RIO BLANCO OIL SHALE PROJECT

TRACT C-a

M-K JOB No. 1023

ACCESS ROAD
TRACT C-a TO MEEKER/RIFLE
VIA COUNTY ROAD 24

MORRISON-KNUDSEN COMPANY, INC.
CONTRACTORS – ENGINEERS – DEVELOPERS

November 21, 1975

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INTRODUCTION

Considerable attention and study has been given to access roads for Federal Oil Shale Lease Tract C-a. Previous studies have addressed themselves primarily to the distribution of worker trips with resulting justification of a proposed route westerly to Rangely. In each of the studies there has been an implied existing roadway system capable of handling any vehicular traffic that might be eastbound from the tract.

This report considers these eastward movements as a separate problem; the problem of a system. The principal system elements include County Roads 5 and 24 and State Highways 13 and 64. These four roads together with a Rangely road comprise the primary distribution system for all transportation service to Tract C-a. The weakest system element is County Road 24, through Ryan Gulch. Specific attention is given herein to improvement of County Road 24.

Exhibit 1 shows the location of the proposed County Road 24 (Ryan Gulch Road) improvement as well as other major transportation facilities (existing and proposed) in the vicinity of Tract C-a. For clarity Tables are included within the text and Exhibits are found at the end of the report.

SECTION 2

SYSTEM DESCRIPTION

SECTION 2

SYSTEM DESCRIPTION

The transportation system serving Tract C-a is basically highway oriented. This is a fact of the existing system and a probable necessity of any future transportation system because of topographic constraints. Thus, a good highway system, to both east and west, connecting with major highways, railroads, and air service is necessary. The existing roadway system connecting the tract to major transportation facilities includes State Highways 13 and 64 and Rio Blanco County Roads 5 and 24.

Air service to the tract by commercial airline is through Vernal or Grand Junction. Vernal, approximately 75 miles west, is served by Frontier Airlines with four flights daily. Grand Junction, approximately 120 road miles from the tract, is served by both Frontier and United Airlines with seven regular flights daily.

Rifle, some 58 miles southeast of Tract C-a, is the nearest railhead. The Denver and Rio Grande Western Railroad mainline passes through Rifle with connections to the east through Denver, to the southeast through Pueblo, and to the west through Salt Lake City.

State Highway 64 (SH 64) is an east-west route from Meeker through Rangely to a connection with U.S. Highway 40 before entering Utah. U.S. 40 passes through Vernal, Utah, into Salt Lake City. SH 64 is asphalt surfaced in good condition. Horizontal and vertical alignment is very good with a few minor exceptions.

State Highway 13 (SH 13) is a north-south route beginning at Rifle and continuing north through Meeker and Craig, Colorado, into Wyoming via

Baggs. At Rifle, SH 13 interchanges with U.S. 6 and 24 and Interstate Route I-70. SH 13 is asphalt surfaced in good condition. Horizontal and vertical alignment is good.

Rio Blanco County Road 5 (Piceance Creek Road) follows Piceance Creek from Rio Blanco, on SH 13, approximately 42 miles to SH 64 at Rio Blanco Lake on the White River. County Road 5 is asphalt paved in fair condition. The north half of this road is scheduled for repaving in the spring of 1976 through a special legislative appropriation. The paving will improve the load carrying capacity of this section. However, the proposed paving width of 24 feet will remain substandard according to current Colorado Department of Highways design standards. In addition to being a connecting link in the Tract C-a transportation system, County Road 5 is also the principal element of highway service to Federal Oil Shale Lease Tract C-b.

Rio Blanco County Road 24 (Ryan Gulch Road) is the final segment of the system of roadways serving Tract C-a to the east. County Road 24 begins from an intersection with Piceance Creek Road approximately 16 miles southwest of SH 64. It is approximately 15 miles along County Road 24 to Tract C-a. Although the alignment is generally good, the roadway is not surfaced. Improvement of County Road 24 is necessary to complete a viable transportation network toward the east from Tract C-a.

SECTION 3

TRAFFIC LOADING

SECTION 3

TRAFFIC LOADING

In previous studies, distribution of worker trips to and from Tract C-a has been discussed in great detail. A summary of the worker distribution, as it pertains to an eastern access to Tract C-a, is presented here.

Little discussion pertaining to movement of goods and by-products, however, has been presented in other Tract C-a access study reports. Since these movements directly affect the proposed eastern access to Tract C-a, discussion is presented herein.

3.1 Worker Commuting

In earlier studies, the mathematical gravity model approach was employed for the purpose of trip distribution. The principle behind the model is: given any town, the measure of attractiveness of that community is directly proportional to the population of the community and inversely proportional to a function of the time or distance between the community and any destination. The formula is as follows:

$$F = \frac{P}{(D \text{ or } T)^n}$$

where: F = Measure of attractiveness

P = Population

D = Distance

T = Time

n = Exponential Modifier

Estimates of work force were furnished by Rio Blanco Oil Shale Project. In summary, they include:

Total Work Force	1,000 Employees
Average Vehicle Occupancy	1.8 Persons per Vehicle
Daily Trips for Services, Sales, etc. from surrounding communities	100 Trips

Converting the above to average daily vehicle trips was accomplished as follows:

The average worker at Tract C-a would work 230 days per year; that is, 260 week days minus 5 days of sick leave, 15 vacation days, and 10 holidays.

The average daily work force for a 365-day year is then

$$\frac{230}{365} \times 1000 = 630 \text{ workers/day.}$$

The average daily vehicle work trips were then computed as

$$\frac{630 \text{ workers}}{1.8 \text{ workers/vehicle}} \times 2 \text{ one-way trips} = 700 \text{ one-way vehicular trips/day}$$

Adding the 100 daily trips for services, sales, etc., yielded 800 one-way vehicular trips per day.

Using the gravity model, the 800 one-way vehicular trips per day were distributed. To simplify analysis, and in concert with previous studies, the trips were distributed only between Tract C-a and Rangely and Tract C-a and Meeker.

A distribution of the estimated 800 daily vehicles of Tract C-a traffic between Meeker and Rangely was computed based upon the most current study alignments. The exponential modifier was set at two as in Reference 1.

The trip distribution was 130 trips between Tract C-a and Meeker and 670 trips between Tract C-a and Rangely.

3.2 Movement of Goods and By-Products

The development and operation of a commercial oil shale mine and plant will generate a significant amount of truck traffic. During development phases, large volumes of construction materials will be transported to the site by truck. During operation, truck traffic will be generated for incoming fuels, lubricants, etc., and for shipment of by-products to rail terminals.

In analysis of required transportation facilities for access to Tract C-a, the longevity of the various traffic generating activities associated with the tract was considered of utmost importance. Construction activity is not expected to be nearly as significant or lasting as the life of the commercial operation. Hence, construction truck traffic generated by the development was not considered viable for use in the estimate of traffic loading and subsequent justification of an access road. Nonetheless, traffic generated during this period must be provided with an adequate roadway which should be a permanent facility capable of future traffic growth.

The operating truck traffic loads will have a significant effect on the type of road needed for access to Tract C-a. Based on a nominal 50,000 barrel per stream day (BPSD) production rate, it is estimated that 60 round trip truck movements will be generated per day for outgoing by-

product shipment, and 15 round-trip truck movements will be generated per day for incoming goods shipment. It is expected that these trucks will be semi-trailer combinations.

Presently, a rail terminal facility is being planned for Rifle. This facility will consist of a siding from the Denver and Rio Grande Western track with facilities for handling of incoming goods for construction staging and operation, and for potential by-product handling. It is expected that the truck trips described above will have one terminal at the rail siding facility in Rifle. Truck access to and from Tract C-a will need to be via the Ryan Gulch access road during the operating life of Tract C-a.

SECTION 4

DESIGN CRITERIA

SECTION 4

DESIGN CRITERIA

The proposed Ryan Gulch access could fall under any of three governmental jurisdictions including Bureau of Land Management, State of Colorado Department of Highways, or Rio Blanco County. Each of these governmental units has an operating road function; however, only the State of Colorado Department of Highways has published criteria that deal routinely with traffic volumes approaching the magnitude anticipated.

Because the standards of the Colorado Department of Highways (CDOH) are an accepted statewide standard for the safe and efficient construction and operation of roadways, to accept a lesser standard would be derelict. The introduction of the CDOH design standards states:

> "Minimum Standards
>
> "The following standards generally represent minimum values. The word 'minimum' implies the lowest acceptable limit in design.
>
> "Departures from the Standards
>
> "Design policies and standards are not inflexible. Higher standards may be used within reasonable economic limits. To insure uniform practice on a statewide basis, lower design standards may not be used without approval from the Chief Engineer.
>
> "Policy on Use of AASHO Standards
>
> "The American Association of State Highway Officials has published policies on Geometric Design of Rural and Urban Highways.
>
> "The Colorado Division of Highways generally follows these policies. When standards used in this manual differ from the AASHO policies, this manual shall govern."

CDOH Table 101.2, revised November 1973, outlines various highway classifications. This table is reproduced herein as Table 4-1.

