The Republic of Cuba
Ministry of Transport

Project for Formulation of National Transport Master Plan in the Republic of Cuba

Final Report

March 2023

Japan International Cooperation Agency (JICA)

Oriental Consultants Global Co., Ltd.
Nippon Koei Co., Ltd.
ALMEC Corporation
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USD	1.00 = JPY	130.121
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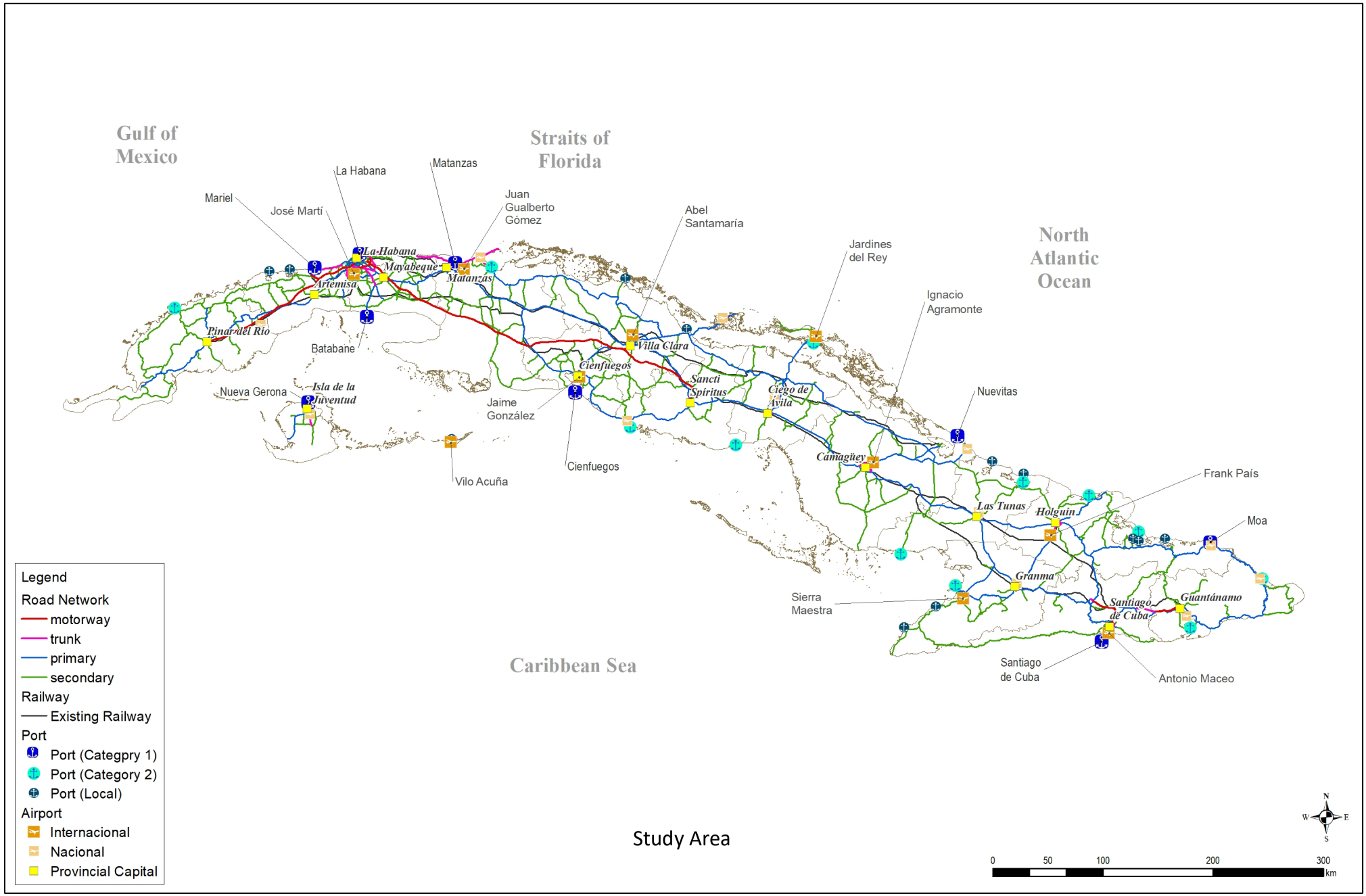
(February 2023)


Gulf of Mexico
Straits of Florida
North Atlantic Ocean
Caribbean Sea
Mariel
José Martí
La Habana
Matanzas
Juan Gualberto Gómez
Abel Santamaría
Jardines del Rey
Ignacio Agramonte
Nuevitas
Frank País
Moa
Holguin
Las Tunas
Granma
Guantánamo
Santiago de Cuba
Antonio Maceo
Sierra Maestra
Santiago de Cuba
Camagüey
Ciego de Avila
Sancti Spiritus
Villa Clara
Cienfuegos
Jaime González
Cienfuegos
Vilo Acuña
Isla de la Juventud
Nueva Gerona
Batabano
Pinar del Rio
Artemisa
Mayabeque
Matanzas
La Habana
Legend
Road Network
motorway
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primary
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Railway
Existing Railway
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200
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Study Area

Project for Formulation of National Transport Master Plan in the Republic of Cuba

Final Report Summary

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List of Abbreviations

Abbreviation		Full Name	
English	**Spanish**	**English**	**Spanish**
AFD	AFD	French Development Agency	Agencia Francesa de Desarrollo
ATF	ATF	Railway Transport Administration	Administración del Transporte Ferroviario
ATC	CAT	Advanced Traffic Control	Control de Tráfico Avanzado
ATS	DAT	Automatic Train Stop	Detención Automática de Tren
AUSA	AUSA	Almacenes Universales SA	Almacenes Universales S.A.
AZCUBA	AZCUBA	Sugar Group	Grupo Azucarero
BCC	BCC	Central Bank of Cuba	Banco Central de Cuba
BOT	COT	Build-Operate-Transfer	Construcción-Operación-Transferencia
CABEI	BCIE	Central American Bank for Economic Integration	Banco Centroamericano de Integración Económica
C/P	C/P	Counterparts	Contrapartes
CACSA	CACSA	Cuban Aviation Corporation Enterprise	Corporación de la Aviación Cubana S.A.
CAF	CAF	Development Bank of Latin America	Banco de Desarrollo de América Latina
CAP	CAP	Council of Provincial Administration	Consejo de Administración Provincial
CCD	CCD	Center of Loading and Unloading	Centro de Carga y Descarga
CCRC	CCRC	Chamber of Commerce of the Republic of Cuba	Cámara de Comercio de la República de Cuba
Cimab	Cimab	Center for Environmental Research and Management of Transport	Centro de Investigación y Manejo Ambiental del Transporte
CITMA	CITMA	Ministry of Science, Technology and Environment	Ministerio de Ciencia, Tecnología y Medio Ambiente
CNoA	CNoA	Non-Agricultural Cooperative	Cooperativa No agropecuaria
CNAP	CNAP	National Center for Protected Areas	Centro Nacional de Áreas Protegidas
CNV	CNV	National Roads Center	Centro Nacional de Vialidad
COF	COF	Railway Operation Center	Centro de Operaciones Ferroviarias
COMECON	CAME	Council for Mutual Economic Assistance	Consejo de Ayuda Mutua Económica
CPV	CPV	Provincial Road Center	Centro Provincial de Vialidad
CSCT	TIC	Computer Science and Communication Technologies	Tecnologías de la Información y las Comunicaciones
CUC	CUC	Cuban Convertible Peso	Peso Cubano Convertible
CUP	CUP	Cuban Peso	Peso Cubano
Cupet	Cupet	Cuba Petrol Union	Unión Cuba Petróleo
CWR	RSC	Continuous Welded Rail	Riel Soldado Continuo
DAC	CAD	Development Assistance Committee	Comité de Ayuda al Desarrollo
DC	CD	Direct Current	Corriente directa
DEL	LDE	Diesel Electric Locomotive	Locomotora Diésel-Eléctrica
DF/R	BI/F	Draft Final Report	Borrador de Informe Final
DGTH	DGTH	General Directorate of Transport of Havana	Dirección General de Transporte de La Habana

Abbreviation		Full Name	
English	**Spanish**	**English**	**Spanish**
DHL	LDH	Diesel Hydraulic Locomotive	Locomotora Diésel Hidráulica
DRIMS	SMIRD	Dynamic Response Intelligent Monitoring System	Sistema de Monitoreo Inteligente de Respuesta Dinámica
DWT	TPM	Deadweight tonnage	Tonelaje de peso muerto
ECASA	ECASA	Cuban Enterprise of Airports and Aeronautical Services S.A.	Empresa Cubana de Aeropuertos y Servicios Aeroportuarios S.A.
ECOING	ECOING	Engineering Works Construction Enterprise	Empresa Constructora de Obras de Ingeniería
ECVF	ECVF	Construction Enterprise of Rail tracks	Empresa Constructora de Vias Férreas
EDI	IED	Electronic Data Interchange	Intercambio Electrónico de Datos
EEA	EAE	Estrategic Environment Assessment	Evaluación Ambiental Estratégica
EFC	EFC	Central Railway Enterprise	Empresa Ferrocarriles Centro
EFCE	EFCE	Central East Railway Enterprise	Empresa Ferrocarriles Centro Este
EFO	EFO	East Railway Enterprise	Empresa Ferrocarriles Oriente
EFOC	EFOC	West Railway Enterprise	Empresa Ferrocarriles Occidente
EIA	EIA	Environment Impact Assessment	Evaluación de Impacto Ambiental
EIIF	EIIF	Industrial Enterprise of Fixed Installations	Empresa Industrial de Instalaciones Fijas
EMCARGA	EMCARGA	General Freight Transport Enterprise	Empresa de Carga por Camiones
EMCOMED	EMCOMED	Medicine Commercializing Enterprise	Empresa Comercializadora de Medicamentos
EMPA	EMPA	Food Product Wholesale Enterprise	Empresa Mayorista de Productos Alimentarios
ENOC	ENOC	National Container Operator Enterprise	Empresa Nacional Operadora de Contenedores
ENOT	ENOT	National Scheme of Territorial Planning	Esquema Nacional de Ordenamiento Territorial
EON	EON	National Bus Enterprise	Empresa de Ómnibus Nacionales
EPS	ESP	Port Services Enterprise	Empresa de Servicios Portuarios
EPT	EPT	Provincial Transport Enterprise	Empresa Provincial de Transporte
ETAG	ETAG	Bulk Cargo Transport Enterprise	Empresa de Transporte de Alimentos a Granel
ETE	ETE	School Transport Enterprise	Empresa de Transporte Escolar
ETT	ETT	Transport Enterprise for Workers	Empresa de Transporte para Trabajadores
EU	UE	European Union	Unión Europea
EV	VE	Electric Vehicle	Vehículo eléctrico
F/R	I/F	Final Report	Informe Final
FDI	IED	Foreign Direct Investment	Inversión extranjera directa
GAE	GAE	Group of Enterprise Management	Grupo de Administración Empresarial
GDP	PIB	Gross Domestic Product	Producto Interno Bruto
GEA	GEA	Business Group of Automotive Transport Services	Grupo Empresarial de Servicios de Transporte Automotor
GEMAR	GEMAR	Business Group of Port Maritime Transport	Grupo Empresarial de Transporte Marítimo Portuario
GESIME	GESIME	Business Group of the Siderurgical Industry	Grupo Empresarial de la Industria Sideromecánica

Abbreviation		Full Name	
English	**Spanish**	**English**	**Spanish**
GIS	SIG	Geographic Information System	Sistema de Información Geográfica
GPS	GPS	Global Positioning System	Sistema de Posicionamiento Global
GSE	EAT	Ground Support Equipment	Equipo de apoyo terrestre
GSM-R	GSM-R	Global System for Mobile Communications–Railway	Sistema Global para las Comunicaciones Móviles–Ferroviario
H.E.	S.E.	His Excellency	Su Excelencia
HDM-4	HDM-4	Highway Development and Management Model 4	Modelo de Desarrollo y Gestión de Carreteras 4
IC/R	II	Inception Report	Informe Inicial
ICD	DCI	Inland Container Depot	Depósito de contenedores en el interior
IMF	FMI	International Monetary Fund	Fondo Monetario Internacional
INOTU	INOTU	National Institute of Spatial Ordering and Town Planning	Instituto Nacional de Ordenamiento Territorial y Urbanismo
IPF	IPF	Institute of Physical Planning	Instituto de Planificación Física
IRI	IRI	International Roughness Index	Índice de Rugosidad Internacional
IT/R	I/P	Interim Report	Informe Parcial
JCC	CCC	Joint Coordination Committee	Comité de Coordinación Conjunta
JPY	JPY	Japanese Yen	Yen japonés
JST	EEJ	JICA Study Team	Equipo de Estudio de JICA
JV	EM	Joint Venture	Empresa Mixta
LCC	TBC	Low Cost Carrier	Transportista de bajo costo
LOS	NDS	Level of Service	Nivel de Servicio
LWR	RSL	Long Welded Rail	Riel Soldado Largo
M/M	A/R	Minutes of Meeting	Actas de Reunión
M/P	P/M	Master Plan	Plan Maestro
MED	MED	Ministry of Education	Ministerio de Educación
MEP	MEP	Ministry of Economy and Planning	Ministerio de Economía y Planificación
MES	MES	Ministry of Higher Education	Ministerio de Educación Superior
MICONS	MICONS	Ministry of Construction	Ministerio de la Construcción
MINAG	MINAG	Ministry of Agriculture	Ministerio de la Agricultura
MINAL	MINAL	Ministry of Food Industry	Ministerio de la Industria Alimentaria
MINCEX	MINCEX	Ministry of Foreign Trade and Foreign Investment	Ministerio del Comercio Exterior y la Inversión Extranjera
MINCIN	MINCIN	Ministry of Domestic Trade	Ministerio del Comercio Interior
MINDUS	MINDUS	Ministry of Industries	Ministerio de Industrias
MINEM	MINEM	Ministry of Energy and Mines	Ministerio de Energía y Minas
MINFAR	MINFAR	Ministry of Revolutionary Armed Forces	Ministerio de las Fuerzas Armadas Revolucionarias
MINTUR	MINTUR	Ministry of Tourism	Ministerio del Turismo
MITRANS	MITRANS	Ministry of Transport	Ministerio del Transporte
MLIT	MLIT	Ministry of Land, Infrastructure,	Ministerio de Tierra, Infraestructura, Transporte

Abbreviation		Full Name	
English	**Spanish**	**English**	**Spanish**
		Transport and Tourism, Japan	y Turismo, Japón,
MOFA	MOFA	Ministry of Foreign Affairs, Japan	Ministerio de Asuntos Exteriores, Japón
MTSS	MTSS	Ministry of Labor and Social Security	Ministerio del Trabajo y Seguridad Social
NC	NC	Cuban Standard	Norma Cubana
NEXCO	NEXCO	Nippon Expressway Company Limited	Compañía Limitada de Expresos de Japón
NEXI	NEXI	Nippon Export and Investment Insurance	Seguros de Exportación e Inversión de Japón
NIEI	INIE	National Institute of Economic Investigations	Instituto Nacional de Investigaciones Económicas
NRMT	NRMT	Ministry of Transport Branch Standard	Norma Ramal del Ministerio del Transporte
NSS	SNE	Non-State Sector	Sector No Estatal
OAD	AOD	Official Agency for development	Asistencia Oficial para el Desarrollo
O&M	O&M	Operation and Maintenance	Operación y Mantenimiento
OACE	OACE	Agency of the Central State Administration	Órgano de la Administración Central del Estado
OD	OD	Origin-Destination	Origen-Destino
ODA	AOD	Official Development Aid	Ayuda Oficial para el Desarrollo
OJT	FEE	On-the-Job-Training	Formación en el empleo
ONEI	ONEI	National Office of Statistics and Information	Oficina Nacional de Estadística e Información
OSDE	OSDE	Higher Organization of Business Management	Organización Superior de Dirección Empresarial
PBB	PEP	Passenger Boarding Bridge	Puente de embarque de pasajeros
PC	HP	Prestressed Concrete	Hormigón Pretensado
PC	PC	Personal Computer	Computadora Personal
PCU	UCP	Passenger Car Unit	Unidad de Autos de Pasajeros
PDA	APD	Personal Data Assistant	Asistente Personal de Datos
PFI	IFP	Private Finance Initiative	Iniciativa de financiación privada
PPP	APP	Public Private Partnership	Asociación Pública Privada
PROCUBA	PROCUBA	Promotion of Foreign Trade and Foreign Investment in Cuba	Promoción del Comercio Exterior y la Inversión Extranjera de Cuba
QGC	QGC	Quay Gantry Crane	Grúa pórtico de muelle
R/D	R/D	Record of Discussion	Registro de Discusión
RES	FRE	Renewable Energy Sources	Fuentes renovables de energía
RTG	RTG	Rubber Tired Gantry Crane	Grúa pórtico sobre neumáticos
SAB	BSA	Semi-Automatic Block	Bloqueo Semiautomático
SCB	SCB	Signals, Centralization and Blocking	Señales, centralización y bloqueo
SDC	COSUDE	Swiss Development Cooperation Agency	Agencia Suiza para el Desarrollo y la Cooperación
SDGs	ODSs	Sustainable Development Goals	Objetivos de Desarrollo Sostenible
SEA	EAE	Strategic Environmental Assessment	Evaluación Ambiental Estratégica

Abbreviation		Full Name	
English	**Spanish**	**English**	**Spanish**
SEN	SEN	National Electric System	Sistema Electroenergético Nacional
SEZ	ZED	Special Economic Zone	Zona Especial de Desarrollo
SNAP	SNAP	National System of Protected Areas	Sistema Nacional de Áreas Protegidas
SNCF	SNCF	French National Railway Company (Societe National des Chemins de Fer)	Sociedad Nacional de Ferrocarriles Franceses
SNS	SRS	Social Networking Service	Servicio de redes sociales
SOLCAR	SOLCAR	Commander “Tony Santiago” Rail tracks Construction Enterprise	Empresa Constructora de Vías Férreas Comandante “Tony Santiago”
SSHWS	SSHWS	Saffir-Simpson Hurricane Wind Scale	Escala de huracanes Saffir-Simpson
TAZs	ZATs	Traffic Analysis Zones	Zonas de Análisis de Tráfico
TIS	STI	Transport Intelligent System	Sistema de Transporte Inteligente
TBD	PD	To Be Decided	Por determinar
toe	tcc	Ton of Oil (Conventional Fuel) Equivalent	Tonelada de Combustible Convencional
ToR	TR	Terms of Reference	Términos de Referencia
TWG	GTT	Technical Working Group	Grupo Técnico de Trabajo
UEB	UEB	Grassroots Business Unit	Unidad Empresarial de Base
UET	UET	State Unit of Traffic	Unidad Estatal de Tráfico
UFC	UFC	Cuban Railway Union	Unión de Ferrocarriles de Cuba
UN	ONU	United Nations	Naciones Unidas
UNDP	PNUD	United Nations Development Programme	Programa de las Naciones Unidas para el Desarrollo
UNE	UNE	National Electric Union	Unión Nacional Eléctrica
UNS	SNU	United Nations System	Sistema de las Naciones Unidas
US	EEUU	United States	Estados Unidos
USD	USD	US Dollars	Dólares estadounidenses
VHF	VHF	Very High Frequency	Frecuencia Muy Alta
WG	GT	Working Group	Grupo de Trabajo
WTTC	WTTC	World Travel & Tourism Council	Consejo Mundial de Viajes y Turismo

Chapter 1 Introduction

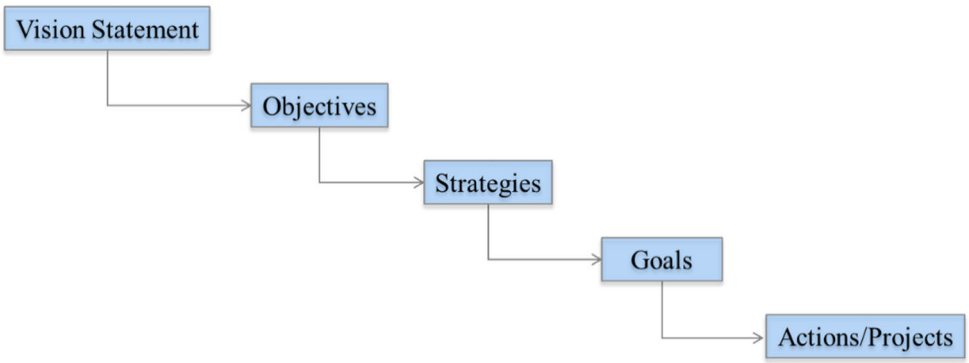
1.1 Structure of the Master Plan

The formulation of this master plan has been guided by observation of Cuba's existing conditions, as well as upstream policies relevant to the transport sector in the "Conceptualization of the Economic & Social Model," the "National Economic & Social Development Plan 2030," "Indications from the President, June 2019," and "Cuba and its Economic & Social Challenges, September 2020." Therefore, this master plan for Cuba's national transport sector can be read as a grand strategy to realize state policy and objectives.

This master plan is based on the hierarchical structure shown in Figure 1.1.1. Recognizing the current situation and principles stated in the upstream policies, the vision statements inform the desired future in 2030, the plan's target year, deemed achievable during the planning horizon.

To realize the vision, specific objectives need to be specified by considering six key areas of planning, as described below. Then, following the identified objectives, multiple and implementable strategies are prepared to realize the objectives, and corresponding numerical goals are set as milestones (to be expressed numerically as much as possible) to be achieved in implementing those strategies. Consequently, specific tactics, that is, actions/projects, to achieve the goals, are identified by a series of numeric analyses such as demand forecasts.

From this process, a clear picture emerges of the inputs required (funding for project implementation, in other words, future fixed capital formation) to execute the strategies and achieve the goals. However, given potential future budget constraints, it may be necessary to revise targets, and investment amounts downward. But by reiterating this process, feasible final goals can be set, corresponding actions/projects can be finalized, and mechanisms for execution (budget and organization) can be identified.



Vision:	Desired future for the transport sector consistent with state development policy and principles.
Objectives:	Aims to achieve or directions to follow in the transport sector in six key planning areas.
Strategies:	Strategizing is a process to rationalize coherence between objectives and corresponding goals and actions/projects and to ensure that strategies are practical and implementable within the plan's 2030 time horizon.
Goals:	Quantifiable values, informing targets to be achieved within the plan's time horizon. For example, "output and outcome indicators" such as the population to be served by a new transport intervention. Goals can be revised in response to changes in external factors such as economic growth scenarios.
Projects:	Projects can be understood as "the use of resources" in line with the strategies and goals. In this regard, costs (investment amount: expected fixed capital formation plus the cost of project implementation) must be roughly estimated.

Source: JICA Study Team

Figure 1.1.1 Structure of the Master Plan

1.2 Key areas of consideration

In this transport master planning process, six planning criteria will be addressed:

1. Planning and coordination

   Under each OACE, a new organization named OSDE (GEA, GEMAR, CACSA, UFC) was established to manage and supervise Empresas under its umbrella. Therefore, OSDE can be seen as an organization equivalent to a coordinator in delivering transport services in each mode.

   The Ministry of Transport includes various directorates/departments in charge of roads, railroads, ports/shipping, airports/civil aviation, accounting, general affairs, etc. OSDEs attended by MITRANS (GEA, GEMAR, CACSA, UFC) approve the transport development plans of enterprises integrated under them, and monitors their implementation status. At present, as each enterprise's plans are formulated separately, there is evident scope to improve coordination in planning between different modes of transport.

   Vertical coordination (like a command/report system) needs to be well designed from the Ministry level to the Empresa level. At the same time, a horizontal coordination mechanism at the same organizational level is required. Besides, coordination needs to be made with organizations under different ministries. For that purpose, it is necessary to clarify the roles and responsibilities in a vertical and horizontal relationship. From this point of view, it is essential to define the planning issues that can be addressed within the 2030 planning horizon.

Source: JICA Study Team

Figure 1.2.1 General Institutional Structure (a division of roles)

2. Infrastructure development (fixed capital formation)

   A series of projects (repair, rehabilitation, renewal, new development, etc.) are prepared in line with the strategy and goals. The individual projects that make up the strategy need to have specific targets. Also, it is necessary to propose projects that can be implemented within the planning period, considering budget and time constraints. The progress of each project also needs to be monitored using output indicators.

3. Environment, Safety, and Security

   The transport sector must give due consideration to environment-related policies following the SDGs. The transport sector is one of the major sources of carbon dioxide emissions. Accordingly, efforts are needed to minimize or reduce carbon dioxide emissions in the course of expected economic growth in the future. From this point of view, a series of objectives, strategies, goals, and projects must be prepared.

   Safety should always be a priority, but measures can be implemented progressively as budget constraints allow. Restoration of infrastructure and facilities that natural disasters have severely damaged should be prioritized from the viewpoint of safety.

   Also, as COVID-19 or similar diseases must be anticipated in the future, public health measures should be thoroughly considered and developed in the transportation sector.

   Regarding the security of passenger and cargo transportation, measures against terrorism should be considered, and sufficient measures should be taken. In particular, it is vital to demonstrate an adequate security system inside and outside the country to promote tourism.

4. Transport service and industry development

   Freight transport needs of Empresas under various OSDEs are usually met by the producer or another Empresa under the same OSDE in charge of transportation. However, transport capacity is often insufficient, so transport is entrusted to other transport organizations under MITRANS. This matching of transportation demand and supply is achieved through a coordination function called Balance de Cargas. It is issue in the near future to strengthen this coordination function and realize more efficient transportation based on the existing coordination system. Conversely, expanding transport service capacity by introducing 3PL services by non-state-owned enterprises should also be considered.

   MITRANS and local transportation bureaus (ETP) play a vital role in domestic passenger transportation (intercity and urban transportation). In the provision of inter-city public transport, MITRANS' nationwide capability needs to be further strengthened. For urban public transport, on the other hand, capacity building (bus procurement, staff training, route planning, monitoring, etc.) may be better handled in each province according to local conditions.

   MINFAR plays a major role in bus transport for international tourists. Opening this role to the non-state sector in the future may be controversial. However, it may be worth considering from the perspective of promoting private/foreign capital introduction.

   Although this National Transport Master Plan cannot discuss the urban transport needs of each province in detail, it may be possible to consider the private capital into the urban transport sector through some form of deregulation.

5. Transport pricing and resource allocation

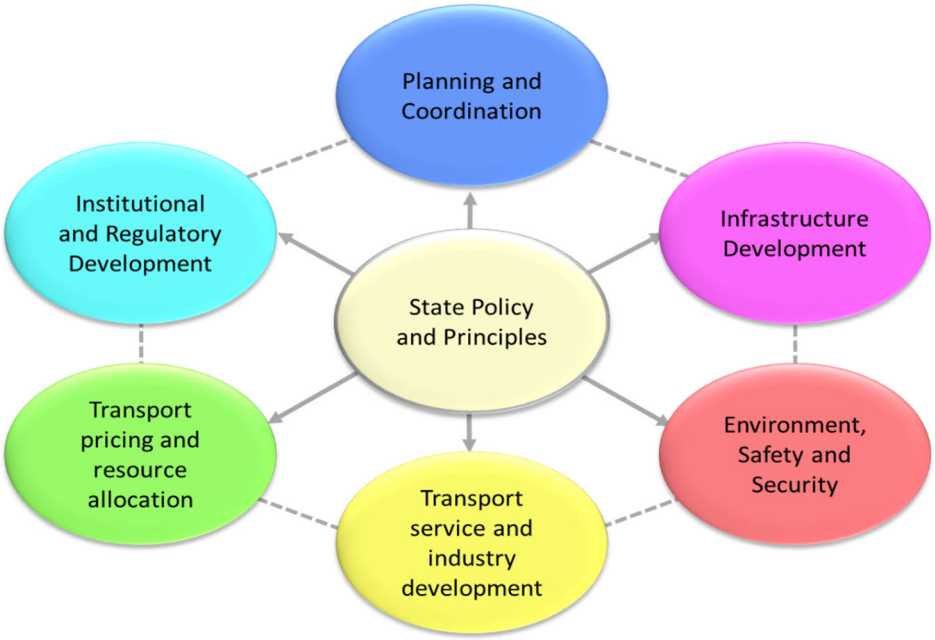
   It is still uncertain how currency unification will affect transport pricing and financing. However, the pricing system for services provided by the transportation service organization (Empresa) integrated under OSDEs, attended by MITRANS, may be reviewed from the viewpoint that each transportation service organization (Empresa) eventually becomes financially independent/sustainable.

   To recover invested capital, charges should be considered for infrastructure such as roads, bridges, airports (runway, terminal buildings, GSE, etc.), railway and rail coaches, etc. For example, some road sections have already been tolled in the road sector. Therefore, further research on pricing the use of transport infrastructure should be conducted.

   Regarding financing for infrastructure development, concession methods, joint ventures with foreign investors, institutional funding organizations (sovereign wealth fund, pension fund, etc.), and utilization of ODA may be considered.

6. Institutional and regulatory development

   To carry out strategies based on criteria 1 to 5 above, it is vital to develop the legal frameworks, organizational capabilities, and human resources needed to ensure effective implementation. To achieve this, careful consideration is needed to identify an overall strategy for MITRANS and other transport-related organizations.



Source: JICA Study Team

Figure 1.2.2 Key Areas of Consideration

1.3 Report organization

Chapter 1 provides an introduction to the report. Subsequent chapters are summarized as follows:

Chapter 2 provides frameworks for Cuba's transport planning, including (1) Demographic framework; (2) Economic growth & development framework; (3) Natural conditions, social & environmental framework; (4) Spatial development framework; (5) Institutional & regulatory framework; (6) Financial framework; and (7) Investment opportunities.

Chapter 3 explains the demand forecasting method and the base case forecast result. This base case forecast is prepared based on the frameworks discussed in Chapter 2.

Chapter 4 summarizes present conditions and major planning issues in each transport sub-sector. A summary of the TWG discussion (identified planning issues) is given in this chapter. This is the basis for formulating the vision and corresponding objectives and strategies.

Chapter 5 informs the Vision statements and associated Objectives, Strategies, and Goals as drafted by the TWG members based on understanding existing conditions, expected growth, and foreseen constraints in the near future.

Chapter 6 outlines the overall implementation plan and strategy with project profiles (Appendix)

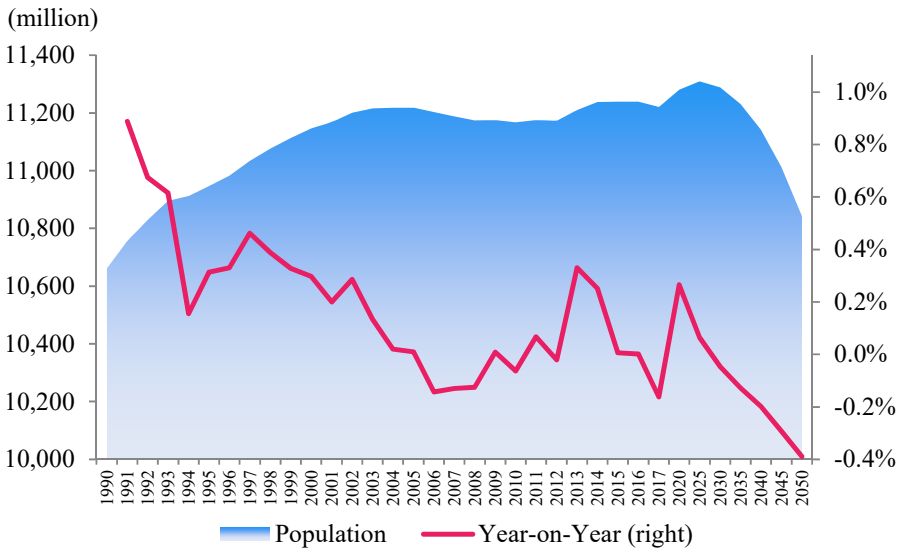
Chapter 2 Frameworks for National Transport Planning

2.1 Demographic Framework

2.1.1 Current Condition and Forecast

(1) Population Trends and Forecast

In 2017, Cuba's total population was 11,221,060, of which 8,638,905 (77%) were in urban areas, and 2,582,155 (23%) were in rural areas[1]. The population will reach 11,288,750 in 2030 and 10,842,072 in 2050 (the horizon year for ONEI population forecasts). The population is forecasted to peak in 2025 (11,309,665) and then decline towards 2050 (see Figure 2.1.1).



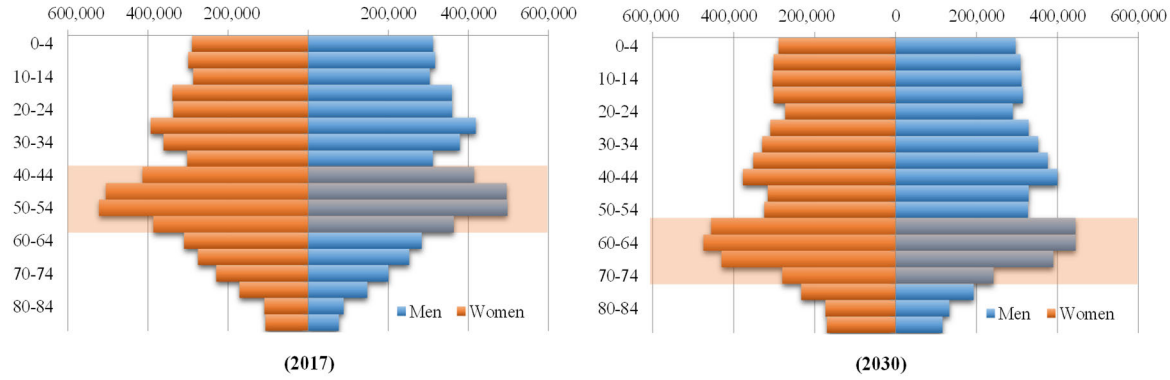
Source: ONEI

Figure 2.1.1 Population Trends and Forecast (1990-2050)

(2) Demographic Composition by Age

Demographic composition by age shows an aging population: in 2017, 32% were between 40 and 60 years old; 24% of the population will be in the 60-80 age cohort in 2030. As evident in Figure 2.1.2, Cuba is an aging society.

[1] According to ONEI definitions, urban population is considered to be in settlements with 2,000 or more permanent residents that meet the urban living conditions such as access to waste treatment system, medical care, education, etc.

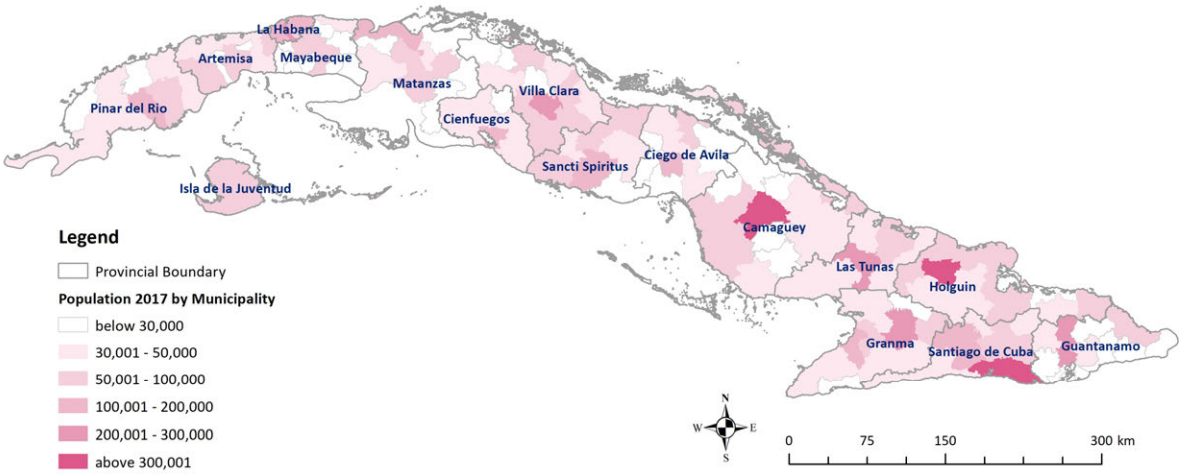


Source: ONEI

Figure 2.1.2 Demographic Composition by Age (2017 actual, 2030 forecast)

(3) Population distribution

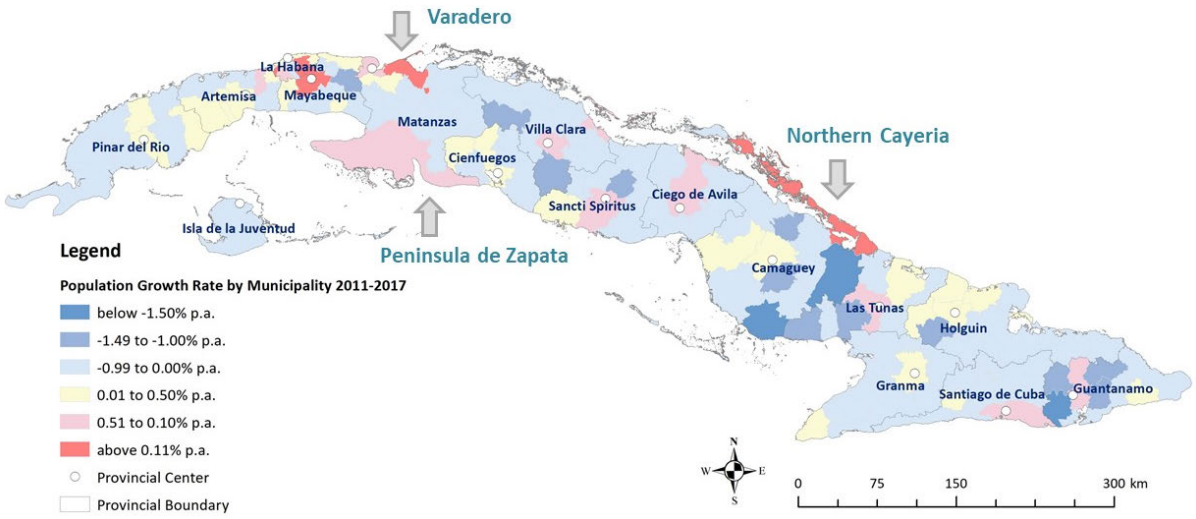
Population distribution by the municipality in 2017 is shown in Figure 2.1.3. The Havana area appears to have a lower population due to the divided area, although its total population is over two million. Typically, population centers are located in the middle of the mainland along the Autopista. Sparsely populated municipalities are mainly mountainous areas or/and wetlands.



Source: JST based on the data of "Anuario Estadistico de Cuba 2017" by ONEI

Figure 2.1.3 Population Distribution by Municipality in 2017

In terms of population growth, Cuba's average growth of 0.07% per year from 2011 to 2017 was relatively low compared to neighboring countries. At the provincial level, population growth in the same period is shown in Figure 2.1.4: the dark and light pink colored areas had population increases at a higher rate, 0.5% p.a, than the national average. Population increases for municipalities can be categorized by three types: 1) provincial centers tended to increase in population; 2) neighboring municipalities of Havana maintained their population; and 3) municipalities with tourism development areas, such as Cardenas near Varadero, Nuevitas (including Northern Cayeria) and Zapata close to the Zapata Peninsula, show higher population growth. This population growth pattern indicates that Cuba is following an urbanization trend as tourism development and other economic activities create employment opportunities.

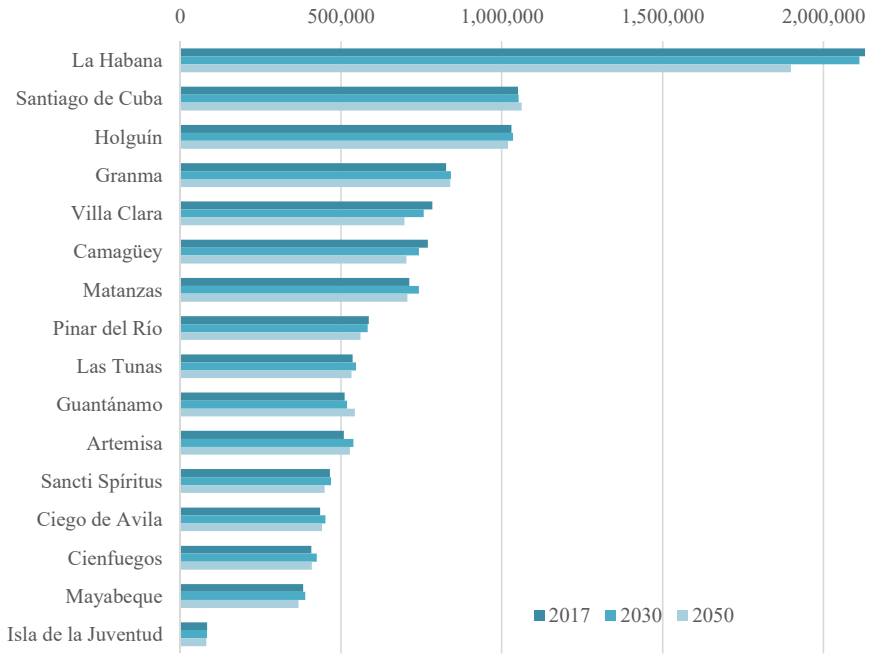


Source: JST based on the data "Population in 2017" by ONEI

Figure 2.1.4 Population Growth by Province from 2011 to 2017

(4) Demographic Composition by Province

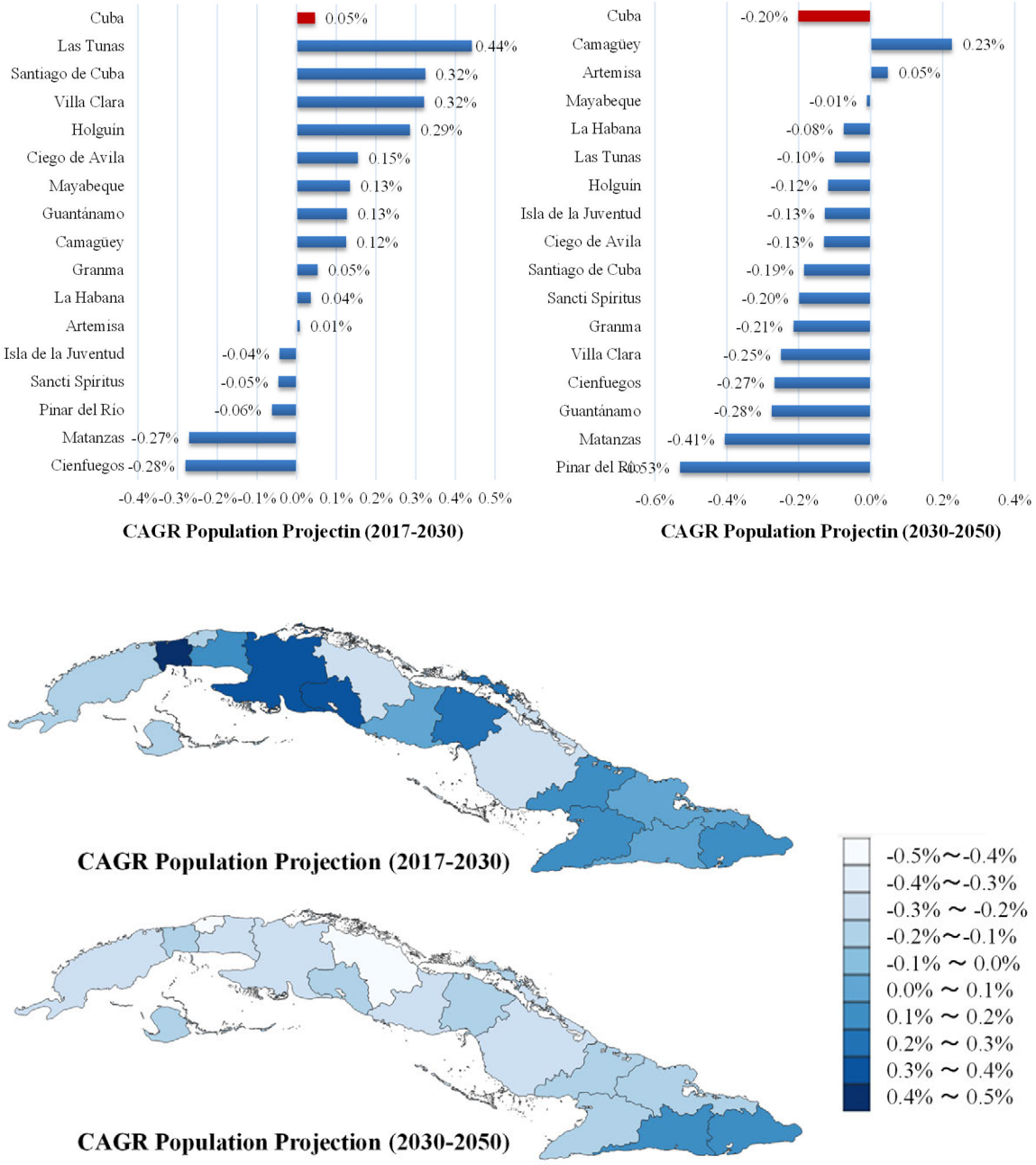
The demographic composition by province shows that in 2017, La Habana was the most populated province (2.1 million), and Isla de la Juventud was the least populated province (0.08 million). While the population of provinces such as La Habana, Villa Clara, and Camaguey is predicted to continue decreasing towards 2030 and 2050, the population of Santiago de Cuba is expected to grow.



Source: ONEI

Figure 2.1.5 Demographic Composition by Province (2017, 2030, 2050)

The population projection's CAGR (Compound Annual Growth Rate)[2] indicates the growth average will be 0.05% between 2017 and 2030 and -0.20% between 2030 and 2050. Estimates say that 11 out of 15 provinces will achieve positive annual population growth between 2017 and 2030, but only two provinces will record positive growth between 2030 and 2050.



Source: ONEI

Figure 2.1.6 CAGR Population Projection

[2] The formula for calculating CAGR is (End Value/Start Value)^(1/Periods) -1

2.1.2 Labor Force

(1) Employment Status

ONEI defines the "working-age population" as those aged between 17 & 64 for males and between 17 & 59 for females. The "active population" refers to people among the working-age population who meet the requirements to be included as either employed or unemployed. Therefore, the "economically active population rate" is calculated by dividing the "working-age population" by the "active population."

The economically active population rate dropped from 74.2% in 2012 to 63.4% in 2017, and the unemployment rate dropped from 3.5% to 1.7% during the same period, meaning that the work participation rate increased over those six years.

Table 2.1.1 Employment Status (2012-2017) (Unit: thousand)

Employment Status	2012	2013	2014	2015	2016	2017
Working age Population	6,845.20	6,976.10	7,097.20	7,202.80	7,191.00	7,173.10
Active Population	5,077.90	5,086.00	5,105.50	4,832.70	4,686.20	4,550.00
Economically Active Population Rate	74.2%	72.9%	71.9%	67.1%	65.2%	63.4%
Workers Employed	4,902.20	4,918.80	4,969.80	4,713.70	4,591.10	4,474.80
Unemployment Rate	3.5%	3.3%	2.7%	2.5%	2.0%	1.7%

Source: ONEI

(2) Employment Breakdown

The employment breakdown in 2017 shows that 69% were employed in the government sector, with 10.2% employed in agricultural cooperatives and 0.4% in non-agricultural cooperatives. The labor force in the non-state sector increased from 15.4% in 2014 to 20.3% in 2017, of which self-employed also increased from 9.7% to 13.0%.

Table 2.1.2 Employment Breakdown (2014-2017)

	2014		2015		2016		2017	
Employment Breakdown	('000)	(%)	('000)	(%)	('000)	(%)	('000)	(%)
Government	3591.3	72.3%	3460.1	73.4%	3,262.10	71.1%	3,087.50	69.0%
Agriculture Cooperatives	608.6	12.2%	523.6	11.1%	435.4	9.5%	458.3	10.2%
Non-Agriculture Cooperatives	5.5	0.1%	7.7	0.2%	11.3	0.2%	18.6	0.4%
Private	764.4	15.4%	722.3	15.3%	882.3	19.2%	910.4	20.3%
(of which Self-Employed)	483.4	9.7%	499	10.6%	540.8	11.8%	583.2	13.0%

Source: ONEI

2.2 Economic growth and development framework

2.2.1 The economic system

Cuba's fundamental development strategy is based on four important documents: **"Conceptualización del Modelo Económico y Social Cubano de Desarrollo Socialista," "el Plan Nacional de Desarrollo Económico y Social hasta 2030," "Lineamientos de la Política Económica y Social del Partido y la Revolución para el Período 2016-2021," and "Cuba and its Social and Economic Challenges."**

The economic planning system is fundamentally based on centralized material balance sheets, which has been the most widely used technique for aligning production demands with social needs. The sheets are comprised of various balances that assign the possible sources and uses of all available and/or necessary resources, trying to capture all the interdependencies in the productive process.[3] This system is vertical supply planning based on one-year and five-year projections of what would be received, which tends to inhibit the development of horizontal linkages among enterprises.

2.2.2 GDP growth scenario

In 2019, the Economist Intelligence Unit (EIU) made an initial forecast of the Cuban economy up to 2023 (Table 2.2.1). However, this forecast should be reviewed and updated due to unexpected events after March 2020.

Table 2.2.1 Growth Forecast by EIU

	2018	2019	2020	2021	2022	2023
Real GDP Growth (%)	1.2	0.2	-0.6	3.1	3.8	3.9

Source: EIU Country Report Cuba, May 2019

The Cuban economy is highly vulnerable to external conditions. A further tightening of US economic sanctions against Cuba in 2020/2021 resulted in stalled oil imports, restrictions on remittances from Cubans working abroad, and the implementation of Title III of the Helms-Burton Act that led to a reduced appeal for FDI in Cuba. All of these were significant blows to the already stressed Cuban economy. Besides, COVID-19 has heavily damaged the tourism sector since March 2020, and as a result, a negative GDP was recorded in 2021.

Based on this, the Master Plan's forecast makes the following assumptions:

1. The current US sanctions will not be lifted for the time being
2. The tourism sector will recover slowly in pace with the pandemic
3. The export of medical products will increase steadily
4. The world economy will recover from the impact of COVID-19 gradually from early 2022

According to the recent MEP's forecast (plan) for the period after 2022, the Cuban economy should recover continuously from 2022 and continue to grow at 4% (at constant prices) annually.

[3] Oscar Fernández Estrada, 2017, The Cuban Economy in a New Era

Table 2.2.2 Growth Forecast (Plan) by MEP

	2018	2019	2020	2021	2022	2023~26
Real GDP Growth (%)	2.2	-0.2	-10.6	2.0	4.0	4.0

Source: MEP, 2022

2.2.3 Cuba's Social and Economic Challenges

The social and economic strategy entitled **"Cuba and its Social and Economic Challenges,"** announced in September 2020, includes more than 370 measures summarized in the following areas with the specific measures as shown in Table 2.2.3. The national transport master plan 2030 follows the national-level strategies in this document as the most up-stream guidelines.

a. Foreign currency acquisition

Due to the foreign exchange shortage and economic difficulties, foreign currency acquisition measures of FDI promotion and tourist attraction are emphasized. In food production, sugar agri-industry, tourism, professional services, manufacturing, and foreign trade are among the measures to accelerate foreign investment projects. Modifying the foreign currency system to stimulate foreign currency acquisition by the business system is also featured.

b. Export promotion

Aiming to attract partners and investors to boost the development of the national economy, promoting exportable products and services of Cuban companies is included in the Strategy. Sectors of food production, professional services, telecommunications, manufacturing, and foreign trade are prioritized, and structuring the financing for the development of the national production for exports is included in the financial system plan.

c. Import substitution, national production

Reducing dependence on imports by replacement with locally produced goods is stressed as this helps diversify the nation's productive base. Sectors of food production, professional services, telecommunications, construction, energy, and integrated logistics of hydraulic and manufacturing are included as import substitution measures. Employment and wage policy highlight economic and development incentive schemes to promote increased national production.

d. Efficiency improvement

Improving efficiency within the current socio-economic structure is one of the key measures in the strategy. Food production, health, energy, integrated logistics of transport, domestic trade, and foreign trade sectors will see efficiency improvements. The transport sector is emphasized, given the importance of multimodal transport to achieve efficiency in the supply chain.

e. Organizational reform

Organizational reforms of state-owned enterprises, cooperatives, and non-state sectors are essential. Sectors of food production, sugar agri-industry, tourism, health, telecommunications, construction, integrated logistics of transport, integrated logistics of hydraulics, manufacturing, foreign trade, and financial systems are included in measures related to organizational reform. These measures will

allow state-owned enterprises greater autonomy in decision-making and business planning. In addition, the non-state sector and cooperatives will be able to import and export outside the state monopoly.

f. Digital transformation

In response to the growing importance of digital transformation and e-commerce globally, the strategy highlights digital transformation in tourism, telecommunications, construction, integrated logistics of transport, manufacturing, domestic trade, and financial systems. Specific projects such as e-commerce platforms, blockchain, and automated processes are proposed in these sectors.

g. Use of foreign currency in the domestic economy

The government has increasingly allowed the use of foreign currency in various sectors such as tourism, telecommunications, integrated transport logistics, and domestic trade. For example, selling tourism packages or electric devices in foreign currency will be allowed.

Table 2.2.3 Key Measures in 16 Sectors

Sector	Measures
1. Food production	**a. Foreign currency acquisition** - Accelerate management, implementation, and execution of foreign investment projects (chicken, pigs, agri-industry of fruits/vegetables, cattle breeding) **b. Export promotion** - Prioritize the development of exports and linkages between agricultural producers and national industries - Exportable fruits, vegetables, tobacco, charcoal, coffee, cocoa, beekeeping products **c. Import substitution, national production** - Promote municipal self-supply of agricultural products - Increase and consolidate mini-industries for processing of agricultural products for municipal self-supply - Foster fish farming - Increase national production of animal fodder - Secure national production of ice cream **d. Efficiency improvement** - Sowing of most long/short-cycle rustic crops will receive differentiated and preferential attention, especially those domestically popular that require fewer inputs and yield more, e.g., yucca, plantain, and malanga **e. Organizational reform** - Recover and build new modules in all enterprises, UEB, and cooperatives
2. Sugar agri-industry	**a. Foreign currency acquisition** - Study the participation of foreign investment in this sector **c. Import substitution, national production** - Reach annual sowings of more than 130,000 hectares from 2022, increasing sugar production and eliminating idle areas **e. Organizational reform** - Conclude the reordering of AZCUBA Group by March 2021
3. Tourism	**a. Foreign currency acquisition** - Incentivize international tourism to return to the 2018 level of visitors - Increasing foreign investment for the development of facilities linked to welfare, health, and life-quality tourism - Incentivize collection of foreign currency directly from abroad, with timely use of specific clauses from contracts

Sector	Measures
	e. Organizational reform - Analyze organizational structures in some OSDEs **f. Digital transformation** - Strengthen and increase online sales channels - Implement digital services within the facilities and electronic commerce of products and services outside hotels **g. Use of foreign currency in the domestic economy** - Sell tourist packages in foreign currency to Cubans to travel abroad - Incentivize collection of foreign currency directly from abroad, with timely use of specific clauses from contracts
4. Professional services	**a. Foreign currency acquisition** - Develop health tourism and promote the health-drugs chain, in accordance with the Cuban experience and international recognition, in the treatments and applications of our pharmacological portfolio **b. Export promotion** - Promote exports of medical services, including assistance, products, and health security services and the confrontation of far-reaching epidemiological events **c. Import substitution, national production** - Incorporate medical programs associated with immunological disorders and other pathologies (e.g., diabetes and cancer) with Cuban biotechnology products and new dental services. In addition, define programs that can be offered in tourist packages.
5. Health	**d. Efficiency improvement** - Strengthen primary care, open family doctor/nurse offices according to needs and location - Apply effective supply management of medicines with better distribution **e. Organizational reform** - Take advantage of all the lessons of COVID-19 regarding the linkage of the industry with the health sector and the link with science, among others
6. Pharmaceutical, biotechnology	**a. Foreign currency acquisition** - Materialize new projects of foreign investment **b. Export promotion** - Consolidate the biopharmaceutical and technology industry as one of the activities with the greatest export capacity - Accelerate development of innovative products with potential for export and improvement of quality of life of the population
7. Telecommunications	**b. Export promotion** - Establish business agreements between private postal operators and the Cuban Post Office group to increase exports by postal and cargo means **c. Import substitution, national production** - Develop the electronics industry through national production **e. Organizational reform** - Develop cooperatives in the IT sector or other forms of non-state management to enable greater production of applications and computer services **f. Digital transformation** - New platform for cell phone deposits/payments (Etecsa's mobile wallet) - Start Correos de Cuba online store for the sale of products and postal services - Implement projects such as Big Data, blockchain **g. Use of foreign currency in the domestic economy** - Include electronic devices for sale in foreign currency, e.g., cellphones, computers, laptops, tablets, and digital TV decoder boxes in authorized stores - Collect foreign currency at origin for customs duties on postal packages and cargoes sent to Cuba

Sector	Measures
8. Construction	**c. Import substitution, national production** - Plan local production of items that contribute to the substitution of imports, e.g., glue, wood carpentry, elaborated marble, additives, ceramic pavements, etc. **e. Organizational reform** - Incorporate the elaboration and evaluation of feasibility studies for non-state players, such as non-agricultural cooperatives - Strengthen the general contractors of works **f. Digital transformation** - Introduce an electronic window to speed up the processing of the permits
9. Energy	**c. Import substitution, national production** - Prioritize operation/maintenance of generators that need no imported fuel - Expand exploration of new deposits in the medium term **d. Efficiency improvement** - Maintain control, by energy administrations and councils, of measures to save electrical energy and all energy carriers in the state sector - Continue with maintenance and improvement of refining capabilities
10. Integrated logistics of transport	**d. Efficiency improvement** - Continue to improve processes of Port-Transportation-Internal Economy Operations, to reduce demurrage expenses and achieve greater efficiency of supply chain components - In coordination with universities, devise mathematical models to optimize traffic in the load balance system to improve the use of transport capacity (trucks, railway wagons, and boats) and reduce the use of fuel - Continue the process of improving the railway system, with the creation of companies for transporting sugar products, construction, repair, and maintenance of railroads, and express service of railroad loads **e. Organizational reform** - Organize the implementation of incentives for innovation, recovery, and manufacturing of spare parts in the workshops - Provide leasing by state entities for means of transport to private companies - Extend to more provinces Havana's experience in applying non-state forms of management in the auxiliary and related services of transport **f. Digital transformation** - Promote extension and use of the Fleet Management and Control System in all transport companies in the country, making adjustments to the mobile web platform to facilitate and ensure a higher level of monitoring and analysis - Development of Electronic Trade and Comprehensive Policy for rearrangement of passenger transport in Havana **g. Use of foreign currency in the domestic economy** - Authorize MotorCentro and MCV Servicios S.A to provide services in foreign currency (MLC) to individuals.
11. Integrated logistics of networks & facilities, hydraulic and sanitary	**c. Import substitution, national production** - Establish a mechanism to allow private producers to finance HDPE pipes, accessories, and hydraulic equipment in foreign currency to increase agricultural irrigation, etc. - Develop national solutions for the production of pumping equipment, including motors and other parts **e. Organizational reform** - Establish a mechanism to allow alliances between companies in the hydraulic sector and self-employed workers for agricultural/livestock production focused on providing hydraulic solutions, and joint management, with shared benefits - Establish alliances between business/cooperative sectors and self-employed workers to strengthen water flushing in pipes in selected places to improve this service and download to the state of avoidable costs.

Sector	Measures
12. Manufacturing	**a. Foreign currency acquisition** - Create or actively participate in developing industrial and technology parks and promote the insertion of technology parks abroad. - Orient financing for the development of the industry through the increase of foreign direct investment and the creation of funds for exports. **b. Export promotion** - Design an export concept for industrial production and services integrated into the internationalization strategy of Cuba's professional services sector. **c. Import substitution, national production** - Prepare the industry to respond to national demand with competitive offers as the primary way for import substitution. Apply the principle of not importing what can be produced in the country - Develop an import substitution strategy aimed at taking advantage of the industrial capacity, of no less than 80%, mainly in cleaning products, textiles and clothing, plastic articles, polygraphy, electronic equipment and lighting, sanitary products, tires, and mechanical production for transport, agriculture, and construction **e. Organizational reform** - Promote the productive chain using the integral development of strategic programs and projects of high impact, which allows reaching market shares mainly with tourism, agri-industry, and the energy sector, focused on the use of renewable energy sources and transport electrification, as well as with the construction, introducing new technology. Construction systems of high productivity and developing the industry of building materials. - Develop inter-industrial integration with modern services to increase competitiveness, with an orientation to new technological trends: incorporating advanced manufacturing processes, 3D printing, nanotechnologies, and printed circuits, through automation with own designs and precision mechanics, with the alliance of foreign investment. **f. Digital transformation** - Automate and computerize processes with the application of modern services based on ICTs, the development of industrial design, the use of robotics, and the application of intelligent systems.
13. Domestic trade	**d. Efficiency improvement** - Achieve supply chain integration of producers related to selected retail units **e. Organizational reform** - Develop wholesale market commercialization modalities to guarantee the supply to the forms of non-State management, including the consignment, and apply insurance schemes for sale in foreign currency of products required for their productive activities. **f. Digital transformation** - Strengthen and expand trade and e-government, taking advantage of the existing infrastructure as much as possible. - Promote electronic commerce, assuring the management of collection and payment via electronics. - Transform retail sales structure by e-commerce. **g. Use of foreign currency in the domestic economy** - Expand the range of retail sales in foreign currency as a necessary mechanism in the current conditions to sustain a level of offerings. - Open up supply markets in foreign currency with non-state forms of management that offer equipment, parts, and supplies.
14. Foreign trade	**a. Foreign currency acquisition** - Perfect the monetary treatment of foreign investment, giving it more autonomy in its financial management. - Present proposals on the investment possibilities of Cuban-born persons, whether or not they are settled in Cuba.

Sector	Measures
	- Promote foreign investment in the financial sector and professional consultancies, mainly in economic matters. - Promote foreign investment in the food production sector, both in primary production and manufacturing, always under the principle that it provides technology, financing, and, if possible, an export market - Assess the benefit of concessions to foreign companies for the integral development of specific areas. **b. Export promotion** - Promote the export of services, medical equipment, pharmaceuticals, and other high-value-added products, without neglecting traditional exports and other areas in progress, from local initiatives and consolidating the work with the territories to develop exportable funds. - Incentivize the creation and consolidation of exporting poles in territories closer to ports and airports. - Promote the export of computer science and programming, telemedicine and second opinion consultations, health tourism, sports, cultural, and other professional services, including video conferencing as a new modality. **d. Efficiency improvement** - Increase efficiency of economic, commercial, and financial relations in trade policy and establish concrete/realistic lines of work to expand/diversify them **e. Organizational reform** - Provide export and import services to non-state forms of management through trade companies abroad, with payments backed by foreign currency - Stimulate exports by implementing the Measures for the Improvement of the Socialist State Enterprise, which are aimed at creating economic incentives and making more flexible mechanisms for stimulating exports, including business with foreign capital.
15. Financial system	**a. Foreign currency acquisition** - Modify the economy's foreign currency financing system, moving towards one that effectively stimulates foreign currency acquisition by the business system **b. Export promotion** - Structure the financing for the development of national production and exports **e. Organizational reform** - Promote the Socialist State Enterprise, which requires a profound transformation in its organization, powers, and decision-making, starting from the fact that all enterprises are not equal **f. Digital transformation** - Develop new banking products and increase services provided through electronic payment channels to contribute to the consolidation of e-commerce.
16. Employment & wage policy, security, and social care	**c. Import substitution, national production** - Economic development incentive schemes to promote the increase of national production, particularly food, productive chains, the export of goods and services, import-substitution, the application of science and innovation **d. Efficiency improvement** - Transform the activity of social workers in the community by improving the scope of his/her management, priorities in care, and links with community factors

Source: JICA Study Team based on Special Tabloid

2.2.4 Provincial Development Scenario 2016-2020

Each provincial government has drafted a provincial development plan for 2030, both as a provincial development plan for 2016-2020 and as an annual provincial plan based on “Conceptualización del Modelo Económico y Social Cubano de Desarrollo Socialista”; the “Plan Nacional de Desarrollo

Económico y Social hasta 2030"; and "Lineamientos de la Política Económica y Social del Partido y la Revolución para el Período 2016-2021." These draft plans are submitted to the MEP for evaluation and then finalized as the official development plans.[4]

Although these plan documents were not available as of writing this report, the statistical data of each province informs that the existing production structure is almost the same across the provinces, except for a few material productions such as nickel in Holguin and salt in Guantanamo. In addition, although the volume is small, tobacco and beer are produced in almost all provinces.

The characteristics of each province as of 2017 are summarized as follows.

Table 2.2.4 Major Economic Activities of Provinces

	Population		Agriculture(Ton)		*Vianda*	*Hortalizas*	*Cereales*	*Lenguminosa*	*Tabaco*	*Frutas*	Turistas	Industrias
Piñar del Rio	587,378	5.2%	694,137	12.3%	*242,470*	*291,552*	*88,435*	*14,014*	*17,611*	*40,055*	603,753	Tabaco, Madera
Artemisa	507,347	4.5%	251,900	4.5%	*159,400*	*53,700*	*10,400*	*2,100*	*2,400*	*23,900*	218,388	Concrete, Stone, Agriculture
La Habana	2,129,817	19.0%	16,196	0.3%	*5,739*	*8,538*	*758*	*466*	*0*	*695*	5,386,753	Mix feed, Flour, Beverages, Cerveza, Construction materials
Mayabeque	382,074	3.4%	442,537	7.8%	*199,762*	*142,764*	*36,841*	*13,533*	..	*49,637*	139,913	Alcoholic beverages, Construction materials
Matanzas	711,063	6.3%	384,000	6.8%	*126,700*	*99,100*	*72,200*	*10,600*	*0*	*75,400*	162,939	Crude Oil, Gas, Bagazo
Villa Clara	786,051	7.0%	511,399	9.0%	*192,281*	*167,596*	*50,374*	*14,060*	*0*	*87,088*	561,620	Polypropylene, Fabric, Tobaco, Commerce
Cienfuegos	407,470	3.6%	431,802	7.6%	*158,266*	*161,941*	*66,647*	*7,147*	*31*	*37,770*	260,043	Mixed feed, Tobaco, Commerce
Sancti Spiritus	466,145	4.2%	520,344	9.2%	*178,122*	*193,133*	*87,053*	*10,266*	*11,087*	*40,683*	2,127,427	Pescado, Cerveza
Ciego de Avilla	435,042	3.9%	515,842	9.1%	*219,708*	*184,844*	*37,164*	*12,901*	-	*61,225*	4,180,687	Canned fruit, Tobaco, Wood
Camaguey	771,037	6.9%	231,065	4.1%	*43,339*	*82,697*	*77,095*	*2,314*	*0*	*25,620*	276,030	Dairy product, Pescado, Camaron
Las Tunas	536,658	4.8%	185,484	3.3%	*90,958*	*50,956*	*13,661*	*2,809*	*1,360*	*25,740*	351,993	Dairy product, Beverage, Cerveza, Tobaco, Cardboard, containers
Holguin	1,032,178	9.2%	103,379	1.8%	*28,508*	*40,569*	*0*	*3,191*	*0*	*31,111*	2,127,427	Dairy product, Meet, Pescado, Cerveza, Tobaco
Granma	829,067	7.4%	713,749	12.6%	*244,217*	*267,993*	*181,955*	*5,056*	*32*	*14,496*	110,134	Cake, Bread, Tobaco, Concrete, Commerce
Santiago de Cuba	1,052,518	9.4%	519,756	9.2%	*180,728*	*193,765*	*77,363*	*5,554*	*0*	*62,346*	225,828	Mixed feed, Tobaco, Wood, Commerce
Guantanamo	512,029	4.6%	132,599	2.3%	*49,262*	*57,597*	*6,931*	*2,891*	*0*	*15,918*	51,980	Salt, Commerce, Books, Notebook,
Isla de Juventud	84,273	0.8%	6,388	0.1%	*275*	*3,737*	*173*	*396*	*8*	*1,799*	53,818	Langosta, Pescado, Marble, Construction materials, electricity, water
Total	11,230,147		5,660,577									

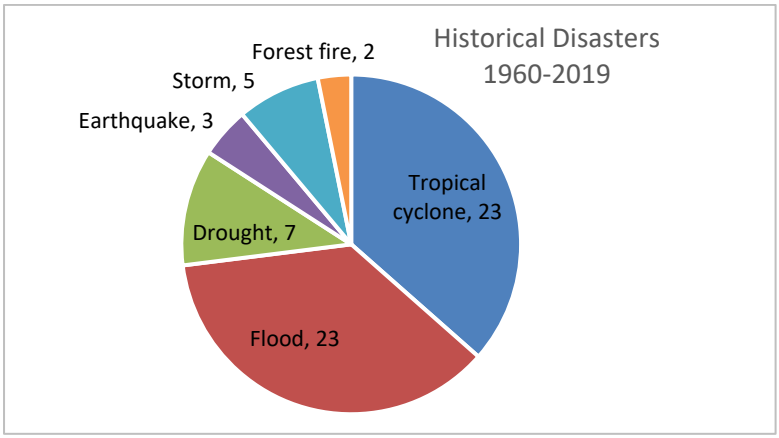
Source: ONEI Provincial Report, figures in the latest year

2.3 Natural conditions, social and environmental framework

2.3.1 Natural Disasters in Cuba

The principal natural disasters in Cuba between 1960 and 2019 have been hurricanes and floods, as shown in Figure 2.3.1. These disasters are considered the most common triggers for the potential risk of physical damage to people and settlements and damage to transport infrastructure and economic activities. Therefore, considering these risks in formulating transport plans is vital.

[4] These draft plans were not available when this report was prepared.



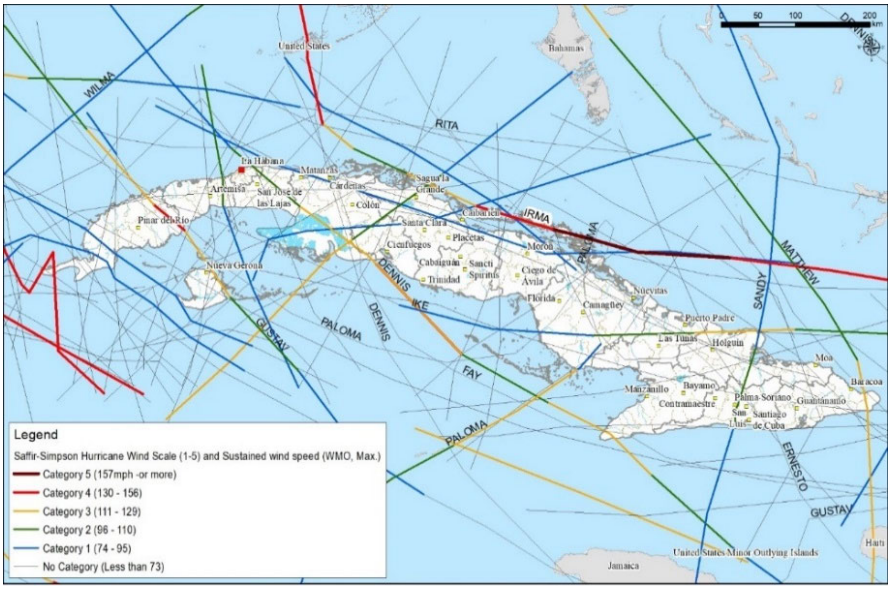
Source: EM-DAT: The Emergency Events Database - Université Catholique de Louvain (UCL) - CRED, D. Guha-Sapir - www.emdat.be, Brussels, Belgium

Figure 2.3.1 Number of Natural Disasters in Cuba (1960-2019)

(1) Hurricanes (Tropical Cyclone)

Hurricanes are the primary natural disaster in Cuba. From 2005 to 2017, Cuba was hit by 12 significant hurricanes. Cuba's rainy season is between May and October, while hurricane season is generally between June and November.

Figure 2.3.2 shows hurricane tracks in Cuba between 1970 and 2017 with the Saffir-Simpson hurricane wind scale (SSHWS). Based on this scale, SSHWS Category 3 and higher are recognized as major hurricanes, while categories 1 and 2 are also powerful enough to cause damage to impacted areas.[5] Thus, Cuba experiences many severe hurricanes periodically, and it is necessary to fully consider hurricane risks in the master planning process, along with other natural hazard risks.



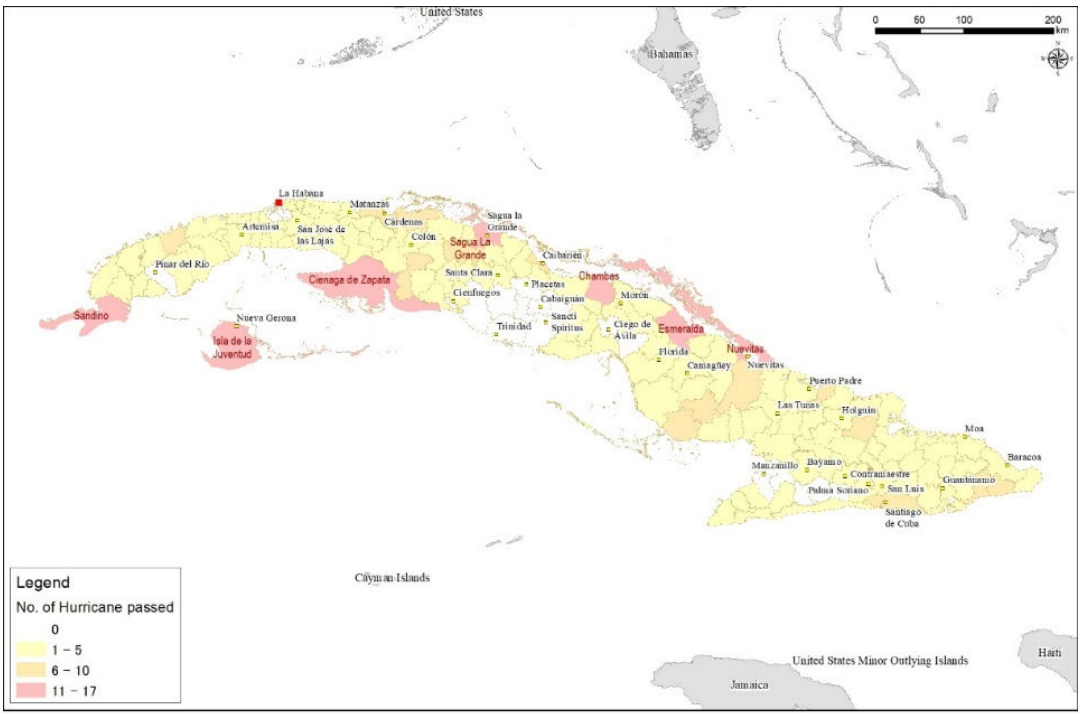
SSHWS Category
1: Very dangerous winds will cause some damage
2: Extremely dangerous winds will cause extensive damage
3: Devastating damage will occur
4: Catastrophic damage will occur
5: Extremely catastrophic damage will occur

Source: Schreck, Carl & National Center for Atmospheric Research Staff (Eds). Last modified 06 Nov 2013. "The Climate Data Guide: IBTrACS: Tropical cyclone best track data." Retrieved from https://climatedataguide.ucar.edu/climate-data/ibtracs-tropical-cyclone-best-track-data.

Figure 2.3.2 Tropical Hurricane Tracks between 1970 and 2017

[5] National Hurricane Center and Central Pacific Hurricane Center, https://www.nhc.noaa.gov

Figure 2.3.3 depicts the number of hurricanes crossing municipalities in Cuba between 1970 and 2017. Central-north coast areas, including major tourist areas of Cayo Coco, south coast areas of Sandino and Cienaga de Zapada, and Isla de la Juventud, have experienced more hurricanes than other municipalities.



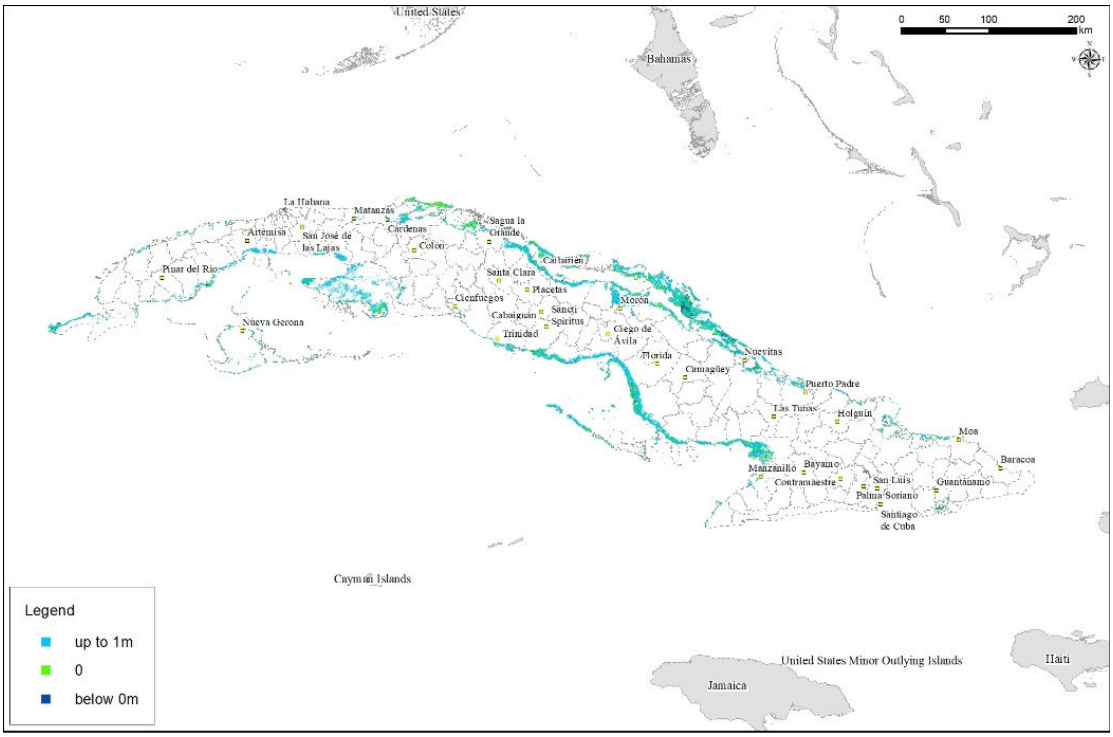
Source: JICA Study Team based on Schreck, Carl & National Center for Atmospheric Research Staff (Eds). Last modified 06 Nov 2013. "The Climate Data Guide: IBTrACS: Tropical cyclone best track data." Retrieved from https://climatedataguide.ucar.edu/climate-data/ibtracs-tropical-cyclone-best-track-data.

Figure 2.3.3 No. of Hurricanes by Province (1970-2017)

(2) Floods

Nineteen flood events were recorded between 2000 and 2019 in Cuba: eleven were associated with hurricanes or strong storms, while the other eight were riverine or flash floods. Generally, Cuba's rainy season is between May and October, and most floods occur during this period. However, several floods have happened outside the rainy season.

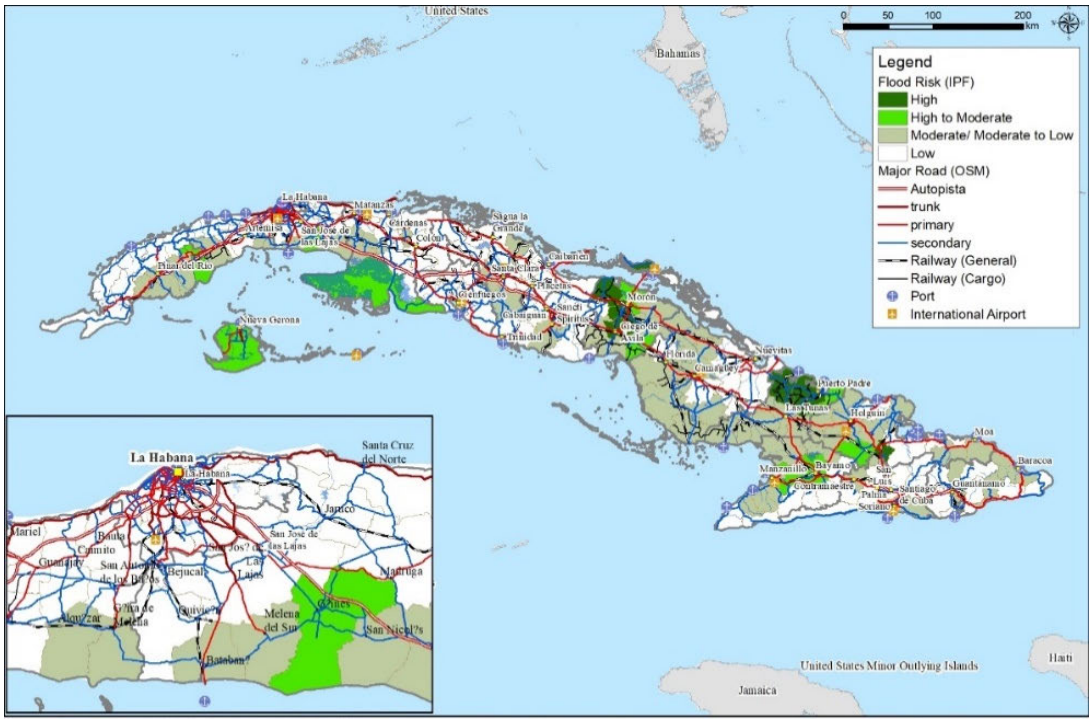
In addition, there are future risks of coastal flooding due to rising sea levels. Figure 2.3.4 shows areas with elevation less than one meter above sea level, estimated at about 1,230 km^2, or almost 10% of Cuba's total land area. As many settlements, industries, ports, tourist destinations, and important transport infrastructure are located in these areas, and it is critical to consider this risk in the planning process.



Source: SRTM 3arc DEM

Figure 2.3.4 Distribution of Areas below 1-meter

Figure 2.3.5 shows flood risks and Cuba's current transport network. This map indicates that Chambas, Ciro Redondo, and Ciego de Avila municipalities in Ciego de Avila province; Manati, Puerto Padre municipalities in Las Tunas; and Cueto Municipality in Holguin have high flood risks.

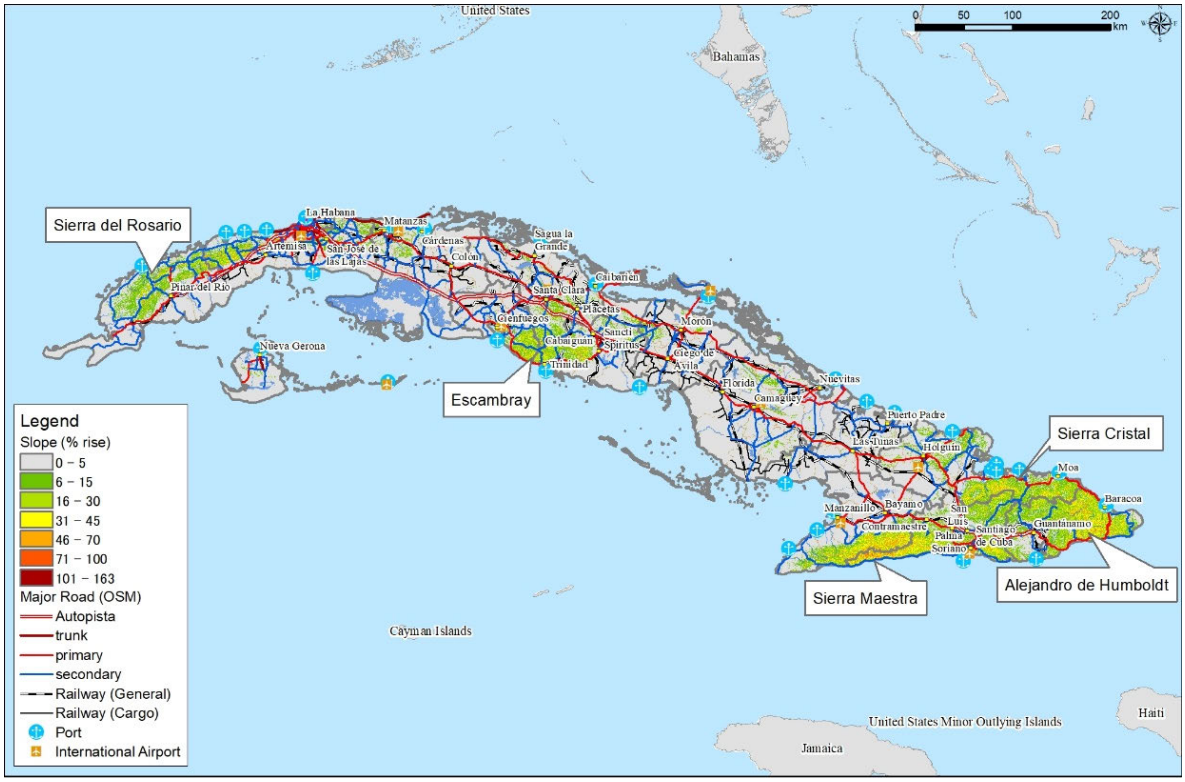


Source: Based on "Mapa de Riesgo a Inundaciones por Municipios" prepared by IPF, JST reproduced data

Figure 2.3.5 Flood Risk and Current Transport Network in Cuba

(3) Slopes

Figure 2.3.6 shows Cuba's schematic slope condition analysis based on Digital Elevation Model data. Steep slope areas are spread throughout the Sierra del Rosario range in the west; the Escambray range in the central area; the Sierra Cristal range in the northeast; the Sierra Maestra range in the southeast; and Alejandro de Humboldt National Park in the easternmost area of Cuba. It is clear that the current transport network avoids these steep slope areas.



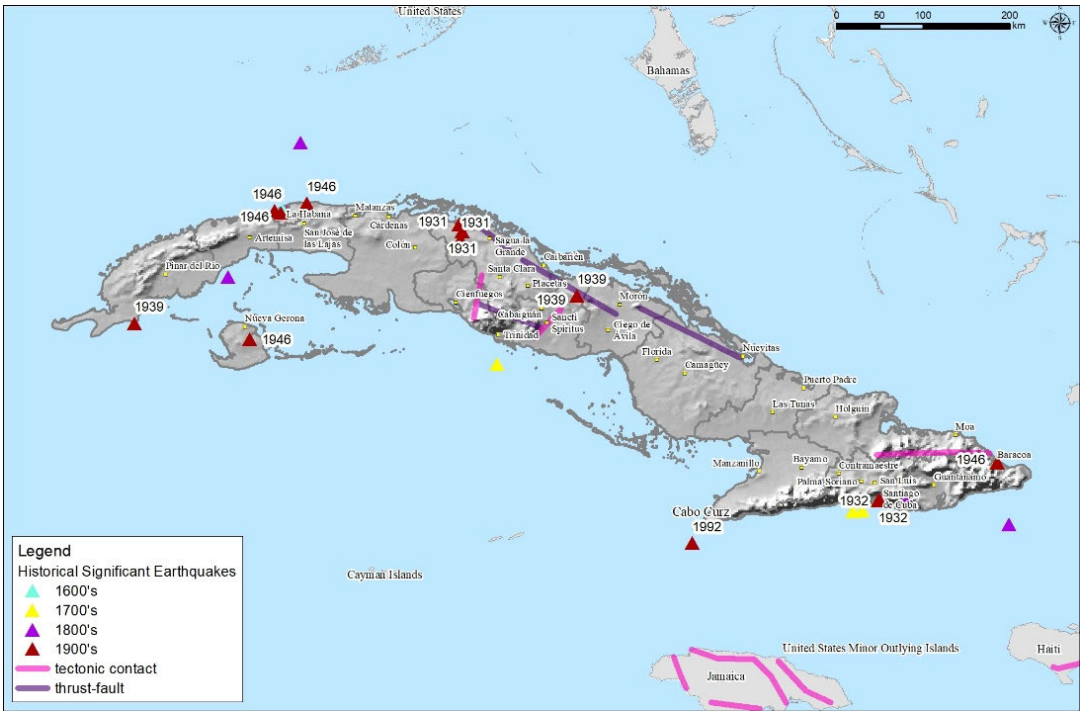
Source: SRTM 3 arc digital elevation data

Figure 2.3.6 Slope Conditions in Cuba

(4) Earthquakes

Figure 2.3.7 shows the distribution of fault lines and historical earthquake events in Cuba since 1600. This data includes quakes that meet at least one of the following criteria: 1) moderate damage (approx. $1 million or more); 2) 10 or more deaths; 3) Richter scale magnitude 7.5 or greater; 4) modified Mercalli Intensity X or greater; or 5) earthquake generated a tsunami.[6]

The most recent significant earthquake occurred in 1992 near Cabo Cruz at a magnitude of 6.9.



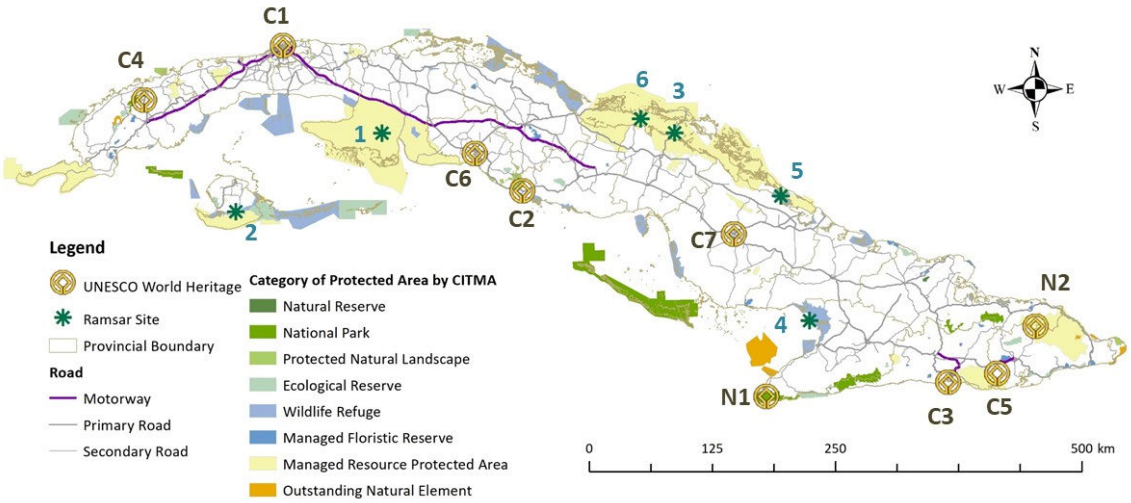
Source: National Geophysical Data Center / World Data Service (NGDC/WDS): Significant Earthquake Database. National Geophysical Data Center, NOAA. doi:10.7289/V5TD9V7K

Figure 2.3.7 Historical Earthquake and Faults in Cuba

[6] https://www.ngdc.noaa.gov/nndc/struts/form?t=101650&s=1&d=1

2.3.2 Environmentally Sensitive Areas

From a spatial development viewpoint, environmentally sensitive areas should be carefully considered in the transport master planning process. Cuba has three types of protected areas, as shown in Figure 2.3.8, (1) areas designated by the Ministry of Science, Technology & Environment (CITMA), (2) areas registered by UNESCO as world heritage sites, and (3) wetland areas confirmed by the Ramsar Convention. Since tourism development sites are likely to locate near the protected areas, the development of tourism-related transport facilities should be carefully studied to avoid impacting such environmental assets.

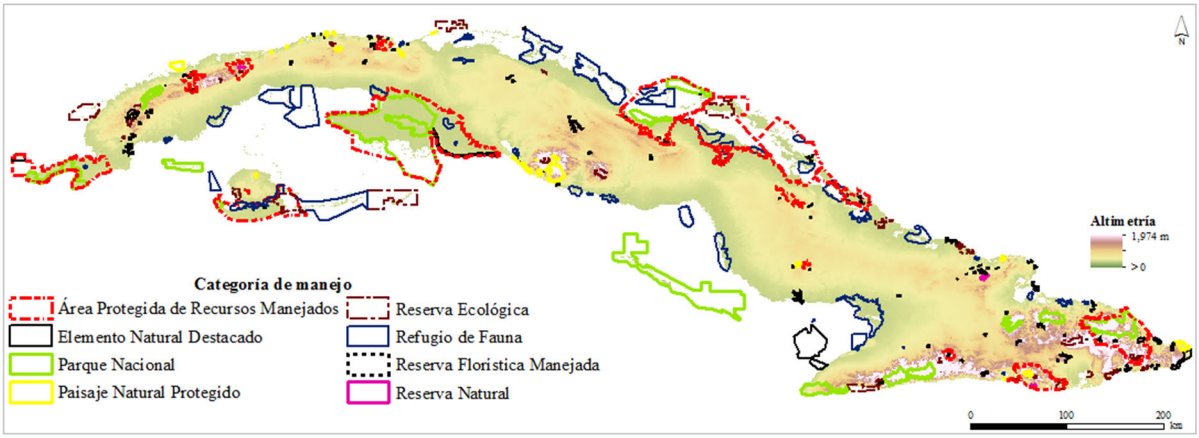


Source: JST based on CITMA, UNESCO, and Ramsar data

Figure 2.3.8 Environmentally Sensitive Areas and Sites

2.3.3 Protected Areas

3.7 million hectares, or 21% of the country, have been designated protected areas in Cuba. Two hundred eleven (211) protected areas have been approved in eight target regions at the central and provincial government levels. Of these protected areas, 120 areas are managed by SNAP, the National System of Protected Areas of Cuba. The National Center for Protected Areas (CNAP) – under CITMA and SNAP – controls development actions to conserve ecosystems and biodiversity in protected natural areas. Seventy-seven (77) protected areas are of national and local significance, while about 12 are internationally recognized, as shown in Figure 2.3.10. In addition, Parque Nacional Desembarco del Granma and Parque Nacional Viñales were designated as UNESCO World Heritage sites in 1999.



Source: SNAP

Figure 2.3.9 Protected Areas of Cuba

Source: CITMA

Figure 2.3.10 **Internationally Recognized** Protected Areas of Cuba

2.3.4 UNESCO World Heritage Sites

Seven (7) cultural and two (2) natural heritage sites have been registered in Cuba as of June 2019. Old Havana became Cuba's first registered heritage in 1982. In addition, another three (3) sites are under consideration for nomination: 1) the National School of Art (cultural heritage) in Playa Municipality, La Habana Province, 2) Ciénaga de Zapata National Park (natural heritage) in Ciénaga de Zapata Municipality, Matanzas Province, which is also adopted as a Ramsar Site, and 3) the Reef System in the Caribbean known as Canarreos and Jardines de la Reina, offshore from Sandino Municipality, Piñar del Rio Province.

World Heritage designations are highly valued in tourism as they attract many international tourists. However, development on/near heritage sites is likely to be severely restricted by UNESCO. Master transport planning should, therefore, carefully consider these areas.

