable.

38. The wire ropes which were substituted last monsoon in lieu of the usual hempen haulers for the flying bridges at Koregaon and Poona, are likely to prove far more economical than the latter; and with the improved species of traverser which has been introduced instead of the ordinary swinging block, the passage of each raft across the river is reported by the boatmen in charge of the flying bridges to be effected with much greater celerity than formerly. The only fault or failing in the wire rope that has yet been discovered, is its liability to oxidation, but this may possibly be remedied by an annual coating of tar.

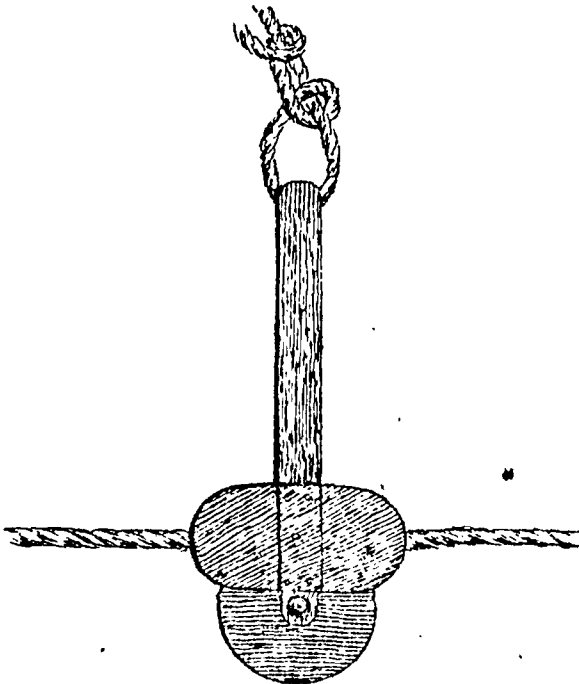
Wire ropes for flying bridges.  
Their efficiency.

39. The new traverser just alluded to, the efficiency of which was stated in my last year's Report to be then under trial, has these advantages over the old block: 1st—that it is but very slightly worn away during a season by the friction of the rope, instead of being rendered useless as the block was in the course of a month; 2dly—that it can never be top-heavy as the blocks frequently were, and

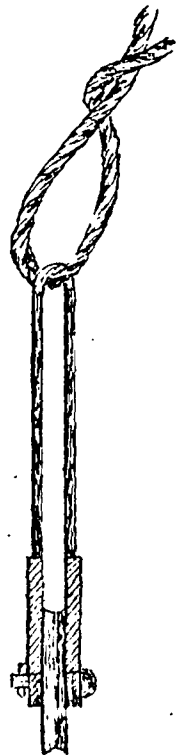
Substitute for swinging block.

that it therefore traverses more freely; 3dly—that it is shipped and unshipped simply by the removal and replacing of the pin of the sheave, while the fixing or unfixing of a block necessitated the unfastening and refastening of the rope itself; and 4thly—that it costs seven Rupees less in the construction. As it is not likely, however, that the mere detailing of its advantages will convey a correct idea of this simple contrivance, a sketch is subjoined, which will obviate any necessity for further description. The sheaves or rollers, it may be observed, are case hardened exteriorly, and the loops or shanks are of wrought iron.

Rupees 7.



*Side view*



*Front view*

40. The new line between Poona and Wangoolie *viâ* Kurradee, I have already alluded to in mentioning Lieut. Bruce's performances, but as it is not improbable that at some future day this may be the only established line of communication towards Nuggur, I may here take the opportunity of stating, that the construction of a bridge across the Moota Moola at Kurradee having been deemed by yourself of greater primary importance than the completion of a road without the bridge, the Military Board have directed the subject to be taken into consideration.

Proposed new line between Poona and Wangoolie.

41. The flying bridge which plied opposite the town, and which became useless on the completion of the Poona bridge, has been removed to Kurradee, where it is now being established at a contract cost of Rupees one thousand nine hundred and thirty-one. The chief causes of this work being so expensive are, 1st—the extensive repairs required by the two boats and other woodwork of the raft, and 2ndly—the great amount of rock-cutting which was found to be requisite at the new site in the formation of Ramps.

Removal of Poona flying bridge to Kurradee.

Rs. 1,931.

#### IV. ROAD BETWEEN POONA AND NEERA BRIDGE.

42. This road is still under charge of Mr. Scott, and has been repaired during the past season at a cost of Rupees two thousand six hundred and forty-six, which has been laid out with great advantage and considerably improved its condition. The Bapdeo Ghaut will always be a formidable obstacle to traffic, which is not however so important on this line as to render the construction of a new ghaut advisable.

State and expenditure.

Rs. 2,646.

Bapdeo Ghaut.

43. On the requisition of the Post Master of the Deccan, an estimate has been prepared and submitted, amounting to Rupees five hundred and thirty-nine, for the erection of huts at five stages between Poona and Jeejoorie, for the use of the dawk runners on this line.

Huts for dawk runners.

Rupees 539.

V. ROAD BETWEEN NAGOTNA AND  
MAHABLESHWUR.

- State and ex-  
penditure.  
Rupees 5025.
44. This road has been repaired by contract under Captain Pruen, at an expense of Rupees five thousand and twenty-five, and is in fair order, and but little damaged by Mr. Baretto's Phaetons having been re-established between Mhar and Nagotna.
- Ceiling to bungalow at Indapoor.  
Removal of rocks in Nagotna river.  
Rupees 101.
45. The only works which have been performed on this line during the past season are of a trifling nature, one being a numda ceiling to the travellers' bungalow at Indapoor, at a cost of Rupees one hundred and one; and the other, the removal by blasting of certain rocks which impeded the navigation of the Nagotna river, at a cost of Rupees thirty-six.
- Rupees 36.

VI. CROSS ROADS IN THE POONA  
COLLECTORATE.

- Expenditure.  
Portion of road now used as Mail Road will revert to its former use of cross road.  
Rupees 4,348.
46. The roads which are classed under this head, and which are in length  $54\frac{3}{4}$  miles, have been repaired during the past season at an aggregate cost of Rupees four thousand three hundred and forty-eight. The portion of road which connects the Dapoorie bridge with the Bhojapoor road, which is *2 m. 5 f. 180 yds.* in length, and which has heretofore been repaired as part of the Mail road at a cost per mile of Rupees three hundred and three and a half, will revert to its former use as part of the Narriangaum road on the completion of the Akoor-die new line, and will be repaired like the rest of that road with moorum instead of metal, at an annual expense of ninety-eight Rupees per mile.
- Rupees 303½.
- Rupees 98.

VII. CROSS ROADS IN THE NUGGUR  
COLLECTORATE.

47. The repairs to these roads, which still remain under charge of Mr. Scott, have been made during the past season at a cost of Rupees seven hundred and thirty-seven, and their state remains the same as at the date of my last Report.
- Rupees 737.

VIII. CROSS ROADS IN THE NASSICK  
SUB-COLLECTORATE.

48. The outlay on these roads for the past season amounts to Rupees one thousand six hundred and thirty-nine, and they are in tolerable order.

State and expenditure.  
Rupees 1,639.

49. A bridge over a large nullah on the road between Nassick and Sinnur, and about a mile distant from the former place, was partially swept away by a heavy flood in the month of June of last year, and was repaired at a cost of Rupees two hundred and ninety-seven, and the Nassurdy Causeway was also slightly injured on the same occasion. No damage would in my opinion have been sustained by either of those works, had their style of construction been as good as it ought to have been.

Injury to a bridge from last monsoon flood.  
Rupees 297.

IX. CROSS ROADS IN THE TANNAH  
COLLECTORATE.

50. The aggregate expenditure on these roads for the past season amounts to Rupees three thousand five hundred and twenty-two. The Collector of Continental Customs and Excise, under date the 29th August last, suggested the advisability of widening and raising certain portions of the road between Khopoolie and Dhurm Tur, and a Report has been received from Captain Pruen on the subject, which is now under consideration.

Expenditure.  
Proposed improvement.  
Rupees 3,522.

51. The Collector of Customs at the same time recommended the construction of branch roads to the Salt works at Wansee and Oomarda, which are situated, the former at three miles, and the latter at one mile, from the main road; but it appeared to Captain Pruen, after an examination of the country, that the work would be more expensive than the occasion called for, and that it would be sufficient to bridge two salt-water creeks, which, after the middle of the month of November, are the only impediments that exist to traffic. Plans and estimates for these works are consequently in course of preparation.

Two salt-water creeks proposed to be bridged near Penn.

X. CROSS ROADS IN THE RŪTNAGHERRY  
COLLECTORATE.

State and expenditure. 52. The roads in the above Collectorate have been repaired during the past season at a cost of Rupees one thousand one hundred and sixty-nine, and are represented to be in good order.

Rupees 1,169.

XI. ROADS IN SALSETTE.

State and expenditure. 53. These roads are still under Lieutenant Mungavin, and have been repaired during the past season at a cost of Rupees eleven thousand seven hundred and thirty-one. Though a trifle better than they were, they have not been improved to the extent that I anticipated at the date of my last Report; and I was informed by Lieutenant Mungavin, that during last rains the iron rollers, which have been found so effective elsewhere, had but little effect on the Salsette roads. The only way in which I can account for this is under the supposition, that the roads have been so deteriorated for some years past by the admixture of bad moorum and earth with the metal, that it is now impossible to get a thin layer of the latter material to form a compact surface.

Rupees 11,731.

New line of road in Salsette under construction by subsidiary Jail. 54. The new line of road between Coorla and the twentieth mile-stone *viâ* Bhandoop, which was stated in my last Report to have been sanctioned by the Government of India, and about to be undertaken by a Subsidiary Jail, was not commenced till the 16th of December last, in consequence of the delay that occurred in supplying guards, by which means six weeks of the working season were irretrievably lost. When once commenced, however, the work proceeded with rapidity, and up to the end of April last, a length of nearly four miles had been completed, inclusive of bridges and cross-drains, with the exception of the parapets.

Do. Representation by Framjee Cowasjee, Esq. regarding his estate of Poway. 55. In the month of February last, when some progress had been already made, a representation which had been addressed to Government by Framjee Cowasjee,

Esquire, was received in this Office, to the effect that the value of his estate of Poway would be very much deteriorated by the abandonment of the old and the construction of the new road, the former having passed through the estate, while the latter would merely skirt it; and it was further attempted to be shewn, that a shorter and a better line than the Bhandoop one might be carried through another part of Poway, with mutual advantage to the public and the proprietor.

56. In consequence of this representation, instructions were received by the Military Board from Government, to cause Framjee Cowasjee's new line to be surveyed and levelled; but as this duty had already been performed by Captain Ash when engaged on the Vehar Khind survey, whose field books were in my Office, nothing was easier than to plot the survey, and lay down the longitudinal section on paper with accuracy. This was accordingly done, and in company with a detailed Report, which a careful inspection of the ground had enabled me to prepare, the survey and section were submitted to the Military Board in the month of March, the whole plainly proving, that Captain Crawford's Bhandoop line was, in all the essential characteristics of a good road, superior to the Poway one. It was better watered, better wooded, shorter, and more level, and the Government in consequence decided, that it should be carried out as originally contemplated; but with the view of preventing any injury to Framjee Cowasjee's estate, instructions were subsequently issued by Government, that on the completion of the new line a branch road should be constructed connecting it with Poway, and the necessary sketch is now under preparation by Lieutenant Mungavin.

Superiority of  
Captain Crawford's  
Bhandoop line,  
over Framjee  
Cowasjee's Poway  
line.

57. It was originally intended, and instructions were given to that effect by the Military Board, that the accounts connected with the cost of the Subsidiary Jail should be so carefully kept, that the relative expense of convict and free labour in the construction of roads in

Cause of extra  
expense on account  
of present Subsidi-  
ary Jail.

this Country should be satisfactorily determined. This object, I need hardly say, has been most carefully kept in view; but I am inclined to believe, that the result of the experiment will be less favourable to the employment of convicts than it would have been had no delays been permitted to occur; and this much I think is clear, that a Subsidiary Jail would be employed to much greater comparative advantage on a line of work that could be completed in one season, than on an undertaking of greater magnitude, where more than one season would be required; for the contingent expenses incurred on account of guards and establishment during the monsoon, when there is no equivalent in the shape of work, must make a material addition to the debit side of the Jail account. \*

Bridge undercon-  
struction at Erla  
Parla.

Failure of mud  
centerings.

58. The proposed new bridge at Erla Parla, which was stated in my last Report to have been then estimated for, was commenced by contract under the orders of Lieutenant Mungavin in the month of February last, and progressed fairly and satisfactorily till the beginning of June, when the self-same cause which proved so injurious to the centerings and arches of the bridge at Kondapoor on the Seroor road, had a similar effect on the work at Erla Parla. A heavy and unlooked for fall of rain caused one of the centerings to sink, and the arch to crack, so that I have been obliged to direct Lieutenant Mungavin to see that the contractor re-constructs it on a correct centering.

Advantage and  
defects of mud cen-  
terings.

59. In both cases the centerings were of mud and rubble, a style of construction which is in so far preferable to wood, that it is much cheaper, and more expeditiously carried on; but, as will have been seen by the instances now brought to notice, it is not to be relied on in wet weather, and becomes decidedly dangerous as the rains approach. Mud centerings ought never, therefore, to be used, except in cases where there is a certain prospect of the arches being completed, and the mortar set, before the usual period of the first monsoon showers.



## XII. POONA AND SHOLAPOOR ROADS.

60. The piece of metalled road leading out of the town of Poona in the direction of Sholapoor, is 2m. 3f. 200y. in length, and has been repaired by Mr. Scott during the past season at a cost of Rupees six hundred and thirty-one. That part of it which is beyond the camp having been but recently completed, needed but very little re-metalling, and thus the average cost per mile appears somewhat small, but during the current year it will more nearly approximate to the usual charge for other metalled roads under this Department.

Portion leading out of Poona.

Rupees 631.

61. That portion of the Poona and Sholapoor Road which is now under construction between Patus and Indapoor—a distance of 44 miles and 6 furlongs—has been expeditiously carried on, since the date of my last Report, by Mr. Sub-Conductor Armitstead. On the 30th April of last year, 9 miles and six furlongs had been trenched and raised with moorum; on the 30th April of the present year, 43 miles and 5 furlongs had been trenched and raised, 13 miles cross-drained, 17 miles curbed, and 7 miles completely finished. On the portion cross-drained, 1 small bridge, 3 culverts, and 66 drains of sorts, had been constructed. The entire expenditure had amounted to Rupees one lack, forty-two thousand, two hundred and eighty-four, out of which sum Rupees one lack, twenty-three thousand two hundred and eight, had gone solely on labour and its trifling proportion of superintendence.

New road under construction between Patus and Indapoor.

Progress and expenditure.

Rs. 1,42,284.

Rs. 1,23,208.

62. An estimate for the completion of the road and all the works required thereon, accompanied by appropriate and well executed designs, was received from Mr. Armitstead in February last, and forwarded to the Military Board on the 16th of that month. It provided for all work that remained to be performed on the first day of the present year, and amounted to Rupees one lack, thirty-one thousand six hundred and forty-three; so that as the expenditure up to the close of last year had

Estimated cost of completion.

Rs. 1,31,643.

Rs. 1,22,985. amounted to Rupees one lack, twenty-two thousand, nine hundred and eighty-five, the total probable cost for the entire piece of road between Patas and Indapoor will be Rupees two lacks, fifty-four thousand, six hundred and eighty-eight, or Rupees five thousand, six hundred and ninety per mile.

Rs. 2,54,628.

Rupees 5,690.

Style of work described.

63. After visiting Indapoor in November last, and carefully examining the works in progress, I was enabled to submit a very satisfactory account of Mr. Armitstead's proceedings to the Military Board; such deviations as had been made from the old track appeared to me judicious, and the work of every description was excellent. The masonry of the culverts and drains is composed of hammer dressed, or rough cut, stone and chunam, and the workmanship is inferior to none that I have seen in this Presidency. The curb stones are of an almost uniform size, and of the best basalt, varying not more than from 10" x 10" x 18" to 9" x 9" x 15"; and should any objection be made, either to these or to the masonry, on the score of their being too good or too expensive, I have only to mention, that good as they are, the curb stones only cost three and a quarter Rupees per 100 running feet; and that excellent as the masonry is, a culvert of 3 arches, each of 5 feet span, is completed for the moderate sum of Rupees six hundred and forty-seven.

Rupees 34.

Rupees 647.

Mode of proceeding in constructing the road, with cause.

64. This road, as I mentioned in my last Report, was undertaken for the sake of affording employment to a distressed population; and as those who sought relief were either cultivators out of employ, or the Mhars of the surrounding villages, unmixed with builders or other artificers, it was of course necessary, with the view of turning their physical strength to the best account, to set them to work on what required the least teaching, *i. e.* the trenching and raising of the roadway.

Proposed mode of proceeding in opening a new line of communication,

65. Thus it is, that the entire raising of 44 miles was almost completed before a single bridge or drain had been commenced; but under other circumstances, where

choice should be the guide and not necessity, the system which you have before now advocated is the one that would be followed; and the passage of such rivers and streams as were calculated to impede traffic, would be the first step to be accomplished in opening a new line of communication. The Military Board, indeed, guided by the same views, have already instructed me to send in rough estimates of the cost of bridging the remainder of the Sholapoor Road.

### XIII. NAGPOOR DAWK LINE.

66. Captain Dennis still retains charge of the line of works between Nuggur and the Wurda River, and the expenditure during the past season in repairing and renewing old works amounts to Rupees ten thousand three hundred and six.

Expenditure.

Rupees 10,306.

67. Delays on this line appear now to be of rare occurrence, instead of great frequency, as was the case some few years back; and it may be safely inferred, therefore, that rude and unstable as many of the bridges and other constructions are, they are yet moderately efficient so long as they last.

Fewer delays than formerly.

68. A sample of the rope suspension bridge, which it was proposed at the date of my last Report to substitute for flying bridges over the large nullahs on this line, was completed in the month of July of last year by Captain Dennis, who reported favourably of its utility and suitability for the dawk runners or foot passengers; but he at the same time gave it as his opinion, that great difficulty would be experienced in crossing the horses, who would naturally take alarm at the oscillating motion of the foot way. This opinion was undoubtedly well founded, for the bridges were only designed with the view to afford a safe and speedy passage to the men themselves, for which the flying bridges had been so ill-adapted.

Sample of rope suspension bridge completed in last monsoon.

69. As it did not appear impossible, however, to make such improvements in the construction and sub-

Possibility of adapting them to the passage of horses.

stantiality of bridges of this description as would admit of horses crossing over without difficulty or fear, an experiment is about to be tried with wire-ropes and a firm flooring, protected on either side by a light railing.

Proposed flying bridge at Toka. 70. The ferry across the Godavery at Toka has been transferred to the charge of Captain Dennis from that of Mr. Scott, as proposed in my Report of last year, and, on the recommendation of the former Officer, is about to be converted into a flying bridge, for which the raft which was constructed by this Department last season will answer the purpose very well. As no flying bridge exists on this side of India of so great a span as this will be, the standards will require to be of unusual height and strength, and the rope it is intended shall be of wire  $3\frac{1}{2}$ " in circumference, which is equal in strength to an  $8\frac{1}{4}$ " hempen hawser.

#### XIV. WORKS OFF THE REGULAR LINES OF ROAD.

New bridge at Poona. 71. The Poona bridge, which was commenced on a design of Major Peat's in the month of November 1844, was completed by contract under Lieutenant Cowper's orders in December last, at a total cost of Rupees twenty-eight thousand two hundred and twelve, out of which the inhabitants of the Town bore Rupees ten thousand three hundred and eighty-two. To this outlay has subsequently been added the sum of Rupees one thousand three hundred and fifty-two, being the calculated amount of expense the contractor was put to in pulling down and removing the centerings, and the consequent amount of compensation adjudged by Government. The entire cost of the bridge, therefore, from first to last, has amounted to Rupees twenty-nine thousand five hundred and sixty-four, and no one can deny that it is extremely moderate.

Rs. 28,212.

Rs. 10,382.

Rs. 1,352.

Rs. 29,564.

Gokhirwa bridge, excess upon the estimate. 72. The partial re-construction and improvement of the Gokhirwa Bridge near Bassein, which was stated in my last Report to have been then estimated for and

sanctioned by Government at a cost of Rupees five thousand seven hundred and two, has also been carried on during the past season, and must ere this have been completed: but numerous circumstances have combined to render an excess upon the estimate unavoidable. In addition to the fact of building materials having turned out to be much dearer in that neighbourhood than was originally calculated on, it was found, on dismantling the bridge, that the timbers were in such a state as to preclude the possibility of their being used to a tenth of the extent that was allowed for; and as a still further cause of increased expenditure, the progress of the work was much retarded by the tides, by which at the springs the piers and abutments were covered for several days. A supplementary estimate, therefore, became unavoidable, and Government have accordingly sanctioned an additional sum of Rupees nine hundred and seventy-six.

Rs. 5,702.

Rs. 976.

73. Lieutenant Scott has also constructed a flight of steps to the Jetty at Callian, and repaired the Mamlutdar's Cutcherry at the same place, the former at a cost of Rupees forty-three, and the latter at a cost of Rupees two hundred and twenty-eight; and the same Officer has likewise finished the extensive repairs which were required to the Kusseylee Bunder, and which, as stated in my last Report, has been postponed on account of the rains, the total expense having amounted to Rupees one thousand seven hundred and eighty-two.

Works at Callian and Kusseylee Bunder.

Rupees 43.

Rupees 1,782.

74. Lieutenant Mungavin completed the boat intended for the ferry at Oomergaom, at a cost of Rupees five hundred and seventy-one, and despatched it to that place in the month of January last.

Oomergaom ferry Boat.

Rupees 571.

75. An estimate for a Mamlutdar's Cutcherry at Oorun in Carrinja was sanctioned by Government under date the 30th April last, for Rupees one thousand three hundred and sixty-seven, and will be commenced by contract under the orders of Captain Pruen, on the opening of the season.

Cutcherry at Oorun.

Rupees 1,367.

Cutcherry and  
Bungalow at Kelwa  
Mahim and Bas-  
sein.

Rupees 4,914.

Rupees 5,400.

76. Estimates, accompanied by plans, were submitted to the Military Board in the months of October and February last, for an Assistant Collector's Cutcherry at Kelwa Mahim, and for a Bungalow for one of the Un-covenanted Assistants of the Collector of Continental Customs and Excise at Bassein, the former amounting to Rupees four thousand nine hundred and fourteen, and the latter to Rupees five thousand four hundred; but nothing has been communicated in regard to their sanction.

### XV. MILITARY BUILDINGS.

Regimental build-  
ings at Tannah.

Rupees 117.

Rupees 3,470.

Rupees 212.

Rupees 779.

77. The repairs to the Military Buildings at Tannah have been completed by Lieutenant Mungavin for Rupees one hundred and seventeen, and the same Officer has constructed four new pendalls, and improved two old ones, for the sum of Rupees three thousand four hundred and seventy, a saving of Rupees two hundred and twelve having been effected on the estimate for the repairs, and a saving of Rupees seven hundred and seventy-nine on the estimate for the new pendalls, the former in consequence of the reduction of work caused by the removal of the temporary pendalls, and the latter in consequence of the employment of convict labour.

New Hospital at  
Tannah.

Rs. 4,310.

78. Lieutenant Mungavin is also now engaged in building a Detachment Hospital at Tannah, 56½ feet in length by 18½ feet in breadth, with dispense rooms and out-offices, the estimates for which, amounting to Rupees four thousand three hundred and forty, were sanctioned by Government under date the 12th March last.

Two additional  
pendalls for Ghaut  
Light Infantry.  
Rs. 2,138.

79. An estimate prepared by Lieutenant Mungavin, amounting to Rupees two thousand one hundred and thirty-eight, and accompanied by a plan, was submitted to the Military Board in the month of May last, for two new pendalls for the use of the Detachment of Ghaut Light Infantry stationed at Tannah, but no intimation of sanction has yet been received in this Office.

80. The Regimental Buildings, which were stated to be in progress at Nassick at the date of my last Report, were completed under the orders of Lieutenant Chapman in the month of September last. The estimated and sanctioned amount was Rupees three thousand three hundred and sixty-six, but through the extreme carelessness and negligence of Sub-Conductor Viges, to whom the superintendence of the work had been entrusted by Lieutenant Chapman while himself otherwise engaged, this sum was exceeded by a very large amount. From Lieutenant Chapman's explanation of the business, it appeared that the estimate itself was deficient to the extent of Rupees four hundred and twenty-one, but independently of all the legitimate causes which could be assigned for an excess upon the sanctioned amount, Lieutenant Chapman discovered, on investigating the case, that there was an additional sum of Rupees one thousand one hundred and fifty expended, for which Mr. Viges was totally unable to account.

Buildings at Nassick.  
Heavy excess.  
Sub-Conductor Viges's misconduct.

Rs. 3,366.

Rs. 421.

Rs. 1,150.

81. That the Sub-Conductor did not appropriate the whole of this money to his own use was very clear, as certain sums were traceable into the possession of some of the Native subordinates, who absconded; that he took even a portion of it has not been proved, and may be doubted; but that the loss was entirely owing to the most gross negligence, enhanced by indulging in habits of intemperance, was unfortunately but too evident.

82. This, however, was not Mr. Viges's only breach of duty. He abstracted from the bag entrusted to his charge for the payment of the people employed on road repairs, the sum of Rupees two hundred and thirty, with which he liquidated a private debt. The fault was freely acknowledged, and it is possible Mr. Viges might have intended to re-place the money as soon as he was able; but it was perfectly clear, that a man who could be guilty of such neglect of duty and dishonesty was unfit for any situation of trust under Government; he was there-

Rs. 230.

fore removed from this Department, and remanded to his Corps as a 2nd Corporal.

Addition to build-  
ings at Nassick.  
Rs. 591.

83. Some additions to the buildings alluded to were sanctioned by Government in the month of January last, at a probable cost of Rupees five hundred and ninety-nine, and are now progressing towards completion.

#### XVI. TANKS, BUNDS, AND WELLS.

Extension of ir-  
rigation.

84. Though the energies of the Road and Tank Department have been directed to the accomplishment of more important undertakings than had ever previously engaged the attention of any branch of the Public Work Department under this Presidency, still it has furnished cause for complaints, and has been a source of regret to myself, that comparatively speaking, but little has been effected towards the extension of irrigation throughout the country by means of Tanks, Bunds, and Wells.

Conflicting in-  
terests.

85. To remedy this deficiency, the most strenuous efforts have been latterly made, but owing to the numerous difficulties which have been encountered; and the many conflicting interests which often have to be reconciled before a work can be undertaken, less progress has been made than could have been wished, though, on perusal of the following Report, I think it must be admitted that, as far as the Road and Tank Department is concerned, matters are in fair train towards effectual and speedy amendment.

Bunds construct-  
ed by former Go-  
vernments many of  
them easily repair-  
ed.

86. Before entering into particulars, however, I would request permission to say a word or two on the subject generally; and first, in regard to the policy and advantage of putting into an efficient state such of the old works which are to be found scattered throughout the country, as may now only need a few repairs to render them as productive to the revenue of the existing Government as they were to those of former times. Of these works, the most deserving of attention are the bunds and bundarras by means of which the land on either



bank of many rivers and rivulets was fertilized and rendered productive throughout the greater part of the year. To say what amount of profit would be yielded by the repair of each, would of course require the knowledge and experience of a Government Revenue Officer; but as far as rendering them efficient may be concerned, numerous are the instances in which a trifling expenditure, and a very small amount, of engineering skill, would suffice to secure the desired result; and surely, unless my judgment is greatly at fault, it would be but a common act of prudence to incur a small outlay in perfecting those ancient works, whose strength and substantiality have resisted the floods of possibly a century, and whose utility has been proved beyond a doubt, before we make attempts at constructing most costly and expensive new ones—attempts, moreover, which like others of recent date might chance to prove abortive, despite the amount of science and talent which would doubtless be brought into requisition.

87. With views such as these, it was my anxious wish to have had some fifty bunds in the Nassick Collectorate put into a state of efficiency; and as the Collector and the Superintendent of the Revenue Survey were both agreed as to the advisability of the measure, I proposed to the Military Board, under date the 11th August 1846, that a First Assistant of the Department should be employed in reporting on and estimating for the whole. This duty would have been in consequence performed by Captain Jacob long ere this, but for his untimely removal from the Department, to superintend the re-construction of the damaged portion of the Jamsetjee Bund at Poona; and as no other Officer's services have been available for the work, it still remains in abeyance.

Bunds in the Nassick Collectorate requiring repair.

88. Another remark which ought to precede my Report on the subject of works for irrigation is, that easy as it may appear at first sight to discover places where bunds might be constructed with effect, there are

Two essentials in the site of a bund.

two points to be considered and made to agree before any thing definite can be attempted ; for not only ought the locality selected to be free from all engineering difficulties, and to afford every facility for the construction of the proposed work, but it ought also to be so peculiarly situated as to render remuneration from increase of revenue a moral certainty. Many are the places where the eye of an Engineer might detect desirable sites for drains and bunds ; but few there are in comparison, where the Revenue Officer could see any prospect of a profitable return to Government.

Clearing out and  
improving the  
Ratraz Tank.

89. The most expensive project which has been contemplated during the past year, in connection with the subject of an increased supply of water, is that which has already been briefly alluded to in the 11th para. of this Report, viz. the clearing out and improvement of the Ratraz Tank. The attention of this Department has for some years past been directed to the advisability of removing the earth which has been gradually accumulating for the last half century in the bed of the tank ; and a proposition was made by Lieut. Hart, while a Second Assistant in the Department, to make openings in the bund through which the mud, after having been stirred up by labourers, might be forcibly carried by the rush of water in the rains. This suggestion was fortunately objected to by the Honorable Court of Directors in their letter to Government of the 21st May 1844, and directions were given, that a very careful survey might be made of the nullah which supplies the tank, with the view of devising some remedy for the prevention of further accumulation in its bed. A most accurate survey was accordingly made by Captain Jacob, the place was carefully examined by both of us on more than one occasion, and the means of effecting the desired object were fully discussed ; the result of which was, that an estimate was prepared and sent in to the Military Board on the 26th December last, accompanied by a survey and sections, for the excavation and removal of a mass of

earth whose solid contents amounted to 2,900,000 cubic feet, and for the re-opening of a channel and repair of a bund, which had been originally constructed with the intention of carrying off all earthy matter, and preventing any deposit in the tank, but which had fallen into complete neglect and disuse. The probable cost of these several improvements amounted to Rupees forty-six thousand seven hundred and sixty-five; and the additional quantity of water which Captain Jacob calculated would be available for the inhabitants of Poona, amounted to a 30 days' supply.

Rs. 46,765.

Proposed aqueduct at Yeola on the Nuggur and Malligaum Road.

Rs. 29,972.

90. Another project of some importance which has engaged the attention of this Department is that which is alluded to in the 4th para. of the Superintending Engineer's Report for 1844 | 45, and which at that period was affording some employment in estimating and designing to the Executive Engineer of Nuggur. I mean the proposed aqueduct at Yeola, for the supply of the town with water. It appears that an estimate, amounting to Rupees twenty-nine thousand nine hundred and seventy-two, had been prepared by the Executive Engineer under date the 9th February 1846, but that the project had been temporarily abandoned in consequence of the inhabitants of the town evincing a disinclination to pay the amount of subscription originally agreed on by them. At the recommendation of the Revenue Commissioner, however, the project was revived by this Department, and it was intended that Captain Jacob should have been deputed to examine the locality, and prepare fresh estimates, if the proposed means of supply appeared likely to prove sufficient; but Captain Jacob's employment on the special duty already alluded to prevented this arrangement, and I contrived, therefore, during my tour of inspection, to visit Yeola and examine the place myself.

91. The complaint regarding the scarcity of water I found to be but too well founded. The wells in the town and its immediate vicinity, which are the only available

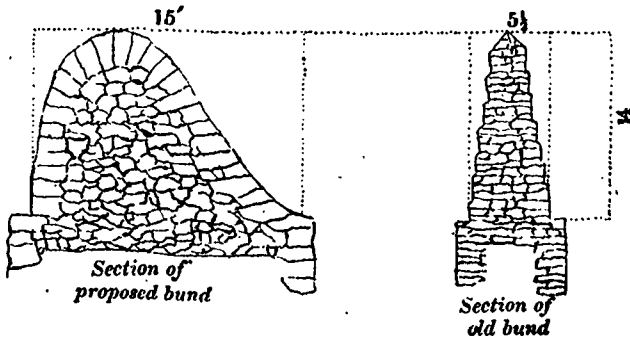
sources of supply, though numerous, are for the most part of little use, and many of them, even in the month of January, were perfectly dry. The Panmulla well, from which it was proposed to supply the town, and which is about half a mile distant from the walls, is the only favorable exception that can be pointed out; and as it is fortunately fed by a very strong spring, it yields a moderate supply to a great proportion of the towns-people during the hot weather. The depth of water at the time of my visit was eleven feet, and the rate of supply, on being carefully tested, was found to amount to 2,800 gallons per hour. This, though of course insufficient for all the inhabitants, would have yet been enough to fill some 3 or 4 reservoirs; and with a Persian wheel to raise the water, and masonry pipes to convey it to the town, the expense I think would have been very moderate compared to what the Executive Engineer of Nuggur had reckoned it at. The chief inhabitants, with whom I held some conversation on the subject, though evidently extremely anxious to avail themselves of any liberality the Government might be pleased to extend towards them, manifested a very great and extraordinary reluctance to bear any portion of the expense of thus adding to their own comforts; and as it appeared to me to be advisable, before estimating for the work, to ascertain from the proper quarter to what extent this disinclination might extend, reference was made to the Collector of Nuggur, under date the 23d February last, which to this day remains unreplyed to. Nothing further, therefore, has been done.

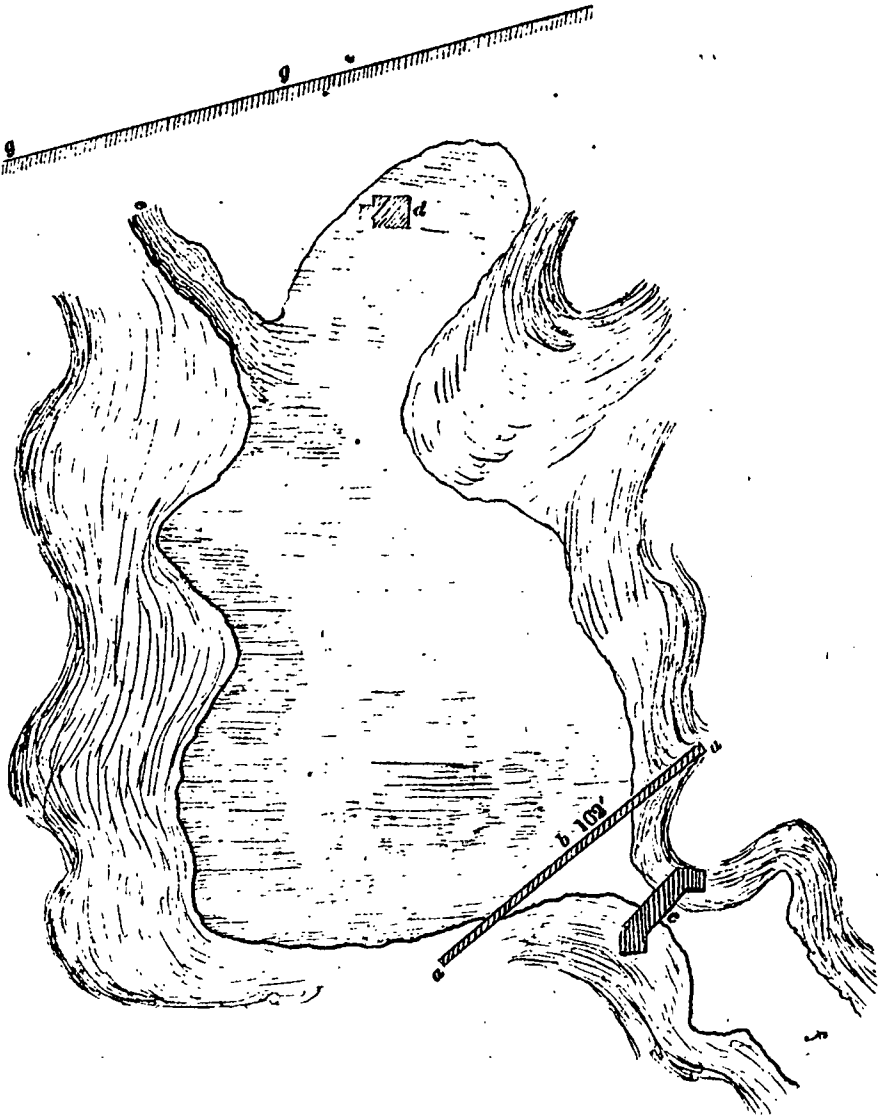
Projects for increasing the supply of water on Thull Ghaut Road.

92. Various projects have been under consideration for increasing the supply of water on the Thull Ghaut Road, and some I hope ere long will be sufficiently matured to be laid before Government and approved of. Without entering into particulars, I may mention that estimates are either in progress for proposed new works or improvement at Kussara, Kurdee, and Kullungaom, or else that the necessary preliminary enquiries are being made with a view to the preparation of those documents with sufficient accuracy to be submitted to superior authority.

Proposed new  
bund at Kullun-  
gaom..

93. The work proposed at the last mentioned place is a new bund, which I think might be constructed at a very trifling outlay, and with a certainty of success. The original one was built by this Department in 1837, and appears to me to have been faultily designed, loosely constructed, and injudiciously placed, so that its failure so shortly afterwards is easily accounted for. Though 14 feet in height, its thickness at the base is only  $5\frac{1}{2}$  feet; and though intended to stem a stream of some force, as well as to resist the pressure of a column of water of the height first stated, the masonry is of rubble and choonam, and that not of the best quality. As to the site, I am unable, except by a sketch, to convey a correct idea of its inferiority to another which might have been selected, and I therefore add the subjoined rough outline, shewing the position of the proposed new bund as well as that of the old, together with their relative dimensions and construction.





*a.* Old Bund.  
*b.* Breach in do.  
*c.* Proposed Bund.  
*d.* Well.

*e.* Feeding Nullah.  
*f.* Outlet.  
*g.* Main Road.

94. At the requisition of the Collector of Tannah, an estimate by Lieutenant Scott was sent in on the 1st May last, amounting to Rupees two thousand three hundred and twenty-five, for clearing out, and adding a bund and escape channel to, the tank at Colsette, which the Collector stated would not only benefit the inhabitants of that village, but the travellers generally who frequented that great line of road. The villagers themselves offered to contribute the sum of Rupees two hundred and fifty-one, in cash and manual labour. A report and sketch have also been received from the same Officer, and are now under consideration, for improving in a similar manner the tank at Kulwa, opposite Tannah.

Estimate for clearing out and improving the tank at Colsette.  
Rs. 2,325.

Rs. 251.

95. The best means of improving the Wuddala Tank at Panwell, from which the inhabitants draw so large a portion of their supply of water, has also afforded matter for consideration and office labour. It appears that during a flood which occurred in 1844, the earthen embankment by which the water is retained together with the masonry retaining wall on the inner side, were partially but extensively injured, and that the breach so made was promptly repaired by an individual of the name of Sookul Sing, to the extent, that is, of renewing the embankment; but the retaining wall was not rebuilt, and a proposition was made by the Acting Collector of Tannah to remedy the defect. On an inspection of the place, however, the standing portion of the retaining wall appeared to me to be so deficient in foundation and strength, that it afforded no protection or support to the embankment, and that it would be therefore useless renewing the breached portion on the same plan as the old wall. It was clear, moreover, that the embankment itself was amply strong enough to retain the water, as long as it was not overflowed, and I proposed therefore to make escape channels, to give egress to the surplus water after it should have reached the level of the top of the retaining wall. The Military Board having approved of this

Proposed method of improving the Wuddala Tank at Panwell.

suggestion, an estimate has been called for, and is under preparation by Captain Pruen.

Large Tank at Tannah attempted to be cleared out; cause of ill success.

96. On the recommendation of the Judicial Commissioner for Goozerat and the Concan, an attempt was made in the month of May of last year to clear out a large tank in Tannah which affords the chief supply of water to that town, and which had become choked up to a great extent with mud and weeds. As it was found to be a too expensive work to be done by free labour, I suggested that all the convicts who were then available from the Tannah Jail might be employed on it; and this proposition having been approved of by Government, Mr. Mungavin took out 250 prisoners on the 22nd of May, and commenced work. He had made, however, but four days' progress, when the convicts were withdrawn by order of the Acting Session Judge in consequence of a recommendation to that effect from the Civil Surgeon, and this exceedingly useful work was thus abandoned.

Chowdar Tank at Mhar cleared out.

97. The clearing out of the Chowdar Tank at Mhar, which was stated in last year's Report to have been postponed in consequence of the prevalence of cholera, has been this year satisfactorily completed by contract. The accepted tender amounted to Rupees six thousand and forty-seven, but as the mud in the bed of the tank was found, after the water was drawn off, to be but  $4\frac{1}{2}$  feet in depth instead of  $5\frac{1}{2}$  as had been originally calculated on and estimated for, a corresponding deduction has been made from that sum, so that there is an unexpended balance of Rupees one thousand six hundred and fourteen. This balance it is proposed to lay out in repairing certain portions of the retaining wall which are in a dilapidated state.

Rs. 6,047.

Rs. 1,614.

Sluice gates constructed in the bund at Kullud,

98. The sluices which it was proposed to make in the bund across the Kuna at the village of Kullud, as mentioned in my Report for 1844 | 45, have been completed by Mr. Scott during the past season, at a cost of Rupees six hundred and thirty-seven, the expense hav-

Rs. 637.



ing been defrayed partly by Mahadgo Rao Nilkunt Poorundurry Jagheerdar, and partly by the villagers.

99. A new well with cut stone retaining wall and stone parapet is under construction by Lieutenant Chapman at Egutpooree near the top of the Thull Ghaut, at an estimated cost of Rupees seven hundred and fifty-one; and as the site is well chosen, there is every prospect of its affording such an abundant supply of water, that, together with the excellent well which now exists, it will prevent any further complaints of scarcity at this constantly frequented halting place. A well is also being cleared out and improved by Mr. Scott at Shikrapoor, on the Seroor road, at an estimated cost of Rupees one hundred and seventy-six.

New well at Egutpooree and improving a well at Shikrapoor.

Rs. 751.

Rs. 176.

#### XVII. BUILDING AND BUILDING MATERIALS.

100. In my Report of last year, I ventured to offer a few remarks on the bad policy and false economy of resorting too generally to what is usually denominated "cheap work" on lines of communication intended to be permanent, and I was in hopes that the examples therein cited of the comparative cost and durability of good work and "cheap work" might have the effect of bearing out my opinions.

"Cheap work."

101. As it is possible I may have been misunderstood, however, when I stated that "the better a work is constructed, the cheaper it will eventually prove," I now beg to explain, that I never intended the word "costlier" to be used synonymously with the word "better," and it was very far from my purpose to advocate the construction of ornamental or highly finished work. I merely wished to make it appear, that where the best of all known building material abounded, it was a great mistake not to take advantage of it; in other words, that where stone was to be had on the spot for the mere cost of quarrying, as it is in almost all parts of the Deccan, it was a pity to use wood, which has to be brought at an enormous expense from the Calicut or Dhang forests,

Explanation of the term "good work" as relates to the Deccan.

and a still greater pity to resort to rubble work, which, though cheaper at the outset than cut stone, possesses not a tenth of its durability.

Good work need not be costly, and it is in reality cheaper than bad.

102. The style of work whose general adoption on permanent lines of communication in the Deccan I respectfully contend for, is any thing but a costly one; in fact, it is not more expensive than those which I condemned. A good bridge of roughly cut or hammer dressed stone, chisel edged at the joints, would not cost more than a bridge of rubble and chunam abutments and piers, and teakwood superstructure: it would be beyond all comparison more lasting, and it would not require annual pointing and dammering and other repairs to prevent decay and dilapidation, as the other most assuredly would. With the material now advocated, therefore, abundant as it every where is in the Deccan, and easily prepared, I think I may venture to re-assert without fear of misapprehension, that "the better a work is constructed, the cheaper it will eventually prove."

Building materials should vary as the productions of a country vary.

103. Viewed in the light I intend, the rule might be made applicable to the products of all countries. In Goozerat for instance, where stone does not exist, and where brick and chunam are the most easily procurable of all building materials, and with a little trouble are generally to be had of good quality, I would construct all bridges, where a good foundation was to be had, of masonry so composed; and to carry out the rule I have laid down, I would invariably insist upon the work being of the *best* description, firmly believing that it would eventually prove the *cheapest*.

Instances of impolicy of "cheap work."

104. Of the sad impolicy of "cheap work," the Report I have now the honor to submit furnishes additional proof. The failure in 1840 of the bund at Kullumgaom, and its prototype at Kurroond, and the present failure of the approaches of the Shikrapoor Bridge and the small bridge near Nassick, are either solely or in part attributable to the fact of a very inferior description of work having con-

tented the designer or the builder; and to these instances I might add that of the parapet walls of a second bridge on the Mail road between the Sungum and Kirkee, which are in so dilapidated a state, that a heavy shower of rain would probably wash them away. Other works there are, of greater magnitude, which might be adduced as examples of the fault I complain of, but at present, it comes not within my province to notice them.

### XVIII. DEPARTMENT AND ESTABLISHMENTS.

105. Several changes have taken place amongst the European Overseers. Mr. Sub-Conductor Vigés was re-manded to his Corps in December last for the extreme negligence and untrustworthiness which he had manifested in the case of the Regimental Buildings at Nassick, as explained in the 81st paragraph of this Report; and Corporal Acting Sub-Assistant Overseer Godfrey was transferred to the Executive Engineer's Office at Poona in November, in order that he might be instructed in his duties.

European Sub-ordinates. Removals and appointments.

106. Serjeant Assistant Overseer Brock was transferred from Lieutenant Mungavin's Office to that of Lieutenant Chapman in April 1846, and Corporal Sub-Assistant Overseer Tudor was also placed under the latter Officer for employment on the Thul Ghaut, in January of the present year. Corporal Sub-Assistant Overseer Mungavin rejoined the Department, after a temporary absence at Aden of eighteen months, in August of last year. Gunner Morgan of the Horse Artillery was admitted into the Department, and joined in October following, as an Acting Sub-Assistant Overseer; and Serjeant Assistant Overseer Roberts was also transferred to the Department, and placed under Captain Pruén's orders in March last. In consequence of these changes, the number of European Overseers now at the disposal of the Department exceeds by one the number available at the date of my last Report.

Promotions and  
conduct.

107. By the promotions in the Public Work Department which were published in Government General Orders of the fifteenth of February last, Serjeant Overseer Armitstead rose to the rank of Sub-Conductor, and Serjeants Levien and Brock, from Assistant Overseers to that of Overseers. On the conduct of the former, no further commendation need now be bestowed, as it was solely on account of his exemplary behaviour and superior qualifications that he was selected by the Military Board to fill the responsible situation in which he is at present placed, and to hold the rank he now does. Serjeant Levien is also well worthy of his promotion, and his steady conduct and high attainments as a draftsman give him claims to the favourable notice of his superiors. Of the rest of the European Overseers, Serjeants Tailor and Angus have most distinguished themselves by uniform excellence of behaviour and great attention to their duties, and Serjeant Brock is also favourably spoken of by Lieutenant Chapman.

Bad conduct of  
an Overseer.

108. The only Overseer whose conduct has been complained of is Serjeant Allyman, whose unfortunate addiction to intemperance has at last compelled Captain Pruen to solicit his removal; and his loss will be the less felt, as his acquirements are of so ordinary a kind as to be barely useful except in superintending road repairs and such like work.

Assistant Sur-  
veyors and Build-  
ers.

Changes.  
Conduct.

109. The only changes which have been made amongst the Assistant Surveyors and Builders since the date of my last Report, are the departure of Hurbajee Rowjee to Aden, and the re-appointment of Govind Moreshwar to the Department, and the conduct of all the others has given satisfaction to the several Officers under whom they are placed. Venaik Bhicajee, as usual, has entitled himself to great praise for his invariable willingness and diligence, as well as for his qualifications, and Ragoba Hurjee has also maintained his previous good character.

110. That all of the Assistants have been diligently employed, either in carrying on sanctioned works or in estimating for proposed ones, will be fully credited, I trust, after a persual of the foregoing account, and an inspection of the appended list of estimates which have been submitted for consideration or sanction. And having now concluded my Report of the proceedings of the Department for the past official year, I am contented to hope that the satisfaction which Government were pleased to express at its performances of the preceding year, may be augmented in proportion to the increase of work which has been herein detailed.

I have the honor to be, &c.

(Signed) H. BERTHON, Captain,

*Superintendent Roads and Tanks.*

*Poona, 4th August 1847.*





## Statement.—(Continued.)

NAMES OF WORKS.	AMOUNT.		TOTAL.
	Rs.	a. p.	
Brought over Rs....	1,74,068	11 6	
Annual repairs to Main road Seroor to Nuggur 4C   47....	3,362	9 10	
Ditto Bridge and Drains ditto .....ditto....	447	13 0	
Ditto Cross roads.....ditto.....	737	2 10	
Ditto Bridges and Drains.....ditto....	73	12 2	
Minor Works.....	24	2 2	
Annual repairs to works on Nagpore Dak line.....	5,841	9 4	
Special repairs to..... ditto .....ditto.....	1,733	7 7	
Erection of New Works ditto .....ditto.....	1,660	5 2	
Maintenance of Ferry-men and Haulers ditto.....	3,092	1 1	
Taking charge of stores..... ditto.....	240	0 0	
Annual repairs to Main road from Thull to Candore { Ghaut..... 1846   47. }	12,936	2 7	
Annual repairs to Bridges and Drains ..... ditto .....	178	15 11	
Ditto Cross roads Nassick Sub-Collectorate....	1,639	13 5	
Ditto Bridges and Drains ditto.....ditto ....	83	6 7	
Ditto Ferry boats and Flying bridges.....	162	14 7	
Special repairs to Main road.....	23	14 10	
Converting Kadoo ferry boat into a flying bridge.....	54	15 7	
Repairing a Bridge on Sinnur cross road.....	296	15 5	
Minor Works.....			
Pulling down and stacking frame work of the Undwell } Bridge.....	85	6 2	
Completing lower and experimental portions of road on } the Thull Ghaut.....	16,091	11 9	
Ditto upper portion ..... ditto .....	6,702	0 11	
Special repairs to Main road, Colsette ferry to Thull Ghaut.	89	0 7	
Annual repairs to ditto ditto..... 1846   47....	9,070	10 4	
Repairing Bridge at Gokhirwa.....	5,305	9 11	
Minor Works.....	18	12 0	
Constructing steps to Jetty at Callian.....	43	3 6	
Repairs to Bridge at Bassein.....	102	14 5	
Annual repairs to roads in Bhowndy 1846   47.....	134	6 8	
Special repairs to Kusseylee bunder (called erroneously in } last year's Report, owing to a mistake of the copyist, } "Callian Pier").....	1,006	7 6	
Conveying four guns from Tannah to Kusseylee bunder....	21	0 0	
Repairing road from Anick to Chemboor.....	115	4 5	
Building a Boat for Oomergaom ferry.....	421	10 1	
Breaking down and re-building wing walls of Mullar Bridge	404	7 0	
Constructing four roller frames.....	120	0 0	
Annual repairs to main road, Sion to Colsette, 1846   47....	5,042	15 9	
Ditto ditto Bandora to Ghorebunder ditto, ...	5,695	0 0	
Ditto ditto Trombay to Sion..... ditto.....	993	7 0	
Special Ditto to ditto between Tannah and Perseck.....	51	0 2	
Minor Works.....	45	4 5	
Annual repairs to road from Chemboor to Mhoul.....	165	0 0	
Special repairs to Sankie bridge and Vohar bund.....	16	5 2	
Removing guns from the ramps of the Tannah Causeway } and substituting mooring rings.....	152	11 6	
Erecting a bridge at Erla Parla.....	1,500	0 0	
Constructing new road from Coorla to Bhandoop by con- } vict labour.....	7,500	0 0	
Carried forward Rs. ....	2,68,152	12 10	

## Statement.—(Continued.)

NAMES OF WORKS.	AMOUNT.		TOTAL.	
	Rs.	a. p.	Rs.	a. p.
Brought over Rs.....	2,68,152	12 10		
Providing metal for the Mail road from Panwell to Khopoolie out of the sanction for 1845   46.....	145	15 7		
Annual repairs to Nagotna and Mahableschwur road ditto..	3,025	0 0		
Repairing Platform of Panwell bunder.....	4,342	8 8		
Annual repairs to Mail road, 1846   47.....	5,973	7 1		
Ditto Bridges and Drains..... ditto..	91	10 8		
Ditto Nagotna and Mahableschwur road.. ditto..	4,670	0 0		
Ditto Cross roads Tannah Collectorate .. ditto..	3,357	13 2		
Constructing a piece of road leading into the Town of Chiploon.....	1,439	0 0		
Annual repairs to Cross roads Southern Concan, 46   47..	1,169	1 5	292,367	5 5
<b>TANKS, WELLS, AND BUNDS.</b>				
Deepening Wells at Wursoolie.....	16	4 4		
Building coping of cut stone to two wells in the Khundalla Tank.....	551	9 0		
Opening sluice gates in the Dhurrun at Kullud.....	637	15 10		
Opening sluice gates of Kutrass Tank.....	6	0 0		
Closing..... ditto..... ditto.....	47	0 0		
Repairs to wells, Nassick Sub-Collectorate.....	34	7 11		
Deepening and enlarging well at Kussara.....	221	12 10		
Improving the Tank at..... ditto.....	109	15 7		
Clearing Tank in the Town of Tannah.....	9	5 6		
Clearing out Chowdar Tank at Mhar.....	4,355	0 0	5,989	7 0
<b>BUILDINGS.</b>				
Annual and special repairs to Travellers' Bungalows and Furniture, for 1846   47.....	4,145	12 3		
Building a Post Office at Khundalla.....	286	0 0		
Supplying plank weather frames to Karlee and Wurgaon bungalows and out-houses.....	113	4 5		
Building a Privy at Neera Bridge bungalow.....	171	0 0		
Repairs to roof of Seroor Bungalow.....	37	3 2		
Repairs to ditto of Chandore bungalow out-houses.....	20	14 0		
Erecting Military Buildings at Nassick.....	3,852	4 8		
Certain additions to..... ditto..... ditto.....	497	7 10		
Annual repairs to store room at Bhewndy.....	9	2 9		
Ditto Military Buildings ditto.....	6	9 0		
Special repairs to Tannah Church.....	9	11 10		
White-washing Hospital at Bhewndy.....	34	5 6		
Annual repairs to buildings in Customs Department at Tannah.....	165	4 1		
Special repairs to..... ditto..... ditto.....	10	4 0		
Constructing a gate and repairing enclosure wells of Mamlutdar's Cutcherry at Callian.....	258	3 1		
Annual repairs to Civil and Detacht. Hospl. at Tannah..	90	15 3		
Ditto Store room..... ditto.....	42	0 0		
Weather Screens for entrance to Tannah Church.....	93	7 0		
Special repairs to Office of Collector of Customs Tannah..	40	7 3		
Annual repairs to permanent and temporary pendalls.....	117	9 6		
Carried forward Rs.....	10,001	13 7	2,98,356	12 5



Statement.—(Continued.)

NAMES OF WORKS.	AMOUNT.			TOTAL.		
	Rs.	a.	p.	Rs.	a.	p.
Brought over Rs....	10,001	13	7	2,98,356	12	5
Erecting four new and improving two old ditto.....	3,470	7	8			
Constructing three Sentry boxes.....	24	15	8			
Erecting a new Detachment Hospital.....	1,500	0	0			
Constructing a new Bungalow at Par.....	1,250	0	0			
Furniture for..... ditto.....	90	0	0			
Nunda Ceiling to Indapoor Bungalow.....	101	11	11			
				16,439	0	10
Grand total, Three Lacs, fourteen thousand, seven hundred and ninety- five, thirteen annas, and three pies.....				3,14,795	13	3

*STATEMENT shewing the Amount expended by each Officer of the Road and Tank Department from the 1st of May 1846 to the 30th April 1847.*

NAMES OF OFFICERS.	Roads and Bridges.			Tanks, Wells and Bunds.			Buildings.			TOTAL.		
	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.
Lieutenant Cowper.....	32,565	14	1	567	13	4	1,581	7	7	34,715	3	0
Mr. Scott.....	20,427	2	5	690	15	10	1,972	2	10	23,090	5	1
Mr. Armitstead.....	1,25,721	3	0							1,25,721	3	0
Captain Dennis.....	12,567	1	2							12,567	1	2
Lieutenant Chapman.....	38,856	5	9	34	7	11	4,985	10	9	43,876	8	5
"    Scott.....	15,792	0	11	331	12	5	919	7	7	17,043	4	11
"    Mungavin.....	22,223	1	6	9	5	6	5,471	14	4	27,704	5	4
Captain Pruett.....	24,214	8	7	4,355	0	0	1,508	5	9	30,077	14	4
Total.....	2,02,367	5	5	5,989	7	0	16,439	0	10	3,14,795	13	3

*RETURN shewing the Expense of Engineering and Superintendence with reference to actual outlay.*

NAMES OF OFFICERS.	Expense of Establishment per annum.	Expenditure.	Rate per cent.
	Rs.	Rs.	
Lieutenant Cowper.....	8,048	34,715	23 $\frac{1}{2}$
Mr. Scott.....	9,047	23,090	39 $\frac{1}{2}$
Mr. Armitstead.....	1,576	1,25,721	1 $\frac{1}{2}$
Captain Dennis.....	7,140	12,567	56 $\frac{1}{2}$
Lieutenant Chapman.....	7,805	43,876	17 $\frac{1}{2}$
„ Scott.....	8,859	17,043	52
„ Mungavin.....	7,773	27,704	28
Captain Pruett.....	8,415	30,077	28

Total Expenditure during the year..... Rs. 3,14,795  
 Cost of Establishments ..... do..... „ 58,663  
 Average rate per cent..... 18 $\frac{1}{2}$

(Signed) H. BERTHON, Captain,  
*Supt. Roads &c.*

NOTE.—Captain Dennis is Post Master as well as in charge of the Nagpoor Dak Line, and the allowances drawn by that Officer should not therefore be all debited to the Road and Tank Department, especially as his engineering duties are confined to one line of works.

(Signed) H. BERTHON, Captain,  
*Superintendent Roads, &c.*

*List of Estimates prepared by the Officers of the Road and Tank Department, and submitted for sanction between the 1st of May 1846 and the 30th of April 1847.*

ESTIMATES.	AMOUNT.	
	Rs.	a. p.
<b>CAPTAIN JACOB.</b>		
Estimate for a new Terminus to the Poona and Panwell Mail road, } accompanied by a survey, sections, and 11 designs..... } Supplementary estimate for certain alterations to ditto..... } Estimate for clearing out and improving the Tank at Kutraj, accompanied } by a survey and sections..... } }	2,55,592 9,947 46,765	0 0 0 0 0 0
<b>LIEUTENANT NORTH.</b>		
Rough estimate for a new line of road between Kussara and Kurdee, } accompanied by a survey and sections..... } }	1,33,391	0 0
<b>LIEUTENANT BRUCE.</b>		
Estimate for a new line of road between Poona and Wagoolie, accom- } panied by a survey, sections, and 22 designs..... } }	88,986	0 0
<b>LIEUTENANT COWPER.</b>		
Estimate for a coping to the approaches of the Poona bridge..... } Ditto.... for re-building approaches and parapets of a bridge on the Mail } road, accompanied by a plan..... } Estimate for supplying plank weather frames to Karlee and Wargaoon Tra- } vellers' bungalows and out-houses..... } Estimate for constructing a piece of road to connect the Karlee bungalow } with the Mail road..... } Estimate for securing railing posts of Wellesley bridge..... } Estimate for 53 Drains and Culverts on Bombay road, accompanied by plans. } }	580 1,060 120 195 216 31,224	0 0 0 0 0 0 0 0 0 0 0 0
<b>MR. SCOTT.</b>		
Supplementary estimate for construction of Toka raft..... } Estimate for repairing retaining wall of Shierapore bridge..... } Ditto for removing the Poona flying bridge, and establishing it at } Kurradee, accompanied by a section of the river, plan &c..... } }	424 460 2,498	0 0 0 0 0 0
<b>MR. SUB-CONDUCTOR ARMITSTEAD.</b>		
Estimate for completing the new road between Patus and Indapoor, ac- } companied by a survey, section, and numerous designs..... } }	1,31,643	0 0
<b>LIEUTENANT CHAPMAN.</b>		
Estimate for a well at Egutpoora, accompanied by a plan..... } Ditto for additions and alterations to Military buildings at Nassick, } accompanied by plans..... } }	751 915	0 0 0 0
Carried forward Rs.....	7,04,762	0 0

ESTIMATES.	AMOUNT.	
<b>LIEUTENANT CHAPMAN.—(Continued.)</b>		
	Rs.	a. p.
Brought over Rs. ....	7,04,762	0 0
Estimate for repairing a bridge on Sinnur cross road, accompanied by a plan.	297	0 0
Ditto for completing new road on the Thull Ghaut, with several designs.	1,48,391	0 0
Ditto for improving the main road at Kokungaom.....	258	0 0
<b>LIEUTENANT SCOTT.</b>		
Estimate for a weighing shed for the Tannah Custom House, accompanied } by a plan..... }	770	0 0
Estimate for repairing Mamlutdar's Cutcherry at Callian.....	260	0 0
Ditto for constructing stairs to the Callian setty, accompanied by plan..	49	0 0
Estimate for a bungalow for the Assistant Collector at Kolwa Mahim, } accompanied by a plan.... }	4,914	0 0
Estimate for a bungalow for the Assistant Collector of Customs at Bassein..	5,400	0 0
Estimate for building a well at Bhowdy .....	135	0 0
Ditto for removing rubbish from gutters of Ruttoonda pass.....	99	0 0
Ditto for clearing out and improving the tank at Colsette, with plan &c..	2,325	0 0
<b>LIEUTENANT MUNGAVIN.</b>		
Estimate for a Bridge at Erla Parla, accompanied by a plan.....	5,310	0 0
Ditto for an Hospital at Tanna.... ditto..... ditto.....	4,569	0 0
<b>CAPTAIN PRUEN.</b>		
Estimate for a numda ceiling to Indapoor Travellers' bungalow.....	103	0 0
Ditto for a Mamlutdar's Cutcherry at Oorun, accompanied by a plan....	1,367	0 0
<b>CAPTAIN DENNIS.</b>		
Estimate for a suspension Bridge over a nullah on the Nagpoor Dak Line, } accompanied by a plan..... }	767	0 0
<b>ANNUAL REPAIRS.</b>		
Estimates for annual repairs to roads for the year 1847   48.....	97,060	0 0
Ditto for .....ditto..to Bungalows &c.....	4,878	0 0
Grand Total....	9,81,714	0 0

(Signed) H. BERTHON, Captain,  
*Superintendent Roads &c.*

THE  
BOMBAY ENGINEERS' REPORT

FOR THE  
OFFICIAL YEAR 1848-49;

COMPRISING REPORTS FROM

LIEUTENANT COLONEL C. W. GRANT, CAPTAINS H. J. MARGARY,  
P. L. HART, W. G. HEBBERT, AND W. D. GRAHAM.



**Bombay:**

PRINTED FOR GOVERNMENT

AT THE

BOMBAY EDUCATION SOCIETY'S PRESS.

1850.



ACCOUNT OF THE EXPENDITURE  
 IN THE  
 GARRISON ENGINEER'S DEPARTMENT,  
 FOR  
 THE YEAR 1848-49.  
*Bombay, 1st May 1849.*

Names of Works.	Amount.	Total.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
<i>Annual Repairs.</i>		
Making annual repairs to the public buildings occupied by troops, &c., in the Castle, Fort George, Garrison, Esplanade, Colabah, and at Out-posts.. . . . .	14,786 3 11	
<i>Petty Repairs.</i>		
Making petty repairs to the public buildings occupied by troops, &c., in the Castle, Fort George, Garrison, Esplanade, Colabah, and at Out-posts.. . . . .	5,474 10 4	
		20,260 14 3
<i>Certain Works.</i>		
Making a new entrance through the Bastion to the Sewree Fort, and converting the present entrance into a Magazine.... . . . .	275 0 0	
Whitewashing the whole of the buildings occupied by the Wing of Her Majesty's 8th Regiment at Colabah.. . . . .	694 11 0	
Putting up a ceiling to the office room of the Assistant Garrison Engineer.. . . . .	101 12 0	
Cleaning out the Fort ditch, and caulking the sluice gates . . . . .	164 0 8	
Repairing the roofs of the Government bake-house .. . . . .	23 5 11	
Repairing the stable slope leading into it from the road belonging to the Military Pay Office.. . . . .	36 0 0	
Repairing and whitewashing the store rooms, &c., at the Government Cooperage.. . . . .	126 6 0	
Carried forward, Rs. . . . .	1,421 3 7	20,260 14 3

Names of Works.	Amount.			Total.		
	<i>Rs.</i>	<i>a.</i>	<i>p.</i>	<i>Rs.</i>	<i>a.</i>	<i>p.</i>
Brought forward, Rs.....	1,421	3	7	20,260	14	3
Repairing the well and stable at Sion Fort.....	90	8	0			
Repairing the road leading to the Officers' Quarters, and the Mess-house at Colabah..	317	13	0			
Renewing the present boarding, and building a new facing of Porebunder stone to the Ball-court of the Town Barracks..	143	7	11			
Building a wall at the Marine Battalion Line, N. I., on the Esplanade....	680	0	0			
Constructing a chimney to the furnace in the Gun Carriage Manufactory, and a door in the Foundry..	411	15	1			
Sinking a well outside the tank in Fort George..	32	11	8			
Making palisade railing, &c., in the gorge of Hodge's Ravelin..	425	0	0			
Constructing open verandahs for the protection of the fire engines in charge of the 26th Regiment N. I., and Marine Battalion	95	9	0			
Supplying with water the troops quartered on Colabah, by laying down pipes from the wells in the neighbourhood of the Cooperage..	14,646	15	5			
Constructing a temporary shed for the sentinel of Her Majesty's 22nd Regiment at Colabah..	51	6	0			
Constructing two masonry platforms for pivot guns, on the left flank of the Colabah Barracks.	168	9	8			
Making alterations to the Serjeant's quarters, &c., of the Rowles Hill Magazine..	107	0	0			
Making alterations to the Artillery Hospital in Fort George	65	7	0			
Extending the compound of the Sanatarium and the Native Garrison Hospital	206	0	0			
Making alterations and improvements to the Brigade Hospital at the Presidency..	344	0	0			
Constructing four plank partitions, and a corresponding number of doors, to the privy for Natives at the Gun Carriage Department..	63	9	0			
Putting nine glass windows to the Mess-room at Colabah	98	0	0			
Making alterations, and opening sky-lights, to the Turners' shed in the Gun Carriage Department at Colabah	880	0	0			
Constructing a verandah to the prisoners' room in Fort George	150	0	0			
Draining the Native Lines at Boreebunder.	975	0	0			
Dispatching 3,000 teak rafters to Kurrachee, from Nigra Bunder, six miles below Nagotna.	400	0	0			
Making alterations and additions to effect a communication between the Petty Stores and Sail-makers' workshop in the Grand Arsenal	70	0	0			
Renewing the boarded floor of the light ammunition room in the Grand Arsenal....	100	0	0			
Carried forward, Rs.....	21,944	3	4	20,260	14	3



Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought forward, Rs. ....	21,944	3	4	20,260	14	3
Fitting glass windows to the quarters occupied by the Adjutant of the 22nd Regiment N. I., at Boreebunder ..	150	0	0			
Constructing a tank and oven for copperising timber ..	68	0	11			
Rebuilding the charcoal cylinder furnace, Mazagon Powder-works ..	75	0	0			
Putting a shed over the well in the compound of the 22nd Regiment N. I. ..	20	0	0			
Hammallage and boat hire, &c., for conveying the wood and iron works of the Barracks to Hydrabad in Scinde ..	21	2	0			
Making a bed of masonry, composed of one stone, in the Artificers' yard in the Grand Arsenal ..	4	0	0			
Substituting iron net work for wire gauze to the doors and windows of the Laboratory in the Grand Arsenal ..	184	0	0			
Putting up two punkas in the Military Board Office.	49	0	0			
Making alterations to the stable attached to Major Greathed's bungalow at Colabah ..	93	11	0			
Constructing a bed of masonry in which to fix the crane in the Foundry of the Gun Carriage Department ..	75	0	0			
				22,684	1	3
<i>Buildings.</i>						
Erecting three solitary cells, and privy, with surrounding palisade rails, and a new Guard-room, near the Depôt Barracks at Colabah. ..	3,500	0	0			
Erecting two lightning conductors to the Gunpowder Magazine situated on the brow of Rowlee Hill, near Sion ..	193	0	0			
Preparing doors and windows for the buildings appertaining to the new European Barracks at Hydrabad in Scinde ..	403	0	0			
Supplying wood works of framed and unframed timber for various buildings for a Troop of Horse Artillery at Kurrachee ..	129	9	4			
Preparing the wood work required for the Horse Artillery buildings at Kurrachee ..	833	8	3			
Supplying wood work required for the roof of the Canteen, Library, and Quarter Guard to the new European Barracks at Hydrabad in Scinde ..	602	10	9			
Preparing the wood work for four trusses required for the Artillery Barracks at Kurrachee ..	73	0	0			
Preparing the frameworks for doors and windows of the temporary pendalls at Kurrachee. .	1,000	9	8			
				7,434	6	0
Carried forward, Rs. ....				50,379	5	6

Names of Works.	Total.
	<i>Rs. a. p.</i>
Brought forward, Rs....	50,379 5 6
Levelling the Esplanade, supplying water to the Dhobees, annual repairs to the Dhobeevada, and expenses in collecting the Esplanade, fees, &c. ....	8,007 3 2
Amount paid to artificers and labourers engaged for, or returning from out-stations ..	25,399 15 5
Total, Rupees Eighty-three Thousand Seven Hundred and Eighty-six, Annas Eight, and Pic One..	83,786 8 1

(Signed) H. J. MARGARY, Capt.,  
*Acting Garrison Engineer at the Presidency.*

*Statement of the Sums expended by the Garrison Engineer at the Presidency, from 1st May 1848 to 30th April 1849.*

Names of Officers.	Annual and Petty Repairs.	Certain Works.	Buildings.	Expended from Esplanade Fund.	Expended for Artificers and Labourers engaged for or returning from Out-stations.	Total.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Captain J. H. G. Crawford, Captain H. J. Willoughby, and Captain H. J. Margary, Garrison Engineers at the Presidency.....	20,260 14 3	22,684 1 3	7,484 6 0	8,007 3 2	25,399 15 5	83,786 8 1

*Statement showing the Cost of Engineering and General Superintendence of the Garrison Engineer's Department, for the above period.*

Names of Officers.	Expense of Establishment per Annum.	Expenditure.	Rate per Cent.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	
Captain J. H. G. Crawford, Captain H. J. Willoughby, and Captain H. J. Margary, Garrison Engineers at the Presidency.....	18,875 8 2	83,786 8 1	22½

(Signed) H. J. MARGARY, Captain,  
Acting Garrison Engineer at the Presidency.

