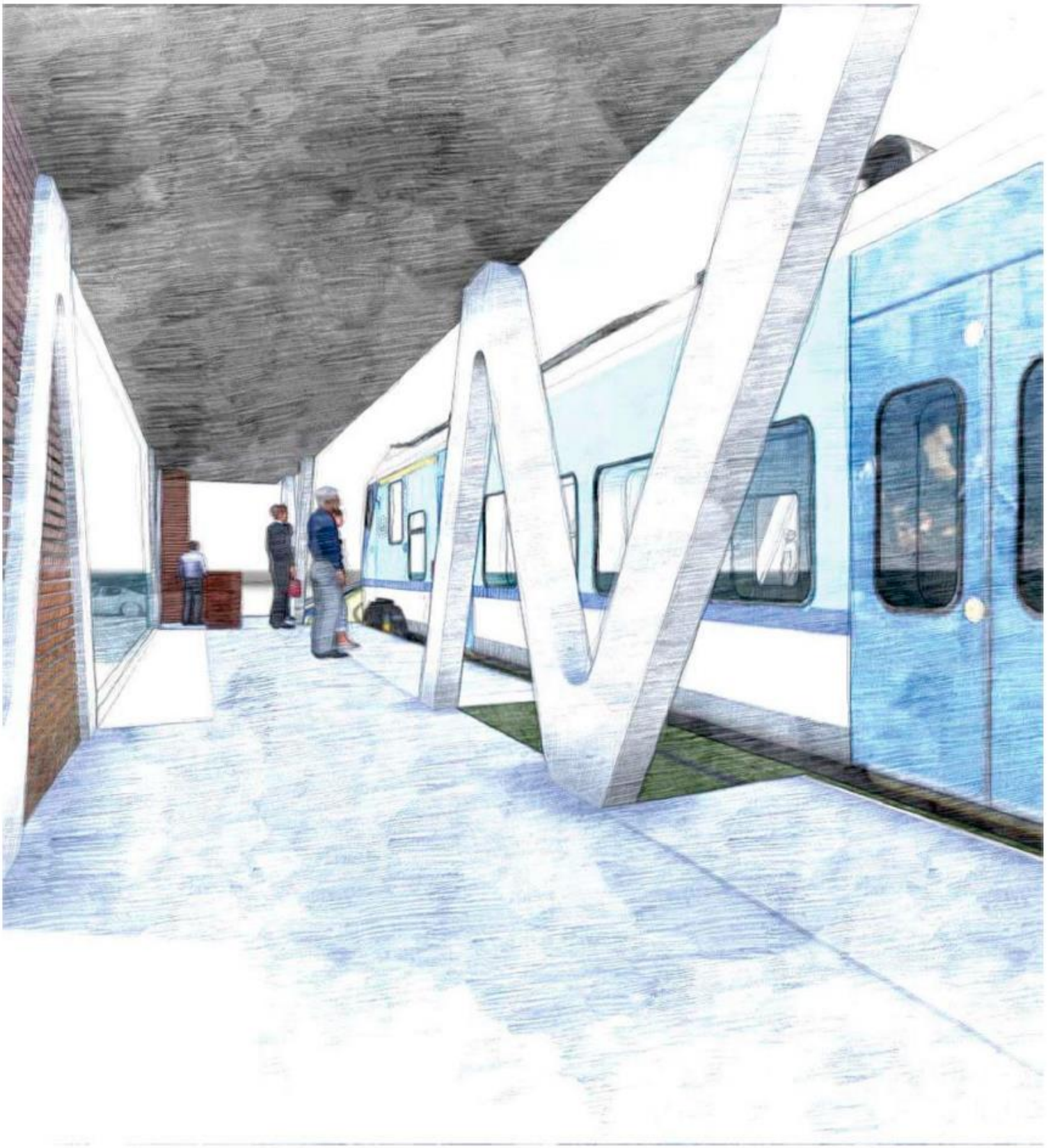
LRV OF SALVADOR

- LIGHT-RAIL VEHICLE -



VOLUME I

Report of the Integrated DRC for Preliminary Design of LRV

LRV of Salvador

VOLUME I

PROGRAMS AND ACTION FOR URBAN TRANSPORT AND MOBILITY

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1. DESCRIPTION OF PHYSICAL ENVIRONMENT

1.1 Description of the enterprise area

Salvador is leaning over the calm sea of Todos os Santos Bay, at the tip of a peninsula. Its urban morphology configuration comes in two parts: Cidade Alta (upper town) and Cidade Baixa (lower town). On high ground stands up Cidade Alta, connected to Cidade Baixa by Lacerda Elevator and the Inclined Planes of Pilar, Liberdade and Gonçalves. The urban context, called Cidade Baixa is the part at the bottom morphology of the geological fault that marks the territory of the city.