Table 2.3.1 World Heritage Sites in Cuba

No.	Name	Registered Year	Type
C1	Old Havana and its Fortification System	1982	Cultural
C2	Trinidad and Valley de los Ingenios	1988	Cultural
C3	San Pedro de la Roca Castle, Santiago de Cuba	1997	Cultural
C4	Viñales Valley	1999	Cultural
C5	First Coffee Plantations in the Southeast of Cuba	2000	Cultural
C6	Urban Historic Centre of Cienfuegos	2005	Cultural
C7	Historic Centre of Camagüey	2008	Cultural
N1	Desembarco del Granma National Park	1999	Natural
N2	Alejandro de Humboldt National Park	2001	Natural

Note: Numbers refer to Figure 2.3.8
Source: UNESCO

2.3.5 Wetlands protected by Ramsar

Cuba adopted the Ramsar Convention in 2001 with six registered sites, as shown in Table 2.3.2. As Ramsar protected areas are generally wetlands, this designation usually has little impact on land transport planning. But three Ramsar Sites in Northern Cayeria, including Cayo Coco, Cayo Sabinal, and Cayo Guillermo, are also key tourism areas. As wetland boundaries are unfortunately not yet clearly defined, careful consideration will be needed in planning roads, bridges, and maritime transport in such areas.

According to the National System of Protected Areas (SNAP), two areas are proposed: Guanahacabibes Peninsula and Humedal Sur de Los Palacios in Piñar del Rio Province. But, as these areas are also targeted for tourism development, careful planning is required for tourism transport development.

Table 2.3.2 Ramsar Convention Sites in Cuba

No.	Name	Area (ha)
1	Ciénaga de Zapata	452,000
2	Ciénaga de Lanier y Sur de la Isla de la Juventud	126,200
3	Gran Humedal del Norte de Ciego de Ávila	226,875
4	Humedal Delta del Cauto	47,836
5	Humedal Río Máximo-Cagüey	22,000
6	Buenavista	313,500

Note: Numbers refer to Figure 2.3.8.
Source: Ramsar

2.3.6 Social Considerations

(1) Safety

The National Traffic Safety Strategic Plan 2009-2024 set a goal of reducing the death rate to less than five deaths per 100,000 residents. According to ONEI statistics, the death rate from traffic accidents is 7.0, and the situation has not improved. The National Road Safety Commission (CNSV) has renewed the strategic plan for 2018-2030 to reduce accidents and related economic losses by 50%.

Table 2.3.3 Traffic Accident Statistics

	2012	2013	2014	2015	2016	2017
Accidents	11,627	11,685	11,294	11,104	10,895	11,187
Injuries	8,710	8,236	8,831	8,185	8,209	7,999
Fatalities	708	687	746	788	767	750
Fatalities /100,000 ppl	6.3	6.1	6.6	7.0	6.8	7.0

Source: Traffic Accidents 2017, ONEI

(2) Access to social services

Access to education and health services is based on socialist principles that recognize the right of all citizens to receive such services free of charge. According to 2017 ONEI statistics, enrollment is high in Cuba's primary schools (at 99.5%) and secondary schools (at 83.5%). Tertiary education facilities, including provincial and medical colleges, are located in each province; specialized colleges are mainly available in Havana.

Primary and secondary healthcare (e.g., family clinics and polyclinics) is decentralized and widely accessible. In addition, tertiary hospitals, such as general hospitals, are available in each province. However, specialized hospitals are concentrated in Havana and unavailable in some provinces, such as Artemisa and Isla de la Juventud.

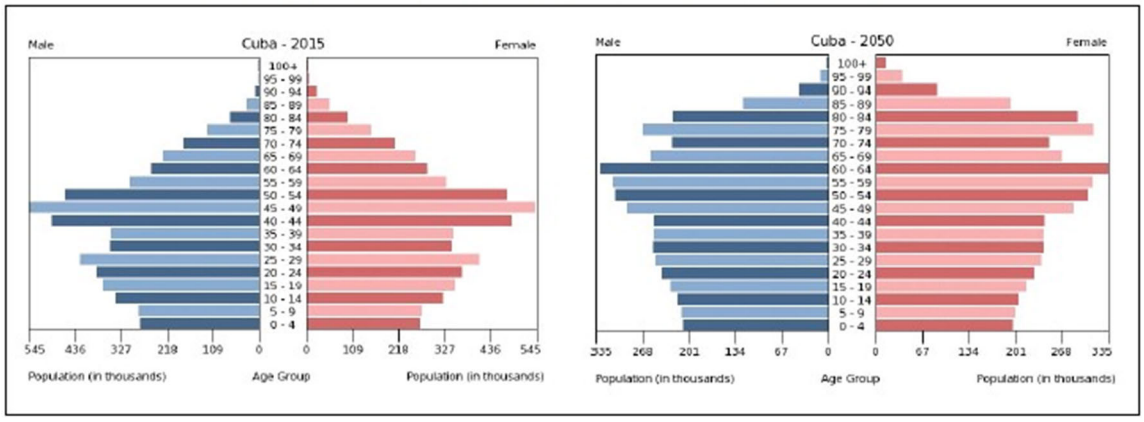
Table 2.3.4 Healthcare units by province

Province	General Hospital	Specialized hospital	Polyclinics	Family clinics
Pinar del Rio	2	1	20	626
Artemisa	4	0	19	444
Havana	2	9	82	2,022
Mayabeque	2	1	20	348
Matanzas	4	1	28	631
Villa Clara	3	4	37	837
Cienfuegos	1	1	20	368
Santi Spiritus	4	2	23	461
Ciego de Avila	2	1	19	394
Camaguey	5	2	31	674
Las Tunas	2	1	14	539
Holguin	8	2	42	1,055
Granma	4	1	28	794
Santiago de Cuba	7	2	42	1,048
Guantanamo	2	1	22	556
Isla de la Juventud	1	0	3	72
Total	53	30	450	10,869

Source: Public Health 2017, ONEI

(3) Vulnerable Groups

According to 2017 statistics, 20.1% of the population is 60 or older, which is expected to grow to more than 30% by 2030. Therefore, the guidelines call for promoting actions to satisfy all population groups' social and economic needs, particularly women, older adults, children, youth, and adolescents. Particularly from the transport sector, the existing infrastructure and services are inadequate to accommodate elderly and disabled persons, limiting their access and mobility. Therefore, special attention should be paid to the mobility of an aging population to minimize social isolation.



Source: Association for the Study of the Cuban Economy, 2016

Figure 2.3.11 Population Pyramid in 2015 and 2050 (Projected)

(4) Gender

The Cuban government mandates the economic inclusion of everyone, regardless of gender, race, or ethnicity. This is reflected in transport sector organizations, where a gender balance is secured for each position: managers, engineers, and staff in the Ministry of Transport and Cimab. The difference of opinions by gender is also reflected in development projects, and efforts are made to consider gender from policy decision-making to project implementation, operation and maintenance, and public consultation to the citizens.

Table 2.3.5 Women's Participation in the Cuban Workforce

No. of Women	2015	2016	2017
Higher education graduates	60.5%	64.9%	-
Workforce	37.4%	37.2%	37.3%
Technicians	58.8%	62.7%	63.2%
Administrative	63.4%	63.7%	65.5%
Managers	34.1%	36.5%	35.4%

Source: Employment, Education 2016, ONEI

2.3.7 Pollution

(1) Air

Transport is among the main sources of air pollution. The prevalence of aging vehicles with energy-inefficient technologies in Cuba contributes to exceptionally high emissions. Plus, the quality of fuels

produced in the country prevents the use of the latest generation of automotive technology, worsening the impact.

For example, the EU 6th-generation emission standards set CO emissions at 1.0g/km for gasoline vehicles and 0.5g/km for diesel. Estimated by the average age of vehicles in Cuba, the current fleet average is at about EU 2nd-generation – almost double current international standards. The following tables show current emission standards in Cuba that are under review.

Table 2.3.6 Maximum permissible emission standards for gasoline and diesel vehicles

Year of manufacture	Gasoline vehicle		Diesel vehicle	
	Hydrocarbon (CO) (% vol.)	Hydrocarbons (HC) (ppm)	Light absorption coefficient (K)(m-1)	Percent opacity (%)
1980 and earlier	7.5	1,500	2.94	70
1981-1998	3.5	900	2.23	60
1999 and later	2.0	300	1.69	50

Source: Resolution 172/2001

Table 2.3.7 Maximum permissible PM emission standards

Year of manufacture	PM emission (mg/m^3)
1999 and earlier	24.5
2000-2011	24.5
2011 and later	18.3

Source: CIMAB

Among all modes, road transport accounts for over 50% of emissions, followed by aviation (15%), agriculture-related transport (13%), and construction-related transport (8%)[7]. Table 2.3.8 shows the emission factors of different transport modes. CO_2 is a direct greenhouse gas, and CO is an indirect greenhouse gas.

Table 2.3.8 Emission factors of transport modes

(Unit: g/kg)

Mode of transport		NOx	CH4	COVDM	CO	N_2O	CO_2
Road vehicles	Gasoline	27.0	8.4	144.9	893.4	0.1	591.6
	Diesel	42.0	0.2	8.0	36.0	0.1	3,140.0
Railway	Diesel	40.0	0.2	4.7	11.0	1.2	3,140.0
Maritime	Ships	87.0	-	-	1.9	0.1	3,212.0
	Boats	67.5	0.2	4.9	21.3	0.1	3,188.0
Aviation	Propellor	3.5	2.6	24.0	1,034.0	0.0	3,172.0
	Jet aircraft	11.0	0.0	0.7	7.0	0.1	3,150.0

Source: Estimated emissions in Cuba's transport sector, 2016

(2) Water

Shipping and ports contribute to marine pollution and biodiversity risks via dumping wastes in the sea (e.g., oil spills), domestic and industrial wastewater discharge, dredging operations, etc.

[7] Estimated emissions from Cuba's transport sector in 2016

According to studies on coastal water quality, Cuba's major bays have relatively high rates of NH_4 and NO_3 content, mainly due to the inflow of domestic wastewater. In concentrations of hydrocarbons from oil in surface sediments, most bays exceed the permissible limits recommended by the CARIPOL/IOCARIBE program for water monitoring in the Caribbean Region (20 mg kg-1 dry matter). Some basins, including Havana, Santiago de Cuba, Mariel, and Cienfuegos, showed a higher rate than the maximum value set by UNESCO in 1976 (70 mg kg-1 dry matter).

Table 2.3.9 Range and mean value of hydrocarbons in surface sediments

(Unit: mg kg-1 dry matter)

Location	Range of values	Mean value	Year
Havana Bay	910 – 1080	926	2016
Mariel Bay	235 - 520	403	2018
Cienfuegos	65-265	127	2018
Sagua Bay	10 - 165	58	2018
Moa Bay	14 - 69	42	2009
Nuevitas Bay	10 - 66	40	2018
Matanzas Bay	12 – 19	19.9	2018
Varadero to Cardenas	19 – 44	28.6	2018
Santiago de Cuba Bay	325 - 1050	630	2018

Source: Project Not Associated with a Program (PNAP): Monitoring environmental quality of Cienfuegos Bay ecosystem, CIMAB, 2018

A study of metal content in surface sediments found concentrations of cadmium (Cd) and lead (Pb) were below the detection limit of the technique used (<1 and <10 µg g-1, respectively) and therefore excluded from statistics. But results found high chromium (Cr) and nickel (Ni) concentrations in Moa Bay, a major nickel and cobalt mining site. Guantanamo and Nuevitas bays show high concentrations of Cr and Ni, while Guantanamo and Mariel bays show high concentrations of Zn.

Table 2.3.10 Mean concentrations of metals in surface sediments

(Unit: µg g-1)

Location	Cr	Cu	Ni	V	Zn	Year
Mariel Bay	26.47	26.47	25.90	20.42	63.80	2018
Matanzas Bay	69.52	23.10	18.96	5.57	48.00	2018
Moa Bay	6,675.50	103.67	2,350.75	-	364.00	2017
Nuevitas Bay	76.19	19.97	73.39	-	47.76	2016
Guantanamo Bay	120.66	40.45	123.16	43.33	87.33	2017

Source: Project Not Associated with Program (PNAP): Monitoring of environmental quality of Mariel Bay ecosystem, CIMAB, 2018

(3) Soil

Soil pollution by transport includes uncontrolled spillage of lubricants, fuels, and used oils at airports, transport terminals, and road intersections, plus erosion of road surfaces. Solid and hazardous wastes are also among the risks of soil contamination from the transport sector.

2.3.8 Laws and policy framework

(1) Laws & regulations on environmental and social considerations

The legal framework and guidelines for major environmental/social considerations are based on a law enacted in 1997 (Ley 81 De Medio Ambiente). Table 2.3.11 lists the main laws and regulations related to environmental/ social considerations in the transport sector.

Table 2.3.11 Main laws and regulations related to environmental & social considerations

Year	Laws & regulations
1981	Law 33 "Law on Environmental Protection and the Rational Use of Natural Resources"
1990	Decree 118 "Law on National System, Organization and Function for Environmental Protection"
1993	Decree 138 "Inland Waters"
1997	Law 81 "Environmental Law"
1998	Law 85 "Forest Law"
2009	CITMA Order 23/2009 "National Program against Environmental Pollution 2009-2015"
2014	CITMA Order 159/2014 "National Protected Area System 2014-2020"
2016	CITMA "National Environmental Education Strategy 2016-2020"
2016	CITMA "National Environmental Strategy 2016-20"
2019	Constitution 2019 Article 75 (1976, 1992 Article 27) of the Republic of Cuba

CITMA: Ministerio de Ciencia, Tecnología y Medio Ambiente (Ministry of Science, Technology & Environment)
Source: Republica de Cuba (1992) (2010)

1) Cuba's constitution

Adopted in 1976 (amended in 1992 & 2019), the constitution recognizes the importance of environmental protection and its close link with sustainable development. Article 75 reads, "All persons have the right to enjoy a healthy and balanced environment. The State protects the environment and natural resources of the country. It recognizes their close link with the sustainable economic and social development for making human life more sensible, and for ensuring the survival, welfare and security of present and future generations."

2) SEA Guide

While Cuba has no specific SEA law, there is an SEA Guide for Development Plans & Programs (Guía para la Evaluación Estratégica Ambiental de Planes y Programs de Desarrollo) prepared by CITMA under Environmental Law 81. According to the Guide, development projects subject to SEA include urban and industrial development, forest management, and developments related to water, tourism, mining (including oil), fisheries, and soil management. But transport development is not included in the list. However, considering transport development is closely related to urban, industrial, and tourism developments, SEAs will be conducted for transport development plans.

Essential requirements mentioned in the SEA Guide are summarized below. According to CITMA and CIMAB, past SEAs include the Mariel Integral Development Plan. But in this study, whether the SEA Guide procedures were followed could not be confirmed.

Table 2.3.12 Key requirements of Cuba's SEA Guide

Information to be included in the environmental report
• Objectives of the plan or program • ***Environmental protection objectives*** • Probable or ***significant environmental impacts*** • ***Environmental factors*** (biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material goods, cultural heritage, landscape, other factors, and interrelation between these factors) • Planned ***measures to prevent, reduce and compensate for any significant negative impact*** • Reasons for the selection of the ***alternatives***, evaluation method, any difficulties • Description of the measures in the ***monitoring program***
Aspects to consider in SEA
• How the plan ***establishes a framework*** for projects and other activities concerning location, characteristics, dimensions, operating conditions, or investment resources • How the plan ***influences other plans***, including the country's prioritized economic programs and integration of environmental dimensions to promote sustainable development • Significant ***environmental problems*** for the plan (likelihood, duration, frequency, and reversibility of ***environmental impacts and cumulative impacts, magnitude, and spatial environmental impacts***) • Risks to human health or the environment (e.g., ***accidents***) • ***Protected areas*** of high natural value or cultural heritage • ***Compliance with environmental regulations*** or exceeding environmental quality limit values • Assessment of ***costs associated with mitigation of negative environmental impacts***, reduction of risks, treatment of wastes, rehabilitation of disturbed areas, and environmental monitoring to guarantee the safety and health of workers

Source: JST

SEA requirements of the JICA Guidelines and Cuba's SEA Guide are compared in Table 2.3.13, along with "gap-filling measures." The main gaps identified are scoping of priority projects and stakeholder meetings, which were included in the NTMP SEA process.

Table 2.3.13 Comparison of JICA Guidelines and Cuba's SEA Guide

JICA Guideline*1	SEA Guide*2	Gap-filling measures
(1) Review objectives & goals of policies & plans	Objectives of plan or program, plus the extent to which it influences other plans	N/A
(2) Consider development alternatives to achieve objectives	Reasons for selection of alternatives, evaluation method	N/A
(3) Consider the content of policies & plans	Objectives of plan/program plus the extent to which it influences other plans	N/A
(4) Scoping of impacts	Risk to human health, environment, protected areas of natural value & cultural heritage	N/A
(5) Confirm baselines (natural/social conditions)	Environmental factors	N/A
(6) Confirm environmental regulations & institutions	Compliance with environmental regulations	N/A
(7) Predict environmental impacts	Probable or significant environmental impacts	N/A
(8) Assess impact and alternative options	Significant environmental problems for the plan	N/A
(9) Consider mitigation measures	Measures to prevent, reduce, and compensate for a significant negative impact	N/A

JICA Guideline*1	SEA Guide*2	Gap-filling measures
(10) Consider monitoring method	Description of measures in monitoring program	N/A
(11) Scoping of priority projects	N/A	Scoping of priority projects to be included
(12) Stakeholder meetings	N/A	Stakeholder meetings during the planning process

*1 5th Working Group, JICA Operational review of Guidelines for Environmental and Social Considerations

*2 SEA Guide for Development Plans & Programs (Guía para la Evaluación Estratégica Ambiental de Planes y Programs de Desarrollo) // Source: JST

3) Environmental Impact Assessment (EIA) guidelines

Procedures and guidelines for preparing an EIA are stipulated in Environmental Law Articles 28 & 29, and the resolution on environmental impact assessment procedures was enacted in 1999 (Resolucion 77/99, revised in 2009 as Resolucion 132). Table 2.3.14 shows the general process for obtaining an environmental license.

Table 2.3.14 EIA procedure

No.	Procedure
a)	The project owner submits Project Summary Report (Tarea Tecnica) & Technical Examination Report (Estudio Tecnico), including environmental aspects, to the provincial branch of National Institute of Physical Planning (IPF)
b)	IPF considers permission for Land Use and the necessity of EIA based on the Project Summary Report and Technical Examination Report
(EIA not required)	
c-1)	The project owner submits clarification of conditions specified in the Environment License Application, Project Summary Report, and Technical Examination Report to IPF.
c-2)	IPF consults related ministries, including CITMA, on the project. If requested, the project owner submits revised documents to IPF.
c-3)	IPF asks the Center for Inspection & Environmental Control (CICA) to analyze after reviewing resubmitted documents
c-4)	CICA analyzes documents and presents comments to the project owner as necessary.
c-5)	The project owner gets Environment License by submitting revised documents, including answers to CICA comments.
(EIA required)	
d-1)	The project owner implements EIA to clarify environmental matters described in the Technical Examination Report
d-2)	The project owner implements EIA via subcontractor as necessary.
d-3)	The project owner carries out the process from c-1) to c-5) including submitting the EIA report.

Source: JST

4) Environmental standards

These laws and standards regulate the main environmental items for transport-sector projects in Cuba, requiring consideration based on the 1997 Environmental Law:

- Effluent standards in coastal and marine waters (NC 521)
- Effluent standards in surface waters and sewerage (NC 27)

- Emission standard (NC 39)
- Air-quality standard (NC 1020)
- Water-quality standard (NC 827)
- Measurement law (NC 900)
- Waste collection, treatment, and disposal law (NC 133, 134, 135)

5) Land acquisition and resettlement

Cuba has no specific laws and regulations related to land acquisition and resettlement. However, chapter 2, Article 8 of Law 33, "Law on Environmental Protection & Rational Use of Natural Resources," and Law 81, "Environmental Law," mention that land acquisition and resettlement should be made correctly. Furthermore, in terms of land acquisition, Law 300, "Law on National Land Use," stipulates regulations related to land use.

(2) Relevant policies, strategies, and plans

Cuba has a wide range of policies and strategies to promote environmental protection, sustainable use of natural resources, and sustainable development. Table 2.3.15 lists the main international agreements and national policies relevant to environmental and social aspects related to the transport sector.

Table 2.3.15 Main international/national policies, strategies & plans

Level	Policies & plans
International	• UNFCCC Paris Climate Agreement 2015 • UN Convention on Biological Diversity • UN Sustainable Development Goals
National	• National Economic and Social Development Plan 2016-2030 • Guidelines for Economic and Social Policy 2016-2021 • Spatial Plan for Transport Infrastructure (ENOT) 2013-2014 • National Environmental Strategy (EAN) 2016-2020 • Action Plan for Protected Areas (SNAP) 2014-2020 • Cuban government plan to face climate change (Tarea Vida 2017) • Renewable energy policy

Source: JST

1) Conceptualization of Cuba's social & economic development model

Cuba's social and economic development model lays out the main characteristics of the nation's social policy. Priority is given to elevating the quality of life for all population segments – with emphasis on food and energy security, access to education, health, drinking water, public transport, housing, culture, computerization, sports & recreation, community services, and care support.

2) National economic & social development plan

The national economic & social development plan up to 2030 provides six strategic axes to foster development: i) Government, institutionality & macroeconomics; ii) Productive transformation & international insertion; iii), Infrastructure, iv) Science, technology & innovation; v) Natural resources & environment**;** vi) Human development, equity & social justice. The main ideas of axes v) and vi) are described below.

v) Natural resources & environment promotes compliance with the constitutional mandate to ensure a healthy and balanced environment and achieve the objectives of the PNDES-2030 and Sustainable Development Goals.

vi) Human development, equity & social justice highlights the need to pay close attention to an aging population and vulnerable groups to ensure their inclusion in economic, political, and social spheres. It also addresses the regional disparity in access to services and opportunities by promoting territorial and inclusive development.

Source: National Economic and Social Development Plan 2030

3) National environmental strategy 2016-2020

The National Environmental Strategy 2016-2020 (EAN: Estrategia Ambiental Nacional) guides Cuban environmental policy, establishing principles on which national environmental works are based. Strategic directions are 1) Rational management of natural resources; 2) Improvement of environmental quality; 3) Confronting climate change; 4) Improvement of policy instruments and environmental management. In addition, various programs and action plans are laid out for implementing EAN, as shown below.

- National Program for the Improvement and Conservation of Soils
- National Hydraulic Program 2015-2020
- National Forestry Program
- National Program of Biological Diversity 2016-2020
- National System of Protected Areas 2014-2020
- Program to eradicate sources of pollution affecting water supply 2014-2020
- Program to confront bay contamination
- Sanitary Hygiene and Quality Commission Environmental Program
- Program to eliminate harmful substances from the ozone layer
- National Program for the Development of Renewable Energy
- Directives for the Confrontation of Climate Change 2016-2020
- National Program to Combat Desertification and Drought
- Beach Recovery Program
- Action plans for chemical products and high-impact waste
- National Environmental Education Program 2016-2020

Source: National Environmental Strategy 2016-20

Major environmental issues identified in the National Environmental Strategy are shown in Table 2.3.16. Issues related to transport planning, in particular, include forest-cover reduction, loss of diversity, environmental pollution, and the emerging issue of climate change impact.

Table 2.3.16 Environmental issues identified in National Environmental Strategy

2007-2010	2011-2015	2016-2020
• Soil degradation • Forest-cover reduction • Environmental pollution • Loss of biodiversity • Water shortage	• Soil degradation • Forest-cover reduction • Environmental pollution (waste management, air pollution, noise, chemicals, etc.) • Loss of biodiversity • Water shortage, water quality, limited access to water • Climate-change impact	• Soil degradation • Forest-cover reduction • Environmental pollution • Loss of biodiversity & ecosystem deterioration • Water shortage, water quality, limited access to water • Climate-change impact • Deterioration of sanitary and hygienic conditions in human settlements

Source: National Environmental Strategy documents

4) MITRANS environmental strategy 2016-2020

Based on the EAN, each ministry prepares an environmental strategy. MITRANS' environmental strategy 2016-2020 proposes measures for prevention, elimination, or minimization to improve environmental protection and promote rational use of natural resources while achieving sustainable development goals for transport in Cuba. The following principles support the strategy:

1. Contribute to economic and social development on a sustainable basis.
2. Recognize citizens' rights to a healthy environment, where improving the population's quality of life constitutes the center of the national environmental task.
3. Make the most of the financial mechanisms that support the confrontation of main environmental issues.
4. Active participation of all social actors at central and local levels, based on coordinated action, cooperation, and co-responsibility.
5. Promote science and technology to contribute to the solution of the main environmental problems.
6. Increase in environmental awareness, with emphasis on education training and environmental actions.
7. Sustain environmental work based on intersectoral discussion, cooperation, and coordination.
8. Consider territoriality and decentralization as axes of national environmental management.
9. Apply the ecosystem approach.
10. Develop an adequate international environmental policy, seeking adequate levels of cooperation and coordination.

Source: Environmental Strategy of MITRANS 2016-2020

5) Cuban government plan to face climate change (Tarea Vida 2017)

"Tarea Vida (Life Task)" is the country's most ambitious program to combat climate change, including five strategic actions and 11 tasks aimed at encouraging preventive measures in vulnerable areas. It identifies 15 priority zones as flood-prone areas (listed below), advocating redevelopment of settlements to reduce the impact of sea-level rise, plus an adaptation of agricultural practices for food security. Tasks include implementing and monitoring climate change adaptation and mitigation measures from sectoral policies and plans, including renewable energy, energy efficiency, territorial & urban planning, and transport.

- Southern regions of Artemisa and Mayabeque
- Havana's shoreline
- Havana Bay
- Mariel SDZ
- Varadero and its tourist corridor
- Villa Clara resorts
- Ciego de Ávila's northern resorts
- Ciego de Ávila's northern and southern coastlines
- Camagüey resorts and northern coastline
- Holguín's northern coastline
- Santiago de Cuba Bay
- Coastal cities threatened by rising sea levels: Cienfuegos, Manzanillo, Moa, Niquero, and Baracoa
- Coastal settlements are expected to be permanently inundated between 2050 and 2100 in Sancti Spíritus, Camagüey, Pinar del Río, and Villa Clara provinces.
- Sandy beaches facing severe erosion that could disappear if impacted by extreme weather events, plus other beaches of tourist and recreational interest, in Camagüey, Pinar del Río, Granma, Holguín, Las Tunas, Isla de la Juventud provinces.
- Unprotected coastal areas facing saline intrusion in Pinar del Río, Matanzas, Granma, Camagüey, Cienfuegos, and Sancti Spíritus provinces

Source: Tarea Vida 2017

6) MITRANS program for Tarea Vida (Life Task)

Coordinated by CITMA, each ministry prepares programs for "Tarea Vida (Life Task)." MITRANS programs from 2021 to 2030 include substituting 45% of automotive transport with electric vehicles and procuring modern track, railbuses, and aircraft with better energy efficiency to reduce the use of fossil fuels. It also includes a plan for a regulatory framework/monitoring system for GHG emissions produced by transport sectors[8].

7) Renewable energy policy

Cuba's current renewable power capacity is just 225 MW, which is very small compared to oil-fired generators. However, the government has set a target of producing 24% of the nation's power from renewable sources by 2030[9]. Proposals to accomplish this objective include 755 MW of biomass-fired power plants, 700 MW of photovoltaic solar farms, 633 MW of wind power, and 56 MW of small hydroelectric generation[10]. Although there are no specific strategies in the transport sector, NTMP priority projects include studies of hydrogen and solar potential in the railway sector.

8) Sustainable Development Goals

The Sustainable Development Goals (SDGs) are the UN's blueprint for a more sustainable future for all. Cuba has performed well in meeting the SDG targets, ranked 49 out of 165 countries in 2021. While Cuba ranks high in goals such as SDG 4-Education, SDG 5-Gender Equality, SDG 7-Energy, SDG 8-Decent work, and SDG 13-Climate Action, faster progress is required on goals including SDG

[8] Programs of "Tarea Vida (Life Task)" in MITRANS for 2021-2030 period
[9] National Economic and Social Development Plan for 2030
[10] Power December 1, 2020, "Projected Development of Renewables in Cuba" (https://www.powermag.com/projected-development-of-renewables-in-cuba/)

9- Industrialization, SDG 14-Life Below Water, SDG 15-Life on Land and SDG 16-Peace and Justice. Among subcriteria concerning transport planning, protected areas and biodiversity (SDG 15-Life on Land) and satisfaction with public transport (SDG 11-Sustainable Cities) were identified as major challenges.

SDGs and criteria requiring improvement are:

- SDG 9: Industry Innovation and Infrastructure (% of internet and mobile use, R&D expenditure)
- SDG 14: Life Below Water (clean water, fisheries)
- SDG 15: Life on Land (red list species, change in protected areas),
- SDG 16: Peace, Justice, and Strong Institutions (homicides, press freedom)
- SDG 11: Sustainable Cities and Communities (satisfaction with public transport)

Note: Red requires fast progress, followed by Orange, Yellow, and Green
Source: SDG Index and Dashboards Report 2021

In 2021, Cuba prepared its first National Voluntary Report on SDG progress, listing progress and identifying areas for improvement. Key focus areas identified in the transport sector include the use of renewable energy (SDG 7), expanding investment in modernizing basic infrastructure (SDG 9), focusing on public transport and ensuring logistics to rural and mountainous areas (SDG 11), and less carbon-intensive land transport (SDG 13).

(3) Relevant institutions

1) Ministry of Science, Technology & Environment (CITMA)

CITMA was established in 1994 (Law 147) with a mandate to propose and evaluate scientific and technological strategies and policies in correspondence with the economic and social development of the country.

2) Environment Agency (AMA)

AMA is a body under CITMA that implements scientific research programs/projects and participates in elaborating environmental policies and strategies, as well as in the creation of environment-related legal documents.

3) Office of Environmental Regulation, Safety & Nuclear (ORASEN)

ORASEN was formerly known as the Center for Inspection & Environmental Control (CICA), established in 2002 by CITMA (Resolution No. 6/02). It now consists of four centers: 1) Center for Inspection & Environmental Control (CICA); 2) National Center for Biological Safety (CSB); 3)

National Center for Nuclear Safety (CNSN); 4) Executive Center of the National Authority for Prohibition of Chemical Weapons (CEANPAQ). Its main task is to propose regulations, grant licenses & permits, and conduct inspections. In addition, CICA is the focal point for SEAs and EIAs.

4) Center for Environmental Research & Management of Transport (CIMAB)

CIMAB was established in 2012 by MITRANS (Resolution 986/12) as an agency responsible for the entire transport sector with the merger of three research centers: 1) Center for Engineering & Environmental Management of Bays & Coasts (CIMAB); 2) Center for Transport Research & Development (CETRA), 3) Center for East Transport Engineering (CIT). The roles and responsibilities of the organizations mentioned above are summarized below.

Table 2.3.17 Roles & responsibilities of related organizations

Organization	Roles & responsibilities
CITMA	• Propose/evaluate scientific & technological strategies/policies in correspondence with Cuba's economic & social development.
AMA (under CITMA)	• Conduct scientific research programs and projects. • Participate in preparing environmental policies/strategies, plus creating environment-related legal documents.
ORASEN* (CITMA affiliate)	• Development of environmental impact evaluation process • Granting of licenses, permits & authorizations, and conducting inspections • Responsible for environmental inspection
CIMAB (under MITRANS)	• Responsible for all transportation sector-related environmental research • Conducts EIAs related to transport sector development projects

*Former CICA
Source: JICA Study Team

2.3.9 Strategic Environmental Assessment (SEA) in Cuba

The importance of environmental and social consideration is well recognized in Cuba's Constitution and upstream policies. For example, in the 7th Congress of the PCC, the government announced that "Sustainability in the economic, social and environmental sectors is associated with development that ensures: prosperity with justice and social equity in harmony with the environment, rational use and preservation of natural resources, as well as the care and enrichment of the nation's heritage."

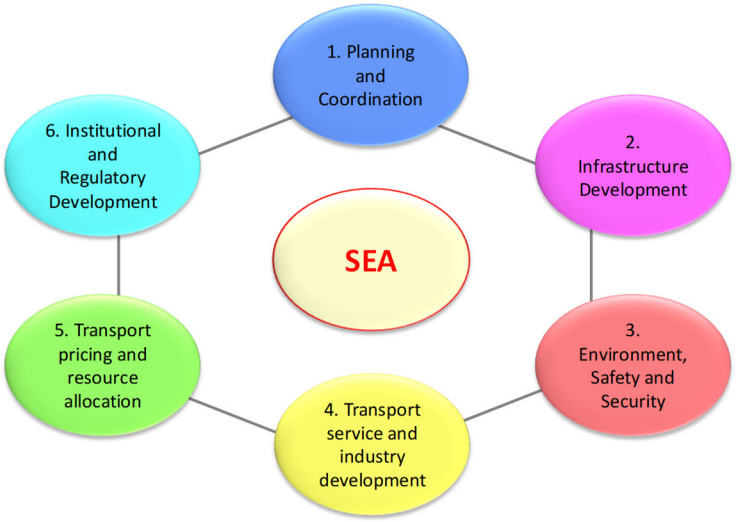
Environmental and social consideration has been practiced as an Environmental Impact Assessment (EIA) based on Law 81. However, the Strategic Environmental Assessment (SEA) is not a legal requirement as of 2021.

There is an "SEA Guide for Development Plans and Programs" (SEA Guide) prepared by CITMA, but it has not been applied to master plans in Cuba. Therefore, for this national transport master plan (NTMP), SEA is carried out by referring to international best practices and the SEA Guide.

(1) The Positioning of the SEA in the Master Plan

SEA is a tool to incorporate sustainability principles in preparing policies, programs, and plans, providing opportunities for planners and decision-makers to consider the most suitable development directions, taking into account the environmental and social implications in the process.

To ensure that the transport master plan incorporates environmental and other sustainability aspects, the SEA is positioned as the point of reference for each planning area, as shown in Figure 2.3.12.



Source: JICA Study Team

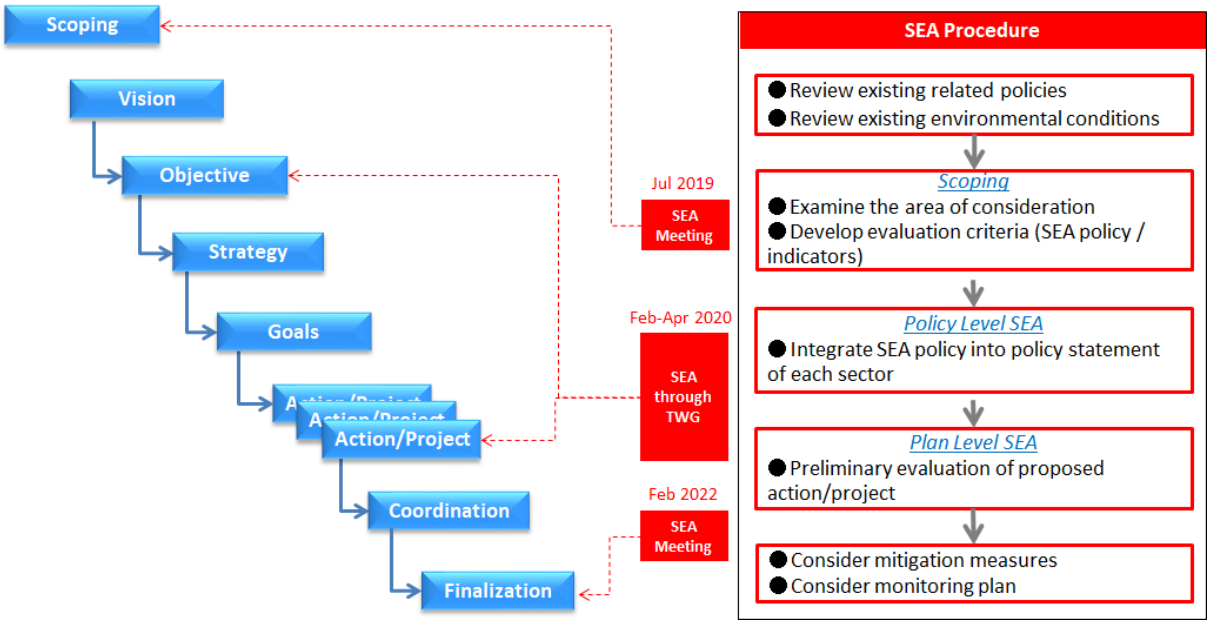
Figure 2.3.12 Positioning of SEA

(2) SEA Procedures

SEA procedures for the transport master plan include four main stages, as shown below: scoping work, policy level SEA, plan level SEA, and recommendations.

1) Scoping work
   - Review upstream policies to confirm key directions of NTMP
   - Review existing conditions to identify key NTMP consideration areas
   - Develop SEA policies, indicators, and tools based on identified key areas for consideration
2) Policy-level SEA
   - Integrate SEA policies into transport policy and strategy
3) Plan-level SEA
   - Conduct spatial analysis via GIS & prepare development suitability map
   - Conduct a preliminary assessment of proposed projects
4) Recommendations
   - Identify NTMP mitigation measures and recommendations from an SEA perspective

The interaction and integration of the SEA and NTMP planning process are shown in Figure 2.3.13.



Source: JICA Study Team

Figure 2.3.13 SEA Procedure and NTMP Planning Process

(3) Stakeholder Engagement

Stakeholder engagement is a key process in conducting a SEA. The main purpose is to incorporate the views and comments of concerned parties in the planning process. Understanding that the master plan involves various aspects, SEA stakeholders include not only environmental and social experts of the C/P but also from different sectors such as the C/P, TWGs, JCC members, and other local organizations.

The method and timing of stakeholder engagement in the SEA process are shown below.

1) Scoping work - Key scoping items were identified with C/P & TWGs, and SEA policies and indicators were developed
2) Policy-level SEA - In TWGs, SEA policies were incorporated into each sector's objectives
3) Plan-level SEA - Based on SEA indicators, projects in each sector were subject to a rapid assessment by TWGs
4) Recommendations - SEA results were shared to invite comments before finalizing the M/P

(4) Scoping

The identified key areas of consideration for SEA were organized from the economic, environmental, and social aspects, as listed below. In addition, the impact of COVID-19 was also discussed in TWGs.

1) Upstream Policies

A review of upstream policies and international commitments identified key directions for the NTMP:

- Rational management of natural resources is linked to sustainable economic & social development, which is essential for present and future generations.
- Ensuring the right & access to work, health, education, and recreation is essential to improving the quality of life for all people. Specifically, consideration of access to social facilities and services is an important aspect of transport planning.

- Climate-change adaptation efforts are critical in coastal areas. Disaster-resilient infrastructure and operating systems must be built as part of transport planning. Likewise, the development of residential areas must be mindful of potential disaster risks. Large-scale development requires attention to possible land-use changes affecting agricultural areas and food security.
- Integrated logistics systems must be strengthened, linking points of entry, storage and distribution services.

2) Key Issues

Through a review of the existing situation and current issues in the transport sector, several key issues were identified from economic, environmental, and social perspectives:

Economic issues

- Modernization of transport infrastructure, facilities, and services are critical to attracting investments in Cuba.
- Fuel management is a critical concern. Optimizing traffic and transport operations through coordination is essential to managing and reducing fuel use.
- Import substitution is a key economic development goal. Need to strengthen supply chains from production sites to export points, including logistics and storage systems.
- Efficient logistics systems between/within provinces are important to ensure equitable distribution of medical and daily necessities (COVID-19 consideration).

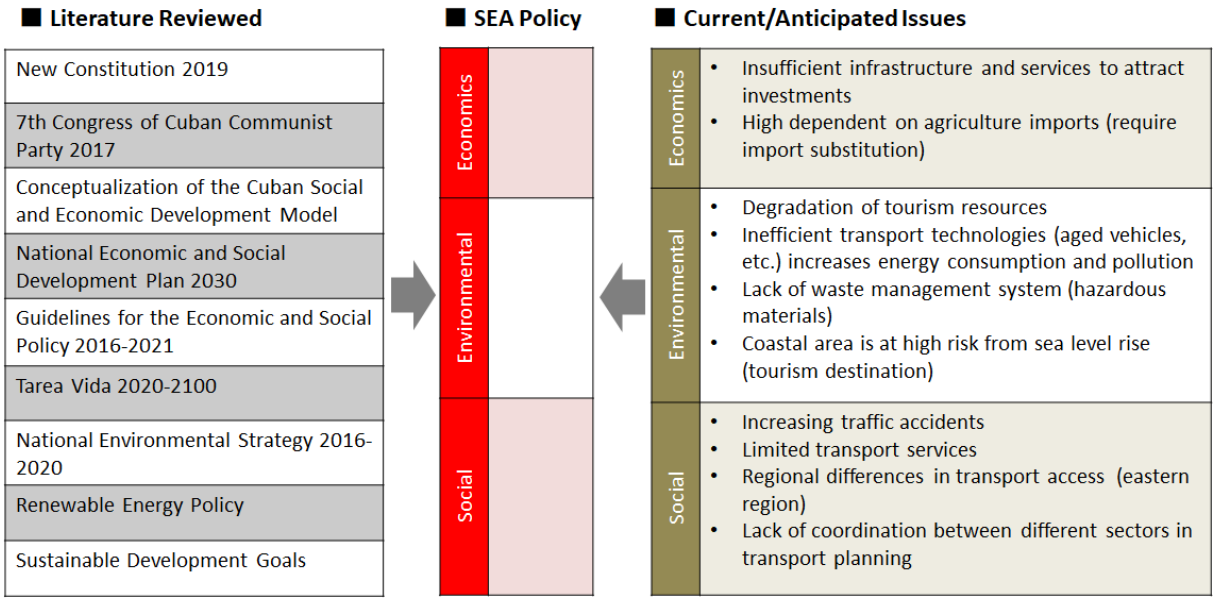
Environmental issues

- Loss of biodiversity and coastal resources from physical infrastructure development threatens the natural ecosystem and degrades tourism resources.
- Coastal areas have a high risk of natural disasters due to hurricanes and sea-level rise.
- Inefficient transport technology and aged vehicles increase fuel consumption and air pollution. The degradation of water quality at ports is a concern that must be addressed in planning. Waste management systems, especially for hazardous materials, are insufficient.

Social issues

- Increasing transport-related accidents are a significant concern. Overusing second-hand and refurbished vehicles and poorly maintained transport infrastructure are key factors behind traffic accidents.
- In inter-provincial transport, central and eastern regions have less connectivity and accessibility due to the incomplete Autopista. Furthermore, transport networks in remote and mountainous areas are also lacking.
- In intra-provincial transport, current capacity and service levels are not meeting the population's needs.
- Equal access to jobs and social services must be ensured. In addition, the recent pandemic highlights the importance of emergency transport services to tertiary hospitals (COVID-19 consideration).

The process of defining SEA policies from upstream policies and key issues is shown in Figure 2.3.14 below.

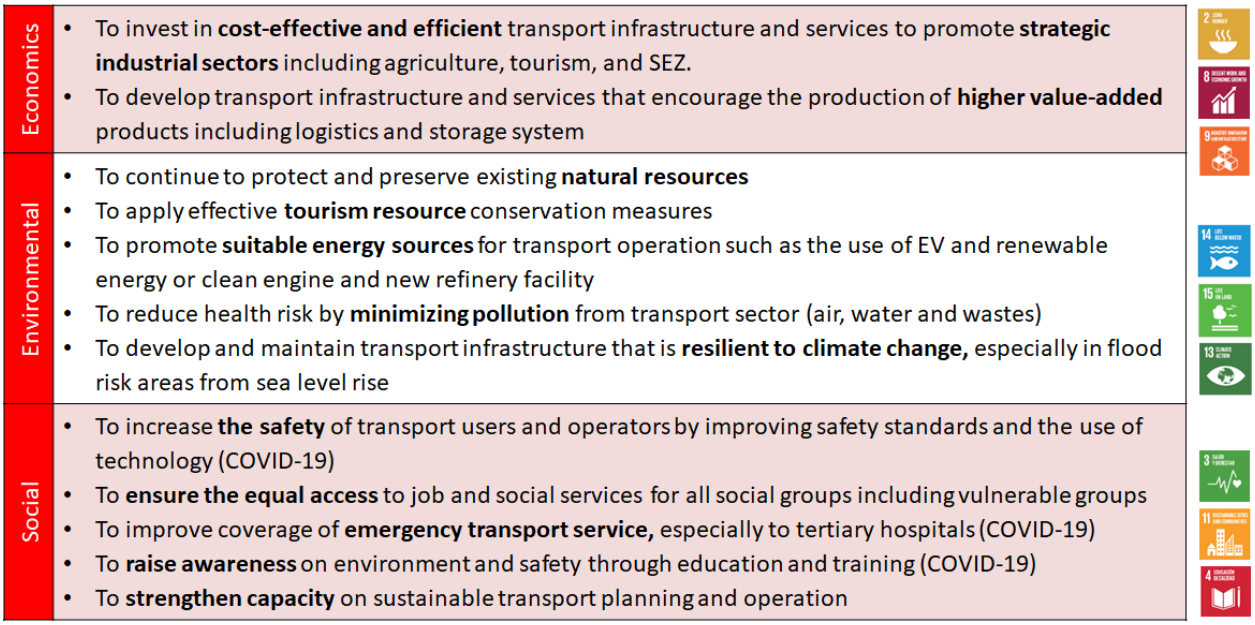


Source: JICA Study Team

Figure 2.3.14 Scoping for SEA in the Master Plan

(5) SEA Policies

Twelve (12) SEA policies were formulated from economic, environmental, and social perspectives from the identified six key areas of consideration. These policies were used at the Policy-level SEA to guide transport policy and strategy preparation. They are consistent with the SDGs and aim to contribute to the goals below.

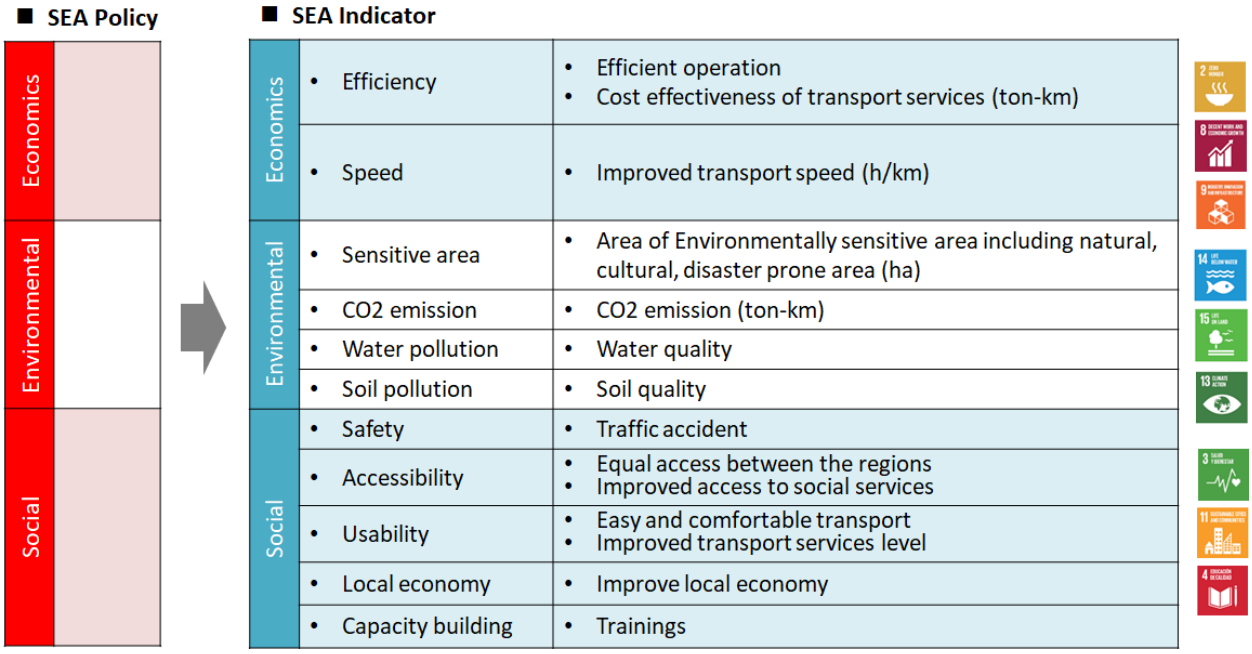


Source: JICA Study Team

Figure 2.3.15 SEA policy for policy-level SEA

(6) SEA indicators

The SEA indicators assessed the potential impacts of proposed projects/actions at Plan-level SEA. Therefore, SEA indicators should represent the principal ideas of SEA policies and be measurable with available data and information. For this reason, 11 SEA indicators were selected, as shown in Figure 2.3.16.



Economics	• Efficiency	• Efficient operation • Cost effectiveness of transport services (ton-km)
	• Speed	• Improved transport speed (h/km)
Environmental	• Sensitive area	• Area of Environmentally sensitive area including natural, cultural, disaster prone area (ha)
	• CO2 emission	• CO2 emission (ton-km)
	• Water pollution	• Water quality
	• Soil pollution	• Soil quality
Social	• Safety	• Traffic accident
	• Accessibility	• Equal access between the regions • Improved access to social services
	• Usability	• Easy and comfortable transport • Improved transport services level
	• Local economy	• Improve local economy
	• Capacity building	• Trainings

Source: JICA Study Team

Figure 2.3.16 SEA indicators for plan-level SEA

2.3.10 Development of Suitability Maps

(1) Use of GIS for SEA

GIS-based "suitability analysis" is a beneficial tool for carrying out SEA, which can address socio-ecological and disaster-risk aspects spatially and numerically and recommend suitable corridors where the proposed transport infrastructure projects can be placed, minimizing the anticipated negative social and environmental impacts.

Ecological and social elements of high value should be preserved, such as wetlands, mangroves, dense forests, and protected areas.). At the same time, the degree of possible adverse impacts caused by natural-disaster and weather and geographical conditions, such as floods, landslides, and hurricanes, should be numerically assessed. Consolidated assessment of the ecological & social aspects and the natural conditions/disaster aspect can be used for evaluating and prioritizing the proposed transport infrastructure projects

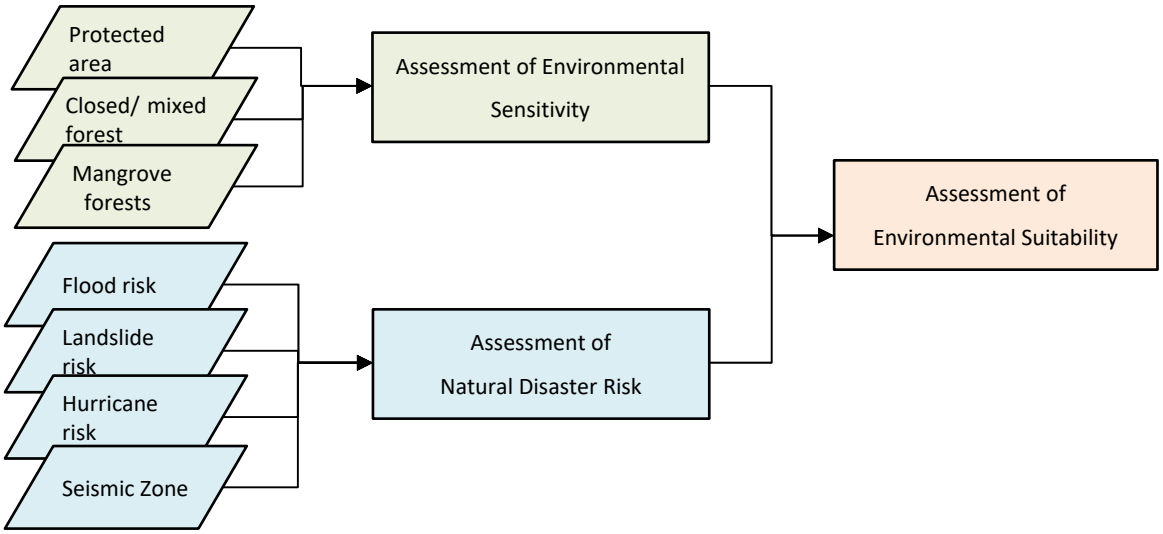
In the SEA process, GIS is used for the following activities.

1) For scoping: GIS produces "suitability maps" using natural, geographical, social, and economic data. GIS-based suitability maps inform areas that can be used for building transport infrastructure with small risks and adverse impacts.

2) For evaluation: GIS helps analyze the impacts to be caused by the proposed project, using the suitability maps from social, environmental, and risk aspects

(2) Methodology for the assessment of environmental suitability

Environmental suitability was assessed from environmental sensitivity and natural disaster risks using Spatial Multi-Criteria Analysis (SMCA). SMCA is a method used to consolidate geographic information using a scoring system to visualize the aggregated data. Steps for the assessment of environmental suitability are shown in Figure 2.3.17.



Source: JICA Study Team

Figure 2.3.17 Steps for the assessment of environmental suitability for SEA

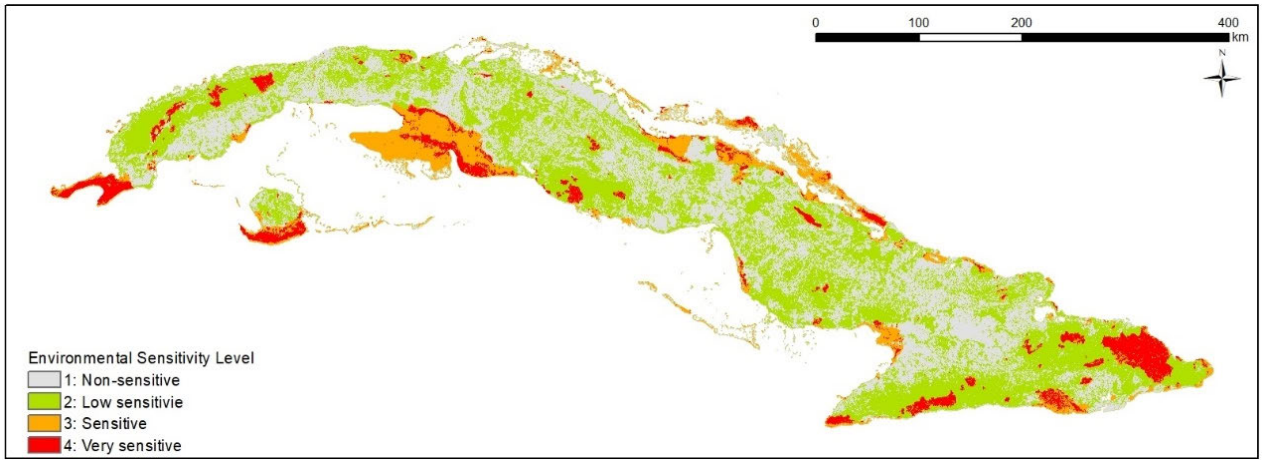
(3) Assessment of environmental sensitivity

Firstly, environmental sensitivity was assessed based on land cover, mangroves, and protected areas. Table 2.3.18 shows the scoring system for the environmental sensitivity analysis, and the result is shown in Figure 2.3.18.

Table 2.3.18 Environment sensitivity assessment scoring system

Features	Score				Weight	Remarks
	0 (low)	1	2	3 (high)		
Protected areas	-	-	-	Yes	2	All protected have high priority
Forest cover	Others	Open forest*1	Closed forest*2	-	1	Based on ESA land cover 2015
Mangrove	-	-	-	Yes	1	

Note: *1) Open forest = tree canopy > 70% / *2) Closed forest = top layer trees 15 – 70%
Source: JST



Source: JICA Study Team

Figure 2.3.18 Environmental sensitivity levels

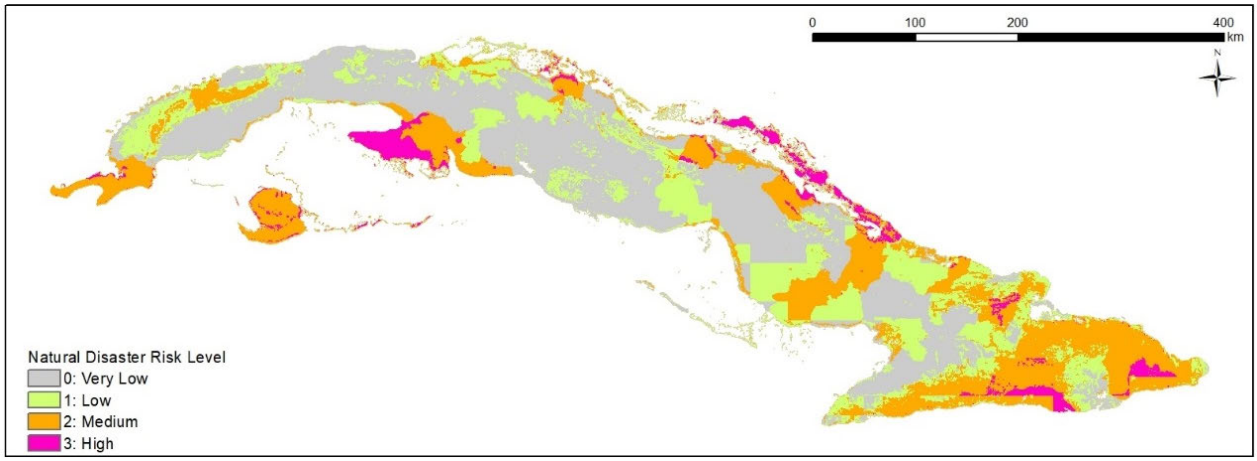
(4) Natural-disaster risk assessment

Secondly, the natural-disaster risk was assessed based on flood risk, landslide susceptibility, hurricane intensity, and seismic hazards. The scoring system for natural-disaster risk is shown in Table 2.3.19, and the result is shown in Figure 2.3.19.

Table 2.3.19 Scoring system for natural-disaster risk assessment

Features	Score				Weight	Remarks
	0 (low)	1	2	3 (high)		
Flood risk	-		-	High risk	1	
Landslide susceptibility	1	2	3	More than 4	1	From literature review
Past hurricane intensity	X<4	4<=X<9	9<=X<14	14<=X	2	From literature review
Seismic hazard (PGA, g)	<0.92	0.92<X<1.8	1.8<X<3.4	3.4<X<6.5	1	From literature review

Source: JICA Study Team



Source: JICA Study Team

Figure 2.3.19 Natural-disaster risk levels

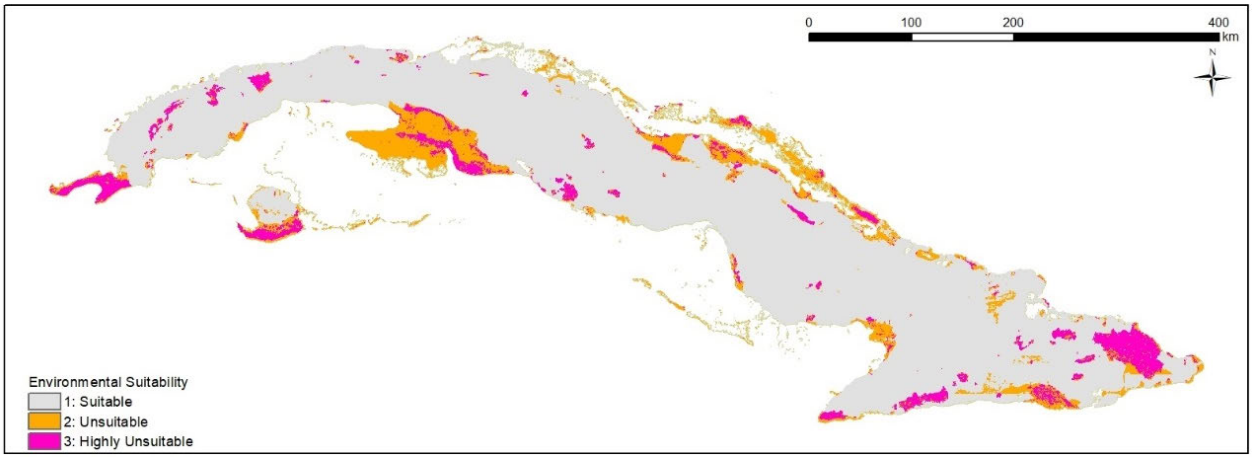
(5) Environmental suitability assessment

Finally, environmental sensitivity and natural disaster risk information were consolidated to produce environmental suitability maps for assessment. By overlaying four levels of environmental sensitivity with four levels of natural-disaster risk, the entire country was classified into 16 combinations, as shown in Table 2.3.20, then reclassified into three levels of environmental suitability, as shown in Figure 2.3.20.

Table 2.3.20 Environmental suitability reclassification table

Environmental suitability level		Environmental sensitivity level	Natural-disaster risk level
1	Suitable	Non-sensitive	Very low
2	Suitable	Non-sensitive	Low
3	Suitable	Non-sensitive	Medium
4	Unsuitable	Non-sensitive	High
5	Suitable	Low sensitive	Very low
6	Suitable	Low sensitive	Low
7	Suitable	Low sensitive	Medium
8	Unsuitable	Low sensitive	High
9	Unsuitable	Sensitive	Very low
10	Unsuitable	Sensitive	Low
11	Unsuitable	Sensitive	Medium
12	Unsuitable	Sensitive	High
13	Highly unsuitable	Very sensitive	Very low
14	Highly unsuitable	Very sensitive	Low
15	Highly unsuitable	Very sensitive	Medium
16	Highly unsuitable	Very sensitive	High

Source: JICA Study Team



Source: JICA Study Team

Figure 2.3.20 Environmental suitability assessment results

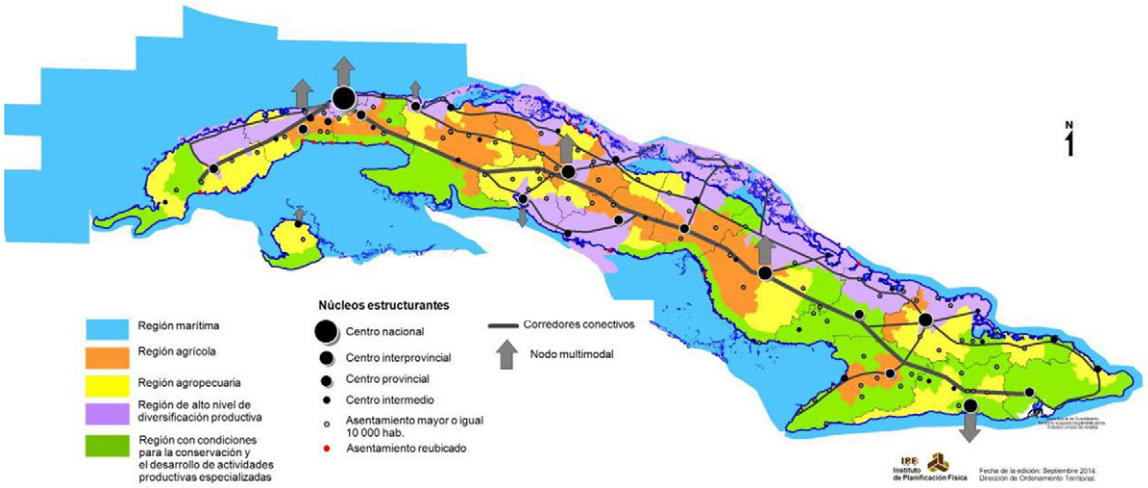
2.4 Spatial Development Framework

2.4.1 National Territorial Regulation Scheme (ENOT)

Cuba's spatial development plan, the "National Territorial Regulation Scheme" (ENOT), manages the country's spatial and land-use planning. ENOT is prepared to implement the Model[11] derived from the Guidelines.[12] ENOT is prepared by the Institution of Physical Planning (IPF) and relevant ministries, each responsible for their respective sectors. For the transport sector, MITRANS contributes to preparing documents, data, and analyses as key inputs to ENOT, which IPF then integrates with other sectors into one national spatial development plan.

ENOT is prepared in three stages:

- Preparatory Stage: focuses on the revision of existing data and evaluation based on the Guidelines.
- Planning Stage comprises two phases; the "Spatial[13] Information Phase" and the "Spatial Diagnosis Phase." In the transport sector, these works are conducted following 7 axes: 1) road infrastructure, 2) rail transport, 3) maritime transport, 4) automotive transport infrastructure, 5) cargo transport, 6) passenger transport, and 7) civil aviation. Development scenarios and spatial policies are prepared at the end of these two phases. In the latest ENOT, three scenarios – trend, contrasted, and desired – were examined through workshops organized by 5 aspects; economic, social, environmental, policy institutional, and external variable, from which 20 spatial policies were then determined.
- Management Stage: Based on the scenarios and policies, the "Spatial Physical Model of the Country to 2030" concludes with proposed development programs and subprograms following the spatial development policies prepared in the Planning Stage. After corresponding approvals, these proposed programs and subprograms should be implemented with the investment plans.



Source: INOTU (former IPF)

Figure 2.4.1 ENOT Land Use Model 2030

[11] Conceptualization of the Cuban Social and Economic Development Model
[12] Guidelines for the Economic and Social Policy
[13] Originally, in the documents of ENOT use "territorial", however, the JST employs "spatial" for taking account of the familiarity with planning terminology generally.

Figure 2.4.1 above shows that the land-use model includes five regions, considering potentialities, economic distribution, settlement, and infrastructure.

Table 2.4.1 Regions in ENOT Land Use Model 2030

Category	Description
Maritime Region	This category includes Exclusive Economic Zone. In this region category, a balanced spatial development, including tourism, gas oil extraction, fishery, and the protection of natural resources, is expected.
High Productivity Region	In this region category, diversified economic activities are expected via tourism and manufacturing, including Mariel, Havana, Cienfuegos, Trinidad, Varadero, and the northern part of Piñar del Rio to Holguin through Northern Cayeria.
Agricultural Region	This region category includes areas with the best soil and water resources, and agriculture is emphasized for agri-industrial production.
Agricultural/Livestock Region	The region is mainly crop and livestock land, focusing on food self-sufficiency.
Low Productivity Region	This region category includes protected areas, forests, mountainous areas, and environmentally vulnerable areas, including Vinales, Zapata, and the mountains of eastern Cuba.

Source: Study for the Territorial Regulation of Transport Infrastructure ENOT-MITRANS 2013-14

General land use in ENOT needs to be reflected in the "Provincial Territorial Regulation Scheme" (EPOT[14]) as a lower level of the spatial plan.

The latest ENOT was approved by the Council of Ministries in late 2018. However, details of the plan have not been released yet (as of June 2019).

2.4.2 Transport Sector in ENOT

The "Study for the Territorial Regulation of Transport Infrastructure ENOT-MITRANS 2013-14[15]" and the ENOT summary were published in February 2019. These two publications were used as the transport sector's input for developing ENOT.

The following are considered important developments and economic engines to achieve the general objectives of ENOT, which should be considered in formulating the transport master plan.

- Formation of the Mariel Special Development Zone.
- Consolidation and development of the gas-oil industry in the western region of the country
- Industrial development, mainly in the following five provinces: Artemisa, Mayabeque, Matanzas, Ciego de Avila, and Camaguey, as well as the cities of Matanzas and Cienfuegos, in the northern region of Holguín and the north of Piñar del Río.
- Consolidation of existing tourist spots in the country and development of new capacities in Varadero and the northern islands from Villa Clara to Camagüey as sun-and-beach tourism.
- Consolidation and development of productive centers corresponding with agricultural activity.
- Formation of programs associated with development; sugar cane, derivatives of the sugar industry, the food industry, and the fishing industry.
- Development of hydraulic activity.

[14] "Esquemas Provinciales de Ordenamiento Territorial"
[15] "Estudio para el Ordenamiento Territorial de las infraestructuras del transporte" ENOT-MITRANS, , 2013-14

- Development programs for construction materials.
- Develop housing policy and population distribution in response to economic development needs.

Along with the spatial policies, 32 programs and 59 subprograms were proposed in the transport sector by MITRANS. As shown in Table 2.4.2, some programs and subprograms indicate priority areas. These subprograms have an implementation time horizon, generally three target years; 2020, 2025, and 2030. These programs and subprograms should be well examined and reflected in the master plan.

Table 2.4.2 List of Proposed Projects for ENOT prepared by MITRANS

No.	Program	Subprogram	Priority Area	Charge	Period
1	Conservation and improvement of soils	Development of non-motorized agricultural transport	Plains of Cienfuegos, north of Villa Clara and Sancti Spíritus; the central part of the peninsula Camagüey-Holguín, the plateau of Nipe and the northeast central plain	MINAG MITRANS	2015-2020
		Specialized transport development for livestock	Not specified	MINAG MITRANS	2015-2020
2	Forestry program	Reforestation of highway medians, roads, and railways plus trees and gardening in the parterres in urban areas.	Not specified	MINAG MITRANS	2015-2030
		Improve transportation of loads in difficult-to-access mountain areas.	Not specified	MITRANS	2015-2030
3	Gas-oil program	Obtain methane gas for automotive fuel.	Havana-Matanzas corridor	MINEM MITRANS	2015-2025
4	Urban consolidation program	Redesign/relocate technical facilities and transport services in Havana, main cities (interprovincial and provincial centers), and intermediate centers (inter-municipal centers)	Interprovincial and provincial centers and inter-municipal centers	MITRANS IPF, INV	2014-2025
5	Mariel development program	Develop internal transportation systems of Mariel SDZ	Mariel Special Development Zone	DIP Mariel MITRANS	2014-2025
6	Develop special zones in the preferred tourist use program	Develop internal transport systems in Special Zones for tourist use	Guanahacabibes, Habana, Varadero, Sabana, Camagüey, North of Holguín and Costa South (Cienfuegos-Trinidad corridor)	MINTUR CITMA MITRANS	2015-2030
7	Industrialization of agricultural products	Develop cargo transport systems for agricultural producers and their processing industries	Artemisa, Mayabeque, Matanzas, Ciego de Ávila and Camagüey	MINAL MINDUS MINAG MITRANS	2015-2025

No.	Program	Subprogram	Priority Area	Charge	Period
8	Rice program	Develop cargo transport systems for poles dedicated to rice and its processing.	Piñar del Río, south of Sancti Spíritus and Camagüey, and in Granma	MINAG MITRANS	2015-2025
9	Sugarcane program	Replace/modernize vehicles for cargo transport in the sugar sector	Not specified	MITRANS AZCUBA	2015-2030
10	Forestry program	Modernize and maintain lumber vehicles	Piñar del Río	MINAG MITRANS	2016-2020
11	Fishing productions program	Promote transport of general and specialized cargo for aquaculture	Piñar del Río, Villa Clara, Sancti Spíritus, Camagüey, Granma, Santiago de Cuba	MINAL MITRANS	2015-2025
12	Develop fluvial, lacustrine, auxiliary, and related maritime transport	Integral development of fishing ports and specialized vessels	Not specified	MINAL MITRANS	2015-2025
		Naval construction and repair	Not specified	MITRANS MINAL MINTUR	2015-2030
13	Conservation of cultural and natural heritage.	Replace/modernize fleet of light vehicles and buses for the transport of tourists, their auxiliary and related services	World Heritage Sites in Piñar del Río, Habana, Cienfuegos, Sancti Spíritus, Camagüey, Holguín, Granma, Santiago de Cuba and Guantánamo	MINTUR MITRANS	2015-2020
14	Develop nautical industry	Develop port infrastructure	Guanahacabibes	MINTUR MITRANS	2016-2030
15	Develop maritime transport, etc.	Establish/expand logistics base with attention to cruise ships and ferries	Ports of Havana, Cárdenas, Cienfuegos, Nuevitas, Antilla, Santiago de Cuba and Casilda	MINTUR MITRANS	2015-2020
16	Create infrastructure for a gradual introduction of sustainable fuels	Assimilation of fuels, alternatives in transport, vehicle, railway, maritime, and air	Not specified	MINEM MITRANS	2016-2020
17	National railway system	Construct new railway sections in the country's development areas	Main 10 corridors	MITRANS	2015-2025
		Elimination of no less than 10% of level crossings on railway mainlines		MITRANS	2016-2030
		Modernize main rail lines		MITRANS	2016-2025
		Complete overpasses on Central Line in Havana - Santa Clara section		MITRANS	2015-2020
		Establish protection systems for level crossings		MITRANS	2015-2030

No.	Program	Subprogram	Priority Area	Charge	Period
18	Modernize/expand logistics infrastructure at main multimodal nodes	Establish/consolidate logistics infrastructure of Mariel multimodal node	Multimodal node: Mariel Main multimodal nodes: Havana, Santa Clara, Camagüey, and Santiago de Cuba Secondary nodes: Piñar del Río, Artemisa, San José de las Lajas, Matanzas, Jovellanos, Cienfuegos, Sancti Spíritus, Ciego de Ávila, Nuevitas, Las Tunas, Holguín, Bayamo, Alto Cedro and Guantánamo	MITRANS	2015-2025
		Develop main and secondary multimodal nodes		MITRANS	2015-2030
		Create a database of the National Logistic Plan		MITRANS	2016-2020
		Reorganize/develop existing facilities for the comprehensive technical assurance of road transport		MITRANS	2015-2020
		Assimilate new rescue, overhaul, maintenance, and repair services for transport and equipment		MITRANS	2015-2025
19	Develop maritime transport	Development of cabotage	Not specified	MITRANS	2015-2030
		Port rehabilitation	Not specified	MITRANS	2015-2030
20	Airport infrastructure development	Modernize/expand airport services nationwide	10 international airports	MITRANS	2015-2030
		Restructure national routes, passenger/cargo flows		MITRANS	2016-2025
21	Urban improvement program (elderly and cancer care and cultural facilities)	Increase, replace and modernize light motor vehicles and buses for passenger transport	Not specified	MITRANS	2015-2020
		Increase transport accessibility for those with mobility issues	Not specified	MITRANS	2015-2025
22	Existing settlement program with growth potential	Create transport infrastructure in areas with growth potential	Not specified	MITRANS	2016-2030
		Create transport infrastructures with induced migrations	Ciego de Ávila, Camagüey and Cienfuegos	MITRANS	2016-2030
		Create transport infrastructure in places where developments of national importance occur, esp. in regions with a high level of productive diversification	Not specified	MITRANS	2015-2025
23	Development of Havana	Transportation development in the Capital	Havana	MITRANS, IPF, MEP, DPT	2015-2030
24	Integral development of municipalities	Transport development in interprovincial centers	Santiago de Cuba, Santa Clara, Camagüey, Holguin	MITRANS, IPF, MEP, DPT	2016-2030

No.	Program	Subprogram	Priority Area	Charge	Period
25	Urban improvement program	Transport development in interprovincial centers	Guanajay, San Antonio de los Baños, Cárdenas, Caibarién, Trinidad, Morón, Nuevitas, Moa, Manzanillo, Baracoa and Nueva Gerona	MITRANS, IPF, MEP, DPT	2016-2030
26	Urban consolidation program	Transport development in 14 depressed intermediate centers	Sandino, San Cristóbal, Güines, Santa Cruz del Norte, Colón, Jagüey Grande, Sagua la Grande, Jatibonico, Florida, Puerto Padre, Banes, Mayarí, Palma Soriano, and Boatswain; and promote 7 other settlements to strengthen this territorial function: Consolación del Sur (Piñar del Río), Bauta (Artemisa), Jovellanos (Matanzas), Guáimaro (Camagüey), Colombia (Las Tunas), Niquero (Granma) and San Antonio del Sur (Guantánamo)	MITRANS, IPF, MEP, DPT	2016-2030
		Develop cabotage		MITRANS	2015-2030
27	Development of public transport services for inter-municipal and municipal passengers	Implementation of Biran Project results	Municipal subcenters	MITRANS	2015-2030
		Consolidate bus/train intermodal transfers		MITRANS	2015-2025
		Establish new passenger transport systems in mountainous areas		MITRANS	2016-2025
		Design new passenger transport systems in the central and eastern area		MITRANS	2016-2025
		Modernize auxiliary and related services network		MITRANS	2016-2025
28	Road system development program	Reconstruct/extend National Highway to Ciego de Ávila	National Highway to Ciego de Avila	MITRANS	2016-2020
		Construct unfinished sections of National Hwy.	National Highway	MITRANS	2016-2025
		Creation of continuous expressway: Camagüey to Santiago de Cuba	Camagüey to Santiago de Cuba	MITRANS	2020-2030
		Improve the technical status of the road network with priority in agricultural/livestock regions.	Not specified	MITRANS	2015-2030
		Repair/modernize roads in mountainous areas	Not specified	MITRANS	2015-2025

No.	Program	Subprogram	Priority Area	Charge	Period
		Improve technical parameters of roads in central and eastern regions	Not specified	MITRANS	2016-2025
		Repair urban road network	Not specified	MITRANS	2015-2030
29	Development of maritime transport	Integral subprogram in the maritime passenger transport	Sea/rivers in Artemisa, Havana, Mayabeque, Villa Clara, Cienfuegos, Las Tunas, Holguin, Granma, Santiago de Cuba, Guantanamo, Isla de la Juventud	MITRANS	2016-2030
30	Climate change adaptation program	Infrastructure/ transport services in Villa Clara, other relocated areas	The southern coast of Artemis and Mayabeque and the northern coast of Villa Clara	MITRANS IPF	2016-2025
31	Environmental pollution/ decontamination of bays	Control and elimination of pollutant sources from transport	Not specified	MITRANS CITMA	2015-2030
32	Improve land use and urban planning	Develop transport infrastructure info. system	Not specified	MITRANS IPF	2015-2025

Source: JICA Study Team based on ENOT

2.5 Institutional and Regulatory Framework

2.5.1 Legal System

As the highest legal norm, the 2019 Constitution suggests the direction of the sector. Principal legislation for the transport sector is issued by either the National Assembly of People's Power (ANPP), the Council of State, or the Council of Ministers. The Foreign Investment Act affirms the promotion and protection of foreign investment in the transport sector.

(1) Constitution

The 2019 Constitution declares that Cuba is to remain a socialist state guided by Marxism-Leninism; it also claims to be guided by the examples of José Martí and Fidel Castro. The constitutional reforms that have materialized the new constitution are part of the attempt to modernize the Cuban government.

The 2019 Constitution informs the recognition of several forms of property ownership, including "socialist," "cooperative," "non-state," and "mixed." Socialist property refers to ownership by the state in the name of the people and includes most businesses and industries. Cooperative property is owned collectively by members. Finally, non-state property, which used to be prohibited, is recognized to be held by individuals, including Cuban citizens or foreign businesses, and is delegated a complementary role in the economy. Among other constitutional reforms are:

- Restoration of the positions of President and Prime Minister of Cuba, as posts separated from President of the Council of State;

- Transfer of head of Council of State to the President of the ANPP;
- Position of Lieutenant Governor being added to that of the president of a municipal assembly;
- Creation of a requirement for Presidential-appointed Provincial Governors and Deputy Governors to be ratified by local People´s Power Municipal Assemblies;
- Acknowledgment of climate change and its threat;
- Creation of a two consecutive five-year term limit imposed on high-level positions;
- Extending the terms of municipal council delegates to five years; and
- Prohibiting discrimination based on gender, race, ethnic origin, sexual orientation, or disability.

(2) Sources of Law

The ANPP is empowered to issue laws (*leyes*). The Council of State has the authority to promulgate decree-laws (*decretos-leyes*) between sessions of the ANPP. The Council of Ministers issues decrees (*decretos*) to implement laws and decree-laws. Laws, decree-laws, and decrees are general and in scope. There is a series of regulatory instruments that Cuban state organs utilize for administrative purposes. National, provincial, and municipal government bodies in Cuba have the constitutional authority to regulate the organization and functioning of the areas within their jurisdictional competence. The regulatory instruments utilized for this purpose include agreements (*acuerdos*), regulations (*reglamentos*), resolutions (*resoluciones*), instructions (*instrucciones*), orders (*órdenes*), and circulars (*circulares*).

All laws and related provisions must be published in the Official Gazette: this includes resolutions and regulations of general interest; decree-laws of the Council of State; decrees, resolutions, and regulations issued by the Council of Ministers; laws of the ANPP; and instructions, resolutions, and agreements of the Governing Council of the People's Supreme Court. Laws enter into force on the date determined by the laws themselves when they are disclosed in the Official Gazette.

(3) Transport Legislation

Fundamental laws and decree-laws dealing with land, sea, and aerial transport of passengers and cargo transport include:

1. Decree-Law No. 168 of 1996 on transportation operation licensing
2. Law No. 109 of 2010 on the road safety code
3. Decree-Law No. 348 of 2017 on railways
4. Decree-Law No. 230 of 2002 on ports
5. Decree-Law No. 115 of 2013 on maritime, fluvial, and lacustrine navigation
6. Decree-Law No. 255 of 2007 on civil aviation
7. Law No. 1218 of 1968 on the flight over the national territory

(4) Foreign Investment Legislation

The primary legal framework governing foreign investments in Cuba is set out in the Foreign Investment Act (Law No. 118 of 2014). This act supersedes and repeals the previous Law No. 77 of 1995 on foreign investment. Furthermore, detailed rules applicable to the operations of foreign investment measures are contained in the generally applicable legislation dealing with matters such as labor, construction,

insurance, banking, and others, as well as the Cuban Civil Code and the Commercial Code. In addition, the general tax rules are set out in Law No. 113 of 2012 on the taxation system.

The Foreign Investment Act provides essential investment protection and other general rules relevant to foreign investors, including:

- Foreign investments will enjoy protection and security and may not be expropriated unless such action is executed for reasons of public or social interest, in accordance with the Constitution, the international treaties signed by Cuba, and the legislation in force, with appropriate compensation for their commercial value established by mutual agreement.
- The State will guarantee the free transfer abroad, in freely convertible currency, free from taxes or other fees, of the dividends or profits obtained by the foreign investor.
- The foreign investor can sell or transfer his rights to the State, the parties of the economic association, or to a third party, provided the government previously authorizes this.
- Foreign investment will be subject to the special tax regime established in the Act until the deadline for this special tax regime is due.

The Foreign Investment Act classifies foreign investments into the following two types:

- Direct investments: where the foreign investor participates as a shareholder in a given project, thus participating actively in the management of the project.
- Indirect (financial) investments: where the foreign investor invests in equities or other securities or bonds, either public or private, without any active contribution to the project management.

This law recognizes three main modalities for foreign investments in Cuba:

1. Joint venture company (JV):
   JV is the most common type of company in foreign investment in Cuba. It represents a company opened in Cuba with a minimum of one local partner and at least one foreign investor. A JV company has limited liability and registered shares. The management of JV companies is generally overseen by a board of directors, consisting of members named by each shareholder according to the shareholdings. Usually, it is possible to approve that certain positions in the upper management will be occupied by foreign managers named by the foreign investor. A JV company may establish offices, representations, branch offices, and subsidiaries within Cuba and abroad and participate in entities abroad.

2. International economic association contract (IEAC):
   According to the Foreign Investment Act, the second most common type of company that can be set up in Cuba is an IEAC, which represents an unincorporated partnership founded by a contract between two or more Cuban partners and foreign investors. An IEAC establishes the mutual goals and the particular rights and obligations of all parties regarding the common activities which will be carried out, however, it does not establish a separate legal body, with each partner continuing to act always in their name. An IEAC includes the risk contract for exploring nonrenewable natural resources, construction, agricultural production, hotel, production or services management, and the contract for professional services.

3. Full foreign ownership company:
   In a full foreign ownership company, the foreign investor manages the business by themselves, responsible for all the obligations enforced by the governmental approval that authorizes the company's activities. A complete foreign ownership company can be established in the form of either (i) a person who acts in her/his name, (ii) a share company incorporated under the Cuban legislation that is owned entirely by a foreign investor, or (iii) a branch office of a foreign business.

All sectors of the Cuban economy are open to foreign investments under the Foreign Investment Act, except for (i) health, (ii) education, and (iii) the armed forces. The law defines eleven (11) priority sectors for foreign investments:

1. Transport
2. Construction
3. Agriculture and forestry
4. Food industry
5. Energy and mining
6. Sugar industry
7. Light, chemical, and electrical industries
8. Pharmaceutical industry
9. Wholesale trade
10. Healthcare (in relation to the export of health services and tourism)
11. Tourism

The Mariel Special Development Zone is located to the west of Havana city and constitutes a space in the national territory that is not delimited within the customs boundaries and in which special policies and regimes are applied to promote foreign trade and investments. The foreign investment to be established in the zone is regulated by Decree-Law No. 313 of 2013.

Both the Foreign Investment Act (Law No. 118 of 2014) and the Mariel Special Development Zone Law (Decree-Law No. 313 of 2013) contain particular rules applicable to the taxation of Cuban income earned by foreign investors, such as the following taxes:

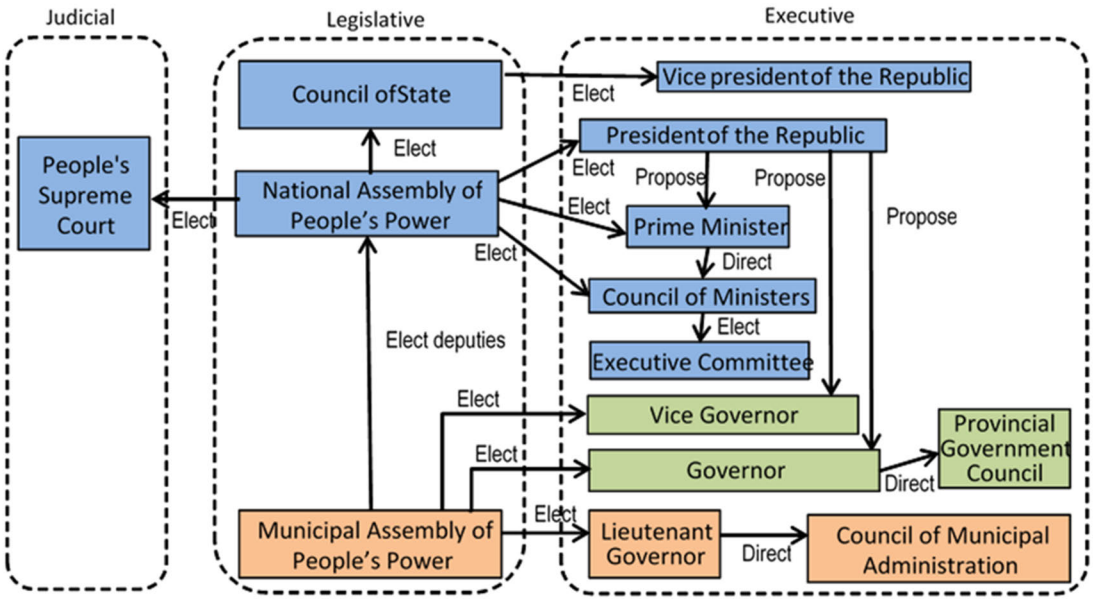
1. Corporate tax
2. Payroll tax
3. Social security contribution
4. Customs duties
5. Services tax
6. Wholesale goods tax
7. Territorial contribution to local development
8. Tax on the use and exploitation of forestry and wild fauna
9. Land transportation tax
10. Document tax
11. Withholding tax
12. Personal income tax

2.5.2 Institutional Framework

(1) Government Structure

The 2019 Constitution implemented changes in political structures at the state and local levels, such as the creation of the President of the Republic, the Vice President, and the Prime Minister. Those new positions were filled by elections in 2019 according to the Electoral Act (Law No. 127 of 2019). Figure 2.5.1 shows the new government structure.

Before October 2019, the Government of Cuba was divided into three essential organs: the National Assembly of People's Power (ANPP), the Council of State, and the Council of Ministers. After October 2019, the Council of State is part of the ANPP, and the President, Vice President, and Secretary are the same persons for both organs. In addition, the President of the Republic and the Prime Minister are key positions that the 2019 Constitution newly defines.



Source: JICA Study Team compilation based on Feb 2020 situation

Figure 2.5.1 Government Structure in Cuba

1) National Assembly of People's Power (ANPP)

The ANPP is the supreme organ of the power of the state and controls the constitutive and legislative power, as well as being endowed with the capacity to choose the components of the executive and judicial authorities and those of complementary organs. The ANPP is composed of representatives elected through a vote of electors, in proportion and according to the procedure determined by the law. A given part of the deputies is directly appointed by the ANPP, according to the state interests. Duties assigned to the ANPP are to:

1. Agree upon reforms to the Constitution
2. Issue a general and obligatory interpretation of the Constitution and the laws
3. Approve, modify, or derogate the laws and submit them, in necessary cases, to the prior consultation of the people

4. Adopt agreements in correspondence with the laws in force and ensure and monitor their enforcement
5. Ensure the constitutionality of the laws
6. Ratify decrees with the force of law and agreements of the Council of State
7. Revoke decrees with the force of law, presidential decrees, decrees, agreements, and general provisions that contradict the Constitution or the laws
8. Revoke the agreements or rulings of the Municipal Assemblies of the People's Power (AMPP) that violate the Constitution, the laws, the decrees with the force of law, the presidential decrees, decrees, and other provisions
9. Discuss and approve the general objectives and methods of the annual plans as well as the country's short-, medium- and long-term social and economic development plans
10. Approve the principles of the management system of economic and social development
11. Discuss and approve the budget of the State and monitor compliance with it
12. Arrange the monetary, financial, and fiscal systems
13. Establish, modify, or terminate taxes
14. Approve the general guidelines of the country's internal and external relations
15. Declare War, at the proposal of the President of the Republic
16. Establish and modify the political-administrative division; approve regimes of administrative subordination, special systems of regulation for municipalities or other territorial demarcations, as well as the administrative districts
17. Appoint permanent or temporary commissions and friendly parliamentary groups
18. Exercise the highest levels of supervision over the organs of the State
19. Familiarize itself with and evaluate the reports and analyses of the State business systems
20. Familiarize itself with, evaluate, and adopt decisions regarding the accountability reports presented to it by the Council of State, the President of the Republic, the Prime Minister, the Council of Ministers, the People's Supreme Court, the Attorney General of the Republic, the Comptroller General of the Republic, and the organizations of the Central Administration of the State, as well as of the provincial governments
21. Create or terminate the organizations of the Central Administration of the State or arrange any other organizational method
22. Grant amnesty
23. Arrange for the convocation of referendums or plebiscites
24. Agree upon its regulation and that of the Council of State

As indicated in the ninth duty above, **the National Transport Master Plan should be reviewed and approved by the ANPP** after submitting its final report to the Council of Ministers.

2) Council of State

The Council of State is the state's highest decision-making body that acts, representing the ANPP between the ordinary sessions of the ANPP. The Council of State comprises the President, the Vice President, the Secretary of the ANPP, and other members. Members of the Council of Ministers cannot be members of the Council of State. Powers with which the Council of State is invested include to:

1. Ensure the implementation of the Constitution and the laws
2. Give a general and obligatory interpretation, in necessary cases, for the laws in force
3. Issue decree-laws with the force of law and agreements
4. Arrange for the holding of extraordinary sessions of the ANPP
5. Agree upon the date of the elections and convene the periodic renovation of the ANPP and the AMPPs
6. Analyze the legal proposals submitted for the consideration of the ANPP
7. Mandate the implementation of the agreements of the ANPP
8. Suspend the presidential decrees, decrees, agreements, and other provisions that contradict the Constitution and the laws
9. Suspend the agreements and decrees of the AMPPs that do not comply with the Constitution or the laws
10. Revoke or modify the agreements and other orders of the provincial governors or councils that contradict the Constitution and the laws
11. Choose, designate, suspend, revoke, or substitute, between periods of the ANPP's sessions, the individuals that may occupy the roles that the ANPP is responsible for deciding, with the exception of the President and Vice President of the Republic, the President, Vice President, and Secretary of the ANPP, the members of the Council of the State, and the Prime Minister.
12. Assume, upon the proposal of the President of the Republic, the powers to declare War
13. Give instructions of a general character to the courts through the Council of Government of the People's Supreme Court
14. Create legislative committees
15. Ratify and renounce international treaties
16. Designate and remove, upon the proposal of the President of the Republic, the chiefs of Cuba's diplomatic missions within other states
17. Exercise the monitoring and supervision of the organs of the State
18. Create or terminate organizations of the Central Administration of the State or arrange any other organizational means during the periods that take place between the sessions of the ANPP
19. Approve the methods of foreign investment
20. Examine and approve, between periods of the ANPP, the adjustments that are necessary to realize the budgetary provisions of the State
21. Coordinate and guarantee the activities of the representatives and the permanent or temporary working commissions of the ANPP

3) Council of Ministers

The Council of Ministers is the highest executive and administrative organ, composed of the Prime Minister, the Deputy Prime Ministers, the Ministers, the Secretary, and other members. Among them are ministers and presidents of all the 22 ministries of Cuba and four (4) important public entities, as shown in Table 2.5.1 below.

Table 2.5.1 Members of the Council of Ministers

1. Ministry of Education
2. Ministry of Finance and Prices
3. Ministry of Labor and Social Security
4. Ministry of Science, Technology, and Environment
5. Ministry of the Revolutionary Armed Forces
6. Ministry of Interior
7. Ministry of Foreign Affairs
8. Ministry of Construction
9. Ministry of Transport
10. Ministry of Foreign Trade and Foreign Investment
11. Ministry of Tourism
12. Ministry of Agriculture
13. Ministry of Industries
14. Ministry of Higher Education
15. Ministry of Food Industry
16. Ministry of Internal Trade
17. Ministry of Economy and Planning
18. Ministry of Public Health
19. Ministry of Energy and Mines
20. Ministry of Communications
21. Ministry of Culture
22. Ministry of Justice
23. Central Bank of Cuba
24. Cuban Institute of Radio and Television
25. National Institute of Sports, Physical Education, and Recreation
26. National Institute of Hydraulic Resources

Source: JICA Study Team

The Executive Committee is composed of the Prime Minister, the Deputy Prime Ministers, the Secretary, and other members of the Council of Ministers. The Executive Committee makes decisions regarding the questions sent to the Council of Ministers during the periods between its sessions. Duties assigned to the Council of Ministers include to:

1. Comply with and ensure compliance with the Constitution and the laws
2. Organize and direct the execution of the political, economic, cultural, scientific, social, and defense activities agreed upon by the ANPP
3. Propose the general goals and objectives for the development of the State's short, medium, and long-term social and economic development plans of the State, and, once the ANPP has approved them, organize, direct, and monitor their execution
4. Approve and submit international treaties for the ratification of the Council of State
5. Direct and monitor foreign commercial relations as well as foreign investment
6. Prepare the budget of the State and, once approved by the ANPP, ensure its execution
7. Implement and demand compliance with the approved objectives in order to strengthen the monetary, financial, and fiscal systems
8. Prepare legislative proposals and submit them for the consideration of the ANPP or the Council of State
9. Provide for the national defense, the maintenance of internal security and order, and the protection of citizens' rights, and safeguard lives and property in case of disaster

10. Direct the administration of the State, unify, coordinate, and supervise the activity of the organizations of the central administration of the State, the national entities, and the local administrations
11. Evaluate and adopt decisions regarding the reports provided by the provincial governments
12. Create, modify, or terminate subordinate or appointed entities of the Council of Ministers
13. Orient and monitor the management of the provincial governors
14. Approve or authorize the appropriate forms of foreign investment
15. Execute the laws and agreements of the ANPP, as well as the decree-laws of the Council of State, decrees of the Council of Ministers, and presidential decrees, and, in necessary cases, regulate them
16. Issue decrees and agreements with a foundation in compliance with the laws in force and monitor their implementation
17. Propose to the Council of State the suspension of the agreements of the AMPPs that contravene the law and other policies in force or that affect the interests of other communities or the general interest of the country
18. Suspend the agreements and other policies of the councils of the municipal administrations that are not in accordance with the Constitution or other laws, or when they affect the interests of other localities or the general interests of the country, report to the Council of State or the ANPP
19. Revoke the policies issued by provincial governors when they contravene the Constitution, other laws, or those that affect the interests of other localities or the general interests of the country
20. Revoke the policies of the chiefs of the State's central administration organizations when they contravene the higher norms that they are obligated to comply with
21. Create the commissions deemed necessary to facilitate compliance with the tasks assigned to it
22. Designate or substitute leaders and functionaries
23. Submit its statutes for the approval of the ANPP or the Council of State

The JICA Study Team notes, as indicated in the third duty above, that the Council of Ministers should propose the National Transport Master Plan to the ANPP; it is also the Council of Ministers' duty to organize, direct and monitor its execution.