GEOMETRIC DESIGN STANDARDS FOR HIGHWAY CONSTRUCTION

AVERAGE TRAFFIC, DESIGN PERIOD (1)	PAVEMENT TYPE (2)	NO. OF LANES	LANE WIDTH	SHOULDER WIDTH, MIN.		DESIGN SPEED	DESIRABLE MAX. GRADE %	R.O.W. WIDTH			DESIRABLE ACCESS CONTROL	MAXIMUM DEGREE OF CURVE	BRIDGES AND SEPARATIONS	
				OUTSIDE	INSIDE	MPH		DESIRABLE	MINIMUM WITH FRONTAGE ROADS	MINIMUM WITHOUT FRONTAGE ROADS			DESIGN LOAD	CLEAR ROADWAY WIDTH (9)
TYPE A-A														
4,001-8,000 (DHV)						ø							(7)	
25,001-50,000 (ADT)	HIGH	6	12'											
Plains				10'	8'	60-80		300'	275'	175'	Full		HS20-44	
Rolling				10'	8'	60-80		300'	275'	175'	Full		HS20-44	
Mountainous				10'	8'	70		300'	275'	175'	Full		HS20-44	
TYPE A														
705-4,000 (DHV)	HIGH OR HIGH MEDIUM	4	12'			ø					(6)		(7)	
4,401-25,000 (ADT)														
Plains				10'	4'	60-80		300'	250'	150'	Full		HS20-44	
Rolling				10'	4'	60-80		300'	250'	150'	Full		HS20-44	
Mountainous				10'	4'	70		300'	250'	150'	Full		HS20-44	
TYPE B														
401-704 (DHV)	HIGH OR HIGH MEDIUM	(3) 2	12'	8'	-	30-80					(6)		(7) HS20-44	
1,501-4,400 (ADT)														
Plains								250'+	250'	150'				
Rolling								250'+	250'	150'				
Mountainous								250'+	250'	150'				
TYPE C														
201-400 (DHV)	HIGH MEDIUM	(3) 2	11'	8'	-	30-40				(5)	(6)		HS20-44	
751-1,500 (ADT)			12'	8'	-	50-80							HS20-44	
Plains								150'	--	120'			(7)	
Rolling								150'	--	120'				
Mountainous								150'	--	120'				
TYPE D														
101-200 (DHV)	MEDIUM	(3) 2	10'	6'	-	30				(5)	(6)		H20-44	
401-750 (ADT)			11'	6'	-	40-60							H20-44	
			12'	6'	-	65-80							H20-44	
Plains								120'	--	80'			(8)	
Rolling								120'	--	80'				
Mountainous								120'	--	80'				
TYPE E														
(DHV) < 100	LOW MEDIUM	2	10'	4'	-	30-50	See Table 202.3			(5)	(6)	See Table 201.2	H20-44	
251-400 (ADT)			11'	4'	-	60-70							H20-44	
			12'	4'	-	75-80							H20-44	
Plains								100'	--	60'			(8)	
Rolling								100'	--	60'				
Mountainous								100'	--	60'				
TYPE F														
51-250 (ADT)	LOW	2	10'	4'	-	30-70				(5)	(6)		H20-44	
			12'	4'	-	75-80							H20-44	
Plains								100'	--	60'			(8)	
Rolling								100'	--	60'				
Mountainous								100'	--	60'				
TYPE G														
0 - 50 (ADT)	GRAVEL	2	10'	3'	-	20-60				(5)	(6)		H20-44	
Plains								80'	--	60'			(8)	
Rolling								80'	--	60'				
Mountainous								80'	--	60'				

(4) See FOOTNOTES on next sheet.

ø Speeds of 75 or 80 mph are applicable only to highways with full control of access or where such control is planned for in the future.

GEOMETRIC DESIGN STANDARDS FOR HIGHWAY CONSTRUCTION

FOOTNOTES

(1) *The "Types" indicated refer to details shown on Division Standard covering typical cross sections. All designs are now based on the 30th highest hour (Design Hourly Volume) (DHV). Unless actual traffic counts give a different value, the 30th highest hour is assumed to be 16% of the 24-hr. annual traffic volume.*

(2) *PAVEMENT TYPES:*

HIGH	=	*Portland Cement Concrete or Bituminous Pavement (>5")*
HIGH MEDIUM	=	*Bituminous Pavement (5")*
MEDIUM	=	*Bituminous Pavement (3" to 5")*
LOW MEDIUM	=	*Bituminous Pavement (3")*

When comparative estimates indicate that a higher surface type can be constructed for a cost approaching the cost of lower surface type, the higher type shall be used

(3) *Climbing lanes to be provided in accordance with 202.5.*

(4) *In unusual cases, the maximum shown may be altered after approval by the Chief Engineer. Grades on Interstate shall be a maximum of 5% which may be increased to 7% in rugged terrain.*

(5) *In unusual cases, the minimum shown may be altered after approval by the Chief Engineer.*

(6) *To be decided on an individual project basis. Interstate requires full access.*

(7) *Alternate loadings for two 24,000-pound axles shall be used where applicable on Interstate.*

(8) *Where the character of traffic is predominantly passenger vehicles or other unusual conditions exist, this loading may be reduced on order of the Chief Engineer.*

(9) *Bridge widths will be determined in accordance with requirements set forth in the latest revision of AASHO Publications,* A Policy on Design Standards - Interstate, Geometric Design Standards for Highways Other than Freeways, Standard Specifications for Highway Bridges *and* Division "M" Standards. *Special cases will be subject to consideration by the Bridge Engineer.*

The previous section on estimated traffic loading established an average daily traffic (ADT) value for employee commuting and daily service trips, sales trips, etc., east of the tract of 130 vehicles per day. Additionally, it is expected that all major truck trips for incoming goods and outgoing by-products would be via a system east of Tract C-a to a rail terminal at Rifle. Adding 60 round trips for by-product shipment (120 one-way trips) and 15 round trips for incoming goods (30 one-way trips) to the above employee commuting value yields an ADT of 280 vehicles. Referring to Table 4-1 for this ADT indicates that Type E standards are applicable for the Ryan Gulch access road. Table 4-2, which summarizes the CDOH criteria for Type E geometrics, is presented on the following page.

Horizontal alignment properties for design were determined as follows:

Relating speed to radius of curvature used in design, the formula is

$$R = \frac{0.067v^2}{e + f}$$

where: e = Rate of roadway superelevation, foot per foot

f = Side friction factor for design

v = Speed in mph

Assuming a value of e = 0.08 ft/ft, recommended maximum in higher elevations, and values of f from CDOH Table 201.2 interpolated, the resulting radii are shown in Table 4.3 on the following page.

Design speed for the route was set at 50 mph or greater (i.e., minimum radius of 758').

TABLE 4-2

GEOMETRIC DESIGN STANDARDS

Item	Type E
Pavement Type	Low Medium
No. Lanes	2
Lane Width	10' - 12'
Shoulder Width	4'
Design Speed	30 - 80 mph
Max. Grade (1)	
Flat	4% - 6%
Rolling	5% - 7%
Mountainous	7% - 9%
Min. Radius (2)	
Flat	758'
Rolling	464'
Mountainous	250'

(1) Higher figure denotes design spped 30 mph
(2) Assuming maximum superelevation of 0.08 ft/ft

TABLE 4-3

RELATION OF SPEED TO CURVE RADIUS

Speed (mph)	e + f	Radius (R)
30	0.24	250
35	0.235	348
40	0.23	464
45	0.225	600
50	0.22	758
55	0.215	938

Because of the nature of the traffic expected to utilize the Ryan Gulch access (over 50% heavy trucks), it is recommended that the access road be built to higher standards than Type E. Although the design speed warrants two 10' lanes, it would be desirable to utilize 12' lanes to facilitate the heavy truck movement. Furthermore, using a medium pavement type, as warranted by Type D standards, would increase the expected pavement life and subsequently minimize major road maintenance.

Exhibits 2 and 3 are "Standard Typical Sections" CDOH Standard M-400-C1 and M-400-C2, revised 11/6/73. These sheets describe the salient elements for the proposed roadway. Exhibit 4 shows the typical section for the proposed route.

SECTION 5

ROUTE DESCRIPTION

5.1 Description

(a) Route Log - Rio Blanco County Road 24, commonly known as Ryan Gulch Road, extends between the northeast corner of Tract C-a and Piceance Creek Road (County Road 5). The existing road can best be described in three sections:

- Section 1, between Tract C-a and 84 Ranch, a distance of approximately 5.6 miles (Exhibits 5 and 6).
- Section 2, between 84 Ranch and Ryan School, a distance of approximately 3 miles (Exhibits 6 and 7).
- Section 3, between Ryan School and Piceance Creek Road, a distance of approximately 6 miles (Exhibits 7 and 8).

Section 1 currently follows Corral Gulch from the tract boundary to 84 Ranch. This 5.6-mile section was improved under a contract awarded by Rio Blanco County in the summer of 1975. The improvement was for safety reasons and considered temporary because of possible development plans in Corral Gulch. A dam is planned across Corral Gulch immediately above 84 Ranch and will require the relocation of this section.

The proposed relocated route begins near the planned plant site at a junction with the proposed Tract C-a to Rangely Road in Section 28. The road heads east across 84 Mesa, following near the canyon rim, and turns south on a 1500 foot radius curve at Station 1230. The road then descends into Corral Gulch through a draw on a 7.5% grade.

The alignment ascends out of Corral Gulch above the high water line of the proposed dam onto a ridge. Following the minor side draws cutting this ridge on grades up to 8% and curves of 750 foot radius, the alignment descends into Stake Springs Draw near its confluence with Corral Gulch. The proposed route crosses Stake Springs Draw, south of 84 Ranch, and turns southeast as it joins the present County Road 24 at approximately Station 1440.

Section 2 was realigned on an improved grade line and widened to a 32-foot section in the same contract with Section 1. The improvement project included a 6-inch surfacing of pit run sandstone. The surfacing material was tested in the laboratory of the Colorado Department of Highways and judged to be good for sub-base and base material but poor for wearing course surfacing. Upgrading of this section from Station 1440 to Station 1600 will require minor shaping of the roadbed and asphalt surfacing with quality aggregates not available in the area.

