

Technical, Economic-Financial, Environmental, Social and Vulnerability Feasibility Studies for the Construction, Equipment, Start-up, Operation and Maintenance, under the Public Service Work Concession modality, of the Rapid Passenger Train System (TRP) of the Greater Metropolitan Area (GAM).

## **Fourth Report: Economic and Financial Study**

### **Document 4: Technical Tariff and System Integration Analysis**

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## 1 INTRODUCTION

This document is the fourth of the four documents that make up the fourth report of the Technical, Economic-Financial, Environmental, Social and Vulnerability Feasibility Studies for the Construction, Equipment, Start-up, Operation and Maintenance, under the Public Service Work Concession modality, of the Rapid Passenger Train System (TRP) of the Greater Metropolitan Area (GAM).

The study consists of six reports:

- First Report: Work Plan.
- Second Report: Technical environmental, social, vulnerability assessment and gender studies.
- Third Report: Technical feasibility study.
- **Fourth Report: Economic and Financial Study.**
- Fifth Report: Financial Structuring and Document for the Bidding Process.
- Final Report.

Specifically, the objective of the economic-financial study is to combine and analyze the elements necessary to evaluate and structure the proposal that would provide the greatest economic-financial viability to the project.

For this purpose, the Third Report: Technical Feasibility will be taken into account, as well as the fiscal contingencies for the analysis of the competent authorities.

Based on the cost estimates made, the overall impact of all technically satisfactory interventions will be analyzed and the preliminary cost of the project will be analyzed on the basis of the technical feasibility. This includes a unit price study and a costing of elements based on the local experience of the consulting firm in the country.

For a correct understanding of the contents included in this report, it is divided into six main sections according to the different types of economic-financial studies required by the project throughout the evaluation horizon.

These are:

- Financial analysis at a conceptual level
- Cost-Benefit Analysis ("CBA")
- Risk analysis
- Value-for-money analysis
- Analysis of the technical and user fee tariffs
- System integration analysis

In short, the Fourth Report: Economic and Financial Study consists of four documents:

- Document 1: Economic-financial analysis.
- Document 2: Cost-benefit analysis.
- Document 3: Risk analysis and value for money.
- **Document 4: Technical tariff and system integration analysis.**

In the economic and financial analysis document, several alternative scenarios of remuneration and scope of the project have been proposed. Given this diversity of models, from which one must be selected for the bidding poster, only one scenario has been evaluated for this analysis: the scenario of total development at the beginning of lines 1 to 5, both inclusive.

## 1.1 Project description

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The GAM Electric Train consists of the development of a bidirectional rail system connecting the cities of Cartago, San José, Heredia and Alajuela. The intention is to take advantage of the existing route to strengthen the east-west connection of the GAM and for this transportation system to become the reference mode of public transportation in the area, promoting sustainable mobility.

The proposed system covers a length of more than 84 km with 46 stations along the route and is composed of 5 lines delimited by INCOFER's right-of-way. Lines 1 (Paraíso-Atlántico), 2 (Atlántico-Alajuela) and 3 (Atlántico-Ciruelas) will operate independently, while lines 4 (Alajuela-Ciruelas) and 5 (Ciruelas-El Coyol) are proposed as extensions of lines 2 and 3 respectively. In addition, there will be 4 parking lots and 1 workshop with their corresponding administrative buildings. The Paraíso parking lot, located on Line 1, will be able to accommodate up to 20 trains, the Pacífico parking lot, which serves Line 3, will have a capacity for 24 trains, and the Ciruelas parking lot, corresponding to Line 4, will have space

for 12 trains. The Las Cañas parking lot, which is located on Line 2, apart from being able to accommodate 24 trains, will be in charge of performing the most complex maintenance tasks of the entire system since it will be the only one with a workshop.

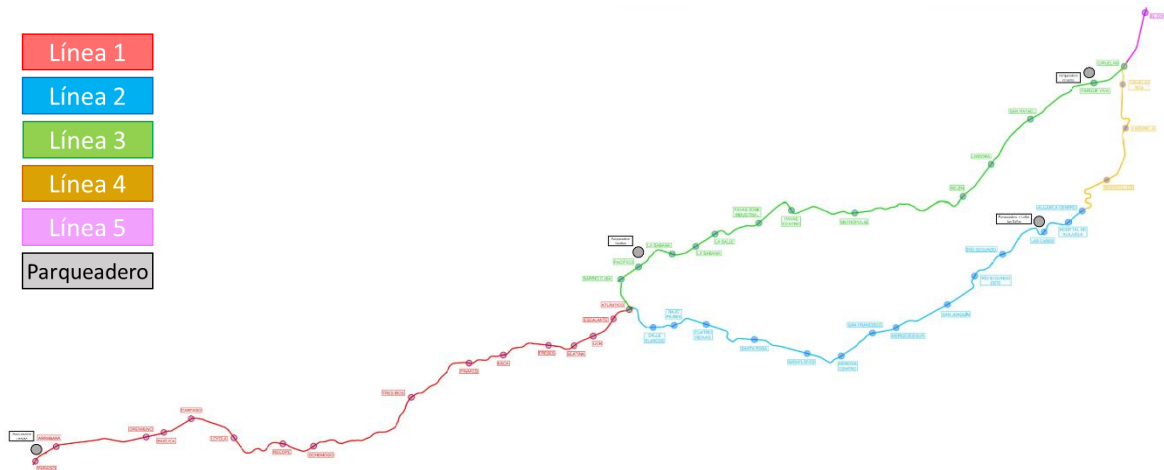


Figure 1. GAM Electric Train.

The stops that make up the GAM Electric Train can be seen in the following figure.



Figure 2. GAM Electric Train Stations.

In order to cope with the demand, it is proposed to operate the 3 main lines (i.e. lines 1, 2 and 3) with frequencies of 5 minutes at peak hour (15 minutes off-peak) and with frequencies of 10 minutes at peak hour (30 minutes off-peak) for the extensions on weekdays. During non-working days, weekends and holidays, the frequencies are reduced to 10 minutes at peak time (20 minutes off-peak) and 20 minutes at peak time (40 minutes off-peak) for lines 1-2-3 and 4-5 respectively.

All this is detailed in Report 21: Operation of the Third Report, with its corresponding technical justification.

	Home	End
Off-peak time tomorrow	05:00	06:00
Morning rush hour	06:00	10:00
Noon off-peak time	10:00	15:30
Late rush hour	15:30	19:30
Afternoon off-peak time	19:30	23:00

Table 1. Periods of demand variation.

	Lines 1, 2 and 3		Lines 4 and 5	
	Workable	Non-working	Workable	Non-working
Off-peak time	15 minutes	20 minutes	30 minutes	40 minutes
Peak hour	5 minutes	10 minutes	10 minutes	20 minutes

Table 23. Frequencies of operation on lines as a function of type hour and day.

From the tariff point of view, each of the lines will be charged independently with a base tariff for the main lines and a reduced tariff for the extensions.

In order to meet the demand of the system, with the frequencies explained, 78 trains are required (including maintenance and reserve trains) as detailed in Report 21: Operation of the Third Report, which will be light articulated trains with electric traction of 5 modules in double composition. The capacity of this type of trains ranges from 430 passengers (4 passengers/m<sup>2</sup>) to 600 passengers (6 passengers/m<sup>2</sup>) without exceeding a length of 70m. However, given the length of the station platforms (80 m), if future demand so requires, the rolling stock could be adapted to 7 modules in order to increase its transport capacity.

The following table summarizes the main characteristics of each line.

	Layout	Length	Stations	Parking	Workshop
Line 1	Urban/Interurban	27.4 km		Paradise/Pacific	Las Cañas
Line 2	Urban/Interurban	21.6 km		Pacific/Airport	Las Cañas
Line 3	Urban/Interurban	25.4 km		Pacific/Ciruelas	Las Cañas
Line 4	Interurban	7.8 km	5	Plums/Las Cañas	Las Cañas
Line 5	Interurban	2.7 km		Plums	Las Cañas

Table 45. Main characteristics of the lines.

