



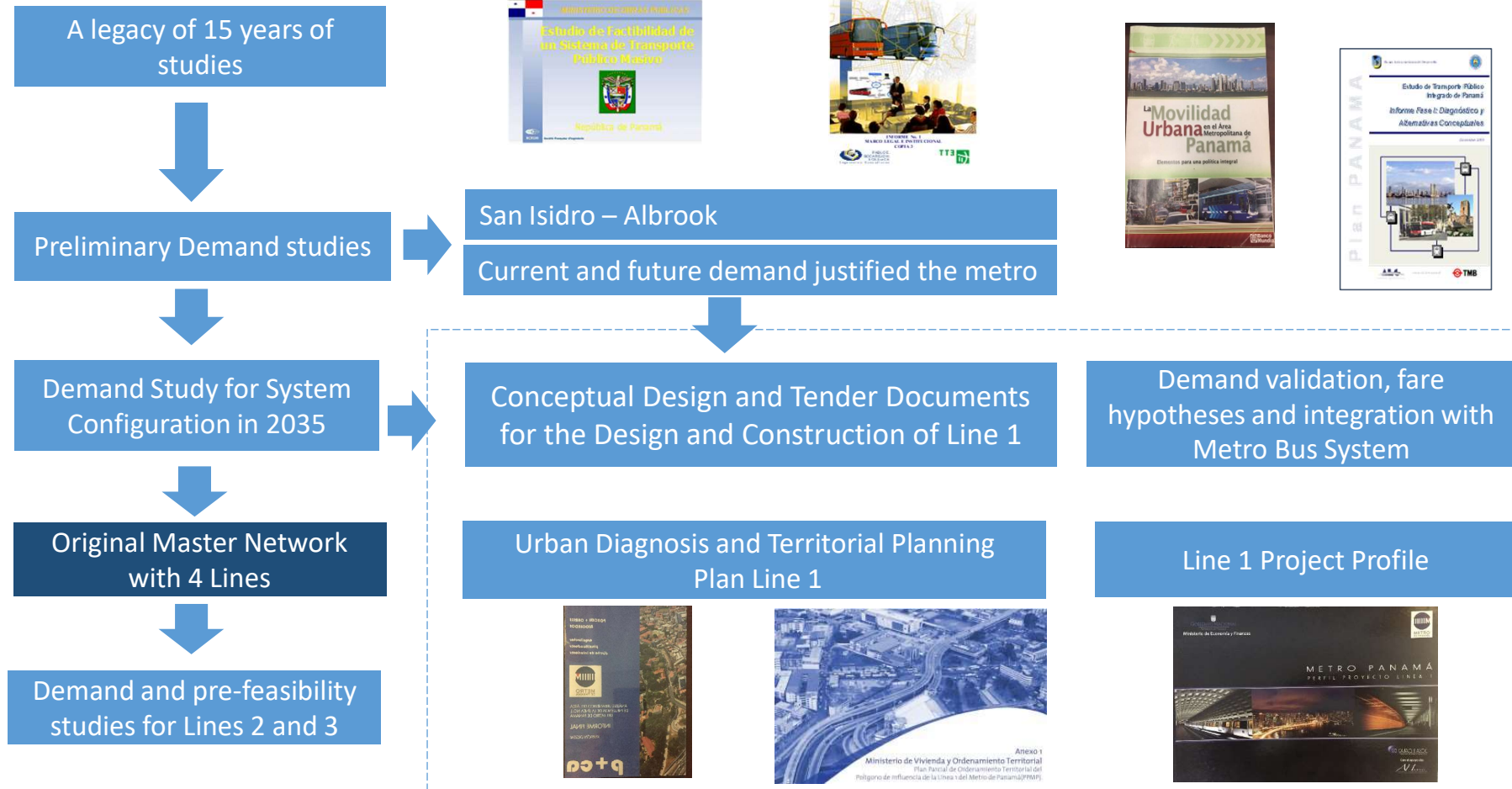
Panama Metro

Building and Operating a Sustainable Transportation Network

Abdiel Pérez
Deputy General Director

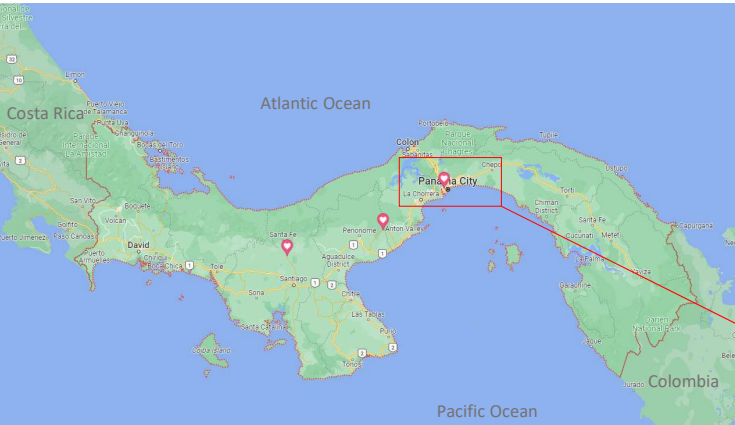
Initial Planning

Secretary of the Panama Metro 2009 -2014

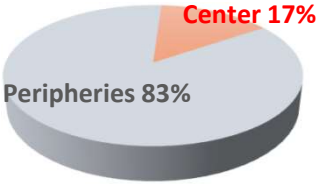


II. Socioeconomic and Urban Framework

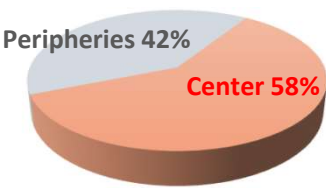
Panama, 4.2 MM hab. (2023)