*The Account of the Expenditure in the Civil Architect's  
Department for the Year 1849.*

*Bombay, 1st May 1849.*

Names of Works.	Amount.	Total.
	<i>Rs. a. p.</i>	<i>Rs., a. p.</i>
<b>GENERAL DEPARTMENT.</b>		
<i>Annual and Petty Repairs.</i>		
Annual repairs to the buildings in the General Department for 1848-49 .. . . . . .	7,908 0 0	
Petty repairs to the buildings in the General Department.. . . . . .	2,981 0 1	
		10,889 0 1
<i>Certain Works.</i>		
Making repairs, &c., to the verandah of the Observatory at Colaba .. . . . . .	836 3 0	
Erecting a new privy, and making some alterations to the old one, in the Secretariate compound .. . . . . .	840 0 0	840
Making certain alterations and repairs to the Office of the Deputy Secretary to Government in the Persian Department.. . . . . .	265 0 0	
Making certain alterations and additions to the Government House at Parell .. . . . . .	453 0 0	
Cudjanning a portion of a wall on the monsoon side of the Government House at Parell .. . . . . .	32 2 0	
Erecting a considerable portion of new railing, and making other improvements to the Government Grounds at Parell.. . . . . .	1,575 0 0	
Making certain additions to the new privies lately erected, and altering the two entrances to the Secretariate compound .. . . . . .	262 0 0	262
Making certain alterations to the Lunatic Asylum at Colaba.... . . . . . .	1,975 0 0	
Making certain repairs to the road between the houses of the Hospital servants and the cook-rooms of the J. J. Hospital.. . . . . .	133 0 0	
Making certain repairs to the road and bridge of the Sally-port to the North of the Church Gate.	174 0 0	
Making several petty repairs to the buildings at Parell .. . . . . .	474 0 0	
Making alterations and additions required to the buildings at Parell.. . . . . .	1,028 8 0	
Carried forward, Rs.....	8,047 13 0	10,889 0 1

Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought forward, Rs.....	8,047	13	0	10,889	0	1
Making the necessary repairs on the windows of the Grant Medical College, to prevent the rain from coming in .. .. .	88	0	0			
Making certain works, and supplying articles for the use of the Government House at Parell ....	212	0	0			
Making alterations and repairs to the Government buildings at Malabar Point.....	2,390	0	0			
Making certain improvements to the buildings of the Jamsetjee Jejeebhoy Hospital, and its compound .. .. .	475	0	0			
				11,212	13	0
<i>Buildings.</i>						
Constructing a privy for the use of the Serjeant in Charge of the Malabar Point Flag-staff. ..	150	0	0			
Constructing a building, with fittings and cook-room, for the use of the students of the Grant Medical College .. .. .	2,730	0	0			
Constructing quarters for the Assistant and Apprentices attached to the Jamsetjee Jejeebhoy Hospital. ....	2,515	0	0			
Erecting a new building required for the accommodation of the servants at the Government House at Malabar Point .. .. .	770	0	0			
Making extra stabling and shed for the carriages at the Government House at Malabar Point....	1,052	0	0			
Constructing a temporary building at Parell for the use of the Governor's establishment.....	959	0	0			
				8,176	0	0
<b>JUDICIAL DEPARTMENT.</b>						
<i>Annual and Petty Repairs.</i>						
Annual repairs to the buildings in the Judicial Department for 1848-49. .. .. .	1,100	0	0			
Petty repairs to the buildings in the Judicial Department .. .. .	947	3	2			
				2,047	3	2
<i>Certain Works.</i>						
Repairing the shed which connects the Police Office at Mazagon to an adjoining out-house, used as a Chowkey .. .. .	93	3	0			
Providing further accommodation in the female prisoners' ward in the House of Correction....	156	10	0			
Constructing a raised wooden step at the carriage entrance to the Supreme Court House.. .. .	12	0	0			
				261	13	0
Carried forward, Rs.....				32,586	13	3

Names of Works.	Amount.	Total.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Brought forward, Rs. ....		32,586 13 3
<i>Buildings.</i>		
None.		
<b>TERRITORIAL DEPARTMENT.</b>		
<i>Annual and Petty Repairs.</i>		
Annual repairs to the buildings in the Territorial Department for 1848-49 .. .. .	2,874 0 0	
Petty repairs to the buildings in the Territorial Department .. .. .	355 4 0	
		3,229 4 0
<i>Certain Works.</i>		
Making glass casements to the 27 windows of the Custom House, and a rubble masonry gutter for the cargo shed of that establishment .....	465 0 0	
Making repairs to the Soolamon Cadoo's Salt-pans .. .. .	694 4 11	
Erecting four stands for hanging scales in the Fort Custom House, and railing-in one weighing place.. .. .	90 6 0	
Constructing a wooden privy over the Sea, and converting a room into a privy for the use of the Custom House establishment.... .. .	310 0 0	
Constructing two ventilators to the melting room of the Mint .. .. .	636 0 0	
Making alterations to the Musjed Bunder Custom House .. .. .	395 0 0	
Making alterations and improvements to the Government Salt-pans and Chowkies.... .. .	510 0 0	
Raising the embankment of the Soolamon Shah Salt-pans.. .. .	3,118 0 0	
		6,218 10 11
<i>Buildings.</i>		
None.		
<b>ECCLESIASTICAL DEPARTMENT.</b>		
<i>Annual and Petty Repairs.</i>		
Annual repairs to the buildings in the Ecclesiastical Department for 1848-49) .. .. .	100 0 0	
Carried forward, Rs. ....	100 0 0	42,034 12 2

Names of Works.	Amount.	Total.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Brought forward, Rs.....	100 0 0	42,034 12 2
Petty repairs to the buildings in the Ecclesiastical Department .. ....	308 3 0	408 3 0
<i>Certain Works.</i>		
Replacing 12 broken panes of glass in the windows of St. Andrew's Church.. ....	2 4 0	
Making slight repairs to St. Andrew's Church..	93 15 0	
Making repairs to the Roman Catholic Chapel at Colaba .. ....	28 3 0	124 6 0
<i>Buildings.</i>		
None.		
<b>POLITICAL DEPARTMENT.</b>		
<i>Annual and Petty Repairs.</i>		
Petty repairs to the buildings in the Political Department.. ....	15 10 6	15 10 6
<i>Certain Works.</i>		
None.		
<i>Buildings.</i>		
None.		
<b>MARINE DEPARTMENT.</b>		
<i>Annual and Petty Repairs.</i>		
Annual repairs to the buildings in the Marine Department for 1848-49 ... ..	2,827 0 0	
Petty repairs to the buildings in the Marine Department .. ....	771 12 6	3,598 12 6
<i>Certain Works.</i>		
Making repairs to the Mazagon Bunder.. ....	111 10 0	
Removing the Admiral's Bungalow, with the compound and out-offices, on the Esplanade..	66 15 6	
Carried forward, Rs.....	178 9 6	46,181 12 2

Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought forward, Rs. ....	178	9	6	46,181	12	2
Removing the Naval Captain's Bungalow, with the compound and out-offices, on the Espla- nade. ....	56	4	9			
Making repairs to the Pilot's Bunder at Colaba..	440	8	0			
Remedying the dangerous state of the Apollo Pier ....	410	0	0			
Enlarging the head of the Mazagon Pier.. ....	7,217	0	0			
				8,302	3	3
<i>Buildings.</i>						
None.						
Grand Total, Rupees Fifty-four Thousand Four Hundred and Eighty-three, Annas Fifteen, and Pies Five. ....				54,483	45	5



*Statement of the Sums expended by the Civil Architect at the Presidency, from 1st May 1848 to 30th April 1849.*

Names of Officers.	Annual and Petty Repairs.	Certain Works.	Buildings.	Total.
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Captain J. H. G. Crawford, Captain H. J. Willoughby, and Capt. H. J. Margary, Civil Architects.				
General Department..	10,889 0 1	11,212 13 0	8,176 0 0	30,277 13 1
Judicial Department..	2,047 3 2	261 13 0	0 0 0	2,309 0 2
Territorial Department ..	3,229 4 0	6,218 10 11	0 0 0	9,447 14 11
Ecclesiastical Department ..	408 3 0	124 6 0	0 0 0	532 9 0
Political Department..	15 10 6	0 0 0	0 0 0	15 10 6
Marine Department..	3,598 12 6	8,302 3 3	0 0 0	11,900 15 9
Grand Total..	20,188 1 3	26,119 14 2	8,176 0 0	54,483 15 5

*Statement showing the Cost of Engineering and General Superintendence of the Civil Architect's Department for the above Period.*

Names of Officers.	Expense of Establishment per Annum.	Expenditure.	Rate per Cent.
	Rs. a. p.	Rs. a. p.	
Captain J. H. G. Crawford, Captain H. J. Willoughby, and Captain H. J. Margary, } Civil Architects at the Presidency. ....	17,042 0 0	54,483 0 0	314

(Signed) H. J. MARGARY, Captain,  
Acting Civil Architect at the Presidency.

No. 159 of 1849.

MARINE DEPARTMENT.

To

THE SECRETARY TO THE MILITARY BOARD,

*Bombay.*

SIR,

I have the honor to transmit the annexed Report of the Proceedings of this Department, for the official year ending 30th April 1849.

2. The Statement No. I. shows the actual expenditure on the various works in course of prosecution under me for the past official year, amounting to Rupees (64,203) sixty-four thousand two hundred and three.

3. The Statement No. II. shows the cost of Engineering, including every charge in detail, amounting to eighteen (18) per cent.

4. The only works worthy of any particular notice executed during the year, are as follows:—

1. The Basin.
2. The Breakwater.
3. The Cofferdam.
4. Fitting the Gate of the old Duncan Dock to the Bombay Dock.

1.—*The Basin.*

5. Scarcely anything has been done to this work. The contracts which were entered into for a portion of the supply of stone required, have been partially fulfilled. The contractors have, however, been requested not to quarry the quantity wanting to complete, until they receive further instructions on the subject, as the question of the large or small Basin appears to be still undetermined. The following is the quantity of stone received during the year:—

		No.	Cubic feet.
Cut stones .....	3' × 2' × 2'	459	5,438
Do. for Gate wheels ..	3½ × 2 × 1½	51	459
Do. Gate sill ....	3½ × 2½ × 1½	21	255½
Do. Caisson.....	4½ × 2 × 1½	19	256

2.—*The Breakwater.*

6. *Plan No. 1.*—On this Plan is entered the total portion of the sea wall of the Breakwater, completed to the 30th April 1849, and by deducting the work finished up to the 30th April 1848 from this quantity, the remainder will show the result of the last year's labour.

The total facing, with backing, to the 30th April 1849 is in square feet ..... 10,667 0

And the portion to the 30th April 1848 is square feet ..... 1,482 5

Square feet of sea wall facing, cut stone, with backing, completed in 1848-49 ..... 9,184 5 0  
Which is equal to an extent of sea wall four hundred and fifty-nine (459) feet long, and twenty (20) feet high, constructed according to the Section Fig. III. Plan No. II.

7. The progress of this work has been slow, not for want either of materials or labour, both of which were at hand in abundance, but the lower courses being fixed only during the

low water spring-tides, with frequently the water on a level with the top of the lower or curb course, and the tides only receding sufficiently three days every month, during which the maximum time the work could be proceeded with averaged about two hours each day, it may easily be conceived how tedious was the operation of laying the first few courses of stone. During the monsoon the lower courses cannot be laid at all, as the South-West wind prevents the tide receding sufficiently; and even during the fair season, a strong Southerly wind has sometimes prevented the prosecution of the work from the same cause.

*Plan No. 2.*—In this Plan the three Sections of the sea wall of the new ground, and present Breakwater, are shown for the sake of comparison.

Fig I. is the Section of the old sea wall of the new ground.

Fig II. the original Section of the new sea wall of the Breakwater, and

Fig III. the Section of the sea wall as actually executed.

8. It will be observed that the only difference between the last two Sections is one foot in height: this one foot makes the greatest difference in the prosecution of the work. There are scarcely more than three tides throughout the year during which Fig II. could be executed.

9. In addition to the extent of sea wall completed, as mentioned in the concluding part of para. 6, the following quantities of stone have been collected :—

Squared stone .....	34,710 Cubic feet.
Rubble stone.....	10,41,332 ditto.
Khandkees for facing .....	8,057 Running feet.
Chunam ready for the mill..	3,492 Candies.

10. In my last year's Report I annexed a List of the contract prices of the stone.

3.—*The Cofferdam.*

11. The following is the quantity of materials prepared for this work :—

*Wood Work.*

Main piles .....	No.	94
Sheet piles .....	"	771
Do. do. small .....	"	760
Outer sheet piles .....	"	95
Wales, 279 in number .....	Running feet	6,273
Plank, 3 inch .....	No.	253
Do. 2 do. ....	"	255

*Iron Work for Piles.*

Shoes, iron, large .....	"	93
Do. do. small .....	"	827
Do. do. do. ....	"	653
Iron bolts, round .....	"	368
Rings, iron, large and small .....	"	95

*Winches.*

Crab crane .....	"	6
Monkeys .....	"	4
Pile, wooden frames .....	"	6
Wheels, iron, with axles .....	"	6
Plumber blocks .....	"	12
Ketches, iron, wrought .....	"	12
Sheers, iron, with wooden blocks .....	"	5

12. The above comprise the whole of the articles that need for the present be prepared for the Cofferdam, which is three hundred feet long : the order for its commencement is anxiously awaited. Any further supply of articles that may be required can be easily furnished as the work proceeds, without in the least delaying its execution.

4.—*Fitting the old Gates of the outer Duncan Dock to the outer Bombay Dock.*

13. The outer Duncan Dock having been increased in width from 55 to 63½ feet, and fitted with new gates, so as to

admit the largest class of steamers in the Indian Navy, it was considered advisable to replace the outer gates of the Bombay Dock, which were in a very ruinous and precarious state, with those removed from the Duncan Dock.

14. On the completion of the Duncan Dock, these gates were floated out of the Dock, in which they had been deposited during the execution of the work, to the slope near the mast-shed, where they underwent a thorough repair; and before the Dam was commenced to the Bombay Dock, they were floated from the mast-shed slope into the Dock, and laid on the blocks, where the fitting to the hollow quoins of the heel-post and to the sill of the Dock took place.

*Plan No. 3.*—This Plan shows the staging it was necessary to erect on each side of the Dam, to make a platform for the pile engines to drive the main piles.

*Plan No. 6* shows the staging in elevation, with cross ties, also the same in section.

*Plan No. 4* is a plan of the Dam itself, with the staging on each side omitted. The Dam is fifty-eight feet in length, twenty-three and a half high, and six feet in width. There is a slight curve outwards of one foot in its length. It is composed entirely of main piles and planking; the former are connected together by four rows of single wale pieces on the inside, and three on the outside, the ends of these wales being well let into the masonry of the Dock walls. The framing is again strengthened by four-and-twenty bolts, from the outside of one wale to the outside of the other, in three rows of eight bolts each. The Dam is wholly supported from the inner side by fourteen horizontal struts, the ends of which are either let into the masonry or rest in the steps; the other ends abut on a straining beam, between each pair of struts, above each of the wale pieces. The object of this arrangement was to have the sills perfectly clear, to allow the gates to be properly fitted, and adjusted to their places.

• *Plan No. 5* shows a transverse section of the Dam itself,

exhibiting the inner struts which support the Dam, the straining beams and wale pieces in section, with the main piles and planking, the inner and outer puddle, with the penstock four feet from the bottom, to admit or let out the water as might be required. The mouth of the penstock and manner of closing is also shown on a larger scale. The clay forming the puddle was brought from the Harbour off Sewree and Rewus, and could not possibly have been of a superior description: with a head of nearly twenty feet of water during the spring-tides the Dam leaked very slightly.

15. The pile engines were principally made up in the Mint and Gun-carriage Manufactory. The monkeys were made from the old unserviceable rollers used in the former establishment for breaking and rolling the different metals, of five and ten hundred-weight each in weight. The crab winches which raised them were cast in the Gun-carriage Manufactory, and of excellent workmanship. As the piles could not be driven more than four feet before the rock was reached, very few blows of the monkey soon drove each pile into its place.

*Plan No. 7.*—In this Plan, the old method of securing the heel-posts of the Dock gates to the masonry is shown by a wooden cap, fitted over the top of the posts, secured to horizontal pieces of timber, which are again bolted firmly to upright posts set in masonry. These caps took up at least two feet of the Dock entrance, and were occasionally obliged to be removed when any very large vessel came into Dock. From the plan and section of these caps, the simple but somewhat clumsy method of securing the heel-posts will be easily seen.

*Plan No. 8.*—This Plan shows the substitution of iron anchors for the wooden caps above described; a written description will scarcely be necessary, as a glance at the Plan will immediately show the alteration effected.

16. This work was commenced the 15th September 1848, and completed the 26th April 1849. It appears a long time,

but if the gates had been used before the masonry in which the anchor-bolts were fixed had thoroughly set, a derangement of the heel-posts by the anchors yielding might have been anticipated. The mere execution of the work took a much shorter time.

17. The estimated amount sanctioned for this work was.....	Rupees	6,687	0	0
And the total cost.....	„	4,813	0	0
Leaving a saving of.....	„	1,874	0	0

18. This includes every item of expense for the Dam, and the masonry. Repairing the old gates of the Duncan Dock, removing the old gate of the Bombay Dock, and replacing them in the former, as also the iron gate anchors, are not included, these portions of the work being performed by the Master Builder's Department.

19. I think, on the whole, this may be pronounced a cheap undertaking.

20. A list of the prices of materials and workmanship is annexed, in Statements III. and IV.

I have the honor to be, &c.

(Signed) P. L. HART, Captain,

*Engineer to the Dockyard.*

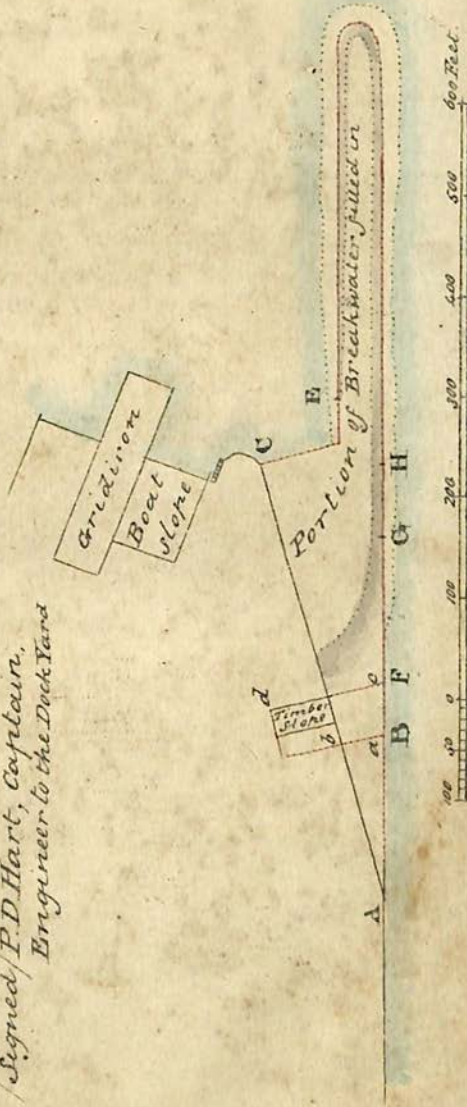
*Bombay,  
Dockyard Engineer's Office,  
7th July 1849.*



Sketch of the Breakwater, shewing the portion completed to the 30<sup>th</sup> April 1849.

	A	B	C	D	E	F	G	H	a	b	c	d
Height	1	1	1	1	1	1	1	1	1	1	1	1
Length	100	100	100	100	100	100	100	100	100	100	100	100
Total portion completed	100	100	100	100	100	100	100	100	100	100	100	100
Height	1	1	1	1	1	1	1	1	1	1	1	1
Length	100	100	100	100	100	100	100	100	100	100	100	100
Total portion completed	100	100	100	100	100	100	100	100	100	100	100	100

Signed P. D. Hart, Captain,  
Engineer to the Dock Yard



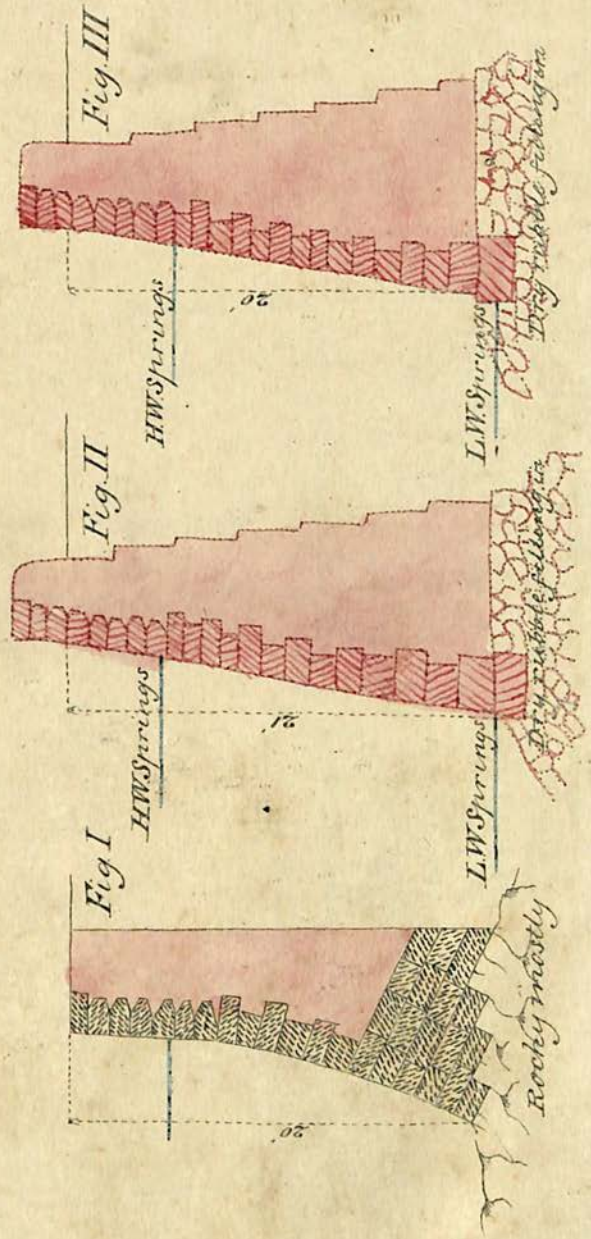
The red line shews the upper edge of the Retaining Wall when completed  
The shade of Indian Ink shews the portion filled in with dry rubble stone last year.



Section of Sea Wall to  
portion of the new Ground.

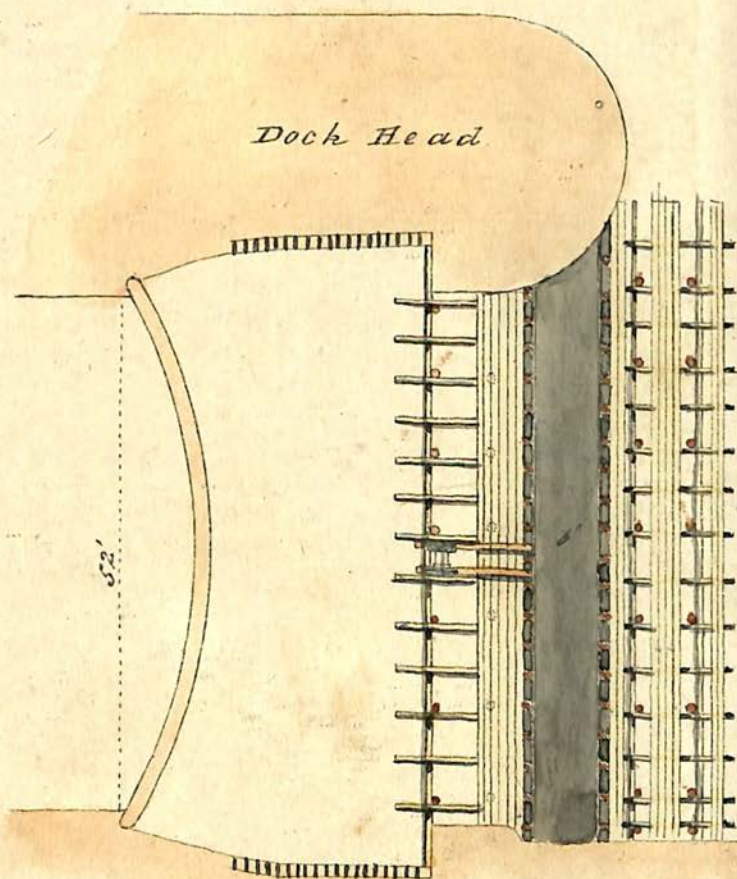
Original Section  
of new Sea Wall

Section of Sea Wall as  
actually constructed



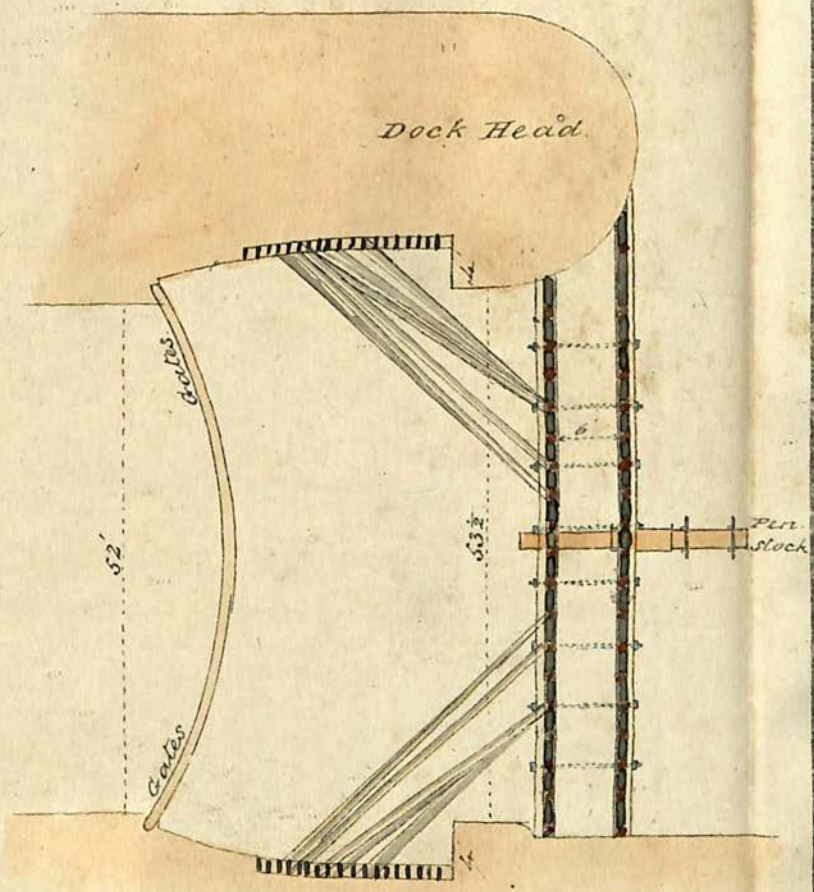


Plan of the staging on each side of  
the Dam for driving the Piles.





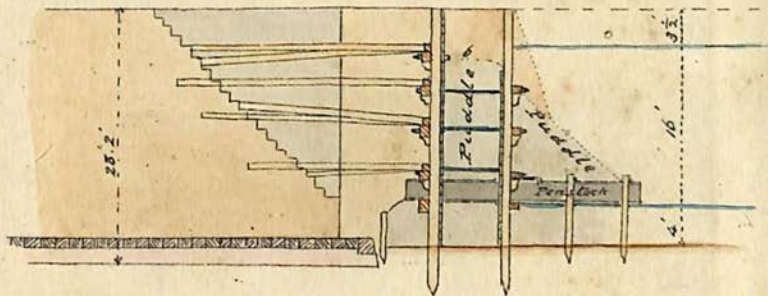
Plan of the Dam without the stages,  
shewing the Perstock and method  
of strutting it up from the inside.



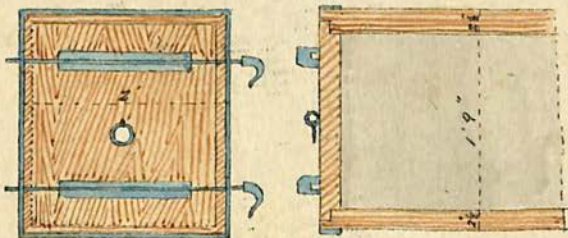




*Transverse Section through the Dam.*

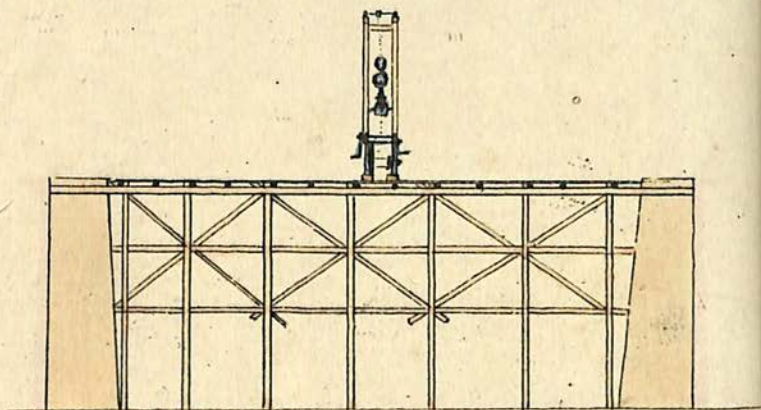


*Mouth of Peristock to a larger Scale.*

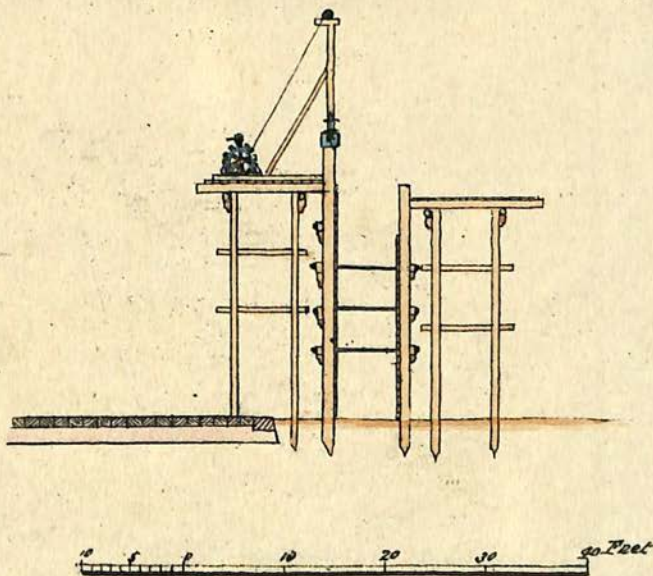




*Elevation of Stage for driving the Piles.*

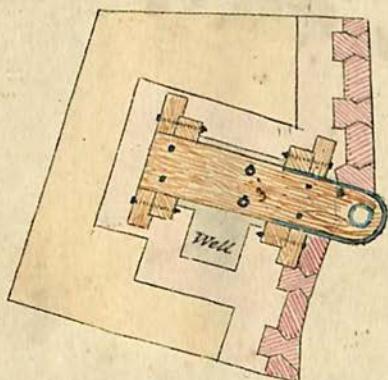


*Section through the Stage for driving the Piles.*

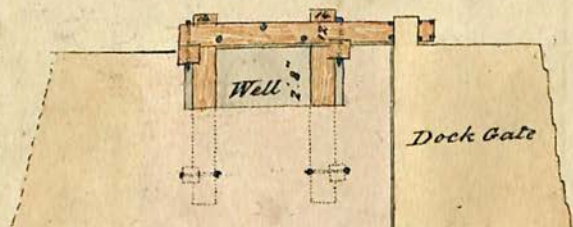




*Plan of the Wooden Cap for securing  
the Heel Parts of the Dock Gates, / old method /*



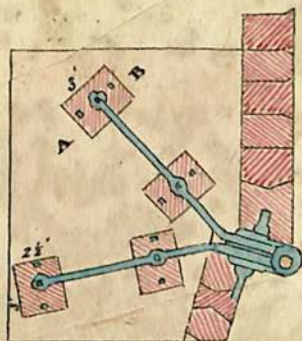
*Section through the above.*



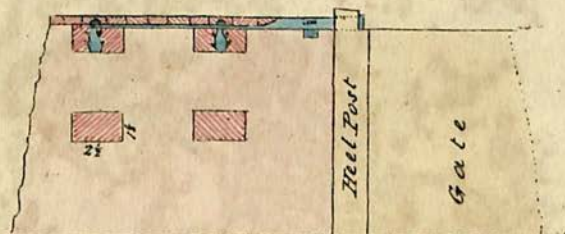
5 4 3 2 1 0 5 10 15 20 Feet.



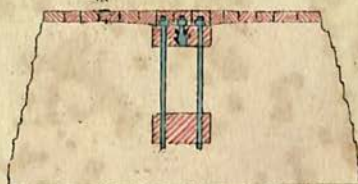
*Plan of the Anchors substituted for the  
Wooden Caps for drawing the Heel Posts.*



*Section through the above.*



*Section on AB.*







## No. I.

## MARINE DEPARTMENT.

*Statement showing the actual Expenditure upon Works carry-  
ing on under the Engineer to the Dockyard, for the Official  
Year from 1st May 1848 to the 30th April 1849.*

Names of Works.	Amount.	Total.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
<i>New Works.</i>		
1. Constructing a Building-yard to the S. E. of the Dockyard and Saluting Battery, comprising three slips for building ships of war of the 1st Class of Her Majesty's Navy.	1,168 12 4	
2. Constructing a portion of the work connected with the proposed Basin and Breakwater, viz. Basin .....Rs. 1,525 8 0 Breakwater ..... 29,762 1 3 Cofferdam ..... 16,611 1 1	47,898 10 4	
3. Rendering the buildings in the Dockyard more secure against the risk of fire.....	736 15 10	
4. Erecting the various portions of the timber for the Horse Artillery Barracks at Kurrachee.	542 7 5	
5. Enclosing with railing the Battery premises between the Colaba Causeway and Apollo Pier.. ....	140 0 0	
6. Erecting a work-shed and store-room for the Engineer to the Dockyard.. ....	2,236 0 0	52,722 13 11
<i>Repairs to Fortifications and Buildings.</i>		
7. Annual repairs to the buildings in the Dock and Building-yards for 1848 ....	2,080 0 0	
8. Replacing the cadjan on the shed erected over H. M.'s ship "Mecance" .. ....	820 0 0	
9. Erecting a shed over the schooner now building for the Crown ....	175 0 0	
10. Making certain alterations to the Indian Naval Storekeeper's premises ....	426 7 5	
11. Fitting the old gates of the Duncan Dock to the Bombay Dock ....	4,813 4 7	8,314 12 0
Carried forward, Rs. ....		1,037 9 11

Names of Works.	Amount.		Total.	
	Rs.	a. p.	Rs.	a. p.
Brought forward, Rs.....	61,037	9 11		
<i>Emergent Works.</i>				
12. Building two wooden posts on the Duncan Dock, on the new ground, with rough masonry .....	10	12 1		
13. Repairing a breach in the face of the old Saluting Battery wall .....	77	7 10		
14. Repairing the parapet wall of the bridge and road from the arch to the new ground. ....	268	12 0		
15. Replacing wooden frame and sluice-post of the slips on which the "Meeanee" was built.. ....	9	8 2		
16. Enlarging the accommodation of the Dockyard Guard.... ..	23	1 6		
17. Adjusting the cadjan roofing of the Police hulk "Zenobia." .....	73	7 0		
18. Repairing the railing round the engine house boiler trough.. ....	55	11 5		
19. Repairing a portion of the wall of I. N. Storekeeper's yard .....	28	5 1		
20. Making the necessary repairs to the water-courses in the Storekeeper's yard and the Conductors' room at the Dépôt .. ..	23	5 4		
21. Replacing the few broken windows of an apartment of the Officers of the Indian Navy, and also repairing the whitewashing in passage and kitchen of the same building .....	47	7 7		
22. Erecting a cadjan shed over the schooner lately built on the new ground ... ..	71	12 8		
23. Cutting a doorway and fitting a door in the warping Lascars' Bank Shall .....	8	5 2		
24. Répairing the slip outside the wall of H. M.'s gun ship "Meeanee".. ..	14	7 5		
25. Removing the cadjan from the side of the mould loft .....	2	11 0		
26. Repairing and whitewashing the wall of the mould loft .....	63	12 8		
27. Removing the sea wall of the slip No. 1, for the purpose of launching H. M.'s gun ship "Meeanee".... ..	142	5 10		
28. Removing the shed from the "Meeanee" as soon as possible .....	290	12 10		
29. Repairing the road between the outer and inner gates of the new ground .....	33	9 1		
30. Repairing the masonry work of the Dockyard steam kiln .....	12	9 7		
31. Constructing masonry work for the new ground steam kilu .....	37	15 5		
Carried forward, Rs.....	1,200	3 8	61,037	9 11

Names of Works.	Amount.	Total.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Brought forward, Rs. ....	1,290 3 8	61,037 9 11
32. Conveying the stores from the Dockyard to the Engineers' yard on the new ground ....	17 13 6	
33. Fitting the grooves of the caisson to the iron brace of the caisson ....	0 15 '5	
34. Making a small opening or aperture in the lower part of the chimney of the Dockyard Engine-room.. ....	2 7 10	
35. Effecting the several repairs to premises in the Dockyard.. ....	91 9 10	
36. Repairing the gates of the Dockyard ....	54 7 10	
37. Completing the slope on the new ground by the 15th January, for the launch of the "Colonial Scheme." ....	275 15 4	
38. Fixing forty bolts on the slip on which the schooner for the Colonial Government is under construction ....	15 3 11	
39. Effecting the necessary repairs to the pilot and warp boats Lascars' Bank Shall ..	64 1 0	
40. Reconstructing that part of the sea wall of new ground, at the end of the slip lately occupied by H. M.'s ship "Meanee" ..	529 13 8	
41. Refixing the boiler for the Dockyard engine.	424 7 2	
42. Making and fitting wooden rollers to the stone slope on one side of the gridiron, for the purpose of more readily hauling up and launching the Governor's bunder boat ..	59 3 1	
43. Removing the railing between the rampart and Superintendent's Office, and enclosing the Office veranda of the Master Attendant's lower Office with railing.. ....	67 10 6	
44. Repairing the hinges of the main gates of Dockyard, and gates on the new ground, and also replacing some stones that have been washed out of the sea wall near the Warden's quarters ....	27 2 2	
45. Erecting a shed over the small engine at the end of the smithy ....	157 14 8	
46. Removing the stones obstructing the thoroughfare and communication of the Dockyard ....	86 6 9	
		3,165 8 4
	<u>Rupees.....</u>	<u>64,203 2 3</u>

(Signed) P. L. HART, Captain,  
*Engineer to the Dockyard.*

*Bombay,*  
*Dockyard Engineer's Office,*  
*7th July 1849.*

## No. II.

### MARINE DEPARTMENT.

*Statement showing the Cost of Engineering in the Marine Department, under the Engineer to the Dockyard, from 1st May 1848 to 30th April 1849.*

	Amount of Establishment.		Total amount of Establishment.		Expenditure.		Rate per cent.
	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	
Captain P. L. Hart's Pay for Marine and Steam Departments, for the month of May 1848	600	0 0					
Ditto do. June	600	0 0					
Ditto do. July	600	0 0					
Ditto do. August	600	0 0					
Ditto do. September	600	0 0					
Ditto do. October	600	0 0					
Ditto do. November	600	0 0					
Ditto do. December	600	0 0					
Ditto do. January	600	0 0					
Ditto do. February	600	0 0					
Ditto do. March	600	0 0					
Ditto do. April	600	0 0					
			7,200	0 0			
Carried forward, Rs.....							
			7,200	0 0			

Establishment for the month of	Brought forward, Rs.....	.....	.....	.....	.....
Ditto	.....	.....	.....	.....	.....
do. June.....	.....	353 0 0	.....	.....	.....
Ditto July.....	.....	351 0 0	.....	.....	.....
Ditto August.....	.....	300 11 10	.....	.....	.....
Ditto September..	.....	433 0 0	.....	.....	.....
Ditto October ..	.....	465 14 5	.....	.....	.....
Ditto November..	.....	493 0 0	.....	.....	.....
Ditto December ..	.....	438 11 11	.....	.....	.....
Ditto January ..	.....	882 4 9	.....	.....	.....
Ditto February ..	.....	392 4 9	.....	.....	.....
Ditto March .....	.....	392 4 9	.....	.....	.....
Ditto April .....	.....	392 4 9	.....	.....	.....
				7,200 0 0	
					64,203 2 3
					18½
				4,887 9 2	
				12,087 9 2	
				Total, Rs.....	

(Signed) P. L. HART, Captain,  
*Engineer to the Dock-yard.*

*Bombay,*  
*Dockyard Engineer's Office,*  
*7th July 1849.*

## No. III.

## MARINE DEPARTMENT.

*List of Prices of Work-people employed on fixing the old  
Gates of the Duncan Dock to the Bombay Dock.*

	Rates.			Per
	Rs.	a.	p.	
English Writer .....	0	6	2	Day.
Subness .....	0	7	4	do.
Carpenters .....	0	12	4	do.
Ditto .....	0	10	8	do.
Ditto .....	0	9	8	do.
Ditto .....	0	8	0	do.
Ditto .....	0	7	10	do.
Ditto .....	0	7	2	do.
Ditto .....	0	5	4	do.
Ditto .....	0	4	3	do.
Ditto .....	0	3	2	do.
Ditto .....	0	2	7	do.
Stonecutter Maistry ..	0	13	6	do.
Ditto .....	0	12	4	do.
Stonecutters ..	0	7	10	do.
Ditto .....	0	7	2	do.
Ditto .....	0	6	5	do.
Bricklayers ..	0	7	10	do.
Ditto .....	0	7	2	do.
Mahratta Writer .....	0	3	1	do.
Caulkers .....	0	9	10	do.
Ditto .....	0	7	4	do.
Ditto .....	1	0	0	do.
Drillers .....	0	9	10	do.
Ditto .....	0	7	4	do.
Nowghancees ..	0	4	0	do.
Ditto .....	0	4	0	do.
Iron Smith ..	0	7	10	do.
Hammerman ..	0	4	0	do.
Waterman ..	0	3	4	do.
Muckadum ..	0	4	11	do.
Ditto .....	0	4	0	do.
Sarang .....	0	6	2	do.
Lascars .....	0	4	7	do.
Ditto .....	0	3	9	do.
Beldars .....	0	7	2	do.
Chowkeydar ..	0	3	2	do.
Ditto .....	0	3	9	do.
Peon .....	0	3	9	do.



## No. IV.

## MARINE DEPARTMENT.

*List of Prices of Materials used in fixing the old Gates of the Duncan Dock to the Bombay Dock.*

	Rates.	Per
	<i>Rs. a. p.</i>	
Main piles, 19 in No. Length 28' × 1 Diam..	19 11 9	Each.
Sheet do. 12 in No. do. 19' × 9' .....	4 8 0	do.
Do. do. 5 in No. do. 19' × 9' .....	2 10 4	do.
Wales Sotta, 8 in No. do. 277' × 1" .....	4 14 0	do. piece.
Do. do. 6 in No. do. 209' × 9" .....	4 6 0	Ditto.
Struts, 4 in No. do. 33' × 1" .....	8 7 0	Each.
Do. 3 in No. do. 25' × 1" .....	4 13 4	do.
Sotta, Jungle .....	4 8 0	do.
Rafters, do. ....	8 0 0	Corge, 20 in No.
Iron bolts, 16 in No. do. 6'-2" × 2" .....	3 7 0	Maund, or 28 lbs.
Large spikes .....	0 6 6	Each.
Straps, iron, 2 in No. ....	3 0 0	Maund, or 28 lbs.
Iron screw-bolts, each long 2' × $\frac{7}{8}$ Diam. with screw, nuts, and washer complete ....	0 9 0	Each.
Mud or clay for puddle..	2 4 0	Brass, 116 cubic feet.
Do. do. ....	2 3 0	Ditto.
Steel, square....	4 0 0	Maund, or 28 lbs.
Do. ....	3 8 0	Ditto.
Nails, two-pointed..	2 8 0	Ditto.
Nails, Country, 5 to 15 inch..	2 12 0	Ditto.
Do. 10 to 15 do..	2 8 0	Ditto.
Do. ....	2 0 0	Ditto.
Nails, Europe, 2 inches..	4 8 0	Ditto.
Spike nails .....	3 0 0	Ditto.
Nails, Europe, 1½ inch ...	5 0 0	Ditto.
File, three sides..	0 3 6	Each.
Chalk ..	0 0 4	Seer.
Grease .....	0 4 0	Pound.
Stones, 3¼ × 2¼ × 1¼, seven in No. ....	0 7 0	Cubic foot.
Do. 3 × 2 × 1¼, one in No..	0 7 0	Ditto.
Do. 2½ × 2 × 1¼, nine in No..	0 7 0	Ditto.
Oakum .....	2 0 0	Maund, or 28 lbs.
Wax, caulking ..	2 8 0	Ditto.
Cotton, spun ....	0 1 8	Seer.
Rope, coir .....	1 6 0	Maund, or 28 lbs.
Coirs ..	1 0 0	Ditto.
Gingely Oil .....	2 4 0	Ditto.
Cocconut do....	0 1 0	Seer.
Pitch ..	0 14 0	Maund, or 28 lbs.
Do. ..	0 13 0	Ditto.





No. 2811 of 1849.

## GENERAL DEPARTMENT.

To

THE SECRETARY TO THE MILITARY BOARD,

*Bombay.*

SIR,

I have the honor to forward the Annual General Report of the Proceedings of the Department of Public Works in the Southern Provinces during the official year 1848-49.

2. The total expenditure from the 1st May 1848 to the 30th April 1849, in the Military and Civil Departments, is as follows:—

*Total Expenditure, in the Military and Civil Departments of the several Executive Officers of the Public Work Department in the Southern Provinces.*

Names of Divisions.	Amount expended on each.	Amount of Superintendence.	Superintendence percentage.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	
<b>POONAH.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs . . . . .	11,109 14 1		
Annual repairs.. . . .	7,993 10 0		
New works.. . . .	71,013 7 1		
Military Department, Total.. . . .	90,116 15 2		

Names of Divisions.	Amount expended on each.	Amount of Superintendence.	Superintendence percentage.
<b>CIVIL DEPARTMENT.</b>			
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	
Repairs . . . . .	1,663 11 3	•	
Annual repairs . . . . .	7,312 12 6		
New works.. . . .	5,536 14 11		
Civil Department, Total.. . . .	14,513 6 8		
Military Department, Total.. . . .	90,116 15 2		
Grand Total.. . . .	1,04,630 5 10	16,425 11 9	15½
<b>AHMEDNUGGUR.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs . . . . .	2,229 10 4		
Annual repairs . . . . .	6,348 12 2		
New works.. . . .	368 1 6		
Military Department, Total.. . . .	8,946 8 0		
<b>CIVIL DEPARTMENT.</b>			
Repairs . . . . .	3,381 4 3		
Annual repairs . . . . .	1,562 7 0		
New works.. . . .	6,487 5 0		
Civil Department, Total.. . . .	11,431 0 3		
Military Department, Total.. . . .	8,046 8 0		
Grand Total.... . . .	20,377 8 3	6,858 3 7	33½
<b>BELGAUM.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs . . . . .	1,128 11 5		
Annual repairs . . . . .	4,798 6 11		
New works.. . . .	4,641 8 11		
Military Department, Total.. . . .	10,568 11 3		
<b>CIVIL DEPARTMENT.</b>			
Repairs . . . . .	7,135 15 2		
Annual repairs . . . . .	24,514 13 7		
Special repairs . . . . .	69 10 1		
New works.. . . .	3,926 4 7		
Civil Department, Total.. . . .	35,646 11 5		
Military Department, Total.. . . .	10,568 11 3		
Grand Total.... . . .	46,215 6 8	16,332 2 1	35½

Names of Divisions.	Amount expended on each.	Amount of Superintendence.	Superintendence percentage.
<b>DHARWAR.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs . . . . .	565 8 2		
Annual repairs . . . . .	74 7 11		
New works.. . . .	0 0 0		
Military Department, Total.. . . .	640 0 1		
<b>CIVIL DEPARTMENT.</b>			
Repairs . . . . .	2,234 13 10		
Annual repairs . . . . .	2,103 10 0		
New works.. . . .	11,087 8 3		
Civil Department, Total.. . . .	16,326 0 1		
Military Department, Total.. . . .	640 0 1		
Grand Total.. . . .	16,966 0 2	10,810 14 5	63 $\frac{1}{2}$
<b>KOLAPOOR.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs . . . . .	744 12 6		
Annual repairs . . . . .	1,953 4 7		
New works.. . . .	5,389 11 7		
Military Department, Total.. . . .	8,087 12 8		
<b>CIVIL DEPARTMENT.</b>			
Repairs . . . . .	0 0 0		
Annual repairs . . . . .	111 11 9		
New works.. . . .	0 0 0		
Civil Department, Total.. . . .	111 11 9		
Military Department, Total.. . . .	8,087 12 8		
Grand Total.... . . . .	8,199 8 5	2,312 2 5	28 $\frac{3}{4}$
<b>SHOLAPOOR.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs . . . . .	0 0 0		
Annual repairs . . . . .	1,905 11 7		
Special repairs . . . . .	157 15 9		
New works.. . . .	0 0 0		
Military Department, Total.. . . .	2,063 11 4		

Names of Divisions.	Amount expended on Each.	Amount of Superintendence.	Superintendence percentage.
<b>CIVIL DEPARTMENT.</b>			
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	
Repairs .....	0 0 0		
Annual repairs .....	40 5 7		
Special repairs .....	103 0 1		
New works.. ..	0 0 0		
Civil Department, Total.. ..	143 5 8		
Military Department, Total.. ..	2,063 11 4		
Grand Total....	2,207 1 0	880 0 0	39+ $\frac{3}{4}$
<b>KANDEISH.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs .....	400 5 3		
Annual repairs .....	609 4 7		
New works.. ..	688 2 8		
Military Department, Total.. ..	1,697 12 6		
<b>CIVIL DEPARTMENT.</b>			
Repairs .....	9,556 15 8		
Annual repairs .....	21,053 14 2		
Special repairs .....	56 9 8		
New works.. ..	51,627 0 8		
Civil Department, Total.. ..	82,294 8 2		
Military Department, Total.. ..	1,697 12 6		
Grand Total....	83,992 4 8	28,599 2 11	34
<b>ASSEERGHUR.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs .....	390 6 0		
Annual repairs .....	185 0 0		
New works.. ..	115 7 11		
Military Department, Total.. ..	690 13 11		
<b>CIVIL DEPARTMENT.</b>			
None .. ..	0 0 0		
Military Department, Total.. ..	690 13 11		
Grand Total....	690 13 11	0 0 0	0

Names of Divisions.	Amount expended on each.	Amount of Superintendence.	Superintendence percentage.
<b>DAPOOLEE.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs . . . . .	253 3 2		
Annual repairs . . . . .	400 0 0		
New works.. . . .	52 15 0		
Military Department, Total.. . . .	706 2 2		
<b>CIVIL DEPARTMENT.</b>			
None .. . . .	0 0 0		
Military Department, Total.. . . .	706 2 2		
Grand Total.... . . . .	706 2 2	140 0 0	0.19½
Grand Total amount of Expenditure . . . . .	2,83,985 3 1		

3. I beg also to forward Lieutenant Bell's annual Report of the proceedings of the Civil Engineer's Department in Candesh, for the official year 1848-49.

4. The separate Report called for, regarding Military Buildings, Roads, Cantonments, &c., will be forwarded as soon as it is prepared.

I have the honor to be, &c.,

(Signed) C. W. GRANT, Lieut. Colonel,  
*Superintending Engineer, S. P.*

*Superintending Engineer's Office, S. P.,  
Poonah, 27th November 1849.*

*Extracts from a Letter from the Civil Engineer, Candesh, to the Acting Superintending Engineer, S. P., No. 637, of the 15th October 1849.*

#### TERRITORIAL DEPARTMENT.

5. *Cunnassee Bundarrah.*—This work was stated in the Annual Report for the official year 1847-48 to be completed, with the exception of some trifling additions required to the aqueduct, which had been decided on by the Assistant Collector and myself, in March 1848, as likely to be useful. These additions, consisting of scouring sluices above and below the aqueduct, were executed in May 1848, at a cost of Rupees four hundred and sixty-eight, Annas twelve, and Pies eleven (468-12-11); but on the 22nd of July the parapets of the aqueduct were carried away by a flood, and repaired on emergency, at a cost of Rupees four hundred and seven, Annas seven, and Pies nine (407-7-9), in which was included the cost of a cross wall near the mouth of the water-course; but the fundamental defect noticed in the last Annual Report, viz. the steep slopes to the sides of the cutting of the water-course, deep in bad soil, not having been remedied (such a work being impossible of execution at the season), it is not surprising that on the 4th of October, nearly the last flood of the season again carried away the parapet walls so lately repaired. Nothing remaining to be done after this last accident but effectually to remedy the fundamental defect in the water-course, I was permitted to proceed with the work in April last, adopting such measures as I might think necessary for the effectual security of the entire line of water-course. By the end of the official year considerable progress had been made in the required cutting down of the high banks of the water-course, as well as in the effectual repair of the aqueduct, the main arch of which had been found to be so broken and injured by the last accident, as to necessitate its entire removal, by which

opportunity was afforded for a new construction of superstructure, giving an increase of water-way of one (1) foot in width. The entire modifications and improvements are to be duly explained by plans, &c.

6. *Improvements to the Chowdana Bundarrah.*—This work is noticed in the last Annual Report as nearly completed. The finishing stroke was given to it very shortly after the commencement of the official year 1848-49, by fitting with teak planks the three (3) sluices in the Bundarrah. The work appears to have been followed by very satisfactory results. A large body of water now occupies the place of a mass of sand and deposit previously choking up the rear of the Bundarrah wall, and the supply of water has enabled the villagers to bring under wet cultivation land previously yielding monsoon crops only. The total cost of the work has been Rupees fifteen hundred and three, Annas nine, and Pies nine (1,503-9-9).

7. *Improvements to the Kundanah Bundarrah.*—This work, which is on the same river, about two miles above the Chowdanah Bundarrah, was also noticed in the last Annual Report as “nearly completed.” The repairs were completed very shortly after the commencement of the official year, at a total cost of Rupees eleven hundred and thirty-nine, and one Pie (1,139-0-1), but without the satisfactory result attending the repairs of the lower Bundarrah at Chowdanah, as it appears that no water occupies the place of the previously accumulated deposit, or at least but in quantities too trifling to be of any service. This proves the existence of good springs in the bed of the river between the Kundanah and Chowdanah Bundarrahs, as otherwise the former, being the upper Bundarrah, would have been better supplied than the lower. It is to be regretted that this outlay should have been thus lost to Government, but it would have been difficult, if not impossible, to have anticipated such a failure.

8. *Constructing the Seerumunee Bundarrah.*—At the close of the official year 1847-48 the foundations of this work, as modified by me from Captain Hart’s original design, were in



progress. Between the commencement of the past official year and the setting in of the monsoon of 1848 they were completed, with the exception of a corner of no consequence, and were thus left with confidence to the effects of the monsoon floods of last year. The modified design for the superstructure having received the approval and sanction of Government during the season of the suspension of all district works, the work was resumed at the opening of the working season, according to the revised design, and by the end of the past official year had been completed with the exception of some trifling details, which, however, bring its completion into the official year 1849-50, to be noticed in the next Annual Report, with a statement of the effects of the present monsoon (a very heavy one) on the new work of the first Bundarrah ever constructed by the Engineer Department new "in toto."

9. *Completing the Zeykeira Bundarrah.*—I had expected to have been able to have reported the completion of this extensive work during the past official year, but though complete in respect to all the more difficult works of tunnels, &c., there remained at the close of the past official year sufficient work to render it doubtful whether it might not be stopped by the monsoon before all could be completed. The repairs and improvements to render the magnificent Bundarrah efficient, were completed before the monsoon of 1848, as well as the first tunnel on the line; and on resuming the operations at the commencement of the year 1849 it was gratifying to find that the work done the previous year had not suffered in the least from the effects of the monsoon. The next Annual Report will, I have no doubt, contain satisfactory notice of the completion of this work.

10. *Improvements to the Dhabaree Patna Bundarrah,* noticed in the last Annual Report as nearly completed, was completed, and the four (4) sluices fitted with teak planks, very shortly after the commencement of the past official year, at a cost of Rupees three thousand seven hundred and twelve, Annas nine, and Pies eleven (3,712-9-11). The monsoon of 1848

did not in any way injure the new work, but the shifting of the deposit in rear of this Bundarrah, consequent on the construction of the four (4) sluices on the left bank, and the prolongation of the wall on the right bank, has not given satisfaction to the villagers of the two (2) villages Dhabaree and Patna, on the opposite banks of the river, who are constantly quarrelling about the supply of water. In a river having low banks, like the Girna River, at the point where this Bundarrah is constructed, it does not appear to me possible to modify an old existing Bundarrah so as to supply water in the required proportions to land on both sides of the river. All that can be done is to render the Bundarrah and water-courses so efficient that there may be as little loss as possible of the water supplied by the river, leaving it to the villagers, under the superintendence of the proper revenue authorities, to divide the water proportionably to their requirements on either side of the river.

11. *Improvements to the Mandul Bundarrah, improvements to the Jappee Bundarrah, and improvements to the Jamholee Bundarrah.*—The repairs to these three (3) Bundarras and their water-courses were noticed in the last Annual Report as nearly completed. They were all completed very shortly after the beginning of the past official year, at the costs of Rupees seventeen hundred and thirty-two, Annas three, and Pies four (1,732-3-4), Rupees seventeen hundred and thirty-nine, Anna one, and Pies ten (1,739-1-10), and Rupees five hundred and eighty-nine, Annas fifteen, and Pies five (589-15-5), respectively. I have not myself had an opportunity of visiting the localities of these works, which have been carried on and completed under the superintendence of my Assistant, Lieutenant Jones, who reported their satisfactory completion. To the best of my belief they have answered their purpose effectually.

12. *Improvements to the Moodee Bundarrah* were nearly completed at the close of the official year 1847-48, and were satisfactorily completed shortly after the commencement of

the past official year, under the superintendence of Lieutenant Jones, at a total cost of Rupees two thousand nine hundred and three, Annas five, and Pies nine (2,903-5-9), being Rupees two hundred and seventy-five, Annas five, and Pies nine (275 5-9) in excess of the sanctioned estimate, which has been duly explained, and the modifications made by Lieutenant Jones sanctioned.

24. *Constructing two Sluices in the lower Bundarrah of the Village of Arrai.*—This was not an emergent work, though sanctioned on a rough estimate sent by me to the Collector. The Arrai Bundarrah is lower down the same river as the Kundanah and Chowndanah Bundarrahs, and its rear was, like theirs, choked with sand. It is hoped that by means of the two sluices, which have been completed at a cost of Rupees one hundred and fifty-four, Annas thirteen, and Pies four (154-13-4), the deposit may be carried off to a great extent by the present monsoon of 1849, but the case of the Kundanah Bundarrah shows that, unless there are springs to supply the Bundarrah, very little will be gained by the removal of the deposit.

25. *Repairs to the Bundarrah and Water-course of the Town of Shada.*—The repairs to this Bundarrah and water-course consisted of stopping a considerable leak in the rear of the Bundarrah wall, by backing the wall with new masonry, near the leaky point, and constructing four (4) breast walls on the line of the water-course. The work at Shada is at a great distance from Malligaum, and when I visited it during the progress of the work, some additions and modifications were considered by me absolutely necessary, such as building up an extensive gap on the down-stream side of the Bundarrah wall, and constructing a waste weir and scouring sluice at the mouth of the water-course, which I accordingly ordered to be done, causing an excess of no great amount above the estimated cost. The work has since been completed satisfactorily, at a cost of Rupees six hundred and eighty-three, Annas three, and Pies five (683-3-5):

26. *Repairs to the Bundarrah and Water-course of the Town of Muchmull.*—The old Bundarrah, being unserviceable, was to be rejected, and a new Bundarrah built; a short distance below it, considerable new cuttings for water-course, on the line of which were also to be constructed two (2) aqueducts, and four (4) breast walls. On visiting the work, which is in a most unhealthy district in Western Candeish, I found it necessary to make some modifications in the sanctioned design of the work of the Bundarrah, which I found totally unprovided with a protecting screen-wall to the mouth of its water-course, a defect not to be tolerated in a new work undertaken by the Department. A waste weir and scouring sluice were also added by me for obvious reasons. Having had no time to spare, I was not able to examine the entire line of water-course, but left this for Lieutenant Jones to do. Before the end of the official year the modified Bundarrah had been nearly completed, with a portion of the new water-course. Serious difficulties have been met with in the course of this work, from the unhealthiness of the locality causing the disablement or desertion of the work-people. Lieutenant Jones was himself disabled by sickness in this part of the country.

28. *Constructing a Breast Wall across the Sakree Nullah; &c. &c. &c., at Khutghur.*—The Sakree Nullah destroyed, at every flood, the villagers' kutchā dam for the water-course, which has now been replaced by a pukka breast wall, with a screen-wall to the water-course, on the side where the force of the nullah is greatest. The work was very nearly completed at the close of the official year, as had been the repairs of an old aqueduct a short distance below the new breast wall.

29. *Repairs and improvements to the centre Bundarrah and Water-course of Seerwarra.*—These consisted of breaking two (2) scouring sluices in the main Bundarrah wall, which is in excellent order, though quite choked with deposit in its rear; building a screen-wall, with an arched opening, at the mouth of the water-course; and breaking a small open-headed scouring sluice below this screen-wall. The parapets of an old

aqueduct on the line of water-course, a short distance from the Bundarra, had to be renewed. This work was sanctioned on a rough estimate furnished by me to the Collector, and was nearly completed at the close of the official year.

30. *Repairing the Bundarra and Water-course of Akheira.*—The usual defects to be remedied and repairs executed; raising the general level of the crest of the Bundarra; breaking two (2) scouring sluices to remove the accumulated deposit in rear; and the construction of breast walls in weak or injured portions of the water-course, where entered or crossed by a nullah. Considerable progress had been made in these works before the close of the official year.

31. *Repairing the Bundarra and Water-course of Bhadne.*—Similar repairs and improvements to the above, with the addition of cutting into a slope of forty-five degrees ( $45^{\circ}$ ) the sides of a portion of the water-course in deep cutting, with perpendicular sides, as these were continually falling in by the action of the water, and choking the water-course. Great progress towards completion before the close of the official year.

47. *Annual Repairs to the made Roads and Bridges for 1848-49.*—The usual periodical repairs have been executed at a cost of Rupees fourteen thousand and twenty-eight, Annas eight, and Pies eleven (14,028-8-11), being in excess of the estimated cost by the amount of Rupees three hundred and ten, Annas eight, and Pies eleven (310-8-11). This excess was principally caused by severe injuries to the road by floods while under repair. The amount of annual sanction per mile for the made moorum portion of the line, viz. a hundred (100) Rupees, is not sufficient for the repair with proper material of the whole line of made road, of which few portions run through soil favourable for road making. Every attempt was made during the repairs to supply as good material as could be obtained, without causing an excess in the estimate, but the want of effective superintendence prevented the most good being got out of the sanctioned amount, by slight repairs to the better portions affording larger expenditure of money and

moorum of a good description on the worse portions of the line, the general rule with Native superintendents being to lay a coat of the best material to be obtained near at hand, of uniform thickness over the whole line.

50. *Improvements to the Agra Road, from Chandore Ghaut to Scindwa Pass.*—Executed on a monthly sanction of Rupees one thousand (1,000). During the past official year, the improvements to this line of road in the Province of Candeish have been as follows :—

Between Chandore and Malligaum. Very little has been done to this portion of the line, as it has for some time past been completely bridged, with the exception of the large river the Girna; and though its original construction, by embanking in some portions with inferior material, and subsequently repairing annually with the same, is not to be commended, there is no portion that can be said urgently to require reconstruction, while so many miles of road remain unconstructed. An improvement to the ford at the Girna River ferry has been made, by blasting away the rock on the right bank of the river, to save the bottom of the ferry-boat from injury, the cost of which has been Rupees fifty-seven, and Annas fifteen (57-15-0).

51. A similar but more extensive work of blasting has been completed, at a cost of Rupees one hundred and ninety-one, Annas two, and Pies ten (191-2-10), in the rocky bed of the right bank of the River Moosum, to form a safer landing-place for the ferry-boat, the rock excavation being now filled with sand and deposit. Nothing more in the way of improvement has been executed to this portion of the line of road, which, though it has the general defect throughout the greater part of its length of not being embanked to a sufficient height above the surrounding country, to admit of efficient drainage and sufficient water-way for the bridges on the line, may be said to be a very fair piece of moorum road. It is bridged but half way to Dhoolia, but, with the exception of a large bridge over the

Boree River, of which the design is before Government, cannot be said to be urgently in want of completion with bridges throughout.

52. The piece of road between Dhoolia and Soanghier is  
 Between Dhoolia over favourable soil, and may be said to be  
 and Soanghier. the best portion of the whole line in that  
 respect, short lengths of course excepted. It is in this portion, however, that the greatest delay to the dawk occurs during floods, on account of the numerous nullahs, few of which have been bridged. Nothing has been done towards the improvement of this portion of the line during the past official year beyond the usual periodical repairs.