In addition, 14 of the aforementioned stations are proposed as intermodal stations, where passengers would be transferred between the bus system and the Electric Train.

The main magnitudes and characteristics of the project are summarized below to give a better idea of its size:

- Infrastructure: Track infrastructure, systems and rolling stock.
- Length of the route: 84.85 km.
- Number of stations: 46.
- Rolling stock required: 78 the year of commissioning.
- Maximum speed: 25 km/h in urban areas, 50 km/h in semi-urban areas, and 70 km/h in interurban areas.
- Frequency of trains: 5 min during rush hour.
- Passenger capacity: 600 passengers per unit in double composition.

In short, the Urban Electric Train project consists of the improvement of the current train that runs between San José de Costa Rica and the towns of Alajuela, Belén and Paraíso on three respective lines, together with the extension from Belén to Ciruelas and two new sections from Alajuela to Ciruelas and from Ciruelas to El Coyoil, respectively.

## 2 RATE SETTING BASED ON MARGINAL COSTS AND VALUE OF TIME

The new Passenger Rapid Transit System (TRP) is an opportunity to improve the overall mobility of the Greater Metropolitan Area (GAM).

Mobility and traffic are essential components of urban life. They constitute an expression of freedom that enables people to make trips that arise from the need to carry out various activities, from going to work, taking children to school, going to the theater, going to the doctor, etc.

The main objective of a transport system is to satisfy demand by providing an adequate supply (price and frequency) that meets the requirements of users, transport customers. This objective is ambitious because there is always an imbalance between supply and demand, with periods with higher demand and others with lower demand and, of course, there is a cost for the service provided.

The next two sections will deal with the cost of the service, the estimated amount for the Administration derived from how the concessionaire is remunerated for the service provided and, finally, the cost represented for the user, the transport ticket.

### 2.1 Technical Tariff (base CAPEX scenario)

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The planned system of remuneration to the concessionaire is based on the implementation of a revenue guarantee and a sequence of payments from the State under the model of "availability payments", usual in Public-Private Participation Contracts ("PPP" or "APP"), in a scenario of installments in the period linked to the operating period, and conditioned to the fulfillment of certain levels of service or performance indicators provided for in the Concession Contract.

The number of years will be defined based on the fiscal capacity of the State to face fees of a certain size, with the understanding that the longer the term, the lower the annual fee for the Availability Payment. In the present project, an operating period of 30.5 years has been defined, during which the concessionaire will receive payment for the transportation service provided.

In this case, the Contract guarantees a minimum income and will establish compliance indicators linked to said Service Levels which, depending on the real situation of compliance evaluated from the control system applicable to the activity of the Concessionaire, could



imply the application of deductions to the periodic payment foreseen, if certain levels of non-compliance are found.

### 2.1.1 Consideration of demand risk

The estimation of demand in a railroad project is complex, and is one of the main risk factors that must be delimited in order for the private sector to actively participate in its development.

One possibility to limit this risk is the establishment of a Minimum Traffic Guarantee or "Demand Contingent Subsidy". This is a fundamental mechanism in urban rail transport projects, particularly when it is a question of articulating a new transport system (a "greenfield" project) or reformulating an existing one with a substantially lower operational scope (projects that are in a "mix" between a "greenfield" and a "brownfield", as could be the case of the project promoted by INCOFER).

Thus, this project considers a minimum annual income guaranteed to the concessionaire based on the annual reference demand of the Project, equivalent to the Technical Tariff that allows obtaining a viable project (7.5% nominal profitability), in the period after the Ramp up (>2027).

### 2.1.2 Dealer income

The concessionaire receives three sources of income during the operating period:

- Revenue from passengers actually transported. Payment on Demand  
Effectively, there is a transfer of demand risk given that fewer passengers transported implies a lower remuneration for this concept. A minimum demand revenue value of USD 40,388,054 is guaranteed after the ramp-up period, i.e. after 2027. This minimum demand revenue has been calculated as the one that allows obtaining an IRR of 50% of the target IRR (7.5%, approximately the bond yield). This demand revenue ranges between 22% and 25% of total annual revenue in the case of the reference demand scenario, with all five lines in full operation (>2030). In practice, this demand revenue will only be triggered if demand falls by more than 10% compared to the baseline scenario.
- Income from transportation services. Payment for availability  
It is a payment for availability and, therefore, with risk transfer, in which the annual OPEX costs are taken as a reference for its establishment. These revenues are

affected by the optimum performance of the service. For risk to be transferred, the concessionaire cannot always have 100% of the income for this concept.

This revenue ranges between 25% and 28% of total annual revenue in the case of the reference demand scenario and with all five lines in full operation (>2030).

Optionally, these revenues could be adjusted if the demand is lower than a minimum, allowing the concessionaire to adjust the supply of seats (always maintaining the reference frequency), by using shorter trains. This would reduce the concessionaire's costs and, consequently, the Administration's payment for this concept.

- CAPEX income. Subsidy

It is a concept linked to the availability of the Project, which covers the investment, interest and allows its viability. It is the fundamental component of the technical tariff subsidy. There is, therefore, no risk transfer. In principle, it is applied during the entire period of operation, without restrictions.

This income ranges between 27% and 30% of total annual income in the case of the reference demand scenario.

Optionally, in order to reduce the Administration's contributions, these revenues could be reduced if demand were to increase above the reference level, a possible and very favorable case for the concessionaire, which would see an increase in its collection revenues.

A possible scenario, called Total Guarantee, is that the granting Administration assures the minimum income of the concessionaire considering the three items analyzed: Demand. OPEX and CAPEX. This scenario, assuring the concessionaire an IRR of 7.95%, allows obtaining a minimum amount of **153,247,726 USD**.

As shown below, the Administration's payment is different if the demand risk or the total irrigation including the three concepts mentioned above is considered.

The different types of income are presented below, in absolute values and as a percentage.

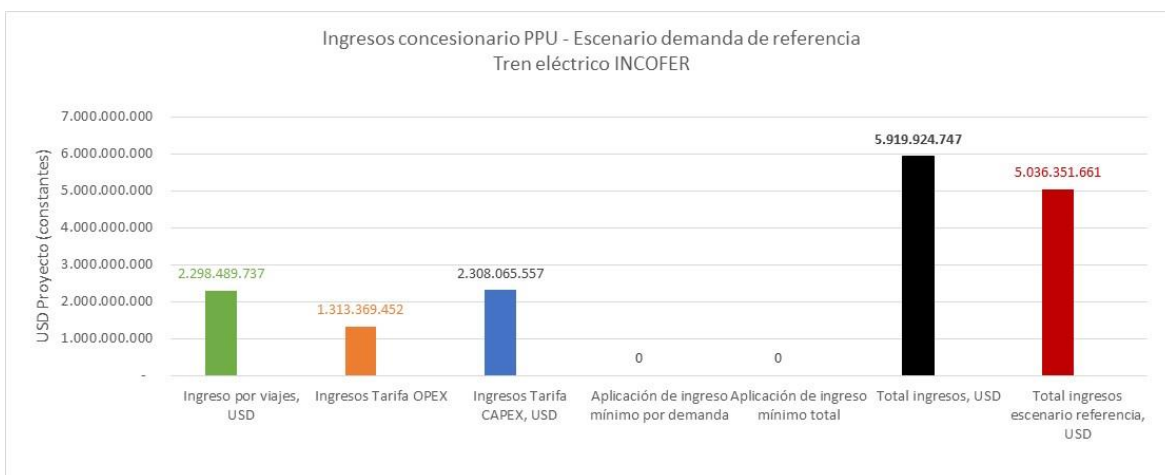


Figure 3. Concessionaire revenues. Reference scenario, USD (base CAPEX scenario).