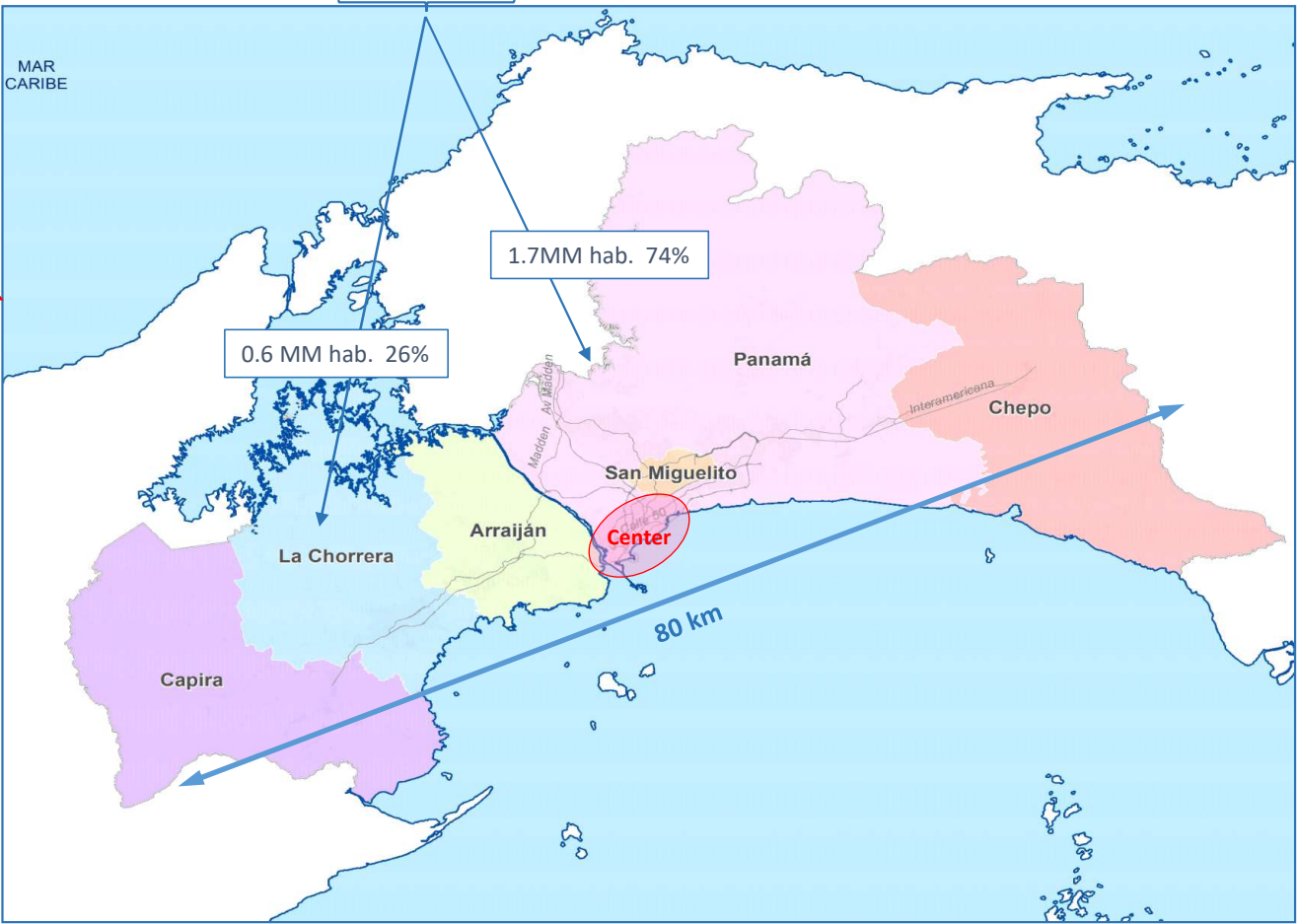
Population



Jobs



Metropolitan Area, 2.3 MM hab. (55%) → 2.9 MM, 1.7M jobs by 2040





RED MAESTRA SISTEMA METRO DE PANAMÁ



Airport Connection – 2023



Line 1 Extension - 2024

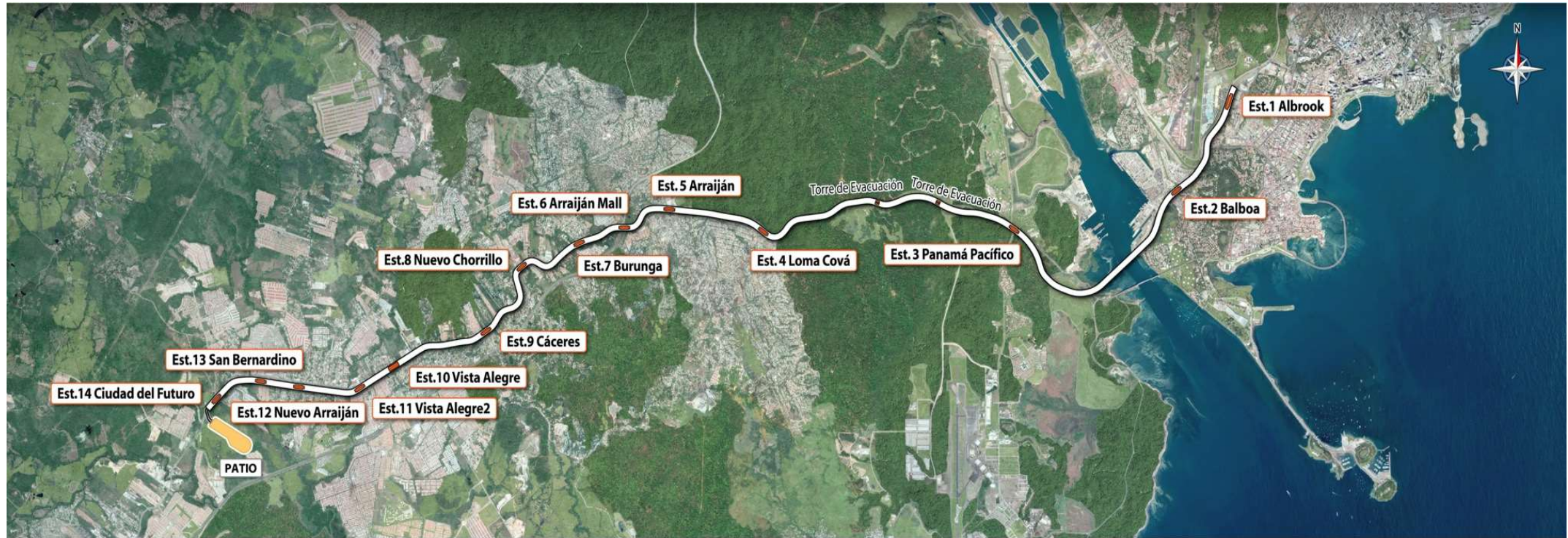


- **2.2 km extension** at L1 north end.
- “Terminal station”, **capacity for 10,000 pas. at peak hour.**
- Includes parking for **800 vehicles.**
- Execution time of **33 months**, to be completed.
- In service by the **first quarter of 2024**
- Built by Consortium Línea Panamá Norte conformed by **OHL and MOTA ENGIL S.A.**
- Cost: **USD 177,967,848.33**

Line 1 Extension - Terminal Station



Line 3 – West Side



VIGA DE RODAJE Y VIADUCTO



ESTACIÓN ALBROOK



ESTACIÓN VISTA ALEGRE



URBANIZACIÓN



PATIO Y TALLERES

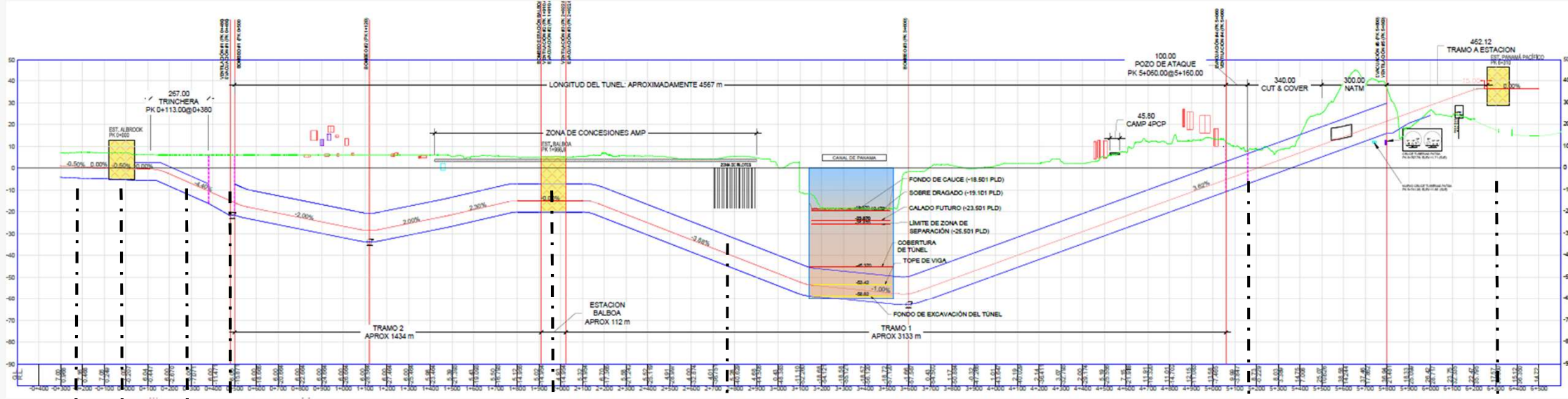


Line 3 – West Side



- **24.7 km long** between Albrook and Ciudad del Futuro, with 14 stations.
- **Monorail** system with **6-car trains** with a capacity of **20,000 passenger** at peak hour.
- **Notice to proceed** given in **Feb. 2021**, with an execution time of **54 months**.
- Awarded to Consortium **HPH Joint Venture** – conformed by **Hyundai Engineering & Construction Co., Ltd**, **Posco Engineering & Construction Co, Ltd.** and **Hyundai Engineering Co, Ltd.**
- Panama **Canal crossing** changed from a bridge to an underground solution including a TBM tunnel, **4.5 Km long, 13 meter in diameter**.
- **42% completion** by August 2023.
- Expected total completion by **end of 2026**.

