

United Mexican State Feasibility Study on Introducing AGT System in Cancun

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Ministry of Economy, Trade and Industry

Japan International Consultants for Transportation Co., Ltd. (JIC)

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1. Study Contents

● Background

- It is necessary to improve the mobility of tourists and residents in Cancun, which is a global beach resort and the population is rapidly increasing, and to reduce traffic congestion.

● Objective

- Improve the public Transportation system and Urban Transportation, revitalize the economy, and enhance social benefit (public interest).
- Introduce AGT system and promote infrastructure export.

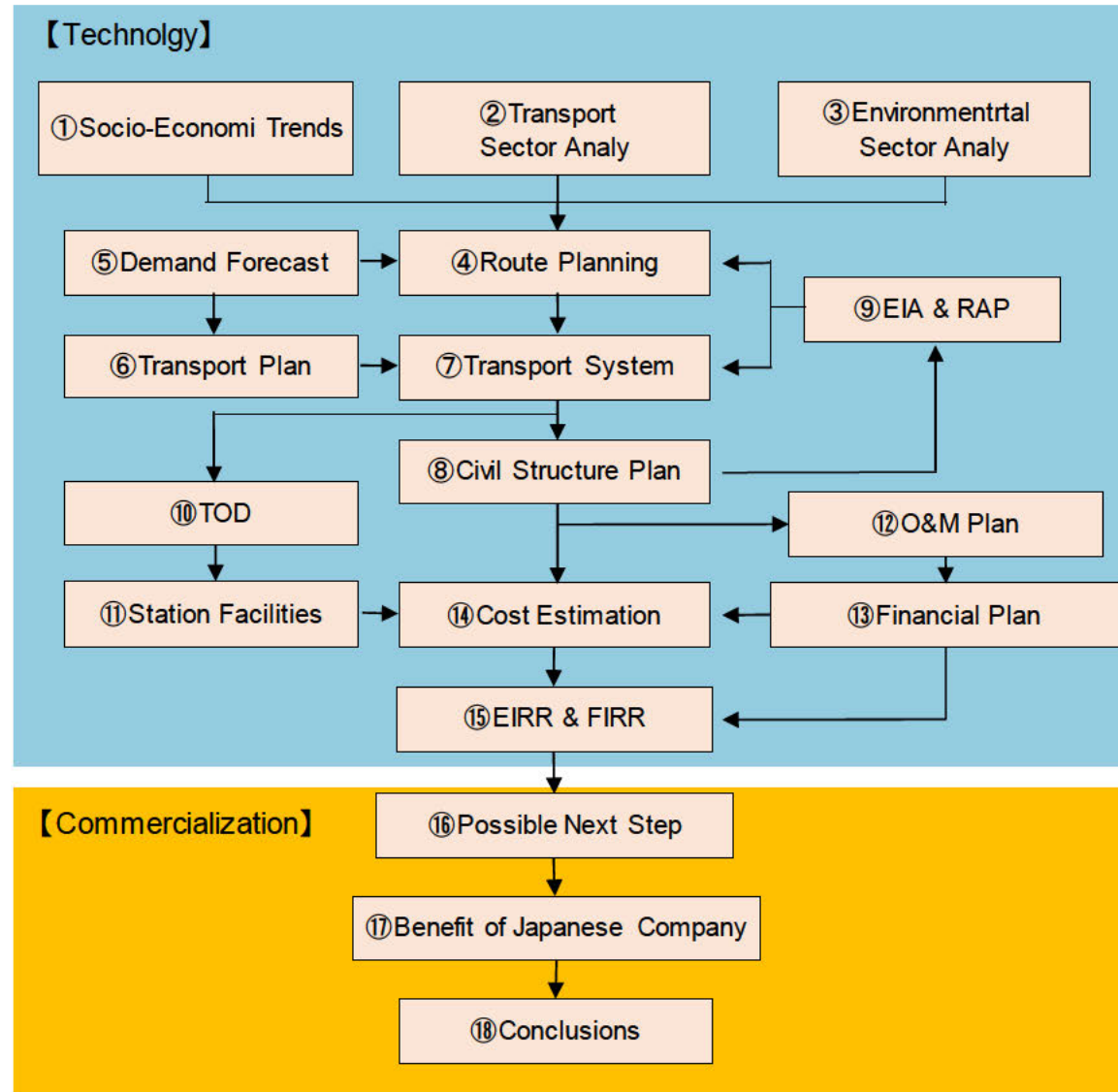
● Schedule

Item/Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
METI Study(This study)	■									
FS, Environmental and Social Consideration		■								
Basic Design			■							
Detailed Design				■						
Negotiation(Loan Procedure, Bidding, Examination, etc)				■	■	■				
Loan Contract/ Agreement Signing						▼				
Procurement / Construction / Construction Supervision						■	■	■	■	
AGT Operation									▼	
O&M									■	■

1. Study Contents



● Study Flow



2. Socio-economic trends and transport sector analysis



- Social Economics

- The United Mexican States participated in the APEC (since 1993) and the OECD (since 1994) . NAFTA had already been in effect since 1994. Figures are shown in the table below. Mexico's GDP growth rate shows steady development.
- The AMLO administration invests in infrastructures. Projects such as Oil refinery (State of Hidalgo • State of Nuevo León), the Maya Train have already been started.

Item	Denomination	Figures
Population	(Ten thousand)	12,619
GDP	(Billion USD)	1,223
GDP Growth Rate	(%)	2.0
GDP per Capita	(USD)	9,807

- Natural hazard

- Hurricane is the most concerned natural hazard on the Caribbean Coastal area of Mexico. The state of QuintanaRoo is facing the Caribbean Sea therefore it is likely to occur landing of a hurricane than other states. In October 2020, Hurricane Willma landed and caused damages to the hotel area.

Frequency of landing of hurricanes (by states)

State	Figures*
Baja California Sur	19
Sinaloa	18
Quintana Roo	13
Michoacán	9

*Second half of 20th century (1951~2000)

2. Socio-economic trends and transport sector analysis



● Economical Structure

- State of Quintana Roo rated 25th out of 32 states on the ranking of population, economic growth rate reaches 4.1% (2018) and it rated third out of 32 states. The economical figures for the State of Quintana Roo are shown in the table below.

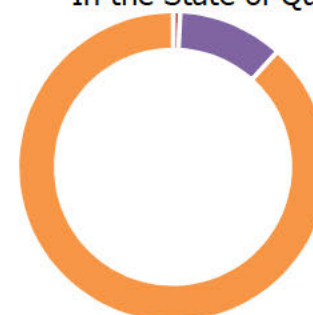
Item	Denomination	Figures	Rate (Out of 32)	Years
Population	1000 person	1722.6	25	2018
State GDP	Million Mexican Pesos	374,569	18	2019
State GDP growth rate	%	4.1	4	2018
State GDP per capita	Mexican Pesos	196,487	10	2017

- Population by sector of economic activity in the State of Quintana Roo is mostly covered by tertiary industry (commerce, service) and it represents 88.28% (2017)
- In 2019, the airports with the highest number of foreign passengers were Cancún.

Main airports of arrival

Airport	Arrival(person)
Cancún	7,889,646
Mexico City	4,989,201
Los Cabos	1,791,769
Pto. Vallarta	1,515,681

Population by sector of Economic Activity
In the State of Quintana Roo

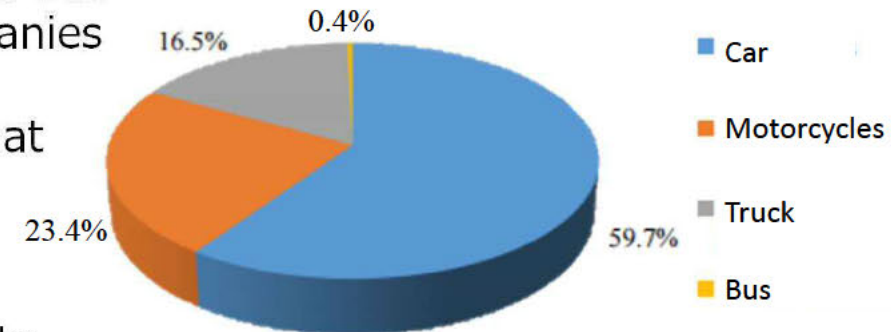


Legend
 Primary sector : ■
 Secondary sector : ■
 Tertiary sector : ■

2. Socio-economic trends and transport sector analysis



- In the case of Benito Juárez, a total of 280,897 cars are in operation, and the traffic share of cars is about 60%.
- 36 routes from 4 companies are operating in Cancun, and it shows that the share of bus traffic is high. (11 routes from 4 companies goes to the hotel zone)
- Regarding bus traffic, the issues are that the punctuality is impaired due to overlapping routes and scattered congestion points.
- When introducing AGT, it is necessary to consider reorganizing these bus route networks.