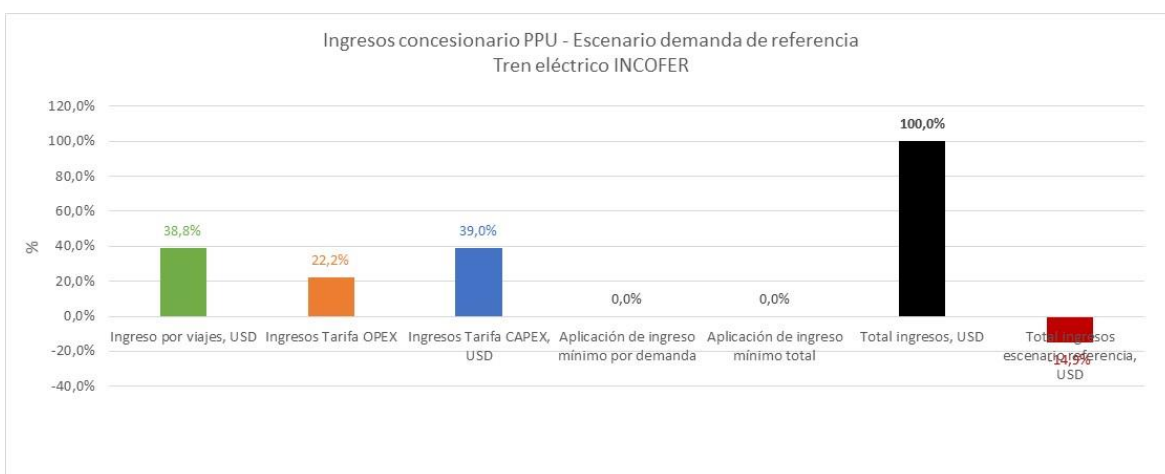


Figure 4. Concessionaire revenues. Reference scenario, % (base CAPEX scenario).

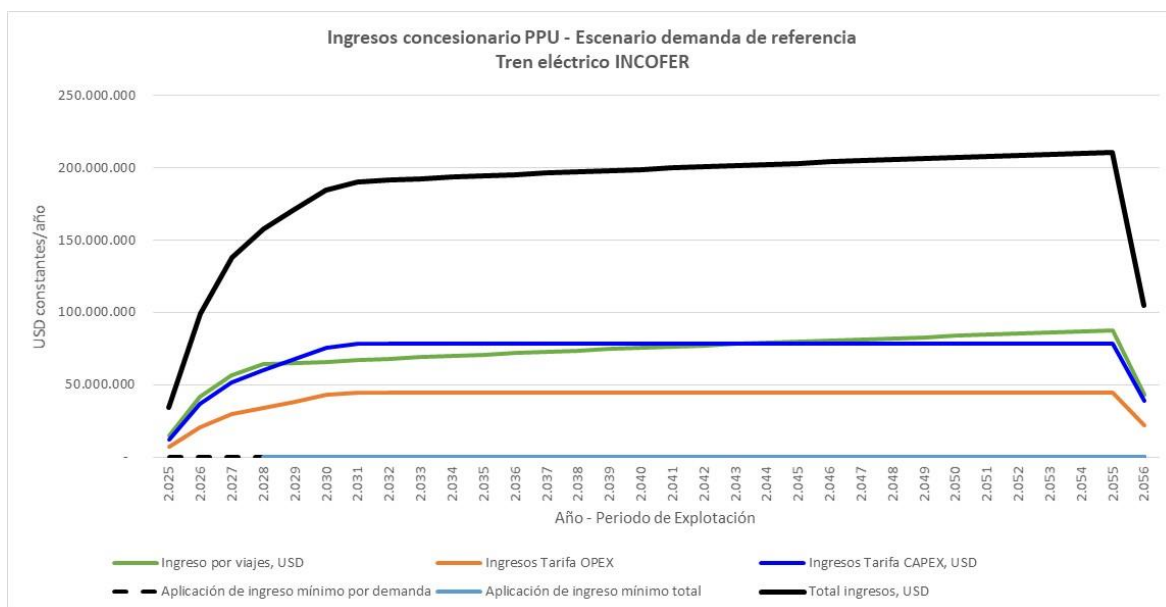


Figure 5. Concessionaire's revenue evolution. Reference scenario (base CAPEX scenario).

Analyzing a possible Total Guarantee scenario, the amounts to be paid by the Administration are observed with a 10% drop in demand.

In the current situation, considering a Guaranteed Minimum Revenue (GMR) for the total OPEX; CAPEX and DEMAND, the risk of paying the Administration (INCOFER) is different if we consider only the demand, or the totality of the three concepts.

In other words, for the demand "trigger" to be triggered, demand must fall by approximately 10% with respect to the reference demand. In this case, only at the end of the concession would this "trigger" be triggered and it only occurs because half a year is considered. In other words, it is highly unlikely that the demand trigger will be triggered at the current tariffs during the operating period.

Thus, for example, in a scenario in which demand falls by 10% with respect to the reference scenario, the graph shows that INCOFER would pay nothing for the demand guarantee. However, considering the total "trigger", this would jump in the year 2028 (the most unfavorable year, the first year of the IMG), and INCOFER would have to pay about 5 MUSD that year.

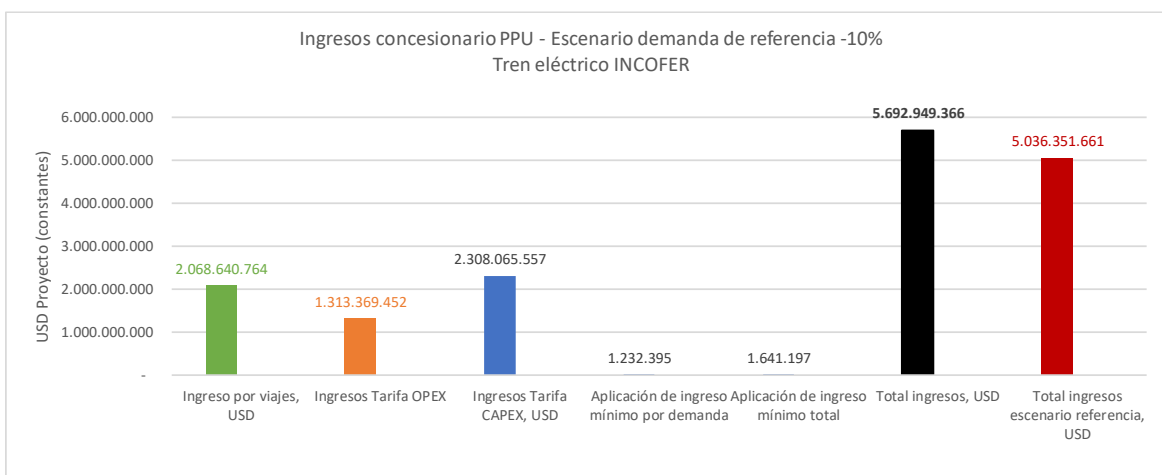


Figure 6. Concessionaire Revenues. Total Guarantee, USD (base CAPEX scenario).

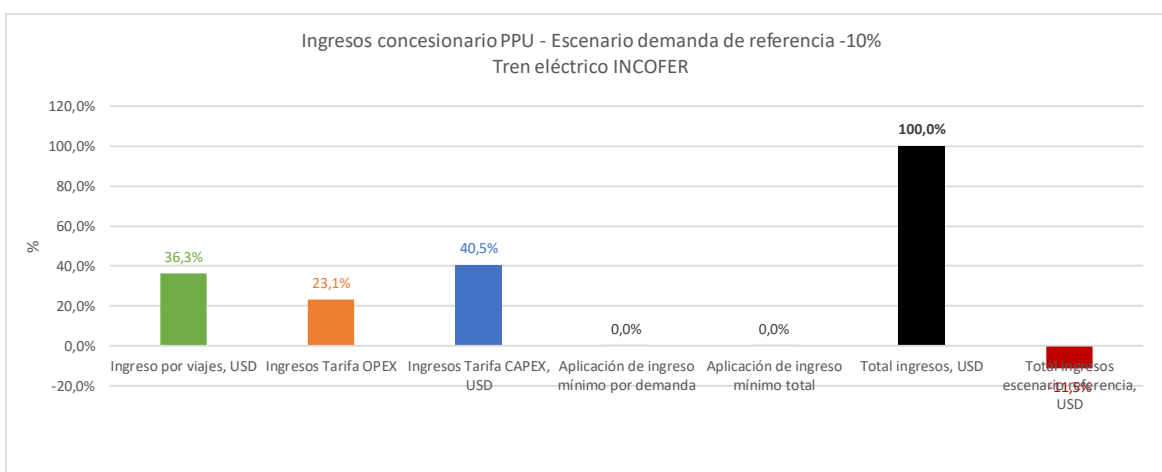


Figure 7. Concessionaire revenues. Total guarantee, % (base CAPEX scenario).