Estación
Pacífico



Non-reimbursable Technical Cooperation from Korea

Studies being carried out through the Central American Bank for Economic Integration (CABEI):

1. Line 5: Execution of the Feasibility Study for line 5. (COMPLETED August 2023)

The study for USD 630,000. (Jan2022- Jun2023), approved within the framework of the Fund Korea Single Donor Trustee (KTF). The study was developed by DOHWA ENGINEERING CO., LTD (together with WSP and SAMAN Corp.)

2. Study to Improve the Financial Sustainability of the Panama Metro System. (COMPLETED)

With funds from the Korean Urban Infrastructure and Development Corporation Abroad (KIND), the study for 280,000.00 USD, was completed in Dec 2022. It provided recommendations for marketing strategies and sustainability of operations, and improvements in the quality of service to increase passenger demand.

3. Integration of the Public Bus and Metro Transport Systems in the Province of Panama West. Currently in tender process.

With funds from Sole Donor Trust Fund (KTF) for USD 600,000. The objective of is to develop a strategy for the restructuring of the public transport system in the Metropolitan Area of Panama (AMP), specifically in the districts of Arraiján and Chorrera.

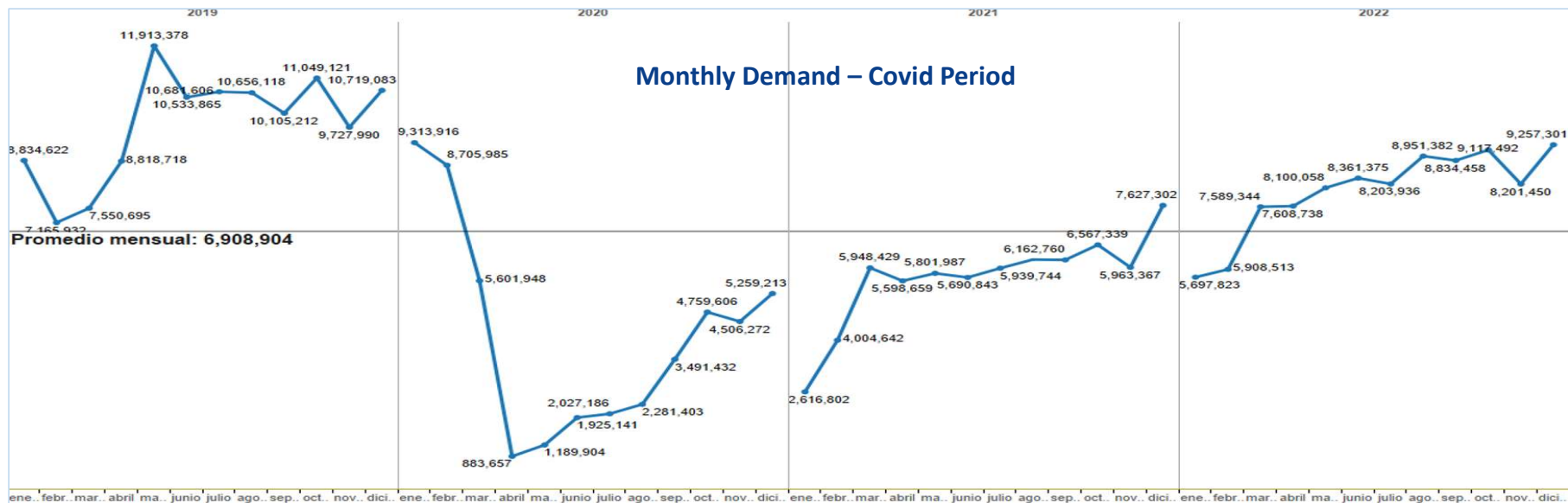
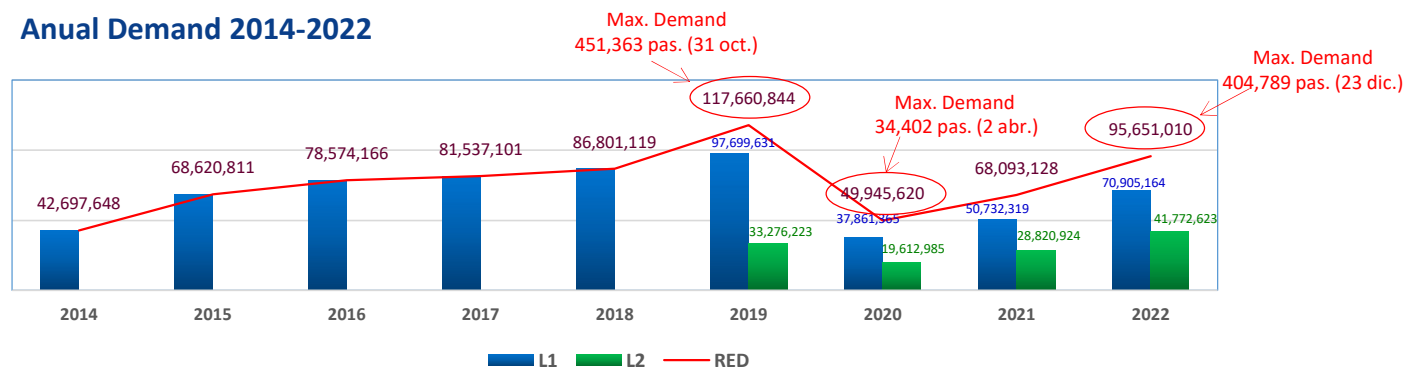
4. Feasibility Study for Phase 2 of Metro line 3, extension to the Chorrera District. Starting tender process.

Approved on March 6, 2023, a Single Donor Trust Fund (KTF) KOREA, for an amount of 800,000 USD, for the Feasibility Study of Phase 2 of Line 3, starting from the conceptual scheme defined in the feasibility study of Line 3 (EFL3), up to the level of preliminary design for the specifications for the bidding of the project's design and construction.