Section 3 has relatively good alignment with roadway widths varying from approximately 16 feet to 34 feet. The natural surface of weathered sandstone and shale generally holds its shape with motor patrol maintenance, even in wet weather. During dry periods, surface dust is disturbed by all vehicle movement. Approximately 5 miles of this section from Station 1600 to about Section 1865 is planned for improvement including some realignment, widening and drainage. The last mile of this section from Station 1865 to Piceance Creek Road was improved in early 1975 with County forces. The planned improvements should be implemented together with paving and widening of the bridge span crossing Piceance Creek.

(b) Exposure - The proposed route lies generally in an east-west direction from the plant site to near 84 Ranch in Stake Springs Draw. It follows the existing County Road 24 in a southerly direction to Ryan Gulch. Throughout this section the road will have the advantage of the prevailing winds to minimize snow drifting in winter.

In Ryan Gulch the road lies in a northeast-southwest direction. The winds in Ryan Gulch should help keep the road relatively free of snow.

For the most part, the road is located on the north face of the hills and should be in the sun most of the day. There are some sections between Stations 1300 and 1400 which could be in the shade during the afternoon.

(c) Effect on Existing Road System - Since the proposed Ryan Gulch Road is primarily an improvement of existing County Road 24, the road itself will have little effect on the County and State road system. The increase in traffic on the existing system will be induced by the presence of activities at Tract C-a rather than by the Ryan Gulch Road improvement. Some additional signing will be required at the intersection of Piceance Creek Road (Rio Blanco County Road 5) and Ryan Gulch Road.

(d) Effect on the Terrain - Cut and fill for the section of new road construction between the proposed plant site and approximately Station 1435 near 84 Ranch is relatively minimal. Adequate design precautions as well as adherence to guides on revegetation and erosion control during construction will help mitigate the visual impact of the roadway.

From Station 1435 to the intersection with Piceance Creek Road, the proposed route essentially follows the existing road with little significant terrain alteration.

(e) Right-of-Way - No private lands are crossed by the proposed route. Some state land is crossed at the plant site area between Stations 1145 and 1180, at Corral Gulch crossing between Stations 1275 and 1290, and along the existing County road in Ryan Gulch between Stations 1600 and 1740 and 1880 and Piceance Creek Road. The remainder of the route traverses BLM land.

5.2 Alignment and Profile

Exhibits 5 through 8 are plan and profile sheets prepared from USGS mapping indicating the approximate location and expected grades on the route. Due to the scale of the mapping and contour interval, the lines are approximate only, and refinements will be made when more precise mapping is available.

Pertinent USGS quadrangles utilized included:

Calamity Ridge Quadrangle, 7.5 minute series, 1962
Sagebrush Hill Quadrangle, 7.5 minute series, 1964
Wolf Ridge Quadrangle, 7.5 minute series, 1952
Square S Ranch Quadrangle, 7.5 minute series, 1952

In summary, the grades for the route are:

Grades	Length
0 - 4%	11.0 miles
4 - 6%	1.2 miles
6 - 8%	2.4 miles

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In summary, the grades for the route are:

Grades	Length
0 - 4%	11.0 miles
4 - 6%	1.2 miles
6 - 8%	2.4 miles

5.3 Geology

Basically, the rock encountered is sandstone or shale, with some intermixing of the two reported. As the dip of the rock layers is toward the south, any tendency toward slippage would be more critical on the north slopes. However, as the dip is not great, this would be of concern only in very high cuts.

The mantle on the talus slopes appears to be quite thin, overlaying weathered rock. Relatively steep cut slopes should be little problem with the exception of a normal amount of surface raveling.

5.4 Cost

The estimated construction cost for the route was based on unit costs compiled by the Colorado Department of Highways. The costs were escalated to a January, 1976 base.

It is estimated that the improved County Road 24 will cost $2,172,500. The cost for each section is presented in summary form in Tables 5-1 through 5-3.

Annual maintenance cost for the route based on $1,350 per mile per year would total $19,710.

Due to the scarcity of local aggregates, it is anticipated that paving aggregates will come from a granite quarry near Dinosaur.

TABLE 5-1

CAPITAL COSTS - ROAD CONSTRUCTION

SECTION 1: PLANT SITE TO 84 RANCH (5.6 Miles)

Item No.	Description	Unit	Unit Cost($)	Quantity	Total Cost($)
1	Select sandstone base course (6")	Ton	3.000	40,000	120,000.00
2	Aggregate bituminous base (5") and surface course	Ton	5.700	31,500	179,550.00
3	Asphalt (AC-5)	Ton	72.000	1,890	136,080.00
4	Tack Coat (CSS-1) .15 gal/s.y.	Gal.	0.500	17,100	8,550.00
5	Prime Coat (MC-70) .45 gal/s.y.	Gal.	0.500	51,300	25,650.00
6	Haul Cost	Ton-Mi.	0.120	1,844,750	221,370.00
7	Drainage	L.F.	24.000	1,200	28,800.00
8	Unclassified Excavation	C.Y.	0.878	271,200	238,120.00
9	Compaction	C.Y.	0.150	271,200	40,680.00
10	Wetting	M.G.	3.000	16,800	50,400.00
11	Clearing and Grubbing	Ac.	1,000.000	55	55,000.00
12	Heavy Drainage	Ea.	27,000.000	2	54,000.00
				TOTAL	$1,158,200.00

TABLE 5-2

CAPITAL COSTS - ROAD CONSTRUCTION

SECTION 2: 84 RANCH TO RYAN SCHOOL (3 miles)

Item No.	Description	Unit	Unit Cost($)	Quantity	Total Cost($)
1	Select sandstone base course (correct irregularities)	Ton	3.000	2,200	6,600.00
2	Aggregate bituminous base (5") and surface course	Ton	5.700	16,700	95,190.00
3	Asphalt (AC-5)	Ton	72.000	1,050	75,600.00
4	Tack Coat (CSS-1) .15 gal/s.y.	Gal.	0.500	9,100	4,550.00
5	Prime Coat (MC-70) .45 gal/s.y.	Gal.	0.500	27,200	13,600.00
6	Haul Cost	Ton-Mi.	0.120	558,000	66,960.00
7	Reconditioning	Mi.	2,500.000	3	7,500.00
			TOTAL		$270,000.00

TABLE 5-3

CAPITAL COSTS - ROAD CONSTRUCTION

SECTION 3: RYAN SCHOOL TO PICEANCE CREEK (6 miles)

Item No.	Description	Unit	Unit Cost($)	Quantity	Total Cost($)
1	Select sandstone base course (6")	Ton	3.000	40,260	120,780.00
2	Aggregate bituminous base (5") and surface course	Ton	5.700	31,300	178,410.00
3	Asphalt (AC-5)	Ton	72.000	1,880	135,360.00
4	Tack Coat (CSS-1) .15 gal/s.y.	Gal.	0.500	17,000	8,500.00
5	Prime Coat (MC-70) .45 gal/s.y.	Gal.	0.500	51,000	25,500.00
6	Haul Cost	Ton-Mi.	0.120	1,136,250	136,350.00
7	Drainage	L.F.	24.000	1,500	36,000.00
8	Unclassified Excavation	G.Y.	0.850	57,000	48,450.00
9	Compaction	G.Y.	0.150	57,000	8,550.00
10	Wetting	M.G.	3.000	4,800	14,400.00
11	Clearing and Grubbing	L.S.			5,000.00
12	Heavy Drainage	Ea.	27.000	1	27,000.00
			TOTAL		744,300.00

5.5 Travel Time

It is estimated that design speeds of 55 mph can be maintained for nearly the full length of the route. Based on an average running speed of 50 mph, the trip between Piceance Creek Road and the plant site would be about 17.5 minutes.