In the Demand Guarantee scenario, the concessionaire receives minimum revenues, two of which (OPEX and CAPEX) are operational and functionally independent of demand. In addition, minimum demand revenues are guaranteed (possible scenario called Demand Guarantee) for trips when a certain limit is not reached (the one that guarantees a reasonable profitability to the concessionaire). See attached figure.

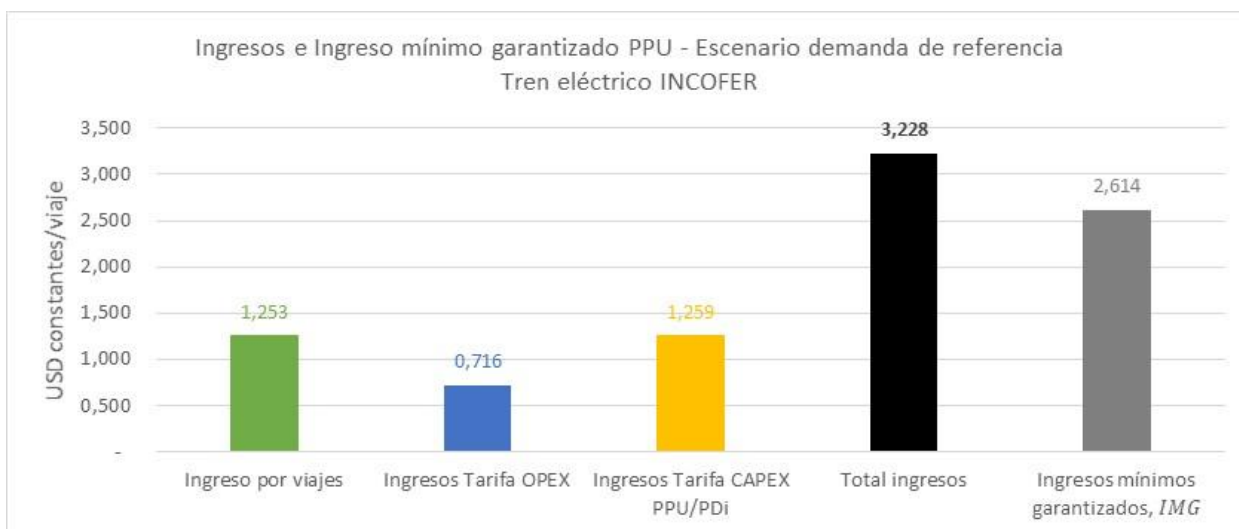


Figure 8. Concessionaire Revenues. Demand Guarantee, USD (base CAPEX scenario).

### 2.1.3 Tariff subsidy. Technical Tariff in Demand Guarantee Scenario

One of the most frequent alternatives applicable both to cover operating costs as well as investment costs, if applicable, is the application of subsidies to the fare, which is a formula known and usually applied by the Competent Authorities in the scope of any type of urban mass passenger transportation.

In the case of Costa Rica's new Rapid Passenger Train System (TRP), this concept applies, but with important nuances given that there is some demand risk for the concessionaire.

The applicable Tariff Subsidy is determined by means of the so-called "Technical Tariff" per passenger transported (3.228 USD/passenger transported), as a value that allows the Concessionaire to recover its costs and obtain a reasonable profit, the Tariff Subsidy being the difference between the referred Technical Tariff and the Commercial Tariff, the latter being understood as the consideration to be paid by the Users for the rendering of the service.

The Fare Subsidy, in short, in this case, would consist of a cash transfer, in Colones or U.S. Dollars as established, to be made by the State on a monthly basis to the Concessionaire per Passenger transported in said period, as of the beginning of the Operation Stage. This

average value is USD 1,974 per passenger transported, provided that the demand does not fall below a certain limit. In practice, this limit is approximately 10% of the reference demand.

This subsidy has limits given that there is a demand risk, as mentioned above. In this project, the maximum Tariff Subsidy is a known value, obtained from a guaranteed minimum income (except in the Ramp up period), coming from:

- OPEX and CAPEX revenues.
- and the minimum income guarantee on demand, as previously defined.

Therefore, in the event that demand were to collapse, the concessionaire would receive a maximum payment of US\$2,614/traveler.

The Ramp Up period shows the difference between the theoretical payment of the Technical Tariff, which considers all years the same revenues generated, and the revenues obtained by the Project based on the reference demand scenario, with progressivity in the first years of the concession, as is usual in reality.

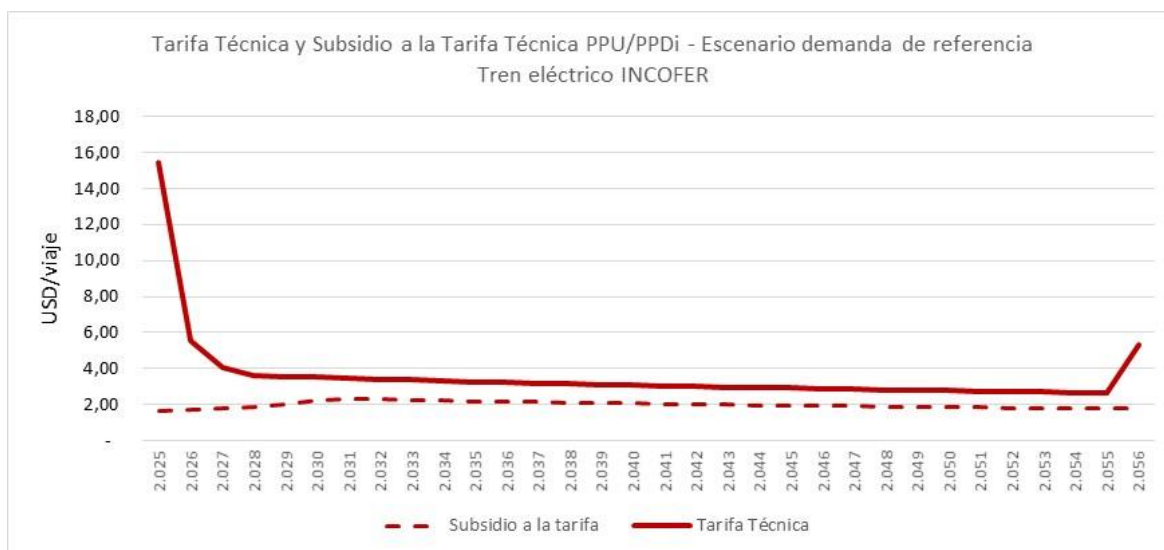


Figure 9. Demand Guarantee and Subsidy Technical Tariff, USD/trip (base CAPEX scenario).

