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Malagasy Republic

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NATIONAL INTELLIGENCE SURVEY

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Transportation and
Telecommunications

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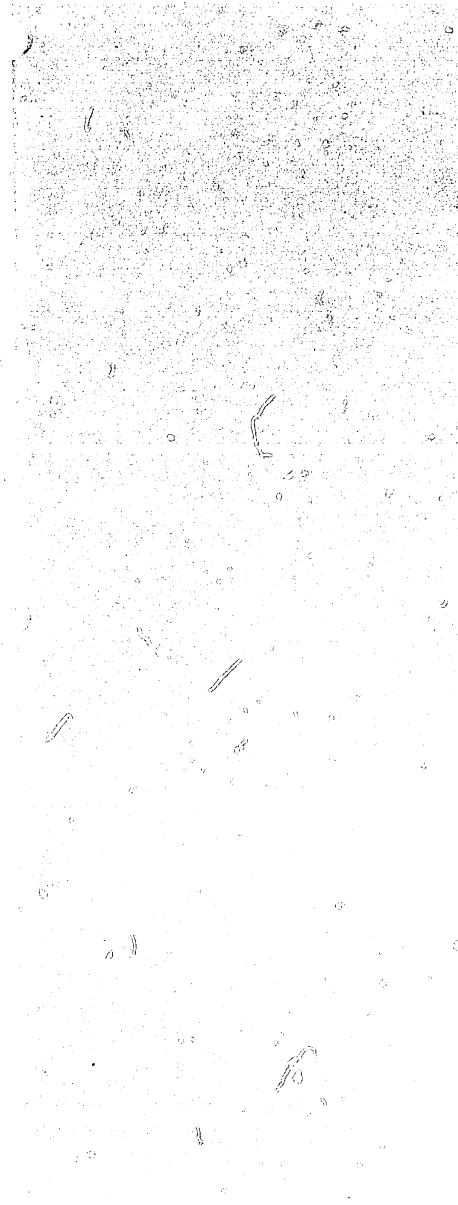
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This chapter was prepared for the NIS by the Defense Intelligence Agency and includes contributions on merchant marine from the Department of the Navy and on airfields from the Defense Mapping Agency, Aerospace Center. Research was substantially completed by April 1973.



Malagasy Republic

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Diego-Suarez (U OU)

Transportation and Telecommunications

A. Summary (C)

1. Systems

Transportation and telecommunication (telecom) facilities of Madagascar (Malagasy Republic) are limited. The nation depends upon coastal shipping for the sizable interchange of goods among its regions and for transporting cargoes to and from oceangoing carriers which normally call only at the major ports. The 4 major and 13 minor ports are fairly evenly distributed along the island's coastline and satisfy the trade requirements of the various economic regions (see Terrain and Transportation map at the end of the chapter).

Overland transportation consists basically of a mutually supporting rail and road network in which the fairly efficient but short rail system is less important than the more extensive but poorer quality highway system. The 549-mile meter-gage (3'3 $\frac{3}{8}$ ") government-owned railroad comprises two unconnected systems which serve only a limited area of the island's eastern coast but provide an important link between east coast ports, Tananarive, and industrial and agricultural centers of the interior. Highways provide feeder and distribution services to the railroad and are virtually the only means of transportation throughout large areas of the country. Most roads extend in a north-south direction along the east coast and in the interior. The road network is extremely sparse in the west. Inland waterway transport is of minor importance; only the Betsiboka river, Lac Alaotra, and the Canal des Pangalanes have any significance. Air transportation is well developed and commonly used, especially in the interior. Because of the sparsity of surface transportation, the national air carrier, Air Madagascar, provides numerous scheduled domestic flights. Four airports of entry for aircraft from worldwide points are among the 166 usable airfields.

An adequate telecom system covers the whole island and reaches all important towns. The basic network is composed of carrier-equipped open-wire lines; radiocommunication networks supplement the wire system. Radio-relay links are significant on main

trunks south of Tananarive, the principal telecom center. Services also include television broadcast, telephone, telegraph and telex, and a new satellite ground station.

Administration of the transportation and telecom systems is provided by the Ministry of Development of the Territory, and radio and television broadcasting are under the Ministry of Information. The most significant improvements planned for transportation and telecommunications are the construction of a rail line linking the northern and southern networks; the provision of a surfaced road linking Tananarive with the port of Diego-Suarez;¹ and further modernization of the telephone, radio-relay, radiobroadcast, and television systems.

2. Strategic mobility

The transportation system would afford only limited support to large-scale military operations. The two unconnected rail networks have light axleload limits, steep grades and sharp curves, and lack alternative routes. The highway network is deficient in capacity and distribution and could not meet the demands of military movement and supply operations. Military forces would be restricted by the sparsity of the network throughout the island generally and the absence of roads in large areas of the west and north. Numerous bottlenecks including steep grades and sharp curves, ferries and fords, and narrow, low-capacity bridges would impede operations. Additionally, heavy rainfall from November through April causes washouts and landslides, and earth roads become softened and slippery, often unable to support even minimal vehicular traffic. Offroad or cross-country movement is limited owing to unfavorable terrain in many areas. Steep slopes in the dissected plains, hills and mountains, numerous depressions and marshy areas in southwest coastal areas, and dense forests or thick thorny scrub (*savoka*) on the plains would preclude cross-country operations.

¹For diacritics on place names, see the list of names on the apron of the Terrain and Transportation map, the map itself, and maps in the text.

Inland waterways have only limited potential to assist military movement. The four major maritime ports and most of the minor ports are adaptable to military use, but only Tananave and Majunga have adequate facilities and clearance routes to support sustained operations. The seven dry cargo ships of the merchant fleet have a considerable military-support potential. These units, with an estimated capacity of 25,900 cargo deadweight tons, have a short-haul (48 hours steaming) troop-lift capability which could be used for near-seas operations. Their self-loading and unloading capability is enhanced by the fact that one ship has at least one heavy-lift boom of 50 long tons and three have hatches of more than 50 feet in length. The only tanker in the fleet has an estimated capacity of 174,557 barrels (U.S.) of petroleum and related products and could provide a moderate military-support capability.

The island's 166 usable airfields could support military operations to varying degrees. Diego Suarez/Andrakaka and Ankazobe are military fields, and Tananarive/Ivato is a joint facility capable of handling sustained C-141-type aircraft operations. The Air Madagascar fleet readily could be converted to military transport use in the event of a national emergency. Mobilization of aeroclub and privately owned aircraft is of questionable value, most being of the 2- and 4-place variety. Additionally, most of the owners and pilots are foreign nationals, and their service would depend on the political situation.

Vulnerability of the telecom system to sabotage is high, because there are great lengths of unprotected wire lines and the radiocommunication stations are isolated. There are, however, some alternate facilities. The greatest disruption to telecom would result from damage to the international radio-communication station, the communication satellite ground station, or associated wire and radio-relay links, all in the Tananarive area.

B. Railroads (C)

The Malagasy Railways (CFM) totals 549 route miles. The sparse rail network is concentrated in the east-central portion of the country and consists of two unconnected meter-gage (3'3³/₈") systems, which rely on integration with highway transportation for feeder and distribution services. The system is single tracked except for 5 miles of double tracked line in the vicinity of Tananarive. The northern system consists of a main line that extends south from Tamatave along the coast and then west through the mountains to Tananarive. Branch lines extend from Moramanga north to

Ambatosotra, Volidiala northeast to chrome mines at Morarano, and Tananarive southwest to Antsirabe. The southern system extends from Manakara northwest to Fianarantsoa and reaches gradients of 3.5%, the highest on the network.