Operation and Maintenance

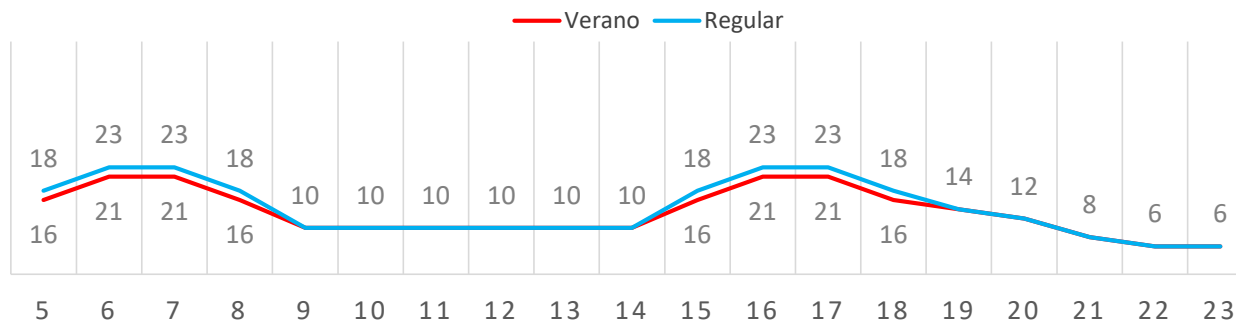


Anual Demand 2014-2022



Service Train Deployment

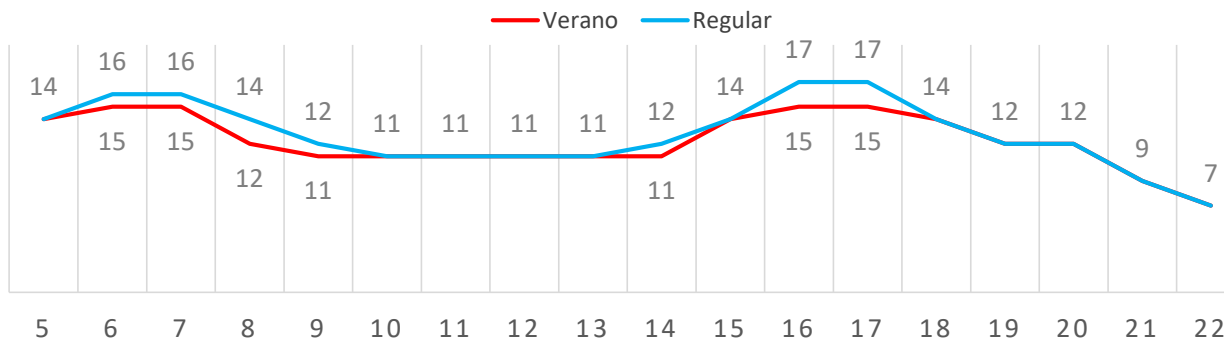
Work week L1



Summer Offer

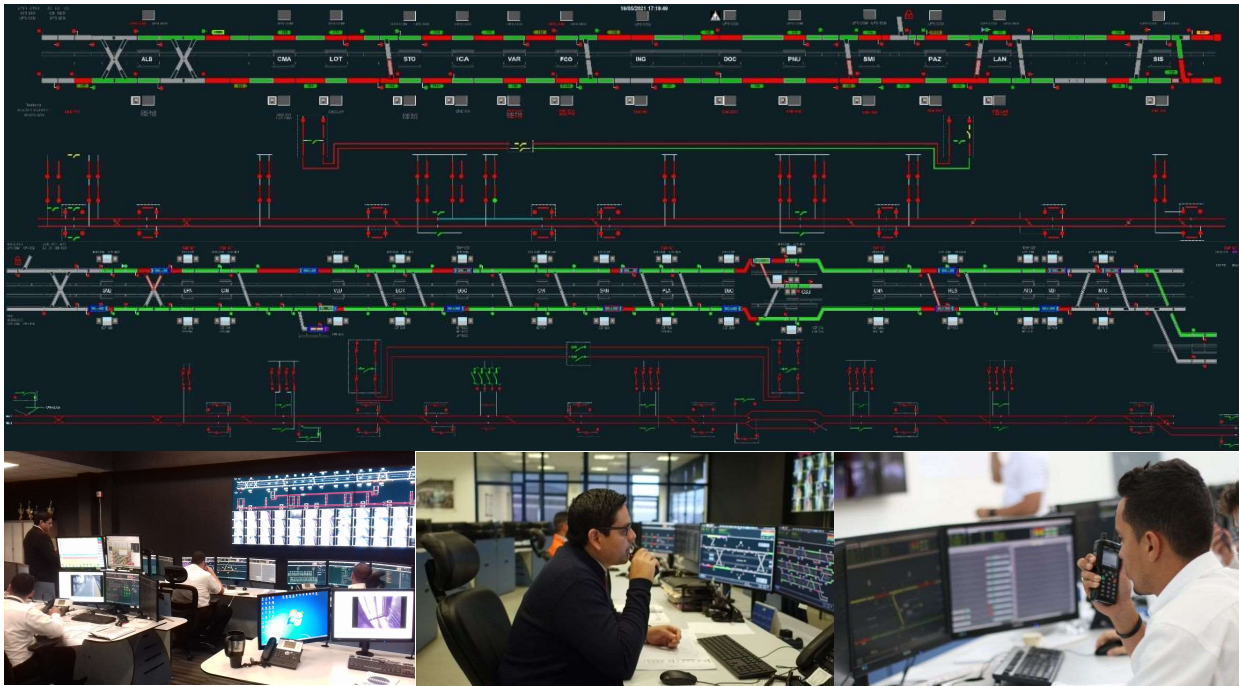
- Daily Trips: 852 (-8%)
- Waiting time increased by 15 sec.
- Train maximum load 85% (+4%)
- Frees 13 operators.
- Distance covered -18,900 km/mth (-5%)
- Energy saved: \$ 52,000/mth.

Work week L2



Operation Control

Control Center- CCO



Control Systems

- Communication Based Train Control (CBTC)
- Automatic Train Control System (ATS)
- Supervision, Control & Data Acquisition (SCADA)
- Train Programming (Goal-rail System)
- Operators programming (Goal-driver)
- On-board Train Load (ALSTOM Help Hub)

Main Operating Systems

Rolling Stock



- 47 trains
- Maintenance contract by ALSTOM*
- 3 hangars, 24 hours
- 329 maintenance activities

Railway and Catenary



- 180 km of tracks
- 86 km of catenary
- 75 mobile and shop equipment
- Maintenance contract by TCP Rail
- 77 technicians & adm. personnel

Power Systems



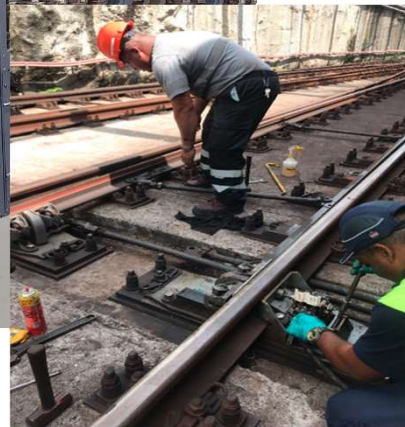
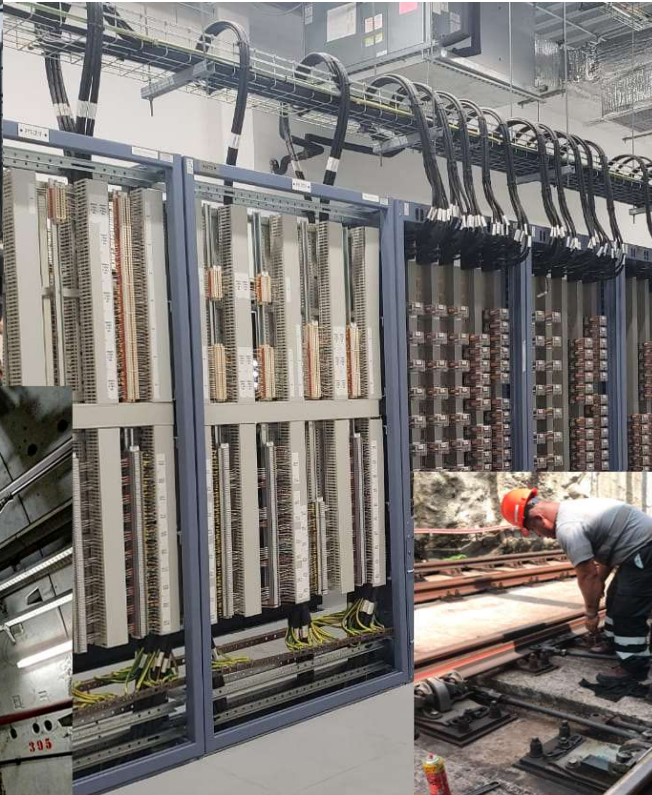
- 2 auxiliary substations
- 4 incoming stations
- 43 traction /passenger substations
- 114 transformers, 891 cabinets
- 78 UPS'
- Maintenance contract by ALSTOM*

Other Equipment and Operating Systems

Signaling

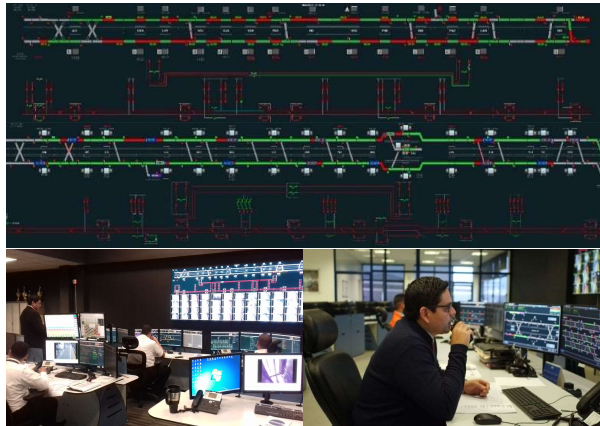
(safe train driving system)

- 3,221 track equipments (90 km)
- 376 train onboard equipments
- 878 cabinets and panels
- 638 electronic PCB
- Maintenance contract by ALSTOM