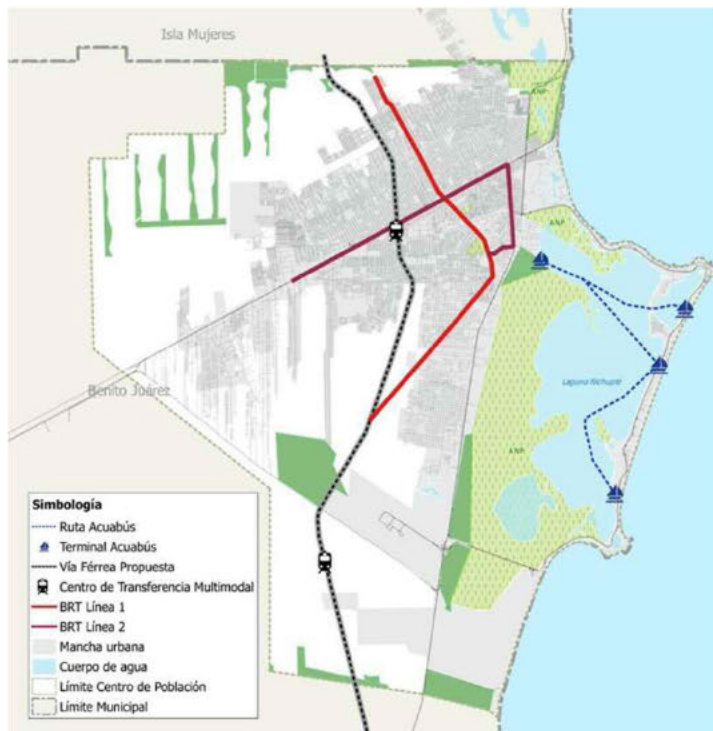
Source: Composición del parque vehicular en el Municipio de Benito Juárez(2015)

Figure. Traffic sharing rate in Benito Juárez



3. Master Plan ▪ Latest Trends

- The State of Quintana Roo has formulated the Urban Transport Master Plan
 ※PIMUS= Plan Integral de Movilidad Urbana Sustentable)
 【Mobility Strategy】 : Efficiency of Public Transport System
 - BRT type transportation system (Currently considering LRT type)
 - Transport hub development



Pranned Route (PIMUS)



Pranned Route (PIMUS)

※AGT introduction route (2019)

【Summary】

- Higher-level plan
 - : National Development Plan 2013 – 2018
 - : Quintana Roo State Plan 2016 – 2022
 - : Urban Development Program of the Population Center of Benito Juárez 2014 – 2030
- Urban development
 - : The city spreads radially.
- transportation network
 - : Traffic Jam in the City, insufficient traffic maintenance of the hotel
 - : Insufficient public transportation system (Consideration of introducing urban transportation system)

【Organizations】

- FONATUR = Fondo Nacional de Fomento al Turismo
- AGEPRO = AGencia de PROyectos estratégicos

3. Master Plan ▪ Latest Trends

- 「MEXICO PROJECTS HUB –Investment & Infrastructure」 (December 22, 2020)

○PROJECT

DESIGN, CONSTRUCTION, EQUIPMENT, OPERATION, ADMINISTRATION AND MAINTENANCE OF THE URBAN and TOURIST LIGHT TRANSPORTATION SYSTEM IN THE CITY OF CANCÚN, IN THE STATE OF QUINTANA ROO.

Type of Investment	: Green Field
Type of Contract	: PPP
Selection Process	: International Open Tender
Subsector	: Urban Mobility
Asset(s)	: Transport System 47KM
Contract Currency	: \$ 1,645 million



Pranned Route

○PLAN

- Stage1 : 33 km of elevated lanes across the hotel zone (Kukulcan boulevard) Until reaches the Cancun international airport Junction.
- Stage2 : 14 km of ground level confined lanes across Tulum Ave. and Universidades Ave
- 29 Stations and 2 multimodal terminals.
- Workshop and garage in the airport area.
- Estimated demand: 66,800passenger per day

○PROJECT SCHEDULE

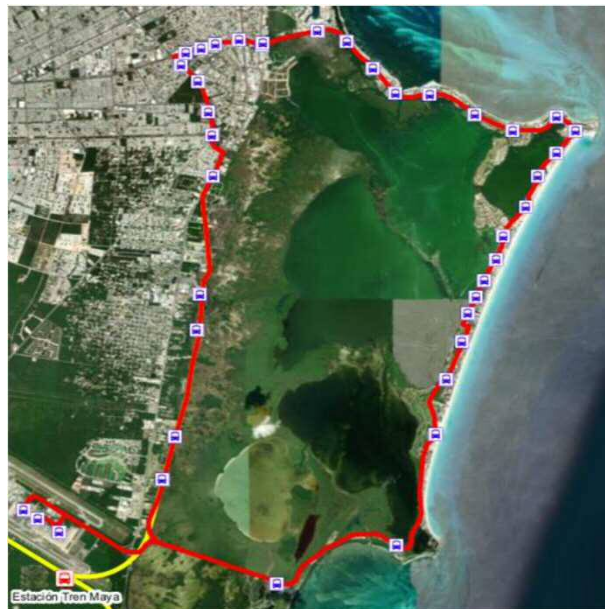
TERMS	Proposals Reception	Ruling	Contract Signing	Execution/ Construction Starting Date	Operation Starting Date	Term of the Contract
DATES	2021 1 ST QUARTER	2021 1 ST QUARTER	2021 2 ND UARTER	2021 3 RD QUARTER	2022 3 RD QUARTER	2053

3. Master Plan ▪ Latest Trends

● AGEPRO ASSUMED ROUTE

○PLAN

- Total Length: Approximately 47 km, 40 Stations (Connection route with Maya Railway)
- Stage
 - AirPort ⇌ Urban Area: 14 km of ground level confined lanes across Tulum Ave. and Universidades Ave
 - AirPort ⇌ Hotel Zone: 33 km of elevated lanes across the hotel zone until reaches the Cancun international airport Junction.



Planned Route



Maya Railway Extension

○CURRENT

- FONATUR : Examination of transportation system to the Airport and the City Until 2023, introduced part-time transportation system
- AGEPRO : The purpose is feeder transportation of Maya Railway, Connection with Maya Railway is important (Transportation network construction)