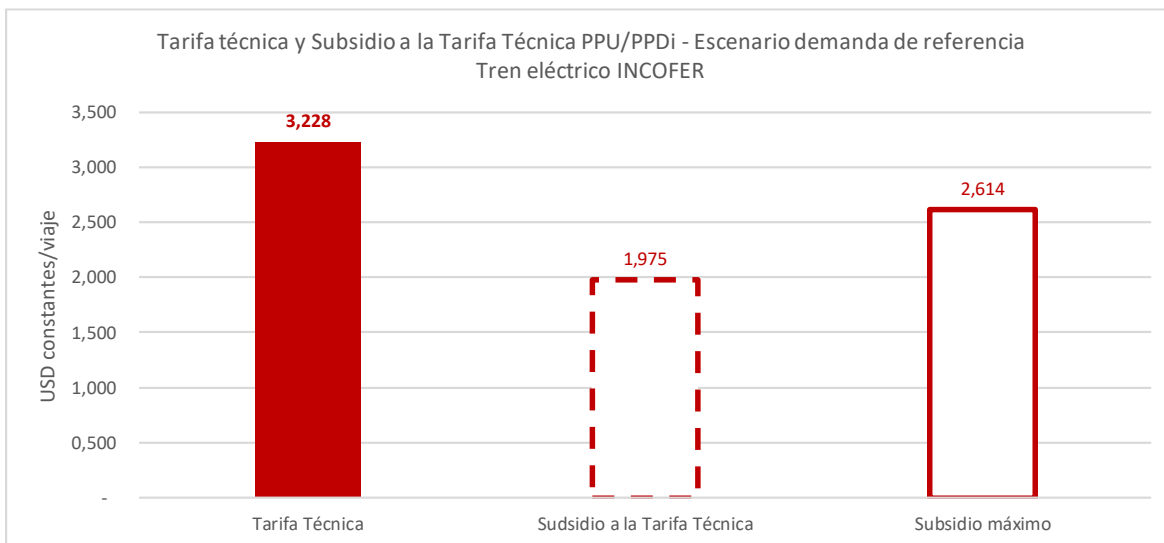
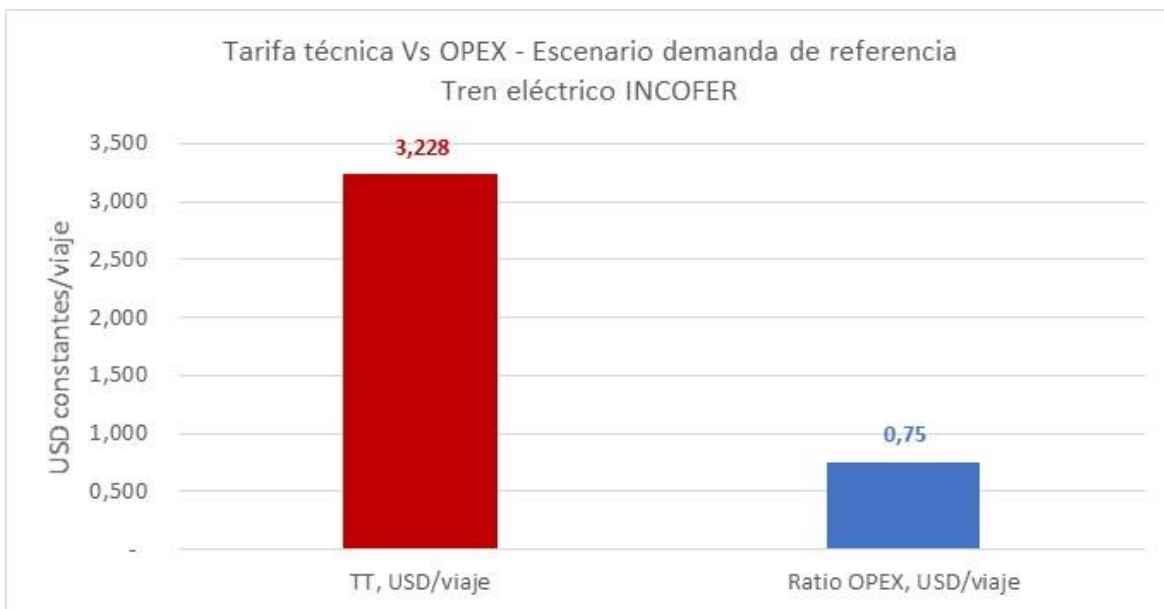


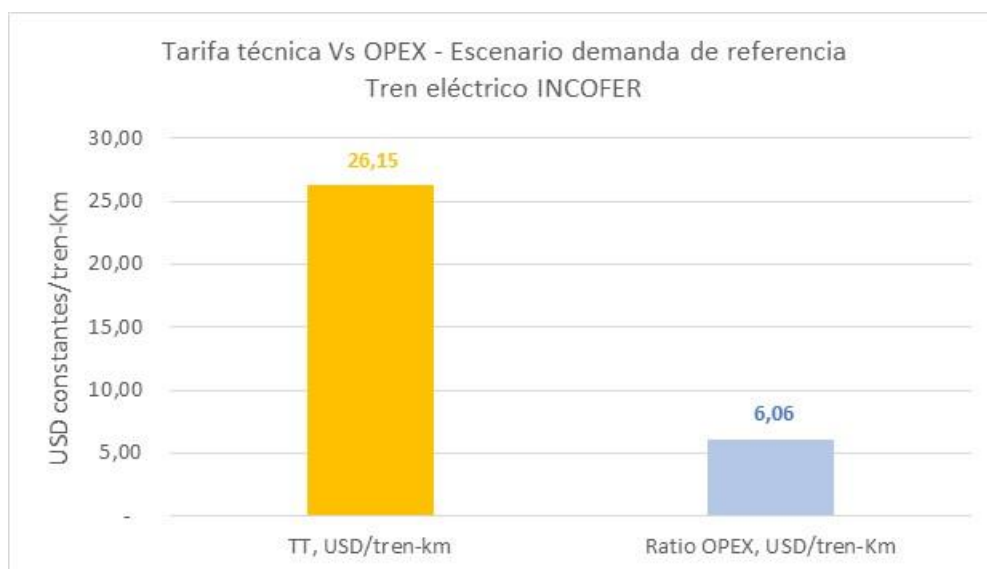
Figure 10. Demand Guarantee Technical Tariff, Subsidy and Maximum Subsidy, USD/trip (base CAPEX scenario).

Putting into context the technical tariff, calculated per passenger and per train-km in relation to the OPEX costs, the following can be observed:



Demand Guarantee Technical Tariff Vs OPEX, USD/trip (base CAPEX scenario).





Demand Guarantee Technical Tariff Vs OPEX, USD/train-Km (base CAPEX scenario).

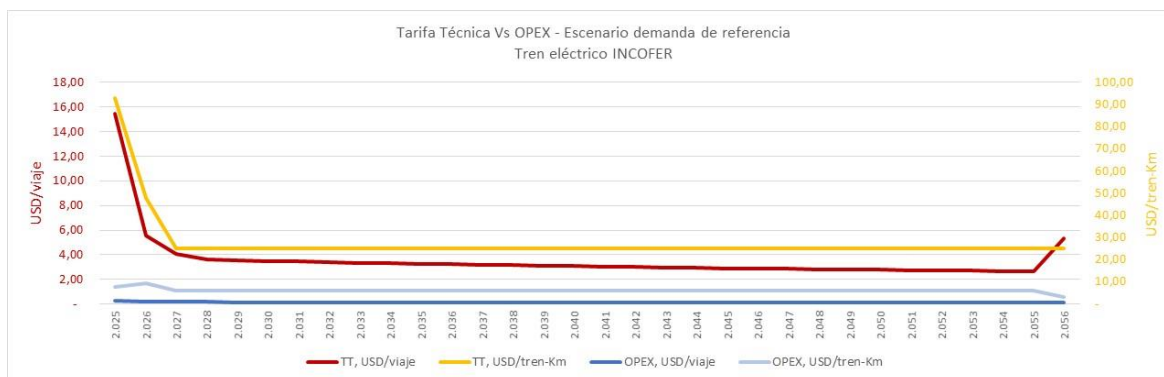


Figure 11. Evolution of Demand Guarantee Technical Tariff Vs OPEX, USD/trip and USD/train-Km . (base CAPEX scenario)

## 2.2 Ticket price

The ticket price of the new Passenger Rapid Transit (PRT) system paid by the user, the transport customer, is critical for estimating demand relative to other competing modes.

Passenger mobility is a complex concept that has to do with balance, with the balance between supply and demand, and how users choose to make their journeys. One of the determining factors is the price of the ticket.

The modeling procedure followed in this study is based on the traditional four-stage model: trip generation, trip distribution, modal split and assignment, which has made it possible to determine the price that users are willing to pay for the use of the new rail mode.

Mode choice plays a key role in public transport decision making. The mode choice issue is probably the most important element in transportation planning and decision making.