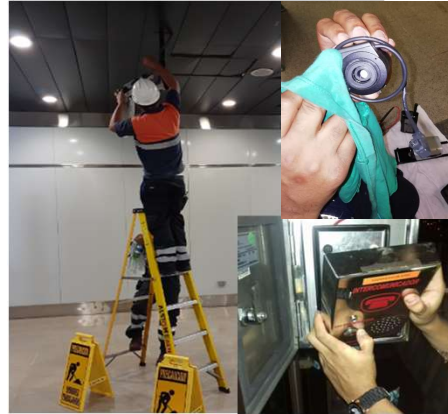


Other Equipment and Operating Systems

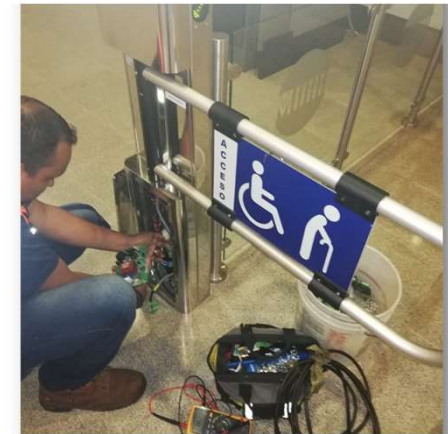
Control & Telecommunication



CCTV, telephone, intercom



Access Control



Escalators and Elevators



Air Conditioning and Ventilation



Other Equipment and Operating Systems

Fire Protection



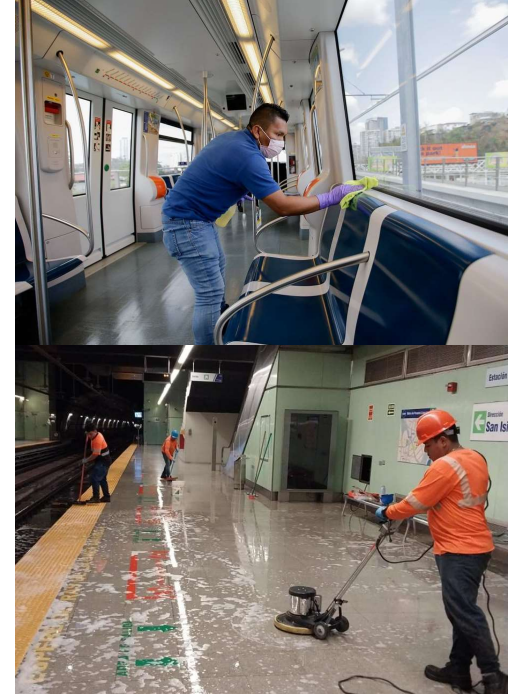
Tunnel Ventilation



Pumping and Treatment
Plants



Cleaning Services



UPS

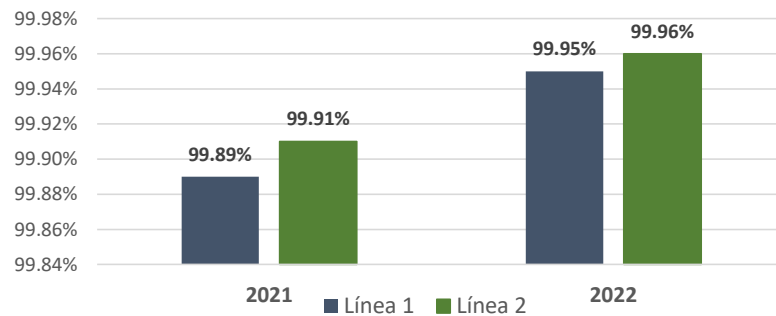


Rolling Doors

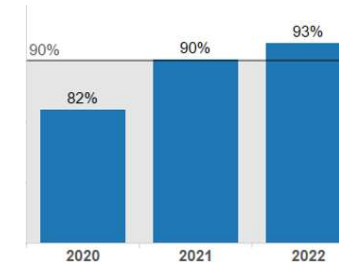


Operation Performance Indicators

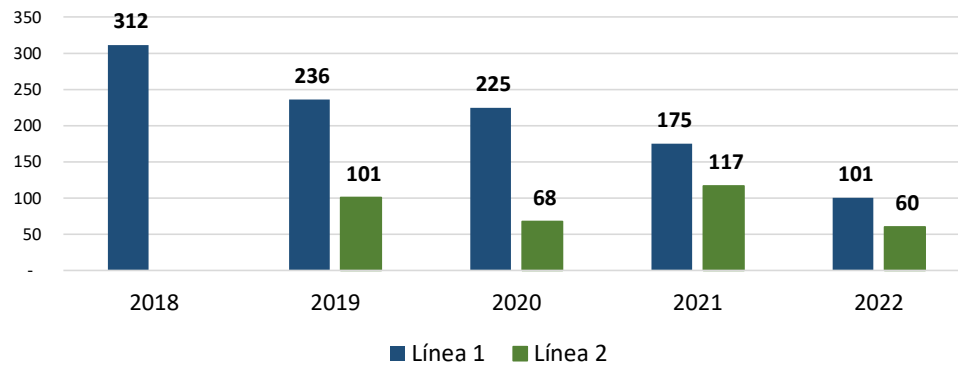
Offer Compliance



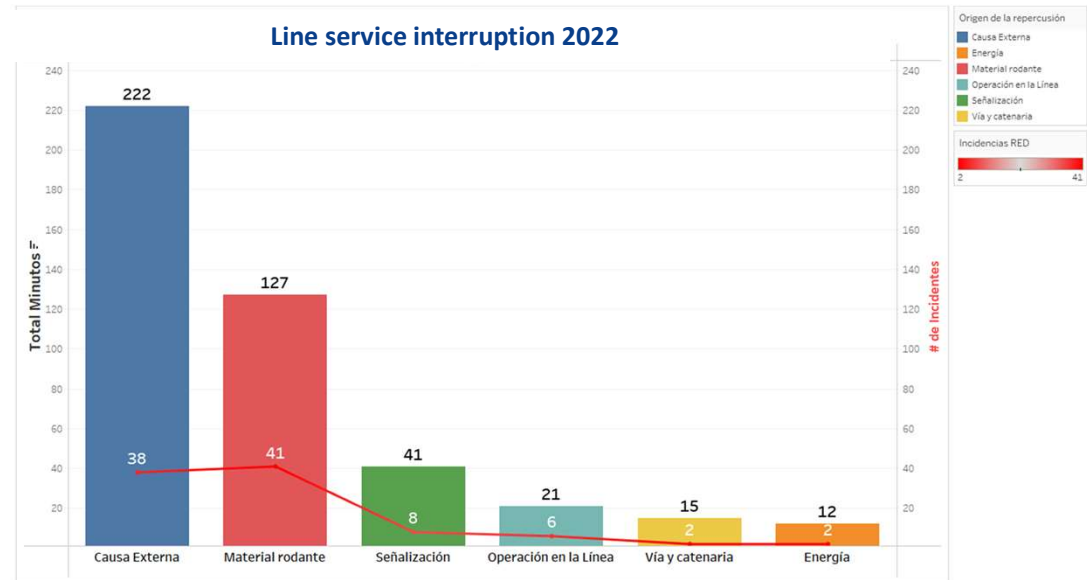