4. Route Plan

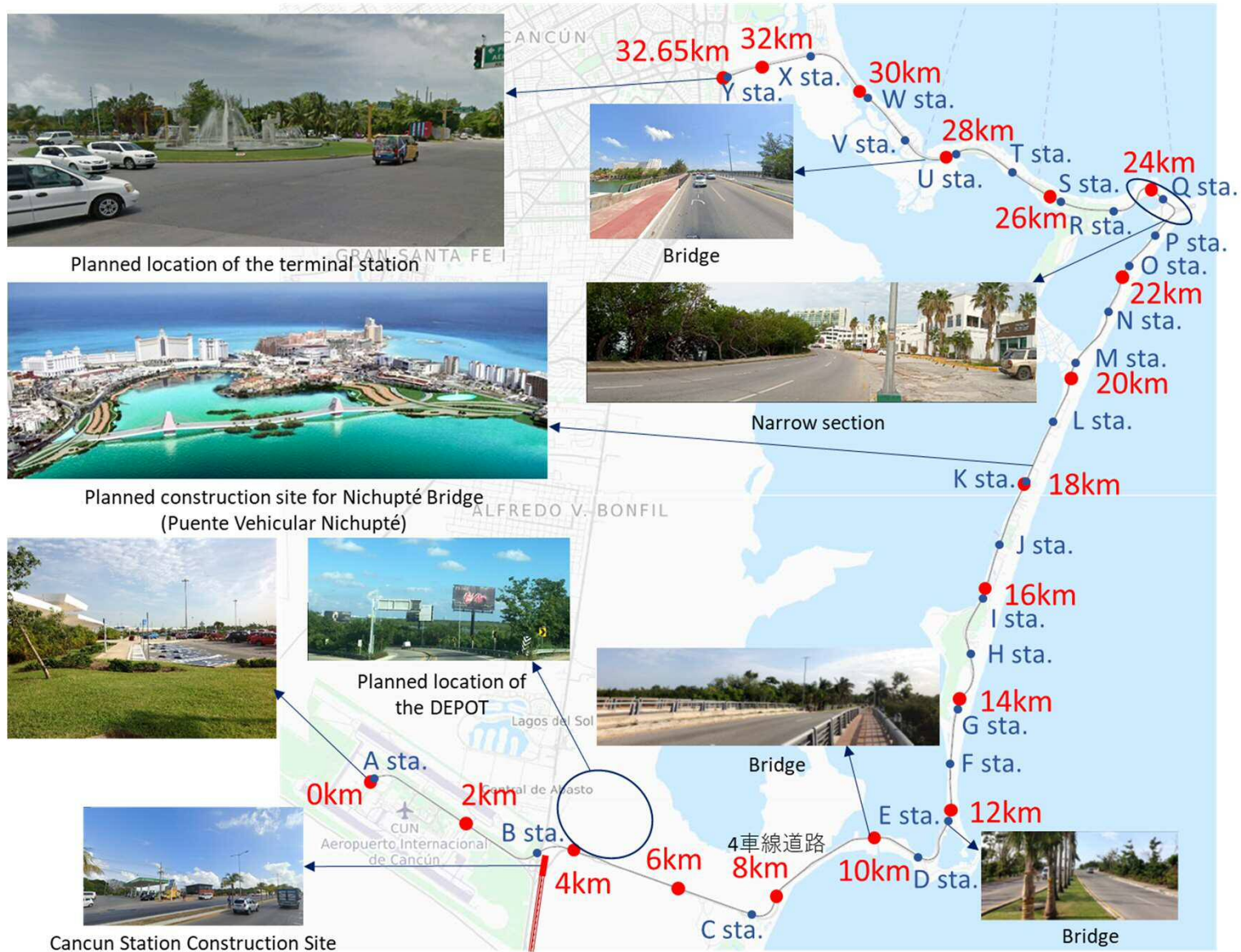
- Linear Condition

Topic	Standard
Maximum Speed	60km/h (design maximum speed 80km/h)
Number of Track	2 tracks (Double track)
Distance between centers of tracks	3.45m
Gauge	1,700mm (Center of tire width)
Minimum curve radius	Main track: R=40m Depot: R=30m
Steepest gradient	Main track: 60‰ (Topographical reasons: 100‰ Station section: 3‰ (principle: Level gradient) Depot: Level gradient