The CFM, government owned and operated by the Ministry of the Development of the Territory, compares favorably with other systems in sub-Saharan Africa. The equipment pool is modern, and operationally the railroads are equal to those of Mozambique or Ethiopia but are not as sophisticated as those of South Africa or Rhodesia. The technical competence of CFM employees is high, and their number is adequate to effectively operate the railroad. Training is provided both on the job and in schools operated by the individual departments. Some students are sent to France each year for advanced training. Railroad personnel in Madagascar total 5,050.

Yards, terminals, and repair facilities are well distributed throughout each system and suffice for current traffic needs. Major yards are located at Tananarive, Tamatave, Moramanga, Manakara, and Fianarantsoa. Extensive repair of locomotives and rolling stock is accomplished at Tananarive and Fianarantsoa; light repair facilities are available at Tamatave, Moramanga, Antsirabe, and Manakara. Small quantities of rolling stock are assembled at Tananarive. Container facilities are being constructed at Tananarive and will include two 28-short-ton capacity cranes. Flatcars available for container transportation can carry one 40-foot or two 20-foot containers. Container traffic by rail totaled 1,000 units in 1970 and has steadily increased. Containers can be offloaded at stations, yards, or private sidings where cranes or forklift trucks are available.

Madagascar has 249 railroad bridges 12 feet and over in length with an aggregate length of approximately 28,400 feet. Steel through-truss, deck-plate girder, and masonry arch bridges are most common, but reinforced concrete is increasingly being used in place of structural steel. The 11-span 1,273-foot steel bridge 11 miles east of Tananarive is the longest on the network. The 87 railroad tunnels total 30,297 feet; the longest, 3,516 feet, is located 26 miles east of Fianarantsoa. Most tunnels are cut through solid rock and are not ventilated or lined. There are eight galleries on the network, with an aggregate length of 1,524 feet.

Train control is by the permissive manual block system, by which a second train can enter an occupied block only with special train orders. All block entrances are at stations. Fixed signals are semaphore and color light. In some areas hand or flag signals are

utilized. Central dispatching offices in Tananarive and Fianarantsoa control the northern and southern systems respectively. Telephone communications link all stations.

Almost all motive power units and rolling stock are imported from France. Equipment is in good condition and available in adequate numbers to meet normal operating demands; however, some shortages occur during the peak traffic period (July-October). The 1972 equipment inventory was as follows:

Diesel-electric locomotives:	
Mainline	34
Switchers	19
Total	52
Diesel-electric railcars	
Trailers	21
Passenger cars	54
Freight cars	58
Service cars	884
Tank cars (privately owned)	174
	52

Line locomotives are all diesel-electric units ranging from 635 to 3,600 horsepower. The current trend has been to replace the 635 with 1,100 and 3,600 horsepower locomotives. Rolling stock includes four-axle freight cars equipped with side screw, hook and link couplers, and central buffers located 2 feet 5 1/2 inches above top of rail. Passenger cars and trailers are fitted with automatic center coupler-buffers located 2 feet 5 inches above top of rail. Rolling stock is equipped with vacuum brakes.

Crude petroleum is imported from Bahrain and refined petroleum products from the Persian Gulf states, Malaysia, South Africa, and east African nations. The diesel oil needs of the railroad are supplied by the refinery at Tamatave.

Modern maintenance techniques and equipment are employed on the CFM. Renovation of the permanent way, including welding rail and replacing ties and ballast, is a continuing project. Numerous sharp curves and steep grades have been eliminated, and 50-pound-per-yard rail is being replaced by 60-pound rail. A 9-mile realignment between Brickaville and Ambila Lemaitso, which will reduce grades from 2.5% to 1.0% and increase the radius of curvature to 393 feet, is under construction. Other improvements include the modernization of repair facilities, renovation of older stations, and construction of new stations. Freight facilities have been constructed at Vohidiala and Morarano. A new rail line to chrome mines at Morarano was completed in 1969. A cyclone in February 1972 caused severe damage to the Tananarive-Tamatave, Moramanga-Ambatosoratra (Figure 1), and Vohidiala-Morarano lines. Traffic resumed on main lines by late April, but repair of the Vohidiala-Morarano line is still in progress. Plans for the near future include the construction of a new rail line to link Antsirabe with Fianarantsoa, construction of freight facilities at Brickaville, Ambatondrazaka, and Moramanga, continued modernization of all stations, and the improvement of communication facilities between Tananarive and Tamatave.

The CFM transported 1,146,200 short tons of freight 167,348,185 short-ton-miles and 2,360,000 passengers 124,200,000 passenger-miles in 1971. The northern system between Tananarive and Tamatave has the highest traffic density and accounts for almost 75% of all revenue traffic. Principal imports and domestic commodities transported by rail include basic food staples such as rice and other grain, salt, petroleum products, industrial products, chemicals



FIGURE 1. Damage to Iankana river bridge on the Moramanga-Ambatosoratra line caused by a recent cyclone (U/OU)

FIGURE 2. Characteristics of the railroads (C)

TERMINALS AND ROUTE MILES	MAXIMUM GRADE		MINIMUM RADIUS OF CURVATURE	PASSING TRACK			REMARKS
	Going	Coming		MAXIMUM AXLELOAD	Maximum interval	Minimum length	
	Percent	Percent		Short tons	Miles	Feet	
Tamatave Moramanga... (155 miles)	2.5	1.5	164	17.6	12	1,312	...
Moramanga Tananarive... (76 miles)	2.5	2.5	262	17.6	11	1,312	Five miles of double track in Tananarive area used in common with the Tananarive Antsirabe line.
Tananarive Antsirabe... (96 miles)	1.6	1.6	410	11.2	12	354	...
Moramanga Ambatoso- ratra. (104 miles)	1.9	2.0	410	11.2	12	354	Branch line with the same general characteristics extends 12 miles from Vohidiala (MP 76) to chrome mines at Mora- rano.
Manakara Fianarantsoa... (101 miles)	3.5	2.6	262	17.6	11	354	...

and pharmaceuticals, machinery, cement, alcoholic beverages, sugar, coffee, livestock, peanuts, and timber. Export traffic includes coffee, sugar, rice, vanilla, clove oil, manioc, mineral products—graphite, chromite, and mica—scrap iron, and timber.

Operating problems occur as a result of steep grades, sharp curves, and limited axleload capacities. Serious traffic interruptions result from heavy storms and tropical cyclones which cause washouts, landslides, and weakening of bridges and culverts. Freight trains from Tamatave to Tananarive are limited to 35 cars or 1,100 short tons and must be hauled by four 850 or three 1,100 horsepower locomotives in multiple units. In the opposite direction trains are usually double headed and are limited to 20 cars to permit adequate passage of east and westbound trains at all stations.

The CFM is operating at a profit despite the need for organizational and managerial reform. The railroads are aided by a policy of underinvestment in the competing highway system and by physical restrictions on truck movements. Operating revenues in 1971 were US\$10,787,000, while expenditures totaled \$7,909,600.

Rails are T-section types ranging in weight between 50 and 62 pounds per yard and varying in length from 22 feet 10 inches to 39 feet 5 inches; there are 191 miles of welded rail. Ties are spaced 1,930 to 2,400 per mile. Steel ties are utilized in the interior of the country, treated wooden ties on the coast. Crushed granite or broken stone ballast is available locally.

Wooden ties are furnished by a treatment plant at Perinet; rail, steel ties, and track hardware must be imported.

Figure 2 lists the major characteristics of the meter-gage (3'3 3/4") railroads of Malagasy.

C. Highways (C)

The basic highway network totals approximately 5,300 miles and consists of 1,875 miles of bituminous-surfaced roads, 2,225 miles of crushed stone and gravel roads, and 1,200 miles of earth roads. Additionally, there is an undetermined but substantial mileage of tracks throughout the remote areas forming isolated local networks which connect in places with segments of the developed network. Earth roads and tracks frequently are made impassable by washouts and flooding during heavy rains.