Schedule time compliance



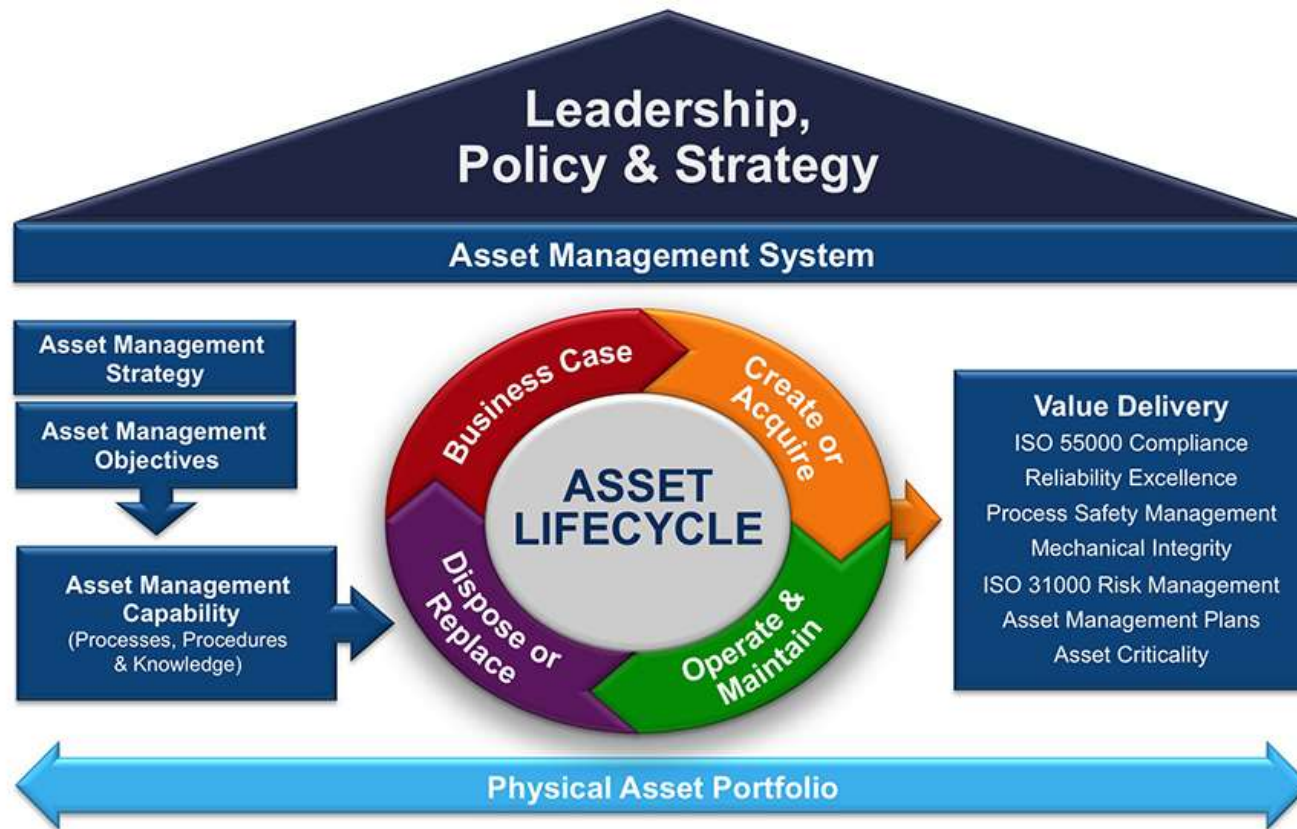
Accumulated train failures (min per million of kilometers)



Line service interruption 2022



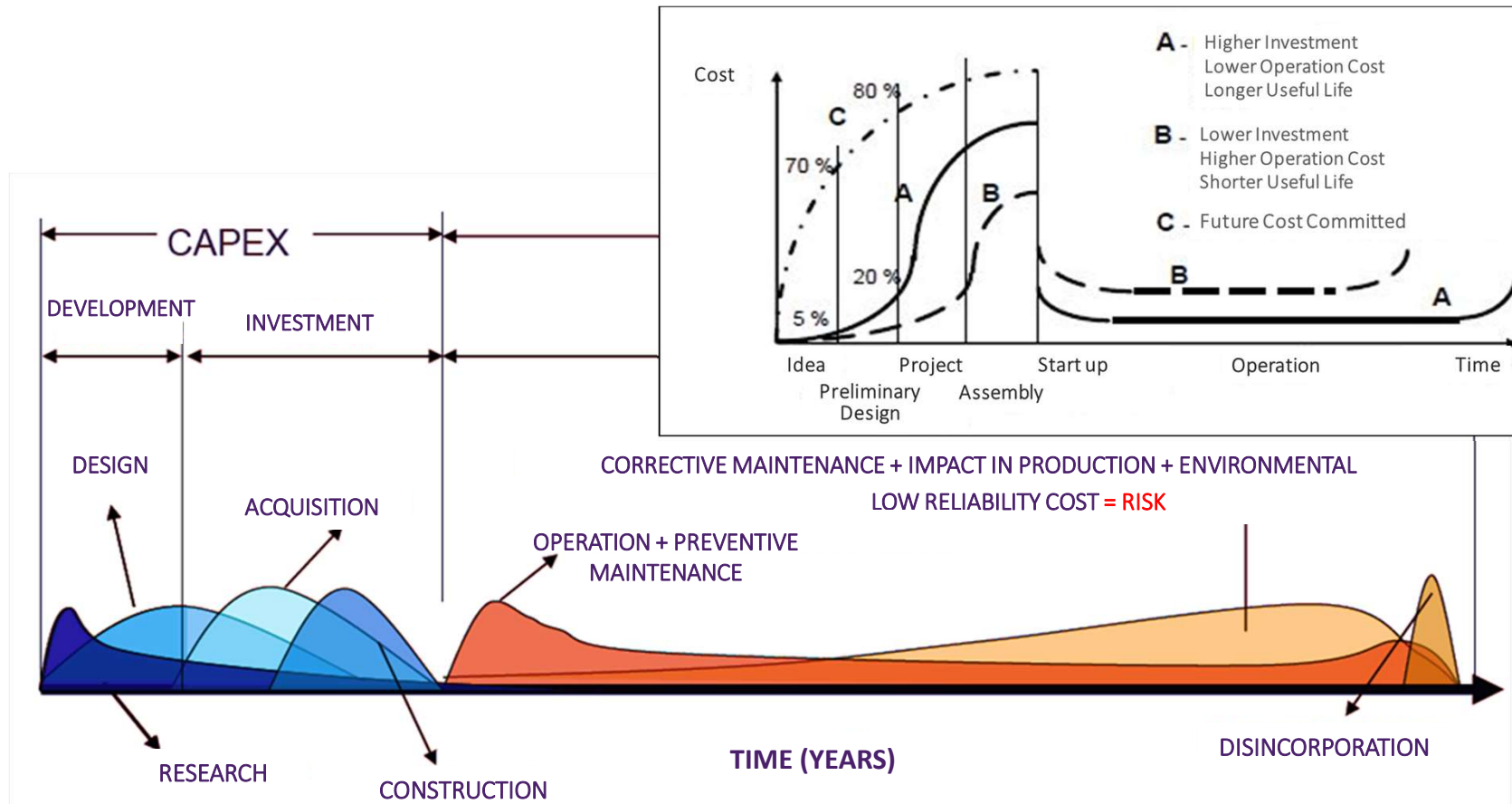
Asset Management System

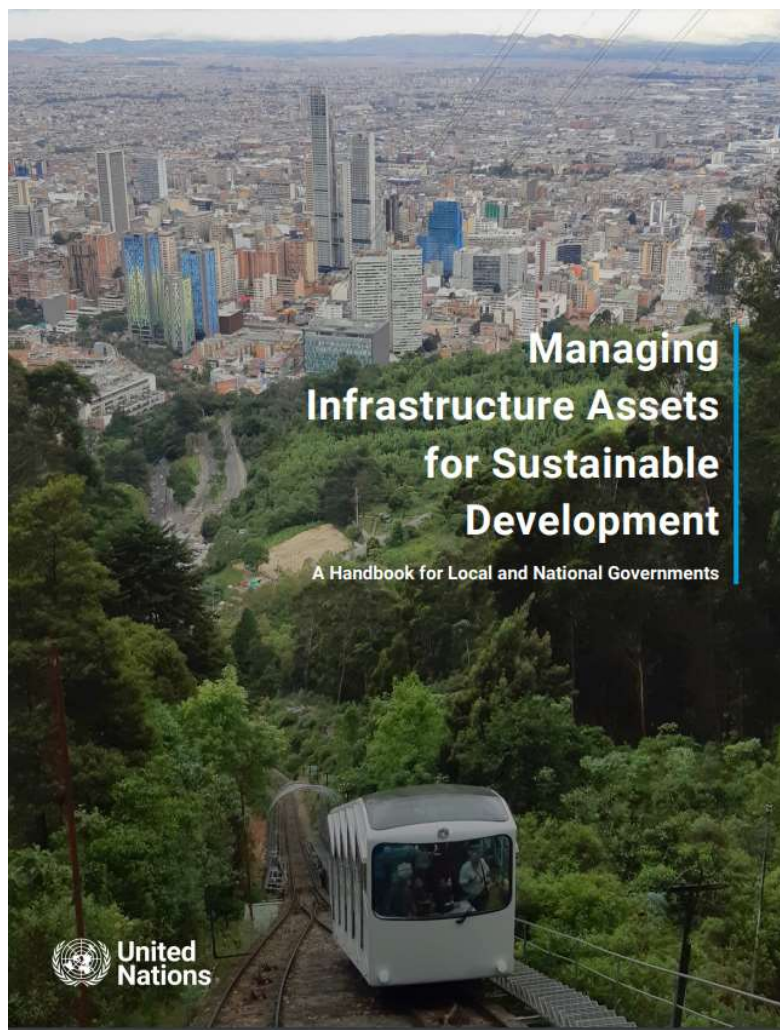


The discipline of Asset Management:

- Full regard for achieving maximum benefit from the organizations' assets.
- Such expertise draws from all functions within an organization: business, financial, human resources, operations and maintenance.
- It is particularly challenging to gain a good understanding of the discipline across the whole breadth of the knowledge base.