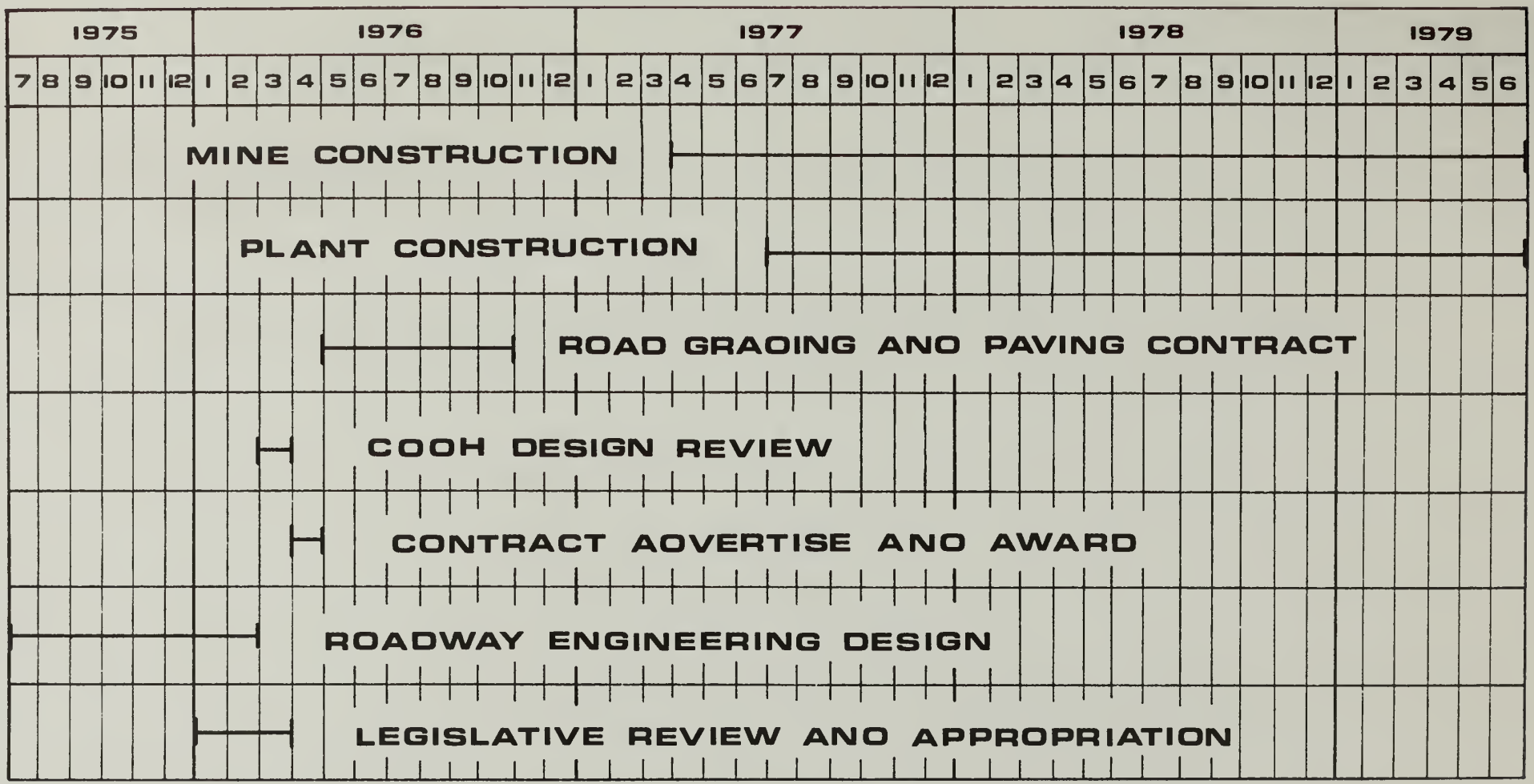
5.6 Timing

The timing of the County Road 24 improvement is crucial. The commencement of development activities on Tract C-a, presently scheduled for 1977, will necessitate good access for incoming goods during construction. Since most construction materials and commodities will be shipped by rail to Rifle and then trucked to Tract C-a, access for incoming goods to the tract will be via State Highway 13 and County Roads 5 and 24. It is imperative that the proposed improvement be implemented by the start of construction activities to facilitate incoming goods shipment.

A chart showing the time schedule for critical events appears as Table 5-4 on the following page.

TABLE 5-4

TIME SCHEDULE FOR CRITICAL EVENTS



SECTION 6

BENEFITS

SECTION 6

BENEFITS

The benefit of a route improvement is usually discussed in terms of dollar savings to the road user. By definition, the monetary benefit of an improvement is the road user costs for the base, unimproved condition minus road user costs for the improved condition minus any added maintenance expenses.

The above approach is a useful tool for analyzing many new highway and highway improvement projects. However, a proposed improvement frequently offers savings to the road user which are difficult to quantify based upon present road user research data. The proposed County Road 24 improvement is the type of project which does offer significant benefits which are most difficult to quantify.

As discussed earlier, the present County Road 24 consists of sections which are surfaced with gravel and sections which are designated as a natural surface road. The imposition of 280 additional daily vehicular trips on this road, many of which are truck movements, will create a tremendous dust problem. It is doubtful whether fugitive dust can be kept at acceptable levels if County Road 24 is not paved.

The reduction of traffic safety hazards has, for a number of years, been considered a prime means of reducing the number and severity of traffic accidents. Unfortunately, there is not a multitude of data available which can be used to monetarily justify a capital expenditure for roadway improvement based on this approach. Nevertheless, it is possible to qualitatively analyze a proposed improvement by assessing the mitigation of traffic hazards and subsequent reduction of accident potential.

In a 1975 publication by the U. S. Department of Transportation entitled "Positive Guidance in Traffic Control," means of identifying and eliminating traffic hazards are discussed from the human factors standpoint. As stated in that publication:

> "The condition of the highway, its design features, and its state of maintenance all may contribute to a highway condition hazard."

The publication further states:

> "Drivers get considerable information from seeing the roadway. The selection of speed and path is quite dependent upon the driver's ability to see the road. He must see the road directly in front of him, and, also see enough of that road at some distance ahead to predict its alignment and grade, its width, and several other factors, with a high degree of accuracy."

One of the best means to make a roadway visible to a driver is through good delineation. This includes marking of centerline and roadway edge lines. Obviously, a roadway cannot be striped unless it is paved.

Even more difficult to quantify when analyzing a proposed improvement is the concept of driver expectancy. Again, quoting from the Department of Transportation publication:

> "Expectancy relates to the readiness of the driver to respond to events, situations, or information. Based on the driver's experience, when expectancies are met, performance tends to be error-free. When expectancies are violated, longer response time and driver errors are the usual result."

The implementation of the proposed County Road 24 improvement will upgrade the road to the standards of the other transportation links in the area system. The road geometrics and conditions will be approximately the same from virtually any origin to any destination within the system. Thus, the driver's expectancies will not be violated and, hopefully, safer travel will result.

SECTION 7

REFERENCES

SECTION 7

REFERENCES

1. International Engineering Company, Inc., "Preliminary Feasibility Route Selection C-a to Rangely," Rev. March 4, 1975.

2. U. S. Bureau of Commerce, Bureau of Public Roads, "Calibrating & Testing a Gravity Model for Any Size Urban Area," October 1965.

3. State of Colorado, Office of the Governor, Oil Shale Planning and Coordination, Impact, An Assessment of the Impact of Oil Shale Development - Colorado Planning and Management Region 11. "Volume IV, General Services," December 1974.

4. State of Colorado, State Department of Highways, Division of Highways, "Roadway Design Manual," January 1972.

5. International Engineering Company, Inc., "Proposed Rangely Access Road to Tract C-a," August 11, 1975.

6. U. S. Department of Transportation, Federal Highway Administration, "Fatal and Injury Accident Rates on Federal-Aid and Other Highway Systems/1969."

7. International Engineering Company, Inc., "Rangely Road Relocation, Geologic Reconnaissance Report," August 18, 1975.

8. Morrison-Knudsen Company, Inc., "Access Road Tract C-a to Rangely," November 14, 1975.

9. U. S. Department of Transportation, Federal Highway Administration, Office of Traffic Operations, "Positive Guidance in Traffice Control," April 1975.

APPENDIX

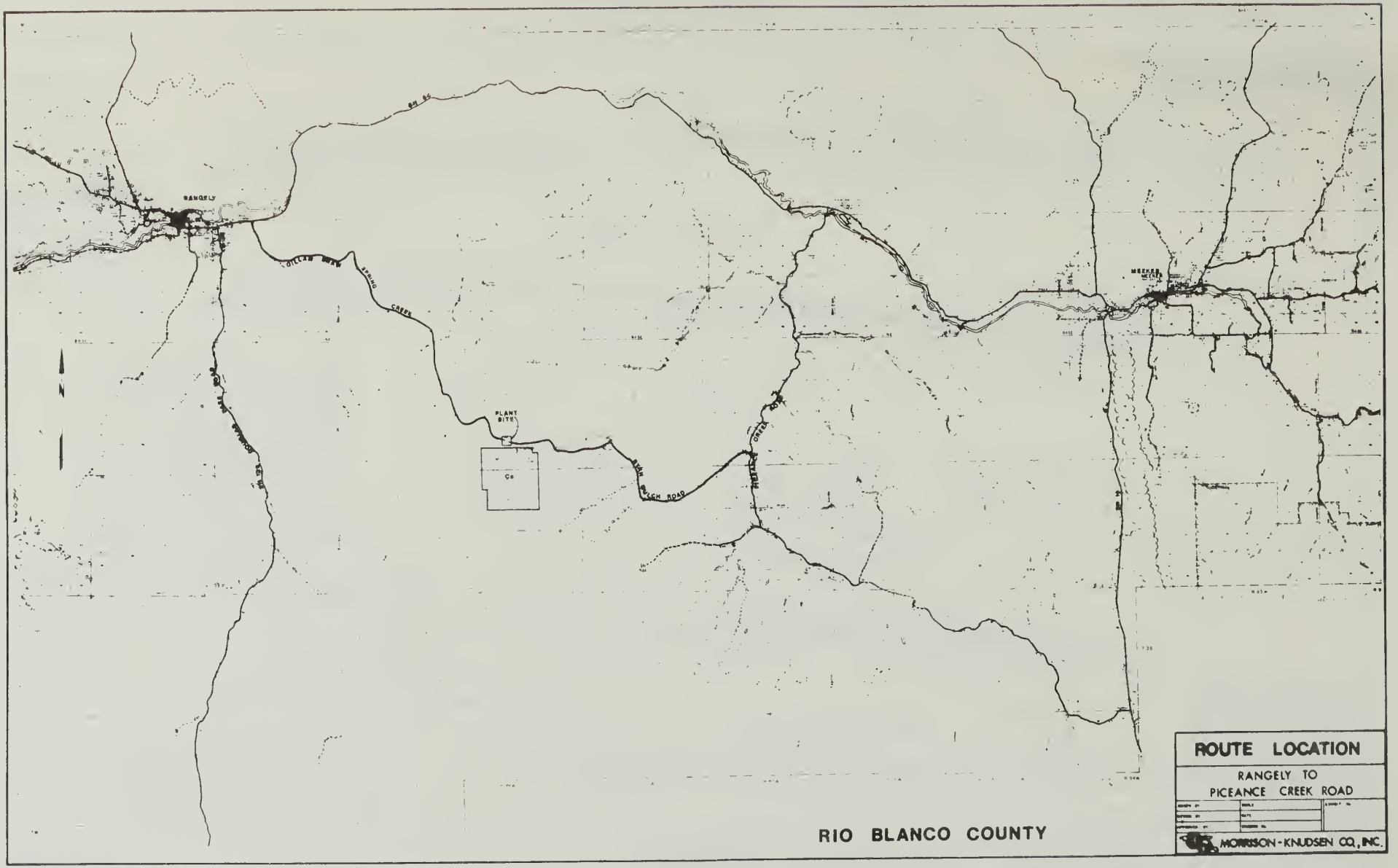

RANGELY
PLANT SITE
RIO BLANCO COUNTY
ROUTE LOCATION
RANGELY TO
PICEANCE CREEK ROAD
MORRISON-KNUDSEN CO., INC.