4) President of the Republic

The President of the Republic is the head of state and is elected by the ANPP from among its representatives, reports to the ANPP, and is responsible for the management of the ANPP. Duties of the President of the Republic include to:

1. Comply with and ensure respect for the Constitution and the laws
2. Represent the State and direct its general policies
3. Direct in matters related to foreign policy, relations with other states, and with regard to the defense and security of the nation
4. Sign the laws emitted by the ANPP, and arrange for their publication in the Official Gazette

5. Present to the ANPP, upon election by this body, the members of the Council of Ministers
6. Propose to the ANPP or the Council of State designation, suspension, revocation, or substitution of persons occupying the roles of the Prime Minister, the President of the People's Supreme Court, the Attorney General of the Republic, the Comptroller General of the Republic, the President of the National Electoral Council, and the members of the Council of Ministers
7. Propose to the appropriate delegates of the AMPPs the election or revocation of provincial governors and deputy governors
8. Familiarize himself with, evaluate, and adopt decisions regarding the reports presented by the Prime Minister documenting his management, as well as those of the Council of Ministers, or those of the Executive Committee
9. Discharge the duties of the Commander in Chief of the armed forces and determine their general organization
10. Preside over the Council of National Defense and propose to the ANPP or to the Council of State to declare War
11. Order a general mobilization when the defense of the country requires it, as well as declare a state of emergency or a situation of a disaster, giving notice of the decision to the ANPP or the Council of State in the event that they may not be convened, the proper legal remedies will be applied
12. Promote in rank and role the top officials within the hierarchy of the military institutions of the nation and order their cessation
13. Decide on the granting of Cuban citizenship, accept renunciations, and issue orders regarding the loss of Cuban citizenship
14. Propose the suspension, modification, or revocation of the orders and agreements of the organs of the State that contradict the Constitution or the laws or that affect the general interests of the country
15. Issue presidential decrees and other orders
16. Create commissions or temporary working groups for the realization of specific projects
17. Propose to the Council of the State the designation or removal of the chiefs of Cuba's diplomatic missions within other States, organs, or international organizations
18. Concede or retract the rank of the ambassador of Cuba
19. Grant decorations and honorific titles
20. Grant or deny the approval of heads of diplomatic missions from other States
21. Receive the credentials of the chiefs of foreign missions. The Vice President may assume this function in exceptional circumstances
22. Grant pardons and request concessions of amnesty from the ANPP
23. Participate by his right in the meetings of the Council of State and convene them
24. Preside over the meetings of the Council of Ministers or the Executive Committee

5) Prime Minister

The Prime Minister is the head of the government of Cuba and is designated by the ANPP upon the proposal of the President of the Republic. The Prime Minister is responsible before the ANPP and the

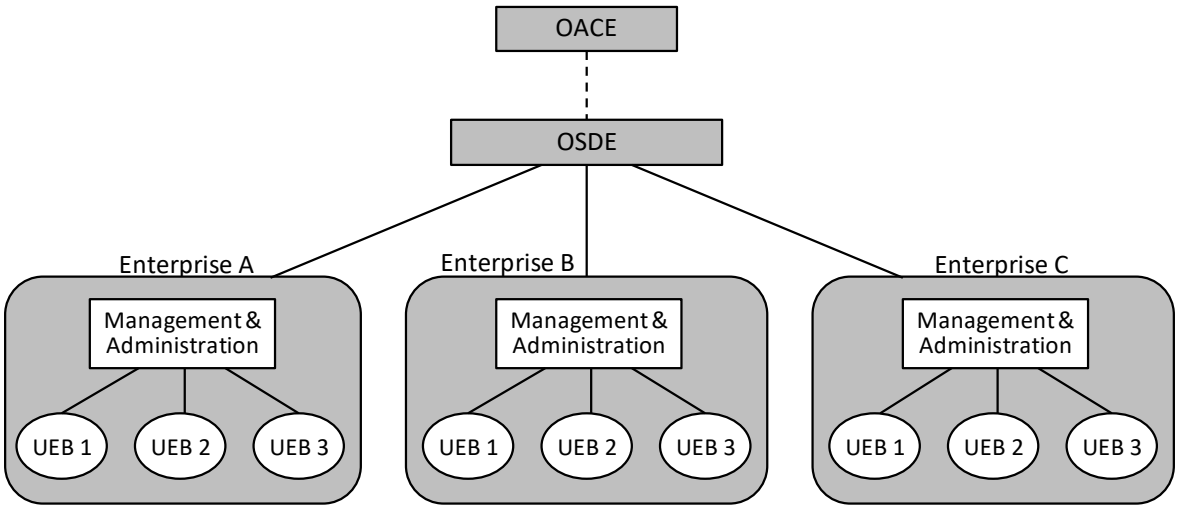
President of the Republic, to whom the Prime Minister must report and inform of his activities, those of the Council of Ministers or its Executive Committee. Duties corresponding to the Prime Minister include to:

1. Comply with and ensure respect for the Constitution and the laws
2. Represent the Government of the Republic
3. Convene and direct the sessions of the Council of Ministers or its Executive Committee
4. Attend to and monitor the performance of the activities of the State's central administration organizations, the national entities, or the local administrations
5. Assume temporarily and under extraordinary circumstances, the direction of any of the State's central administration organizations
6. Notify the President of the Republic when the pertinent organizations are interested in replacing members of the Council of Ministers and, in each case, propose the corresponding replacement
7. Monitor the labor of the heads of the State's central administration organizations
8. Deliver instructions to the provincial governors and monitor their implementation
9. Adopt, in exceptional circumstances, decisions regarding the executive-administrative issues within the competency of the Council of Ministers when the urgent character of the situation or the issue to solve require it, informing this body or its Executive Committee of the decision
10. Designate or substitute leaders or functionaries
11. Sign legal orders adopted by the Council of Ministers or by its Executive Committee and make them available by publication in the Official Gazette
12. Create commissions or temporary working groups for the realization of specific projects

(2) State Enterprise System

Cuba's policy of Enterprise Improvement (*Perfectionamiento Empresarial*) is a continuous process to improve the internal management of state enterprises, aiming for high performance in producing goods or providing services. The basic concept of Enterprise Improvement is self-sustenance, where a state enterprise covers its expenses with its income while yielding profits through increased efficiency and effectiveness. To realize this, the enterprise is granted autonomous powers to establish policies and make decisions. The history of Enterprise Improvement dates back to the 1990s when it was applied to a limited number of state enterprises as an experiment. With successful results, it was later legalized and extended to the much wider state enterprise system. The latest legislation is Decree-Law No. 334 of 2017, Decree 334, Decree 335, and Decree 336, in which fundamental organs and the management system applied in Enterprise Improvement are redefined.

Figure 2.5.2 shows the basic structure of the state enterprise system linked with its superior organ. Along the bottom, there are state enterprises; within each enterprise, there are Grassroot Business Units (UEB). Each enterprise also has a non-UEB sphere, most of which are management and administration sections. Finally, there is a Superior Organization of Enterprise Management (OSDE) to attend multiple enterprises. OSDEs are attended by the ministry in charge of the sector, one of the State Central Administration Bodies (OACE) and they re subordinated to the Council of Ministers.



Source: JICA Study Team

Figure 2.5.2 Linkages in State Enterprise System

1) Superior Organization of Enterprise Management (OSDE)

A Superior Organization of Enterprise Management (OSDE) is created from a need to separate state functions from business in the state enterprise system. Under an OSDE, multiple state enterprises with technological and productive similarities are bundled and subject to an integrated management system. Among the reasons for creating OSDEs, it allows the member enterprises to have greater strength to enter the market, connect themselves productively, and obtain better development strategies. Thus, OSDEs must coordinate inter-ministerial issues and properly transmit state demands and policies to their affiliated enterprises.

An OSDE has an independent judicial personality, and contributions from member enterprises finance its expenses. There are two modalities an OSDE can bundle its subordinated enterprises. One is the "Group", under which enterprises with different technological structures, production, services, and marketing are affiliated. The other is "Union", where enterprises with high interrelation and dependence on each other are affiliated. According to the October 2019 National Statistics, there are 75 OSDEs by sector, of which MITRANS attends four. Of those four, the group type OSDEs are the GEA, the GEMAR, and the CACSA. Only the UFC is a union-type OSDE.

2) Enterprise

Enterprise refers to a state entity with judicial disposition, independent financial balance, and autonomous economic, financial, organizational, and contractual management. An enterprise is created for the technical, economic, and commercial management of the production of goods and services. According to the October 2019 National Statistics, there are 2,011 enterprises across sectors, of which 87 are attended, through their OSDEs, by MITRANS.

3) Grassroot Business Unit (UEB)

The Grassroot Business Unit (UEB) is a segment or internal division that the enterprise or the OSDE can create. A UEB is designed to organize and perform production processes of goods and services; it does not have its judicial disposition but is granted relative independence, being still subordinated to

the general director of the enterprise. A UEB's business line should be consistent with one assumed by the enterprise or the OSDE, thus can be a basic unit, factory, division, branch, project management team, brigade, or other types of agglomeration.

4) State Central Administration Body (OACE)

The State Central Administration Body (OACE) includes 26 members of the Council of Ministers. In the State Enterprise System context, an OACE is a competent authority overseeing OSDEs whose business falls under its counterpart realm. Such a role of competent authority over OSDEs can also be assumed by the Council of Ministers, which is not included in the OACE.

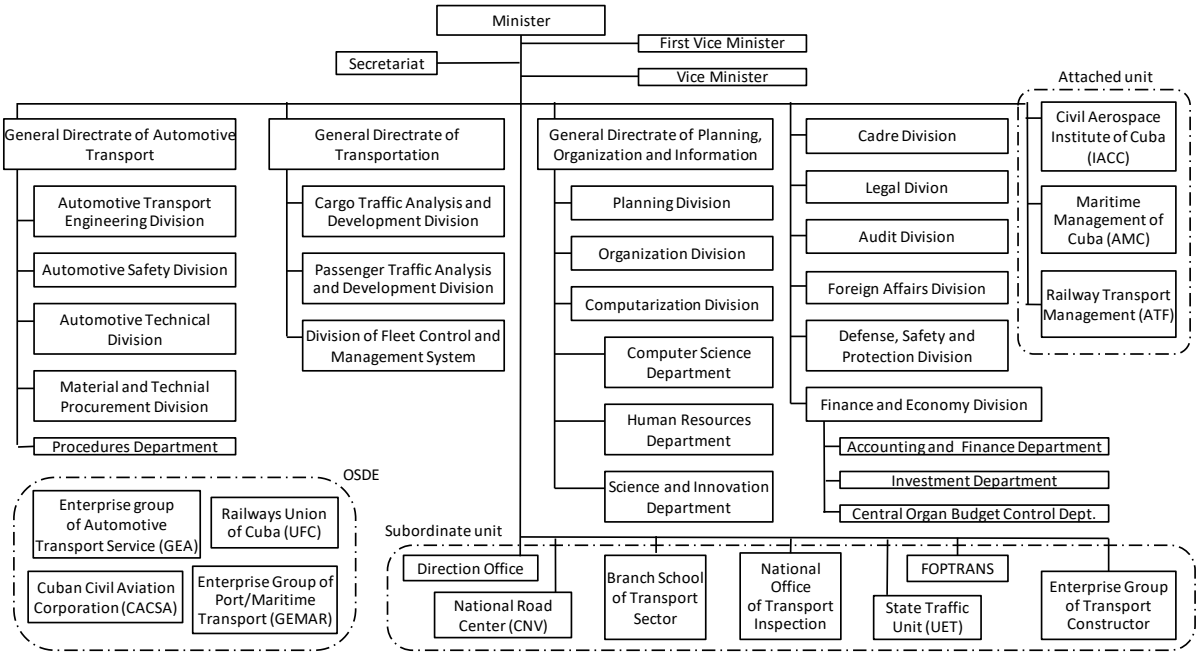
(3) Ministry of Transport

The Ministry of Transport (MITRANS) was created in 1961 by Law No. 960 as a state agency that exercises the governing functions in transportation. MITRANS's missions are to direct, execute, and monitor the State and government policies related to land, river, lake, aerial transport, infrastructure, and auxiliary or connected services. Among its specific functions are to:

1. Direct the development policy and the provision of land, air, maritime, lake, and river transport services, and related services
2. Establish and approve the rules and plans that encourage the participation and use of the different systems and means of transport in traffic
3. Establish regulations and technical standards for the acquisition, maintenance, partial or capital reparation, technical modifications, manufacturing, exploitation, control, and deregistration of the means of transport and other equipment of the different transport services
4. Exercise the aeronautical, maritime, fluvial, and lacustrine authority, and regulate the road activity, and the automotive and rail transport
5. Grant, limit, modify, suspend or cancel the licenses, permits, and certificates of aptitude for the provision of any transport service and the auxiliary and related services by the state and non-state sectors of the economy
6. Regulate and control the norms and conditions for the safety of land, air, maritime, fluvial and lacustrine transportation, maritime and civil air navigation; issue the corresponding certificates and dictate as many security measures; participate or dispose of the search and rescue operation
7. Regulate the operation of the investigation commissions to the effects on railway safety, maritime accidents or accidents and air accidents
8. Apply and control the use of communication systems, global positioning, and signaling for infrastructure, as well as the use of the radio spectrum in the bands assigned to civil aviation and navigation maritime
9. Regulate and control the services of maritime and air civil navigation, and the operation or operation of the technical activities and services of the ports, airports, stations, terminals, loading and unloading centers, and other transportation facilities
10. Regulate and control the planning, projection, construction, maintenance, rehabilitation, and conservation of the roads, the stripes of location, the railways and the stripes of the right of way and development, ports, airports, and their security zones or neighboring these

11. Establish and control technical standards and conditions for cargo and passenger transportation services, as well as regulations on the development, investment, and logistics of transportation facilities and infrastructure
12. Exercise inspection and state control in transportation; and impose contraventions, penalties, and penalties on carriers or operators for violating regulations
13. Establish the classification of land routes, ports, aerodromes, airports, sea routes, airways, and other transport facilities; issue, modify or cancel the authorization and certification of operation for ports and marinas, aerodromes, airports, stations, terminals, loading and unloading centers, and other transport facilities
14. Control and execute the process of registration or update of the goods, rights, licenses, and permits that are registered in the records and issue the corresponding certifications
15. Regulate the participation of the different national and foreign airlines in Cuban air transport
16. Direct, regulate and control civil air traffic

In 2019, MITRANS was in the final phase of reorganization for functional and structural improvement. The reorganization aims to achieve greater efficiency in its management with a more rational, compact, and flexible structure through a better distribution of functions among its organizational units. The most recent reorganization was put into effect in 2017, in which a significant change was that the competent authority of the four OSDEs was transferred from MITRANS to the Council of Ministers. One of the reasons behind this change was to give those OSDEs a more direct and efficient path when they deal with inter-ministerial issues. By putting those OSDEs under the subordination of the Council of Ministers, the OSDEs can legitimately bypass ministerial checkpoints in certain issues involving ministries other than MITRANS. The Minister of MITRANS, however, still “attends” the OSDEs by supervising, orienting, and coordinating their business. Activities such as auditing, defense, security, protection, and state reserve, are exceptionally directed by different divisions or departments of MITRANS. The latest organizational structure of the MITRANS in 2020 is depicted in Figure 2.5.3.



Source: JICA Study Team based on MITRANS information

Figure 2.5.3 Organization Chart of the Ministry of Transport

The organization of the MITRANS is roughly divided into four spheres, which are: (i) central body, (ii) attached units, (iii) subordinate units, and (iv) OSDEs. The attached units are three (3) regulating the port, railway, and aviation sectors, respectively. The number of OSDEs is four (4), bundling automotive transport, port-maritime, railway, and aviation sectors. It should be noted that the road sector OSDE has no counterpart as an attached unit because cargo and passenger transport by road is relatively busier than the maritime, aerial, and railway sectors. Therefore, MITRANS still maintains a grip on the road sector through its central body and subordinate units rather than having one attached unit and letting it supervise the sector.

1) Central Body

Under the central body, various units perform mainstream and auxiliary functions to govern the transport sector, meaning the establishment of policy, implementation, and monitoring of transport activities in terms of land, sea, river, lake, and air transport, including its infrastructure and related services. Table 2.5.2 below summarizes the functions of the Central Body.

Table 2.5.2 Functions of the Central Body of the Ministry of Transport

Name of Unit / Position	Function
Minister	Heads the ministry
First vice-minister	Deputize for the minister
Vice-minister	Assist the minister; each of the vice-ministers is tasked with a different area or sector
Directorate General of Automotive Transport (DGTA)	Tasked with every corresponding technical activity of the vehicle operation, automotive infrastructure, workshops, spare parts, etc.
Automotive Transport Engineering Division	Deal with automotive infrastructure
Automotive Safety Division	Deal with safety issues of transportation
Automotive Technical Division	Deal with technical issues of transportation
Material and Technical Procurement Division	Deal with workshop and parts issues
Procedures Dept.	Issue special transport permits for upper echelons
Directorate General of Transportation	Coordinate cargo and passenger transportation
Cargo Traffic Analysis and Development Division	Analyze and supervise nationwide cargo traffic based on the cargo balance database
Passenger Traffic Analysis and Development Division	Analyze and supervise passenger traffic at the national level; Plan logistics of passenger transport in national events
Division of Fleet Control and Management System	Analyze and supervise the truck movement
Directorate General of Planning, Organization, and Information	Manage the six units below
Planning Division	Deal with planning
Organization Division	Deal with organization
Computerization Division	Deal with computerization
Computer Science Department	Deal with computer science application
Human Resources Department	Deal with personnel and training issues
Science and Innovation Department	Deal with research and development issues in the transport sector
Cadre Division	General affairs unit dealing with cadre issues
Legal Division	General affairs unit dealing with legal issues
Audit Division	General affairs unit dealing with an audit
Foreign Affairs Division	General affairs unit dealing with foreign affairs issues
Defense, Safety, and Protection Division	General affairs unit dealing with defense, safety, and protection issues
Finance and Economy Division	General affairs unit managing the three units below
Accounting and Finance Department	General affairs unit dealing with accounting issues
Investment Department	General affairs unit dealing with investment issues
Central Organ Budget Control Department	General affairs unit dealing with budget control issues

Source: MITRANS

1) Attached Units

As part of MITRANS, the attached units regulate the aerial, maritime, port, and railway sectors and attend to each corresponding OSDE. Table 2.5.3 below summarizes the functions of the attached units.

Table 2.5.3 Functions of Attached Units of the Ministry of Transport

Name of Unit	Function
Maritime Management of Cuba (AMC)	Attend and partially control the maritime sector; attend GEMAR. The Mariel Port in Special Economic Zone is outside the regulation of AMC, instead of under GAESA.
Railway Transport Management (ATF)	Attend and partially control the railway sector; attend UFC
Institute of Civil Aeronautics of Cuba (IACC)	Attend and partially control the aviation sector; attend CACSA

Source: MITRANS

2) Subordinate Units

The subordinate units support the work of the central body and the attached units, although some of the subordinate units function practically like a central body or attached unit. Table 2.5.4 summarizes the functions of the subordinate units.

Table 2.5.4 Functions of Subordinate Units of the Ministry of Transport

Name of Unit	Function
National Road Center (CNV)	Responsible for the planning (preparing budget) and maintenance of national roads in Cuba. Local branches of CNV that belong to provincial governments are called Provincial Road Centers (CPV) and maintain the national roads within each province. There are 15 CPVs in each province and 1 CPV in Isla de la Juventud.
National Office of Transport Inspection	Inspect transport policy observance, technical standards, and regulations in all transport sectors.
State Traffic Unit (UET)	Inspect vehicle operation (cargo, vehicle, driver) nationwide; issue vehicle operation license.
Direction Office	Deal with issues of management staff
Branch School of Transport Sector	School for the staff of MITRANS and state enterprises
FOPTRANS	Training facility for professionals in the transport sector

Source: MITRANS

3) OSDE

The functions of the four (4) OSDEs attended by the Minister of MITRANS are summarized in Table 2.5.5. The subordination of those OSDEs was transferred from MITRANS to the Council of Ministers in 2017. One of the reasons behind this change was to give those OSDEs a more direct and efficient path when dealing with inter-ministerial issues. By putting those OSDEs under the competence of the Council of Ministers, they can bypass legitimately ministerial checkpoints in certain issues involving ministries other than MITRANS. Nevertheless, MITRANS still “attends” the OSDEs by orienting and controlling their business. It should be noted that only the Railway Union of Cuba (UFC) is an “Union” type OSDE, which bundles enterprises with high interrelation and dependence on each other.

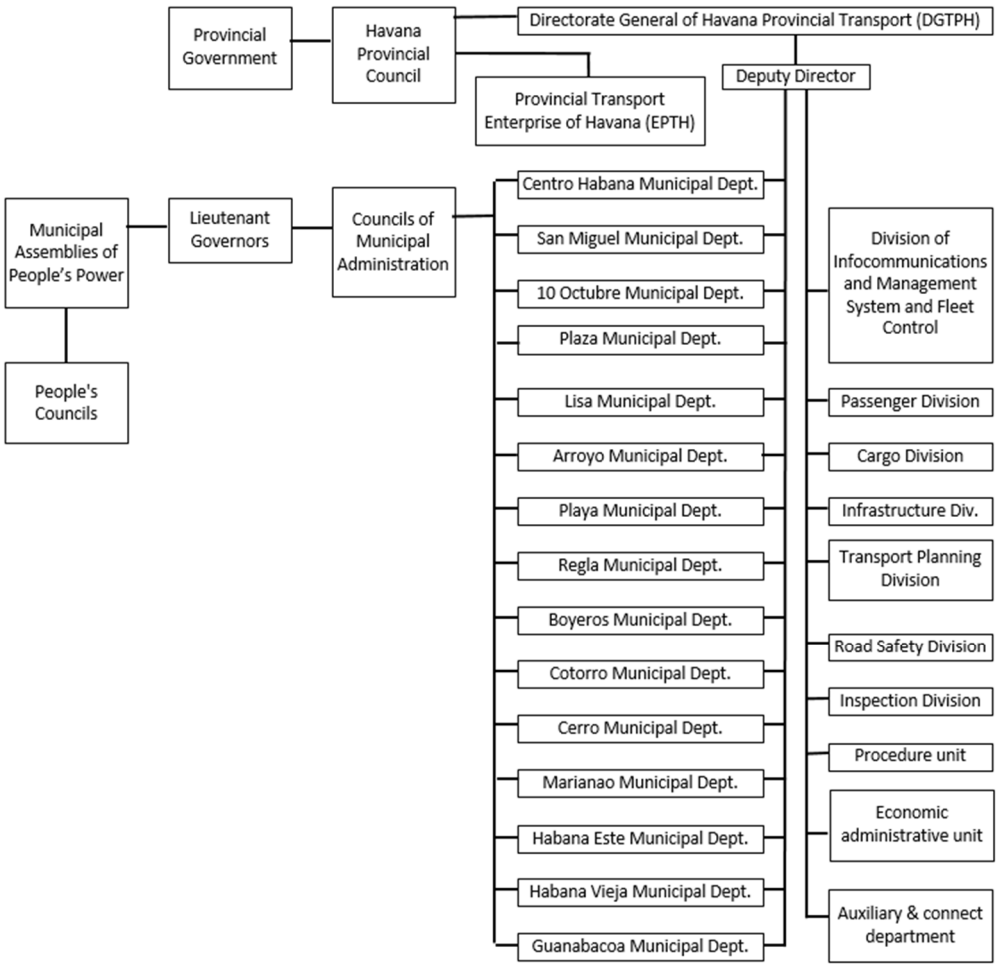
Table 2.5.5 Functions of OSDEs Attended by Ministry of Transport

Name of OSDE	Function
Enterprise group of Automotive Transport Service (GEA)	Holding company that bundles 19 enterprises dealing with cargo/passenger transport.
Enterprise Group of Port/Maritime Transport (GEMAR)	Holding company that bundles 27 enterprises dealing with port/maritime business that manages all ports in Cuba except the Mariel Port
Cuban Civil Aviation Corporation (CACSA)	A holding company that incorporates 14 aviation enterprises that manage aeronautics and airports in general
Railway Union of Cuba (UFC)	Holding company that bundles seven (7) railway enterprises dealing with the operation, rehabilitation, maintenance, and repair.

Source: MITRANS

(4) Local Government

The central government oversees the provincial and municipal governments through a hierarchical network. Figure 2.5.4 shows the organizational link between the provincial governments and transport authorities in Havana Province.



Source: hearing by JICA Study Team

Figure 2.5.4 Local Governments and Transport Authorities in Havana Province

The Governors and the Vice Governors of the province are proposed by the President of the Republic and appointed by the Municipal Assemblies of People's Power (AMPP). A Governor directs the administrative operation in the province.

The Municipal Assembly of People's Power (AMPP) is a municipality's superior organ composed of elected delegates. Among its main functions are to (i) approve and monitor the economy plan, the budget, and the integral development plan of the municipality, (ii) approve the land use plan, and (iii) monitor compliance.

The Lieutenant Governor is elected by the AMPP at a proposal of the President of the AMPP.

The Council of Municipal Administration (CAM) is a body designated by the AMPP to which the CAM is subordinated and accountable. It is chaired by the Lieutenant Governor and performs administrative functions.

An additional bottom tier of the AMPP is the People's Council. In the case of Havana Province, each municipality has three (3) to ten (10) People's Councils, totaling around 100.

In the case of Havana Province, the Provincial Council has the Directorate General of Havana Provincial Transport (DGTPH) for transportation services; the DGTPH is under the direct supervision of the Provincial Council. In the Cuban administrative structure, a department within each Provincial Council is also supervised by its counterpart ministry at the state level. Thus, MITRANS is also regarded as the supervisory authority of DGTPH at the state level. DGTPH supervises a transport department in each municipality, which constitutes part of the administrative wing of each corresponding CAM.

The Provincial Transport Enterprise of Havana (EPTH) is an affiliated company of the Havana Provincial Council. The EPTH is a service provider of passenger transport by road.

Similar to Havana Province, other provinces also have a Provincial Transport Enterprise (EPT) as their affiliated enterprise. Those EPTs provide essential services for intra-provincial bus and cargo transport. However, not all the provinces have a corresponding Provincial Department of Transport (DPT) that directly supervises the planning, control, and management; only Mayabeque, Artemisa, Santiago de Cuba, and Guantanamo provinces have a DPT. The EPTs include the transport planning and control function in the provinces with no DPT.

(5) Cooperative

Until 2013, the only authorized cooperatives were agricultural. Legislated by Decree-Law No. 305 of 2012, the Council of Ministers began to approve the experimental creation of cooperatives in other products and services sectors, including transportation. The modality of cooperative that the transport sector can currently employ is the Non-Agricultural Cooperative (CNoA).

The CNoA is an organization with economic and social purposes, voluntarily constituted based on the contribution of goods and rights. The CNoA has a judicial personality and is based on the work of its partners of three (3) minimum, whose general objective is producing goods and providing services. In 2020, twelve (12) CNoAs operated in the transport sector (Table 2.5.6). Most of those CNoAs are created under the initiative of governmental authorities such as MITRANS, MICONS, and Provincial Councils.

Table 2.5.6 Non-Agricultural Cooperatives under the Guidance of MITRANS

Name	Business Outline	Initiative taker
Taxi Rutero 1	Taxi services for Cuban citizens in Havana	MITRANS
Taxi Rutero 2	Taxi services for Cuban citizens in Havana	MITRANS
SERVIPAS	Passenger transportation and auxiliary services, maintenance and repair of vehicles, parking services	MITRANS
Servicios Automotorices	Vehicle maintenance and repair, including manufacturing, repair, and sale of parts, attachments and accessories, metalwork, painting, scrubbing, upholstery, vehicle wraps, breakdown assistance	Private
Artemisa	Urban, interurban, and rural transportation by mid-size bus in 11 municipalities of Artemisa Province. Vehicle maintenance and repairs such as mechanics, lathe turning, electricity, scrubbing, greasing, metalwork, manufacturing, repair, and assembly of exhaust pipes.	Artemisa Provincial Council
Reconstructora de Vehiculos	Vehicle maintenance and repair. Total or partial reconstruction of vehicles. Transportation services of vehicles by trailers.	Havana Provincial Council
La Cubana	Scrubbing service for automotive equipment	Havana Provincial Council
La Complaciente	Repair and screening of steering, greasing, locks, and automotive glassware, electricity and general mechanics, audio equipment installation, cleaning services, and radiators.	Havana Provincial Council
Novedades	Scrubbing, greasing, repair of tubes and tires, services of air to cycles and automotive equipment, balancing of tires, repair and screening of steering, locksmith and automotive glassware, electricity and general mechanics, installation of audio equipment, electronic mechanics, and reconstruction of audio coils. Cleaning and repair of radiators. Parking services.	Havana Provincial Council
Jupiter	Scrubbing greasing, repairs of tubes and tires, services of air to cycles and automotive equipment, the balance of tires, repair and screening of steering, locksmith and automotive glassware, electricity, and general mechanics, installation of audio equipment, electronic mechanics, and reconstruction of audio coils. Cleaning and repair of radiators. Parking services.	Havana Provincial Council
El Carruaje	Horse carriage transport for tourists	Historian Office of Havana
AUTOCHAPT	Vehicle maintenance and repair, sheet metal working, painting, upholstery	MITRANS

Source: MITRANS

2.5.3 Transport Sector Participants

This section provides a bird's-eye view of Cuba's transport sector, listing organization names and types, areas, functions, and interrelation. Subsequently, key players and their functions are described.

Transport sector participants are summarized in Table 2.5.7, and their functions are summarized in Table 2.5.8. The workforce size and composition of major sector participants are shown in Table 2.5.9.

Table 2.5.7 Major Participants in the Transport Sector

Area	Enterprise/Organ	OSDE	Competent authority	Main regulator
Road planning	CNV, CPV	Not applicable	Not applicable	MITRANS, MININT
Road construction	ECOING (contractor)	GECONS	MICONS	MICONS, CGP
Road maintenance	EMAVIC (contractor)	Not applicable	Provincial Council	
Railway	EFOC, EFC, EFCE, EFO	UFC	Council of Ministers	ATF
	ECOING (construction)	GECONS	MICONS	
Airport	ECASA	CACSA	Council of Ministers	IACC
	ECOING (construction)	GECONS	MICONS	
Aviation	ECA, Aerovaradero	CACSA	Council of Ministers	
	Aerogaviota	GAE	MINFAR	
Port	SEPOC, SEPC, SEPCE, SEPO, SEPMPD	GEMAR	Council of Ministers	AMC, MININT
	TC Mariel	GAE	MINFAR	MINFAR
	ECOING (constraction)	GECONS	MICONS	
Maritime	ENC, Pilots of Cuba, Transcargo	GEMAR	Council of Ministers	AMC
Cargo transport (road-based)	ETAG, ENOC, EMCARGA	GEA	Council of Ministers	UET/MITRANS
	TRANZMEC	AZCUBA	Council of Ministers	
	ENCOMED	BioCubaFarma	Council of Ministers	
	Empresa de Materiales de Construcción	GECONS, GEICON	MICONS	
	LABIOFAM, etc.	GAF, GAG, GEAF, GEEF, GEGAN, GELMA, LABIOFAM, TABACUBA, ACOPIO	MINAG	
	Empresa prosesadora de soya, etc.	GEIA, CORALSA, Cubaron	MINAL	
	EMPA	GCPIS, GEMPA	MINCIN	
	ENCOMIL, CAMACHO, PROQUIMIA	GEIQ, GEMPIL, GESIME	MINDUS	
	Empresa Nacional de Abastecimiento	GEMINED	MINED	
	CUVENPETROL, etc.	CUPET, GEOMINSAL, CUBANiquel, UNE	MINEM	
	TRD-CARIBE, CIMEX, AUSA	GAE	MINFAR	
	PROVARI	Not applicable	MININT	
	ENSUME	GEASP	MINSAP	
	Empresa de Logística PALCO	PALCO, SERVITUR	MINTUR	
	Aguas de la Habana	Not applicable	INRH	
	EPT	Not applicable	Provincial Council	
Passenger transport (road-based)	EPTH, EPT	Not applicable	Provincial Council	
	ETT, ETE	GEA	Council of Ministers	
	EON, Viazul/EON, Taxis Cuba, CUBATAXI	GEA	Council of Ministers	
	Cooperativa Taxi Rutero 1&2	Not applicable	Not applicable	
	Private taxi & truck-bus	Not applicable	Not applicable	
	Transtur	GETTT	MINTUR	
	Transgaviota	GAE	MINFAR	

Source: JICA Study Team

Table 2.5.8 Functions by Transport Sector

	Operation	Maintenance (excl. large scale)	Budget planning and Monitoring	Construction
Road	• National road: CNV/CPV • Provincial road: DPSC/CAP	• Operators; Contractors such as EMAVIC	• National road: CPV→CNV→MEP • Provincial road: DPSC/CAP→MEP	• MICONS-supervised enterprises such as ECOINGs
Railway	• EFOC, EFC, EFCE, EFO	• Rolling stock: Operators; Contractors • Upper-side track: SOLCAR • Lower-side track: MICONS	• EFs→ UFC→ ATF→ Government Board→ MEP	• MICONS-supervised enterprises such as ECOINGs and UFC-affiliated enterprises such as SOLCAR
Aviation	• Airport: CACSA-affiliated enterprises such as ECASA, Aerovaradero, etc. • Airline: Cubana airlines, Aerogaviota	• CACSA-affiliated enterprises	• CACSA-affiliated enterprises such as ECASA, etc.→ CACSA→ Government Board→ IACC→ MEP	• MICONS-supervised enterprises such as ECOINGs and CACSA-affiliated enterprises
Maritime	• Port: SEPOC, SERPO, ESPCE, ESPC, ESPMPD, Puerto Mariel • Cargo: ENC • Passenger: Pilots of Cuba	• Operators	• [SEPs, Pilots of Cuba, ENC]→ GEMAR→ Government Board→ AMC→ MEP	• MICONS-supervised enterprises such as ECOINGs and GEMAR-affiliated enterprises
Cargo transport by road	• ETAG, ENOC, EMCARGA, TRANZMEC, EPT	• Operators; Contractors such as Motocentro/GEA	• [ENOC, EMCARGA, ETAG]→ GEA→ MEP • EPT→ DGTA/MITRANS → MEP	• Not applicable
Passenger transport by road	• EON, Taxis Cuba, CUBATAXI, EFOC, EFC, EFCE, EFO, ETE, ETT,Taxi Rutero, Transgaviota, Transtur, EPT, EPTH	• Operators; Contractors	• [EON, Taxis Cuba, CUBATAXI, etc.]→ GEA→ Government Board→ MEP • [Transtur, Transgaviota]→ GAE→ Government Board→ MEP • EPTH→DGTPH→DGTA/MITRANS→MEP • EPT→ (DTP→) DGTA/MITRANS→MEP	• Not applicable

Source: JICA Study Team

Table 2.5.9 Workforce Size and Composition of Transport Sector Participants

OSDE / Enterprise	Number of staff (actually employed)					
	TOTAL	Managemt.	Qualified	Admin.	Service	Operator
GEMAR	107	20	63	0	14	10
Empresa de Servicios Portuarios de Occidente (SEPOC)	1,351	10	174	34	153	980
Empresa de Servicios Portuarios del Centro	640	15	101	16	61	447
Empresa de Servicios Portuarios del Centro Este	701	31	165	6	102	397
Empresa de Servicios Portuarios del Oriente (SERPO)	803	14	176	30	85	498
Empresa de Servicios Portuarios Manuel Porto Dapena	156	8	32	4	36	76
Empresa de Navegación Caribe (ENC)	780	17	155	2	356	250
Empresa Astilleros del Caribe (ASTICAR)	426	17	76	0	26	307
Astillero Roberto Nodarse	132	6	19	0	6	101
Empresa de Astilleros del Oriente (ASTOR)	431	10	103	0	76	242
Empresa Nacional de Astilleros (ENA)	316	8	36	3	39	230
SERVITALLY	423	10	231	5	174	3
Empresa Empleadora Portuaria (AGEMPORT)	17	3	10	2	0	2
Prácticos de Puertos de la República de Cuba (Pilots of Cuba)	372	18	121	0	87	146
SUMARPO	133	11	72	0	31	19
Consignataria Mambisa	200	14	129	3	21	33
Habana Inmuebles (HINES)	291	14	18	4	174	81
Agencia General de Seguridad y Protección (AGESP)	6,367	110	630	0	5,568	59
Empresa de Servicios y Mantenimientos (SERVIMANT)	152	8	45	0	13	86
SELECMAR	42	5	35	0	1	1
REGISTRO CUBANO BUQUES	126	10	109	0	4	3
Empresa Transitaria de Cargas (TRANSCARGO)	168	12	116	7	11	22
Centro de Investigación y Manejo Ambiental del Transporte (Cimab)	150	18	120	0	4	8
Caribbean Drydock Company (CDC)	752	28	119	2	91	512
Consultores Marítimos (COMAR)	15	4	9	0	1	1
Thunder Container Leasing and Repair	16	4	10	0	1	1
Empresa de Corretaje de Combustible (PETROMAR)	7	1	4	0	2	0
Total GEMAR group	15,074	426	2,878	118	7,137	4,515
GEA	135	14	99	0	11	11
ENOC	1,313	21	461	2	122	707
EMCARGA	2,758	32	772	3	248	1,703
ETE	5,599	29	1,253	28	905	3,384
ETAG	629	11	190	6	42	380
ETT	4,482	25	906	19	363	3,169
EON	4,837	28	699	102	1,213	2,795
CUBATAXI	6,035	26	886	47	887	4,189
TAXISCUBA	502	32	333	0	17	120
MCV Services	303	17	129	0	3	154
MOTORCENTRO	821	15	228	1	107	470
ERTA	265	9	233	0	9	14
Viajero	840	13	193	24	597	13
AXESS	325	26	161	0	98	40
Sistrans	173	13	122	0	25	13
GCOM	132	11	112	0	2	7
TRAMOS	3	1	2	0	0	0
TransProy	261	11	195	0	8	47
PubliCentro	82	5	40	0	3	34
Total GEA group	29,495	339	7,014	232	4,660	17,250
UFC	227	19	167	0	23	18
Western Railway Enterprise (EFOC)	4,261	46	763	57	901	2,494
Central Railway Enterprise (EFC)	4,103	31	721	31	996	2,324
Central East Railway Enterprise (EFCE)	5,067	30	939	47	1,044	3,007
Eastern Railway Enterprise (EFO)	5,130	39	914	36	1,017	3,124
SOLCAR	386	12	118	0	71	185
EIIF	321	16	66	2	31	206
Sumifer	129	7	35	0	52	35
Total UFC group	19,624	200	3,723	173	4,135	11,393

OSDE / Enterprise	Number of staff (actually employed)					
	TOTAL	Managemt.	Qualified	Admin.	Service	Operator
CACSA	172	34	136	1	0	1
Empresa de Servicios a la Aviación Civil (SERVAC)	407	14	143	10	116	124
Empresa Cubana de Aviación (ECA: Cuban airlines)	1,403	138	747	23	407	88
Empresa Cubana de Aeropuertos y Servicios Aeroportuarios (ECASA)	5,471	191	1,199	118	1,634	2,329
Empresa Nacional de Servicios Aéreos (ENSA)	636	42	422	1	39	132
Empresa Cubacatering	1,871	71	423	48	753	576
Empresa Aviaimport	137	16	85	0	12	24
Empresa Aerovaradero	517	29	229	26	43	190
Empresa Contratista de Obras para la Aviación (CCOA)	77	8	56	0	4	9
Empresa de Seguridad y Protección a la Aviación Civil (ESPAC)	2,868	44	676	6	2,114	28
Empresa Comercial Take Off	248	7	195	1	36	9
Empresa Hispano Cubana de Mantenimiento de Aeronaves IBECA	52	1	47	0	0	4
Empresa Logística de Carga Aérea (ELCA)	17	1	8	0	1	7
Grupo Aeronáutico de Mantenimiento (GAM)	40	1	33	0	2	4
Empresa Cubana de Navegación Aérea (ECNA)	798	19	706	1	22	50
Total CACSA group	14,714	616	5,105	235	5,183	3,575
GECONS / MICONS						
ECOING 25	2,067	65	406	49	218	1,329
ECOING 5	555	18	104	0	76	357
ECOING 17	660	11	191	1	129	328
ECOING 24	850	35	176	3	93	543
Total ECOING	4,132	129	877	53	516	2,557
Grand total (GEMAR+GEA+UFC+CACSA+ECOING)	83,039	1,710	19,597	811	21,631	39,290

NOTE: The enterprises integrated under OSDE GECONS, although they are not included in transport sector, but in MICONS, they work in the construction of transport infrastructure.

Source: JICA Study Team

The major sector participants shown above are generally divided into five groups, which are GEMAR (maritime), GEA (road transport), UFC (railway), CACSA (aviation), and ECOING (transport infra-building). The workforce categories are also fivefold: management, qualified, administrative, service, and operator.

The category “Management” includes workers who plan, organize, coordinate or direct activities of bodies, associations, enterprises, units, directorates, departments, or sections, under their responsibility and within the powers received. Examples include ministers, presidents, vice presidents, directors, heads of departments, heads of sections, and administrators.

The category “Qualified” includes workers with a professional title and knowledge who apply scientific methods to agricultural, industrial, economic, and social-technological problems. In addition, those workers engage in technical tasks related to research, development, and scientific practice or perform educational or juridical activities requiring professional formation acquired in universities, institutions of technical education, or similar establishments in Cuba or abroad. This category includes physicians, engineers, economists, sociologists, lawyers, teachers, and nurses.

The category “Administrative” includes workers who, under the supervision of a superior, are directly or indirectly involved with the management of any state entity. Examples include secretaries, typists, office workers, and office assistants.

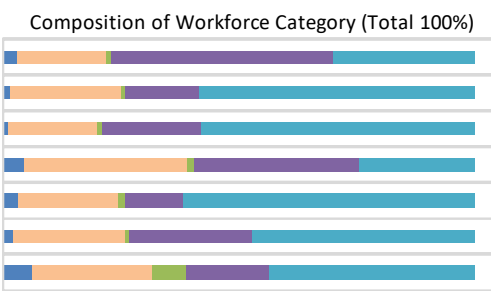
The category “Service” includes workers who, in a regular and continuous way, satisfy personal and social needs. Examples include messengers, postmen, barbers, hairdressers, and gastronomic staff.

The category “Operator” includes workers who, directly or indirectly through production means, modify, transform, or change the condition and/or the location of the work object and the finished product. Examples include lathe operators, masons, mechanics, and carpenters.

Table 2.5.10 shows the workforce size and composition of each transport sector.

Table 2.5.10 Summary of Workforce Size and Composition of the Transport Sector

Enterprise	TOTAL	Managemt.	Qualified	Admin.	Service	Operator
GEMAR group	15,074	3%	19%	1%	47%	30%
GEA group	29,495	1%	24%	1%	16%	58%
UFC group	19,624	1%	19%	1%	21%	58%
CACSA group	14,714	4%	35%	2%	35%	24%
ECOINGs	4,132	3%	21%	1%	12%	62%
Total transport	83,039	2%	24%	1%	26%	47%
Overall sectors	4,482,700	6%	25%	7%	18%	44%



Source: JICA Study Team

Each enterprise group is not necessarily composed of homogeneous enterprises. For example, AGESP, the largest enterprise in the GEMAR group by the number of employees, provides security guards to many enterprises under other OSDEs attended to by MITRANS. Albeit such inclusion of dissimilar enterprises, we can deduce some tendencies from the summary data:

- Since the aviation sub-sector has been developed more recently than the road and train sub-sectors, more technical skills may be required. This is reflected in the CACSA group's higher proportion of qualified staff (35%) and a lower proportion of operator staff (24%) compared to the other subsectors.
- GEA, UFC, and ECOINGs (The enterprises integrated under OSDE GECONS, although they are not included in transport sector, but in MICONS, they work in the construction of transport infrastructure, show a relatively similar composition, which is 1-3% for management, 19-24% for qualified, 1% for administration, 12-21% for service, and 58-62% for operators.
- The percentage of service in GEMAR (47%) is notably high, possibly due to peculiar job classifications in the maritime sector.
- The high percentage of operators in ECOINGs (62%) may represent characteristics of the construction industry where a large number of workers of this sector, are attended by a limited number of qualified personnel, such as civil engineers.

(1) Roads

1) Operation and Maintenance

a) National roads

The National Road Center (CNV), a subordinate unit of MITRANS, is responsible for national roads' operation and maintenance (O&M). Maintenance includes small-scale rehabilitation. The CNV supervises the Provincial Road Centers (CPVs), tasked with the O&M of national roads. The maintenance is contracted to provincial enterprises such as *Empresa de Mantenimiento Vial y Construcciones* (EMAVIC).

b) Provincial roads

The Provincial Offices of Community Service (DPSC) are responsible for the O&M of provincial roads. Maintenance is contracted to construction enterprises such as ECOINGs.

2) Construction

a) National roads

Construction and large-scale rehabilitation are performed by public enterprises such as ECOINGs, whose OSDE is GECONS.

b) Provincial roads

Construction and large-scale rehabilitation are contracted to public enterprises such as ECOINGs, whose OSDE is GECONS.

3) Planning and Monitoring

a) National roads

The CNV makes the annual budget planning, requests to MEP, and performance monitoring after compiling information prepared by the CPVs.

b) Provincial roads

Provincial governments make the annual budget planning, requests to MEP, and performance monitoring.

(2) Passenger Transport by Road

1) Operation and Maintenance

a) National level

The Directorate General of Automotive Transport, under MITRANS, is responsible for the automotive administration in Cuba, including private vehicles, buses, taxis, and trucks. The Automotive Transport Group (GEA) is the corresponding OSDE that attends to the operation, maintenance, repair, and other regulations regarding road transport. In Cuba, there are three entities for inter-provincial bus service. The National Bus Enterprise (EON) provides scheduled inter-provincial bus services for Cubans (EON bus) and foreigners (Viazul bus). In addition, Transtur and Transgaviota, bus operators under MINTUR and MINFAR, respectively, provide different tour bus services for international tourists.

b) Provincial level

Provincial Councils are responsible for the administration of each province. The passenger transport planning in each province is also handled by the Provincial Council, except for Havana Province, where a special section named the Directorate General of Provincial Transport in Havana (DGTPH) is responsible for the transport planning in Havana Province.

The Provincial Transport Enterprise (EPT) is a fundamental service provider for intra-provincial buses. As of February 2020, Mayabeque, Artemisa, Santiago de Cuba, and Guantanamo provinces each have a Provincial Direction of Transport (DPT). The general responsibility of a DPT is to plan, control, and manage intra-provincial transport as a direct higher organization of EPT and related entities. In Havana, the DGTPH not only plans, controls, and manages intra-provincial transport but also invests in

infrastructure development, including road, public transport, and freight vehicles. All provinces are expected to have their DPT in the near future.

The UET, a subordinate unit of MITRANS, is responsible for automotive administration, such as vehicle registration and daily monitoring. Besides bus transportation, taxi and other passenger transportation services are provided, as shown in Table 2.5.11.

Table 2.5.11 Classification of Road-based Passenger Transport Services for Provincial Level

Service Type	Service Coverage	Currency	Operation Body	Regulation Body
Interurban (Inter-municipal)	Short-distance bus services to link between municipal capitals (less than 200 km/trip)	CUP	EPT	DGTPH (Havana), DPT (Major Provinces)
Rural Service	Rural bus services to link cities with rural areas or between them			
Suburban Service	Bus services to connect cities and small towns/villages			
Urban Service	Urban bus services in provincial capitals and some large municipalities			
Transport of Workers	Transport service for workers to/from working locations		ETT (Transmetro)	
School Service	Transport service for schoolchildren or students and teachers to/from special educational centers		ETE	
Taxi (Piquera)	Taxi services for Cuban social activities in CUP		CUBATAXI	
Route Taxi (Taxi Rutero)	Supplemental microbus/bus/taxi services in large municipalities for Cuban citizens in CUP		Cooperativa 1&2, CUBATAXI,	
Free Taxis (Taxis Libre)	Taxi services basically for visitors in CUP	CUP	Taxis Cuba	
Private Taxis	Private taxi services with operating authorization (Including motorized vehicles and also horse-drawn vehicles)	CUP	Private drivers/owners	UET, MITRANS

Source: NRMT 69-2003, MITRANS, and Cimab edited by JICA STUDY TEAM

2) Planning and Monitoring

EON establishes annual plans for operation and investment based on trend analysis. Once the annual plan is approved by MEP, the necessary budget and fuel are allocated. Transtur and Transgaviota also establish an annual plan based on trend analysis and the hotel development plan; MEP then reviews and approves this plan. In addition, travel agencies offer tourist demand under MINTUR and MINFAR, respectively. Therefore, EON, Transtur, and Transgaviota are required to plan and operate efficient bus routes to meet passenger demand as much as possible.

The annual plan consists of planned activities, required budget, and assets to implement the activities of each enterprise integrated under GEA. Budget planning begins in January at each of the subsidiary enterprises. The GEA receives budget plans from the enterprises, examines and compiles them, and tables them to the Government Board. The Government Board is composed of: (i) the Vice Minister of Transport, (ii) the Director General of GEA, (iii) a specialist of MEP, (iv) a specialist of MINDUS,

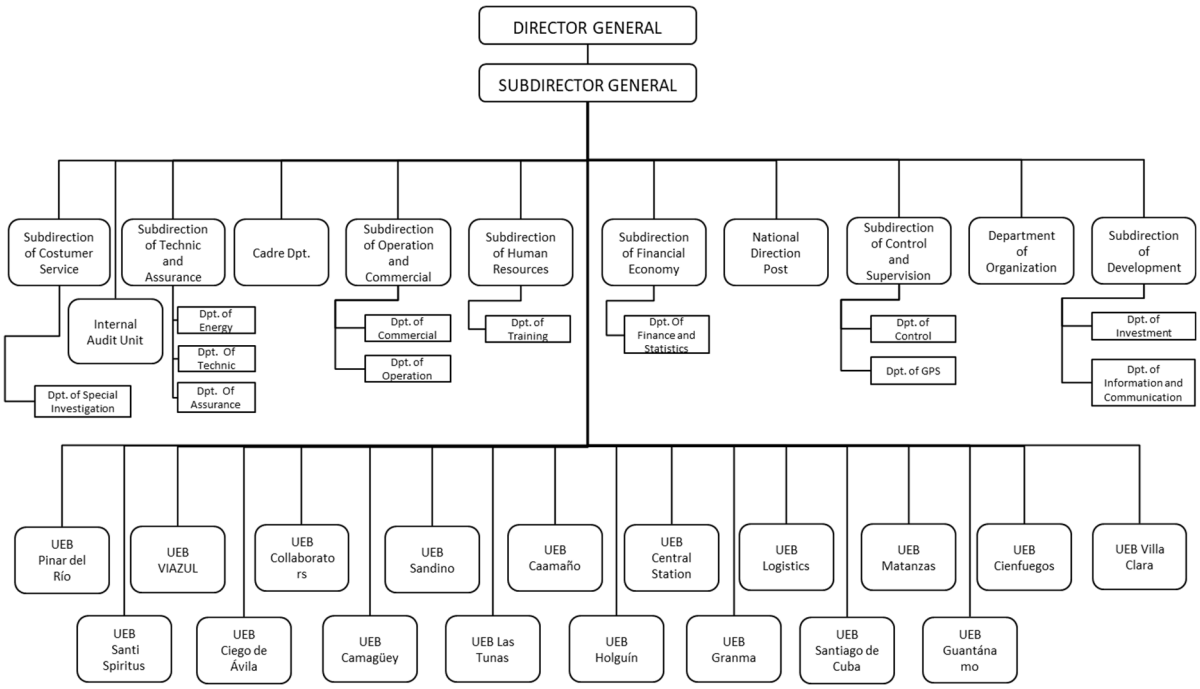
(v) a specialist of MFP, and (vi) a specialist of Central Bank of Cuba. The Government Board examines the budget plan and specifies if there are matters to be corrected. Afterward, the GEA's budget goes to MEP for approval. The examining process at MEP finishes in November, and then the ANPP determines in December if it should be approved as prepared or with any discount.

The monitoring of budget execution and operation performance at the GEA level is done by involving the Management Council of GEA and the Government Board. Every month, the Management Council examines the operation performance record. Every three months, the Management Council and the Government Board check the record; the check report is sent to MEP every three months. In addition, operation performance is examined at monthly and quarterly checks, and corrective action is discussed.

2) Major Service providers

a) EON

Figure 2.5.5 shows the organizational structure of EON. The operation of interurban bus transport is subdivided into 18 UEBs, depending on their service province and given functions. For example, UEB Piñar del Rio works on the EON bus service for the province of Piñar del Rio, while UEB Viazul operates the Viazul service mainly for visitors.



Source: EON

Figure 2.5.5 Organizational Structure of EON

As summarized in Table 2.5.12, EON employed 4,468 workers as of February 2019. However, given the broad scale of EON services to contribute to the national transport development, the human resource in the Main Office is limited to 128 workers.

Table 2.5.12 Human Resources of EON in 2019

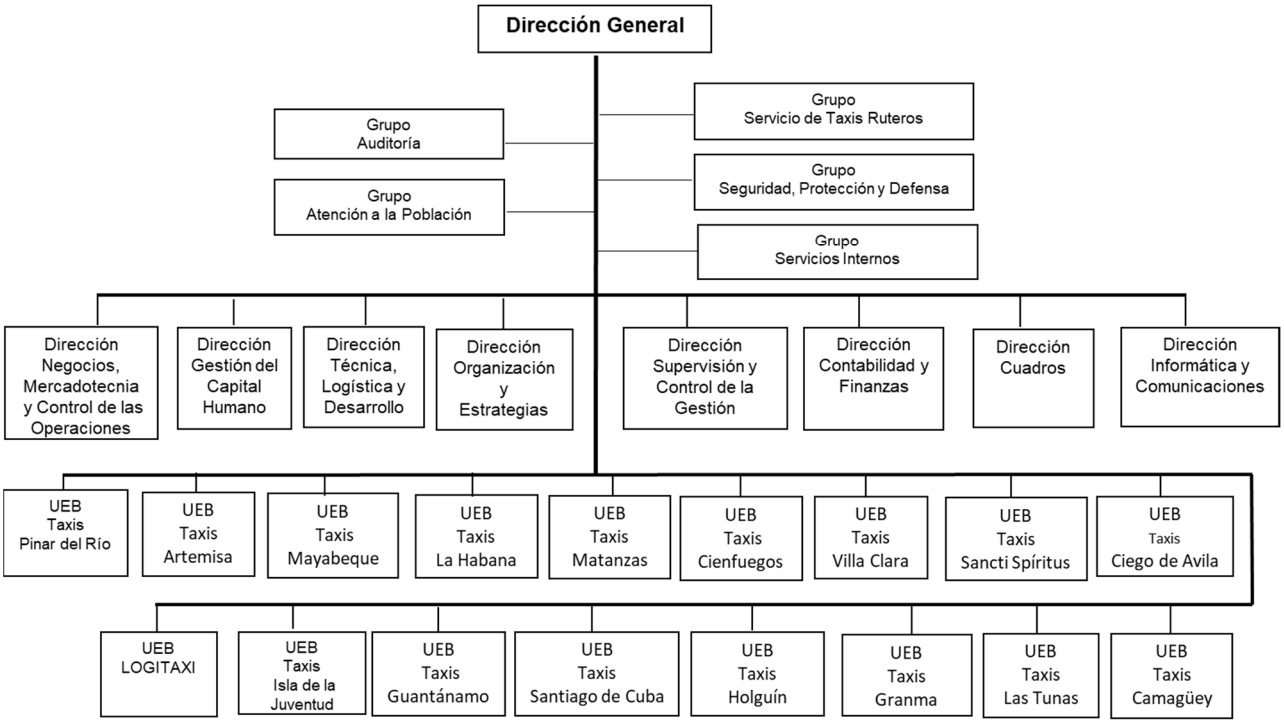
No.	UEB	No. of Workers
1	Main Office	128
2	Piñar del Rio	207
3	Matanzas	101
4	Viazul	403
5	Sandino	395
6	Camaño	204
7	Santa Clara	265
8	Cienfuegos	256
9	Sancti Spiritus	305
10	Ciego De Avila	198

No.	UEB	No. of Workers
11	Holguin	257
12	Santiago de Cuba	256
13	Guantanamo	220
14	Central Station	290
15	Camaguey	257
16	Granma	268
17	Collaborator	234
18	Las Tunas	224
TOTAL		4,468

Note: Number of Workers as of February 2019 / Source: EON

b) CUBATAXI

CUBATAXI is a taxi service company for Cuban citizens in CUP. Figure 2.5.6 illustrates the organizational structure of CUBATAXI in 2019.



Source: CUBATAXI

Figure 2.5.6 Organization Structure of CUBATAXI

There is 5,700 staff personnel in CUBATAXI, with approximately 4,000 personnel for operations (Table 2.5.13). In addition, CUBATAXI also provides a car maintenance service for private drivers.

Table 2.5.13 Human Resources of CUBATAXI in 2019

Category	Number of Workers
Management	25
Technicians	791
Administrative	46
Services	781
Operators	4,027
Total	**5,670**

Source: Cimab and CUBATAXI

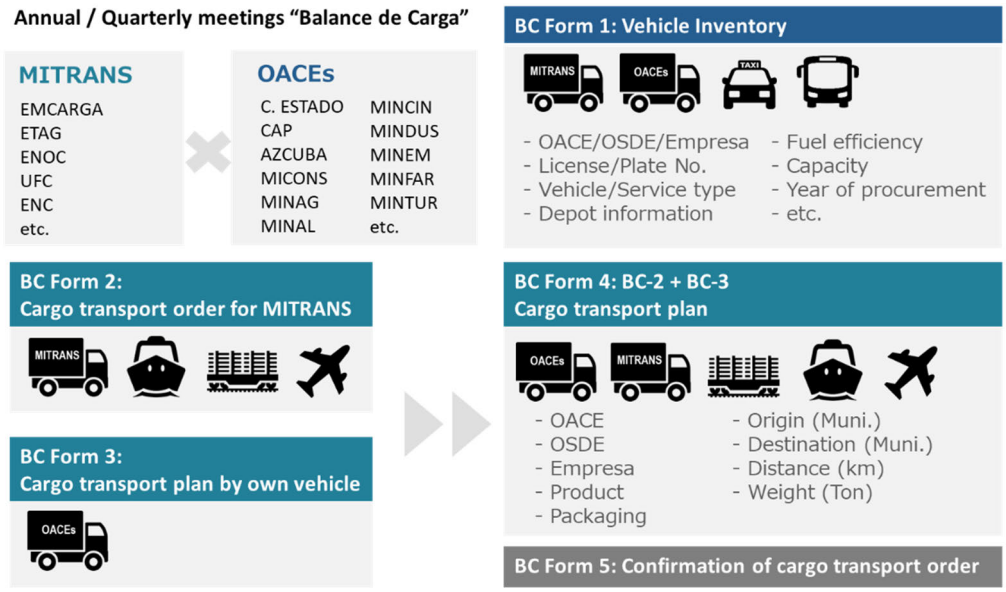
(3) Cargo Transport by Road

1) National Level Planning and Operation

In 2019, there were 388 enterprises integrated under the Superior Organization of Enterprise Management (OSDEs), providing cargo transport service in Cuba. EMCARGA, ETAG, ENOC, UFC, and ENC are major cargo service providers in MITRANS sector. Besides those service providers in MITRANS sector, cargo owners and cargo service providers (Empresas) in other ministries´ sectors own trucks and transport cargo, such as AZCUBA, MINAG, MINAL, MINDUS, MINEM, and MINFAR.

Cuba established a unique system of freight transport allocation among a variety of OACEs (ministries) across the country through the "*Balance de Cargas*" (Balance of Cargo, BC), as illustrated in Figure 2.5.7. MITRANS holds annual and quarterly meetings on freight distribution to coordinate expected demand and supply on transporting commodities among OACEs. OSDEs are requested to submit their cargo transport plan with unified forms to the Cargo Transport Direction of MITRANS. The BC forms consist of the following seven forms:

- BC Form 1 (BC-1): Inventory of transport vehicles;
- BC Form 2 (BC-2): Demand for cargo transport (Cargo transport transported by MITRANS);
- BC Form 3 (BC-3): Operations plan by own vehicles;
- BC Form 4 (BC-4): Cargo transport plan (Origin and Destination Information); and
- BC Form 5 (BC-5): Confirmation of cargo transport order by service providers.
- BC Form 6 (BC-6): Summary of the group of entities involved in the activities of the BC.
- BC Form BC-R: Sumnary report of the cargo transportation (transport actitivities planned and performed).



Source: JICA Study Team

Figure 2.5.7 System of Balance de Cargas

BC-1 records the integrated inventory information of both passenger and cargo transport vehicles owned by all of the entities in Cuba. As listed in Table 2.5.14, this inventory contains a variety of information about owned vehicles and their operation licenses, such as OACE, OSDE, Empresa, license and plate numbers, vehicle and service types, depot, registered fuel efficiency, capacity, etc.

Table 2.5.14 Major Contents on BC-1

Category	Contents
Owner	- Province / Municipality - OACE / OSDE - Empresa - Address
Vehicle	- Plate no. - Registration condition - Vehicle type - Service type - Brand / Model - Capacity (persons, ton) - Fuel type - Fuel efficiency (Indice de consumo de combustible, ICC) - Year of procurement - Depot no. and address - Service scope (National, provincial, municipal) - Issued date, Expired date
License (LOT)	- License no. - Registration condition - License type - License service type - License service scope (National, provincial, municipal) - Requested date, approved date, expired date, etc.

Source: Balance de Cargas Form 1 (BC-1)

OSDEs individually submit their cargo transport plan, collected through all the enterprises integrated under it to request MITRANS transport their commodities as BC-2 and transport them by their cargo vehicles as BC-3. MITRANS allocates cargo transport demand submitted through BC-2, which has not been contracted to cargo service providers in MITRANS sector, considering the type of cargo, commodities, and transport distance. The combination of BC-2 and BC-3 is recorded as BC-4 with basic information about each cargo transport plan, including OACE, OSDE, Empresa, product, type of cargo packaging, origin and destination, travel distance, and cargo weight, as listed in Table 2.5.15. The required budget and fuel are provided to each entity after the approval by MEP, under the consent of the Cargo Transport Direction of MITRANS. The BC also controls and analyzes the fulfillment of the last-period plan.

Table 2.5.15 Major Contents on BC-4

Category	Contents
Owner	- Province / Municipality - OACE / OSDE - Empresa
Cargo	- Product - Packaging
Travel	- Origin (Municipality) - Destination (Municipality) - Distance (km) - Weight (Ton)

Source: Balance de Cargas Form 1 (BC-4)

2) Provincial Level Planning and Operation

The Provincial Government is responsible for the administration of each province. The cargo transport planning in each province is also handled by the Provincial Government, except for Havana Province, where the Directorate General of Provincial Transport in Havana (DGTPH) is responsible for the transport planning in Havana Province.

The Provincial Transport Enterprise (EPT) is responsible for the provincial goods transport service. The cargo transport plan is based on the "*Balance de Cargas*". Similar to passenger transport, DPT and DGTPH are responsible for planning, controlling, and managing cargo transport. UET is in charge of trucks, mainly registration and daily monitoring.

(4) Railways

1) Planning

UFC provides railway service for passengers and cargo. The UFC head office decides the passenger train operation plan for national trains. In contrast, each regional railway enterprise decides the passenger train operation timetable for regional and interregional trains. The timetable is revised every five years in principle. However, the timetable used as of 2019 is the same as in 2012. The timetable is set according to the estimation of passenger volume in the next few years, and the estimation of transport volume is based on the last few years' results.

The cargo train operation plan is planned by UFC based on the cargo demand from cargo owners. First, the operation plan with the required budget and fuel is submitted to MITRANS. The required budget and fuel are then allocated after approval from MEP.

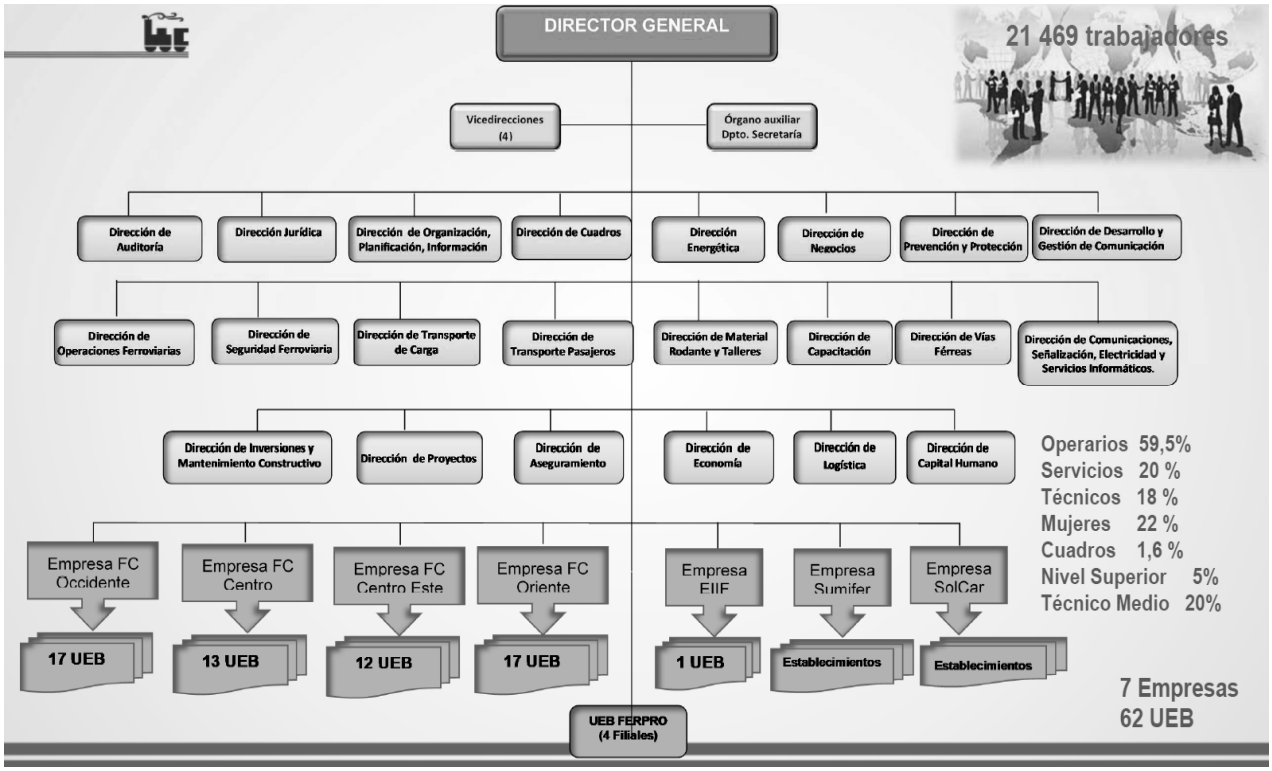
a) Railway Union of Cuba (UFC)

The detailed organization chart of UFC is shown in Figure 2.5.8. In 2019, there were 21,469 workers in UFC in total. Six regional railway operation enterprises (in 2021, they were created 2 new transport enterprises, FERROAZUCAR, in operations related to sugar mills and FERROMAR S.A, a mercantile society for the transportations in Mariel Special Development Zone). operate the railway network integrated under UFC:

(1) *Empresa Ferrocarriles de Occidente* (EFOC: Western Railway Enterprise);
(2) *Empresa Ferrocarriles del Centro* (EFC: Central Railway Enterprise);
(3) *Empresa Ferrocarriles Centro Este* (EFCE: Central East Railway Enterprise); and
(4) *Empresa Ferrocarriles de Oriente* (EFO: Eastern Railway Enterprise).
(5) FERROAZUCAR
(6) FERROMAR S.A.

In addition, UFC has three companies aside from regional railway operation companies:

(1) SOLCAR: Rail welding
(2) EIIF: Sleeper factory
(3) Sumifer: Parts supplier



Source: UFC

Figure 2.5.8 Organizational Chart of UFC

b) Railway Operation Enterprises under UFC

Each regional operation enterprise has the same railway operation and maintenance function for each region.

c) SOLCAR (Empresa Constructora de Vías Férreas: ECVF)

SOLCAR was established in 1982 as the track construction and maintenance organization at the national level. The main works of SOLCAR are:

(1) Construction of new track;
(2) Welding of long rail (300m length);
(3) Track maintenance with heavy machinery;
(4) Inspection of track condition;
(5) Inspection of the condition of bridges.

SOLCAR employs 350 persons in eight teams, with the main teams being:

(1) Welding of rail at the workshop;
(2) Welding of rail at the site;
(3) Construction of track and some parts of bridges;
(4) Replacement of rail;
(5) Maintenance of electrical works;
(6) Maintenance of mechanical works.

SOLCAR is responsible for the replacement work of track to long rail, including rail, sleeper, and fastening systems, while UEB is in charge of the replacement work of the sleeper and fastening system.

d) EIIF

EIIF was established in 1983 to produce concrete sleeper and rail fastening systems. The old sleeper-producing machine, made in the Soviet Union, was replaced in 2009 with a new machine from Italy. The new machine is mainly used to produce sleepers, while the old machine is still workable and used for developing a new type of sleeper.

The new sleeper product line is mechanized but not automated; a well-trained technician must do all controls. The production capacity is one million sleepers per year, but the production results of recent years are about 300,000 sleepers annually; the reason for this is the lack of supply of coarse aggregate, fine aggregate, and cement. Furthermore, the lack of cement is the cause of the low quality of the sleeper; the strength and weather resistance is insufficient.

EIIF has a quarry for coarse and fine aggregates, but the production system is old and deteriorated and works insufficiently.

(5) Aviation

1) Operation

The superior entity of the airport and air transport sector in Cuba is the Institute of Civil Aeronautics of Cuba (IACC), subordinated to the Ministry of Transport (MITRANS), which is the supervising

authority of the transport sector. Under Law 1218 on transport in general, Decree-Law 255 is established as legislation related to civil aviation, and a decree establishes the provisions in more detail. In addition, under such legislation, the IACC establishes regulations and related manuals that meet the International Civil Aviation Organization (ICAO) standards. IACC establishes regulations with the denomination of Cuban Aeronautical Regulations and manuals established by IACC with the denomination of Cuban Aeronautical Manuals.

With the reorganization of MITRANS in 2015, all the departments under the competence of IACC, were placed under the integral management of CACSA of the new organization OSDE (Superior Organization of Business Management). As a result, under CACSA, which currently controls and manages the enterprises integrated under it, 11 in total and 3 international economic associations and is attended by MITRANS. Among these enterprises they are Empresa Cubana de Aeropuertos y Servicios Aeronáuticos (ECASA), Cubana de Aviación (ECA: official Cuban airline), Aerovaradero (enterprise operating air cargo), and three (3) joint venture with foreign capital.

CACSA is responsible of satisfying the passenger and cargo air transportation demands, with sustainable airports and airport infrastructure which guarantees the surveillance and sovereignity of Cuban air space, as well as the demand of agriculture activity, which contributes to the food program in Cuba.

Enterprises and international economic associations integrated under CACSA (2022) are the following:

Empresa Cubana de Aeropuertos y Servicios Aeroportuarios (ECASA S.A.), which deals with the assistance in land to aircrafts and passengers for the 10 international airports in Cuba (do not provide control of air traffic), **Empresa de Navegacion Aerea, (ECNA S.A.),** which provides air, meteorological, telecommunication and aeronautical information services, **Cubana de Aviación S.A.,** founded in 1929, provides passengers and cargo transportation services in regular and non-regular ways. It has different possibilities for national, domestic and interlineal connections. Another air line, Aerogaviota, which operates with military affiliation, provides limited services in five domestic and five international routes. **Aerovaradero S.A**, which generally handles national and international air cargo, **Cubacatering S.A.,** provides air catering and gastronomic services in all the airport facilities in the country, **ESPAC S.A.,** dedicated to the security and safety in all the airport facilities, **Comercial Takeoff S.A**., which attends the representation of air lines and foreign commercial companies, **Aviaimport S.A**., provides services of contract, imports and commercialization of the necessary stuffs for the aviation system, **CCOA S.A**:, provides services of consulting and technical advisory in the preparation and implementation of investments in the civil aviation system, **ENSA S.A**., responsible for the application of chemical and biological products, patrolling and extinction of forest fires; and **SERVAC S.A**., which provides services to the Cuban aviation. The 3 foreign ventures are; **Empresa Hispano Cubana de Mantenimiento de Aeronaves (IBECA),** which provides online maintenance of aircrafts, **ELCA (Empresa Logística de Carga Aérea),** enterprise dedicated to the development of Havana as a transfer point of goods and **GAM Technic, (grupo Aeronáutico de mantenimiento),** providing services of major techncal maintenance to aircrafts.

Cuba's passenger air transport is provided by two air carriers: Cubana Air (Cubana) and Aerogaviota, the latter managed by MINFAR with a limited number of flights. Cubana has approximately a 90% market share, and in 2015 served around 1.2 million passengers. Currently, Cubana operates flights to 11 destinations domestically as well as internationally. Meanwhile, at the four airports of Ciego de Ávila, Trinidad, Cayo Santa María, and Santa Clara, Aerogaviota is the only operator and has also established five international routes to the Dominican Republic.

2) Planning and Monitoring

Budget planning at the CACSA level is an annual process that begins in January at each integrated enterprise. CACSA receives enterprise budget plans, examines and compiles them, and tables them to the Government Board. The Government Board is composed of: (i) the Vice Minister of Transport, (ii) the Director General of GEA, (iii) a specialist of MEP, (iv) a specialist of MINCEX, and (v) a specialist of MFP. First, the Government Board examines the budget plan and specifies if there are matters to be corrected. Afterward, the CACSA budget goes to MEP for approval. The examining process at MEP finishes in November, and then the ANPP determines in December if it should be approved as prepared or with any discount.

Monitoring budget execution and operation performance at the CACSA level involves the Management Council of CACSA and the Government Board. Every month, the Management Council examines the operation performance record. Every three months, the Management Council and the Government Board check the record; the check report is sent to MEP every three months. Operational performance is examined through monthly and quarterly checks, and corrective action is discussed.

3) CACSA Group Human Resource

As shown in Table 2.5.16, the total number of CACSA employees as of December 2018, including those of the 11 enterprises in the group, amounted to about 15,103, of which there were: 805 directors, 4,823 technicians, 231 administrative staff, 3,446 operators, 4,465 services section staff and 1,333 permanent contract and high-season personnel.

Table 2.5.16 CACSA Employee Composition

Occupational category	Approved	Permanent	Seasonal contract	Total	%
	(1)	(2)	(3)	(2 + 3) = 4	(1/2)
Operator	3,969	3,446	226	3,672	87
Services	5,551	4,465	758	5,223	80
Administrative	254	231	6	237	91
Technical	5,653	4,823	343	5,166	85
Manger level	849	757	0	757	89
Director level	52	47	0	47	90
Executive level	1	1	0	1	100
TOTAL	**16,329**	**13,770**	**1,333**	**15,103**	84

Source: CACSA

Educational levels attained by this personnel: 3,844 university graduates, 3,976 2-year university graduates, 4,917 2-year technical university graduates, and 2,256 technical college graduates. Detailed education level numbers are shown in Table 2.5.17.

Table 2.5.17 CACSA Employees' Education Level Composition

Educational level	Permanent	Seasonal	Total	%
University level	3,571	273	3,844	25
College level	3,573	403	3,976	26
Technical college	4,536	381	4,917	33
High school level	1,982	274	2,256	15
6th grade	108	2	110	1
Total	**13,770**	**1,333**	**15,103**	**100**

Source: CACSA

Workforce details by CACSA Group Company are shown in Table 2.5.18.

Table 2.5.18 CACSA Group Companies Employee Composition

Occupational category	Approved (1)	Permanent (2)	Seasonal contract	Total	% (2/1)
CACSA	188	177	1	178	94
SERVAC	411	363	30	393	88
ECA (Cubana airlines)	1,685	1,458	40	1,498	87
ECASA	6,095	5,345	332	5,677	88
ENSA	705	607	52	659	86
CUBACATERING	1,976	1,777	76	1,853	90
AVIAIMPORT	156	119	5	124	76
AEROVARADERO	498	445	28	473	89
CCOA	80	73	6	79	91
ESPAC	3,349	2,379	658	3,037	71
TAKE OFF	270	255	6	261	94
MIXED	118	103	4	107	87
ECNA	798	669	95	764	84
TOTAL	**16,329**	**13,770**	**1,333**	**15,103**	**84**

Source: CACSA

The ethnic composition of CACSA personnel is shown in Table 2.5.19.

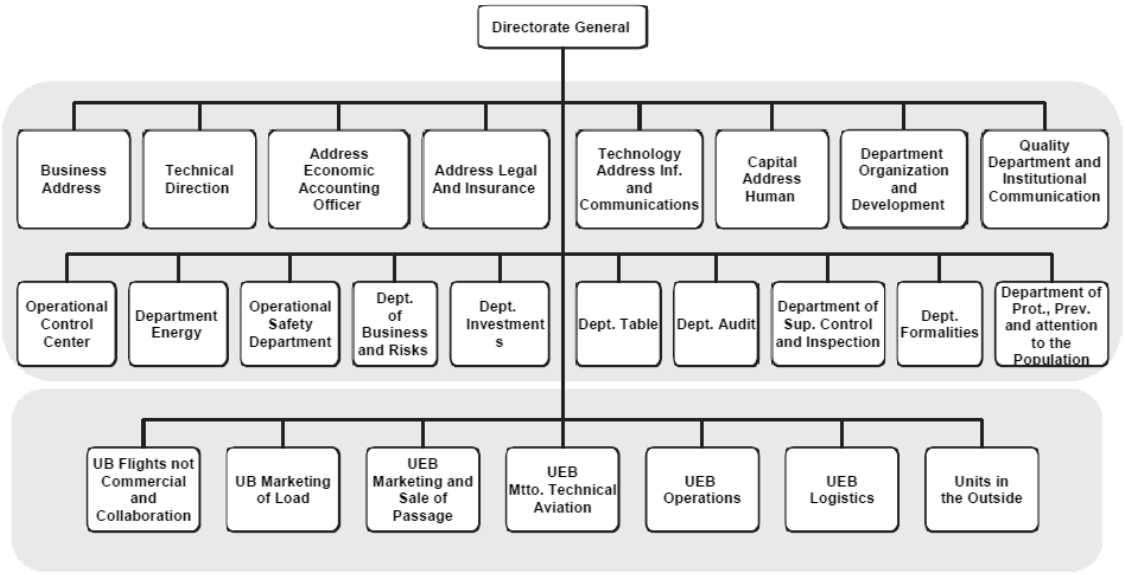
Table 2.5.19 CACSA Ethnic Composition

Age range	Ethnic composition			Sex		
	W	B	M	M	F	%
Up to 35	2,824	753	970	2,807	1,740	30
From 36 to 40	1,268	319	567	1,164	990	14
From 41 to 55	3,461	873	1,151	3,142	2,343	36
From 56 to 60	903	375	474	1,312	440	12
Over 60	680	218	267	987	178	8
Total	**9,136**	**2,538**	**3,429**	**9,412**	**5,691**	**100**
%	**60**	**17**	**23**	**62**	**38**	

Source: CACSA

As part of the workforce employed, there are 83 graduates in training, of which 42 are technicians of upper secondary level, and 41 are university graduates.

ECA or Cubana Airlines (IATA: CU) was founded in 1929 and is the official airline of Cuba, with flights commencing in 1930. In 1932, Pan American World Airways took over the airline until 1945, when Cuban business people acquired the majority share of the airline. Subsequently, Cuba's government assumed control of Cubana in 1959 and operated as a state-owned enterprise under parent *Corporación Cubana de Aviación*. The number of Cubana airlines employees is 1,814. The company organization chart is shown in Figure 2.5.9.



Source: CACSA

Figure 2.5.9 Organization of Cubana Airlines

(6) Maritime

1) Operation

Cuba's maritime shipping business is run under GEMAR, one of four OSDEs in MITRANS sector, and supervises 26 state enterprises covering port and maritime transport services, shipyard, pilotage, and tug services, ship consignee agency, workforce dispatching, etc. The integrated enterprises under GEMAR are shown in Table 2.5.20.

Table 2.5.20 Enterprises integrated under GEMAR

Area	Enterprise name
Port and harbor related	Thunder Container Leasing and Repair
	Empresa Transitaria de Cargas (TRANSCARGO)
	Empresa de Servicios y Mantenimientos (SERVIMANT)
	Consultores Marítimos (COMAR)
	Prácticos de Puertos de la República de Cuba (Pilots of Cuba)
	Empresa de Navegación Caribe (ENC)
	Consignataria Mambisa

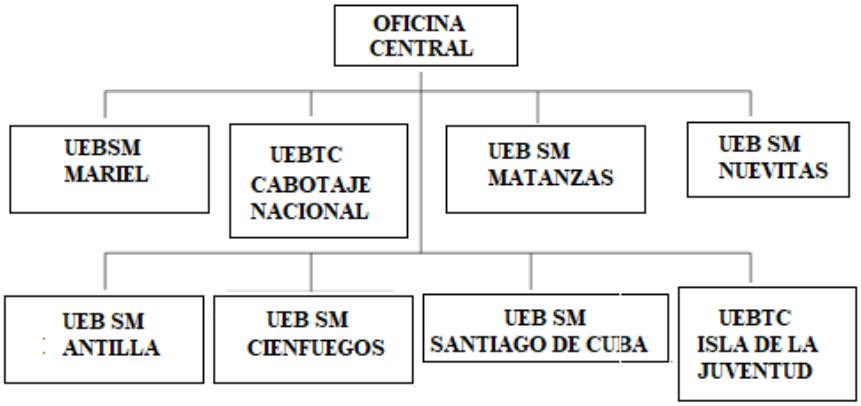
Area	Enterprise name
Manpower	Empresa Empleadora Portuaria (AGEMPORT)
Shipyard and dock	Caribbean Drydock Company (CDC)
	Empresa de Astilleros del Oriente (ASTOR)
	Astillero Roberto Nodarse
	Empresa Astilleros del Caribe (ASTICAR)
	Empresa Nacional de Astilleros (ENA)
Port services	Empresa de Servicios Portuarios Manuel Porto Dapena
	Empresa de Servicios Portuarios del Oriente (SERPO)
	Empresa de Servicios Portuarios del Centro Este
	Empresa de Servicios Portuarios del Centro
	Empresa de Servicios Portuarios de Occidente (SEPOC)
Others	Empresa de Corretaje de Combustible (PETROMAR)
	Habana Inmuebles (HINES)
	Centro de Investigación y Manejo Ambiental del Transporte (Cimab)
	Agencia General de Seguridad y Protección (AGESP)
	SERVITALLY
	SUMARPO
	SELECMAR
	PETROMAR

Source: GEMAR

2) Major Service provider

a) Caribbean Navigation Enterprise (ENC)

Caribbean Navigation Enterprise (ENC) is a shipping enterprise with more than 80 vessels, including tugboats and barges, and has as its core activities the transportation of general and liquid cargo. ENC has 83 vessels: 19 liquid cargo vessels, 18 dry cargo vessels, 10 cabotage tugboats, 30 maneuvering tugboats, and 6 auxiliary vessels. There are eight branches of ENC besides the head office, as shown in Figure 2.5.10.



Source: CIMAB and ENC

Figure 2.5.10 Organization Structure of ENC

b) Pilots of Cuba

Pilots of Cuba, enterprise integrated under GEMAR, provides pilotage and maritime passenger service in Cuba. There are 471 personnel in the company, as shown in Table 2.5.21.

Table 2.5.21 Human Resources of Pilots of Cuba in 2019

No.	Category	Number of Workers
1	Operation	141
2	Technicians	111
3	Services	81
4	Administrative	1
5	Specialists	113
6	Board of Directors	2
7	Executive Board	22

Source: Pilots of Cuba

2.6 Financial Framework - External Funding

The default on debt repayment by the Cuban Government was a strain on trade with foreign countries, and there has been positive movement on Cuba's foreign debt. In November 2013, Mexico exempted the repayment of USD 487 million against the Cuban debt of 70% and agreed with Cuba that Cuba would pay the remaining 30% in 10 years. In 2014, Russia exempted Cuba from repaying 90% of its USD 35 billion in Cuban debt, including that accrued during the Soviet era. In October 2015, Uruguay issued an official gazette of Law No. 19,344, exempting Cuba from paying USD 31.5 million and accrued interest. On December 12, 2015, 14 major creditor countries[16] representing the Paris Club agreed to debt restructuring for the first time since Cuba's default in 1986. The total debt amount was fixed at approximately USD 11 billion, and Cuba agreed to repay $2.6 billion over 18 years, with the remainder exempted from payment. After the Paris Club agreement, it has embarked on measures to remedy medium and long-term debt through bilateral negotiations.

Japan's debt relief measures were announced on September 19, 2016, based on the conclusions reached the Paris Club's Major Creditors Meeting:

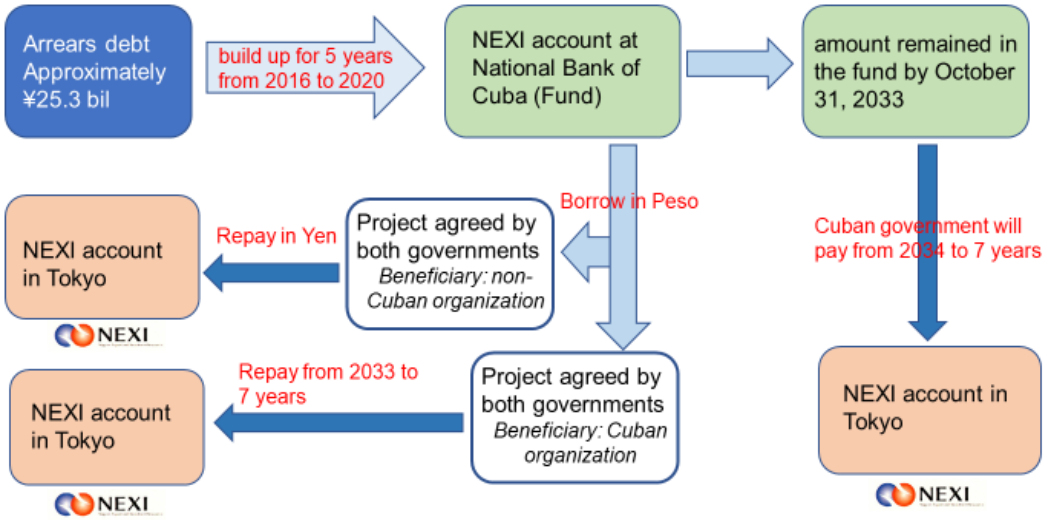
1) The delinquent interest rate of approx. ¥119.7 billion is phased out over 18 years from 2016 to 2033, subject to deferred debt payments, etc.
2) Of the principal and initial contractual interest rates of approx. ¥61.5 billion, approx. ¥36.2 billion will be paid to NEXI (Nippon Export and Investment Insurance) from 2016 to 2033 as arrears on delinquent debt. Therefore, the deferred interest rate is 1.5% per year.
3) Approximately ¥25.3 billion as arrears debt will be accumulated as the fund as follows[17];
    a) Open a "fund" within the National Bank of Cuba and build up funds for 5 years from 2016 to 2020 (the amount deposited in the fund is spent on development projects in Cuba as agreed between the two countries; those who use it will pay NEXI an amount equivalent to the amount of expenditure from the fund).

[16] Australia, Austria, Belgium, Canada, Denmark, Finland, France, Italy, Japan, Netherlands, Spain, Sweden, Switzerland and United Kingdom
[17] JETRO presentation on "Cuban politic and economic situation and opportunity for investment," April 2017

b) If the amount deposited in the fund is not fully paid by October 31, 2033, the Cuban Government will pay the remaining amount to NEXI in 2034 to 7 years.

The fund is used to pay local costs when Japanese companies invest in Cuba. It is converted to CUP when it is withdrawn. A Japanese company that uses the fund pays the same amount to Japanese Trade Insurance (NEXI) in yen. There are three possible ways to use the fund:

i) utilization of peso-denominated paid-in capital when a Japanese company invests in a Cuban operating company;
ii) used as peso-denominated business funds for Japanese companies operating in Cuba; and
iii) use for payment of peso local costs related to what the Cuban company orders from Japan.



Source: JICA Study Team based on NEXI Presentation

Figure 2.6.1 New Fund Scheme Agreed by the Both Governments

If this fund system is implemented, as of May 2019, 15 billion yen has been accumulated as a fund in the NEXI-named account at the National Bank of Cuba; companies that are interested in business in Cuba can utilize it. However, at first glance, this scheme is problematic: the borrower must borrow in CUP and repay it in JPY and is, therefore, fully exposed to foreign exchange risk. The establishment of the fund for the elimination of delinquent debt is one step forward. However, there is room for improvement in the fund's scheme, considering the borrower's convenience. Spain, France, and Italy have also created funds with similar schemes, with private companies utilizing them, and it is hoped that improvements will be made through surveys of the funds from these three countries in the future.

In consultation with the Development Bank of Latin America (CAF), an agreement was signed on September 2, 2016, on future funding from Cuba and funding to Cuba.[18] If a country joins a neoliberal institution such as the IMF or the World Bank, said the country needs to receive recommendations for economic policies that require high social costs. China sought a special case when joining as a socialist country, which should be a lesson for Cuba. It is often said that Cuba needs funding from international organizations, but there is no framework for what type of funding is desirable. An applicable fund(s) that is necessary for growth and can contribute functionally should be identified.

[18] https://www.caf.com/en/currently/news/2016/09/caf-and-cuba-sign-first-agreement-of-understanding-to-establish-a-joint-working-agenda/

In 2016, amendments were made to the Central American Bank for Economic Integration's (BCIE) Constitutive Agreement to strengthen relations and regional integration between Central America and the Caribbean. The Board of Governors accepted the incorporation of the Republic of Cuba in April 2017. On July 11, 2018, completed the process for its incorporation in compliance with the regulatory provisions, officially making Cuba a non-regional member of the Bank. The BCIE is the first multilateral organization in the region that received Cuba as one of its members. The incorporation will allow new integration opportunities with the Caribbean and Central American countries. This will also strengthen trade opportunities between Cuba and the member countries of the Bank.[19]

2.7 Investment Opportunities

The Portfolio of Foreign Investment Opportunity (Portfolio), which lists and describes investment projects that the Cuban Government regards as promising, is based on the Foreign Investment Law. It is published annually by the Centro para la Promoción del Comercio Exterior y la Inversión Extranjera (ProCuba, agency for the promotion of investments under MINCEX), the Ministry of Foreign Trade and Foreign Investment (MINCEX), and Cámara de Comercio de la República de Cuba (CCRC). Five hundred twenty-five promising investment opportunities are listed in the latest Portfolio, and of these, 45 are projects in the Mariel Development Zone. The number of promising investments has increased annually and significantly from 456 in the previous year. Even projects not listed in the Portfolio are also subject to approval.[20] The Foreign Investment Law and sectoral policies define areas where foreign investment is not permitted (see Table 2.7.1). Although not specified as a field where foreign investment is not allowed, according to MINCEX, the food service industry is sensitive because it serves as a private sector job.

Table 2.7.1 Fields where Foreign Investment is not Permitted

Foreign Investment Law	Public Health, Education, Military, Defense, State Security, Property of the Citizens, Areas that Affects Environmental Sustainability
Sectoral Policy	Agriculture, Forestry, Food Sector • Cultivation and Industrialization of Lobster Tourism Sector • Facility to display dolphins Telecommunications, Postal Services • Operation and provision of telecommunications services • The field does not allow 100% foreign capital investment

Source: JICA Study Team

According to the Cuban Government, projects listed in the Portfolio are ones for which Cuba has already conducted feasibility studies. Contents of the project, the type and amount of investment, and in the case of a joint venture or an international economic partnership agreement, the names and contact information of the state-owned companies that will be partners on the Cuban side are listed for each project.

The Foreign Investment Act defines three investment modes (modalities) that are not permitted for foreign investments. For direct investment by investment type, most are joint ventures. Hotels with various foreign companies involved are based on international economic partnership agreements. There have been cases where 100% foreign capital has been approved when investing in the Mariel Development Zone.

[19] BCIE Website: https://www.bcie.org/paises-socios/extrarregionales/cuba/
[20] Cuba Investment Seminar held in Tokyo on 14th March, 2019

In addition, the annual portfolio of investment opportunities created by ProCuba, an investment promotion agency under the auspices of MINCEX, includes a list of investment opportunities by the Mariel Development Zone, with 45 industrial issues of interest and policies by sector. The list includes information on each project (description, investment modality, Cuban partner, estimated investment amount, location, market prospect, expected result, and contact information) and each sector's industrial policy and development plan. The total number of projects targeted for investment is 525, and the absolute investment requirement is USD 10.7 billion. Table 2.7.2 shows the breakdown of the portfolio of investment opportunities. The following can be observed from this table:

- The agri-food sector constantly has a substantial number of projects and is thus important;
- The tourism and petroleum sectors show a large increase, signifying an urgent requirement;
- The health, pharmaceutical, transportation, and insurance (finance) sectors are relatively small in quantity. Therefore, though these sectors are priority sectors in the Economic and Social Development Plan through 2030, they are considered to be state sector plans or of low feasibility.

In interviews with stakeholders at the time of the survey, there were a few cases in which Cuba's industrial policy and development plans were viewed as this investment opportunity portfolio. On the other hand, private-sector companies have predefined Cuban companies in the project list; investors cannot select partners. As a result, there is a lack of options and information for investors to consider an investment, and there is room for improvement.

Table 2.7.2 Number of Projects in Portfolio

Sector	2018-2019	2017-2018	2016-2017
Agrifood	108	104	75
Sugar Industry	7	7	13
Industrial	48	33	8
Tourism	187	152	114
Renewable Energy	12	13	23
Mining	14	10	13
Petroleum	105	78	87
Transportation	5	8	10
Logistics	2	1	
Pharmaceutical and Biotechnological	7	15	2
Health	2	2	3
Construction	14	14	9
Business	4	4	6
Audio-visual	2	3	3
Hydraulic	6	7	5
Cultural	2	2	
Real Estate		1	
Insurance		2	
Subtotal	**525**	**456**	**371**
Mariel Special Development Zone	45	50	24

Source: Portfolio of Opportunities for Foreign Investment 2018-19

Projects in the Portfolio are distributed throughout the country. However, the distribution is uneven in each province (Table 2.7.3).