Asset Life Cycle Cost





Managing Infrastructure Assets for Sustainable Development

A Handbook for Local and National Governments

Edited by

Navid Hanif, Caroline Lombardo,
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*United Nations Department of
Economic and Social Affairs*

Jaffer Machano, Dmitry Pozhidaev
and Suresh Balakrishnan
*United Nations Capital
Development Fund*



Foreword

Welcome to *Managing Infrastructure Assets for Sustainable Development: A Handbook for Local and National Governments*.

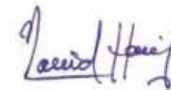
With this publication, we aim to provide practical guidance to local and national governments on how to manage the assets on which people rely every day — the roads they use to get to work, the buildings where they live or attend school, the parks where their children play and the water and sanitation facilities they use to stay healthy.

Effective asset management has become as critical as ever across the globe and in the face of mounting pressures, such as limited resources, growing urban populations, shifting patterns of employment and land use, climate-related disruptions and health emergencies, including the COVID-19

agement at the national and local levels. Done well, local and national asset management efforts not only improve essential service delivery, they also yield positive signals to citizens and public, private, domestic or foreign investors, helping governments to mobilize the resources needed for sustainable development and demonstrating to citizens that their representatives are safe custodians of the public common property.

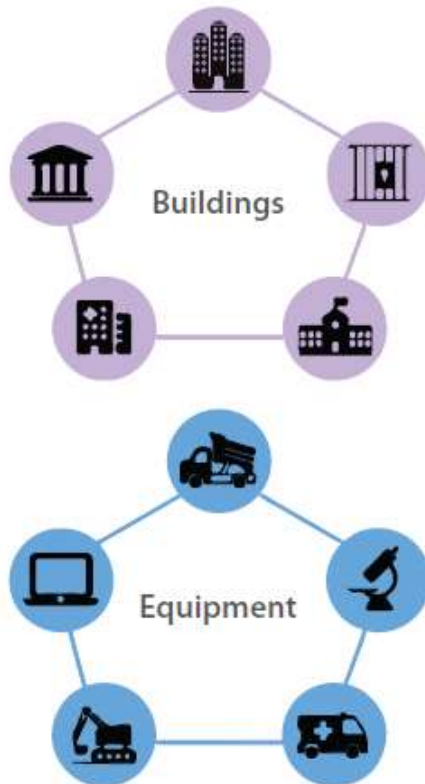
The better governments become at managing their assets and anticipating what they will need, the more resilient they will be. This handbook shows how to improve the reliability and longevity of assets, and how to plan ahead with improved coordination among government and community stakeholders.

Effective infrastructure asset management is an often overlooked yet high impact area for capacity development at the local level. We hope this practical handbook and its wide dissemination and use by local and national authorities will begin a new era of resilient infrastructure asset management for a sustainable future, in which no one is left behind.



Navid Hanif
Director, Financing for Sustainable Development Office
UN Department of Economic and Social Affairs

Public Assets



Asset management planning, short- and long-term

Strategic

- Long-range, reflects financial or business aspects
- Relies on forecasting future demand
- Included in master development plans, long-term capital plans and investment plans
- Involves senior administrators

5-25 years

Tactical

- Includes asset portfolio management plan
- Included in capital, operational and financial plans—costs are estimates
- Involves community leaders and managers responsible for assets and planning

2-5 years

Operational

- Project-level plan, based on performance and need to acquire, replace or recapitalize assets
- Costs are known, and local governments must make financial provisions in annual budget

2 years

The 'six whats' of asset management



1. What and where is the asset?



2. What is it worth?



3. What is the condition?



4. What is its remaining service life?



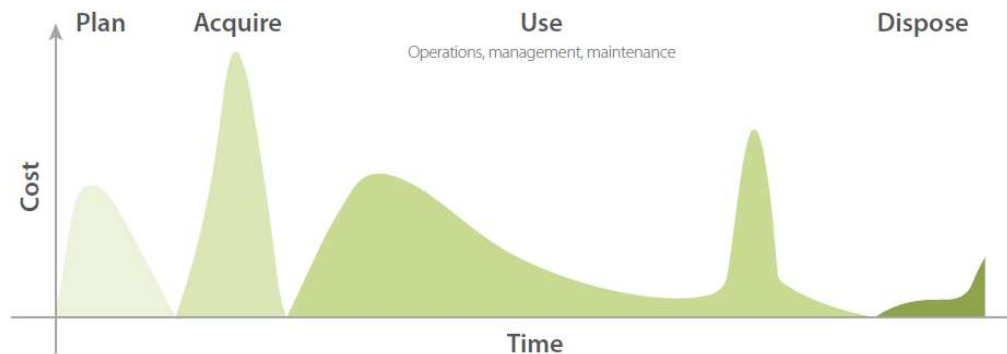
5. What is its deferred maintenance?



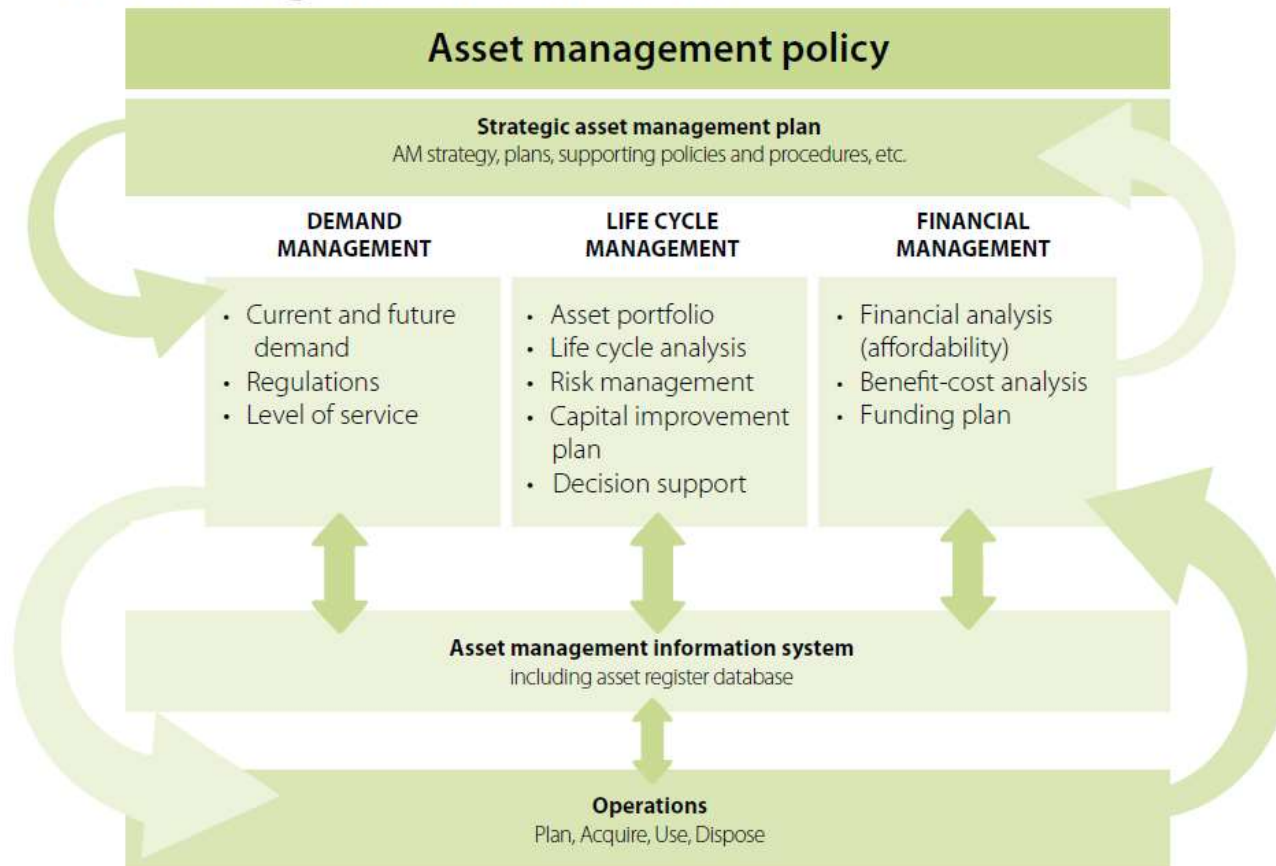
6. What should you fix first?