EXHIBIT 1

CROWNED SECTION

TYPE B Through F SECTION

STANDARD M-400-C1

(OCTOBER 22, 1971)

FEDERAL ROAD REGION NO.	DIVISION	PROJ NO	SHEET NO	TOTAL SHEETS
VIII	COLORADO			

REVISIONS			
R-1	11-6-73	Slopes, Dim & Sl Tables, Seal Coat	M R H

NOTE

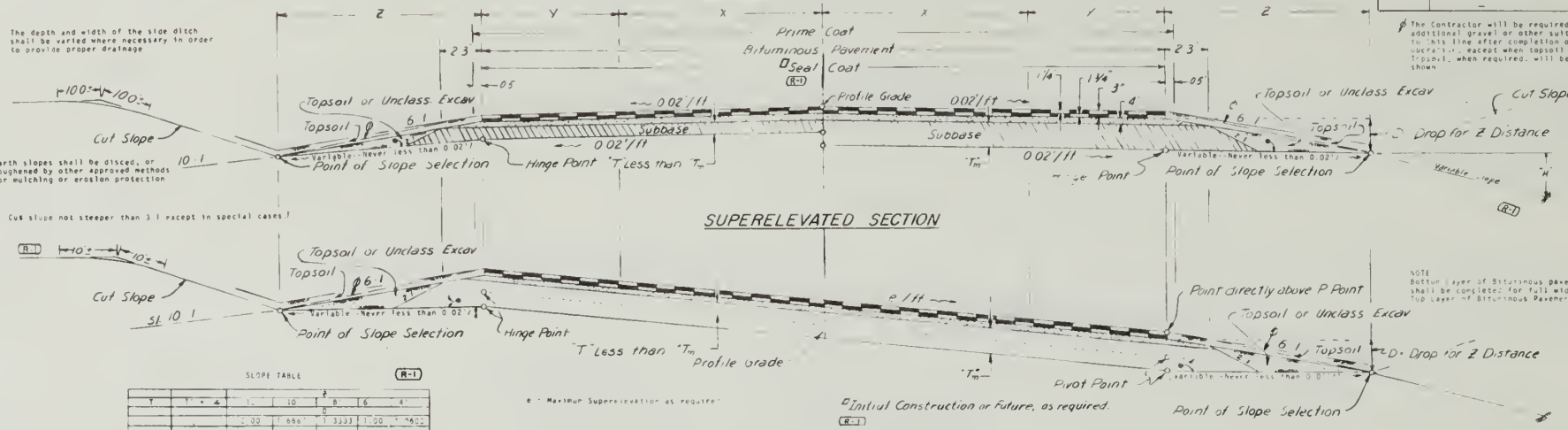
See Standards for Details of Cut Slope Treatment, Flaring & Widening

The depth and width of the side ditch shall be varied where necessary in order to provide proper drainage

Earth slopes shall be disced, or roughened by other approved methods for mulching or erosion protection

Cut slope not steeper than 3:1 except in special cases

½ SECTION (Subbase less than "T" Thickness) TANGENT SECTION ½ SECTION (Subbase approx "T" Thickness)



Ø The Contractor will be required to place additional gravel or other suitable material to this line after completion of paving operations, except when topsoil is called for Topsoil, when required, will be placed to the line shown

NOTE
Bottom layer of Bituminous Pavement shall be completed for full width before Top Layer of Bituminous Pavement is placed

SLOPE TABLE (R-1)

T	T + 4	S	10	B	6	4
		.00	.1666	.3333	.1.00	.1.500
4	8	0.11	0.120	0.083	0.056	0.056
5	9	0.104	0.092	0.073	0.041	0.044
6	10	0.097	0.083	0.063	0.028	0.033
7	11	0.090	0.076	0.054	0.015	0.022
8	12	0.083	0.069	0.044	0.000	
9	13	0.076	0.056	0.031		
10	14	0.069	0.052	0.021		
11	15	0.063	0.042	0.010		
12	16	0.056	0.033	0.000		
13	17	0.049	0.025			
14	18	0.042	0.017			
15	19	0.035	0.008			
16	20	0.028	0.000			
17	21	0.021				
18	22	0.014				
19	23	0.007				

SLOPE

*T = SUBBASE THICKNESS

(R-1) *Slope of subgrade from shoulder to point of slope selection

ø = Maximum Superelevation as required

Ø Initial Construction or Future, as required. (R-1)

NOTES

All Sections shown are subject to modifications dependent upon requirements of each project

All thicknesses of base course and Surface Course are to be shown as approximate. Thickness determined at minimum as shown for Structural requirement is governed by stability value of the Base Course

Details of speed change lanes will be shown on plans

(R-1)

Sharp points on slopes and in bottom of ditches shall be rounded on construction for a pleasing appearance

The lines shown how the distance below subgrade at the locations on the slope where construction of embankment and treatment of cut areas with moisture and density control is required

(R-1)

SLOPE	
10' OR LESS	6:1
10' TO 20'	4:1
OVER 20'	3:1

* In special cases slope may be steepened

DIMENSION TABLE

TYPE SECTION	DHV	ADT	DESIGN SPEED MPH	X FT	Y FT.	X+Y FT	Z FT	** T_m FT.
B	401-704		30 - 80	12	8	20	12	1.43
C	201-400		30 - 40	11	8	19	12	1.43
			50 - 80	12	8	20	12	1.43
D	101-200	401-750	30	10	6	16	10	1.14
			40 - 60	11	6	17	10	1.14
			65 - 80	12	6	18	10	1.14
E	< 100	251-400	30 - 50	10	4	14	8	0.84
			60 - 70	11	4	15	8	0.84
			75 - 80	12	4	16	8	0.84
F		51-250	30 - 70	10	4	14	6	0.55
			75 - 80	12	4	16	6	0.55
G		0- 50	20 - 60	10	3	13	4	0.92

(R-1) (R-1)

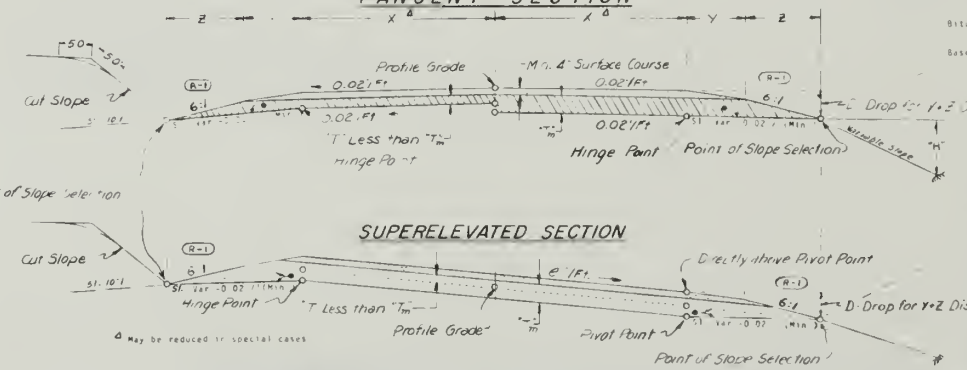
** If the required subbase thickness "T" for a section exceeds "T_m" dimension "Z" must be increased to "ZZ" which is the distance where the required thickness of subbase "T" continued on 0.02'/ft slope intersects the 6:1 slope from the shoulder

(R-1)

"T_m" thickness is the mathematical thickness which allows the bottom subbase line dropping on a 0.02'/ft slope, to intersect the 6:1 line from the shoulder point exactly "Z" distance from the shoulder point

TYPE G SECTION

TANGENT SECTION



Δ May be reduced in special cases

Material shall be placed in separate courses at the following rated per 100 linear feet of roadway

Bituminous Pavement	Top Layer	Tons
	Bottom Layer	Tons
Base Course		Tons

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
DIVISION OF HIGHWAYS

Standard Typical Sections

Designed by J W R	Approved by
Mods by	Staff Design Engineer
Checked by O L V	Date October 22, 1971

STANDARD M-400-C1

EXHIBIT 2

MORRISON-KNUDSEN CO., INC.

CROWNED SECTION STANDARD M-400-C2

TYPE B Through F SECTION

(OCTOBER 22, 1971)

FEDERAL ROAD REGION NO.	DIVISION	PROJ NO	SHEET NO	TOTAL SHEETS
VIII	COLORADO			

REVISIONS			
R-1	11-6-73	Slopes, Dim. & Fill Slope Tables	M.R.H.