4. Route Plan

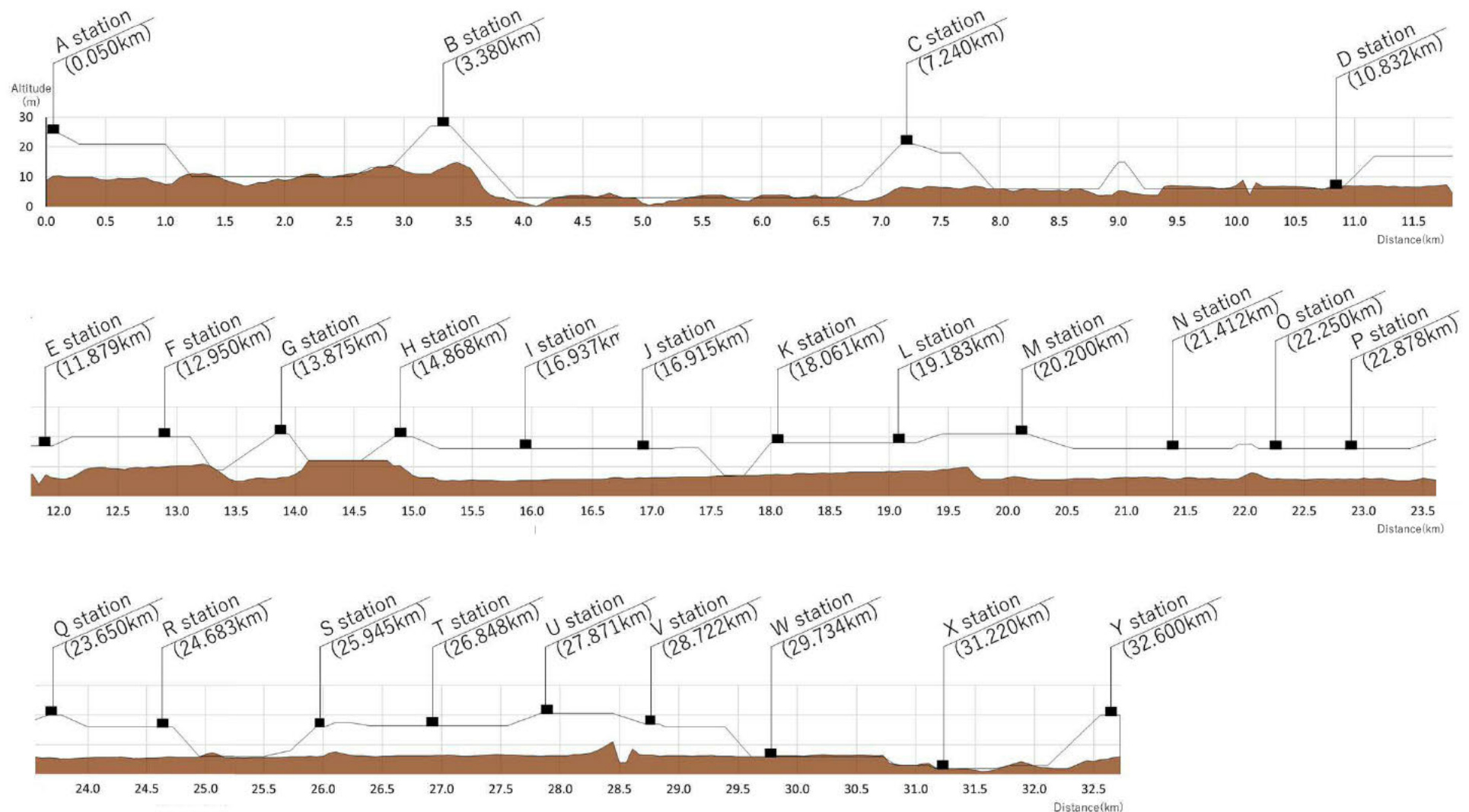


- Plane view



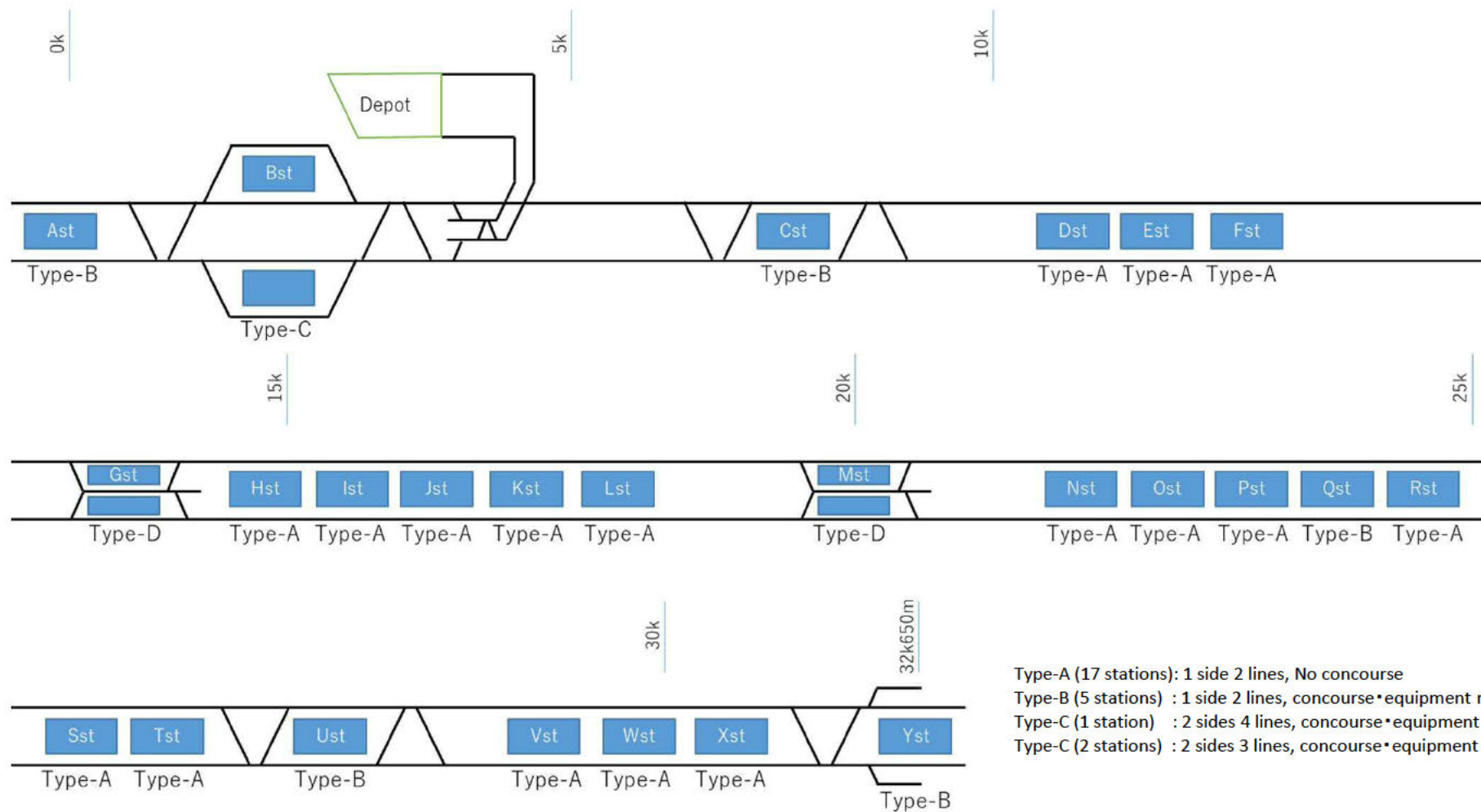
4. Route Plan

● Longitudinal Drawing



4. Route Plan

● Wiring Plan



Type-A (17 stations): 1 side 2 lines, No concourse

Type-B (5 stations) : 1 side 2 lines, concourse•equipment room

Type-C (1 station) : 2 sides 4 lines, concourse•equipment room

Type-C (2 stations) : 2 sides 3 lines, concourse•equipment room

4. Route Plan

- Station layout

No.	Station name (Provisional)	Distance	Note
ST-01	A station	0k050m	Cancun International Airport
ST-02	B station	3k380m	Maya Railway Cancun Station (The planned construction)
ST-03	C station	7k240m	Large amusement facility
ST-04	D station	10k832m	Recreational facilities
ST-05	E station	11k879m	
ST-06	F station	12k950m	
ST-07	G station	13k875m	Golf course, El Rey Archaeological Site
ST-08	H station	14k868m	
ST-09	I station	15k937m	
ST-10	J station	16k915m	Recreational facilities
ST-11	K station	18k061m	Nichupte Bridge (The planned construction)
ST-12	L station	19k183m	
ST-13	M station	20k200m	Aquarium, Shopping mall, Villa ground
ST-14	N station	21k412m	
ST-15	O station	22k250m	
ST-16	P station	22k878m	Shopping mall, Downtown
ST-17	Q station	23k650m	
ST-18	R station	24k683m	Golf course
ST-19	S station	25k945m	
ST-20	T station	26k848m	Recreational facilities
ST-21	U station	27k871m	Memorial park, Recreational facilities
ST-22	V station	28k722m	
ST-23	W station	29k734m	
ST-24	X station	31k220m	Large shopping mall
ST-25	Y station	32k600m	City

5. Demand Forecast

- The outline of the demand forecasting method of this survey is shown in the figure below.
- For the traffic from the CBD to the hotel zone and from the airport to the hotel zone, the forecast was made based on the conversion rate and the traffic sharing rate respectively.
- The binary logit model adopted by PIMUS was applied for the conversion rate, and the traffic sharing rate was referred to the Naha airport sharing rate (equivalent to the monorail).

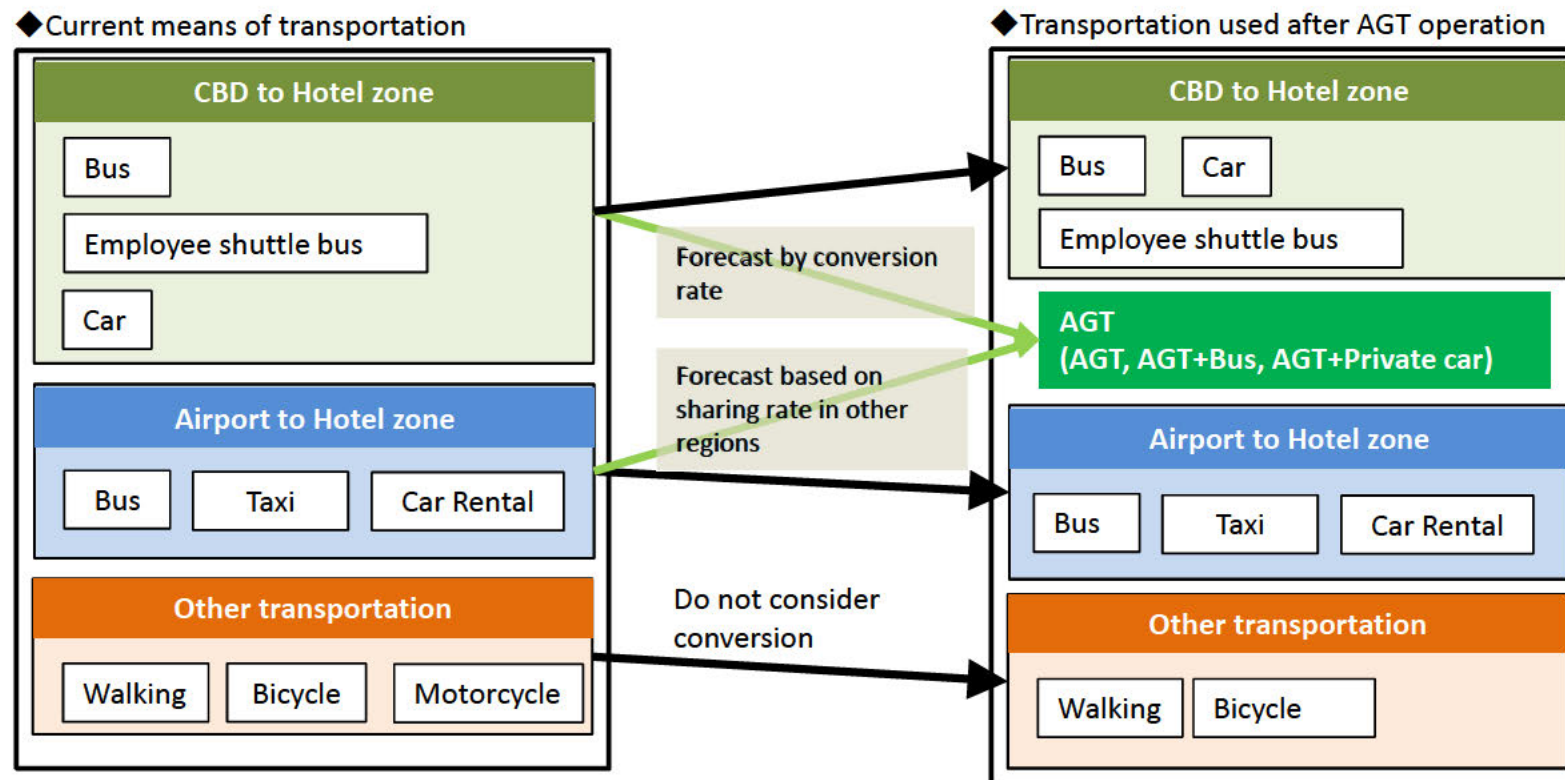


Figure. Overview of demand forecasting method

5. Demand Forecast

- The table below shows the calculation results of the converted traffic volume for the current traffic demand.
- The AGT fare is set at a flat rate of 32 Mexican pesos.
- By applying the population growth rate of the Cancun CBD area and the growth rate of the number of tourists to the current conversion traffic volume, it is predicted to be 78,836 (people/day/both directions) in the commercial opening year (2028).

Forecast result of conversion traffic volume (as of 2018)

Origin Destination Pair	Transportation	Traffic Volume	Converted Traffic Volume
①CBD ⇄ Hotel zone	Bus	90,000	47,451
②CBD ⇄ Hotel zone	Employee shuttle bus	18,000	7,097
③CBD ⇄ Hotel zone	Private car	15,000	2,845
④Airport ⇄ Hotel zone	Bus, Taxi, Shuttle Bus and Car Rental	30,000	6,531 (Naha Airport Sharing Rate : Monorail 21.8%)
		153,000	63,924

All traffic volume are (people / day / both directions)

Maximum cross-section traffic: 5,125 (people/time/one direction)

※ Peak rate: 10.5%, Heavier direction ratio: 0.83

6. Operation ▪ System Plan

● Operation Plan

- Each condition(variable) to plan operation is set by the PIMUS and other sources.
- Substitute each condition on the formula below and calculate the number of train and number of train set(TS) which in service during peak hour.
- There is a gap on a sectional demand.
- The maximum sectional demand is X~Y station. Comparing sectional demand on M~L, the rate of a passenger who trips through M station will be 41.6%(Based on the data of 2028)

Conditions	Commentary	Figures used on the Formula
Peak hour demand	Demand forecast for Person Per Hour Per Direction (PPHPD)	6127persons (on 2028)
Scheduled Speed	The average train speed including dwell time at stations. Total section extension ÷ (Running time + Dwell time(at station)) × 60	25km/h (Presumed from performance data on Japanese AGT)
Total section extension	Total extension (Km) of line.	32.65km (City center ~ Hotel Area ~ Airport)
Vehicle capacity	Seating capacity + Capacity calculated by floor dimension.	6car : 474persons (m ² /persons)
Vehicle usage rate	The rate of Vehicle in use each day.	90% (Presumed from performance data on Japanese AGT)
Gap on sectional demand	Sectional demand of section where the gap is recognized ÷ Maximum sectional demand	41.6% (41.6% of passengers who use AGT pass through M station.)