The highway network is denser and better developed along the east coast and southern portion of the country. Two main highways serve the island, one extending the length of the country from the extreme northern point at Diego-Suarez to the southern tip at Ambovombe, and the other paralleling the eastern coastline. A system of transverse roads connects with these main highways and provides access to interior and western areas of the country. The northern half of the country has a sparse network, and extensive areas in the west are devoid of roads.

Surface widths of the bituminous or bituminous-treated segments of the road system range up to 18 feet. Current standards for new bituminous construction specify 18-foot surface widths, and most existing bituminous or bituminous-treated segments meet or approximate this standard. Surface widths of crushed stone and gravel roads range from 9 to 18 feet, but most are 16 to 18 feet. Earth roads generally range from 10 to 18 feet, the lesser widths being more prevalent on the unimproved earth roads. Constructed shoulders are not common and exist only on the bituminous or bituminous-treated roads of more recent construction. Shoulders are usually of earth construction and of varied widths.

Bridges on the main highways over 100 feet long are concrete or steel structures and are 9 to 25 feet wide. Concrete structures (Figure 3) are the most prevalent. Narrow timber bridges, common on the secondary roads, are being replaced by permanent concrete or steel bridges as the system is improved and expanded. There are 33 known bridges which exceed 200 feet in length. The longest of these is the recently completed 2,650-foot structure over the Sofia river just north of Port-Berge.

Ferries and fords are common throughout the highway system but the use of these facilities is frequently restricted by high water levels for varying periods during the rainy season (generally November through April in most of the country). Submerged structures called *radiers* are also common throughout the road network. These are usually of masonry or concrete construction and, although elevated above the streambed to afford crossing at normal water levels, they too become impassable during periods of high water or seasonal flooding. There are no tunnels on the network.

Responsibility for highway transport coordination rests with the Ministry of Development of the



FIGURE 3. Masonry arch bridge over Mania river between Ambatofinandrahana and Ambositra (U/OU)

Territory. There are four directorates under this ministry, one of which, the Directorate for Public Works, is responsible for construction of primary and secondary roads, road maintenance, and maintenance of the equipment park. Work in the field is carried out through six regional divisions. The ministry's Central Planning Service, in cooperation with the Directorate for Public Works, is in charge of highway planning to insure that investments in highways are made in accordance with certain criteria—such as giving priority to construction of the more heavily traveled roads and those serving areas with good development potential. The Central Technical Service, within the Directorate for Public Works, is responsible for engineering, tendering, and supervision of road construction. It is adequately organized and staffed to carry out a substantial part of this work; however, for anything beyond its capacity, it utilizes consultants. The six major road contractors are subsidiaries of French firms, and even the smaller contractors are usually foreign. The local roadbuilding industry is not well developed because of the scarcity of capital and the lack of credit facilities and professional skills. Construction contracts are usually awarded on the basis of local or international competitive bidding. Most maintenance of the highway network is carried out by the Bridge and Road Service of the Directorate of Public Works. Maintenance work is mechanized to a large extent. Large maintenance and pavement surfacing projects are executed by contract. Some road construction and maintenance is performed by a civic action group which utilizes the armed forces in small public works projects throughout the country on mostly local roads.

Many factors affect highway construction and maintenance. Highway development has been restricted by government policy which favors railroad transport, limiting investment in roads and imposing restrictions on the movement of trucks. In addition, providing an adequate road network over an extensive geographic area with a relatively low density of population presents economic problems. Also, terrain and climate pose significant obstacles to road construction and maintenance. The interior of the island, served by the greater part of the network, is extremely mountainous. Rivers are numerous throughout the island and most flow from the interior toward the coasts and cross the main north-south highway routes. The difficulty of construction in mountainous terrain, the necessity for extensive bridging, and heavy rainfall are major obstacles to the construction and maintenance of highways.

FIGURE 4. Selected highways (C)

ORIGIN AND DESTINATION	DISTANCE	SURFACE TYPE	SURFACE		REMARKS
			WIDTH	SHOULDER WIDTH	
<i>Miles</i>					
Tananarive to Tuléar.....	604	Bituminous or bituminous treatment.	14 18	0 3	Mountainous.
Tananarive to Mile 325. (325 miles)		Crushed stone or gravel.	9 18	0 3	Undulating to mountainous. Some low-level structures (grazers) may be impassable after heavy rains.
Sakaraha to Tuléar. (196 miles)		Bituminous or bituminous treatment.	14 18	0 3	Undulating to hilly.
Tananarive to Majunga. (83 miles)	343	Bituminous.	14 18	0 3	Undulating to mountainous.
Tananarive to Maroanisetra. (72 miles)	482	Bituminous.	18	0 3	Undulating to hilly.
Tananarive to Moramanga. (161 miles)		Crushed stone or gravel.	9 18	0 3	Flat to hilly. Bituminous sections approx. 25 miles east of Moramanga and south of Tamatave.
Tamatave to Fenerive. (65 miles)		Bituminous or bituminous treatment.	14 18	0 3	Flat.
Fenerive to Maroanisetra. (184 miles)		Crushed stone or gravel.	9 18	0 3	Flat. Traverses coastal lowlands. Subject to flooding during heavy rains. Sections may be impassable.
Junct. with Tananarive to Maroanisetra Highway to Fort-Dauphin. (155 miles)	581	Unimproved earth and gravel.	9 14	0 3	Flat to undulating; 9 known ferry crossings.
Mile 0 to Manakara. (314 miles)		Bituminous.	18	0 3	Flat to undulating; 3 known ferry crossings.
Manakara to Vangaindrano. (112 miles)		Unimproved earth.	9	0 3	Flat to undulating; 10 known ferry crossings.
Vangaindrano to Fort-Dauphin. (155 miles)	95	Bituminous or bituminous treatment.	14 18	0 3	Undulating to hilly.
Diogo-Suarez to Port St.-Louis.	171	Crushed stone or gravel.	9 18	0 3	Flat to mountainous. Sections may be impassable during heavy rains.

Timber, stone, and gravel generally are available in adequate quantities from domestic sources. A cement plant at Amboanio on the west coast produces about two-thirds of the country's requirements; the remainder is imported. Although there are iron deposits in the Ambatolampy area, south of Tananarive, there are no facilities for steel processing, and requirements must be met by imports. Bituminous materials must also be imported. Transportation of all road construction materials has been costly.

A second 5-year development plan to succeed the first which ran from 1964 to 1968 was modified owing to adverse economic conditions. Not all of the original highway development goals were achieved, and under the present 3-year economic plan (1972-74), work will continue on the Tananarive to Diego-Suarez highway, on roads to link the Lac Alaotra area to the east coast, and on the Tananarive to Diego-Suarez highway. The eastern coastal road is being extended, and the section from Vohemar to Sambava is being improved and paved under terms of an approximately US\$10 million grant by the European Development Fund in August 1972. The International Bank for Reconstruction and Development granted approximately \$13.9 million in late 1972 for studies and construction on roads from Antsirabe to Morondava, Tananarive to Tsiranomandidy, and a network in the Lac Alaotra region. Foreign investments in development of the highway system have been substantial; principal participants are the European Development Fund of the European Communities, *Kreditanstalt für Wiederaufbau* (Bank for Reconstruction) of the Federal Republic of Germany, Fund for Aid and Cooperation of France, U.S. Agency for International Development, and the International Bank for Reconstruction and Development.

Adequate standards have been established for current and future construction projects. Minimum surface width of roads has been set at 18 feet, and bituminous surfacing materials are being used almost exclusively throughout the network. Bridge construction standards have been established to insure sound construction practice, nonrestrictive dimensions, and adequate load limits.

Excessive rainfall, mostly from December through April, creates significant traffic interruptions. This is especially true in the lowlands along the east coast, where many roads become badly rutted and impassable, and washouts of roadways and small structures are frequent. Many of the *radiers* become more deeply submerged and are either dangerous to use or entirely impassable as streams rise above normal depths. Many ferries cease to operate during high

water levels. Highway traffic is also restricted by poor road surfaces, steep grades, sharp curves, and narrow, low-capacity bridges, particularly in the mountainous interior.