It is important to develop and use models that are sensitive to those travel attributes that influence an individual's travel mode choices, such as time savings and travel cost.

These two variables are the basis for the demand results obtained for the Passenger Rapid Transit System, which are shown below.

As can be seen in the following figure, the Project covers an extension that goes beyond the metropolitan limits of San José, generating a diversity of Origin/Destination pairs and, therefore, a multiplicity of urban and interurban trips.

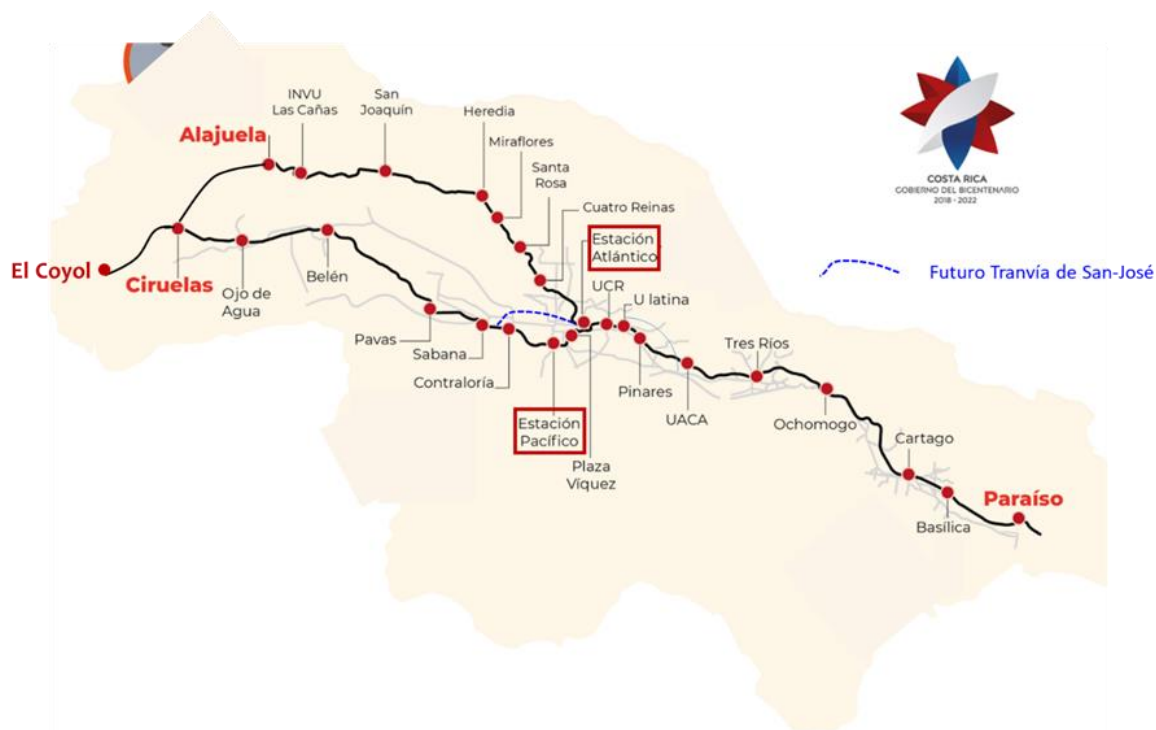


Figure 12. Area of influence of the Project.

The comparison of modes of transport allows us to summarize the results in the following tables, which show the time savings of the new rail mode.

COMPARATIVA MODAL TRAMOS	LONGITUD (km)			VELOCIDAD MEDIA (km/h)			TIEMPO DESPLAZAMIENTO (min.)		
	TREN	BUSES	COCHE	TREN	BUSES	COCHE	TREN	BUSES	COCHE
TRAMO 1: Paraíso – Atlántico	27,3	30,0	29,8 35,1	30,0	13,7	23,0 20,0	54,6	131,4	77,7 105,3
TRAMO 2: Atlántico – Alajuela	21,7	21,5	20,7 28,6	30,0	12,4	21,5 19,0	43,4	104,0	57,8 90,3
TRAMO 3: Atlántico – Ciruelas	25,3	29,3	26,1	30,0	8,5	27,0	50,6	206,8	58,0
TRAMOS 4 y 5: Alajuela – Ciruelas – El Coyo	10,5	10,1	10,2	30,0	5,7	18,0	21,0	106,3	34,0

Table 6 Comparison of transportation modes.

COMPARATIVA MODAL TRAMOS	AHORRO TIEMPO DESPLAZAMIENTO (%)		AHORRO TIEMPO DESPLAZAMIENTO (%)
	TREN Vs COCHE		TREN Vs BUS
TRAMO 1: Paraíso – Atlántico	✓ -30%	-48%	-58%
TRAMO 2: Atlántico – Alajuela	✓ -25%	-52%	-58%
TRAMO 3: Atlántico – Ciruelas	-13%		-76%
TRAMOS 4 y 5: Alajuela – Ciruelas – El Coyo	-38%		-80%

Table 7 Project time savings.

In relation to travel costs, the unit toll assumptions considered in the road alternatives to the different sections are shown in the following table:

TARIFA UNITARIA Peaje (USD/viaje)	
Tramo 1	0,13
Tramo 2	0,13
Tramo 3	0,13
Tramos 4 & 5	0,00
Tramos 1 - 5	0,39
Promedio Tramos	0,12

Table 8. Hypothetical unit toll rates in the lanes corresponding to the sections.

The following table shows the estimated Value of Time.

Hipótesis sobre valor del tiempo (1)	DATOS	
Salario Medio en Costa Rica en CRC (2018)	435.000	
Promedio de horas de trabajo al mes	205,71	
Reparto de viajes: trabajo	80%	
Reparto de viajes: ocio	20%	

Hipótesis sobre valor del tiempo (2)	USD	CRC
Valor del tiempo (por hora) - Media ponderada (2019)	4,63	2.566

Table 9. Hypotheses considered in the time savings.

The results obtained are as follows.

	TARIFA UNITARIA Tren (USD/viaje)	Bus (USD/viaje)
Tramo 1	1,00	1,74
Tramo 2	1,00	2,41
Tramo 3	1,00	0,90
Tramos 4 & 5	0,50	0,75
Tramos 1 - 5	3,50	5,80
Promedio Tramos	0,94	1,52

Table 10. Train and bus unit fare assumptions.

In global terms of Captured Demand, the following results have been obtained. Captured Demand or Transferred Demand is the demand that, once the Project is put into operation, is transferred to the train, thus eliminating the use of the previous respective modes of transport (bus and private vehicle).

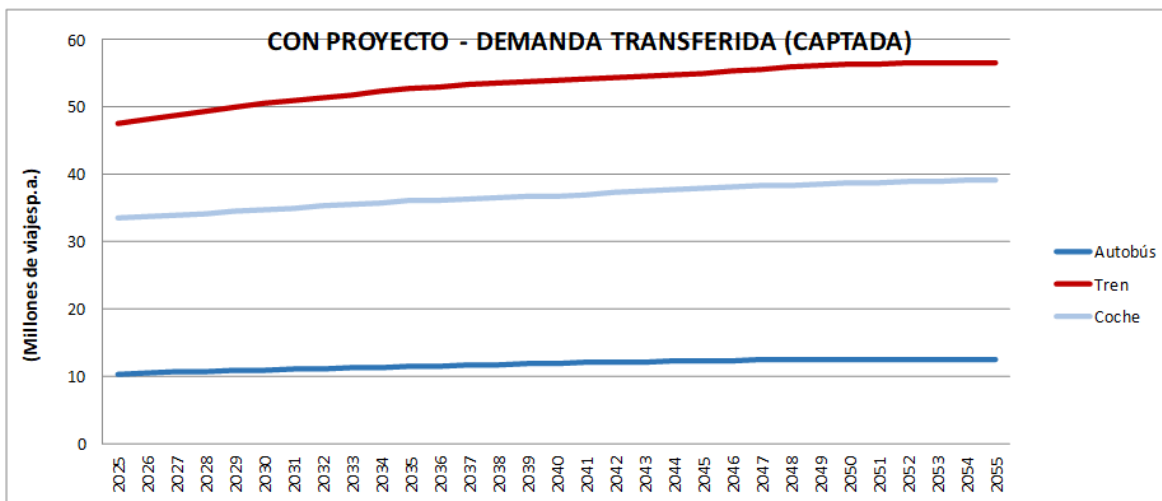


Figure 13. Demand captured.