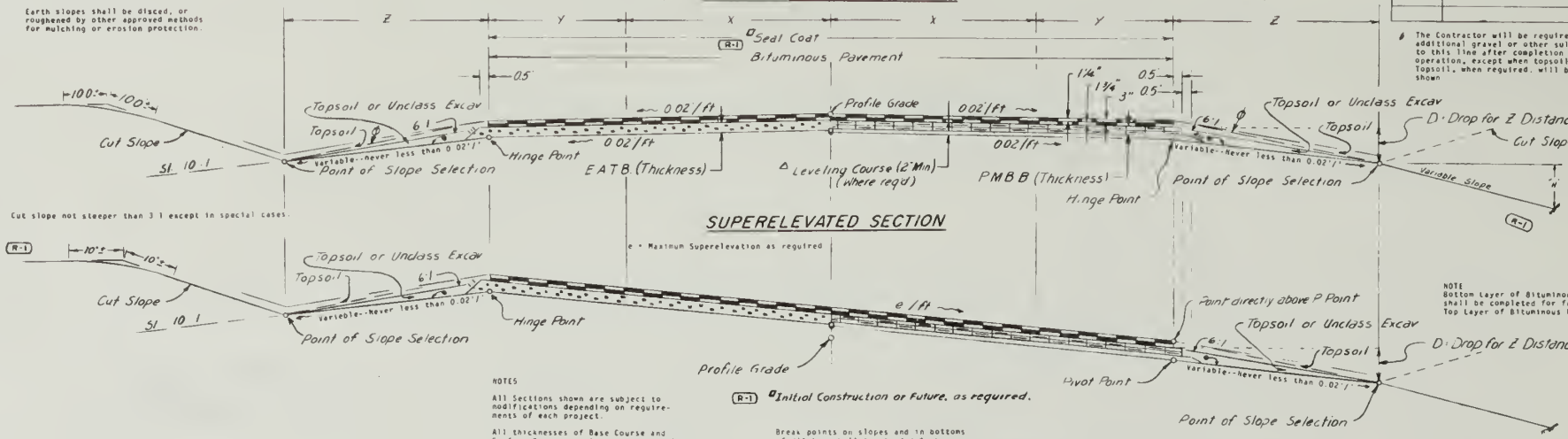
NOTE

See Standards for Details of Cut Slope Treatment, Flaring & Widening

The depth and width of the side ditch shall be varied where necessary in order to provide proper drainage.

Earth slopes shall be disced, or roughened by other approved methods for mulching or erosion protection.

½ SECTION (Emulsified Asphalt Treated Base) — TANGENT SECTION — ½ SECTION (Plant Mixed Bituminous Base)



Cut slope not steeper than 3:1 except in special cases.

R-1 Initial Construction or Future, as required.

STANDARD M-400-C2

(OCTOBER 22, 1971)

NOTES

All Sections shown are subject to modifications depending on requirements of each project.

All thicknesses of Base Course and Surface Course are to be shown on plans as approximate

Details of speed change lanes will be shown on plans.

Break points on slopes and in bottoms of ditches shall be rounded during construction for a pleasing appearance

The plans will show the distance below subgrade and the locations on the project where construction of embankment and treatment of cut areas with moisture and density control is required

NOTE

Bottom Layer of Bituminous pavement shall be completed for full width before Top Layer of Bituminous Pavement is placed

Ø The Contractor will be required to place additional gravel or other suitable material to this line after completion of paving operation, except when topsoil is called for Topsoil, when required, will be placed to the line shown

SLOPE TABLE

THICKNESS EATB OR PMBB + 2" E.C.	SLOPE	12' T 2.00	10' T 1.66667	8' T 1.33333	6' T 1.00
2		0.153	0.150	0.146	0.139
3		0.146	0.141	0.136	0.125
4	4	0.139	0.133	0.125	0.111
5	5	0.132	0.125	0.115	0.097
6	6	0.125	0.117	0.104	0.083
7	7	0.118	0.108	0.094	0.069
8	8	0.111	0.100	0.083	0.056
9	9	0.104	0.092	0.073	0.042
10	10	0.097	0.083	0.063	0.028
11	11	0.090	0.075	0.052	
12	12	0.083	0.067	0.042	
	13	0.076	0.058	0.031	
	14	0.069	0.050	0.021	

SLOPE

• Slope of subgrade from shoulder to point of slope selection

R-1 FILL SLOPES Ø

"H"	SLOPE
10' OR LESS	6:1
10'+ TO 25'	4:1
OVER 25'	3:1

Ø In special cases slope may be steepened

NON SWELLING SOILS ON SUBGRADE

Δ where required a leveling course (2" min.) may be used to

1. Enable fine grading on rough subgrade
2. Act as a temporary wearing course where traffic must use the road before P M B B is applied
3. Or as recommended by the district

On non-swelling subgrades, the leveling course may be gravel or other non-swelling soils.

SWELLING SOILS ON SUBGRADE

Δ where required a leveling course may be used to enable fine grading on the swelling soil subgrade.

On swelling subgrades, gravel will not be permitted as a leveling course, and dense non-swelling soils shall be used in lieu of gravel to help prevent moisture from getting to the subgrade and also cut down on hydrogeresis

Material shall be placed in separate courses at the following rates per 100 linear feet of roadway

Bituminous Pavement	Top Layer	Tons
	Bottom Layer	Tons
Base Course		Tons
Treated Base		Tons

R-1 DIMENSION TABLE R-1

TYPE SECTION	DHV	ADT	DESIGN SPEED MPH	X FT	Y FT	X+Y FT.	Z FT.
B	401-704		30 - 80	12	8	20	12
C	201-400		30 - 40	11	8	19	12
			50 - 80	12	8	20	12
D	101-200	401-750	30	10	6	16	10
			40 - 60	11	6	17	10
			65 - 80	12	6	18	10
E		251-400	30 - 50	10	4	14	8
			60 - 70	11	4	15	8
			75 - 80	12	4	16	8
F		51-250	30 - 70	10	4	14	6
			75 - 80	12	4	16	6

R-1

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
DIVISION OF HIGHWAYS

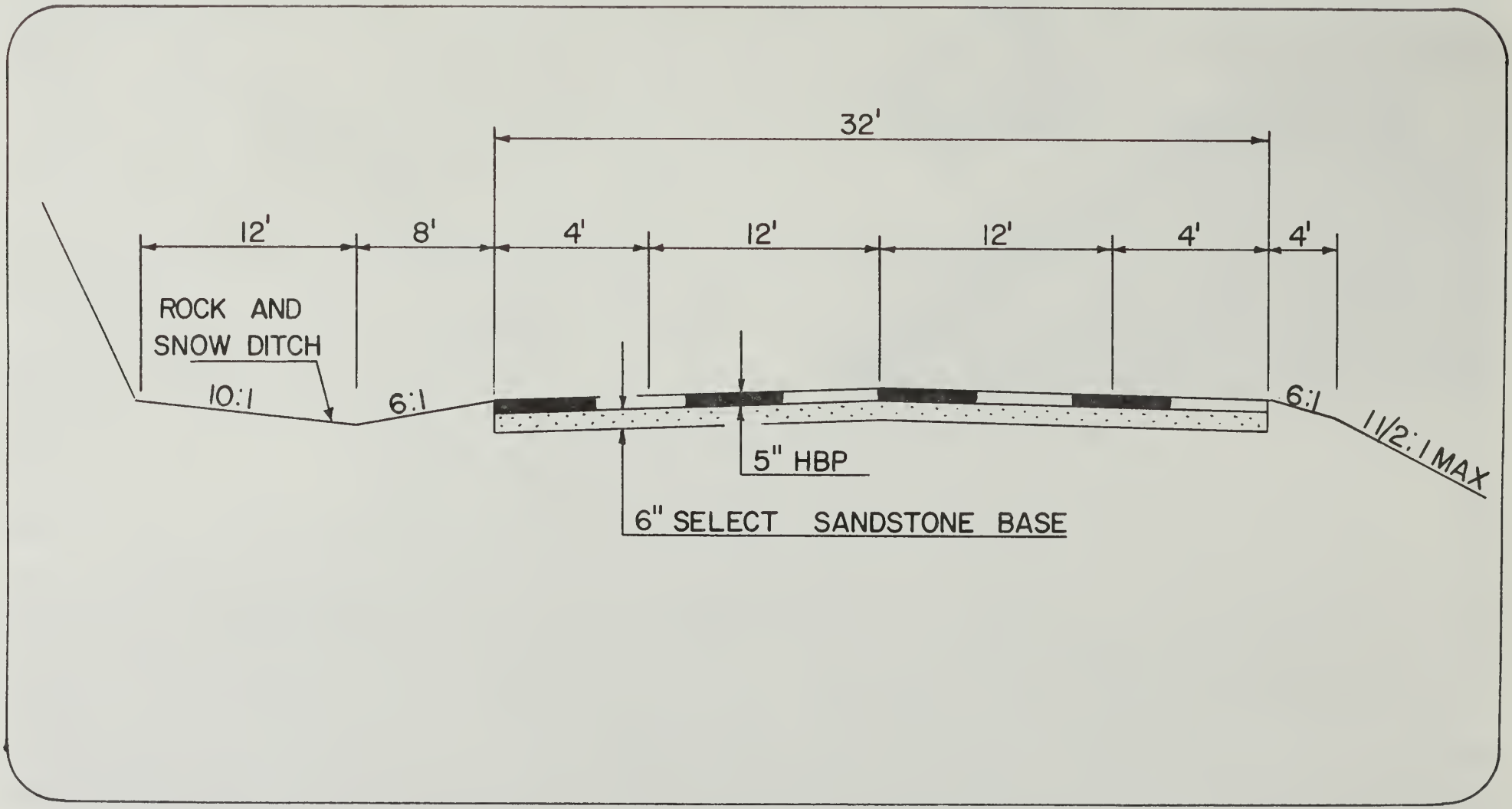
Standard Typical Sections

Designed by J W R	Approved by
Mode by	Staff Design Engineer
Checked by O L V	Date: October 22, 1971