Table 2.7.3 Territorial Distribution of the Projects in Portfolio of the Investment Opportunity

Province	Number of Project
Piñar del Rio	20
Artemisa	64
La Habana	85
Mayabeque	15
Matanzas	35
Villa Clara	12
Cienfuegos	20
Sancti Spiritus	19
Ciego de Avilla	22
Camaguey	30
Las Tunas	11
Holguin	35
Granma	13
Santiago de Cuba	23
Guantanamo	7
Isla de Juventud	4
No identification for province	112
Total	**527**

Source: Study Team by Portfolio of Investment Opportunity 2018-2019, ProCuba

Chapter 3 Demand Forecast

3.1 Approach

Figure 3.1.1 shows the inputs and outputs of the traffic demand forecast. Projections of future population, numbers of foreign tourists, and GDP growth are the major inputs. Using these inputs, demand forecast models were separately developed for three categories: i) Cuban passengers, ii) Non-resident passengers, and iii) cargo transport, considering fare systems and market segments in Cuba. It should be noted that the model for non-residents (visitors) was based on CUC when it was developed. Given that the currencies were consolidated into CUP in January 2021, the model needs to be updated using CUP. But this may require another survey: visitor transport behavior under the new pricing system.

3.1.1 Passengers

Future trip generation by Cuban residents was estimated based on future population projections by ONEI. Estimates for non-residents (tourists & visitors) are based on trend analysis of international passenger forecasts.

Three cases were considered in determining unit trip-generation rates of Cuban residents:

- Case 1: Current trip rate (OD survey result)
- Case 2: Stated preference trip rate (SP survey result)
- Case 3: Trip rate before the dissolution of the USSR

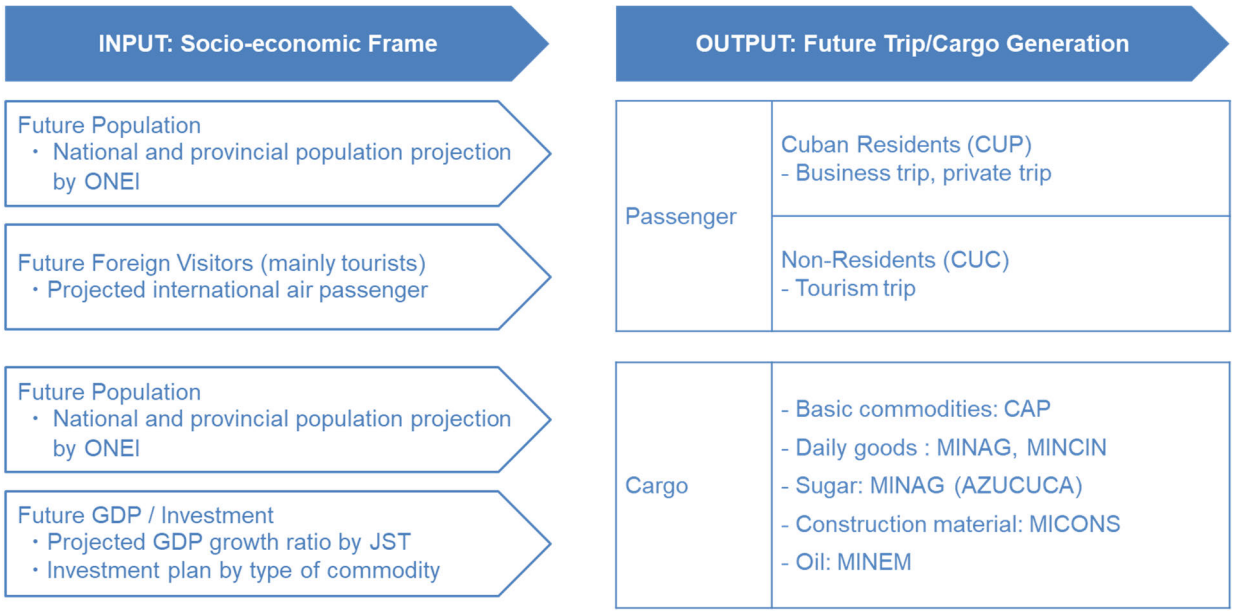
Since the current trip generation is estimated under the 2019 conditions of limited supply (limited availability of transport capacity for which demand could exceed), it indicates that revealed trip generations were smaller than desired trip generations. Given this, a stated preference survey (SP survey) was conducted to capture Cuban citizens' desired trip generations (Case 2). Case 3 was considered by assuming that trip generation reverts to the level in 1986 prior to the demise of the USSR (i.e., 1.45 times the bus passenger volume in 2017).

No significant differences are found between Case 1 and Case 2. So, even under the limited transport capacity, the revealed trips are almost the same as the stated preference case. Referring to the historical records of bus passenger volume, Case 3 was considered but not used in the demand forecast because it was considered that the people could use other modes of transport, such as a shared vehicle. In conclusion, Case 1 trip rates are used in the model.

3.1.2 Cargo

Using BC-4 data and other statistics, cargo OD matrices were separately developed for 23 commodities.

For the base-case demand forecast, existing OD patterns are used in developing future commodity OD matrices (Frater method). For cargo trip generation rates, two economic growth scenarios were prepared: i) a likely growth scenario, and ii) a restricted growth scenario reflecting international trade difficulties.



Source: JICA Study Team

Figure 3.1.1 Demand forecasting inputs & outputs

3.2 Methodology

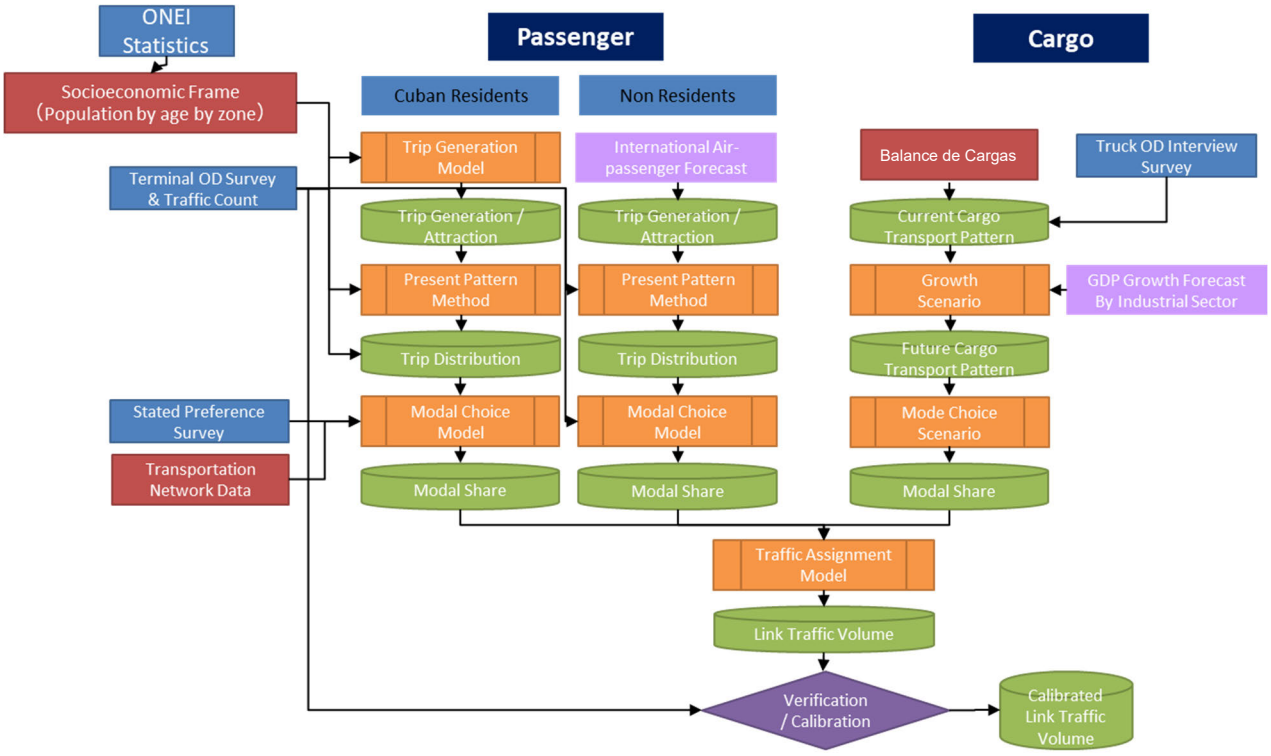
3.2.1 Planning horizons

Since the field traffic survey was carried out in 2019, and 2018 BC-4 data were used in developing the commodity OD matrices, 2019 is the base year for the transport modeling. The ultimate target year is 2030 (per the upstream policy documents), and 2025 is the mid-term planning horizon. Demand forecasts were prepared for three planning horizons:

- Base year: 2019
- Mid-term planning horizon: 2025
- Long-term planning horizon: 2030

3.2.2 Demand forecasting process

Figure 3.2.1 shows an overall flow chart for demand forecasting. For passenger demand, a conventional four-step modeling method (strategic transport modeling) was used. Cuban resident and non-resident passenger traffic and movement patterns were estimated separately. Cargo demand was forecast based on current cargo movements along with a GDP growth ratio forecast for each industrial sector.



Source: JICA Study Team

Figure 3.2.1 Demand forecasting flow

3.2.3 Traffic analysis zones

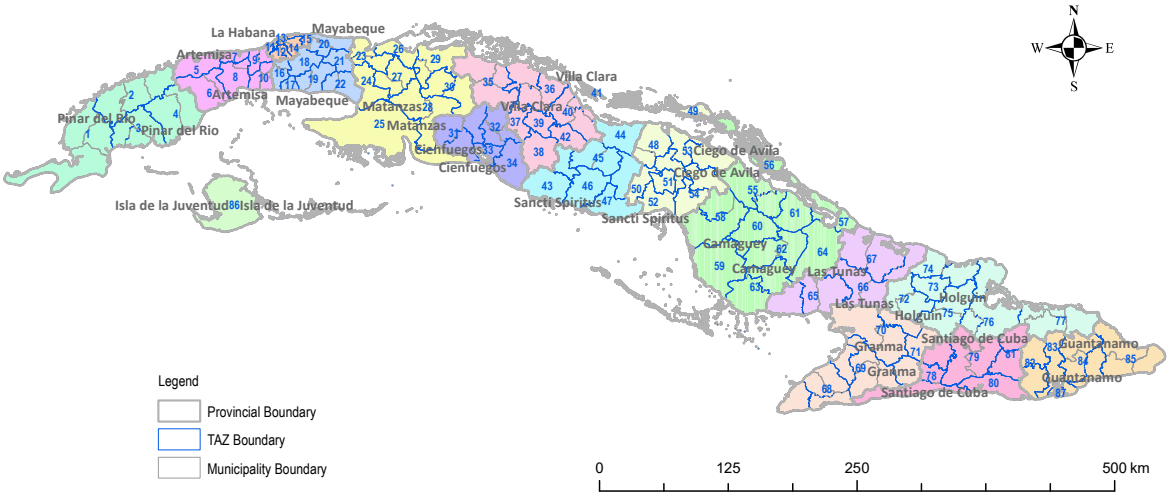
To create a scheme of traffic analysis zones across Cuba's 15 provinces, a special municipality (Isla de la Juventud & 169 municipalities, available socio-economic data, transportation networks, and existing traffic data were considered. The result is 87 Traffic Analysis Zones (TAZs), as shown in Figure 3.2.2. Plus, seven airports, eight ports, and ZED Mariel are treated as special generation zones, as shown in Table 3.2.1.

Table 3.2.1 Special zones

Special zones	TAZ
Camaguey airport	88
Cayo Largo del Sur airport	89
Havana airport	90
Holguin airport	91
Santa Clara airport	92
Santiago de Cuba airport	93
Varadero airport	94

Special zones	TAZ
Havana port	95
Cienfuegos port	96
Santiago port	97
Matanzas port	98
Nuevitas port	99
Mariel port	100
Moa port	101
ZED Mariel	102

Source: JICA Study Team

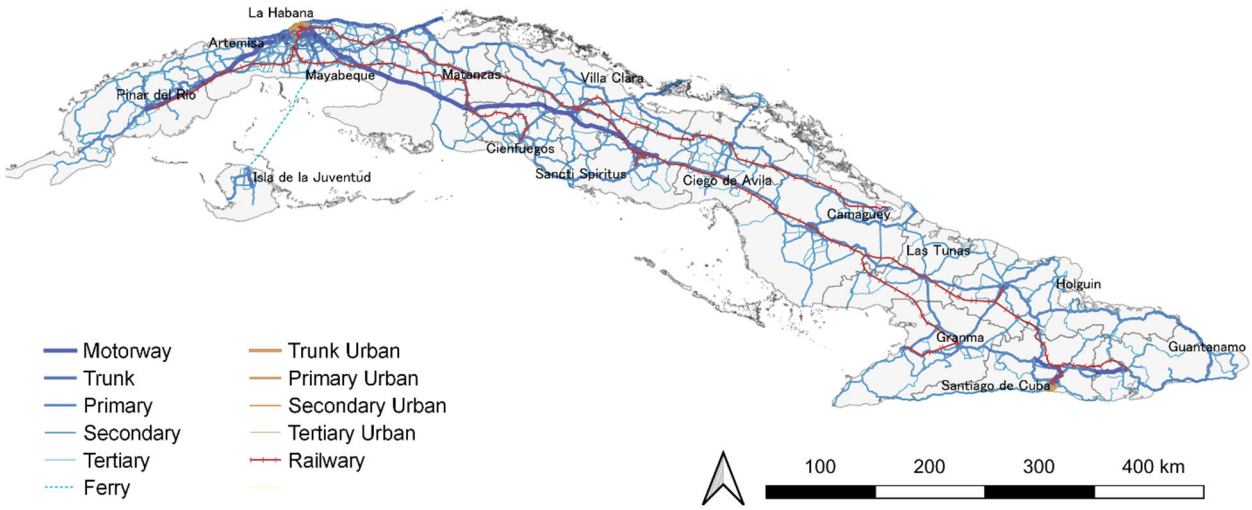


Source: JICA Study Team

Figure 3.2.2 Traffic analysis zones

3.2.4 Transportation network

Figure 3.2.3 shows a computer-generated rendering of road and rail networks used in the traffic assignment process. The road network includes motorways and trunk routes, plus primary, secondary, and tertiary roads. The capacity and free-flow speed of each road category are defined as shown in Table 3.2.2.



Source: JICA Study Team

Figure 3.2.3 Transportation network

Table 3.2.2 Transportation network link attributes

Category	Daily capacity	Speed
	PCU/lane	km/h
Motorway	27,600	100
Trunk	16,140	100
Primary	16,140	80
Secondary	16,140	70
Tertiary	16,140	60
Ferry	-	30

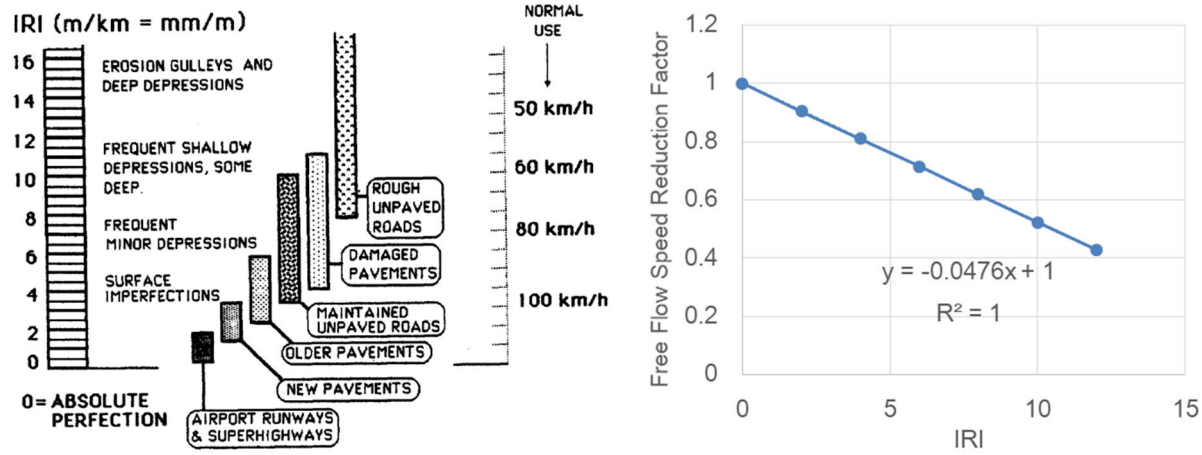
Category	Daily capacity	Speed
	PCU/lane	km/h
Trunk urban	12,120	100
Primary urban	12,120	70
Secondary urban	12,120	60
Tertiary urban	12,120	50
Railway	-	35

Source: JICA Study Team

3.2.5 Speed reduction factors

(1) Roughness of road surface

The free-flow speed of road traffic is affected by the roughness of the road surface. Based on the "Guidelines for Conducting & Calibrating Road Roughness Measurements," the relation between IRI and speed reduction is defined as shown in Figure 3.2.4. The free-flow speed of each road section is calculated as the speeds given in Figure 3.2.3, multiplied by the reduction factor of IRI. In the study, IRI information was collected from a field survey in 2019 on major road sections. The average IRI of each road class was applied where links do not have an observed IRI.



Source: Guidelines for Conducting and Calibrating Road Roughness Measurements, JICA Study Team

Figure 3.2.4 Relation between IRI and speed reduction

(2) Volume delay function

In addition to IRI, traffic congestion has an impact on driving speed. The standard Bureau of Public Roads (BPR) equation is applied as the volume delay function in this study. The BPR equation is:

$$S = \frac{S_f}{1 + \alpha \left(\frac{V}{C}\right)^{\beta}}$$

where:

S = predicted mean speed
S_f = free flow speed
V = traffic volume
C = practical capacity
$\alpha = 0.15$ (parameter)
$\beta = 4$ (parameter)

3.2.6 PCU factor & average occupancy

Table 3.2.3 shows 12 vehicle types considered in this study. The Passenger Car Unit (PCU) is defined based on the Highway Capacity Manual. The average occupancy is calculated based on field surveys in this study.

Table 3.2.3 PCU factor & average occupancy

ID	Vehicle type	PCU	Average occupancy
1	Motorcycle/three-wheeler	0.3	1.49
2	Car/Jeep	1.0	3.04
3	Passenger van	1.0	4.61
4	Microbus	1.6	15.57
5	Large bus	2.0	34.52
6	Truck-bus/semi-omnibus	2.0	30.97
7	Pickup/three-wheeled truck	1.0	2.45
8	Panel van	1.0	2.36
9	Light truck	2.0	2.21
10	Heavy truck	2.0	1.9
11	Articulated set	2.0	1.79
12	Others	1.0	1.95

Source: JICA Study Team

3.2.7 Transit network

A computer-generated inter-provincial transit network, including intercity buses, railways, airlines, and ferries, was developed as part of this demand forecast model. Given the dual strata of transport service in Cuba, network attributes were set separately for Cuban residents and non-residents. It should be noted that this transit network model does not include urban/inter-urban services within provinces (which are mainly provided by EPT). In the dataset for this network, key attributes were set for each transit line:

- Route
- Stops

- Service frequency
- Fare system
- Passenger capacity

A summary of transit network settings, shown in Table 3.2.4, is based on actual schedules, current operational performance, and the fare system.

Table 3.2.4 Transit network setting

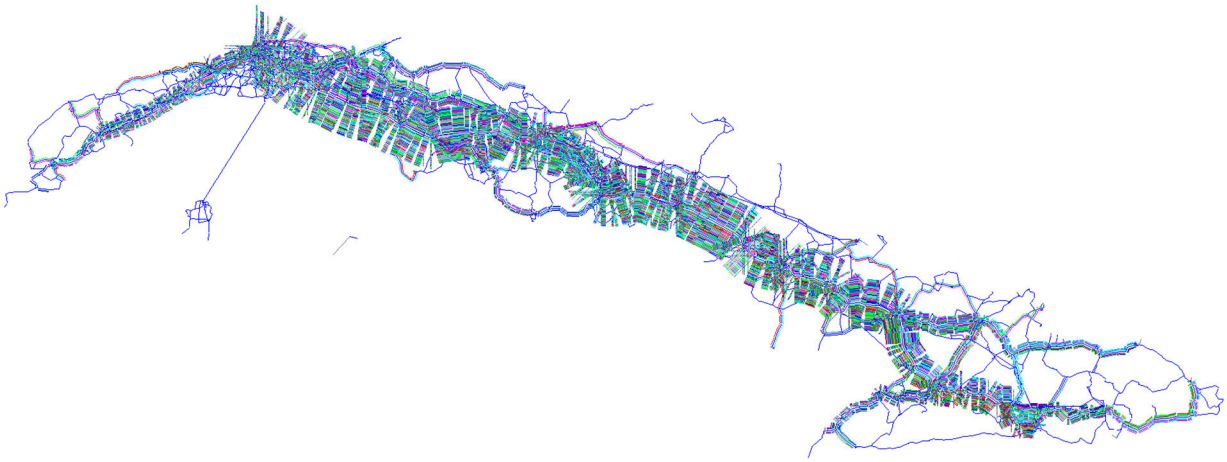
ID	Mode	Speed	Tariff	
			Residents	Non-residents
1	Car	Road link speed	1.70 CUP/km	0.55 CUC / km
2	Bus	Road link speed * 0.9	0.1945 CUP/km	0.0559 CUC / km
3	Railway	35 km/h	0.0359 CUP/km	0.0359 CUC / km
4	Ferry	30 km/h	51 CUP (Batabano- Nueva Gerona)	51 CUC (Batabano- Nueva Gerona)
5	Air	600 km/h	51 CUP (Havana – Nueva Gerona) 65 CUP (Havana – Cayo Largo) 188 CUP (Havana – Holguin) 220 CUP (Havana – Stgo. de Cuba) 228 CUP (Havana – Guantanamo)	51 CUC (Havana – Nueva Gerona) 65 CUC (Havana – Cayo Largo) 188 CUC (Havana – Holguin) 220 CUC (Havana – Stgo. de Cuba) 228 CUC (Havana – Guantanamo)

Source: JICA Study Team

(1) Bus network

Separate bus transit networks were developed for residents and non-residents based on their different service components in terms of route, vehicle type, fare system, quality of service, etc.

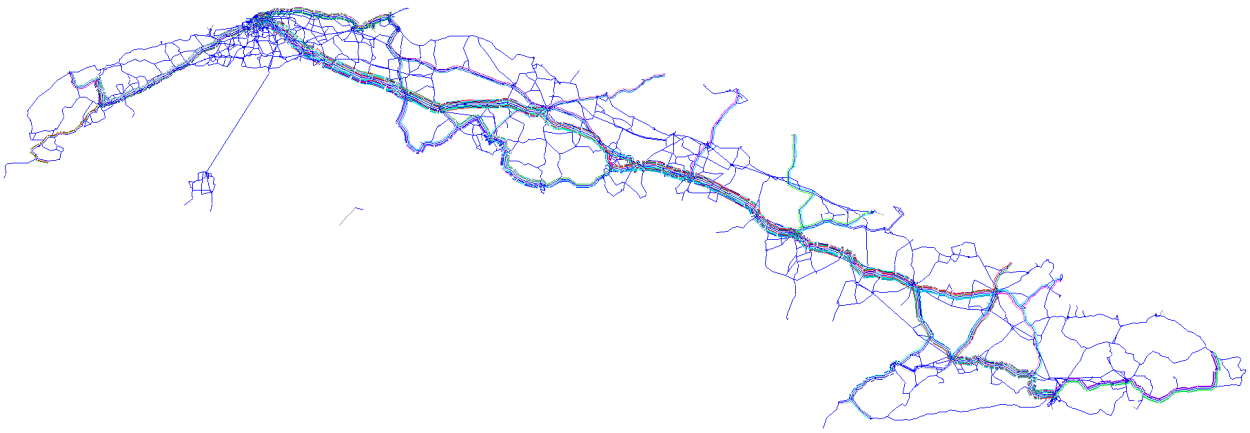
The dataset for bus services for Cuban residents was created based on current inter-provincial bus services provided by EON, as shown in Figure 3.2.5. Given the fundamental role of *Camiones* as a gap filler between inter-provincial travel demand and supply, a certain number of services provided by *Camiones* on the same corridors as EON were also assumed, depending on the estimated travel demand for bus transport.



Note: Each color shows one of the inter-provincial transit lines by direction
Source: JICA Study Team

Figure 3.2.5 Bus lines for Cuban residents

The dataset of bus services for non-residents was based on the current route network of Viazul (under EON), as shown in Figure 3.2.6. However, it should be noted that due to the unavailability of data for tourist services provided by Transtur and Transgaviota, certain bus route variations were added, assuming tour bus services are offered to major tourist destinations not served by Viazul, such as Cayo Santa Maria, Cayo Coco, and Cayo Cruz.

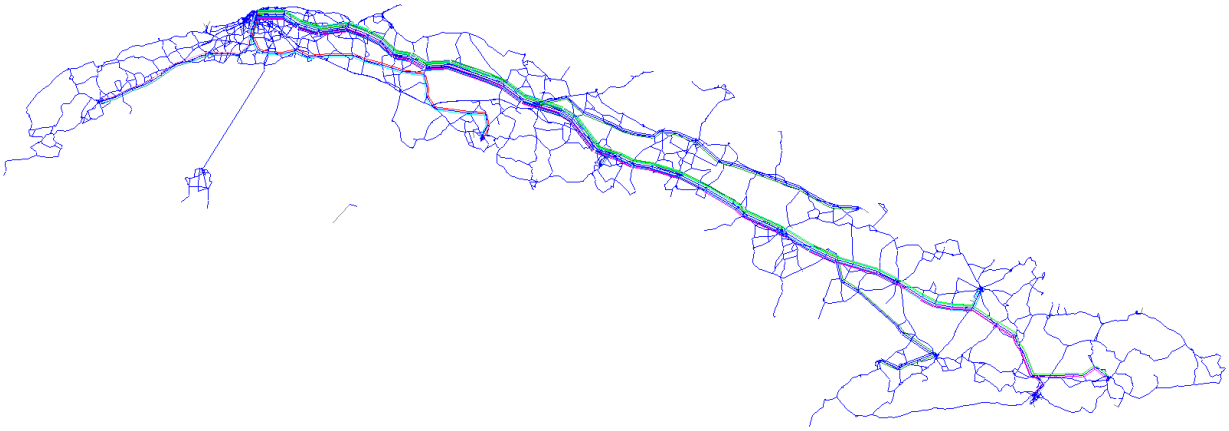


Note: Each color shows one of the inter-provincial transit lines by direction
Source: JICA Study Team

Figure 3.2.6 Bus services for non-residents

(2) Railway network

The passenger rail network dataset was developed for both Cubans and non-residents, based on inter-provincial rail service information provided by UFC, as shown in Figure 3.2.7.



Note: Each color shows one of the inter-provincial transit lines by direction
Source: JICA Study Team

Figure 3.2.7 Passenger railway lines

(3) Ferry network

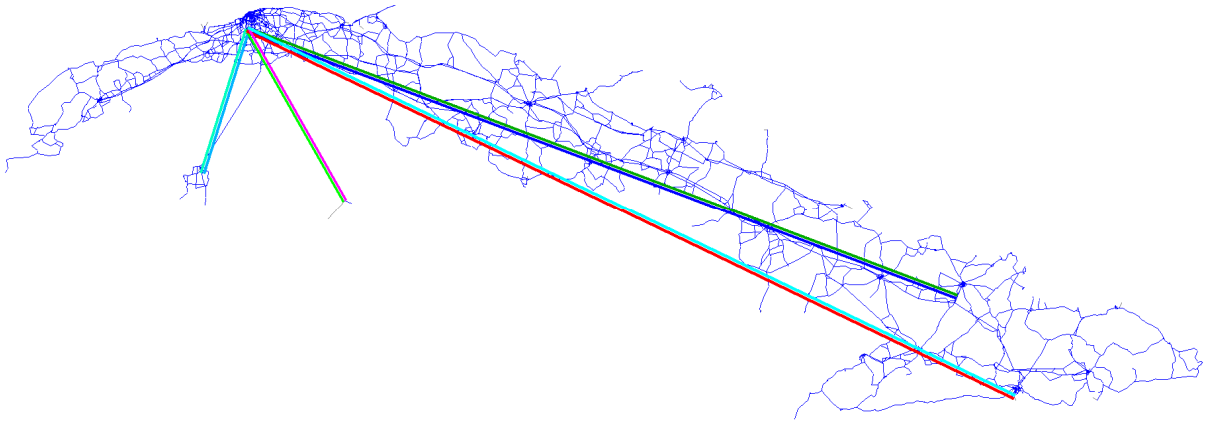
A dataset for ferry services linking Batabano and Nueva Gerona was developed from service information provided by Pilots of Cuba, as shown in Figure 3.2.8.

Note: Each color shows one of the inter-provincial transit lines by direction
Source: JICA Study Team

Figure 3.2.8 Ferry services

(4) Air services

A dataset for the network of domestic air transit services was developed radially from Havana based on service information provided by Cubana de Aviación, as shown in Figure 3.2.9.



Note: Each color shows one of the inter-provincial air services lines by direction
Source: JICA Study Team

Figure 3.2.9 Domestic air services

3.3 Socio-economic trends

3.3.1 Demographic trends

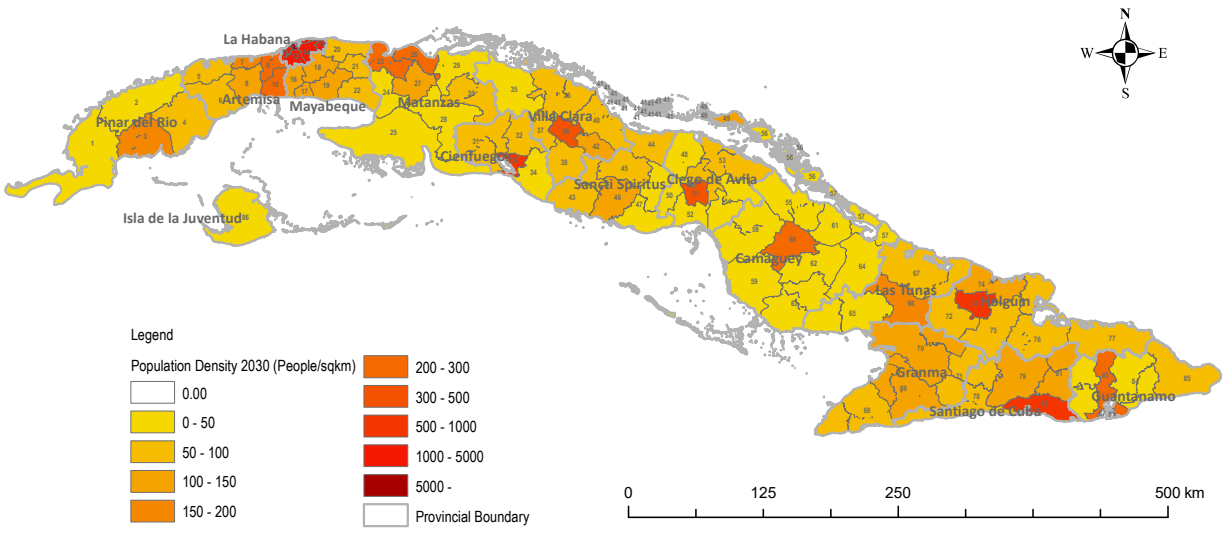
- ONEI forecasts of the future population by province show Cuba's total population in Cuba slightly increasing from **11.21 million in 2018 to 11.30 million in 2025**, followed by a decrease after 2025 to reach **11.28 million in 2030.**
- Based on ONEI projections of future population by province and population by the municipality in 2018, estimates of the future population of each TAZ were made.

Table 3.3.1 Population forecasts by province

Unit: thousand people

Province	2018	2020	2025	2030
Pinar del Rio	586	587	586	583
La Habana	2,131	2,129	2,130	2,107
Matanzas	715	725	738	743
Artemisa	511	519	532	539
Mayabeque	383	385	389	388
Isla de la Juventud	84	84	84	83
Cienfuegos	407	417	422	425
Sancti Spiritus	466	469	470	469
Villa Clara	781	778	769	755
Ciego de Avila	435	441	448	452
Camaguey	767	760	751	741
Las Tunas	535	543	546	547
Granma	824	839	841	842
Santiago de Cuba	1,049	1,053	1,052	1,052
Holguin	1,027	1,036	1,036	1,035
Guantanamo	509	515	517	519
Total	11,210	11,281	11,310	11,280
AAGR	-	0.3%	0.1%	-0.1%

Source: ONEI



Source: JICA Study Team

Figure 3.3.1 Forecast population density by traffic analysis zone in 2030

3.3.2 Economic trends

GDP growth by the industrial sector was estimated by the JICA Study Team, as shown in Table 3.3.2, based on current GDP trends. For tourism-related sectors (including construction, communications, hotels & restaurants, and transport & storage), two scenarios were prepared:

- Scenario 1 follows current growth trends (AAGR=6.8%)
- Scenario 2 is based on a less optimistic scenario (AAGR=4.5%).

Table 3.3.2 GDP forecasts by the industrial sector

	Sce. 1: Current trend			***Sce. 2: Tourism loses steam***		
		Tourism	**6.8%**		**Tourism**	**4.5%**
		Others	**2.2%**		**Others**	**2.2%**
	2019	**2025**	**2030**	**2019**	**2025**	**2030**
GDP	58,948	72,512	87,135	58,621	69,331	79,945
Agriculture, livestock & forestry	2,185	2,495	2,788	2,185	2,495	2,788
Fishing	63	72	81	63	72	81
Mining & quarrying	275	314	351	275	314	351
Sugar industry	161	183	205	161	183	205
Manufacturing industries (except sugar)	6,684	7,635	8,529	6,684	7,635	8,529
Electricity, gas & water supply	806	920	1,028	806	920	1,028
Construction	4,492	6,666	9,262	4,395	5,724	7,133
Commerce; personal effects repair	11,012	12,578	14,051	11,012	12,578	14,051
Hotels & restaurants	4,189	6,216	8,637	4,098	5,337	6,651
Transportation, storage & communications	6,486	9,625	13,374	6,346	8,265	10,299
Financial intermediation	1,480	1,691	1,889	1,480	1,691	1,889
Business services, actv. real estate & rental	2,044	2,334	2,608	2,044	2,334	2,608
Public administration, defense; social security	2,054	2,346	2,621	2,054	2,346	2,621
Science & technological innovation	275	314	351	275	314	351
Education	3,406	3,890	4,345	3,406	3,890	4,345
Public health & social assistance	10,004	11,426	12,765	10,004	11,426	12,765
Culture & sport	2,000	2,284	2,552	2,000	2,284	2,552
Other actv. of serv. communal, association, personal	853	974	1,088	853	974	1,088
Import duties	480	548	612	480	548	612

(1997 constant price, million pesos) // Source: JICA Study Team

3.4 Passenger demand forecast

3.4.1 Cuban residents

(1) Trip generation

Dummy variables were used in the trip-generation model to reflect regional (spatial) characteristics in Cuban residents' trip-generation rates, as shown in Table 3.4.1. In the trip-generation model, the zonal population is used as an explanatory variable in the following equation[1]. Compared to other TAZs, the rate of trip volume to population is quite high in the central Havana area[2], the Havana south area[3], Santa Clara, Camaguey, and Santiago de Cuba. To reflect such differences, dummy variables were applied. Trip attraction values are assumed to be the same as those for trip generation.

$$G_i = 0.0035133 * Pop_i + 3396.346 * dum_1 + 1443.921 * dum_2$$

where

G_i : Future trip generation at zone i,

POP_i : Future population at zone i,

dum_1 : Dummy at Havana center area,

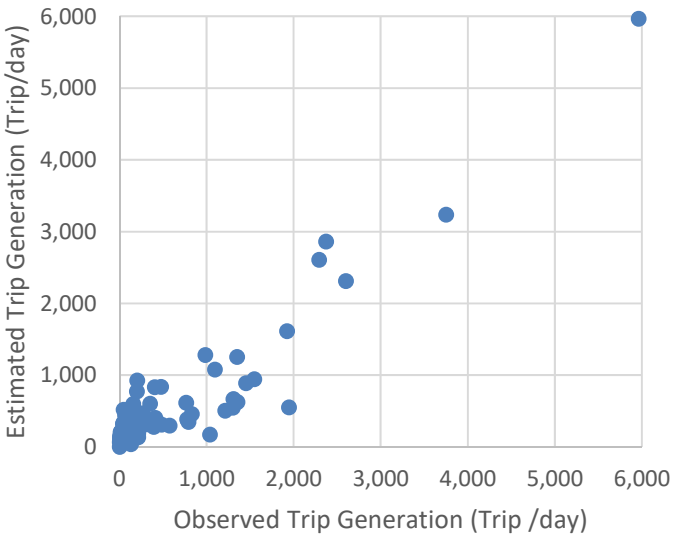
dum_2 : Dummy at Havana south area, Santa Clara, Camaguey & Santiago de Cuba

Table 3.4.1 Trip generation/attraction model

	Generation model	
Variables	Coefficient	t-value
Population	0.0035133	12.75
Dummy1	3396.346	8.04
Dummy2	1444.391	7.11
Adjusted correlation coefficient	0.88	
Number of samples	87	

Source: JST

[1] Total trip generation was estimated for all trip purposes since economic indicators by zone were not available.
[2] La Havana Vieja, Plaza de la Revolución, Centro Havana, Regla, Diez de Octubre and Cerro
[3] Boyeros, Arroyo Naranjo



Source: JICA Study Team

Figure 3.4.1 Comparison of estimated trips & observed trips

Table 3.4.2 Future trip generation (2020 – 2030)

Unit: Trips/day

Prov	Province	2020	2025	2030
21	Pinar del Rio	2,061	2,057	2,048
22	Artemisa	1,825	1,868	1,894
23	La Habana	12,320	12,323	12,242
24	Mayabeque	1,354	1,366	1,365
25	Matanzas	2,546	2,592	2,610
26	Villa Clara	4,179	4,145	4,095
27	Cienfuegos	1,463	1,484	1,493
28	Sancti Spiritus	1,647	1,651	1,647
29	Ciego de Avila	1,550	1,574	1,588
30	Camaguey	4,114	4,083	4,046
31	Las Tunas	1,908	1,919	1,921
32	Holguin	3,641	3,638	3,635
33	Granma	2,948	2,954	2,957
34	Santiago de Cuba	5,142	5,141	5,142
35	Guantanamo	1,811	1,816	1,825
40	Isla de la Juventud	296	295	293
	Total	48,805	48,907	48,801

Source: JICA Study Team

(2) Trip distribution

Per-person trip distribution for inter-zonal travel is estimated using the Frater method, as below:

$$T_{ij} = t_{ij} \cdot \frac{G_i}{g_i} \frac{A_j}{a_j} \cdot \frac{1}{2} \left(\frac{g_i}{\sum_j t_{ij} \cdot A_j / a_j} + \frac{a_j}{\sum_i t_{ij} \cdot G_i / g_i} \right)$$

where,

T_{ij} : Future trip distribution at zone i to j,
G_i : Future trip production at zone i,
A_j : Future trip attraction at zone j,
t_{ij} : Current trip distribution at zone i to j,
g_i : Current trip production at zone i, and
a_j : Current trip attraction at zone j

(3) Modal split

The modal split model for Cuban residents was designed to simulate user preferences in transport mode, and modal share was estimated with trip generation & distribution models. This model was developed using the Cuban dataset of the Passenger OD Interview Survey, which asked respondents to answer their revealed preferences (RP) on actual travel choices such as origin, destination, trip purpose, and mode choice. It should be noted that this model was developed before the currency unification in January 2021 and the integral adjustment of salaries and prices. This policy was adopted with the introduction of the unified exchange rate between the currencies and simultaneous increases in average salary levels and fares for both urban and inter-provincial transport services. In the following estimation, we assume this policy has not led to significant changes in price sensitivity for each transport mode choice. The modal split for each OD pair was estimated based on the following formula, which represents the probability function of the multinomial logit model using a utility function for each of the five modal choices: car, bus, rail, ferry, and air, as listed in Table 3.4.3.

$$P_n(i) = \frac{e^{v_{in}}}{\sum_{j=1}^{j} e^{v_{jn}}}$$

where,

P_{in}: Probability of choosing transport mode *i* in a choice set *n*
V_{jn} : Utility function of transport mode *j* in a choice set *n*
i, j : Transport mode for Cuban residents

Table 3.4.3 List of transport mode choices

No.	Transport mode choice
1	Car
2	Bus
3	Rail
4	Ferry
5	Air

Source: JICA Study Team

The estimated parameters are summarized in Table 3.4.4 using the utility functions shown in Table 3.4.5. The explanatory variables in the utility functions representing travel impedance (which consists of trip time & cost) were estimated based on a pair of origin/destination TAZs by transport mode using the demand forecast model. It should be noted that to refine the model, samples that match one or more certain conditions for exclusion – e.g., intra-provincial trips within Havana, intra-zonal trips, and samples traveling with an unavailable mode choice – are excluded from this estimation.

The results indicate that Cubans prefer cheaper and faster modes. However, the alternative-specific constants tend to vary depending on the modal choice, mainly due to external constraints such as passenger capacity and reservation systems. Also, while air transport has a lower share, it would be a preferable choice to/from Havana because of the rapid services from Havana Jose Marti Airport.

Table 3.4.4 Result of parameter estimation for modal choice model for Cuban residents

Name	Value	Std. Err	t-test	p-value	Notes
ASC_CAR	0	fixed			Alternative specific constant for choice "CAR"
ASC_BUS	2.64	0.118	22.4	< 0.01	Alternative specific constant for choice "BUS"
ASC_RAIL	2.24	0.181	12.4	< 0.01	Alternative specific constant for choice "RAIL"
ASC_FERRY	3.4	0.163	20.9	< 0.01	Alternative specific constant for choice "FERRY"
ASC_AIR	-1.4	0.199	-7.02	< 0.01	Alternative specific constant for choice "AIR"
B_COST	-3.2	0.32	-9.99	< 0.01	Parameter of travel cost (CUP in thousand)
B_LHA_AIR	0.859	0.162	5.32	< 0.01	Parameter of binary variable (dummy) of air passengers to/from Havana Province
B_TIME	-1.44	0.102	-14.1	< 0.01	Parameter of natural logarithm of travel time (mins)

Note: Estimated by Python Biogeme using the dataset of Passenger OD Interview Survey. Samples that match certain conditions for exclusion are excluded from this estimation. //

Source: JICA Study Team

Table 3.4.5 Alternatives & utility function in modal choice model for Cuban residents

Modal choice	Specification
Car	ASC_CAR + B_TIME * CAR_TIME_LN+ B_COST * CAR_COST_SCALE
Bus	ASC_BUS + B_TIME * BUS_TIME_LN + B_COST * BUS_COST_SCALE + B_LHA_BUS * LHA
Rail	ASC_RAIL + B_TIME * RAIL_TIME_LN + B_COST * RAIL_COST_SCALE
Ferry	ASC_FERRY + B_TIME * FERRY_TIME_LN + B_COST * FERRY_COST_SCALE
Air	ASC_AIR + B_TIME * AIR_TIME_LN + B_COST * AIR_COST_SCALE + B_LHA_AIR * LHA

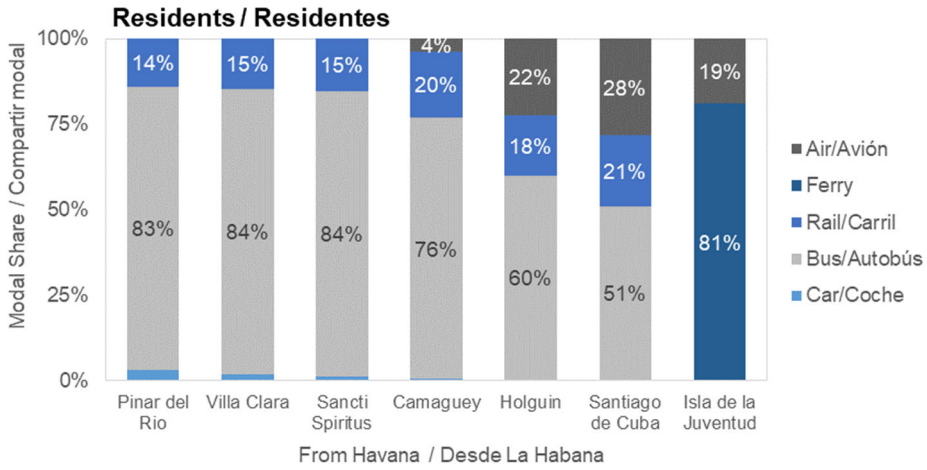
Source: JICA Study Team

The estimated modal share shows Cubans' heavy reliance on bus transport for inter-provincial travel, as shown in Figure 3.4.2. In particular, bus transport's modal share of short/mid-distance trips up to about 600 km is consistently over 75%. This shows the importance of buses as a fundamental transport service nationwide. By contrast, the share of car transport among residents is quite low with no significant relation to travel distances.

Air transport has a significant share of long-distance travel for trips such as Havana-Santiago de Cuba. As a result, the bus share drops to 51% between these two major cities due to competition from the air

(28% share) and rail (21% share). Rail has a slightly higher share for longer-distance travel, but its share is relatively flat compared to bus and air transport.

Between Havana and Isla de la Juventud, ferry is the dominant mode with 81% share versus air transport at 19%. Both modes face significantly degraded service, affecting the modal share balance.



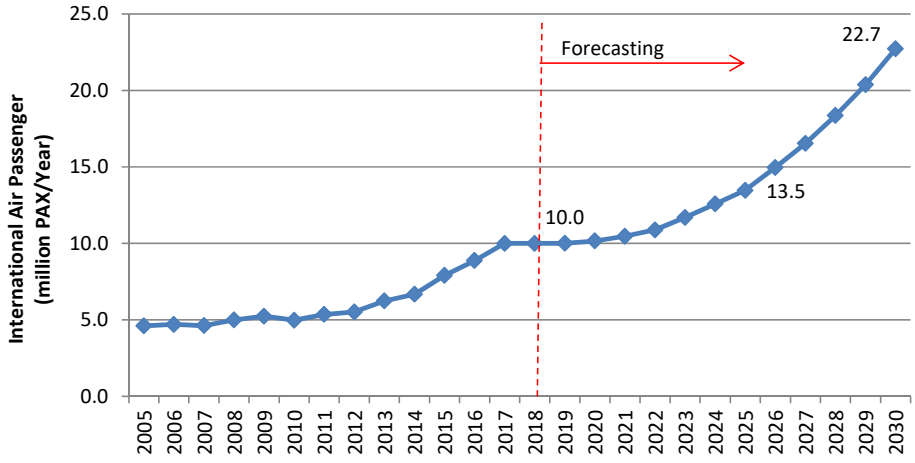
Source: JICA Study Team

Figure 3.4.2 Cuban residents' estimated modal share

3.4.2 Non-residents

(1) International passenger forecast

Considering past trends and a traffic decline due to Cuba's temporary fleet shortage, future air passenger demand is forecast in Figure 3.4.3. The total number of air passengers is expected to increase from 10 million in 2018 to 13.5 million in 2025 and 22.7 million in 2030.



Source: JICA Study Team; details are shown in IT/R1

Figure 3.4.3 International air passenger forecast

Table 3.4.6 Summary of international air passenger forecast

Items	Unit	2008	2018	2025	2030
International passengers	Million PAX/year	5.0	10.0	13.5	22.7
AAGR[4]	%	-	7.2%	4.4%	11.0%

Source: JICA Study Team; details are shown in IT/R1

Table 3.4.7 Summary of international air passenger forecast by major airport

Unit: million passengers/year

Year	HAV	VRA	SNU	HOG	CCC	SCU	Others	Total
2018	5.9	1.5	0.8	0.7	0.5	0.2	0.3	10.0
2025	7.5	2.0	1.0	0.9	0.7	0.9	0.5	13.5
2030	12.5	2.4	2.6	1.8	1.5	1.2	0.8	22.7

Source: JICA Study Team; details are shown in IT/R1

(2) Trip distribution

Per-person trip distribution of non-residents for inter-zonal travel is estimated using the Frater method, the same as for Cuban residents.

$$T_{ij} = t_{ij} \cdot \frac{G_i}{g_i} \frac{A_j}{a_j} \cdot \frac{1}{2} \left(\frac{g_i}{\sum_j t_{ij} \cdot A_j / a_j} + \frac{a_j}{\sum_i t_{ij} \cdot G_i / g_i} \right)$$

where,

T_{ij} : Future trip distribution at zone i to j,
G_i : Future trip production at zone i,
A_j : Future trip attraction at zone j,
t_{ij} : Current trip distribution at zone i to j,
g_i : Current trip production at zone i, and
a_j : Current trip attraction at zone j

(3) Modal split

The modal split model for non-residents was designed to estimate their choice of transport mode, and developed in the same way as for Cuban residents, using the non-residents' dataset of the Passenger OD Interview Survey. Again, note that this model was developed before the currency unification in January 2021. In the following estimation we assume that this has not significantly affected the price sensitivity of non-resident travelers for each transport mode choice. The modal split for each trip was estimated based on the following formula, using a utility function for each of the four modal choices: car, bus, rail and air, as listed in Table 3.4.3.

[4] AAGR: Annual Average Growth Ratio

$$P_n(i) = \frac{e^{v_{in}}}{\sum_{j=1}^{j} e^{v_{jn}}}$$

where,

P_{in}: Probability of choosing transport mode i in a choice set n

V_{jn} : Utility function of transport mode j in a choice set n

i, j : Transport mode for non-residents

Table 3.4.8 Ranking of transport mode choices

No.	Transport mode choice
1	Car
2	Bus
3	Rail
4	Air

Source: JICA Study Team

This model is summarized in Table 3.4.9, and the results of parameter estimation are listed in Table 3.4.10, using utility functions shown in Table 3.4.12. The same criteria were applied for the sample exclusion procedure as in the model for Cuban residents. The result again indicates that cheaper and faster mode choices are preferred by non-residents, while other specific constants tend to vary depending on modal choice, mainly due to external constraints such as passenger capacity and reservation systems. Also, the fact that most non-residents are tourists skews modal choice towards bus, given that tour buses are often the only available mode.

Table 3.4.9 Parameters of modal choice model for non-residents

Name	Value	Std. Err	t-test	p-value	Notes
ASC_CAR	0	fixed			Alternative specific constant for choice “CAR”
ASC_BUS	0	fixed			Alternative specific constant for choice “BUS”
ASC_RAIL	-4.98	0.506	-9.84	< 0.01	Alternative specific constant for choice “RAIL”
ASC_AIR	0	fixed			Alternative specific constant for choice “AIR”
B_COST	-0.495	0.0609	-8.13	< 0.01	Parameter of natural logarithm of travel cost (CUC) by car, bus & rail
B_DIST_BUS	-0.144	0.0298	-4.83	< 0.01	Parameter of natural logarithm of travel distance (km) by bus
B_LHA_CAR	1.47	0.17	8.6	< 0.01	Parameter of binary variable (dummy) of car passengers to/from Havana Province
B_TIME_CAR	-3.62	0.653	-5.54	< 0.01	Parameter of travel time by car (mins./thousand)
B_TOURIST_BUS	1.5	0.166	9.04	< 0.01	Parameter of binary variable (dummy) of trips for tourism/travel purposes by bus

Note: Estimated by Python Biogeme using the dataset of Passenger OD Interview Survey. Samples that match certain conditions for exclusion are excluded from this estimation.

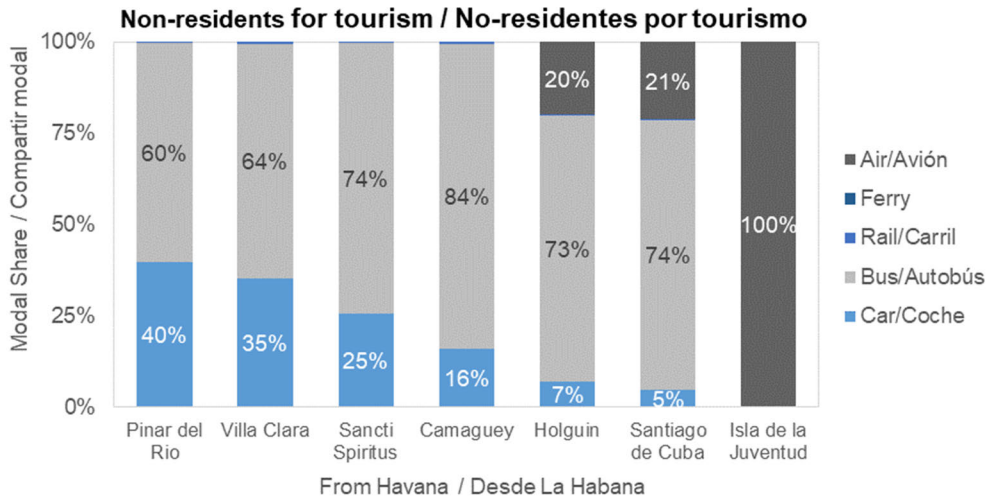
Source: JICA Study Team

Table 3.4.10 List of alternatives & utility functions of modal choice model for non-residents

Modal choice	Specification
Car	ASC_CAR + B_COST * CAR_COST_LOG + B_TIME_CAR * CAR_TIME_S + B_LHA_CAR * LHA
Bus	ASC_BUS + B_COST * BUS_COST_LOG + B_TOURISM_BUS * TOURISM + B_DIST_BUS * BUS_DIST_LOG
Rail	ASC_RAIL + B_COST * RAIL_COST_LOG
Air	ASC_AIR + B_COST * AIR_COST_LOG

Source: JICA Study Team

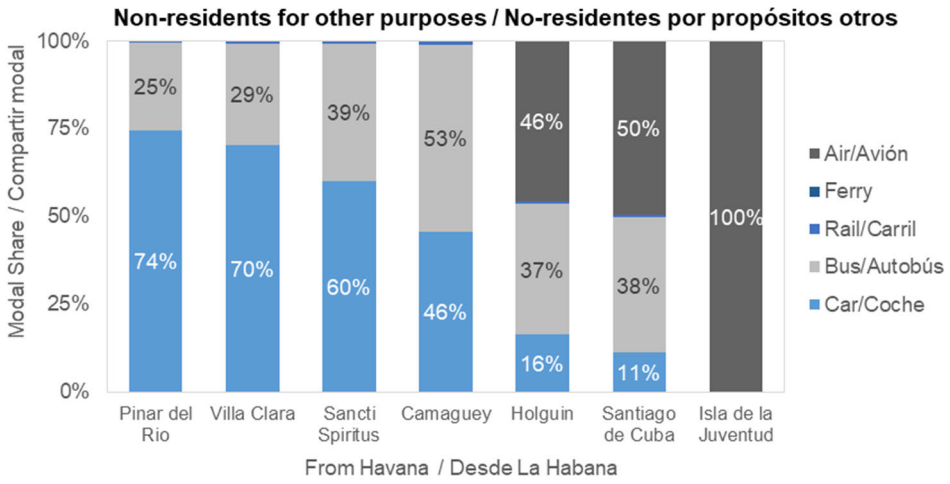
As with the modal share for Cuban residents, the estimated share shows non-residents' heavy reliance on bus transport for inter-provincial travel, as shown in Figure 3.4.4. As above, the availability of tour bus services such as Transtur and Transgaviota likely contribute to these high shares, which account for more than 60%, regardless of travel distance. Even for long-distance travel, bus transport has a high share of traffic from Havana to Holguin (73%) and Santiago de Cuba (74%). Despite the fact that non-residents have considerably more disposable income to spend, air transport's modal share is quite low, likely due to a lack of air services oriented towards tourists.



Source: JICA Study Team

Figure 3.4.4 Estimated modal shares of non-resident travel for tourism purposes

Nevertheless, the share of car transport is much higher than for residents, especially for short-distance trips within about 300 km, such as Havana to Pinar del Rio with a car at 40% and to Villa Clara at 35%. The modal share of car transport tends to be even higher for non-tourism trips, as shown in Figure 3.4.5, especially from Havana to Pinar del Rio (74%) and Villa Clara (70%). Air transport also shows a higher share in long-distance, non-tourist travel, with Havana to Holguin at 46% and Santiago de Cuba at 50%.



Source: JICA Study Team

Figure 3.4.5 Estimated modal share of non-resident trips for other purposes

3.5 Cargo demand forecast

3.5.1 Cargo volume growth scenario

Table 3.5.1 shows applied growth rates of cargo volume by commodity type for the years 2020, 2025, and 2030. Three different growth rates were applied based on projected population growth, general GDP growth, and GDP growth in tourism, as estimated in this project.

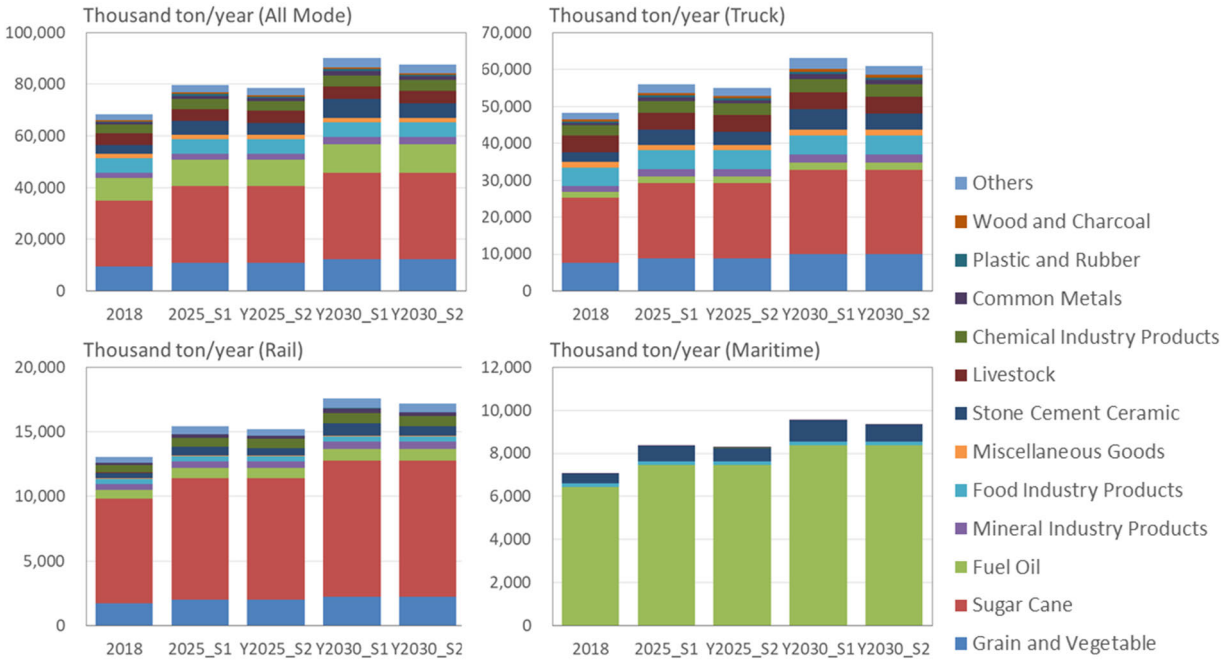
Table 3.5.1 Cargo volume growth scenario

HS Code	Commodity short name	Frame	2020		2025		2030	
			Sce. 1	Sce. 2	Sce. 1	Sce. 2	Sce. 1	Sce. 2
1	Livestock	Population	1.01		1.01		1.01	
2	Grains & vegetables	General	1.04		1.16		1.30	
3	Animal or vegetable oils	Population	1.01		1.01		1.01	
4	Food industry products	Population	1.01		1.01		1.01	
5	Mineral industry products	General	1.04		1.16		1.30	
6	Chemical industry products	General	1.04		1.16		1.30	
7	Plastic & rubber	General	1.04		1.16		1.30	
8	Fur & leather products	Population	1.01		1.01		1.01	
9	Wood & charcoal	General	1.04		1.16		1.30	
10	Pulp & paper	General	1.04		1.16		1.30	
11	Textiles	Population	1.01		1.01		1.01	
12	Footwear, hats	Population	1.01		1.01		1.01	
13	Stone, cement, ceramic & glass	Tourism	1.14	1.09	1.58	1.36	2.20	1.70
14	Precious metals, jewelry	Population	1.01		1.01		1.01	
15	Common metals	Tourism	1.14	1.09	1.58	1.36	2.20	1.70
16	Machines, equipment & parts	Tourism	1.14	1.09	1.58	1.36	2.20	1.70
17	Transport materials	Tourism	1.14	1.09	1.58	1.36	2.20	1.70
18	Precision equipment	Population	1.01		1.01		1.01	

HS Code	Commodity short name	Frame	2020		2025		2030	
			Sce. 1	Sce. 2	Sce. 1	Sce. 2	Sce. 1	Sce. 2
19	Weapons	General	1.04		1.16		1.30	
20	Miscellaneous goods	Population	1.01		1.01		1.01	
21	Art & antiques	General	1.04		1.16		1.30	
22	Fuel oil	General	1.04		1.16		1.30	
23	Sugarcane	General	1.04		1.16		1.30	

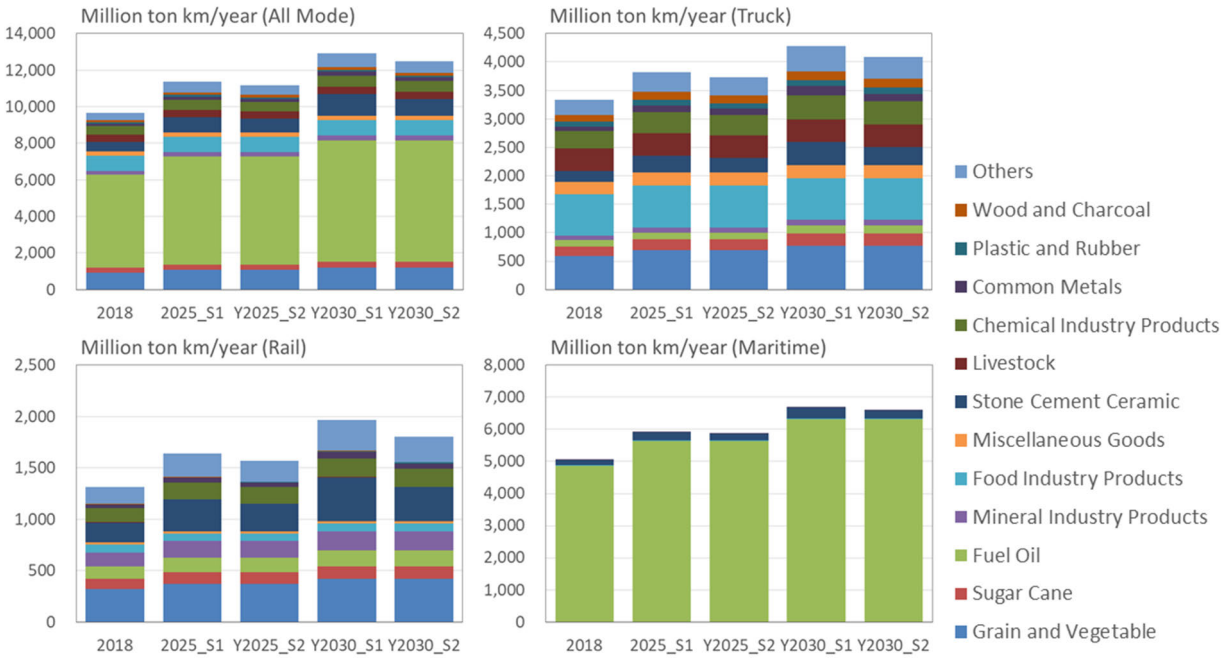
Source: JICA Study Team

Figure 3.5.1 and Figure 3.5.2 show future cargo volume and volume distance by scenario, mode, and commodity type. As a base scenario, it was assumed that the future modal share of cargo transport is the same as the current situation for each commodity. In 2030 Sce.1, total cargo volume is estimated to increase to 90 million tons/year, with about 60 million tons assumed to be transported by truck.



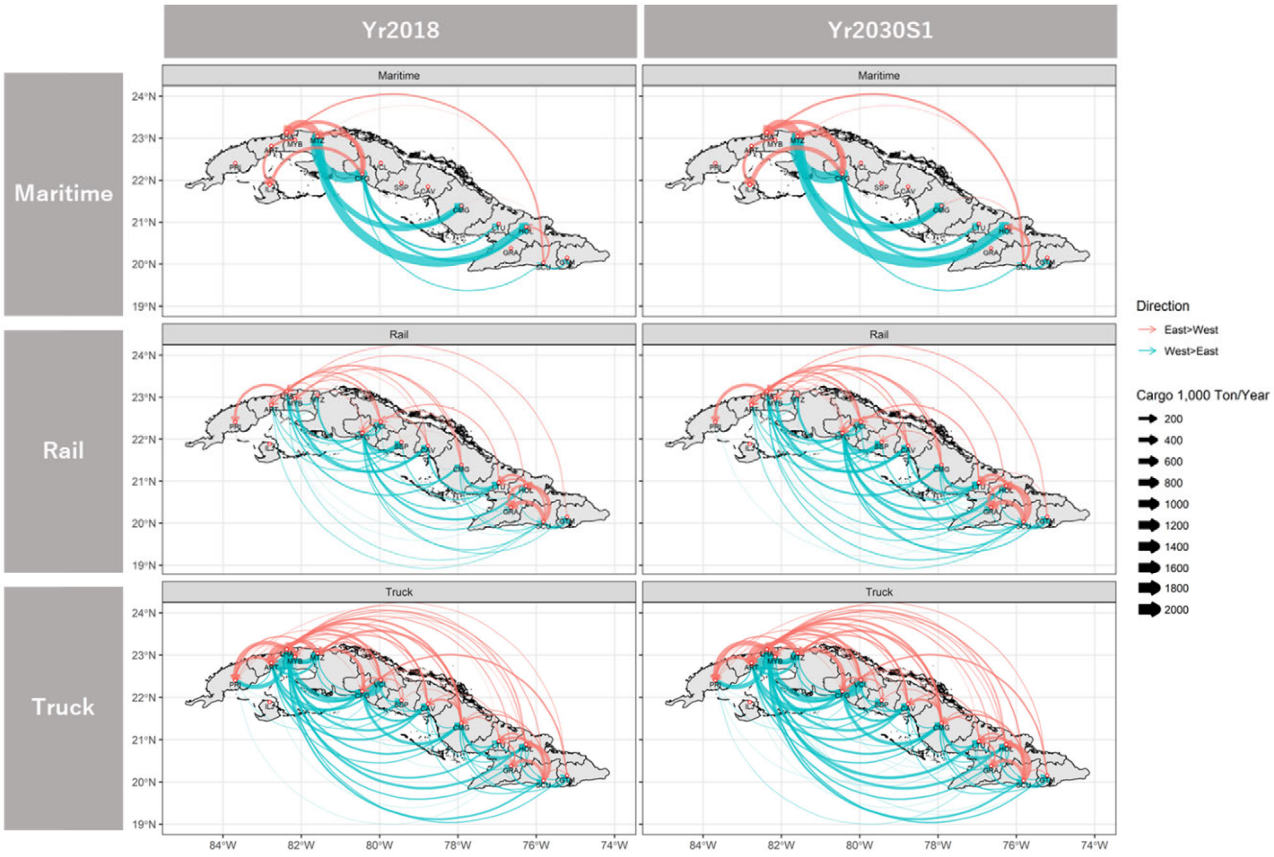
Source: JICA Study Team

Figure 3.5.1 Future cargo volume by mode (1,000 tons/year)



Source: JICA Study Team

Figure 3.5.2 Future cargo volume distance by mode (million-ton km/year)



Source: JICA Study Team

Figure 3.5.3 Future cargo transport volume by mode

3.5.2 Conversion from truck ton OD to truck vehicle OD

After developing the "Ton OD" of future truck cargo, it was necessary to convert it to "Vehicle OD" for traffic assignment on the road network. This conversion was done using the following equation, using the average loading volume and the composition of truck types.

$$V_{i,j,o,d} = \frac{W_{i,o,d}\, C_{i,j}}{L_i}$$

where

$V_{i,j,o,d}$: Number of vehicles transporting goods i from o to d by truck type j incl. empty trucks
$W_{i,o,d}$: Volume of goods i transporting from o to d by truck
$C_{i,j}$ = Composition of truck type j for transportation of goods i
L_i = Average loading volume of goods i

Table 3.5.2 show the applied parameters ($C_{i,j}$, L_i). These values were calculated based on the Truck OD Interview survey results. As shown in Table 3.5.2, the average loading volume varies across commodity types because of the difference in density and composition of truck types for each commodity.

Table 3.5.2 Average loading & composition of truck types by commodity

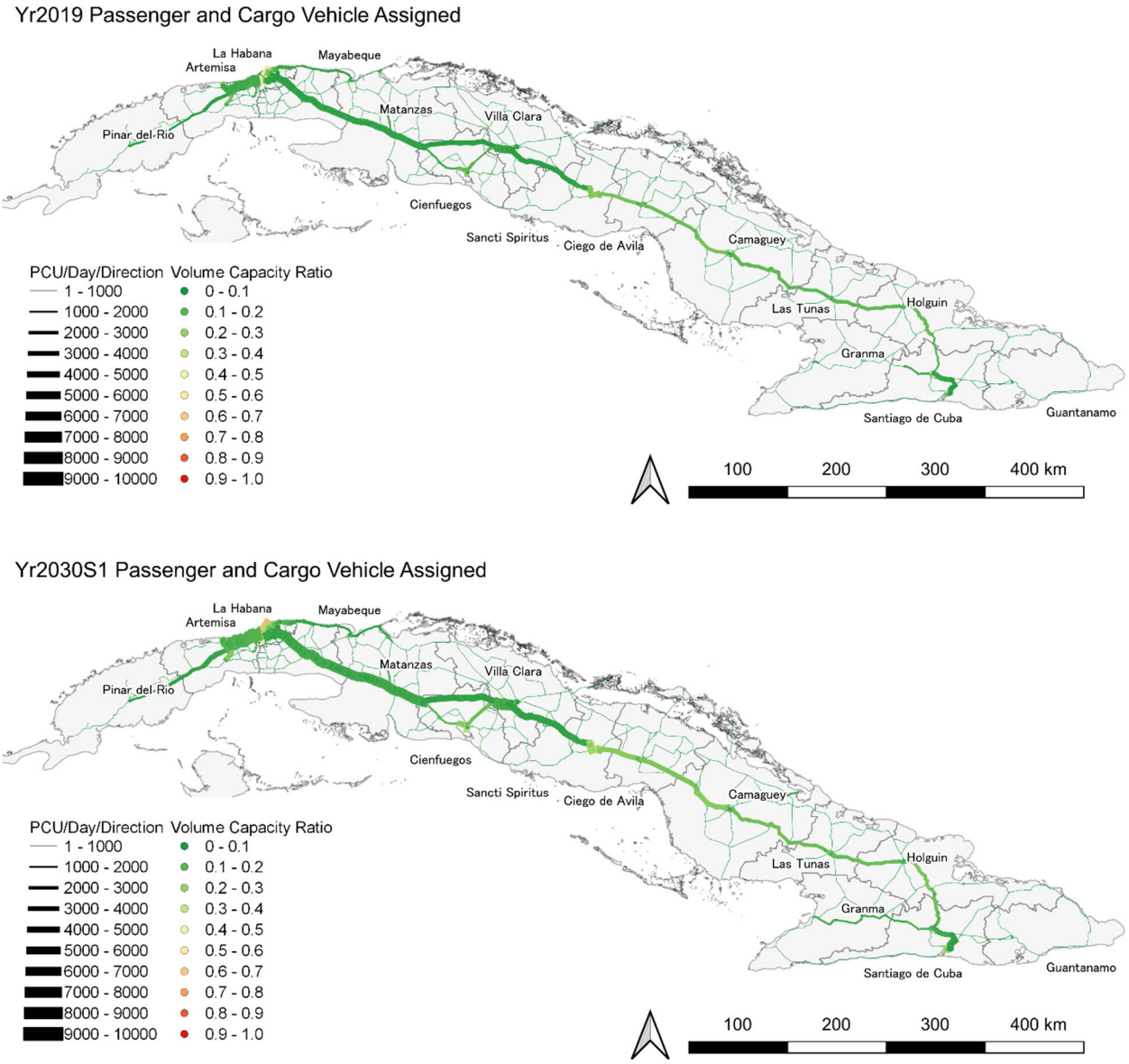
HS Code	Commodity Short Name	Average Loading (ton)	Truck Type		
			7,8 Camioneta, Panel Van	9 Truck (2 axles)	10,11 Truck, Trailer (3+ axles)
1	Livestock	8.6	0%	22%	78%
2	Grain and Vegetable	4.1	9%	57%	33%
3	Animal or Vegetable Oil	7.7	14%	34%	52%
4	Food Industry Products	7.7	14%	34%	52%
5	Mineral Industry Products	10.9	30%	7%	63%
6	Chemical Industry Products	7.1	16%	29%	55%
7	Plastic and Rubber	6	28%	37%	35%
8	Furs and Leather Products	1	0%	70%	30%
9	Wood and Charcoal	3.7	45%	22%	34%
10	Paper and Pulp	2.4	46%	16%	37%
11	Texitiles	2.4	46%	16%	37%
12	Footware, Hats	3.1	19%	36%	44%
13	Stone, Cement, Ceramic and Glass	8.8	0%	26%	74%
14	Precious metal, Jewerly	3.1	19%	36%	44%
15	Common Metals	6.7	7%	17%	76%
16	Machines, Electric Equipment and Parts	4	34%	15%	52%
17	Transport Material	5.8	0%	21%	79%
18	Precision equipment	3.1	19%	36%	44%
19	Weapons	4	34%	15%	52%
20	Miscellaneous Goods	3.1	19%	36%	44%
21	Art and Antiques	3.1	19%	36%	44%
22	Fuel Oil	10.9	30%	7%	63%
23	Sugar Cane	4.1	9%	57%	33%

Note: After expansion, excluding empty trucks
Source: JICA Study Team

3.6 Network assignment results

3.6.1 Road traffic assignment

Figure 3.6.1 shows the results of traffic assignment on the road network. A comparatively large traffic volume is observed along the *Autopista* and road sections near Havana. Compared to 2019, traffic volume will increase slightly in the 2030-S1 scenario. As for congestion levels, no severe congestion is estimated even in 2030. The volume capacity (V/C) ratio is less than 0.5 in most sections. The section between Sancti Spiritus and Camaguey shows a slightly higher V/C ratio because the *Autopista* ends in Sancti Spiritus.

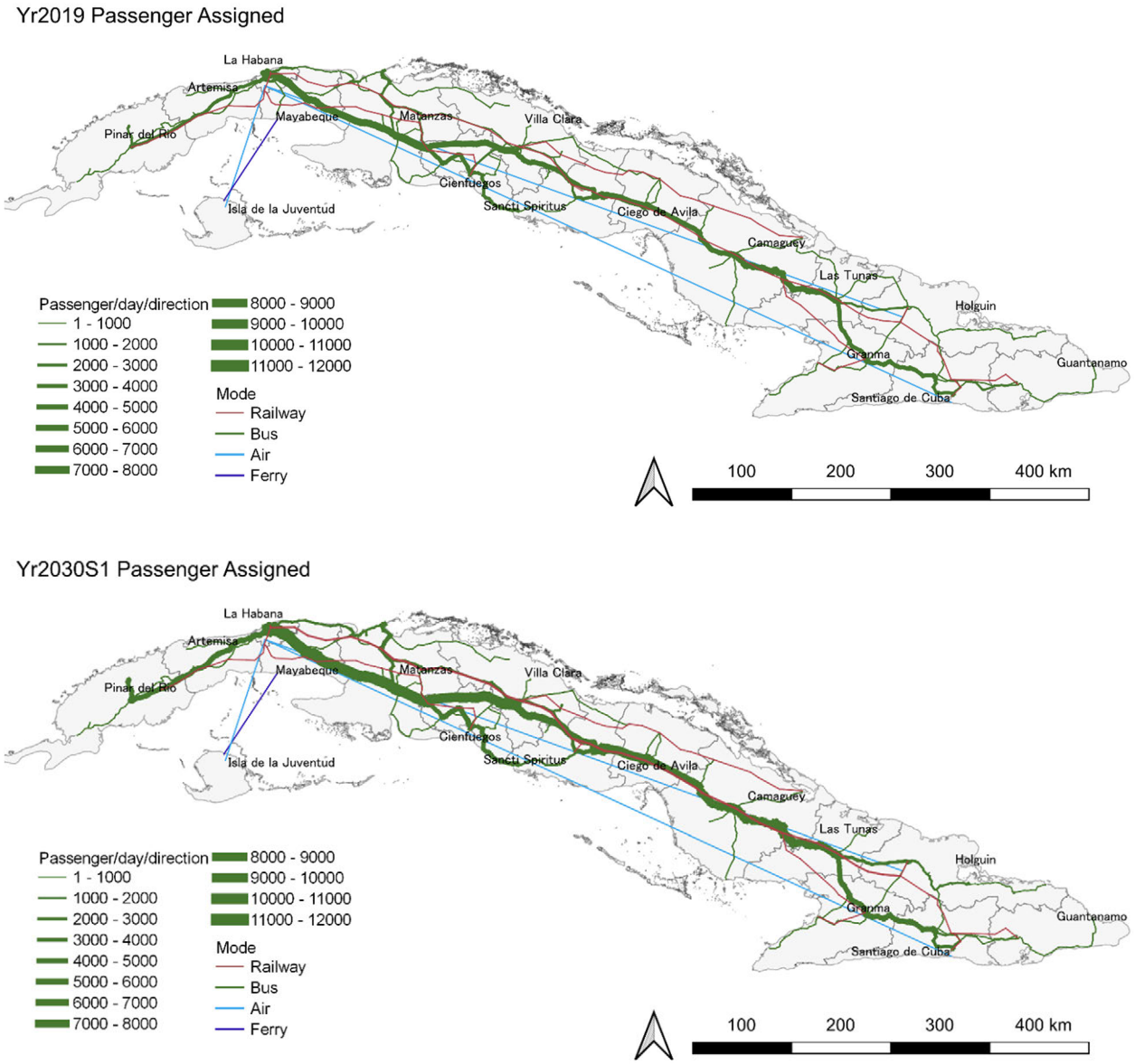


Source: JICA Study Team

Figure 3.6.1 Road traffic assignment results in 2019 & 2030-S1 (PCU/day/direction)

3.6.2 Public transport passenger assignment

Figure 3.6.2 shows passenger assignment results for public transport users. Buses play an important role in both short- and long-distance transport. Based on current assumptions, bus and rail passengers will increase slightly in the major sections.

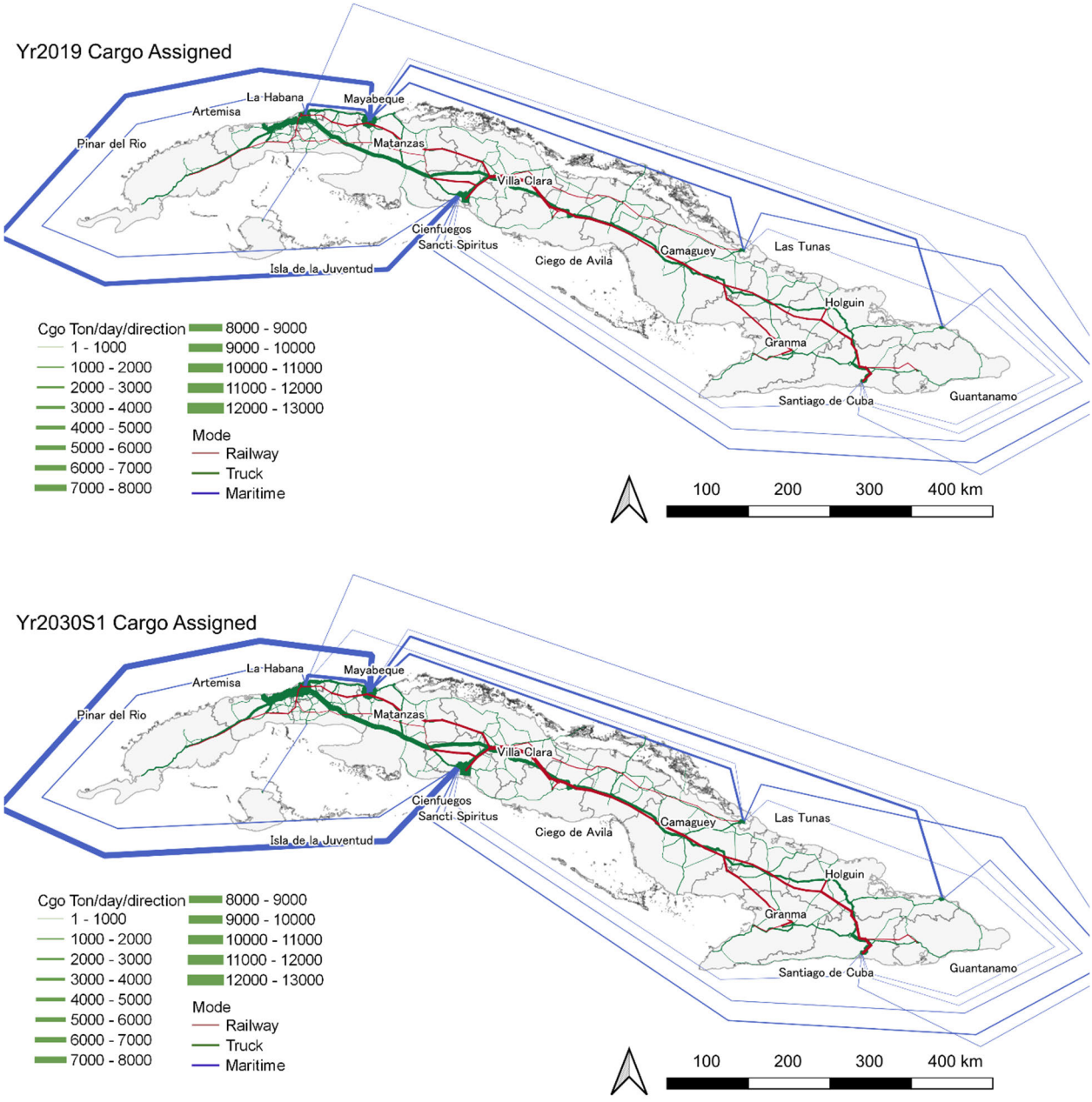


Source: JICA Study Team

Figure 3.6.2 Passenger assignment results for 2019 and 2030-S1 (passenger/day/direction)

3.6.3 Cargo assignment

Figure 3.6.3 shows cargo assignment results by transport mode on the network. In the western region, truck transport is significant. In central and eastern regions, rail also plays an important role in mid- and long-distance cargo transport. In 2030-S1, the growth of cargo volume can be seen in the lower map.



Source: JICA Study Team

Figure 3.6.3 Cargo assignment results in 2019 & 2030-S1 (ton/day/direction)

Chapter 4 Planning Issues

4.1 Cross-sector Transport Planning Issues

4.1.1 Selective and focused investments

Cuba's transport challenges and socioeconomic/infrastructural conditions foreseen up to 2030 can be summarized as follows:

- If no substantial capital investments are made, much of the nation's transport infrastructure and facilities will continue to deteriorate, becoming more expensive and technically challenging to repair. The level of safety and services in the transport sector will be accordingly diminished.
- Tourism, Cuba's key source of foreign currency, may be hindered by a continuing pandemic.
- Ongoing economic sanctions may pose severe barriers to mobilizing funds for the development of transport and other industrial sectors.
- Due to a lack of foreign exchange reserves, Cuba may face shortages of electric power and fuel.
- As Cuban society ages, a shortage of highly skilled staff in the transport sector is anticipated.
- Cubans' purchasing power may not significantly improve by 2030.

Understanding these potential constraints and under the policy framework of adhering to socialist principles while selectively adopting some features of a market-driven economy, it is necessary to consider what can be achieved via a National Transport Master Plan with 2030 as its planning horizon.

In principle, the period through 2030 is defined as a preparatory period for future growth. As such, several common strategic directions can be considered:

i. Intensive and selective investment in infrastructure/equipment renewal that stimulates foreign currency acquisition and reduces maintenance costs for aged/deteriorated infrastructure, facilities, and equipment.
ii. Securing critical transport infrastructure to meet Cubans' basic human needs.
iii. Abandonment of obsolete transport infrastructure (where appropriate).
iv. Increasing the efficiency of existing infrastructure/equipment via information and communication technology (ICT) as a part of the state's digital transformation effort.
v. Clean transportation to protect/enhance tourism resources and reduce Cuba's carbon footprint.

In this context, a number of transport planning directions stand out:

- Establishing a transportation network that contributes to the acquisition of the foreign currency, such as high-standard roads to tourist destinations.

- Transportation systems and services that support export industries, such as high-value agricultural and medical products.
- A system able to efficiently and affordably transport goods (domestic and imported) to any point in the country.

Major tourist destinations include Havana, Varadero, Pinar del Rio, Santiago de Cuba, beach resorts in the northeast, and cities with World Heritage sites such as Sancti Spiritus. To support and promote tourism-centered development, it is vital to connect airports, hotels, and tourist destinations with a well-designed transportation network that meets international standards.

The trip origin & destination (OD) patterns of international tourists (obtained from the 2019 field survey) show that the tourists concentrate in Havana and Pinar del Rio provinces in the west and Sancti Spiritus province in the east. But few tourists visit centers in the east, such as Santiago de Cuba, because domestic travel is inconvenient: the Autopista ends at Sancti Spiritus, and flights between Havana and Santiago de Cuba are infrequent.

Considering such factors, strategic investments that can boost tourism may include:

- Completion/improvement of the Autopista (with lighting, better pavement, rest areas, etc.)
- Repair/improvement of causeways to the northeastern beach/island resorts
- Hershey electric railway track improvement and rolling-stock renewal
- Making railways tourist-friendly, e.g., with a more accessible ticket reservation system, in-car catering, etc.)
- Improving major railway stations, e.g., mixed-use station buildings with kiosks, etc.)
- Revitalizing tramways in Havana and Santiago de Cuba as tourist attractions
- International airport improvements (capacity increase, related business development, etc.)
- Renewal of aircraft, especially for Havana and Santiago de Cuba
- Renewal of vessels (purchase, lease, or build) for coastal shipping and ferries to Isla de la Juventud
- Tourism-focused redevelopment of Havana port, including cruise ship terminal
- More and better sightseeing buses and taxis

Strategic transport investments with the potential to support Cuba's export industries include enhancing the transportation links to the Mariel Special Development Zone, between agricultural/fishery production sites (tobacco, sugarcane, mango, lobster, etc.) and processing plants or to end users (e.g. fresh seafood to tourist hotels). To this end, strategic investments candidate may include:

- Construction of a bulk terminal a Mariel Port
- Building storage facilities for export-bound agriculture/fishery products near sea or airports
- Enhancing cargo transport by rail

For efficient distribution of imported goods throughout the country:

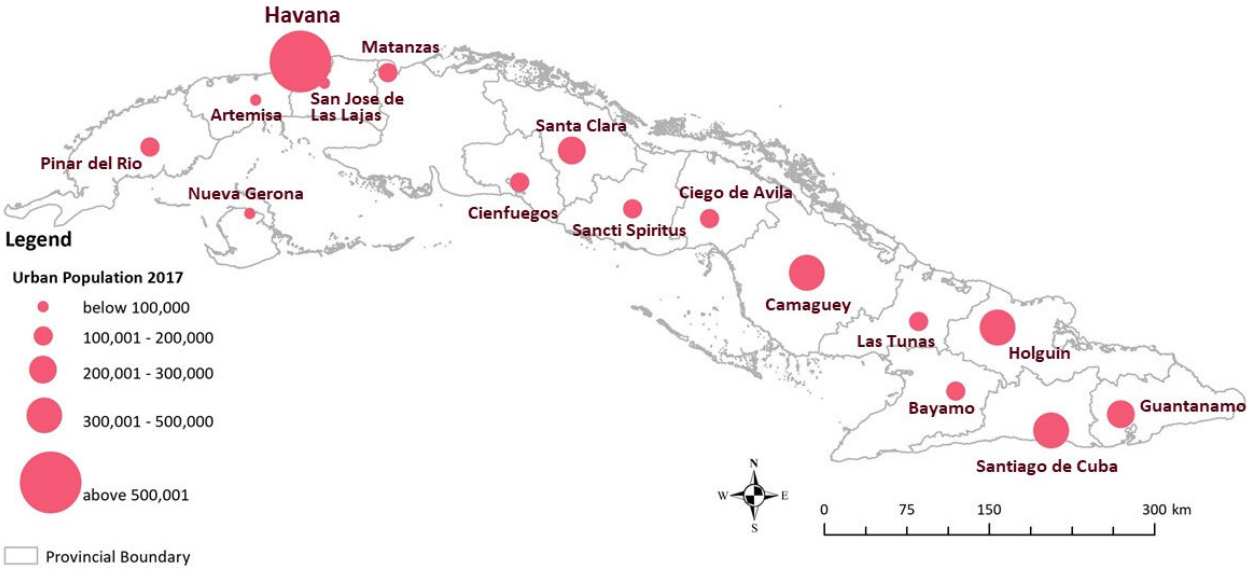
- Highway/rail networks to/from the ports of Mariel in the west and Santiago de Cuba are vital
- Modernization and enhancement of cargo collection, storage, and delivery centers in each province, including frozen food (meat, fish, etc.) and grain storage facilities
- Modernization of oil import terminals and increased coastal product tanker capacity

4.1.2 Robust and efficient transport network

(1) Capital City and Provincial Centers

The populations of the capital city and provincial centers[1] are shown in Figure 4.1.1. With over 2 million people, Havana province is the largest city in Cuba. Santiago de Cuba, Camaguey, and Holguin are the following largest centers.

As shown in Table 4.1.1, available service functions highlight the characteristics of the major centers. Based on population and available facilities, the centers can be classified into four levels, from primary to quaternary centers. Havana, the primary center, has the capital function and a wide variety of services. As secondary centers, three cities can be identified: Santa Clara, Camaguey, and Santiago de Cuba, which have relatively large populations and a variety of service functions. According to ENOT, these three cities are also termed "main cities." Other cities are classified as tertiary centers except for Nueva Gerona, deemed a quaternary center due to its geographical location.



Source: JICA Study Team, based on the data from "Population in 2017" by ONEI

Figure 4.1.1 Population Size by Service Center in 2017

Table 4.1.1 Summary of Service Center Function

Major Centers	Population in 2017	Hospital	University	Int'l Airport	Railway Station	Bus Terminal	Cargo Terminal	Class
Pinar del Rio	156,643	3	0	0	1	1	1	III
Artemisa	59,983	0	0	0	1	0	1	III
Havana***	2,129,553	44	4	1	21	3	1	I
San José de Las Lajas	52,264	3	0	0	1	0	0	III
Matanzas	148,799	0	0	1	4	1	1	III
Santa Clara	224,522	12	2	1	2	1	1	II
Cienfuegos	166,152	3	0	1	1	1	1	III
Sancti Spiritus	119,584	5	0	0	1	1	1	III

[1] Source: 2017 population data by ONEI

Major Centers	Population in 2017	Hospital	University	Int'l Airport	Railway Station	Bus Terminal	Cargo Terminal	Class
Ciego de Avila	130,782	6	1	0	1	1	1	III
Camaguey	310,942	5	0	1	2	1	1	II
Las Tunas	180,788	1	0	0	1	1	1	III
Holguin	302,731	3	0	1	1	1	1	III
Bayamo	171,289	3	0	0	1	1	1	III
Santiago de Cuba	454,906	13	3	1	1	1	1	II
Guantanamo	218,706	2	0	0	2	1	1	III
Nueva Gerona	68,908	1	0	0	0	0	0	IV

Note: *** Population of Havana City is considered as the whole province
Source: Information on hospitals and universities from OSM, others from Cimab

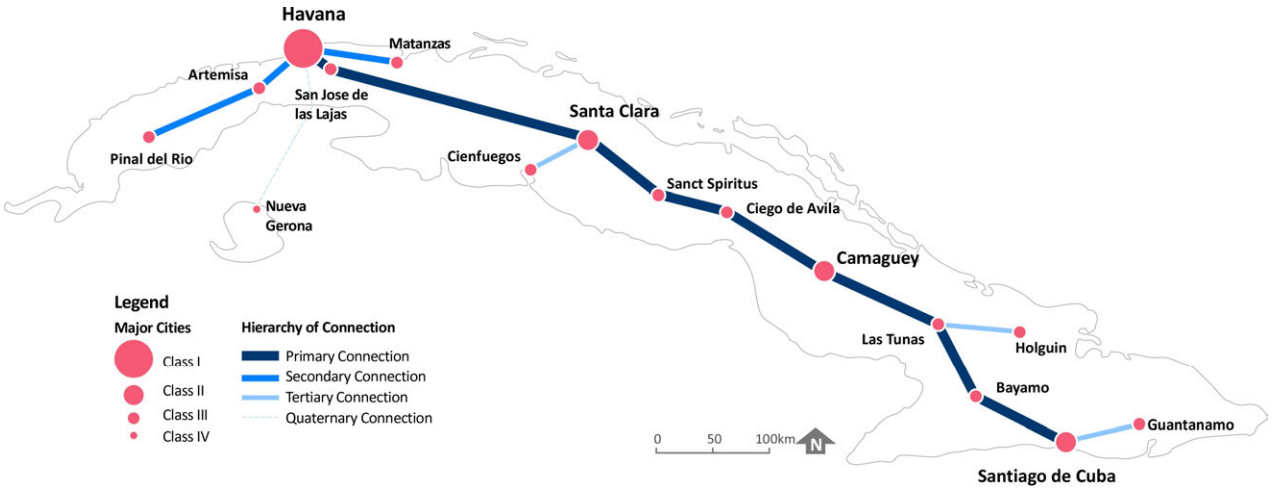
(2) Hierarchical Network

The hierarchy of centers suggests the need for the formation of a hierarchical network. Based on the center hierarchy, the existing national network is also classified into four levels as shown in Table 4.1.2 and Figure 4.1.2. The network between Havana and Santiago de Cuba is the most important link connecting service centers.