### 3 POSSIBILITIES FOR INTEGRATION OF THE SYSTEM WITH OTHER EXISTING PUBLIC TRANSPORT SYSTEMS

In many cities, public transport is provided by private sector transport operators, sometimes consisting of a single driver and vehicle.

The (commercial) interests of these transport operators are naturally focused on profitable routes and not on providing good user service. It is therefore obvious that quality and access to public transport in general is difficult to maintain without sensible regulation and proper coordination.

The integration of the different public transportation systems through a single ticketing system may result in changes in the overall demand of the system. This factor leads to a significant variation in the expected revenues and, consequently, in the cash flows that define the financial viability of the Project.

The integration of transport systems in large cities has led to improvements in mobility thanks to the possibility and convenience of new modal interchanges, coupled with the ease of payment.

The integration of the existing modes of transportation with the new Rapid Passenger Train System (TRP) of the Greater Metropolitan Area (GAM) rail system configures a scenario with different aspects.

- Territorial coverage of integration. GAM area
- Definition and coordination of integrated services
- Ticketing system
- Means of payment

In each one of them, a reasonable hypothesis will be established to establish an Integration scenario, aligned with the scope of this Project.

### 3.1 Target

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The objective of this section is to define a possible scenario for the integration of the new Passenger Rapid Transit System (TRP) of the Greater Metropolitan Area (GAM) with other modes of transportation, which will facilitate and increase the use of public transportation by users, customers of the transportation service.

The implications of the integration will be measured in the Project through the estimated demand, the revenues obtained in the new Rapid Passenger Train System (TRP) of the Greater Metropolitan Area (GAM), the costs of such integration and, finally, its feasibility will be analyzed through the internal rate of return of the Project.

### 3.2 Mobility in the Greater San José Metropolitan Area

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Mobility, according to the current GAM 2013 Plan, already defines an integrated mass public transportation system according to the Integral Dense Centralities (CDI) model.

The integrated mobility model was based on an east-west backbone axis (interurban passenger train system), a connecting axis in the center of the GAM (tramway), and a sectorized bus system as a regional feeder complement to promote increased non-motorized mobility (bicycles and pedestrians) within the GAM.

At the same time, it defined the priority road projects to generate regional connectivity (connection between the GAM without crossing central urban areas) and road redundancy to expand the possibility of travel and the efficient connection of industrial zones, according to the proposed CDI model. It also established the development structure in which the needs for individual motorized travel in private vehicles are reduced in order to reduce the vehicular load within the cores of the Integral Dense Centralities. See all of the above in the attached Figure.

As has been diagnosed in the demand studies, and as the main studies carried out coincide, the San José Metropolitan Area currently suffers from a lack of coordination of transportation services. This is the reason why the present Project materializes the Integration scenario foreseen in the GAM Plan, acting as a spearhead for the necessary coordination of services towards a more sustainable transportation.

The previous studies that support this Project are the following:

- Prefeasibility Study for the GAM Passenger Rapid Train System. Final Report. Prepared by L.C.R. Logística S.A. (November 2016).
- Technical, Legal, Financial and Environmental Feasibility Study for the Financing and Management for the Concession of the Metropolitan Electric Train Project in Costa Rica, prepared by Engevix. (May 2009).

The 2011-2030 GAM Land Use Plan itself establishes in its diagnosis:

*The current organization of the transportation system and roads in the GAM implies a series of deficiencies and problems that result in heavy congestion, loss of efficiency and environmental deterioration due to the primacy of private vehicles over mass transportation and pedestrians, disintegration of the system, favoring the mono-centric and radial model, lack of functional hierarchy of roads, lack of road continuity and links to key points of the GAM and the lack of road and transportation infrastructure.*

The Greater Metropolitan Area of Costa Rica totals 1,779 square kilometers between the Central Valley and the El Guarco Valley. It partially comprises four provinces (Alajuela, Heredia, San José and Cartago) and corresponds to 31 cantons distributed among them, some of them partially included, and 152 districts.

The GAM is home to about 50% of the country's population, grouped into 31 municipalities from Paraíso de Cartago in the east to Atenas de Alajuela in the west.

Four metropolitan areas comprising San José, Heredia, Cartago and Alajuela:

- San José area (13 municipalities): San José, Escazú, Desamparados, Aserrí, Mora, Goicoechea, Santa Ana, Alajuelita, Vásquez de Coronado, Tibás, Moravia, Montes de Oca and Curridabat.
- Heredia area: (9 municipalities): Heredia, Barva, Santo Domingo, Santa Bárbara, San Rafael, San Isidro, Belén, Flores and San Pablo.
- Cartago area (6 municipalities): Cartago, Paraíso, La Unión, Alvarado, Oreamuno and El Guarco.
- Alajuela area (3 municipalities): Alajuela, Atenas and Poás.



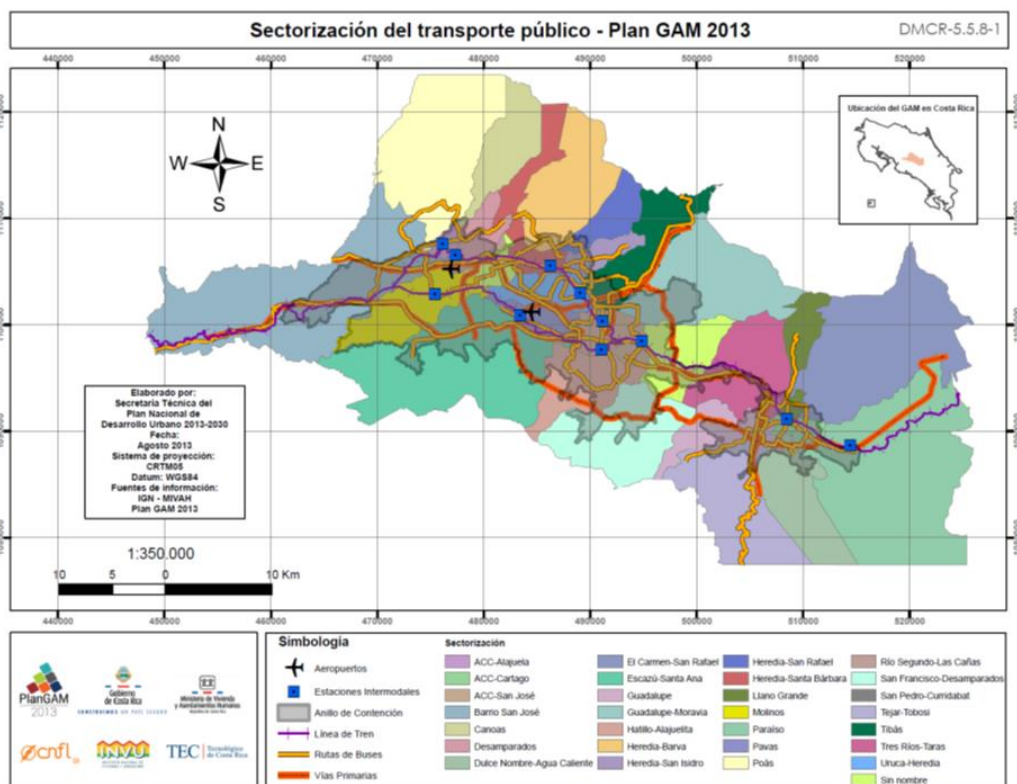


Figure 14. Sectorization of public transportation Plan GAM.