53. The portion of the roadway between Soanghier and  
 Between Soanghier Sirpoor, and for three or four miles be-  
 and Sirpoor. yond that place, is undoubtedly the worst on the line, and most in need of immediate attention and improvement. From the point where the good moorum soil terminates in the deep black soil of the valley of the River Taptee, a new piece of road was commenced after the monsoon of 1848, and carried for a length of rather more than three (3) miles, at a total cost of Rupees ten thousand and thirty-five, Annas six, and Pies three (10,035-6-3), including the cost of a small bridge of three (3) arches, each of six (6) feet span, which was constructed for a sum of Rupees eight hundred and fifty, Annas three, and Pies nine (850-3-9), near a place called Sarwa, about the middle of the new piece of road. More could have been done during the past official year in the prolongation of this new piece of road, but as there was reason to fear an excess of the annual sanction of twelve thousand (12,000) Rupees in carrying on a piece of road at a cost of between three thousand (3,000) and four thousand (4,000) Rupees a mile, the work was suspended, to be resumed in succeeding years, should it be considered advisable. The great cost of this portion of the line of road may be easily explained by the fact of no road-making material being near at hand. The annual repairs of this road when completed will

never be properly executed under three hundred (300) Rupees a mile.

54. The road beyond Sirpoor is, as before stated, equally bad, and equally in need of immediate improvement, for about three or four miles from Sirpoor, but nothing has been done to it beyond its usual periodical repairs as a fair weather road. There is a great deal to be done in the way of bridging, excavating, and embanking, on the portion of the road between Sirpoor and the foot of the Scindwa Ghaut, but this can be deferred with propriety until the other bad portion is made into a moorum road. Above the Scindwa Ghaut is another bad portion of the line, but nothing has yet been done towards its improvement.

55. *Completing with Bridges the Road between Jhorgu and Nusseerabad.*—The works on this road were not all completed by the end of the official year, but the following bridges and breast walls had been completed :—

1st. A bridge of one (1) segmental arch, twenty (20) feet span, and three feet four inches (3'-4") rise (arc of 60 degrees), has been completed over a large nullah between Borekoond and Babra, at a cost of Rupees nineteen hundred and seven, Annas five, and Pies seven (1,907-5-7).

2nd. A bridge of three (3) segmental arches, thirty (30) feet span, and ten (10) feet rise, occupying a total length between outsides of abutments of a hundred and twenty-two (122) feet, breadth under soffit of arches seventeen (17) feet, and with a clear roadway of fourteen (14) feet, has been completed near Babra, at a cost of Rupees six thousand five hundred and sixty-one, Anna one, and Pies four (6,561-1-4).

3rd. Two (2) bridges, each of one (1) segmental arch, eight (8) feet span, and one (1) foot rise, (arc of 60°,) with a breadth under soffit of arch of seventeen (17) feet, and a clear width of roadway of fourteen (14) feet, have been constructed, one near Dholee, and the other near Bola, at a total cost of Rupees one thousand and fifty-one, Annas eleven, and Pies four (1,051-11-4),



4th. A bridge of three (3) segmental arches, twenty (20) feet span, and three feet four inches (3'-4") rise, (arc of 60°), with a breadth under soffit of arches of seventeen (17) feet, and a clear width of roadway of fourteen (14) feet, has been completed over a large nullah at Bola, at a total cost of Rupees three thousand three hundred and forty-four, Anna one, and Pies eight (3,344-1-8).

5th. A breast wall, four hundred and fifty (450) feet in length, mean thickness three feet five inches (3'-5"), and mean height three feet ten inches (3'-10"), has been constructed across the rocky bed of a branch of the Boreè River, not far from Oondeerkheira, at a cost of Rupees twelve hundred and thirty-one, Anna one, and Pies four (1,231-1-4); and,

6th. A breast wall, one hundred and sixty-three (163) feet in length, three (3) feet in thickness, and four feet two inches (4'-2") in mean height, has been constructed across the Oondeerkheira Nullah, at a cost of Rupees three hundred and twenty, Annas fifteen, and Pies eight (320-15-8); the object of the above breast walls being to secure a soft sandy roadway over the deposit that will accumulate in their rear, in place of the former difficult and destructive passage across the uneven rocky beds of the river and nullah; a very good arrangement, when the construction of a bridge is objectionable on account of its expense, or impracticable without heavily embanked approaches.

There remains but little more of the estimated work to be completed on this line, of which an account will be given in the next Annual Report.

No. 1101 of 1849-50.

GENERAL DEPARTMENT.

To

THE SECRETARY MILITARY BOARD,

Bombay.

SIR,

I have the honor to forward the Annual Report of Works in the Northern Provinces for the year ending 30th April 1849.

*Statement of the Sums expended by each Officer under the Superintending Engineer, Northern Provinces, from 1st May 1848 to 30th April 1849.*

Names of Officers.	In the Military Department.	In the General Department.	In the Judicial Department.	In the Revenue Department.	In the Territorial Department.	In the Political Department.	In the Ecclesiastical Department.	Total.
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
Major Goodfellow, Captain Hebert, and Lieutenant Kennedy, Executive Engineers, Surat Division...	1,269 5 4	6,500 9 10	2,682 3	6,3714 10 5	545 1 10	0 0 0	65 3 0	14,777 1 11
Lieutenant Dickinson, Executive Engineer, Ahmedabad Division .....	11,728 0 9	25,228 12 6	2,912 5	2,044 8 9	2,347 9 5	1,100 3 1	1,987 12 0	47,349 3 8

Captain Evans and Lieut. Brown, Acting Executive Engineers, Deesa Division .....	28,800	1	8	26	9	8	0	0	0	0	0	0	0	0	0	588	2	10	20,414	14	2			
Lieutenant Wilkinson, Captains MacGregor and Taylor, in Charge of Public Works at Rajkote..	2,831	2	8	0	0	0	0	0	0	0	0	0	0	0	371	0	0	593	3	0	3,795	2	8	
Lieut. Moyle, in Charge of Public Works at Bhooj .....	1,456	9	3	0	0	0	0	0	0	0	0	0	0	0	122	0	0	172	14	11	1,751	8	2	
Total..	46,085	3	8	31,756	0	0	5,594	8	8	5,759	3	2	2,892	11	3	1,593	3	1	3,07	0	9	97,087	14	7

*Statement showing the Cost of Engineering and General Superintendence of each Officer under the Superintending Engineer, Northern Provinces, from 1st May 1848 to 30th April 1849.*

Names of Officers.	Expense of Establishment per annum.			Expenditure.			Rate per cent.
	Rs.	a.	p.	Rs.	a.	p.	
Major Goodfellow, Captain Hebbert, and Lieutenant Kennedy, Executive Engineers, Surat Division .....	8,842	5	7	14,777	1	11	59 $\frac{2}{3}$
Lieutenant Dickinson, Executive Engineer, Ahmedabad Division .....	11,867	11	3	47,349	3	8	25 $\frac{1}{8}$
Captain Evans and Lieutenant Brown, Acting Executive Engineers, Deesa Division .....	6,147	8	4	29,414	14	2	20 $\frac{9}{16}$
Lieutenant Wilkinson, Captains MacGregor and Taylor, in Charge of Public Works at Rajcote.....	242	0	0	3,795	2	8	6 $\frac{1}{2}$
Lieutenant Moyle, in Charge of Public Works at Bhooj .....	158	0	0	1,751	8	2	9
Total.....	27,257	9	2	97,087	14	7	28 $\frac{1}{4}$

During the last year no works of general or permanent professional interest have been executed, and there do not appear to have been any facts recorded worthy of publication.

From the outlay at Ahmedabad, there have been Rupees 21,537 expended on local and general improvements. From that at Deesa, Rupees 13,209 have been expended on the improvement of the Aboo Road, and buildings for the use of the sick Europeans on the Mountain.

I have the honor to be, &c.,

(Signed) W. G. HEBBERT, Captain,  
Acting Superintending Engineer, N. P.

Superintending Engineer's Office, N. P.,  
Surat, 10th October 1849.

*Statement of Expenditure in the Construction and Repair of  
Public Works in the Road and Tank Department, from the  
1st of May 1847 to the 30th of April 1848.*

*Bandorah, 12th January 1850.*

Names of Works.	Amount.	Total.
	Rs. a. p.	Rs. a. p.
<i>Works connected with the Communication of the Country.</i>		
Constructing a piece of road connecting Karlee Travellers' Bunglow with main line.....	128 15 3	
Rolling mail road for 1847-48.....	678 2 4	
Minor works.....	13 9 2	
Repairing bridge on mail road near Sungum..	306 14 1	
Annual repairs to mail road for 1846-47....	6,593 6 1	
Bridging and metalling the new Akoordee road.	18,028 12 0	
Securing railing posts of Welesly Bridge....	192 0 0	
Annual repairs to flying bridges for 1847-48..	239 0 0	
Removing centering of the Poonah bridge..	1,352 4 0	
Annual repairs to bridges and drains on cross roads for 1847-48.....	9 9 5	
Annual repairs to bridges to cross roads for 1847-48.....	4,228 0 0	
Annual repairs to bridges to mail road for 1847-48.....	10,262 0 0	
Annual repairs to bridges and drains on mail road for 1847-48.....	806 0 0	
Constructing junction road between Dapoorce and Holker's Bridge.....	3,828 10 6	
Renewing parapet wall of the 2nd bridge on main road beyond the Sungum.....	690 0 0	
Annual repairs to fair weather roads for 1847-48.....	158 0 0	
Annual repairs to flying bridges at Koregaum and Seroor for 1847-48.....	812 1 3	
Marine stores expended on ditto.....	1,258 10 10	
Cost of working the flying bridges.....	1,252 0 0	
Annual repairs to roads, bridges, &c. for 1847-48, in the Poonah Collectorate....	9,882 10 3	
Constructing a bridge over the Kondapoor nullah.....	2,640 0 0	
Constructing a bridge over Wussudwadee nullah.....	2,585 0 0	
Making up four more steel traversers.....	12 11 6	
Transmission of Engineer stores.....	1 5 0	
Removing the flying bridge from Poonah, and re-erecting it at Khurralee.....	1,931 0 0	
Carried forward, Rs.....	67,890 9 8	

Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought forward, Rs.....	67,800	9	8			
Removing one of the flying bridges at Seroor ; dismantling and repairing one at Koregaum.	740	7	5			
Petty repairs and petty charges in the Poonah Collectorate .....	169	3	5			
Driving an experimental pile in the Seena river .....	151	13	4			
Annual repairs to roads, bridges, &c. for 1847-48, in the Nuggur Collectorate.....	4,575	8	5			
Petty repairs and petty charges in the Nuggur Collectorate .....	168	2	5			
Constructing a new road between Patus and Indapoor .....	94,224	1	7			
Annual and special repairs to Nagpoor dawki line.....	3,368	2	10			
Maintenance of ferry men and hawlers on Nagpoor dawki line .....	3,570	2	8			
New works on Nagpoor dawki line .....	5,148	13	4			
Clearing a new line of road from the village of Vulludgaum to Aurungabad.....	101	13	0			
Petty repairs of sheds for the boats at the Godavery and Poonah rivers .....	14	2	8			
Annual repairs to Nagpoor dawki line for March and April 1848 .....	574	13	0			
Constructing Thul Ghaut experimental and lower portions of roads.....	52	6	10			
Constructing Thul Ghaut new road .....	48,184	2	2			
Annual repairs to main road from Chandore Ghaut to Thul Ghaut for 1845-46.....	3	0	0			
Annual repairs to main road from Chandore Ghaut to Thul Ghaut for 1846-47 .....	39	6	9			
Annual repairs to main road from Chandore Ghaut to Thul Ghaut for 1847-48.....	10,003	1	2			
Annual repairs to the experimental and lower portions completed on that Ghaut new road for 1847-48 .....	438	15	9			
A cut across the angle formed by a sharp turn in a nullah near the village of Kokungaum, between Nassick and Chandore, for the protection of main road.....	257	15	9			
Annual repairs to Pimpree and Sinnur cross roads for 1847-48 .....	1,441	0	1			
Annual repairs to bridges and drains on main road for 1847-48 .....	50	11	10			
Petty repairs.....	2	8	4			
Annual repairs to bridges and drains on the Sinnur cross road for 1847-48.....	131	13	2			
Annual repairs to ferry boats and flying bridges in the Nassick Sub-Collectorate for 1847-48.....	57	15	2			
Carried forward, Rs.....	2,41,360	14	9			

Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought forward, Rs.....	2,41,360	14	9			
Petty repairs.....	65	7	8			
Clearing away rubbish from the gutter and roadway on the Thul Ghaut road, near the Rurtonda Pass.....	98	0	2			
Repairing and improving the bridge at Gokhurwah.....	1,372	6	1			
Annual repairs to main road for 1847-48...	9,070	8	11			
Special repairs to main road for 1847-48....	221	7	8			
Annual repairs to road in the Cantonment at Bhowdy for 1847-48.....	196	13	0			
Special repairs to road between Tannah and Purlick.....	118	3	4			
Annual repairs to main road from Sion Causeway to Colsette ferry for 1847-48.....	5,117	0	0			
Annual repairs to main road from Bandorah to Ghore Bunder for 1847-48.....	5,359	0	0			
Annual repairs to main road from Trombay to Sion Causeway for 1847-48.....	873	0	0			
Annual repairs to main road from Chemboor to the Mhual boundary for 1847-48.....	166	0	0			
Erecting bridge at Erla Parla, on the Bandorah and Ghore Bunder road.....	4,500	0	0			
Constructing a new road from Coorla to the 20th mile-stone, near Tannah.....	1,500	0	0			
Surveying the Esplanade at Tannah.....	7	8	0			
Annual repairs to mail road from Panwell to Khopoles for 1847-48.....	6,686	2	5			
Annual repairs to bridge and drains on mail road for 1847-48.....	170	5	11			
Annual repairs to main road from Nagotna to Mahableshwur for 1847-48.....	5,025	0	0			
Annual repairs to cross roads in the Northern Conkun for 1847-48.....	3,163	3	8			
Annual repairs to cross roads in the Southern Conkun for 1847-48.....	1,329	2	10			
Completing the works of the Panwell Bunder platform.....	1,591	11	5			
Re-constructing Nudhel bridge, on mail road..	773	12	4			
Re-constructing a bridge on Cullian road....	220	15	0			
Minor works.....	67	3	3			
				2,89,053	14	5
<i>Tanks, Bunds, and Wells.</i>						
Deepening a well on mail road, near Wursolee.	79	3	8			
Constructing sluices in the Dhurrun at Kullud.	43	14	11			
Clearing and building parapet wall to the well at Shikarpoor, on main road between Poonah and Seroor.....	176	0	0			
Carried forward, Rs.....	299	2	7	2,89,053	14	5

Names of Works.	Amount.	Total.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Brought forward, Rs. ....	299 2 7	2,80,053 14 5
Sinking and building a well at Egutpooree, between Nassick and Thul Ghaut. ....	13 5 4	
Clearing out and building up an old well at Bhewndy. ....	96 14 10	
Clearing out and effecting certain improve- ments to a tank at Colsette. ....	450 14 0	
Improving the tank at Khurdee. ....	782 10 1	
Clearing out tank and well at Woundall. ....	137 11 3	
		1,780 10 1
<i>Buildings.</i>		
Annual repairs to furniture of Travellers' Bungalows for 1846-47. ....	31 14 2	
Annual repairs to the Travellers' Bungalows for 1847-48. ....	974 6 9	
Constructing new pendalls on Bombay road. .	7,224 4 0	
Constructing Mamedar's Cutcherry at Khair. .	450 12 8	
Annual repairs to the Travellers' Bungalows in the Poonah Collectorate for 1847-48. ....	280 0 0	
Annual repairs to the Travellers' Bungalows in the Ahmednuggur Collectorate for 1847-48. ....	1,263 0 0	
Annual repairs to the Travellers' Bungalows in the Nassick Sub-Collectorate. ....	304 10 6	
Petty repairs. ....	18 12 1	
Petty repairs to the Military buildings at Nas- sick for 1847-48. ....	30 10 7	
Making certain additions required to the Mi- litary buildings at Nassick. ....	93 1 3	
Petty works. ....	22 0 0	
Petty repairs. ....	28 10 3	
Annual repairs to store-room at Bhewndy for 1847-48. ....	19 12 0	
Annual repairs to the Travellers' Bungalows for 1847-48. ....	613 3 4	
Repairing furniture of the Travellers' Bun- galows for 1847-48. ....	24 0 0	
Constructing new and repairing weather screens, and also constructing new gate to the compound of the Church at Tannah, for 1847-48. ....	222 1 2	
Annual repairs to the Church at Tannah. ....	6 14 0	
Petty repairs to the Church at Tannah. ....	73 9 5	
Constructing a weighing shed near the Custom house at Tannah. ....	768 7 1	
Annual repairs to the buildings in the Custom Department at Tannah for 1847-48. ....	360 4 11	
Carried forward, Rs. ....	12,810 6 2	2,90,834 8 6



Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought forward, Rs.....	12,810	6	2	2,90,834	8	6
Special repairs to the buildings in the Custom Department at Tannah for 1847-48 .....	570	2	8			
Annual repairs to the Quarter Guard-room and Hospital.....	51	4	3			
Emergent repairs to the Quarter Guard-room at Bhowndy .....	44	8	2			
Annual repairs to Civil Department Hospital for 1847-48.....	84	0	0			
Annual repairs to the Travellers' Bungalow and out-houses for 1847-48. ....	69	0	0			
Annual repairs to the Engineer store-room and out-houses for 1847-48.....	38	0	0			
Annual repairs to permanent and temporary pendalls .....	390	0	0			
Erecting a new Hospital for the Military Department at Tannah.....	2,840	0	0			
Removing Tannah Church bell from tower of Church to Bombay, bringing back, and replacing.....	35	0	0			
Colouring and whitewashing Civil Hospitals at Tannah.....	38	8	0			
Annual repairs to the Travellers' Bungalow in the Southern Conkun for 1847-48.....	43	4	9			
Annual repairs to the Travellers' Bungalow in the Northern Conkun for 1847-48.....	231	5	2			
Constructing a Cutcherry for the Mahalkurly at Oorun.....	1,100	0	0			
				18,345	7	2
Total, Company's Rupees Three lacks, Nine thousand One hundred and seventy-nine, Fifteen Annas, and Eight Pies.....				3,09,179	15	8

(Signed) W. D. GRAHAM, Bt. Captain,  
*Superintendent of Roads and Tanks.*

*Statement showing the Amount expended by each Officer of the Road and Tank Department, from the 1st of May 1847 to the 30th April 1848.*

Names of Officers.	Roads and Bridges.		Tanks, Wells, and Bunds.		Buildings.		Total.	
	<i>Rs.</i>	<i>a. p.</i>	<i>Rs.</i>	<i>a. p.</i>	<i>Rs.</i>	<i>a. p.</i>	<i>Rs.</i>	<i>a. p.</i>
Captain Cowper .....	47,515	2 10	79	3 8	8,681	5 7	56,275	12 1
Mr. Scott .....	26,180	9 10	219	14 11	1,543	0 0	27,943	8 9
Mr. Armistead .....	94,224	1 7	..	..	..	..	94,224	1 7
Captain Dennis .....	12,777	15 6	..	..	..	..	12,777	15 6
Lieutenant Chapman .....	60,728	8 8	18	5 4	497	12 8	61,239	10 8
Lieutenant Scott .....	10,959	8 10	1,880	6 11	2,754	3 0	15,049	13 9
Lieutenant Mungavin .....	17,640	11 4	..	..	3,494	8 0	21,135	3 4
Captain Pruen .....	19,027	8 10	137	11 3	1,374	9 11	20,539	14 0
Total.....	2,89,055	14 5	1,780	10 1	18,945	7 2	3,09,170	15 8

(Signed) W. D. GRAHAM, Bt. Captain,  
Superintendent of Roads and Tanks.

*Return showing the Expense of Engineering and Superintendence with reference to actual Outlay.*

Names of Officers.	Expense of Establishment per annum.	Expenditure.	Rate per cent.
	<i>Rs.</i>	<i>Rs.</i>	
Captain Cowper .....	8,855	56,275	15 $\frac{2}{3}$
Mr. Scott .....	10,605	27,943	37 $\frac{1}{3}$
Mr. Armistead .....	3,527	94,224	3 $\frac{2}{3}$
Captain Dennis .....	7,430	12,777	58 $\frac{1}{2}$
Lieutenant Chapman .....	9,257	61,239	15 $\frac{1}{2}$
Lieutenant Scott .....	9,939	15,043	66 $\frac{1}{4}$
Lieutenant Mungavin.....	8,272	21,135	39 $\frac{1}{2}$
Captain Pruett .....	8,176	20,539	39 $\frac{2}{3}$

Total Expenditure during the year ..... Rs. 3,09,179 $\frac{1}{2}$   
 Cost of Establishments ..... 66,061  
 Average rate per cent..... 21 $\frac{1}{2}$

(Signed) W. D. GRAHAM, Bt. Captain,  
*Superintendent of Roads and Tanks.*

NOTE.—Captain Dennis is Post Master as well as in charge of the Nagpoor Dawk Line, and the allowances drawn by that Officer should not therefore be all debited to the Road and Tank Department, especially as his Engineering duties are confined to one line of works.

(Signed) W. D. GRAHAM, Bt. Captain,  
*Superintendent of Roads and Tanks.*

*Statement of Expenditure in the Construction and Repairs of  
Public Works in the Road and Tank Department, from the  
1st of May 1848 to the 30th of April 1849.*

Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
<i>Works connected with the Communication of the Country.</i>						
Annual repairs to mail road for 1847-48 . . . .	4,274	0	0			
Annual repairs to bridges and drains on mail road for 1847-48 . . . . .	714	0	0			
Rolling mail road for 1847-48 . . . . .	31	4	8			
Annual repairs to cross roads for 1847-48 . . . .	175	0	0			
Annual repairs to roads, bridges, &c., for 1847-48 . . . . .	1,465	1	11			
Annual repairs to flying bridges at Koregaum and Seroor, for 1847-48 . . . . .	82	14	9			
Annual repairs to roads, bridges, &c. for 1847-48 . . . . .	639	13	8			
Bridging, draining, and metalling the new Akoordee road . . . . .	11,193	5	4			
Junction road between Dapoores and Holkur bridge . . . . .	2,978	7	3			
Annual repairs to mail road for 1848-49 . . . .	8,142	7	1			
Annual repairs to cross roads for 1848-49 . . . .	4,385	5	9			
Rolling mail road . . . . .	416	12	3			
New road on the South side of Bheema, lead- ing from cross road to the town of Khair . . . .	34	10	8			
Annual repairs to bridges and drains on mail road for 1848-49 . . . . .	1,063	8	0			
Minor works . . . . .	278	1	3			
Annual repairs to fair weather roads for 1848-49 . . . . .	158	0	0			
Annual repairs to flying bridges for 1848-49 . .	227	15	3			
Constructing a branch road from Dapoores bridge to Government House . . . . .	700	0	0			
Renewing one of the flying bridges at Seroor, and repairing at Koregaum . . . . .	1,502	13	6			
Annual repairs to the flying bridges at Kore- gaum for 1848-49 . . . . .	1,007	0	0			
Annual repairs to roads, bridges, &c. for 1848-49 . . . . .	8,073	15	3			
Minor works . . . . .	235	15	8			
Annual repairs to roads, bridges, and drains for 1848-49 . . . . .	3,853	0	7			
Minor works . . . . .	4	0	0			
Annual repairs to works on Nagpoor Dawk line for 1848-49 . . . . .	7,500	2	5			
Maintenance of ferrymen and haulers for 1848-49 . . . . .	3,628	8	1			
Carried forward, Rs. . . . .	62,766	3	4			

Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought forward, Rs.....	62,766	3	4			
New works for 1848-49 .....	3,188	4	3			
Replacing the retaining walls with three drains for the masonry bridge at Hewrah, No. 8..	374	0	0			
Petty repairs to sheds for the roads at the Godavery and Poonah rivers, &c.....	11	5	10			
Constructing the Thull Ghaut experimental portion of road.....	1,840	1	3			
Completing the Thull Ghaut new road .....	56,118	13	1			
Improvement of Chandore Ghaut .....	128	9	9			
Annual repairs to main road from Chandore Ghaut to Thull Ghaut for 1845-46 .....	165	9	4			
Annual repairs to main road from Chandore Ghaut to Thull Ghaut for 1847-49 .....	2,354	10	10			
Annual repairs to main road from Chandore Ghaut to Thull Ghaut for 1848-49 .....	12,690	1	9			
Repairs to the experimental and lower portions completed on the Thull Ghaut new road for 1848-49.....	332	11	5			
Rebuilding and repairing the retaining walls of the Chandore Ghaut, also building portions of parapet walls of the Chandore Ghaut for 1848-49 .....	3,886	14	4			
Annual repairs to Sinnur and Pimpree cross roads for 1847-48 .....	198	7	10			
Annual repairs to Sinnur and Pimpree cross roads for 1848-49 .....	1,755	5	1			
Annual repairs to road constructing between the Camp and the town of Nassick .....	115	15	4			
Petty repairs to Sinnur cross road.....	18	9	8			
Annual repairs to bridges and drains on main road for 1846-47 .....	156	3	9			
Annual repairs to bridges and drains on main road for 1847-48.....	91	1	4			
Annual repairs to bridges and drains on main road for 1848-49.....	87	7	5			
Minor works.....	39	15	11			
Constructing bridge over Pharasherry river, at Pimpulgaum.....	6,737	10	9			
Annual repairs to bridges and drains on Sinnur cross road for 1848-49.....	21	14	1			
Annual repairs to flying bridges for 1847-48.	130	15	6			
Annual repairs to flying bridges for 1848-49.	208	4	0			
Petty repairs to flying bridges.....	295	2	3			
Constructing new line of road from Kussorah to Khurdee for 1848-49.....	25,161	2	0			
Special repairs to main road.....	104	14	0			
Annual repairs to main road for 1848-49.....	9,470	15	5			
Annual repairs to road in the Cantonment at Bhowndy for 1848-49 .....	117	0	10			
Carried forward, Rs.....	1,88,568	6	10			

Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought forward, Rs.....	1,88,568	6	10			
Repairing the bridge at Gokhurwa.....	47	13	1			
Constructing a platform at the port of Bhowndy	476	7	1			
Repairs to the steps of the Kasseylee Bunder.	43	7	8			
Special repairs to the road between Tannah and Persick.....	306	0	0			
Constructing a road between Coorla and the 20th mile-stone, near Tannah.....	475	13	3			
Annual repairs to main road from Sion Cause- way to Colsette Ferry for 1848-49. ....	3,073	8	0			
Annual repairs to main road from Bandora to Ghora Bunder for 1848-49 .....	4,738	8	0			
Annual repairs to main road from Trombay to Sion Causeway .....	599	4	0			
Annual repairs to main branch road from Chemboor to Mhoul boundary.....	124	8	0			
Completing the Bhandoop road .....	2,745	4	10			
Annual repairs to mail road from Khopolee to Panwell for 1848-49 .....	2,999	8	5			
Annual repairs to bridges and drains from Khopolee to Panwell for 1848-49.....	41	10	6			
Annual repairs to main road from Nagotna to Mahableshwur, for 1848-49.....	4,667	7	6			
Annual repairs to cross roads in the Northern Conkan for 1848-49. ....	3,406	4	9			
Annual repairs to cross roads in the Southern Conkan, for 1848-49.....	1,635	15	2			
Reconstructing Needhul bridge, on mail road.	210	0	2			
Constructing road from Poona to Inda- poor .....	31,604	12	3			
				2,45,784	11	6
<i>Tanks, Wells, and Bunds.</i>						
Clearing out and building up an old well at Bhowndy .....	37	10	8			
Clearing out and effecting certain improve- ments to a tank at Colsette .....	834	8	0			
Improving tank at Khurdes .....	3,908	5	1			
Sinking a new well at Pudgah, near the Tra- vellers' Bungalow .....	159	13	1			
Building a facing to prevent leakage to the bund of Kussara tank.....	99	12	0			
Sinking a well at Egutpooree, between Nassick and Egutpooree.....	300	0	0			
Petty repairs to Wuddalee well on main road.	50	0	0			
Clearing water holes below the Layna Hills, near main road.....	33	10	6			
Minor works .....	27	15	6			
				5,451	10	10
Carried forward, Rs.....				2,51,236	6	4

Names of Works.	Amount.	Total.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
<i>Buildings.</i>		
Brought forward, Rs.....		2,51,236 6 4
Constructing new pendalls on Bombay road..	7,974 9 4	
Constructing Mamledar's Kutcherry at Khair.	2,724 3 4	
Annual repairs to Travellers' Bungalow for 1847-48.....	91 9 3	
Annual repairs to Travellers' Bungalow for 1848-49.....	343 12 3	
Constructing new Travellers' Bungalow at Akoordee.....	2,026 10 2	
Annual repairs to Travellers' Bungalows for 1847-48.....	127 0 0	
Annual repairs to Travellers' Bungalows for 1848-49.....	399 0 0	
Annual repairs to Travellers' Bungalows for 1848-49.....	955 0 0	
Annual repairs to Travellers' Bungalows for 1848-49, in Northern Conkan.....	9 4 0	
Annual repairs to Travellers' Bungalows for 1848-49, in Southern Conkan.....	8 14 0	
Constructing new pendalls at Chowke and Panwell.....	11,630 0 0	
Emergent repairs to Mamledar's Kutcherry at Panwell.....	904 6 4	
Minor works.....	111 13 11	
Annual repairs to Store-room at Bhowndy for 1848-49.....	19 14 2	
Annual repairs to Travellers' Bungalows for 1848-49.....	608 7 4	
Repairing and fixing the door of one of the bath rooms of Travellers' Bungalow at Kussarah.....	0 9 3	
Constructing new and repairing old weather screen, and also constructing a new gate to the compound wall of the Church at Tannah.	68 5 10	
Annual repairs to the Church at Tannah for 1848-49.....	576 10 2	
Tarring railing surrounding the burial-ground of the Church at Tannah.....	50 7 0	
Repairing venetians of the windows of the Tannah Church.....	10 5 6	
Repairing plaster of the Tannah Church...	79 13 4	
Annual repairs to the buildings in the Custom Department at Tannah for 1848-49.....	711 7 9	
Repairing the 1st Assistant Collector's bungalow at Kelwa, Mahim.....	150 14 7	
Repairing plaster of the buildings in the Custom Department at Tannah.....	50 7 3	
Repairing hips and ridges of the buildings in the Custom Department at Tannah.....	9 12 0	
Carried forward, Rs.....	29,643 4 9	

Names of Works.	Amount.	Total.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Brought forward, Rs.....	29,643 4 9	2,51,236 6 4
Making props and fixing furls, &c. to the bamboo mat frames of the buildings in the Custom Department at Tannah for 1848-49.	3 8 11	
Dammering gutters of the buildings in the Custom Department at Tannah for 1848-49.	15 9 6	
Annual repairs to Quarter Guard room and Hospital of the Native Veteran Battalion at Bhewndy for 1848-49 .....	328 1 9	
Repairing hips and eaves of the Hospital of the Native Veteran Battalion at Bhewndy.....	12 1 1	
Whitewashing the Hospital of the Native Veteran Battalion at Bhewndy.....	21 10 0	
Remaking floor of the Hospital of the Native Veteran Battalion at Bhewndy.....	19 6 5	
Annual repairs to the Civil Hospital at Tannah.	79 0 0	
Annual repairs to the Travellers' Bungalows..	34 0 0	
Annual repairs to the Engineer Store-room, &c.	104 0 0	
Annual repairs to the Military buildings....	346 0 0	
Constructing railing and fixing glass windows in the Military Hospital at Tannah.....	307 0 0	
Minor works.....	190 7 10	
Annual repairs to Travellers' Bungalows for 1847-48.....	30 3 2	
Annual repairs to Travellers' Bungalows for 1848-49.....	204 9 1	
Petty repairs.....	83 9 8	
Petty works .....	5 9 2	
Improvement in the Police and Civil Hospital at Nassick.....	42 1 5	
Repairs to Military buildings for 1847-48-49, and petty repairs.....	213 7 11	
Cleaning the privies of the Nassick Jail, by means of water from an old well, also a paved washing place to provide for the prisoners .....	238 7 1	
		31,922 1 9
Grand Total, Rupees Two Lacs Eighty-three thousand One hundred and Fifty-eight, Annas Eight, and Pie One.....		2,83,158 8 1



*Statement showing the Amount expended by each Officer of the Road and Tank Department, from the  
1st of May 1848 to the 30th April 1849.*

Names of Officers.	Roads and Bridges.		Tanks, Wells, and Bunds.		Buildings.		Total.	
	<i>Rs.</i>	<i>a. p.</i>	<i>Rs.</i>	<i>a. p.</i>	<i>Rs.</i>	<i>a. p.</i>	<i>Rs.</i>	<i>a. p.</i>
Captain Cowper ..	...	...	0	0	14,641	12 4	66,279	5 2
Mr. Armistead ..	...	...	0	0	0	0 0	31,604	12 3
Captain Dennis ..	...	...	0	0	0	0 0	14,702	4 7
Lieutenant Chapman ..	...	...	411	10	817	15 6	88,604	2 2
Lieutenant Scott ..	...	...	5,040	0	2,737	7 10	43,199	5 3
Mr. Scott ..	...	...	0	0	1,060	7 10	13,123	5 11
Lieutenant Boddam ..	...	...	0	0	12,664	6 3	25,645	4 9
Total, Rupees.....	2,45,784	11 6	5,451	10 10	31,922	1 9	2,83,156	8 1

*Return showing the Expenses of Engineering and Superintendence, with reference to Actual Outlays.*

Names of Officers.	Expense of Estab- lishment per Annum.	Expenditure.	Rate per Cent.
	Rs.	Rs.	Rs.
Captain Cowper .....	16,806	66,279	25½
Mr. Armistead .....	8,681	31,604	11½
Captain Dennis .....	7,002	14,702	47¾
Lieutenant Chapman.. ..	6,148	88,604	6 <sup>3</sup> / <sub>8</sub>
Lieutenant Scott .....	9,877	49,199	22½
Mr. Scott.....	8,618	18,123	65½
Lieutenant Boddam.. ..	6,558	25,645	25½

Total Expenditure during the year.....Rs. 2,83,158  
 Cost of Establishments, ditto....." 58,690  
 Average Rate per Cent....." - 20½

NOTE.—Captain Dennis is Post Master as well as in Charge of the Nagpoor Dawk Line, and the allowances drawn by that Officer should not therefore be all debited to the Road and Tank Department, especially as his Engineering duties are confined to one line of works.

NOTE.—The original Establishment kept up for the superintendence of the Chimboor Causeway, and the employment of prisoners, has not as yet been reduced, which is the cause of the very high rate of superintendence.

(Signed) W. D. GRAHAM, Bt. Captain.  
*Superintendent of Roads and Tanks.*

*List of Estimates prepared by the Officers of the Road and Tank Department, and submitted for Sanction, between the 1st May 1848 and the 30th April 1849.*

Estimates.	Amount.		
	Rs.	a.	p.
<b>CAPTAIN COWPER.</b>			
Estimate for constructing new ferry boats on the rivers Bhama and Bheema, on the Narraingaum road.....	660	0	0
Estimate for constructing Moonsiff's Court-house at Wurgaum.	1,276	0	0
Making certain alterations and repairs to the old palace at Phoolshare.. . . . .	1,013	11	3
Rebuilding the Eastern approach of the Shickarpore bridge...	6,134	0	0
Estimate for constructing a Mamedar's Kutcherry at Khurkallah . . . . .	3,574	0	0
Making certain additions to the Poonah Travellers' Bungalow..	199	0	0
Constructing additional staging pendulls on the road from Poonah to Panwell .. . . .	31,692	0	0
Repairing and rendering serviceable a well at Lownee . . . . .	445	0	0
Constructing branch road to Government House, Dapooree...	1,508	0	0
<b>MR. SUB-CONDUCTOR ARMISTEAD.</b>			
Construction of the Patus and Poonah road A.....	1,02,000	0	0
Ditto ditto ditto B.....	1,08,966	0	0
Ditto ditto ditto C.....	1,31,221	0	0
Restoring the bund of Kassoodee tank....	39,656	1	4
Repairing embankment of ditto ditto....	21,562	3	5
Constructing tank at Yewut . . . . .	3,070	0	0
Statement exhibiting the probable reduction in the estimated cost of drains, bridges, &c. for the Patus and Poonah road..	8,592	0	0
<b>LIEUTENANT CHAPMAN.</b>			
Estimate for the approaches to the proposed bridge over the Undwell river, accompanying plan . . . . .	14,787	0	0
Estimate of rebuilding and repairing the retaining walls of Chandore Ghaut, accompanying sections.. . . .	3,887	0	0
Estimate for cleaning the privies of the Nassick Jail by means of water from an old well, and accompanying plan.. . . .	226	0	0
Fixing the railing of Undwell river, on one side of the Nasurdee causeway . . . . .	482	0	0
Removing of certain defects in the Police and Civil Hospital at Nassick .. . . .	44	0	0
Building bridges over two nullahs, one between the Kadoo river and Pimpulgaum, and the other near Konkungaum, on the main road, in the Nassick Sub-Collectorate.. . . .	1,324	0	0
Carried forward, Rs.....	4,82,819	0	0

Estimates.	Amount.
	<i>Rs. a. p.</i>
Brought forward, Rs. ....	4,82,819 0 0
Building a dip across a nullah on the connecting road between the Camp and Nassick, accompanying sketch . . . . .	234 0 0
Fixing a permanent site, and for making approaches and providing standands, ramps, &c. to the Godavery flying bridge at Nassick . . . . .	5,326 0 0
<b>LIEUTENANT SCOTT.</b>	
Supplementary estimate for extending the facing to the Kusara tank . . . . .	86 0 0
Estimate for constructing three new weather screens, and repairing the remainder; also constructing one new gate to the compound at the Tannah Church . . . . .	294 0 0
Estimate for sinking a new well at Pudgha, near the Travellers' Bungalow, with plan . . . . .	163 0 0
Estimate for constructing a new Custom House at Oomergaum, with plan . . . . .	1,134 0 0
Estimate for repairing cut stone steps, &c. to the Kusseylee bunder, with plan . . . . .	56 0 0
Estimate for constructing a new horse boat for the Dantewra ferry, with plan . . . . .	1,145 0 0
Estimate for repairing the 1st Assistant Collector's Bungalow at Kelwa Mahim, in the Bassein District, with plan . . . . .	1,433 0 0
Estimate for erecting a bund, and cutting a channel for the purpose of stopping the encroachment of the Oomergaum river on the town of Oomergaum, with plans . . . . .	12,804 0 0
Estimate for building two new boats for the use of the passengers at the Colsette ferry, with plan . . . . .	1,066 0 0
Estimate for constructing a teakwood gate, with the posts, to the compound of the Native Veteran Battalion Hospital at Bhowndy, with plan . . . . .	50 0 0
Estimate for constructing a defaulters' room to the present Quarter Guard of the Native Veteran Battalion at Bhowndy.	193 0 0
<b>MR. SCOTT.</b>	
Estimate for erecting fence on two sides of the Military Hospital at Tannah, and fixing glazed windows . . . . .	395 0 0
Statement for completing the Bhandoop road . . . . .	15,400 0 0
Estimate for repairing the bungalow on the Tannah Fort rampart, to be converted into a Jail Hospital . . . . .	1,851 0 0
Estimate for constructing a road at Bundora, leading to the hill of Senhora de Monte . . . . .	6,240 0 0
Estimate for erecting three permanent pendalls for the use of the Detachment at Tannah . . . . .	3,693 0 0
Estimate for erecting two new defaulters' rooms joined to the Quarter Guard at Tannah . . . . .	214 0 0
Carried forward, Rs. ....	5,34,596 0 0

Estimates.	Amount.
	<i>Rs. a. p.</i>
Brought forward, Rs.....	5,34,596 0 0
Estimate for substituting plank ceiling for the choonam ones to the verandah of the Collector's House at Tannah .....	1,074 0 0
Estimate for repairing the injuries sustained by the Bhandoop road .....	905 0 0
Estimate for repairing the double boat plying between Tannah and Kulwa .. .. .	397 0 0
<b>LIEUTENANT BODDAM.</b>	
Supplementary estimate for constructing Nedhul bridge, on mail road .. .. .	256 0 0
Estimate for emergent repairs to the Mamledar's Kutcherry at Panwell .. .. .	1,356 0 0
<b>CAPTAIN DENNIS.</b>	
Estimate for new works on Nagpoor Dawk line.... ..	3,188 4 3
Replacing the retaining walls, with three drains, for the masonry bridge at Hewra, No. 8 .. .. .	374 0 0
<b>ANNUAL REPAIRS.</b>	
Estimate for annual repairs for roads, &c. for the year 1849-50.	1,10,907 0 4
Estimate for annual repairs for buildings.. .. .	6,216 0 0
Grand Total, Rupees.....	6,59,269 4 7

(Signed) W. D. GRAHAM, Bt. Captain,  
*Superintendent of Roads and Tanks.*



THE  
BOMBAY ENGINEERS' REPORT

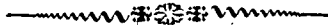
FOR THE  
OFFICIAL YEAR 1849-50;

COMPRISING

EXTRACTS FROM A LETTER FROM THE MILITARY BOARD, AND  
FROM A LETTER FROM THE SUPERINTENDENT  
OF ROADS AND TANKS;

ALSO REPORTS FROM

MAJOR W. B. GOODFELLOW, CAPTAINS W. D. GRAHAM, J. H. G.  
CRAWFORD, C. W. TREMENHEERE, P. L. HART, AND  
LIEUT. H. W. B. BELL.



**Bombay:**  
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1852.





*Extract, paras 7 to 11, of a Letter from the Military Board,  
No. 625, dated 31st July 1851.*

7. Adverting to paragraph 40 of the Report, we believe that the late Major Peat, in stating that a road, the wear and tear of which amounted to four inches in depth of metal in one year, had its wear reduced to half an inch by a bottoming of rubble stone, refers to evidence quoted in page 151 of Parnell's Treatise on Roads. The expression therein used is, "I found four inches gone." There being no stone bottoming, the stone had sunk into the clay soil; when the soil is favorable, and kept dry, we are rather of opinion that an uniform bottoming of such soil, sand for instance, or other homogeneous softish material, saves the wear greatly, and will give a truer and smoother surface to the road. All that McAdam insists on is that the sub-stratum be kept dry, and this is the difficulty, because, till the metalling be consolidated, it will not form a coating impervious to wet. The Chief Engineer assures us, from his own experience, that an absolutely unyielding foundation, formed entirely of hard stone, will prevent the metal above it from consolidating.

8. We are inclined to think that in black soil a layer of rubble stone under the metal may be useful, though not absolutely necessary, if the metalling be made thick enough. A metal coat, twelve inches thick, without bottoming, would be preferable to a coat six or seven inches thick, with a bottoming of rubble stone.

9. In paragraph 64, in writing of raised roads, Captain Graham remarks that a rubble pavement, with three inches of metal on it, is preferable to an earthen embankment with six inches of metal; and he adds that a raised road, without a foundation of rubble stone, never runs light; but we must

observe, 1st, That six inches of metal are not a sufficient thickness over an embankment—McAdam's minimum is ten inches; 2nd, In the course of time, and with a coating of proper thickness over it, the embankment will become consolidated, and remain dry during wet weather, and carriages will then run light over it; 3rd, That a bottoming, or pavement of rubble, with three inches only of metal, would not stand; the rubble stones would constantly work up to the top, especially in dry weather; 4th, Where the bottoming is entirely of rubble to a great depth, without any soft bottoming below, the metal on the top will not consolidate, although a road of this sort ought, according to Parnell's Treatise, to be perfect; the metalling will be in constant motion, and will become rolled like shingle. This was the case with the Colaba Causeway, although plentifully watered, and it was only remedied by repeated coats of sand-stone, in which the metalling was at length buried and at rest.

10. A portion of new road adjoining the Colaba Causeway, on the Esplanade, metalled in the same manner, and at the same time, on a bottoming of a sea sand, remained undisturbed, and formed a smooth hard surface.

11. Captain Graham appears to think that the Bombay roads are laid without a stone bottoming. All the main roads are bottomed with rubble, and the result does not appear to us altogether favorable, for they are often rough, and worn in holes. The road from Back Bay to Malabar Hill is an exception, and is a fair example of the faults and advantages of this system; here there was no stone bottoming, and the embankment being on the side of a hill, exposed to a heavy fall of water during the monsoon, gave way considerably, and in some places slipped. The first coating was also too thin, and did not sufficiently protect the embankment beneath it; nevertheless, in parts the original metalling may be seen to this day, after twenty years' service, showing that the wear of surface on a road of this sort cannot be very great. The original cost was of course smaller than if the embankment had been

formed of stone, and we think the surface is more smooth and uniform.

*Extract paras. 39 to 40, and 42 and 43 and 64 of a letter from the Superintendent of Roads and Tanks No. 856, dated 3rd April 1851.*

39. The Akoordee Road, commencing at the Dapooree Bridge, was in very good repair in the month of December 1849, but, the traffic increasing, it became dreadfully broken up during the hot weather, and on the 1st of June last it was so bad that it was quite dangerous for carriages to pass over it. It consequently became necessary to apply for a separate sanction to repair it; this has been done, and it is in very good order at present, but I much fear that it will get cut up again in the hot weather.

40. Raised roads, such as this is, (more especially over black soil,) should always have a foundation or bottoming of rubble stone. Major Peat states in one of his reports that the wear and tear of a road in England was found to amount in the course of the year to four inches of metal, and even then it could not be kept in good order, when a bottoming of rubble stone was laid down, and the wear and tear was reduced to half an inch only of metal. At the expiration of the present season I shall be better able to judge whether there is a necessity for recommending this alteration. I am in hopes, however, that it will not be required, as the road is being widened from 20 to 25 feet, and the wear and tear from cart traffic will be thus diffused over a greater surface, and consequently there is a greater chance of its not getting into bad order.

42. The retaining walls to the approaches of the Dapooree Bridge, which were built of dry stone, were found to have settled slightly, with some appearance of their giving way, whilst the wooden railing at each end was a constant source of annoyance, for ever being as it was repaired, and as often

being knocked down again. To avoid the expense of building masonry retaining walls, it was determined to try the experiment of throwing up a broad mound of earth on each side, by way of protection to the road, and doing away with the railing : this has been done ; trees have been planted every 25 feet apart, and when they have grown up they will form an avenue, which will tend greatly to improve the appearance of the bridge, whilst all fear of accidents occurring has been prevented. The estimated cost of the alteration came to Rupees 2,250-0-0, which far exceeds the sum that has been expended.

43. The above idea was taken from some little protection mounds of earth which Lieut. Chapman had raised along the upper portion of the Thull Ghaut Road, to save the expense of building parapet walls, and the plan has answered so excessively well at the Dapooree Bridge, and is so much cheaper than retaining walls, whilst it adds greatly to the appearance of an approach to a bridge, that I cannot recommend it too strongly to my brother Officers for adoption, as I am sure it will be approved of. I should here add, that if the above plan had been carried out to the Shikrapore Bridge, instead of building masonry walls, a saving of from three to four thousand rupees would have been effected ; the idea, however, was not hit on until after the masonry walls had been begun, when the design could not be altered.

64. There are two methods in practice of constructing a raised road over rice fields. One is that of allowing the embankment to settle one or two monsoons, and then laying six inches of metal on it, as the roads in Bombay are made. The other is that of laying down a rubble pavement, or bottoming, on which about three inches of metal is laid. The latter is in my opinion the preferable method of the two, as a raised road, without a foundation of rubble stone, never runs light, and, during the monsoon, it is always heavy. This accounts for carriages going the old or upper road from Tannah to Coorla during the rains, and also for the Akoordee Road being in such bad order.

## STATEMENT OF EXPENDITURE

*In the construction and repairs of Public Works in the Road and Tank Department, from the 1st of May 1849 to the 30th of April 1850.*

*Camp Nassick, 3rd April 1851.*

Names of Works.	Amount.	Total.
<i>Works connected with the communication of the Country.</i>		
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Bridging, draining, and metalling the new Akoordees Road . . . . .	1,785 9 4	
Annual repairs to cross roads in the Poona Collectorate, for 1848-49 . . . . .	1,154 0 3	
Rolling mail road from Poona to Khopolee, for 1848-49 . . . . .	41 8 5	
Annual repairs to mail road from Poona to Khopolee, 1848-49 . . . . .	4,812 5 10	
Annual repairs to bridges and drains on mail road from Poona to Khopolee, 1848-49 . . . . .	9 8 0	
Annual repairs to roads, bridges, &c. in the Poona Collectorate, 1848-49 . . . . .	739 0 9	
Ditto to flying bridges at Khurradee, Koregaum, and Seroor, 1849-50 . . . . .	983 1 2	
Ditto to roads, bridges, &c. in the Poona Collectorate, for 1849-50 . . . . .	7,906 10 2	
Ditto to mail road from Poona to Khopolee, for 1849-50 . . . . .	8,046 5 1	
Ditto to cross roads, Poona Collectorate, for 1849-50 . . . . .	4,231 8 10	
Rolling mail road from Poona to Khopolee, for 1849-50 . . . . .	417 15 11	
Annual repairs to Moosee flying bridge, for 1849-50 . . . . .	188 0 0	
Ditto to fair-weather roads, for 1849-50 . . . . .	316 0 0	
Making road-way for cattle . . . . .	45 0 0	
Constructing a branch road from Dapoorie Bridge to Government House . . . . .	607 0 0	
Constructing new ferry boats at Bheema and Bheema Rivers . . . . .	627 0 0	
Constructing a ferry boat at Kulumb . . . . .	1,237 0 0	
Constructing Shickrapoor approaches . . . . .	5,895 0 1	
Supporting and strengthening the retaining walls at each end of the Dapoorie Bridge. . . . .	91*11 9	
Making stone rollers . . . . .	1,020 0 0	
Carried forward, Rupees	40,244 5 7	

Names of Works.	Amount.			Total.		
	<i>Rs.</i>	<i>a.</i>	<i>p.</i>	<i>Rs.</i>	<i>a.</i>	<i>p.</i>
Brought forward, Rupees	40,244	5	7			
Repairs to Neera Bridge .. . . .	27	0	0			
Annual repairs to roads, bridges, &c. in the Ahmednuggar Collectorate, for 1848-49..	470	3	1			
Ditto ditto for 1849-50..	3,048	3	2			
Constructing a new line of road from Poona to Patus .. . . .	46,098	4	3			
Annual repairs to roads from Patus to In- dapoor, for 1849-50 .. . . .	2,766	4	6			
Clearing bullock track over the Deewah Ghaut.	229	1	4			
Widening and improving the approaches to the Wanowree Bridge .. . . .	183	10	3			
Annual repairs to bridges on Nagpoor.dawk line, for 1849-50. .... .	4,265	0	9			
Maintenance of ferry-men and haulers .. . . .	3,724	8	1			
New works .. . . .	4,667	10	5			
Amount paid to the Military Paymaster, P. D. A., on account of hempen ropes receiv- ed from the Principal Commissary of Orda- nance .. . . .	657	15	9			
Petty repairs to shed for the Godavery River.	7	1	0			
Annual repairs to bridges, for 1850-51 .. . . .	749	0	0			
New Works .. . . .	686	4	0			
Constructing Thull Ghaut, experimental por- tions. .... .	59	9	8			
Ditto ditto new road .. . . .	26,382	3	6			
Improvement of ditto ditto .. . . .	5,038	12	4			
Annual repairs to main road from Thull Ghaut to Chandore, for 1846-47 .. . . .	25	10	8			
Ditto ditto for 1849-50. .... .	13,294	15	5			
Ditto experimental portions, for 1849-50..	405	0	0			
Petty repairs .. . . .	166	11	4			
Annual repairs to Sinnur and Pimpree Cross Roads, for 1843-44. .... .	19	14	6			
Ditto ditto for 1849-50.. .... .	1,772	0	3			
Annual repairs connecting road between the camp and town of Nassick, for 1849-50. .... .	163	14	8			
Building a dip across a nullah on the con- necting road between camp and town of Nassick .. . . .	234	0	0			
Constructing a bridge over the Pharashem River .. . . .	4,566	3	1			
Building bridges over the two nullahs, one between Kadoo River and Pimpulgaum, and another near Konkungauin, on the main road between Nassick and Chandore.	1,041	0	6			
Improving the Agra line of road between the Thull Ghaut and Chandore .. . . .	4,827	0	10			
Annual repairs to bridges and drains, for 1849-50. .... .	190	13	3			
Carried forward, Rupees	1,66,842	6	2			

Names of Works.	Amount.			Total.		
	<i>Rs.</i>	<i>a.</i>	<i>p.</i>	<i>Rs.</i>	<i>a.</i>	<i>p.</i>
Brought forward, Rupees	1,66,842	6	2			
Petty repairs . . . . .	2	2	8			
Ditto to the Sinnur cross-road . . . . .	65	0	0			
Annual repairs to ferry boats, for 1849-50 . . . . .	227	14	8			
Petty works to ferry boats, 1849-50. . . . .	17	15	8			
Petty charges, ditto . . . . .	29	1	9			
Annual repairs to mail road from Panwell to Khopolee, for 1848-49. . . . .	1,734	14	0			
Ditto to bridges and drains, on road from Panwell to Khopolee, for 1848-49. . . . .	85	8	5			
Ditto to main road from Nagotnah to Mahableshwur, for 1848-49. . . . .	543	13	5			
Constructing Nudhel Bridge, on mail road from Panwell to Khopolee . . . . .	228	4	10			
Annual repairs to mail road from Panwell to Khopolee, 1849-50. . . . .	6,206	4	2			
Ditto from Nagotnah to Mahableshwur, 1849-50. . . . .	4,251	2	8			
Ditto to cross roads, Northern Conkan. . . . .	3,195	6	0			
Ditto to cross roads, Southern do. . . . .	1,102	5	11			
Petty repairs . . . . .	467	11	5			
Annual repairs to main road from Sion Causeway to Colsetts Ferry, for 1848-49. . . . .	1,027	8	0			
Ditto to main road from Bandora to Gorebunder for 1848-49. . . . .	1,586	8	0			
Ditto to main road from Trombay to Sion Causeway, for 1848-49. . . . .	199	12	0			
Ditto to branch road from Chemboor to Mhoul boundary, for 1848-49. . . . .	41	8	0			
Constructing a new road leading to the Hill of Senhora DeMonte, at Bandora. . . . .	7,775	6	0			
Completing the Bhandoop road, and repairing the damage done to it during the last two seasons. . . . .	12,462	7	5			
Annual repairs to roads in Salsette, for 1849-50. . . . .	9,459	15	0			
Repairing certain works on the Sunky and Ghorebunder roads . . . . .	84	15	10			
Repairing the double boat plying between Tanna and Kulwa . . . . .	356	0	0			
Renewing the deck planking of horse boat stationed at Ghorebunder . . . . .	141	4	3			
Repairing the foundation of the Dysur Bridge. . . . .	34	2	11			
Constructing new horse boat for the Dantewra Ferry . . . . .	1,335	10	6			
Constructing two new boats for the use of the Colsette Ferry. . . . .	647	8	0			
Constructing new line of road between Kussara and Khurdee. . . . .	83,790	0	2			
Annual repairs to main roads from Colsette Ferry to Thull Ghaut, for 1849-50. . . . .	9,471	3	4			
Carried forward, Rupees	3,13,413	13	2			

Names of Works.	Amount.	Total.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Brought forward, Rupees	3,13,413 13 2	
Extra repairs to the main roads from Colsette Ferry to Thull Ghaut, for 1849-50. ....	2,238 3 6	
Annual repairs to road in the Cantonment at Bhowndy, for 1849-50 .. .. .	58 0 6	
Repairing teak wood railing of the Gokherwa Bridge .. .. .	9 4 9	
Constructing a bridge over a nullah between Bhowndy and Nizampoor .. .. .	1,497 12 5	
		3,17,217 2 4
<i>Tanks, Wells, and Bunds.</i>		
Building a well at Egutpoora .. .. .	457 9 5	
Repairing a well at Jhulegaum .. .. .	50 0 0	
Building a water-course and small reservoir for the water of a spring .. .. .	31 8 0	
Repairing bundaraha at Salpoor, Musrool, and Kursool .. .. .	1,034 3 7	
Improvement and repairs to Wuddalla Tank at Panwell .. .. .	58 0 0	
Clearing and effecting certain improvements to the Tank at Colsette.. .. .	1,814 0 6	
Clearing the wells in the Lines at Tanna .. .. .	50 5 11	
Improving the tank at Khurdee .. .. .	384 6 9	
Constructing a well at Kussara, close to the bridge .. .. .	686 8 10	
Excavating a well at Kussara .. .. .	30 8 2	
Constructing a dam across the Rutonda River.	3,971 7 3	
Building facing to prevent leakage to the bund of the Kussara Tank .. .. .	99 12 0	
Facing on the inner side of the bund of the Kussara Tank .. .. .	172 4 6	
Clearing out the Kussara Tank .. .. .	38 0 0	
Painting a portion of the bund of the Kussara Tank .. .. .	44 12 9	
		8,923 7 8
<i>Buildings.</i>		
Constructing new pendalls on Bombay road, above the Ghaut .. .. .	1,522 2 3	
Constructing cook rooms and platforms to four staging pendalls, on the Ghaut .. .. .	3,120 0 0	
Constructing Mamledar's Cutcherry at Khurkalla .. .. .	2,168 0 0	
Constructing Moonsiff's Court House at Wurgaum .. .. .	1,429 0 0	
Constructing new travellers' bungalow at Wurgaum .. .. .	414 0 0	
Repairs to Phoolshair Palace .. .. .	1,038 10 11	
Making certain additions to the Poona travellers' bungalow .. .. .	180 0 0	
Carried forward, Rupees	9,871 13 2	3,26,140 9 0



Names of Works.	Amout.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought forward, Rupees	9,871	13	2	3,26,140	9	0
Annual repairs to travellers' bungalows, Poona Collectorate, for 1848-49. . . . .	105	3	9			
Ditto for 1849-50. . . . .	1,075	12	3			
Ditto Ahmednuggur, for 1848-49. . . . .	126	0	0			
Ditto ditto for 1849-50. . . . .	833	7	3			
Building a travellers' bungalow at Patus . . . . .	1,890	10	4			
Annual repairs to travellers' bungalows and dhurmsallas in the Nassick Sub-Collec- torate, for 1849-50. . . . .	349	12	8			
Petty repairs to ditto ditto, for 1849-50. . . . .	346	0	3			
Annual repairs to military buildings at Nas- sick, for 1849-50. . . . .	57	9	7			
Petty works to ditto, for 1849-50 . . . . .	46	4	4			
Petty repairs to ditto, for 1849-50. . . . .	15	9	3			
Repairs to civil jail at Nassick . . . . .	159	6	2			
Making certain necessary repairs and im- provements to the criminal jail at Nassick.	203	8	3			
Building a toll house on the Thull Ghaut. . . . .	202	7	2			
Emergent repairs to Panwell Mamledar's Kutcherry . . . . .	143	0	2			
Annual repairs to travellers' bungalows in the Northern Conkan, for 1849-50. . . . .	59	10	10			
Constructing cook rooms and platforms to staging pendalls below the Ghaut. . . . .	1,102	9	3			
Constructing three new permanent pendalls at Tanna . . . . .	3,688	0	0			
Annual repairs to the military buildings, for 1849-50. . . . .	158	0	0			
Ditto to work shop, store rooms, and cattle shed, for 1849-50 . . . . .	53	2	2			
Ditto to civil hospitals and buildings ap- pertaining to them, for 1849-50.	60	0	0			
Ditto to travellers' bungalow and build- ings appertaining to it for 1849-50	46	0	0			
Ditto to the Collector's premises at Tan- na, for 1849-50. . . . .	198	12	6			
Converting the old Commandant's quarters in the Tanna Fort into a jail hospital . . . . .	1,843	0	10			
Annual repairs to the Assistant Judge's pre- mises at Tanna, for 1849-50. . . . .	388	3	1			
Ditto to the buildings in the Custom De- partment, for 1849-50. . . . .	214	13	0			
Ditto to the church at Tanna, for 1849- 50. . . . .	182	13	1			
Petty repairs, for 1849-50. . . . .	1,001	3	0			
Erecting a new quarter guard and defaulters' room at Tanna. . . . .	211	9	0			
Annual repairs to the military buildings at Tanna, for 1850-51. . . . .	0	8	7			
Carried forward, Rupees	24,634	13	11	3,26,140	9	0

Names of Works.	Amount.			Total.		
	<i>Rs.</i>	<i>a.</i>	<i>p.</i>	<i>Rs.</i>	<i>a.</i>	<i>p.</i>
Brought forward, Rupees	24,634	13	11	3,26,140	9	0
Renewing the veranda ceilings of the Collector's official residence at Tannah. ....	408	2	5			
Re-roofing the Custom-house at Tannah. ....	289	1	0			
Making new railing to the Khurdee bungalow.	18	7	3			
Annual repairs to travellers' bungalows, for 1849-50. ....	504	11	7			
Ditto to store room at Bhowndy, for 1849-50	2	8	6			
Providing new tie beam to one of the trusses of the Kussara bungalow ....	86	12	4			
Ditto ditto ditto ....	96	0	0			
Replacing bamboo battans, tiles, &c. of the dhurmsalla at Kussara ....	22	12	0			
Emergent repairs to the Kussara dhurmsalla. ....	29	1	3			
Fixing panes of glass to the windows of the different travellers' bungalows on the Thull Ghaut Road ..	15	4	8			
Re-making floor, white and blue washing of the travellers' bungalows at Kalhair, Pudgah, Shapoor, Khurde, and Kussara ....	129	12	0			
Repairing the 1st Assistant Collector's bungalow at Kelwa Mahim ....	1,233	7	5			
Constructing new gate to the compound of the hospital of the Native Veteran Battalion, at Bhowndy, 1849-50. ....	47	9	1			
Annual repairs to quarter guard-room and hospital of N. V. Battalion, at Bhowndy, 1849-50. ....	30	9	6			
Repairing the choonam ridge of the hospital of the Detachment of the Native Veteran Battalion, at Bhowndy ..	1	10	3			
White and yellow washing the hospital of the Detachment of the N. V. Battalion, 1849-50. ....	45	2	6			
				27,595	13	8
<i>Miscellaneous Charges.</i>						
Making a new cupboard and drawing board for the use of Lieutenant Chapman's Office	35	10	11			
Rattaning the bottoms of three chairs belonging to the travellers' bungalow, at Kussara ...	1	8	0			
Providing belts to eleven peons of the travellers' bungalows at Kalhair, Pudgah, Shapoor, Khurdee, Kussara, Bassein, Dantewra, Seergaun, Cheenchnee, Dahanoo, and Oomergaum ....	14	7	0			
				51	9	11
Grand Total, Three lacs, Fifty-three thousand, Seven hundred and Eighty-eight, anna One, and pies Seven..	3,53,788	1	7			

*Statement showing the Amount expended by each Officer of the Road and Tank Department, from  
the 1st May 1849 to the 30th April 1850.*

Names of Officers.	Roads and Bridges.		Tanks, Wells, and Bunds.		Buildings.		Miscellaneous Charges.		Total.	
	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.
Captain Cowper .....	44,689	11 10			12,012	4 5			56,702	0 3
Mr. Armistead .....	40,277	4 4			1,890	10 4			51,167	14 8
Captain Dennis .....	14,757	8 0							14,757	8 0
Lieutenant Chapman ..	58,460	0 9	1,573	5 0	1,380	9 8	35	10 11	61,449	10 4
" Fuller .....	17,815	6 10	58	0 0	1,305	4 3			19,178	11 1
Mr. Scott.....	38,169	7 5	1,864	6 5	8,743	4 8			48,777	2 6
Lieutenant Scott .....	97,549	14 9	5,427	12 3	2,263	12 4	15	15 0	1,05,257	6 4
" Trevor .....	1,497	12 5							1,497	12 5
Total.....	3,17,217	2 4	8,923	7 8	27,595	13 8	51	9 11	3,53,788	1 7

*Return showing the Expense of Engineering and Superintendence, with reference to actual Outlay.*

Names of Officers.	Expense of Establishment per annum.		Rate per Cent.
	Rupees.	Expenditure.	
Captain Cowper	17,087	56,702	307 <sup>1</sup> / <sub>2</sub>
Mr. Armistead	4,276	51,167	8 <sup>1</sup> / <sub>2</sub>
Captain Dennis	7,422	14,757	50 <sup>7</sup> / <sub>8</sub>
Lieutenant Chapman	5,717	61,449	9 <sup>7</sup> / <sub>8</sub>
” Fuller	8,347	19,178	43 <sup>1</sup> / <sub>2</sub>
Mr. Scott	9,534	43,777	21 <sup>3</sup> / <sub>4</sub>
Lieutenant Scott	11,864	1,05,257	11 <sup>1</sup> / <sub>4</sub>
” Trevor*	3,827	1,497	255 <sup>1</sup> / <sub>2</sub>

\* Has been principally employed on Survey Duty.

Total Expenditure during the Year.....	Rupees	3,53,788
Cost of Establishment do.....	”	68,054
Average rate per Cent.....	”	19 <sup>1</sup> / <sub>2</sub>

(Signed) W. D. GRAHAM, Bt. Captain,  
Supt. of Roads and Tanks.

NOTE.—Captain Dennis is Postmaster as well as in Charge of the Nagpore Dak Line, and the Allowances drawn by that Officer should not therefore be all debited to the Road and Tank Department, especially as his Engineering duties are confined to one line of works.

(Signed) W. D. GRAHAM, Bt. Captain,  
Superintendent of Roads and Tanks.