The deployment universe of the LRV is developed in the Cidade Baixa, and consists of three sections delimited as follows: Section 1: From Comércio Neighborhood (Port Authority) to the Railway Station, in Calçada Neighborhood. Section 2: From that Railway Station, the current Suburban Trains Station, to Paripe Stop. Section 3, the smallest of all, extends from Paripe to the end point of Avenida São Luís.

This area, in all its extension, has been, over the years, subject matter of plans, designs and intervention programs, always on the bias to promote physical and urban qualifications or restructuring capable of absorbing the changes imposed by the new economic models in force every time.

Figure 1 - Description of the enterprise area. Source: Google Maps.

1.1.1 Cidade Baixa

In this part of town are situated Comércio Neighborhood, the Port of Salvador, now revalued with the installation of the new Maritime Terminal of Tourist Cruises, situated in Avenida da França, after demolishing of Warehouses 1 and 2, the Água dos Meninos Neighborhood, Calçada Neighborhood and all that part from the Itapagipe Peninsula, extending the suburb region, which together adorn much of the west coast of the city in the border of Todos os Santos Bay.

In this context, are some of the most precious heritage of religious and commercial architecture, with buildings of historical transactions, at the time of the primary export model.

Stand out in that territory Lacerda Elevator, Mercado Modelo (former Customs building), some churches, such as the Conceição da Praia and Santa Luzia do Pilar, and other ascenders, many Commercial Buildings, the former Headquarters of Correios, Bank of Brasil's head office, the Cocoa Institute, the Moinho Salvador, the Conjunto da Casa Pia and Colégio dos Órfãos de São Joaquim, the Calçada Neighborhood - with Centro Atlântica Railway Station - former Viação Férrea Federal Leste Brasileiro, the neighborhoods and regions of the Itapagipe Peninsula, extending this territory by filigree called Railway Suburban, among others.

1.1.2 Comércio Neighborhood

Comércio Neighborhood emerged from successive landfills and expansions of the original beach area, which in the sixteenth century, reached the foot of the "mountain". Since the arrival of the Portuguese in Bahia the place was a trading post and arrival of European ships.

It is the first business neighborhood organized in the country and home of one of the main financial centers and services in Salvador, and having been the most important complex of exports of the city.

However, the neighborhood suffered a period of stagnation in the early 80s, with the migration of business to the Iguatemi region, starting to recover its position in the recent period, with the installation of Private Universities and new business units and services.

1.1.2.1 Location and Access

Comércio is located in the border region to the Port of Salvador, next to the Todos os Santos Bay. The following borders the bay, to the west; Sé, Pelourinho and Pilar, east; with 2 de Julho neighborhood in the south Água de Meninos in the north.

Three addresses, parallel to the Port, cut the neighborhood: Avenida da França (where the França's Terminal, for city buses, the Warehouses and the new Cruise Terminal), Avenida Estados Unidos and Rua Miguel Calmon. The three are confluent to the south with Avenida Lafayete Coutinho that just as Ladeira da Montanha, connect the neighborhood to Cidade Alta (Upper Town). Thus, the neighborhood connects Cidade Alta to the neighborhoods of Itapagipana Peninsula and Suburban Railway.