Formula

$$\text{PPHPD} \div \text{Vehicle Capacity} = \text{「Number of trains」}$$

$$60\text{minutes} \div \text{Number of trains} = \text{「Train head way」}$$

$$\{ (\text{Total operation time(One way)} + 5 \text{ minutes(Turning-back time)}) \times 2 \} \div \text{Train head way} = \text{「Number of TS」}$$

$$\text{Number of TS} \div \text{Vehicle usage rate} = \text{「Number of deployed TS」}$$

6. Operation ▪ System Plan

- Number of Trains(NoT), Number of Train Sets(NoTS), on peak hour.
- Number of Deployed Train Set (NoDTS)
 - Dividing PPHPD by the Gap on sectional demand and calculate the “NoT”.
 - AGT will operate both sectional and direct service with M station as the dividing point.
 - “Headway” shows train minimum headway on Y~M station where both direct and sectional train runs.
 - PPHPD will increase with each passing year. To reduce the “NoDTS” congestion will be tolerated by 105%.
 - ✓ Japanese AGT(Nippori-Toneri Liner) performed 90person/car at peak hour, 105% congested Type-B AGT will be 83persons/car. Comparing those figures, it is possible to handle 105% of congestion.

Year	PPHPD (Trips)	PPHPD		NoT		Headway (M:SS)	NoTS	NoDTS	NoDTS (Cars)	Congestion rate (Comparing to the Year 1)	Congestion rate (Comparing to the Year 11)	Congestion rate (Comparing to the Year 16)
		Direct	Sectional	Direct	Sectional							
2028	6127	2549	3578	6	8	4:17	27	30	180	92.33%		
2037	6999	2912	4087	6	8	4:17	27	30	180	105.47%		
2038	7097	2952	4145	7	8	4:00	30	34	204		99.82%	
2042	7466	3106	4360	7	8	4:00	30	34	204		105.01%	
2043	7564	3147	4417	7	9	3:45	31	35	210			99.74%
2057	7727	3215	4512	7	9	3:45	31	35	210			101.89%

- “NoDTS” will be 30TS at 2028, 4TS added at 2038, 1TS added at 2043, 35TS will be deployed in total.
- Headway will be 3:45 and it can be handled without any special equipment.

6. Operation ▪ System Plan

- System Plan
 - (1) Vehicle Plan.

Considering future demand and restriction of construction space, Type-B (Middle sized) among 3 Japanese Standards is selected due to its high performance against infrastructure and high competitiveness.

➤ Type-B: Body width (2.5m) × Body Length (8.5m), Permitted Maximum Weight: 18 t/car

Main Specification: based on “Urbanismo18”, supplied by Mitsubishi Heavy Industries Engineering

Items	Specification					
Vehicle Body	Aluminum Alloy: Double Skin Type *FRP on Front Face					
Train Configuration	6 Vehicles-all motor mounted, Total Length:54,000 mm					
Passenger Capacity (6 Persons/ m2)	474 persons/ Train-set (116 seats: included)					
Car No.	No.1	No.2	No.3	No.4	No.5	No.6
Passenger Capacity (persons)	75	81	81	81	81	75
Seats Numbers (included)	20	19	19	19	19	20
Tare Weight (t)	11.0	10.5	10.5	10.5	10.5	11.0
Body Length (mm)	8550	8500	8500	8500	8500	8550
Max. Operation Speed	60 km/h					
Power Supply	DC 750V					
Max. Acceleration	3.5km/h/s					
Max. Deceleration	3.5 km/h/s (Service) 、 4.5 km/h/s (Emergency)					
Propulsion System	VVVF Control Induction Motor System					
Brake System	Electric Regenerative Brake and Hydraulic Disk Brake					
Bogie Type	One-Axis Type, Track Width:1700 mm, One Motor Bogie & One Trailer Bogie / Vehicle					
Operation System	*GoA Level 4 : corresponding to unattended operation					

- Exterior/ Interior Image



* FRP: Fiber Reinforced Plastics GoA: Grade of Automation

6. Operation ▪ System Plan

- System Plan

(2) Power Supply System : Composition and Specification

Item	Function	Notes
Receiving Method	Receiving from two dedicated power source of Local Power Authority.	CFE (Federal Electricity Commission)
Receiving Substation	Transform and distribute the received power.	Set in the Depot (1 location)
Transmission Lines	Connect Receiving Substation and Feeding Substation/Station power Room	Installed along the Track
Traction Substation	Transform the power for Traction and Station Facility	Set in the Depot and stations every 5-6 km
Station Power Room	Transform the power for Station Facility	Set in the stations without Traction Substation
Contact Line	Installed along the Track and supply power for Traction	DC 750V Double Rigid Conductor System Side Current Collection

6. Operation ▪ System Plan

- System Plan

(3) Signaling and Telecommunication System : Specification and/or Facility

Item	Function / system part	Specification / Facility	Note
Block system	Control train distance	Moving Block by CBTC	Or Fixed Block
Signal aspect	Aspect signal to train	Cab signal by CBTC	Or Ground signal
Control trains	Control operating trains	Centralize control from OCC	
Train operation	Train operation system	ATO (GoA4)	Need more discussion ATO level
Train protection	Protect train(s) accident	ATP by CBTC	Or ATC, ATP Balise
Interlocking	Chain control and/or lock of signals and/or turnout	Electronic Interlocking	Or relay interlocking, centralized EI
Telecommunication network	Providing communication network for train operating	Private network using Optical Fiber cable	
Communication system	Voice communication tool for operators each other about operating	Centralizing telephone, Train radio, Yard phone	
Passenger Information	Providing Informations to Passenger	Automatic announcement, Passenger information Display	
Monitoring system	Monitoring each system(s) or Station facility	Station facility (ESC/EV, fire, PSD,), SIG/TEL facility, Disaster, CCTV etc.	

7. Railway Structure and Station Planning



● Structure Planning

Design Condition

- Geological condition . . . Limestone is main ground. Detailed soil investigation must be needed because properties of the soil varies wildly.
- Seismic design . . . Mexico is an earthquake-prone country, but big earthquakes occur on the Pacific side. Special seismic design isn't required.

Structure

- Viaduct . . . The foundation will be constructed with cast-in-place piles, and PC girders will be erected with a crane.
- Ground . . . Surface improvement may be needed depend on the soil condition.
- Bridge . . . Refer to the construction method on the parallel roads.

Track and Turnout

- Track
 - AGT track on the girder.
- Turnout
 - By changing the movable guide plate with point machine, the direction of travel of the vehicle is sorted.



Turnout (Point Machine(Red) and movable guide(Yellow))

7. Railway Structure and Station Planning

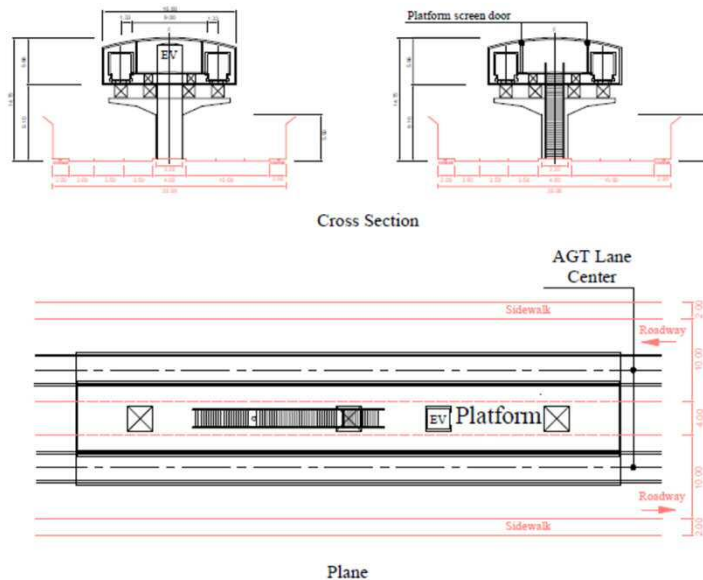


● Contents examined in the station planning

- Platform length and concourse size according to the number of passengers
- Standard Station and Special Station (Starting and ending Sta. or Nearest Sta. of the Depot, etc.)
- Station Facilities and Connecting passage
- Universal Design Facilities (Elevator, Escalator, Leading Block, etc.)
- Platform screen door and Safety equipment



Example of platform
(Yurikamome : Shiodome Sta.)