Table 4.1.2 Classified Network

Network	Connected Service Center	Route
Primary Connection	Class I and Class II	• Havana – Santa Clara – Camagüey – Santiago de Cuba
Secondary Connection	Class I and Class III	• Havana – Artemisa – Pinar del Rio • Havana - Matanzas
Tertiary Connection	Class II and Class III	• Santa Clara – Cienfuegos • Las Tunas - Holguin • Santiago de Cuba - Guantanamo
Quaternary Connection	Class I and Class IV	• Havana – Nueva Gerona (via Batabane Port)

Source: JICA Study Team

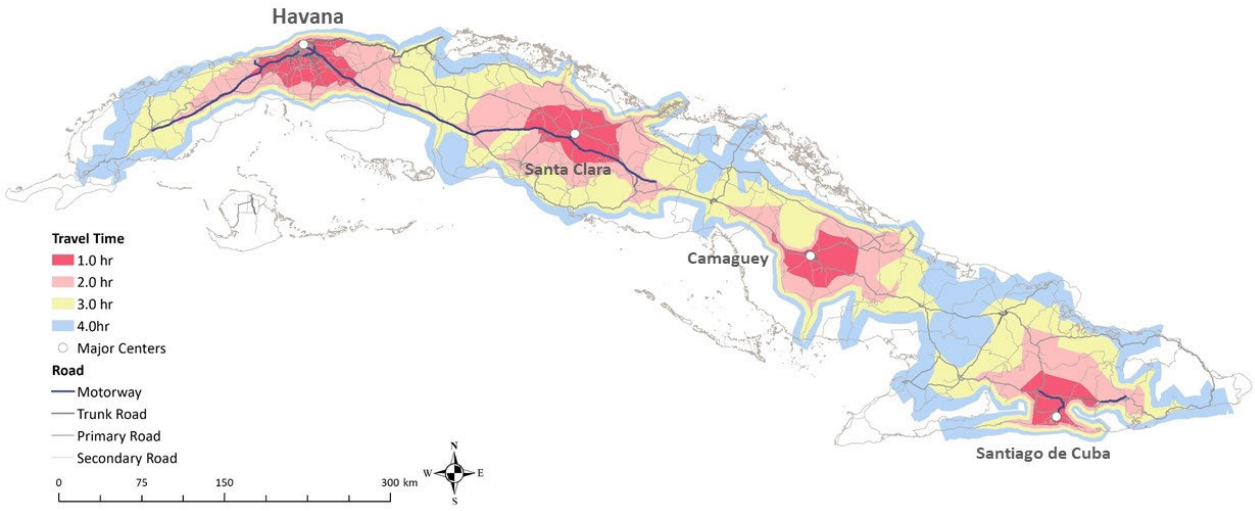


Source: JICA Study Team

Figure 4.1.2 Classified Network (existing)

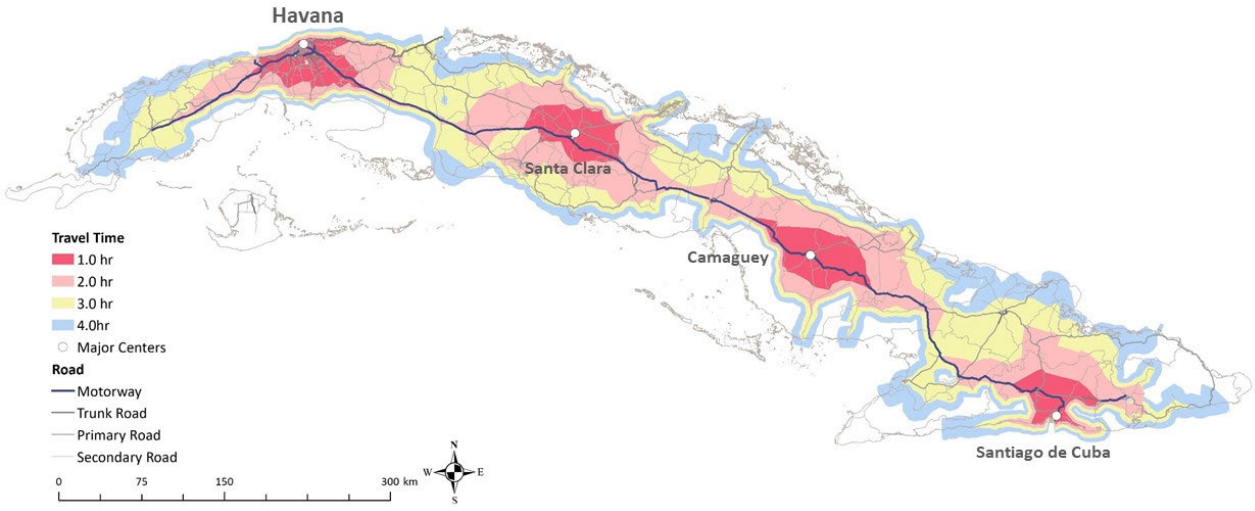
The service coverage (areas) by roads from the primary and secondary centers are shown in Figure 4.1.3, which is calculated based on travel time using the current road network[2]. In the figure, blue- and white-colored areas show poor accessibility to these centers. For instance, in the areas between Camaguey and Santiago de Cuba, it takes about four hours to reach the secondary centers by car at present.

Completion of the Autopista would contribute to improved accessibility in the eastern area, as shown in Figure 4.1.4. The transport network between Havana and Santiago de Cuba is classified as a primary connection and the most important network for supporting people's life in Cuba. In this regard, the completion of Autopista is seen as one of the most strategically important projects.



Source: JICA Study Team

Figure 4.1.3 Travel Time from Major Service Centers under Existing Network Conditions



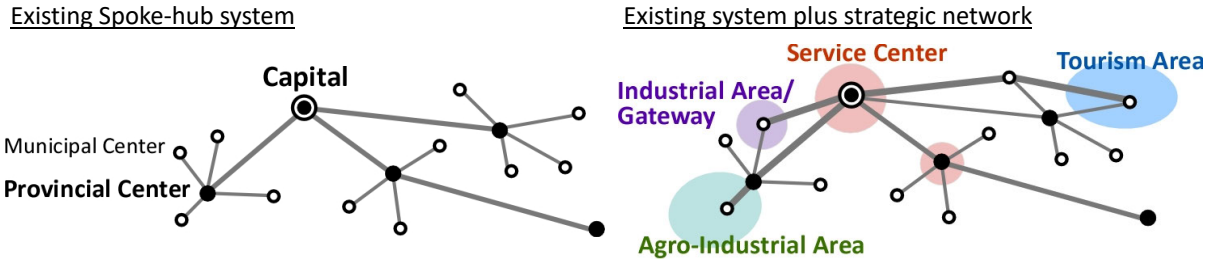
Source: JICA Study Team

Figure 4.1.4 Travel Time from Major Service Centers with Completion of the Autopista

[2] Since figures are based on road networks, Isla de la Juventud is excluded from the calculation.

(3) Network Structure

Cuba's current transport network is essentially a spoke-and-hub structure, with state and provincial capitals as hubs connected by spoke roads to municipal centers. Plus, the spatial distribution of major tourist destinations, potential industrial areas, and major international gateways should be considered important nodes on the network that should be strategically connected by appropriate modes of transport.



Source: JICA Study Team

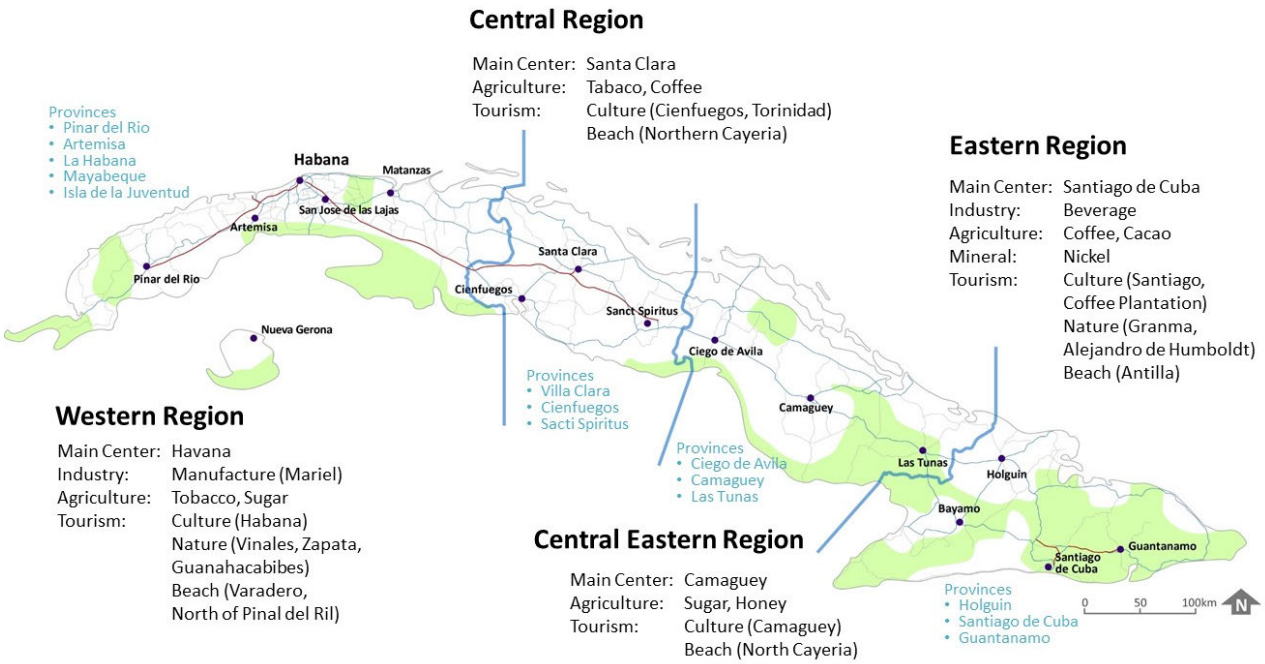
Figure 4.1.5 Conceptual Network Structure

(4) Regional development approach

The current spatial planning system in Cuba follows an administrative hierarchy, with ENOT as a national plan and EPOT as a series of provincial plans. But in between ENOT and EPOT, there is no consolidated planning system covering multiple provinces.

Since international tourists, agricultural and mineral products various general commodities all move across provincial boundaries, it is worthwhile to consider a transport network development plan from an integrated regional development point of view.

Considering the spatial distribution of centers and gateways, Cuba can be divided into four regions: Western, Central, Central-Eastern, and Eastern Regions, each containing three to five provinces. Each region has a primary or secondary center and a major gateway, such as an airport and/or seaport. The major characteristics of the regions are outlined in Figure 4.1.6.



Source: JICA Study Team

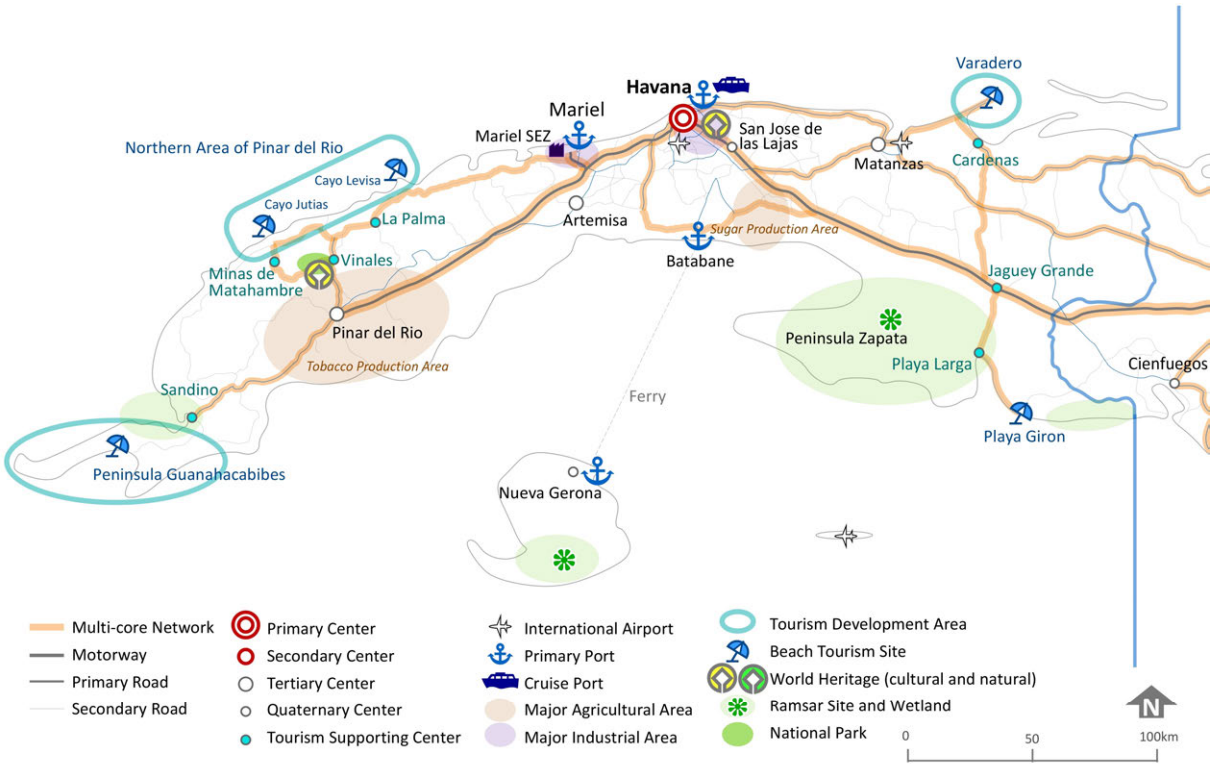
Figure 4.1.6 Characteristics by Region

(5) Western Region

The Western Region consists of five provinces: Havana, Artemisa, Matanzas, Pinar del Rio, and Isla de la Juventud. Havana is the primary regional center, as well as the international gateway for both passengers and cargo. Plus, another three seaports are located in this region: Mariel, Batabano, and Nueva Gerona. In particular, Mariel is recognized as an industrial gateway port.

Major economic activities in this region include manufacturing, tourism, and agriculture. Havana has a variety of industries: manufacturing, tourism, and agri-industries such as rum and cigars. The Mariel SDZ has developed as the largest industrial area in Cuba and is expected to attract foreign investment. Tourism, especially beach resorts, is also expected to grow in this region following the successful development of Varadero. The northern area of Pinar del Rio province and Guanahacabibes Peninsula will be developed in the near future. To support these tourism developments, neighboring towns should house tourism business employees, such as Cardenas, La Palma, Minas de Matahambre, and Sandino. As cultural tourism sites, Havana and Viñales also continue to attract international tourists. In southern Matanzas province, there are also smaller tourist destinations such as Playa Giron, which draws tourists from Varadero on day trips. In agriculture, tobacco production in Pinar del Rio is dominant in this region.

A focused transport network plan is shown in Figure 4.1.7 based on potential development areas.



Source: JICA Study Team

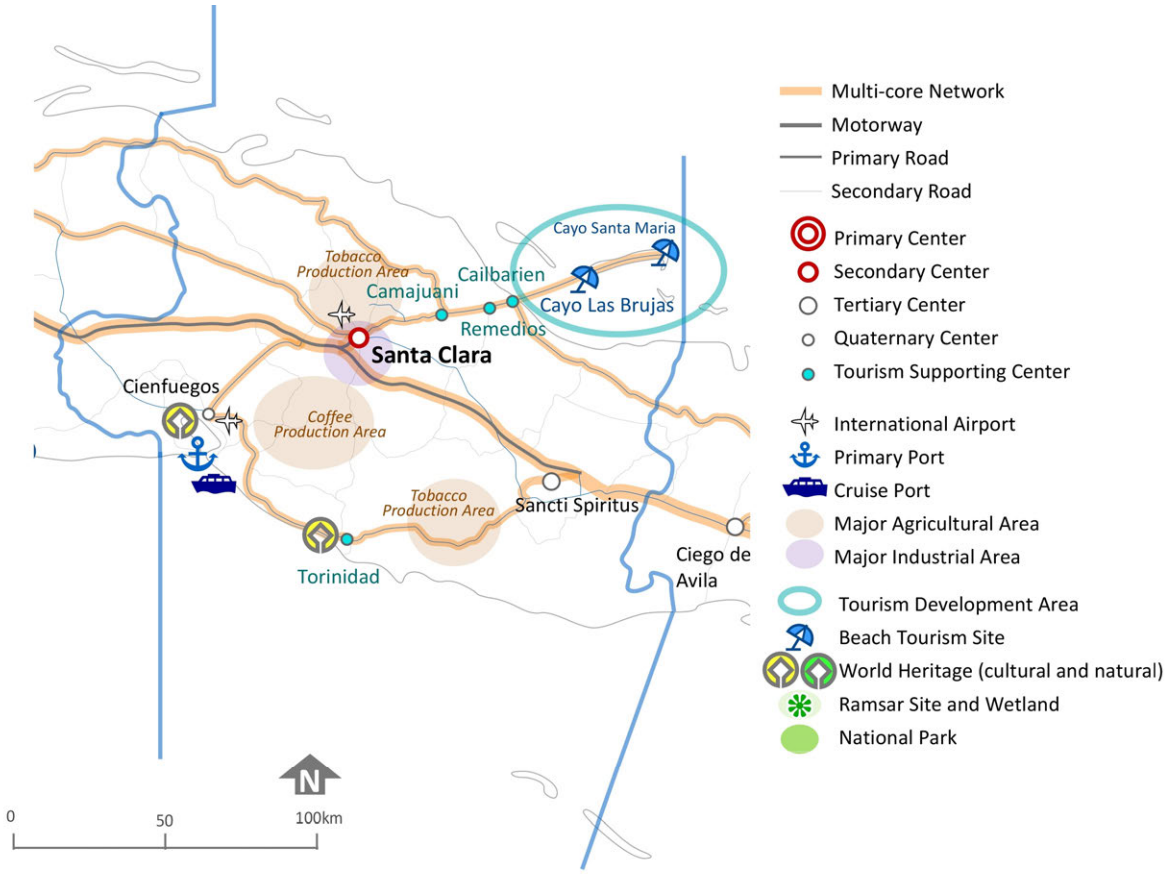
Figure 4.1.7 Transport Network for Potential Areas in Western Region

(6) Central Region

The Central Region consists of three provinces: Villa Clara, Cienfuegos, and Sancti Spiritus. Santa Clara, the provincial center of Villa Clara, is a secondary service center and a regional center as well. Santa Clara and Cienfuegos are regional gateways. The port of Cienfuegos welcomes cruise ship tourists.

Major economic activities in this region are agriculture, agri-industry, and tourism. International tourists visit UNESCO world heritage sites at Cienfuegos and Trinidad in the southern part of the region. Cayo Las Brujas and Cayo Santa Maria are planned for beach tourism. Supporting towns that could house tourism workers include Caibarién, Remedios, and Camajuani. In agriculture, tobacco and coffee are produced here, but in relatively low volumes. Meanwhile, the tobacco industry is active in Santa Clara.

A focused transport network plan is shown in Figure 4.1.7 based on potential development areas.



Source: JICA Study Team

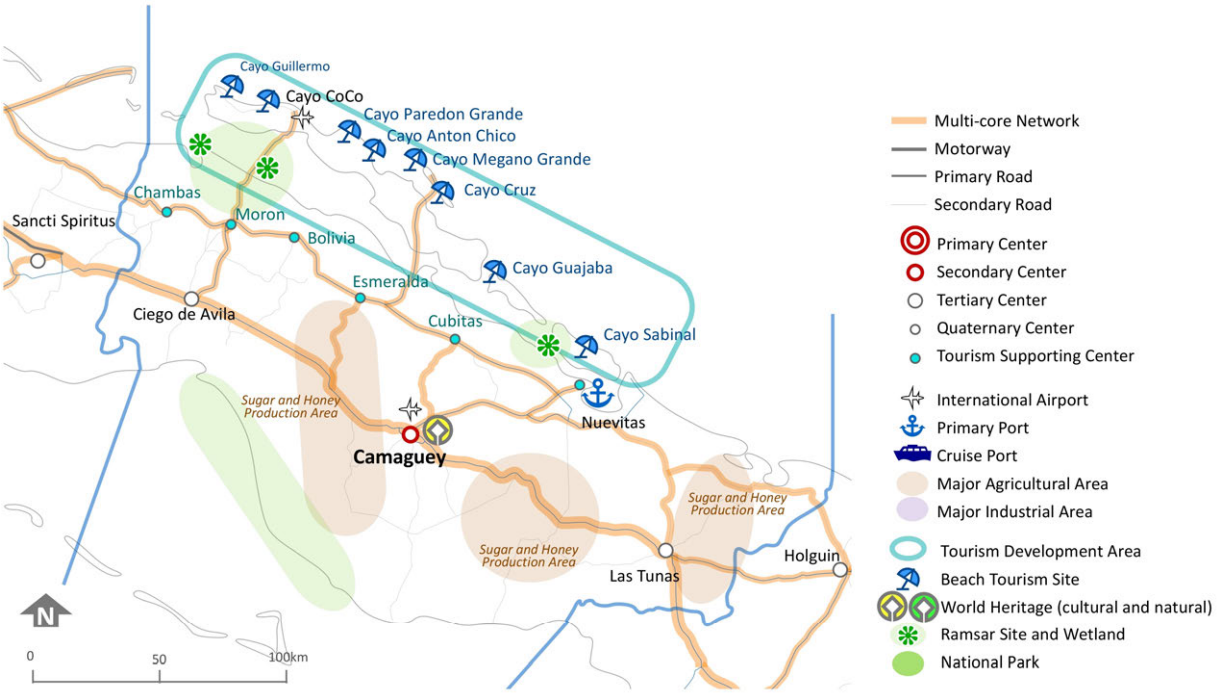
Figure 4.1.8 Transport Network for Potential Areas in Central Region

(7) Central Eastern Region

The Central Eastern Region spans three provinces: Ciego de Avila, Camaguey, and Las Tunas. Camaguey is a secondary service center and regional center. As regional gateways, Camaguey and Cayo Coco have international airports, while Nuevitas has a primary seaport. Visitors to beach resorts in Cayo Coco tend to fly directly to this island from outside Cuba.

Major economic activities in this region are tourism and agriculture. Large-scale tourism developments in the northern islands are expected to greatly stimulate the economy of this region and all of Cuba. In total, 33,400 hotel rooms are planned in the area. Towns in the northern area that will need to house an increasing population of workers include Chambas, Moron, Bolivia, Esmeralda, Cubitas, and Nuevitas. From an environmental perspective, since wetlands, including Ramsar-protected sites, cover the northern coasts, any infrastructure development needs to protect these areas. Plus, Camaguey has a cultural world heritage site. In agriculture, high-volume sugar and honey production dominates in this region.

A focused transport network plan is shown in Figure 4.1.7 based on potential development areas.



Source: JICA Study Team

Figure 4.1.9 Proposed Network and Potential Areas in Central Eastern Region

(8) Eastern Region

The Eastern Region includes four provinces: Holguin, Granma, Santiago de Cuba, and Guantanamo. Santiago de Cuba is a secondary service and regional center and Cuba's second-largest gateway, with an international airport and seaport. Two other international airports are in Holguin and Bayamo, and one more primary seaport is in Moa.

Major economic activities in the region are industry, mining, tourism, and agriculture. In manufacturing, large beverage factories are located in Holguin, while agri-industries in Santiago de Cuba include rum and cigars. Nickel mines are located near Moa. In tourism, the region has a variety of resources, such as beach attractions and natural world heritage sites, and national parks, such as Alejandro de Humboldt and Desembarco del Granma. Cultural world heritage sites have also been registered in Santiago de Cuba. Beach tourism development is planned around Antilla. In agriculture, sugar, honey, coffee, and cacao are produced in this region.

A focused transport network plan is shown in Figure 4.1.7 based on potential development areas.

Source: JICA Study Team

Figure 4.1.10 Transport Network for Potential Areas in the Eastern Region

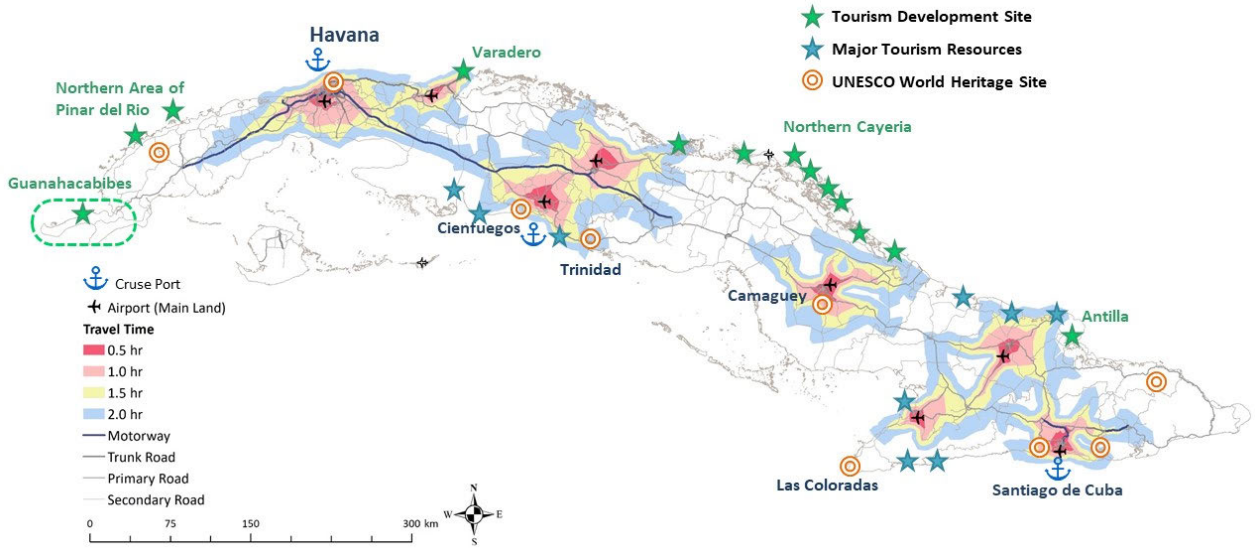
4.1.3 Transport for international tourists and tourism sector employees

(1) Transport for Tourists

Beach resorts and nature/culture world heritage[3]sites are the major destinations for tourists. There are two main types of gateways for tourists: international airports and cruise-ship ports. Cuba has 10 international airports, eight on the mainland and two on other islands. Havana, Cienfuegos, and Santiago de Cuba are cruise-ship gateways.

Figure 4.1.11 shows simulated travel times from major international gateways via the existing mainland road network. This shows that most tourism destinations, including future development sites, cannot be reached from a major gateway by car within two hours. In particular, this indicates that tourism development sites in Pinar del Rio and Camaguey provinces need better access from the major gateways.

[3] Registrado por UNESCO como Sitio de Patrimonio Mundial



Source: JICA Study Team

Figure 4.1.11 Travel Time from Major Airports to Tourism Sites

(2) Transport for tourism sector employees

Table 4.1.3 shows tourism development areas and the number of hotel rooms planned by 2030. Havana, Varadero, and Northern Cayeria will have the lion's share of 55,300 planned additional rooms. The number of hotel industry employees required by 2030 (excluding construction workers) can be estimated at 69,300 by multiplying the number of planned rooms (55,300) by the average number of employees per hotel room (1.25[4]). If all these staffs bring their family members along (the average Cuban household size is 3.1 persons[5]), 214,800 additional persons would need to be settled in surrounding areas.

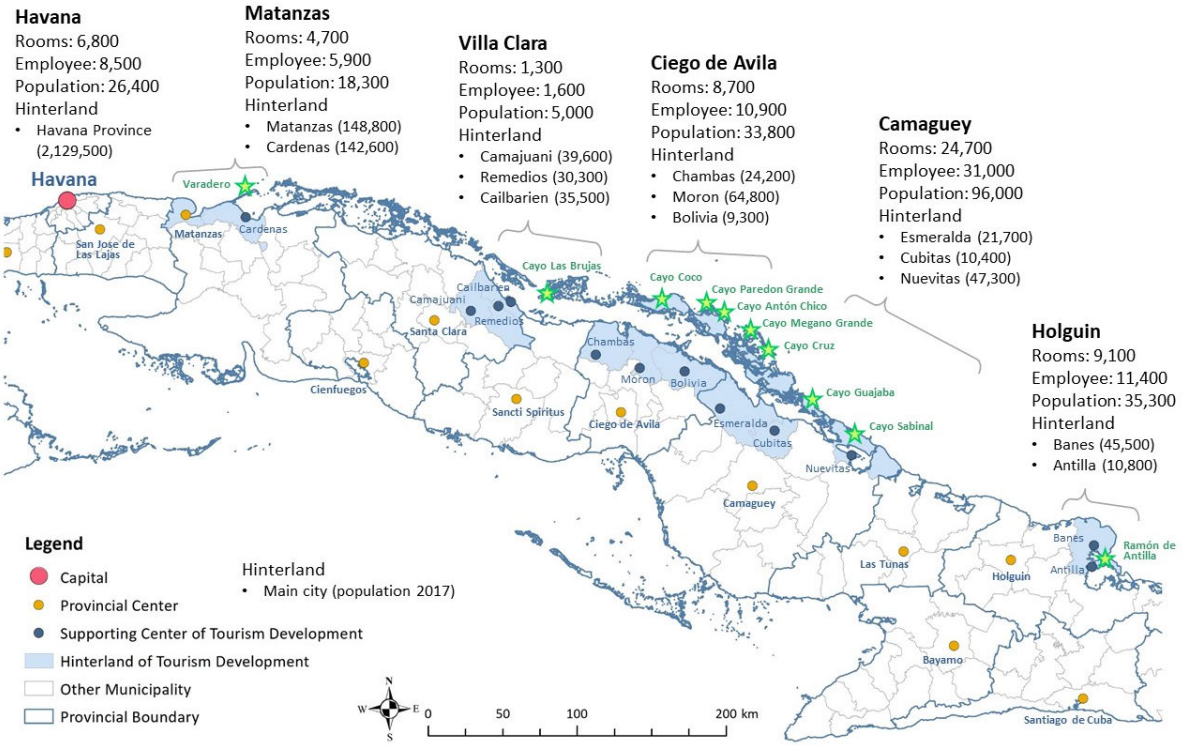
Table 4.1.3 Tourism Development Areas, Planned Hotel Rooms, and Estimated Hotel Workers

Province	Area of Development	Planned Hotel Rooms 2019-2030	Estimated Required Hotel Workers	Estimated Increased Population	Total Increased Population by Province
Havana	Havana	6,800	8,500	26,400	26,400
Matanzas	Varadero	4,700	5,900	18,300	18,300
Villa Clara	Cayo Las Brujas	1,300	1,600	5,000	5,000
Ciego de Avila	Cayo Coco	5,300	6,600	20,500	33,800
	Cayo Paredon Grande	2,600	3,300	10,200	
	Cayo Antón Chico	800	1,000	3,100	
Camaguey	Cayo Cruz	10,600	13,300	41,200	96,000
	Cayo Sabinal	12,800	16,000	49,600	
	Cayo Mégano Grande	300	400	1,200	
	Cayo Guajaba	1,000	1,300	4,000	
Holguin	Ramón de Antilla	9,100	11,400	35,300	35,300
	Total	55,300	69,300	214,800	214,800

Source: JICA Study Team based on planned hotel room data from Cimab

[4] Source: Japan Ryokan and Hotel Association
[5] Source: 2018 United Nations data

In the above plan, target sites excluding Havana are located on islands slated for beach development where employees are not allowed to live. So, they and their families need to be settled in the hinterland. Near Varadero, Matanzas and Cardenas are comparatively large towns that could accommodate the new settlers. But as towns in the hinterland of Northern Cayeria are relatively small, extensive housing and infrastructure development will be necessary to accommodate new hotel workers and their families. In particular, hotel developments in Camaguey and Holguin provinces could bring large demographic changes, with an estimated 1.5 to 2.2 times the current population near the sites. What is more, these hinterland towns will need links to major service centers for access to public services.



Source: JICA Study Team based on the data of planned hotel rooms by Cimab and population data by ONEI

Figure 4.1.12 Tourism Development in Havana, Varadero, Northern Cayeria, and Antilla

Another tourism development plan has been prepared for Pinar del Rio province, centered on the northern coast and the Guanahacabibes Peninsula, but detailed information was not publicly available as of writing this report. These areas will also require an increased population for the tourism workforce.

According to population projections by ONEI (see Table 4.1.4), Cuba's total population will decrease after 2025, and the elderly cohort will increase rapidly. In 2030, the working-age population will be below 55% of the total, while people over 60 years of age will make up 30%. Under these circumstances, securing an adequate labor force in rural towns may be a steep challenge, given the trend of urbanization in Cuba. But, according to discussions with the Ministry of Labor & Social Security, the required labor force can be recruited from neighboring provinces. This implies that the workforce transport network should be planned not only within each province but also to serve inter-provincial commuting to large-scale tourism development areas.

Table 4.1.4 Population Projection by ONEI

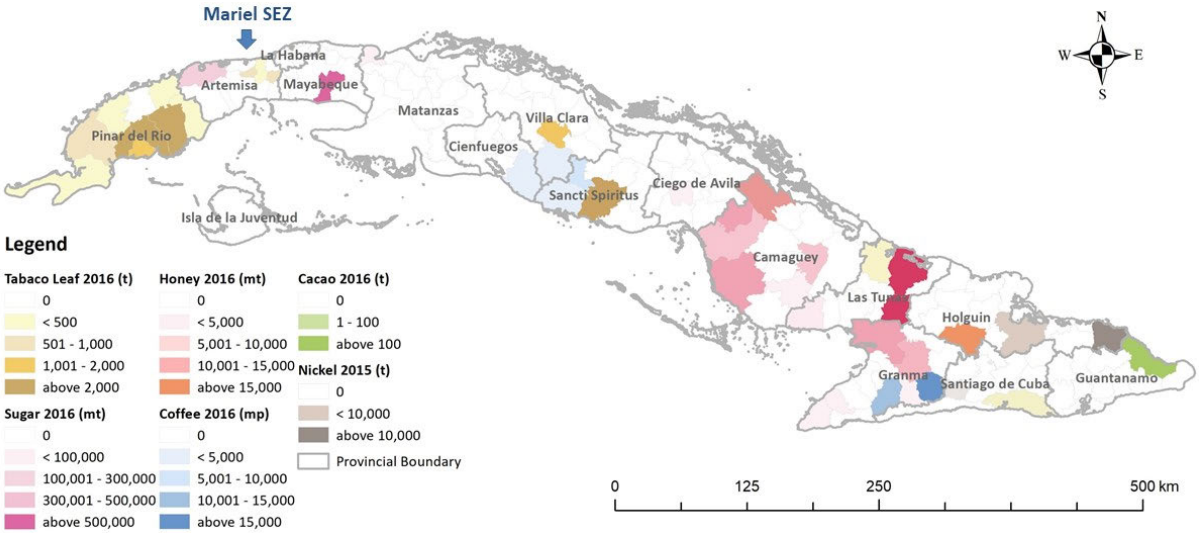
	2010	2015	2020	2025	2030
Total Population	11,241,161	11,220,354	11,280,651	11,309,665	11,288,750
Growth Rate % p.a.		-0.04%	0.11%	0.05%	-0.04%
Working Population	7,298,165	7,266,343	7,005,284	6,525,677	6,141,080
Share %	64.9%	64.8%	62.1%	57.7%	54.4%
Growth Rate % p.a.		-0.09%	-0.73%	-1.41%	-1.21%

Note: Working population is between 15 and 59 years old
Source: JICA Study Team based on data from ONEI

4.1.4 Cargo Transport

(1) Spatial distribution of Major Agricultural and Mineral Production Area

Certain agricultural products and minerals are regarded as strategic industries for further development in Cuba. Agricultural products for domestic consumption are widely cultivated, while export products are focused in designated areas. Tobacco is produced mainly in the western region; sugarcane and honey are concentrated in the central region; coffee, cacao, and nickel are produced in the eastern region. Figure 4.1.13 is a consolidated map of potential areas for agriculture and minerals. These industrial clusters indicate important economic areas that require efficient transport networks and services. The Mariel SDZ and port should also be a priority for enhanced transport networks and services.

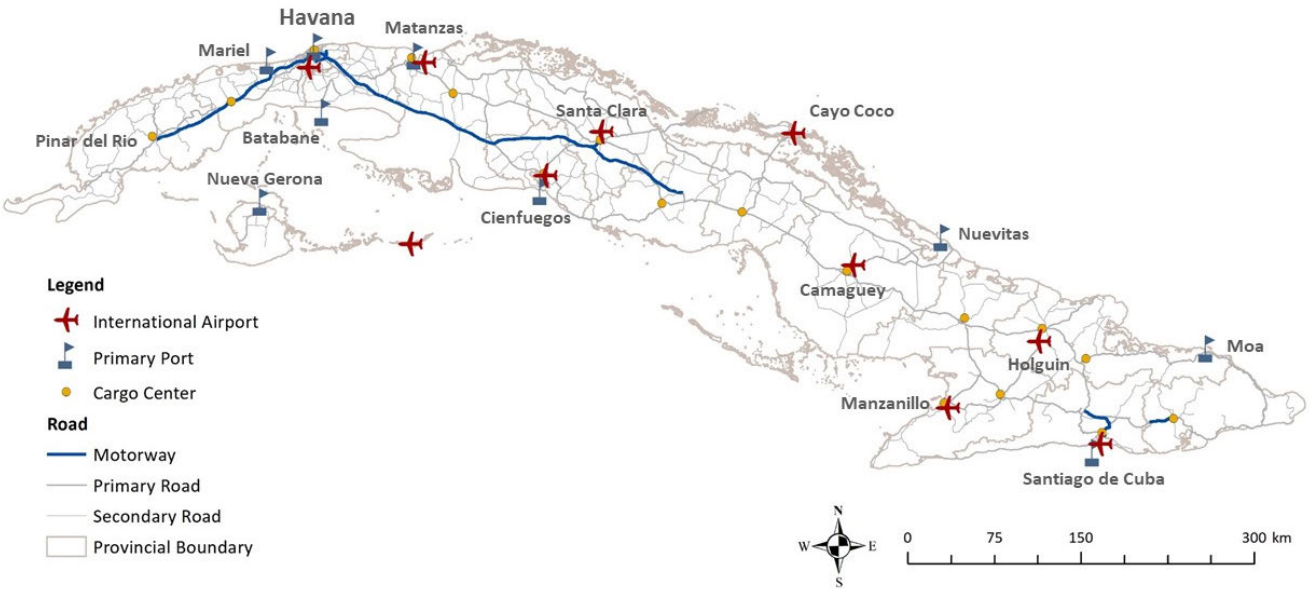


Source: JICA Study Team based on data from "Municipal Anuario Estadístico de la Oficina Municipal de la ONEI 2016."

Figure 4.1.13 Production Volumes of Major Agri-industries and Minerals by Municipality

(2) Logistics Gateways

Major logistics gateways that facilitate Cuba's international trade include 10 international airports and nine primary seaports. Cargo centers have also been developed in every province for delivering and collecting commodities. These logistics points need to be connected efficiently. Figure 4.1.14 shows the locations of these logistics points.



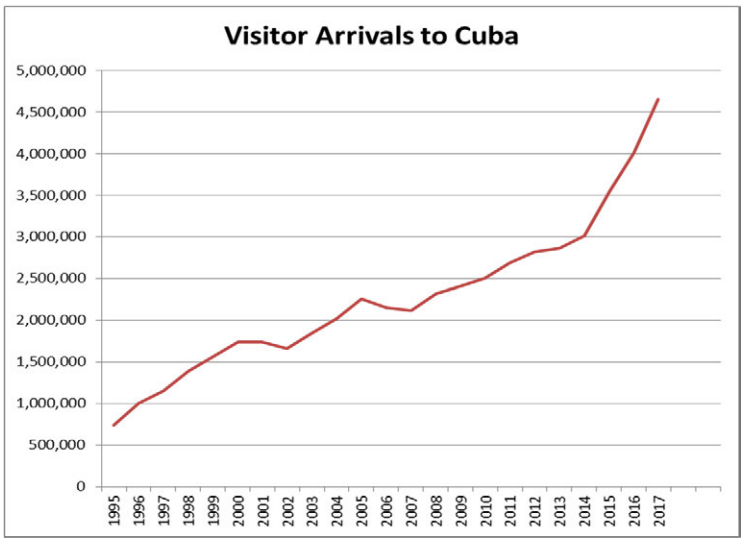
Source: JICA Study Team based on the data by CIMAB

Figure 4.1.14 Major Logistics Gateways in Cuba

4.1.5 Tourism

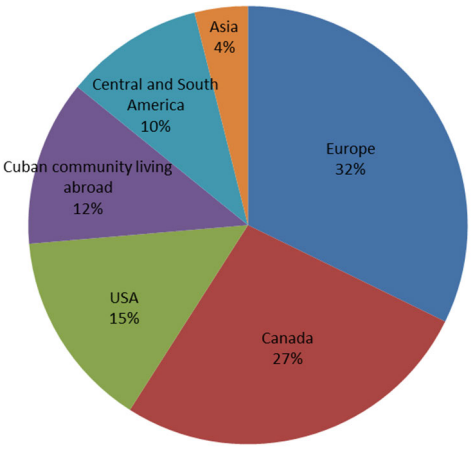
As tourism is a critical sector for acquiring foreign currency, the transport sector is expected to play a vital role in supporting tourism and related economic activities.

The number of visitor arrivals to Cuba in 2017 increased by about 16% from the previous year. In 2018, there were 4.7 million visitor arrivals, and 5 million were forecast in 2019.



Source: 1995-2012: World Tourism Organization, Yearbook of Tourism Statistics, Compendium of Tourism Statistics and data files, 2013-2017: Anuario Estadístico de Cuba 2017 Turismo Edición 2018 ONEI

Figure 4.1.15 Visitor Arrivals to Cuba (unit: tourists)



Source: Anuario Estadistico de Cuba 2017 Turismo Edición 2018 ONEI

Figure 4.1.16 International Tourists by Country of Origin

Visitor arrivals to Cuba in 2017 by origin included 59% from Canada and Europe, 15% from the U.S., 12% from Cubans living abroad, 10% from Latin America, and 4% from Asia. A comparison of 2016 and 2017 visitor arrivals shows that U.S. tourists increased by 217% and that the US sanctions against Cuba have had a significant impact on Cuba's tourism industry. Recently, the number of visitors from Russia has also increased. Viajes Cuba (OSDE of MINTUR), aims to receive 10 million tourists in 2030.

Half the 4.7 million visitors in 2018 arrived in Cuba via José Martí International Airport in Havana. Canadian and European visitors are more likely to enter via airports close to resort areas in the north of Cuba. Tourism resources in each province are shown in Table 4.1.5

Table 4.1.5 List of Tourism Resources in Cuba

ID	Province	Tourism Resources	Category	Gateway (Airport)
0	Pinar del Río	Valle de Viñales	World Heritage	International Airport José Martí
1	Pinar del Río	Cayo Levisa	Playa/Beach	
2	Pinar del Río	María la Gorda	Buceo/Diving	
3	Pinar del Río	Centro de Pinar del Río	Ciudad/ City	
4	Pinar del Río	Punta Colorada	Cultura/ Culture	
5	Pinar del Río	San Diego de los Baños	Salud/ Health	
6	Pinar del Río	Cayo Jutías	Playa/Beach	
7	Artemisa	Soroa	Naturaleza/ Nature	International Airport José Martí
8	Artemisa	Las Terrazas	Cultura/ Culture	
9	Artemisa	San Antonio de los Baños	Ciudad/ City	
10	Artemisa	Pan de Guajaibón	Naturaleza/ Nature	
11	Artemisa	Sierra del Rosario	Naturaleza/ Nature	
12	Artemisa	Playa El Salado	Playa/Beach	
13	Artemisa	Artemisa	Ciudad/ City	
14	La Habana	Parque Almendares	Parque/ National Park	International Airport José Martí
15	La Habana	Habana Vieja	Ciudad/ City	
16	La Habana	Plaza de La Revolución y Cementerio de Colón	Cultura/ Culture	

ID	Province	Tourism Resources	Category	Gateway (Airport)
17	La Habana	Cojímar	Cultura/ Culture	
18	La Habana	Parque Lenin y Jardín Botánico Nacional	Parque/ National Park	
19	La Habana	Hershey Electric Railway	Cultura/ Culture	
20	La Habana	Playas del Este	Playa/ Beach	
21	La Habana	Fortaleza de San Carlos de la Cabaña	Cultura/ Culture	
22	La Habana	Cabaret Tropicana	Cultura/ Culture	
23	La Habana	El Templete	World Heritage	
24	La Habana	Catedral	World Heritage	
25	La Habana	Marina Hemingway	Marina/ Marine	
26	La Habana	Casa Fuster	Cultura/ Culture	
27	La Habana	Cabaret Parisien	Cultura/ Culture	
28	La Habana	Kcho Estudio Romerillo Laboratorio Para El Arte	Cultura/ Culture	
29	La Habana	Callejón de Hamel	Cultura/ Culture	
30	La Habana	Museo del Ron	Histórico/ History	
31	Mayabeque	Playa Jicoba	Playa/Beach	International Airport José Martí
32	Mayabeque	Parque Escaleras de Jaruco	Parque/ National Park	
33	Mayabeque	San José	Ciudad/ City	
34	Matanzas	Matanzas	Ciudad/ City	International Airport Juan Gualberto Gómez
35	Matanzas	Varadero	Playa/Beach	
36	Matanzas	Ciénaga de Zapata	Cultura/ Culture	
37	Matanzas	Playa Girón y Museo Girón	Beach, Diving	
38	Villa Clara	Santa Clara	Ciudad/ City	Abel Santamaría
39	Villa Clara	Caibarién	Ciudad/ City	Airport las Brujas
40	Villa Clara	Cayo Santa María	Playa/ Beach	
41	Villa Clara	Cayo Las Brujas	Playa/ Beach	
42	Villa Clara	Remedios	Cultura/ Culture	
43	Villa Clara	Corralillo	Ciudad/ City	Abel Santamaría
44	Villa Clara	Manicaragua	Ciudad/ City	
45	Villa Clara	Isabela de Sagua	Ciudad/ City	
46	Villa Clara	Campo de Golf Caibarién-Remedios	Cultura/ Culture	Airport las Brujas
47	Cienfuegos	Centro Histórico Urbano de la Ciudad de Cienfuegos	World Heritage	Airport Jaime González
48	Cienfuegos	Rancho Luna	Beach, Diving	
49	Cienfuegos	El Nicho	Naturaleza/ Nature	
50	Cienfuegos	La Milpa Golf	Cultura/ Culture	
51	Cienfuegos	Playa Ingles Golf	Cultura/ Culture	
52	Sancti Spíritus	Ciudad de Sancti Spíritus	Ciudad/ City	Airport Alberto Delgado
53	Sancti Spíritus	Centro Histórico de Trinidad	World Heritage	
54	Ciego de Ávila	Cayo Coco	Playa/ Beach	Airport Jardines del Rey
55	Ciego de Ávila	Cayo Guillermo	Playa/ Beach	
56	Ciego de Ávila	Cayo Paredón Grande	Playa/ Beach	
57	Ciego de Ávila	Ciudad de Ciego de Ávila	Ciudad/ City	

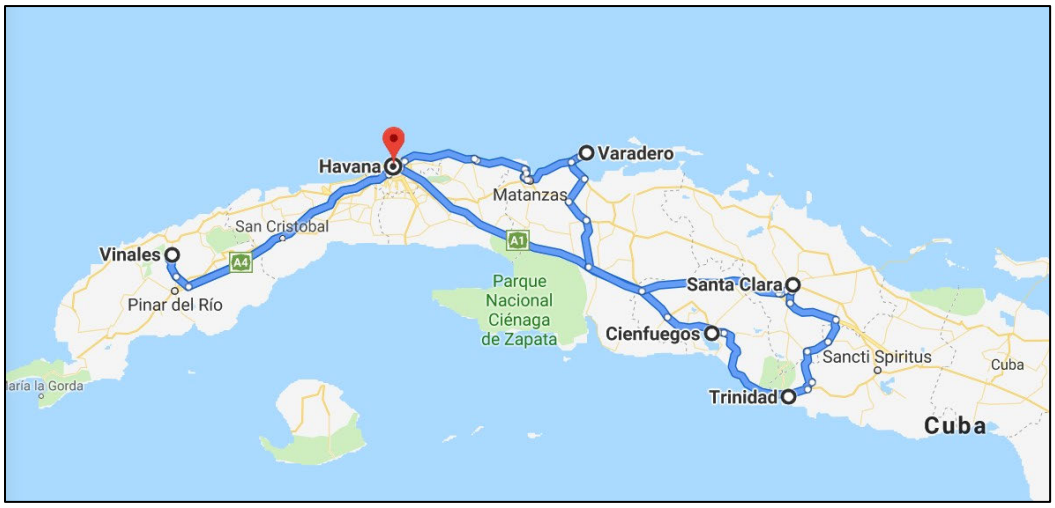
ID	Province	Tourism Resources	Category	Gateway (Airport)
58	Ciego de Ávila	Cayo Antón Chico	Playa/ Beach	
59	Ciego de Ávila	Laguna de la Leche	Naturaleza/ Nature	
60	Ciego de Ávila	Morón	Ciudad/ City	
61	Ciego de Ávila	Florencia	Cultura/ Culture	
62	Camagüey	Jardines de la Reina Archipiélago	Buceo/ Diving	Airport Alberto Delgado
63	Camagüey	Centro Histórico Urbano de la Ciudad de Camagüey	World Heritage	International Airport Ignacio Agramonte
64	Camagüey	Playa Santa Lucía	Playa/ Beach	
65	Camagüey	Cayo Sabinal	Playa/ Beach	Airport Jardines del Rey
66	Camagüey	Cayo Guajaba	Playa/ Beach	
67	Camagüey	Cayo Romano	Playa/ Beach	
68	Camagüey	Nuevitas	Ciudad/ City	International Airport Ignacio Agramonte
69	Camagüey	Cayo Cruz	Playa/ Beach	Airport Jardines del Rey
70	Las Tunas	Ciudad de Las Tunas	Ciudad/ City	Airport Hermanos Amejeiras
71	Las Tunas	Puerto Padre	Ciudad/ City	
72	Las Tunas	Punta Covarrubias	Playa/ Beach	
73	Holguín	Alejandro de Humboldt national park	World Heritage	Airport Orestes Acosta
74	Holguín	Pinares de Mayarí	Naturaleza/ Nature	Airport Frank País
75	Holguín	Gibara	Ciudad/ City	
76	Holguín	Guardalavaca	Playa/ Beach	
77	Holguín	El Ramón	Playa/ Beach	
78	Holguín	Ciudad de Holguín	Ciudad/ City	
79	Holguín	Antilla	Cruise Port	
80	Granma	Marea del Portillo	Naturaleza/ Nature	Airport Sierra Maestra
81	Granma	Santo Domingo	Histórico/ History	
82	Granma	Ciudad de Bayamo	Ciudad/ City	
83	Granma	Manzanillo	Ciudad/ City	
84	Granma	El Macío	Naturaleza/ Nature	
85	Granma	Punta Hicacos	Naturaleza/ Nature	
86	Granma	Cabo Cruz	Naturaleza/ Nature	
87	Granma	Río Cauto	Naturaleza/ Nature	
88	Santiago de Cuba	Gran Piedra	World Heritage	International Airport Antonio Maceo
89	Santiago de Cuba	El Cobre	Cultura/ Culture	
90	Santiago de Cuba	Santiago de Cuba city	Ciudad/ City	
91	Santiago de Cuba	Pico Turquino	Naturaleza/ Nature	
92	Guantánamo	La Farola, de las siete maravillas	Cultura/ Culture	Airport Guatavo Rizo
93	Isla de la Juventud	Nueva Gerona	Ciudad/ City	Airport Rafael Cabrera
94	Isla de la Juventud	Finca el Abra	Naturaleza/ Nature	Airport Rafael Cabrera
95	Isla de la Juventud	Presidio Modelo	Histórico/ History	
96	Isla de la Juventud	Cueva Punta del Este	Naturaleza/ Nature	
97	Isla de la Juventud	Punta Francés	Buceo/ Diving	
98	Isla de la Juventud	Cayo Largo del Sur	Playa/ Beach	Vilo Acuña

Source: Cimab

Source: JICA Study Team added information based on Infotur Map

Figure 4.1.17 Tourism Resources and Transport Access

Major sightseeing routes from Havana and Varadero are shown in Figure 4.1.18. More than half of international visitors visit these tourist destinations.



Source JICA Study Team

Figure 4.1.18 Major Sightseeing Routes in Cuba

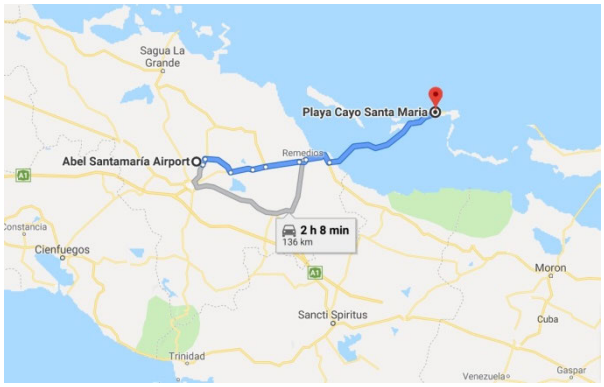
Distances and travel times between tourist sites are shown in Table 4.1.6.

Table 4.1.6 Distances & Travel Times on Major Sightseeing Routes

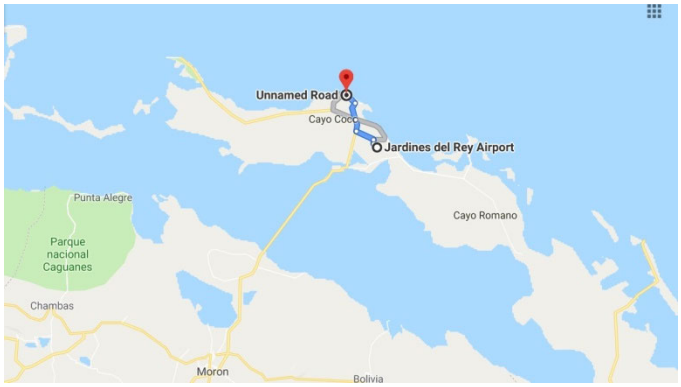
Route	Distance	Travel Time (Hours)
Havana → Viñales	183 km	2:30
Havana → Varadero	145 km	2:00
Havana → Cienfuegos	233 km	2:40
Cienfuegos → Trinidad	83 km	1:20
Trinidad → Santa Clara	120 km	2:00
Santa Clara → Varadero	232 km	3:00

Source JICA Study Team

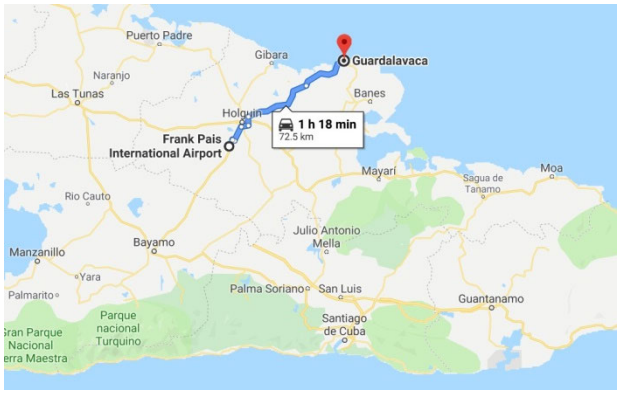
Other tourist routes from international airports to major beach resorts are shown in Figure 4.1.19.



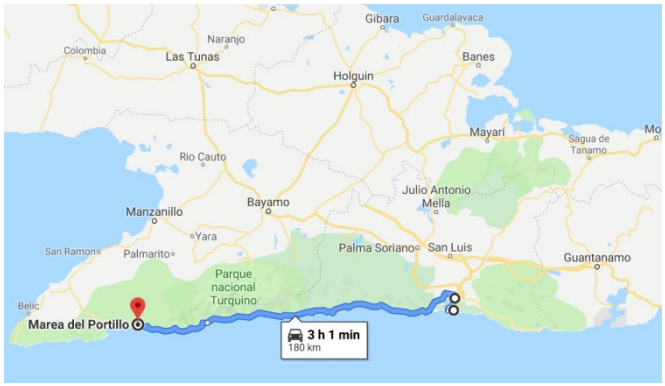
Cayo Santa Maria
From Abel Santamaria Airport → Cayo Santa Maria
136km, 2:00 hours
From Cayo Las Brujas Airport → Cayo Santa Maria
12km, 0:20 min



Cayo Coco
From Jardines del Rey Airport → Cayo Coco
14km, 0:20 min



Guadalavaca
From Frank Pais International Airport → Guadalavaca
73km, 1:20 hours



Guadalavaca
From Antonio Maceo International Airport → Marea del Portillo
180km, 3:00 hours

Source JICA Study Team

Figure 4.1.19 Major Beach Resort Access Routes in Cuba

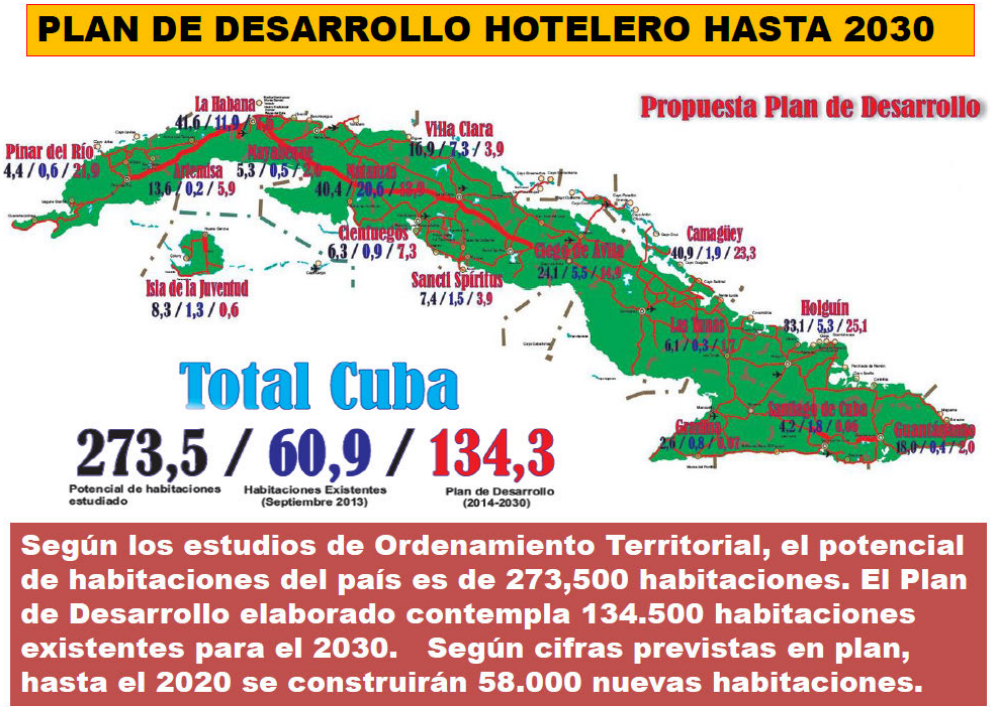
(1) Hotel development plan

To remedy the shortage of accommodations following the rapid increase in visitor arrivals since 2015, the government formulated a hotel development plan that aims to add 58,000 rooms to the existing 73,000-room inventory in order to provide 134,500 rooms by 2030. In addition, although a plan to develop accommodations has been announced for the national development plan "Plan Nacional de Desarrollo Económico y Social para 2030", the current situation is that investment has not yet caught up. At the same time, along with the increase in accommodations, it will be necessary to develop a system to accept tourists. Concretely, tourism infrastructure development must be considered, along with securing hotel employees, improving the transport system for employees, maintaining service quality, etc.

Table 4.1.7 Inventory of Accommodations (Rooms) in Cuba, 2017

Accommodations	Rooms
5-star Hotel	23,285
4-star Hotel	23,430
3-star Hotel	7,043
2-star Hotel	4,346
1-star Hotel	381
Hotel-Apartments	1,640
Motels	509
Hostels	110
Villas	595
Other facilities	12,199
Total	73,538

Source: Anuario Estadistico de Cuba 2017 Turismo Edicion 2018 ONEI



Source: Cimab

Figure 4.1.20 National Hotel Development Plan by 2030

Tourism development plans for 2030 in each province also include new plans for accommodations and are moving towards eliminating the shortage of accommodations at the national level.

The GAVIOTA group of MINFAR plans to develop an additional 57,000 rooms by 2031. In particular, focusing on tourism development of the beach resort areas in the northern region of Villa Clara, Ciego de Ávila, and Camagüey, which constitutes about 70% (about 40,000 rooms). The Las Tunas area aims at developing an all-inclusive hotel with FDI.

Table 4.1.8 Hotel Development Plan for 2030 by GAVIOTA Group

No.	Provincia/Province	Región/Region	Crecimiento Habitacional y Apertura de Instalaciones de Servicios/Hotel Room Growth and Opening of Services Facilities														TOTAL (Room)
			2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	
	La Habana	Centro Tradicional	378	412	181	422	214	0	0	0	0	0	0	0	0	0	1,607
	La Habana	Miramar	0	0	0	1,039	400	100	0	0	0	0	0	0	0	0	1,539
	La Habana	Plaza de la Revolución	0	0	0	0	0	0	0	800	0	0	0	0	0	0	800
	La Habana	Vedado	0	0	0	600	1,846	0	800	0	0	0	0	0	0	0	3,246
1	**La Habana**	**Total**	**378**	**412**	**181**	**2,061**	**2,460**	**100**	**800**	**800**	**0**	**0**	**0**	**0**	**0**	**0**	**7,192**
2	**Matanzas**	**Varadero**	**0**	**200**	**537**	**567**	**1,044**	**500**	**0**	**450**	**396**	**1,009**	**0**	**0**	**0**	**0**	**4,703**
	Villa Clara	Cayo Las Brujas	979	632	621	0	0	0	0	0	0	0	0	0	0	0	2,232
	Villa Clara	Cayo Santa María	804	0	0	0	0	0	0	0	0	0	0	0	0	0	804
3	**Villa Clara**	**Total**	**1,783**	**632**	**621**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3,036**
	Ciego de Ávila	Cayo Coco	0	0	0	0	0	700	2,800	1,225	595	0	0	0	0	0	5,320
	Ciego de Ávila	Cayo Guillermo	218														218
	Ciego de Ávila	Cayo Paredon Grande	594	1,196	610	800	0	0	0	0	0	0	0	0	0	0	3,200
	Ciego de Ávila	Cayo Antón Chico			800												800
4	**Ciego de Ávila**	**Total**	**812**	**1,196**	**1,410**	**800**	**0**	**700**	**2,800**	**1,225**	**595**	**0**	**0**	**0**	**0**	**0**	**9,538**
	Camagüey	Cayo Cruz	606	450	450	121	2,130	1,100	600	1,045	1,530	1,226	187	626	1,176	550	11,797
	Camagüey	Cayo Sabinal	0	0	0	0	0	395	910	1,030	720	2,065	4,140	1,125	2,400	0	12,785
	Camagüey	Cayo Mégano Grande						250									250
	Camagüey	Cayo Romano	0	0	0	0	0	1,100	0	0	0	0	0	0	0	0	1,100
	Camagüey	Cayo Guajaba									1,000						1,000
5	**Camagüey**	**Total**	**606**	**450**	**450**	**121**	**2,130**	**2,845**	**1,510**	**2,075**	**3,250**	**3,291**	**4,327**	**1,751**	**3,576**	**550**	**26,932**
	Holguín	Pesquero	640														640
	Holguín	Ramón de Antilla	0	0	860	1,330	0	700	700	1,350	700	480	1,400	900	700	200	9,320
6	**Holguín**	**Total**	**640**	**0**	**860**	**1,330**	**0**	**700**	**700**	**1,350**	**700**	**480**	**1,400**	**900**	**700**	**200**	**9,960**
	Grand Total		**4,219**	**2,690**	**3,522**	**4,312**	**4,590**	**4,345**	**5,810**	**5,450**	**4,545**	**3,771**	**5,727**	**2,651**	**4,276**	**750**	**56,658**

Source: Proyección Para La Transportación De Trabajadores Del Turismo en el Periodo 2019-2031 CRECIMIENTO HABITACIONAL GRUPO GAVIOTA (2018.10.24)

(2) Northern Region Tourism Development Plan

Although MINTUR's Tourism Master Plan has not yet been confirmed, there is a Tourism Development Plan for each province up to 2030, with the Northern Cayo area as a priority development area.

Source: JICA Study Team

Figure 4.1.21 Location of the Northern Cayo Area

The Cayo beach resorts are only partially developed, and each province plans beach resort tourism developments by 2030, as listed in Table 4.1.9.

Table 4.1.9 Development of Northern Cayo Area

Province	Cayo	No. of Rooms in 2018	No. of Rooms in 2030
Villa Clara	Cayo Santa Maria	11,626	13,000
Ciego de Ávila	Cayo Coco	6,890	12,873
	Cayo Guillermo	1,514	3,201
	Cayo Paredon Grande	0	2,590
	Anton Chico	0	800
Camagüey	Cayo Cruz	546	12,217
	Cayo Sabinal	0	12,000
	Cayo Romano	0	1,085
	Cayo Guajaba	0	1,000

Source: Delegation of each Province

Cayo Santa Maria is the entrance to Jardines del Rey, and the Ministry of Transport considers access-road maintenance as an urgent issue as this area is slated to be a priority tourist destination second only to Varadero in the Master Plan. The northern coast (from Cayo Santa Maria to Peninsula de Ramón in Holguín) and Jardines del Rey are top priorities for tourism development, but infrastructure, including access roads, was severely damaged by Hurricane Irma in September 2017. Cayo Coco International Airport (Jardines del Rey) was also damaged, and the port on the south side has yet to resume operations.

The causeway linking the mainland to Cayo, built 30 years ago, needs continual repairs and lacks guardrails – which means that vehicles often fall into the sea. So urgent measures are needed for safety.

Causeway to Cayo Santa Maria under repair

With no guardrails, vehicles often fall into the sea

Source: JICA Study Team

Figure 4.1.22 Causeway to Cayo Santa Maria

Road conditions are worsened by heavy truck traffic carrying construction materials for the area's many new hotels. In the tourism infrastructure development plan, road maintenance is flagged as a high priority.

(3) Pinar del Rio Province

Large-scale golf resorts are planned by Punta Colorada S. A. (joint venture with Spanish interests, 3,000ha area, aiming for completion in 2050) around Mantua and Sandino on the west side of Pinar del Rio province. The approval process by INOTU and other related ministries is in the final stage. Plans call for 1,600 units (condominiums, villas, and bungalows), a marina with 300 berths, two golf courses, and three hotels with a total of 1,250 rooms, all to be executed in seven years.

Punta Colorada Development Plan

Source: Punta Colorada S.A.

Figure 4.1.23 Pinar del Rio Development Plan

The former U.S. Army airfield at Sandino, west of Pinar del Río, currently has no passenger capabilities and is used for pilot training. But this airfield is planned as a tourism gateway, although the 45 km access road to Pinar de Río is in poor condition and needs improvement.

The Viñales Valley, a UNESCO World Heritage Site since 1999, is a magnet for ecotourism, trekking, mountain climbing, horse riding, cycling, zip-lining, and other tourist attractions. There are plans to increase accommodations around Viñales by 200 rooms by 2030. However, the road from Pinar de Río to Viñales needs improvement as the road is too narrow for tourist buses.

Pinar del Río to Viñales road is too narrow for two buses to pass safely

Parking lot in Viñales

Source: JICA Study Team

Figure 4.1.24 Road from Pinar de Río to Viñales

(4) Havana Province

In Havana, which struggles to host 2.5 million tourists annually with 12,000 hotel rooms, the shortage of accommodations reached a critical point in 2017. New hotels are planned with 2,800 rooms, but development plans have been delayed by hurricanes and oil shortages. Havana also has 15,000 rooms in Casa Particulars (private pensions), of which 9,500 are rented for foreigners. The number of guestrooms will be increased by 1,600 in 2021.

(5) Matanzas Province

Varadero (with 52 hotels and 22,000 rooms) is now a two-hour drive from Havana. If this travel time is shortened, it is expected that more tourists staying at Varadero will visit Havana and Viñales. Varadero's room occupancy rate in 2018 was 92% in high season and 41% off-season. There are plans to add 30,000 rooms by 2030. The Cienaga de Zapata area, in the south of Matanzas Province, was the site of the 1961 Bay of Pigs incident. Now it is a national park and an ecotourism magnet with alligators in the wetlands. The Bay of Pigs is also famous for diving. But access roads from Varadero to Cienaga de Zapata are narrow, and the trip takes 2.5 hours, so road improvements for capacity and safety are needed.

(6) Cienfuegos Province

A 369-ha golf resort at Playa Ingles is planned by a joint venture of Cuba Golf and a Spanish firm, with two 18-hole golf courses, a 5-star hotel with 280 rooms, and further plans for 1,770 units, including hotels, villas, and apartments. In La Milpa around Playa Rancho Luna, there are plans for a golf resort

with a 355-room 5-star hotel and apartments with 1,045 units.

The neighboring town of Trinidad (Sancti Spíritus Province) is also a key tourist destination, and visitors to Cienfuegos often go on to Trinidad. The scenic 70-km coast road (Circuit Sur) from Cienfuegos to Trinidad is too narrow for tourist buses and requires expansion.

Roads are too narrow for two buses to pass safely

Road widening in progress

Beautiful sea views from the road

Tour bus passing through town

Source JICA Study Team

Figure 4.1.25 Roads in Cienfuegos Province

(7) Villa Clara Province

Villa Clara's Cayos area, famed for diving, is undeveloped apart from a marina in the northwest part. But there are plans to develop resort hotels in the future. Road conditions from Isabela de Sagua to Elguea are poor and need improvement. At Manicaragua, in the south of Villa Clara, there are plans to develop ecotourism (camping, fishing, trekking, etc.) around Lake Hanabanilla. Other plans envision 11 golf courses in two locations, Santa Clara (six courses) and Caibarien (five courses).

(8) Ciego de Ávila Province

In addition to the existing resorts in the north of the province, the unspoiled Cayo area includes Cayo Paredon Grande and Anton Chico. Besides, the south Cayo (Jardines de la Reina) is also a popular tourist destination. Jardines de la Reina, accessed by boat from Jucaro Port, is famous for fishing and diving. Unfortunately, there are no hotels, so visitors stay on ships. As for access from the mainland, road conditions from Ciego de Ávila city to Jucaro port (90 km) are poor and need improvement.

(9) Camagüey Province

In the undeveloped northern Cayo area, numerous hotel projects are planned: Cayo Sabinal, 15 5-star hotels (12,000 rooms); Cayo Romano, 1,085 rooms; Cayo Guajaba, 1,000 rooms and the unspoiled Cayo Cruz. At Nuevitas Bay, 72 km east of Camagüey city, a cruise-ship port is planned.

(10) Holguín Province

In the Guardalavaca area, the expansion of the Brisas Guardavaca Hotel is planned. Palmares plans to establish a new cultural center and develop a new hotel and golf course. Better access roads to the neighboring provinces of Bayamo and Santiago de Cuba will be critical for tourism development.

El Ramon plans to develop a large-scale golf resort with three courses, a marina, and accommodations. Antilla is a small seaside town, founded as a railway terminal with a small port. Building materials for tourism development (e.g., El Ramon) can be transported from the port by rail. Once resort facilities are open, the port could host cruise ships, and visitors could travel to the golf resort by train.

(11) Granma Province

Near Cabo Cruz on the west end of Granma, the Desembarco del Granma National Park (World Natural Heritage Site since 1999) offers trekking and caving. As the mountain access road to the park is in poor condition, however, road improvements will be critical. Santo Domingo is an optional day-trip destination, with Turquino National Park offering forest trekking. Plus, there is the site of Fidel Castro's forest base during the revolution. Plans call for nature tourism development for Villa Santo Domingo, but the access road from Yara is in poor condition and needs improvement.

The 162 km road from Niquero to Marea del Portillo suffered hurricane damage and is in very poor condition, and some parts are only accessible by 4WD vehicles.

Rio Cauto has many natural resources, such as mangroves, birds, alligators, and fish, and is scheduled to be developed for ecotourism. There are also plans to develop attractions such as boat trips and canoeing.

The site of the HQ at the time of the revolution (Comandancia de Fidel en la Plata)

Pictures of a seaside road

Source: JICA Study Team

Figure 4.1.26 Granma Province

(12) Santiago de Cuba Province

The access road to Granma was severely damaged by a hurricane and is in very poor condition, so repairs are urgently needed. However, the scenery along this stretch of road is remarkable.

4.1.6 Tourism Infrastructure improvements

(1) Tourist Transportation

Cuba's tourist transportation is mainly limited to buses and taxis. Tourists travel either by buses included in tour packages, Viazul intercity public buses, or Conectando Cuba buses running between major hotels operated by Viajes Cubanacan. Plus, national taxis, classic car taxis, and car rentals are available.

Domestic flights run between major cities, but delays and cancellations are so frequent that tour agencies do not include domestic air travel in their itineraries, focusing instead on land transport.

With the increase in tourism, traffic congestion caused by tourist buses and taxis, along with obstructions to the landscape by illegal parking, have become a problem in Havana, especially in the historic Old Town. This has become an urgent issue that needs to be resolved as soon as possible.

In rural areas, there are many attractive tourist destinations, but road maintenance, including bridge repair, has been delayed. The fast, safe and comfortable access that tourists expect is not available. To achieve this, transportation infrastructure planning should dovetail with tourism master planning.

(2) Information Infrastructure

Cuba launched 3G mobile internet services in December 2018. Information & Communication Technology (ICT) makes it easy to obtain, share, transmit, store, analyze and use information in real time and to make all activities more convenient and efficient. For tourism, ICT in Cuba is expected to prompt significant changes. In advanced tourism countries, 4G and widely available free Wifi make it easy to obtain tourist information with a smartphone. In the near future, it will be necessary to promote the use of ICT for tourism in Cuba as part of developing an environment that can welcome more foreign visitors. To improve the visitor experience, increase repeat visitors and improve Cuba's reputation as a destination, the following ICT applications are recommended:

- Provide free Wifi spots in public spaces, such as airports, bus terminals, hotels, restaurants, etc.
- Make internet access easier for international tourists
- Develop a multilingual online booking and payment environment for hotels, transportation, etc.
- Provide smartphone applications: tourist guides, navigation, voice interpretation, multilingual restaurant search, evacuation behavior support in the event of natural disasters, etc.
- Use of ICT devices such as tablet-type equipment: Multilingual car navigation and road maps, videophone interpretation service, etc.

4.1.7 Manufacturing Industry

The Ministry of Industries was established on February 23, 1961, and Commander Ernesto Che Guevara was entrusted with its direction.[6] The ministry is the Central State Administration responsible for proposing, approving, directing, and controlling the implementation of policies and strategies for industrial development, such as sidero-mechanics (SIME), chemistry, recycling, textile, clothing & accessories, printing, packaging, furniture, ornamental ceramics, etc. MINDUS attends OSDEs as shown in Table 4.1.10.

Table 4.1.10 OSDEs attended by MINDUS

OSDE	
GEIQ	Grupo Empresarial de la Industria Química
GEMPIL	Grupo Empresarial de la Industria Ligera
GESIME	Grupo Empresarial de la Industria Sideromecánica
GELECT	Grupo Empresarial de la Industria Electrónica

Source: MINDUS

GEIQ constitutes a sector with high incidence in the increase of the added value of the products and in the development of other industrial activities, which include as industrial activities: rubber, industrial and medicinal gases, chlorine, caustic soda and its derivatives, paper, cardboard, and its conversion, glass, fertilizers, sulfuric acid, and pesticides. To develop chemical productions, prioritizing the transformative industry of plastics, the production of chlorine, salt, fertilizers, and tires. Fertilizer is important in the agriculture sector and has a large volume of transactions. The largest factory is located at Cienfuegos. A new chlorine factory will be open in Havana in 2019, and another new glass factory will be open in Mariel SEZ in 2021. Although safety is treated as a priority, the decrepit infrastructure of transport equipment hampers it.

Taking into account that the light industry is in charge of designing products of first necessity for the life of the citizens, it can be considered as one of those with the greatest impact on the population. GEMPIL covers the following industrial activities: sacks and ropes, matches and candles, tanneries and skins, saddlery, footwear, textiles, textiles, paints and varnishes, toiletries and cosmetics, sanitary-hygienic products, the sports industry, furniture, polygraph, polyurethane foam and mattresses, the transformation of plastics and ceramics. GMPIL, as OSDE, has 33 Empresas, eight out of which are JV with foreign capital, and it does not own transportation or equipment by itself. Its function is to monitor and manage. The main Empresa under GEMPIL that owns its own transport vehicles is ENCOMIL, CAMACHO, and PROQUIMIA.

GESIME constitutes sustenance to the development of other industries and the economy of a country, basically, for the manufacture of capital goods, consumer goods, intermediate products, repairs, and maintenance. This industry comprises 21 industrial activities grouped into the manufacture of metal structures: structures, metal products, panels, metal services, and metal carpentry. Manufacture and assembly of equipment: agricultural, construction; industrial plants; elevators; medical equipment. Manufacture of transport equipment: manufacturing, automotive services; railway. Repair and

[6] MINDUS web site at https://www.mindus.gob.cu/en/node/21

maintenance services: machine tools, boilers, lift truck. Insurance of the industry: oleo-hydraulics; fastening elements; refractory; cables; bathroom scales; taps metal containers. Industrial support services: casting and forging, heat treatment, surface treatment, molds, and dies. In the fuel consumption structure, the most important activity is the transportation of cargo, which represents 56% of the total consumption of the carrier, which requires executing a set of actions to ensure their savings, among which find: organizational measures of an internal nature and joint work with the specialized companies of MITRANS.

4.1.8 Non-agricultural cooperatives attended by MINDUS

Non-Agricultural Cooperatives (CNoA) are organizations with economic and social purposes formed voluntarily, based on the contribution of goods and rights, and are based on the work of its partners, whose general objective is as follows: The activities of CNoAs approved by the Council of Ministers in the experiment correspond to authorized activities in the Own-account Work and of Policies approved by MINDUS that affect the experiment.

Province/Municipality	Quantity
Pinar del Rio	1
Isla de la Juventud	-
Artemisa	1
Mayabeque	2
La Habana	7
Matanzas	4
Cienfuegos	1
Villa Clara	2
Sancti Spíritus	2
Ciego de Ávila	1
Camagüey	2
Las Tunas	-
Holguín	1
Granma	1
Santiago de Cuba	2
Guantánamo	1
Total	28

Source: MINDUS

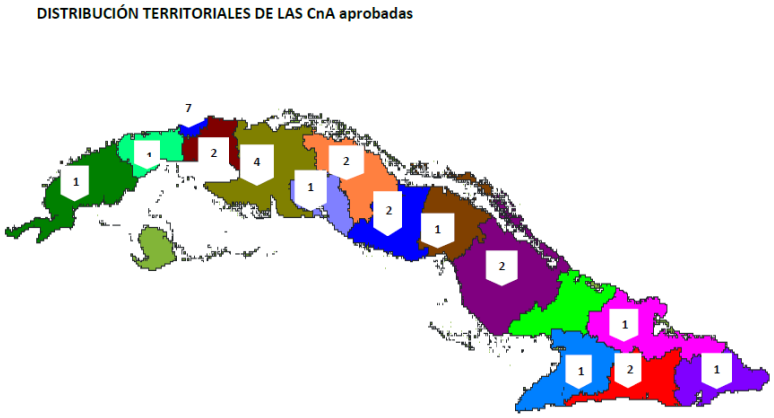


Figure 4.1.27 Territorial Distribution of Approved CNoAs

4.1.9 Health and Medical Services

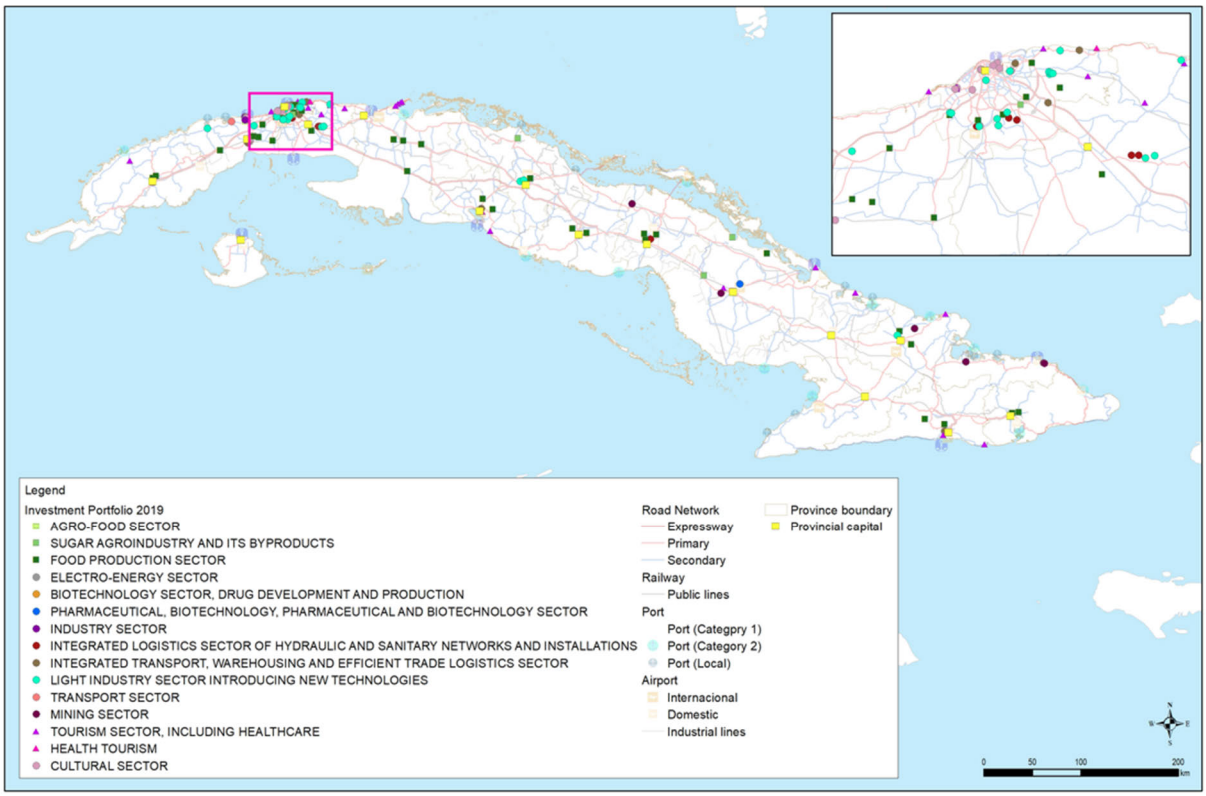
Since Cuba is a society where all can receive education and medical care free of charge, the regional primary care medical system has been developed with a large number of medical sector workers. In addition to a high standard of medical care, Cuba's medical profession is characterized by its strong economic position in the biotechnology and pharmaceutical industries. However, the deterioration of the public transport system in recent decades has contributed to a worsening of the health system.

4.1.10 Strategic Projects

The locations of potential investment projects specified in "Investment Portfolio 2018" are plotted in Figure 4.1.28, along with transport infrastructure. Out of 527 projects, 192 are identified with locations and investment volumes (USD 4,358.18 million), while the production volume/value or details of projects are not determined.

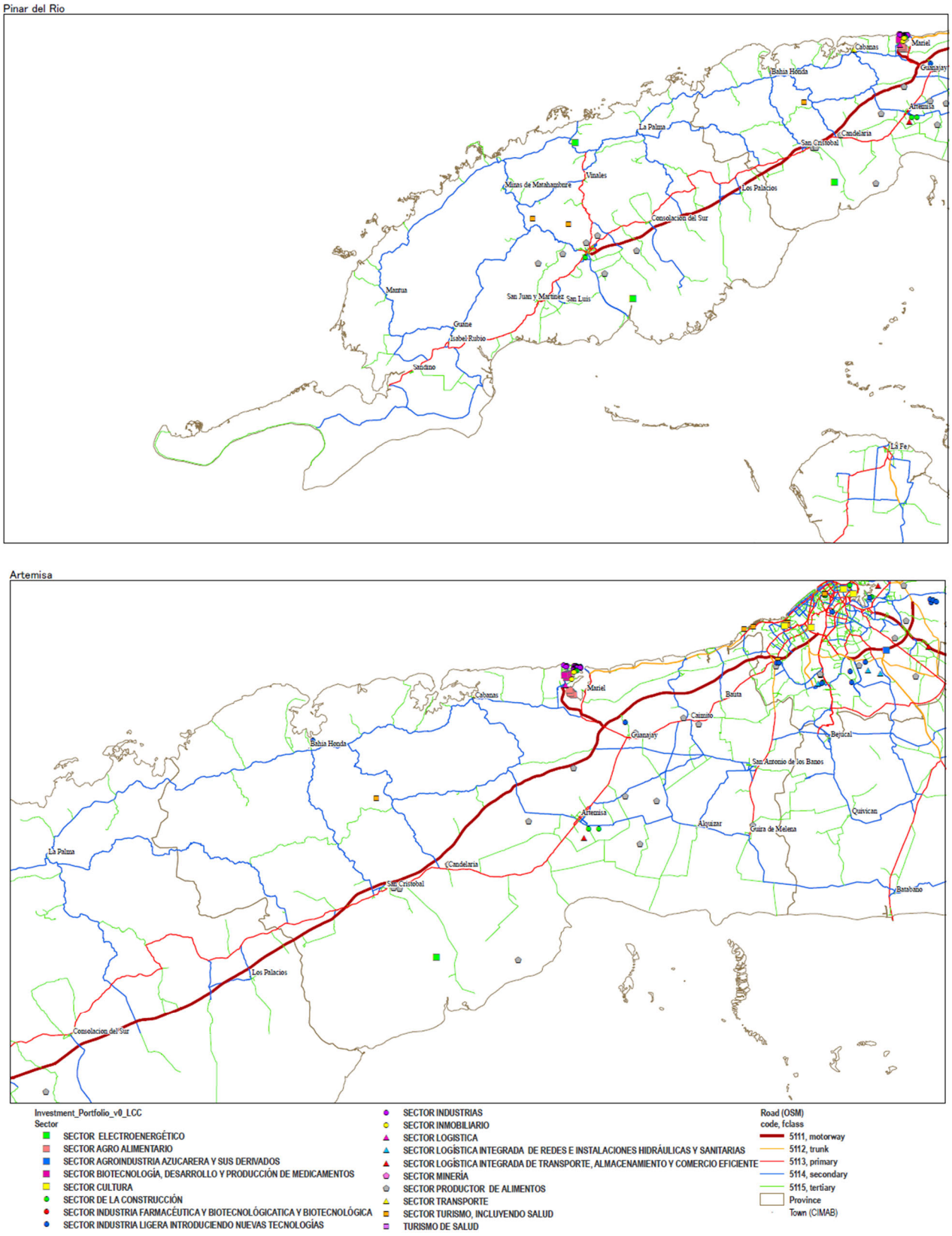
Analysis of the connections between investment-concentrated areas and major transport infrastructure will be one of the factors to prioritize in planning transport infrastructure.

The following figures show the location of the proposed investment listed in the 2018 ProCuba portfolio. The transport network and services are expected to support these planned investments.