Adapted from D.J. Vanier, p. 4, with select icons from the Noun Project¹³

The life cycle of a physical asset



Asset management framework



Pillar 1

Demand management

- Current and future demand
- Regulations
- Level of service

Pillar 2

Life cycle management


- Asset portfolio
- Life cycle analysis
- Risk management
- Capital improvement plan
- Decision support

Examples of levels of service

 Water provision	 Waste collection	 Land	 Equipment
<ul style="list-style-type: none"> • Piped directly to buildings • Piped to community access point • Community or individual boreholes 	<ul style="list-style-type: none"> • Direct collection from buildings • Collection from community waste points • Collection from central point • No local collection 	<ul style="list-style-type: none"> • Land fully serviced (water, electricity) • Services in close proximity • Unserviced 	<ul style="list-style-type: none"> • Available 24 hours per day, 7 days per week • Available 12 hours per day, 7 days per week • Available 8 hours per day, 5 days per week

Figure 12

Setting levels of service for water provision

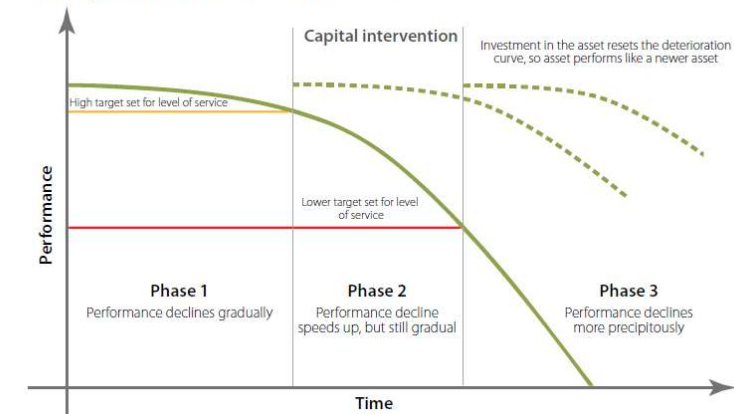
National goal	Universal access to safe water
Performance goal	To provide safe and reliable basic water supply to 95% of population by 2025
Level of service	<ul style="list-style-type: none"> • Universal access to safe water based on population • Piped directly to buildings in the central business district • Piped to community access point for areas outside of the central business district but in the urban core • Community boreholes outside the urban core
Level of service attributes	<ul style="list-style-type: none"> • Reliability • Availability • Compliance • Responsiveness • Accessibility • Safety 
Service area comprising the assets	Water supply and distribution system

Sustainability costs

 Economic costs	<ul style="list-style-type: none"> • Business loss • Property damage
 Social costs	<ul style="list-style-type: none"> • Business disruption • Service disruption • Traffic delays • Gender-unequal impacts • Reduced accessibility
 Environmental costs	<ul style="list-style-type: none"> • Contamination • Pollution • Public health impacts

“It is often tempting to try and save costs through cheap construction methods or cutting back on operations and maintenance costs. Therefore, decreasing costs in short-term leads to increasing costs in long-term.”

Asset performance over time



Pillar 3

Financial management

- Financial analysis (affordability)
- Benefit-cost analysis
- Funding plan

Elements of operational planning

EMERGENCY MANAGEMENT How we deal with immediate service disruptions

BUSINESS CONTINUITY How we maintain critical services over the longer term

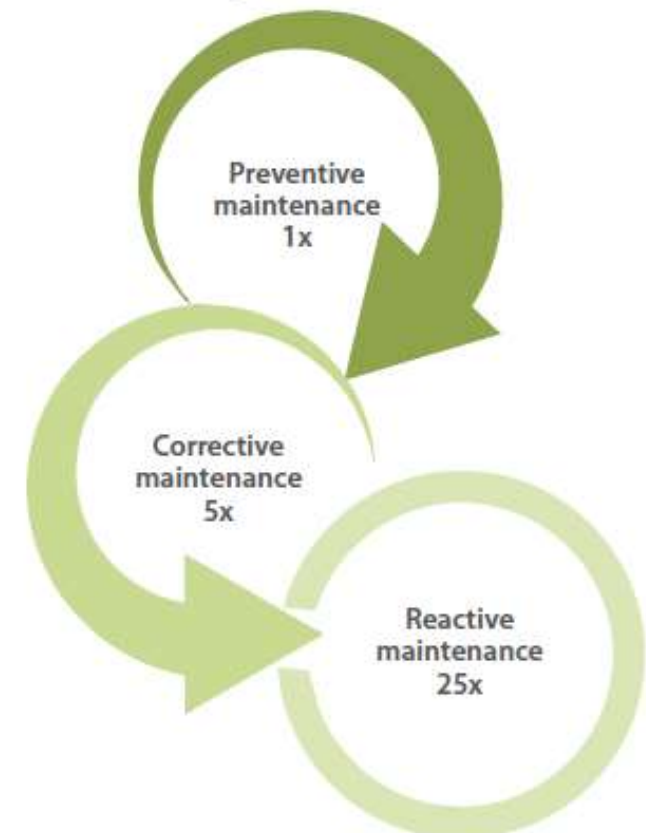
ENERGY MANAGEMENT How we minimize energy usage by our assets, such as electricity, water, and fuel

UTILIZATION How we maximize the use of our assets so that they are close to capacity and we get the best return on our investment.

SUSTAINABILITY How we operate our assets so that we don't compromise service delivery through overuse .

- O&M plans & strategies enable us to keep assets in adequate conditions, meet service needs and minimize costs.
- Operations plans and strategies focus on service delivery.
- Maintenance plans and strategies focus on keeping assets functioning as required to meet service objectives.
- Some 65–80 % of life cycle costs occur during the 'Use' phase.

The 'law of fives'
Deferred maintenance will cost you



Conclusions

Providing **the infrastructure necessary to “efficiently” satisfy the needs of the population depends on** multiple factors, among which the following must be highlighted:

1. **A strong commitment by leaders** to identify the most critical needs of the population, evaluate possible solutions and commit all the resources required to implement an integrated strategy and execution plans.
2. **Evaluation of all the needs for infrastructures in an integrated form** to better prioritize solutions because of limited resources, such as financial capability and qualified people and time.
3. **A thorough analytical evaluation of all aspects**, including determining key variables to be considered and the availability of reliable data. To avoid bias as much as possible, the selection of solutions should be valued against pre-established criteria.
4. **Conducting life cycle cost analysis of the alternatives**, paying close attention to realistic costs for operation and maintenance of the assets being evaluated.
5. **Developing and establishing the operation and maintenance plan and strategy** to keep assets in adequate condition, meet service needs and minimize costs.
6. **A thorough identification of the needs for qualified people** and implementation of a plan to get them, including alternatives such as hiring, training and development of in-house personnel.



Panama Metro