Example of standard station



Example of platform screen door
(Yurikamome : Toyosu Sta.)

8. Operation and Maintenance

- Number of personnel required for Cancun AGT operators

Department		Number of personnel (persons)	Note
Officer		6	2% of all employees
Headquarters department	General Affairs	32	10% of all employees
	Transportation	69 (70) [71]	32% of the working department
	Engineering		
	Subtotal	101 (102) [103]	
Working department	Transportation	80	3.2 persons/station
	Operation	33	1.3 persons/station
	Facility	30	0.9 persons/operation-km
	Electric	36	1.1 persons/operation-km
	Rolling Stock	36 (41) [42]	0.2 persons/car
	Subtotal	215 (227) [221]	
Total		316 (322) [324]	

※ Operation-km: 33km, No. of Stations: 25 stations

※ No. of car: At the Opening: 180 cars, after 11th year from the opening: 204 cars, after 16th year from opening: 210 cars

※() is the number of personnel after the 10th year from opening, and [] is the number of personnel after the 16th year from opening.

9. Project Cost Estimation

1. Quantity Estimation

The project cost is estimated based on quantity estimation shown in the table below.
Summary of Quantity Estimation

No	Item			Unit	Quantity	Remark
1	Infrastructure	Track	Total	km	32.65	
			Elevated	km	21.55	
			At Grade	km	11.10	
		Station	Total	No.	25	
			Elevated	No.	21	
			At Grade	No.	4	
		Depot		ha	5	
2	E&M	System	Total	km	32.65	
		Rolling Stock	Opening	Car	180	
			11th year	Car	24	
			16th year	Car	6	

2. Project Cost Estimation

Consequently the total project cost including the engineering service fee requires about 213 billion JPY, which is about 6.5 billion JPY per km.

In order to reduce the infrastructure cost, the simple type of civil and station structures that can satisfy the minimum requirements of the specifications has been adopt.

10. Economic and Financial Analysis

- Economic Analysis (measuring the degree of efficiency in resource allocation in the national economy)

■ Preconditions

- Price base date: January 2021
- Evaluation period: 2022 to 2057 (construction period for 7 years, 30 years after opening in 2028)
- Exchange rates: USD 1 = JPY 103.735
- USD 1 = MXN 19.863
- MXN 1 = 5.22262 JPY
- Social discount rate: 12%
- Standard conversion factor (SCF): 0.94

■ Economic Costs

- ① Initial cost ② Replacement cost ③ O&M cost

■ Economic Benefits

- ① Savings in Vehicle Operating Costs
- ② Savings in Travel Time Costs
- ③ Reduction of CO2 emission
- ④ Reduction of traffic accidents

■ Results of Economic Analysis

Indicator	Result
EIRR	-3.11%
ENPV (mil MXN)	-21,934
B/C	0.20

- Financial Analysis (cash flow analysis as a single project)

■ Preconditions

- Opportunity cost of capital: 6.77% (30-year government bond yield in Mexico)
- Other preconditions are the same as economic analysis

■ Revenue

- ① Fare-box revenue
- ② Non-fare-box revenue (kiosks, advertisements, etc.)

■ Expenditure

- ① Initial cost ② Replacement cost ③ O&M cost

■ Number of daily average passenger and annual revenue

	(2028)	(2037)	(2047)	(2057)
Number of passengers (trip)	78,836	91,993	104,208	104,208
Total income (million MXN)	808	944	1,069	1,069

■ Results of Financial Analysis

Indicator	Result
FIRR	-6.88%
FNPV (mil MXN)	-31,289
B/C	0.21

10. Economic and Financial Analysis

● Sensitivity Analysis of Financial Analysis (Public-Private Partnership)

	1) O&M Company	2) Vertical Separation
Civil Engineering Work	Govt. of Mexico	Govt. of Mexico
Rolling Stock (incl. replacement costs)	Govt. of Mexico	Private company (with subsidies of Govt. of Mexico)
E&M (incl. replacement costs)	Govt. of Mexico	Govt. of Mexico
O&M	Private company	Private company

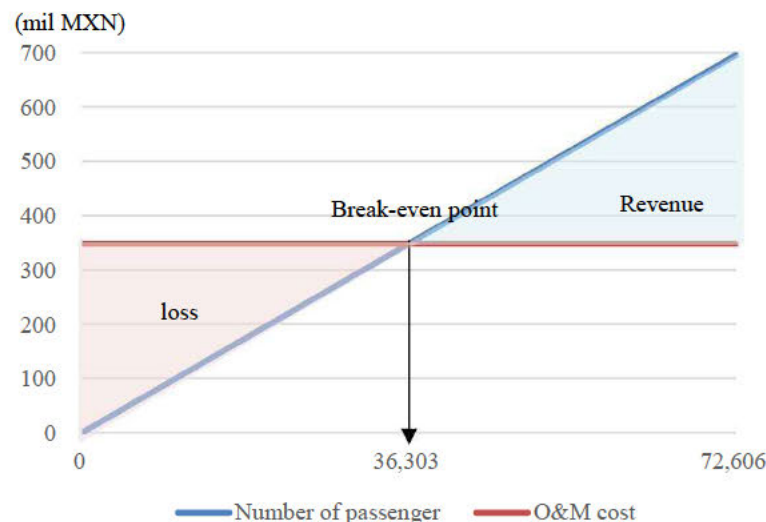
1) O&M Company

(Preconditions)

- A private company will only bear O&M costs.

(Results)

- If a daily passenger of more than 36,303 is secured, O&M costs can be covered.
- With the adoption of the availability payment method, it is possible to avoid the risk of income decrease even if the passenger revenue decreases.



2) Vertical Separation

(Preconditions)

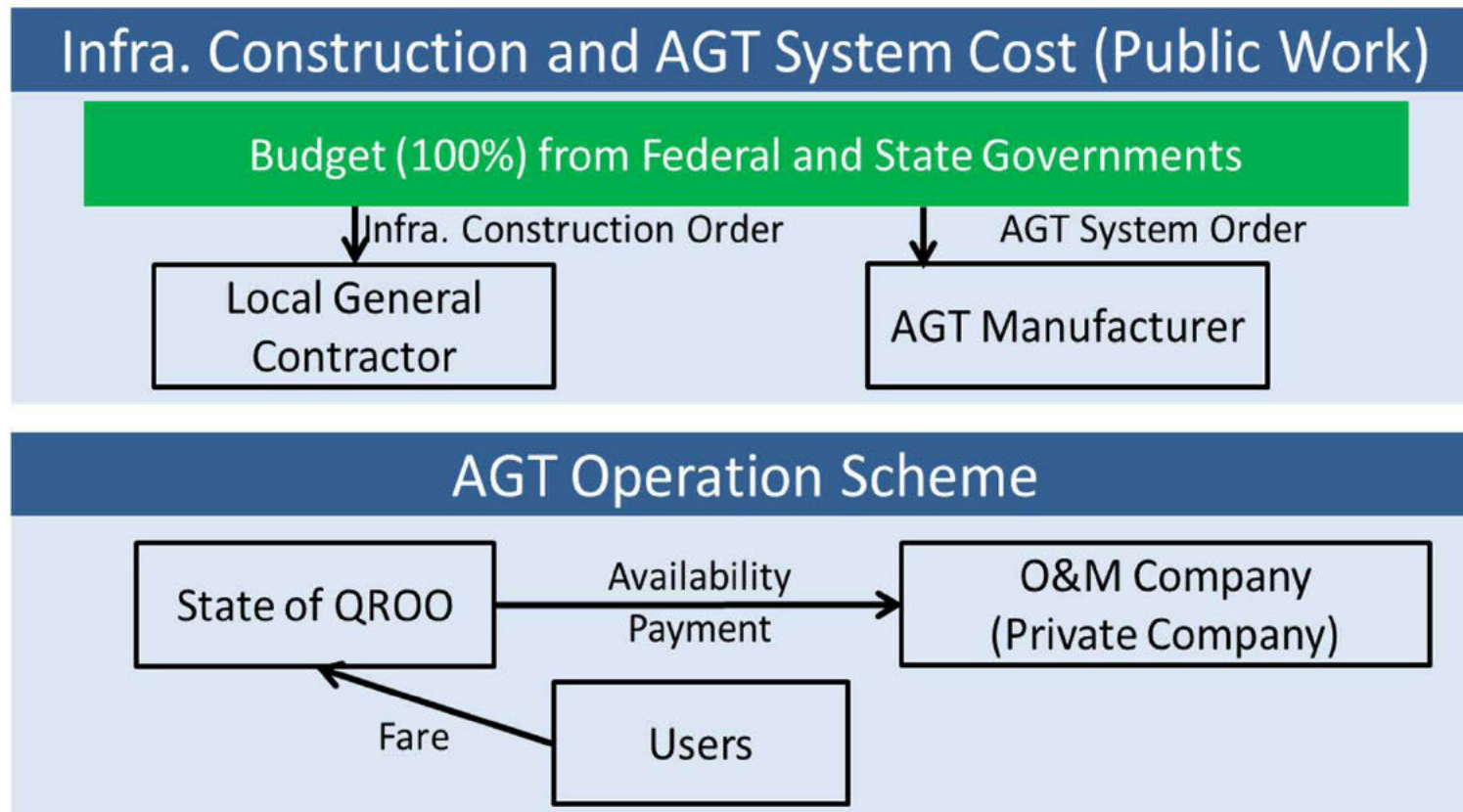
- A Special Purpose Company (SPC) will bear the cost of rolling stock and O&M, and that some of the rolling stock cost will be subsidized by the Mexican government.
- Taking into account the nominal value calculation (inflation rate of 3%), depreciation and corporate tax
- Equity:Debt = 30:70, borrowing conditions of 30-year repayment period and an interest rate of 5%. WACC = 9.5%