Highway freight and passenger transport services are provided throughout Madagascar mainly by numerous highly competitive small carriers. There are two bus companies of some importance which operate on the Antsirabe-Fianarantsoa highway. In addition, 8 transport cooperatives in the Tananarive Province run about 350 minibuses. The largest freight transport company owns 28 trucks with a carrying capacity of 230 tons. A number of truck cooperatives also exist, the largest of which operates from 60 to 80 trucks. Except for insurance and periodic inspection, there are no regulations governing the industry.

Motor transport extends to all regions of the country, although the greatest transport activity occurs in the interior regions via roads radiating from Tananarive. Agricultural products and materials related to the farming industry constitute the bulk of goods moved over the road network.

As of January 1971 there were 87,791 vehicles registered, including 45,453 automobiles and 42,338 trucks and buses. There are also about 4,600 motorcycles and motorbicycles registered. All vehicles and vehicle parts are imported. There are two vehicle assembly plants on Madagascar. During 1970, 1,245 automobiles and 1,048 trucks and vans were produced. Figure 4 lists characteristics of the most important highways of the Malagasy Republic.

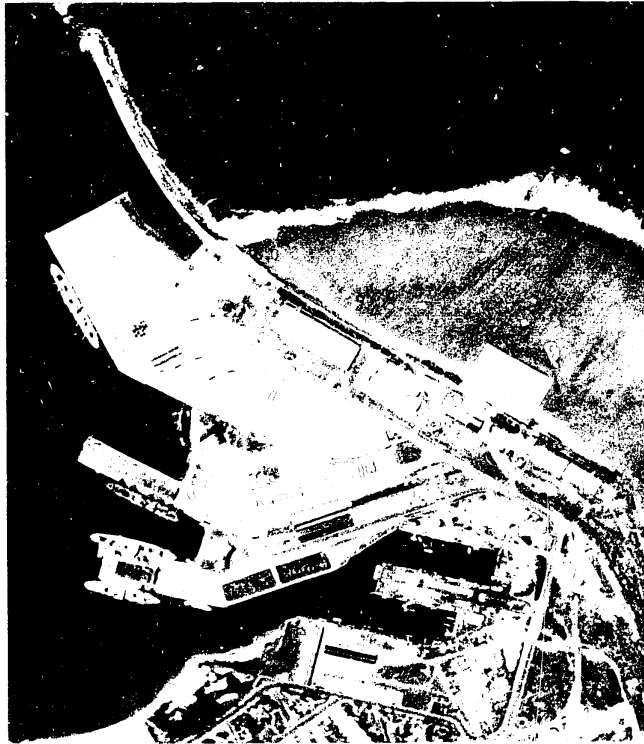
D. Inland waterways (C)

Navigation is possible on approximately 1,200 miles of unconnected and mostly unimproved inland waterways, less than half of which are perennially navigable. Only three waterways are used commercially—the Canal des Pangalanes along the east coast, Lac Alaotra, and the lower reaches of the Betsiboka river on the west coast. The remainder of the navigable stretches are capable of sustaining only canoe traffic.

Extending about 400 miles along the east coast, the Canal des Pangalanes comprises numerous lagoons, lakes, and streams linked by land cut canals, which together form the major water route of the country. Through navigation is not possible, however, because of one uncut canal portion near Tamatave and a 5.5-mile rock shelf near Masameloka. Although there are plans to eventually join the three unconnected portions of the canal, chances appear slim and hardly justified because of present light traffic.

Tubcor

FIGURE 5. Major ports (C)



Tamatave



Diego-Suarez



Majunga

Lac Alaotra, approximately 25 miles long, is a traditional link in the road-rail-water movement of agricultural products from the north interior to the east coast. The Betsiboka river, which is navigable year round for 125 miles, is the only important waterway on the west coast.

Silting and floating debris, particularly during flood periods, are major impediments to navigation on all waterways. Shifting channels and seasonal high winds create additional navigational problems. There are more than 20 bridges crossing navigable portions of the waterways; most are on the Canal des Pangalanes.

Inland ports are typically small with limited handling facilities and storage space. However, Majunga on the Betsiboka and Tamatave on the Canal des Pangalanes are deep-water ports accommodating oceangoing traffic, and Marovoay on the Betsiboka is a sizable inland waterway port. A small fleet of barges, generally in poor condition, operates on the main waterways. The most common type of craft is the native pirogue. Inland waterway construction and maintenance are performed by private contractors under the supervision of the Directorate for Public Works.

E. Ports (C)

Madagascar has 4 major ports, Tamatave, Diego-Suarez, Tulcar, and Majunga (Figure 5), and 13 minor ports. Physical and economic factors have inhibited port development and adversely affected the growth of trade. There are few natural harbors, and most of the coastal indentations which afford protection from the open sea are located in remote areas with little economic significance or are unprotected from the prevailing winds and periodic hurricanes. Most of the numerous estuaries that interrupt the coastline cannot accommodate maritime trade because of silting and shifting sandbars. The physical isolation of the island's economic regions has forced the government to maintain 17 ports, rather than concentrate on the development of the principal ports.

Tamatave (Figure 6), the principal port and second leading commercial center of the country, serves the central east coast and central highland regions and is the primary ocean terminal for Tananarive. Port facilities at Tamatave are modern and are served by rail and road clearance routes, enabling the port to handle the majority of Madagascar's maritime traffic. Diego-Suarez, a major commercial port, is also the site of the principal French naval base for the Indian Ocean area and is the only natural maritime harbor in

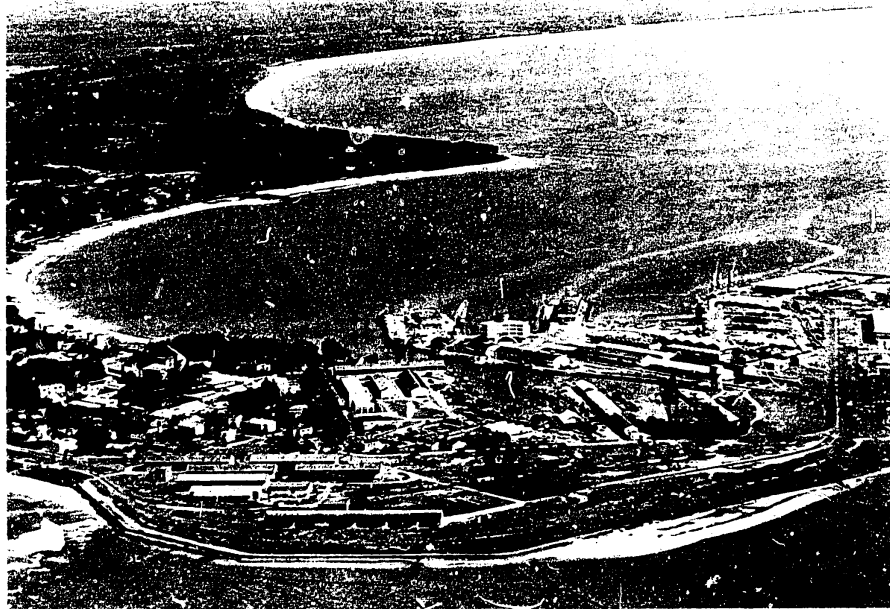


FIGURE 6. Port of Tamatave (U OU)

this region. The naval base operates the largest ship repair and shipbuilding facilities on Madagascar. However, the economic significance of Diego-Suarez is reduced because of mountain ranges which isolate it from the rest of the island. Majunga, a lighterage port, is well protected and has well-equipped facilities for handling about 20% of the island's total foreign trade; it is second only to Tamatave in commerce. Tulcar, the major port for the western and southern regions, is an ocean port largely because it has the most sheltered roadstead in the area. This port's deepwater pier has been enlarged, with alongside depths dredged to accommodate ocean vessels.