*List of Estimates prepared by the Officers of the Road and Tank Department, and submitted for sanction between the 1st May 1849 and the 30th April 1850.*

Estimates.	Amount.		
	↻	Rs.	a. p.
<i>Superintendent.</i>			
Estimate of a proposed new road and causeway from the Dysur Bridge, on the Ghorebunder road, to a place called Rai Moordee . . . . .	1,06,619	0	0
Estimate of a proposed line of mail road from Khalapoor Bridge to Mora Bunder, to connect the old Bombay road..	5,52,502	0	0
<i>Captain Cowper.</i>			
Estimate for constructing cook rooms and platforms to Officers' tents for four pendalls . . . . .	3,120	0	0
Ditto for repairing Phoolshair Palace .. . . .	1,339	0	0
Ditto for constructing stone rollers .. . . .	3,100	0	0
Ditto for constructing cook rooms to Copergaum travellers' bungalow . . . . .	852	0	0
Ditto for widening the road from Kirkee to Dapooree . . . . .	3,476	0	0
Ditto for constructing armracks and shelves to four staging pendalls . . . . .	1,761	0	0
Ditto for adding bath rooms and necessaries to Lonee travellers' bungalow . . . . .	752	0	0
Ditto ditto ditto Seroor and Soopa . . . . .	752	0	0
Ditto for building a new travellers' bungalow at Wurgaum.	3,488	0	0
Ditto for repairing roof and out-houses of Wye travellers' bungalow .. . . .	634	0	0
Ditto ditto Neera Bridge . . . . .	2,890	0	0
Ditto ditto Jooneer Aqueduct.....	951	0	0
Ditto for constructing paved drains round the court of the staging pendalls .. . . .	555	0	0
Ditto for building a new chowkee in the Thulegaum Khind.	429	0	0
Ditto for repairing approaches of the Dapooree Bridge....	2,250	0	0
Ditto for improving the Akhoordee line of road .. . . .	1,352	0	0
Ditto for repairs to railing of a bridge over Indrawnee River at Allundee .. . . .	299	0	0
<i>Mr. Armistead.</i>			
Estimate for erecting six travellers' bungalows between Poona and Indapoor (A) .. . . .	21,203	0	0
Ditto ditto ditto ditto (B) . . . . .	16,847	0	0
Ditto ditto ditto ditto (C) . . . . .	13,460	0	0
Ditto for repairing injury done by floods to the Poona and Patas Road . . . . .	655	0	0
Ditto for erecting six travellers' bungalows between Poona and Indapoor (D) .. . . .	12,000	0	0
Ditto ditto ditto ditto (E)....	12,000	0	0
Carried forward, Rupees	7,63,186	0	0

Estimates.	Amount.
	<i>Rs. a. p.</i>
Brought forward, Rupees	7,63,186 0 0
Estimate for widening and rendering safe the approaches to the Wanowree Bridge on the Sholapoor road . . . .	286 0 0
Ditto for ramping down the sides of the Patus and Poona new road, while bridges, &c. are in progress, to admit of the line used by carts . . . . .	197 0 0
Ditto for constructing aqueducts for garden irrigation wherever the new line of road between Poona and Indapoor is an impediment thereto . . . . .	288 0 0
Ditto for clearing the present track over the Dewah Ghaut, to render it practicable for laden bullocks . . . .	500 0 0
<i>Captain Dennis.</i>	
Estimate for new works on the Nagpoor Dawk Line.. . . .	5,536 0 0
<i>Lieutenant Chapman.</i>	
Estimate for making approaches and masonry standards to Godavery Flying Bridge . . . . .	9,306 0 0
Ditto for constructing a new piece of road to supersede that at present in use near Warewarah . . . . .	9,990 0 0
Ditto for lessening the steepness of the slopes of the portion of the Agra road near Warewarah . . . . .	12,541 0 0
Supplementary estimate for extra work done in the jail compound at Nassick . . . . .	48 14 11
Estimate for providing a wooden ceiling and glass windows to the Egutpooree travellers' bungalow . . . . .	309 0 0
Ditto for widening the verandah of the travellers' bungalow at Egutpooree . . . . .	394 0 0
Ditto for making the roof of the travellers' bungalow at Egutpooree water-tight, and providing glass windows for the rooms. . . . .	398 0 0
Ditto for making the requisite special repairs and improvements in the civil jail at Nassick . . . . .	724 0 0
Ditto for building a toll-house on the Thull Ghaut . . . .	3,610 0 0
Ditto for widening a dangerous steep ascent, and widening the road near Chandora . . . . .	3,090 0 0
Ditto for paving the lower portion of the ramps of the Kadwa Flying Bridge . . . . .	652 0 0
Ditto for building a house at Pimpulgaum for Overseers . .	721 0 0
Ditto for improvements and alterations on the Thull Ghaut new road . . . . .	8,678 0 0
<i>Lieutenant Fuller.</i>	
Estimate for constructing cook rooms and platforms for an Officer's tent at Chowke and Panwell . . . . .	2,147 0 0
Ditto for stone rollers for the mail road . . . . .	400 0 0
Ditto for arm racks and shelves to staging pendalls, do..	963 0 0
Carried forward, Rupees	8,24,863 14 11

Estimates.	Amount.		
	Rs.	a.	p.
Brought forward, Rupees	8,24,863	14	11
Estimate for adding bath-rooms and necessaries to the travellers' bungalow at Panwell....	469	10	7
Ditto for constructing a well near the Chowke pendall....	1,004	0	0
Ditto for repairs to Government bungalow and its out-houses at Oorun....	696	0	0
<i>Mr. Scott.</i>			
Estimate for renewing the deck planking of the horse-boat stationed at the Ghorebunder Ferry....	198	0	0
Ditto ditto the fence surrounding the premises occupied by the Assistant Judge at Tanna....	961	0	0
Ditto for roughly securing the foundations of the bridges on the new Bhandoop road ..	195	0	0
Rough estimate of the work performed in building 4,041 feet of the new Bhandoop road....	4,048	15	1
Estimate for building a kutcherry for the Sir Carcoon of the Continental Customs and Excise Department at Tanna....	2,773	0	0
Ditto for building a branch road to the Poway Estate....	38,399	0	0
Rough estimate of the protection mounds proposed for the new Bhandoop road....	24,926	0	0
Estimate for building a kutcherry for the Sir Carcoon of the Continental Customs and Excise Department at Tanna....	2,505	0	0
Ditto for building a branch road between the Poway Estate and the new Bhandoop road ..	10,177	0	0
Ditto for re-roofing the Custom-house at Tanna....	2,465	0	0
Ditto for renewing the veranda ceiling of the Collector's official residence at Tanna ..	947	0	0
Rough estimate for making a foundation of pavement for the new Bandora road..	2,301	0	0
Estimate for removing a salt chowkee from Goglah, and rebuilding it at Bodnaka....	646	0	0
Ditto for building a quarter-guard for the 1st Grenadiers, at Tanna..	1,902	0	0
Ditto for making kar-stone rollers for the metal roads in Salsette ..	498	0	0
Ditto for certain repairs to the Chemboor Causeway....	195	0	0
Ditto for fitting up the room in the Fort at Tanna with arm-racks and pegs ..	118	0	0
Ditto for laying down masonry pavement of the Dysur Bridge....	422	0	0
Ditto for building an enclosure wall to the compound of the travellers' bungalow at Taana....	684	0	0
Ditto for putting up boarded weather-frames to the Church at Tanna..	409	0	0
Ditto for repairing the premises occupied by the Assistant Judge at Tanna....	4,010	0	0
Ditto for building parapets to and coping the wing-walls.			
Carried forward, Rupees	9,26,713	8	7

Estimates.	Amount.
	<i>Rs. a. p.</i>
Brought forward, Rupees	9,26,713 8 7
Estimate of the improvement proposed to the Hill of Senhora DeMonte at Bandora, in connection with the new road now built at that place. ....	426 0 0
Ditto for putting up boarded weather-frames to the Church at Tanna.. ....	11,558 0 0
Ditto of the improvements proposed to the Hill of Senhora DeMonte at Bandora ....	375 0 0
Ditto ditto ditto ....	1,975 0 0
Ditto ditto ditto ....	1,854 0 0
Ditto ditto ditto ....	6,060 0 0
Ditto for building a branch road between the Poway Estate and the new Bhandoop road. ....	7,770 0 0
Ditto for putting the Persick road in a thorough state of repair.. ....	3,765 0 0
Ditto for building an enclosure wall to the compound of the travellers' bungalow at Tanna ....	422 0 0
Ditto for re-roofing the Custom-house at Tanna.. ....	3,286 0 0
Ditto for additional accommodation required for the head quarters of the 1st Grenadiers, stationed at Tanna.	2,661 0 0
Ditto for building Lines for the several parties of the Police employed on the Island of Salsette ....	2,404 0 0
<i>Lieutenant Scott.</i>	
Estimate for constructing two wells near the village of Kussara, with plan .. ....	2,092 0 0
Ditto for constructing a bridge over the nullah which divides the town of Bhowndy from that of Nizam-poor, with plan ....	4,216 0 0
Ditto for making a deck with railing for the new horse-boat for the Colsette Ferry ....	414 0 0
Ditto for constructing a drain across the Rurtoonda River, with plan.. ....	4,635 0 0
Ditto for constructing a chiselled stone pavement of six feet width round the well at Kussara .. ....	365 0 0
Ditto for facing on the inner side of the bund of the Kussara Tank ....	341 0 0
Ditto for making a bullock track leading from the village of Kussara and the tank at that place .. ....	215 0 0
Ditto for a new chair for the travellers' bungalow at Khurdee .. ....	6 0 0
Ditto for making certain improvements to the Colsette Ferry, with three plans ....	1,70,497 0 0
<i>New Line of Road between Kussara and Khurdee.</i>	
Estimate for improving the portion of the old road between the foot of the Thull Ghaut and commencement of the 1st Division ....	14,577 0 0
Ditto for 1st Division ....	49,298 0 0
Ditto for 2nd Division ....	1,01,054 0 0
Carried forward, Rupees	13,10,979 8 7



Estimates.	Amount.
	<i>Rs. a. p.</i>
Brought forward, Rupees	1310979 8 7
Estimate for making stone rollers for the use of the mail road.	600 0 0
Ditto for constructing addition to the Mamledar's Kutcherry at Moorbaaur, with plan . . . . .	2,129 0 0
Ditto for additions to the Mahalkurrie's Kutcherry at Kenowlee . . . . .	2,047 0 0
Ditto for rebuilding the quarter-guard of the Native Veteran Battalion, at Bhowndy . . . . .	406 0 0
Ditto for repairing the ferry-boat at Oomergaum . . . . .	559 0 0
Ditto ditto at Dahanoo . . . . .	519 0 0
Ditto for providing new tie-beam to one of the trusses of Kussara travellers' bungalow . . . . .	379 0 0
Ditto ditto ditto Pudgah ditto . . . . .	379 0 0
Ditto for replacing bamboo battens, tiles, &c. for the Dhurmsalla at Kussara . . . . .	91 0 0
Ditto for emergent repairs to the Kussara Dhurmsalla . . . . .	43 0 0
<i>Lieutenant Trevor.</i>	
Estimate for a proposed new line of road from Khurdee to Shahpoor . . . . .	1,43,384 0 0
Ditto for annual repairs to roads and bridges, &c. for 1850-1851 . . . . .	1,21,342 0 0
Ditto for annual repairs to travellers' bungalows and buildings in the General, Military, Territorial, Judicial, and Ecclesiastical Departments, for 1850-51.	7,092 0 0
Grand Total . . . . .	15,88,880 8 7

(Signed) W. D. GRAHAM, Brevet Captain,  
Superintendent of Roads and Tanks.

*Statement shewing the Amount expended on Public Works by the Road and Tank Department, from the year 1841-42 up to the present period, as recorded in the Engineers' Reports published by order of Government.*

*Camp Nassich, 3rd April 1851.*

Year.	No. of Assistants.	Amount Expended.			Cost of Superintending.		
		<i>Rs.</i>	<i>a.</i>	<i>p.</i>	<i>Rs.</i>	<i>a.</i>	<i>p.</i>
1841-42	8	1,76,108	0	0	79,260	0	0
1842-43	8	1,24,914	0	0	79,504	0	0
1843-44	7	1,27,814	0	0	71,944	0	0
1844-45	7	1,27,044	0	0	72,427	0	0
1845-46	8	1,96,357	0	0	52,572	0	0
1846-47	8	3,14,795	0	0	58,663	0	0
1847-48	8	3,09,179	0	0	66,061	0	0
1848-49	7	2,83,158	0	0	58,600	0	0
• 1849-50	8	3,53,788	0	0	68,054	0	0

(Signed) W. D. GRAHAM, Brevet Captain,  
Superintendent of Roads and Tanks.

STATEMENT OF THE EXPENDITURE  
IN THE  
GARRISON ENGINEER'S DEPARTMENT,  
FOR  
THE YEAR 1849-50.

*Bombay, 1st May 1850.*

Names of Works.	Amount.	Total.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
<i>Annual Repairs.</i>		
Annual repairs to the public buildings occupied by troops, &c. in the Castle, Fort George, Garrison, Esplanade, Colaba, and at Out-posts... ..	13,440 11 3	
<i>Petty Repairs.</i>		
Petty repairs to the public buildings occupied by troops, &c. in the Castle, Fort George, Garrison, Esplanade, Colaba, and at Out-posts .....	9,362 12 6	
		22,803 7 9
<i>Certain Works.</i>		
Sinking a well outside the tank in Fort George.	215 9 10	
Supplying with water the troops quartered in Colaba, by laying down pipes from the wells in the neighbourhood of the Cooperage.	565 15 3	
Despatching 3,000 teak rafters to Kurrachee from Negra Bunder, six miles below Nagotna .....	35 13 6	
Draining the native Lines at Boree Bunder ..	625 0 0	
Fitting with glass windows the quarters occupied by the Adjutant of the 22nd Regiment N. I., at Boree Bunder .. ..	29 12 0	
Constructing a tank and oven for copperising timber .....	160 4 0	
Re-building charcoal cylinder furnace, Mazon powder works .....	336 12 6	
Experiment of copperising wood for keeping away the white ants which at present infest the Grand Arsenal.. ..	47 14 1	
Carried forward, Rupees	2,026 1 2	22,803 7 9

Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought forward, Rupees	2,026	1	2	22,803	7	9
Repairing the quarters of the Assistant Surgeon to the European General Hospital..	636	12	6	,		
Cleaning out the Fort ditch, and caulking the sluice gates .. .. .	107	9	4			
Repairs to the eudjan porch, mat frames, &c., to the premises occupied by the Medical Storekeeper at Colaba .. .. .	20	0	0			
Constructing the veranda for the quarters of the Serjeant Major of the Depôt, at Colaba.	109	0	0			
Renewing the boarded floor of the light ammunition room in the Grand Arsenal .. .	339	4	0			
Additions and alterations to the Government Printing Press buildings, to adapt them to the purposes of a Depôt and Government Dispensary .. .. .	8,226	0	0			
Providing a residence for the Superintendent of the Government Cooperage....	371	0	0			
Pulling down and rebuilding the quarters of the Staff Serjeant in Fort George .. .	1,166	0	0			
Constructing two bathing rooms, and making certain improvements to the hospital privy of the 2nd Battalion Artillery, at Fort George.	365	0	0			
Cleaning the ditches round the Fort George Barracks .. .	450	0	0			
Constructing iron net-work over the windows of the solitary cells, and adding a new room to the quarter-guard of the barracks occupied by H. M.'s 22nd Regiment, at Colaba.	950	0	0			
Constructing a pallsade railing with a gate, to prevent the people entering the Grand Arsenal .. .	315	0	0			
Repairs to the cook house at the north-east end of the Barracks, at Colaba .. .	244	0	0			
Glazed windows and side weather-frames, also repairing plank shutters of windows for the 2nd Battalion Artillery Hospital in Fort George .. .	290	0	0			
Repairing a part of the road leading to the Hospital at Colaba .. .	173	0	0			
Constructing a brick wall to the out-office No. 119, at Colaba .. .	8	0	0			
Re-constructing the covered way from the barracks to the privies, at Colaba .. .	182	0	0			
Widening the drains, and constructing a new cess-pool at the entrance of the Castle .. .	165	0	0			
Constructing a drain for carrying away the wastage water from the Doctor's quarters of the European General Hospital..	8	6	0			
Repairs to the fire-engine shed....	630	0	0			
Carried forward, Rupees	10,782	1	0	22,803	7	9

Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought forward, Rupees	16,782	1	0	22,803	7	0
Repairs to the roof and floor of the stone pavement of the buildings at Butchers' Island	800	0	0			
Placing wire gratings over the windows of the solitary cells at the Queen's Troops Depôt, at Colaba	30	0	0			
Copperising the wood of the boarded floor of the light ammunition room in the Grand Arsenal	31	0	3			
Alterations at the Grand Arsenal	28	0	0			
Alterations to the store-room No. 1, in the Audalut warehouse, under the Deputy Commissary General's Office	88	0	0			
Repairs to the quarters No. 1, on the Esplanade.	50	0	0			
Constructing a depository for patterns of casting in the Gun Carriage Department	75	0	0			
Breaking the wall, and fixing a door between the two rear rooms of the quarters occupied by the Adjutant 2nd Battalion Artillery, in Fort George	25	8	0			
				17,900	0	3
<i>Buildings.</i>						
Preparing doors and windows for the buildings appertaining to the new European barracks, at Hydrabad, in Scinde	566	5	0			
Preparing the wood-work required for the Horse Artillery buildings, at Kurrachee	5	0	1			
Supplying wood-work required for the roof of the canteen, library, and quarter guard to the new European barracks, at Hydrabad, in Scinde	14	6	1			
Preparing the frame-works for doors and windows of the new temporary pendalls, at Kurrachee	96	3	4			
Constructing a cook-house for the Serjeant Major, Marine Battalion Native Infantry	68	0	0			
Constructing a new ball-casting shed in the Grand Arsenal	1,550	0	0			
				2,200	14	6
Levelling the Esplanade, supplying water to the dhobeas, annual repairs to the Dhobeewada, and expenses in collecting the Esplanade fees, &c.	....			0,421	13	6
Amount paid to artificers and labourers engaged for or returning from Out-Stations, &c.	....			7,816	15	10
Total, Rupees sixty thousand, two hundred and fifty-one, annas twelve, and pies ten				60,251	12	10

(Signed)

J. H. G. CRAWFORD, Captain,  
Garrison Engineer, Presidency.

*Statement of the Sums expended by the Garrison Engineer at the Presidency, from 1st May 1849 to 30th April 1850.*

Names of Officers.	Annual and Petty Repairs.		Certain Works.		Buildings.		Expended from Esplanade Fund.		Expended for Artificers and Labourers engaged for or returning from Out-stations.		Total.
	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	
Captain H. J. Margary and Captain J. H. G. Crawford, Garrison Engineers at the Presidency .....	22,803	7 9	17,909	9 3	2,299	14 6	9,421	13 6	7,816	15, 10	60,251 12 10

*Statement showing the Cost of Engineering and General Superintendence of the Garrison Engineer's Department, for the above period.*

Names of Officers.	Expense of Establishment per Annum.		Expenditure.	Rate per Cent.
	Rs.	a. p.		
Captain H. G. Margary and Captain J. H. G. Crawford, Garrison Engineers at the Presidency .....	14,322	6 10	60,251 12 10	23 12 0

(Signed) J. H. G. CRAWFORD, Captain,  
Garrison Engineer at the Presidency.

*Statement of the Expenditure in the Civil Architect's Department, for the year 1849-50.*

*Bombay, 1st May 1850.*

Names of Works.	Amount.	Total.
	Rs. a. p.	Rs. a. p.
<b>GENERAL DEPARTMENT.</b>		
<i>Annual and Petty Repairs.</i>		
Annual repairs to the buildings in the General Department, for 1849-50 . . . . .	6,901 7 0	
Petty repairs to the buildings in the General Department .. . . .	2,330 0 2	
		9,231 7 2
<i>Certain Works.</i>		
Certain alterations and repairs to the detached buildings of the Secretariat used by the Judicial Department . . . . .	700 0 0	
Certain alterations and repairs to the Jamsetjee Jejeebhoy Hospital. . . . .	2,359 2 0	
Alterations and repairs required to the Jamsetjee Jejeebhoy Hospital . . . . .	01 0 0	
Putting up teak trellis partitions in the new General Post Office . . . . .	145 0 0	
Placing lamps and affixing moveable chain on the Town Custom Bunder . . . . .	902 0 0	
Making glass and venetian windows to the room of the Section Writers of the Revenue and Financial Departments in the Secretariat premises . . . . .	530 0 0	
Putting two tablets in the Grant Medical College . . . . .	196 5 0	
Opening an extra door to the coach-house, and making one of the stalls into a box, at the Government House at Malabar Point . .	24 0 0	
Additional works at the Government House at Malabar Point . . . . .	67 11 0	
Alterations to the Lunatic Asylum, by cutting a door-way through a wall, and fixing a door at the back of an out-house in which an European keeper lives . . . . .	14 9 0	
Putting in a proper state of repair the Government House at Parell . . . . .	2,100 0 0	
Additional works in the kitchen at the Government House at Parell . . . . .	55 14 0	
Putting up a range of huts for the use of the ghorrawallas at the Government House at Parell . . . . .	260 0 0	
Constructing temporary sheds at Malabar Point, for the use of followers of his Highness the Guikwar . . . . .	158 5 1	
Carried forward, Rupees	7,603 14 1	9,231 7 2

Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought forward, Rupees	7,603	14	1	9,231	7	2
Fixing in the Parell kitchen a smoke-jack, arrived from England ..	202	8	0			
Making steps to the presses in the General Record room of the Secretariate ..	70	14	0			
Alterations and repairs to the road to the Powder-works through the village of Matarpacady, at Mazagon ..	500	0	0			
Opening two extra arches at the doorway, and furnishing wooden steps to the same, also making three large presses for glass-ware, &c. at the Government House at Parell ..	425	5	10			
Erecting a porch to the door of the bungalow at Parell of the Military Secretary to the Right Honorable the Governor ..	165	0	0			
Oneteak-plank shelf for saddlery in the 2nd Aide-Camp's stable, and one plank cover for retaining wall of a cistern in the garden bungalow at the Government House at Parell.	33	11	0			
Making holes in the parapet walls of certain wells on the Island, for the introduction of the suction-pipes of fire-engines ..	15	15	6			
Certain improvements to the buildings of the Jamsetjee Jejeebhoy Hospital, and its compound ..	1,900	0	0			
Certain improvements in the compound of the Jamsetjee Jejeebhoy Hospital ..	467	2	4			
Erecting a considerable portion of new railing, and making other improvements to the Government grounds at Parell ..	25	0	0			
				11,409	6	9
<i>Buildings.</i>						
Constructing quarters for the Assistant and Apprentices attached to the Jamsetjee Jejeebhoy Hospital ..	1,782	14	0			
Constructing a permanent shed in the compound of the Lunatic Asylum, at Colaba ..	1,200	0	0			
				2,982	14	0
<b>JUDICIAL DEPARTMENT.</b>						
<i>Annual and Petty Repairs.</i>						
Annual repairs to the buildings in the Judicial Department, for 1849-50 ..	1,758	9	0			
Petty repairs to the buildings in the Judicial Department ..	1,355	12	6			
				3,114	5	6
<i>Certain Works.</i>						
Adding three windows to the Picket-chowkey on the Esplanade, and constructing a tiled shed at the Mazagon Police Office ..	111	0	0			
Carried forward, Rupees	111	0	0	26,738	1	5

Names of Works.	Amount.	Total.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Brought forward, Rupees	111 0 0	26,738 1 5
Covering over and enclosing by means of teak plank the cog-wheels of the treadmills in the Coupty Jail. ....	52 2 0	
A new window, with iron bars, one iron grating door in Moonbadavee Chowkey, and one small back door for a privy ..	40 14 0	204 0 0
<i>Buildings.</i>		
None.		
<b>TERRITORIAL DEPARTMENT.</b>		
<i>Annual and Petty Repairs.</i>		
Annual repairs to the buildings in the Territorial Department, for 1849-50. ....	2,673 9 0	
Petty repairs to the buildings in the Territorial Department ....	1,780 2 9	4,453 11 9
<i>Certain Works.</i>		
Putting the wheel-crane on the Town Custom-house Wharf in an efficient state of repair ....	703 5 0	
Making repairs to the wooden tenders of the hoisting-places of the Town Custom-house Bunder ....	583 12 0	1,287 1 0
<i>Buildings.</i>		
None.		
<b>ECCLESIASTICAL DEPARTMENT.</b>		
<i>Annual and Petty Repairs.</i>		
Annual repairs to the buildings in the Ecclesiastical Department, for 1849-50. ....	240 0 0	
Petty repairs to the buildings in the Ecclesiastical Department ..	287 11 0	527 11 0
<i>Certain Works.</i>		
Repairs to the Parsonage House. ....	42 14 0	
Thirty kneeling boards for the Roman Catholic Chapel at Colaba ..	63 4 0	106 2 0
Carried forward, Rupees	....	33,316 11 2



Names of Works.	Amount.	Total.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Brought forward, Rupees	....	33,316 11 2
<i>Buildings.</i>		
None.		•
<b>MARINE DEPARTMENT.</b>		
<i>Annual and Petty Repairs.</i>		
Annual repairs to the buildings in the Marine Department, for 1849-50. ....	2,279 9 0	
Petty repairs to the buildings in the Marine Department .. . ....	1,754 11 6	4,034 4 6
<i>Certain Works.</i>		
Remedying the dangerous state of the Apollo Pier.. ....	132 15 0	132 15 0
<i>Buildings.</i>		
Constructing a building at the Observatory for the reception of the electrometrical apparatus lately received from England ..	563 2 0	
Constructing a look-out house at the Castle, and one at Mahaluxumee; also a look-out Lascar's house at Malabar Point.. ....	691 9 4	
Constructing a tiled shed for the peons employed to watch the Coal Dépôt near the Pilot Bunder, at Colaba. ....	150 0 0	
Constructing a cook-room for the use of the Gunner at the Light House at Colaba ....	188 0 0	1,592 11 4
Grand Total, Rupees Thirty-nine thousand and seventy-six, and Annas ten.. ....		39,076 10 0

*Statement of the Sums expended by the Civil Architect at the Presidency, from 1st May 1849 to 30th April 1850.*

	Names of Officers.		Annual and Petty Repairs.	Certain Works.		Buildings.	Total.
	Captain H. J. Margary, and Captain J. H. G. Crawford, Civil Architects.			Rs. a. p.	Rs. a. p.		
General Department	....	....	9,281 7 2	11,409 6 9	2,982 14 0	23,672 11 11	
Judicial ditto ..	....	....	3,114 5 6	204 0 0		3,318 5 6	
Territorial ditto ..	....	....	4,453 11 9	1,287 1 0		5,740 12 9	
Ecclesiastical ditto ..	....	....	527 11 0	106 2 0		633 13 0	
Marine ditto ..	....	....	4,034 4 6	132 15 0	1,592 11 4	5,759 14 10	
			21,361 7 11	13,139 8 9	4,575 9 4	39,076 10 0	
		Grand Total.....					

*Statement showing the Cost of Engineering and General Superintendence of the Civil Architect's Department, for the above period.*

Names of Officers.	Expense of Establishment per Annum.		Expenditure.		Rate per Cent.
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
Captain H. J. Margary, and Captain J. H. G. Crawford, Civil Architects at the Presidency.	16,695 0 0	39,076 0 0	42½		

(Signed) J. H. G. CRAWFORD, Captain,  
Civil Architect at the Presidency.





## No. I.

## MARINE DEPARTMENT.

*Statement showing the actual Expenditure upon works carrying on under the Engineer to the Dockyard, for the official year from 1st May 1849 to 30th April 1850.*

Names of Works.	Amount.	Total.
<i>New Works.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
1. Constructing a building-yard to the South-east of the Dockyard and Saluting Battery, comprising three slips for building ships of war of the 1st class of Her Majesty's Navy. ....	521 2 4	
2. Constructing a portion of the work connected with the proposed basin and breakwater :—		
Basin.....Rs. 2,070 14 9		
Breakwater .. 23,020 3 4		
Cofferdam .. 10,498 15 10		
	36,490 2 4	
3. Rendering the buildings in the Dockyard more secure against the risk of fire ....	3,876 7 4	
4. Erecting a work-shed and store-room for the Engineer to the Dockyard ....	673 9 3	
5. Erecting a shed over the small engine at the end of the smithy. ....	267 1 4	
6. Constructing a porch at the entrance of the house of the Commander in Chief of the Indian Navy.. ....	274 0 0	
7. Erecting expense magazine, &c. for the battery on the Apollo Pier .. ....	2,836 5 4	
		44,938 11 11
<i>Repairs to Fortifications and Buildings.</i>		
8. Annual repairs to the buildings in the dock and building yard for 1849-50..	1,990 0 0	
9. Repairs to the present stabling in the Indian Naval Storekeeper's premises..	361 5 4	
10. Converting the ground floor of the building lately occupied as a sail-loft into a store-room ....	590 0 10	
11. Levelling the floor for the reception of the iron tank for the Indian Navy Storekeeper's yard.. ....	177 0 4	
Carried forward, Rupees	3,118 6 6	44,938 11 11

Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought forward, Rupees	3,118	6	6	44,938	11	11
12. Repairing the mast shed, several of the posts having sunk .....	236	3	8			
13. Removing the railing that stands between the Superintendent's Office and the Rampart .....	126	5	10			
14. Making and fitting wooden rollers to the stone slope on one side of the grid-iron, for the purpose of more readily hauling up and launching the Governor's bunder boat .....	80	11	10			
15. Erecting the endjan shed over the new steamer "Zenobia" .....	2,345	0	0			
16. Emergent and petty works and repairs ..	1,025	9	7			
	Total, Rupees			6,992	5	5
	Total, Rupees			51,971	1	4

(Signed) C. W. TREMENEERE, Captain,  
 Engineer to the Dockyard,  
 Bombay, Dockyard, Engineer's Office, 1st May 1850.

No. II.

MARINE DEPARTMENT.

*Statement showing the Cost of Engineering in the Marine Department under the Engineer to the Dockyard, from 1st May 1849 to 30th April 1850.*

	Amount of Es- tablishment.	Total Amount of Establishment.	Expenditure.	Rate per Cent.
Lieutenant and Brevet Captain P. L. Hart's Staff Pay, for Marine and Steam Departments, from the 1st May 1849 to the 8th January 1850....	<i>Rs. a. p.</i> 4,954 13 4	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	
Lieutenant F. W. Marriot's Staff Pay, for Marine and Steam Departments, from 9th January to the 17th March 1850....	687 1 4			
Captain C. W. Tremeneheere's Staff Pay, for Marine and Steam Departments, to the 30th April 1850....	870 15 4			
Establishment from 1st May 1849 to the 30th April 1850..	3,813 14 8	10,326 12 8	51,871 1 4	19½

(Signed) C. W. TREMENEHEERE, Captain,  
Engineer to the Dockyard.

*Bombay, Dockyard, Engineer's Office, 1st May 1850.*

No. 3089 of 1850.

## GENERAL DEPARTMENT.

To

THE SECRETARY TO THE MILITARY BOARD,

Bombay.

SIR,

I have the honor to forward the Annual General Report of the Proceedings of the Department of Public Works in the Southern Provinces during the official year 1849-50.

2. The total expenditure from the 1st May 1849 to the 30th April 1850 in the Military and Civil Departments is as follows :—

*Total Expenditure in the Military and Civil Departments of the several Executive Officers of the Public Works Department in the Southern Provinces.*

Names of Divisions.	Amount expended on each.	Amount of Superintendence.	Superintendence percentage.
<b>POONA.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs . . . . .	Rs. a. p.	Rs. a. p.	
Repairs . . . . .	13,462 4 2		
Annual Repairs . . . . .	9,298 4 4		
New Works .. . . .	19,583 3 7		
Military Department.....Total	42,343 12 1		
<b>CIVIL DEPARTMENT.</b>			
Repairs . . . . .	Rs. a. p.		
Repairs . . . . .	4,514 0 0		
Annual Repairs . . . . .	4,907 4 0		
New Works .. . . .	11,579 8 8		
Civil Department.....Total	21,000 13 2		
Military Department.....Total	42,343 12 1		
Grand Total .. . . .	63,344 9 3	18,570 12 9	29½



Names of Divisions.	Amount expended on each.	Amount of Superintendence.	Superintendence percentage.
<b>AHMEDNUGGUR.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs . . . . .	2,315 4 5		
Annual repairs . . . . .	4,743 12 0		
New works .. . . .	7,173 4 8		
Military Department . . . . . Total	14,232 5 1		
<b>CIVIL DEPARTMENT.</b>			
Repairs . . . . .	3,338 12 10		
Annual repairs . . . . .	1,056 14 3		
New works .. . . .	3,000 10 3		
Civil Department . . . . . Total	7,396 5 4		
Military Department . . . . . Total	14,232 5 1		
Grand Total .. . . .	21,628 10 5	5,736 11 2	26½
<b>BELGAUM.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs.. .. .	2,175 14 11		
Annual repairs . . . . .	5,301 8 8		
New works .. . . .	8,517 2 9		
Military Department . . . . . Total	15,994 10 4		
<b>CIVIL DEPARTMENT.</b>			
Repairs . . . . .	2,701 14 11		
Annual repairs . . . . .	10,735 14 10		
New works .. . . .	7,847 3 0		
Civil Department . . . . . Total	21,285 0 9		
Military Department . . . . . Total	15,994 10 4		
Total.. . . .	37,279 11 1		
Deduct, for Extra Establishment.	1,551 2 2		
Grand Total.. . . .	35,728 8 11	14,371 5 2	40½
<b>DHARWAR.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs . . . . .	315 2 0		
Annual repairs . . . . .	35 9 6		
New works .. . . .	0 0 0		
Military Department . . . . . Total	350 11 6		

Names of Divisions.	Amount expended on each.	Amount of Superintendence.	Superintendence percentage.
<b>CIVIL DEPARTMENT.</b>			
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	
Repairs . . . . .	14,317 7 11		
Annual repairs . . . . .	2,054 2 9		
New works .. . . .	30,620 11 3		
Civil Department.....Total	46,992 .5 11		
Military Department.....Total	350 11 6		
Grand Total.. . . .	47,343 1 5	12,783 0 7	27
<b>KOLAPORE.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs . . . . .	0 0 0		
Annual repairs . . . . .	2,967 7 11		
New works .. . . .	1,284 8 11		
Military Department.....Total	4,252 0 10		
<b>CIVIL DEPARTMENT.</b>			
Repairs . . . . .	0 0 0		
Annual repairs . . . . .	103 0 4		
New works .. . . .	0 0 0		
Civil Department.....Total	103 0 4		
Military Department.....Total	4,252 0 10		
Grand Total.. . . .	4,355 1 2	868 3 3	19½
<b>SHOLAPORE.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs . . . . .	0 0 0		
Annual repairs . . . . .	1,950 0 0		
New works .. . . .	815 0 8		
Military Department.....Total	2,765 0 8		
<b>CIVIL DEPARTMENT.</b>			
Repairs . . . . .	0 0 0		
Annual repairs . . . . .	204 10 0		
New works .. . . .	3,414 11 10		
Civil Department.....Total	3,619 5 10		
Military Department.....Total	2,765 0 8		
Grand Total.. . . .	6,384 6 6	1,284 0 0	20½

Names of Divisions.	Amount expended on each.	Amount of Superintendence.	Superintendence percentage.
	<i>Rs. a. p<sup>rs</sup></i>	<i>Rs. a. p.</i>	
<b>KHANDEISH.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs . . . . .	360 0 2		
Annual repairs . . . . .	331 1 4		
New works .. . . .	785 12 9		
Military Department.....Total	1,476 14 3		
<b>CIVIL DEPARTMENT.</b>			
Repairs . . . . .	5,307 11 2		
Annual repairs . . . . .	9,533 12 11		
New works .. . . .	43,159 0 11		
Civil Department.....Total	58,000 9 0		
Military Department.....Total	1,476 14 3		
Grand Total....	59,477 7 3	31,525 0 11	53½
<b>ASSEERGHUR.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs . . . . .	657 12 11		
Annual repairs . . . . .	94 13 0		
New works .. . . .	170 0 0		
Military Department.....Total	922 9 11		
<b>CIVIL DEPARTMENT.</b>			
None.			
Military Department.....Total	922 9 11		
Grand Total... . . . .	922 9 11		
<b>DAPOOLIE.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs . . . . .	396 6 4		
Annual repairs . . . . .	582 7 8		
New works .. . . .	0 0 0		
Military Department..Total....	978 14 0		

Names of Divisions.	Amount expended on each.	Amount of Superintendence.	Superintendence percentage.
<b>CIVIL DEPARTMENT. *</b>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	
Repairs . . . . .	73 8 1		
Annual repairs . . . . .	37 2 0		
New works . . . . .	0 0 0		
Civil Department . . . . . Total	110 10 1		
Military Department . . . . . Total	978 14 0		
<b>Grand Total . . . . .</b>	<b>1,089 8 1</b>	<b>168 0 0</b>	<b>15½</b>
<b>Grand Total, amount of Expenditure . . . . .</b>	<b>2,40,273 14 11</b>		

3. I beg also to forward Lieutenant Bell's Annual Report of the Proceedings of the Civil Engineer's Department in Candesh, for the official year 1849-50.

I have the honor to be, &c.

(Signed) J. KILNER, Captain,  
Acting Suptg. Engineer, S. P.

*Superintending Engineer's Office, S. P.,  
Camp, Sattara, 21st November 1850:*

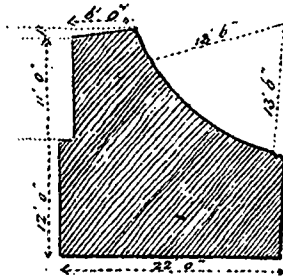
*Extract of a Report of the Proceedings of the Department of the Civil Engineer in Candesh, during the Official Year 1849-50.*

#### TERRITORIAL DEPARTMENT.

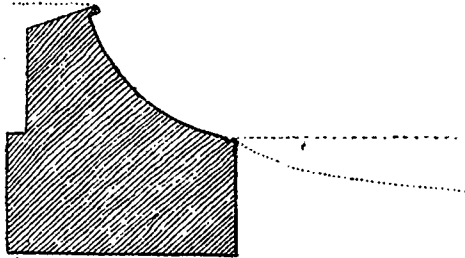
**NEW WORKS.**—*Constructing the Seerusmeenee Bundarrahs.*  
—This work was close on its completion at the end of the last official year, and was finished in the month of May 1849, at a total cost of Rs. 9,647-12-2 (nine thousand six hundred and forty-seven, annas twelve, and pies two). It is the first bundarrahs constructed from its foundation by the Engineer Department in the Province, and the effect of the first monsoon upon it was looked forward to with some anxiety, on account of its want of a *rock foundation* in the bed of the river across which it is constructed. The arrangement of the masonry work, &c. on either bank of the river was much the



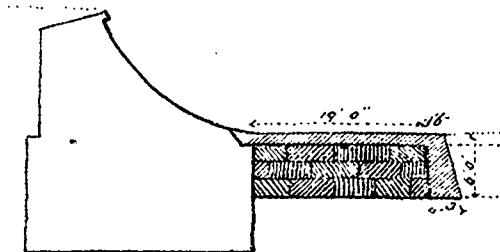
N<sup>o</sup> 1.



N<sup>o</sup> 2.



N<sup>o</sup> 3.



same as had been adopted in modifications of old existing bundarrahs, to prevent the bundarrah wall being outflanked by the river in floods, with the addition, however, in this case, at the mouth of the water-course, of a reservoir and sluice apparatus, to prevent smaller floating rubbish entering the water-course. The main bundarrah wall required to be twelve (12) feet in height above the river bed, which being of a nature likely to be torn up by the water-fall over the crest of the bundarrah during floods, to the possible destruction of the wall, a section (as in diagram No. 1) was considered advisable. The flood appears, by marks made at my request by the villagers, to have risen at times to such a height that seven (7) feet of water was falling over the crest of the bundarrah during the monsoon of 1849, an unusually heavy one, and at the close of the monsoon the water-fall had excavated the upper stratum of the river bed below the bundarrah wall, as seen in diagram No. 2, and some slight injuries had occurred to the pointing, but the work in general had borne the violence of the monsoon as well as could have been wished. It was, however, considered advisable to repair the pointing, and to prevent possible future injury to the bundarrah by the washing away of the river bed soil, and accordingly,

*Repairs, &c. to Seerusmeenee Bundarrah* were undertaken out of the unexpended balance of the bundarrah work. The pointing repairs were executed, and the excavation in the river commenced to be filled in with dry stone-work of large stones, protected by a "pukka" masonry apron above, and supported by a retaining wall, as shewn in diagram No. 3. The completion of this work, and the effect on it of the present monsoon, may be noticed in the next Annual Report.

*Completing the Zeykheira Bundarrah, &c.*—This extensive work of irrigation, which has been noticed in the reports of two past years as being in progress, was completed satisfactorily before the monsoon of last year, at a total cost from the first of Rs. 35,451-15-11 (thirty-five thousand four hundred and fifty-one, annas fifteen, and pies eleven). The magnificent old bundarrah, which for some portion of

its length is from twenty (20) to thirty (30) feet in height, and ten (10) feet thickness at top, has been raised, and strongly though roughly coped, for the purpose of securing a larger supply of water in its rear. The mouth of the water-course adjoining the bundarrah has been protected by an inner screen wall, and complete sluice apparatus. The water-course is carried for a length of about five (5) miles, through most difficult ground, from the bundarrah to the irrigated land, and in its course is carried through three (3) tunnels of considerable length, (built of masonry, and of the pointed Gothic section, and with masonry shafts at proper intervals,) and over three (3) nullahs, by means of arched aqueducts. The water of nullahs on a higher level than the water-course is carried clear over it in four (4) places by means of aqueducts for that purpose, and in three (3) places village roads cross the water-course by means of road bridges, constructed for that purpose; and lastly, where smaller nullahs enter the water-course, or it crosses larger ones nearly on a level with their beds, breast-walls, large and small, twenty (20) in number, protect the bank from injury. The work thus completed satisfactorily affords a fine specimen of the application of the resources of the Engineer Department to the restoration and improvement of an old work of irrigation. It is only to be hoped that a work, on which upwards of thirty-five thousand rupees have been expended by Government from the time it was taken in hand, may not suffer injury from the notorious inattention of the villagers (in whose charge it now is) to the care of all permanent works on the line of their water-courses.

*Improvements to the Khutghur Water-course.*—This work was noticed and described in the last Annual Report as nearly completed. It was satisfactorily completed, at a cost of Rs. 1,226-7-6 (twelve hundred and twenty-six, annas seven, and pies six), shortly after the commencement of the past official year, and was inspected as completed by me before the monsoon of 1849, and though I have had no opportunity of inspecting it since then, I have no doubt that the work has proved successful, as I have heard nothing to the contrary.



*Improvement to the Seerwara Bundarrah.*—This work was also nearly completed, and noticed as such in the last Annual Report. I have not seen it since its completion, shortly before the rains of 1849, at a cost of Rs. 513-14-11 (five hundred and thirteen, annas fourteen, and pies eleven), but I have been informed that it has not been at all injured by the monsoon, and that the sluices broken in the bundarrah have proved quite efficacious in removing the long-accumulated deposit from the rear of the bundarrah wall, which is now occupied by a fine sheet of water, and the water-course is plentifully supplied.

*Improvements to the Wulwareh Bundarrah.*—This work was abandoned after commencement nearly at the close of the official year 1848-49, in consequence of an assault on the works by the villagers of Wurnere, whose bundarrah is lower down the same river, and who were afraid of a deficiency in their supply of water if the Wulwareh Bundarrah, which had hitherto been a leaky “kutchra” dam, was rendered “pukka,” and did not let any water escape through it. The offending parties have been punished, and the work resumed during the past working season, and was nearly completed at the close of the past official year.

*Improvements to the Cunnussee Water-course.*—The improvements noticed in the last Annual Report as being in progress were satisfactorily completed before the setting in of the monsoon of 1849, at a total cost of Rs. 4,961, (four thousand nine hundred and sixty-one). The aqueduct parapets, which had three times given way, were enabled, by the new section given to them, aided by the important remedy to the evils on the line of water-course by the giving the sides a better slope, to withstand all the floods of the monsoon of 1849, without suffering at all. I visited the locality before the present monsoon, and had the satisfaction of finding that all the remedial measures proposed and executed by me had been perfectly successful. •

*Constructing a Relieving Sluice near the Aqueduct of the Water-course belonging to the villages of Bhoosnee and Kul-*

*wan*.—This work was noticed in the last Annual Report as commenced only. At a point of the water-course a short distance above the aqueduct, which has twice suffered from floods, a breast-wall has been constructed, with a waste weir and scouring sluice, by which any surplus water, turned off by a screen-wall across the water-course, is carried away into a nullah below, through a cutting made for the purpose. The aqueduct was uninjured by any flood during the monsoon of 1849, possibly because of this safety breast-wall above it, and on my visit to the locality during the past working season, I found it in good order. This work was completed for a total cost of Rs. 250-12-8 (two hundred and fifty, annas twelve, and pies eight).

*Repairing the Bundarrah and Water-course of Bhadne*.—The nature of the works required to this bundarrah and water-course was described in the last Annual Report. The work was completed satisfactorily under the superintendence of Lieutenant Jones, for a total cost of Rs. 2,993-1-11 (two thousand nine hundred and ninety-three, anna one, and pies eleven), shortly after the commencement of the official year. I visited the work while in progress, but have not had an opportunity of observing the effect upon it of the monsoon of 1849, immediately following its completion.

*Repairing the Bundarrah and Water-course of Muchmull*.—This work was described in the last Annual Report. The monsoon of 1849 put a stop to the works shortly after the completion of the bundarrah, with its protecting screen-wall at the mouth of the water-course, and waste weir and sluice apparatus, as modified by me from the sanctioned design. A great portion of the past official year was taken up with the correspondence explanatory of these modifications, and the obtaining sanction to the supplementary estimate required. On visiting the locality towards the close of the past official year, when the works were again in progress, I had the pleasure of finding the bundarrah (which was, if anything, too well and expensively finished, owing to the great sickness and defection among the masons compelling Lieutenant

Jones to employ stone-cutters on the work,) but slightly injured in its coping by the monsoon of 1849, and otherwise in excellent order. Great progress had been made towards the completion of the works by the end of the official year, and they were finished before the monsoon of the present year, and will be duly noticed as such in the next Annual Report.

*Repairing the Bundarrah and Water-course of Akheira.*—This work was described in the last Annual Report. It was satisfactorily completed under the superintendence of Lieutenant Jones, shortly after the commencement of the past official year. I visited the work while in progress, but have not had an opportunity of observing whether it has in any way suffered from the monsoon of 1849, shortly before which it was completed. The total cost of this work has been Rs. 1,183-8-7 (eleven hundred and eighty-three, annas eight, and pies seven).

*Constructing a new Bundarrah at Wuzzur.*—This new Bundarrah consists of a “pukka” masonry wall, of small section, thrown across the rocky bed of a small river, and so arranged in plan as to supply water from its rear equally to two (2) water-courses, one on either side of the river, both of which are provided with screen walls at their mouths, waste weirs, and sluice apparatus. The Bundarrah thus takes the place of two “kutchha” dams, originally reconstructed annually by the villagers. The work was nearly completed at the close of the past official year, and will be noticed as completed in the next Annual Report.

#### ROADS AND BRIDGES.

##### *Roads and Bridges, Agra Line.*

*Improvement of the Agra Road, from Chandore Ghaut to Scindwa Pass.*—The amount of annual sanction for this work is Rs. 12,000 (twelve thousand). The expenditure during the official year 1848-49 was only Rs. 10,284-8-1 (ten thousand two hundred and eighty-four, annas eight, and pie one), being

less than the sanctioned amount ; which the expenditure of the past official year 1849-50 has exceeded, having amounted to Rs. 13,228 (thirteen thousand two hundred and twenty-eight). The improvements carried on and completed during the past official year have been as follows :—

*Between Chandore Ghaut and Malligaum.*—Nothing has been done for the further improvement of this portion of the line of road. It is complete with bridges and drains, with the exception of the large river, the Girna, close to Malligaum, and a small river, close to Soundanah, where there is a travellers' bungalow, for a bridge across which a design is about to be submitted, as it will exceed the usual cost.

*Between Malligaum and Chickulwall Travellers' Bungalows.*—Distance eight and a quarter ( $8\frac{1}{4}$ ) miles. A double slab drain has been constructed at the junction of the Agra Road into the branch road from Malligaum Camp, and a single drain, of the same description, not far from the Moosum Ferry, on the Malligaum side. These two drains have been constructed at a total cost of Rs. 56-2-1 (fifty-six, annas two, and pie one). The Moosum River still continues unbridged, and a ferry establishment is kept up, but a design for the construction of a bridge across it, on a new and economical principle, proposed by Mr. T. Edwards, a Surveyor and Draughtsman in my Office, has been sent in to Government, who have expressed great approval of the same, and it is to be hoped that it may shortly be sanctioned, and, if found to be as good as is expected, that many other like constructions may be permitted to be taken in hand. At a point about a mile from the bank of the Moosum River, the road was continually turned into a swamp of black mud, from the washing over it during floods of the soil from the adjacent fields, which are on the same level as nearly as possible with the road. Here a paved dip, eighty (80) feet in length, was considered advisable, and constructed at a cost of Rs. 127-12-6 (one hundred and twenty-seven, annas twelve, and pies six), and has been found effectual in making the road passable at all seasons, and being always covered with soil or mud to the

depth of an inch or two, does not present the objections that paved dips in general do. At the foot of the Durregaum Ghaut a treble slab drain has been constructed, at a cost of Rs. 116-15-11 (one hundred and sixteen, annas fifteen, and pies eleven), and at the top of the ghaut an arched culvert, six (6) feet span, at a cost of Rs. 169-4-4 (one hundred and sixty-nine, annas four, and pies four). Near a well, some distance further on, a double slab drain has been constructed, at a cost of Rs. 90-13-9 (ninety, annas thirteen, and pies nine), and still further on, near the base of a rocky hill, a single slab drain, at a cost of Rs. 43-14-5 (forty-three, annas fourteen, and pies five). The above completes the account of the works of improvement on this portion of the line, which may now be said to be complete in every respect, with the exception of the large bridge across the Moosum, as noticed above.

*Between Chickulwall and Arnee Travellers' Bungalows.*—Ten and a half ( $10\frac{1}{2}$ ) miles. Descending from the travellers' bungalow at Chickulwall, the road is carried across the Kanolee Nullah by means of a substantial masonry bridge, of two (2) elliptical arches, twenty-four (24) feet span each, constructed by my predecessor, Captain Hart, but from this bridge having an insufficient water-way during heavy floods, the embanked approaches have been carried away in two successive years, (to be noticed below,) and it was therefore recommended to add two (2) arches to the bridge, and construct, at a point a short distance beyond the bridge, a rubble masonry treble culvert, of three (3) arches, each five (5) feet span; and beyond this again, in place of an old non-effective wooden bridge, a single arch bridge, of rubble masonry, fifteen (15) feet span, arc of sixty (60) degrees. This, as a separate sanction, was not approved of at the time of recommendation, but the treble culvert was nevertheless constructed during the last official year out of the annual sanction, at a cost of Rs. 527-9-6 (five hundred and twenty-seven, annas nine, and pies six), and the small bridge, at a cost of Rs. 553-4-8 (five hundred and fifty-three, annas four, and pies eight), besides which an extensive cutting on the up-stream side of

the line of embankment, connecting the old and the two new bridges to protect it, and to conduct the flood water to the proper water-ways, has been made, at a cost of Rs. 408-3-9 (four hundred and eight, annas three, and pies nine). The addition of two arches to the original Kanolee Bridge has lately been sanctioned, in consequence of a repetition of the flood injuries during the monsoon of 1849, and the work will be duly noticed in the next Annual Report. Continuing along the road, several small slab drains are required between Chickulwall and Jhorgah, but no bridge whatever, the last work of this kind required having been constructed during the past official year, at the Puddolee Nullah, about a mile before reaching Jhorgah. This is a rubble masonry bridge, of three (3) arches, each fifteen (15) feet span, and are of sixty (60) degrees breadth, under soffit of arches twenty-one (21) feet, and with a clear roadway of eighteen (18) feet, and has been completed at a cost of Rs. 1386-6-3 (thirteen hundred and eighty-six, annas six, and pies three). Near the town of Jhorgah several drains require to be made, of these one, a treble slab drain was constructed during the past official year, at a cost of Rs. 161-7-10 (one hundred and sixty-one, annas seven, and pies ten). At a distance of two (2) miles beyond Jhorgah are two nullahs, within a short distance of each other, both called Naundun. Two (2) bridges have been constructed here, the first, a bridge of two (2) arches, each fifteen (15) feet span, and are of sixty (60) degrees breadth, under soffit of arches twenty-one (21) feet, and a clear width of roadway eighteen (18) feet, completed at a cost of Rs. 1,541-0-1 (fifteen hundred and forty-one, and pies one), and the second, a larger bridge, of similar design and details, but with three (3) arches, has been completed at a cost of Rs. 1,810-14-2 (eighteen hundred and ten, annas fourteen, and pies two). Between these bridges and the Boree River nothing further has been done in the way of improvement during the past official year, though three or four works will be duly noticed in the next Annual Report, as constructed during the current official year. The design and estimate for the greatly-required bridge







across the Boree River, with its rocky, uneven, cart-destroying bed, was submitted for sanction in October 1848. Beyond the Boree River the road has been carried across a nullah of some size, called the Mhow Nullah, by means of a bridge of the same construction as that previously described as the larger Naundun Bridge, having three (3) arches. It was completed at a cost of Rs. 1417-6-11 (fourteen hundred and seventeen, annas six, and pies eleven).

*Between the Arvee and Dhoolia Travellers' Bungalows.*—Twelve (12) miles. Immediately after passing the travellers' bungalow at Arvee, the road, previously to the completion of the improvements about to be noticed, entered a nullah, called the Lendee Nullah, close to the village wall of Arvee, and followed its sandy bed for about 300 or 400 yards to its junction with the Toolsee Nullah, across which the road was carried, and regained the high ground. By a deviation from the old line, a high and dry line of roadway has been constructed, crossing the nullahs by two (2) bridges. The Lendee Bridge is of (2) arches, of the construction previously described, but from the combination with the bridge of a long tunnelled arched culvert, four (4) feet span, crossing the road diagonally, and from the necessity of adapting the several wing walls to a branch road leading to the travellers' bungalow immediately from the bridge, its cost when completed amounted to Rs. 1,981-2-6 (nineteen hundred and eighty-one, annas two, and pies six), while the Toolsee Bridge, which is one of three (3) arches, of the construction described above, has been completed satisfactorily at a cost of Rs. 1,354-11-2 (thirteen hundred and fifty-four, annas eleven, and pies two).

As the new bridges described in the two preceding paras. have all been constructed on one general design, differing only in details according to circumstances, and as no others have to be noticed in the further account of the Agra Road, I here beg leave to draw attention to the accompanying sketch, in elevation, of a two (2) arch bridge, of the construction spoken of, the peculiarities of which may be thus described: The parapets of coursed rubble masonry (which are 18 inches in thick-

ness) are surmounted by a semicylindrical coping of cut stone, and terminate at either extremity over the abutments in cylindrical pillars of coursed rubble masonry, two (2) feet in diameter, surmounted by a single large stone, cut to a hemisphere. The wing walls slope from the level of the roadway to that of the spring of the arches. They are made of sufficient length to embrace the whole width of the river in floods, and splay in plan from the line of the parapet of the bridge, according to the base of the slope of the embankment at their termination, where is also a pillar similar to that at the end of the parapet wall, and connecting these is a teak railing, dammered, running up the slope of the wing wall. I believe this to be the kind of bridge best adapted to our nullahs in Can-deish, having abundance of waterway, being well protected from the flank action of spreading floods, and not so liable to injury in its superstructure from ignorant and careless cartmen, and mischievous travellers, as those previously constructed with rounded plaster or flat projecting copings, surmounting parapet walls, or pillars of rectangular plan. I now return to my account of the road improvements.

*Between Dhoolia and the River Taptee.*—Twenty-six and a half (26½) miles. The only work of improvement carried on in this portion of the line has been the excavation of double drains, at a cost of Rs. 936-3-8 (nine hundred and thirty-six, annas three, and pies eight), for the security of the new piece of road of about four (4) miles in length, constructed by Lieutenant Jones during the previous official year 1848-49 between Soanghier and Nurdanah. Several bridges and drains are required, and will gradually be constructed on the line as far as Nurdanah nearly, but beyond this it were in vain to multiply such works, while the connecting portions of road are merely “fair-weather” roads, and impassable during wet weather. It was stated in the last Annual Report that, for reasons assigned, the construction of the permanent way of good material would cost between Rs. 3,000 and 4,000 a mile, through the valley of the Taptee. This expense must be incurred some day or another, to meet the increasing

demands for improved postal arrangements and despatch, but the small amount of annual sanction will never be found sufficient for this purpose, as it would take seven or eight years, devoting the entire annual sanction on this work, to do what is required.

*Between the Taptee River and Scindwa Fort.*—Thirty-five (35) miles. Several surveys have been made, and sections taken, preparatory to the improvement of this portion of the line, (which is certainly very bad, principally in consequence of deep black soil in some places, and from its running in a line, as it were entangled, with the course of the River Arnawantee, on which Sirpoor stands, and which the road crosses several times,) but no work of improvement has been executed during the past official year. Indeed, it would be of little use expending large sums on improvements on this portion of the line of road, while the portions of the line to the south of the Taptee, connecting it with Dhoolia, and to the north, through the Nimar Territory, continued very inferior “fair-weather” roads. However, *some* improvements are in contemplation, especially near the town of Sirpoor, where a deviation from the existing line may be made with great advantage.

#### *Agra Road, Nimar Line.*

48. *Converting into a Fair-weather Road the Line, forty-three (43) miles in length, through the Nimar Territory, between Scindwa and the Nerbudda River.*—This work was commenced at the beginning of the present year, under the superintendence of Mr. Conductor Whittenbury, who was detached from Poona for employment under me for that purpose. I visited the locality, and went over the line with Mr. Whittenbury in April last, and had every reason to be satisfied with his work, so far as it was completed at the time I saw it. The nature of the work required was of course merely the removal of obstructions, the cutting of side drains, and the sloping the approaches into rivers and nullahs. The completed work will be duly noticed in the next Annual Report.

49. Before quitting the subject of the Agra Line, I have to remark that, on two or three occasions during the past official year, reports by travellers from Bombay through Indore have been furnished to the Resident at his request, regarding the bad state of the roads between the Taptee and the Nerbudda, and the Resident, having sent them to our Government, they have eventually been forwarded for my information. Not having acknowledged these reports individually, I would take this opportunity of stating that no traveller can report worse of the portion of the line of road in question than I have done, and am willing to do myself, if comparisons are to be allowed between it and the excellent portion of the line between Nas-sick and Dhoolia, but otherwise it is not worse than might be expected, and the only remedy is an expenditure much larger than has hitherto been sanctioned.

*Jhorgah and Nusseerabad Road.*

50. *Completing with Bridges the Road between Jhorgah and Nusseerabad.*—This work was noticed at length in the last Annual Report as having been nearly completed at the end of the official year 1848-49. The works were completed in the past official year, by the construction of a bridge at Paldee, with a single arch of eight (8) feet span, arc of sixty (60) degrees, a breadth under soffit of arch seventeen (17) feet, and a clear roadway of fourteen (14) feet, at a cost of Rs. 561-12-1 (five hundred and sixty-one, annas twelve, and pies one,) and in addition to this a further expenditure, amounting to Rs. 172-15-6 (one hundred and seventy-two, annas fifteen, and pies six), in slight repairs to the embankments and roadways of the bridges previously constructed, in consequence of the country-people having cut them up with their carts before the earth-work had had time to consolidate. The total expenditure on this now completed work has been Rs. 15,151-0-4 (fifteen thousand one hundred and fifty-one, and pies four).

*Statement showing the Total Amount of Expenditure in the Engineer's Department in the Province of Candeish, during the Official Year 1849-50.*

*Mulligam, Civil Engineer's Office, 1st May 1850.*

Names of Works.	Amount expended on each Building, &c.	Total Expenditure on each description of Works, &c.	Total Expenditure in each Department.	Amount of Superintendence of Department.	Per-centage of Superintendence over Expenditure.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	
<b>MILITARY DEPARTMENT.</b>					
<i>New Works.</i>					
Erection of a new store-room for the use of the Detachment of Regulars stationed at Dhoolia . . . .	675 6 6				
Annual Repairs . . . . .	43 8 4				
Petty Repairs . . . . .	17 13 6	736 12 4			
			736 12 4		
<b>TERRITORIAL DEPARTMENT.</b>					
<i>New Works.</i>					
Constructing the Semusunnee Bundarrah Repairs, &c. to the Seerunnee Bundarrah . . . .	54 8 1				
Completing the Zeykheira Bundarrah . . . .	17 6 2				
Improvements to the Khutghur Water-course . . . .	5,475 1 1				
	24 11 3				
Carried forward, Rupees.	5,571 10 7		736 12 4		

Names of Works.	Amount expended on each Building, &c.	Total Expenditure on each description of Works, &c.	Total Expenditure in each Department.	Amount of Superintendence of Department.	Per-centage of Superintendence over Expenditure.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	
Brought forward, Rupees	5,571 10 7		786 12 4		
Improvements to the Seerwarra Bundarrah .....	38 0 11				
Ditto to the Wulwarah Bundarrah .....	458 0 11				
Ditto to the Cumnaasee Water-course .....	4,470 11 11				
Constructing a relieving sluice near the aqueduct of the water-course belonging to the villages of Bhoosmie and Kulwan .....	196 14 2				
Repairing the bundarrah and water-course of Bhadine. Ditto ditto of Muchmull ..	857 0 8				
Ditto ditto ditto of Akheira ..	1,953 10 11				
Constructing a new bundarrah at Wuzzur ..	190 - 2 11				
Repairs and improvements to the upper bundarrah and water-course of Daturtee ..	1,014 11 11				
Constructing a bungalow for the use of the 3rd Assistant Collector at Bataurid ..	4,854 0 10				
Repairs and additions to the Collector's bungalow at Dhoolia .....	365 2 10				
	394 12 0				
Annual repairs .....	20,365 0 7				
Emergent works and repairs ..	237 14 4				
Petty repairs ..	383 15 4				
	136 14 3				
		21,123 12 6	21,123 12 6		

JUDICIAL DEPARTMENT.

*New Works.*

Constructing a wall to surround the solitary cells and work-sheds of the Dhoolia Jail . . . . . 2,968 3 2  
 Constructing four flights of stone steps to top of cook-rooms, Dhoolia Jail . . . . . 159 5 9  
 Improving the floor of the hospital necessary of the Dhoolia Jail . . . . . 6 8 0  
 Constructing a new flooring to the central guard-room of the Dhoolia Jail . . . . . 100 1 2  
 Arranging the urinary drains, Dhoolia Jail . . . . . 648 7 11  
 Constructing a bridge over the trench dug round the Jail at Dhoolia . . . . . 101 15 2

Annual repairs . . . . . 3,084 9 2  
 Emergent works and repairs . . . . . 287 10 4  
 Petty repairs . . . . . 335 2 10  
 . . . . . 310 15 10

4,918 6 2

4,918 6 2

ECCLESIASTICAL DEPARTMENT.

Emergent works and repairs . . . . . 177 9 4

177 9 4

GENERAL DEPARTMENT.

*New Works.*

Constructing two new boats for the Girna and Moomsun river ferries near Malligaum . . . . . 175 15 5

Carried forward, Rupees. . . . . 175 15 5

26,956 8 4

Names of Works.	Amount expended on each Building, &c.	Total Expenditure on each description of Works, &c.	Total Expenditure in each Department.	Amount of Superintendence of Department.	Per-centage of Superintendence over Expenditure.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	
Brought forward, Rupees	175 15 5		26,956 8 4		
Transporting the Kokurnoonda ferry-boat to its destination .. .. .	36 4 4				
Erecting a store-room at Saweldah for the stowage of ropes, &c. belonging to the Taptee Ferry .. . . .	310 5 7				
Improvements to the travellers' bungalow, Malligaum. Ditto .. .. .	173 5 3				
Cibickwall.	197 7 7				
Making up furniture for the travellers' bungalows at Bodwur and Edulabad .. .. .	220 13 8				
Making up furniture for the use of the Civil Engineer's Office in Candeish .. .. .	86 10 2				
Improvement of the Agra Road, from Chandore Ghaut to Scindwa Pass .. .. .	13,228 0 0				
Converting into a fair-weather road the line, 43 miles in length, between Scindwa and the Nur-budda .. .. .	3,106 3 9				
Completing with bridges the road between Jborgah and Nusseerabad .. .. .	734 11 7				
Making up stone rollers for the use of the roads .. . . .	155 10 6				
Annual repairs .. .. .	18,425 7 10				
Emergent works and repairs .. .. .	9,006 4 3				
Petty repairs .. .. .	3,392 2 7				
	954 14 4				
		31,780 13 0	31,780 13 0		



AMOUNT OF SUPERINTENDENCE.

Lieutenant Bell, Civil Engineer.....	.....	.....	8,613 0 0
Lieutenant Jones, 1st Assistant Civil Engineer .....	.....	.....	5,613 0 0
Captain Adams, Acting 2nd Assistant Civil Engineer.....	.....	.....	5,786 10 4
Conductor and Supervisor .....	.....	.....	751 2 5
Surveyors.....	.....	.....	5,169 12 5
Office Establishment ..	.....	.....	8,831 15 3
Pioneers .....	.....	.....	1,789 8 6
Total.....	58,737 5 4	31,525 0 11	53½ nearly.

(Signed) H. W. B. BELL, Lieutenant,

Civil Engineer.

No. 26 of 1851-52.

GENERAL DEPARTMENT.

To

THE SECRETARY MILITARY BOARD,

Bombay.

Sir,

I have the honor to forward the Annual Report of Works in the Northern Provinces, for the Year ending 30th April 1850.

*Statement of the Sums expended by each Officer under the Superintending Engineer, Northern Provinces, from the 1st May 1849 to 30th April 1850.*

Names of Officers.	In the Military Department.		In the General Department.		In the Judicial Department.		In the Revenue Department.		In the Territorial Department.		In the Political Department.		In the Ecclesiastical Department.		Total.	
	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.
Lieutenant M. Kennedy, Executive Engineer, Surat Division .. .. .	1,475	5 8	7,290	1 0	3,389	1 11	2,385	8 10	346	12 9	2	15 6	42	6 0	14,832	3 3
Lieutenant W. R. Dickin-son, Executive Engineer, Ahmedabad Division ..	15,925	7 8	5,524	0 5	4,077	7 3	5,592	15 2	3,228	13 7	1,323	14 10	290	11 10	36,163	6 4

Lieutenant G. G. Brown, Acting Executive Engineer, Deesa Division ..	32,221 0 7	31 4 8	....	....	....	....	....	148 7 0	32,400 12 3
Captain Taylor, Lieutenant Becher, Captains Morse, and Cristall, Majors of Brigade, in Charge of Public Works, Rajkote ..	848 5 7	....	....	....	....	....	826 10 2	17 0 0	1,691 15 9
Lieutenants J. G. Moyle and G. Skipton, Line Adjutants in Charge of Public Works, Bhooji ..	1,205 13 3	....	....	....	....	....	267 10 9	270 0 1	1,743 8 1
Total ..	50,975 15 11	12,845 6 1	8,206 9 2	7,978 8 0	3,575 10 4	2,421 3 3	768 8 11	86,831 13 8	

*Statement showing the Cost of Engineering and General Superintendence of each Officer under the Superintending Engineer, Northern Provinces, from 1st May 1849 to 30th April 1850.*

Names of Officers.	Expense of Establishment per annum.			Expenditure.			Rate per Cent.
	Rs.	a.	p.	Rs.	a.	p.	
Lieutenant M. Kennedy, Executive Engineer, Surat Division .. .. .	9,659	7	7	14,832	3	3	65½
Lieutenant W. R. Dickinson, Executive Engineer, Ahmedabad Division ..	11,356	0	10	36,163	6	4	31½
Lieutenant G. G. Brown, Acting Executive Engineer, Deesa Division ..	5,724	2	7	32,400	12	3	17½
Captain Taylor, Lieut. Becher, Captains Morse and Cristall, Majors of Brigade, in Charge Public Works, Rajkote ..	90	0	0	1,691	15	9	5½
Lieutenants J. G. Moyle and G. Skipton, Line Adjutants, in Charge Public Works, Bhoj .. .. .	158	0	0	1,743	8	1	9¼
Total ..	26,987	11	0	86,831	13	8	31¼

2. During the official year 1849-50 no works of general or permanent professional interest have been executed, and there do not appear to have been any facts recorded worthy of publication.

3. From the outlay at Surat, Rs. 3,205-11-10 have been expended in constructing the Mucca Gate Bridge. From that at Ahmedabad Rs. 3,762-3-3 have been expended on the local general improvements.

4. Rs. 6,448-6-8 have been expended on the improvement of the Aboo Road, for the sick Europeans on the mountain.

I have the honor to be, &c.,  
 (Signed) W. B. GOODFELLOW, Major,  
*Superintending Engineer, N. P.*

*Superintending Engineer's Office, N. P.,  
 Surat, 5th May 1851.*

*Statement of Expenditure on Public Works in the Sattara Territory, from the 17th January 1850 to the 30th April 1850.*

Description of Works.	Amount expended from January to April 1850.	Total.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
<b>GENERAL DEPARTMENT.</b>		
<i>Bridges.</i>		
Bridges and drains, ten large and thirty-five small nullahs, on the line of road from Neera Bridge to Sattara . . . . .	421 5 4	
Ditto on the line of road from Sattara to Mahableshtar . . . . .	2,795 15 11	
Bridge over the Yenna .. . . .	668 5 9	
Bridge over the Wusna .. . . .	200 0 0	
		4,080 11 0
<i>Buildings, Repairs.</i>		
To the old Native buildings at Beejapoor ..	489 0 0	
		489 0 0
<i>Buildings, New.</i>		
Travellers' bungalow at Punderpoor . . . .	300 0 0	
Ditto at Wangee . . . . .	47 0 7	
		347 0 7
<i>Buildings, Repairs Annual, 1849-50.</i>		
Travellers' bungalow, Sattara, 1849-50 . . . .	92 2 6	
Commissioner's ditto ditto . . . . .	336 0 0	
		428 2 6
<i>Roads, Repairs Annual, 1849-50.</i>		
From Neera Bridge to Mahableshtar . . . .	3,457 7 7	
In the town of Sattara . . . . .	1,851 6 6	
Watering and preserving trees on the high-ways . . . . .	1,005 13 5	
		6,314 11 6
<i>Roads, New.</i>		
<i>Between Kurar and Punderpoor.</i>		
Shangaom Khind . . . . .	} 127 4 9	
Kulleedoon Khind . . . . .		
Seodasheoghur Khind.. . . .		
<i>Between Sattara and Beejapoor.</i>		
Pulsee Ghaut . . . . .	} 111 1 0	
Nandree Ghaut . . . . .		
Nagvy Ghaut . . . . .		
Carried forward, Rupees	238 5 9	11,650 9 7

Description of Works.	Amount expended from January to April 1850.	Total.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Brought forward, Rupees	238 5 9	11,659 9 7
<i>Between Sattara and Punderpoor.</i>		
Triputte Khind . . . . .	19,697 14 0	
Wardunghur Khind .. . . .		
River Krishna, east bank Maholee . . . . .		
Sattara to Girre Khind .. . . .	1,850 6 11	
Pelien Khind .. . . .	3,222 15 0	
Prutanb Gunj Road, in the Town of Sattara.	1,913 2 5	
Clearing a road over the Kailghur Ghaut . . . . .	1,386 9 8	
Extension of the same from Veir Mall to		
Bawurwuree . . . . .	2,301 3 6	
Pussernee Khind . . . . .	191 8 0	
Korel Khind .. . . .	95 12 0	
Constructing a tunnel at Bazaar Peida . . . . .	2,549 15 7	
		27,447 12 10
<b>TERRITORIAL DEPARTMENT.</b>		
<i>Bunds.</i>		
Wakeshwur Bund, across the Yerla River .. . . .	1,173 0 1	
<i>Tanks.</i>		
Godolee Tank .. . . .	124 13 1	
Gowlee Tank . . . . .	191 12 1	
Memadapoor Tank . . . . .	832 0 0	
		2,321 9 3
<b>JUDICIAL DEPARTMENT.</b>		
New Jail at Mahableswhar . . . . .	777 0 0	
		777 0 0
<b>MILITARY DEPARTMENT.</b>		
Military buildings occupied by troops and departments at Sattara . . . . .	77 12 1	
		77 12 1
Total, Rupees forty-two thousand two hundred and eighty-three, annas eleven, and pias nine . . . . .		42,283 11 9

*Abstract of the Expenditure from January to April 1850.*

Works connected with the communications of the Sattara		
Districts . . . . .	<i>Rs.</i>	37,843 3 4
Buildings . . . . .	"	2,118 15 2
Works of irrigation . . . . .	"	2,321 9 3
Grand Total as above . . . . . Rupees		<u>42,283 11 9</u>

*Statement showing the Expense of Engineering and Superintendence, with reference to Actual Outlay.*

Names.	Expense of Es- tablishment.	Expenditure.	Rate per Cent.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	
<i>Establishment for January 1850.</i>			
Captain P. L. Hart's salary	401 9 9		
<i>Establishment for February 1850.</i>			
Captain P. L. Hart's salary	880 0 0		
Ditto travelling allowance	280 0 0		
Serjeant Assistant Overseer Mulligan's salary	69 4 9		
Ditto ditto six days' horse allowance	2 2 3		
<i>Establishment for March 1850.</i>			
Captain P. L. Hart's salary	830 0 0		
Ditto travelling allowance	310 0 0		
Serjeant Assistant Overseer Mulligan's pay and allowances	69 4 9		
	2,792 4 9		
Carried forward, Rupees			

Names.	Expense of Es- tablishment.	Expenditure.	Rate per Cent.
	Rs. a. p.		
	2,792 4 9		
<i>Establishment for April 1850.</i>			
	Brought forward, Rupees		
Captain P. L. Hart's salary	.....	890 0 0	
Ditto travelling allowance ..	.....	270 0 0	
Serjeant Assistant Overseer Mulligan's pay and allowances ..	.....	69 4 9	
Assistant Surveyor and Builder Luximon Durmajee's pay	.....	80 0 0	
Ditto ditto ..	.....	20 0 0	
Ditto ditto horse allowance ..	.....	20 0 0	
	Total, Rupees	4,081 10 3	9
		42,283 11 9	
Expenditure to the close of the official year 1849-50 .....	.....	Rs. 42,283 11 9	
Expense of Civil Engineer's Establishment .....	.....	4,081 10 3	
Rate per Cent. ....	.....	Nine.	