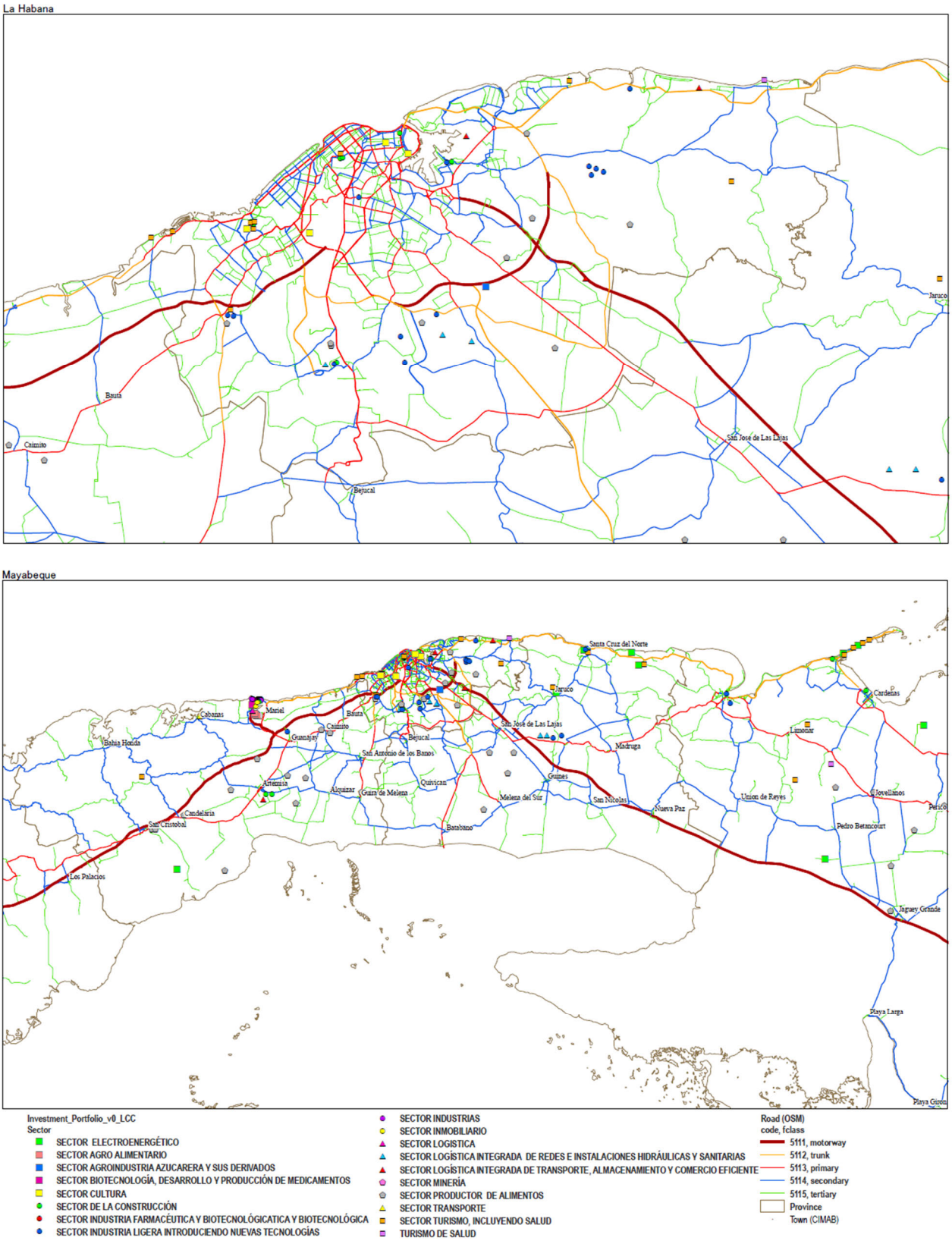
Source: JICA Study Team

Figure 4.1.28 Investment Portfolio 2018 and Transport Infrastructure in Cuba



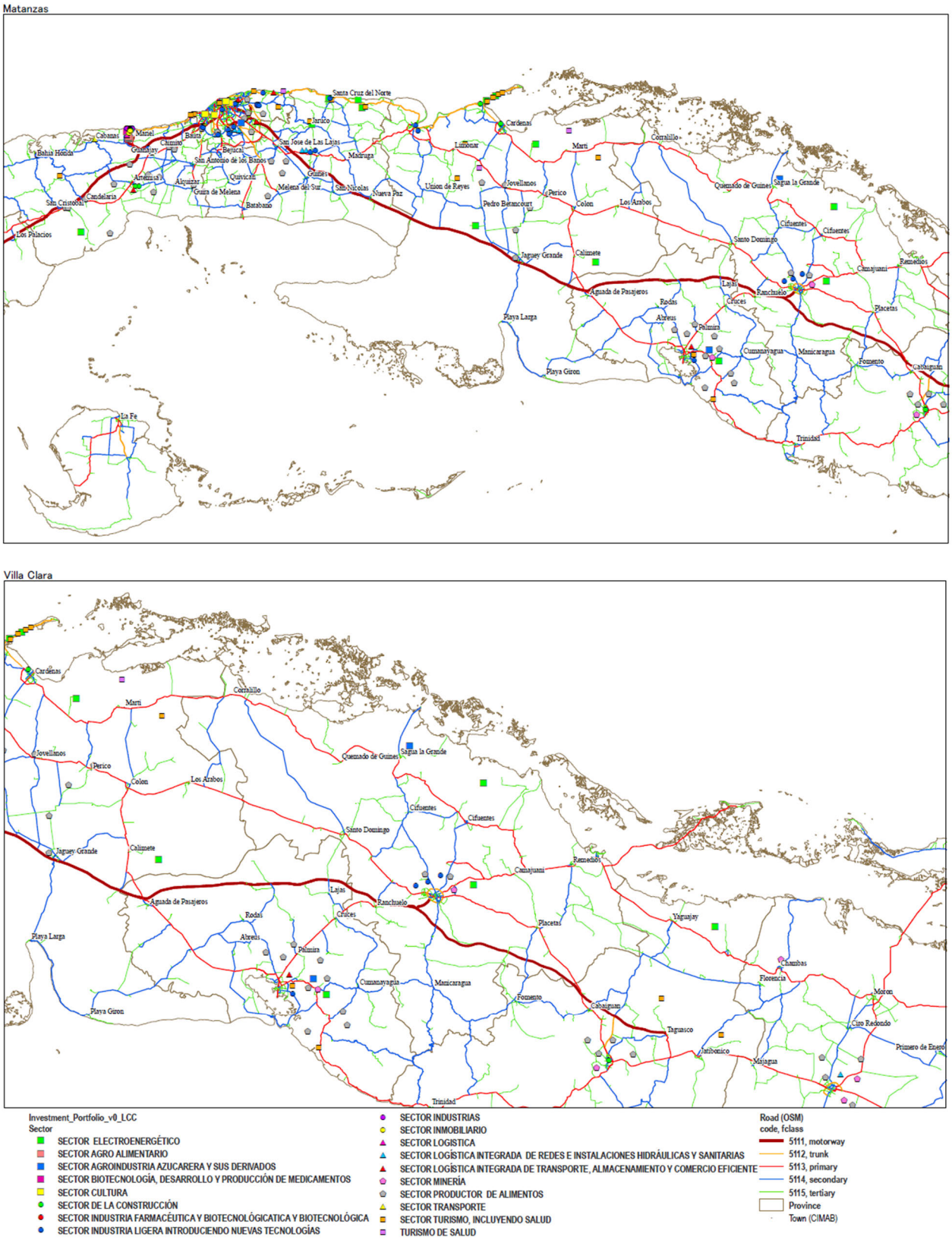
Source: JICA Study Team

Figure 4.1.29 Investment Portfolio (Pinar del Rio and Artemisa provinces)



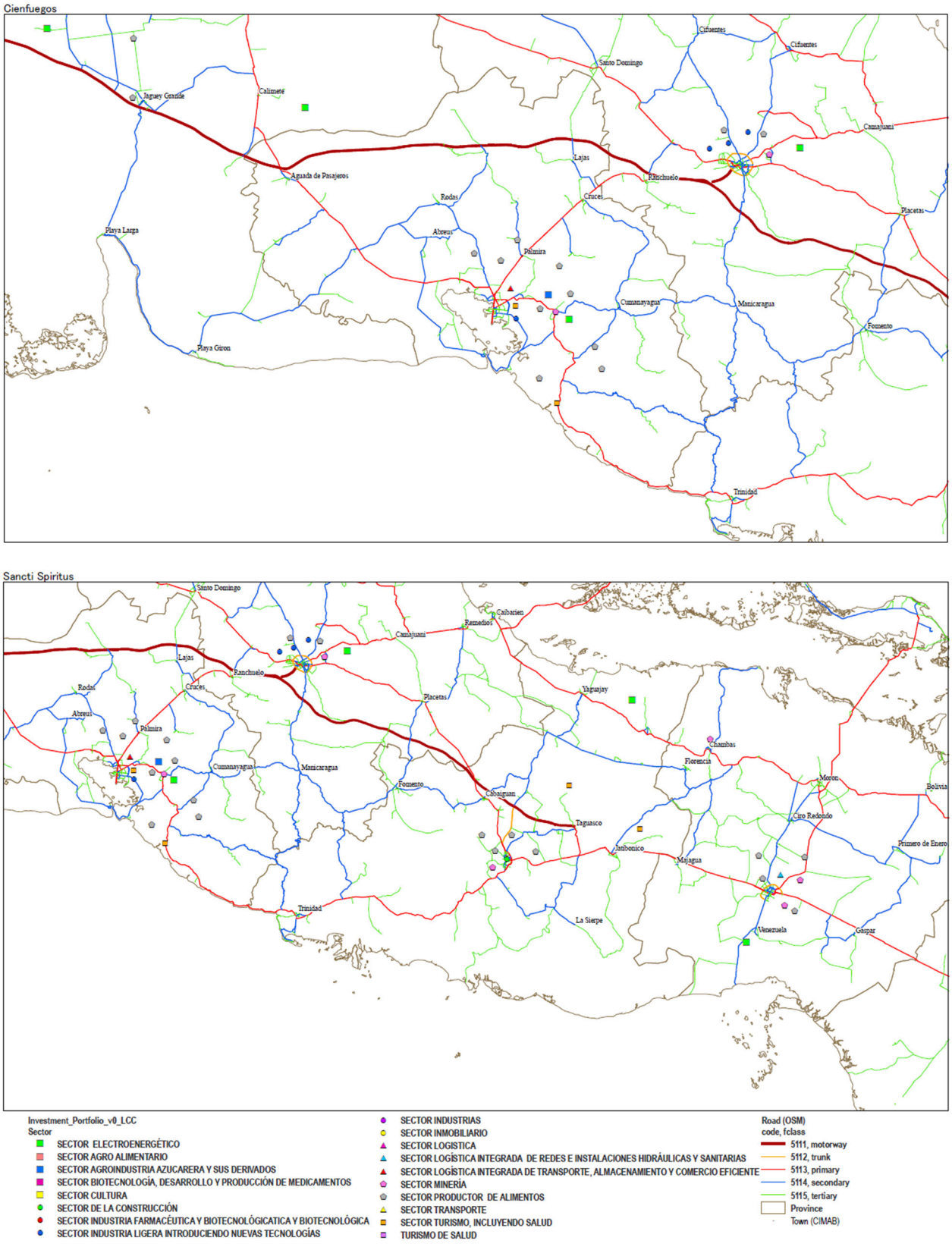
Source: JICA Study Team

Figure 4.1.30 Investment Portfolio (La Habana and Mayabeque provinces)



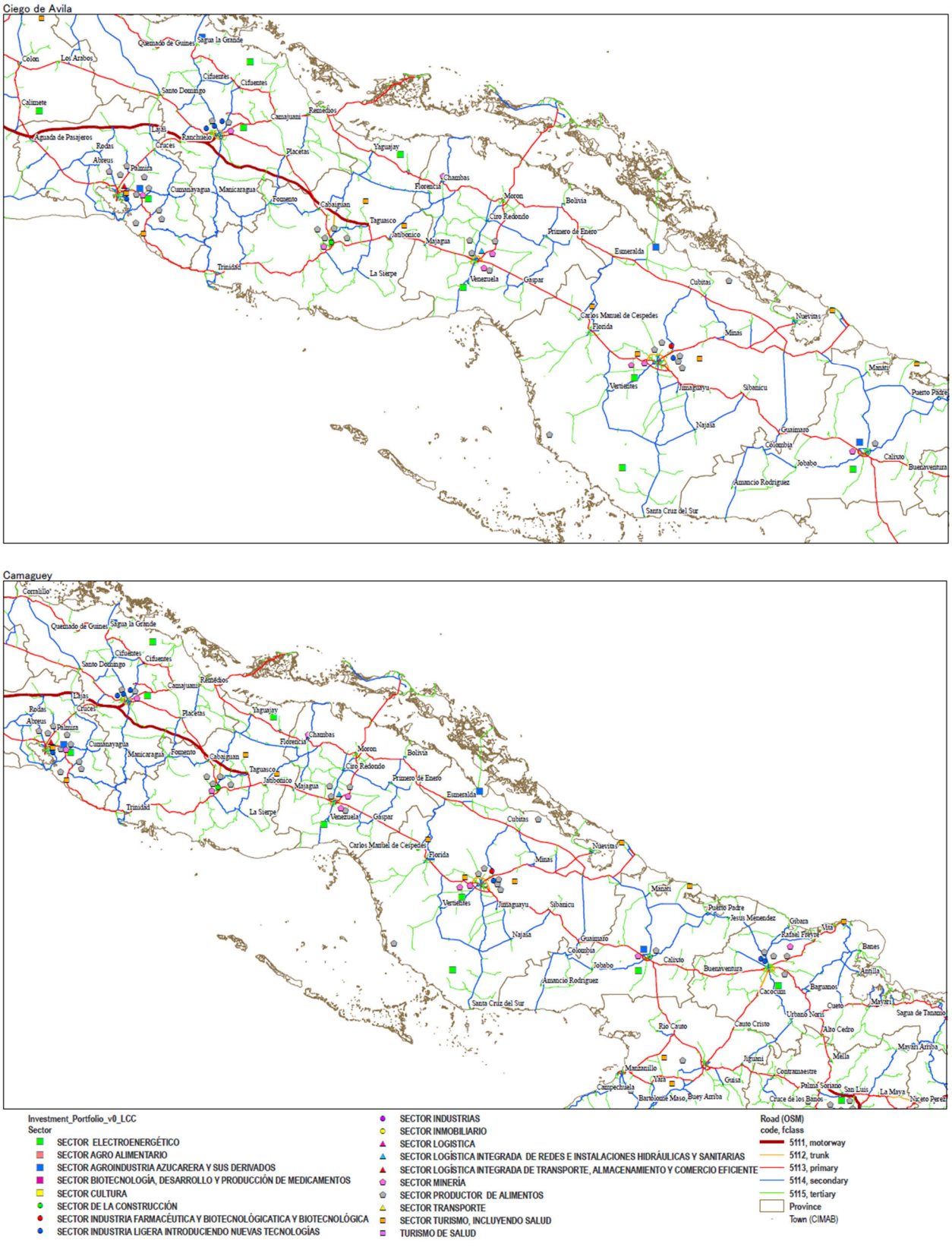
Source: JICA Study Team

Figure 4.1.31 Investment Portfolio (Matanzas and Villa Clara provinces)



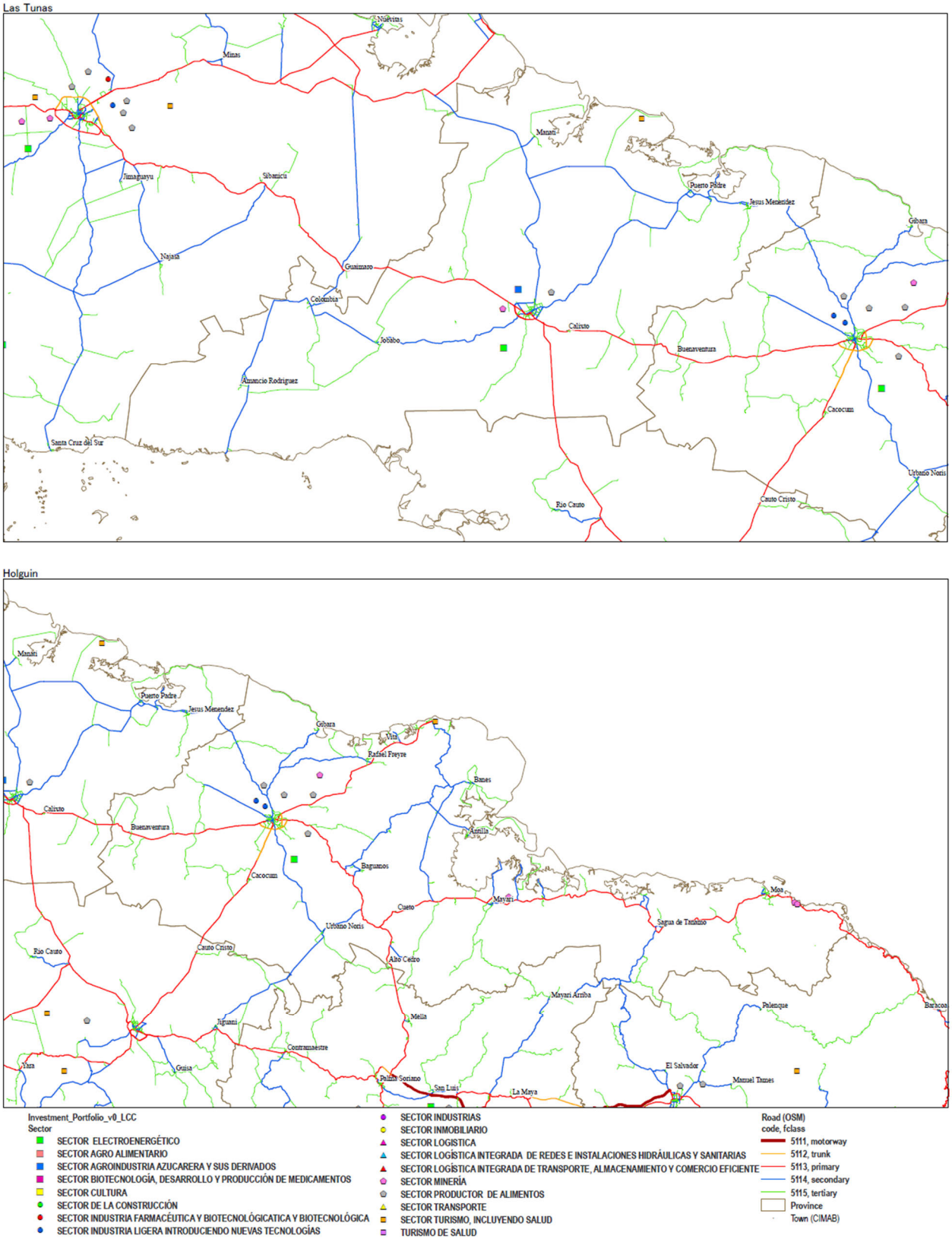
Source: JICA Study Team

Figure 4.1.32 Investment Portfolio (Cienfuegos and Sancti Spiritus provinces)



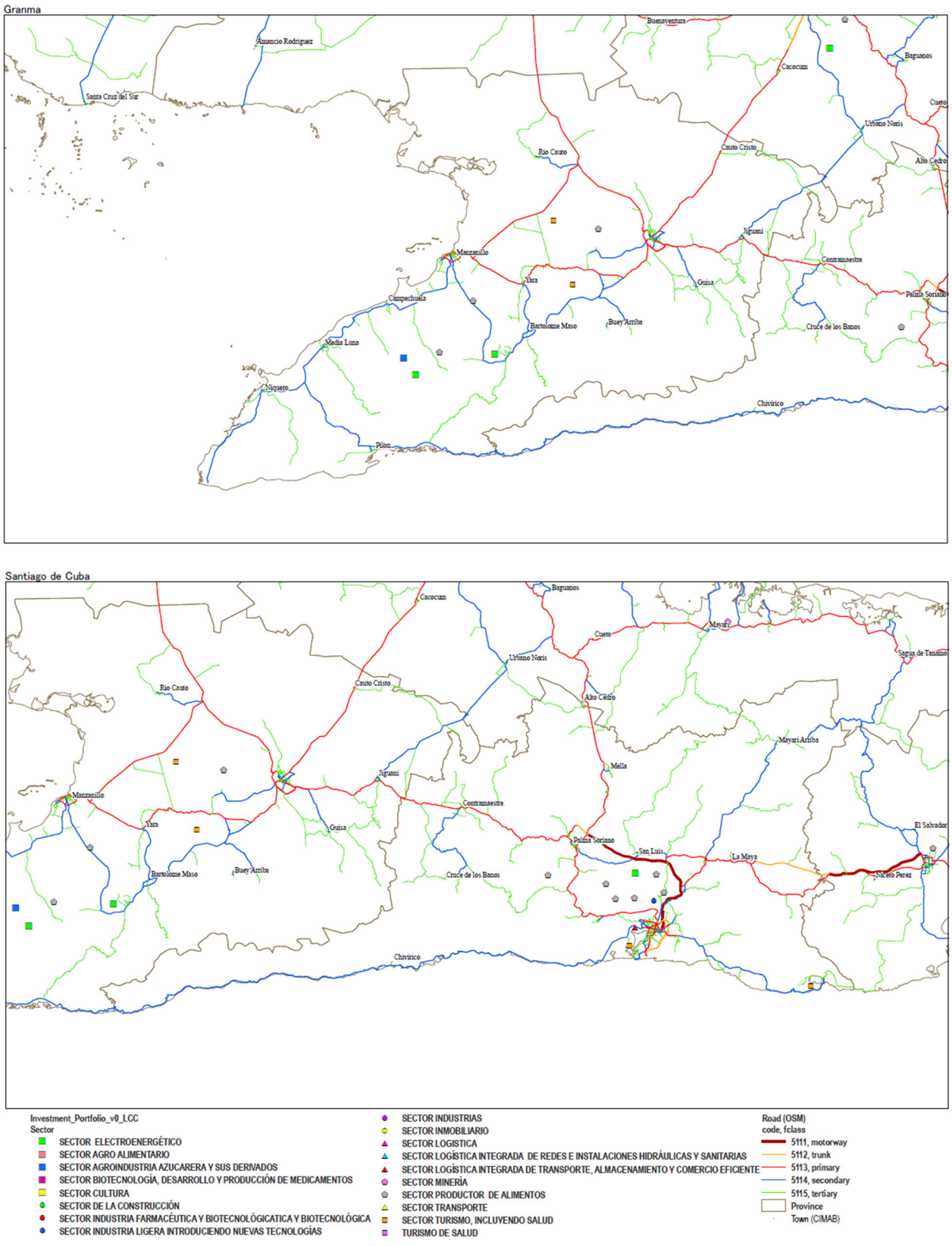
Source: JICA Study Team

Figure 4.1.33 Investment Portfolio (Ciego de Avilla and Camaguey provinces)



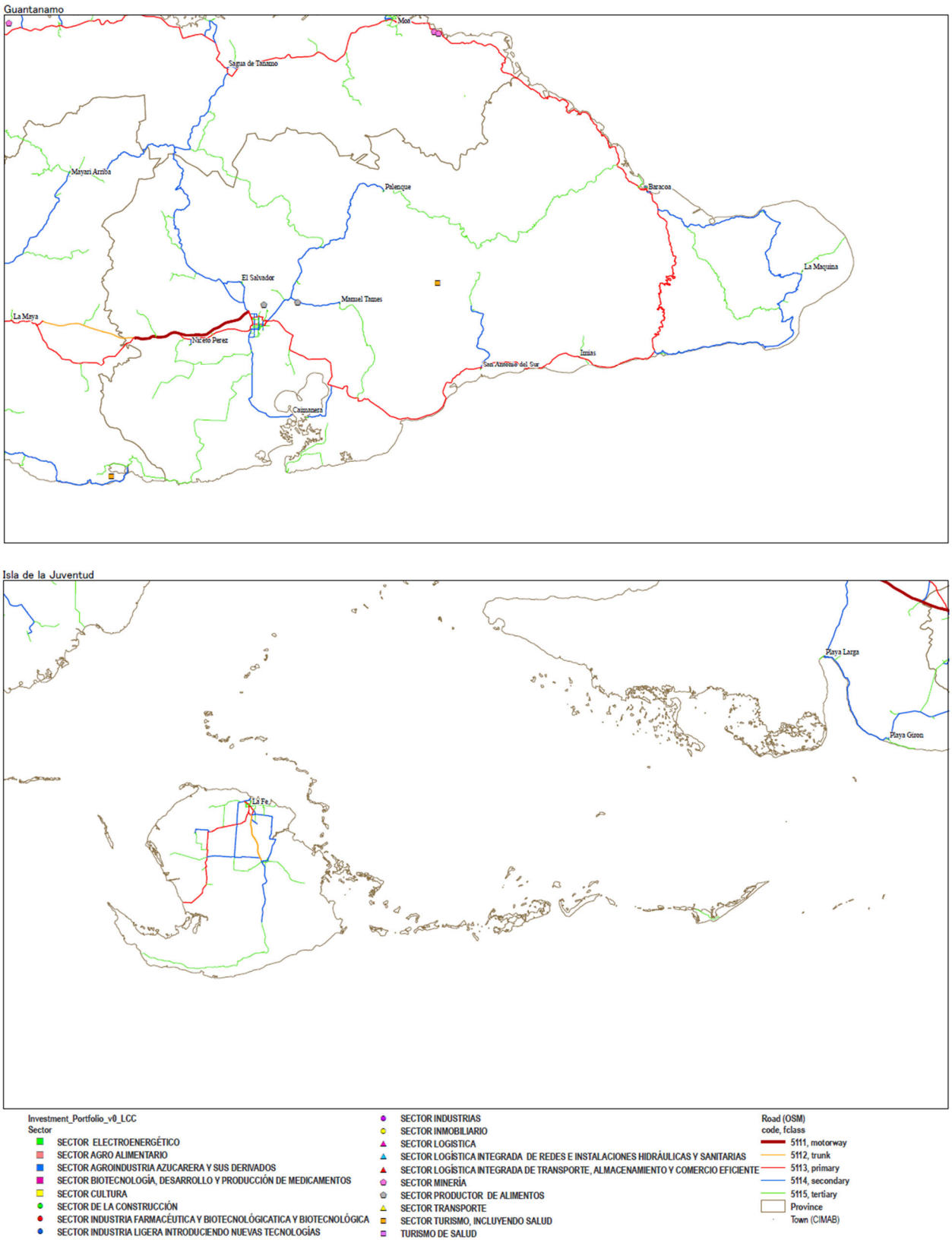
Source: JICA Study Team

Figure 4.1.34 Investment Portfolio (Las Tunas and Holguin provinces)



Source: JICA Study Team

Figure 4.1.35 Investment Portfolio (Granma and Santiago de Cuba provinces)



Source: JICA Study Team

Figure 4.1.36 Investment Portfolio (Guantanamo province and Isla de la Juventud special municipality)

4.1.11 Investment portfolio 2019 and 16 key areas

"Cuba: Portfolio of Opportunities for Foreign Investment 2019-2020," published by ProCuba, an entity under MINCEX, listed 460 projects in various sectors, of which 47 projects are located in the Mariel Special Development Zone. Table 4.1.11 summarizes investment projects categorized by 16 key areas with major projects. The investment portfolio features four culture projects, two audiovisual projects, and one real estate project not included in the strategy. The transport sector is expected to contribute to the actualization of the expected investments.

Table 4.1.11 Investment portfolio and 16 key areas

Sector	No. of Projects	Major projects
1. Food production	81	- Production and commercialization of fine-aroma cocoa - Increased production potential for shrimp farming
2. Sugar agri-industry	5	- Managing sugar mills with bioelectrical power - Modernizing boiler factory
3. Tourism	116	- Building/launching top-quality hotels in the Havana resort area - Network of eco-accommodation for nature tourism
4. Professional services	0	
5. Health	4	- Quality of life service - Repair and re-engineering of medical device factory
6. Pharmaceutical, biotechnology	6	- Setting up facilities for cytostatic products production - Production of injectable cephalosporin and oral penicillin
7. Telecommunications	3	- Call center - Information technology service center
8. Construction	14	- Modernizing engineering systems for construction and set-ups - Services for heavy-lift transport and load handling
9. Energy	139	- Risk oil exploration and shared production contracts in coastal water blocks in the national territory - Bioelectrical plants
10. Integrated logistics of transport	8	- Operation and management of Casablanca shipyards - 3PL logistical operation for the management of supply chains for refrigerated foods
11. Integrated logistics of networks and facilities, hydraulic and sanitary	4	- Modernizing the national workshop for repairs to the pumping equipment of the hydraulic resources system - Managing the production of smooth or corrugated pipes
12. Manufacturing industry	32	- Production/sales of footwear, electrical conductors, batteries, etc. - Integrated handling system for solid urban waste
13. Domestic trade	4	
14. Foreign trade	0	
15. Financial system	0	
16. Employment & wage policy, security & social care	0	
Mariel SDZ	47	- Industrial pillar projects (logistics, biotechnology, pharma, and advanced manufacturing)
Others	7	- Culture: building a recording studio - Audiovisual: informatics and educational audiovisual production
Total	460	

Source: Investment Portfolio 2019-2020

4.1.12 Cross-sector Planning Issues

Transport planning issues were addressed from the perspective of six key areas: 1) Planning and coordination (planning administration); 2) Transport infrastructure development; 3) Environment, safety, & security; 4) Transport service and industry development; 5) Transport pricing and resource allocation, and 6) Institutional and regulatory development.

Cross-sector issues were identified, as summarized in Table 4.1.12, which were identified through discussions in the TWG. These issues need to be addressed, and corresponding objectives should be identified within the planning horizon of 2030.

Table 4.1.12 Cross-sector Transport Planning Issues

Key areas	Planning issues to be addressed
1. Planning and coordination	• Establishment of well-organized traffic and transport statistics, data collection systems, and databases. Digital transformation needs to be accelerated in this regard.
	• Integration and coordination of strategic transport plans and spatial development initiatives (ENOT, EMOT, Mariel SDZ, Northern coastal area/islands, etc.).
	• Integration of strategic transport plans and business investment opportunities (investment portfolio).
	• Coordination of planning activities among transport infrastructure plans (GEMAR 2030 Plan, UFC 2028 Plan, CACSA 2030 Plan) to achieve better synergistic effects and outcomes.
	• Prioritization of transport investment based on quantitative analysis (demand forecast, cost-benefit analysis, etc.).
2. Transport infrastructure development	• Urgent improvement/replacement of seriously damaged/deteriorated transport infrastructure to maintain safe transport and support the daily life of Cubans.
	• Establishing a transportation (service) network that contributes to the acquisition of the foreign currency, e.g., high-standard roads to tourist destinations.
	• Transport infrastructure to support export industries such as medical products and high-value agricultural products.
	• Increase (recover) transport and storage capacity and improve the efficiency of all transport subsectors that are caused by the deterioration of existing infrastructure and aged facilities and equipment.
	• Effective and efficient use of existing transport assets is needed – "maximum utilization of the existing assets" using ICT and other advanced technologies.
3. Environment, safety, and security	• Social & environmental considerations in the planning and design process of transport infrastructure need to be strengthened by introducing SEA and SDGs.
	• Safety standards and enforcement mechanisms, especially highway safety standards, need to be enhanced.
	• The use of inefficient/obsolete transport technologies (aged vehicles, etc.) in the transport sector exacerbates energy consumption.
	• The use of renewable energy needs to be encouraged.
	• Emergency (ambulance) transport services need to cover the whole country.
4. Transport service and industry development	• Enhancement of coordination (intermodality) and smooth transfer between different transport modes and services to increase efficient travel and modal transfer.
	• By adapting the existing "*balance de cargas*" system to a modern system, cargo transport services can be improved. One possible solution is to enhance cargo transport capacity under OSDEs attended by MITRANS. Another solution is to introduce Third-Party Logistics (3PL) with a non-state sector.
	• Consider the introduction of the "competition principle" between transport service providers.
	• Consider foreign direct investment (FDI) or Joint Venture (JV) in the logistics sector.

Key areas	Planning issues to be addressed
5. Transport pricing and resource allocation	• Ensure efficient use, upgrading, and maintenance of existing transport assets before major new investments are committed.
	• Investment returns/cost recovery in the transport sector can be hindered by low ridership/cargo volume, especially in rural areas – the "balance between investment efficiency and equity" needs to be carefully considered.
	• Introduction of a pricing system based on the quality of services (level of service: LOS and needs (demand) can be considered.
	• The impacts of transport investments on spatial development (increase in land value) are not well understood, including the use of transport infrastructure to increase attractiveness to investors.
6. Institutional and regulatory development	• Roles of the State in supply, management, and maintenance of transport infrastructure and services need clarifying – a clear "regulator" role
	• Roles of OSDEs in supply, management, and maintenance of transport infrastructure and services need clarifying – a clear "manager" role
	• The roles of *Empresa* in the supply, management, and maintenance of transport infrastructure and services need clarifying – the "service provider" role
	• Legislative and regulatory frameworks for transport infrastructure provision and operation (service production) need updating – introduction of PPP, etc. - enhanced scope for private-sector involvement in providing transport infrastructure and services.
	• Foreseeable shortage of human resources (aging) must be considered - institute long-term training programs in transport sector planning, management, and operations to improve human resource capabilities.

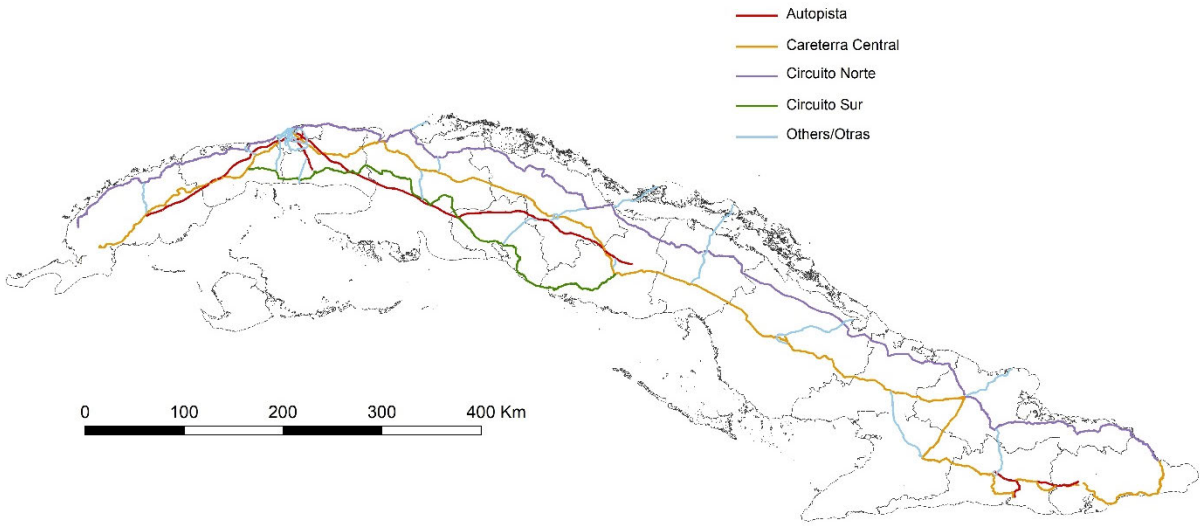
Source: TWG and JICA Study Team

4.2 Road & Bridge Sector

4.2.1 Present Road Conditions

Cuba has established road design standards and regulations based on norms set by AASHTO (American Association of State Highway & Transportation Officials). While there is no specific problem with having this standard, many roads and bridges were built to older specifications and did not comply with width or cross-sectional composition requirements. Moreover, insufficient maintenance due to a lack of construction machinery along with hurricanes, torrential rain, and droughts, have led to the deterioration of roads throughout the country.

A 2019 road-surface condition survey conducted by CIMAB and CNV, covered four major highways: Autopista, Carretera Central, Circuito Norte, and Circuito Sur, as well as major urban roads in Havana and other important links, as shown in Figure 4.2.1 below.



Source: JICA Study Team

Figure 4.2.1 Major Roads for Road-condition Survey

The road-surface condition survey rated each section of these roads as “good” (IRI <= 4), “fair” (4 < IRI <= 8), or “poor” (IRI > 8) and aggregated results by province, as shown in Table 4.2.1. Overall, 61% were classified as “fair”, followed by “good” with 32%, and “poor” with 7%. Larger ratios of “poor” roads were found in eastern provinces such as Camaguey, Granma, Santiago de Cuba, and Guantanamo.

Table 4.2.1 Road-condition Survey Results by Province

Province	Length (km)	Road Condition					
		Good		Fair		Poor	
		(km)	%	(km)	%	(km)	%
Piñar Del Rio	214.7	37.3	17.4	173.7	80.9	3.7	1.7
Artemisa	182.5	110.4	60.5	72.1	39.5	0.0	0.0
La Habana	67.7	45.6	67.4	22.0	32.6	0.0	0.0
Mayabeque	128.2	71.2	55.5	56.5	44.1	0.5	0.4
Matanzas	218.1	86.0	39.4	122.3	56.1	9.8	4.5
Villa Clara	285.7	63.5	22.2	202.3	70.8	19.8	6.9
Cienfuegos	227.4	65.4	28.8	162.0	71.2	0.0	0.0
Sancti Spiritus	145.6	17.1	11.7	128.5	88.3	0.0	0.0
Ciego de Avila	117.2	7.8	6.7	98.7	84.2	10.7	9.1
Camagüey	238.3	44.6	18.7	128.9	54.1	64.7	27.2
Las Tunas	61.1	21.7	35.6	36.8	60.2	2.6	4.2
Holguín	238.5	158.0	66.2	75.1	31.5	5.4	2.3
Granma	79.5	2.2	2.8	68.1	85.6	9.2	11.6
Santiago de Cuba	117.4	7.3	6.2	81.1	69.0	29.1	24.7
Guantánamo	72.5	29.4	40.6	29.3	40.4	13.8	19.0
Total	**2394.3**	**767.5**	**32.1**	**1457.5**	**60.9**	**169.3**	**7.1**

Source: JICA Study Team

(1) Expressways (Autopista)

Cuba's 400 km of expressway include the Autopista between Piñar del Rio and Havana (4-8 lanes, 148 km), the east-west expressways connecting Havana to Sancti Spiritus (Taguasco) and Santiago de Cuba to Guantanamo (6 lanes, excluding 33 km section with only 3 lanes without a median). The expressway carriageways generally consist of three lanes in each direction, but in some sections, road-surface conditions are so bad, that only one or two lanes are passable.

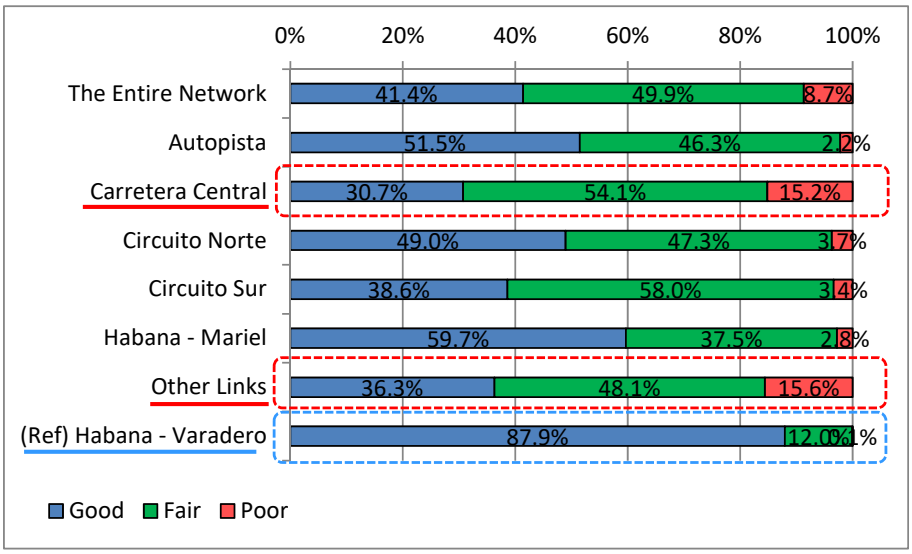
Plus, the two Autopista sections are not connected in Havana Province, leaving a 3 km gap. Furthermore, interchanges and grade separations have yet to be developed, as shown in Figure 4.2.15. Consequently, in many sections, cyclists and pedestrians enter the motorway. There is a further lack of night driving facilities, such as lighting and reflectors, and this causes serious safety issues. Review and repair work for these problems and full development of the expressway up to Santiago de Cuba will be a grand project to be implemented in the mid- to long-term.

(2) Main Arterials

Cuba's road network is relatively developed in terms of road density considering the population and other factors. Besides expressways, the major road network includes three main east-west arterials linking major cities and towns: Carretera Central, Circuito Norte, and Circuito Sur.

The most important arterial road is Carretera Central (built 85+ years ago), with two lanes (one in each direction). Its narrow width makes the passing of vehicles quite dangerous in many sections with poor

surface conditions, especially on bridges. Conditions and maintenance vary by province, but as about 15% of its length is in poor condition (see Figure 4.2.2), Carretera Central has the worst conditions among Cuba's main arterial roads, according to the road-surface survey. Plus, Carretera Central has safety issues due to a lack of night-driving facilities, such as lighting, delineators, and reflectors.



Source: JICA Study Team

Figure 4.2.2 Main Arterial Road Surface Conditions

(3) Bridge Conditions

Cuba has about 4,000 bridges, most of which were constructed in the first half of the 20th century. As such, most are now worn out and in need of repair or reconstruction. According to CIMAB, data on bridge locations and conditions is gathered by CNV. But information on bridge type, length, and the condition is managed by CPV. A summary of bridge conditions by province in Table 4.2.2 shows that 134 bridges are in poor condition and need repair or reconstruction. Regionally, Piñar del Rio and Guantánamo have over 30 bridges in poor condition.

Table 4.2.2 Bridge Conditions by Province

Province	No. of Bridges	Bridge Condition					
		Good		Fair		Poor	
			%		%		%
Piñar Del Rio	472	368	78.0	71	15.0	33	7.0
Artemisa	246	225	91.5	21	8.5	0	0.0
La Habana	54	44	81.5	7	13.0	3	5.6
Mayabeque	123	94	76.4	27	22.0	2	1.6
Matanzas	236	215	91.1	19	8.1	2	0.8
Villa Clara	404	345	85.4	51	12.6	8	2.0
Cienfuegos	165	140	84.8	18	10.9	7	4.2
Sancti Spiritus	501	493	98.4	7	1.4	1	0.2
Ciego de Avila	363	319	87.9	38	10.5	6	1.7
Camagüey	321	287	89.4	19	5.9	15	4.7
Las Tunas	196	183	93.4	10	5.1	3	1.5
Holguín	258	240	93.0	15	5.8	3	1.2
Granma	200	169	84.5	21	10.5	10	5.0
Santiago de Cuba	278	230	82.7	40	14.4	8	2.9
Guantánamo	241	155	64.3	54	22.4	32	13.3
Isla de la Juventud	61	51	83.6	9	14.8	1	1.6
Total	**4,119**	**3,558**	**86.4**	**427**	**10.4**	**134**	**3.3**

Source: Data from CIMAB

To gauge the current condition of these bridges, the Study Team conducted bridge inspections following the "Bridge Inspection Manual" issued by Japan's MLIT in 2014. Bridge inspection work was done by visual checking; measurement of crack width and hammering tests were also carried out. Based on site inspection results, bridges were categorized as shown in Table 4.2.3.

Table 4.2.3 Damage Categories and Definitions for Site Inspection of Bridges

Damage Category		Definition
I	Soundness	No interference in the bridge function
II	Preventive Maintenance Stage	No interference in bridge function, but recommending countermeasure from a preventive maintenance point of view
III	Prompt Countermeasure Stage	Possible interference in bridge function, recommend prompt countermeasure
IV	Emergency Countermeasure Stage	High possibility of bridge function interference, need emergency countermeasures

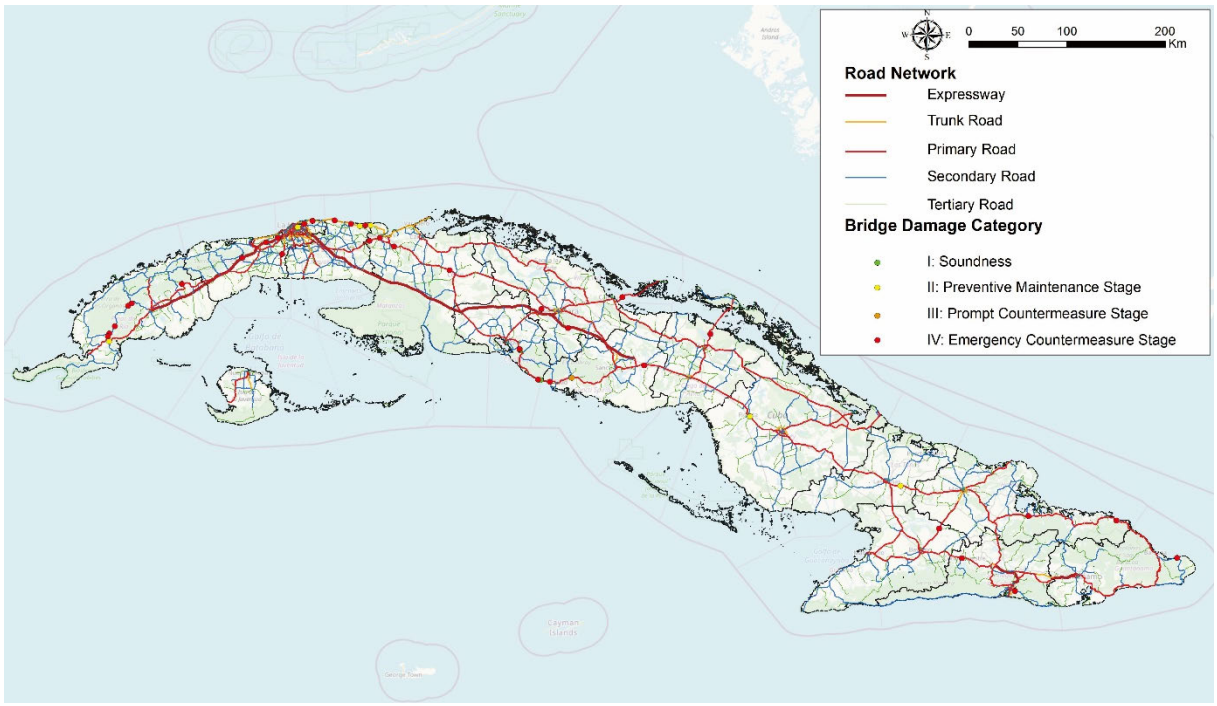
Source: "Bridge Inspection Manual" issued by MLIT in 2014

Bridges were selected for inspection based on their importance in the road network along four major highways: Autopista, Carretera Central, Circuito Norte, and Circuito Sur. Plus, other bridges were selected at the request of CPV. Inspected bridges are summarized by province in Table 4.2.4.

Table 4.2.4 Bridges Inspected by Province

Province	No. of Bridges	Province	No. of Bridges
Piñar del Rio	7	Ciego de Avila	1
Artemisa	4	Camagüey	1
Havana	4	Las Tunas	1
Mayabeque	4	Holguín	2
Matanzas	4	Granma	1
Villa Clara	3	Santiago de Cuba	2
Cienfuegos	4	Guantánamo	1
Sancti Spiritus	3	Total	42

Source: JICA Study Team



Source: JICA Study Team

Figure 4.2.3 Inspected Bridge Location and Damage Category

Based on category and bridge length, the bridge inspection results are summarized in Table 4.2.5, and the damage category for each bridge is mapped in Figure 4.2.3 below. It was confirmed that most of the inspected bridges are categorized as Damage Category IV, which requires an emergency countermeasure.

Table 4.2.5 Damage Category and Bridge Length

Bridge Length	Damaged Category				Total
	I	II	III	IV	
~ 15		1		1	2
~ 30		1		1	2
~ 50				8	8
~ 100		2		11	13
~ 150	1	1		4	6
~ 200				3	3
~ 300	1			3	4
Over 300		1	1	2	4
Total	2	6	1	33	42

Source: JICA Study Team

(4) Road Traffic and IRI

Cuba's most recent road traffic volume data was collected through surveys conducted in 2005-2006 and finalized in 2009. Since these observed traffic volumes were more comprehensive than a later 2019 survey, all of the Annual Average Daily Traffic (AADT) data for trunk roads in 2005/2006 have been updated by region, using adjustment factors at 44 total survey locations in 2019, as shown in Figure 4.2.7.

According to this survey, traffic volume in Havana Province is noteworthy. Other corridors with significant traffic volumes include Vía Blanca in the northern corridor connecting Havana, Matanzas, and Varadero; the Central Highway; and the corridor linking Cienfuegos, Santa Clara, and Caibarien. Although traffic volumes are projected to increase gradually, highly congested sections have not been observed at the national level. Consequently, road safety issues caused by the deterioration of roads and bridges is the priority issue to be addressed.

Results of the road-condition survey show differences in IRI (i.e., "good," "fair," or "poor) not only by main arterial road but also by region. To analyze further, in this survey, "section" is defined as the road from a major intersection to the next major intersection on each target main arterial road, and the sections are numbered from Havana to outwards, either to the east or to the west.

Mean / iri	Section																							
Route	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total
A1	2.6	2.8	3.6	3.8	3.4	4.0	4.6	5.5	3.8	4.3	3.9	6.4	6.9	4.6										4.4
CC	5.5	5.4	3.8	4.0	4.0	4.9	5.3	5.8	6.6	6.4	4.8	5.9	5.0	6.7	7.0	4.0	6.9	4.8	6.9	7.0	5.2	6.3	5.2	6.0
CC-W	3.3	2.5	3.1	4.2	4.2																			3.8
CN	4.7	3.0	3.0	3.7	4.7	3.5	4.8	4.2	4.5	4.0	5.4													4.3
CN-W	4.1	5.6	7.2	6.8																				5.5
CS	4.5	3.8	5.5	4.6	5.2	4.9	4.3	4.7																4.7

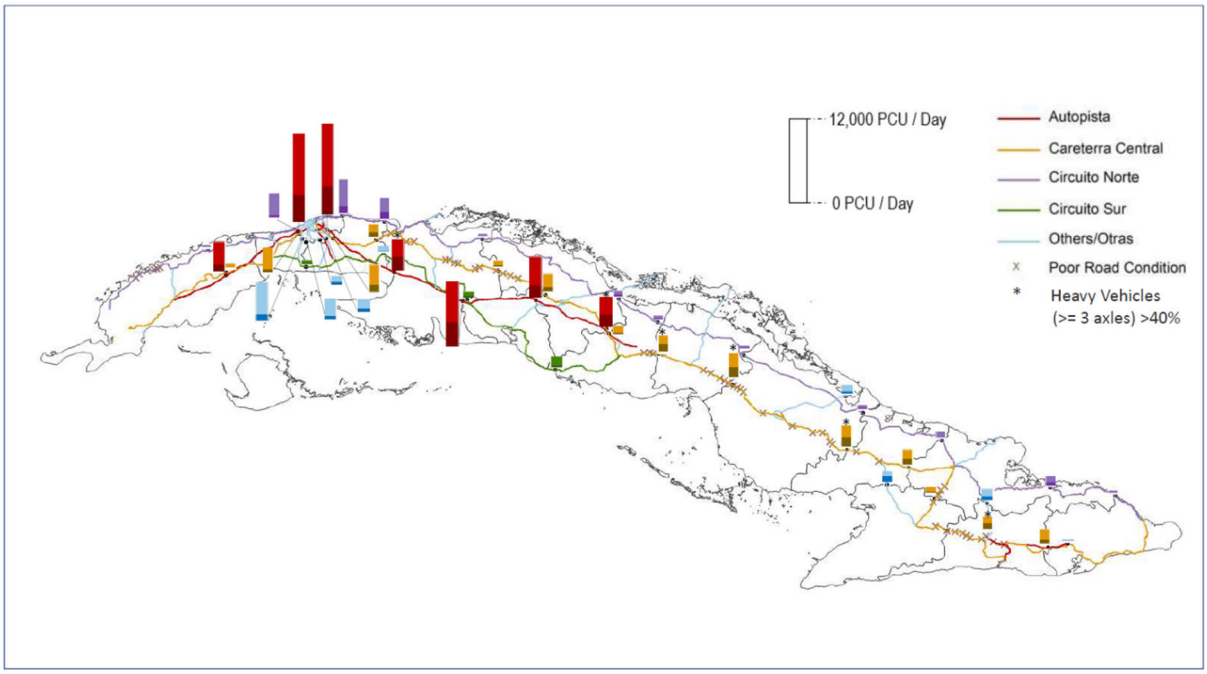
Note: A1: Autopista (Havana - Sancti Spiritus, Santiago de Cuba - Guantanamo), CC: Carretera Central (from Havana to the east), CC-W: Carretera Central (from Havana to the west), CN: Circuito Norte (from Havana to the east), CN-W: Circuito Norte (from Havana to the west), CS: Circuito Sur

Source: JICA Study Team

Figure 4.2.4 Average IRI on Main Arterial Road by Section

IRI averages by section on the main arteries are shown in Figure 4.2.4. Lower-numbered sections are nearer to Havana. On the Carretera Central, the most important arterial road in the national network, Sections 14 ~ 20 ("A" in the figure) and 9 ~ 10 ("C" in the figure) had relatively poor conditions. The former are sections between Sancti Spiritus Province and Santiago de Cuba Province (excluding the cities of Camaguey, Holguin, and Bayamo and their suburbs) where there is no expressway running in parallel. The latter are sections in the western part of Matanzas Province toward Santa Clara.

On the Autopista, Sections 12 ~ 13 ("B" in the figure) are rated as poor in the center of Santiago de Cuba province, between Palma Soriano and Dos Caminos. On the Circuito Norte from Havana to the west, Sections 3 ~ 4 ("D" in the figure), the northwest side in Piñar del Rio Province, has poor road surface conditions. Those poor road sections are indicated on the road network along with traffic volumes (PCU per day) at the traffic count survey locations shown in Figure 4.2.5. Ratios of heavy vehicles with 3 or more axles are also indicated in darker colors in the bars, and locations where heavy vehicle ratios are over 40% (in PCU) are marked. Heavy vehicle ratios are particularly high on main east-west arterial roads such as the Autopista and Carretera Central. Poor road sections on the Carretera Central in eastern Cuba may be partly due to such high heavy vehicle ratios.



Note: Darker colors in the bars indicate heavy vehicles.
Source: JICA Study Team

Figure 4.2.5 Sections with Poor Road Surface Conditions with Traffic Volume

4.2.2 Road issues

(1) Western Region

The total length of roads in Havana Province (population: about 2.1 million, area: 728.6 km^2) is about 3,368 km, of which about 20% are national and provincial roads. Overall, road conditions are relatively good, as shown in Table 4.2.1. However, the conditions of other roads are not good, and about 30% of the 160 principal arterial roads in Havana need improvement.

The Carretera Central, which links Havana with Piñar del Rio Province, has a section where the Autopista runs in parallel. There are three fairly old truss bridges in this section, plus two other old bridges that need to be replaced in the section west of Isabel Rubio.

The Viñales Valley is a priority area for tourism development. But poor road surface conditions on the Circuito Norte on the northwest side of Piñar del Rio Province make it difficult to access Cayo Jutias, said to be one of the best beaches in Cuba. If roads were better, it would be possible for tourists to make day trips to these areas from Havana.

(2) Central Region

The principal artery, Vía Blanca, is part of the Circuito Norte, built in the 1950s as an important national highway and tourist road from Havana to Varadero, a key tourist destination. The road surface is relatively good, but the bridges look outdated, and several require repair.

Via Blanca also serves as an industrial road, and it has several problems related to the heavy volume of truck traffic. One issue is the conflict between heavy trucks and tourist buses/taxis that leads to safety issues. But the biggest problem is the roads in Matanzas City which are severely deteriorated. To solve these problems, a Matanzas bypass for trucks is planned, but as the area is hemmed in between mountains and the sea, this may be a considerable challenge.

Two key projects in Matanzas Province (and Matanzas City) are the construction of the uncompleted section of the viaduct (coastal road with an elevated section) and separation of traffic for tourism and freight by constructing a Matanzas northern bypass, including two new bridges that will directly connect Via Blanca and Carretera Central. Plus, another challenge is to improve the daily commute of 25,000 tourism employees to/from Varadero.

In Villa Clara Province, the key issue to address in the near term is the rehabilitation of 44 prestressed concrete bridges on the causeway (Pedraplén) to Cayo Santa María. The superstructures of several bridges have been rehabilitated, but work on the foundations is also required. Pedraplén is a toll road, and 2 CUC is charged (payment in CUP for nationals) for private cars and 4 CUC (payment in CUP for nationals) for trucks and buses (when the JICA's survey was conducted). The toll revenue goes to the national treasury. Daily traffic volume on the Pedraplén is around 500 toll-paying vehicles for tourism purposes. But construction vehicles and employee buses also use the bridges, raising concerns about the structural durability of the Pedraplén.

Another project is widening the road between Santa Clara Airport and Caibarién from two to four lanes. The 55.5 km project includes four sections, of which only the 10.3 km airport-Salamina section has been completed. Speeding up the completion of the road is important as it is a key tourism route.

Plus, the national road connecting Santa Clara and Cienfuegos is a key north-south corridor, and the early completion of improvement works is seen as vital to tourism and industrial development.

(3) Central-eastern Region

While improving the Carretera Central and Circuito Norte, both important arteries, is a high priority, the extension of the Autopista through Sancti Spiritus Province has been long suspended due to economic reasons. Improving access roads from the Autopista to the tourist city of Trinidad is also a priority.

Camagüey, Cuba's third-largest city, is located on the Carretera Central. Due to a high volume of thru-traffic, traffic accidents occur with great frequency, and poor road conditions are seen as one of the main causes of accidents. Improvement of accessibility from the Carretera Central to resort areas on the northern coasts of Camagüey and Las Tunas provinces is another key priority.

(4) Eastern Region

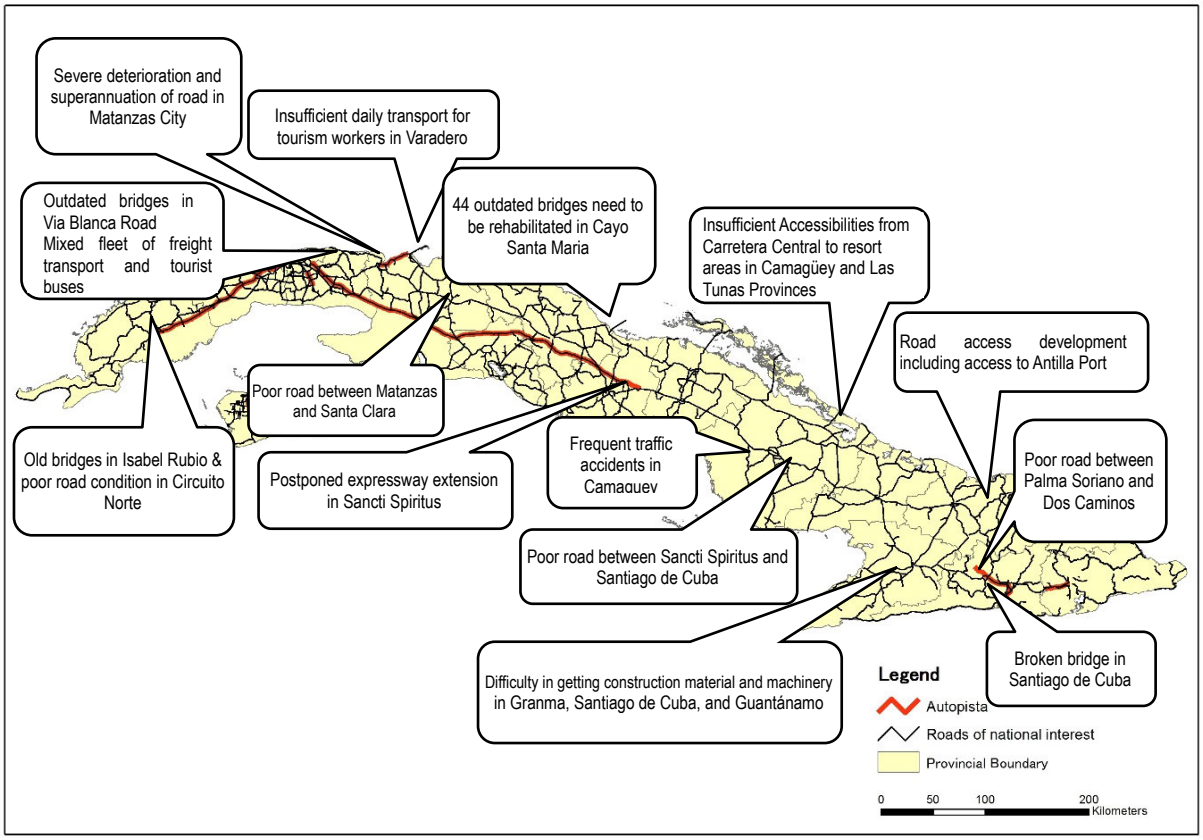
In the eastern region (Las Tunas, Holguín, Granma, Santiago de Cuba, and Guantánamo), as indicated in Table 4.2.1, the ratio of roads in poor or fair condition is much higher than the national average. In Granma, Santiago de Cuba, and Guantánamo, over 10% of roads are rated as poor. Partly, this may be due to the difficulty of getting construction materials in this region and a lack of construction machinery. Plus, many areas are prone to flooding. But the eastern region is home to 4 million people, over one-third of Cubans, and an economically important region for its mining and tourism sectors. As such, the central government, MITRANS, and MICONS are committed to improving road conditions in the region.

In Santiago de Cuba Province, bridges on the coast road to Granma are urgently in need of repair. As this 147 km artery (a key tourist route) is prone to natural disasters, there is a plan to build two tunnels (860m and 540m long) to prevent falling rocks, but the works have not been implemented.

In the eastern region, there are 958 bridges, some made of iron. The Rio San Juan Bridge on Santiago de Cuba's ring road is broken. Macario Bridge on the Carretera Central is very old, with a USSR standard height limit of only 4 meters – which often leads to damage when high-cube container trucks cross it.

Holguín Province, whose capital is Cuba's fourth largest city, has key industries such as iron and nickel mining and the manufacturing of agricultural machinery. Plus, the northern coast is a resort area. To boost the provincial economy, better road access to Antilla Port is needed.

The following map provides a regional overview of road transport issues in Cuba.



Source: JICA Study Team

Figure 4.2.6 Cuba Road Transport Regional Overview

4.2.3 Road and Bridge Sector Planning Issues

Planning issues in the road and bridge sector were discussed in a series of TWG-3 meetings from the viewpoint of six key areas: 1) Planning & coordination; 2) Transport infrastructure development; 3) Environment, safety and security; 4) Transport service and industry development; 5) Transport pricing and resource allocation; 6) Institutional & regulatory development. These are summarized in Table 4.2.6.

Table 4.2.6 Planning Issues in the Road and Bridge Sector

Key areas	Planning issues to be addressed
1. Planning and coordination	• Lack of well-organized traffic and transport statistics and data.
	• Need quantitative survey of road/bridge conditions for maintenance & management
	• Need for coordinated planning among institutions related to transport infrastructure at the national level.
	• Integration of the strategic transport plan (this master plan) and spatial development initiatives (ENOT, Mariel SEZ, Northern coastal area/islands, etc.) needs strengthening.
	• Integration of the strategic transport plan (this master plan) and business investment opportunities (investment portfolio) requires strengthening.
	• Need for a resilient road and bridge network to natural disasters.
	• Prioritization of transport investment based on quantitative analysis (cost-benefit analysis, etc.)

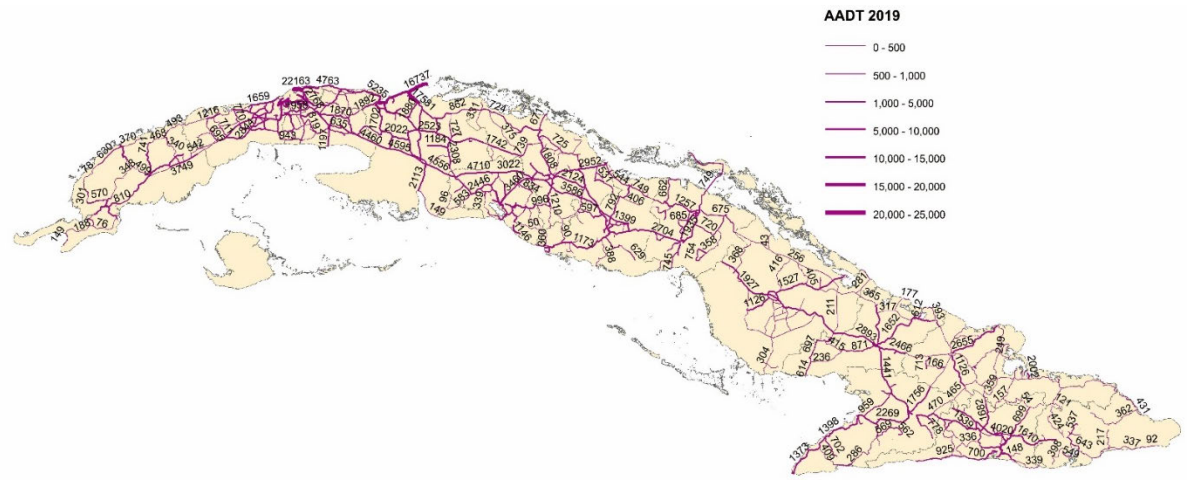
Key areas	Planning issues to be addressed
2. Transport infrastructure development	• Many roads and bridges were built based on old specifications without complying with road width and cross-sectional composition requirements.
	• Urgent repair of seriously damaged/deteriorated transport infrastructure is needed.
	• Shortage of construction equipment and inadequate facilities lacking capacity and efficiency.
	• Effective and efficient use of the existing transport assets is needed – "maximum utilization of existing assets."
	• Shortage of night driving safety facilities.
	• At-grade intersections on the Autopista
	• Enhancement of connectivity between centers of activity/growth/tourism and international gateways.
	• Utilization of ICT.
3. Environment, safety and security	• Safety standards and enforcement mechanisms, especially highway safety standards, need overhauling.
	• The use of inefficient transport technologies (aged vehicles, etc.) in the transport sector exacerbates energy consumption.
	• Emergency (ambulance) transport services to cover the whole state are needed.
	• By introducing the idea of SEA and SDGs, social and environmental considerations in the planning process and design of transport infrastructure need to be strengthened.
	• Enlightenment of the people on countermeasures against the COVID-19 pandemic.
4. Transport service and industry development	• Improvement of road-related business opportunities and establishment of stop and rest stations (michi-no-eki)
	• Capacity building of CNV and Empresa Constructora de Obras de Ingeniería (ECOING) through technical training programs in the road and bridge sector.
5. Transport pricing and resource allocation	• Introduction of the "Beneficiaries' Payment Principle" in using roads and bridges and application of "Affordable Pricing" to maintain the accessibility of transportation.
	• Ensuring the necessary funding in the annual budget for urgent projects.
6. Institutional and regulatory development	• Roles of the State, provinces, and Empresa in supply, management, and maintenance of road/bridge infrastructure and services need clarifying for further capacity building.
	• Foreseen shortage (aging) of human resources needs to be considered - institute long-term training programs in transport sector planning, management, and operations to improve human resource capabilities.
	• Legislative and regulatory frameworks for transport infrastructure provision and operation (service production) need updating; introduction of PPP, etc. - enhanced scope for private-sector involvement in providing transport infrastructure and services.

Source: JICA Study Team

(1) Planning and Coordination

- Lack of well-organized traffic and transport statistics and data.
- Need for a quantitative survey of road and bridge conditions for maintenance and management.

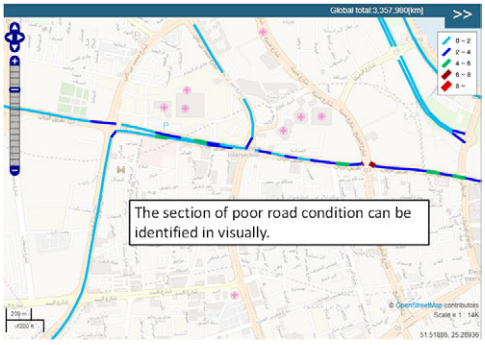
In this study, a traffic count survey was conducted for the first time in over a decade. Though survey locations were rather limited, traffic volume data (AADT) in major road sections all over the country have been updated, as shown in Figure 4.2.7. Since traffic count data is the basis for determining priorities for road rehabilitation and development, more frequent monitoring of road traffic and road conditions are essential.



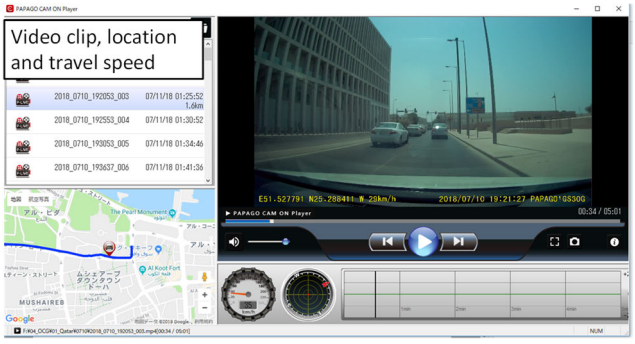
Source: CIMAB database updated by JST

Figure 4.2.7 AADT (Average Annual Daily Traffic) at Major Road Links Updated for 2019

According to CNV, Cuba's roads are evaluated in a subjective manner (good, fair and poor) by inspectors, so variation in results is an issue. A quantitative survey of road conditions, using a smartphone and a drive recorder attached to a standard passenger vehicle, would be more reliable as done by the Study Team (Figure 4.2.7). This method could be relatively easily conducted regularly by the road administrator. The necessity of strategic planning for road maintenance is also well recognized. In short, the establishment of a road maintenance cycle adapted to Cuba's situation is required to make maximum use of limited financial resources.



Source: JST powered by BumpRecorder

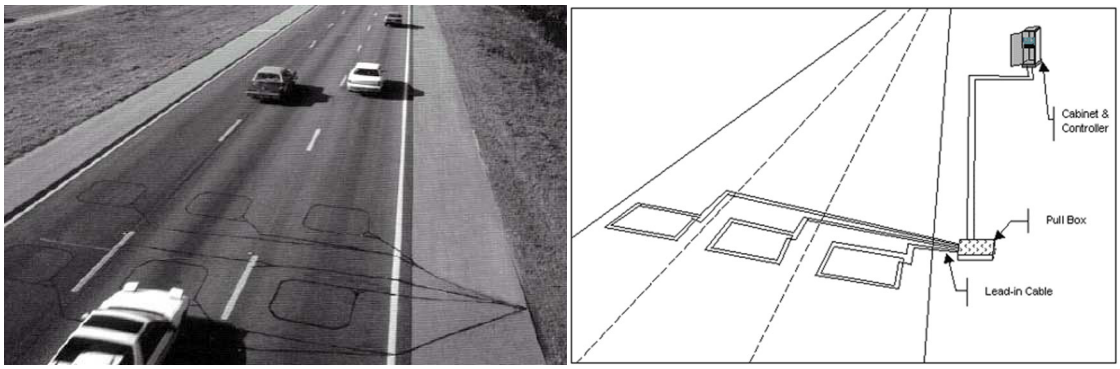


Source: JST powered by Papago Cam on Player

Figure 4.2.8 IRI Measurement Using Video Images with Coordinates

On the other hand, traffic counts could also be conducted semi-automatically with automatic traffic counters placed on roads; a method now applied at low cost in many countries. According to the U.S. Federal Highway Administration Traffic Monitoring Guide (2015), the lowest cost for automatic traffic measures is a system with inductive loops (Figure 4.2.9) with several strengths such as accuracy for count data compared to other commonly used techniques, well-understood technology, provide basic traffic parameters (volume, speed, headway, and gap), an incentive to inclement weather, and so on.[7] Alternatively, existing CCTV or IP cameras mounted at major road sections, if any, could also be utilized for manual or automatic traffic counting. Traffic data should also be collected and input regularly to more efficiently and effectively allocate the budget for road and bridge maintenance.

[7] https://metrocount.com/products/roadpod-vehicle-tube-classifier/



Source: https://ops.fhwa.dot.gov/freewaymgmt/publications/frwy_mgmt_handbook/chapter15_01.htm

Figure 4.2.9 Example of Implementation of Inductive Loop

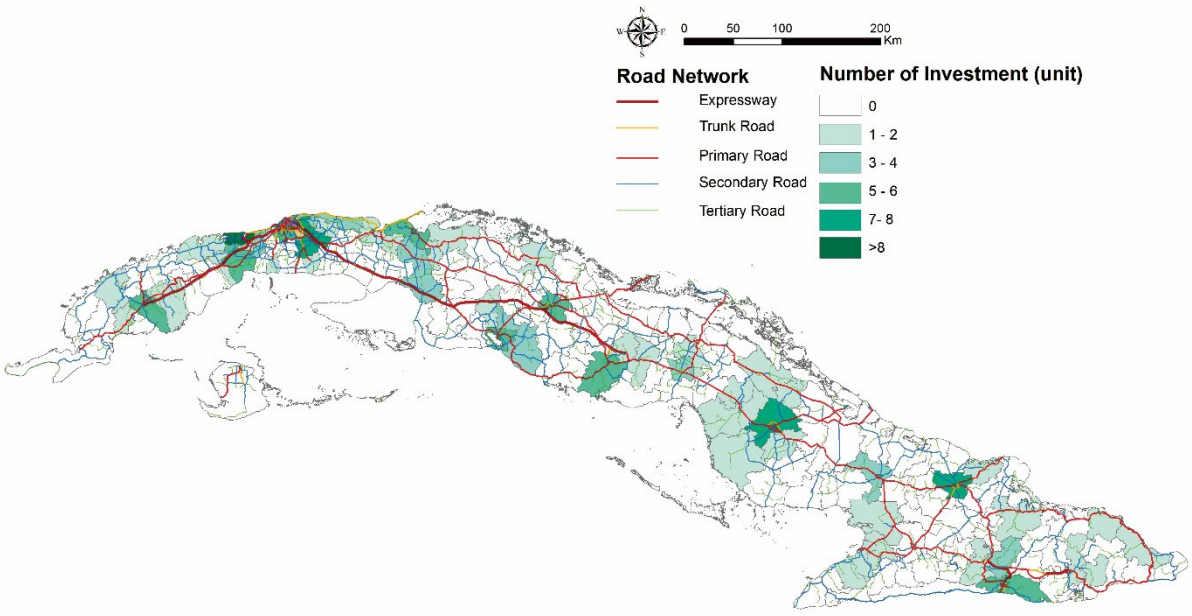
- Need for coordinated planning among institutions related to transport infrastructure at the national level.
- Integration of strategic transport plan (this master plan) and spatial development initiatives (ENOT, Mariel SEZ, Northern coastal area/islands, etc.) requires strengthening.

For planning, development, and maintenance, the National Road Center (CNV) under the MITRANS is the organization that manages roads of national interest. Its role is defined by the Road Safety Law (no. 109, 2010), and it is in charge of the development, maintenance, and investment plans of roads nationwide, etc. Since there is almost no toll revenue, it is positioned as an organization under the direct control of the Minister of MITRANS. Each province has a Provincial Road Center (CPV) as a branch office of CNV, which manages national roads in the province, including Autopista.

Furthermore, road planning should be closely related to the "National Territorial Regulation Scheme" (ENOT) that manages spatial and land use planning for the entire country. For road planning, this study should consider key ideas for the Mariel Special Development Zone and Varadero and the northern islands from Villa Clara to Camagüey as sun-and-beach tourism, which are considered to be important developments and economic engines to achieve the general objectives of the ENOT.

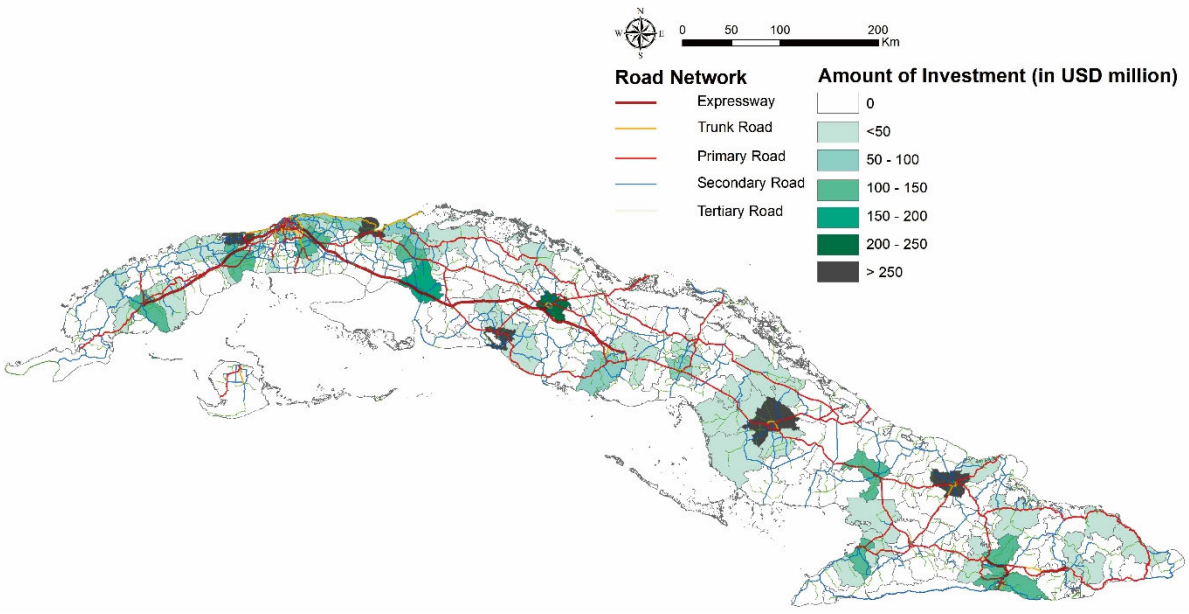
- Integration of strategic transport plan (this master plan) and business investment opportunities (investment portfolio) requires strengthening.

Based on the collected investment portfolios, the number and amount of investments by municipality are presented in Figure 4.2.10 and Figure 4.2.11. The municipality of Mariel has by far the largest number of investments, totaling 19, while Havana, as a province, has a total of 44 investments. Besides Mariel Port and Havana, a high concentration of investments in terms of the number and the total amount is observed in the municipalities of Piñar del Rio, Matanzas, Cienfuegos, Santa Clara, Camaguey, Holguin, and Santiago de Cuba. It also implies that the road network connecting those municipalities is highly important to realize the investments. Among others, Autopista, the entire Carretera Central, and part of Circuito Norte and Circuito Sur would need to support those investments.



Source: JICA Study Team, based on data from CIMAB

Figure 4.2.10 Number of Investments by Municipality



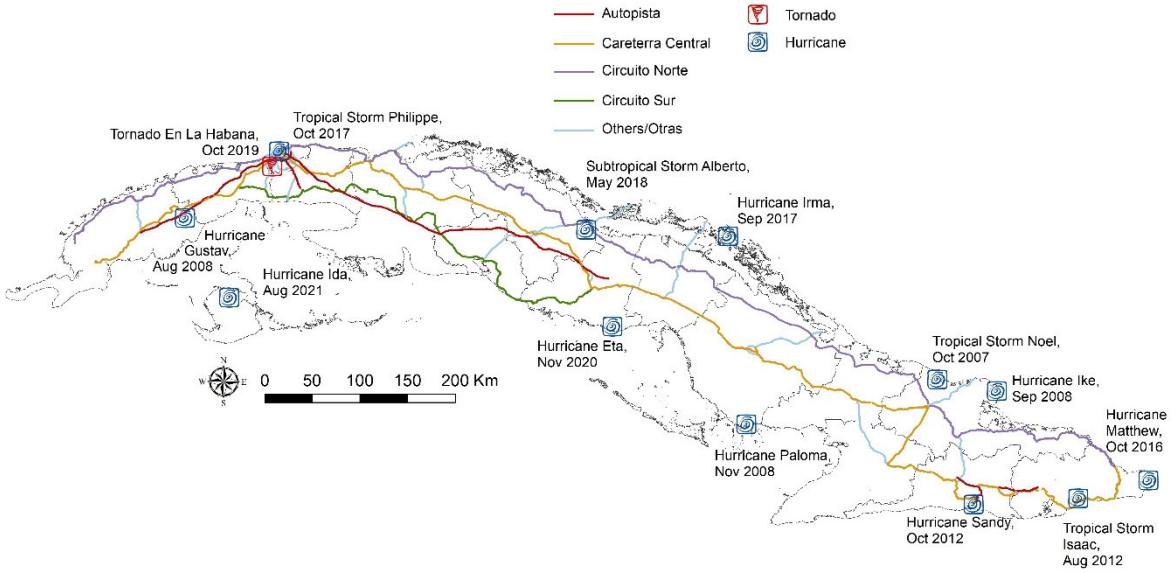
Source: JICA Study Team, based on data from CIMAB

Figure 4.2.11 Investment Amounts by Municipality

- Need for a road and bridge network resilient to natural disasters.

Cuba's 400 km expressway network includes the Autopista from Pinar del Rio to Havana (4-8 lanes, 148 km); the Autopista from Havana to Taguasco (354 km); and the Santiago de Cuba to Guantanamo Autopista (6 lanes, excluding 33 km section with only 3 lanes and no median). However, the section from Taguasco to Santiago de Cuba is still undeveloped, and the completion of the highway to Santiago de Cuba should be implemented in the mid- to long-term in terms of ensuring high-speed mobility through the country from east to west.

Meanwhile, insufficient maintenance due to a lack of construction machinery along with severe weather events such as hurricanes, torrential rain, and droughts (see Figure 4.2.12) have led to road deterioration throughout the country. Thus, roads and bridges resilient to natural disasters are urgently needed across all major arteries.



Source: JICA Study Team, based on data from CIMAB

Figure 4.2.12 Road Network in Cuba and Natural Disasters Since 2007

- Prioritize transport investments based on quantitative analyses (cost-benefit analysis, etc.)

Economic and financial analyses are two types of benefit-cost (B/C) analysis commonly used to evaluate the feasibility of transport investment projects. The economic analysis aims to calculate the national benefit that the project can be expected to generate. Financial analysis, on the other hand, calculates the likely return on investment from toll revenue. For a non-toll road project, only economic analysis is conducted to determine project viability.

There are several direct benefits that typically result from a road project:

- Savings in Travel Time Cost (TTC) and Vehicle Operating Cost (VOC) (time saved by using the road & congestion relief)
- Savings in capital and operational expenses
- Reduction of traffic accidents
- Reduced environment pollution

Economic analyses usually consider direct benefits from saving in TTC (both private vehicles and public transport) and VOC only. The saving in travel time cost is calculated based on the total travel time saved by the project, multiplied by the value of time (VOT) for each type of vehicle or person.

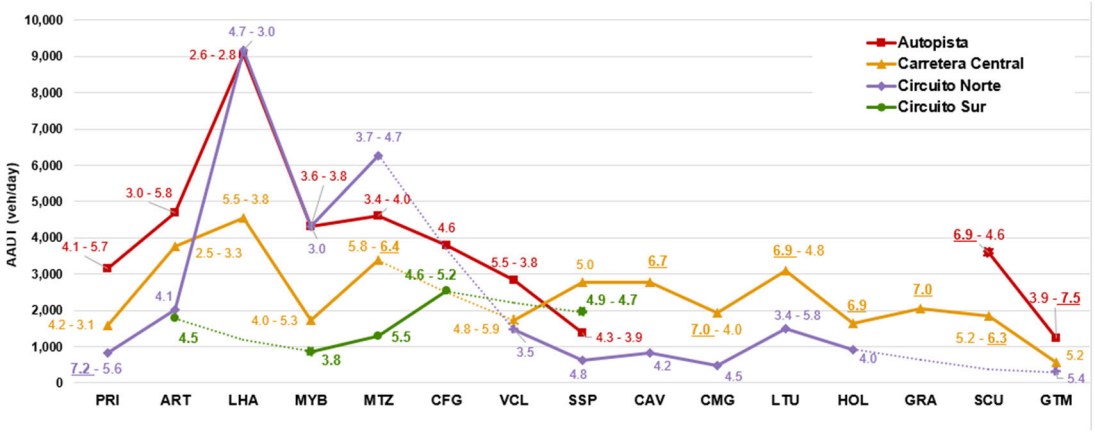
However, for Cuba, VOT has not yet been adequately estimated. For example, VOT per person could be estimated at 290-510 CUP per hour as the only clue from the demand forecast model made by the Study Team. But there is a huge gap from the average Cuban wage rate, 6.3 CUP per hour, which can

be calculated by the published average monthly salary of 879 CUP divided by 190.6[8] (average monthly work hours).

(2) Transport Infrastructure Development

- Many roads and bridges built to old specifications do not comply with contemporary road width and cross-sectional composition requirements.
- Transport infrastructure was seriously damaged and deteriorated

Figure 4.2.13 summarizes the road surface condition survey results (average IRI) and traffic volumes (AADT) for the expressway (Autopista) and three national roads. Overall, there are many sections of poor road surface condition in the central corridor (Carretera Central) and highways (Autopista) in eastern Cuba. This may be due to the high traffic volume, but the poor condition of roads and bridges is also the case on other trunk roads. The condition of the roads, especially the arterial roads, needs to be improved as soon as possible.



Note: Numbers beside the dots indicate average IRI values. Values over 6.0 are underlined, implying that there are many sections with poor road conditions

Source: JICA Study Team

Figure 4.2.13 AADT and Average IRI on Autopista and Main Arteries by Province

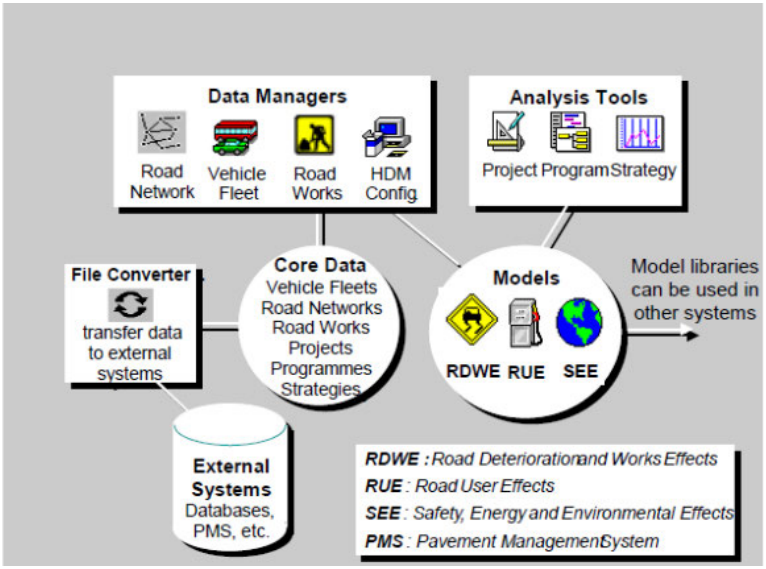
- Shortage of construction equipment and inadequate facilities that lack capacity and efficiency.
- Effective/efficient use of existing transport assets is needed: "maximum utilization of existing assets."

Although the importance of maintaining the road network is well-recognized, road rehabilitation is stalled due to a lack of budget. Plus, there are few workable asphalt milling machines in Cuba. In 2016, there were only four asphalt milling machines in the country, and only one was in workable condition. MICONS would need nine sets of road construction equipment including milling machines, trucks and other machines for the entire country. So it is vital to equip road maintenance enterprises with the necessary machines. Plus, the National Highway Center (CNV) of MITRANS, which oversees the management and routine maintenance of arterial roads, needs road maintenance equipment such as vehicles, for measuring the surface conditions of the roads.

[8] Definido en la Ley No.49, diciembre 28, 1984., Gaceta Oficial No. 2, febrero 23, 1985., Código de Trabajo

Deterioration will be more serious in the future if there is no improvement or periodic maintenance due to a lack of budget. Under the currently limited maintenance budgets, the asset management system plays a very important role. Asset management is an innovative technique that supports the efficient allocation of material assets, human resources, and budgets for road/bridge infrastructure by using an electronic database instead of paper documents. In a pilot project, three provinces – Havana, Granma, and Holguín – have adopted this system to guide decision-making in road investments.

HDM-4 (see Figure 4.2.14) is an asset management system for road improvement and maintenance developed by the World Bank. It starts with digitizing knowledge and analog data to create a database that enables simulations of likely roadway deterioration and restoration scenarios for various alternatives. The program attempts to efficiently allocate capital, human and financial resources based on a certain standard of road maintenance and management and seeks to support decision-making that is considered optimal from a social point of view. The program has three analysis modes: analysis of road network strategy, analysis of implementation plans, and business-strategy analysis. In fact, it is a very effective instrument for establishing an asset management system that can support the formulation of basic plans, implementation plans, and project management plans related to the road management process.



				2000		2001		2002		2003	
Priority Rank	Road Section	Length (km)	Province or District	Road Work	Cost $m	Road Work	Cost $m	Road Work	Cost $m	Road Work	Cost $m
1	N1-2	20.5	2	RESEAL	5.4	R.M.	0.185	R.M.	0.185	R.M.	0.185
2	N4-7	23.5	7	OVL40MM	10.9	R.M.	0.212	R.M.	0.212	R.M.	0.212
3	N2-5	12.5	5	RECON	8.6	R.M.	0.113	R.M.	0.113	R.M.	0.113
4	R312-1	30	4	WIDEN-4	31.4	R.M.	0.180	R.M.	0.180	R.M.	0.180
5	R458-3	36.2	3	OVL60MM	16.3	R.M.	0.217	R.M.	0.217	R.M.	0.217
:	:	:	:	:	:	:	:	:	:	:	:
16	N4-16	32.1	6	R.M.	0.289	RECON	22.8	R.M.	0.289	R.M.	0.289
17	R13-23	22.4	4	R.M.	0.134	OVL40MM	9.7	R.M.	0.134	R.M.	0.134
18	N521-5	45.2	2	R.M.	0.407	WIDEN-4	41.3	R.M.	0.407	R.M.	0.407
:	:	:	:	:	:	:	:	:	:	:	:
28	N1-6	30.2	4	R.M.	0.272	R.M.	0.272	RESEAL	8.2	R.M.	0.272
29	N7-9	17.8	3	INLAY	0.240	R.M.	0.200	OVL60MM	9.2	R.M.	0.160
30	F2140-8	56.1	1	PATCH	0.202	R.M.	0.202	RECON	34.9	R.M.	0.168

Note: RM = Routine Maintenance

Source: Overview of HDM-4 Volume 1.0

Figure 4.2.14 Overall Structure and Sample Program Analysis of HDM-4

- Shortage of night driving safety facilities
- At-grade intersections on the Autopista

The highway has no measures in place to prevent encroachment, and the highway and the public road intersect at a level (with no traffic signals). At present, due to the low traffic volume, pedestrians and bicycles can be seen crossing and entering the expressway (see Figure 4.2.15). In addition, there are very limited nighttime lights, reflectors, or other facilities to assist nighttime driving, making nighttime driving unsafe. However, road sections near population centers have relatively high traffic volumes, and in such locations, pedestrian overpasses or other facilities are needed to cross the highway.

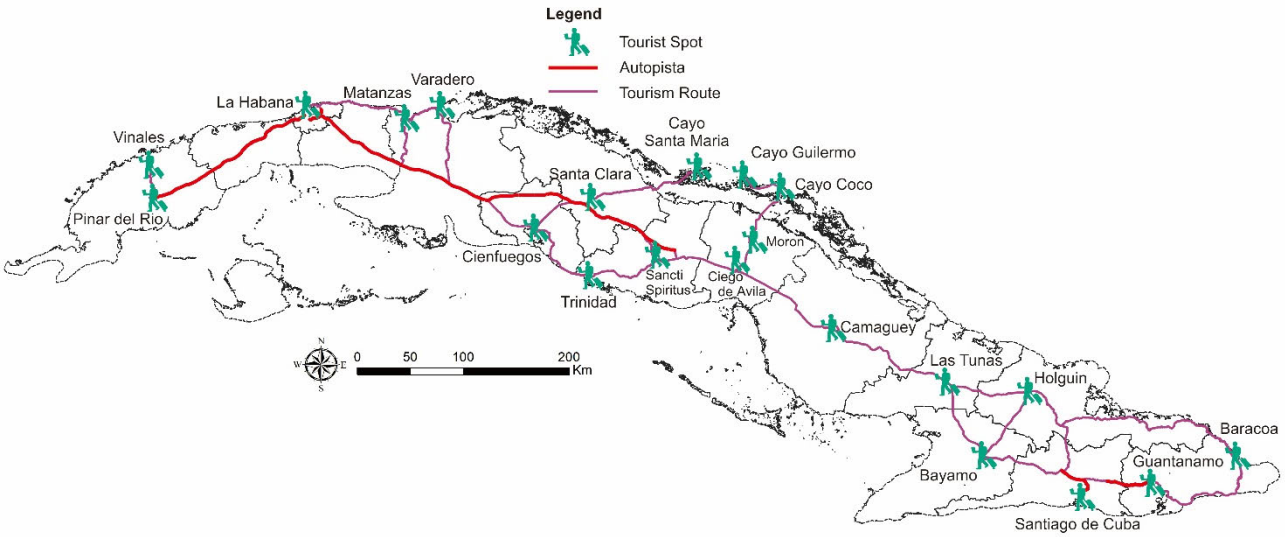
Source: JICA Study Team

Figure 4.2.15 At-grade Intersections on the Autopista

- Enhancement of connectivity between centers of activity/growth/tourism and international gateways

Completion of the Autopista to Santiago de Cuba will be a major project for the mid- and long-terms. In the meantime, traffic volume on the Carretera Central is expected to increase. But it is physically difficult to expand the road to four lanes from the current two lanes. Given these constraints, to support economic development and tourism nationwide, completion of the Autopista is highly desirable. To upgrade the existing Autopista to a global-standard expressway and complete the missing sections, several obstacles must be overcome, including the shortage of construction machinery, obsolete asphalt plant infrastructure, and the shortage of asphalt production.

TWG-3 members regard enhancing connectivity to tourism resorts as the priority for road and bridge improvement and development. In addition to the existing Autopista, the road network that is critical for tourism connectivity is shown in Figure 4.2.16.

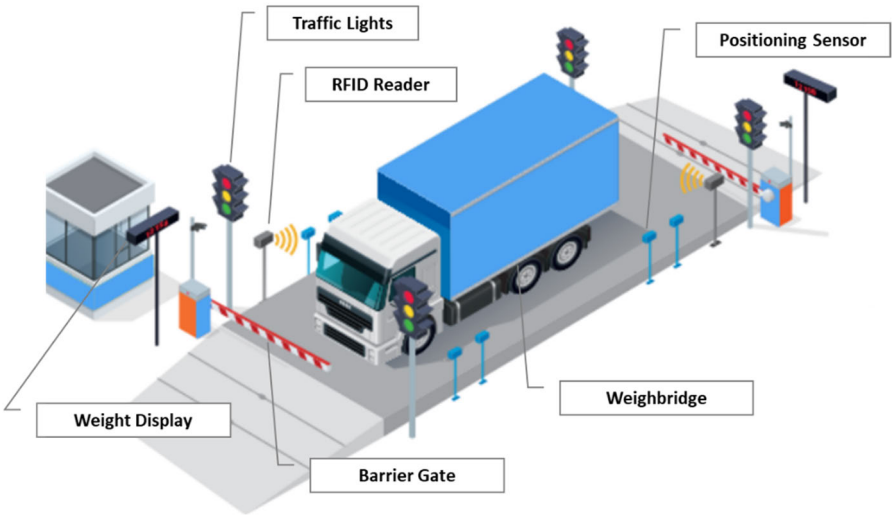


Source: JICA Study Team, based on the information from https://viazul.wetransp.com/destinations

Figure 4.2.16 Road Network Connecting Key Tourism Spots

- Utilization of ICT

Utilization of RFID (Radio Frequency Identifier) is recommended in the road sector as part of an ITS (Intelligent Transport System) for electronic road tolling and also for tracking heavy trucks and weigh-in-motion (or automated weighbridge as shown in Figure 4.2.17) to control overloading on the highways. RFID could also be used in the railway sector for monitoring train operations and maintenance/ management of rail infrastructure.



Source: http://www.imagicsolution.com/Unattended_Weighbridge_System.php

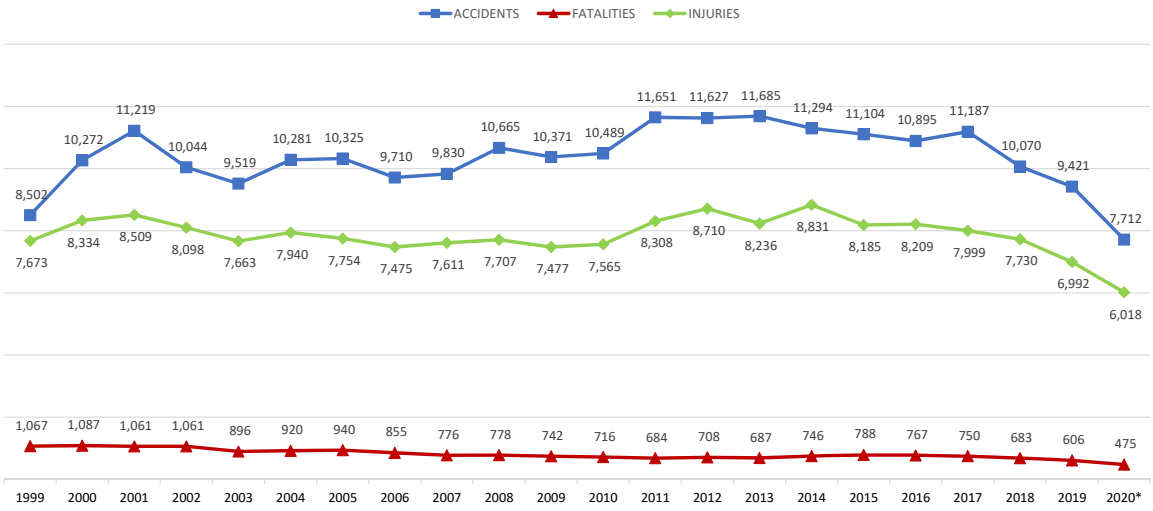
Figure 4.2.17 Example of Automatic Weighbridge

(3) Environment, Safety, and Security

- Safety standards and enforcement mechanisms, especially highway safety standards, need overhauling.

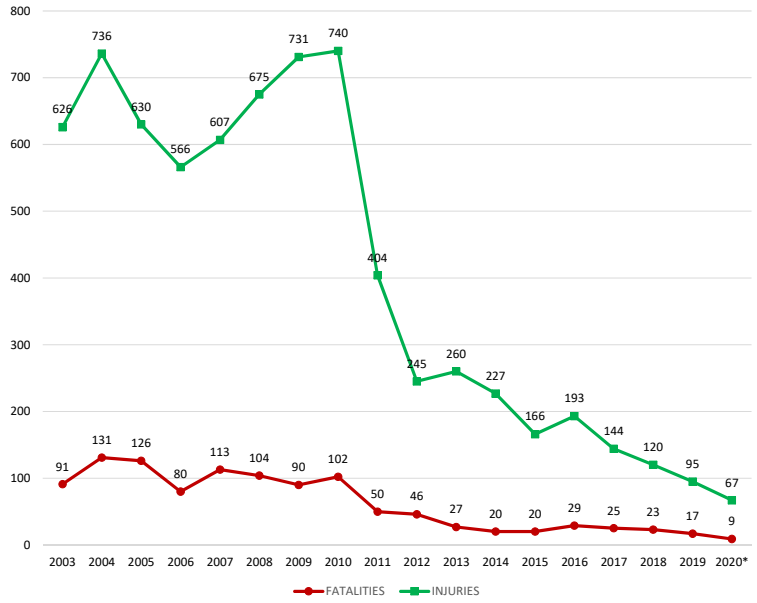
Trends in traffic accidents, fatalities, and injuries in Cuba and those involving pedestrians are shown in Figure 4.2.18 and Figure 4.2.19. While overall fatalities and injuries have been decreasing in recent years, fatalities and injuries involving pedestrians have decreased remarkably since 2011. According to the National Commission of Road Security of MITRANS, this trend was a result of the following measures taken by the Commission:

- Decrease in allowable speeds in urban perimeters
- Improvement in signaling in areas highly affected by pedestrian accidents
- Extension/widening of medians in dual carriageways
- Increase in pedestrian green traffic light times (mainly to help handicapped persons)
- Increase in information and enlightenment activities at different levels nationwide, for example, in places where several road accidents have occurred due to poor visibility



*Information for 2020 is not yet complete.
Source: CIMAB, ONEI

Figure 4.2.18 Trends in Traffic Accidents, Fatalities and Injuries



*Information for 2020 is not yet complete.
Source: CIMAB, ONEI

Figure 4.2.19 Number of Fatalities and Injuries in Accidents Involving Pedestrians

Traffic safety measures for pedestrians are very important and need to be further implemented. These traffic safety issues are partly due to insufficient road ancillary facilities such as lighting, guardrails, delineators, safety signage, etc. Such measures can increase with minimum investment.

Damaged road surfaces on existing highways must be repaired to ensure safe speeds. Specifically, in the 33 km Autopista section, where only the three eastbound lanes are functional and used for traffic in both directions with no median, another carriageway must be built in the existing right-of-way.

- The use of inefficient technologies (aged vehicles, etc.) in the transport sector exacerbates energy consumption.
- Emergency (ambulance) transport service to cover the whole country needs to be enhanced.

While these issues may not be directly related to the road and bridge sector, in goods transport, for example, critical supplies (stored in large warehouses in provincial capitals) such as food, teaching materials, and medicines, called Canasta Basica, are transported to each community by the Empresa Provincial de Transporte (EPT) of each province. While the company is responsible for maintaining the trucks, which were once provided by the central government, most are now very old and decrepit. There is also a risk of serious accidents. Each EPT typically owns a half-ton truck or a 6-10-ton heavy truck, which is not efficient in delivering to 300 or more communities in each province. Therefore, it is necessary to renew provincial distribution systems by introducing a new variety of types, such as refrigerated trucks, containers, tankers, and trucks with lifts.

- By introducing the SEA and SDGs concepts, social and environmental considerations in the planning process and design of transport infrastructure need to be strengthened.

The Cuban government is concerned with environmental and social aspects. Environmental measures will be featured in all new economic and social policies. Under the new 2019 Constitution,

environmental policy is a focal point widely supported by the people. Following government policy, Strategic Environmental Assessments (SEA) should be included in the process of strategic transport planning in accordance with the SEA Guide for Development Plans and Programs.

The UN's Sustainable Development Goals (SDGs) are the blueprint for a more sustainable future for all. Cuba has performed well in meeting its SDG targets, ranked 42 out of 156 countries in 2018. While goals related to SDG 3-Health, SDG 4-Education, and SDG 5-Gender Equality show higher ratings for Cuba, goals for SDG 9-Industrialization, SDG 14-Life Below Water, and SDG 15-Life on Land require faster progress. In addition, among the sub-criteria, CO_2 emissions from fuel combustion (SDG 7-Affordable & Clean Energy) and satisfaction with public transport (SDG 11-Sustainable Cities) also require further improvement.[9]

- Enlightenment of the people on countermeasures against the COVID-19 pandemic.

As the authority responsible for COVID-19 measures in the transportation sector, the Ministry of Transportation (MITRANS) is in charge of managing public transportation and its users within the city, between municipalities, and in the suburbs. Citizens using public transportation are required to wear face masks and passenger capacity has been reduced. Transportation operators were required to spray disinfectants on a regular basis to prevent viral infections in their vehicles. Meanwhile, to support the continuation of the tourism industry, the government is providing collective inter-provincial bus service for passengers, especially for who have booked accommodations and tourist facilities. Currently, the government periodically evaluates measures and revises regulations according to the epidemic situation. The COVID-19 measures by the Ministry of Transportation are effective and should continue to be applied and improved as needed with the cooperation of the public.