STANDARD M-400-C2

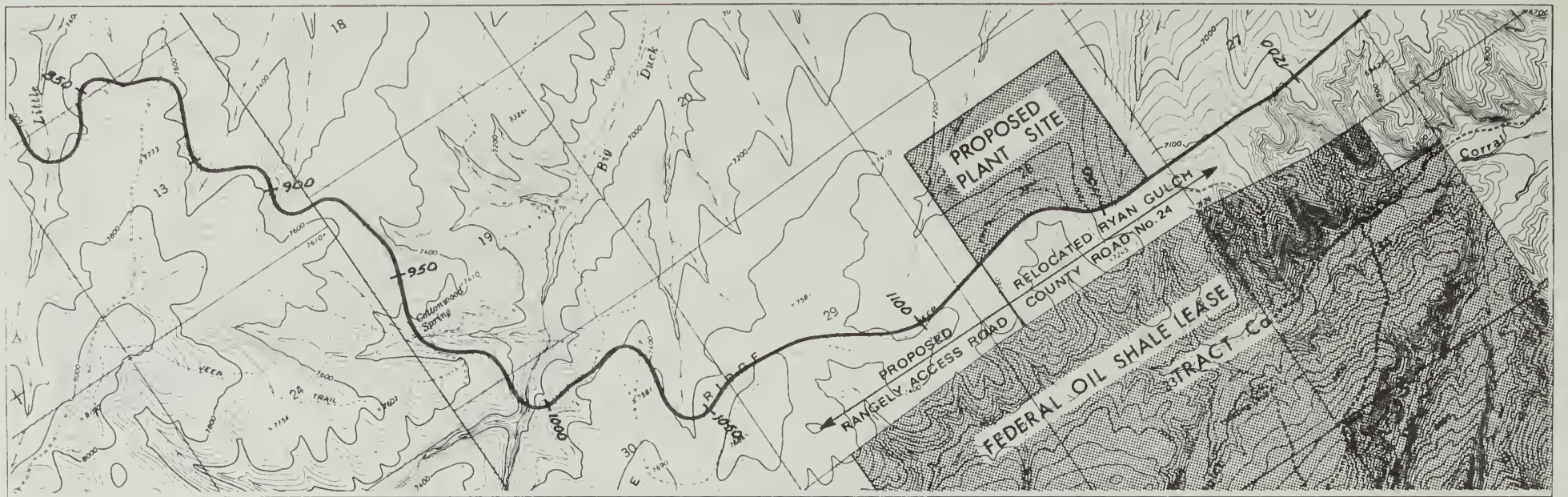
EXHIBIT 3

MORRISON-KNUDSEN CO., INC.



TYPICAL SECTION

EXHIBIT 4



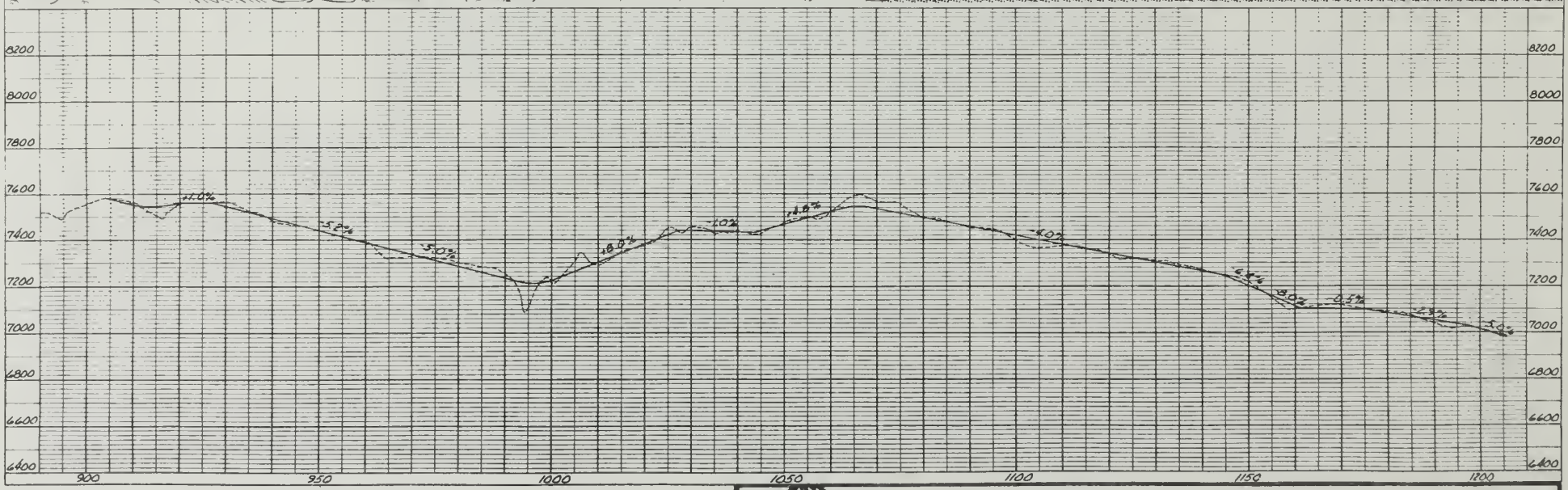


EXHIBIT 5

ROAD ALIGNMENT PLAN AND PROFILE
STA. 900 TO STA. 1200

MORRISON-KNUDSEN CO., INC.

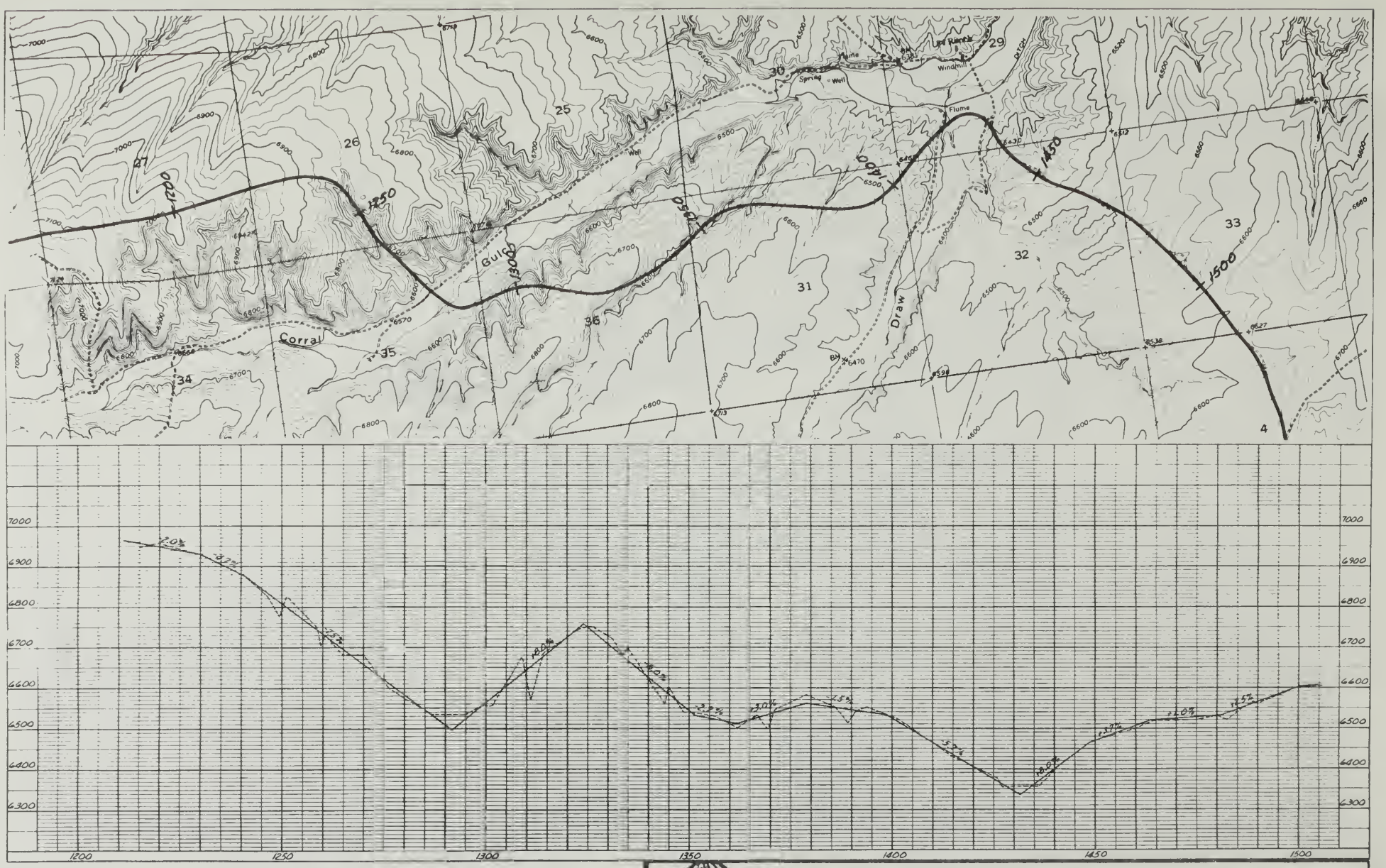
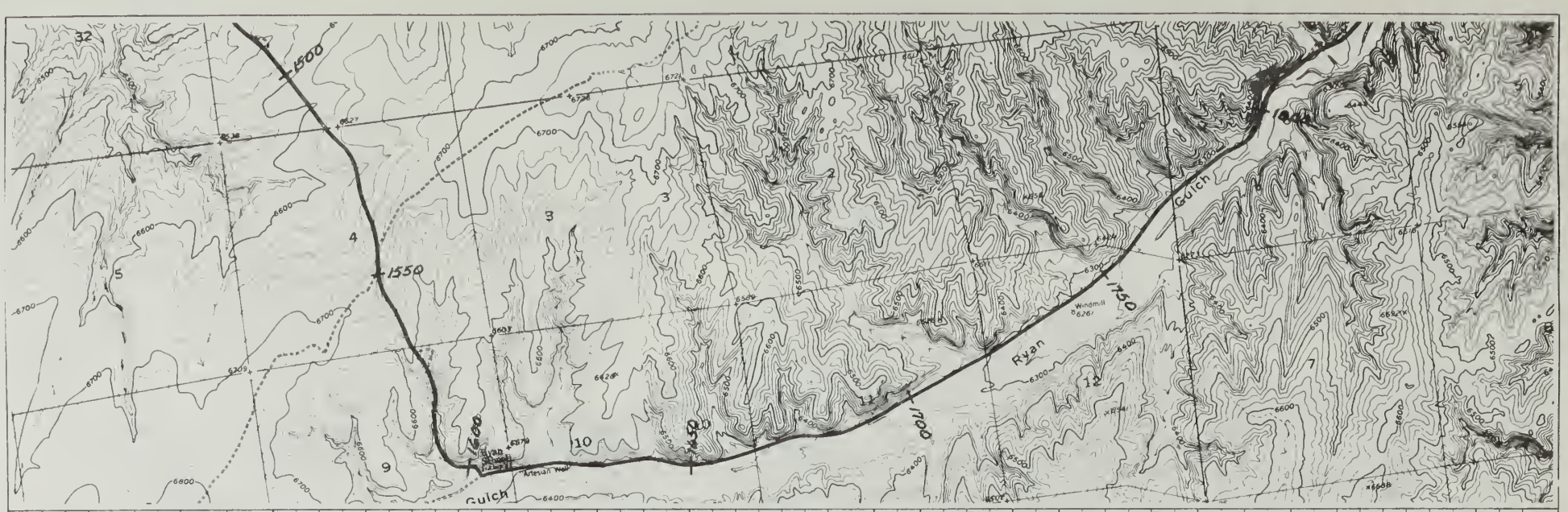