*List of the Public Works in hand in the Sattara District at the date of this Report.*

Names of Works.	Amounts sanctioned.
<b>GENERAL DEPARTMENT.</b>	
<i>Rs. a. p.</i>	
<i>Boats, Ferry.</i>	
Three small boats to be placed at Hulwunk Tamband Meera..	{ Each Boat 625 0 0
<i>Boat, Ferry, repairs annual.</i>	
A double boat on the Krishna, and one on the Yenna ....	{ Emergent Order.
<i>Bridges.</i>	
Bridges and drains on the line between Neera Bridge and Sattara ....	General Sanction.
Ditto Sattara and Mahableshtar ..	{ General Sanction.
Bridge over the Yenna ..	3,000 0 0
Bridge over the Wusna ..	15,000 0 0
	*4,000 0 0
	†4,000 0 0
Bridges and drains between Linibkhand and Panchwur ....	8,000 0 0
Bridge over the Quoina, near Kurar ..	‡25,000 0 0
<i>Buildings, New.</i>	
Dhumsala at Poossoosalee ....	400 0 0
Travellers' bungalow at ditto ....	600 0 0
Ditto ditto Kurar ..	1,500 0 0
Ditto ditto Punderpoor ..	1,500 0 0
Ditto ditto Wange ..	600 0 0
<i>Buildings, repairs.</i>	
Old native building at Beejapoor ....	5,200 0 0
<i>Buildings, repairs annual.</i>	
Travellers' bungalow at Sattara ..	317 0 0
Commissioner's bungalow at Sattara ....	511 0 0

\* Subscribed by Inamdars.

† Sanctioned by Government.

‡ Subscribed by the Punt Prittiniddy, reference made to the Supreme Government.

Names of Works.	Amounts sanctioned.
	<i>Rs. a. p.</i>
Native buildings in the town of Sattara . . . . .	} Emergent Order.
<i>Improvements.</i>	
In the town of Sattara, 1850-51 .. . . .	5,000 0 0
Ditto ditto .. . . .	490 0 0
Ditto ditto .. . . .	760 0 0
Improving supply of water in the town of Sattara .. . . .	25,000 0 0
<i>Roads, repairs annual.</i>	
In the Sattara districts, watering and preserving trees on the side of roads . . . . .	25,218 0 0
Planting trees . . . . .	1,000 0 0
<i>Roads, New.</i>	
<i>Between Kurar and Punderpoor.</i>	
The Shangaom Khind .. . . .	
The Kulludoon Khind .. . . .	
The Sodasheoghur Khind . . . . .	
<i>Between Sattara and Beejapoor.</i>	
The Pulsee Ghaut . . . . .	
The Nandree Ghaut . . . . .	
The Nawguz Ghaut . . . . .	
<i>Between Sattara and Punderpoor.</i>	
The Tirputtie Khind .. . . .	
The Wurchinghur Khind . . . . .	
Mahoolee River bank .. . . .	
From Sattara to Pumb Khind.†	
Peliew Khind . . . . .	17,000 0 0
Prutunb Gunj Road, in the town of Sattara.‡	
Road cleared over the Kailghur Ghaut .. . . .	7,000 0 0
Extension of road to Malcolm Peth :—	
Pussernee Khind . . . . .	20,000 0 0
Chürrygaom Khind .. . . .	4,000 0 0
Ambaolee Ghaut, cutting a trial-path down it . . . . .	2,000 0 0
Ambaolee Ghaut . . . . .	35,860 11 9

Annual sanction for five years, 10,000 Rs.

\* Fees, &c. paid into the Treasury by the Architect to His Highness the late Rajah of Sattara.

† Executed by prisoners, with the aid of a few labourers.

‡ Ditto ditto ditto.

|| Balance of saving paid into the Treasury by the troop pagah.

Names of Works.	Amounts sanctioned.
	<i>Rs. a. p.</i>
Range between the Oormoorree and Quoina Rivers, cutting a trial-path .. .. .	2,000 0 0
<i>Koombharlee Ghaut, clearing all obstacles, sanctioned.</i>	
Wurrundur Ghaut .. .	{ *8750 0 0
	{ †8750 0 0
<i>Road from Sattara to Kolapoor, extension of the road sanctioned.</i>	17,500 0 0
Koral Khind .. .	5,000 0 0

## TERRITORIAL DEPARTMENT.

<i>Bunds.</i>	<i>Rs. a. p.</i>
Bund across the Yerla River .. .	9,500 0 0
Pulsee Bund .. .	5,000 0 0
<i>Tanks.</i>	
Godolee Tank .. .	} Commission- Gowlee Tank .. . } er's Letters.
Gowlee Tank .. .	
Munadapoor Tank .. .	
	8,000 0 0

## JUDICIAL DEPARTMENT.

	<i>Rs. a. p.</i>
New Jail at Malcolm Peth .. .	6,148 0 0

## MILITARY DEPARTMENT.

	<i>Rs. a. p.</i>
Repairs to the buildings at Sattara, occupied by troops and departments .. .	1,212 0 0

\* By the Pant Suechew.

† By Government.

(Signed) P. L. HART, Captain,  
Civil Engineer.



THE  
BOMBAY ENGINEERS' REPORT

FOR THE

OFFICIAL YEAR 1850-51;

COMPRISING

REPORTS FROM LIEUTENANT COLONEL W. B. GOODFELLOW,  
MAJOR H. B. TURNER, CAPTAINS C. W. TREMENHEERE,  
J. ESTRIDGE, P. L. HART, AND W. D. GRAHAM,  
AND LIEUT. H. W. B. BELL.



**Bombay:**

PRINTED FOR GOVERNMENT

AT THE

BOMBAY EDUCATION SOCIETY'S PRESS.

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1852.



# MILITARY.

## ACCOUNT OF THE EXPENDITURE,

IN THE

### GARRISON ENGINEER AND CIVIL ARCHITECT'S DEPARTMENT,

FOR THE YEAR 1850-51.

*Bombay, 1st May 1851.*

Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
<i>Annual Repairs.</i>						
To the public buildings occupied by troops, &c., in the Castle, Fort George, Garrison, on the Esplanade, in Colaba, and at Out-posts . . . . .	18,038	10	0			
<i>Petty Repairs.</i>						
To the public buildings occupied by troops, &c., in the Castle, Fort George, Garrison, on the Esplanade, in Colaba, and at Out-posts . . . . .	10,555	5	4	28,593	15	4
<i>Certain Works.</i>						
Additions and alterations to the Government Printing-press Buildings, to adapt them to the purposes of a Dépôt and Government Dispensary . . . . .	3,363	4	0			
Pulling down and rebuilding the quarters of the Staff Serjeants in Fort George . . . . .	490	0	0			
Constructing a depository for patterns of castings in the Gun Carriage Department . . . . .	105	0	0			
Preparing specimens of wood, pickled by the sulphate of copper, to be sent to various officers for trial . . . . .	12	8	0			
Carried forward, Rupees	3,970	12	0	28,593	15	4

Names of Works.	Amount.			Total.		
	<i>Rs.</i>	<i>a.</i>	<i>p.</i>	<i>Rs.</i>	<i>a.</i>	<i>p.</i>
Brought forward, Rupees	3,970	12	0	28,593	15	4
Substituting five glass windows for venetians in the bungalow No. 104, at Colaba . . . .	52	8	0			
Renewing the sluice gate of the ditch on the south side of the new Mandavee Lunette . . .	148	0	0			
Covering with cudjans the sheds on the ramps of the two wells on the Esplanade, where the bullocks draw water for the troops, &c. at Colaba . . . . .	180	0	0			
Erecting a temporary bathing-shed in rear of the hospital at Fort George, for the use of the men of Her Majesty's 78th Regiment . .	29	0	0			
Filling up the ditch, &c. in rear of the barracks at Fort George . . . . .	3,360	0	0			
Constructing a defaulters'-room in the verandah of the quarter guard of the 28th Regiment Native Infantry . . . . .	115	0	0			
Additions and alterations to the Staff Sergeants' Quarters in Fort George . . . . .	422	0	0			
Making partitions in the barracks at Fort George . . . . .	619	0	0			
Experiment of watering with solution of sulphate of copper the floors in the Grand Arsenal, at present infested with white ants.	7	13	8			
Constructing a small reservoir at the Dépôt of Queen's Troops at Colaba . . . . .	483	0	0			
Additions and alterations to the Medical Stores in the Fort . . . . .	438	0	0			
Constructing a new drain in the Marine Battalion Native Infantry Lines . . . . .	364	0	0			
Erecting a cudjan shed over the well in the compound of the senior Regimental Surgeon on the Esplanade, also cleaning it out, and clearing the compound of weeds, &c. . . . .	33	15	7			
Alterations and improvements to the armoury branch of the Grand Arsenal . . . . .	198	0	0			
Extending the chebootras in front of the doorways of the bungalows No. 45 and 47, at Colaba . . . . .	90	8	0			
Additions to the new Medical Stores, in consequence of a portion of the building being required by the Board of Conservancy for widening Apollo Street . . . . .	105	0	0			
Fixing four unserviceable guns, as pivots to 56-pounder traversing carriages, for the new bunder at Colaba . . . . .	287	9	2			
Making a moveable boarded floor, adding six sky-lights, and removing the plank ceiling, in the large working-room of the Percussion Cap Manufactory at Mazagon Powder Works . . . . .	1,106	0	0			
Carried forward, Rupees	12,010	2	5	28,593	15	4



Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought forward, Rupees	12,010	2	5	28,593	15	4
Constructing stone steps, in lieu of the wooden steps, to the quarters of the Adjutant of the 2nd Battalion Artillery. ....	63	0	0	0		
Constructing wooden groins to protect Mahim Fort.. ....	788	0	0			
Improvements in the Commissariat Stores..	900	0	0			
Substituting six glass windows for venetians to the quarters No. 102, at Colaba ....	50	0	0			
Constructing a new drain from the cess-pool of the Dispensary Cook-room of the Medical Stores in the Fort to the street drain..	18	0	0			
Supplying kuskus, required for tatties for the European barracks, &c. at Hydrabad, in Scinde ....	218	12	9			
Repairs to the building at Butchers' Island..	190	0	0			
Repairs to the quarters No. 1 on the Esplanade.. ....	489	0	0			
Levelling the ground in front of the men's barracks in Fort George ....	115	3	6			
Repairs to the European General Hospital, and to the Assistant Surgeon's Quarters..	110	0	0			
Repairing the frame-work of the Bombay cast cylinder mill of the Powder Works, at Mazagon ....	73	0	0			
Cleaning out the Fort Ditch ....	485	0	0			
				15,510	2	8
<i>Buildings.</i>						
A new ball-casting shed in the Grand Arsenal.	979	0	0			
A new drawing-room to the Chief Engineer's Office. ....	3,259	0	0			
New quarters for the Serjeant Major of the Marine Battalion ....	936	0	0			
Repairing 300 doors and 60 windows complete, required for the barracks at Kurrachee....	6,903	11	3			
				12,077	11	3
<i>Miscellaneous.</i>						
Levelling the Esplanade ; supplying water to the dhobeas ; annual repairs to the Dhobeewada, &c. ; sinking a new well, or circular shaft ; covering the rubbish with sand near the Colaba Causeway ; repairing, filling in, and strengthening the sea face of the Esplanade ; cleaning out and deepening the wells, and expenses in collecting the fees, &c.	....			11,726	4	5
Paid to artificers and labourers engaged for, or returning from, Out-stations, &c. ....	....			4,945	4	5
				72,853	6	1
Total, Rupees Seventy-two thousand Eight hundred and Fifty-three, Annas Six, and Pie One ... }						

*Statement of the Sums expended by the Garrison Engineer and Civil Architect at the Presidency, from 1st May 1850 to 30th April 1851.*

Names of Officers.	Annual and Petty Repairs.	Certain Works.	Buildings.	Expended from Esplanade Fund.	Expended for Artificers and Labourers engaged for, or returning from, Out-stations.	Total.		
							Rs.	a.
Captain J. H. G. Crawford, Garrison Engineer and Civil Architect, and Captain J. Estridge, Acting Garrison Engineer and Civil Architect at the Presidency.....	Rs. 28,593 15 4	Rs. 15,510 2 8	Rs. 12,077 11 8	Rs. 11,726 4 5	Rs. 4,945 4 5	Rs. 72,853 6 1		

*Statement showing the Cost of Engineering and General Superintendence of the Garrison Engineer and Civil Architect's Department, for the above period.*

Names of Officers.	Expense of Establishment per annum.			Expenditure.			Rate per cent.
	Rs.	a.	p.	Rs.	a.	p.	
Captain J. H. G. Crawford, Garrison Engineer and Civil Architect, and Captain J. Estridge, Acting Garrison Engineer and Civil Architect at the Presidency .....	Rs. 14,623 12 0			Rs. 72,853 6 1			20 1/2

(Signed) J. ESTRIDGE, Captain,  
Acting Garrison Engineer and Civil Architect at the Presidency.

## CIVIL.

## ACCOUNT OF THE EXPENDITURE

IN THE

GARRISON ENGINEER AND CIVIL ARCHITECT'S  
DEPARTMENT,

FOR THE YEAR 1850-51.

*Bombay, 1st May 1851.*

Names of Works.	Amount.	Total.
<b>GENERAL DEPARTMENT.</b>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
<i>Annual and Petty Repairs.</i>		
Annual repairs to the buildings in the General Department, for 1850-51 . . . . .	4,296 13 2	
Petty repairs to the buildings in the General Department .. . . .	4,931 14 5	
		9,228 11 7
<i>Certain Works.</i>		
Alterations and repairs to the road to the Powder Works through the village of Mat-tarpacady, at Mazagon.. . . .	1,048 0 0	
Constructing two additional fireplaces in the Parsee cook-room, and putting up a copper boiler in the Mahratta cook-room of the Jamsetjee Jejeebhoy Hospital.. . . .	255 0 0	
Putting up lamps and a moveable chain on the Town Custom House Bunder . . . . .	5,853 0 0	
Constructing a wooden railing across the centre of the receiving-hall of the Jamsetjee Jejeebhoy Hospital . . . . .	56 0 0	
Opening two doors, and removing a portion of the wall, in the Revenue Secretary's Office.. . . .	76 4 0	
Alterations and additions to the Government House at Parell . . . . .	610 11 11	
Carried forward, Rupees	7,898 15 11	9,228 11 7

Names of Works.	Amount.	Total.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Brought forward, Rupees	7,898 15 11	9,228 11 7
Placing cudjans in front of the doors and windows of the new quarters for the apprentices and hospital assistants of the Jamsetjee Jejeebhoy Hospital . . . . .	45 0 0	
Removing four mussal's steps and six mussal's trays, also the rafter railing of a well, and repairing wooden water wheels and interior wall of a well near the Troopers' stable at the Government House at Parell.. . . .	152 0 0	
Placing the buildings at Malabar Point in proper condition for the reception of His Excellency the Commander in Chief, as also the stabling and other out-offices . . . . .	774 0 0	
Certain alterations in the office of the Revenue and Financial Secretary to Government.	1,082 5 10	
Putting the Government House and buildings at Parell in a proper state of repair.. . . .	2,719 0 0	
Additional teakwood shelves in the Government Record-room in the Town Hall. . . . .	1,322 8 0	
Alterations required to adapt the present quarters of the Medical Officer in Charge of the Lunatic Asylum at Colaba for the reception of Lunatics . . . . .	5,205 0 0	
Alterations necessary to the wing of the Secretariat occupied by the General Department, both for improved ventilation and convenience.... . . . . .	656 0 0	
Constructing reservoirs on the Esplanade.... . . . .	2,045 5 0	
Putting up a wooden bathing place complete, with leaden sheet and pipe, in the Government House at Parell.... . . . .	116 5 2	
Making an opening through the roof of the cook-room at the Parell Flag-staff, for the smoke to pass out . . . . .	13 10 0	
Certain alterations and repairs to the Jamsetjee Jejeebhoy Dhurumshalla . . . . .	487 0 0	
Re-opening five wells, and sinking seven temporary shafts, on the Esplanade, and surrounding them by rafter fences . . . . .	695 0 0	
Deepening the Phansee Tank on the Esplanade.. . . .	2,000 0 0	
Placing wire screens over the windows facing the street of the general record-room attached to the Secretariat premises. . . . .	122 0 0	
Cleaning, colouring, and painting the Town Hall, and making other necessary repairs. . . . .	573 10 8	
		25,907 12 7
Carried forward, Rupees.....		35,136 8 2

Names of Works.	Amount.			Total.		
	Rs.	a.	p.	Rs.	a.	p.
Brought forward, Rupees	.....			35,136	8	2
<i>Buildings.</i>						
A bungalow at Colaba for the Medical Officer in Charge of the Lunatic Asylum.. ....	4,838	0	8			
A building in the compound of the Grant Medical College, to accommodate the Establishments of the Oculist and Vaccinator, as well as the Country Dispensary.. ..	7,654	0	0			
				12,492	0	8
<b>JUDICIAL DEPARTMENT.</b>						
<i>Annual and Petty Repairs.</i>						
Annual repairs to the buildings in the Judicial Department, for 1850-51. ....	1,501	9	0			
Petty repairs to the buildings in the Judicial Department.. ....	1,896	15	7			
				3,398	8	7
<i>Certain Works.</i>						
Substituting plank flooring for the stone pavement in the cells in the upper storey of the southern building in the County Jail, and in the ward and verandah occupied by the prisoners of the Court of Requests ..	1,460	0	0			
A cudjan shed near the Police Chowkey at Mattoonga, for the use of the police horses.	51	0	0			
Four cudjan necessaries, with six seats, in the yards of the House of Correction, for the use of the European prisoners....	40	12	0			
A tiled roof over the outer part of the four condemned cells in the County Jail.. ..	250	0	0			
Replacing six panes of glass in the windows of the Cattle Pound on the Esplanade, and iron barring the windows in the Serjeant's Quarters, also one in the Chowkey.. ..	24	3	9			
Certain alterations to the Picket Chowkey on the Esplanade.. ....	808	4	0			
Two new moveable docks on each side of the present one in the Court House.. ....	43	4	4			
Closing five covered drains, and substituting for them small tanks of masonry, with wooden covers, at the County Jail.. ..	63	6	0			
				2,740	14	1
<i>Buildings.</i>						
Nonc.						
Carried forward, Rupees	.....			53,776	15	6

Names of Works.	Amount.		Total.	
	<i>Rs.</i>	<i>a. p.</i>	<i>Rs.</i>	<i>a. p.</i>
Brought forward, Rupees	.....		53,776	15 6
<b>TERRITORIAL DEPARTMENT.</b>				
<i>Annual and Petty Repairs.</i>				
Annual repairs to the buildings in the Territorial Department, for 1850-51 .. . . .	1,249	5 11		
Petty repairs to the buildings in the Territorial Department. .... .	2,461	12 0		
	<hr/>		3,711	1 11
<i>Certain Works.</i>				
Removing and re-erecting the Custom Chowkey at Sonapoor, and the Custom Chowkey at Colaba .... .	267	7 0		
Constructing an additional sluice within the reservoir of the Soolaman Shah Salt Works.	224	0 0		
	<hr/>		491	7 0
<i>Buildings.</i>				
None.				
<b>ECCLESIASTICAL DEPARTMENT.</b>				
<i>Annual and Petty Repairs.</i>				
Annual repairs to the buildings in the Ecclesiastical Department, for 1850-51 .. . . .	206	0 0		
Petty repairs to the buildings in the Ecclesiastical Department .... .	768	3 0		
	<hr/>		974	3 0
<i>Certain Works.</i>				
Renewing the gate of the Scotch Burial Ground .... .	56	14 0		
	<hr/>		56	14 0
<i>Buildings.</i>				
A new shed for the protection of funeral parties at the Protestant Burial Ground at Back Bay .... .	305	0 0		
	<hr/>		305	0 0
<b>MARINE DEPARTMENT.</b>				
<i>Annual and Petty Repairs.</i>				
Annual repairs to the buildings in the Marine Department, for 1850-51 .. . . .	1,403	7 0		
Petty repairs to the buildings in the Marine Department.... .	1,561	2 0		
	<hr/>		2,964	9 0
Carried forward, Rupees: .....			62,280	3 2

Names of Works.	Amount.	Total.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Brought forward, Rupees	.....	62,280 3 2
<i>Certain Works.</i>		
A cutjan shed required for the thermometers at the Colaba Observatory ....	158 0 0	0
<i>Buildings.</i>		
None.		
Grand Total, Rupees Sixty-two thousand Four hundred and Thirty-eight, Annas Three, and Pies Two. }		62,438 3 2

*Statement of the Sums expended by the Garrison Engineer and Civil Architect at the Presidency, from 1st May 1850 to 30th April 1851.*

Names of Officers.	Annual and Petty Repairs.		Certain Works.		Buildings.		Total.
	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	
Captain J. H. G. Crawford, Garrison Engineer and Civil Architect, and Captain J. Estridge, Acting Garrison Engineer and Civil Architect at the Presidency.							Rs. a. p.
General Department .....	9,228	11 7	25,907	12 7	12,492	0 8	47,628 8 10
Judicial ditto .....	8,398	8 7	2,749	14 1	0	0 0	6,148 6 8
Territorial ditto .....	8,711	1 11	491	7 0	0	0 0	4,202 8 11
Ecclesiastical ditto .....	974	3 9	56	14 0	305	0 0	1,386 1 9
Marine ditto .....	2,964	9 0	158	0 0	0	0 0	3,122 9 0
Grand Total	20,277	2 10	29,368	15 8	12,797	0 8	62,438 3 2

*Statement showing the Cost of Engineering and General Superintendence of the Garrison Engineer and Civil Architect's Department, for the above period.*

Names of Officers.	Expense of Establishment per annum.		Expenditure.		Rate per cent.
	Rs.	a. p.	Rs.	a. p.	
Captain J. H. G. Crawford, Garrison Engineer and Civil Architect, and Captain J. Estridge, Acting Garrison Engineer and Civil Architect at the Presidency .....	14,163	1 4	62,438	3 2	224 ½

(Signed) J. ESTRIDGE, Captain,  
Acting Garrison Engineer and Civil Architect at the Presidency.



No. 3344 of 1851.

To

The SECRETARY TO THE MILITARY BOARD,

*Bombay.*

SIR,

I have the honor to forward a Statement of the Expenditure of the Public Work Department, in the Southern Provinces, for the Year ending the 30th April 1851, exhibiting the Amounts spent for Repairs, Annual Repairs, and New Works, in the Civil and Military Departments separately, with the actual charge for Superintendence, and the percentage it bears to the whole amount expended.

*Statement of Expenditure in the Military and Civil Departments of the several Executive Officers of the Public Work Department in the Southern Provinces.*

Names of Divisions.	Amount expended on each.	Amount of Superintendence.	Superintendence percentage.
<b>POONA.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs ....	11,814 1 3		
Annual Repairs ....	10,885 7 8		
New Works ..	33,290 9 4		
<b>Military Department.... Total</b>	<b>55,990 2 3</b>		
<b>CIVIL DEPARTMENT.</b>			
Repairs ....	3,170 6 0		
Annual Repairs ....	6,032 12 0		
New Works ..	2,324 6 6		
<b>Civil Department..... Total</b>	<b>11,527 8 6</b>		
<b>Military Department .... Total</b>	<b>55,990 2 3</b>		
<b>Grand Total</b>	<b>67,517 10 9</b>	<b>20,030 1 9</b>	<b>29½</b>

Names of Divisions.	Amount expended on each.	Amount of Superintendence.	Superintendence percentage.		
<b>AHMEDNUGGUR.</b>					
<b>MILITARY DEPARTMENT.</b>					
Repairs . . . . .	2,983 6 11				
Annual Repairs . . . . .	3,605 8 9				
New Works .. . . .	5,605 2 0				
<b>Military Department.... Total</b>	<b>12,194 1 8</b>				
<b>CIVIL DEPARTMENT.</b>					
Repairs . . . . .	1,412 10 4				
Annual Repairs . . . . .	629 10 11				
New Works .. . . .	5,925 7 10				
<b>Civil Department ..... Total</b>	<b>7,967 13 1</b>				
<b>Military Department .... Total</b>	<b>12,194 1 8</b>				
<b>Grand Total</b>	<b>20,161 14 9</b>	<b>5,383 15 0</b>	<b>26<math>\frac{1}{2}</math></b>		
<b>BELGAUM.</b>					
<b>MILITARY DEPARTMENT.</b>					
Repairs . . . . .	3,149 2 4				
Annual Repairs . . . . .	4,757 3 3				
New Works.. . . .	2,435 13 1				
<b>Military Department.... Total</b>	<b>10,342 2 8</b>				
<b>CIVIL DEPARTMENT.</b>					
Repairs . . . . .	2,513 10 7				
Annual Repairs . . . . .	20,979 7 10				
New Works .. . . .	22,822 3 9				
<b>Civil Department ..... Total</b>	<b>46,315 6 2</b>				
<b>Military Department .... Total</b>	<b>10,342 2 8</b>				
<b>Total</b>	<b>56,657 8 10</b>				
<b>Deduct for Extra Establishment.</b>	<b>2,488 13 5</b>				
<b>Grand Total</b>	<b>54,168 11 5</b>	<b>12,948 11 11</b>	<b>23<math>\frac{1}{2}</math></b>		
<b>DHARWAR.</b>					
<b>MILITARY DEPARTMENT.</b>					
Repairs . . . . .	308 10 6				
Annual Repairs . . . . .	65 12 1				
New Works .. . . .	519 1 5				
<b>Military Department.... Total</b>	<b>893 8 0</b>				

Names of Divisions.	Amount expended on each.	Amount of Superintendence.	Superintendence percentage.
<b>CIVIL DEPARTMENT.</b>			
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	
Repairs ....	16,507 9 2		
Annual Repairs ....	4,058 7 11		
New Works ..	17,624 5 3		
Civil Department ..... Total	38,190 6 4		
Military Department..... Total	893 8 0		
Grand Total	39,083 14 4	13,024 4 8	33½
<b>KHOLAPOOR.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs ....	0 0 0		
Annual Repairs ....	1,930 3 2		
New Works..	5,499 11 4		
Military Department.... Total	7,429 14 6		
<b>CIVIL DEPARTMENT.</b>			
Repairs ....	0 0 0		
Annual Repairs ....	120 1 11		
New Works..	0 0 0		
Civil Department ..... Total	120 1 11		
Military Department..... Total	7,429 14 6		
Grand Total	7,550 0 5	1,380 4 9	18½
<b>SHOLAPOOR.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs ....	0 0 0		
Annual Repairs ....	1,901 0 0		
New Works..	3,080 8 3		
Military Department.... Total	4,981 8 3		
<b>CIVIL DEPARTMENT.</b>			
Repairs ....	0 0 0		
Annual Repairs ....	1,618 0 0		
New Works ..	6,400 12 0		
Civil Department ..... Total	8,018 12 0		
Military Department .... Total	4,981 8 3		
Grand Total	13,000 4 3	2,404 0 0	19¾

Names of Divisions.	Amount expended on each.	Amount of Superintendence.	Superintendence percentage.
<b>KHANDEISH.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs ....	391 5 6		
Annual Repairs ....	528 0 6		
New Works ..	795 9 8		
<b>Military Department....Total</b>	<b>1,714 15 8</b>		
<b>CIVIL DEPARTMENT.</b>			
Repairs ....	5,710 9 10		
Annual Repairs ....	16,502 4 9		
New Works ..	42,326 6 11		
<b>Civil Department .....Total</b>	<b>64,539 5 6</b>		
<b>Military Department....Total</b>	<b>1,714 15 8</b>		
<b>Grand Total</b>	<b>66,254 5 2</b>	<b>32,629 0 3</b>	<b>49½</b>
<b>SATTARA.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs ....	0 0 0		
Annual Repairs ....	1,205 12 1		
New Works ..	1,912 0 0		
<b>Military Department....Total</b>	<b>3,117 12 1</b>		
<b>CIVIL DEPARTMENT.</b>			
Repairs ....	2,469 0 0		
Annual Repairs ....	29,066 4 6		
New Works....	1,92,517 11 11		
Miscellaneous..	1,261 12 11		
<b>Civil Department.....Total</b>	<b>2,25,314 13 4</b>		
<b>Military Department .... Total</b>	<b>3,117 12 1</b>		
<b>Grand Total</b>	<b>2,28,432 9 5</b>	<b>25,584 15 6</b>	<b>11</b>
<b>ASSEERGHUR.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs ....	196 7 5		
Annual Repairs ....	460 0 0		
New Works..	120 15 11		
<b>Military Department....Total</b>	<b>777 7 4</b>		

Names of Divisions.	Amount expended on each.	Amount of Superintendence.	Superintendence percentage.
<b>CIVIL DEPARTMENT.</b>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	
None.			
Military Department....Total	777 7 4		
Grand Total	777 7 4		
<b>DAPOOLEE.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs .... .	601 2 4		
Annual Repairs .... .	911 0 0		
New Works.. .... .	0 0 0		
Military Department....Total	1,512 2 4		
<b>CIVIL DEPARTMENT.</b>			
Repairs .... .	35 6 0		
Annual Repairs .... .	19 0 0		
Civil Department .....Total	54 6 0		
Military Department....Total	1,512 2 4		
Grand Total	1,566 8 4	285 5 2	18 $\frac{3}{8}$
Grand Total Amount of expenditure.. .. }	4,98,513 6 2		

2. The expenditure, it will be seen, is more than double that of last year, arising from its including that under the Civil Engineer of the Sattara Districts, amounting to Rupees 2,28,432-9-5 (two lacs twenty-eight thousand four hundred and thirty-two, annas nine, and pies five).

3. The per-centage the cost of superintendence bears to the gross expenditure has generally decreased: the highest rates are still those in the Khandeish and Dharwar Collectories, arising from the comparatively inexpensive character of the works generally, their great distance apart, and their being, for the most part, works connected with irrigation, requiring, as superintendents, a class of subordinates possessing higher attainments than those who are com-

petent to undertake ordinary buildings, the construction of roads, &c.

4. The per-centage in the Sattara Districts is the smallest, but the records of the Board will prove that the apparent economy is not real ; and that, in fact, the works would have been much more advantageously and profitably carried out had they been superintended by persons better qualified, and consequently higher paid.

5. With the exception of the Civil Engineer of the Sattara Districts, Captain Hart, the whole of the Executive Officers have submitted their Statements of Expenditure without comment or report of any kind on the projects executed by them ; and on looking over them I cannot discover a single work that appears to call for any special notice. Captain Hart's Report is more detailed, and I transmit it for the Board's information, as there are portions of it to which he specially requests their attention.

6. One of Captain Hart's undertakings, the Bazar Peera Tunnel, being of a novel, and, therefore, both useful and interesting character for publication, I requested him to furnish a full description of it, the mode in which it has been carried out, and any rates he might have been able to deduce from the work executed, accompanied by explanatory sketches, but, on the ground that the work is still unfinished, he has replied that at present such information might be considered premature, and that when the work is finished he will do his best to comply with my wishes. A brief account has, he informs me, been submitted by him through the Commissioner, for the information of the Chairman of the Railway Committee, a copy of which, should the Board think it desirable, might of course be obtained.

I have the honor to be, &c.,  
 (Signed) H. B. TURNER, Captain,  
 Superintending Engineer, S. P.

*Superintending Engineer's Office, S. P.,  
 Poona, 30th September 1851.*

No. 631 of 1851.

## GENERAL DEPARTMENT.

From

The CIVIL ENGINEER, Sattara Districts,

To

The SUPERINTENDING ENGINEER,

Southern Provinces, Poona.

*Sattara, Civil Engineer's Office, 1st May 1851.*

SIR,

I have the honor to submit the following Report of the Proceedings of the Civil Engineer's Department, in the Sattara Districts, for the official year 1850-51, with a Statement annexed of the Expenditure during that period, and of the Cost of Engineering and Superintendence.

2. The expenditure has been Rupees 2,28,432-9-5, (two lacs twenty-eight thousand four hundred and thirty-two, annas nine, and pies five,) which may be divided under the following heads :—

* Roads.....	Rs. 1,33,196	7	2
† Bridges.....	53,020	15	2
‡ Civil Buildings.....	26,833	8	11
Military Buildings.....	3,117	12	1
Bunds and Tanks.....	11,002	1	2
Miscellaneous .....	1,261	12	11
		<hr/>	
Total....	Rs. 2,28,432	9	5

Rs. 338	0	0	* This includes Rupees 338 of the Suchow Punt's Rupees 8,750 (see para. 35).
4,000	0	0	† This includes Rupees 4,000 subscribed by the Enamdars of the Waeo Valley.
10,794	4	4	‡ In this is included the sum of Rupees 10,794-4-4 expended on the Tunnel through the Jukutwarree Hill, at Sattara, the whole amount being subscribed by the followers and dependents of His Highness the late Raja, in commemoration of him.
Rs. 15,132	4	4	

And taking the average yearly amount of Revenue of the Sattara Territory at fourteen lacs and a half,\* and deducting the amount of private subscriptions, 15,132-4-4, the expenditure on public works will be 14 per cent. of the Revenue for the official year 1850-51. The cost of engineering and superintendence, including all charges of pay to the Civil Engineer and his Establishment on the expenditure, is eleven per cent. In this per-centage is included the cost of the surveys of the Amboolee and Khoombharlee Ghaut Lines, which, if deducted from the charge on works actually executed, would somewhat decrease it.

\* \* \* \* \*

5. I will now proceed to notice in detail the works in the List annexed.

GENERAL DEPARTMENT.†

BRIDGES.

1st.—*Bridges and Drains between Sattara and Mahableschwur.*

6. The number of bridges and drains taken in hand between Sattara and Mahableschwur will be seen from the following Table :—

	DRAINS.														BRIDGES.			
	1 Waterway 5 feet span.	1 Waterway 3 feet span.	3 Waterways 5 feet span.	1 Waterway 2½ feet span.	1 Waterway 2 feet span.	3 Waterways 5 feet span.	2 Waterways 5 feet span.	5 Waterways 5 feet span.	2 Waterways 5 feet span.	4 Waterways 4 feet span.	1 Waterway 4 feet span.	2 Waterways 2½ feet span.	3 Waterways 3 feet span.	1 Waterway 1½ feet span.	1 Waterway 1 foot span.	1 Arch 20 feet span.	1 Arch 30 feet span.	4 Arches small.
Total number taken in hand .....	5	0	1	0	1	2	3	1	1	5	1	1	1	1	1	1	3	1
Number completed in 1850-51.....	5	0	1	0	1	2	3	1	1	5	1	1	1	1	1	1	..	1
Remaining to complete on the 1st May 1851.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3	..	..

\* The average Revenue is between fourteen and fifteen lacs, of course exclusive of Inamdars, Huckdars, and Alienations of Revenue of all kinds, and the average charge against this sum is between ten and eleven lacs.

† The headings and numbers of the work refer to the list annexed.



Thirty-eight drains of sorts, one bridge, of 20 feet span, and a smaller one, have been completed, and three bridges, of 30 feet span each, commenced, one of which is nearly completed, and the remaining two in a forward state. On the completion of these works a distance of ten miles from Sattara to Bunning will be bridged and drained, with the exception of the River Yenna. From Bunning to Meera, a distance of about three miles, the line of road requires to be altered, and a regular survey made of it, before the estimate can be submitted; this portion, for the present, therefore, must remain untouched.

*2nd.—Bridges and Drains between Sattara and the Neera Bridge.*

7. The number taken in hand and completed during the year has been as follows:—

	DRAINS.						BRIDGES.
	1 Waterway 5 feet span.	1 Waterway 3 feet span.	2 Waterways 3 feet span.	1 Waterway 2½ feet span.	1 Waterway 2 feet span.	1 Arch of 50 feet span.	
Total number taken in hand .....	5	17	1	2	1	1	
Number completed in 1850-51 .....	4	16	..	2	..	..	
Remaining to complete on the 1st May 1851 .....	1	1	1	..	1	1	

So that during the last season twenty-two drains of sorts have been completed, and four drains and one bridge about two-thirds finished. These will complete the bridges and drains from the Neera Bridge to the foot of the Salpee Ghaut, about 12 miles.

*3rd.—Bridge across the Wusna River.*

8. From May to the middle of October the principal operations were entirely confined to the preparation of materials, building chunam mills, and other preliminary works,

owing to the sudden floods to which this river is liable during the above period. The foundations of the abutments were commenced in October, and completed by February, the excavation and drainage of which was found extremely difficult, and the South abutment was completed up to the cornice, and the North one built  $16\frac{1}{2}$  feet high. The piles for supporting the superstructure of the bridge were completely driven by the end of April to a depth of about 12 feet into the bed of the river, until they could be sunk no further than a quarter of an inch, with thirty strokes of a monkey of one thousand pounds weight. The timber work is also in a forward state, and the greater portion of the iron work ready.

*4th.—Bridge across the Yenna River.*

9. The abutments, wing walls, and the arch of the bridge, are completed, being about two-thirds of the whole work finished.

*5th.—Bridges and Drains between Nimb Khind and Panchwar.*

10. The following Table shows the number of bridges and drains taken in hand:—

	DRAINS.						BRIDGES.		
	1 Waterway 5 feet span.	1 Waterway 8 feet span.	2 Waterways 5 feet span.	1 Waterway 2 $\frac{1}{2}$ feet span.	1 Waterway 6 feet span.	1 Waterway 12 feet span.	1 Arch 20 feet span.	2 Arches 18 feet span.	1 Arch 17 feet span.
Total number taken in hand....	5	1	1	2	1	1	2	1	1
Number completed in 1850-51..	..	..	..	..	..	..	..	..	..
Remaining to complete on 1st } May 1851 .....	5	1	1	2	1	1	2	1	1

Fifteen of the above works have been taken in hand; and although all are in a forward state, some trifling work remains to each of them before they can be pronounced as completed.

6th.—Two Drains on the Sattara and Kholapoor Road.

11. The Table below shows the quantity taken in hand and completed :—

	DRAINS.	
	1 Waterway 5 feet span.	4 Waterways 5 feet span.
Total number taken in hand .....	1	1
Number completed in 1850-51 .....	1	..
Remaining to complete on 1st May 1851 .....	..	1

These two drains commenced on the Kholapoor Road during the last season, one of which is finished, and the other very nearly so, are in fulfilment of His Highness the late Raja's intention to complete the portion of road from Gollowree to the plain beyond the Koloree Khind, at Shendrey, where the piece of road ordered by the Raja was to have terminated. A survey of the whole line of road, extending from Sattara to Tandoolwarree, on the banks of the Worna, was submitted by me to the late Commissioner in October last, together with a rough estimate for the construction of the bridges and drains in December following. They were forwarded to Government, strongly recommended by both Mr. Frere and the Military Board: no reply has yet been received. This line, both in a Military and Civil point of view, is of the greatest importance, the Head Quarters of the Division, and the Arsenal, being completely isolated for at least one-third of the year for want of a road, and even during the fair season the track is a very difficult one for wheeled carriages, owing to the numerous rivers and water-courses intersecting the line. As a traffic communication it is a direct feeder to the Khoombarlee Gihaut Line, and passes through a rich populous country the whole way. The Punt Preetee Needee of Kurar

having lately contributed the munificent sum of a quarter of a lac of Rupees towards the construction of a bridge across the Quoina, one of the largest rivers on the line, it is sincerely to be hoped that Government will sanction the gradual construction of the smaller bridges and drains along this important communication.

*7th.—Bridge across the Quoina River near Kurar.*

12. As above observed, the Punt, having given this handsome subscription towards a bridge across this large river, and the subject brought to the notice of the Supreme Government, a plan and estimate for the bridge was called for in July last. On arriving at Kurar, on my tour in January, a site was selected, a section of the river taken, and trial-pits sunk to obtain a foundation. For nearly one-half the breadth of the river a solid rock substratum was found at an inconsiderable depth, and I trust, in the course of a short time, to be able to submit these documents.

*8th.—Bridge across the Kodally River.*

13. The construction of a bridge across this river was sanctioned by Government in February last, for Rupees 6,503 (six thousand five hundred and three), but owing to an error in under-estimating the distance from which stone had to be brought, a fresh estimate was submitted in March following, for Rupees 8,748 (eight thousand seven hundred and forty-eight).

*9th.—Travellers' Bungalow at Punderpoor.*

*10th.—Ditto ditto at Wangi.*

*11th.—Ditto ditto at Poosusaolee.*

*12th.—Ditto ditto at Kurar.*

*13th.—Supplying Furniture to Travellers' Bungalows.*

14. All the above works have been completed, and other travellers' bungalows are much required in the Sattara Territory, particularly between Sattara and Punderpoor, Sattara and Kholpoor, and Kurar and the Khoombharlee Ghaut.

14th.—*Civil Engineer's Office.*

15th.—*Civil Engineer's Store-room.*

15. These works are not yet commenced, but the sites will be selected, and the ground applied for, as soon after my arrival at Sattara for the rains as possible.

16th.—*Providing accommodation in the Hazree Bungalow for the Treasury.*

16. This petty work has been completed, but before these premises are suited for the Commissioner's Establishment, considerable alterations and additions will be necessary.

17th.—*Alterations and additions to the Civil Hospital at Sattara.*

17. This work has not been yet commenced, but immediately I arrive in Sattara the buildings shall be lined out, and the work set going.

18th.—*Planting Trees on the High-roads in the Sattara Districts, for the year 1850-51.*

18. Contracts have been entered into for the excavation of the holes to receive the trees, and filling the same up with black earth. To the close of April 730 holes have been prepared, and during the monsoon the slips will be planted from Sattara to Wurooj, a distance of six miles. Trees have been planted on each side of the road, and the present expenditure is on an extension of the line from Wurooj towards the Neera Bridge, a length of 26 miles.

19th.—*Constructing a Tunnel at Bazar Peera, Sattara.*

19. This tunnel was completely driven through the range joining Enteshwar and the Fort of Sattara into the Oormoore Valley in January last. The length is 192 feet, breadth of base 30 feet, and breadth at top 24 feet, and the height from the bottom to the roof 24 feet: there still remains a small portion

at the sides and Southern end to finish off. A plan and detailed estimate for completing the work, by building entrances, and opening out the mouths, was submitted by me in September last, and sanction accorded in April following; but I was precluded from prosecuting the work until a further promised subscription of Rupees 3,476-0-0 have been received. The former subscriptions to this work by the servants and dependents of His Highness the late Raja have been collected, and amount to.....Rs. 10,233 14 9

Further subscription not yet received, as above.....	3,476 0 0
Total amount subscribed by the Natives.	Rs. 13,709 14 9
Total amount sanctioned by Government.	17,791 0 0
Total....Rs. 31,500 14 9	

A model of the entrance has been made, and on intimation from the Commissioner of the realization of the further amount of subscriptions, the prosecution of this interesting work need be no longer delayed.

*20th.—Improving the supply of Water to the Town of Sattara.*

20. During the rains of 1850 the greater portion of the town of Sattara, and the various old aqueducts supplying it with water, were surveyed by Mr. Radenhurst, of my Establishment, and carefully inspected by me, and various information collected on the subject. From all I have at present been able to learn, the following points appear to me to first require attention :—

- 1st.—To provide an increased supply of water to the present aqueduct, which could easily be obtained from springs on the top of Enteshwar, beyond the spot where the water from the present one is collected.
- 2nd.—A junction of the old and new aqueducts, to be effected so as to have either only one main channel, or, at any rate, the water to issue from one main channel of

supply, into the town, the water of both being collected in a tank or reservoir before distribution.

3rd.—A fresh distribution throughout the town, to be effected by means of iron pipes.

The sum placed at my disposal for increasing the supply of water to the town is Rupees 25,000-0-0, a totally inadequate amount for carrying out any one of the above propositions efficiently during the rains. It is my intention to ask the Commissioner to call a meeting of the principal inhabitants, with a view of ascertaining the probable amount of private subscriptions on account of this useful work. Supposing the subscriptions to fall short, perhaps the best plan would be to repair the old aqueduct built by Shao Mahraj, as originally intended. The amount above mentioned is no regular sanctioned sum for the purpose, but the appropriation of a balance paid into the treasury by His Highness the late Raja's Architect, the late Ranojee Naick, on account of Karkoonée Discount and Dustooree on the various large works he had the superintendence of.

The proper preparations of plans for improving the supply of water to the town of Sattara is a subject which I have not yet had leisure to take up: it is almost the work of one Officer alone, especially as I am absent from Sattara the whole of the fair season, and have my attention and time most fully occupied with the district works; and unless some efficient individual is appointed to assist me in this matter, I can hold out no reasonable hope of either a report or plans, sections and estimates, being submitted for a considerable time to come. The amount of subscriptions, whatever they may be, and the total amount available, would, of course, be the chief guides in submitting any projects for improving the supply of water to the town.

21st.—*Roads between Kurar and Punderpoor, Shamgaom Khind and Kulleedoon Khind.*

21. The two principal obstructions on this line are the

khinds above mentioned. The road over the Shamgaom Khind was contracted for and is completed, a final inspection of this work alone remaining. The road over the Kulleedoon Khind is about two-thirds finished.

*22nd.—Roads between Sattara and Beejapoor, Pulsee Ghaut, Nandrey Ghaut, and Naghuz Ghaut.*

Of these ghauts the two first are small, the latter a larger work; the Pulsee and Nandrey Ghauts are finished; the Naghuz about two-thirds completed.

*23rd.—The Seodasheoghur Khind.*

23. A line down this khind was marked out with a slope of 1 in 20 in March 1850, a footpath cut, and a plan and estimate submitted in October last. To the close of the official year no sanction has been received for its construction.

*24th.—Roads between Sattara and Punderpoor, Krishna River Bank, Mahowlee, Tirputtee Khind, and Wurdunghur Khind.*

24. The bank of the Krishna River has been lined out and completed with a good slope; the Tirputtee Khind finished; and the Wurdunghur Khind very nearly so.

*25th.—Pelieu Khind.*

25. The road over this khind is also very nearly finished.

26. On these lines of road, Kurar and Punderpoor, Sattara and Beejapoor, and Sattara and Punderpoor, all the formidable impediments may be now said to be overcome on the Sattara and Beejapoor Line: there remains one small khind near Eetch, the Kehnavée, and on the Sattara and Punderpoor Line another, the Mimunghur, which it will be most desirable to complete. It is my intention shortly to submit an estimate for clearing the roads between the different khinds which have been completed, so as to open out the roads more efficiently to cart traffic.



26th.—*Clearing the Roads between Kurar and Punderpoor, Sattara and Punderpoor, and Sattara and Beejapoor.*

*Note.*—The sanction accorded was Rupees 200 per mile, for the purpose of giving employment to the population of the Eastern districts during an apprehended scarcity, but the period of scarcity having passed over before Captain Hart availed himself of the sanction, it was cancelled.—*M. B.*

27th.—*Road between Sattara and the Limb Khind.*

\* \* \* \* \*

29. This is a part of the Sattara and Wae Road, or direct Sattara and Poona Road. The portion denoted above, about four miles, was completed by the prisoners as far as the Yenna River, about two miles; the remaining distance, from the river to beyond the khind, was made by Ballajee Punt Nathoo, Inamdar of Panchwar, at his own expense. From the top of the khind another three and a half miles has been bridged and drained, the Inamdars of the Wae Valley giving Rupees 4,000, and Government another 4,000 (see para. 10 in which these works are detailed). A bridge has also been sanctioned across the Kodally River (see para. 13). It will be seen that this important line is very gradually making head. When pitched at Pussurnee I prepared a design for a bridge across the Krishna River, and also had a line (1 in 20) marked out down the Kamalkee Ghaut, but the expense being about Rupees 70,000, the probable cost of the two projects, and the uncertainty of either of them being sanctioned, deterred me from submitting them. The following very serious obstacles on the line first demand attention :—

The Yenna River.  
The Krishna River.  
The Kamalkee Ghaut,  
The Neera River.  
The Katriz Ghaut.

28th.—*The Prutab Gunj Peth Road, in the Town of Sattara.—Improvements in the Town of Sattara.*

30. The road in the Prutab Gunj Petta in the town has

been completed by the prisoners, with the aid of a few free labourers, and the following improvements have been effected in the town :—

A block of houses removed at the junction of the Seodasheo Prutab Gunj, Bhowaree, and Sunwar Peth Roads, which gives a convenient open space at their junction.

The roadway of a small bridge widened, leading to the vegetable market.

Some chuppers and huts removed, blocking up the entrance to the market.

A line of road carried through the market, joining the Sunwar and Prutab Gunj Peth Roads.

A large arched drain constructed on the Southern approach to the tunnel.

An approach lined out, and executed in the rough by the prisoners, from the town to the tunnel entrance, South side.

This approach partly extended into the town by the Imaumpoora Tank by the prisoners.

A line of new road, 2,740 feet long, made, running at the back of the Palace joining the Shukurwar Petta, and the Genda Mall Lines.

A vegetable market formed out of the old Engineer's Stores, yielding a yearly rent of Rupees 375, and every stall rented and occupied.

*29th.—Clearing a Road over the Kailghur Ghaut.—Extension of the same to Veer Mall and Dawurwarree.—Blasting the narrowest portions of the Kailghur Ghaut.*

31. This line of road over the Kailghur Ghaut, and its extension to Veer Mall and Dawurwarree, has been completed. This line in the fair season is not quite safe for carts, it being in many places where it crosses the precipices not more than 11 feet broad, with a valley of some hundreds of feet deep on the lower side. The line was opened out by Mr. Smith, and, wherever the cuttings were easy, the full breadth of road has been made; but on reaching the lines of scarp rock on the

upper portion, extending for a distance of about three miles, very little of the side cutting, which is in many places solid rock, has been blasted away, and, to increase the breadth of road where possible, slight dry stone retaining walls were built; there being no drainage in the monsoon everything is carried away, and the upper part of the line, even to a foot passenger, is scarcely passable.\*

30th.—*Clearing a Road over the Pussurnee Khind.*

*Note.*—This work has been suspended by order of Government, pending the receipt of a detailed estimate for completing it.—*M. B.*

31st.—*Constructing a Bullock-Track over the Korol Khind.*

\* \* \* \* \*

33. A road was lined out over this khind in May last, with a slope of 1 in 25 (para. 4), and an estimate submitted for constructing a bullock-track over it, 12 feet broad, (which could eventually be opened out to the full breadth for a cart road,) in June, and its construction sanctioned in July. The work was commenced after the monsoon, in August, and carried on until November, but owing to the inefficient superintendence of it by one of the old Maistrees, formerly in His Highness the late Raja's service, I was compelled to stop it. The portion executed was done too well. Instead of forming the road 12 feet broad, the Maistry had cut into the hill side 12 feet, making the road in some places 20 feet broad. A supplementary estimate to complete it was submitted and sanctioned, but having no efficient subordinate to put on the work, it has not yet been recommenced. I hope, however, to take it in hand after the monsoon, and complete it before the close of the next working season. The total length is about ten miles, of which two have been completed.

32nd.—*Constructing a Road over the Churrygaum Khind.*

34. An estimate for this work, prepared by my Assistant,

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\* *Note by the Military Board.*—Estimate for the completion of the work has been called for.

Mr. James Smith, was submitted in March 1850, and sanctioned by Government in April, for Rupees 4,000. The work was commenced by Mr. Smith in May 1850, and in January 1851 I carefully inspected it, but as the quantity of work executed, and the system pursued in carrying it out, was so unsatisfactory, I directed it to be stopped, and intend to submit a revised plan and estimate as soon as the season opens after the monsoon. There is a balance on the work still unexpended of Rupees 831-12-10.

33rd.—*Constructing a Line of Road from Moondwa (close to Kurar), down the Khoombharlee Ghaut, to the Port of Chiploon.*

*Note.*—This important work is in progress.—*M. B.*

34th.—*Constructing a Line of Road up the Oormooree Valley, over the intervening Range between the Oormooree and Quoina Rivers, down the Amboolee Ghaut.*

*Note.*—The question of constructing this line of road is still under consideration.—*M. B.*

35th.—*Constructing a Bullock-Track over the Wurrundur Ghaut to Mhar.*

37. At the commencement of the official year in May 1850 a Report was submitted by me to the late Commissioner regarding the line of road down this ghaut, being the natural outlet for traffic from the valley of the Neera River to the Port of Mhar. The line would lead from Phultun, through Bhore, to Herdosee, down this ghaut to Mhar. As a great part of the proposed line would pass through the territory of the Suchew Punt, I proposed to the Commissioner that the Punt might be requested to contribute; and, on Mr. Frere's visiting Bhore, the subject was broached to him, and he expressed his willingness to assist in this manner, and his anxiety to do anything in his power to promote a work of such great public utility, and so likely to benefit his own sub-

jects; so that, with the Punt's subscription of Rupees 8,750, and the Government sanction of an equal amount, Rs. 17,500 has been placed at my disposal for this line. At the opening of the season in November I again visited this ghaut, and selected the line down it, making it over to Mr. Smith to complete the marking it out.

*Note.*—This work is in progress.—*M. B.*

*36th.—Constructing a Bullock-Track over the Chinch Khind.*

\* \* \* \* \*

39. This khind is situated on the direct line of road between Neera and Wae, and, at the request of the late Commissioner, a line was marked out by my Assistant, Mr. Smith, with a slope of 1 in 20, the length of the line being about two and a half miles, for the greater part, the cuttings being through solid rock, and an estimate submitted, amounting to Rupees 3,063, which was sanctioned by Government in November last. On Mr. Smith being directed to commence the work, he reported that it could not be completed for the amount. It was therefore suspended, and a fresh estimate called for, which Mr. Smith submitted, amounting to Rupees 8,389. This was returned as incorrect, and showing no details, when another was received, amounting to Rupees 7,146, which was submitted to the Military Board. Further information was called for, which was submitted, and the original sanction cancelled.

*37th.—Smoothing the Line of Road between Rymutpoor and the Nahavee Ghaut.*

40. This line of road is an extension of the cleared portion between Sattara and Sap, which was constructed at the sole expense of the Inamdar of Sap, the cost of the present portion from Rymutpoor to the Nahavee Ghaut has been subscribed for by Pandoorung Malhar, of Rymutpoor, the amount given being Ankoosee Rupees 800, or Company's Rupees 768. Mr. Smith was directed to begin the work in December last, but up to the close of the official year it had not been commenced.

38th.—*Repairing the old Mahomedan Buildings at  
Beejapoor.*

41. At the commencement of the official year the sum of Rupees 5,200 was sanctioned by Government for the repairs of these old buildings, being the amount of an estimate I prepared at the request of the late Commissioner. It was clearly understood that these buildings could not be put into efficient repair for this amount, or anything approaching to it, but merely the progress of decay in them to some extent arrested to the close of the official year. The following portions of work have been executed :—

*Ibrahim Rozah.*—The terraced roof of the Rozah, and also of the Musjid attached to it, have been thoroughly repaired, and all holes and fissures filled up; supporting the large stone beams in the outer verandah by an arched stone rib under each beam has also been commenced. •

*Taj Bowree.*—The steps have been repaired, and also a dwarf wall built.

*Jumma Musjid.*—The holes and fissures in the terraced roofs have all been repaired, also a dwarf wall on the terrace, which had fallen, and a new curtain has been supplied to the Mehraub.

*Ashar Mubarak.*—The difficulty and expense of procuring the immense wooden beams required to replace the injured ones was so great, that it was considered better to support the old ones by two pointed arches, 18 feet in breadth, height to the springing 20 feet, and 21 feet rise. These have been completed, and, while affording most efficient supports to the roof, in no way disfigure the building.

*Gol Gomuz.*—The holes and fissures in the dome and terraced roof have been all filled in and repaired.

39th.—*Annual repairs to Travellers' Bungalows, Sattara,  
for 1850-51.*

40th.—*Annual repairs to the Commissioner's Bungalow,  
Sattara.*

41st.—*Annual repairs to Native Buildings in the Town of Sattara.*

42nd.—*Repairs to Ferry Boats.*

43rd.—*Petty repairs for 1850-51.*

44th.—*Annual repairs to Roads in the Town of Sattara.*

45th.—*Watering and preserving Trees.*

46th.—*Annual repairs to Roads in the Sattara Districts.*

47th.—*Presenting a Gold Armlet to each of the Sons of the late Ranojee Naick.*

48th.—*Preparing Architectural Drawings of the Principal Mahomedan Buildings at Beejapoor.*

49th.—*Petty Charges for the year 1850-51.*

46. There is nothing particular to remark about any of the above but No. 48. I was called upon by the late Commissioner in August last to submit an estimate of the probable cost of preparing architectural drawings of the buildings as per margin, which was submitted at the latter end of the month, and sanctioned by Government in January following; owing, however, to the great difficulty in procuring good draftsmen for so laborious, intricate, and difficult an undertaking, I could not commence work until March last. The first building taken in hand is, perhaps, the most difficult of the whole, the Ibrahim Rozah; the progress to the end of April has, however, been satisfactory on the whole.

1. The Ibrahim Rozah.
2. Taj Bowree.
3. Mehta Mahal.
4. Jumma Musjid.
5. Ashar Mubarak.
6. Gol Gomuz.

commissioner in August last to submit an estimate of the probable cost of preparing architectural drawings of the buildings as per margin, which was submitted at the latter end of the month, and sanctioned by Government in January following; owing, however, to the great difficulty in procuring good draftsmen for so laborious, intricate, and difficult an undertaking, I could not commence work until March last. The first building taken in hand is, perhaps, the most difficult of the whole, the Ibrahim Rozah; the progress to the end of April has, however, been satisfactory on the whole.

#### TERRITORIAL DEPARTMENT.

50th.—*Wakeshwar Bund across the Yerla River.*

47. In March 1850 a Report regarding this work was submitted by me to the late Commissioner, but having at the time no subordinates of any sort capable of taking the levels, with a view of ascertaining whether the land could be irrigated

by a dam built on this site, which had been commenced before I joined the Department, but was suspended by me until an opportunity offered. I again visited the work this season, had the levels carefully taken, and hope soon to submit a detailed Report on the subject, with a diagram showing the section of the river, and the height to which the water must be raised to irrigate the land proposed.

*51st.—Godolee Tank.*

48. This tank was completed in December last.

*52nd.—Memadapoor Tank.*

49. A retaining wall has been built at the Eastern end of this tank (the large one), in rear of the present old bund, to strengthen it, containing 65,700 cubic feet of solid masonry. The small tank has been carefully pointed on the inside, to prevent the leakage. On visiting the work in February it appeared to me that a prolongation of the retaining wall of the old tank would be extremely beneficial, if not positively necessary, for the stability of the old work. It required pointing also on the inside, and the sluices to be opened up and repaired. I accordingly submitted an estimate for these repairs, amounting to Rupees 8,540, to which the sanction of Government was given in March last: Rupees 2,500 of which, at my recommendation, was to be given by the Inamdars, &c. of the village. This will complete the retaining wall to a length of 639 feet, averaging from 6 to 43 feet high, and with the other repairs tend to the preservation of this magnificent old Mahomedan work.

50. In my last year's Report I remarked on the amazing capabilities of the Sattara Districts to the westward for irrigation, by means of dams across the various rivers; but I regret to notice that during the last year's working season I have not a single work of this nature to submit, which has even been commenced on, arising entirely from an utter want of an experienced subordinate in this description of works.



## JUDICIAL DEPARTMENT.

53rd.—*Constructing a Jail at Mahableswur.*

\* \* \* \* \*

55. This work is very nearly completed, and the way in which it has been executed reflects credit on Serjeant Mulligan, who was the Resident Overseer of the work.

## MILITARY DEPARTMENT.

54th.—*Annual Repairs to the Military Buildings at Sattara, for 1849-50.*

*Ditto ditto for 1850-51.*

55th.—*Constructing an additional Room to the Quarter Guard of the 18th Regiment N. I.*

56th.—*Enlarging the Gun-shed in the Gobindauze Lines, Sattara.*

I have the honor to be, &c.,

(Signed) P. L. HART, Captain,

Civil Engineer, Sattara Districts.

*Expenditure on Public Works in the Sattara Districts, from the 1st May 1850 to the 30th April 1851.*

No. referred to in the Report.	Description of Work.	Date of Sanction.	Amount of Sanction.	Expenditure during the official year 1850-51.	Remarks.
			<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	
	<b>GENERAL DEPARTMENT.</b>				
	<i>Bridges.</i>				
1	Bridges and drains between Sattara and Mahableshwur .....	G. L. 1930, 5 May 1849.	.....	24,039 14 7	
2	Bridge and drains between Sattara and Neera Bridge .....	Do. ....	.....	11,740 0 0	
3	Bridge across the Wusna River .....	Do. ....	15,000 0 0	6,955 5 1	
4	Bridge across the Yenna River .....	Do. ....	9,000 0 0	4,278 11 6	
5	Bridges and drains between Nimb Khind and Panchwar .....	G. L. 2124, 10 May 1850.	* 8,000 0 0	5,173 0 0	* Of this amount Rs. 400 was subscribed by the Embarcaders of the Wasee Valley.
6	Two drains on the Sattara and Kholapoor Road ..	Com. L. 1097, 8 Oct. 1850.	.....	834 0 0	† This sum of Rs. 25,000 is the subscription towards the work by the Punt Preetee Nee-dee of Kurar.
7	Bridge across the Quina River near Kurar ....	No sanction yet received.	† 25,000 0 0	.....	
8	Bridge across the Kodally River .....	Do. ....			
	<i>New Buildings and Works.</i>				
9	Travellers' bungalow at Punderpoor .....	G. L. { 1930, 5 May 1849.	1,500 0 0	955 0 0	
10	Travellers' bungalow at Wangi .....	{ 2535, 24 June 1850.	255 0 0	003 10 2	
11	Travellers' bungalow at Poosusaalee .....	G. L. 5261, 4 Dec. 1849.	600 0 0	589 0 0	
		Do. ....	600 0 0		

12	Travellers' bungalow at Kurar .....	G. L. 1930, 5 May 1849.	1,500	0	0	.....	.....	
13	Supplying furniture to travellers' bungalows .....	G. L. 3496, 4 Sept. 1850.	598	0	0	594	0 0	
14	Civil Engineer's office at Sattara .....	G. L. 3579, 11 Sept. 1850.	1,382	0	0	.....	.....	
15	Civil Engineer's work-shed and store-room .....	G. L. 204, 17 Jan. 1851.	8,844	0	0	.....	.....	
16	Providing accommodation in the Hazree Bungalow for the Treasury .....	G. L. 2195, 7 Mar. 1851.	155	0	0	.....	.....	
17	Alterations and additions to the civil hospital, Sattara .....	G. L. 1936, 10 May 1851.	4,538	0	0	.....	.....	
18	Planting trees on the high-roads, for 1850-51 .....	G. L. 3432, 27 Aug. 1850. { Com. L. 662, 25 April 1851.	1,000	0	0	332	0 0	
19	Constructing a tunnel at Bazar Peera, Sattara .....	{ G. L. 1923, 14 April 1851.	10,233	14	9	10,794	4 4	
20	Improving the supply of water to the town of Sattara .....	{ G. L. 2185, 13 May 1850. + 25,000 0 0	3,476	0	0	47,701	0 0	
<i>New Roads.</i>								
21	Between Kurar and Punderpoor .....	{ G. L. 53, 3 Jan. 1850.	.....	.....	.....	18,867	14 6	
22	Between Sattara and Beejapoor .....	{ G. L. 53, 3 Jan. 1850.	.....	.....	.....	9,101	10 1	
23	Seodasheoghur Khind .....	No sanction yet received.	.....	.....	.....	12,334	12 10	
24	Between Sattara and Punderpoor .....	{ G. L. 53, 3 Jan. 1850.	.....	.....	.....	13,463	0 2	
25	Pelieu Khind .....	{ G. L. 962, 25 Feb. 1850. { G. L. 1898, 9 May 1851.	17,000	0	0	15,262	1 9	
							50,161	8 10
Carried over, Rs.								

\* Private subscriptions by followers and servants, of H. H. the late Raja, Rs. 18,709-14-9.  
† Appropriation of a balance of the Troop Payah in the late Raja's Treasury.

No. referred to in the Report.	Description of Work.	Date of Sanction.	Amount of Sanction.	Expenditure during the official year 1850-51.	Remarks.
			<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	
26	Clearing roads between Kurar and Punderpoor, Sattara and Beejapoor, and Sattara and Punderpoor.....	Brought over, Rs.	.....	50,161 8 10	
27	Road between Sattara and the Limb Khind .....	G. L. 4249, 30 Oct. 1850. The work executed by Prisoners .....	64,000 0 0	.....	
28	Prutab Gunj Peth Road, in the town of Sattara... Improvements in the town of Sattara .....	Do. do.....	.....	1,689 5 10	
	Do. do.....	G. L. 3596, 30 April 1850	5,000 0 0	315 15 7	
	Do. do.....	G. L. 3077, 5 Aug. 1850.	760 0 0	4,170 0 0	
	Do. do.....	G. L. 3129, 7 Aug. 1850.	426 0 0	760 0 0	
29	Clearing a road over the Kailghur Ghaut.....	G. L. 1930, 5 May 1849.	7,000 0 0	426 0 0	
	Extension of same to Veer Mall and Dawurwarree.	G. L. 4052, 19 Oct. 1850.	4,711 0 0	2,711 9 2	
	Blasting narrowest portions of Kailghur Ghaut .....	G. L. 908, 4 Mar. 1851.	4,900 0 0	571 8 1	
30	Clearing road over the Pussurnee Khind.....	G. L. 4279, 11 Oct. 1850.	20,000 0 0	.....	
31	Constructing bullock-track over the Korol Khind.	G. L. { 3396, 17 July 1850.	5,000 0 0	39,541 11 2	
32	Constructing road over the Churrygaum Khind..	{ 1278, 25 Mar. 1851.	3,056 0 0	2,599 13 9	
33	Constructing a line of road from Moondwa, down the Khoombharlee Ghaut, to Chiptoon.....	G. L. 1413, 16 April 1850.	4,000 0 0	3,168 3 2	
34	Constructing a line of road up the Oornoores Valley, over the intervening range between the Oornoores and Quooina Rivers, down the Amboolee Ghaut .....	G. L. 1677, 12 April 1850.	.....	115 0 0	* Rs. 35,800-11-9 appropriated from a balance in the Troop Fund. Account in H. H. the late Rajah of Sattara's Treasury.
			{ 2,000 0 0	211 0 0	
			{ 2,000 0 0	531 0 0	
			{ *35860 11 9	.....	