(Results)

- As a result of the financial analysis of SPC, if the burden of rolling stock cost exceeds 80%, FIRR is 11.5%, which exceeds the value of WACC.

Indicator	Scenario 1	Scenario 2	Scenario 3
Rolling stock costs borne by the Mexican government	0%	50%	80%
FIRR	-2.61%	3.21%	11.50%
FNPV (Million MXN)	-7,214.93	-2,410.62	417.93

11. Financial Scheme • Possible Next Step

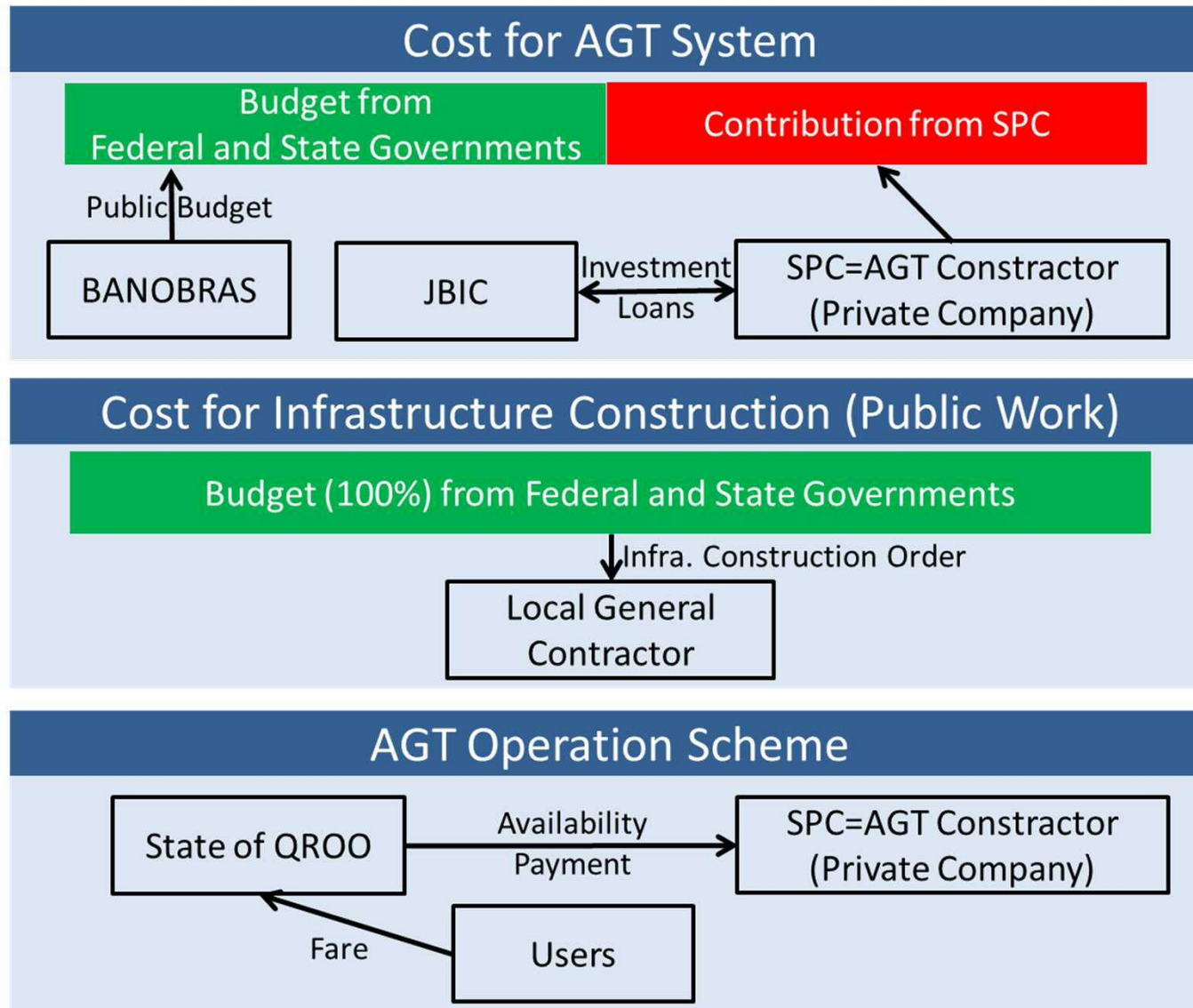


Source: Elaborated by Survey Team

In the Case of O&M Company Founded

- Implementing all of the cost in public funds in accordance with AGT system introduction
- The operating cost is borne by the O&M company. Availability payment method reduces risk.

11. Financial Scheme - Possible Next Step



In the Case of Scheme of Separating Infrastructure and Operation

- Separation of Operations from Infrastructure System to be applied. SPC to contribute to a part of AGT System cost. Infrastructure Cost to be covered by Public Sector.
- SPC's risk to be reduced by applying Availability Payment Mechanism

Source: Elaborated by Survey Team

11. Financial Scheme ▪ Possible Next Step



The followings are possible schemes for AGT construction to move forward after the Pre-feasibility Study.

Institution in Charge	Scheme	Activities	Conditions
AOTS	Technical Cooperation & Emerging Market Development Program	Human Resource Development (Training, Dispatching Expert)	Proposal by JP company necessary.
METI	Technical Cooperation & Emerging Market Development Program	Human Resource Development (Training, Dispatching Expert)	Proposal by JP company necessary.
METI	Study on Business Opportunity of High-quality Energy Infrastructure to Overseas	Survey on infra. projects utilizing JP companies' technology	To be approval based on proposal and necessity for further investigation after this Pre-FS
JICA	Preparatory Survey (Overseas Loan and Investment)	FS	Expected to form overseas loan and investment project afterward.
JICA	Survey on Basic Data/Information Collection and Confirmation	Preparatory Survey before FS	Expected to form project financed by JP Gov't afterward.
JICA	Cost Share Technical Cooperation	Training – cost to be shared by JP and MX gov'ts	Scheme for ODA graduates – special approval needed in case of Mexico.