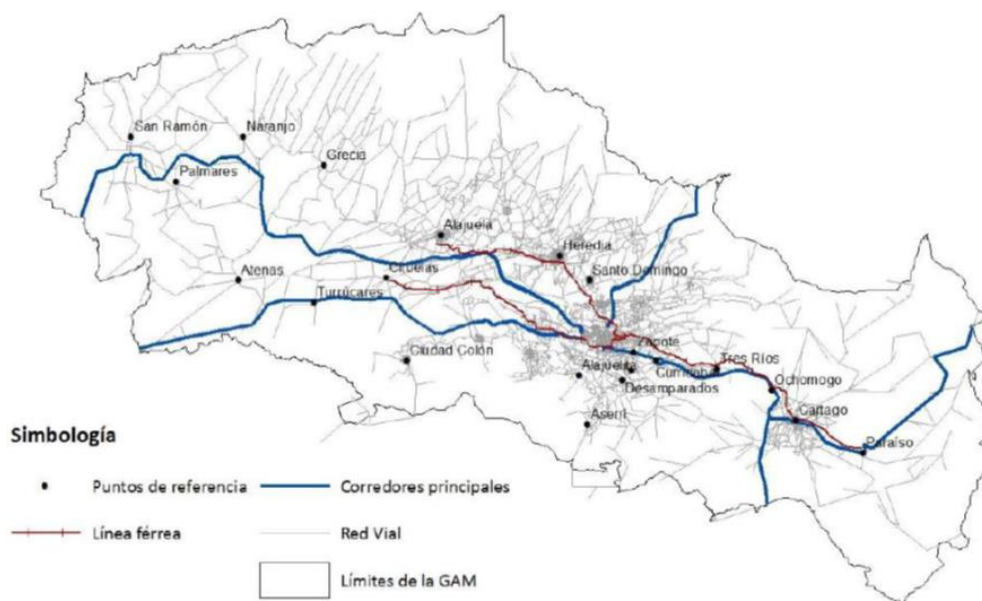


Figure 15. GAM boundary, territorial coverage, Integration scenario.

From the point of view of fares and coverage of transport services, and for the sake of simplicity of the integration model, the four metropolitan areas are considered to be of equal importance. This model should consider the following transport flows.

Generally speaking, four types of trips can be grouped in the Greater San José Metropolitan Area: regional and interregional trips, metropolitan interurban trips (medium and long distance), short distance urban trips, and local trips.



Figure 16. Area of influence of the Project.

- Regional and interregional flows: These are flows associated with long distance travel between regions. For example, flows originating outside the GAM that arrive or pass through the GAM.
- Metropolitan interurban flows (medium and long distance): these are flows associated with medium and long distance trips within GAM. For example, flows derived from trips between GAM zones such as Cartago-Alajuela, Cartago-Heredia, etc.

- Short distance urban flows: These are flows associated with trips between zones of the same metropolitan area, for example, Guadalupe-Uruca, San Pedro-Pacas, Paraíso-Cartago centro, etc.
- Local flows: these are flows associated with short-distance local trips between nearby areas or within the same area.

Therefore, according to the urban development plans in the country, the territorial coverage of the Integration scenario, given the scale of the railroad project, should be the **GAM area**, geographically centered in the capital city of San José.

### 3.3 Project Description. Integration and Intermodality

The Electric Train operates in an 84.85 km corridor with a total of 46 stations, which will connect travelers from the East and West ends of the GAM with the City of San José.

The following is an image of the development along which the Electric Train route will run, which is limited to the INCOFER right-of-way.

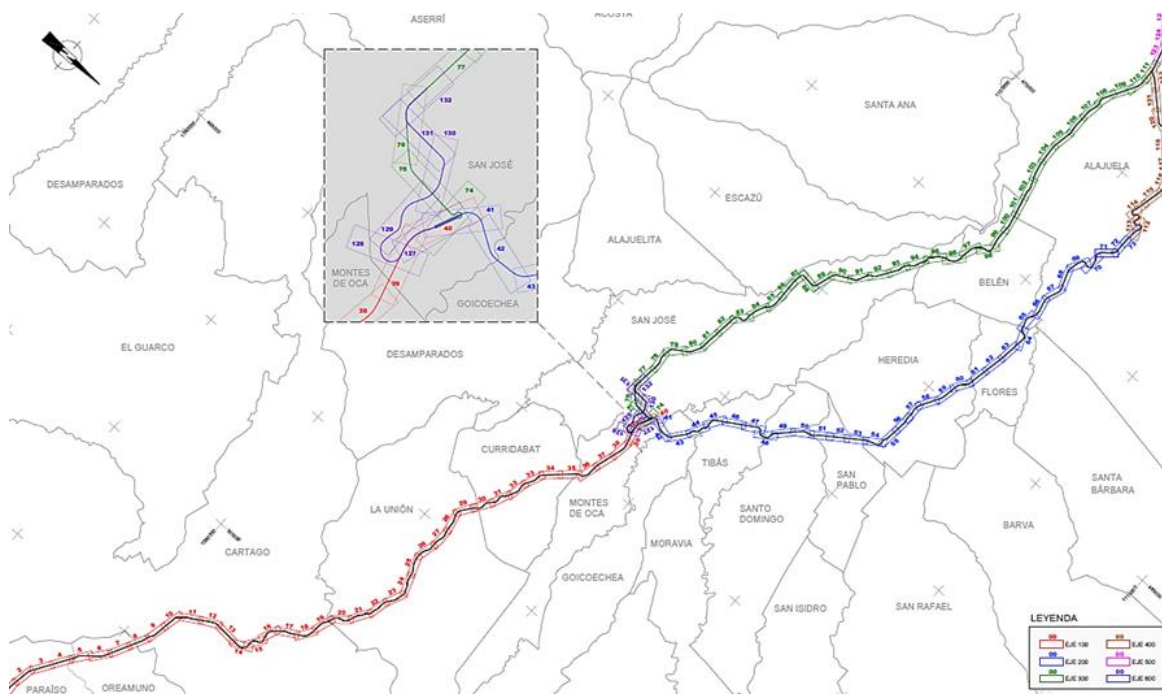


Figure 17. GAM Electric Train Project. Projected route.

**In addition, 14 of the aforementioned stations are proposed as interurban stations, where passengers will be transferred between the bus system and the Electric Train.**

Likewise, in the construction design phases of the project and through negotiations with the corresponding municipalities, park-and-ride lots could be proposed at some stations, which would allow for modal interchange between private vehicles and public rail transport.

Some of the stations have bus stop areas that facilitate modal interchange between the bus and the Electric Train.

### 3.3.1 Main features of the new railway system

The main magnitudes and characteristics of the project are described below in order to have a better idea of its size:

Infrastructure: track, systems and rolling stock

- Length of route: 84.85 Km
- Number of stations: 46.
- Rolling stock required: 78 the year of commissioning.
- Maximum speed: 25 km/h in urban areas, 50 km/h in semi-urban areas, and 70 km/h in interurban areas.
- Frequency of trains: 5 min during rush hour
- Passenger transport capacity: 600 passengers per unit in double composition (6 passengers/m<sup>2</sup>).

	Home	End
Off-peak time tomorrow	05:00	06:00
Morning rush hour	06:00	10:00
Noon off-peak time	10:00	15:30
Late rush hour	15:30	19:30
Afternoon off-peak time	19:30	23:00

*Table 11. Periods of demand variation.*

	Lines 1, 2 and 3		Lines 4 and 5	
	Workable	Non-working	Workable	Non-working
Off-peak time	15 minutes	20 minutes	30 minutes	40 minutes
Peak hour	5 minutes	10 minutes	10 minutes	20 minutes

Table 12. Frequencies of operation on the lines according to the type of hour and day.

### 3.3.2 Integration Proposals

Once the integration area has been defined as the GAM Area, possible integration actions are proposed:

- Definition of integrated services: INCOFER electric train, urban and interurban bus, future tramway.
- Single fare on rail and bus modes (integrated services) of USD 1.5/trip
- Free transfer on integrated services within one hour after the first trip is made
- Multi-trip card ticketing system and possibility of payment via mobile application
- New on-board ticketing systems on rolling stock
- ...

The new demand would consider a 3% increase in demand as induced demand from new users who, favored by the Integration of the Transportation System, would make new trips.