Nine minor ports are open to maritime trade; several were improved during the 1960's, and are being used as centers at which produce from inland areas is collected by coastal vessels for shipment to one of the ocean ports. Madagascar's ports are

generally adequate to meet the present maritime trade requirements.

Except for Tamatave, all commercial port facilities are owned and operated by the Department of Maritime Ports, Lighthouses, and Beacons, an agency of the Ministry of Development of the Territory. Tamatave is administered by the Malagasy Railways.

Development plans for ports are included through 1971 in the second economic plan. The program calls for lengthening the breakwater mole, for furnishing additional covered storage buildings and handling equipment at Tamatave, and for providing industrial development and ship-repair facilities for super tankers in Narinda Bay in the northwest. Studies related to port improvements, including techniques of unitization of cargo (containers and palletized cargo), are under consideration at several ports.

Characteristics of major ports are listed in Figure 7.

FIGURE 7. Major ports (C)

NAME; LOCATION; MILITARY PORT CAPACITY*	ACTIVITIES	HARBOR	BERTHS
Tamatave 18°09'S., 49°25'E.; on E. coast, 133 statute miles E.N.E. of Tananarive. 6,500	Leading commercial port; has 5,500 linear ft. of wharves, covered storage buildings, POL tanks, open stacking space, and mechanical handling equipment; road and rail clearance to Tananarive, and inland waterway clearance on Canal des Pangahanes. 660,000 tons of general and bulk cargoes transferred in 1970. Major receipts are crude oil, foodstuffs, vehicles, textiles, and metal products; major shipments are refined POL, products, coffee, sugar, vanilla, peanuts, rice, cocoa, tobacco, bananas, hides, crocodile skins, chromium, and graphite. Minor floating repairs to ocean-type vessels by small shipyard which has 2 marine railways; largest has loading capacity of 120 tons.	Improved natural coastal harbor; has small protected anchorage; usual approach through Passe du Sud with controlling depth of 36 ft. at mean low water springs. Alternative approach through Passe du Nord with least depths of 66 ft. Ships must move out to sea during severe storms because strong winds cause scotch (wave oscillation) in the harbor which batters ships berthed alongside.	Alongside—For 1 large, 1 standard, and 2 small ocean-type and 1 cargo vessels, 1 standard and 1 small coaster-type cargo vessels, and 23 lighters. Fixed mooring—Stern-to-berth, for 1 standard ocean-type tanker. Anchorage—For 1 large passenger ship, 1 ocean-type cargo vessel, and 1 coaster-type cargo vessel.
Diego-Suarez 12°16'S., 49°17'E.; in extreme north. 1,450	French naval base and major commercial port; has 1,200 linear ft. of substantial wharves, covered storage buildings, POL tanks, and limited mechanical handling equipment; road clearance S. and SW. to national system connecting with Tananarive. Tananarive route. About 100,000 tons of bulk and general cargoes transferred annually, with receipts consisting of foodstuffs, textiles, construction materials, POL, coal, and machinery. Shipments are hides, crocodile skins, vanilla, peanuts, coffee, and sisal. Site of Madagascar's principal ship-repair and shipbuilding facility; can perform hull and engine repairs to oceangoing merchant ships and naval ships up to destroyer size. Tank landing ship (LST) under construction here.	Natural coastal harbor excellent protection in Baie de Diego-Suarez with estimated 35 sq. miles of anchorage. Entrance through Passe d'Orange, with least depth of 42 ft. at mean low water springs.	Alongside—For 2 standard ocean-type cargo vessels, 1 small coaster-type cargo vessel, 2 motor torpedo boats, and an alternative berth for 1 small ocean-type tanker. Mediterranean mooring—For 2 frigates. Fixed mooring—For 2 coastal mine-sweepers. Anchorage—For numerous vessels of all classes.

*Footnote at end of table.

FIGURE 7. Major ports (C) (Continued)

NAME; LOCATION; MILITARY PORT CAPACITY*	ACTIVITIES	HARBOR	BERTHS
Mnjunga..... 15°43'S., 46°19'E.; on E. side of entrance to Baie de Bombetoko, NW coast, in estuary of Bessiboka river, 235 statute miles NW of Tammarive. 1,900	Commercial port; has 1,740 linear ft. of lighterage wharves, covered storage buildings, POL storage tanks, mechanical handling equipment; road clearance 377 miles SE. to Tammarive, and inland waterway clearance along Bessiboka river 35 miles to Marovoay. About 312,000 tons of cargo transferred in 1970, receipts comprising machinery, vehicles, and transportation equipment, POL, textiles, and foodstuffs; shipments are rice, bananas, cattle, tobacco, sugar, rum, hides, and crocodile skins. No repairs to ocean-type vessels, but small commercial shipyard repairs coasters and harbor craft and builds wooden-hull small craft; 2 marine railways with unknown hauling capacities.	Natural coastal harbor; well-protected anchorage in roadstead off port and in estuarial channel extending 6 1/2 nautical miles S. to Bonnamy anchorage; anchorage subject to strong currents during ebb tide and rainy season. Cantrailing depth in fairway leading to harbor through the Canal du Nord-Ouest 42 ft. at mean low water springs.	Alongside--For 16 lighters. Fixed mooring--For 1 small ocean-type tanker at offshore pipeline berth. Anchorage--For 5 ocean-type cargo vessels in roadstead off port, and for numerous vessels of all classes in estuarial channel SW. of port.
Tubour..... 23°21'S., 43°40'E.; on SW. coast. 900	Commercial port; has 1,100 pier covered and open storage facilities, bulk POL storage tanks, mechanical handling equipment, road clearance NE. to national system connecting with Tammarive, and N. along coastal route to minor ports of Morombe, Morondava, and Maintirano. About 70,000 tons of general cargo transferred annually, with shipments comprising hides, corn, beans, peas, rice, sisal, wood, and mica; receipts are foodstuffs, textiles, cement, POL, machinery, and manufactured goods. No repairs to ocean-type vessels, but small shipyard repairs coasters and harbor craft and has 1 marine railway of unknown hauling capacity.	Natural coastal harbor; offshore coral reef provides safe anchorage in Baie de Tubour, with general water area of 10 sq. miles and general depths 18 to 48 ft. Approach from S., clear and deep.	Alongside--For 1 standard ocean-type cargo vessel and 3 lighters. Fixed mooring--None. Anchorage--For several ocean-type cargo vessels and numerous coaster-type cargo vessels.

*The estimated military port capacity is the maximum amount of general cargo expressed in long tons that can be unloaded onto the wharves and cleared from the wharf aprons during a period of one 24-hour day (20 effective cargo-working hours). The estimate is based on the static cargo-transfer facilities to the port existing at the time the estimate is prepared and is designed for comparison rather than for operational purposes; it cannot be projected beyond a single day by straight multiplication.

F. Merchant marine (C)

The Malagasy Republic depends on foreign shipping for the transport of most of its international seaborne imports and exports but relies upon its own small merchant fleet for the carriage of a sizable domestic interchange of goods. The merchant fleet of ships of 1,000 gross register tons (g.r.t.) and over consists of nine ships, totaling 40,964 g.r.t. or 59,226 deadweight tons (d.w.t.), as follows:

TYPE	No.	G.R.T.	D.W.T.
Dry cargo	7	21,317	30,826
Tanker	1	18,048	26,100
Chemical carrier	1	1,599	2,300

Of the fleet's total deadweight tonnage, 28% (two ships) are less than 10 years old, 61% (four ships) are between 10 and 14 years old, and 11% (three ships) are between 15 and 20 years old. Seven ships (six dry cargo and one chemical carrier) are between 1,500 and 5,010 d.w.t.; the remaining ships are a 14,500-d.w.t. dry cargo unit and a 18,048-d.w.t. tanker. All ships are diesel powered and have operating speeds of 12 to 16 knots.