Source: Elaborated by Survey Team based on websites of JICA, METI and AOTS

12. Environmental and Social Considerations



Land use classification map

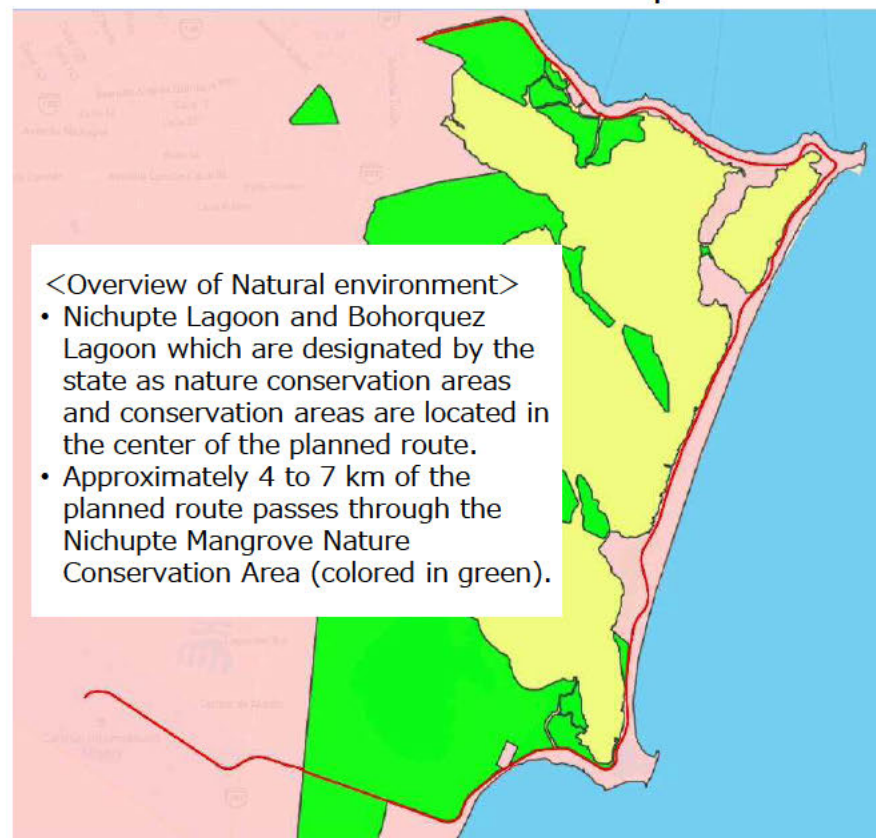


<Overview of Land use>

- There are few residences, and mainly tourism and recreational land around the planned route.
- There are many street trees and a few monuments, steel towers, and pocket parks on median strip of the existing road.
- The candidate site for the depot is a green area (forest zone).

Áreas Verdes	Green Areas
Comercial	Commercial
Mixto	Mixed land
Equipamiento	Public land
Habitacional	Residential
Área Natural Protegida	Protected Natural Area
Industrial	Industrial
Servicios Turísticos Recreativos	Recreational Tourist Services
Turístico	Tourism land

Conservation Area Map



<Overview of Natural environment>

- Nichupte Lagoon and Bohorquez Lagoon which are designated by the state as nature conservation areas and conservation areas are located in the center of the planned route.
- Approximately 4 to 7 km of the planned route passes through the Nichupte Mangrove Nature Conservation Area (colored in green).

Classification	Name
Sustainable use	Cancun Urban Zone
Preservation area	ANP Mangroves of Nichupté
Conservation area	Nichupt lagoon system

— Planned route

12. Environmental and Social Considerations



- Expected impact on the natural environment
 - The route passes through the Nichupte Mangrove Nature Conservation Area, but since it is laid on land beside the current road and no piers are constructed in the lagoon, mangrove logging will not occur.
 - Tree felling will occur in the forest zone where is planned the depot site
- Expected impact on the social environment
 - There are no an in voluntary resettlement
 - The depot and plane section: land acquisition and land modification will occur
 - The elevated section: Street tree felling and relocation or removal of pocket parks and monuments may occur.
- Future tasks
 - After the detailed plan is decided, it is desirable to re-examine the exact impacts such as the values regarding the number of trees that actually need to be cut, the modified area of the land, etc.
 - Also, other than implementation of EIA and acquiring of necessary permits or licenses, discussion and confirmation with business owners or government agencies about the compensation for land and trees and relocation or removal of parks and monuments, etc. are should be conducted.

13. Possibility of Project execution

- Benefit of Japanese company (Possibility of participation)
 - Japanese AGT is superior as a commodity. Mexico is not a developing country, high added value commodity is likely to be approved. Therefore Japanese company likely to participate in the project. (Some Japanese companies showed interest in the project while research.)
 - From the perspective of service factor, Japanese manufacturer/railway operator can participate in the project.
 - It is less likely to Japanese company participate in the field of civil engineering. The Japanese company has some experience in Mexico in the field of construction. Therefore Japanese companies can participate in the project partially. (Some Japanese companies showed interest in the project while research.)

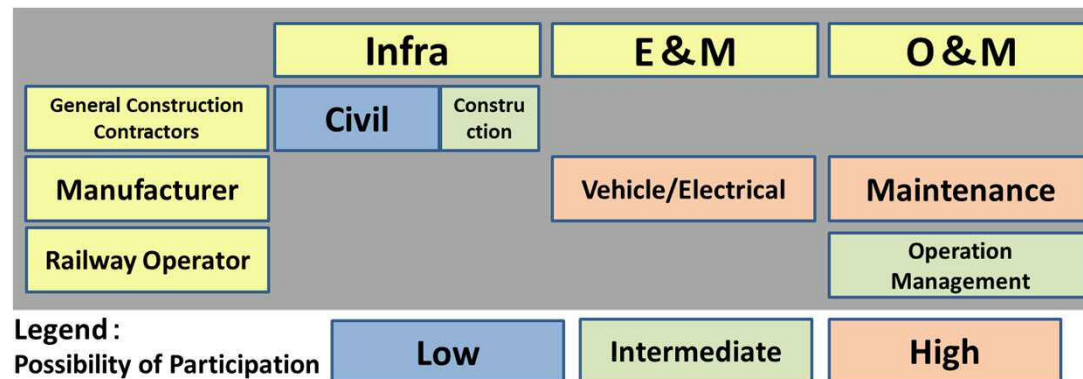


Image of Possibility of Participation by sector and field

- Benefit of Japanese company
 - Japanese companies showed interest in the project and benefit is expected.
 - Japanese AGT regarded as a suitable system for "solution for energy saving / de-carbonization" which stated "Infrastructure Systems Export Strategy" by Japanese government.
 - Effect as a showcase of Japanese AGT export in Latin America will be expected.

14. Conclusions

- There's room for participation.
 - It is confirmed in the interview for AGEPRO that the transportation mode of this route hasn't yet been decided and AGEPRO would like to implement rail transit system rather than BRT. AGEPRO will favor the participation of Japanese companies.
- Necessity of the AGT
 - It is necessary to build a transportation network that follows community development on this project. In this route, the plan which follows transportation network plan community development is strongly demanded.
 - It is expected that this route has a high level of spatial constraints, such as building an elevated track on a road that adjacent to both sea and lagoon. The AGT can meet those constraints, and not interfere with other road transportation. Therefore AGT is regarded as one of the most suitable transportation systems for this route. However, there is still room for other types of transportation systems, so that it is necessary to consider the necessity of AGT on this route.
- Demand forecast
 - Demand forecast for this route was conducted from the perspective of the network of city center ~hotel area ~ airport. It is necessary to conduct consideration for demand forecast after implementation of a direct route from the airport to the city center.
 - Train fares likely to be regarded as expensive compared to other transportation systems. Therefore fare(or price formation) needs to be considered from the perspective of both feasibility and validity.
- Consideration of system specifications and minimization of initial costs.
 - It is necessary to consider the optimization(system specifications, volume, system level .etc) of the AGT system and the possibility of minimization of initial costs on the next step of the survey.

14. Conclusions

- Project Evaluation

- Financial analysis shows that in case evaluate a cash flow of this project both owner and operator is the same entity, this project can not be profitable. It is possible to make this project profitable and reduce the risk of the private sector by implementing the PPP and sharing the project. It is necessary to consider which type of scheme is acceptable for both the private and public sectors of Mexico.

- Project execution scheme

- To secure the profitability of the private sector, it is regarded that a certain amount of public funds or grants are needed. The project scheme is being considered as follows: civil will be constructed by the public sector, the private sector partly bears the cost for the vehicle and other related equipment. The facility will be owned by the public sector and operation will be conducted by the private sector with an availability-payment scheme that can reduce the risk for the private sector. Likewise, it can be considered a scheme that the private sector only pays O&M cost and implement an availability-payment scheme, infrastructure cost(civil, facility), or system implementation cost covered by the public sector.

- Environmental and Social Considerations

- It is necessary to consider with an administrative organization and operator whether it is mandated to preserve or transplant the vegetation and monument in the park or the median strip. (Including conducting EIA that is mandated by Mexican law.)

- Benefit of Japanese Companies

- It can expand the presence of the Japanese railway system in Latin America. Likewise, the project can gain worldwide publicity as a showcase of Japanese AGT.

15. Recommendations for the project realization



As aforementioned on “Conclusions”, project still have some matters for consideration in some area. Since project evaluation showed the unfavorable result, therefore matters as follows need to be considered to risen project possibilities.

- Cost

- Necessity of PSD, possibility of reducing E&M cost.
- Consider reducing the total number of stations that following AGEPRO’s intention.

- Profitability

- Returnability of non-rail service income while implementing the TOD.
- Possibility of introducing benefits from the increased number of tourists and increased income from tourism consumption through AGT development.
- Possibility of increasing rail service income from encouraging to use AGT from airport to hotel area or among hotel area.

- Funding

- Possibility of using private funding and public owned, privately operated scheme.
- To reduce the risk of the private sector that executes the project, consider implementing an availability payment scheme.
- Possibility of using a grant from the Federal government of Mexico