35	Constructing a bullock-track down the Wurrundur Ghaut to Mhar. ....	G. L.	2400, 23 May 1850.	* 17,500 0 0	398 0 0	* Of this amount Rs. 8,750 has been subscribed by the Punt Suchew, of Bihore.
36	Constructing a bullock-track over the Chinch Kind .....	G. L.	4623, 29 Nov. 1850.	3,063 0 0	.....	
37	Smoothing the line of road between Rymnupoor and the Nahavee Ghaut.....	Comm. L.	1374, 19 Dec. 1850.	† 768 0 0	.....	† The whole amount, 800 Ankoos Rupees, given by Pandoorung Mulhar, of Rymnupoor.
<i>Repairs to Buildings.</i>						
38	Repairing the old Mahomedan buildings at Beejpoor.....	{ G. L. G. L.	{ 448, 22 Jan. 1850. 1667, 11 Apr. 1850. }	{ 5,200 0 0 }	2,469 0 0	
<i>Annual Repairs to Buildings.</i>						
39	Travellers' bungalow, Sattara, for 1850-51.....	M. B. L.	3398, 9 May 1850.	317 0 0	308 2 6	
40	Commissioner's Bungalow, for 1850-51.....	M. B. L.	3389, 9 May 1850.	511 0 0	492 0 0	
41	Do. do. for 1851-52 .....	G. L.	721, 24 Feb. 1851.	263 0 0	66 0 0	
42	Native buildings, town of Sattara, for 1850-51 ..	Comm. L.	611, 17 June 1850.	.....	2,041 0 0	
43	Repairs to ferry boats.....	Do.	do. ....	.....	123 0 0	
	Petty repairs for 1850-51 .....	Do.	do. ....	.....	150 1 5	
<i>Annual Repairs to Roads.</i>						
44	In the town of Sattara, for 1849-50 .....			.....	3,180 3 11	
45	Watering and preserving trees, for 1849-50.....			.....	546 3 10	
46	Roads in the Sattara districts, for 1850-51.....	G. L.	1904, 14 May 1850.	25,218 0 0	268 12 9 25,071 0 0	
<i>Miscellaneous.</i>						
47	Presenting a gold armet to two of the sons of the late architect to H. H. the late Raja .....			.....	1,000 0 0	
			Carried over, Rs.	.....	1,000 0 0	

No. referred to in the Report.	Description of Work.	Date of Sanction.	Amount of Sanction.	Expenditure during the official year 1850-51.	Rs. a. p.
48	Preparing architectural drawings of the principal Mahomedan buildings at Bejapoor.....	Brought over, Rs. G. L. 206, 14 Jan. 1851.	..... 9,480 0 0 .....	Rs. a. p. 1,000 0 0 107 0 0 154 12 11	Rs. a. p. ..... .....
49	Petty charges for 1850-51 .....	.....	.....	1,261 12 11	.....
	Total Expenditure in the General Department..	.....	.....	.....	2,06,986 5 8
	TERRITORIAL DEPARTMENT.				
	<i>Bunds.</i>				
50	Wakeshwar Bund, across the Yerla River .....	G. L. 1938, 5 May 1849.	9,500 0 0	92 2 6	
	<i>Tanks.</i>				
51	Godolee Tank .....	Com. L. 539, 4 June 1850.	.....	3,167 10 10	
52	Memadapoor Tank .....	G. L. { 7172, 4 Dec. 1849. 2279, 8 March 1851.	8,000 0 0 } 8,540 0 0 }	7,742 3 10 11,002 1 2	.....
	Total Expenditure in the Territorial Department.	.....	.....	.....	11,002 1 2

JUDICIAL DEPARTMENT.					
53	Constructing a new jail at Malcolm Peth .....	G. L. { 144, 17 Jan. 1850. 5089, 5 Sept. 1850.	6,148 0 0 } 2,538 0 0 }	7,316 6 6 } 7,316 6 6 }	7,316 6 6
Total Expenditure in the Judicial Department ..		.....	.....	.....	7,316 6 6
MILITARY DEPARTMENT.					
54	Annual repairs to the military buildings, Sattara, for 1848-50.....	.....	.....	77 12 1	
55	Annual repairs to the military buildings, Sattara, for 1850-51.....	M. B. L. 3382, 8 May 1850. { M. B. L. 4788, 19 June 50.	1,212 0 0 } 308 0 0 }	1,128 0 0 } 330 0 0 }	
56	Constructing an additional room to the quarter guard 18th Regiment N. I.....	G. L. 2519, 28 Aug. 1850. G. L. 2805, 25 Sept. 1850.	35 0 0 } 1,967 0 0 }	1,582 0 0 } 3,117 12 1 }	
Enlarging the gun-shed in the Golundauze Lines..		.....	.....	.....	
Total Expenditure in the Military Department ..		.....	.....	.....	3,117 12 1
			Grand Total Expenditure, Rupees		2,28,432 9 5

*Statement showing the Expense of Engineering and Superintendence.*

	<i>Rs.</i>	<i>a.</i>	<i>p.</i>
Total amount of current expense bills, for the official year 1850-51.. .. .	26,100	3	7
<i>Deduct,</i>			
Petty repairs.. .. .	Rs. 150	1	5
Petty charges.. .. .	154	12	11
Pay to peons, &c. of the travellers' bungalows.. .. .	210	5	9
	515	4	1
Total charges of Engineering and Superintendence. .. .	25,584	15	6

*Abstract of the Expenditure from the 1st May 1850 to the 30th April 1851, being for the official year 1850-51.*

	<i>Rs.</i>	<i>a.</i>	<i>p.</i>
Roads .. .. .	1,07,310	6	7
New roads .. .. .	Rs. 1,07,310	6	7
Annual repairs to roads. .. .. .	25,886	0	7
Bridges .. .. .		53,020	15
Civil buildings .. .. .		26,833	8
New works and buildings .. .. .	Rs. 13,867	14	6
Repairs to ditto .. .. .	2,467	0	0
Annual repairs to ditto .. .. .	3,180	3	11
Judicial buildings. .. .. .	7,316	6	6
Military buildings.. .. .		3,117	12
Bunds and tanks.. .. .		11,002	1
Miscellaneous .. .. .		1,261	12
Grand Total....Rs.	2,28,432	9	5

*Expenditure, 1850-51.*

	<i>Rs.</i>	<i>a.</i>	<i>p.</i>
Roads .. .. .	1,07,310	6	7
Bridges .. .. .		53,020	15
Civil buildings .. .. .		26,833	8
Military buildings.. .. .		3,117	12
Bunds and tanks.. .. .		11,002	1
Miscellaneous .. .. .		1,261	12
	2,28,432	9	5
Expense of Engineering and Superintendence for 1850-51. .. .	25,584	15	6
Rate per cent., including all charges. .. .. .		11	

(Signed) P. L. HART, Captain,  
Civil Engineer, Sattara Districts.



No. 853 of 1851.

GENERAL DEPARTMENT.

To

The SUPERINTENDING ENGINEER,  
Southern Provinces, Poona.

SIR,

I have the honor to submit my Annual Report, being a summary (with reference to the Statements of Expenditure and of Works performed during the official year 1850-51, forwarded to you on the 25th of July last,) of the proceedings of my Department, during the past official year.

\* \* \* \* \*

15. Before quitting the subject of the works of irrigation constructed, repaired, or improved, by the Engineer Department in this Province, sometimes at considerable cost, I have to notice three particular causes of the subsequent failure, or at least partial inefficiency, of most of the works handed over by the Department in a state of efficiency on completion. These are,

- 1st. The failure of the feeding springs above the bundarrahs in the dry season.
- 2nd. The inability of villagers in some places, through paucity of numbers, or complete occupation in agriculture, to execute the more heavy works of clearing out their deeper excavations, through which their water-course may run, and removing large trees, &c. &c. brought into their reservoir by the monsoon floods, and other such essential repairs.
- 3rd. The ignorance or indifference of the villagers, in most if not all places, regarding the removing at proper times (of which those only on the spot can judge) of the sluices intended to carry off the deposit from their bundarrahs and water-courses, and making use of the running water

for the clearance of their reservoirs, &c., and also of immediately attending to the appearance of weakness in the earth-work flanks of a masonry breast wall or aqueduct; instead of both neglecting this, and, as I have seen in several places, actually filling up the safety waste weirs, left in the masonry work, with earthen dams.

16. The first cause of occasional failure named above at once renders the bundarrahs useless, as irrigation can then only be carried on by drawing water from the reservoir, as from a tank, until the supply fails. Happily this is not of frequent occurrence in the cases of old-existing bundarrahs, the sites of most of which have been well fixed, below springs generally perennial, but its possibility is to be guarded against in the recommendation of new works on the petition of cultivators, who, in hopes of getting a bundarrahs constructed, will assert without hesitation that their nullah or river contains running water all the year round.

*Remarks by the Superintending  
Engineer, S. P.*

4. (*Para. 17.*) Instead of an annual sanction, the Revenue Authorities should remit such portion of Revenue as may enable the cultivators to do the work.

5. (*Para. 18.*) I conceive the Collector or his Deputies,

17. Where the second cause of failure exists, and is fully proven by the evidence of the local Revenue Authorities, there is no doubt that there should be an annual sanction for the necessary repairs once a year, at the proper season, for the preservation of the existing revenue each year; when this is neglected, besides causing deterioration of the Revenue, it increases future labour and expense in the repairs, and endangers the permanent masonry works.

18. As the third and most frequent cause of failure is one

or the Engineer himself or his Assistants, would be perfectly justified in making such repairs ; in fact their failing to do so would at present be a neglect of the interests of Government ; but I think that, in point of fact, the extensive though petty irrigation of Khandeish can never be advantageously looked after by Government officials. Great works, such as masonry bundarrahs and aqueducts, should be the only things to which Government should directly contribute: the people can themselves do earth work cheaper than we can. If they do the work, they will look after it ; if they do not themselves do the work, no amount of fining or instructing will teach them.

6. A very extended intimacy with works of irrigation has forced me to the conclusion that Government can never meddle advantageously with works which benefit one or two villages. The time of their servants is thrown away, and the sum expended in paying them for superintending such works would frequently serve to construct works of importance.

7. I would certainly give them advice if they require it, but nothing further through the Engineer Department. If

that can generally be unmistakeably proven by the state of the work of irrigation, the villagers should either be compelled to give attention to the wants of their water-course, or should be held responsible for its injuries ; and, while I think the power of making immediate slight repairs, without any reference whatever, should be vested in the Engineer Department, the amount expended on such should always be recovered from the villagers, unless the cause of injury is unmistakeably not their ignorance, but inattention to orders.

the work is a paying one, let the Collector make a certain remission, on condition of its performance.

8. I have entered in more detail than I intended on this subject, for it is, I think, the curse of India that Government are appealed to to do the most trifling work, and the people will look on during the construction with the most listless apathy, and neglect it after completion. What I have said relates to works for one or two villages only. When extensive interests are concerned, Government can advantageously do the work, but then they must superintend it afterwards.

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## GENERAL DEPARTMENT.

### NEW WORKS.

#### *Roads and Bridges.*

31. *Improvements to the Bombay and Agra Road, from the foot of the Chandoor Ghaut to the Scindwa Fort, for 1850-51.*—The expenditure during the past official year on this work, for which there is an annual sanction of Rupees 12,000, (twelve thousand,) has been Rupees 11,993-11-0, (eleven thousand nine hundred and ninety-three, and annas eleven). The improvements carried on and completed have been as follows :—

32. Between Chandore Ghaut and the Girna River, near Malligaum, a distance of 18 (eighteen) miles, nothing has been done during the past official year beyond the usual periodical repairs.

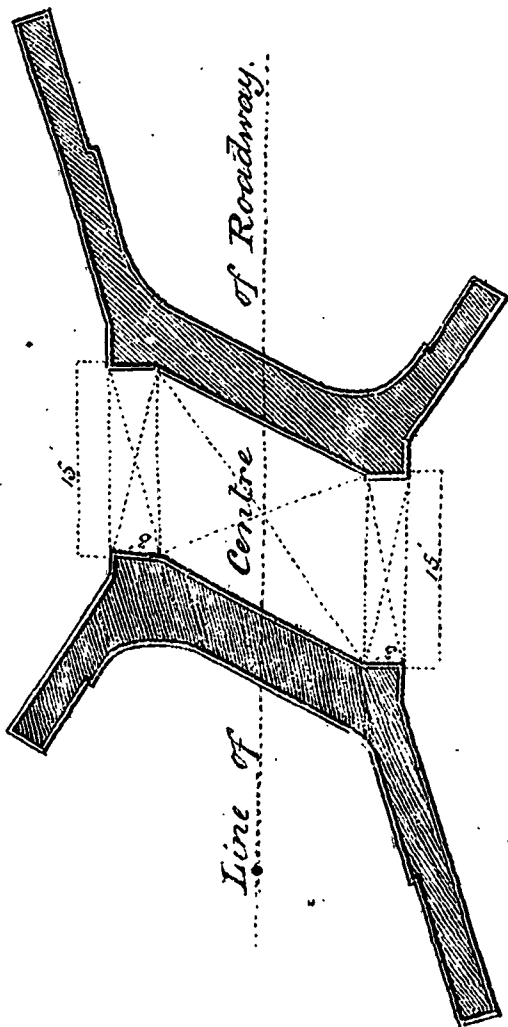
33. Between the Girna and the Moosum Rivers, near Malligaum, nothing except as above has been done on the direct line of the Agra Road; but on the Branch Road, connecting the camp and the travellers' bungalow with the Main Road, a treble slab-drain has been constructed at a cost of Rupees 70-15-8 (seventy, annas fifteen, and pies eight); and near the travellers' bungalow a simple slab-drain, at a cost of Rupees 43-5-3 (forty-three, annas five, and pies three). The new bridge in progress of construction across the Moosum River, being under a separate sanction, will be noticed below.

34. Between the Moosum River and the Chickulwall Travellers' Bungalow, a distance of 8 (eight) miles, low parapets have been added to an existing treble slab-drain near the Wulwarree Bridge, at a cost of Rupees 16-9-2 (sixteen, annas nine, and pies two). The highly-embanked approaches to the Wulwarree Bridge being considered unsafe, have been surmounted by railings with terminating masonry pillars, the whole on a masonry foundation, at a cost of Rupees 200-3-6 (two hundred, annas three, and pies six). A double slab-drain has been constructed near the Chickulwall Travellers' Bungalow, at a cost of Rupees 85-10-9 (eighty-five, annas ten, and pies nine).

35. Between Chickulwall and Arvee Travellers' Bungalows,  $10\frac{1}{2}$  (ten and a half) miles. The work of improvements and additions to the Kanowlee Bridge, near Chickulwall, having been executed on a separate sanction, will be noticed below. The following works have been executed on the line of road between the Kanowlee Bridge and the Chowka Nullah Bridge:—A single arched culvert, 6 (six) feet span, at a cost of Rupees 120-10-1 (one hundred and twenty, annas ten, and pie one); adding low parapets to an existing single slab-drain, at a cost of Rupees 9-3-3 (nine, annas three, and pies three); the same in another place, at a cost of Rupees 9-2-4 (nine, annas two, and pies four); the same again, at a cost of Rupees 5-14-11 (five, annas fourteen, and pies eleven); a double slab-drain, at a cost of Rupees 69-0-7

(sixty-nine, and pies seven) ; a treble slab-drain, at a cost of Rupees 135-11-4 (a hundred and thirty-five, annas eleven, and pies four) ; and a single arched culvert, five (5) feet span, at a cost of Rupees 157-12-5 (one hundred and fifty-seven, annas twelve, and pies five). Further on low parapets have been added to an existing single slab-drain, at a cost of Rupees 4-15-10 (four, annas fifteen, and pies ten). Near the Pudolie Bridge, (constructed during the previous year,) a slab-drain of four waterways has been constructed, at a cost of Rupees 144-14-6 (one hundred and forty-four, annas fourteen, and pies six). Near an old temple at Jhorgah a single arched culvert, 7 (seven) feet span, has been constructed, at a cost of Rupees 134-10-8 (one hundred and thirty-four, annas ten, and pies eight). At Jhorgah a double slab-drain has cost Rupees 95-9-10 (ninety-five, annas nine, and pies ten). Further on, near the Naundan Bridge, (constructed during the previous year,) 2 (two) slab-drains, of 6 (six) waterways each, have been constructed, one at a cost of Rupees 302-12-2 (three hundred and two, annas twelve, and pies two), and the other at a cost of Rupees 274-4-3 (two hundred and seventy-four, annas four, and pies three). At the foot of the small Ghaut, about half way between Jhorgah and Arvee, is Koothee Nullah. Here has been constructed a rubble masonry bridge, of 3 (three) arches, 15 (fifteen) feet span, and arc of  $60^{\circ}$  (sixty degrees) breadth, under soffit of arches 21 (twenty-one) feet, and a clear width of roadway 18 (eighteen) feet, completed at a cost of Rupees 1,215-1-5 (twelve hundred and fifteen, anna one, and pies five) ; and a little further on a single arched bridge, of the same dimensions, has been constructed across the Soondee Nullah, at a cost of Rupees 812-9-9 (eight hundred and twelve, annas nine, and pies nine). Not far from the Boree River a skew bridge, of a single arch, 15 (fifteen) feet span, has been constructed across the Poor Nullah, at a cost of Rupees 396-9-1 (three hundred and ninety-six, annas nine, and pie one), and near this a double slab-drain, at a cost of Rupees 106-10-2 (one hundred and six, annas ten,







and pies two). The Boree River, which is now crossed, will, it is hoped, be bridged before the next monsoon, and noticed as such in the next Annual Report: a revised design and estimate for the work are now before Government. Between this river and Arvee a single arched drain or culvert, 2 (two) feet span, has been constructed, not far from the river, at a cost of Rupees 68-7-8 (sixty-eight, annas seven, and pies eight); and beyond this, near the Mhow Nullah Bridge, (constructed during the previous year,) a skew bridge, of a single arch, 15 (fifteen) feet span, has been constructed across the Wakda Nullah, at a cost of Rupees 619-10-2 (six hundred and nineteen, annas ten, and pies two). A ground plan of this bridge is given on the opposite page, as illustrative of the principle of the design of this and the Poor Nullah Bridge above noticed. It is considered that the parallel *direct* arch rings, of 3 (three) feet in width each, are sufficient to withstand the irregular thrust of the enclosed portion of the oblique arch.

36. *Between Arvee and Dhoolia Travellers' Bungalows, twelve (12) miles.*—At about a mile and a half from Arvee have been constructed a single arched culvert, 4 (four) feet span, at a cost of Rupees 70-7-0 (seventy, and annas seven); and across the Rokedaba Nullah a bridge, of 2 (two) arches, each 15 (fifteen) feet span, arcs of  $60^{\circ}$  (sixty degrees), and other dimensions, the same as the bridges previously noticed, at a cost of Rupees 1,655-10-6 (sixteen hundred and fifty-five, annas ten, and pies six). This bridge and its approaches are entirely out of the line of the old road, and are a great improvement, crossing by the new bridge the same nullah but *once*, which is crossed three times within a quarter of a mile by the old line of road. A little beyond the Rokedaba Nullah, the Byheeram Nullah has been crossed by a bridge, of 2 (two) feet segmental arches, 8 (eight) feet span, and 2 (two) feet rise, other dimensions as before given, which has been completed at a cost of Rupees 873-0-9 (eight hundred and seventy-three, and pies nine). From the Byheeram Nullah it is about half a mile to the foot of the Lulling Ghaut,

and in this distance the following works have been completed during the past official year :—Adding low parapets to an old existing single slab-drain, at a cost of Rupees 9-13-5 (nine, annas thirteen, and pies five); constructing a culvert, of a single arch, 6 (six) feet span, at a cost of Rupees 211-5-3 (two hundred and eleven, annas five, and pies three); and another culvert, of a single arch, 10 (ten) feet span, at a cost of Rupees 319-8-1 (three hundred and nineteen, annas eight, and pie one). On the Lulling Ghaut, with its bridges, constructed by my predecessor, nothing requires to be done beyond the usual periodical repairs; but at the extremity of the embankment of the last bridge so constructed a bridge, of 2 (two) arches, each 15 (fifteen) feet span, arc of 60° (sixty degrees), has been constructed, at a cost of Rupees 1,216-0-5 (twelve hundred and sixteen, and pies five). Between this bridge and the village of Lulling, the following works have been completed :—A small treble slab-drain, at a cost of Rupees 84-15-8, (eighty-four, annas fifteen, and pies eight); a culvert, of a single arch, 10 (ten) feet span, at a cost of Rupees 232-15-10 (two hundred and thirty-two, annas fifteen, and pies ten); another culvert, of a single arch, 15 (fifteen) feet span, at a cost of Rupees 410-2-1 (four hundred and ten, annas two, and pie one); a single slab-drain, at a cost of Rupees 75-1-0 (seventy-five, and anna one); another single slab-drain, at Rupees 69-3-3 (sixty-nine, annas three, and pies three); a breast wall, (at a point where the water from the Lulling Hill runs over the road, and was always washing it away,) at a cost of Rupees 99-4-1 (ninety-nine, annas four, and pie one); and a large double slab-drain, at a cost of Rupees 207-5-7 (two hundred and seven, annas five, and pies seven). In the village of Lulling, and close to the old village wall, a bridge of 2 (two) arches, each 10 (ten) feet span, arc of 60° (sixty degrees), has been constructed, at a cost of Rupees 914-13-11 (nine hundred and fourteen, annas thirteen, and pies eleven). Between Lulling and Dhoolia the following works have been completed :—A culvert, of a single arch, 8

(eight) feet span, at a cost of Rupees 223-9-8 (two hundred and twenty-three, annas nine, and pies eight); another culvert, of a small size, of a single arch, 6 (six) feet span, at a cost of Rupees 82-1-4 (eighty-two, anna one, and pies four); a single slab-drain, at a cost of Rupees 28-4-11 (twenty-eight, annas four, and pies eleven); and lastly, a small treble slab-drain, near the Government Tank, at a cost of Rupees 69-9-6 (sixty-nine, annas nine, and pies six).

37. The whole of the bridges above noticed, correspond, for the most part, in construction with the description given in para. 45 of the Annual Report for the previous official year 1849-50. They have a plain but substantial appearance, and are not likely to require much future repairs.

\* \* \* \* \*

40. *Converting into a Fair-weather Road the Line, 43 (forty-three) miles in length, through the Nimar Territory, between Scindwah Fort and the River Nerbudda.*—This work, which was described in the last Annual Report, was completed under the superintendence of Mr. Conductor Whittenbury, early in the past official year, at a total cost of Rupees 3,705-13-3 (three thousand seven hundred and five, annas thirteen, and pies three). This has been a useful piece of work; but by this time, after undergoing two monsoons, I have no doubt the line cleared by Mr. Whittenbury is fast returning to its original state; the fact is, that an amount, at least equal to that expended by Mr. Whittenbury, is required to be expended *annually* on this piece of road, to make it a clearly marked fair-weather road during the proper season. It is to be hoped that some such arrangement will shortly be made for annual repairs to this Nimar line of road; and that, under better and closer superintendence than can be afforded by the Civil Engineer's Department in Khandeish, it may soon take its proper standing among the fair-weather portions of the Bombay Agra Line.

\* \* \* \* \*

43. *Constructing a Permanent Bridge over the Moosun River, at Malligaum.*—Noticed above in para. 33. This bridge, of a new construction, consisting of a number (48 in this instance) of pukka masonry piers, 14 (fourteen) feet apart, from centre to centre, supporting horizontal teakwood girders, which carry the roadway, was commenced in January last, and had made some progress at the end of the official year. Considerable difficulty was experienced in laying the foundations of the 10 (ten) piers more immediately in the bed of the river, as excavation and clearing out the water was found impracticable. By the end of the official year, however, some foundations had been laid by means of frame-work caissons, and an artificial hydraulic line. The processes and their results will be duly noticed at the completion of the work, it is hoped, before the monsoon of 1852.

I have the honor to be, &c.

(Signed) H. W. B. BELL, Lieutenant,  
Civil Engineer.

No. 228 of 1851.

MARINE DEPARTMENT.

To

The SECRETARY TO THE MILITARY BOARD.

SIR,

I have the honor to submit my Report and Statement of Expenditure for the year 1850-51.

It will be seen that the charges for Engineering amount to 28½ per cent., which is considerably in excess of that shown in the Reports of my predecessor. This is due to the large quantity of stone and materials he had collected and charged to the breakwater, basin, &c., though unused, so that the expenditure gives an erroneous idea of the work done by each.

1847-48, 11 per cent.	
1848-49, 18 do.	
1849-50, 19½ do.	

In the past official year nearly the whole remainder of the foundation course of the breakwater was got in, so that the great impediment to the completion of the work no longer exists. The length of foundation laid during the season was 515 feet, against 482 in the previous one.

I have the honor to be, &c.,

(Signed) C. W. TREMENHEERE, Captain,

Engineer to the Dock-yard.

*Bombay, Dock-yard Engineer's Office,  
16th December 1851.*

No. 1 OF 1850-51.

## MARINE DEPARTMENT.

*Statement showing the actual Expenditure upon Works carrying on under the Engineer to the Dock-yard, for the official year from 1st May 1850 to 30th April 1851.*

*Bombay, Dock-yard Engineer's Office, 15th Dec. 1851.*

	Amount.	Total.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
1. Constructing a building-yard to the South-East of the Dock-yard and Saluting Battery, comprising three slips for building ships of war of the 1st class of Her Majesty's Navy .....	143 0 0	143 0 0
2. Constructing a portion of the work connected with the proposed basin and break-water:—		
Breakwater .....	12,689 9 6	
Cofferdam .....	53 7 5	
		12,743 0 11
3. Rendering the buildings in the Dock-yard more secure against the risk of fire..	817 1 6	
4. Railroad from the Factory round the Dock .....	8,404 5 2	
5. Erecting a beacon on the Kennery Island	1,647 6 1	
6. Erecting a platform for naval gunnery on Butchers' Island .....	1,795 5 2	
7. Fitting venetians to the windows of the Commander in Chief Indian Navy's Office..	347 0 0	
8. Constructing a plank wall to the verandah of the Commander in Chief Indian Navy's Office .....	62 0 0	
9. Constructing ventilators to the two ranges of Bankahall, occupied by the Lascars attached to the Master Attendant's Department .....	350 0 0	
10. Erecting a shed over the 1st Slip .....	499 13 5	
11. Effecting certain alterations and additions to the Coal Depôt .....	3,637 6 9	
12. Wooden frame-work for European barracks at Kurrachee .....	1,048 11 11	
<i>Repairs to the Fortifications and Buildings.</i>		
13. Removing the portion of the rampart near the Dock .....	200 0 0	
Carried over, Rs.	18,809 2 0	12,886 0 11

	Amount.		Total.	
	Rs.	a. p.	Rs.	a. p.
Brought over, Rs.	18,809	2 0	12,886	0 11
14. Replacing the cadjan roof of the shed for the timber prepared for the Cofferdam.	208	5 6		
15. Effecting certain repairs and alterations to the buildings in the Dock-yard...	372	8 0		
16. Annual repairs to the buildings in the Dock and Building-yards, for 1850 .....	3,211	0 0		
17. Annual repairs to the buildings on Butchers' Island.....	207	9 0		
18. Removing the useless portion of wall of the Indian Navy Storekeeper's Yard..	75	13 8		
19. Removing the cross wall in the verandah of the lower barracks on Butchers' Island .....	23	12 2		
20. Deepening the tank and well on Butchers' Island.....	3	0 0		
21. Effecting certain repairs to the premises of the dock-yard .....	104	6 3		
22. Effecting certain repairs to the buildings on Butchers' Island .....	293	2 11		
23. Removing the cadjan shed over the new steamer "Zenobia." .....	23	4 5		
24. Repairing cadjan roof of Police Hulk "Zenobia".....	65	0 0		
25. Taking down and rebuilding walls to Slips Nos. 1, 2, and 3.....	110	5 9		
26. Preparing timber for a bridge in the Sattara territories.....	26	6 2		
27. Preparing wood-work for new Jail at Mahableschwur.....	522	0 9		
<i>Emergent Works.</i>				
28. Repairing the plaster of the Indian Navy Storekeeper's Office .....	18	12 4		
29. Repairing the plaster of the Steam-house.....	33	12 4		
30. Repairing the plaster of the Coal Depôt.	17	15 9		
31. Plank shutters for (6) six windows for the two wooden moveable offices on the new ground .....	34	0 0		
32. Repairing the plaster of the Assistant Storekeeper's Office of the Indian Navy ..	38	9 8½		
33. Pointing stone work for the upper, middle, and lower Docks .....	97	11 9½		
34. Fixing bolts to the windows of the Steam Factory .....	21	6 9		
35. Removing the cadjan roof over the late Police Hulk "Zenobia".....	14	12 1		
36. Panes of glass to the windows of the Superintendent's and Master Attendant's offices.	4	6 0		
Carried over, Rs.	24,337	3 4	12,886	0 11



	Amount.			Total.		
	<i>Rs.</i>	<i>a.</i>	<i>p.</i>	<i>Rs.</i>	<i>a.</i>	<i>p.</i>
Brought over, Rs:	24,337	3	4	12,886	0	11
37. White-washing the bankshall occupied by the Master Attendant's Department . . .	6	9	14			
38. Repairing and white-washing the School-room near the Engine-house . . . . .	4	15	6			
39. Making new doors and windows for Coal Depôt . . . . .	34	2	1			
40. Repairing the gates at the centre entrance to the Dock-yard, and also leveling the roads at the entrance to the offices near Apollo gateway . . . . .	10	13	4			
41. White-washing the Indian Navy Store-keeper's Office . . . . .	34	2	5			
42. Altering the cook-room of the bankshall occupied by the lascars of the Master Attendant's Department . . . . .	34	1	7			
43. White-washing, colouring, and ceiling the Commander in Chief's Office, and also white-washing and repairing the Conductor's room in the Coal Depôt . . . . .	157	12	0			
44. White-washing the offices on the new ground . . . . .	10	13	2			
				24,690	9	4
	Rupees . . . . .			37,516	10	3

(Signed) C. W. TREMENEERE, Captain,  
Engineer to the Dock-yard.



No. 2 of 1850-51.

MARINE DEPARTMENT.

*Statement showing the Cost of Engineering in the Marine Department, under the Engineer to the Dock-yard, from 1st May 1850 to 30th April 1851.*

*Bombay, Dock-yard Engineer's Office, 15th December 1851.*

	Amount of Establishment.		Total Amount of Establishment.		Expenditure.		Rate per cent.	
	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.
Captain C. W. Tremenhoe's Staff Pay for Marine and Steam Department for the month of May 1850.....	Rs.	600	0	0				
Ditto ditto June .....		600	0	0				
Ditto ditto July .....		600	0	0				
Ditto ditto August .....		600	0	0				
Ditto ditto September ..		600	0	0				
Ditto ditto October .....		600	0	0				
Ditto ditto November ..		600	0	0				
Ditto ditto December ..		600	0	0				
Ditto ditto January 1851		600	0	0				
Ditto ditto February ..		600	0	0				
Ditto ditto March .....		600	0	0				
Ditto ditto April .....		600	0	0				
		7,200	0	0				
		7,200	0	0				
Carried over, Rupees								

		Amount of Establishment.	Total Amount of Establishment.	Expenditure.	Rate per cent.
		<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
		7,200 0 0			
	Brought over, Rupees				
	Establishment for the month of May 1850.....	Rs. 313 0 0			
Ditto	ditto June .....	304 12 0			
Ditto	ditto July .....	287 0 0			
Ditto	ditto August .....	287 0 0			
Ditto	ditto September .....	307 0 0			
Ditto	ditto October .....	307 0 0			
Ditto	ditto November .....	307 0 0			
Ditto	ditto December .....	307 0 0			
Ditto	ditto January 1851 .....	305 12 10			
Ditto	ditto February .....	252 0 0			
Ditto	ditto March .....	252 0 0			
Ditto	ditto April .....	252 0 0			
		3,481 8 10	10,681 8 10	37,516 10 3	28 4 0

(Signed) C. W. TREMENHEERE, Captain,  
 Engineer to the Dock-yard.

No. 1836 of 1851.

PUBLIC WORKS.

GENERAL DEPARTMENT.

To

THE SECRETARY TO THE MILITARY BOARD,

Bombay.

SIR,

I have the honor to forward the Annual General Report of the proceedings in the Public Works Department in Scinde, during the official year 1850-51.

2. The Total Expenditure, from the 1st May 1850 to the 30th April 1851, in the Military, Civil, and Marine Departments, are as follows :—

*Total Expenditure in the Military, Civil, and Marine Departments, of the several Executive Officers in Scinde.*

Names of Divisions.	Amount expended in each.	Amount of Superintendence.	Superintending per-centage.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
<b>LOWER SCINDE.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs and alterations.. ..	9,449 1 5		
Annual repairs.. ....	1,494 0 0		
Barrack Department.... ..	4,068 12 7		
New works..... ..	24,169 0 3		
Total, Military Department..	39,180 14 3		
<b>CIVIL DEPARTMENT.</b>			
Repairs and alterations.. ..	410 0 9		
Annual repairs.. ....	56 0 0		
Total, Civil Department..	466 0 9		
<b>MARINE DEPARTMENT.</b>			
Repairs and alterations .. ..	67 9 1		
Total, Military Department..	39,180 14 3		
Total, Civil Department.....	466 0 9		
Grand Total....	39,714 8 1	16,752 4 10	422 10 $\frac{2}{8}$

Names of Divisions.	Amount expended in each.	Amount of Superintendence.	Superintending per-centage.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
<b>CENTRAL SCINDE.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs . . . . .	4,085 8 7		
Annual repairs.. . . .	900 0 5		
New works . . . . .	8,791 10 4		
Total, Military Department..	13,777 3 4		
<b>CIVIL DEPARTMENT.</b>			
Repairs . . . . .	195 0 2		
Annual repairs.. . . .	1,372 15 9		
New works . . . . .	715 13 7		
Total, Civil Department.....	2,283 13 6		
Total, Military Department...	13,777 3 4		
Grand Total....	16,061 0 10	11,187 10 10	69 10 6
<b>UPPER SCINDE.</b>			
<b>MILITARY DEPARTMENT.</b>			
Repairs.... . . . .	2,798 14 3		
Annual repairs.. . . .	1,200 9 4		
New works . . . . .	14,041 3 8		
Total, Military Department..	18,040 11 3		
<b>CIVIL DEPARTMENT.</b>			
Repairs . . . . .	591 4 1		
Annual Repairs. . . . .	409 11 3		
New works..... . . . .	868 15 11		
Total, Civil Department..	1,869 15 3		
<b>MARINE DEPARTMENT.</b>			
Repairs . . . . .	36 12 0		
Annual repairs.. . . .	14 7 6		
New works..... . . . .	17 1 2		
Total, Marine Department....	68 4 8		
Total, Civil Department.....	1,869 15 3		
Total, Military Department ..	18,040 11 3		
Grand Total....	19,978 15 2	9,474 6 2	47 6 9
Total of Expenditure.....	1,13,168 13 11		

I regret that as none of the Executive Officers' Returns were accompanied by Statements of Works of special interest, and as I did not join this Division till more than six months after the official year had closed, I am unable to afford information of any proceedings in the Department for publication.

I have the honor to be, &c.,  
(Signed) H. B. TURNER, Major,  
Superintending Engineer, Scinde.

*Kurrachee, 15th December 1851.*

No. 2065 of 1851-52.

GENERAL DEPARTMENT.

To

THE SECRETARY MILITARY BOARD,

Bombay.

SIR,

With reference to your Letter No. 9727, of the 3rd December last, I have the honor to forward the Annual Report of Works in the Northern Provinces, for the year ending 30th April 1851.

*Statement of the Sums expended by each Officer under the Superintending Engineer, Northern Provinces, from the 1st May 1850 to 30th April 1851.*

	In the Military Department.		In the General Department.		In the Judicial Department.		In the Revenue Department.		In the Territorial Department.		In the Political Department.		In the Ecclesiastical Department.		Total.	
	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.
Lieutenant M. Kennedy, Executive Engineer, Surat Division .....	1,926	14 7	11,048	15 11	2,932	0 2	1,608	12 0	805	8 4	.....	203	14 6	18,531	1 0	
Lieutenant W. R. Dickinson, Executive Engineer, Ahmedabad Division .....	7,486	1 4	13,617	5 8	3,307	14 10	2,017	12 3	2,384	2 0	2,313	6 0	63	1 9	31,680	11 10
Lieutenants G. G. Brown, H. H. James, and D. Nasmyth, Acting, and Executive Engineers, Deesa Division .....	20,681	4 4	47	10 0	.....	.....	.....	.....	.....	.....	.....	.....	1,340	14 2	22,000	12 0
Captain B. R. Powell, Major of Brigade, in charge of Public Works, Rajcote .....	1,270	10 2	.....	.....	.....	.....	.....	.....	.....	.....	605	5 0	15	8 0	1,081	7 2
Lieutenant G. Skippon, Line Adjutant, in charge of Public Works, Bhoopj .....	1,264	12 7	.....	.....	.....	.....	.....	.....	.....	.....	284	9 6	51	15 0	1,601	5 1
Total .....	32,569	11 0	24,708	15 7	6,239	15 0	5,083	8 3	3,689	10 4	3,293	4 0	1,075	4 11	75,863	5 7

*Statement showing the Cost of Engineering and General Superintendence of each Officer under the Superintending Engineer, Northern Provinces, from 1st May 1850 to 30th April 1851.*

	Expense of	Expenditure.	Rate per		
	Establishment per Annum.		cent.		
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>		
Lieutenant M. Kennedy, Executive Engineer, Surat Division.....	11,805 10 0	18,581 1 0	63	8	2
Lieutenant W. R. Dickinson, Executive Engineer, Ahmedabad Division.....	11,893 8 11	31,689 11 10	37	8	0
Lieutenants G. G. Brown, H. H. James, and D. Nasmyth, Acting, and Executive Engineers, Deesa Division.....	6,232 2 3	22,009 12 6	28	8	8
Captain B. R. Powell, Major of Brigade, in charge of Public Works, Rajkote ..	420 0 0	1,981 7 2	21	3	2
Lieutenant G. Skipton, Line Adjutant, in charge of Public Works, Bhooj ....	182 0 0	1,601 5 1	11	4	9
.. Total.....	30,583 5 2	75,863 5 7	40	5	0

2. During the official year 1850-51 no works of general or permanent professional interest have been executed, and there do not appear to have been any facts recorded worthy of publication.

3. From the outlay at Surat, have been expended Rupees 5,063-1-2 in constructing the Mucca Gate Bridge. From that at Ahmedabad Rupees 8,280-11-0 have been expended on the local general improvements ; and Rupees 2,615-13-9 from the Goolaputtee Fund, on the Road at Veercumgaum.

4. Rupees 1,425-8-0 have been expended on the improvement of the Aboo Road, by the Engineer Department at Deesa.

I have the honor to be, &c.,

(Signed) W. B. GOODFELLOW, Lieut. Colonel,  
Superintending Engineer, Northern Provinces.

*Superintending Engineer's Office, N. P.,  
Surat, 13th April 1852.*

## ROAD AND TANK DEPARTMENT.

*Statement of Expenditure in the Construction and Repair of Public Works in the Road and Tank Department, from the 1st of May 1850 to the 30th April 1851.*

*Camp Singhur, 24th May 1852.*

Names of Works.	Amount.	Total.
	Rs. a. p.	Rs. a. p.
<i>Works connected with the Communication of the Country.</i>		
Annual repairs to flying bridges, for 1849-50..	30 0 0	
Ditto to Narraingaum cross-roads, for 1849-50.. .. .	181 13 1	
Ditto to roads, bridges, &c., for 1849-50, in the Poona Collectorate.	31 12 0	
Ditto to mail road for 1849-50, in do.	6,621 13 8	
Rolling mail road .. .. .	35 0 0	
Annual repairs to bridges and drains on mail road, for 1849-50.. .. .	1,012 0 0	
Ditto to roads, bridges, &c., in the Nuggur Collectorate, for 1849-50 .. .. .	11 11 0	
Constructing a new piece of road near Khundallah .. .. .	366 4 10	
Constructing a channel to convey rain-water into the tank near Revenue Commissioner's house.. .. .	667 6 8	
Widening the Akoordee road .. .. .	1,972 14 2	
Annual repairs to roads, bridges, &c., in the Nuggur Collectorate, for 1850-51 .. .. .	2,867 13 4	
Ditto to roads, bridges, &c., in the Poona Collectorate, for 1850-51 .. .. .	20,771 14 7	
Enlarging the store-house of the Kurradee flying bridge.. .. .	79 12 4	
Improving Dapoorie bridge approaches .. .. .	972 1 10	
Making new stone rollers. .. .. .	1,631 11 6	
Repairs to Neera bridge.. .. .	2,570 12 2	
Annual repairs to flying bridge, for 1850-51..	1,161 10 8	
Widening the road from Kirkee to Dapoorie..	2,978 4 5	
Repairs to Allundee bridge .. .. .	71 14 9	
Constructing a masonry drain on the road leading to Poona bridge .. .. .	199 1 2	
Constructing a road from the main line to the Poona travellers' bungalow.. .. .	153 3 11	
Carried forward.. Rs.	44,389 0 1	



Names of Works.	Amount.		Total.	
	<i>Rs.</i>	<i>a. p.</i>	<i>Rs.</i>	<i>a. p.</i>
Brought forward.. Rs.	44,389	0 1		
Widening the road of the Khundallah travellers' bungalow. . . . .	36	7 0		
Constructing a masonry drain of one water-way across the road of the Poona travellers' bungalow. . . . .	58	8 0		
Improving Murrah Ghaut road. . . . .	1,168	15 6		
Rendering passable the road leading from the European Barracks near Ghorpurree to Poona. . . . .	177	4 11		
Rendering passable the swamp on the road from Poona to the Kurradee ford, which passes through the village of Ghorpurree . .	323	7 5		
Minor works . . . . .	541	13 0		
Constructing a new road between Patus and Indapore . . . . .	1,192	0 6		
Constructing a new road between Patus and Poona. . . . .	44,028	2 5		
Annual repairs to the main road between Patus and Indapore, for 1850-51. . . . .	3,410	0 7		
Ditto ditto ditto . . . . .	742	2 11		
Ditto ditto between Patus and Poona for 1850-51 . . . . .	787	12 5		
Ditto ditto ditto . . . . .	29	13 9		
Constructing bullock-track at Deweh Ghaut.	270	14 8		
Widening and rendering safe the approaches to the Wanowree bridge. . . . .	624	6 1		
Forming ramps of earth, &c. in the interim that drains and bridges are being built on the Patus and Poona line of road. . . . .	197	0 0		
Minor works . . . . .	79	5 9		
Constructing a new road between Indapore and Hingungaum . . . . .	4,382	11 10		
Repairs to masonry, wooden, and flying bridges on the Nagpore dawk line. . . . .	2,609	1 0		
Repairs to branch roads leading to the bridges and flying bridges on both sides of the nullahs and rivers on the Nagpore dawk line. .	1,340	10 0		
Cutting the jungle growing on parts of the road, and removing large stones on the Nagpore dawk line. . . . .	307	13 1		
Purchasing four pairs of canoes at Bombay, completed with railings, &c. . . . .	749	0 0		
Maintenance of ferrymen and haulers along the dawk line of road between Ahmednuggur and the Warda river, during the monsoon. .	3,440	5 7		
Clearing a fair-weather road between the Godavery and Warda rivers . . . . .	8,014	15 8		
Building masonry, wooden, and flying bridges, &c. . . . .	1,693	4 6		
Carried forward.. Rs.	1,20,595	0 8		

Names of Works.	Amount.	Total.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Brought forward . . Rs.	1,20,595 0 8	
Repairs to three ghauts on the Nagpore dawki line .. .. .	288 12 5	
Annual repairs to the newly built stable for horses at Sew river, on the Nagpore dawki line.. .. .	46 9 0	
Annual repairs to chuppers for stables for horses, and huts for ferrymen and haulers, on the Nagpore dawki line .. .. .	293 2 6	
Annual repairs to the store-houses.. .. .	163 9 8	
Building masonry, wooden, and flying bridges, on the Nagpore dawki line, for 1851-52.....	3,054 8 0	
Completion of the Thull Ghaut new road....	3,995 3 0	
Improvements on ditto ditto .. .. .	2,863 5 5	
Annual repairs to ditto for 1850-51..	403 14 2	
Ditto to main road from the Thull Ghaut to Chandore Ghaut, in the Nassick Sub-Collectorate .. .. .	13,138 13 8	
Making stone rollers .. .. .	217 3 8	
Annual repairs to cross-roads, for 1850-51 ..	1,751 3 4	
Petty repairs to ditto .. .. .	149 14 10	
Repairs to Annundwelle road .. .. .	154 1 1	
Improvements on the Agra line of road between the Thull Ghaut and Chandore, 1st Sanction .. .. .	4,172 8 1	
Ditto ditto ditto, 2nd Sanction..	146 1 7	
Building a bridge over the Pharashery river, at Pimpulgaum .. .. .	1,212 8 8	
Building two bridges over the nullahs, one between the Kadoo river and Pimpulgaum, and the other near Kokungaum, on the main road between Nassick and Chandore .. .. .	782 13 9	
Building two bridges of 8 feet and 10 feet span over the nullahs Nos. 20 and 21, on the main road between the Thull Ghaut and Egutpoorah .. .. .	4,069 12 4	
Building a bridge over the Undwell river ..	14,666 9 0	
Annual repairs to bridges and drains on the main road, for 1850-51 .. .. .	121 5 5	
Petty repairs to ditto .. .. .	118 15 0	
Annual repairs to bridges and drains on the cross-roads in the Nassick Sub-Collectorate.	68 2 8	
Making a new flying bridge over the Godavery river at Nassick .. .. .	6,376 11 5	
Constructing a ford with approaches, near the site of flying bridge at Nassick .. .. .	818 3 11	
Improving the flying bridge at Kadoo river, between Nassick and Chandore .. .. .	586 7 3	
Annual repairs to ferry boats and flying bridges, for 1850-51.. .. .	178 13 4	
Carried forward . . Rs.	1,80,434 5 10	

Names of Works.	Amount.			Total.		
	<i>Rs.</i>	<i>a.</i>	<i>p.</i>	<i>Rs.</i>	<i>a.</i>	<i>p.</i>
Brought forward..	Rs.	1,80,434	5	10		
Petty repairs and petty charges to ferry-boats and flying bridges, for 1850-51 .. ..		43	4	0		
Making a bullock-track leading from the village of Kussarah to the tank at that place .. .. .		108	4	8		
Making a new line of road between Kussarah and Khurdee.. .. .		60,990	9	10		
Annual repairs to the main road from the Colsette ferry to Thull Ghaut .. ..		11,579	12	2		
Making new stone rollers .. .. .		94	4	8		
Repairing and widening the road leading to the Kussarah travellers' bungalow. ..		57	1	6		
Building two new boats for the use of the Colsette ferry.. .. .		327	8	0		
Constructing temporary bridges over the rivers at Mokhownah, Oomerwallee, Dhamnee, Chirpole, Phursoora, Castna, Dohola, and Pudgah, between the foot of the Thull Ghaut and the Colsette ferry .. .. .		116	6	7		
Constructing flying bridges, and making canvas bags, for bridges over the rivers at Dhamnee, Shahpoor, Sarmul, and Koombharee, between the foot of Thull Ghaut and Colsette ferry .. .. .		629	14	0		
Pay to haulers employed for the purpose of passing the dawk bags over the rivers at Koombharee, Sarmul, and Shahpoor, during the monsoon of 1850-51 .. .. .		56	12	2		
Annual repairs to roads in the cantonment of Bhowndy, for 1850-51 .. .. .		45	4	11		
Constructing a bridge over a nullah which divides the town of Bhowndy from Nizampore .. .. .		2,460	1	2		
Clearing the road between Battana and Kamrollee, for the 4th Troop H. A., as also that between Cullian and Bhowndy .. ..		141	11	1		
Completing the Bhandoop road .. .. .		1,069	2	7		
Constructing a new road leading to the hill of Senhora de Monte, at Bandora .. ..		2,715	10	4		
Annual repairs to roads in Salsette, for 1849-50.		3,038	4	0		
Repairing certain works on the Sankey and Ghorebunder road .. .. .		131	13	9		
Repairing the foundation of the Dhysur bridge.		432	12	11		
Making six stone rollers .. .. .		498	0	0		
Constructing a platform for the two new boats of the Colsette ferry.. .. .		372	9	8		
Annual repairs to roads in Salsette, for 1850-51. .. .. .		18,305	1	1		
Carried forward..	Rs.	2,84,428	10	11		

Names of Works.	Amount.	Total.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Brought forward.. Rs.	2,84,428 10 11	
Repairing the four miles of made road from the Tanna Bunder, in the direction of Panwell .. .. .	2,086 0 2	
Improving the Dhysur, Goregaum, and Sankey bridges, and their respective approaches on the Ghorebunder road ..	894 6 6	
Repairing the horse-boat at the ferry between Ghorebunder and Bassein .. .. .	586 0 6	
Repairing the horse-boat at Colsette .. .. .	490 0 0	
Providing a raft for the Colsette ferry .. .. .	600 0 0	
Constructing a horse-boat for the ferry between Ghorebunder and Bassein .. .. .	250 0 0	
Repairing the ferry-boats at Oomergaum and Danoo .. .. .	213 0 0	
Annual repairs to the mail road from Khapoollee to Panwell, for 1849-50.	1,283 11 1	
Ditto to the mail road from Nagotna to Mahableshwar, for 1849-50 .. .. .	747 13 4	
Ditto to the cross-roads in the Northern Konkan, for 1849-50.	317 10 0	
Ditto to the cross-roads in the Southern Konkan, for 1849-50 .. .. .	24 12 0	
Ditto to the mail road from Khapoollee to Panwell, for 1850-51.	7,414 1 5	
Ditto to the main road from Nagotna to Mahableshwar, for 1850-51 .. .. .	5,019 12 0	
Ditto to the cross-roads in the Northern Konkan, for 1850-51 .. .. .	2,764 2 1	
Ditto to the cross-roads in the Southern Konkan, for 1850-51 .. .. .	941 14 4	
Ditto to bridges and drains on the mail road, for 1850-51 .. .. .	928 12 10	
Making four stone rollers .. .. .	380 0 0	
Petty repairs, and petty charges .. .. .	188 12 1	
Total roads, bridges, &c. ..		3,09,559 7 3
<i>Tanks, Bunds, and Wells.</i>		
Repairs to a well at Loonee .. .. .	2 2 0	
Ditto to Joonnur aqueduct. .. .. .	88 15 0	
Clearing out the tank in the Civil Lines at Poona .. .. .	91 13 1	
Carried forward.. Rs.	182 14 1	3,09,559 7 3

Names of Works.	Amount.	Total.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Brought forward..Rs.	182 14 1	3,09,559 7 3
Aqueducts for garden irrigation between Patus and Indapore .. .. .	36 0 0	
Aqueducts for garden irrigation between Patus and Poona .. .. .	134 7 7	
Sinking a well near the toll house on the Thull Ghaut new road .. .. .	1,083 1 6	
Sinking a shaft below the small bridge on the lower portion of the Thull Ghaut new road.	95 1 4	
Repairs to Musrool bund, Nassick Sub-Collectorate .. .. .	17 10 1	
Ditto to Chinchol do. do.....	9 15 8	
Ditto to Satpoor do. do.....	33 12 11	
Ditto to Kusrool do. do.....	323 10 8	
Constructing a dam across the Kurtoondah river .. .. .	3,114 11 5	
Cut stone pavement to the old well at Kussarah .. .. .	353 3 0	
Constructing a well at Kussarah near the tank .. .. .	1,033 13 11	
Constructing a well at Kussarah near the bridge.. .. .	348 7 1	
Constructing a well at Kussarah .. .. .	391 15 11	
Improving the tank at Khurdee.. .. .	225 7 10	
Facing on the inner side of the bund of the Kussarah tank.. .. .	154 14 1	
Emergent repairs, deepening two wells at Mokhownah .. .. .	159 13 3	
Painting inner side of the bund of the Kussarah tank .. .. .	99 8 0	
Clearing out mud from the two wells at Pudgah.. .. .	8 11 9	
Clearing out and effecting certain improvements to the tanks at Colsette .. .. .	248 11 7	
Improving Wuddala tank at Panwell. .. .	1,720 2 7	
Constructing a well at Chowke pendall ... ..	206 1 10	
Petty repairs .. .. .	70 3 2	
Total tanks, bunds, and wells..		10,052 7 3
<i>Buildings.</i>		
Constructing a new travellers' bungalow at Wurgaum, on Bombay mail road .. .. .	2,667 0 0	
Annual repairs to travellers' bungalow, for 1849-50 .. .. .	118 0 0	
Repairs to Poolshair Palace .. .. .	101 8 9	
Annual repairs to Khair Mamludars Kut-cherry, for 1850-51 .. .. .	54 0 0	
Carried forward..Rs.	2,940 8 9	3,19,611 14 6

Names of Works.	Amount.			Total.		
	<i>Rs.</i>	<i>a.</i>	<i>p.</i>	<i>Rs.</i>	<i>a.</i>	<i>p.</i>
Brought forward.. Rs.	2,940	8	0	3,19,611	14	6
Draining Revenue Commissioner's office compound.. .. .	584	8	2			
Stone gutters under eaves of staging pendalls..	358	13	0			
Tiling the new roof of the Collector's bungalow and its out-houses at Ootoor ..	1,034	3	3			
Constructing a cook-room to the Kopergaum travellers' bungalow, in the Nuggur Collectorate .. .. .	180	15	5			
Kurkallah Kutcherry .. .. .	919	12	5			
Repairing the roof of the Wye travellers' bungalow .. .. .	552	10	4			
Annual repairs to travellers' bungalow, for 1850-51 .. .. .	954	9	0			
Ditto to staging pendalls, for 1850-51.	222	7	11			
Ditto to travellers' bungalow in the Nuggur Collectorate, for 1849-50 .. .. .	22	0	0			
Ditto ditto ditto for 1850-51..	911	10	4			
Petty repairs .. .. .	1,317	15	0			
Constructing five travellers' bungalows between Poona and Indapore.. .. .	5,212	2	8			
Constructing a travellers' bungalow at Patus..	109	7	11			
Ditto ditto at Jeejooris..	837	15	0			
Repairing the chowkee at the top of the Deweh Ghaut.. .. .	15	0	0			
Annual repairs to the travellers' bungalow at Indapore .. .. .	120	13	8			
Furniture for six travellers' bungalows between Poona and Indapore .. .. .	417	1	3			
Annual repairs to travellers' bungalows and dhurrumsallas.. .. .	267	14	1			
Petty repairs to ditto ditto ..	100	1	0			
Repairs to furniture .. .. .	10	9	3			
Annual repairs to military buildings .. ..	125	12	1			
Annual and special repairs to ditto.. ..	332	8	7			
Petty repairs to Nassick jail .. .. .	28	15	7			
Ditto to Moonsiff's court house at Pimpulgaum.. .. .	16	0	7			
Extra work done in the jail compound at Nassick .. .. .	48	14	11			
Annual repairs to military buildings .. ..	69	9	8			
Petty repairs to ditto .. .. .	43	2	0			
Building a toll-house on the Thull Ghaut new road .. .. .	4,961	4	1			
Annual repairs to travellers' bungalow and dhurrumsalla, for 1850-51..	159	15	7			
Ditto to store-room at Bhewandy, for 1850-51 .. .. .	35	4	2			
Carried forward.. Rs.	22,921	11	2	3,19,611	14	6

Names of Works.	Amount.	Total.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Brought forward.. Rs.	22,921 11 2	3,19,611 14 6
Providing a new tie-beam for one of the trusses of the travellers' bungalow at Pudgah .. .. .	207 10 1	
Ditto ditto ditto at Kussarah..	281 11 6	
Replacing bamboo battens, tiles, &c. of the dhurrumsalla at Kussarah .. .. .	67 4 8	
Annual repairs to the hospital of the Native Veteran Battalion at Bhewndy, for 1850-51.	19 1 4	
Providing new bolts, fastening hooks, screws, &c. to the travellers' bungalows at Bassoin, Datewra, Seergaum, Chinchnee, Dhanoo, and Oomergaum .. .. .	44 5 7	
Providing new bolts, fastening panes of glass, &c. to the travellers' bungalows at Kalhair, Pudgah, and Shahpoor .. .. .	30 11 10	
Providing new bolts, fastenings, rattaning chairs, &c. at travellers' bungalows at Khurdee and Kussarah .. .. .	13 15 11	
A new chair supplied to the Khurdee bungalow .. .. .	4 1 6	
Plips and ridge set in chunam, of the hospital of the Native Veteran Battalion at Bhewndy.	17 9 6	
Providing oil, towels, &c. to the travellers' bungalows .. .. .	24 6 0	
Providing iron bolts, slides, fastenings, &c. to the doors and windows, setting in chunam ridge of the hospital of the Native Veteran Battalion at Bhewndy.. .. .	34 11 9	
Re-constructing the quarter guard of the Native Veteran Battalion .. .. .	406 0 0	
Adding defaulters' room to the above work ..	293 7 8	
Erecting a new quarter guard and defaulters' room at Tanna .. .. .	1,705 11 11	
Annual repairs to the military buildings, for 1850-51 .. .. .	575 9 0	
Providing additional accommodation for the head quarters wing of the 1st Grenadier Regiment, at Tanna .. .. .	2,222 0 0	
Renewing the verandah ceilings of the Collector's official residence at Tanna .. ..	532 12 0	
Annual repairs to the buildings in the Ecclesiastical Department at Tanna, for 1850-51 .. .. .	174 9 3	
Ditto ditto in the Customs Department at Tanna, for 1850-51 .. .. .	871 15 9	
Putting up boarded weather-frames to the doors and windows of the Church at Tanna..	265 5 8	
Putting up boarded weather-frames in the General Department, at Tanna .. .. .	97 4 4	
Carried forward.. Rs.	30,804 12 1	3,19,611 14 6

Names of Works.	Amount.			Total.		
	<i>Rs.</i>	<i>a.</i>	<i>p.</i>	<i>Rs.</i>	<i>a.</i>	<i>p.</i>
Brought forward.. Rs.	30,804	12	1	3,19,611	14	6
Putting up boarded weather-frames to the premises occupied by the Collector of Tanna, for 1850-51 .. .. .	41	7	4			
Re-roofing the Custom House at Tanna ..	2,788	8	4			
Annual repairs to the travellers' bungalows in the districts of Bassein, Mahim, and Sungeon, for 1850-51 .. .. .	127	11	4			
Petty repairs, for 1850-51 .. .. .	2,069	9	5			
Erecting pendalls for certain of the police parties stationed in Salsette.. .. .	650	0	0			
Constructing a privy with a covered passage to the military hospital at Tanna .. .. .	322	0	0			
Annual repairs to the travellers' bungalows in Northern Konkan, for 1849-50.	6	9	0			
Ditto in Southern Konkan, for 1850-51 .. .. .	3	7	0			
Ditto ditto in Northern Konkan, for 1850-51 .. .. .	369	4	4			
Repairs to Government bungalow and out-houses at Oorun .. .. .	608	9	8			
Constructing cook-rooms and platforms at Chowke, and Panwell pendall .. .. .	850	0	0			
Extra work performed to the staging pendalls at Panwell and Chowke .. .. .	132	12	4			
Constructing a new travellers' bungalow and out-houses at Nagotna .. .. .	671	10	2			
Ditto ditto ditto at Mhar .. .. .	702	15	4			
Constructing a new line for the sepoy's of Native Veteran Battalion, at Penn.. .. .	30	0	0			
Adding bath-rooms and necessaries to the Panwell travellers' bungalow .. .. .	561	7	5			
Erecting arm-racks and shelves to the staging pendalls at Panwell and Chowke .. .. .	323	3	7			
Petty repairs, &c. .. .. .	220	2	2			
Total buildings.....	.....			42,281	5	10
Grand Total, Company's Rupees Three Lacs, Sixty-one thousand, Eight hundred and Ninety-three, annas Four, and pies Four .....				3,01,893	4	4

W. D. GRAHAM, Brevet Captain,  
Superintendent of Roads and Tanks.



*Statement showing the Amount expended by each Officer of the Road and Tank Department, from the 1st May 1850 to the 30th April 1851.*

Names of Officers.	Roads and Bridges.		Tanks, Wells, and Bunds.		Buildings.		Total.	
	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.
Captain V. A. Cowper .....	46,695	7 11	182 14	1	10,000	2 4	56,878	8 4
Mr. Sub-Conductor T. P. Armitstead .....	51,361	11 1	170 7	7	6,721	9 3	58,253	11 11
Lieutenant J. E. Donne .....	4,382	11 10	.....	.....	.....	.....	4,382	11 10
Captain R. Dennis .....	22,001	11 5	.....	.....	.....	.....	22,001	11 5
Lieutenant W. Chapman .....	56,035	15 7	1,563	4 2	6,004	11 10	63,603	15 7
Lieutenant C. Scott .....	74,095	14 6	5,890	10 3	940	13 5	80,927	6 2
Lieutenant J. S. Trevor .....	2,601	12 3	.....	.....	699	7 8	3,301	3 11
Mr. Scott .....	32,372	13 6	248 11	7	13,434	8 4	46,050	1 5
Lieutenant J. A. Fuller .....	20,011	5 2	1,996	7 7	4,480	1 0	26,487	13 9
	3,09,559	7 3	10,052	7 3	42,281	5 10	3,61,893	4 4

W. D. GRAHAM, Brevet Captain,  
Superintendent of Roads and Tanks.

*Statement showing the Expenses of Engineering Superintendence, with reference to actual Outlays.*

Names of Officers.	Expense of Es- tablishment per Annum.	Expenditure.	Rate per cent.
	Rupees.	Rupees.	Rupees.
Captain T. A. Cowper .....	9,393	56,878	10½
Mr. Sub-Conductor T. P. Armitstead .....	5,409	58,253	9½
Lieutenant J. E. Donne .....	1,167	4,382	26½
Lieutenant W. Chapman .....	10,282	68,603	16
Lieutenant C. Scott .....	11,882	80,927	14½
Lieutenant J. S. Trevor .....	7,376	3,301	223½
Captain R. Dennis .....	7,675	22,001	34½
Mr. Scott .....	10,019	40,056	21½
Lieutenant J. A. Fuller .....	8,454	26,487	31½

Total Expenditure during the year .....	Rupees	3,01,803
Cost of Establishment do. ....		71,627
Average rate per cent .....	”	19½

NOTE.—Captain Dennis is Postmaster as well as in Charge of the Nagpore dock line, and the allowances drawn by that Officer should not therefore be all debited to the Road and Tank Department, especially as his Engineering duties are confined to one line of works.

W. D. GRAHAM, Brevet Captain,  
Superintendent of Roads and Tanks.

*List of Estimates prepared by the Officers of the Road and Tank Department, and submitted for sanction between the 1st May 1850 and the 30th April 1851.*

*Camp Singhur, 24th May 1852.*

Names.	Amount.	
	Rs.	a. p.
<i>Superintendent.</i>		
Estimate of the proposed alterations to the Bombay mail road between Khundallah and Wulwund.. .. .	65,382	0 0
<i>Captain Cowper.</i>		
Estimate for widening the Akoordee road from 20 to 25 feet, and constructing protection-mounds to the embanked approaches of the different bridges along the line .. .. .	8,938	0 0
Ditto for building bath-rooms, necessaries, and servants' room to Poona travellers' bungalow .. .. .	928	0 0
Ditto for deepening the quarry near Collector's Office at Poona.. .. .	1,716	0 0
Ditto for clearing out the aqueduct which conveys water from the Katruz tank .. .. .	3,364	0 0
Ditto for constructing two single, and two double drains, on the Singhur and Murrah Ghaut road.. .. .	650	0 0
Ditto ditto four single drains of 25 feet span, on the Nimbadora Ghaut .. .. .	2,650	0 0
<i>Mr. Armitstead.</i>		
Estimate for constructing a new line of road from Poona, viâ the Deweh Ghaut, to Jeejoorie, with a branch to Sassoor .. .. .	1,57,440	0 0
Ditto for erecting standards at the Kurra rivor.. .. .	223	0 0
Ditto for constructing a new line of road between Jamsetjee bund and Waghoolee .. .. .	35,300	0 0
Ditto for constructing a branch road between Jamsetjee bund and the Cantonment of Poona .. .. .	4,785	0 0
Ditto ditto ditto and Ghorpurree.. .. .	5,100	0 0
Ditto ditto Military ditto and Kirkee.. .. .	6,653	0 0
Ditto ditto ditto and Waghoolee, to join Bombay road .. .. .	5,050	0 0
Ditto for building cross-drains over five dips between St. Mary's Church at Poona, and the Wanowree bridge .. .. .	1,982	0 0
Ditto for widening the approaches to the Wanowree bridge, and adding stone railing.. .. .	522	0 0
Carried forward, Rs.	3,00,083	0 0

Names.	Amount.	
	<i>Rs.</i>	<i>a. p.</i>
Brought forward, Rs.	3,00,683	0 0
Estimate for providing furniture, visitors' books, and peons' belts, for six travellers' bungalows on the Sholapore road .. .. .	580	0 0
Ditto for constructing a bridge over a rivulet near Daluj, on the Patas and Indapore road.. ..	25,037	0 0
<i>Captain R. Dennis.</i>		
Estimate for new works, for the purpose of building masonry, wooden, and flying bridges, on the Nagpore dawk line .. .. .	4,419	0 0
Ditto for clearing a fair-weather road between the Godavery and the Wurda rivers, on the Nagpore dawk line .. .. .	12,250	0 0
Ditto for new masonry, wooden, and flying bridges on the Nagpore dawk line. .. .. .	5,925	0 0
<i>Lieutenant Chapman.</i>		
Estimate for making rollers for the road repairs .. .. .	800	0 0
Ditto for two bridges at nullahs Nos. 20 and 21, on the main road between Nassick and Thull Ghaut.. .. .	4,087	0 0
Ditto for sinking a well near the toll house on the Thull Ghaut new road .. .. .	1,106	0 0
Ditto for erecting a Post Office at Nassick .. .. .	1,097	0 0
Ditto for constructing a ford with approaches near the site of new flying bridge at Nassick .. .. .	2,387	0 0
Ditto for building a bridge over the Undwell river .. .. .	16,445	0 0
Ditto for carrying out certain improvements between the Undwell river and Manickhamb, on the great Agra road. .. .. .	25,956	0 0
Ditto for building a travellers' bungalow at Egutpoorah.. .. .	5,320	0 0
Ditto for connecting the old road on either side of the Undwell river .. .. .	903	0 0
Rough estimate for completing the portion of the Agra road between the Thull Ghaut and Nassick...	3,09,112	0 0
<i>Lieutenant Scott.</i>		
Supplementary estimate for completing the dam across the Kurtoonda river .. .. .	2,640	0 0
Estimate for the 3rd division of the road between Kussarah and Khurdee .. .. .	1,73,755	0 0
Ditto for improving the portion of the old road between Kussarah and Khurdee, denominated the portion of the 2nd and 3rd divisions .. .. .	8,264	0 0
Carried forward, Rs.	9,00,766	0 0

Names.	Amount.	
	<i>Rs.</i>	<i>a. p.</i>
Brought forward, Rs.	9,00,706	0 0
Estimate for repairing the portion of the road from termination of 3rd division between Kussarah and Khurdeo ..	2,278	0 0
<i>Lieutenant Trevor.</i>		
Rough estimate for improving the portion of the Agra road from Shahpore to Colsette ferry .. .. .	2,04,033	0 0
<i>Mr. Scott.</i>		
Estimate for increasing the water-ways of the Sankey, Goregaum, and Dhysur bridges .. .. .	2,826	0 0
Ditto for repairing the horse-boat between Ghorebunder and Bassein. .. .. .	650	0 0
Ditto for building lines for the several parties of Police employed in the Island of Salsette .. .. .	1,520	0 0
Ditto for building a raft for the Colsette ferry .. .. .	1,300	0 0
Ditto for building a horse-boat for the ferry between Ghorebunder and Bassein. .. .. .	1,499	0 0
Ditto for thoroughly repairing the sluice-gates at Aggasee .. .. .	111	0 0
Ditto for repairing horse-boat at Colsette ferry .. .. .	583	0 0
Ditto for building privy with a covered passage to the Military Hospital at Tanna .. .. .	938	0 0
Ditto for repairing the Cooley bridge at Maloondee, in the Mahal of Bassein .. .. .	1,622	0 0
Supplementary estimate for repairing the ferry-boat at Dhanoo. .. .. .	126	0 0
Ditto ditto ditto at Oomergaum .. .. .	145	0 0
Ditto ditto of taking up and relaying the pavement of the ramp at Colsette .. .. .	2,348	0 0
Ditto ditto of building a necessary for the Custom House at Tanna .. .. .	278	0 0
Estimate for taking up, and relaying the pavement of the ramp of the Colsette bunder at Tanna .. .. .	1,621	0 0
Ditto for repairing the raft at Colsette ferry .. .. .	634	0 0
<i>Lieutenant Fuller.</i>		
Estimate for constructing new lines for the Sepoys of the Native Veteran Battalion on treasure guard at Ponn .. .. .	370	0 0
Ditto for building a travellers' bungalow and out-houses at Mhar .. .. .	4,498	0 0
Ditto ditto ditto at Nagotna .. .. .	4,393	0 0
Carried forward, Rs.	11,32,539	0 0

Names.	Amount.
	<i>Rs. a. p.</i>
Brought forward, Rs.	11,32,539 0 0
Estimate for raising the extra plinth to out-houses at at Nagotna .. .. .	343 0 0
Supplementary estimate for the construction of bath-rooms and necessaries to the travellers' bungalow at Panwell .. .. .	91 0 0
Estimate for constructing a new bunder at Nagotna ..	6,266 0 0
Ditto ditto a branch road leading from the main road to the new travellers' bungalow at Nagotna .. .. .	1,232 0 0
Ditto for repairing the out-houses of the travellers' bungalow at Indapore, on the Mahableshtar road .. .. .	400 0 0
Ditto for constructing a ramp at the end of the Panwell bunder .. .. .	897 0 0
Ditto for repairing the out-houses of the travellers' bungalows at Panwell and Chowke .. .. .	478 0 0
Ditto for constructing a dam with sluices over the creek near the village of Wansee .. .. .	7,759 0 0
Ditto for putting up the ceilings to the travellers' bungalows at Panwell and Chowke .. .. .	226 0 0
Ditto for annual repairs to roads and bridges for the year 1851-52 .. .. .	1,36,280 0 0
Ditto for annual repairs to travellers' bungalows, Dhurrumsallas, and buildings in the General, Military, Judicial, Territorial, and Ecclesi- astical Departments, for the year 1851-52. ..	6,642 0 0
Grand Total, Company's Rupees....	12,93,153 0 0

W. D. GRAHAM, Brevet Captain,  
Superintendent of Roads and Tanks.

THE  
BOMBAY ENGINEERS' REPORT

FOR THE  
OFFICIAL YEAR 1851-52.