Merchant tonnage is controlled by the following four beneficial owners (entities which take the profit or loss from operations). *Societe Malgache de Transports Maritimes* (SMTM), Tamatave, is the national shipping line and owns one 14,500-d.w.t. dry cargo unit. SMTM is a joint shipping company in which the government and several foreign shipping companies hold capital shares. *Compagnie Havraise et Nantaise Peninsulaire*, Paris, is an SMTM shareholder and also owns and operates under Malagasy registry six dry cargo ships totaling 16,326 d.w.t. *Societe Maritime de Madagascar*, Tananarive, owns one 2,300-d.w.t. chemical carrier. *Societe Francaise de Transports Pétroliers*, S.A., Paris, owns one 26,100-d.w.t. tanker. Although the merchant fleet is primarily engaged in trade between domestic ports and ports of the east coast of Africa, at least two ships serve ports of west Africa, Western Europe, the Middle East, and Far East.

The Malagasy Republic is a member of the Inter-Governmental Maritime Consultative Organization (IMCO) and a party to the following IMCO conventions: Safety of Life at Sea, 1948 and 1960; Prevention of Collisions at Sea, 1960; Oil Pollution, 1954 and 1962; and Load Lines, 1966.

G. Civil air (C)

Air transportation is well developed and is the main means of transport within the country. Air

Madagascar, the national air carrier, maintains a dense but unprofitable route network. Four airports of entry—Tananarive Ivato, Tamatave, Majunga, Ambovohy, and Nossi Be Fascene (on Nossi Be island) in the northwest)—provide international connections.

Air Madagascar commenced operations in January 1962; ownership is divided between the Malagasy Republic Government (51%), Air France (44%), and private interests. Air Madagascar provides a comprehensive network of service to 50 domestic points; service four times a week to the island of Reunion; service twice a week to France and the French Territory of the Afars and Issas; and weekly services to Tanzania, Mozambique, Kenya, Italy and the Comoro Islands. Air Madagascar's domestic network comprises five major routes, all radiating from Tananarive to the main coastal ports. These basic routes cover approximately 3,750 miles. Air Madagascar initiated an air taxi service in 1965 and took over the distributorship of Piper aircraft. Twenty light aircraft are utilized on air taxi, agricultural, and charter operations, and an Aerospatiale N-262 serves as the executive aircraft of the President of the Malagasy Republic. Air Madagascar leases time on a Boeing 707 for the round trip twice a week to Paris and Marseille via Djibouti in the French Territory of the Afars and Issas. The chief problems of the airline are lack of trained Malagasy personnel and inadequate financing; consequently, the carrier continues to rely heavily on Air France for managerial and technical support.

Madagascar is also served by the Madagascar Air Works (TAM), a small general aviation company affiliated with Air Madagascar that began in 1951. TAM has 13 Piper and Cessna aircraft, primarily engaged in crop dusting and spraying activities but also in some miscellaneous charter work.

The 15 aeroclubs, an important element in local aviation, are subsidized by the government and are authorized to perform charter work and other activities. They employ an estimated 35 light aircraft.

Approximately 115 civil aircraft are based in Madagascar, including 13 which are under French registration. Of the 10 aircraft having a gross weight of over 20,000 pounds, Air Madagascar owns 9—1 Aerospatiale N-262, 2 Boeing 737-200, 1 Douglas DC-3C, and 5 Douglas DC-4's. The airline also wet leases time on a Boeing 707-320 from Air France. The Malagasy Republic Government owns a Douglas DC-3A. The light aircraft are operated by Air Madagascar, TAM, government agencies, aeroclubs, nonaviation enterprises, and private owners.

About 1,200 persons, including an estimated 200 pilots, are engaged in civil aviation activities in the country. Air Madagascar employs over 800 personnel including 25 pilots, 20 other flight crew members, 230 maintenance, and 300 traffic and sales personnel. The Agency for the Safety of Air Navigation in Africa and Madagascar (ASECNA), which provides navigational services under contract to the government, employs about 300. Air Madagascar's mechanics, most flight crew members, and about 50% of its pilots are French nationals.

The aeroclubs provide schools for the training of private pilots. Many commercial pilots are French nationals, and most commercial pilot training takes place in France. ASECNA operates a school near Tananarive for air traffic controllers and airport managers. Students also attend the Training Center for Civil Aviation and Meteorology in Tunis. Other technical training facilities available locally include the National Meteorological Service and the University of Madagascar, both located at Tananarive. The government sponsors an information program in the schools to encourage interest in aviation.

Air Madagascar operates the major civil aircraft maintenance facility at Tananarive/Ivato. All maintenance for Air Madagascar's reciprocating engine aircraft as well as contractual maintenance for other civil aircraft is performed at this facility. Jet aircraft ramp service, electronic repair, and emergency repairs are also available. Major overhaul of the Boeing 737 aircraft is done at Johannesburg under contract with South African Airways. Madagascar Air Service also maintains a repair shop for light aircraft at Tananarive/Ivato. TAM has its maintenance facility at Tulcar airfield. Maintenance on most types of light aircraft is also provided at a facility operated by the aeroclub at Diego-Suarez.

The Directorate of Civil Aeronautics and Meteorology within the Ministry of Development of the Territory is responsible for regulating civil aviation and follows International Civil Aviation Organization (ICAO) requirements. ASECNA, a multinational public establishment with headquarters in Paris, has the responsibility for air navigation and route services.

The Malagasy Republic is a member state of ICAO and a participating state in VERITAS, a French company providing airworthiness, accident investigation, and personnel licensing services. The government has civil aviation agreements or informal arrangements with 12 countries and territories. Four foreign carriers provide international service between Madagascar and 15 cities in Europe, Africa, and neighboring islands.

H. Airfields² (C)

The air facilities system of Madagascar consists of 166 usable airfields, about 200 sites, and 6 seaplane stations. One airfield is joint civil/military, 2 are military, 1 is for government use only, and the rest are either civil or private. The airfields are fairly evenly distributed over the island, with the more important located near the larger metropolitan areas.

Tananarive/Ivato Airfield (Figure 8) at Tananarive is the largest and most modern airfield on Madagascar. It can support sustained operations of aircraft up to and including the Boeing 707. The asphaltic concrete runway is 10,170 feet in length and is well maintained as are the taxiways and aprons. Complete support and repair facilities are available. Other significant airfields are Majunga-Ambovoay, Tananarive-Arivonimamo, and Tamatave. The two military airfields are Diego-Suarez, Andrakaka, and Ankazobe, which is used only occasionally. Most military operations are conducted from Tananarive-Ivato Airfield, which has the personnel and equipment required for support of administrative, operational, and housekeeping functions needed for tactical and training operations.

There are 24 airfields with hard-surface runways ranging in length from 3,609 to 10,170 feet. These airfields are generally in good condition. Existing facilities range from extensive and modern to limited and substandard. The remaining airfields have temporary or natural surfaces and range in length from 1,148 to 5,249 feet; most have no facilities. The sites are of little or no significance.

Airfield maintenance is generally good, varying from minor repairs at the lesser airfields to periodic

²For detailed information on individual airfields on Madagascar see Volume 22, *Airfields and Seaplane Stations of the World*, published by the Defense Mapping Agency Aerospace Center for the Defense Intelligence Agency.