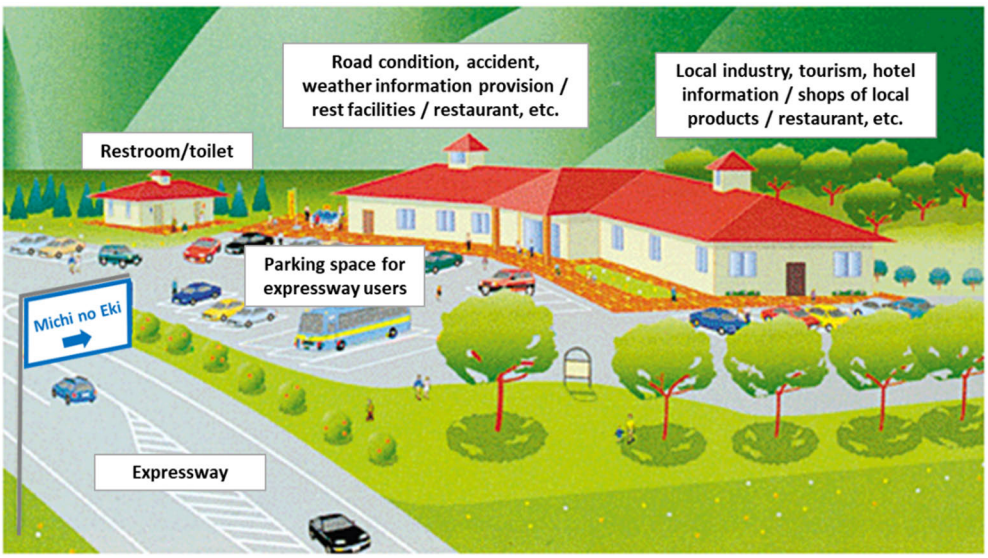
(4) Transport Service and Industry Development

Bus and truck transport issues are discussed separately in TWG-1 meetings on transport planning.

- Improvement of road-related business opportunities and establishment of rest stations ("michi-no-eki").

Along Cuba's arterial roads, there are few resting facilities and service stations. To remedy this, the adoption of a concept developed in Japan is proposed: the "michi-no-eki." In Japan's road network, these roadside services and resting facilities are integrated with regional development functions. They have three major functions: to provide rest for road users, to transmit information to road users and local residents; and to foster regional cooperation among local residents with a michi-no-eki station as a core (Figure 4.2.20).

[9] Project for Formulation of National Transport Master Plan in the Republic of Cuba, Interim Report 1, Section 3.2.



Source: MLIT, translated by JICA Study Team

Figure 4.2.20 Roadside Development Concept – "Michi-no-Eki"

For the Cuban version of michi-no-eki, it is recommended to include not only the above-mentioned functions but also maintenance-related services, vehicle inspection centers, transport terminals, logistics hubs to consolidate agricultural products, postal services distribution functions, etc., thereby creating "new" business opportunities. Thus, the Cuban michi-no-eki will become essential facilities that should be systematically placed at certain intervals depending on the required scale.

- Capacity building of CNV and *Empresa Constructora de Obras de Ingeniería* (ECOING) through technical training programs in the road & bridge sector.

Cuba's road network is relatively well developed with a high density of highways. Therefore, emphasis is placed on maintenance and management rather than new construction. However, regular maintenance work is difficult due to budget shortfalls, lack of construction equipment and materials, and other factors. In addition, since road and bridge inspections are based on visual inspection and are not objectively quantified, it is difficult to allocate maintenance and repair budgets effectively and efficiently.

Since relatively large-scale road and bridge repairs are carried out by ECOING based on plans by CNV, it is important to first improve the technical capacity of these two organizations.

(5) Transport Pricing and Resource Allocation

- Introducing a "Beneficiaries Pay Principle" for the use of roads and bridges and application of "Affordable Pricing" to maintain transport accessibility.
- Ensuring necessary funding in the annual budget for urgent projects.

Causeways and highways (Autopista) to resort islands (Cayo Santa Maria, Cayo Coco, etc.) could be utilized as toll roads since access is controlled, although not completely. As mentioned earlier, with the shortage of financial resources for road and bridge maintenance, it is natural to think that tolling will compensate for the shortage of financial resources. In fact, countries around the world, including Canada and South Africa, are increasingly adopting toll collection as a source of funds for road construction, maintenance, and management.

In Cuba, the expected toll collection may not be possible due to a lack of manpower and bad weather conditions, in addition to the low traffic volume to begin with. On the other hand, if all vehicles are equipped with RFID tags, just as all vehicles are equipped with license plates, it may be possible to introduce an electronic toll collection system. This would address the shortage of personnel due to the aging of the workforce, save on labor costs, and ensure that fees are collected without omissions. Although this measure would require some initial costs, it would lead to stable income in the long run and should be considered.

(6) Institutional and Regulatory Development

- Roles of the State, provinces and Empresa in supply, management, and maintenance of road and bridge infrastructure and services need clarifying for further capacity building.
- The foreseeable shortage of human resources due to aging must be considered and countered by long-term training programs in transport sector planning, management, and operations to improve human resource capabilities.

CNV is the top-level organization for road and bridge infrastructure development and maintenance planning; CPV, a subordinate organization of CNV, is responsible for inspection and minor repair work on national and provincial roads; Cimab is responsible for surveys related to road and bridge planning; and ECOING is responsible for relatively large-scale repairs (under MICONS). It is necessary for the staff of these concerned organizations to acquire modern technical knowkedge and skilss for road and bridge maintenance, as well as to accumulate hands-on experience in road and bridge inspection and repair. Technical training programs, etc. by international donors should be utilized for this purpose.

- Legislative and regulatory frameworks for transport infrastructure provision and operation (service production) need updating to introduce PPP, etc. and enhance the scope for private-sector involvement in the provision of transport infrastructure and services.

One of the priority issues in the “planning and coordination area” is to ensure consistency and coordination with ENOT and the portfolio of investments in the development of the Strategic Transportation Master Plan. While domestic and foreign investors are expected to invest in the projects listed in the portfolio of investments, there is also a possibility that foreign companies will participate in toll road development, rehabilitation, maintenance, and management as profitable projects. There is also a possibility that foreign firms will enter the previously mentioned RFID system development, electronic toll collection systems, and road construction equipment leasing as businesses. In order to meet these expectations, it is necessary to establish a legal and institutional framework for the participation of the private sector, including foreign companies and investors, in road and bridge-related projects.

In applying RFID to road management, it will be necessary to take security measures to prevent privacy violation and unauthorized acquisition and use of personal information, as well as to revise laws related to road transportation.

4.3 Road-based passenger transport sector

4.3.1 Outline of Cuba's road-based passenger transport sector

Buses are the main means of transportation for Cuban citizens and also play an important role as a means of transportation for tourists from abroad. Note that in Cuba, separate bus services exist for nationals and tourists even after the currency unification.

The Cuban national bus service has a hierarchical structure according to the scope and type of service. In particular, the interurban service plays an important role in connecting the provincial capitals and cities within the province, with Havana as the main hub. This service operates according to schedules and routes approved by MITRANS. Inter-city service consists of the following two main segments.

Inter-Urban Service (Inter-Provincial Service): consisting of long-distance service (over 300 km) from Havana to other provincial capitals and medium-distance service (less than 300 km) mainly between provincial capitals (Inter-Province), operated by Empresa de Ómnibus Nacionales (EON), National Bus Enterprise) under the GEA.

Inter-Urban Service (Inter-Municipality Service): This service consists of short distance services (less than 200 km) connecting the Municipalities and is operated by the provincial EPTs (Empresa Provincial de Transporte, Transport Provincial Enterprise). This intra-provincial inter-municipality service serves as a feeder route for the inter-provincial service operated by EON.

Table 4.3.1 Classification of bus passenger transport services

No.	Service type	Service coverage	Operator	Management
1	Interurban (Inter-provincial)	• Long-distance bus services from Havana to provincial capitals (Longer than 300 km/trip) • Medium-distance bus services linking provincial capitals (Less than 300 km per trip)	EON	MITRANS UET, MITRANS
2	Interurban (Inter-municipal)	• Short-distance bus services linking municipal centers (Less than 200km/trip)	EPT	DGTPH (Havana) DPT (Major Provinces) UET, MITRANS
3	Rural service	• Rural bus services linking cities with rural areas or between		
4	Suburban service	• Bus services from cities to small towns/villages		
5	Urban Service	• Urban bus services in provincial capitals and some large municipalities		

Source: NRMT 69-2003, MITRANS and Cimab edited by JICA Study Team

In addition, transportation services for specific purposes, such as transportation of civil servants and schools (students and teachers), cab services with relatively flexible operations, and tourist services for visitors are also set up (Table 4.3.2). Basically, these road passenger transport services fall under the jurisdiction of MITRANS. However, for tourist services, not only does EON operate Viazul, an intercity bus service for visitors, but also Transtur, enterprise under MINTUR (Ministry of Tourism) sector and Transgaviota (Transgaviota S.A) under MINFAR (Ministry of the Revolutionary Armed Forces) sector operate tourist buses.

Table 4.3.2 Classfiation of Other Road-based Passenger Transport Services

No.	Service Type	Service Coverage	Currency	Operation Body	Regulation Body
1	Transport of Workers	• Transport service for workers to / from working locations	CUP	ETT (Transmetro)	DGTPH (Havana) DPT (Major Provinces) UET, MITRANS
2	School Service	• Transport service for schoolchildren or students and teachers to / from educational centers	CUP	ETE	
3	Taxi (Piquera)	• Taxi services basically for Cuban social activities	CUP	Cuba Taxi	DGTPH (Havana) DPT (Major Provinces) UET, MITRANS
4	Route Taxi (Taxi Rutero)	• Supplemental microbus/bus services in large municipalities for Cuban citizens	CUP	Cooperativa 1&2, Cuba Taxi, Taxis Cuba	
5	Free Taxis (Taxis Libres)	• Taxi services basically for visitors	CUP	Taxis Cuba	
6	Private Taxis	• Private taxi services with operating authorization (Including motorized vehicles and also horse-drawn vehicles)	CUP	Private Operators	
7	Tourism Service	• Medium/long-distance bus service basically for visitors (Viazul) • Tourist bus service for visitors (Transtur / Transgaviota)	Foreign currency from aborad/MLC in Cuba	Viazul (EON) Transtur (MINTUR) Transgaviota (MINFAR)	UET, MITRANS MINTUR MINFAR

Source: MITRANS, and Cimab edited by JICA Study Team

(1) Existing facilities and equipment

1) Inter-provincial bus terminals

Currently, a total of 18 interprovincial bus terminals are operated by EON in Cuba's provincial capitals (excluding the Isle of Youth) and some major cities. However, interprovincial buses that provide direct service to other provincial cities that do not have interprovincial bus terminals may, from time to time, transfer to EPT-operated terminals, based on contracts with EON.

There are two bus terminals in Havana: Estación Central (Central Terminal), the largest bus terminal in Cuba, and Estación Villanueva (Villanueva Terminal), a temporary terminal. In the past, Estación Viazul (Viazul Terminal) was established as the dedicated terminal for Viazul in Havana, but in April 2019, its functions were integrated into Estación Central and new facilities such as waiting rooms dedicated to Viazul were built. Villanueva is also planned to be integrated into Estación Central in the future, and all bus terminal locations in Havana will be consolidated into one at Estación Central.

2) Bus vehicles

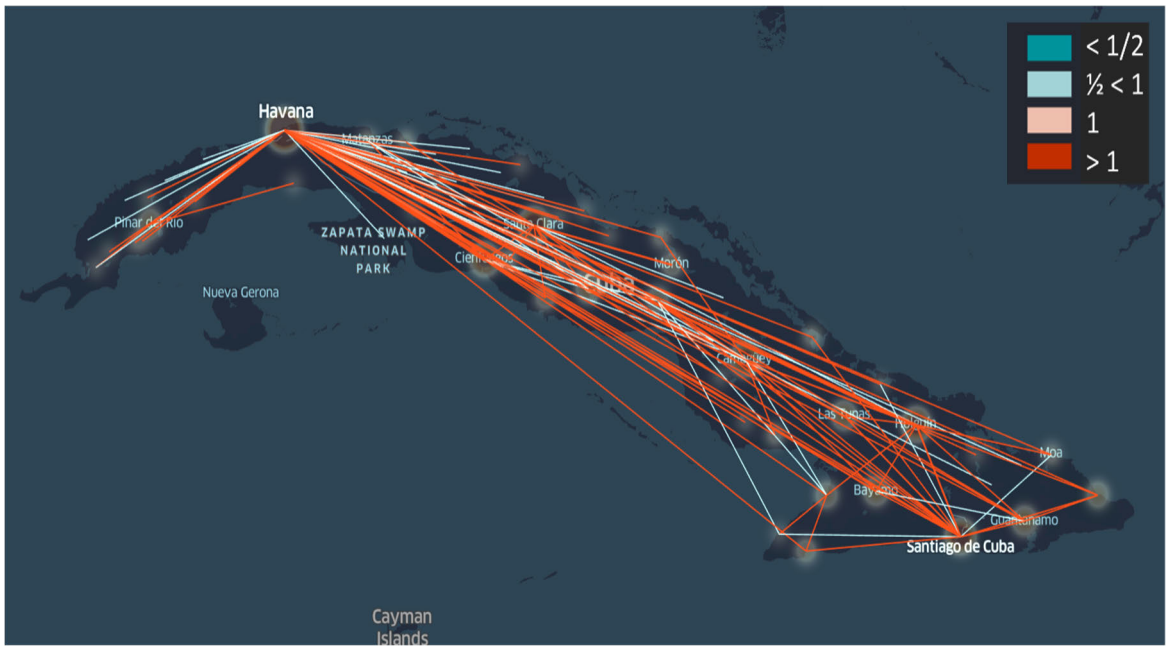
As of February 2019, EON had a fleet of 846 bus vehicles for intercity service, consisting of vehicles procured from Yutong (Zhengzhou Yutong Group Co., Ltd.) in China following the fleet replacement implemented between 2005 and 2018. The procurement price of the vehicles has been increasing every year, which may affect future vehicle procurement.

As of February 2019, EON's vehicle utilization rate is only 61% (516 vehicles). The utilization situation tends to vary by UEB, particularly in Santa Clara, Ciego de Avila, and Santiago de Cuba, where the utilization rate is below 50%. The main reasons for this low vehicle utilization rate are the large number of vehicles that are beyond repair and the chronic shortage of spare parts. The lack of spare parts has also resulted in longer vehicle repair times.

(2) Existing operation & maintenance system

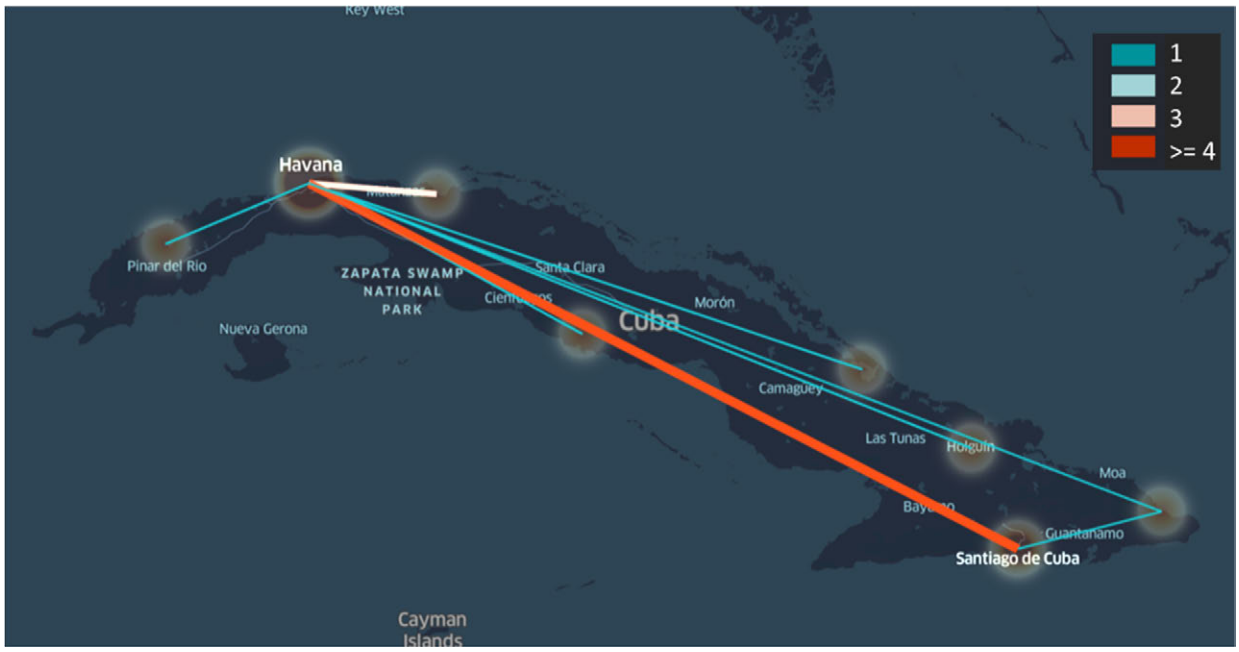
1) Routes and service frequency

Figure 4.3.1 shows the routes and frequency of EON (for Cubans) service, which is characterized by the fact that it operates direct service radially from Havana to provincial cities (all provinces except the Island of Youth). One of the reasons for the provision of this long-distance direct service is the declining level of service on the EPT, which serves as a feeder route within the province (connecting the provincial capital to the provincial cities within the province).



Unit: Annual average number of bus services per day by each pair of origin and destination provinces
Source: Mapbox, OpenStreetMap taken on 31 May 2019, and EON edited by JICA Study Team

Figure 4.3.1 EON service frequency by origin/destination pairs in 2019



Unit: Annual average number of bus services per day by each pair of origin/destination by province
Source: Mapbox, OpenStreetMap taken on 31 May 2019, and EON edited by JICA Study Team

Figure 4.3.2 Viazul service frequency by origin/destination pairs in 2019

On the other hand, in the case of Viazul, which is for travelers and visitors, as shown in Figure 4.3.2, it provides direct service radiating from Havana to major tourist centers within a day trip range, such as Vinales and Varadero, as well as to more distant tourist cities such as Trinidad, Holguín, and Santiago de Cuba.

2) Reservations and ticketing

The inter-provincial transport reservation and ticketing system was undergoing organizational reform in 2019. Replacing EON, Viajero, an enterprise integrated under GEA, now handles a suite of services, including reservations, ticketing, and fare collection. Viajero is responsible for selling tickets for inter-provincial buses, trains, and ferries to Cuban citizens, managing reservation waiting lists, and collecting fares.

Cuban citizens now have three options for reservations on EON buses: general reservations, 72 hours, and last-minute. Sales of general reservation tickets start 90 days before departure. If seats are not available, passengers are registered on a waiting list. Fourteen seats on each departure are preferentially reserved for enterprise workers, disabled people, hospital patients, etc. These are called “72 horas” (72 hours) seats. If unclaimed by members of the preferred groups, these 14 seats go on sale at each bus terminal. The sale of still available or canceled seats starts for passengers on the waiting list two hours before each departure. This reservation system on each departure day is called “Última Hora” (Last Minute). Passengers on waiting lists are requested to go to a designated counter of the origin terminal to confirm the purchase of tickets on the departure day.

UEB Viazul is fully responsible for all Viazul services, including reservations, ticketing, and fare collection. There is no priority reservation service such as 72 Horas, but it is possible to make online reservations up to seven days before departure.

3) Maintenance of vehicles

EON owns 15 bus depots with workshop functions throughout the country. In general, each UEB is responsible for the maintenance of its assigned fleet, with the exception of engine-related parts, which are outsourced to Motorcentro, an enterprise integrated under GEA.

A simple inspection of the vehicles with technical adjustments will be carried out every 200 km or more at the assigned base or at the nearest UEB, or at a simple workshop facility in the terminal. If the terminal is an EPT bus terminal, EON will entrust EPT with a simple inspection and car wash. For journeys of less than 200 consecutive kilometers, the inspection will be performed at the next terminal.

4.3.2 Ongoing Projects

1) Infrastructure Improvement

EON has been focusing mainly on bus terminal repair and renovation, starting with the construction of a bus terminal adjacent to the railroad station in Santiago de Cuba in 2015, followed by the construction of bus terminals and garages in Holguín 2017 and Sancti Spiritus in 2019. In the same year, the bus terminal and garage are scheduled to be upgraded in Las Tunas, followed by Bayamo, Santa Clara, Matanzas, and Pinar del Rio.

2) Procurement of Buses

With regard to bus fleet procurement, the "Plan 2015-2021" was approved by the MEP (Ministerio de Economía y Planificación, Ministry of Economy and Planning), which includes a procurement plan for 764 new vehicles. However, as of February 2019, the procurement of 424 vehicles included in Plan 2015-2021 has been postponed; plans for further vehicle replacements after 2021 are pending MEP approval.

4.3.3 Planning issues in the road-based passenger transport sector

1) Intercity Bus Transportation for Cubans

The following are some of the challenges of intercity bus transportation for the Cuban population.

- Improvement of bus fleet utilization: One of the biggest problems faced by EON and EPT is low fleet utilization due to lack of spare parts, etc. It is pointed out that more than 1,000 vehicles were in operation before the Yutong fleet was introduced, and stable fleet procurement and availability of spare parts to increase fleet utilization are urgent issues.
- Strengthening the Hierarchical Transportation System: As mentioned above, the hierarchical nature of bus transportation in Cuba is a characteristic of the country's transportation system. However, the quality and quantity of transport services, especially in EPT, have been declining, and EON's role as a feeder service has not been fully fulfilled. It is desirable to improve the overall convenience of all transportation systems, including rail and air, for inter-city travel through the realization of a seamless transportation system with a hub-and-scope structure.
- Improvement of the reservation and ticketing system: With the reservation system based on Ultima Hora, passengers on the waiting list cannot check the status of their tickets until just

before each departure and must wait at the bus terminal with their luggage. It is desirable to establish an SMS ticketing notification system and an Internet reservation system.

- Strengthening appropriate control of private operators: Intercity truck buses (camiones) operated by private operators play a role in compensating for the short supply of bus transportation operated by EON and other public corporations, and this role is indispensable, especially in eastern Cuba. However, it has safety problems such as aging vehicles, and most of its routes compete with those of EON/EPT. Therefore, it is desirable for MITRANS to strengthen appropriate control (route approval system, unified fare system, vehicle maintenance management, etc.).

2) Intercity road passenger traffic for visitors

The following issues should be addressed for intercity bus transportation for visitors (mainly foreigners)

- Integration of Viazul and EON services: There is a plan to integrate Viazul with the currently separated Cuban service, which is limited to major tourist cities and destinations. This integration would greatly improve accessibility to regional cities that are currently unreachable by Viazul.
- Improvement of the reservation and ticketing system: Currently, Viazul's Internet reservation system is limited to 7 days prior to each departure, and the number of agents that handle such tickets is limited. Further improvement of the overall reservation system is desired.
- Provide reliable feeder services: Currently, feeder transportation from each bus terminal is basically limited to cabs. It is desirable to provide direct service to the airport and major hotels, transportation services by microbuses and other small vehicles, and cooperation with the Ministry of Tourism, which provides similar services.
- Introduction of advanced services: Currently, Viazul offers only one class of service. It is desirable to introduce an advanced service with improved comfort inside the vehicles and in the bus waiting environment in order to cater to a wider clientele of visitors, who are mainly tourists.

Table 4.3.3 summarizes issues identified based on the understanding of the existing conditions of bus operation, facilities & vehicles, and maintenance.

Table 4.3.3 Road-based passenger transport sector issues to be addressed

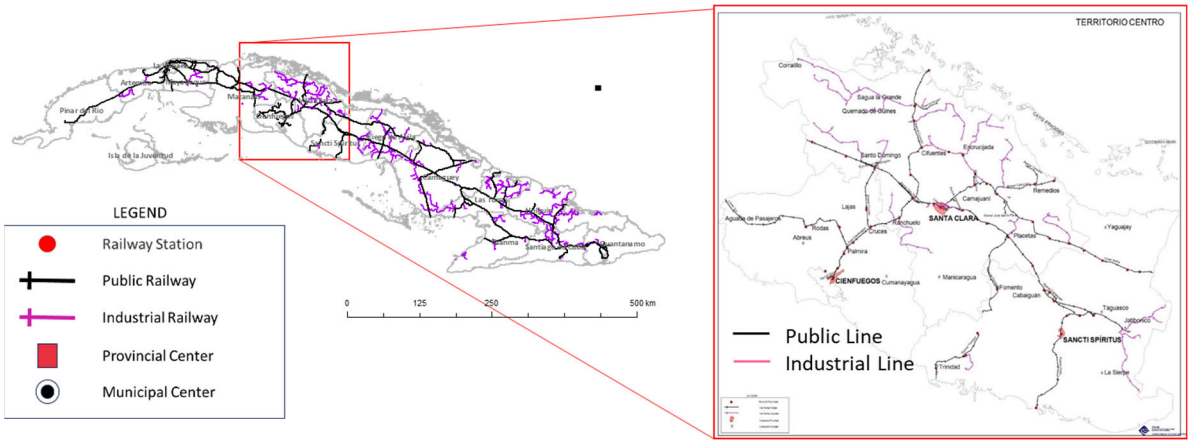
Key areas	Issues to be addressed
1. Planning and coordination	1. Improve the capacity of bus services that contribute to the mobility of foreign tourists. Role/function sharing of bus services under MITRANS, MINTUR, and MINFAR sectors.
	2. Strengthen sustainability and capacity of intercity bus services that contribute to solidarity between cities
	3. Strengthen the sustainability and transportation capacity of bus service, especially for citizens in local cities
	4. Realize multimodal intercity/urban transportation networks
2. Transport infrastructure development	5. Replace/procure buses for intercity services and local cities
	6. Improve bus terminal facility/bus waiting environment and optimize information provision
	7. Strengthen maintenance and management systems for buses (including spare parts procurement)
3. Environment, safety, and security	8. Improve the safety and security of city buses and intercity bus services
	9. Strengthen countermeasures against infectious diseases
4. Transport service and industry development	10. Improve intercity bus reservation/ticketing system
	11. Improve travel comfort by improving intercity service areas
	12. Strengthen the domestic bus manufacturing industry (Diana Bus)
5. Transport pricing and resource allocation	13. Diversification of profits by diversification of bus-related services
	14. Provide advanced services for foreign tourists and consider a flexible fare system
6. Institutional and regulatory development	15. Effective utilization and appropriate public management of private transport service providers (truck bus/taxi businesses)

Source: TWG and JICA Study Team

4.4 Rail Transport Sector Planning Issues

4.4.1 Railway network

Cuba's railway network spans 8,194.6 km (as of February 2019), as shown in Figure 4.4.1. Rail assets are under the jurisdiction of ATF, with rail transport services provided by six regional railway operating companies: EFOC (*Empresa Ferrocarriles Occidental*); EFC (*Empresa Ferrocarriles Centro)*; EFCE (*Empresa Ferrocarriles Centro Este*); EFO (*Empresa Ferrocarriles Oriental*); FERROMAR (Ferroviaria del Mariel. S.A.); and RUN (Rutas Nacionales, an enterprise for long-haul passenger train) under the umbrella of UFC (*Union Ferrocarriles de Cuba*).



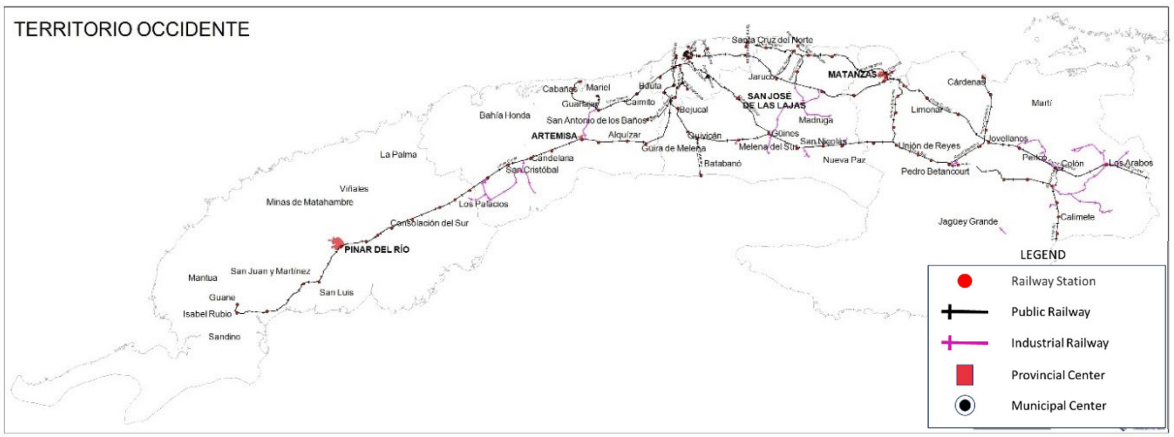
Source: Data from CIMAB

Figure 4.4.1 Cuban Railway Network

Railway lines are divided into two categories, public and industrial lines. Industrial lines (about 3,200 km) used to be under the former Ministry of Sugar Industries (MINAZ) and are now under UFC. These are dedicated to sugar cane transport and local community transport. Most industrial lines developed as spur lines within a province, as shown in Figure 4.4.1.

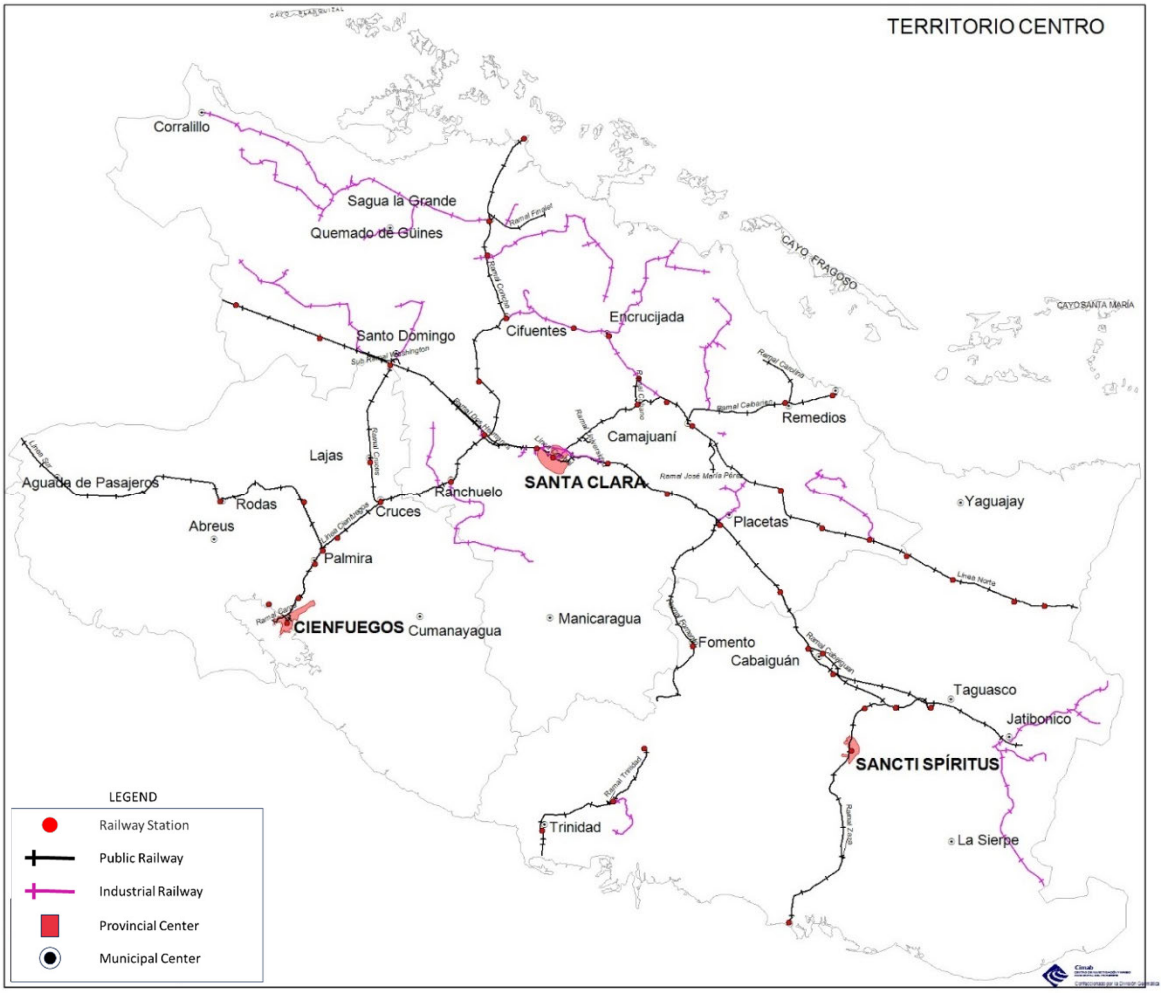
From the standpoint of economic/social importance, the existing railway lines are divided into Category I to Category IV, as shown in Table 4.4.1 (Railway line classifications defined in NC 249:2003 RAILWAY TRANSPORT). As Cuba's railway spine, the 835.5 km Central Line is designated as the sole Category I rail line.

It took nearly 18 hours to travel from Havana to Santiago de Cuba before July 2019, when new Chinese-built trainsets (with air-conditioned/non-air-con seating and a cafeteria car) entered service. Accordingly, operation speed and frequency have increased. The 2020 train timetable now lists travel time from Havana to Santiago de Cuba at about 16 hours for the 854 km journey – an average travel speed of about 53 km/h. To increase train operating speed further, it will be necessary to improve the existing track and train operation/control system with new high-powered locomotives.



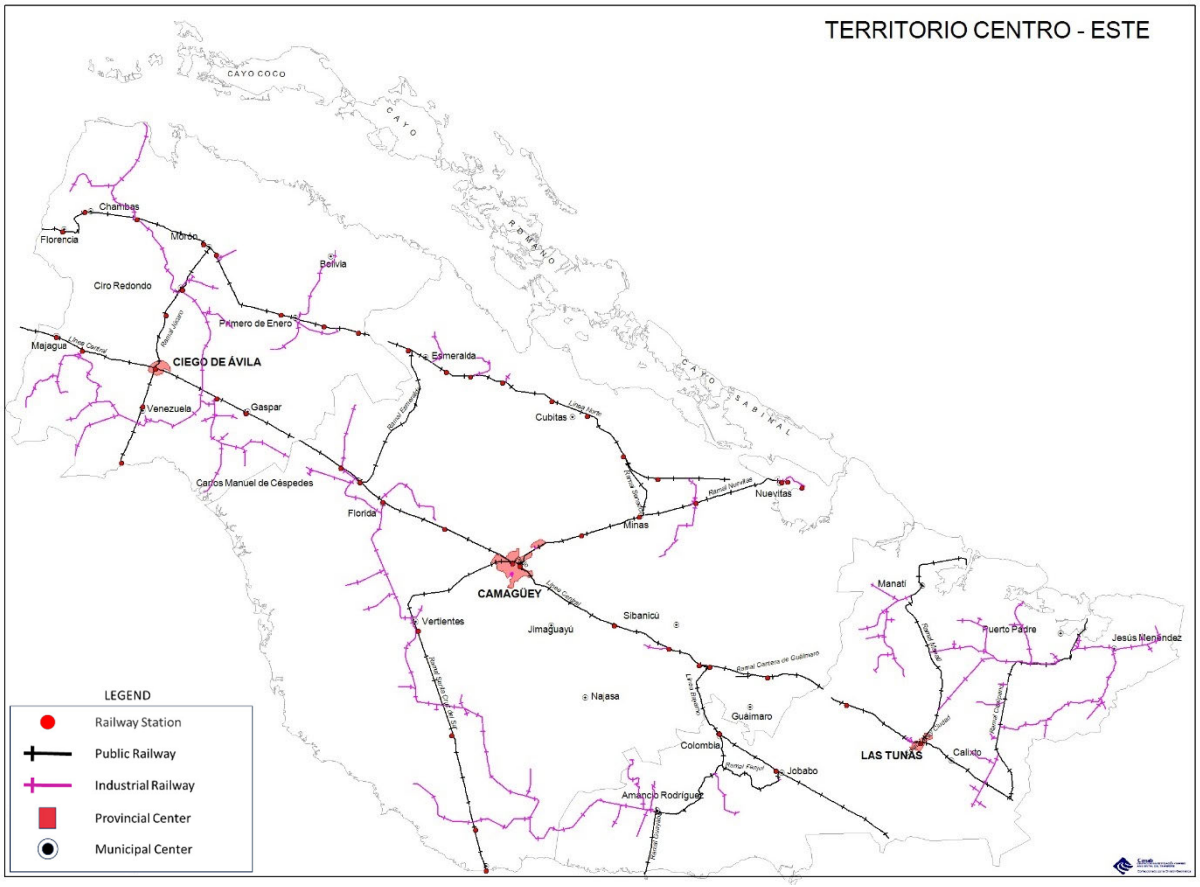
Source: Data from CIMAB

Figure 4.4.2 Cuban Railway Network (Western Railway)



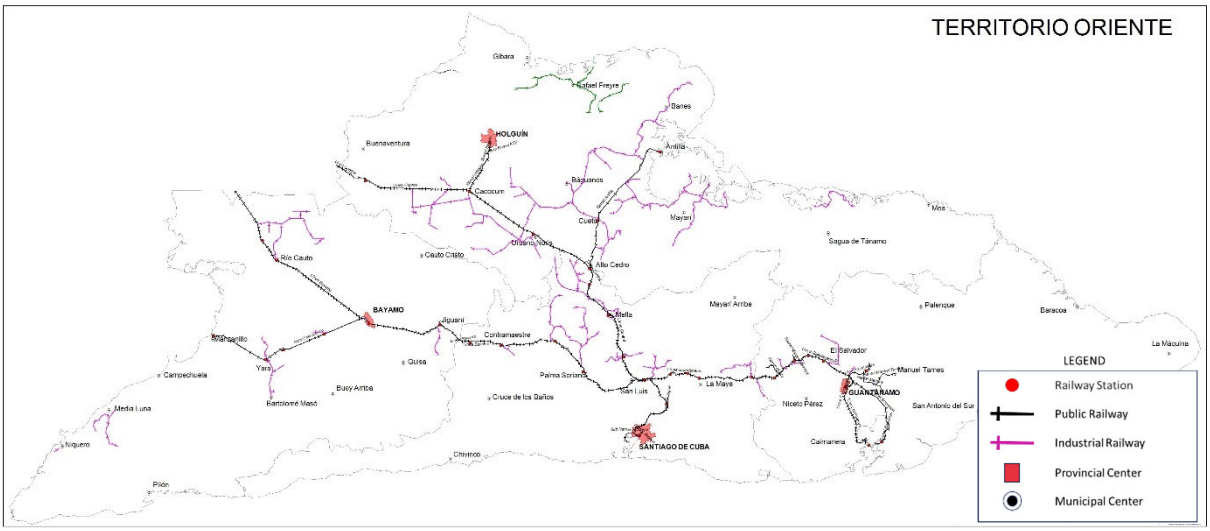
Source: Data from CIMAB

Figure 4.4.3 Cuban Railway Network (Central Railway)



Source: Data from CIMAB

Figure 4.4.4 Cuban Railway Network (Central East Railway)



Source: Data from CIMAB

Figure 4.4.5 Cuban Railway Network (Eastern Railway)

Table 4.4.1 Railway Line Categories

Category	Parameters			
	Economic/social importance of lines	Max. train speed km/h	Net annual traffic mil/ton/km	Trains/day
I	Major 1435mm gauge lines of national importance; mainline linking other lines or branches	100 or more	5 or more	20 or more
II	Major 1435mm gauge lines of regional importance and alternative routes	100	3 ~ 5	10 or more
III	Secondary lines of any gauge, regional or local importance, handling various types of freight and/or passengers.	80	1~3	Up to 10
IV	Secondary lines of any gauge, of local importance, plus lines connecting stations.	60	Less than 1	Up to 10

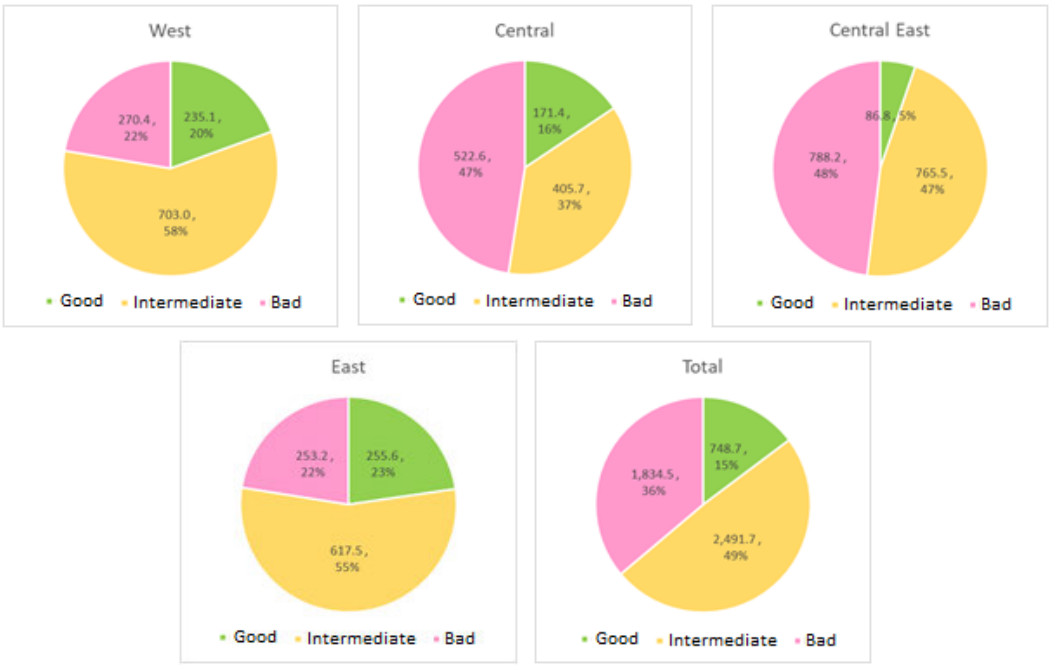
Source: NC 249:2003/UFC

4.4.2 Track condition

(1) General conditions

The existing track evaluated by UFC is categorized into three conditions – good, intermediate and bad – as shown in Figure 4.4.7 (public lines) and in Figure 4.4.7 (industrial lines). Among public lines, 15% are categorized as good condition, 49% as intermediate and 36% as bad.

Track condition varies by region, with the track in the central and central east regions ranked as relatively bad (47% for the central and 48% for the central east region). Conditions in the west and east regions are better than those in other regions, with 22% of tracks in bad condition in both regions. From these top-line statistics, it is clear that priority to increase the efficiency of train operation should be given to rehabilitating tracks in the central and central east regions.

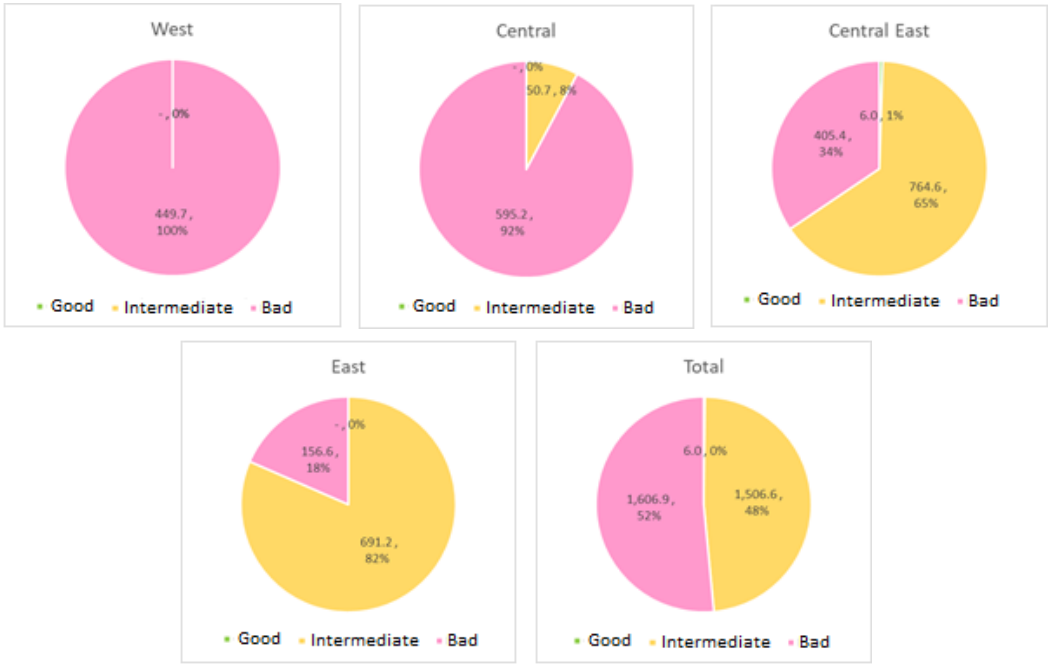


Source: UFC

Figure 4.4.6 Track condition (km, public lines)

JICA study team conducted a visual inspection of the Central Line track from Havana Central station to Matanzas. In this section, P50 welded long rail and PC sleepers with J2 type fastening system are used and ballast is well supplied and maintained. However, defects were found along most of the section, notably bent and buckled rails (plural sun kinks). It is recommended that rail conditions be checked regularly to find the causes of this problem.

On the industrial lines, almost no track is in good condition, as shown in Figure 4.4.7. Conditions in the west and central regions are uniformly bad. Conditions in the east and central east regions are in relatively good condition, but almost no track is in good condition. Industrial lines are used for sugarcane transport in the harvest season and also for local transportation. In this regard, procurement of rail buses under the Biran project is ongoing. Considering the importance of local community transport, special investment in rehabilitating the industrial lines can be considered.



Source: UFC

Figure 4.4.7 Industrial Lines Track Condition (km)

Central Line track

Mariel Line track

Source: JICA Study Team

Figure 4.4.8 Track of Central Line and Mariel Line

(2) Rail

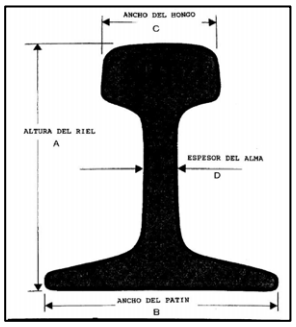
As shown in Table 4.4.2, many types of rails have been used in Cuba. This could be an obstacle to doing efficient rail maintenance. The newest rails are Russian-made, made to the Russian GOST standard.

Table 4.4.2 Rail Dimensions

Indicator	Unit	P50	P43	P38	115	100	85	80	75	70	65	60	55
Weight (p)	kg/m	51.63	44.65	38.42	56.85	49.90	42.25	39.70	37.30	34.80	32.32	29.75	27.25
Height (H)	mm	152	140	135	168.3	152.2	131.8	127	122.2	117.5	112.7	108	103.1
Head width (c)	mm	72	70	68	69.1	68.3	65.1	63.5	62.7	61.9	35.7	34.9	57.2
Base width (B)	mm	132	114	114	139.7	136.5	131.8	127	122.2	117.5	112.7	108	103.1
Web width (d)	mm	16	14.5	13	15.9	14.3	14.3	13.9	13.5	13.1	12.7	12.3	11.9
I (vertical moment)	cm4	2018	1489	1223	2738	2044	1272	1113	960	835	709.5	613.5	509
W (Section modulus)	cm3	286	217	180.3	361	292	216.5	182	164	149.2	126.2	114.7	100
S (total area)	cm2	65.9	57	49.1	72.6	64.2	53.8	50.6	47.65	44.45	41.2	38	34.75
B/H		0.868	0.814	0.844	0.833	0.901	1.000	1.000	1.000	1.000	1.000	1.00	1.00
I/p		39.08	33.35	31.81	48.16	40.96	30.11	28.04	25.74	23.99	21.95	20.62	18.68

Note: Pounds per yard (lb/yd) x 0.496 = kilograms per meter (kg / m) and kg / m / 2,016 = lb / yd.
Example: Lane 100 lb/yd / 2.016 = 49.60 kg / m, which means an equivalent weight in the P-50 but not in their chemical composition profile.
Source: UFC Track Maintenance Manual

UFC has been making an effort to improve track conditions by replacing existing rails with long welded rails to remove rail joints on Category I (Central line) tracks. Rails used for the Central Line (Category I) are mainly P50. When the P50 rails are placed, long welded rail (LWR) work is done, and sleepers and fastening systems are renewed. As LWR length is limited to 300m, continuous welded rail (CWR) has not yet been applied.



Note: A: rail height; B: base width; C: head width; D: web width
Source: UFC Track Maintenance Manual

Figure 4.4.9 Rail Cross-section

Rail welding work is mainly done by SOLCAR at its welding workshop is located near Placetas station on the Central Line. SOLCAR's rail welding is mechanized using machines imported from Russia and Ukraine. It has two rail welding machines, one installed in 1985, the other in 2008. The older one has not been working recently due to a lack of spare parts. SOLCAR's welding uses the flash-butt method, and it has a capacity of 50 km per year.

Source: JICA Study Team

Figure 4.4.10 Rail Welding Line

The condition of the new rail stock is good, as shown in Figure 4.4.11. However, the condition of recycled rail stock is not very good.

LWR transport and installation work is also done by SOLCAR. Welded 300 m long rails are transported by special wagons, as shown in Figure 4.4.12. A set of 24 flat wagons and a rail unloading car are used to transport the long-welded rails. SOLCAR has 2 trainsets and 3 locomotives.

New Rail Stock **Recycled Rail Stock**

Source: JICA Study Team

Figure 4.4.11 Rail Stock

SOLCAR has other heavy machinery to support track works:

- Tamping machine: 4
- Ballast regulator: 5
- Ballast cleaner: 1 (out of order as of Feb. 2019)
- Cleaning machine for the face of the slope: 2
- Cleaning machine for ditch: 3
- Bulldozer: 4
- Folk lift: 1
- Ultrasonic rail flaw detector: 1

However, SOLCAR has no track inspection car.

Long rail unloading machine

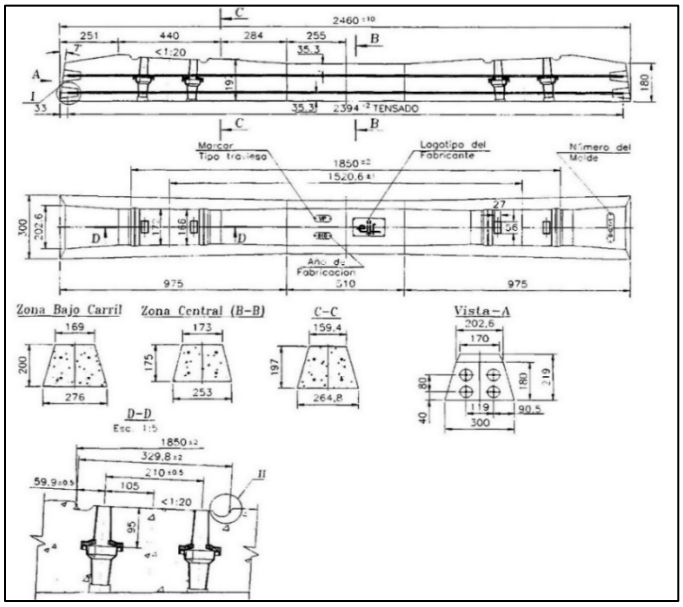
Wagons for long rail

Source: JICA Study Team

Figure 4.4.12 Special Wagons and Long Rail Unloading Car

(3) Sleepers

Rail sleepers are designed and produced by Empresa Industrial de Instalaciones Fijas (EIIF). Figure 4.4.13 shows the design of a concrete sleeper.



Source: EIIF/UFC

Figure 4.4.13 Concrete Sleeper

PC sleeper mold with tension bar before concreting

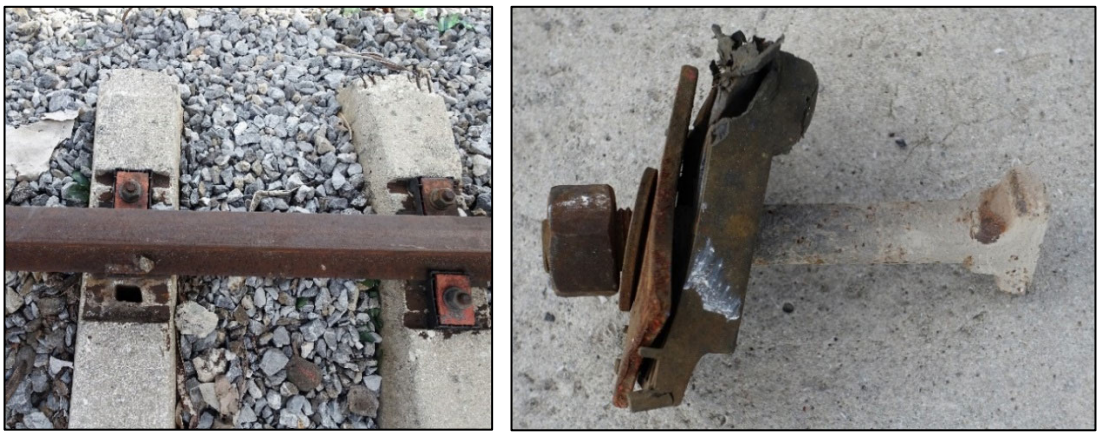
Source: JICA Study Team at EIIF and CIMAB

Figure 4.4.14 PC Sleeper Production Facility (MITRANS Minister's visit)

The current level of sleeper production may not be enough to maintain the current tracks to a required condition. A stable supply of sleepers is one of the priority strategies to strengthen the railway sector.

A T-shaped bolt, used for fastening the rail, is inserted into a rectangular hole and turned 90 degrees. With this, the T edge of the bolt is fixed to the sleeper and tensioned to secure the fastening system.

Proper control of tensioning work in tightening bolts is necessary to properly maintain track condition. But as EIIF's track maintenance teams do not have torque control tools, so they often faste the bolts too tight (or do not tight them tight enough, which also can cause safety issues). This can lead to the deterioration of the fastening system, as shown in Figure 4.4.15.

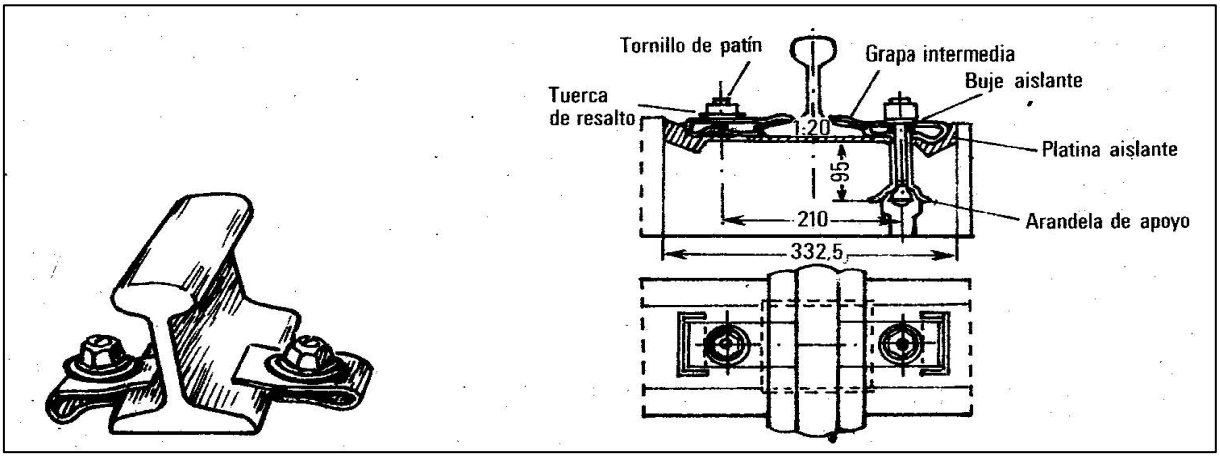


Source: JICA Study Team

Figure 4.4.15 Broken fastening system

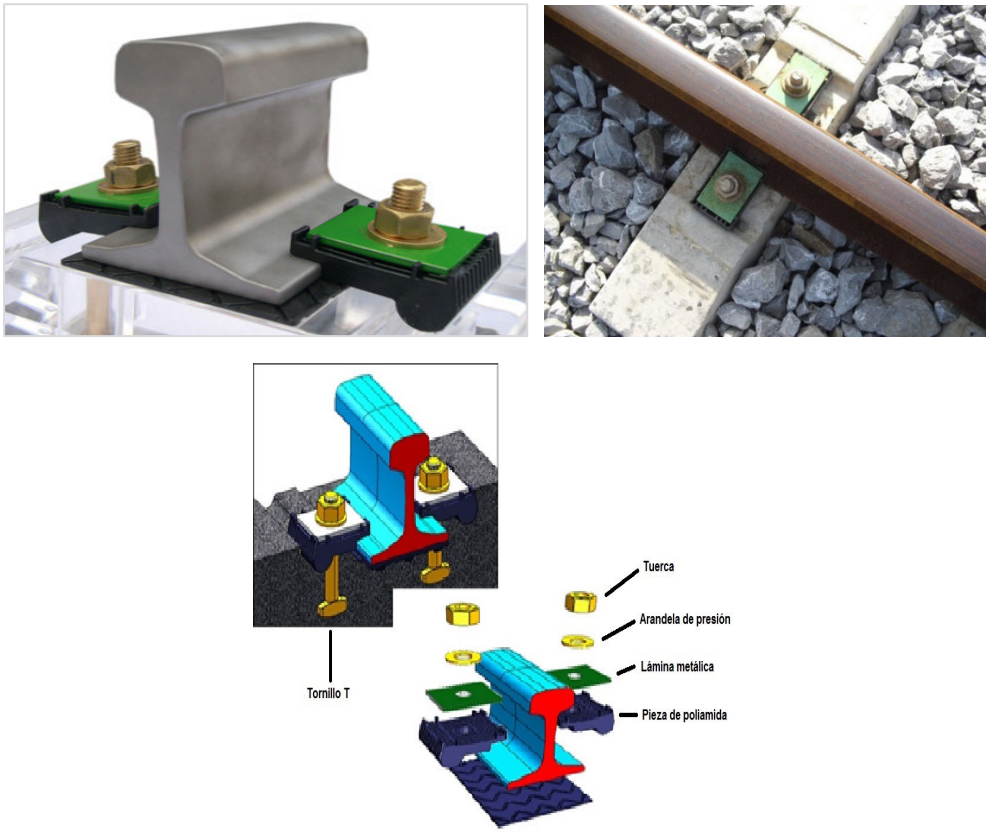
(4) Fastening System

The Type RN fastening system, widely used in Cuba's railways, had many problems. Therefore, UFC has been replacing it with Type J2, which is now used for all new construction and replacement works. The J2 fastening system was used on the recently built Mariel Line and track improvements on the Central Line. The J2 system is a Spanish technology, so the production line was imported from Spain.



Source: UFC

Figure 4.4.16 RN Type Fastening System



Source: UFC

Figure 4.4.17 J2 Type Fastening System

(5) Ballast

Cuba's ballast specification follows NC197: 2004, which is classified into types 1, 2, and 3: Type 1 is for Category I lines; Type 2 is for Category II, and III lines; and Type 3 is for Category IV lines. Ballast quality is shown in Table 4.4.3 and Table 4.4.4. Table 4.4.5 shows a list of the main quarries, including the name, location, kind of stone, and compressive strength.

Ballast for the Mariel line was supplied from the quarry at Cargadero La Molina. The access line to the quarry is connected to the Mariel line at La Molina station.

Table 4.4.3 Ballast of 19.1 to 38.1 mm

Quality Index	Unit of measure	Ballast types		
		1	2	3
Minimum compressive strength (dry)	MPa (Kgf/m²)	80 (800)	60 (600)	40 (400)
Minimum compression strength (saturated)	MPa (Kgf/m²)	70-80 (700)–(800)	50 - 60 (500) - (600)	35 – 40 (350)–(400)
Granulometry. Sieve (mm) 50.8 38.1 25.4 19.1 9.52	% past	 100 85 to 100 20 to 60 0 to 25 0 to 8	 100 85 to 100 20 to 60 0 to 25 0 to 8	 100 85 to 100 20 to 60 0 to 25 0 to 8
Flat and elongated particles	%	20 to 25	15 to 20	15 to 20
Abrasion	%	20 to 25	28 - 35	28 - 35
Clay lumps	%	0.25 (max)	0.25 (max)	0.25 (max)
grindability	%	15	15 to 19	15 to 25
Percent passing the sieve 0.074 (No. 200)	%	1.0 (max)	1.0 (max)	1.0 (max)

Source: NC 197:2004/UFC

Table 4.4.4 Ballast of 38.1 to 63.5 mm

Quality Index	Unit of measure	Ballast types		
		1	2	3
Minimum compressive strength (dry)	MPa (Kgf/cm²)	8 (800)	6 (600)	40 (400)
Minimum compression (saturated) Resistance	MPa (Kgf/cm²)	70-80 (700)-(800)	50 - 60 (500) - (600)	35-40 (350)-(400)
Granulometry. Sieve (mm) 76.2 63.5 50.8 38.1 19.1 0,149	% past	 95 to 100 85 to 100 50 to 80 0 to 25 0 to 8 0 to 1.	 95 to 100 85 to 100 50 to 80 0 to 25 0 to 8 0 to 1.5	 95 to 100 85 to 100 50 to 80 0 to 25 0 to 8 0 to 1.
Flat and elongated particles	%	20 to 25	15 -20	15 -25
Abrasion	%	20 to 25	28 - 35	28 - 35
Clay lumps	%	0.25 (max)	0.25 (max)	0.25 (max)
Grindability	%	15	15 to 19	15 to 25
Percent passing the sieve 0.074 (No. 200)	%	1.0 (max)	1.0 (max)	1.0 (max)

Source: NC 197:2004/UFC

Table 4.4.5 List of Quarries

Name of Site		Name of Quarry	Group	Compressive strength (Kgf/cm^2)
Pinar del Rio	Peña site	Reynaldo Mora	Siliciified Limestone	510-644
Pinar del Rio	La Reforma	Elpidio Berovides	Limestone	560-600
Habana	La Molina	La Monila*	Limestone	6
Matanzas	Coliseum	Antonio Maceo	Limestone dolomitizada	490-510
Matanzas	Alacaranes	December 5th*	Dolomite limestone Calcarea	400-800
Matanzas		The mountain**		up to 600
Cienfuegos	Arriete	Santiago Ramirez	Igneous andesitic porphyry	700-1,000
Villa Clara	El Purio	Mariano Perez	Limestone	770-820
Ciego de Avilla	Jicotea	Jose San Mateo	Porphyrite Dacito ne Igneous andesitic	1,360
Ciego de Avilla		19**		up to 600
Camaguey	Guaimaro	Palp Seco***	Basaltic andesite igneous	1,100-1,960
Camaguey	Sierra de Cubitas	Viet Nam Heroic Limestone		440-700
Camaguey	La Mulata	Luis A. Turcios Lima*	Igneous Basalt	1,100-1,800
Camaguey	Flor de Mayo ayol	Jesus Suarez Gayol	Igneous	1,100
Camaguey		The Sainti**		upto 600
Las Tunas	Cañada Honda	Jose Rodriguez	Limestone	400-600
Las Tunas		The vines**		upto 600
Granma	El Cocoa	Ramon Viamontes	Caliza	530-750
Santiago de Cuba	Los Guaos	Los Guaos	Ingneous andesitic porphyry	650-1,200
Santiago de Cuba		Julio Antonio Melda		upto 500

Note:
* Non activated quarry
** AZCUBA quarry
*** MITRANS quarry
Source: NC197:2004/UFC

4.4.3 Civil Structures

(1) Bridges

Cuba has 2,527 railway bridges, out of which approximately 1,408 are steel bridges, approximately 1,087 are concrete bridges, and 17 are wooden. 40% of them are in intermediate or poor condition, mainly in the industrial lines.

Source: JICA Study Team

Figure 4.4.18 Deteriorated Bridges

(2) Cut and Bank

Construction and maintenance of civil structures (including bridges, but not track ballast) is handled by enterprises of the Ministry of Construction (MICONS) sector. Design standards for work such as embankments and cuttings are according to NC 1237:2018. Cleaning ditches and embankment slopes/cuttings is done by enterprises integrating UFC.

4.4.4 Safety Systems

(1) Signal and Telecommunications System

1) Telecommunications system

Communication between dispatchers, locomotive drivers, and station train operators is by VHF radio (analog communication).

Existing system **New system: GSM-R**

Source: JICA Study Team

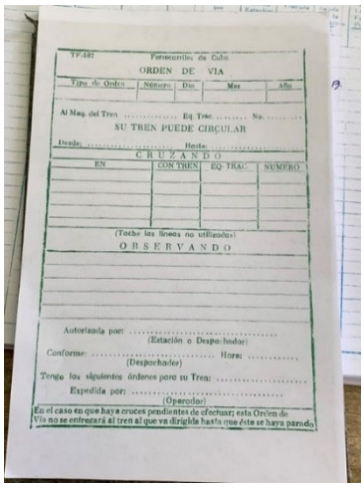
Figure 4.4.19 Train Operation Radio at Railway Station

A new GSM-R telecom system will be installed in Cuba's railway network. The GSM-R system consists of optical cables for mainline telecoms to connect GSM-R base stations and GSM-R radio stations. GSM-R terminal equipment (radio) is installed in locomotives, stations, and train operation dispatch offices.

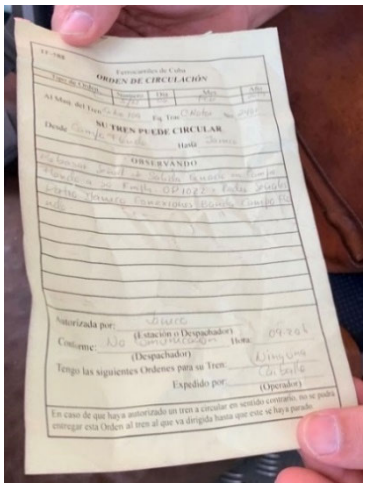
The first stage of this project should have been completed in 2019, followed by phased installation on the remaining rail lines.

(2) Block system

The block system on Cuba's railways is a supplemental system using paper forms as tokens. Several kinds of forms are used for this purpose, and two types are shown in Figure 4.4.20. Some train operation information, such as track conditions and slow-speed operation sections, is shown in these forms. Station train operators issue forms after confirming by radio that the block is clear. Station train operators then hand these forms to the train drivers using the Y-shaped tool shown in Figure 4.4.20. With this form in hand, the driver can then drive the train to the next station.



Blank paper form



Filled paper form

Handling tool

Source: JICA Study Team at Placeta station

Figure 4.4.20 Paper Token

(3) Signal System

For the 22 Central Line stations between Enlace Gas (2.4 km from Havana Central Station) and Piedra (341.7 km from Havana Central Station), centralized point control and signal (centralization) systems have been installed; 160 V electric switch, light signals, and track circuits are used. All the equipment is imported from Russia, using an electromagnetic relay to control the equipment.

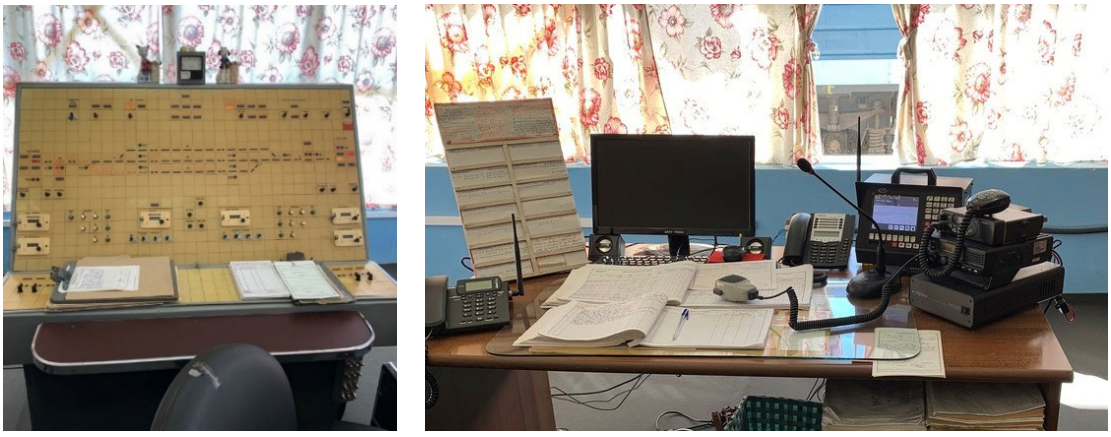
Two types of control systems are used: ZTs-12 and BMRTs-13: ZTs-12, is used for small-scale stations having 15 or fewer connections, while BMRTs-13 is used for large stations having more than 15 connections. Control consoles are installed in each station, and the formation of routes and signals at the stations are controlled via this control console.

The 22 stations equipped with this system are listed in Table 4.4.6. A typical dispatcher's desk is shown in Figure 4.4.21.

Table 4.4.6 Signal Systems Installed at 22 Central Line Stations

STATIONS	LOCATION kilometer	SYSTEM INSTALLED
Enlace del Gas	2.4	BMRTs-13
Cambute	8.1	BMRTs-13
Campo Florido	26.6	ZTs-12
Jaruco	43.1	ZTs-12
Aguacate	62.0	ZTs-12
Mocha	75.8	ZTs-12
Matanzas	89.2	BMRTs-13
Limonar	109.3	ZTs-12
Coliseo	123.7	ZTs-12
Jovellanos	140.7	BMRTs-13
Quintana	153.4	ZTs-12
Colón	169.8	BMRTs-13
Los Arabos	192.1	ZTs-12
Cascajal	212.0	ZTs-12
Cervecería	229.0	ZTs-12
Santo Domingo	242.8	BMRTs-13
Esperanza	264.6	ZTs-12
Santa Clara (Patio Occidental)	278.3	
Cenizas	289.0	ZTs-12
Falcón	301.8	ZTs-12
Calabazas	329.9	ZTs-12
Piedra	341.7	ZTs-12

Source: UFC



Source: JICA Study Team

Figure 4.4.21 Dispatcher's Desk at Signal System Station

A semi-automatic block (BSA) operating system is used to control/regulate the movement of trains on the track section between two neighboring stations (see Table 4.4.6).

No signals along the track sections are used, and no onboard signal is used either. The procedure of the locking is as follows: by telephone, station operators send each other the signal consent, the lock signal

of the track section, and the arrival signal of the whole train to the set position. All these signals are exchanged in different directions between the stations using electrical signals of 55V or 110V DC. This system is installed from Cambute station in Havana to Esperanza in Villa Clara, as well as the Cenizas-Falcon and Calabazas-Piedra sections in the provinces of Villa Clara and Sancti-Spiritus. The total length of BSA in operation is 233.4 km. This system does not include Automatic Train Stop (ATS).

(4) Level Crossing Security Systems

Many railway level crossings are unprotected, with only warning signal indicators to stop motor vehicles from crossing. There are 2,065 level crossings on the existing railway network across the country, and only 92, 4.4% of the total, are protected; 64 of them are on the Central Line.

Most current protection systems are Soviet-made, while some are Spanish and Polish. Different types of level crossing protection systems are installed, including:

- Lighting-sound (automatic),
- Lighting-sound (manual), and
- Lighting-sound with manual barriers.

Currently, 74 modern (Spanish-made) electronic level crossing protection systems are being installed along the Central Line.

The design standard for level crossings is according to NC 196:

- NC 196-1:2004; Part 1: Geometric design
- NC 196-2:2004; Part 2: Visibility requirements in railway-highway grade crossings
- NC 196-3:2006; Part 3: Classification/selection of railway-highway grade crossing protection system
- NC 196-4:2009; Part 4: Level crossing protection systems installation requirements and approach section calculation
- NC 196-5:2003; Part 5: Paint indications for railway highway grade crossings protection devices.

4.4.5 Stations

(1) Havana Central Station

Havana Central Station, built in 1912, is the terminal of the Central and West lines, located in the old town of Havana near the port. The 25-ha station area has various rail facilities; a CCD loading/ unloading center (Centro de Carga y Descarga) along with La Coubre station and rail operations facilities.

The station is now undergoing renovation of the main station building and other facilities, including telecoms, electric power, and water supply. The CCD will be relocated to a new place. Renovation works include station plaza development and parking to provide better inter-modality between rail and road transport users. During renovations, the station building is closed, and trains terminate at Coubre Station, next to Havana Central Station.

Source: JICA Study Team

Figure 4.4.22 Havana Central Station Under Renovation

Existing Station **Planned Station Renewal (Final Stage)**

Source: UFC

Figure 4.4.23 Havana Central Station

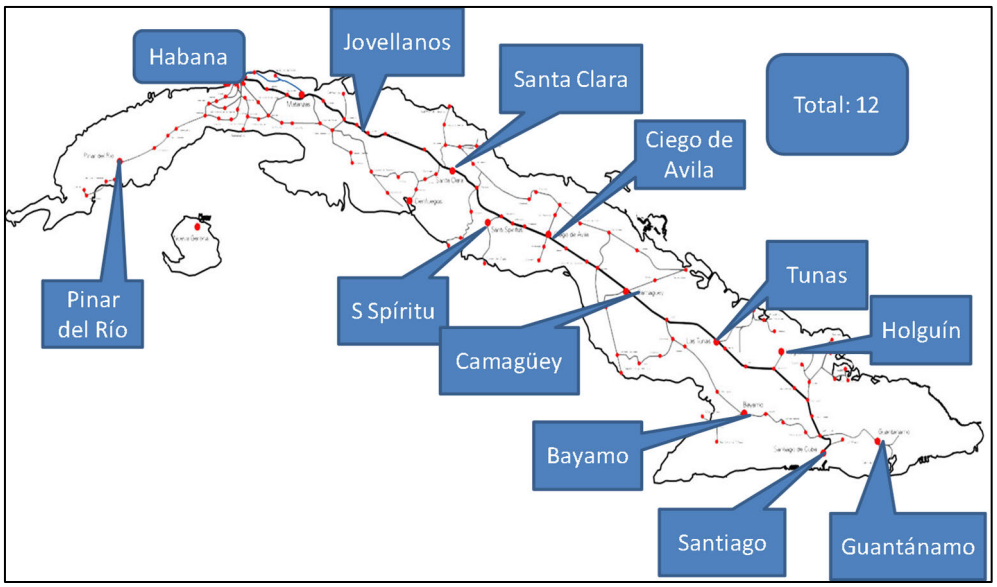
(2) CCDs (Loading/unloading Centers)

Table 4.4.7 lists Cuba's 12 CCDs by province & rail enterprise. Loading/unloading of general cargo is handled at CCDs, while sugarcane is handled at sugar mill stations along the industrial railway lines.

Table 4.4.7 Relation and subordination of CCDs

No.	CCD	Province	Regional Enterprise	UEB (FC. Territoriales)
1	Pinar del Rio	Pinar del Rio	Ferrocarriles de Occidente	Pinar del Rio
2	Estación Central Carga	Havana		Habana
3	Jovellanos	Matanzas		Matanzas
4	Santa Clara	Villa Clara	Ferrocarriles del Centro	Villa Clara
5	Sancti Spiritus	S. Spiritus		Sancti Spiritus
6	Ciego de Avila	Ciego de Avila	Ferrocarriles de Centro Este	Ciego de Avila
7	Camagüey	Camagüey		Camagüey
8	Las Tunas	Las Tunas		Las Tunas
9	Holguín	Holguín	Ferrocarriles de Oriente	Holguín
10	Bayamo	Granma		Granma
11	Santiago de Cuba	Santiago de Cuba		Santiago de Cuba
12	Guantánamo	Guantánamo		Guantánamo

Source: Determinación de las necesidades de mecanización en los centros de carga y descarga del ferrocarril/Cetra



Source: UFC

Figure 4.4.24 Location of CCDs

1) CCD Havana

CCD Havana, located next to Havana Central Station, is a UEB of EFOC. But the cargo station in Havana is Bustamante, which is about 2 km from CCD Havana. Boxcar trains arriving at Bustamante are transferred to Havana Central CCD by CCD's locomotive. Container trains are sent to CCD Arenal.

Eleven tracks are used for loading and unloading cargo at CCD Havana. Two of these are inside the warehouse. One track in the warehouse is exclusively used by Empresa Mayorista Provincial de Alimentos (EMPA), enterprise of MINCIN sector. Main cargos handled at CCD Havana are salt, sugar, rice, and fertilizer. The main clients are Techno Sugar, ACEN, MINCIN sector enterprises (for basic food), and MIO enterprise (soya).

Arrival information of freight trains is informed to CCD Havana 24 hours in advance. One train typically consists of 10 to 12 wagons. A total of 1,400-1,600 tons of cargo per day is handled by CCD Havana. Handling capacity is 600 tons for unloading and 1,200 ton for loading by 8 teams, each with 16 workers.

Cargo loading/unloading is done directly between rail wagons and trucks without intermediate storage facilities. When the arrival of a truck is delayed, arriving cargo is kept in the railway wagon.

2) CCD Santa Clara

Two tracks are branched to CCD Santa Clara from Santa Clara Station, one track for container trains, the other for boxcars. Another track serves a cement silo next to the CCD, but this track is not part of CCD Santa Clara. The effective container line length is about 450m, and about 300m for the boxcar line.

One reach-stacker is available at this CCD. It belongs to Empresa Nacional de Operaciones de Contenedores, Transcontenedores (ENOC), which uses it to transfer containers directly from train to truck. Note that the CCD has no space for the storage of containers or general cargo.

When trains arrive at the CCD, cargo owners are informed, who then arrange trucks for transporting their cargo. General cargo (from boxcars) is transferred to trucks by CCD staff (27 staff, working two shifts.

Source : JICA Study Team

Figure 4.4.25 Santa Clara CCD

4.4.6 Rolling Stock

At of 2021, UFC had 539 locomotives, 13,468 freight cars, 99 motor cars, and 235 passenger cars, all maintained by 7 main workshops and a total of 108 workshops of different sizes. Table 4.4.8 shows the general characteristics of locomotives and Table 4.4.9 the workshops inventory.

The main problem with rolling stock is the low rate of operation caused by the lack of spare parts. Plus, there are too many kinds of locomotives of different ages procured from different manufacturers. Many locomotives are so old that spare parts are no longer available. The low capacity of the workshops is another major problem, mainly due to outdated machinery to repair the equipment or produce spare parts. Note that locomotives recently imported from China have about 40% availability, mainly due to the difficulty of procuring spare parts.

Table 4.4.8 General Characteristics of Locomotives

LOCOMOTORA	U/M	MLW	DF7G-C	C-30-7	GM-1200	TGM-KT	TEM-4	TEM-2
1. LOCOMOTORA INV.								
1.1 Original fablication country		Canadá	CHINA	EE.UU	EE.UU	URSS	URSS	URSS
1.2 Model		MX-624	DF7G-C	C-30	GMD	TGM-8K	TEM-4	TEM-2
1.3 Power	H.P	2600	2466,5	3000	1200	800	1000	1030
1.4 Driving wheel arrange	A.A.R	CO-CO	CO-CO	CO-CO	CO-CO	BO-BO	CO-CO	CO-CO
1.5 Weight	TON	112	123	105	100	78	120	116
1.6 Axle load	TON	19	20.5	24	20.4	19	20	19.3
1.7 Gear assembly		79 / 24	60 / 16	79 / 24	15/62		75 / 17	75 / 17
1.8 Maximum speed	Km/h	135	120	105	102	60	60	57
1.9 Constant minimum speed	Km/h	14,8	18	19	11.9	6	9	9
1.10 Minimun radius of curve	M	64	80	83	63	60	80	80
2. DIMENSIONES								
2.1 Maximum height	M	4.21	4.77	4.72	4.65	4.5	4,66	4.44
2.2 Maximum width	M	3.07	3.30	3.13	3.12	3.2	3.08	3.12
2.3 Length between coupler	M	16.58	18.80	20.50	16.76	14.29	17.28	17.28

LOCOMOTORA	U/M	TEM-15	DF7K-C	TGM-4	TGM-6D	TGM-8	TU-7E	GM-900
1. LOCOMOTORA INV.								
1.1 Original fablication country		URSS	CHINA	URSS	URSS	URSS	URSS	EE.UU
1.2 Model		TEM-15	DF7K-C	TGM-4K	TGM-6D	TGM-8K	TU-7E	GM-900
1.3 Power	H.P	1030	1400	700	900	800	400	900
1.4 Driving wheel arrange	A.A.R	CO-CO	BO-BO	BO-BO	BO-BO	BO-BO	BO-BO	BO-BO
1.5 Weight	TON	116	76	68	78	78	45.5	72
1.6 Axle load	TON	19.3	19	17	19	19	6	18
1.7 Gear assembly		75 / 17	60 / 16					60 / 16
1.8 Maximum speed	Km/h	57	90	60	90	60	60	124
1.9 Constant minimum speed	Km/h	9	13	6	15	6	6	13
1.10 Minimun radius of curve	M	80	80	60	60	60	60	58,82
2. DIMENSIONES								
2.1 Maximum height	M	4.44	46.80	4.42	4.5	4.5	3.55	3,25
2.2 Maximum width	M	3.12	3.14	3.13	3.2	3.2	2.45	2.79
2.3 Length between coupler	M	17.28	14.10	12.55	14.29	14.29	9.4	13.11

Source: UFC

Table 4.4.9 Numbers of Rolling Stock and Workshops

Indicator	Total
Workshop	
for locomotive	1
for wagon	4
Special equipment	1
Mixed	22
Inspection	78
Locomotives	
Diesel-electric	195
Diesel-hydraulic	354
Electric	2
Steam locomotive	11
Passenger cars	235
Motor car	99
Freight wagons	
Boxcars	1,100
Container wagon	672
Tanker for fuel	718
Tanker for cement	288
Dumping wagon	165
Open wagon for sand	187
Hopper	168
Tanker for alcohol	51
Tanker for honey	349
Wagon for sugar	881
Stock car	4,106

Source: UFC

4.4.7 Workshops

There are 108 repair workshops, 3 of which are classified as main workshops for heavy repair work, 21 as principal workshops for general/medium repair work, and 79 as secondary workshops for light repair and inspection.

The main workshops are:

1) Cienaga workshop (UEB): Havana; for locomotives
2) Luyano workshop (UEB): Havana; passenger cars
3) Camaguey workshop (UEB)

The principal workshops for repair work are listed below.

1) Workshop Pinar del Río (Pinar del Río)
2) Workshop November 30 (Artemisa)
3) Camilo Cienfuegos (Mayabeque)
4) Mariel railway workshop, Angosta (Artemisa)
5) Sergio Gonzalez Colon (Matanzas)
6) Matanzas workshop (Matanzas)
7) Cruces workshop (Cienfuegos)
8) Cienfuegos workshop (Cienfuegos)
9) Workshop Hector Rodriguez, Sitiecito (Villa Clara)
10) Ciro Redondo workshop (Santa Clara)
11) Workshop Melanio Hdez. Tuinicú (S. Spíritus)
12) Ciro Redondo workshop, Pina (C.Ávila)
13) Morón workshop (C. Ávila)
14) Workshop A. Guiteras (Las Tunas)
15) Grito de Yara workshop (Granma)
16) Workshop Jesús Suárez Gayol, Banes (Holguín)
17) Antilla workshop (Holguin)
18) Julio A. Mella workshop (Santiago de Cuba)
19) Santiago de Cuba Workshop (Santiago de Cuba)
20) Guantanamo workshop (Guantánamo)
21) Vanguardia Proletaria workshop (Guantánamo)

The workshops have different kinds of machinery, most of which are obsolete or deteriorated and not in working condition. In the workshops, of 1,613 machine tools, only 683 are working; 613 are not working due to technical problems and/or lack of spare parts for repair; 317 can be used but with limited performance. The condition of the machinery is shown in Table 4.4.10.

Table 4.4.10 Quantity and technical condition of workshop equipment

Equipment with quantity	Operating	Not working	Low quality
Cutting equipment: 504	35.9%	36.9%	27.9%
Forming equipment: 177	37.3%	32.8%	27.9%
Lifting equipment: 498	37.4%	47.6%	15.1%
Welding equipment: 225	59.6%	30.2%	10.2%
Compressors: 118	67.8%	22.0%	10.2%
Woodwork equipment: 91	39.6%	41.8%	18.9%

Source: UFC

4.4.8 Fare system

(1) Passenger Fares

Table 4.4.11, Table 4.4.12 and Table 4.4.13 show passenger fares for national and local train services. Fares are based on travel distance, and fare levels are set at a reasonable and affordable level. For example, when developing this report it costed 30 CUP for the 835.5 km long-distance journey between Havana Central and Santiago de Cuba. It should be noted that this fare structure were updated following the currency unification in January 2021.

Table 4.4.11 National Train Passenger Fare

TREN 03-04: HABANA-SANTIAGO DE CUBA. SERVICIO REGULAR. PRIMERA CLASE . LINEA CENTRAL

MINISTERIO DE TRANSPORTE
UNION DE FERROCARRILES DE CUBA
TARIFA OFICIAL DE PASAJE
PARA LA TRANSPORTACION DE PASAJETROS POR FERROCARRIL
ESTACION CENTRAL DE FERROCARRIL - EGIDO Y ARSENAL - LA HABANA

ORIGEN			DESTINOS															
ESTACIONES	COD.	B	KMS.	E.C.	JRO	MTZ	SCL	GYS	CAV	FLD	CMG	LTU	CCM	SGM	ACE	JAM	CMB	SGO
ESTACION CENTRAL	1	A		E.C.	RESOLUCION: DCP-193-94													
		M	0.0															
JARUCO	4	A		2.00	JRO													
		M	43.1	2.00		46.1	235.2	305.2	383.5	449.6	485.3	600.4	672.7	697.3	718.0	736.1	763.0	792.4
MATANZAS	8	A		2.00	2.00	MTZ												
		M	89.2	2.00	2.00		189.1	259.1	337.4	403.5	439.2	554.3	626.6	651.2	671.9	690.0	716.9	746.3
SANTA CLARA	209	A		10.00	8.50	7.00	SCL											
		M	278.3	5.00	4.00	3.50		70.0	148.3	214.4	250.1	365.2	437.5	462.1	482.8	500.9	527.8	557.2
GUAYOS	217	A		12.50	11.00	9.50	2.50	GYS										
		M	348.3	6.00	5.50	4.50	2.00		78.3	144.4	180.1	295.2	367.5	392.1	412.8	430.9	457.8	487.2
CIEGO DE AVILA	402	A		15.50	14.00	12.00	5.50	3.00	CAV									
		M	426.6	7.50	7.00	6.00	2.50	2.00		66.1	101.8	216.9	289.2	313.8	334.5	352.6	379.5	408.9
FLORIDA	411	A		17.50	16.00	14.50	8.00	5.00	2.50	FLD								
		M	492.7	8.50	7.50	7.00	4.00	2.50	2.00		35.7	150.8	223.1	247.7	268.4	286.5	313.4	342.8
CAMAGUEY	417	A		19.00	17.50	16.00	9.00	6.50	3.50	2.00	CMG							
		M	528.4	9.50	8.50	8.00	4.50	3.00	2.00	2.00		115.1	187.4	651.2	232.7	250.8	277.7	307.1
LAS TUNAS	428	A		23.00	22.00	20.00	13.00	10.50	8.00	5.50	4.00	LTU						
		M	643.5	11.50	11.00	10.00	6.50	5.00	4.00	2.50	2.00		72.3	96.9	117.6	135.7	162.6	192.0
CACOCUM	608	A		26.00	24.00	22.50	15.50	13.00	10.50	8.00	6.50	2.50	CCM					
		M	715.8	13.00	12.00	11.00	7.50	6.50	5.00	4.00	3.00	2.00		24.6	45.3	63.4	90.3	119.7
SAN GERMAN	614	A		26.50	25.00	23.50	16.50	14.00	11.50	9.00	7.50	3.50	2.00	SGM				
		M	740.4	13.00	12.50	11.50	8.00	7.00	5.50	4.50	4.00	2.00	2.00		20.7	38.8	65.7	95.1
ALTO CEDRO	620	A		27.50	26.00	24.00	17.50	15.00	12.00	10.00	8.50	4.00	2.00	2.00	ACE			
		M	761.1	13.50	13.00	12.00	8.50	7.00	6.00	5.00	4.00	2.00	2.00	2.00		18.1	45.0	74.4
J. A. MELLA	622	A		28.00	26.50	25.00	18.00	15.50	12.50	10.50	9.00	5.00	2.00	2.00	2.00	JAM		
		M	779.2	14.00	13.50	12.50	9.00	7.50	6.00	5.00	4.50	2.50	2.00	2.00	2.00		26.9	56.3
COMBINADO	625	A		29.00	27.50	26.00	19.00	16.50	13.50	11.50	10.00	6.00	3.00	2.50	2.00	2.00	CMB	
		M	806.1	14.50	13.50	13.00	9.50	8.00	6.50	5.50	5.00	3.00	2.00	2.00	2.00	2.00		29.4
SANTIAGO DE CUBA	630	A		30.00	28.50	27.00	20.00	17.50	14.50	12.50	11.00	7.00	4.50	3.50	2.00	2.00	2.00	SGO
		M	835.5	15.00	14.00	13.50	10.00	8.50	7.00	6.00	5.50	3.50	2.00	2.00	2.00	2.00	2.00	

Source: UFC

Table 4.4.12 Local Train Passenger Fare

TREN : HABANA - LOS PALOS. SERVICIO INTERURBANO SEGUNDA CLASE CORTA DISTANCIA

MINISTERIO DE TRANSPORTE
UNION DE FERROCARRILES DE CUBA
TARIFA OFICINAL DE PASAJE
PARA LA TRANSPORTACION DE PASAJEROS POR FERROCARRIL
ESTACION CENTRAL DE FERROCARRIL - EGIDO Y ARSENAL - LA HABANA

ORIGEN			D E S T I N O S								
ESTACIONES	COD.	B	KMS.	EC	LUY	COT	SJO	GUI	SNL	VEG	PAL
ESTACION CENTRAL	1	A	0.0	EC	RESOLUCION: DCP-193-94						
		M									
LUYANO	120	A	3.4	0.40	LUY	14.9	30.2	49.8	62.7	73.0	80.7
		M		0.40							
COTORRO	128	A	18.3	0.55	0.45	COT	15.3	34.9	47.8	58.1	65.8
		M		0.40	0.40						
SAN JOSE	129	A	33.6	1.05	0.95	0.45	SJO	19.6	32.5	42.8	50.5
		M		0.55	0.50	0.40					
GUINES	98	A	53.2	1.65	1.55	1.10	0.60	GUI	12.9	23.2	30.9
		M		0.85	0.80	0.55	0.40				
SAN NICOLAS	100	A	66.1	2.05	1.95	1.50	1.00	0.40	SNL	10.3	18.0
		M		1.05	1.00	0.75	0.50	0.40			
VEGAS	102	A	76.4	2.35	2.25	1.80	1.35	0.70	0.40	VEG	7.7
		M		1.20	1.15	0.90	0.70	0.40	0.40		
LOS PALOS	104	A	84.1	2.60	2.50	2.05	1.55	0.95	0.55	0.40	PAL
		M		1.30	1.25	1.05	0.80	0.50	0.40	0.40	

Source: UFC

Table 4.4.13 Passenger Fare Mariel Line

TREN : HABANA - MARIEL SERVICIO INTERURBANO SEGUNDA CLASE MEDIA Y CORTA DISTANCIA

MINISTERIO DE TRANSPORTE
UNION DE FERROCARRILES DE CUBA
TARIFA OFICINAL DE PASAJE
ESTACION CENTRAL DE FERROCARRIL - EGIDO Y ARSENAL - LA HABANA

D E S T I N O S — TARIFA: 0.031

ORIGEN	COD.	B	EST.	19 DE NOV.	CIENAGA	C. DEP.	ALMEND.	ALMEND.	TOLEDO	222	EL CANO	AUTOPIS.	P.BRAVA	BAUTA	CAIMITO	GUANAJ.	ANGOSTA	TCM
			KMS.	1.1	2.0	2.9	5.6	11.3	14.3	14.4	18.5	20.2	24.6	30.4	37.3	46.4	65.0	67.7
19 DE NOVIEMBRE		A	1.1	19 DE NOV.	0.9	1.8	4.5	0.0	7.5	7.6	11.7	13.4	17.8	23.6	30.5	39.6	58.2	60.9
		M																
CIENAGA		A	2.0	0.40	CIENAGA	0.9	3.6	0.0	6.6	6.7	10.8	12.5	16.9	22.7	29.6	38.7	57.3	60.0
		M		0.40														
C. DEPORTIVA		A	2.9	0.40	0.40	C. DEP.	2.7	0.0	5.7	5.8	9.9	11.6	16.0	21.8	28.7	37.8	56.4	59.1
		M		0.40	0.40													
ALMENDARES		A	5.6	0.40	0.40	0.40	ALMEND.	0.0	3.0	3.1	7.2	8.9	13.3	19.1	26.0	35.1	53.7	56.4
		M		0.40	0.40	0.40												
ALMENDARES		A	11.3	0.00	0.00	0.00	0.00	ALMEND.	3.0	3.1	7.2	8.9	13.3	19.1	26.0	35.1	53.7	56.4
		M		0.00	0.00	0.00	0.00											
TOLEDO		A	14.3	0.40	0.40	0.40	0.40	0.40	TOLEDO	0.1	4.2	5.9	10.3	16.1	23.0	32.1	50.7	53.4
		M		0.40	0.40	0.40	0.40	0.40										
222		A	14.4	0.40	0.40	0.40	0.40	0.40	0.40	222	4.1	5.8	10.2	16.0	22.9	32.0	50.6	53.3
		M		0.40	0.40	0.40	0.40	0.40	0.40									
EL CANO		A	18.5	0.40	0.40	0.40	0.40	0.40	0.40	0.40	EL CANO	1.7	6.1	11.9	18.8	27.9	46.5	49.2
		M		0.40	0.40	0.40	0.40	0.40	0.40	0.40								
AUTOPISTA		A	20.2	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	AUTOPIS.	4.4	10.2	17.1	26.2	44.8	47.5
		M		0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40							
P. BRAVA		A	24.6	0.55	0.50	0.50	0.40	0.40	0.40	0.40	0.40	0.40	P.BRAVA	5.8	12.7	21.8	40.4	43.1
		M		0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40						
BAUTA		A	30.4	0.75	0.70	0.70	0.60	0.60	0.50	0.50	0.40	0.40	0.40	BAUTA	6.9	16.0	34.6	37.3
		M		0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40					
CAIMITO		A	37.3	0.95	0.90	0.90	0.80	0.80	0.70	0.70	0.60	0.55	0.40	0.40	CAIMITO	9.1	27.7	30.4
		M		0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40				
GUANAJAY		A	46.4	1.25	1.20	1.15	1.10	1.10	1.00	1.00	0.85	0.80	0.70	0.50	0.40	GUANAJAY	18.6	21.3
		M		0.65	0.60	0.60	0.55	0.55	0.50	0.50	0.45	0.40	0.40	0.40	0.40			
ANGOSTA		A	65.0	1.80	1.80	1.75	1.65	1.65	1.55	1.55	1.45	1.40	1.25	1.05	0.85	0.60	ANGOSTA	2.70
		M		0.90	0.90	0.85	0.80	0.80	0.80	0.80	0.75	0.70	0.65	0.55	0.45	0.40		
TCM		A	67.7	1.90	1.85	1.85	1.75	1.75	1.65	1.65	1.55	1.45	1.35	1.15	0.95	0.65	0.40	TCM
		M		0.95	0.95	0.95	0.85	0.85	0.85	0.80	0.80	0.75	0.70	0.60	0.50	0.40	0.40	

Las paradas entre Estaciones (f), apeaderos se aplica la tarifa de la estación posterior según la circulación del tren.
Cuando un viajero no adquiera su boletin en estaciones en servicios o cobradores asignados a expedir boletines en apeaderos, pagaran el 100% de recargo del importe de la tarifa a bordo del tren.