COMPRISING

REPORTS FROM LIEUTENANT COLONEL WALTER SCOTT; MAJOR  
H. B. TURNER; CAPTAINS J. J. F. CRUICKSHANK, C. W.  
TREMENEERE, W. S. SUART, B. R. POWELL, T. L.  
JAMESON, AND W. D. GRAHAM; LIEUTENANTS  
M. K. KENNEDY, W. R. DICKINSON, C. NASMYTH,  
R. LAURIE, AND J. G. FIFE; AND  
MR. T. P. ARMITSTEAD.



**Bombay:**

PRINTED AT THE  
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1853.





ABSTRACT STATEMENT OF THE EXPENDITURE  
IN THE  
GARRISON ENGINEER AND CIVIL ARCHITECT'S  
DEPARTMENT,

FOR THE YEAR 1851-52.

*Bombay, 1st May 1852.*

Names of Works.	Total.
<i>Rs. a. p.</i>	
<b>GENERAL DEPARTMENT.</b>	
Annual repairs to the buildings in the General Department, for 1851-52 .. ..	Rs. 10,771 9 1
Petty repairs to the buildings in the General Department .. ..	6,666 10 2
	17,438 3 3
Other works .. ..	20,190 1 5
<i>Including—</i>	
Alterations required to adapt the present quarters of the Medical Officer in charge of the Lunatic Asylum at Colaba for the reception of lunatics .. ..	4,888 14 4
Reservoirs on the Esplanade .. ..	2,401 0 0
Deepening the Phansees tank on the Esplanade .. ..	1,068 0 0
Alterations to the Jansetjee Jejeebhoy Hospital .. ..	2,645 9 6
Draining the Caves at Elephanta .. ..	808 0 0
Making improvements and alterations to the Lunatic Asylum at Colaba .. ..	3,500 0 0
	15,460 5 9
<i>Including—</i>	
Construction of new wells on the Esplanade, at the expense of Ramlall Thacoorsy-dass, Esq. .. ..	13,686 5 9
<b>JUDICIAL DEPARTMENT.</b>	
Annual repairs to the buildings in the Judicial Department, for 1851-52 .. ..	Rs. 1,065 8 0
Carried forward, Rupees	1,065 8 0, 53,028 10 5

Names of Works.	Total.
	<i>Rs. a. p.</i>
Brought forward, Rupees	1,065 8 0
	53,023 10 5
Petty repairs to the buildings in the Judicial Department .. .. .	1,598 8 0
	2,664 0 0
Other works .. .. .	2,478 0 9
New buildings .. .. .	1,468 0 0
<b>TERRITORIAL DEPARTMENT.</b>	
Annual repairs to the buildings in the Territorial Department, for 1851-52 .. .. .	Rs. 1,327 0 0
Petty repairs to the buildings in the Territorial Department .. .. .	250 4 3
	1,577 4 3
Other works .. .. .	402 0 0
<b>ECCLESIASTICAL DEPARTMENT.</b>	
Annual repairs to the buildings in the Ecclesiastical Department, for 1851-52. .. .. .	Rs. 286 0 0
Petty repairs to the buildings in the Ecclesiastical Department .. .. .	578 5 0
	864 5 0
Other works .. .. .	979 0 0
New buildings .. .. .	352 0 0
<b>MARINE DEPARTMENT.</b>	
Annual repairs to the buildings in the Marine Department, for 1851-52 .. .. .	Rs. 1,046 0 0
Petty repairs to the buildings in the Marine Department .. .. .	1,465 1 8
	3,411 1 8
Other works .. .. .	289 0 0
<b>MILITARY DEPARTMENT.</b>	
Annual repairs to the public buildings occupied by Troops, &c. in the Castle, Fort George Garrison, on the Esplanade, on Celaba, and at Outposts .. .. .	Rs. 25,110 6 0
Petty repairs to the public buildings occupied by Troops, &c. in the Castle, Fort	
Carried forward, Rupees	25,110 6 0
	67,513 6 1

Names of Works.	Total.	
	<i>Rs. a. p.</i>	
Brought forward, Rupees	25,410 6 0	67,543 6 4
George Garrison, on the Esplanade, on Colaba, and at Outposts .. .. .	10,029 5 4	
<u>Other works .. .. .</u>	<u>.. .. .</u>	35,199 11 4
Miscellaneous works .. .. .	.. .. .	82,258 8 4
<i>Including—</i>		12,533 15 4
Levelling the Esplanade, supplying water to the dhobees, annual repairs to the Dhobewada, &c., covering the rubbish with sand near the Colaba causeway, and expenses in collecting the fees, &c. .. .. .	7,550 12 6	
Total expenditure, rupees one lac, ninety-seven thousand, four hundred and forty-five, annas nine, and pie one .. .. .	1,97,445 0 1	

*Statement of the Sums expended by the Garrison Engineer and Civil Architect at the Presidency, from  
1st May 1851 to 30th April 1852.*

Names of Officers.	Annual and Petty Repairs.		Certain Works.		Buildings.		Expended from Esplanade Fund.		Expended for Artificers and Labourers engaged for, or returning from, Out-stations, &c.		Total.
	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	
Captain J. Estridge, Garrison Engineer and Civil Architect; Captain C. W. Tremehere, Officiating Garrison Engineer and Civil Architect; and Captain J. J. F. Cruickshank, Garrison Engineer and Civil Architect at the Presidency.	17,438	3 3	20,130	1 5	15,460	5 9	.....	.....	.....	.....	58,028 10 5
General Department .. .. .	2,864	0 0	2,478	0 9	1,468	0 0	.....	.....	.....	.....	6,610 0 9
Judicial ditto .. .. .	1,577	4 3	402	0 0	.....	.....	.....	.....	.....	.....	1,979 4 3
Territorial ditto .. .. .	864	5 0	979	0 0	352	0 0	.....	.....	.....	.....	2,195 5 0
Ecclesiastical ditto .. .. .	3,411	1 8	289	0 0	.....	.....	.....	.....	.....	.....	3,700 1 8
Marine ditto .. .. .	35,139	11 4	11,417	2 7	70,841	5 9	7,550	12 6	4,983	2 10	1,29,982 3 0
Military ditto .. .. .	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
<b>Grand Total</b>	<b>61,094</b>	<b>9 6</b>	<b>35,695</b>	<b>4 9</b>	<b>88,121</b>	<b>11 6</b>	<b>7,550</b>	<b>12 6</b>	<b>4,983</b>	<b>2 10</b>	<b>1,97,445 9 1</b>

J. J. F. CRUICKSHANK, Captain,  
Garrison Engineer and Civil Architect at the Presidency.

## MARINE DEPARTMENT.

*Statement showing the Actual Expenditure upon Works carried on under the Engineer to the Dockyard, during the Official Year from 1st May 1851 to 30th April 1852.*

*Bombay, Dockyard Engineer's Office, 1st May 1852.*

Names of Works.	Total.
	<i>Rs. a. p.</i>
New works.. .. .	57,570 9 5
<i>Including—</i>	
Construction of a portion of the work connected with the proposed Basin and Breakwater .. 22,045 4 0	
Repairs to the fortifications and buildings .. .. .	6,997 5 2
Emergent works executed .. .. .	421 11 4
Total.. Rupees	64,989 9 11

*Comparative Statement of Expenditure and Establishment in the Marine Department under the Engineer to the Dockyard, from 1st May 1851 to 30th April 1852.*

*Bombay, Dockyard Engineer's Office, 30th October 1852.*

Staff salary .. .. .	Rs. 7,200 0 0
Regimental allowances, less net pay .. .. .	3,523 8 0
Permanent establishment .. .. .	2,849 14 11
	<u>13,573 6 11</u>
Other expenditure .. .. .	64,989 9 11
Gross expenditure .. .. .	<u>78,553 0 10</u>
Per-centage of staff salary and establishment, less net pay, on gross expenditure .. .. .	<u>17,278 0 0</u>

C. W. TREMENHEERE,  
Engineer to the Dockyard.

No. 81 OF 1853.

MILITARY DEPARTMENT.

To the SECRETARY TO THE MILITARY BOARD,

Bombay.

*Commanding Engineer's Office, Aden, 12th February 1853.*

SIR,

I have the honor to send tracings of the drawbridges over the ditch of the Isthmus line of works, as requested by the Military Board, for publication in the Bombay Engineers' Report for the year 1851-1852, should there be no objection thereto.

2. The drawbridge was designed by Colonel Waddington, C. B. It was found, however, necessary to make the escarp from the bridge to the top of the parapet perpendicular, instead of with a batter of 1 in 8, as originally designed, and as in the rest of the escarp. An iron axle turning in brass plummer blocks has also been added; the wooden gudgeons first made having too much friction to turn in the stone beds cut for them.

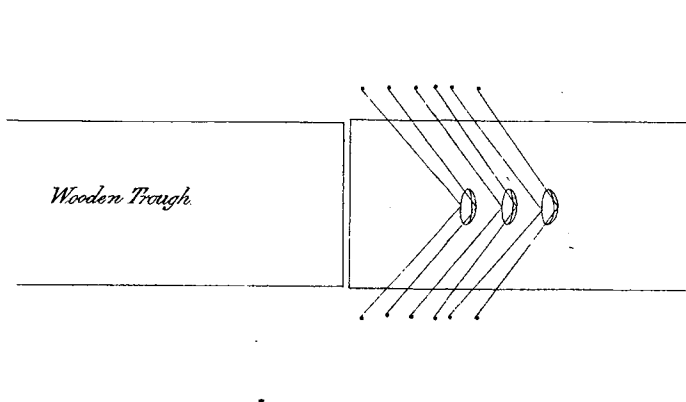
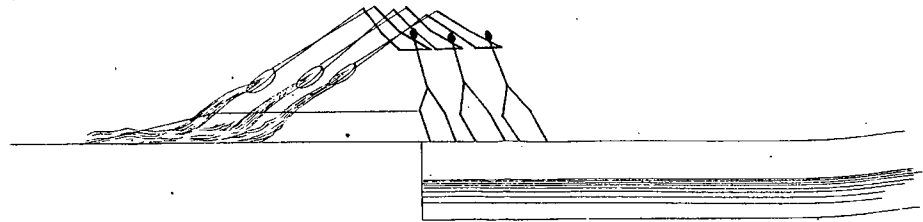
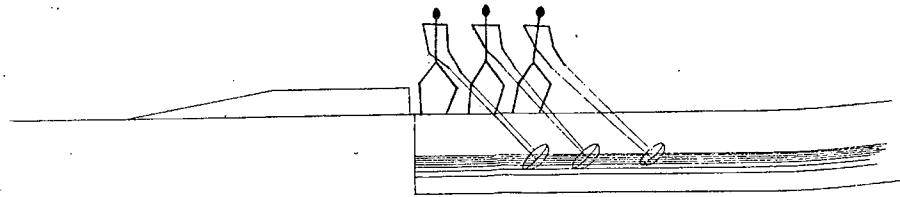
3. The escarp was made perpendicular, because it was found, in raising the bridge, that after passing the centre it fell against the wall with a shock that was felt sensibly by a person standing on the banquette; and because great difficulty, amounting almost to an impossibility, was experienced in pushing the bridge back over its centre, when it was required to be lowered.

4. The bridge under Jibbel Hudeed, which was originally fitted with an iron axle, now that the wall is perpendicular, can be raised and lowered with facility: the weight of the two counterpoise rollers is 2,800 lbs.; the gudgeons of the iron axle are 3 inches in diameter.

5. The level of the bridge being 9 feet above that of



*Sketch showing the Method of bailing water from the foundations of the Work in progress at Aden.*

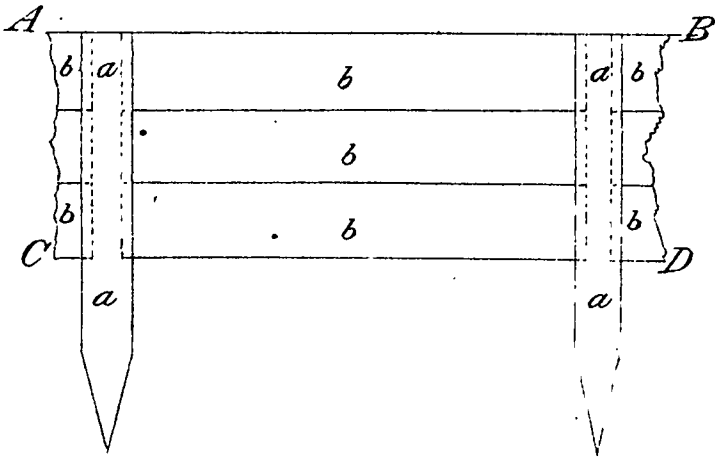


*Foundation to be drained*

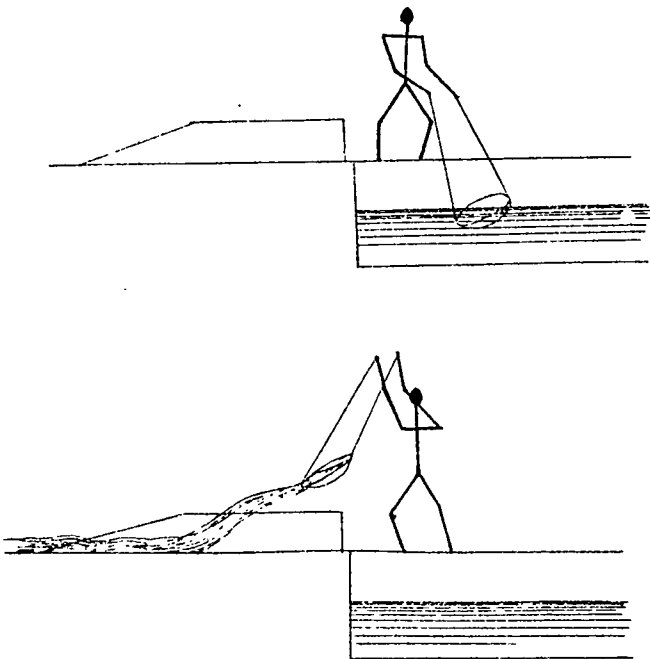




*Sketch 1.*



*Sketch 2.*



the ground at the Isthmus, the long passage leading to it, shown in the plan as within the mass of rampart, was necessary, that the road to it should be of a moderate slope.

6. The section also shows the section of the ditch as made throughout the Isthmus line of works, with the invert arch and beton foundation. The level of the water under the Isthmus is also the level of the bottom of the ditch; the invert and beton are always under water, and the sand forming the Isthmus being in some places very soft and fine, it was found necessary, therefore, in carrying out the work, to retain the sides of the excavation with piles and planks, as in Sketch 1, in which *a a* are the piles; *b b b* the planks between them, fitting into grooves in the piles; *A B* the surface of the water or level of bottom of ditch; *C D* the bottom of the excavation: the piling was only used at the sides, the beton and invert being made in bays, separated by a masonry wall built on the beton, across the line of the ditch. The method adopted (Sketch 2) to bale out the water was with baskets lined with leather, to which four strings were attached, when two men, one on each side of a trench running out from the side of the excavation, and cut on purpose, lifted the water into a wooden trough, from which it was conveyed away in a channel, and allowed to sink in the sand: three pairs of men, with practice, could stand side by side, and bale with baskets, delivering the water into the same troughs. I have shown in a sketch on the annexed sheet the trough and trench, being supposed in section. This method of baling was found more economical than any other, and very successful and expeditious: as many men as were necessary could be employed at the same time; and when the excavation was too deep for one lift, which it was under the hills, the water was lifted twice, by another set of men working above, and at a little distance from the other.

7. The pile-driving machines are two in number, on four wheels, running on sleepers with edge rails fixed along them. The sleepers, four in number for each engine, were laid on

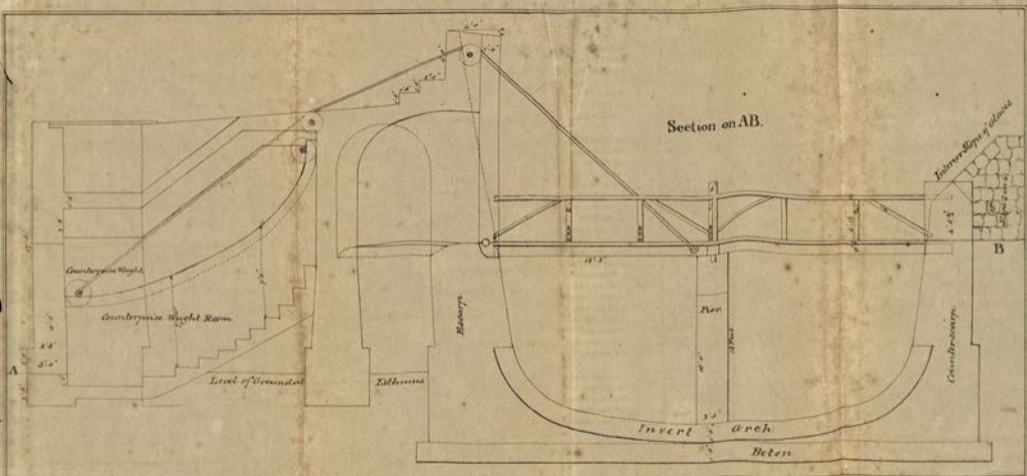
either side of the proposed line of piling, so that the machine could readily advance along it (the sleepers passed over being carried to the front); the machine had trunks, into which the pile to be driven was put, under the monkey, which last worked in the trunk, and was moved by a rope over a pulley, the use of the trunk being as a guide for the monkey (a piece of iron ship's ballast); and to prevent the pile twisting. The whole apparatus answered very well.

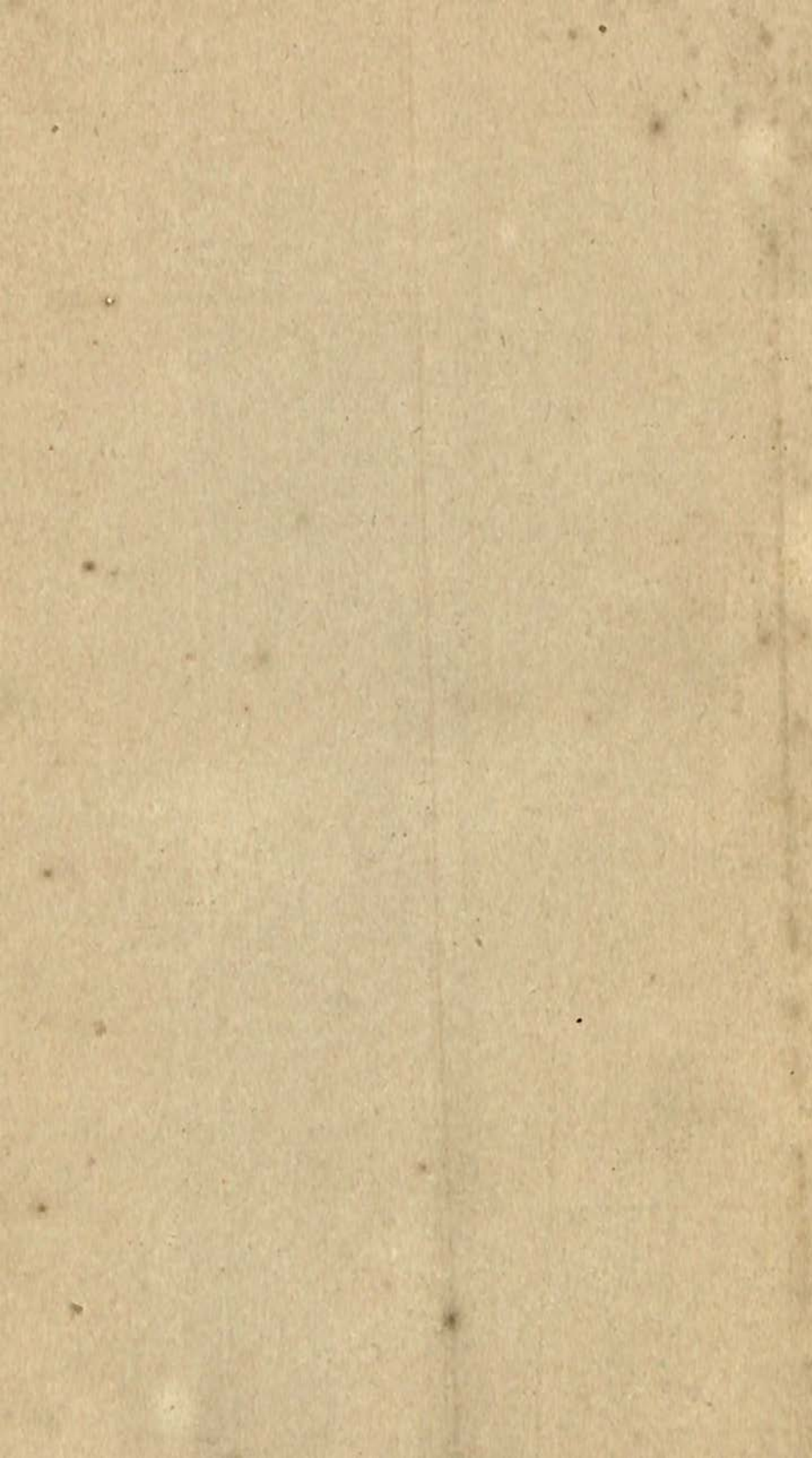
8. The invert arch, in experiments now in progress, has proved a most formidable auxiliary for the defence of the ditch—cannister fired along it, with low charges, and at a low elevation, from an 8-inch short 50 cwt. gun, recocheting along the ditch in every direction. Had there been no invert, nine-tenths of the shot would have been buried in the sandy bottom of the ditch, and, therefore, without the invert, it would have been difficult to have effectually flanked the ditch; as large charges sufficient to carry the cannister to the salients without grazing cannot be used without great injury to the masonry, and much elevation cannot be given, as the cannister shot would spread over the parapet: as it is, the fire from the 8-inch gun with cannister shot is most formidable, sweeping the ditch from 40 yards from the muzzle of the gun in a very effective manner. Within forty yards the grape passes as a ball, but this ground is defended by numerous loop-holes in the parapets of the retired flank gorge wall of bastions, and of curtains; and in the right redan and demi-bastions 20 feet of this 40 yards is occupied by a cunette ditch, that effectually prevents the embrasures from being entered.

9. I also annex two tracings of loop-holes as made in the gateway redan, and on Jibbel Hudeed; the parapet being perpendicular in the former, but having exteriorly a batter of 1 in 8 in the latter. The plans and estimate of their cost were made by Colonel Waddington, C. B., when Commanding Engineer.

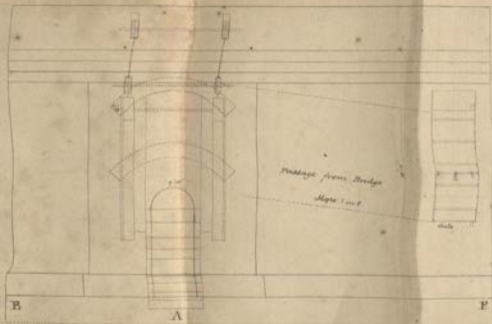
10. The tracings show everything connected with the

Section on AB.

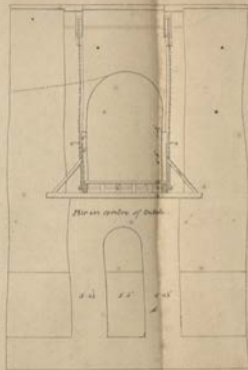




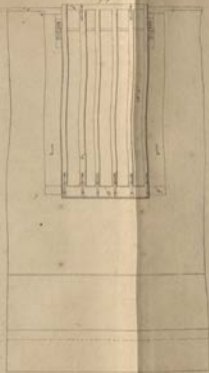
Elevation in rear of Rampart BAE.



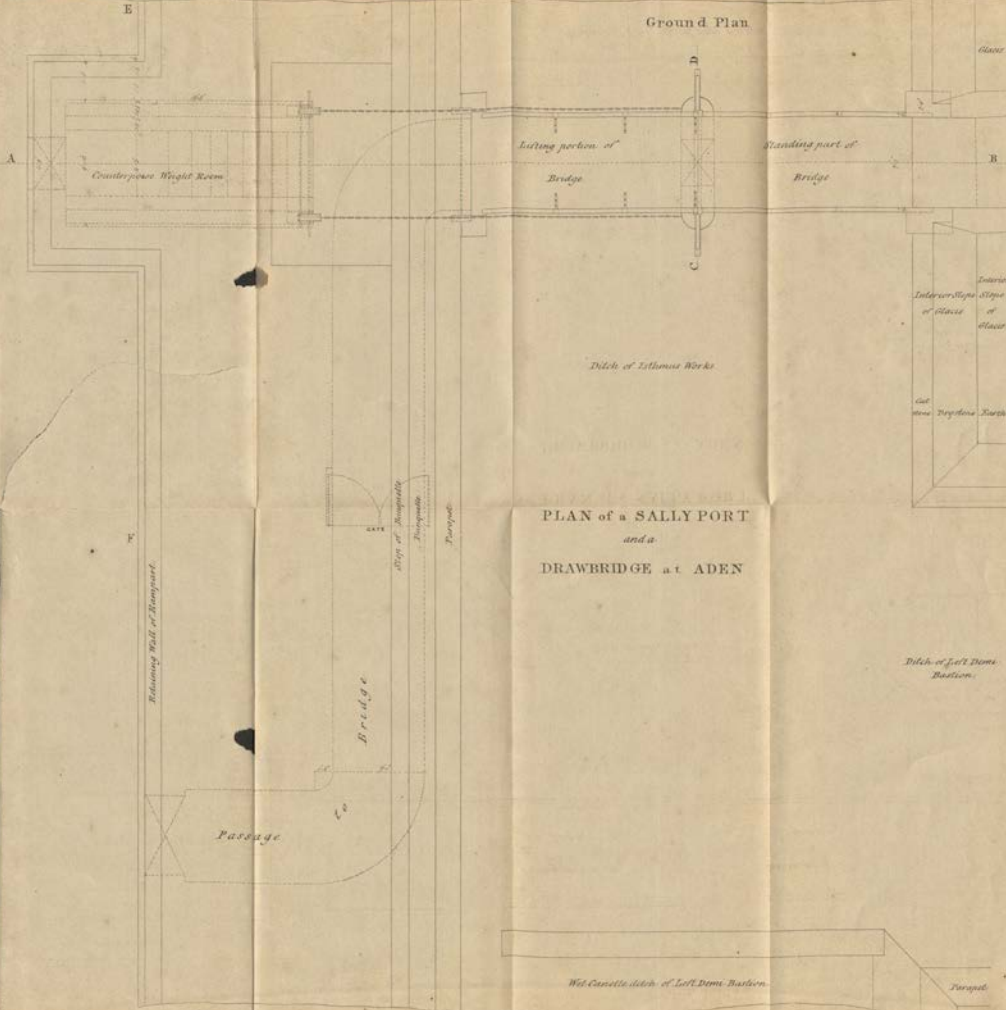
Section on CD with Elevation of Onteway.



Elevation of Gateway with Drawbridge raised.



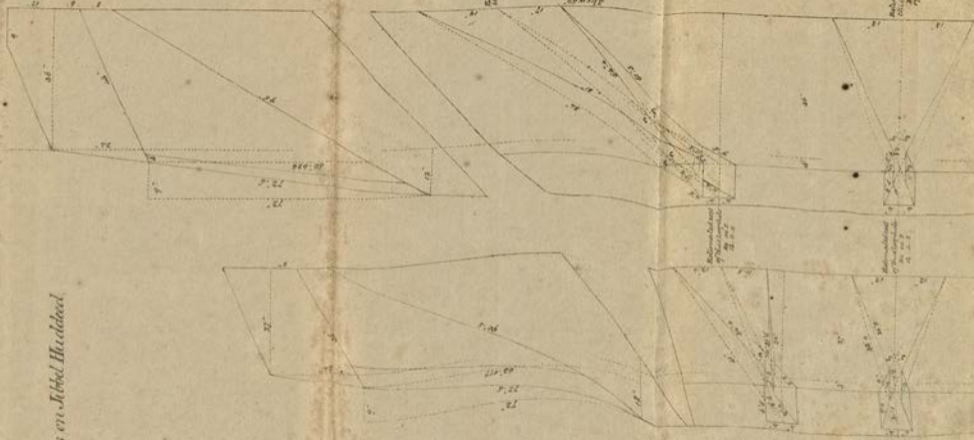
Ground Plan



PLAN of a SALLY PORT  
and a  
DRAWBRIDGE at ADEN



*Leopoldes en Sibbel Huddedeel.*



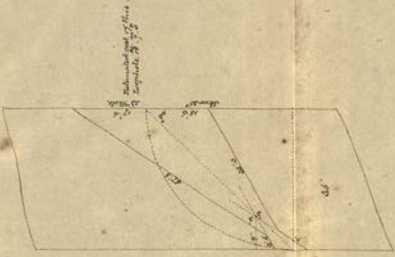
Metmaat van  
de  
22 22 22

Metmaat van de  
22 22 22

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*Isophotes of Right Redden.*

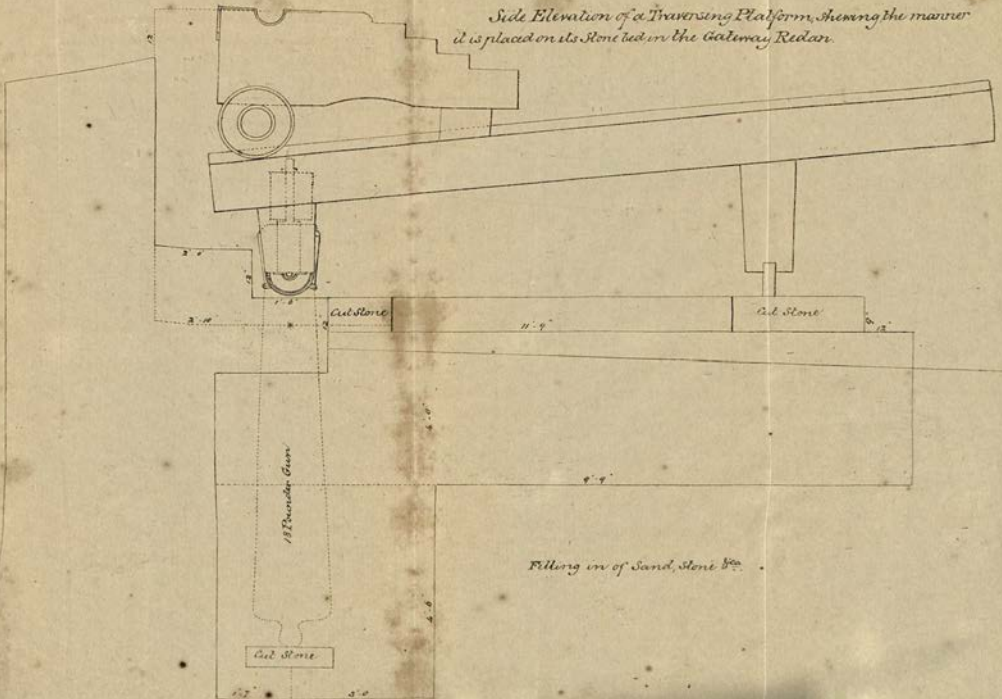


Subsidiary part of  
Isophotes 25 27 28

Subsidiary part of  
Isophotes 25 27 28

Subsidiary part of  
Isophotes 25 27 28

Side Elevation of a Traversing Platform, showing the manner  
it is placed on its Stone bed in the Gateway Redan.







loop-holes very clearly, and it is only necessary here to draw attention to the much greater complexity of construction in loop-holes of nearly similar external openings in a wall with an external batter like that of Jibbel Hudéed, especially when the loop-holes are askew.

11. I also annex a side elevation of a traversing platform, with a plan of its stone bed, showing the manner it is placed on the bed in the gateway redan.

12. The iron racers are screwed to the stone beds, holes being made at the necessary intervals in the stones, and filled with lead to hold the screws.

I have the honor to be,

Sir,

Your most obedient Servant,

W. S. SUART, Captain,

Commanding Engineer, Aden.

*Notes extracted from a Memorandum by Lieutenant J. C. ANDERSON, of the Madras Engineers, of the formation of the Tunnel through the Hill of Ras-el-Girreff, at Aden.*

The tunnel through Ras-el-Girreff was commenced on the 10th June 1845; from which date until the 15th August, a party of Madras sappers and miners was employed in scarping the side of the hill on the *left*, or north-west end, for the purpose of getting a clear face for the entrance. The driftway was commenced on the 15th August 1845. The work at the right or south-east was not commenced until some time afterwards. The date on which the scarping at the side of the hill was commenced cannot be ascertained, but the driftway was not opened until the 1st August 1846. From the 12th August to the 12th September 1846 no progress was made on either side, as the men were required for military duty in camp; but, with the exception of this delay, the driftways were pushed forward without interruption from the dates of commencement, viz. 15th August 1845, and 1st August 1846, until the 23rd of June 1847, on which date an opening was formed, by the two working parties meeting at the distance of 232 feet from the *left* entrance, and 163 feet from the right. The rock in the right portion of the tunnel was generally of a much softer description than that in the left, and the progress was of course proportionally greater. In the *left* tunnel the length of driftway excavated from the 15th August 1845, the date of commencement, to the 1st May 1846, 9½ months, was 109½ feet, or at an average of 11½ feet of progress per month.

In the right tunnel, during the first 9 months, the driftway was excavated to the length of 150 feet, or at the average rate of 16½ feet per month.

In the tunnel through Ras-el-Girreff the workmen had to wait a long time, after the mines were fired, before the smoke cleared away sufficiently to enable them to re-enter the shaft, and continue the work. This evil could have been obviated, in a great measure, if there had been a ventilating apparatus.

The number of privates, sappers and miners, employed in the preliminary scarping of the left tunnel, was 2,329.

The number of pounds of powder expended was 1,074.

The preliminary scarping and excavation in the right tunnel was executed by miners and biggaries : the exact number of men cannot be ascertained, nor can the expenditure of powder, but as the soil was of a very soft description, it is not probable that it exceeded 1,000 lbs.

29,144 privates, sappers and miners, were employed in excavating the tunnel, the content of which is 56,293 cubic feet (not allowing for irregularities), and 14,020 lbs. of powder (as near as can be ascertained) were expended; consequently, the average amount excavated by each man was nearly, but not quite, 2 cubic feet; and 4 cubic feet was the amount excavated for every pound of powder expended.

For dressing off the sides of the tunnel with hammers and chisels, 194 bildars, 463 stone-cutters, and 812 privates of sappers, or in all 1,469 men, were employed in dressing a surface of  $32 \times 393 = 12,576$  square feet, which gives an average per man of 8 $\frac{7}{8}$  square feet.

The expense of excavating the tunnel was very much greater in proportion than the preliminary scarping; as, from the driftway being so confined, a large quantity of powder is required to produce small effects; for, if the rock be hard, it is impossible to bore holes of greater depth than from 1 to 1 $\frac{1}{2}$  feet; and the resistance offered by the tamping is so slight, that the charges in many instances have to be repeated several times before any effect can be produced. A great quantity of powder was expended in removing the projecting portions of rock from the sides, floors, and roof of the tunnel: when this could not be effected with hammers, chisels, &c., small charges were applied; but from their being so very numerous, the expenditure of powder, as well as labour, in this operation, formed a considerable item; also the conveying of the soil from the interior of the tunnel was a laborious operation.

The excavation of the driftway was the most tedious por-



tion of the work, but it formed comparatively a small item of the expense, the quantity of soil excavated in forming it being about one-tenth of the whole cubical content of the tunnel. It would have been desirable to have had the tunnel cleared out to its full size, nearly simultaneously with the driftway, or at all events to within a few feet of its inner end. Only a small party was at work for many months after the commencement of the tunnel, the consequence of which was that the progress in clearing the tunnel was not commensurate with the advance of the driftway; and although a larger working party was afterwards employed, they were not able to keep up with the men in the driftway. The evils resulting from a great length of driftway are excessive heat, and the delay caused when the mines are fired, a considerable time elapsing before the smoke clears away.

*Note of the Expense of the Tunnel, by Captain W. S. SUART.*

From the longitudinal section it will be seen that the driftway of the tunnel was not carried out horizontal (I believe at first it was intended that the road should slope from the centre outwards); that the tunnel is higher in the centre than was intended; and that more rock had consequently been excavated than was necessary.

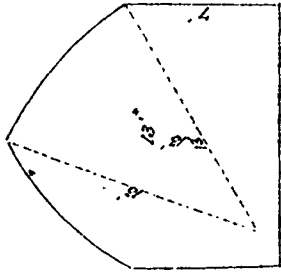
The expense of the tunnel, as shown in the books of the Executive Engineer's Office, was Rs. 7,526; but this sum is exclusive of the value of the labour of the sappers and miners; but includes the value of the powder, which, as 16,094 lbs. were used, will, at 5 annas per lb., be . . . . . Rs. 5,029 6

And the pay of the workmen belonging to the Executive Engineer's Department, with the value of the cotton thread, baskets, coal, steel, drinking water on the works for the sappers, in fact everything paid for by the Executive Engineer . . . . .

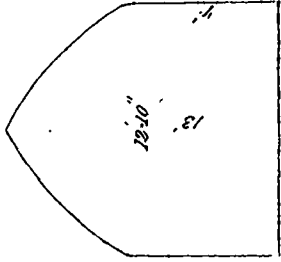
	2,496 10
	Rs. 7,526 0



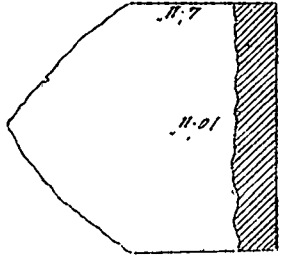
Scale 10 Feet to an Inch.



entrance complete



89 feet from entrance

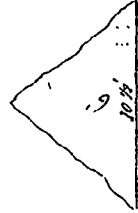


100'8" from entrance

Cross Sections of Tunnel from N.W.



110'8" from entrance



116'8" from entrance



121'8" from entrance



at 130' from entrance



at 135'-8" from entrance



at 140' 1" from entrance

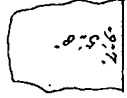
### Cross Sections of Tunnel from S.E.



entrance



at 153' from entrance.



at 20 feet from entrance



at 89 feet from entrance

These Sections taken 11<sup>th</sup> November 1826.

Drift way at N.W. commenced 15<sup>th</sup> August 1825.

D<sup>g</sup> at S.E. 1<sup>st</sup> August 1826.

The Tunnel altogether completed in 1827.

Fig. No. 1 is also the Section of the Tunnel as originally designed by the Special Committee, I. Col<sup>l</sup> Grant of the Eng<sup>rs</sup>, & I. Col<sup>l</sup> Jacob of the Artillery.



To the above must be added—

The working pay* for 31,473 sappers and miners, at Rs. 7-8-8 per 100 .....	Rs. 2,374 0
And the pay and allowances,† also for the same number, at Rs. 53-9-4 per 100....	16,864 0
The total cost of the tunnel may therefore be considered to have been .....	Rs. 26,764 0

W. S. SUART, Captain,  
Commanding Engineer, Aden.

\* The working pay to the sappers is of course part of the cost of the tunnel, and a rate per day for it has been thus formed :—

1 Subedar, 5 annas .....	Rs. 0 5 0
1 Jemadar, 4 annas .....	0 4 0
4 Havildars, 2 annas each .....	0 8 0
8 Naiques, 1½ ditto .....	0 12 0
100 Privates, 11 pies each .....	5 11 8

Cost of working pay per 100 privates, sappers and miners .... Rs. 7 8 8

† It may be a question (as the sappers only work just three-fourths of the time of the labourers of the department) whether the full pay of the native commissioned and non-commissioned officers, or even of the privates, should be charged to the work, leaving nothing to pay for the soldier. I have, however, considered, that as soldiers with very efficient supervision, they should in 7½ hours do as much as workmen in 10 hours; and in the rate used above have taken all the pay, but for only the number of privates absolutely present, and the proportion of native commissioned and non-commissioned due to that number; leaving the Sundays, holidays, the men on guard, &c. to be charged to the Military department. The details of the rate will thus be for a month of 30 days :—

No.		Pay.		Batta.		Value of Rations.			Total Pay to each.			Total.					
		Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.	
1	Subedar .....	42	0	0	15	0	0	3	6	3	58	6	3	58	6	3	
1	Jemadar .....	24	8	0	7	8	0	3	6	3	35	6	3	35	6	3	
4	Havildars .....	14	0	0	5	0	0	3	6	3	22	6	3	89	9	0	
6	Naiques .....	12	0	0	5	0	0	3	6	3	20	6	3	163	2	0	
100	Privates .....	8	0	0	1	8	0	3	6	3	12	14	9	1209	4	4	
1	Smith* .....	10	0	0	3	8	0	2	6	9	15	14	9	15	14	9	
1	Hammerman .....	7	8	0	3	0	0	2	6	9	12	14	9	12	14	9	
1	Bellows Boy .....	2	8	0	3	0	0	2	6	9	7	14	9	7	14	9	
Pay, &c. for a month of 30 days .....												1592	8	1			
Pay, &c. for a single day .....												53	1	4			
Add water supplied to sappers in their lines.....*												0	8	0			
The total expense per day of a working party of sappers of 100 privates, with their superintending native officer, &c.												53	9	4			

\* No carpenters' work in tunnel.

No. 222 OF 1853.

## MILITARY DEPARTMENT.

To the COMMANDING ENGINEER,

Aden.

*Executive Engineer's Office, Aden, 24th March 1853.*

SIR,

I have the honor to acknowledge the receipt of your Memorandum No. 3, of 3rd January last, transmitting copy of Military Board's letter No. 12565 of 1852; and with reference to the latter, I propose briefly to notice the subject of blasting to form the scarp of the defensive position now in progress of construction here.

2. I fear, however, that any details I am able to afford will not be of any very general interest; for it must be borne in mind, that excavation by blasting, as practised here, has not for its sole object the detaching of the largest quantity of material, as in the case of quarrying for stone, but the cutting away of the hill side to a constant and regular figure: rates, therefore, obtained from the work under notice, must be expected to be higher than those that would probably be found sufficient for removing rock in a quarry for building or other purposes.

3. The line, I must premise, runs along the crest of a steep range of hills, and the scarp is excavated to a uniform height of 30 feet, and to a batter of 1 in 8, the side of the hill having an average angle of depression of about 35 degrees; the mass to be removed has, consequently, an average section in the form of a 49 degree sector of a circle of 30 feet radius; and in cutting away the rock to such a figure it is apparent that the same attention to the positions of the blast, the lines of least resistance, depths of the hole, &c. as would be practicable and indispensable in a quarry, cannot be given. But though the rates obtained from the work are, perhaps, higher than would

be necessary, were the removal of a given quantity of material alone the object, yet really valuable data as to tasking miners is available.

4. The miners work either singly or in pairs, with the single or double bar—the former weighing from 30 to 36 lbs., with a cutting edge of about  $2\frac{1}{2}$  to 2 inches, and a length of about 6 or  $6\frac{1}{2}$  feet; the latter weighing from 20 to 25 lbs., with a cutting edge of about  $1\frac{1}{2}$  to  $1\frac{1}{4}$  inch, and a length of about  $4\frac{3}{4}$  to 5 feet. The double bar is the tool in most general use, the single bar being only necessary for trimming off the face of the excavation, and for removing projections and small masses of stone, in situations where it would be inconvenient to employ the larger tool.

5. The positions for the blasts are selected by the Overseers, Maistries, and a class of higher paid miners called Butteewallas (or men who attend to the train and firing), but in a confined ditch-like excavation it is apparent that much attention to this point is not practicable, and that all that can be done is to place the blasts at regular intervals, and to endeavour so to fire them that the explosion of one line shall leave a favourable line of least resistance for those in the next row, or, in other words, to work as much as possible along an edge.

6. The miners are of different classes, and on different rates of pay, and are tasked in proportion; but, to prevent confusion, I shall only notice the first class, or Rs. 15 men, who would probably be considered in India as worth Rs. 10 per mensem. A pair of miners with a double bar will do from 8 to 24 running feet as a daily task, according to the nature and texture of the rock worked through, the working time being taken at ten hours per diem, and one man with a single bar will do half that quantity. Table No. 1 shows the tasks in different kinds of rock. The holes used have all been of the same average depth of between 3 and 4 feet, nothing under the former depth being admitted or counted in the day's work, except under special circumstances.



7. The waste of steel in repointing and tempering and sharpening the bars is about as follows for rock of an average degree of hardness :—for every 178 running feet of rock bored 1 lb. of steel will be expended.

8. The charge varies of course with the depth of the holes, and the nature of the rock in which they are bored. For the softer description of stuff, and those of a cellular cindery nature, in which cracks, hollows, &c. are numerous, as well as in seams and masses of volcanic indurated mud, which, though not exactly of the nature of rock, are still too tough and hard to be touched with the pick, a larger charge has been found necessary than is requisite in the more compact and harder kinds. In the first instance, the rate for calculating the quantity has been taken at 4 ozs. to the running foot, and this has been found to answer very well, all attempts to decrease the charge giving unfavourable results; for the harder rocks 2 to 2½ ozs. per running foot have been found sufficient: between these two quantities, viz. 2 and 4 ozs. per running foot, as minimum and maximum, all the charges have ranged in different degrees, proportioned to the varying nature of the soil worked through. \*

9. The powder used is the ordnance cannon powder, supplied from the Government arsenal, and it appears well adapted for blasting purposes. Some native-made powder, obtained from the Sultan of Lahedge, was used during one period, but it was of inferior quality, and the results given by it are not worthy of notice, except as, I think, going towards refuting a commonly received opinion, that slow inferior powder is better adapted for blasting purposes than that of greater strength and quickness. It is difficult to comprehend on what line of reasoning this opinion has been founded, and I am myself inclined to consider it a fallacious one, and that, in blasting, as well as in every other operation in which that article is employed, the better the powder the better the results obtained, provided the charges are properly proportioned.

10. The tamping is performed in the usual manner, the

material used being a kind of volcanic earth or mud of a homogenous texture, free from stones, and not unlike a very hard description of brick. This is found in masses and seams about the hills, and is apparently the volcanic mud of ancient eruptions, partially calcined, especially near its surface, by the contact of subsequent streams of burning lava which have passed over it. It forms a very strong and safe tamping, and, considering the extent of the operations that have been carried on (the daily average of powder blown away in blasts being at one time 500 lbs.), accidents from premature explosions have been comparatively rare.

11. The strength of the tamping material is so great that it has been found impracticable to use copper or brass priming rods, neither of these metals being sufficiently strong to resist the torsion of turning the rod during the tamping. The miners themselves, with good reason, object to their use: they twist and break almost immediately; and it has been found necessary to substitute iron ones.

12. Dry sand tamping was tried by the men of the sappers and miners, but discontinued as ineffectual. I have great doubts of the efficiency of this description of tamping under any circumstances, except where the line of least resistance is disproportionately small with reference to the length of hole tampered; but here, with shallow blasts, it was found a complete failure.

13. The train for firing the blasts is a quick-match, composed of cotton thread steeped in gunpowder and water, and afterwards dried in the sun. The proportion of material to compose, and mode of construction, are as follows:—1 lb. of cotton thread, cut into lengths of about 3 feet, and twisted into loose strands, composed of nine or ten threads, is steeped in a mixture composed of 2 lbs. of powder and water, and is then dried for use: this quantity will give about 166 running feet of fuze, which will burn at the rate of about 15 feet per minute, and is not easily put out by the falling stones and rubbish of the blasts as they explode in succession. It is necessary to

fix the train firmly into the top part of the tamping of each hole, so that the jerk of the adjoining blast going off may not disengage it, and so cut off the communication. It is also necessary to provide against this accident still further by connecting each blast with several others, so that if the train is cut off at one point by a falling stone, or in any other way, the ignition of the blast may still be effected from another quarter. When these precautions are attended to, misfires are not of very frequent occurrence, although the train is sometimes apparently completely buried in the *débris* of the mines which have first exploded, and the train has, as it were, to burn almost under ground.

14. Table No. 2 shows the classification and distribution of the labour, and the number of the different denominations of workmen, &c. per each 100 miners, taken as a standard.

15. Table No. 3 gives an average detailed rate for excavating in rock, obtained from the work scarping the Munsoorie height, from the accounts of which all the data here given have been obtained.

16. The practice of using large chamber mines in excavating to form scarp has been abandoned, owing to the difficulty of regulating their effects; it having, I believe, been found, on the explosion of a large charge, as difficult to break up for removal the large masses thrown down, and reduce the excavation to the required figure, as it would have been to execute, in the first instance, the entire portion of scarp by blasting alone: added to this, the difficulty, expense, and delay, in cutting shafts, galleries, and chambers in solid rock, is very great, and these considerations have led to the disuse of large mines.

17. In the Munsoorie scarp only one large double mine was sprung, which was intended to blow off the point of a very marked and projecting spur, round which the scarp line had to be carried: the distribution of the layers of volcanic matter which composed it was such as to lead to the belief that the rock could at once be blown out very nearly to the required

figure; and though I have to record a partial failure in this particular, yet I think the experiment was not without its results, as demonstrating the facility of simultaneously exploding two, or even more charges, when placed at no very great intervals from a common centre.

18. The method employed of firing the charges was very simple, and as I have seen it nowhere noticed, I will venture to describe it. The galleries, as usual, branched off from the bottom of the shaft, and terminated in the chambers. The boxes containing the two charges (300 lbs. each) being placed in position, the ends of two stout tin tubes, cased in and strengthened by wooden battens, were introduced, one into the centre of each charge, the other ends meeting in a small box placed midway between the chambers at the bottom of the shaft. In this box was placed an exploding charge of  $1\frac{1}{2}$  lb. of powder, into which was inserted the hose leading up through the tamping in the usual manner. The exploding charge, being fired by the hose, acted through the tubes like the discharge of a couple of muskets into the chambers, and the mines went off quite simultaneously. In this instance the distance between the two chambers was only 12 feet, but I have tried the same arrangement, experimentally, at greater, and also at irregular intervals, with success: up to certain limits it might always, I think, be employed with confidence; but for long distances strong piping would probably be required, to resist the force of the large exploding charge that would be necessary.

19. I am not aware that I can say anything more of interest on this subject: perhaps I have already dilated more than may be considered necessary, for the subject of blasting and quarrying in rock is so well known, and the mode of operation so familiar, that it seems mere repetition to dwell on either. I trust, however, the table of miners' tasks given may be found useful for guidance elsewhere. I can only add that I believe we obtain here a fair amount of labour: the system of fining is very strict, and rigidly attended to, so that the tasks we

exact may be taken with confidence as nearly the utmost that men can be expected to perform for a continuance.

I have the honor to be,

Sir,

Your most obedient Servant,  
M. K. KENNEDY, Lieutenant,  
Executive Engineer, Aden.

TABLE No. 1.

*Statement of Miners' Tasks.*

Nature of Rock.	A pair of 1st Class Miners will perform as a Daily Task	A single 1st Class Miner will perform as a Daily Task	Charge per Running Foot of Hole.	Remarks.
Trap rock of a porphyritic character, very hard.	ft. 8	ft. 4	oz. 2	A good building stone.
Basaltic lava, the crystals composing the paste of which are so minute as hardly to be separately distinguished, also very hard.	8	4	2	This rock is about the same density as the blue trap of the Deccan. It is very brittle, and difficult to work; and, though extremely hard when first excavated, is unfit for building purposes, as the exposed surfaces soon decompose.
Basaltic lava, very like the above in appearance, but not so hard.	11	5	2½	Quite unfit for building.
Basaltic lava, similar to the above in appearance, but still softer, and less brittle.	13	6½	2½	Ditto ditto.
Igneous rock of a cindery description, cellular, and full of holes and cracks.	18	9	4	This, owing to the fissures it contains, is very difficult to get through, some of the blasts producing very little effect.
Indurated volcanic mud, containing stones, and streaks of harder matter.	20	10	4	
Ditto ditto ditto, of an uniform texture.	24	12	4	

There are of course many intermediate descriptions of stuff: those above noticed I have selected as marked specimens of each class. The first and second might be taken as of about the same hardness and density as Deccan trap rock, and a standard of comparison for tasks in India thus instituted.

TABLE No. 2.

*Table showing the Proportion of the different descriptions of Labour, &c. employed on the Blasting Operation to form Scarp, per 100 Miners.*

Miners.	Tampers.	Butte-wallas, or Train Men.	Marwallas, or Men with Crowbars, to remove loosened Rock.	Biggaries, to remove Rock, and clear Excavations.	Average Running Feet of Rock bored.	Average Quantity of Powder exploded.	Average Running Feet of Fuze required.	Average Cubic Feet of Rock excavated and removed.	Remarks.
100	3·871	0·799	16·854	57·93	680½	lbs. 150·39	630	2840	

TABLE No. 3.

*Detailed Rate for Excavating, per 100 Cubic Feet.*

No. or Quantity.	Description.	Rate.	Per	Amount.	Total.
	<b>LABOUR.</b>	<i>Rs. a. p.</i>		<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
4·845	Miners .....	12 11 0	Month.	2 0 10·383	
1·052	Marwallas .....	8 0 0	„	0 4 5·862	
·084	Smiths .....	18 14 0	„	0 0 10·172	
·057	Hammermen .....	9 0 4½	„	0 0 3·291	
2·071	Biggaries .....	7 0 0	„	0 7 8·78	
	Superintendence .....	....	„	0 0 11·178	
				2 15 2·256	
	Deduct fines, &c.....	.....	.....	0 10 11·555	
	Total amount of labour ..	.....	.....	.....	2 4 2·701
	<b>MATERIALS.</b>				
·232	Pounds Cotton Thread ..	0 4 0	lb.	0 1 1·214	
·018	Pounds Swedish Iron ..	2 0 9	Md.	0 0 0·262	
·009	Pounds English Iron....	1 12 0½	„	0 0 0·108	
·072	Pounds Bar Steel Blister.	0 2 1½	lb.	0 0 1·812	
6·439	Pounds Powder .....	0 5 0	„	2 0 2·340	
·077	Cwt. Coal .....	23 8 3½	Ton.	0 1 5·384	
	Sundries .....	....	„	0 1 3·301	
	Water .....	....	„	0 1 8·183	
	Total amount of materials .....	.....	.....	.....	2 5 10·614
	Total for 100 cubic feet of rock excavated ....	.....	.....	.....	4 10 1·315

M. K. KENNEDY, Lieutenant,  
Executive Engineer, Aden.



*Comparative Statement of Expenditure and Establishment in the Executive Engineer's Department, Aden, for the Year 1851-52, called for in Military Board's Circular No. 1464, of 26th October 1852.*

		Rs.	a.	p.	
Executive Engineer..	}	Staff Salary.....	6,000	0	0
		Extra batta.....	703	1	8
		Regimental allowances, less net pay..	1,617	4	6
Assistant Executive Engineer .....	}	Staff salary.....	640	9	6
		Extra batta.....	111	1	6
		Regimental allowances, less net pay..	154	4	11
Permanent establishment .....		10,433	10	7	
		<hr/>	19,660	0	8
Other expenditure .....		1,60,496	4	8	
		<hr/>	1,79,856	2	4
		<hr/>			
Per-centage of staff salary, extra batta, regimental allowances, less net pay, and permanent establishment, on gross expenditure .....			10-903		

M. K. KENNEDY, Lieutenant,  
Executive Engineer, Aden.

*Executive Engineer's Office,  
Aden, 25th January 1853.*

No. 1549 OF 1853.

MILITARY DEPARTMENT.

To the SECRETARY MILITARY BOARD,

Bombay.

*Superintending Engineer's Office, Camp Indee, 12th May 1853.*

Sir,

I have the honor to transmit statement of the expenditure in the Public Works Department, under the Superintending Engineer Southern Provinces, for the year 1851-52, ending 30th April 1852; exhibiting the amount spent for repairs, annual repairs, and new works in the Military and Civil Departments, separately, with the charge for superintendence, as directed in your Circular 11464, of 26th October last.

		POONA.		-			
		Military.		Civil.			
		Rs.	a.	p.	Rs.	a.	p.
Repairs .....		9,410	8	0	5,843	7	2
Annual repairs .....		16,048	12	1	6,645	1	9
New works .....		33,980	13	9	4,711	9	3
		<hr/>					
		59,435	1	10	17,200	2	2
					59,435	1	10
		<hr/>					
					76,685	4	0
<i>Staff Pay.</i>							
Captain Hebbert .....	Rs.	3,983	13	11			
" Berthon .....		2,016	2	1			
		<hr/>			6,000 0 0		

POONA (continued).

Extra Batta.

		Military.	Civil.
		Rs. a. p.	Rs. a. p.
Captain Hebbert.....			
" Berthon.....	Rs. 727 8 10		
	368 3 2		
	<u>1,095 12 0</u>		

Regimental Allowance, less Nett Pay.

Captain Hebbert.....	Rs. 1,618 8 0
" Berthon.....	809 4 0
	<u>2,427 12 0</u>

Permanent establishment.....	9,523 8 0
	<u>11,641 9 7</u>

Per-centage..... 21.641

28

.....	21,165 1 7
	<u>97,800 5 7</u>

AHMEDNUGGUR.

	Military.	Civil.
	Rs. a. p.	Rs. a. p.
Repairs.....		
Annual repairs.....	2,165 15 9	4,208 11 5
New works.....	3,539 0 7	1,421 6 1
	<u>1,927 2 11</u>	<u>5,048 11 5</u>
	7,032 3 3	19,678 12 11
		<u>7,032 3 3</u>
		<u>17,711 0 2</u>

*Staff Salary.*

Major Kilner, half staff .....	625 0 0
Lieutenant Amnesly .....	1,379 9 2
" Nasmyth .....	306 7 3
Captain Hebbert .....	580 10 3
Lieutenant Beamish .....	108 5 4
	<hr/>
	3,000 0 0

*Extra Batta.*

Lieutenant Amnesly .....	Rs. 442 15 0
" Nasmyth .....	75 1 9
Captain Hebbert .....	212 1 3
Lieutenant Beamish .....	26 6 0
	<hr/>
	756 8 0

*Regimental Allowance, less Nett Pay.*

Lieutenant Amnesly .....	1,083 7 9
" Nasmyth .....	215 5 0
Captain Hebbert .....	606 15 0
Lieutenant Beamish .....	53 13 3
	<hr/>
	1,959 9 0
	<hr/>
Permanent establishment .....	5,716 1 0
	<hr/>
	2,983 15 0
	<hr/>
	8,100 0 0
	<hr/>
Per-centage .....	31-382
	<hr/>
	25,811 0 2

N. R. Major Kilner was employed on detached duty, though his half staff salary was drawn at Ahmednuggur.

BELGAUM. 2

	Military.	Civil.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Repairs .....	4,794 8 11	2,758 6 11
Annual repairs .....	3,101 8 10	20,829 10 1
New works .....	5,151 10 8	33,447 10 3
	<hr/>	<hr/>
<i>Captain North.</i>	12,987 7 5	57,095 11 3
		12,987 7 5
		<hr/>
Staff salary .....	Rs. 4,200 0 0	70,023 2 8
Extra batta .....	730 8 0	
Regimental allowance, less nett pay .....	1,618 8 0	
Permanent establishment .....	11,521 9 0	
	<hr/>	<hr/>
Per-centage .....	20 513	18,070 9 0
		<hr/>
		88,093 11 8

DHARWAR.

	Military.	Civil.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Repairs .....	56 7 11	12,121 7 2
Annual repairs .....	27 11 7	5,089 14 1
New works .....	19 0 0	12,549 6 2
	<hr/>	<hr/>
<i>Staff Salary.</i>	103 3 6	29,710 11 5
		<hr/>
		103 3 6
		<hr/>
Captain Cruickshank .....	Rs. 3,528 3 7	29,813 14 11
Lieutenant Wood .....	671 12 5	
	<hr/>	<hr/>
		4,200 0 0

*Extra Batta.*

Captain Cruickshank.....	Rs. 913 2 0
Lieutenant Wood .....	121 12 0
	<hr/>
	1,034 14 0

*Regimental Allowance, less Nett Pay.*

Captain Cruickshank.....	Rs. 3,080 13 0
Lieutenant Wood .....	391 8 0
	<hr/>
	3,472 5 0

Establishment .....	8,707 3 0
	<hr/>
	11,466 15 5
	.....

Per-centage..... 40-358

20,174 2 5  

---

49,988 1 4

KOLAPOOR.

	Military.	Civil.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Repairs .....	.....	.....
Annual repairs .....	1,415 7 3	90 0 0
New works.....	.....	484 4 3
	<hr/>	<hr/>
	1,415 7 3	588 4 3
		<hr/>
		1,415 7 3
Superintending allowances .....	.....	1,998 11 6
		<hr/>
		622 13 0
Per-centage.....	23-757	<hr/>
		2,021 8 6

SHOLAPOOR.

	Military.	Civil.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Repairs .....	468 0 0	1,763 0 3
Annual repairs .....	1,040 1 8	125 10 0
New works .....	611 0 0	.....
	<hr/>	<hr/>
	2,119 1 8	1,888 10 3
		2,119 1 8
Superintending allowances .....	.....	4,007 11 11
		852 0 0
		<hr/>
Per-centage .....		4,859 11 11

KHANDESH.

	Military.	Civil.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Repairs .....	124 4 0	22,584 12 1
Annual repairs .....	442 4 11	12,234 0 6
New works .....	261 8 2	40,756 8 2
	<hr/>	<hr/>
<i>Staff Pay.</i>	828 1 1	75,575 4 9
		828 1 1
		<hr/>
<i>Extra Batta.</i>	8,407 11 11	76,403 5 10
		<hr/>
Lieutenant Bell .....	Rs. 5,400 0 0	
" Jones .....	747 11 11	
Captain Adams .....	2,260 0 0	
	<hr/>	
Lieutenant Bell .....	Rs. 730 8 0	
" Jones .....	182 10 0	
Captain Adams .....	1,094 7 0	
	<hr/>	
		1,917 9 0





SATTARA (continued).

	Military.	Civil.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Staff salary to Captain Hart .....	9,960 0 0	
Travelling allowance .....	2,410 0 0	
Extra batta .....	}	Included in foregoing staff salary.
Regimental allowance, less nett pay .....	}	
Staff salary to Mr. Smith .....	3,000 0 0	
Travelling allowance .....	108 0 0	
Staff salary to Mr. West .....	4,687 5 4	
Tentage .....	890 0 0	
Staff salary to Ensign Elphinstone .....	1,965 8 3	
Extra batta .....	281 15 1	
Regimental allowance, less nett pay .....	1,773 12 10	
Establishment .....	14,884 4 4	
	<hr/>	40,500 13 10
		1,95,367 4 9

34

Per-centage..... 20.772

ASSEERGHUR.

	Military.	Civil.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Repairs .....	747 11 4	747 11 4
Allowance to Officer superintending .....	.....	158 0 0
		<hr/>
Per-centage .....		905 11 4

DAPOOLIE.

	Military.	Civil.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
Repairs .....	588 0 3	92 14 0
Annual repairs .....	202 0 0	.....
New works .....	.....	.....
	<hr/>	<hr/>
	790 0 3	92 14 0

	790 0 3
	882 14 3
	164 8 0
	1,047 6 7

Allowance to Officer superintending .....	.....
Per-centage .....	15.705

I have the honor to be,

Sir,

Your most obedient Servant,

WALTER SCOTT, Lieutenant Colonel,  
Superintending Engineer, Southern Provinces.