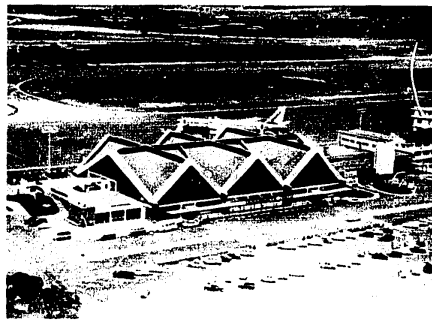


FIGURE 8. Tananarive/Ivato Airfield (U/OU)

FIGURE 9. Selected airfields (C)

NAME AND LOCATION	LONGEST RUNWAY: SURFACE; DIMENSIONS; ELEVATION ABOVE SEA LEVEL	ESWL*	LARGEST AIRCRAFT NORMALLY SUPPORTED	REMARKS
	<i>Feet</i>			
Diego Suarez/Andrakaka 12°15'S., 49°15'E.	Asphalt. 8,202 x 148 200	56,600	C-135.....	Military. Former Navy contingency base. Can handle large jet aircraft. Largest airfield on the NE.
Fort Dauphin..... 25°02'S., 46°57'E.	Asphalt. 4,593 x 98 26	45,500	Convair 880.....	Civil. Largest airfield in SE. Jet fuel available.
Majunga/Amborovy..... 15°40'S., 46°21'E.	Asphalt. 7,218 x 148 85	56,600	Boeing 707.....	Civil. International airfield. Alternate for Tananarive/Ivato. Largest airfield in SW. Jet fuel available.
Nosy Be/Fascene..... 13°19'S., 48°19'E.	Asphalt. 7,185 x 98 33	45,500	Convair 880.....	Civil. Located on island of Nosy Be. Jet fuel available.
Tamatave..... 18°07'S., 49°24'E.	Asphalt. 7,218 x 131 20	45,500do.....	Civil. International airfield. Located on east coast. Jet fuel available.
Tananarive/Arivonimamo..... 19°02'S., 47°10'E.	Asphalt. 8,218 x 148 4,757	56,600	Boeing 707.....	Civil. Alternate to Tananarive/Ivato. Located on central plateau.
Tananarive/Ivato..... 18°48'S., 47°29'E.	Asphalt. 10,171 x 148 4,196	56,600	C-135.....	Joint. International airfield. Main airfield on Madagascar. Jet fuel available.
Tulear..... 23°23'S., 43°43'E.	Asphalt. 4,478 x 131 26	45,500	Convair 880.....	Civil. International airfield. Located on SW coast. Jet fuel available.

*Equivalent Single-Wheel Loading—Capacity of an airfield runway to sustain the weight of any multiple-wheel landing-gear aircraft in terms of the single-wheel equivalent.

major repairs and construction at the primary airfields. The major airfields maintain readily available service and support facilities.

Figure 9 lists the characteristics of the most important airfields.

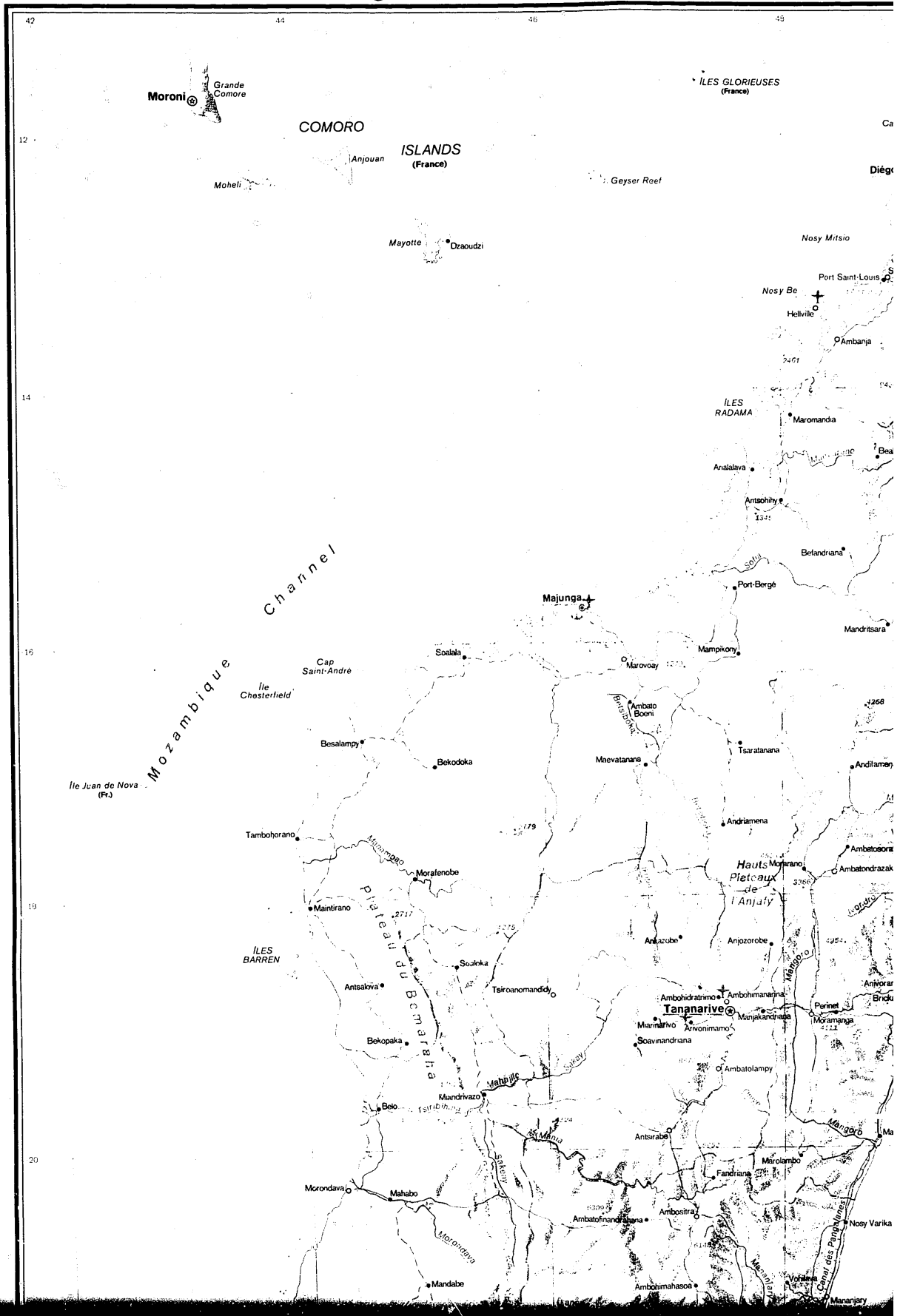
I. Telecommunications (C)