Beatriz López Salgado
Directora Económica
Emp. Ferroc. Occidente

Dpto Comercial
Emp. Ferroc. Occidente

Roberto Pérez Pérez
Director Comercial
Emp. Ferroc. Occidente

Source: UFC

(2) Cargo Tariff

Table 4.4.14 and Figure 4.4.26 show the cargo tariffs for sugarcane and general cargo. Tariffs for sugarcane are set on a linear basis (unit price per km). While tariff rates from Havana Central range from 67 km (Santa Cruz) to 881 km (Guantanamo), different tariff rates are used by types of cargo. Again, it should be noted that this tariff structure was updated following currency unification.

Table 4.4.14 Sugar Cane Tariff

MINISTERIO DE FINANZAS Y PRECIOS
Ministra

ANTERIOR

Resolución Nro. 477/2012
Anexo Nro. 1
Página 1/1

TARIFAS MAXIMAS EN PESOS CUBANOS (CUP) PARA EL SERVICIOS DE TRANSPORTACION DE CAÑA DE AZUCAR POR FERROCARRIL

KM	TARIFA	KM	TARIFA	KM	TARIFA	KM	TARIFA	KM	TARIFA	KM	TARIFA	KM	TARIFA
1 a 10	2.00	40	8.01	70	14.01	100	20.01	130	26.02	160	32.02	190	38.03
11	2.20	41	8.21	71	14.21	101	20.21	131	26.22	161	32.22	191	38.23
12	2.40	42	8.41	72	14.41	102	20.41	132	26.42	162	32.42	192	38.43
13	2.60	43	8.61	73	14.61	103	20.62	133	26.62	163	32.62	193	38.63
14	2.80	44	8.81	74	14.81	104	20.82	134	26.82	164	32.82	194	38.83
15	3.00	45	9.01	75	15.01	105	21.02	135	27.02	165	33.02	195	39.03
16	3.20	46	9.21	76	15.21	106	21.22	136	27.22	166	33.22	196	39.23
17	3.40	47	9.41	77	15.41	107	21.42	137	27.42	167	33.42	197	39.43
18	3.60	48	9.61	78	15.61	108	21.62	138	27.62	168	33.62	198	39.63
19	3.80	49	9.81	79	15.81	109	21.82	139	27.82	169	33.82	199	39.83
20	4.00	50	10.01	80	16.01	110	22.02	140	28.02	170	34.02	200	40.03
21	4.20	51	10.21	81	16.21	111	22.22	141	28.22	171	34.23	Base de Cálculo para la determinación de los Ingresos por la Transportación de Caña por Ferrocarril (Copia Fiel del Original) TARIFA POR KILOMETRO	
22	4.40	52	10.41	82	16.41	112	22.42	142	28.42	172	34.43		
23	4.60	53	10.61	83	16.61	113	22.62	143	28.62	173	34.63		
24	4.80	54	10.81	84	16.81	114	22.82	144	28.82	174	34.83		
25	5.00	55	11.01	85	17.01	115	23.02	145	29.02	175	35.03		
26	5.20	56	11.21	86	17.21	116	23.22	146	29.22	176	35.23		
27	5.40	57	11.41	87	17.41	117	23.42	147	29.42	177	35.43		
28	5.60	58	11.61	88	17.61	118	23.62	148	29.62	178	35.63		
29	5.80	59	11.81	89	17.81	119	23.82	149	29.82	179	35.83		
30	6.00	60	12.01	90	18.01	120	24.02	150	30.02	180	36.03		
31	6.20	61	12.21	91	18.21	121	24.22	151	30.22	181	36.23		
32	6.40	62	12.41	92	18.41	122	24.42	152	30.42	182	36.43		
33	6.60	63	12.61	93	18.61	123	24.62	153	30.62	183	36.63		
34	6.80	64	12.81	94	18.81	124	24.82	154	30.82	184	36.83		
35	7.01	65	13.01	95	19.01	125	25.02	155	31.02	185	37.03		
36	7.21	66	13.21	96	19.21	126	25.22	156	31.22	186	37.23	$ 0,20	
37	7.41	67	13.41	97	19.41	127	25.42	157	31.42	187	37.43		
38	7.61	68	13.61	98	19.61	128	25.62	158	31.62	188	37.63		
39	7.81	69	13.81	99	19.81	129	25.82	159	31.82	189	37.83		

Source: UFC

2017

Origen: Estación Central

DESTINO	Km	Carga General en Casillas	Fertilizantes en Casillas y Otros	Otras Cargas	Yeso, Chatarra, Góndolas y Otros.
Santa Cruz	67	9.34	8.81	8.14	9.09
Artemisa	77	10.17	9.59	8.81	9.90
San Cristóbal	109	12.81	12.08	10.93	12.49
Matanzas	117	13.47	12.70	11.46	13.14
Cárdenas	167	17.61	16.59	14.78	17.19
Los Palacios	134	14.88	14.02	12.59	14.52
Jovellanos	144	15.71	14.80	13.25	15.33
Pinar del Rio	186	19.18	18.07	16.04	18.73
Isabel Rubio	240	23.64	22.27	19.63	23.10
Villa Clara (Santa Clara)	276	26.61	25.07	22.02	26.02
Cienfuegos	285	27.35	25.77	22.61	26.74
Santi Spiritus	377	34.96	32.92	28.72	34.19
Ciego de Ávila	427	39.04	36.81	32.04	38.24
Camagüey	531	47.68	44.90	38.94	46.66
Nuevita	602	53.55	50.42	43.66	52.41
Las Tunas	640	56.69	53.38	46.18	55.49
Laminados	642	56.85	53.53	46.31	55.65
Bayamo	721	63.38	59.68	51.56	62.04
Holguín	732	64.29	60.53	52.29	62.94
Manzanillo	764	66.93	63.02	54.41	65.53
Santiago de Cuba	835	72.80	68.54	59.13	71.27
Guantánamo	881	76.60	72.12	62.18	75.00
Ctral Panorama	575	51.32	48.32	41.87	50.22
Camagüey	506	45.61	42.96	37.29	44.64
Florida					

Source: JICA Study Team at Havana Central station

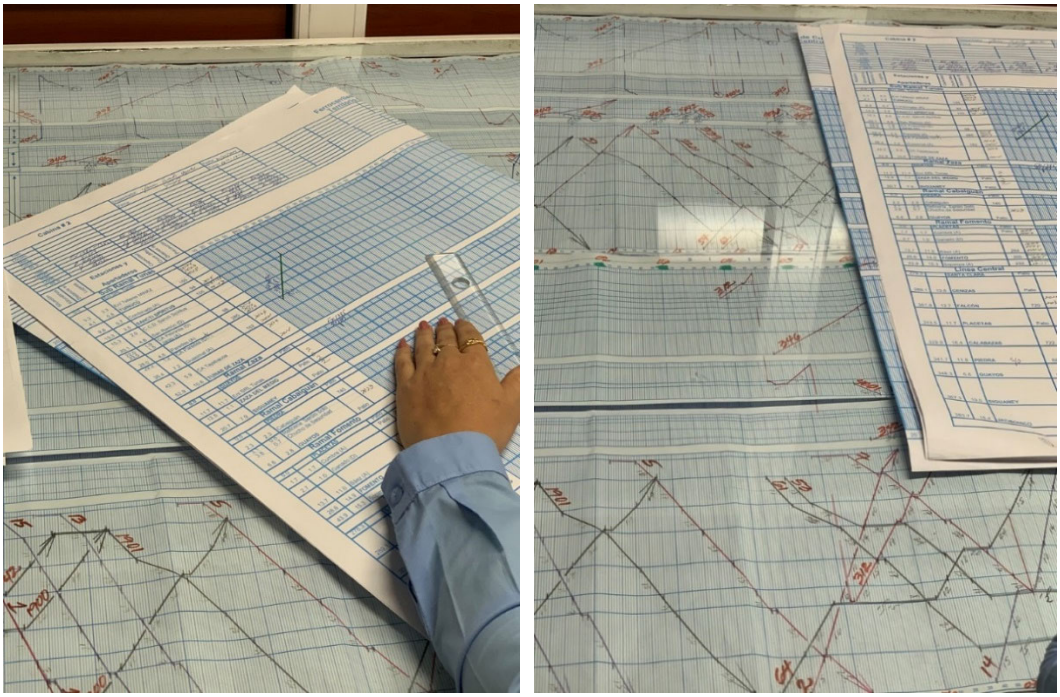
Figure 4.4.26 Cargo Tariff from Havana Central station in 2017

4.4.9 Train Operation

(1) Train Operation System

As of February 2019, train operations were based on the 2012 timetable. Trains are controlled by dispatchers at the dispatch center of each regional railway enterprise.

Train operation control is made according to the train operation diagram with 2-minute spacing. Train operation time is plotted on a train operation diagram following the timetable and the actual operation time is plotted by a dispatcher on another diagram paper to compare these two. This provides the information necessary for a locomotive driver to run the train and a station train operator to adjust the operation time. For national and inter-regional trains, the dispatcher also informs train operation data to the dispatcher in the next region.



Source: JICA Study Team at Santa Clara station dispatch office

Figure 4.4.27 Dispatcher's Train Diagram

A new GPS-based train location system has been installed on 393 locomotives. This system is useful for identifying the location of trains, and this information can be used by a dispatcher for train operations. It should be noted that this GPS system is used only for location identification but not be used as part of the signaling system.

(2) Train Operation Diagram

There are three types of passenger rail services:

1. National trains from Havana to Santiago de Cuba on the Central Line
2. Local trains operated within regional lines
3. Inter-regional trains operated across regional boundaries

The train operation timetables are set by the UFC head office.

As of Feb. 2019, the 2012 timetables were still in use. Timetables should be updated according to estimated transport demand in the next few years (trend-based analysis using data from the last few years).

Actual passenger transport in 2018 was about 48% of the 2012 level due to the decrease in train operation, not a decrease in demand.

The number of trains at the Central Line main stations on the timetable from 1999 and 2012 is shown in Table 4.4.15. The table shows that the number of trains in the 2012 timetable is about 70% of 1999.

Table 4.4.15 Number of Trains in 1999 and 2012

EF	Station	Km	1999 Timetable			2012 Timetable			Comparison
			Passenger	Cargo	Total	Passenger	Cargo	Total	2012/1999
EFOC	Havana Central	0.0	8	0	8	6		6	75%
	Enlace Gas	2.4	12	6	18	7	4	11	61%
	Matanzas	89.1	11	3	14	6	3	9	64%
	Colon	169.8	10	2	12	8	3	11	92%
	Los Arabos	192.1	9	2	11	5	3	8	73%
EFC	Cascajal	212.6	9	2	11	5	2	7	64%
	Santa Clara	278.3	10	2	12	5	2	7	58%
	Guayos	348.4	10	3	13	6	5	11	85%
	Jatibonico	383.7	8	3	11	4	5	9	82%
EFCE	Guayacanes	408.3	9	3	12	5	4	9	75%
	Ciego de Avila	426.6	12	4	16	7	4	11	69%
	Cespedes	485.0	10	3	13	6	2	8	62%
	Camaguey	528.4	10	3	13	10	2	12	92%
	Siboney	559.1	8	3	11	6	3	9	82%
	Las Tunas	643.5	12	2	14	5	2	7	50%
	Omaja	669.1	7	2	9	4	2	6	67%
EFO	MIR	682.4	7	2	9	4	2	6	67%
	Cacocum	715.8	7	3	10	6	1	7	70%
	Alto Cedro	761.1	7	4	11	5	1	6	55%
	Combinado	806.1	9	5	14	7	3	10	71%
	Santiago de Cuba	835.5	9	5	14	6	3	9	64%
	Average								70%

Source: UFC Timetables for 1999 and 2012

Table 4.4.16 shows the timetable from Havana Central to Santiago de Cuba in 1999 and 2012. Some trains are no longer operated due to a lack of locomotives and cars. The fastest train operation is seen in the 2012 timetable, that is, 14:40 hours from Havana Central to Santiago de Cuba, but travel time in the temporary timetable for Feb./Mar. 2019 is about 18 hours.

Table 4.4.16 Travel Time of Central Line from Havana to Santiago de Cuba

Station	Habana Central	Santiago de Cuba			Station	Habana Central	Santiago de Cuba	
Km	0	835.5			Km	0	835.5	
1999								
No.	Outbound train		Time		No.	Inbound train		Time
23	5:45	20:35	14:50		14	7:10	17:00	14:10
19	10:40	22:30	11:50		12	11:10	21:35	13:35
13	16:40	6:40	14:00		24	19:55	5:05	14:50
11	19:30	9:10	13:40		20	20:50	8:55	11:55
	0:00							
	Average (hh:mm)		13:35			Average (hh:mm)		13:37
	Average speed (km/h)		61.5			Average speed (km/h)		61.4
2012								
No.	Outbound train		Time		No.	Inbound train		Time
1	18:27	9:12	14:45		2	10:57	20:17	14:40
3	16:00	8:05	16:05		4	15:41	23:15	16:26
	Average (hh:mm)		15:25			Average (hh:mm)		15:33
	Average speed (km/h)		54.2			Average speed (km/h)		53.7
	Average time 1999/2012 (%)		88%			Average time 1999/2012 (%)		93%
	Average speed 1999/2012 (%)		113%			Average speed 1999/2012 (%)		114%

Source: UFC Timetables for 1999 and 2012

(3) Train Operation Performance

Table 4.4.17 shows selected passenger rail transport performance indicators. Clearly, the performance of passenger rail transport has been declining except for punctuality indicators for departures/arrivals.

Table 4.4.17 Performance Indicators for Passenger Rail Transport

Item	Unit	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Avg. passenger trip distance	km	**128.7**	116.0	97.0	93.0	93.0	85.0	86.0	83.0	**79.0**	**79.7**	**105.0**	**101.0**
Daily working time of locomotive	h	13.2	**18.0**	13.2	12.5	9.6	12.5	11.5	11.1	**9.0**	**12.9**	**12.7**	**11.4**
Avg. daily journey of locomotives	km	270.0	267.1	257.2	287.2	**289.3**	266.4	241.5	**234.2**	258.9	251.3	262.6	250.2
Avg. locomotive commercial speed	km/h	**31.4**	28.6	27.0	29.4	29.5	27.3	27.0	**27.0**	28.9	23.4	25.3	23.6
Train departures scheduled on time	%	86.3	91.0	90.0	90.8	91.5	91.2	88.5	**84.0**	**93.0**	**85.5**	**87.5**	**81.0**
Arrivals scheduled trains on time	%	81.1	84.8	80.0	85.6	87.7	**95.6**	84.9	**73.0**	88.0	81.3	82.8	76.0

Source: Cuba 2017 Statistical Yearbook, Chapter 13: Transport/ONEI

Table 4.4.18 shows selected performance indicators of freight rail transport. Similar to the performance of passenger trains, freight train performance has been declining, especially locomotive performance.

Table 4.4.18 Performance Indicators of Freight Rail Transport for Public Use

Item	UM	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Technical availability coefficient per car	%	70.6	72.0	65.8	66.9	67.4	66.7	66.8	69.0	71.0	69.0	70.5	79.7
Avg. distance of a tonne transported	km	251.1	267.0	240.0	232.0	103.6	83.3	97.0	229.5	224.1	209.6	232.3	226.2
Daily working time of diesel locomotives	h	14.5	13.0	13.2	14.0	12.5	12.5	13.4	11.1	11.5	13.9	12.7	12.7
Avg. daily run of diesel locomotives	km	273.6	257.1	257.2	287.2	264.8	262.7	262.5	245.5	224.8	272.3	262.6	248.7
Avg. diesel loco. daily performance	Mtkmb	286.2	261.5	277.5	288.4	297.9	261.6	272.5	221.5	203.3	205.4	231.5	215.8
Average gross weight per train (incl. loco.)	t	1,093.9	1,113.9	1,152.7	1,055.6	1,155.2	1,036.2	1,042.8	931.2	903.7	852.0	884.7	935.6
Avg. cars per train	OR	23	23	25	22	24	21	21	21	19	20	19	20
Avg. commercial speed	h	18.9	19.8	19.5	20.6	21.2	21.0	21.0	20.2	19.5	19.6	25.3	19.6
Static load per wagon	t	40.3	44.4	49.0	48.5	51.9	47.3	48.2	44.1	46.9	59.4	42.1	44.1
Rotation period of a wagon in service	days	10.3	9.2	12.3	7.6	10.4	10.1	10.3	10.2	10.1	15.0	12.9	12.2
Wagons in service, utilization coefficient	%	68.0	68.0	81.0	A	72.0	67.0	66.0	60.0	61.0	93.0	81.0	84.6

Source: Cuba 2017 Statistical Yearbook, Chapter 13: Transport/ONEI

4.4.10 Hershey Line

The Hershey Line between Casablanca and Matanzas, with branch lines to Jaruco, Playas del Este, and Bainoa, is Cuba's only electrified line and consists of 46 stations along 112 km of track, of which 90.6 km is the main line from Casablanca to Matanzas. In 1994 the line carried 2m passengers on three trains per day from Casa Blanca, three trains per day from Matanzas, and 16 trains per day from the Jaruco Line to Hershey. But in 2020, 72,000 passengers were transported.

Source: UFC

Figure 4.4.28 Hershey Line Network

Two UEBs subordinated to EFOC are responsible for the operation and maintenance of the Hershey Line. One is in charge of passengers, freight, and maintenance of the electric supply, and the other is responsible for maintaining tracks and bridges. Rolling-stock maintenance is done at the Hershey Line workshop near Hershey station.

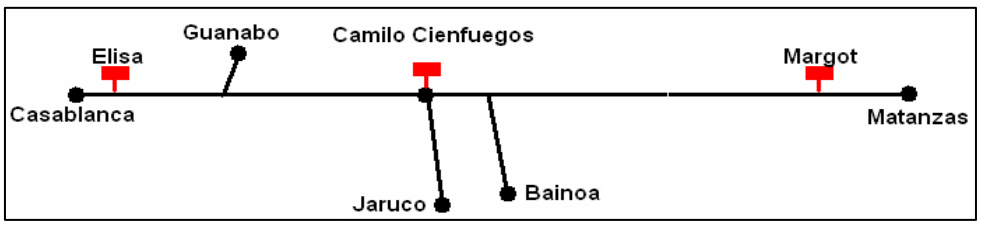
The line was originally built to transport sugarcane and sugar between the mills and the ports of Havana and Matanzas for export to the U.S. Steam locomotive traction was used from the line's opening in 1915 until 1922, when it was electrified. Until recently, Mayabeque province had three sugar mills to which the Hershey Line transported workers and sugarcane. Eight Russian-made diesel locomotives and 250 freight wagons transported sugarcane to the mills and sugar to Matanzas port. There are two small mills for which a UEB transports sugarcane for a short distance with three Russian-made diesel-electric locomotives. After the main sugar mill at Hershey closed in 2003, train operations were reorganized and have been operated by UEBs subordinated to EFOC since 2010.

The line was electrified in 1922 with 1,200 V/DC and three substations, located at Elisa (9.6 km), Hershey (Camilo Cienfuegos, 44.9 km), and Margot (82 km) as shown in Figure 4.4.29 and Table 4.4.19.

Table 4.4.19 List of Power Stations

Substation	Line	Kilometer	Power (KW)	AC input voltage (KV)	DC Voltage Exit (KV)
Elisa	Hershey	9.6	1,500	33.0 / 60 Hz	1.2
Hershey (Buck)	Hershey	44.9	2,000	33.0 / 60 Hz	1.2
Margot	Hershey	82.0	1,500	33.0 / 60 Hz	1.2

Source: UFC



Source: Data and information system electrification railway required by JICA/UFC

Figure 4.4.29 Hershey Line and Power Station

Source: UFC

Figure 4.4.30 Hershey Station and Electric Car

The trolley line height is 6 m from the rail track, which is higher in comparison with other lines of around 5.0 to 5.4 m. The typical electrified line track of the Hershey Line is shown in Figure 4.4.31.

Source: JICA Study Team

Figure 4.4.31 Typical Section of Hershey Line

The newer cars from Catalonia, Spain, have 720 kW power and a severe problem: no spare parts are available as they are no longer produced.

The technical characteristics of the electrical system are:

- The uncompensated contact line (catenary) is formed by wooden posts supporting grooved and hardened copper wire (trolley)
- The trolley wire has a cross-section of 107-110mm^2
- The cable guide is of galvanized 7-twisted-wire steel with a 9.6mm diameter
- Feeder cable comprised of 37-strand aluminum wire (795 MCM)
- Distance between poles: 45m
- Number of suspensions between posts: 10
- Maximum height above rail crown: 6.87m
- Minimum height above rail crown: 6.09m

- Type of train: 2- or 3-car consists formed by tractive cars
- Approximate distance between power substations: 36 km

The Elisa substation and the section from Casablanca to Guanabo are out-of-service due to hurricane damage that affected the substation and catenary. All substations and catenary suffer from obsolescent technology and many years of operation without proper maintenance. They have heavily deteriorated, and it may not be possible to procure spare parts to repair them.

Since the line was damaged by Hurricane Irma in 2017, it has not yet been rehabilitated. According to a site investigation by the study team, the track is not damaged and has no technical issues with train operation, but the electrical system needs to be rehabilitated. The 400mm^2 feeder lines and contact wires cannot be produced in Cuba, and these materials have not been imported. However, some trains have been operated until recently between Guanabo and Hershey for about 20 km and some others are currently operating fuel tank wagons with oil products, since Matanzas to Havana Oil Refinery. The Hershey Line connects with the Central Line at Jaruco Station.

The Hershey Line has many sharp curves; the sharpest section has a 120m radius, which limits train operation speed. Also, wooden sleepers are used; replacing them with new concrete sleepers will be costly. The ballast is from Mena, but currently, no new ballast is being supplied.

Ten-meter wooden poles are used to support the trolley line. Currently, the supply of wooden poles is insufficient, and it is not easy to replace them with concrete poles. Steel, the other alternative, is not possible as this would require imported materials.

Even though the Hershey Line now faces a variety of serious problems, it should be entirely possible to revitalize it as a key tourist attraction and means of transport for the local community.

4.4.11 Capacity for maintenance work

(1) Rolling Stock

Various types of rolling-stock maintenance work (locomotives, wagons, equipment, etc.) are carried out at 109 workshops. Some are specialized for specific types of maintenance.

There are two general types of maintenance, periodic work, and repair work. Some key rolling-stock parts, especially for locomotives, are usually renewed periodically before malfunction. In Cuba, however, due to spare parts shortages, such parts are only renewed after they break down. Plus, there are many other obstacles to proper maintenance work:

- Old and deteriorated machines and tools
- Many broken machines and tools and no spare parts to repair them
- A limited number of skilled technicians/workers to operate the machines
- A limited number of skilled technicians/workers to repair rolling stock
- Shortage of spare parts for rolling stock
- Too many different rolling-stock types make efficient repair work difficult.

UFC has started a workshop modernization project with financial support from Russia. The locomotive repair shop at Cienaga will be modernized with technical support from SNARA, a Russian company.

(2) Track

The responsibility for the maintenance of the track is under UFC, which is contracted by ATF for its maintenance and repair. When larger works related to bridges and earthworks are required, specialized enterprises are contracted.

There are two types of track maintenance work: 1) large-scale maintenance using heavy machinery; 2) small-scale maintenance gangs (teams) using smaller machinery and tools.

Large-scale track maintenance work (replacement of long rail with sleepers & fastening systems) is done by SOLCAR with equipment such as tamping machines, ballast regulators, and ballast cleaners. SOLCAR detects rail flaws using ultrasonic detectors but does not inspect track irregularities.

Small-scale track maintenance is done by maintenance teams of UEBs, using small machines and tools. There are 424 teams, each usually with 10-15 workers and teams of 5-8 workers for small-scale work. The average number is about 0.6 to 0.7 workers/km (excluding industrial lines). Each team is equipped with small manual tools and a gauge measurer.

Table 4.4.20 shows how the organizational structure for the track maintenance work.

Table 4.4.20 Organizational structure of railway track maintenance

Territories	Track & bridge units	Districts	Track maintenance teams	Bridge maintenance teams
West	5	24	102	5
Central	3	23	88	1
Central-east	3	29	132	4
East	4	23	102	4
Total	15	99	424	14

Source: ESQUEMA ORGANIZATIVO DEL MANTENIMIENTO A LAS VIAS FERREAS CUBANAS /UFC

In 2021, a new structure for track maintenance and repair was implemented whereby all track units are subordinated to the track construction enterprise SOLCAR.

Maintenance manuals for track and substructures such as bridges are prepared by UFC and ATF. The necessary technical knowledge and related standards and track maintenance work methods are well documented in these two manuals. Table 4.4.21 shows a list of equipment and machines used at UFC work sites, including SOLCAR and EIIF.

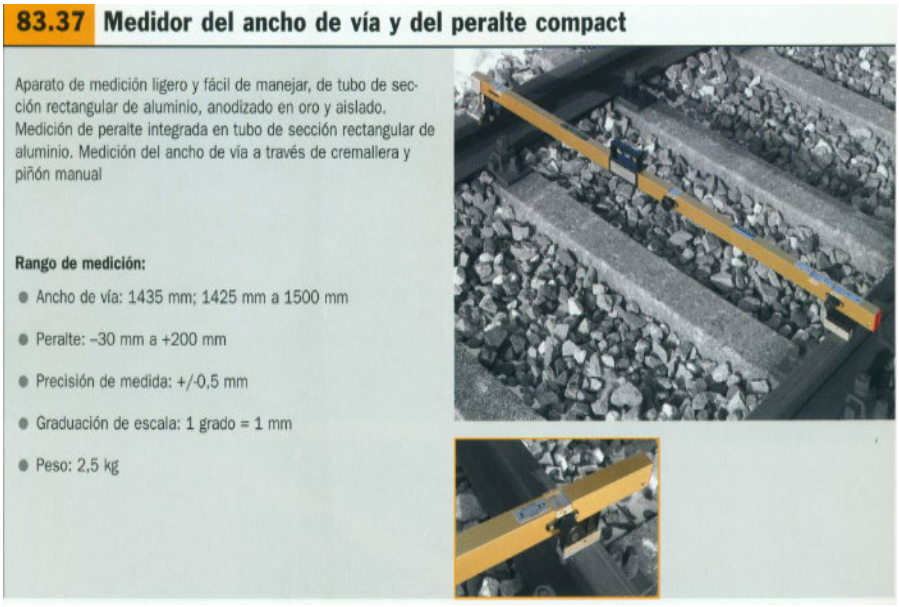
Table 4.4.21 Equipment Inventory of UFC, National Total

Kind of Equipment	Quantity	Remarks
Rail car TD 5 M	532	241 out of service equipment: 100 processed to deregister and 141 lack of spare parts
Track motor car DGKU 5	9	
Track motor car DKM 540	8	3 cars are proposed to deregister. 4 cars are out of service because of lack of spare parts.
Railway crane KDE 25 T	20	6 cranes were out of service by parts and pieces, and two in process to deregister
Railway crane KDE 16 T	2	1 in process to deregister

Kind of Equipment	Quantity	Remarks
Railway crane KTs 266 T 32	7	
Multi loader KGTN Geismar	14	4 out of service by lack of spare parts
Weed cutter and tamper KTBC	4	1 in process to deregister
Sleepers Changer MRT- 2 Geismar	2	2 out of service by lack of spare parts
Ballast regulator SSP 203 Plasser	3	
Ballast regulator PBR - 400 Plasser	2	
Multi tamping machine 08-16 Plasser	2	
Dual tamping machine (two crossbeams) 08-32 Plasser	3	1 out of service by lack of spare parts
Ballast cleaner RM 80 Plasser	1	
Truck rail welding APT - 500 Plasser	1	
Mini tamper BRM8 AC Geismar	1	out of service by lack of spare parts
Light tamper BLH - 20 Geismar	4	2 out of service by lack of spare parts
Front loader Volvo L 220 F	5	1 out of service by lack of spare parts
Front loader HYUNDAI hl-750 C	1	
Grader DZ 122 A	5	2 high oil consumers; need new engines
Grader DZ 143	11	
Grader Tiangong PY160 G	3	2 out of service by lack of spare parts
Vibrating compactor AMMANN ASC 150	1	
Drill rig truck ROC 203	3	
Compressor Atlas Copco Xas 186	3	
Compressor PR 10	1	
Compressor Betico	1	
Hammer pile driver Delman	4	
Tractor Yunz 6	36	13 out of service by motor problems; need a new engine
Tractor MTZ 80	2	
Industrial cranes Relief Horst Brown 75 T	2	
Cranes Takraz EDK - 500 80 T	3	
Dragline (Crane with drag bucket)	2	
Material hoist 4073	4	
Backhoe Yunz 6KM	9	
Bulldozer T - 140	14	3 out of service by lack of spare parts
Bulldozer C- January 00	2	2 out of service by lack of spare parts
Bulldozer Dressta TD 15 M	3	
Bulldozer Dressta TD 25 M	3	1 out of service by lack of spare parts
Dump Truck Belaz 7540 B	5	
Tyred crane E 302	1	
Steel wagon FL M-1 Cuba	7	
Carahatas Cuba	3	
Tractor crane Yunz 6 M	13	4 out of service by engine problems and in process to deregister

Source: Esquema organizativo del mantenimiento a las vias férreas Cubanas /UFC

For track maintenance work, one of the major issues is the inaccurate inspection of track conditions due to the shortage of measurement equipment. But track conditions on the Central Line seem to be good in most sections. When the Central Line was inspected by the JICA study team using a 4-wheel motor car, only minor shocks caused by rail irregularities were observed. There were horizontal irregularities along the rail in some sections, but almost no vertical irregularities.



Source: UFC

Figure 4.4.32 Gauge Measurer Used by UFC

4.4.12 Human Resources

UFC had 21,469 staff in February 2019. Table 4.4.22 shows information about the staff rate by occupational category, educational level and gender. Human resource development (HRD) should be studied as soon as possible..

Table 4.4.22 Staffing of UFC by category

Category	The ratio of total staff (%)
Operator	59.5 %
Service	20.0%
Technical	18.0%
Women	22.0%
Executive	1.6%
Superior level	5.0%
Technical medium	20.0%
Director officers	22 persons

Source: UFC

4.4.13 Ongoing projects

(1) State-funded projects

1) Mariel Line

Construction of the 53.5 km double-tracked Mariel Line from Almendares station to Mariel port started in 2016. The line began temporary operation in 2017. VHF radio which is a trunking technology has been temporarily used for communication, but GSM-R is planned to be installed in the future.

Construction cost for the line is covered by the Mariel port project budget. As of February 2019, seven container trains and two tanker trains were operating between Mariel port and suburban Havana.

2) CCD 222

UFC plans to construct CCD 222 near El Cano station as there is only one freight train terminal, Bustamante, in Havana. But there are two CCDs for general cargo and containers linked by branch lines from Bustamante. UFC plans to integrate CCD functions in Havana.

(2) Projects with support from Russia

Several projects were supposed to be financially supported by the Russian government. With the credits from Russian financial organizations, and based on the 2013 agreement with Russia on Cuba's outstanding debt, several projects are being implemented, including 1) procurement of rolling stock, 2) renovation of workshops, and 3) improvement and renovation of infrastructure. The last one has not started yet.

1) Rolling stock

The procurement and repair program of the rolling stock is shown as follows.

Table 4.4.23 Passenger Car Procurement Plan

Category	Number
Local train	68
DMU	28

Source: UFC

Table 4.4.24 Freight Car Procurement Plan

Category	Number
Boxcar	463
Regular flat wagon	201
Flat wagon for container	20
Dump car	111
Cement silo	130
Sugar hopper wagon	330
TOTAL	**1,255**

Source: UFC

Table 4.4.25 Locomotive Procurement Plan

Type	Number
High power Loco.	28
Medium power Loco.	53
Small power Loco.	15
Total	96

Source: UFC

Table 4.4.26 shows the number of repairs that were planned to be carried out on railway equipment.

Table 4.4.26 Repairment Plan of Rolling Stock

Equipment	2018	2019	2020	2021	2022	2018-2022
Locomotive	30	27	27	27	12	123
Freight car	587	625	625	510	510	2,857
Passenger car	25	23	22	20	20	110
Motor car (DMU)	3	5	5	5	5	23
TOTAL	**645**	**680**	**679**	**562**	**547**	**3,113**

Source: UFC

2) Renovation of workshops

UFC plans to repair its railway equipment and workshops to maintain rolling stock in good condition. A total of 56 workshops are planned to be including the main workshops, Cienaga, Luyano, Camaguey, and Sagua.

3) Rail infrastructure

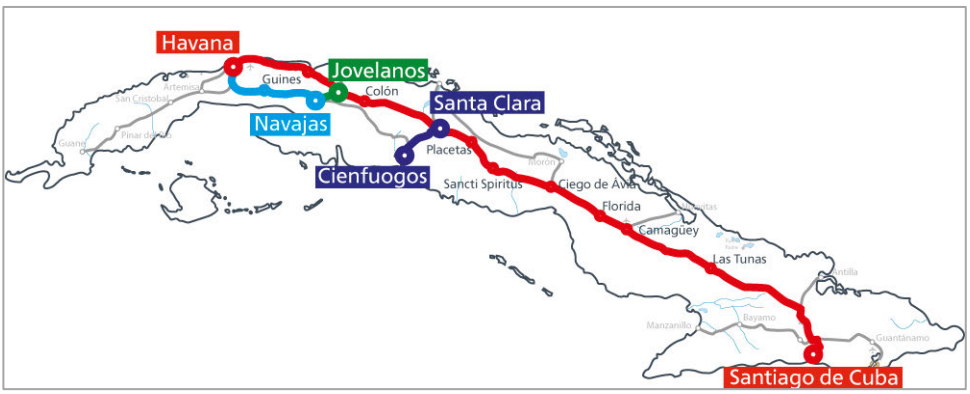
A renovation/modernization project supported by Russia is ongoing. The main aims of this project are to:

1. Increase train operation safety
2. Increase capacity of railway track (network) and cargo carrying capacity
3. Increase maximum running speed to 120 km/h
4. Introduce a strategic development plan in the rail sector based on priorities
5. Increase qualifications of UFC staff

The main target rail lines (1,078.4 km in total) are shown in Figure 4.4.33. This project has not started yet.

The project component includes:

- Reconstruction of 1,078 km of the main railway line and 357 structures
- Installing new signaling systems in stations and level crossings, plus upgrading existing signaling systems on the Central Line (Havana-Santiago de Cuba)
- Construction of the Main Traffic Control Center
- Supply of construction and track machinery, materials, and equipment
- Preparation of the Cuban railway network development master plan
- Training of Cuban railway personnel



Section	Length
Línea Central	835 km
Línea Sur y Nudo de La Habana	166 km
Línea Cienfuegos y Zona Industrial	77.4 km

Source: UFC

Figure 4.4.33 Location of Infrastructure Projects

Completion of the project is expected to increase train speed up to 120 km/h in some sections, increase cargo transport capacity 1.7 times, and increase passenger transport capacity three times. The estimated cost of the project is €1.9 billion. Since a master plan is included in this project package, coordination with planning work by RZD International will be required.

Table 4.4.27 Renovation for 1,078.4 km track

Section	Length
Capital renovation	282 km
Integral maintenance	417.4 km
Mechanized maintenance	466.8 km
Assembly of the long-welded rail (LWR)	480.2 km
Substitution and repair of turnout	718 unit
Repair of level crossing	355 unit
Construction of 1,336 km of lineal fences	

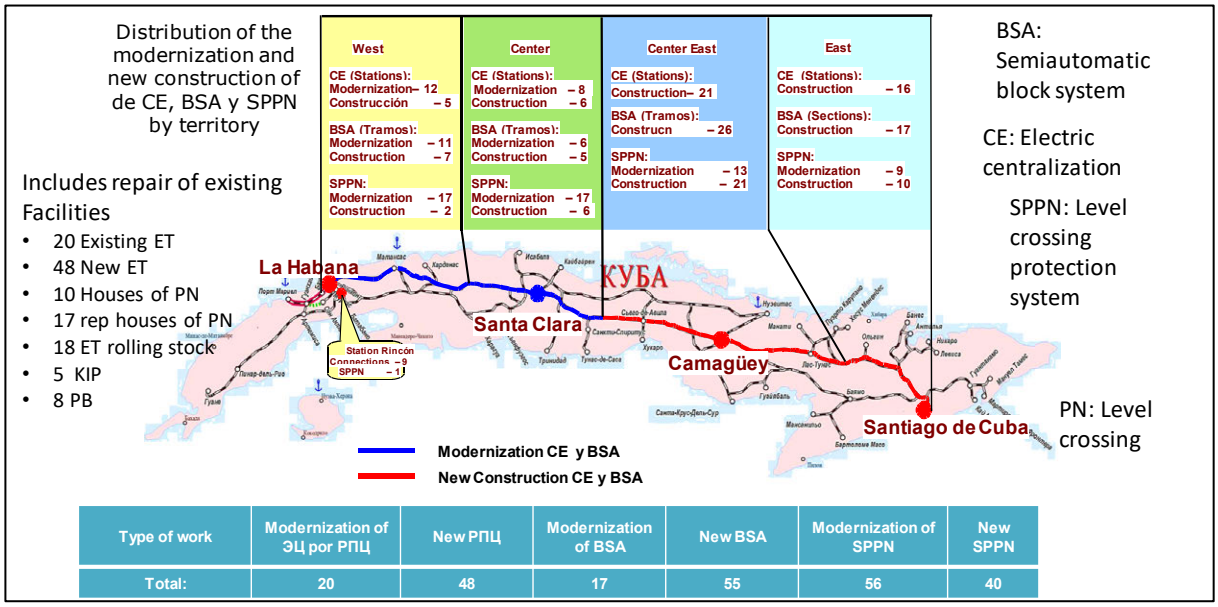
Source: UFC

In detail, the projects include various components:

1. Central Direction Office for transportation management (COF)
2. Machinery and specialized equipment for track construction and maintenance: ballast cleaners, equipment for alignment and leveling of tracks and turnouts, rail-grinding machines, cranes, special platforms and CLS, ballast regulators, ballast hoppers and diagnostic equipment
3. Recovery and repair of the SOLCAR rail welding line
4. Equipment supply for EIIF (sleeper factory)
5. Additional line for ballast production, including supplies and equipment assembly
6. Provide services in a professional manner and training of the client's staff:
    a. Students in Russia in 6 specialties: 1) operation, 2) rolling stock, 3) sales, 4) automatic and telemechanic, 5) railway tracks, and 6) mechanical engineer in railway equipment

b. UFC personnel taking part in training courses
c. UFC cadres and specialists taking part in training courses

7. Construct a workshop for technical maintenance/repair of railway machinery and other parts
8. Implement surveillance and control system for track infrastructure condition, with the necessary supply of machinery and equipment
9. General plan design for the development of Cuba's railways
10. Implement surveillance, control, and repair of rolling stock (supply surveillance/measurement units)



Type of work	Modernization of ЭЦ por РПЦ	New РПЦ	Modernization of BSA	New BSA	Modernization of SPPN	New SPPN
Total:	20	48	17	55	56	40

Source: UFC

Figure 4.4.34 Location of projects

(3) Projects with support from other countries

1) Support from France

A project to modernize the Luyano and Camaguey workshops was in the pre-investigation phase as of February 2019. The project aims to renew the buildings and procurement of machinery and tools. It is also expected that France's SNCF will provide technical services to support rolling stock maintenance.

2) Support from China

From China, 240 passenger rail cars (70 air-conditioned 1st-class coaches (72 seats) and 130 2nd-class coaches (72 seats), 20 baggage/generator cars, and 20 buffet cars (56 seats) will be procured using loan credits. The 26.1m-long coaches are designed for 120 km/h operation and will be used on long-distance services, enabling Cuban Railways to go from one departure every four days to more frequent services. The first batch of 80 cars out of 240 arrived in Havana in 2019.

Source: UFC

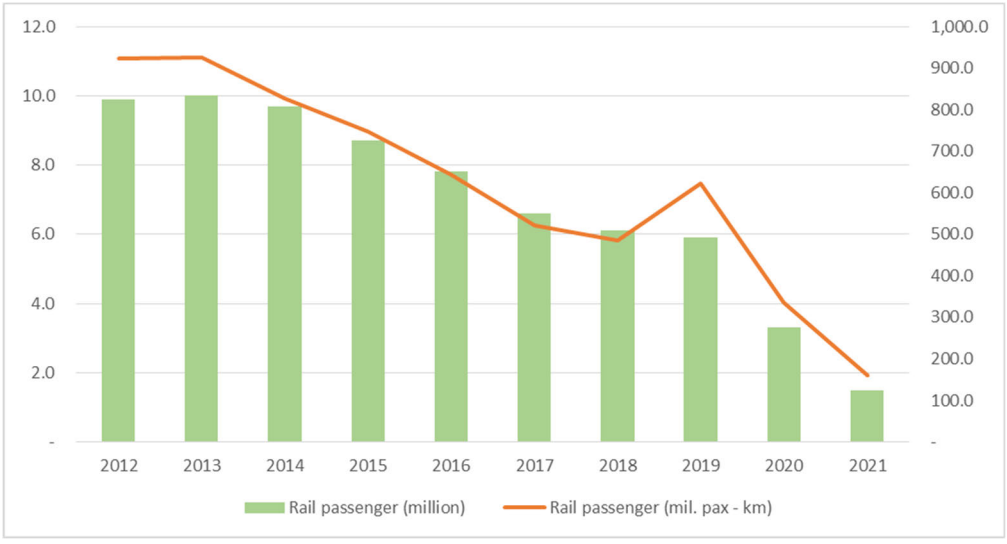
Figure 4.4.35 Passenger Cars support from China

4.4.14 Current Railway Transport Volume

(1) Passenger Transport

Figure 4.4.36 shows the time-series change of rail passengers (million passengers per year) and passenger traffic (million passenger-km per year) from 2012 to 2021.

The railway's share of total passengers decreased from 0.6% (2012) to 0.2% (2021). The railway's share of total passengers-km also decreased from 9.7% (2012) to 6.2% (2021).



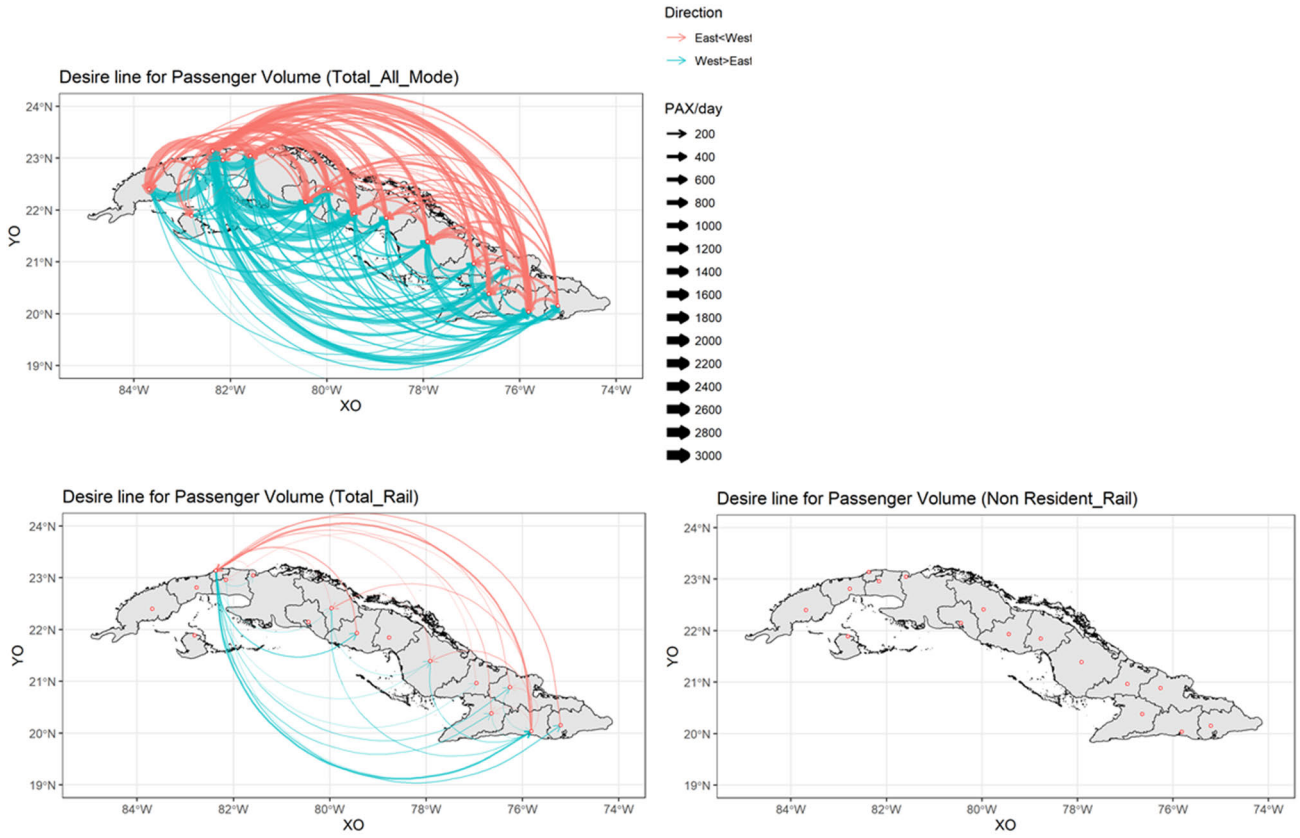
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rail passenger (million)	9.9	10.0	9.7	8.7	7.8	6.6	6.1	5.9	3.3	1.5
Share against total	0.6%	0.6%	0.5%	0.5%	0.4%	0.3%	0.3%	0.3%	0.3%	0.2%
Rail passenger (mil. pax - km)	922.3	925.8	827.9	746.4	643.9	521.8	485.8	621.9	334.9	160.1
Share against total	9.7%	8.8%	7.7%	6.2%	5.4%	4.6%	4.7%	6.6%	9.0%	6.2%

Source: ONEI

Figure 4.4.36 Rail Passenger and Passenger-km

Figure 4.4.37 shows the directional daily inter-provincial passenger volume in 2018. These figures show:

- Rail passenger volumes are quite small in comparison with total passenger volumes.
- The number of long-distance rail passengers (between Havana & Santiago de Cuba) is relatively large via the Central Line, followed by passenger volume on the section between Havana and Sancti Spiritus and another section between Santiago de Cuba and Santa Clara.
- There are almost no non-resident rail users.



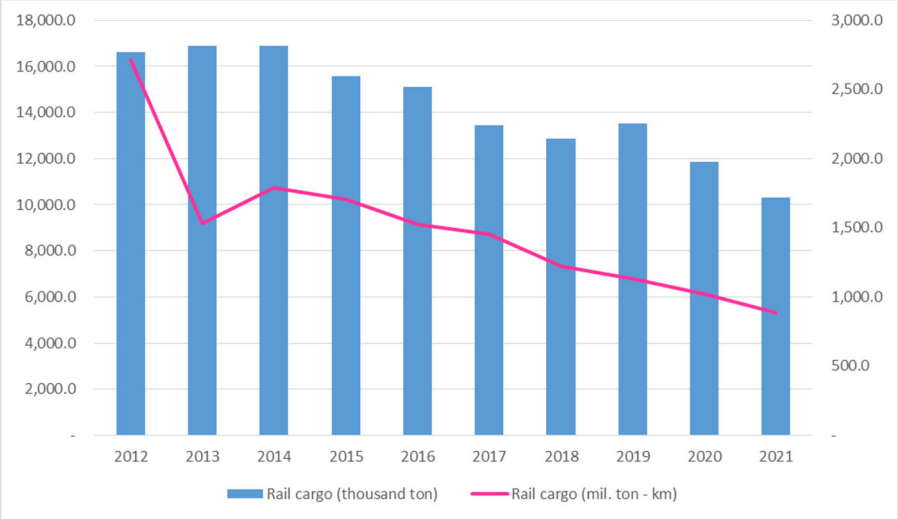
Source: JICA Study Team

Figure 4.4.37 Volume and Direction of Inter-Provincial Passenger Transport

(2) Cargo

Figure 4.4.38 shows the time-series change of total transported cargo volume and railway cargo volume (thousand tons per year), and cargo traffic) (million ton-km) from 2012 to 2021.

The actual amount of cargo transported by the railway has been decreasing since 2014 ro date. In addition, the railway's share of total transported cargo volume decreasd from 27.8% in 2012 to 18.9% in 2020, but slightly increaseed to 20.4% in 2021.

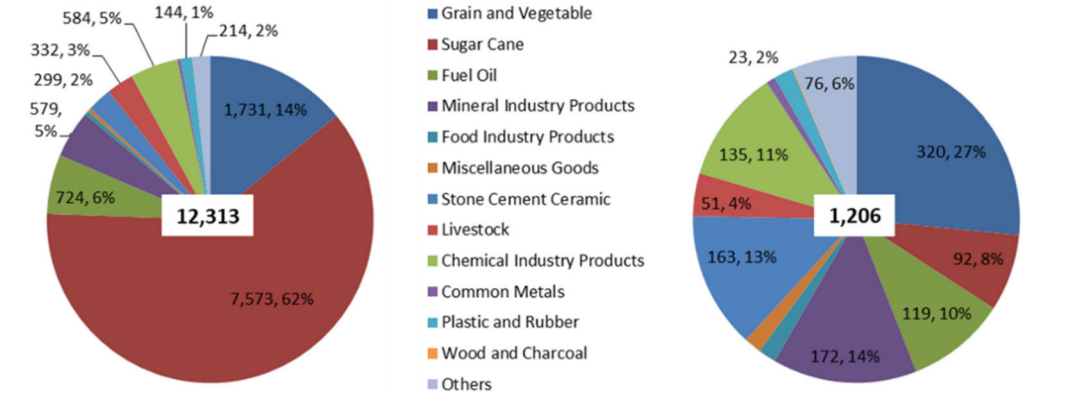


	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rail cargo (thousand ton)	16,617.2	16,879.4	16,892.8	15,566.2	15,119.0	13,449.3	12,856.2	13,525.6	11,840.0	10,292.4
Share against total	27.8%	25.2%	25.9%	24.5%	23.8%	20.4%	20.2%	19.8%	18.9%	20.4%
Rail cargo (mil. ton - km)	2,714.4	1,533.7	1,786.6	1,704.0	1,522.3	1,455.5	1,221.5	1,131.9	1,019.9	883.5
Share against total	30.3%	20.4%	21.7%	19.5%	17.9%	16.9%	14.8%	16.2%	14.3%	21.2%

Source: ONEI

Figure 4.4.38 Rail Cargo volume (,000 ton, left) and traffic (million ton-km, right)

Figure 4.4.39 shows cargo volume and cargo traffic in 2018.



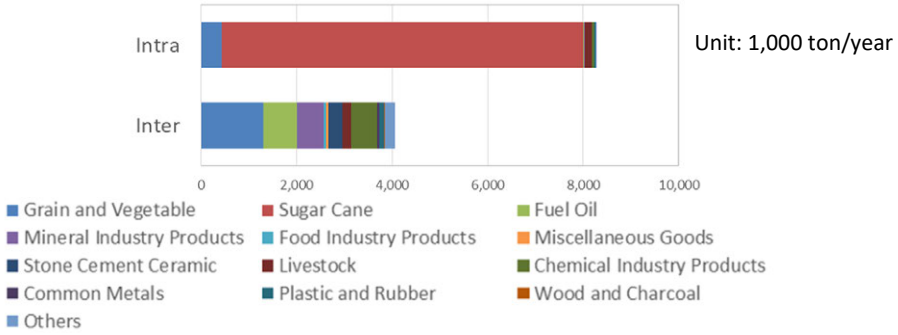
Volume in weight (1,000 tons/year)
- Sugar cane occupies the highest share of 62%
- Grain/Vegetable 14%, Fuel oil 6%

Weight distance (Million ton-km/year)
- Food product 27%
- Common Metals 14%, Stone/Cement 13%

Source: JICA Study Team

Figure 4.4.39 Cargo volume (,000 ton, left) and cargo traffic (million ton-km, right) in 2018

The total volume of railway cargo was reduced to 12.3m tons in 2018. Sugarcane accounts for 62% of total railway cargo in terms of weight, at about 7.5m tons, followed by grain/vegetables, 1.7m tons (14%), and fuel oil, 0.7 million tons (6%).

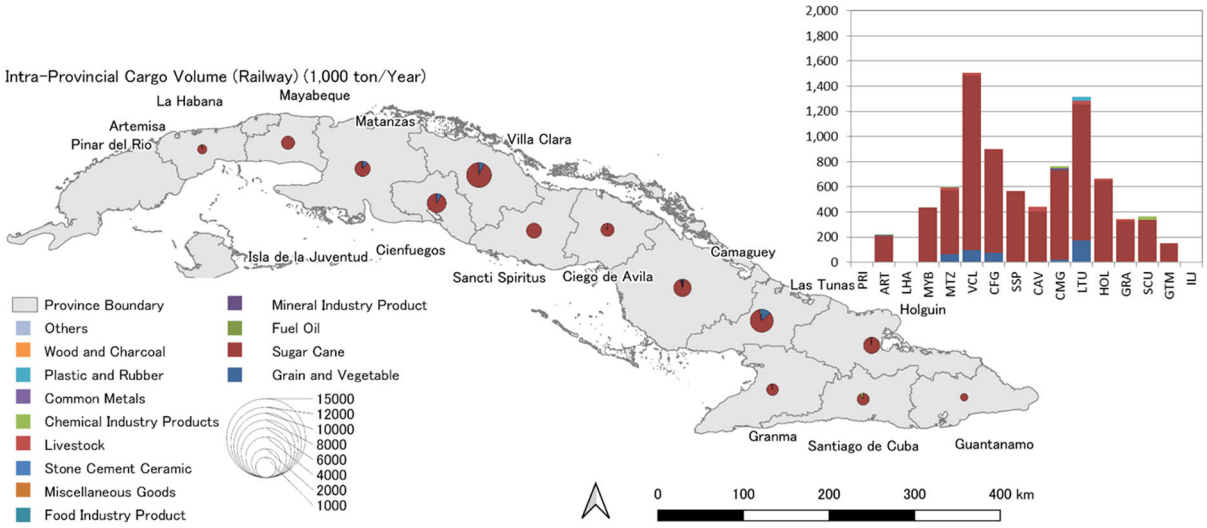


Source: JICA Study Team

Figure 4.4.40 Cargo volume (,000 ton, left) by intra- and inter-provincial movement in 2018

Sugarcane accounts for 92% of total intra-provincial cargo transport by weight, mostly over short-distance industrial lines within provinces.

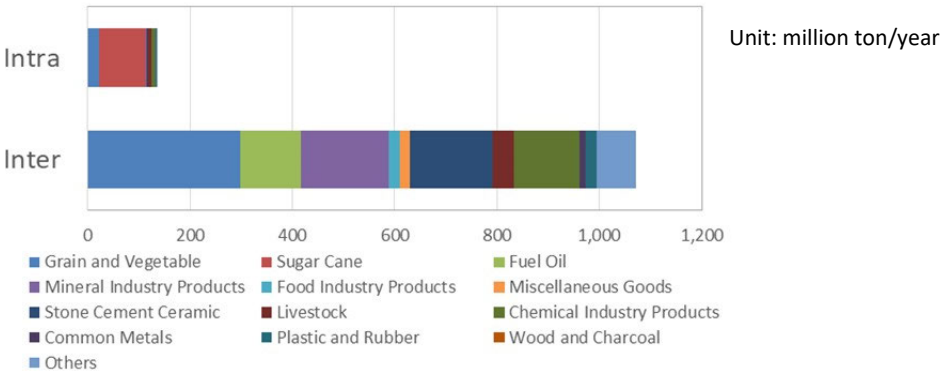
Figure 4.4.41 shows intra-provincial rail cargo generation by province. Villa Clara and Las Tunas are the major sugarcane transport generators, followed by Cienfuegos, Camaguey, Holguin, Matanzas, etc. There is no need for sugarcane transport in La Habana or Pinar del Rio.



Source: JICA Study Team

Figure 4.4.41 Intra-provincial rail cargo generation by province

Various commodities are transported across provincial boundaries. By weight, grain/vegetables account for 32%, followed by fuel oil at 18%.

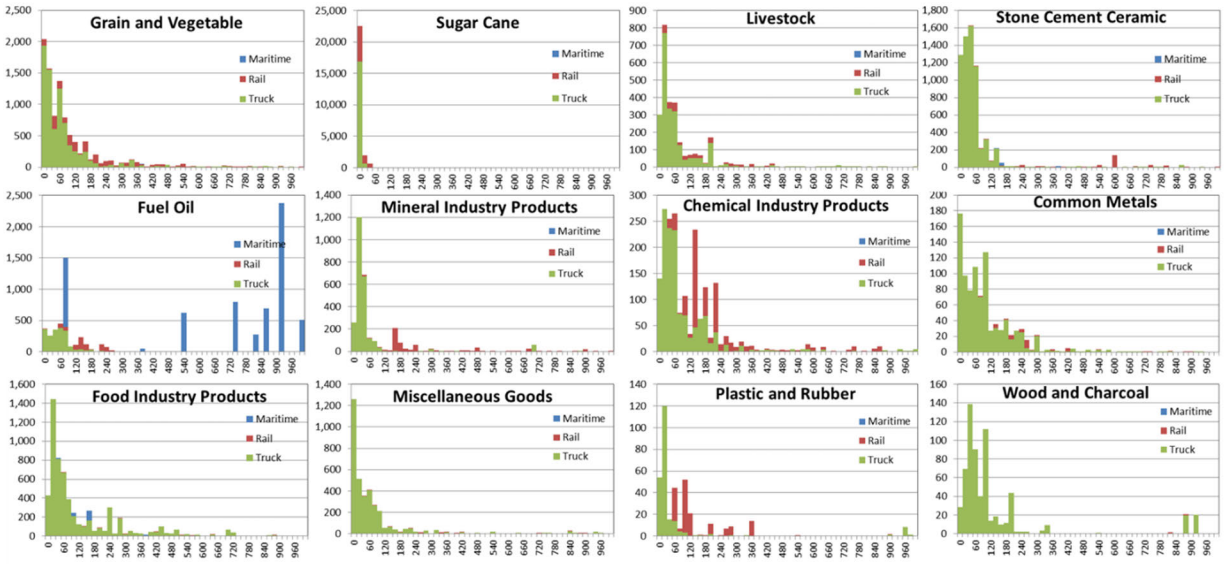


Source: JICA Study Team

Figure 4.4.42 Cargo traffic (million ton-km) in 2018

In 2018, cargo traffic was also reduced to 1.2 billion ton-km. The percentage share of grain/vegetables was 27% (320m ton-km), followed by common metals 14%, stone/cement 13%, chemical products 11%, fuel oil 10%, etc.

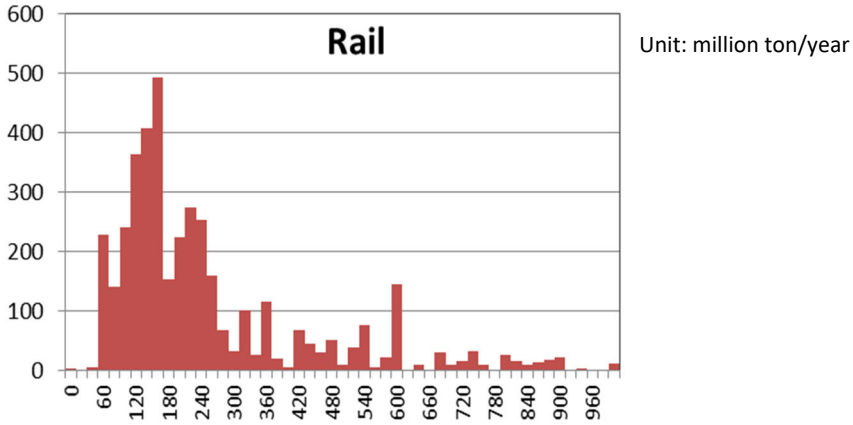
Figure 4.4.43 shows travel distance distribution by type of commodity. Of railway cargo transported in 2018, 80% moved within 180 km. Noted that most short-distance cargo transport (less than 60 km) was for sugarcane.



Source: JICA Study Team

Figure 4.4.43 Transport distance by commodity (intra- & inter-provincial movement combined) (thousand ton) in 2018

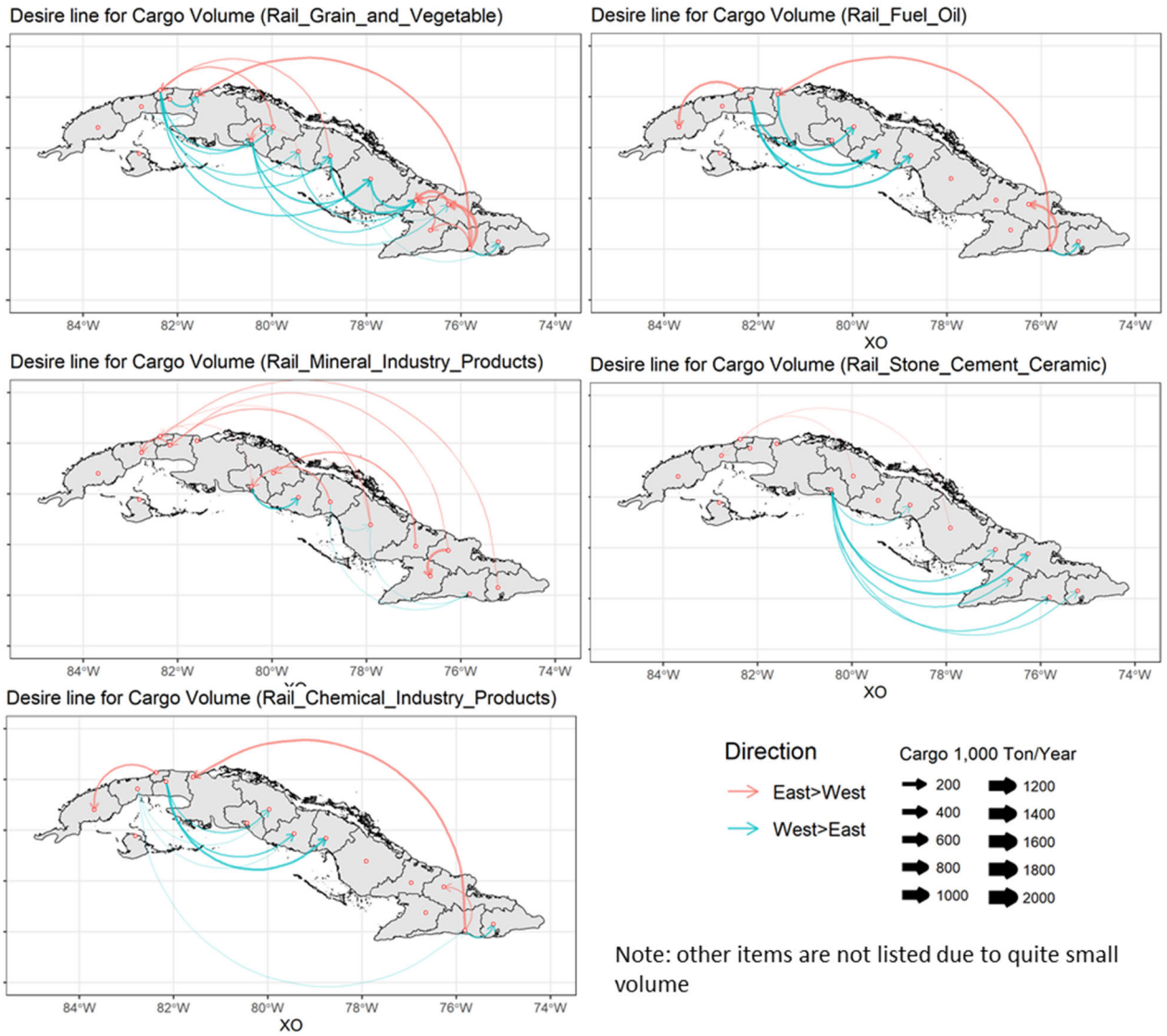
Figure 4.4.44 shows railway cargo transport distance (inter-provincial movement only) in 2018, with distances ranging from 60 km to 900 km. The most frequent transport distance is about 150 km. Dominant commodities for travel around 150 km are chemical products, plastic, and rubber, livestock, and mineral products. Transport distances for minerals, stone/ceramic, chemical products, and plastic/rubber are rather long, ranging from 300 km to 900 km.



Source: JICA Study Team

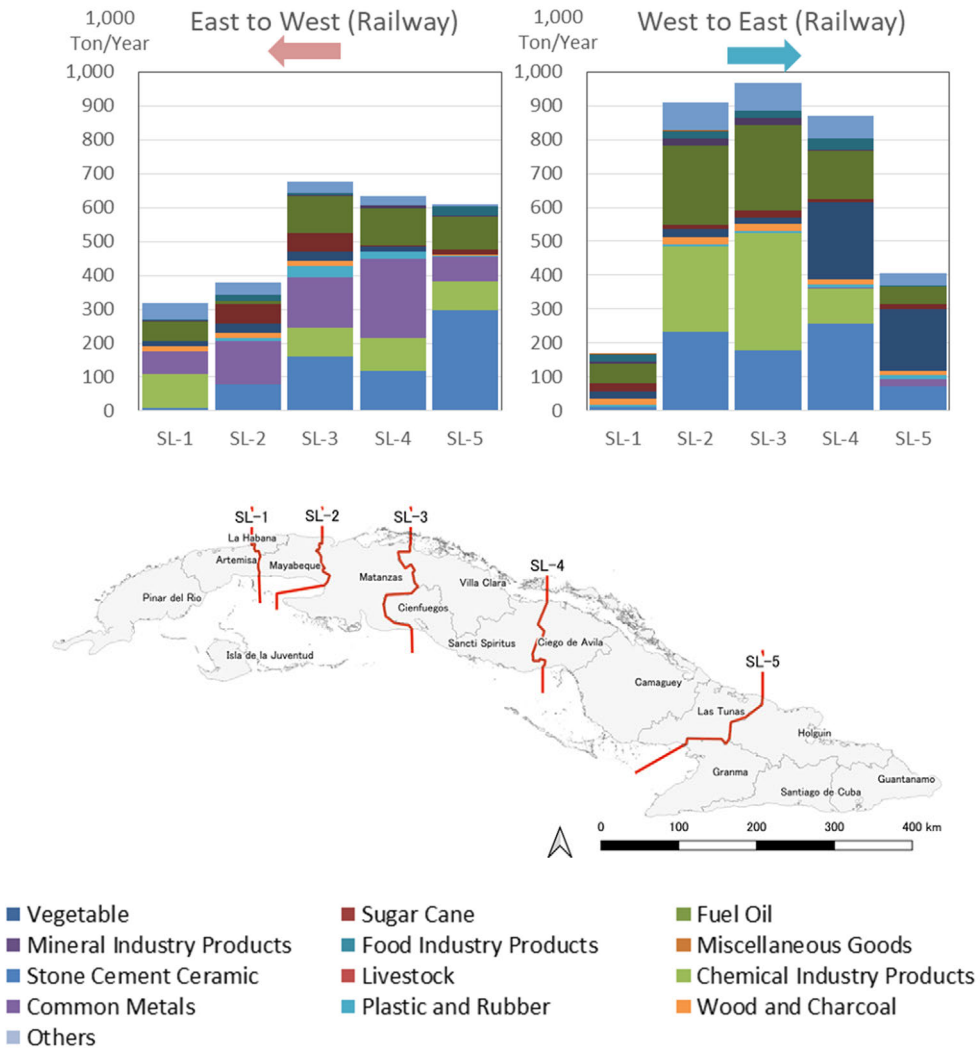
Figure 4.4.44 Railway cargo transport distance distribution (inter-provincial movement) in 2018

Figure 4.4.45 shows rail cargo movement patterns of major commodities. In terms of volume, fuel oil is moved less by rail and more by coastal shipping. But some fuel oil moves by rail from Havana and Matanzas to provinces in the central region. Stone/cement products are moved from Cienfuegos to provinces in the east. Some unique movement patterns are stand out in these figures. Moving from west to east, grain/vegetables, food, fuel oil, chemical products and stone/cement are the main commodities. Moving from east to west, vegetables, mineral products and fuel oil are the dominant commodities. Overall, cargo volume from west to east is larger than from east to west (see Figure 4.4.46).



Source: JICA Study Team

Figure 4.4.45 Rail cargo movement patterns in 2018



Source: JICA Study Team

Figure 4.4.46 Screen line rail cargo volume in 2018

4.4.15 Demand Forecast up to 2030

A preliminary demand forecast was made based on the future population and economic growth scenarios (scenarios 1 and 2).

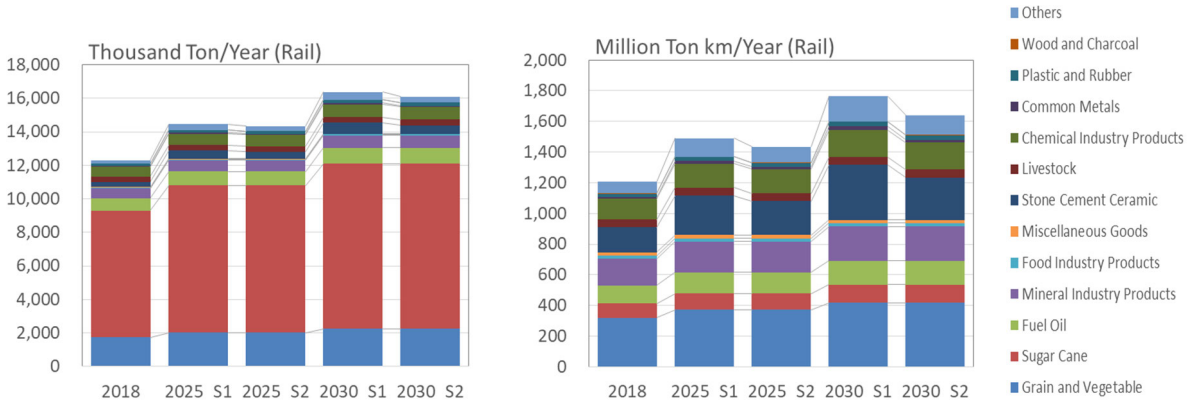
(1) Passenger demand forecast

Passenger travel demand was estimated based on the future population projection by ONEI. Since the population will not grow in the future, total passenger travel demand will be stable. However, given the current situation where the services of passenger trains are limited, there is a possibility that the demand is increased if the level of the services is improved. Hence, to promote the usage of the railway, it is important to make the railway more attractive and convenient. Total passenger trips (inter-provincial) are estimated at 49,000 trips/day up to 2030. Modal split between modes depends on travel distance. For example, the railway's share between Havana and Piñar Del Rio is 14%; for Havana and Villa Clara,15%; for Havana and Camaguey, 20%; for Havana and Santiago de Cuba, 21%.

(2) Cargo demand forecast

Cargo demand forecast was made for two cases based on economic growth scenarios 1 and 2 (S1 and S2) as shown in Figure 4.4.47.

Rail cargo volume will increase to about 1.3 times by 2030, which is not such a significant increase. Short-distance sugarcane transport will still be the major rail transport need in the future if there are no significant changes in the economic structure. In terms of ton-km, the volume will increase to 1.35 to 1.45 times by 2030.



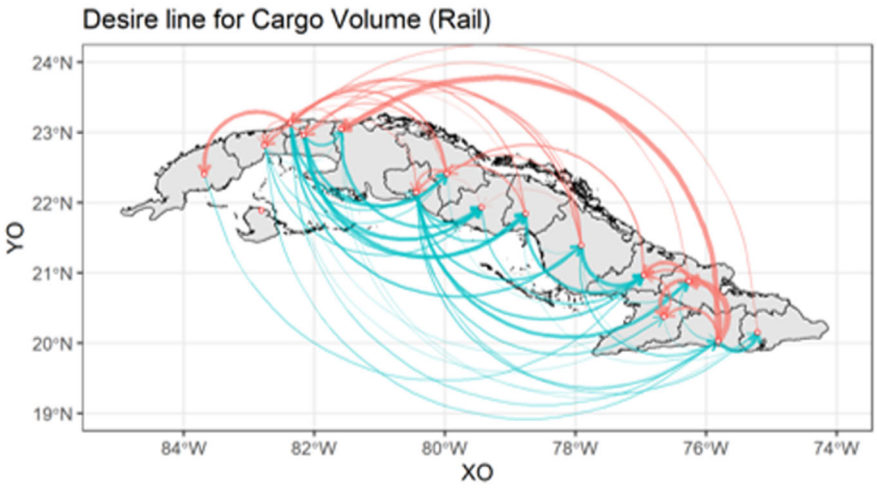
Future cargo volume by railway (1,000 tons/year)

Future cargo traffic distance by railway (million ton-km/year)

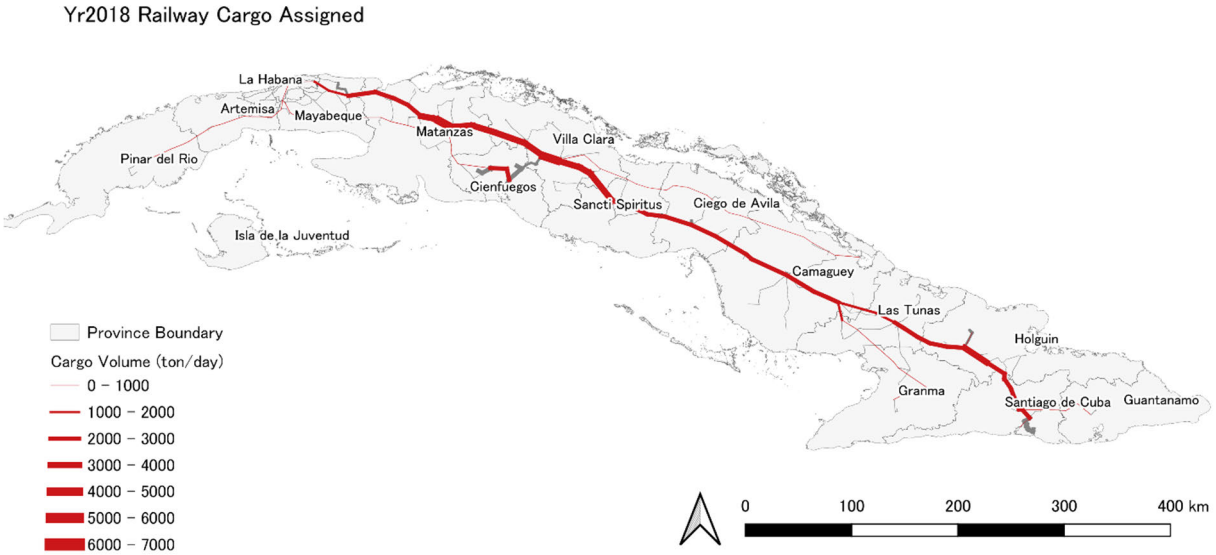
Source: JICA Study Team

Figure 4.4.47 Future rail cargo transport demand

Figure 4.4.48 and Figure 4.4.49 show existing and future (S1) rail cargo movement patterns. Since this demand forecast was made based on observed trends (existing cargo movement patterns), that is, no strategic spatial development (cargo generators) was considered in this demand forecast. So, there are no significant differences between existing and future cargo movement patterns.



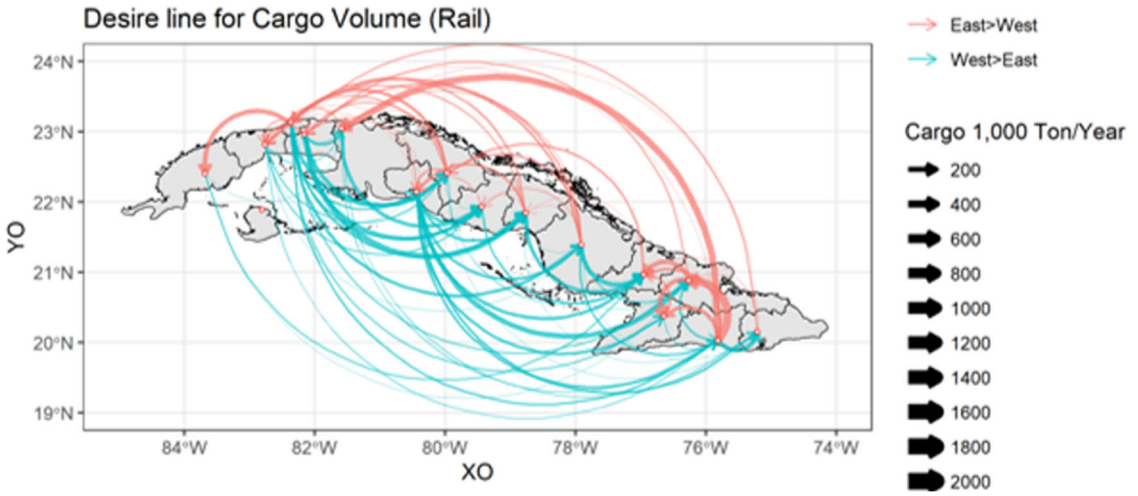
Cargo Movement (desire line) in 2018



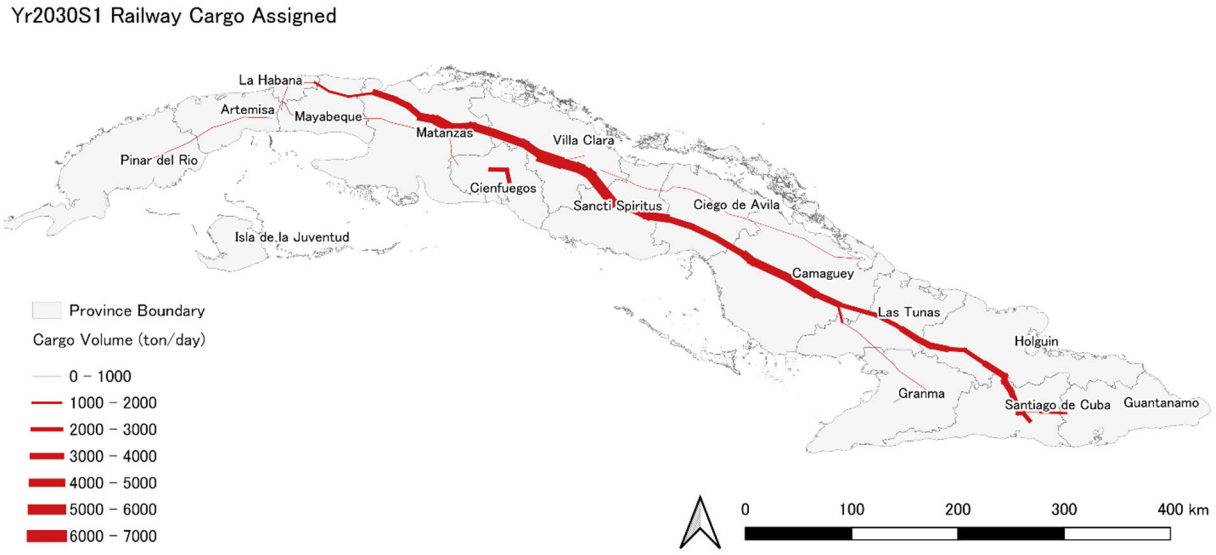
Cargo traffic assignment in 2018

Source: JICA Study Team

Figure 4.4.48 Existing rail cargo movement



Cargo movement (desire line) in 2030 (scenario 1)

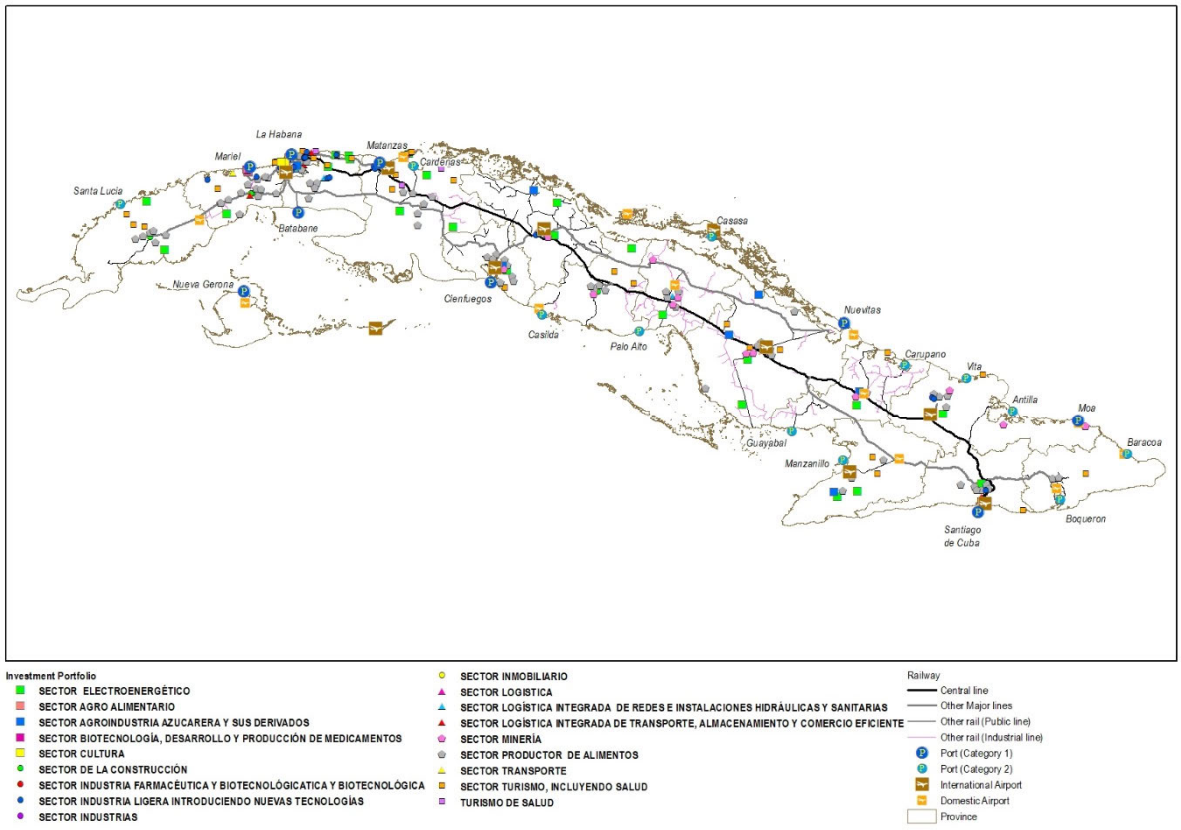


Source: JICA Study Team

Figure 4.4.49 Future rail cargo movement (scenario 1)

4.4.16 Strategic development along rail lines

Figure 4.4.50 shows the locations of expected investments listed in the investment portfolio and the existing rail network. As seen in the figure, many of the expected investments are located close to the rail network. As such, it is valuable to consider feeder services (trucks) for cargo transport between rail stations and such investment locations. In this regard, further detailed analysis will be carried out.



Source: JICA Study Team

Figure 4.4.50 Investments Listed in the Investment Portfolio

4.4.17 Up-stream policies

Two important policies were considered in preparing the vision, objectives, and strategies in the rail sector of the master plan. These are:

- Indications from the President
- Cuba y su desafío económico y social (Cuba and its Economic and Social Challenges)

(1) Indications from the President

"Indications from the President", which covers whole areas related to national development, was issued in June 2019. Table 4.4.28 summarizes the railway sector-related indications.

Table 4.4.28 Railway-related Indications

"Indications from the President" in June 2019
1. Efficiency improvement: to increase the efficiency of rail freight transport by optimizing the transport carrying capacities following the government policy of Operation Port-Transport-Internal Economy (OPTEI).
2. Modal shift: to shift from the road (truck) transport services to railway transport services based on the experiences and to systematize the rail transport services as soon as possible.
3. Financial support from Russia: The Central Bank of Cuba should conclude, in the shortest time possible, negotiations with the Russian banks for implementation of the projects contracted and prioritized with the companies.
4. Capacity increase: To increase the availability of locomotives and freight wagons, starting with the purchase of spare parts, as well as to increase the manufacturing of parts in specialized organizations (UIM, MINDUS).
5. Electric tram in Habana: Study the possibility of introducing the electric traction tram passenger service in La Habana, jointly work with the Ministry of Energy and Mines for the analysis of the required electric system. - CIMAB
6. PC Sleepers: ensure the production plan of sleepers and the repairing of the Santa Clara del FC plant, starting with accelerating the procurement of necessary resources to guarantee the production.
7. PC Sleepers for industrial lines: MICONS is expected to accelerate the procurement of necessary resources for the production of Cuba 71 concrete sleepers for the industrial lines used in the sugar harvest season.
8. Passenger railway in north Holguin: Complete the study of the development of the railway in the north of Holguín to complete the tourist development of that area. - CIMAB
9. Revitalization of the Hershey electric railway: to carry out feasibility on the revitalization of the Hershey electric railway from Casablanca to Matanzas, to use it for passenger transport for tourists as well as the local people. – CIMAB
10. Trinidad-Placetas Line (disconnected section at present): To study alternatives to connect Trinidad and Placetas by rail line (completion of disconnected section) and to connect the line to the main public line.

Source: Indications from the President (summarized by JICA Study Team)

(2) Cuba y su desafío económico y social (Cuba and its economic and social challenges)

The document "Cuba y su desafío económico y social (Cuba and its economic and social challenges)" was issued in September 2020. It includes 10 common development principles for all social and economic sectors as stated below:

1. Maintain the central planning system
2. Protect domestic industries and encourage a self-sustaining economy (structural change from import-dependent economy)
3. Control the market by indirect methods
4. Encourage industrial collaboration between various economic actors
5. Stimulate the domestic market
6. Increase self-sustainability of state-owned enterprises
7. Restructure existing state-owned enterprises (ownership, operation, management, business relations with non-state-owned sectors)
8. Strengthen the competitiveness, increase efficiency in using materials and financial resources, and improve labor productivity and motivation
9. Establish a robust environmental policy in line with social needs
10. Encourage collaboration between various economic actors including foreign direct investment, state-owned enterprises, etc.

It is understood that the vision, objectives, strategies in the rail sector should follow these principles.

Also in this policy document, 16 key economic sectors are designated to revitalize Cuba's economy. Among them, it is understood that the railway sector is expected to support 2) sugar agroindustry and its derivatives (by maintaining industrial lines in each province), 3) tourism (effective use of the new Chinese rail cars to attract tourists, Hershey line improvement, missing section improvement, etc.). Plus, integration with other modes of transport is expected as stated in 10) Integrated logistics of transport, storage and efficient trade.

1) Food production
2) Sugar agroindustry and its derivatives
3) Tourism
4) Professional services
5) Health
6) Pharmaceutical, Biotechnology, and biomedical production industry
7) Telecommunications
8) Construction
9) Energy
10) Integrated logistics of transport, storage and efficient trade
11) Integrated logistics of water and sanitation networks and facilities
12) Manufacturing industry
13) Domestic trade
14) Foreign trade
15) Financial system
16) Employment and wage policy, security, and social care

Some important statements related to the rail sector are summarized in Table 4.4.29.

Table 4.4.29 Implications from "Cuba y su desafío económico y social" in September 2020

Integrated logistics of transport, storage and efficient trade	• Continue to improve processes of the Port-Transportation-Internal Economy Operation (OPTEI) to reduce demurrage expenses and achieve greater efficiency of the chain's components. • Promoting the extension and use of the Fleet Management and Control System in all transport companies in the country, making adjustments to the mobile web platform to facilitate and ensure a higher level of monitoring and analysis, facilitating control for the detection and reorganization of the traffic that leads to inefficient operation of the transport means. Work on the introduction of fuel sensors.
Cargo transportation	• To apply mathematical models in coordination with the universities for the optimization of the traffic included in the load balance, to improve the use of the capacity and route of the means of transport (trucks, railway wagons and ships) and the use of fuel. • To fully use the load capacity of cars and wagons, so that they move with no less than 75% of their capacity. Combine loads from various clients having common origins and destinations.
Passenger transportation	• Encourage the use of bicycles and motorcycles and electric bicycles. Plan for the use of public bicycles, taking in international experience counts. • Study the possible reordering of passenger transportation routes in all territories, in correspondence with worker mobility.

Railway sector	• Continue the process of improving the railway system, with the creation of enterprises for the transportation of sugar products, construction, repair and maintenance of railways, and express service of rail loads. • Transforming the railway service system, modifying the way of contracting and paying for maintenance, guaranteeing the completion of the track brigade's workforce.
Cabotage	• Increase cargo transportation by cabotage by 10%, concerning what was planned in 2020. To this end, use chartered vessels for transportation of cement, in the transportation of food in the returns and thus avoid the movement in ballast. • Reorganize cargo transportation by cabotage with the available means. Evaluate the acquisition of at least two small ships to work in the traffic of both coasts.
Automotive Transport	• Allowing attention in state workshops to the self-employed. • Authorize the companies MotorCentro and MCV Servicios S.A, the provision of services in foreign currency (MLC) to individuals.
Computerization	• Development of electrification and comprehensive policy for the rearrangement of passenger transport in Havana. • To extend in a staggered way the commercialization of tickets for the inter-provincial transportation through the APK Traveling. • Study the incorporation of carriers into the electronic ticket marketing system. • Implement online reservation of the shifts for the technical automotive revision service. • Developing online ticketing of national airlines in CUP. • Develop the computer platform to provide the services of the schools of road education and driving, with the distance and blended mode. • Increase the development and use of simulators in all branches of transport, in coordination with the Simpro research and development center (L 220)
Management	• Organize the implementation of incentives for innovation, recovery, and manufacturing of spare parts in the workshops. • Evaluate in which workshops it would be convenient to transform their management system, including the modalities of non-agricultural cooperatives or others. • Provide the service by state entities for leasing means of transport to private companies. • Extend to the rest of the provinces the experience of Havana in the application of non-state forms of management in the auxiliary and related services of transport.

Source: JICA Study Team

4.4.18 Railway sector planning issues

(1) Understanding of existing conditions

Based on interviews with UFC officials, field investigations by the study team and available data, issues to be addressed in the master plan, especially those focused on physical conditions, are summarized as:

1. Large railway network: Cuba has about 8,195 km of rail lines, including many low-demand lines, non-operating lines, industrial lines, etc. UFC must maintain the whole system as a national asset.
2. Deteriorated infrastructure:
    - Shortage of freight wagons, passenger coaches and locomotives
    - Outdated communication and signal systems and shortage of these
    - Poor condition of more than 300 rail bridges and sewers
    - Poor results in track repair work (less progress than expected)
    - Shortage of spare parts and equipment to repair/maintain infrastructure
    - Non-operating and seasonally operating lines lack proper maintenance.
3. Lack of communication and information sharing among concerned organizations.
    - Workshops fail to share information and materials.

4. Various human resources issues: disobeying orders, frequent job-hopping, shortage of highly qualified/skilled staff, low salaries, poor working conditions (health, safety and environment).

As above, issues were identified in three major areas: 1) infrastructure improvement/maintenance; 2) communication/cooperation between workshops; 3) human resource issues.

(2) Issues identified through TWG activities

Table 4.4.30 summarizes issues identified in the TWG based on understanding of the existing conditions.

Table 4.4.30 Railway sector issues to be addressed

Key areas	Issues to be addressed
1. Planning & coordination	• Develop inventory database of rail infrastructure, equipment, spare parts
	• Develop rail infrastructure maintenance plan/programs
	• Develop human resource database of UFC staff
	• Develop human resource development plan/training programs
	• Develop database for cargo handling and passenger transport records
	• Continue implementing UFC 2028 plan in coordinated manner with other sectors
	• Develop coordination system among MEP, MITRANS, ATF, UFC.
	• Develop coordination system among railway-related Empresas
	• Develop coordination system between workshops
	• Rail sector master plan integrated with other economic sectors (investment portfolio, the northern coastal area/islands, etc.) – as part of the project supported by Russia
	• Develop industrial line improvement/rehabilitation plan (prioritization) for sugar-related industries and local communities
	• Develop intermodal passenger transport service plan, coordinated with bus services
	• Develop intermodal cargo service development plan, coordinated with truck services
	• Develop rail business development plan coordinated with cargo owners
	• Development of non-rail business development plan (kiosk, etc.)
	• Study involving non-state sector/FDI in service provision (cargo and passengers)
2. Transport infrastructure development	• Accelerate ongoing rail infrastructure improvement with support from Russia.
	• Study improvement for missing line (Fomento to Meyer)
	• Study rehabilitating Hershey Line as a tourism attraction and commuter rail system
	• Study development of new lines to serve the northern keys area
	• Phased and continued improvement of the industrial lines
	• Continuous PC sleeper production
	• Continued improvement of communication system and safety device installation
	• Improvement/renewal of workshops
	• Procurement of spare parts, materials, machines, and equipment for maintenance work
	• Study on urban transit systems in Havana and Santiago de Cuba
3. Environment, safety, and security	• Installation of advanced communication systems and safety devices
	• Study on security enhancement
	• Study on electrification of rail systems
	• Public enlightenment about safety and security
	• Prevention measures against COVID-19
	• Public enlightenment about COVID-19

Key areas	Issues to be addressed
4. Transport service and industry development	• Attract more railway passengers by improving LOS (level of service)
	• Introduce an online ticketing service
	• Introduce a smart card system
	• Introduce commuter services using existing railway facilities
	• Attract tourists, especially from abroad
	• Improve/enhance in-train service
	• Attract more cargo consigners by improving the service
	• Revise monthly/weekly “balance de cargas” system to increase efficiency
	• Urgent business plan: effective use of new passenger rolling stock
	• Non-rail business development: commercial facilities in stations, etc.
	• Promote national railway industries
	• Coordinate with the investment portfolio.
	• Introduce 3rd-party Logistics (3PL) service, possibly with non-state sector
5. Transport pricing and resource allocation	• Provision of an appropriate annual state budget for maintenance
	• Increase staff salaries to attract quality human resources to the rail sector
	• FDI can be considered in rail infrastructure development and service provision
	• Increase revenue from non-rail business (station building, etc.)
	• Consider impacts of rail investments on spatial development (increased land value), including the use of transport infrastructure to increase attractiveness to investors.
6. Institutional & regulatory development	• Legislative/regulatory frameworks for rail transport service provision, operation, and maintenance should be reformed, introducing FDI, and more scope for private-sector in providing rail transport infrastructure and services.
	• Coming shortage of human resources due to aging must be countered with long-term training programs in planning, management, and operations to improve staff capability

Source: TWG and JICA Study Team