EXHIBIT 6

ROAD ALIGNMENT PLAN AND PROFILE
STA. 1200 TO STA. 1500

MORRISON-KNUDSEN CO., INC.



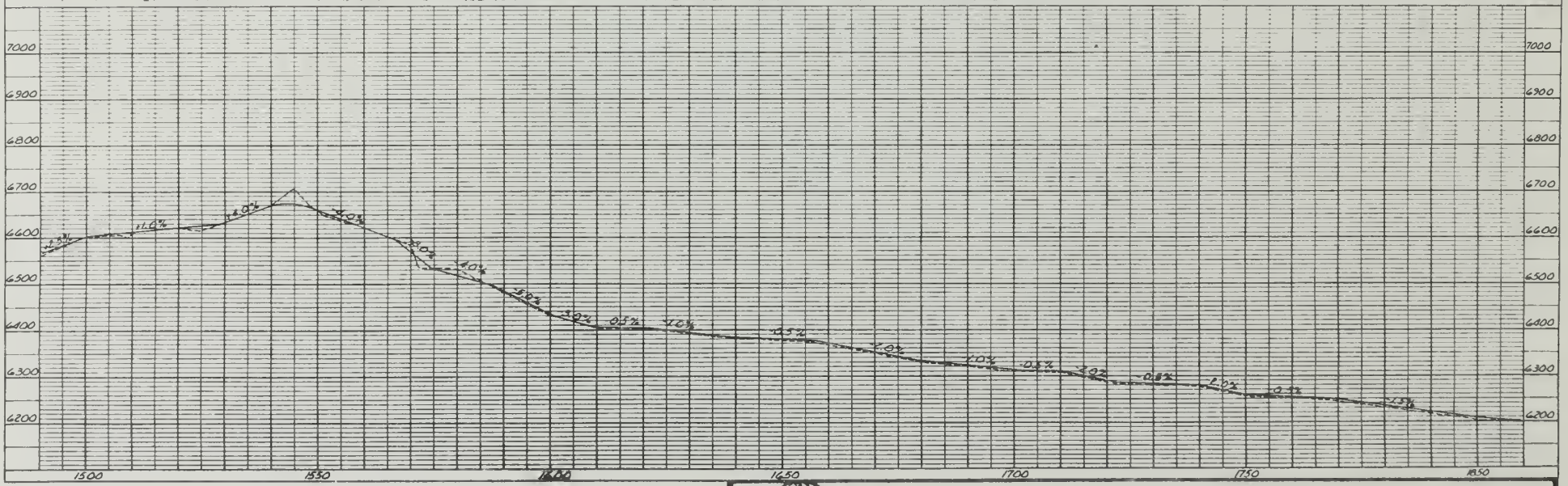


EXHIBIT 7

ROAD ALIGNMENT PLAN AND PROFILE
STA. 1500 TO STA. 1800

MORRISON-KNUDSEN CO., INC.

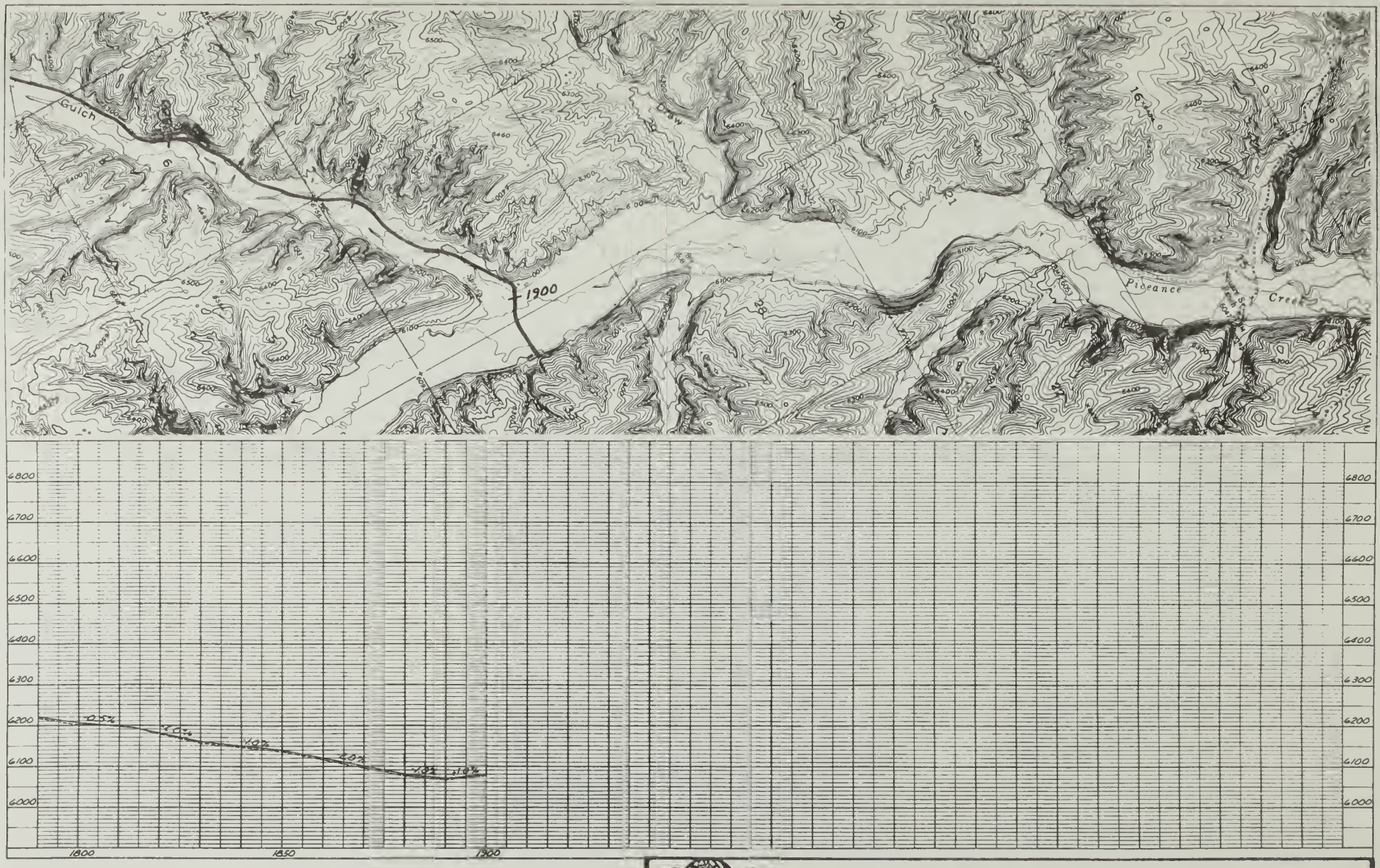


EXHIBIT 8

ROAD ALIGNMENT PLAN AND PROFILE
STA. 1800 TO STA. 1900

MORRISON-KNUDSEN CO., INC.