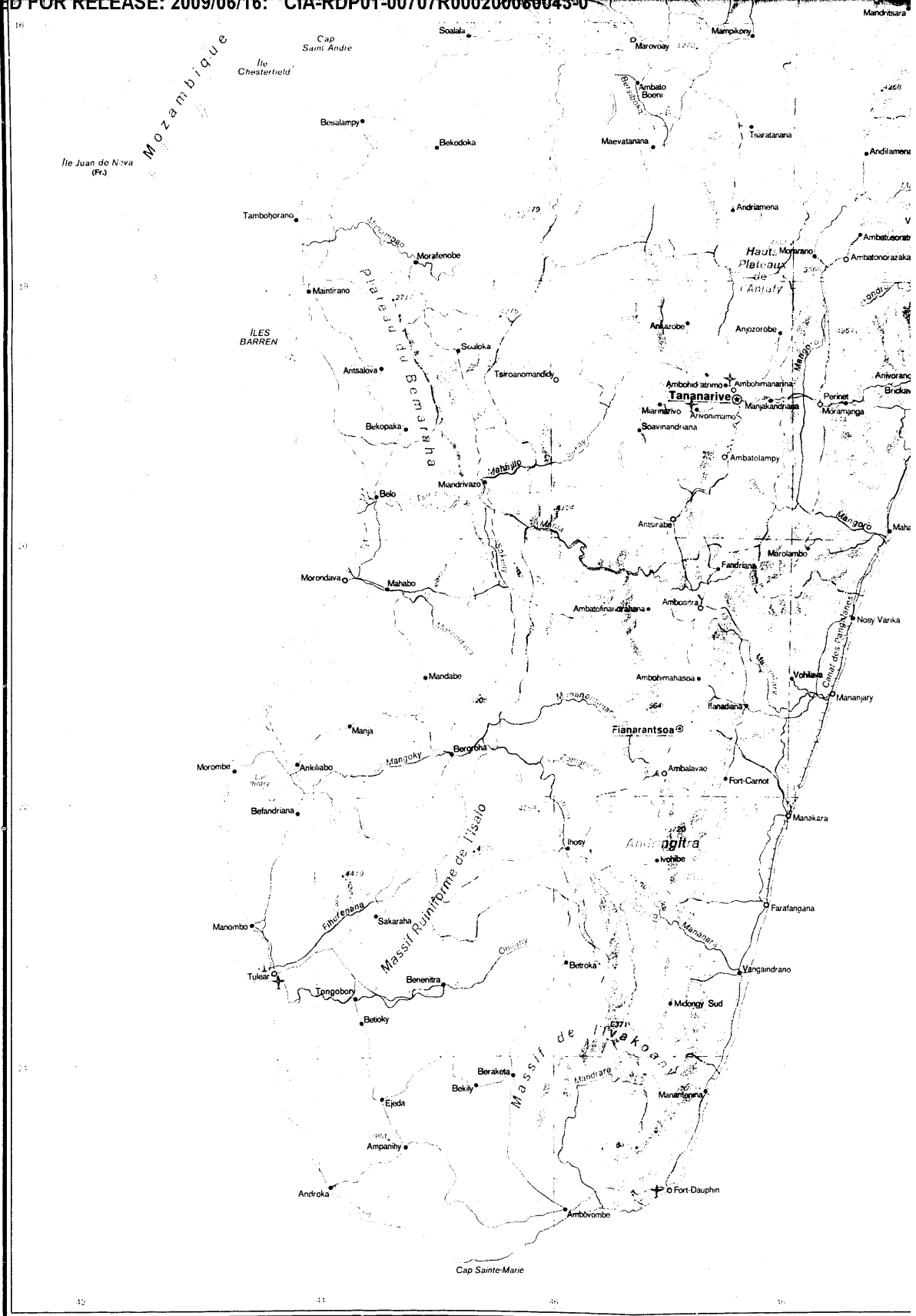
The telecommunications (telecom) system is limited but improving. It is extensive and well distributed, encircling the island and crisscrossing it to reach all populated places of any importance (Figure 10). The principal telecom center is Tananarive; secondary centers are Antsirabe, Fianarantsoa, Majunga, and Tamatave. Telephone, telegraph, and telex services provided by the system are only moderate in quality and subject to interruptions and breakdowns. The level of telecom development is the highest of the former French territories of Africa, but the total number of telephones, about 27,000, is just within the top two-fifths of African nations.

Telecom administration is under the Secretariat of State for Posts and Telecommunications, an agency of

the Ministry of Development of the Territory. Radiobroadcast and TV programming are supervised by the Ministry of Information. Madagascar is a member of the International Telecommunications Union (ITU), International Telecommunications Satellite Consortium (INTELSAT), and African and Malagasy Ports and Telecommunications Union (*Union Africaine Malgache des Postes et Telecommunications—UAMPT*).

The basic domestic long-distance network is composed of widespread open-wire lines including a coastal ring and cross-island connections. New links, however, are being constructed utilizing radio-relay and coaxial cable for greater capacity. Radio relay is installed on the main trunk from Tananarive via Antsirabe to Fianarantsoa, from Morondava to Belo, and from the Arivonimamo satellite ground station to the capital. A new coaxial cable, inaugurated in April 1972, connects Tananarive with Tamatave. Numerous radiocommunication stations supplement these facilities. Main towns have automatic telephone exchanges, 73% of the 27,000 telephones being automatic, and direct-distance dialing is being



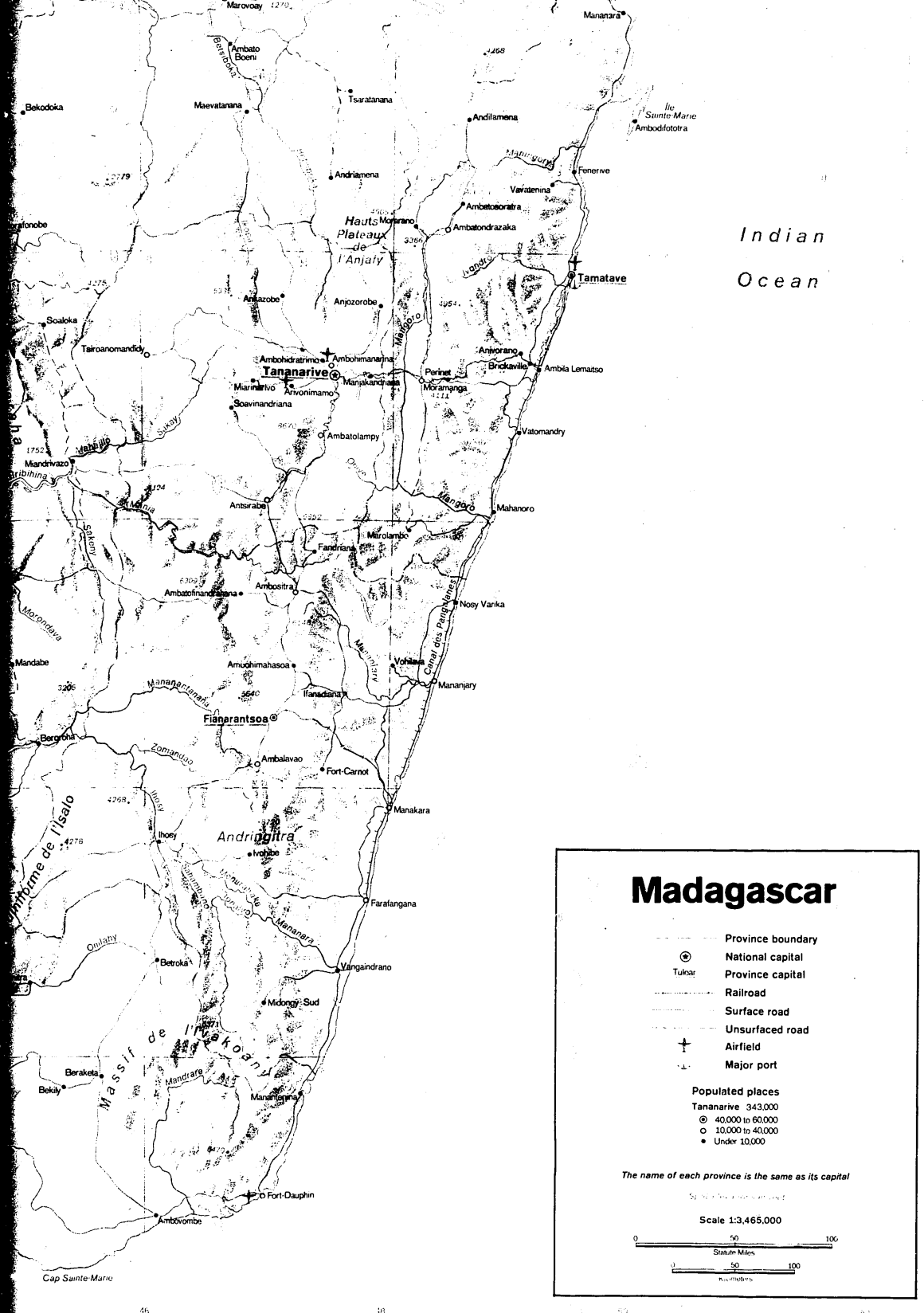


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④

⑧ Terrain and Transportation Figure 11