*Comparative Statement of Expenditure and Establishment for  
the Year 1851-52.*

Staff salary	..	..	..	Rs.	3,600	0	0
Extra batta	..	..	..	..	730	8	0
Regimental allowances, less nett pay	..			..	1,618	8	0

Permanent establishment	..	..			8,894	12	2	{ This amount includes Rs. 701-13-3 batta of Surveyor and Maistry; Rs. 545 office tentage and tent carriage; Rupees 134-0-2 for puggees employed for the protection of public buildings at Kaira and Hursole; and Rs. 120 horse allowance to Serjeant Overseer.
					<hr/>	14,843	12 2	

Other expenditure	..	..	..		36,082	12	3	{ This amount includes Rs. 120 oil allowance for public guards, and Rupees 337-0-7 stationery allowance.
Gross expenditure	..	..	..		<hr/>	50,926	8 5	

Per-centage of staff salary, extra batta, regimental allowances, less nett pay, and permanent establishment, on gross expenditure. .... } 29.147

W. R. DICKINSON, Lieutenant,  
Executive Engineer, Ahmedabad Division.

*Executive Engineer's Office, Ahmedabad,  
6th January 1853.*

*Comparative Statement of Expenditure and Establishment for the Year 1851-52.*

Staff salary.	{	2nd Lieut. D. Nasmyth..Rs.	1,103	3	7	
		Lieut. C. Nasmyth ..	1,296	12	4	
Extra batta.—2nd Lieut. D. Nasmyth ..			251	13	6	{ The extra batta for Lieutenant C. Nasmyth is drawn in the 4th Troop Horse Artillery abstracts.
Regimental allowances, less nett pay. )		2nd Lieut. D. Nasmyth..	593	13	6	Ditto ditto ditto.
Permanent establishment .. ..			3,575	10	7	{ This amount includes Rs. 104-7-4 batta and allowance of Surveyor and Maistry; Rupees 110-5-0 horse allowance to acting Overseer O. Droft; Rupees 47-11-10 horse rent to ditto; and Rupees 90-9-2 for puggeca employed for the protection of public buildings on Mount Aboo.
			<hr/>			6,721 5 6
Other expenditure .. ..			20,911	6	0	{ This amount includes Rs. 120 oil allowance for public guards, and Rs. 148-13-8 for stationery supplied.
Gross expenditure .. ..			<hr/>			27,632 11 6
Per-centage of staff salary, extra batta, regimental allowances, less nett pay, and permanent establishment, on gross expenditure.....			}.....			24-924

C. NASMYTH, Lieutenant,  
Late Acting Executive Engineer, Deesa Division.

*Executive Engineer's Office, Camp  
near Deesa, 17th March 1853.*

*Comparative Statement of Expenditure and Establishment for the Year 1851-52.*

Staff salary .. .. .	Rs.	220	0	0	{ This is not in the bills called a staff salary, but is the amount of Rs. 2 per diem drawn by the Major of Brigade, while he is superintending public works.
Extra batta * .. .. .		.....			
Regimental allowances, less nett pay* ..		.....			Ditto ditto ditto.
Permanent establishment .. ..		.....			None.
			220	0	0
Other expenditure .. .. .		1,647	7	9	{ This amount includes Rs. 144 for a writer; Rs. 60 oil allowance for public guards; and Rs. 0-2-4 the cost of stationery.
Gross expenditure .. .. .		1,867	7	9	
Per-centage of staff salary, extra batta, regimental allowances, less nett pay, and permanent establishment, on gross expenditure.....		} .... 11-780			

B. R. POWELL, Captain,  
Major of Brigade, in Charge of Public Works.

*Rajkote, 20th March 1853.*

*Comparative Statement of Expenditure and Establishment for  
the Year 1851-52.*

Staff salary .. .. .	Rs.	334	0	0	} This is not in the bills called a staff salary, but is the amount of Rs. 2 per diem drawn by the Line Adjutant, while he is superintending public works.
Extra batta .. .. .		.....			
Regimental allowances, less nett pay ..		.....			Ditto ditto ditto.
Permanent establishment .. .. .		.....			None.
			334	0 0	
Other expenditure .. .. .		3,882	1	10	} This amount includes Rs. 132 for a writer; Rs. 60 oil allowance for public guards; and Rs. 17-2-2 the cost of stationery.
Gross expenditure .. .. .		4,216	1	10	
Per-centage of staff salary, extra batta, regimental allowances, less nett pay, and permanent establishment, on gross expenditure.....		.....	7	922	

R. LAURIE, Lieutenant,  
Line Adjutant, in Charge of Public Works, Bhooj.

*Bhooj, 5th April 1853.*

*Comparative Statement of Expenditure and Establishment for  
the Year 1851-52.*

Staff salary.	{	Lieut. M. Kennedy.....	Ra.	1,260	0	0	
		Captain T. L. Jameson..		1,718	4	4	
		Brevet Major J. Kilner .		501	11	6	
Extra batta.	{	Lient. M. Kennedy.....		255	10	9	
		Captain T. L. Jameson..		440	13	1	
		Brevet Major J. Kilner..		198	5	10	
Regimental allowances, less nett pay.	{	Lieut. M. Kennedy ....		466	4	9	The regimental allowance to Captain Jameson is drawn in the 29th Regiment's abstract.
		Brevet Major J. Kilner..		442	15	3	
Permanent establishment .....				8,364	13	5	This amount includes Rs. 332-13-3 for horse allowance to European Overseers; Rs. 3-8-0 passage to ditto; Rupees 371-1-11 for batta and allowances to Surveyors, Writers, Maistry, and Peons, &c.; and Rs. 240 for office rent at Broach.
				<hr/>	13,648	14	
Other expenditure .....				11,371	4	5	This amount includes Rs. 120 oil allowance for public guards; Rs. 312 for stationery allowances; and Rs. 210 passage money.
Gross expenditure .....				<hr/>	25,020	3	
Per-centage of staff salary, extra batta, regimental allowances, less nett pay, and permanent establishment, on gross expenditure .....	{	.....		54	55	1	

T. L. JAMESON, Captain,  
Acting Executive Engineer, Surat Division.

*Executive Engineer's Office, Surat,  
28th March 1853.*

No. 1784 OF 1852.

PUBLIC WORKS.

GENERAL DEPARTMENT.

To the SECRETARY TO THE MILITARY BOARD,

Bombay.

SIR,

I have the honor to forward the Annual General Report of the proceedings of the Public Works Department in Scinde, during the official year 1851-52.

2. The expenditure from the 1st of May 1851 to the 30th April 1852 in the Military, Civil, and Marine Departments, is as follows:—

*Expenditure in the Military, Civil, and Marine Departments of the several Executive Officers in Scinde.*

Names of Divisions.	Amount expended on each.			Amount of Superintendence.			Superintending Percentage.		
	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.
<b>LOWER SCINDE.</b>									
<i>Military Department.</i>									
Repairs .. .. .	7,986	11	0						
Annual repairs .. .. .	3,235	1	3						
Barrack Department .. .. .	2,145	15	7						
New works .. .. .	1,08,569	7	0						
<b>Total Military Department..</b>	<b>1,21,937</b>	<b>2</b>	<b>10</b>						
<i>Civil Department.</i>									
Repairs .. .. .	6,218	5	4						
Annual repairs .. .. .	90	9	4						
New works .. .. .	74,840	1	11						
<b>Total Civil Department....</b>	<b>81,149</b>	<b>0</b>	<b>7</b>						



Names of Divisions.	Amount expended on each.	Amount of Superintendence.	Superintending Percentage.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
<b>LOWER SCINDE (continued).</b>			
<i>Marine Department.</i>			
Annual repairs .. .. .	85 7 9		
New works .. .. .	285 1 10		
Total Marine Department ..	370 9 7		
Total Military Department ..	1,21,937 2 10		
Total Civil Department ....	81,149 0 7		
<b>Grand Total..</b>	<b>2,03,456 13 0</b>	<b>18,709 3 11</b>	<b>9 3 1-571</b>
<b>CENTRAL SCINDE.</b>			
<i>Military Department.</i>			
Repairs .. .. .	6,587 12 7		
Annual repairs .. .. .	997 13 3		
New works .. .. .	17,050 9 4		
Total Military Department..	24,616 3 2		
<i>Civil Department.</i>			
Repairs .. .. .	1,577 13 3		
Annual repairs .. .. .	2,034 7 6		
New works .. .. .	4,138 4 6		
Total Civil Department....	7,750 9 3		
<i>Marine Department.</i>			
Repairs .. .. .	159 3 4		
Total Military Department..	24,616 3 2		
Total Civil Department ....	7,750 9 3		
<b>Grand Total..</b>	<b>32,525 15 9</b>	<b>15,895 10 8</b>	<b>48 13 11</b>
<b>UPPER SCINDE.</b>			
<i>Military Department.</i>			
Repairs .. .. .	3,408 3 1		
Annual repairs .. .. .	592 13 5		
New works .. .. .	8,131 12 5		
Total Military Department..	7,132 12 11		

Names of Divisions.	Amount ex- pended on each.	Amount of Superintend- ence.	Superin- tending Per- centage.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
<b>UPPER SCINDE (continued).</b>			
<i>Civil Department.</i>			
Repairs .. .. .	3,108 12 1		
Annual repairs .. .. .	242 4 5		
New works .. .. .	8,076 4 7		
<b>Total Civil Department..</b>	<b>11,427 5 1</b>		
<i>Marine Department.</i>			
Repairs .. .. .	424.15 6		
Annual repairs .. .. .	247 9 7		
<b>Total Marine Department ..</b>	<b>672 9 1</b>		
<b>Total Military Department..</b>	<b>7,132 12 11</b>		
<b>Total Civil Department ....</b>	<b>11,427 5 1</b>		
<b>Grand Total..</b>	<b>19,232 11 1</b>	<b>8,863 11 6</b>	<b>43 1 10½</b>
<b>Total of expenditure..</b>	<b>2,55,315 7 10</b>		

3. I annex for publication, should the Military Board think fit, Lieutenant Fife's report on a style of roof introduced by him, which its peculiarity, cheapness, and the general success that has attended the various instances in which it has been tried, induce me to regard as a paper of special interest.

4. Under Lieutenant Fife's superintendence, such roofs have been built for the sum of Rs. 9 per 100 square feet. In Central Scinde it is estimated to cost Rs. 13; but, I expect, when the labourers become more accustomed to the work, the rates will nearly correspond. Even Rs. 13, however, is so moderate a rate for a durable roof, that wherever white-ants abound, I consider it well worthy of a trial.

5. Lieutenant Fife's attention was probably attracted to the style of roof by the circular hollow-tiled Syrian roof,

which has, I believe, been largely adopted at Madras, and of which the dome of the ice-house in Bombay is a specimen; but the great superiority of his invention consists in the peculiar form of the hollow tiles, from which a vault can be built with perfect safety (as yet 22 feet span is the largest) without any centering whatever.

I have the honour to be,

Sir,

Your obedient Servant,

H. B. TURNER, Major;

Superintending Engineer, Scinde.

*Kurrachee, 1st September 1852.*

PUBLIC WORKS.

GENERAL DEPARTMENT.

To the SUPERINTENDING ENGINEER IN SCINDE,

Kurrachee.

SIR,

I have the honour to acknowledge the receipt of your letter No. 1790, of the 5th instant, calling on me to report the result of the experiments in vaulting roofs on the plan lately proposed by me.

2. The first experiment made was that mentioned in my first communication on this subject. After succeeding in making the voussoirs, I constructed about 7 feet of the crown of an arch of 15 feet span, to ascertain whether the method was practicable. The result was most satisfactory. It was evident, that beyond the difficulties a workman experiences in constructing anything new to him, nothing existed against the practicability of the plan.

3. The next thing to ascertain was whether the hollow voussoirs would really bear the great strain to which theoretically they were equal. The small vault mentioned in the preceding paragraph was turned on the ground in one of the verandahs of my bungalow, and during the months it remained there it was continually crossed and recrossed by myself and my office establishment. It did not suffer the slightest injury. But to ascertain what the result would be in the case of a complete vault, as it would be constructed in roofing, I made another experiment. I constructed a semi-circular vault (Figs. 1 and 2) of 15 feet span, springing from the ground. The haunches were carried up 5 feet with sun-dried bricks and mud, and the remainder vaulted in with the voussoirs. As this was being done, I placed three rods ( $a, a, a$ ) directly under the crown of the vault, and almost touching it, to see what

amount of settlement would take place. This completed, I commenced loading the vault with bricks. They were piled on without any bond or cement, till they were  $1\frac{1}{2}$  foot deep on the light portion of the vault, and rather more on the haunches. During this process I carefully watched to see what amount of settlement in the vault would take place. When the loading was about 1 foot thick, I observed that the vault had settled about half an inch. I believe that even this trifling settlement was principally due to the haunches, which, being constructed of brick, and having, therefore, a greater number of joints, were more liable to settlement than the other portion of the vault. I did not observe any further settlement when the load was increased. I allowed the vault to remain loaded for two or three days, after which I took it to pieces, to see whether the voussoirs had sustained any injury. Of the 700 voussoirs which formed the vault, only two were broken, and of these one was misshaped (having been hastily removed from the mould), and the other had not been properly burnt. Among those which had borne this severe test there were many so thin as not to weigh more than  $3\frac{1}{2}$  lbs., the solid voussoir weighing 15 lbs. The load borne by the light upper portion of the vault amounted to 13 tons.

4. The practicability of this plan, and its trustworthiness, being thus proved, I made a third experiment, to see what thickness of wall would be sufficient to bear the thrust of a vault of this description. With this view I constructed a vault (Figs. 3, 4, and 5,) of 12 feet span, on walls  $1\frac{1}{2}$  foot thick, and  $9\frac{1}{2}$  feet high, the haunches being carried up 4 feet with brick. The side walls had two arched openings of 4 feet; the end walls had each an arched opening of 10 feet, the wall above the crown of each being carried up to the requisite height in open brick-work, as shown in Fig. 5. With the exception of the arches over the end openings, which were turned with burnt brick, the whole of the walls were constructed with sun-dried brick and mud. Thus constructed, the side walls, which had to bear the thrust of the vault, were but little tied together by

the end walls, and the latter had little substance to prevent their being thrust outwards by any longitudinal thrust the vault might exert in leaning against them. While the vault was being constructed, I carefully watched the walls, to see whether any movement took place. None, however, occurred. I allowed this vault to stand about six weeks. On taking it down, I found the voussoirs uninjured.

5. It is evident, from the result of the last experiment, that in ordinary spans we have nothing to fear from the thrust of the vault. We seldom make verandahs 12 feet wide. The verandah vault, therefore, may be considered to act as a flying buttress to the main vault, supposing there were anything to fear from the thrust of the latter.

6. I had it in view to make further experiments with flat sweep vaults, and also with larger spans. I, however, had no leisure before leaving Shikarpore.

7. The buildings at Shikarpore are being constructed on this plan—the travellers' bungalow lately sanctioned, and a barrack and quarter guard for the Upper Scinde Police. The first of these was commenced very lately, and the vaulting had not been executed when I left Shikarpore. The main vault is to be 16 feet in span, and will rise 5 feet 4 inches, walls 2 feet thick, of sun-dried brick. The verandah vaults are to be  $8\frac{1}{2}$  feet in span, and will rise 2 feet 10 inches; walls  $1\frac{1}{2}$  foot thick. The walls of the quarter guard only have been constructed. The vaults are to be the same as those of the travellers' bungalow. The main and verandah walls are also respectively 2 feet and  $1\frac{1}{2}$  foot thick. The barrack is nearly completed. It consists of two vaults, 240 feet in length, with binding arches about every 30 feet, except in the centre, where there is one interval of 50 feet. The vaults are semi-circular, and of 15 and 9 feet span. It was originally intended that this last building should be domed, and, with this view, its walls had been commenced 5 feet in thickness. There would have been fourteen domes of 15 feet span on the main walls, and the building would have been divided

into as many compartments by thirteen massive binding arches. When, at the suggestion of the Commissioner, Captain Stanley consented to have this building constructed on my plan, I carried the walls up about one-half the thickness that had been determined on, omitted more than half the binding arches, and carried the remainder up to within a foot of the vault; thus not only reducing the walling and arch-work by about one-half, but also obtaining better ventilation, by having the building open from end to end,—an advantage but imperfectly attained in the original plan. This building is a very good example of the advantages of the new plan.

8. The experiments made by me do not furnish data for calculating the exact cost of each item of work, as the workmen employed had to be taught at the same time; and it was, moreover, requisite occasionally to work with great caution. The police barrack, also, is almost useless for this purpose, because it was partly done by convict labour. From this work, however, I have ascertained that the voussoir vaulting is done more rapidly than brick vaulting, *i. e.* a workman can do a greater day's work; and that from the small number of voussoirs required, and the small quantity of cement used, fewer labourers to assist the masons are necessary. As the voussoirs in superficial measurement do not cost more than common bricks, the plan is, therefore, less costly than the brick vault, irrespective of the enormous saving in the walls. I believe that a rate of Rs. 8 or 9 per 100 square feet will cover the expense, supposing the exterior and interior plaster to be of mud and bhoosa. If chunam plaster for the exterior is used, an addition to the above rate must of course be made. The brick-work in the haunches scarcely differs from common walling.

9. The accompanying papers, prepared in a convenient form, explain the method of making the voussoirs, and the manner in which they are used. It will, probably, be remarked, that the plan is troublesome, and, at first, tedious; but I think

that if the method of cutting and seasoning timber, and the time required for the latter process, with the description of the manner of sawing it up, forming it into trusses, and finally constructing the roof, were similarly detailed, the result would be in favour of vaulting. It frequently happens, in carrying on public works in this country, where there is no regular market for timber, that buildings are delayed, or have to be constructed in a faulty manner, from want of seasoned timber. How great, then, is the advantage of a plan which can be in full operation in a few months, and how convenient to be enabled to manufacture the material on the spot, and under your immediate superintendence. These remarks are equally applicable to the Syrian roof described in the Corps' Papers by Major Underwood, of the Madras Engineers, and which construction suggested mine.

I have the honour to be,

Sir,

Your most obedient Servant,

J. G. FIFE, Lieutenant,

Executive Engineer, Upper Scinde.

*Kipree, West Bank of Nara, 24th December 1851.*

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*Description of the Method of making Hollow Hexagonal  
Voussoirs, and Vaulting Roofs with them.*

To form the moulds, a solid wooden voussoir is first made, in the following manner:—a piece of wood about 15 inches in length, and 9 inches in diameter, is shaped into a tolerably accurate cylinder. Its ends are then sloped off, till it becomes oblique, as shown in Fig 1. Hexagons are then inscribed in circles of about 8 inches diameter, at each end, (Figs. 2 and 3,) care being taken, by previously drawing a straight line from top to bottom of the cylinder, to make the hexagons



parallel. From the sides of the hexagon at the bottom half an inch, or whatever may be required, is cut off (Fig. 3). The superfluous wood is then pared away, leaving the solid voussoir, as shown in Figs. 4 and 5, a piece of wood being inserted at the broad end as a handle.

Some common earthen koondas (Fig. 6) are then made, in the ordinary manner, having their tops sloped at the same angle as the voussoir, but accuracy in this case is not necessary. When the koondas are dry, they are sawn in two; after this they may be burnt. They may also be made of wood; but the earthen ones only cost a few annas each, and are not liable to warp.

To make the moulds, clay mixed the day previous, and containing rice bhoosa, to prevent cracking, is beaten into flat cakes with the hand, and placed in the half koondas, and well pressed against the sides and bottom with the hand. The two pieces of koonda are then bound together with a piece of rope. An iron rod something less than a quarter of an inch in diameter is then inserted into a hole at the centre of the bottom of the koonda. Next, the wooden voussoir, which has a hole bored through it for the reception of the rod, is forced into the koonda, pressing the clay against the sides and bottom. This is repeated four or five times, care being taken to keep the voussoir wet, to prevent it adhering to the clay. If there appears to be too little clay in the koonda, from the cakes having been too thin, more can be added, until the wooden voussoir, by compressing it, forms a mould as accurate as itself. The voussoir ought to be carefully withdrawn from the mould, otherwise the mouth will be spoiled.

The mould ought not to be removed from the koonda for four or five days, as, the mass of clay being great, it is liable to crack; it ought, moreover, to be kept in the shade, and, while drying, any cracks that may appear ought to be stopped with moist clay. As the moulds are removed from the koondas, the weight may be greatly reduced by taking an adze, and paving the exterior into the form of a hexagon, corresponding

with the inside of the mould. When they are dry, holes should be made in the bottom, to correspond with the tenons on the wheel (Fig. 8) on which the hollow voussoirs are formed. By doing this before the burning, much labour is saved, the dry clay being easily cut with a chisel. The moulds may then be burnt. Litter is the best fuel for this purpose, wood creating too great a heat, and causing them to lose their shape from fusion.

Two coolies, after a few days' practice, will make from 6 to 8 moulds per day, and a carpenter can reduce the weight, and otherwise complete 15 in the same time. A great number are required, but this is only troublesome at first, for they last a long time. Those I made had been three months in use when I left Shikarpore, and had suffered no injury up to that time. If they do break, it is in the burning, or the first or second time they are used afterwards; and the damage is always caused by carelessness in not mixing the clay well, or in not pressing it into the koonda sufficiently.

I used three different moulds for my vaults. They were radiated to suit spans of 8, 15, and 22 feet. I have now, however, discontinued those for the 8 feet span circular arc, as I intend making the vaults flatter. To enable the workmen to readily distinguish the different kinds, I inserted small pieces of wood into the bottoms of the wooden voussoirs. In this manner all the moulds are stamped, and, consequently, all the hollow voussoirs receive the same distinguishing mark as the wooden ones. I found this simple little precaution of very great use. Before commencing the mould making, the wooden voussoirs should be kept under water for two or three days, and afterwards they should never be allowed to dry; otherwise, from increasing or diminishing in bulk while they are being used, the moulds made with them will not be of the same size.

To make the hollow voussoirs, the clay used should be what is commonly called "strong earth," or what is used for pottery. It should be beaten into dust, and then mixed with

dry horse-dung, also beaten to dust. Water should then be added. An hour or two afterwards, when the clay is completely saturated, it should be well mixed with the hand, sufficient water being added to make it of the consistency of paste or putty, so that it can be taken up in the hand, and easily compressed into any form. It should remain in this state for twenty-four hours, after which it is fit for use.

The mould is filled in the same manner as the koonda. A piece of clay, taken from that before mentioned, is well worked up with the hands on a piece of plank, in the same way in which a native makes his bread. It is then beaten out with the palm of the hand into two flat cakes, which are carefully placed against opposite sides of the mould, and overlapping each other a little. The clay should then be well pressed into all the angles of the mould with the knuckles. After this, a piece of clay, about the size of an apple, should be thrown smartly to the bottom of the mould. If this is well done, it drives the clay previously placed most effectually into the acute angle at the bottom. The pressure of the knuckles is not sufficient there, and, moreover, this last piece of clay makes the circular wedge (Fig. 7) act more effectually. The mould is then placed on the wheel, and a small chip of wood (*a* Fig. 7), an eighth of an inch thick, inserted between the clay and the lower side of the mould. This is to prevent the wedge from making that side of the *voussoir* too thin. There is no necessity for a similar precaution for the other sides. An iron rod, like that previously mentioned, is then passed through the bottom of the mould into the top of the wheel. Next a circular wedge (Fig. 7), about half an inch less in diameter than the breadth of the mould, so as to leave round it about a quarter of an inch of clay for the thickness of the *voussoir*, and having a hole bored through it for the rod, is placed in the mould, and plenty of water sprinkled on it. The wheel, with the mould on it, is then set in motion with the foot, the wedge being firmly held with the hands, and gently pressed downwards.

If it descends very rapidly, it will be found, on taking it:

out, that the cakes of clay are too thin: whenever this appears to be the case, more must be added with the hand. If the wedge does not descend to the bottom, it is owing to there being too much clay, and this will have accumulated under it. This should be removed, care being taken, in doing so, not to tear the sides of the voussoir. The hand should be conveniently placed against the clay, and the wheel set gently in motion. The surplus clay is neatly cut off in this manner. The wedge should then be again inserted, and the process continued, till the inside of the voussoir is perfectly smooth, and free from flaws. The wedge should be slowly removed from the mould, the wheel being kept in motion. The wedge ought to go to the bottom of the mould. This is ascertained by looking at the indentation made in the clay by the projecting piece at the bottom, and which is made to prevent the wedge descending too far, and destroying the bottom of the voussoir. It will be observed, from the manner in which the voussoir has been made, that the acute angle at the bottom is solid. This must be scooped out with the hand, and, at the same time, the water which collects there during the process above described should be removed with a piece of cloth.

The next process is the closing of the mouth. The surplus clay and chip of wood are first removed. A good piece of clay, tolerably stiff, is then rolled between the hands, until it is almost a foot long, and an inch in diameter. One end of this is attached to the mouth of the voussoir, and the wheel being set gently in motion, it is carried all round, and well joined to the voussoir, by pressing it and the side together with the thumb and the finger. This effected, the projecting clay is tightly held between the thumb and finger, and the wheel being kept in motion, the mouth is gradually closed. If there is not sufficient clay, a small cake about the size of a rupee should be gently placed on the aperture, and the escape of the air inside immediately stopped by adding water, and joining the cake to the clay previously placed. If this is not done quickly, the mouth will sink.

The mould containing the voussoir may then be placed in the sun to dry, and when the clay begins to stiffen, the mouth must be hammered flat, a small hole being made to allow the air to escape. In three or four hours the voussoir is sufficiently dry for removal from the mould; the mould being turned upside down, the voussoir drops out.

In four or five days the voussoirs are dry enough for burning. This is done in the same way as with common pottery. A layer of dry sheep's dung is first laid on the ground, and over this a layer of light litter. On this bed two layers of voussoirs are placed, and over the whole is another layer of litter, covered with ashes. The ashes prevent the flame from escaping too soon.

One coolie, with two assistants to fill the mould for him, will, after a month's practice, make 70 voussoirs per day. Allowing the first, in consideration of his skill .....Rs. 0 2 6

And paying the assistants at the usual rate. (viz. 2 annas each) ..... 0 4 0

---

We have Rs. 0 6 6

for the cost of making 70, or say 10 annas per 100.

Again, one "Buttee" maker, assisted by two coolies, will prepare a "Buttee" containing 700 voussoirs in a day. Allowing the buttee maker for his work, and for watching the buttee during the night .....Rs. 0 5 0

Paying the assistants at the usual rate of two annas each .....Rs. 0 4 0

And allowing one cart and a coolie 8 annas per day for two days for collecting litter.....Rs. 1 0 0

---

We have, Rs. 1 9 0

for the cost of burning 700, or say 4 annas per 100. Adding

this to the cost of making, we have 14 annas for the cost of making and burning 100 voussoirs.

Until the coolies are expert, of course the voussoirs cost more than the above; but if the work is only cautiously commenced, and the number of hands gradually increased, the difference is not very great. In my manufactory I employ the carpenter, who makes the wooden voussoirs, to superintend the mould making. I find this a good plan, as he readily detects flaws. I also employ a potter to show the coolies how to mix the clay.

In order to employ convicts to make voussoirs for a barrack for the police, I used two wheels: on one the convicts made the voussoir in the rough, on the other the surplus clay was removed, and the mouth closed by a potter. The potter finished 150 voussoirs per day, with ease, in this manner. I, however, found, that from the voussoirs being frequently left standing in an unfinished state, they were not so well made, the clay becoming too stiff. By giving a man a wheel, and making him do the whole of the work himself, he can be held responsible for the quantity and quality of his work.

The first voussoirs I made had a hexagonal interior, as well as exterior, and were formed outside a mould; one of my reasons for preferring the hexagonal voussoir being, that of all regular figures which fit accurately together, the hexagon is that which has the greatest area compared to the perimeter, and is therefore the lightest form that can possibly be chosen.

This peculiarity has been remarked in the honeycomb, the cells being hexagonal. After a great many trials, however, I was obliged to relinquish this form for the interior, as the voussoirs could not be made free from flaws. By the present method of making them, however, the object I had in view is partly attained by a natural process. It will be observed, that while the circular wedge is being forced into the mould, the sides of the voussoir undergo greater compression than the angles; consequently, when the wedge is removed, the

clay at the sides to a small extent expands again ; and this change is further carried out during the drying, for the clay being thickest at the angles, they shrink more than the sides.

Another object I had in view, viz. making all the sides of the same thickness, even at the bottom, where the voussoir is an elongated hexagon, is also attained by the present method. The circular wedge, being only steadied by the hand at the top of the voussoir, oscillates a little as the wheel is turned, and being almost equally checked in each direction by the clay, forms, provided the process is not continued very long, a circular aperture, which corresponds with the regular hexagon outside it. At the bottom, however, where the wedge is kept steadily in the centre by the iron rod, it forms an elliptical bore in its oblique section, a form which exactly suits the elongated hexagon. (Figs. 10 and 11.)

It may appear from the preceding description, that these voussoirs can only be made with clay of rare quality ; but I feel sure, that wherever the clay is good enough for common pottery, (and there are few places where it is not,) they can be made equally well.

### *The Construction of the Vault.*

The haunches and end walls having been carried up to the requisite height, the first voussoir is let into the end wall at the crown of the curve. (Fig. 12.) Other voussoirs at proper intervals are then similarly let into the wall, till the haunches are reached. About one-half of each voussoir ought to project outside the wall, and the interval between each should be sufficiently large for the reception of half a voussoir and its cement. The vaulting is then commenced at the angles, which are gradually filled in, each course of voussoirs being commenced at the end wall, and carried obliquely down to the haunch in the following manner. The sides of voussoirs 6 and 7 (Fig. 12), and the wall in front, being covered with cement, No. 8 voussoir is thrust in (care being taken in doing so to keep the top parallel to the direction of the vault) with

two or three blows from the hand. It penetrates like a wedge, making the joints quite smooth. After this, the joints should be closed above and below, to make them air-tight, till the clay has stiffened a little. No. 9 is then thrust into its place in the same way as No. 8, forcing the latter, if it is possible, still tighter into its place. This completed, No. 10 in the next course is placed; and so on throughout the whole length of the vault.

It will be observed, that by keeping the haunches of the vault advanced at this angle, any settlement at the crown is prevented. Two sides of each voussoir being perpendicular to the direction of the course, they are directly opposed to any settlement. The vault is kept in the proper curve by a circular piece of plank, standing on the projecting bricks of the cornice; and so little settlement takes place, that this can be made to slide back under the completed portion of the vault.

The voussoirs run about 450 to 100 square feet, and a workman tolerably expert can vault 40 square feet in a day. From the small number of voussoirs required, and the small quantity of cement used, he requires very little assistance.

In all the vaults constructed on this plan, mud and bloosa has been the cement used, and it has been found quite sufficient. Being thrown against the voussoirs, and spread with the hand, it will be found more expeditious than chunam, and of course more economical.

With regard to the haunches, it is evident that they should be carried up as far as ever they will stand securely without the assistance of the thrust from the vault, for the more the centre of gravity of the wall and haunch is brought inwards in this manner, the greater is the stability of the structure when completed. I found from experiment that the haunches of a semi-circular vault of 15 feet span could be carried up to a height of 5 feet. To prevent accidents from a number of work-people congregating on them before the vaulting was commenced, I carried the haunches up to a height of 4 feet



in the first instance, completing them to the requisite height while the vaulting was being executed.

It appears to me impossible to apply the accurate theories of the arch to these vaults, the strength of the cement bearing so great a proportion to the weight. It is evident, moreover, that a portion of the vault is supported by the end wall against which it leans—it may be almost said to rest upon it.

The perfect manner in which the strain is distributed through the mass, owing to the hexagonal form of the voussoir, and the peculiar bond arising from that form, and the obliquity making a rupture extremely difficult, also contribute to render calculation erroneous. Actual experiment must determine the extent to which the principle can be safely carried.

J. G. FIFE, Lieutenant,  
Executive Engineer, Upper Scinde.

*Kipree, West Bank of the Nara, 24th December 1851.*

*Voussoir Making.*

*Fig 1*



*Fig 2*



*Fig 3*



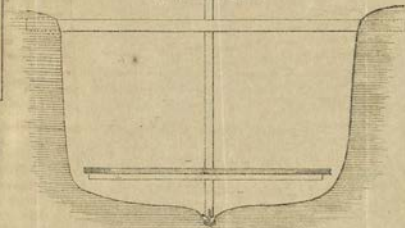
*Section of Mould and circular Wedge.*

*Fig 7*



*Fig 8*

*Wheel.*



*Fig 4*

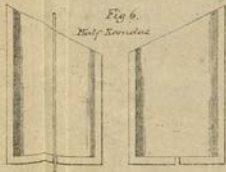


*Fig 5*



*Fig 6*

*Half Squared*



*Section of Hollow Voussoir*

*Section AB.*

*Section CD.*

*Fig 9*



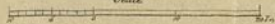
*Fig 10*



*Fig 11*



*Scale*

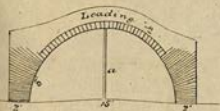


Plans for making vaulted roofs of hollow voussoirs

2<sup>nd</sup> Experiment

Cross Section of Vault

Fig. 1.



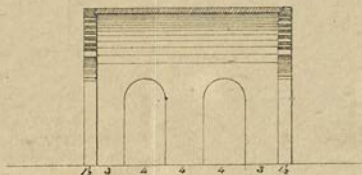
Longitudinal Section

Fig. 2.



Longitudinal Section

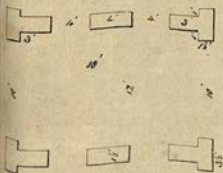
Fig. 5.



3<sup>rd</sup> Experiment

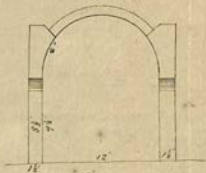
Plan

Fig. 3.

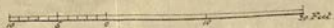


Section

Fig. 4.



Scale

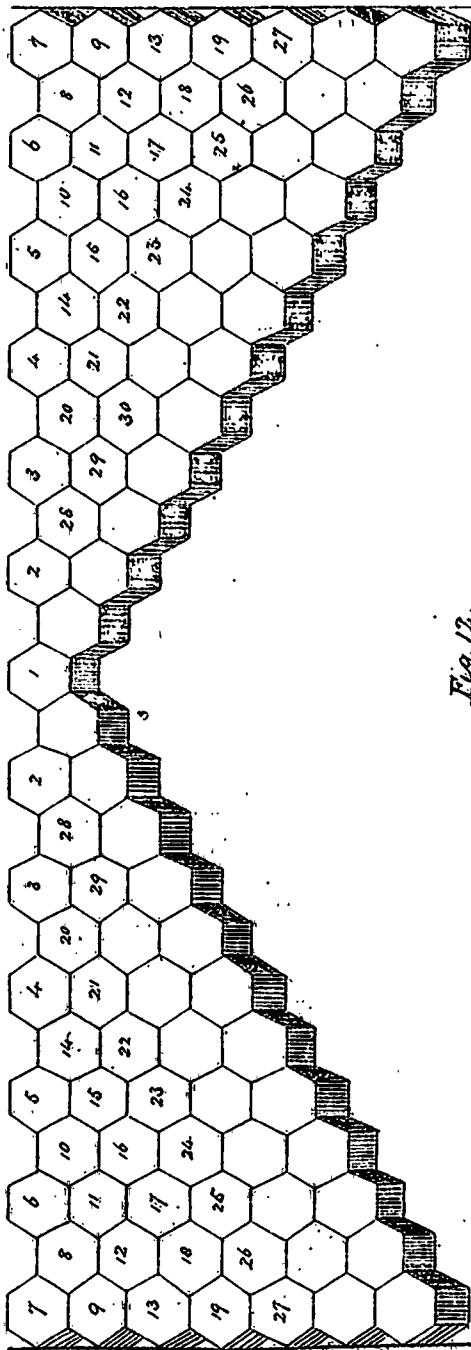




*Developed plan of Vault in course of construction.*

*Wall.*

*End*



*Haunch.*

*Haunch.*

*Fig. 12.*



No. 3627 OF 1852.

PUBLIC WORKS.

GENERAL DEPARTMENT.

To the SECRETARY TO THE MILITARY BOARD,  
Bombay.

SIR,

I have the honor to submit the statement of expenditure in the construction and repair of public works from the 1st of May 1851 to the 30th of April 1852, amounting to Rupees 2,69,082 (two lacs, sixty-nine thousand and eighty-two).

2. The following are the names of the Officers who composed the department :—

Lieutenant Jenkin Jones, 1st Assistant.

Lieutenant W. Waddington, Acting 2nd Assistant.

Mr. Armitstead, 2nd Assistant.

Captain Macdonald, in charge Nagpoor dawk line of road.

Lieutenant J. A. Fuller, 2nd Assistant.

Mr. Scott, 2nd Assistant.

Lieutenant C. Scott, 1st Assistant.

Lieutenant J. S. Trevor, 2nd Assistant.

3. The expenditure during the year amounts to Rs. 2,69,082 (two lacs, sixty-nine thousand and eighty-two), whilst the cost of superintendence comes to  $23\frac{1}{2}$  per cent. on that sum. By a reference to the reports for former years, it will be seen that the expenditure for the last year, as compared with the average of that for the two preceding years, has decreased to the extent of Rs. 88,758 (eighty-eight thousand, seven hundred and fifty-eight), whilst the cost of superintendence has increased from  $19\frac{1}{2}$  to  $23\frac{1}{2}$  per cent. The cause of the diminution in the expenditure is to be ascribed to three circumstances :—

1st.—The suspension of Lieutenant Scott's road from Kusara to Khurdee.

2nd.—The completion of the Thull Ghaut.

3rd.—The completion of the portions of the Poona and Sholapore road which had been sanctioned for a large amount.

4. I am happy, however, to remark, that the recommencement of the first work has been lately sanctioned, as also a large number of other works under different Assistants; and there is every prospect of the expenditure amounting during the present year to what it came to for the two preceding years.

5. I will now proceed to notice the works of importance which have been carried out under each of the Assistants. I shall not refer to the repairs of the roads in the department, which occupy so much of the time and attention of the different officers.

#### WORKS CONNECTED WITH THE COMMUNICATIONS OF THE COUNTRY.

*Lieutenant JENKIN JONES, 1st Assistant, in charge of Public  
Works in the Poona Collectorate.*

6. The improving and widening of the mail road from Da-pooree bridge to Akoordee has been completed, at a total cost of Rs. 10,256-4-3 (ten thousand, two hundred and fifty-six, annas four, and pies three). The road originally was only 20 feet wide; it is now 25 feet wide; and the raised portions of the road have been protected by means of mounds of earth, as a security against accidents. This portion of the road was in very bad order before it was widened. It is now about the best piece of road along the whole line from Poona to Panwell, which circumstance I ascribe to the wear and tear of the road having been diffused over a greater surface, and to the surface of the road having been kept as flat as possible.

7. A cross-road from Chakun, to join the mail road near Wurgaum, was sanctioned under date the 18th March 1851, for Rs. 12,800 (twelve thousand and eight hundred). Considerable progress was made in the execution of the road



during the year, and the traffic between Panwell and Ahmednuggur has already adopted this route, in preference to the old road *viâ* Lohgaum and Waghoolee.

8. A branch road, sanctioned under date the 31st October 1851, for Rs. 3,837 (three thousand, eight hundred and thirty-seven) has been opened out between the mail road and the city bridge at Poona, and it affords a direct communication between the two, which was much wanted. The work has been completed.

9. One double and four single drains on the Nimbadeerah Ghaut, beyond Ahmednuggur, have been built, at a cost of Rs. 320-9-5 (three hundred and twenty, annas nine, and pies five). The road was made many years ago, by means of prisoners, and these drains were left undone; in consequence of which carts were unable to adopt the new line of road which has now been made available.

10. A sum of Rs. 1,304-3-9 (one thousand, three hundred and four, annas three, and pies nine) has been expended during the year in marking out and improving the road up the Moota river in the direction of the Murrah Ghaut. The amount sanctioned was Rs. 3,000 (three thousand), derived from certain funds placed at my disposal by the Collector of Poona. The road was nearly impassable for carts before the new line was opened out. It is now much used, and has proved of much convenience to the public.

*Lieutenant* WADDINGTON.

11. This officer was appointed to the department under date the 18th October 1851, and he has been employed in the construction of two roads, one from Narraingaum to Jooneer, and the other from Narraingaum to the Alleh Khind, in the direction of Sungumnair and Nassick. These roads were sanctioned under date the 18th March 1851, at the rate of Rs. 800 (eight hundred) per mile. Curb stones have been dispensed with. The road has been very well drained through-

out, and, when completed, there will not be a dip along the whole line. Both roads have been considerably advanced.

12. I should also mention, that the road through the Alleh Khind, which was made some twenty years ago, has been put into thorough order. From its not having been repaired for years, it had got into a very bad state, and it was nearly impassable for carts. When the road is sanctioned as far as Sungumnair, and the Chundunpooree Ghaut is properly made, a direct communication for cart traffic between Nassick and the valley of the Godavery will be opened out with Poona and Panwell.

*Mr. ARMITSTEAD, 2nd Assistant.*

13. This Assistant has been principally employed in the construction of the road from Poona towards Sholapore ; and as nothing has been published regarding it for the last three seasons, it may be as well that I should show concisely what has been done up to the present time.

*1st.*—The first portion of the road from Indapore to Patus, a distance of 44 miles, 6 furlongs, and 17 yards, was sanctioned under date the 17th December 1845, for Rs. 2,54,732 (two lacs, fifty-four thousand, seven hundred and thirty-two), and it was commenced under date the 5th of February 1846. The road is 22 feet wide, well raised, levelled, bridged, and drained throughout, with the exception of the ten streams which require bridges of a large size to be built over them.

*2nd.*—The second portion of the road from Poona to Patus, a distance of 36 miles, 6 furlongs, and 170 yards, was sanctioned under date the 31st August 1848, for Rs 1,31,221 (one lac, thirty-one thousand, two hundred and twenty-one), and it was commenced under date the 1st November 1848. It is of a similar construction to the portion above described. It is completed, with the exception of fifteen bridges, which are required to be built over the large streams that intersect the line. The plans and estimates of these bridges have been submitted for sanction.

*3rd.*—The third portion of the road from Indapore to the Bheema river, a distance of 5 miles, 5 furlongs, and 100 yards, was sanctioned under date the 21st November 1850, for Rs. 20,711 (twenty thousand, seven hundred and eleven); it was commenced by the late Lieutenant Donne, and completed by Mr. Armitstead.

*4th.*—The fourth portion includes the continuation of the road from the Bheema river to Tunboornee, a distance of 7 miles, which was sanctioned under date the 15th January 1852, for Rs. 29,430 (twenty-nine thousand, four hundred and thirty); and the construction of the road on both sides of the Leena river was sanctioned under date the 21st November 1850, for Rs. 6,735 (six thousand, seven hundred and thirty-five). Considerable progress was made in the construction of both pieces of road during the official year, and it is expected that about four miles of road will be made beyond Tunboornee within the amount sanctioned.

It appears from the above statement, that 98 miles, 2 furlongs, and 67 yards of this road have been constructed in the course of the last six years; and the following Table shows the masonry works that have been executed, on each portion of the line :—

## List of Bridges and Drains built on

	SLABBED DRAINS.																	
	Single.			Double.			Three Water Ways.	Four Water Ways.	Five Water Ways.	Six Water Ways.								
	Up to 1½ Feet.	2 to 2½ Feet.	3 to 3½ Feet.	3½ to 4½ Feet.	5 to 6 Feet.	1½ Feet.	2 to 2½ Feet.	3 to 3½ Feet.	4 to 4½ Feet.	5 Feet.	6 Feet.	2½ Feet.	4 Feet.	5 to 6 Feet.	4½ Feet.	6 Feet.	4½ Feet.	4½ Feet.
Poona to Patus .....	38	29	38	15	...	...	...	6	13	2	...	1	4	3	1	1	..	2
Patus to Indapore ..	30	85	42	23	2	3	6	18	18	...	...	1	4	...	...	..	..	..
Indapore to Bheema River .....	8	6	17	5	...	...	...	1	7	...	...	2	...	...	..	..	1	1
Bheema River to Yenegaum .....	2	6	12	3	...	...	...	2	1	...	...	...	...	...	..	..	..	1
Total....	40	135	100	69	17	3	6	21	32	13	2	1	7	4	3	1	2	4

REMARKS.—Total length of road from Poona to Yenegaum 98 miles, 2 furlongs, and 67 yards.

Masonry	slabbed drains of sizes....	400
"	culverts of sizes.....	32
"	bridges .....	19
"	" 2 arches .....	1
"	" 3 " .....	1

*the Road from Poona to Yenegaum.*

ARCHED CROSSINGS.													Remarks.			
Culverts.			BRIDGES.													
Single.			Single.					Double.		Three Water Ways.						
5 Feet.	6 Feet.	8 Feet.	9 Feet.	10 Feet.	12 Feet.	15 Feet.	16 Feet.	20 Feet.	21 Feet.	25 } Feet.	26 }	34 Feet.		14 Feet.	15 Feet.	16 Feet.
..	..	..	3	..	..	1	..	..	..	..	2	1	..	..	..	1
13	8	6	1	4	3	1	3	2	1	..	..	..	..	1	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	1	..	..	..	..	..	..	1	..	..	..	..	..	..	..
13	8	7	4	4	3	2	3	2	2	2	2	1	1	1	1	1

Nineteen aqueducts for garden irrigation are not included under the works of road drainage.

(Signed) T. P. ARMITSTEAD,  
2nd Assistant Superintendent of Roads.

14. Roadways have been cleared from the main line to the seven travellers' bungalows between Poona and Indapore, at a cost of Rs. 275-4-9 (two hundred and seventy five, annas four, and pies nine).

15. The bullock track over the Deweh Ghaut, between Poona and Sassoor, sanctioned under date the 20th February 1850, for Rs. 500 (five hundred), has proved of great convenience to the public, and numerous carts even prefer this route to the road over the Bapdeo Ghaut. A new line down this ghaut has been marked out, with a slope of 1 in 20, and the sanction for its construction is daily expected.

16. *Captain* MACDONALD succeeded the late *Captain* Dennis in charge of the dawk road from Ahmednuggur to the Wurda river, in the direction of Nagpoo.

17. Independent of the repairs to this line of road, which are principally made to facilitate the dawk from Calcutta to Bombay, more particularly during the monsoon, a number of masonry, wooden, and flying bridges have been constructed, at an aggregate cost for the years 1850-51-52 of Rs. 4,914-15-6 (four thousand, nine hundred and fourteen, annas fifteen, and pies six); and a fair weather road has been cleared between the Godavery and the Wurda river, the cost of which has amounted on the whole to Rs. 12,237-1-4 (twelve thousand, two hundred and thirty-seven, anna one, and pies four). The work is completed.

*Lieutenant* FULLER, in charge of *Roads in the Northern and Southern Concan.*

18. No new roads or bridges have been carried into execution by this officer during the past Official year.

*Mr.* SCOTT, in charge of *Roads in Salsette.*

19. No new roads have been carried into execution by this Assistant during the past official year, but a number of small works in connection with the communications of the country under his charge have been performed.

20. The Dysur, Goregaum, and Sauky bridges, on the Ghorebunder road, have been enlarged, and their respective approaches improved. A raft has been provided for the Colsette ferry, at a cost of Rs. 1,107 (one thousand, one hundred and seven), and a horse-boat for the ferry between Ghorebunder and Bassein, at a cost of Rs. 1,276 (one thousand, two hundred and seventy-six), whilst several of the other ferry boats have been extensively repaired, and the ferries generally are now well provided with boats. A new horse-boat for the ferry at Satputty is in course of construction, at an estimated cost of Rs. 1,500 (one thousand and five hundred).

21. Milestones have been put up on the Bandoop and Tanna road, at a cost of Rs. 13-11-8 (thirteen, annas eleven, and pies eight).

*Lieutenant Scott, in charge of the new Road from Kussarah to Khurdee, and of the Line from thence to Colsette and Kusseylee Bunders.*

22. The sanction of the new line of road was suspended during the past year, pending a reference to the Government of India, and the extensive works along the line were stopped, with the exception of the viaduct over the Mokhownah river, which was carried up to the springing of the arches. The amount expended thereon during the year came to Rupees 5,059-12-7 (five thousand and fifty-nine, annas twelve, and pies seven). The sum sanctioned for 12 miles, 7 furlongs, 95 yards, and 2 feet of road, comes to Rs. 2,55,849 (two lacs, fifty-five thousand, eight hundred and forty-nine), and the amount already expended to Rs. 1,17,138-5-4 (one lac, seventeen thousand, one hundred and thirty-eight, annas five, and pies four). It is expected that the greater portion of the line will be opened to the public by the next monsoon.

23. The steps to the bunder at Kusseylee have been repaired, at a cost of Rs. 138-10-2 (one hundred and thirty-eight, annas ten, and pies two). Land-slips have been removed on the 1st division of the new road, at a cost of

Rs. 517-1-4 (five hundred and seventeen, anna one, and pies four), and temporary bridges have been erected across all the impassable nullas below the ghaut, for the convenience of the mail during the monsoon, at a cost of Rs. 155-10-6 (one hundred and fifty-five, annas ten, and pies six).

24. *Lieutenant* TREVOR succeeded *Lieutenant* Chapman, under date the 13th August 1851, in charge of the roads and public works in the Nassick Sub-Collectorate.

25. The Undwell bridge, of 100 feet span, built by *Lieutenant* CHAPMAN, was completed in January 1852, and its cost, exclusive of approaches, came to Rs. 16,444-8-4 (sixteen thousand, four hundred and forty-four, annas eight, and pies four).

26. It would be too tedious to mention separately all the new works which have been sanctioned on the great Agra road, between the Thull Ghaut and the limit of the Candeish boundary, more particularly as most of them were only commenced at the beginning of the present year, and will not be completed for the next twelve months. I should observe, however, that they are comprised of a number of large bridges over the Wakee, Kaprah, and Waldevi rivers, designed by *Lieutenant* Trevor, besides several extensive alterations to the present road between the Thull Ghaut and Nassick, and small bridges and drains over many of the nullas that are at present unbridged, the names of which are all specified in the statement of the expenditure.

27. Numerous other bridges on the same line have since been sanctioned, and the estimates for nearly every improvement required have been submitted. I shall, therefore, merely add, that the greater part of the road will most likely be furnished from the Thull Ghaut to Nassick by the next monsoon, by which time all the large bridges will have been finished, and opened to the public, with the exception of that over the Nassurdee river, close to Nassick.

28. I will now merely refer to a few of the works which



Lieutenants Chapman and Trevor conjointly carried into execution during the past year.

29. The flying bridge at the Kadoo river, between Nassick and Chandore, was completed in May 1851; the amount expended on the whole came to Rs. 651-11-0 (six hundred and fifty-one, and annas eleven). The work consisted of new masonry ramps on each side of the river.

30. Constructing a ford with approaches near the site of the new flying bridge at Nassick has been nearly completed, and has for a long time past been open to the public. This work was designed by Lieutenant Chapman, and is a great improvement to this portion of the line of road.

31. The new flying bridge, also, connected with the above work, was completed in June 1851, for Rs. 9,418-10-11 (nine thousand, four hundred and eighteen, annas ten, and pies eleven).

32. A new boat has been built for the ferry at Sungumnair, at a cost of Rs. 604-8-2 (six hundred and four, annas eight, and pies two).

33. The principal improvement carried into execution during the year on the Agra road was the construction of a new piece of road, for the purpose of removing a steep and dangerous ascent near the town of Chandore; and, though not quite finished in April last, it was then open to the public. The work has been very well done, and a small skew bridge has been built over the nulla at the foot of the ascent, both of which works do Lieutenant Trevor infinite credit.

34. The improvement also to the Agra road has been continued during the year, from a sanction which has been periodically granted to the extent of Rs. 9,000 (nine thousand), and the road has now been widened, levelled, and drained from the top of the Thull Ghaut to a spot near the Wakee and Kaprah rivers, a distance of 5 miles, 141 yards, and 2 feet.

35. The Undwell bridge was connected with the old line of road, at a cost of Rs. 902-6-1 (nine hundred and two,

annas six, and pie one), to meet the convenience of the public during the monsoon, and the few remaining improvements to the Thull Ghaut sanctioned after the line was opened were completed at a cost of Rs. 8,678 (eight thousand, six hundred and seventy-eight).

36. The roads in the Peinth States were made over to the charge of Lieutenant Trevor, under date the 21st November 1851; and the road from Sawul Ghaut to Oomralla, and its continuation to Peinth, as also the road from the Suttee Ghaut to Hursole, have, with the exception of the latter, been advanced to as great an extent as the sanctions would permit.

#### TANKS, BUNDS, AND WELLS.

37. *Lieutenant JENKIN JONES* has incurred an expenditure of Rs. 4,065-9-6 (four thousand and sixty-five, annas nine, and pies six), in the construction and repairs of tanks, bunds, and wells in the Poona Collectorate.

38. The Jooneer aqueduct has been cleaned out and thoroughly repaired, at a cost of Rs. 950-5-1 (nine hundred and fifty, annas five, and pie one). It is an old aqueduct, which had fallen into decay. It is intended to afford water to the inhabitants of Jooneer, and it now furnishes a very fair supply.

39. The aqueduct leading to the Hafiz Bagh, near Jooneer, another old Mahomedan work, is intended for irrigation, and it has been partially repaired, at a cost of Rs. 978-13-6 (nine hundred and seventy-eight, annas thirteen, and pies six). It has been necessary, however, to submit a fresh estimate for the completion of the work, which has been duly sanctioned, under date the 19th of March 1852.

40. A well at Loonee, for the use of travellers, has been built, at a cost of Rs. 421-8-11 (four hundred and twenty-one, annas eight, and pies eleven).

41. The large tank or reservoir in the Civil Lines at Poona has been deepened, and the stone used for the purpose

of filtering the water, at a cost of Rs. 368-15-8 (three hundred and sixty-eight, annas fifteen, and pies eight). This water, which is the drainage of a part of the cantonment, has been so purified by means of cleaning out the tank, and filtration, that it is now used by most classes for drinking and cooking purposes.

42. The aqueduct which conveys water from the Katruz tank to the city of Poona has been cleaned out, and the work has been completed, and the supply thereby somewhat increased. An experiment was sanctioned for the purpose of ascertaining whether an increased supply of water could be obtained for the use of the Katruz and Kondwah aqueducts, near to Poona, which has turned out very favourably, and the result will be made known in a future report.

43. *Lieutenant* WADDINGTON made some repairs to the Narraingaum dam, at a cost of Rs. 77-3-8 (seventy-seven, annas three, and pies eight), which have succeeded in stopping a considerable leakage that occurred in some parts of the aqueduct.

44. *Lieutenant* FULLER. This Officer has completed the repairs of the Wuddalah tank, at Panwell, and it holds water very well now, and does not leak. He has also built a ramp at the Panwell bunder, for the purpose of landing carriages and horses, and he has been employed in the construction of a masonry dam at Wasee, for the purpose of irrigating the salt-pans at that place, from which a large revenue is yearly derived. An excess is likely to occur in the completion of this work, which has been caused in different ways, one of which was the giving way, on three different occasions, of the earthen dam thrown up for the purpose of keeping out the tide.

45. *Mr.* SCOTT has executed some petty works in Salsette, and he has built a sluice-gate to the Government Khar at Bhinder, near Ghorebunder, at a cost of Rs. 234-9-5 (two hundred and thirty-four, annas nine, and pies five). The work has been completed satisfactorily.

46. *Lieutenant* SCOTT has completed the dam across the Ruttoondah, which he built the year before, and he has opened out two wells, one at Kussarah, and the other half way between that place and Khurdee, both of which have answered very fairly ; but in the month of May the supply is not so good as it was expected to be.

47. *Lieutenant* TREVOR. This Officer has constructed and repaired several bundaras in the Nassick Sub-Collectorate, at a cost of Rs. 2,131-12-2 (two thousand, one hundred and thirty-one, annas twelve, and pies two), and he has sunk a well near the top of the Thull Ghaut, which will prove of great convenience to travellers and cartmen, it being close to a great halting place.

#### BUILDINGS.

48. *Lieutenant* JENKIN JONES has incurred an expenditure of Rs. 4,748-5-6 (four thousand, seven hundred and forty-eight, annas five, and pies six) in the construction and repair of the buildings under his charge. The most important seem to be the addition of bath-rooms and necessaries to the travellers' bungalow at Poona, and the construction of arm-racks and shelves to the different staging pendalls above the Ghaut, at a cost of Rs. 1,666 (one thousand, six hundred and sixty-six). The other works are, more or less, of a petty kind, requiring no particular notice.

49. *Mr.* ARMITSTEAD has finished the building of the fine new travellers' bungalow between Poona and Indapore ; and the one at Jeejooree, on the same plan, was nearly completed in April last. These buildings have two sitting-rooms, with a verandah all round, and a bath-room and necessary at each end of the verandah, on the rear side. They are built entirely of masonry ; and the estimated cost, including out-houses, comes to Rs. 2,117 (two thousand, one hundred and seventeen).

50. Furniture has been provided for all the buildings, at the cost specified in the statement.

51. *Lieutenant FULLER* has finished the construction of the new travellers' bungalows at Mhar and Nagotna, and they are both very nice buildings. The estimated cost came to Rs. 4,736 (four thousand, seven hundred and thirty-six), and the one at Mhar to Rs. 4,498 (four thousand, four hundred and ninety-eight). Both have been completed within the estimates.

52. The arm-racks and shelves to the staging pendalls below the Ghauts have been completed, and the furniture supplied to the new bungalows above mentioned, for the sums specified in the statement.

53. New police lines have been built at Penn, at a cost of Rs. 370 (three hundred and seventy).

54. *Mr. SCOTT* has incurred an expenditure of Rs. 5,076-10-3 (five thousand and seventy-six, annas ten, and pies three) in the construction and repairs of the buildings under his charge, none of which are of that importance as to require particular notice, with the exception of a number of pendalls or chowkies, which he has built for the police in different parts of Salsette, and which have been completed at a cost of Rs. 1,346 (one thousand, three hundred and forty-six).

55. *Lieutenant SCOTT, 1st Assistant*, has expended the sum of Rs. 925-3-3 (nine hundred and twenty-five, annas three, and pies three) in the repair of the buildings under his charge.

56. *Lieutenant TREVOR* has incurred an expenditure of Rs. 2,759-8-9 (two thousand, seven hundred and fifty-nine, annas eight, and pies nine) in the buildings under his charge. A building for stores, and the use of Overseers, has been built half way between Nassick and Chandore, at a cost of Rs. 712-13-4 (seven hundred and twelve, annas thirteen, and pies four); and the travellers' bungalow at Egutpoora has been altered and much improved, at a cost of Rs. 994-6-1 (nine hundred and ninety-four, annas six, and pie one).

57. The above concludes the remarks that I have to offer regarding the works which have been carried into execution during the preceding year in this Department; and the only

thing now left for me to add is, that I have every reason to feel pleased with the exertions made by the Assistants and their subordinates in the execution of the works entrusted to their charge.

I have the honor to be,

Sir,

Your most obedient Servant,

W. D. GRAHAM, Brevet Captain,

Superintendent of Roads and Tanks.

*Poona, Superintendent of Roads Office,*

*25th December 1852.*

*Comparative Statement showing the Expenses of Engineering and Superintendence on account of the Road and Tank Department, for the Year 1851-52.*

Names.	Staff Salary.		Extra Batta.		Regimental Allowances, less Nett Pay.		Permanent Establishment.		Total.		Other Expenditure.		Gross Expenditure.		Per-centage of Staff salary, Extra Batta, Regimental Allowances, less Nett Pay, and Permanent Establishment, on Gross Expenditure.
	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	
Captain Cowper, 1st Assist.															
Supt. of Roads .....	818	11 4	.....	.....	.....	.....	.....	.....	4,561	7 11	54,832	9 1	59,394	1 0	7.680
Lieutenant Jenkin Jones, 1st Assist. Supt. of Roads ..	1,410	0 0	.....	.....	.....	2,392	12 7	.....	}	}	}	}	}	}	}
Lieutenant Waddington, 2nd Assist. Supt. of Roads ..	1,896	0 0	.....	.....	.....	360	0 0	.....							
Mr. Armitstead, 2nd Assist. Supt. of Roads .....	77	6 8	1,488	0 11	.....	2,572	1 7	.....	4,197	9 2	58,088	14 4	62,176	7 6	6.654
Captain Dennis, Post Master, in charge Negpore Dawk Line .....	3,609	7 8	.....	.....	.....	2,198	5 6	.....	}	}	}	}	}	}	}
Lieutenant Bird, Acting Post Master, in charge Negpore Dawk Line .....	984	12 4	.....	.....	.....	488	7 8	.....							
Captain Macdonald, Post Master, in charge Negpore Dawk Line .....	118	8 0	.....	.....	.....	252	0 0	.....	7,651	9 2	18,556	7 7	26,208	0 9	29.195

Names.	Staff Salary.	Extra Batta.	Regimental Allowances, less Nett Pay.	Permanent Establishment.	Total.	Other Expenditure.	Gross Expenditure.	Percentage of Staff Salary, Extra Batta, Regimental Allowances, less Nett Pay, and Permanent Establishment, on Gross Expenditure.
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
Lieutenant Fuller, 2nd Assist. Supt. of Roads ..	4,740 0 0	....	....	4,058 10 4	8,798 10 4	28,811 0 8	37,604 11 0	23-383
Mr. Scott, 2nd Assist. Supt. of Roads .....	5,640 0 0	....	....	3,578 13 1	9,218 13 1	31,458 3 3	40,677 0 4	22-663
Lieutenant Scott, 1st Assist. Supt. of Roads .....	6,484 5 7	....	....	6,148 9 10	12,632 15 5	20,668 12 4	33,301 11 9	37-934
Lieutenant Chapman, 1st Assist. Supt. of Roads ..	1,895 10 8	....	....	1,514 15 8	3,409 15 8	10,674 11 4	14,083 11 6	20-273
◆ Assist. Supt. of Roads ..	4,740 0 0	....	....	5,243 15 10	13,394 10	52,674 11 4	66,069 5 6	

W. D. GRAHAM, Brevet Captain,  
Superintendent of Roads and Tanks.

Camp Chakun, Superintendent of Roads' Office,  
18th January 1853.



*Statement of Expenditure in the Construction and Repair of  
Public Works in the Road and Tank Department, from  
the 1st of May 1851 to the 30th of April 1852.*

*Superintendent of Roads' Office, Poona, 25th December 1852.*

Names of Works.	Amount.	Total.
	Rs. a. p.	Rs. a. p.
<i>Works connected with the Communications of the Country.....</i>	.....	2,31,464 10 7
<i>Including—</i>		
Annual repairs to roads, bridges, &c. for 1850-51.....	6,274 4 8	
Improving and widening the Akoordees road..	8,283 6 1	
Annual repairs to roads, bridges, &c. for 1851-52 .....	15,643 10 10	
Ditto to roads from Poona to Se- roor, for 1851-52 .....	3,557 5 5	
Constructing a new cross-road from Chakun via Tullegaum, to join the Poona mail road.	3,385 13 1	
Constructing a new road from the old Panow- lee road to join the present Poona mail road, and widening the road from new Poona bridge to old Panowlee road .....	2,493 11 10	
Annual repairs to roads, bridges, &c. for 1851- 52, in the Ahmednuggur Collectorate ....	3,784 4 9	
Constructing one double and four single drains on the road from Nuggur to Neembadeera.	920 9 5	
Improving Murra Ghaut road .....	1,304 3 9	
Making a road from Narraingaum to Jooneer.	1,906 1 2	
Do. do. do. to Alleh Khind.	1,340 11 0	
Constructing a new line of road between Poona and Patus.....	14,371 0 0	
Constructing a new line of road between Inda- pore and Bheema.....	17,583 14 10	
Constructing a new line of road between the Bheema river and Timboornee .....	2,836 10 1	
Annual repairs to main road from Poona to Patus, for 1851-52 .....	7,712 10 5	
Do. do. from Patus to Indapore, for 1851-52 .....	5,311 10 0	
Do. do. from Poona to Neera bridge, for do. ....	2,711 5 4	
Fixing standards from Poona to Neera bridge.	1,060 14 2	
Annual repairs to masonry, wooden, and flying bridges on the Nagpore dawk line, for 1851-52 .....	5,868 9 1	

Names of Works.	Amount.			Total.		
	<i>Rs.</i>	<i>a.</i>	<i>p.</i>	<i>Rs.</i>	<i>a.</i>	<i>p.</i>
Building masonry, wooden, and flying bridges for the year 1850-51 .....	2,191	4	6			
Maintenance of ferrymen and haulers along the dawk line of road, for 1851-52.....	3,297	3	11			
Clearing a fair weather road between the Godavery and the Wurda river .....	4,222	1	8			
Building masonry, wooden, and flying bridges, for the year 1851-52.....	2,723	11	0			
Annual repairs to mail road, for 1851-52....	5,425	3	1			
Do. to cross roads in the Northern Konkun, for do. ....	3,412	8	2			
Do. to main road for do. ....	4,572	0	1			
Do. to cross roads in the Southern Konkun, for do.....	1,691	9	1			
Improving the Dhysur, Ghoregaum, and Sankey bridges, and their respective approaches on the Ghorebunder road.....	1,510	1	8			
Constructing a horse boat for the ferry between Ghorebunder and Bassein.....	1,026	0	0			
Repairing the ferry boats at Oomergaum and Dhanoo .....	1,007	0	0			
Annual repairs to the several lines of roads in Salsette, for 1851-52 .....	10,407	2	5			
New line of road between Kussara and Khurdee .....	5,059	12	7			
Annual repairs to main road, for 1851-52....	11,980	5	8			
Building a bridge over the Undwell river and approaches .....	1,777	15	4			
Constructing a bridge over the Waldevi river. Do. bridges over the Wakeo and Kaprah rivers, and over a nulla near Egutpooree, and making a new road on both sides .....	1,441	0	2			
For constructing ford, with approaches, near the site of the new flying bridge at Nassick.	1,524	1	11			
For the new flying bridge over the Godavery river, at Nassick .....	3,041	15	6			
For removing a steep and dangerous ascent on the great Agra road, near the town of Chandore .....	3,894	3	5			
For the improvement of the portions of the Agra line of road between the Thull Ghaut and Chandore Ghaut .....	8,853	6	3			
Annual repairs to the completed portions of the road between Kussarah and Egutpoora, for 1851-52 .....	1,895	4	0			
Repairs to main road in the Nassick Sub-Collectorate, for 1851-52.....	13,427	15	4			
Do. to cross road in the Nassick Sub-Collectorate, for 1851-52.....	1,883	8	7			
Making a new road from Sawull Ghaut to Oomeralla .....	3,724	7	11			

Names of Works.	Amount.	Total.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
<i>Tanks, Bunds, and Wells</i> .....	.....	10,711 4 8
<i>Including—</i>		
Repairs to Jooneer aqueduct .....	861 6 1	
Do. to Hafiz Baugh aqueduct, at Jooneer.	978 13 6	
Clearing out the aqueduct which conveys water from the Katruz tank to the city of Poona .....	1,210 13 11	
Constructing a ramp at the end of the Panwell bunder .....	897 0 0	
Do. a dam with sluice over the creek near the village of Wassee....	766 7 5	
Do. a well at Kussarah .....	574 1 5	
Building a bundara at the village of Loneewara .....	680 14 5	
Sinking a well at Tullegaum, between the Thull Ghaut and Egutpoora .....	669 9 10	
Repairing a bund at the village of Boralah, Talooka Dindooree .....	539 14 1	
<i>Buildings</i> .....	.....	26,906 10 0
<i>Including—</i>		
Construction of bath-rooms and necessaries to Poona travellers' bungalow .....	810 0 0	
Arm-racks and shelves to staging pendalls.	1,666 0 0	
Annual repairs to travellers' bungalow in the Ahmednuggur Collectorate, for 1851-52 ..	620 0 0	
Erecting five travellers' bungalows between Poona and Indapore .....	3,375 8 9	
Do. a new travellers' bungalow at Jeejooree .....	645 10 10	
Constructing a new travellers' bungalow at Mhar .....	3,276 8 5	
Do. do. do. at Nagotnah.	3,763 15 9	
Erecting pendalls for certain of the police parties stationed in Salsette .....	696 0 0	
Petty repairs for 1851-52 .....	2,102 1 3	
Grand Total Company's Rupees two lacs, sixty-nine thousand, and eighty-two, Annas nine, and Pies three. ....		2,69,082 9 3

W. D. GRAHAM, Brevet Captain,  
Superintendent of Roads and Tanks.

*Statement showing the Amount expended by each Officer of the Road and Tank Department, from the 1st May 1851 to the 30th April 1852.*

Names of Officers.	Roads and Bridges.		Tanks, Bunds, and Wells.		Buildings.		Total.	
	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.
Lieutenant Jenkin Jones .....	46,018	12 10	4,065	6 9	4,748	5 6	54,832	9 1
Lieutenant W. Waddington .....	3,964	11 0	77	3 8	.....	.....	4,041	14 8
Mr. Armitstead .....	63,231	7 0	109	13 4	4,697	10 0	68,038	14 4
Captain A. Macdonald .....	18,556	7 7	.....	.....	.....	.....	18,556	7 7
Lieutenant J. A. Fuller .....	18,184	2 6	1,927	9 11	8,699	4 3	28,811	0 8
Mr. Scott .....	26,069	8 8	912	5 4	5,076	10 3	31,458	3 3
Lieutenant C. Scott .....	18,516	15 6	1,226	9 7	925	8 3	20,668	12 4
Lieutenant J. S. Trevor .....	46,922	14 6	2,992	4 1	2,759	8 9	52,674	11 4
<b>Total.....</b>	<b>2,31,464</b>	<b>10 7</b>	<b>10,711</b>	<b>4 8</b>	<b>26,906</b>	<b>10 0</b>	<b>2,60,082</b>	<b>9 3</b>

W. D. GRAHAM, Brevet Captain,  
Superintendent of Roads and Tanks.

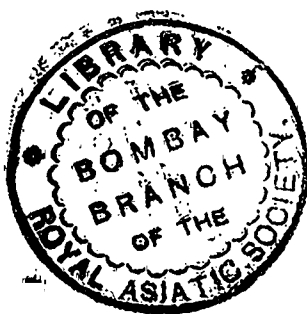
*Statement showing the Expenses of Engineering and Superintendence with reference to actual Outlays.*

Names of Officers.	Expense of Es-	Rate per	
	tablishment per Annum.	Expenditure.	Cent.
	<i>Rupees.</i>	<i>Rupees.</i>	<i>Rupees.</i>
Lieutenant Jenkin Jones .....	4,561	54,832	8½
Lieutenant W. Waddington .....	2,256	4,041	55½
Mr. Armitstead .....	4,137	58,038	7½
Captain A. Macdonald .....	7,651	18,556	41½
Lieutenant J. A. Fuller .....	8,783	28,811	30½
Mr. Scott .....	9,218	31,458	23½
Lieutenant C. Scott .....	12,632	20,008	61½
Lieutenant J. S. Trevor .....	13,394	52,674	25½

Total Expenditure during the year..... Rs. 2,69,082  
 Cost of Establishments do. .... 62,642  
 Average rate per cent. .... 23½

NOTE.—Captain Macdonald is Postmaster as well as in charge of the Nagpore dawk line, and the allowances drawn by that Officer should not therefore be all debited to the Road and Tank Department, especially as his engineering duties are confined to one line of works.

W. D. GRAHAM, Brevet Captain,  
 Superintendent of Roads and Tanks.











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