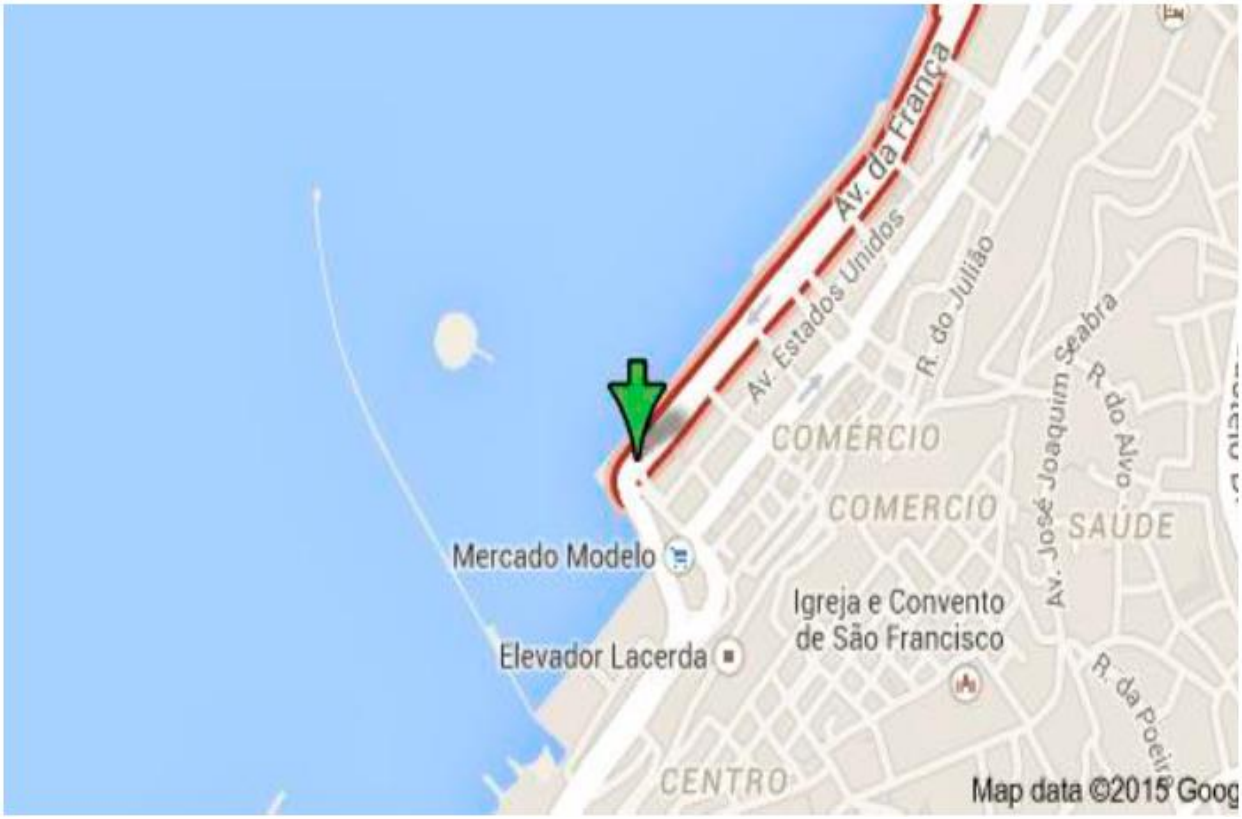

Figure 2 - Location of Comércio Neighborhood.
Source: Google Maps.

1.1.2.2 Facilities and monuments

There are located, besides the Port, São Marcelo Fort, the Bahia Nautical Center, the Port Authority, the Mercado do Ouro (or Cais do Ouro), Cocoa Museum, the lower station of the Plano Inclinado Gonçalves, the Basilica of Nossa Senhora da Conceição da Praia. In Praça Visconde de Cairu there is an important monument in fiberglass of Mário Cravo artist, the Fonte da Rampa do Mercado (or Monument to the City of Salvador), the Mercado Modelo and the lower station of Lacerda Elevator.

It is the financial heart of Salvador. Neighborhood in which is situated the Headquarters of the Ministry of Finance and ESAF. The surroundings reserve good alternatives to the gastronomic scenario (Comércio, Pelourinho, Bahia Marina and Barra) and walks (Pelourinho, Bonfim, Campo Grande among others).

Figure 3 - Perspective of Todos os Santos Bay, Cidade Baixa and Comércio. Photo: Tempostal Museum.

For 400 years, the region has figured as the only commercial, industrial and port center of Salvador. The construction of Avenida Lafaiete Coutinho - Avenida Contorno, in 1962, changed the aspect of Comércio, promoting the implementation of a modern Trading Center at the time.

With the growth and evolution of the city to other areas such as Paralela and Iguatemi, the Comércio neighborhood began to concentrate mainly banks and government agencies, as well as some universities and many shops.

1.1.2.3 Comércio / Calçada / Suburban Railway Articulation

Following the seaboard that adorns the Comércio neighborhood, from Conceição da Praia, going through Água de Meninos, São Joaquin and Calçada, toward the bottom of the Bay, you can find the Itapagipe Peninsula that houses at its highest hill, the Church of Nosso Senhor do Bonfim.

Lower down, Boa Viagem, Monte Serrat and Ribeira, still retain an air of small town, but with its bucolic air, they show huge entrepreneurial potential focused on leisure, tourism and culture.

Adorning this extensive coast the so called Cidade Baixa, it must be noted that a good part of the edges of Todos os Santos Bay, with filigree of Itapagipe, the Coves of Tainheiros and Cabrito, adds to the no less beautiful edges of the so-called Suburban Railway, come to constitute most of the territory to benefit from the new mode of transport to be deployed, the LRV, from the use of the existing rail network area, which embodies the so-called Suburban Train.

1.1.3 Calçada Neighborhood

Calçada Neighborhood today is predominantly linked to Comércio and continues to be a departure and arrival point of trains users of the former Estação Leste, moving from the Largo da Calçada to Suburban Railway.

In their streets there is a large concentration of small hotels and small shops, and the residential function in a changing very fast.

Calçada is the first neighborhood between Cidade Baixa and the Suburban Railway of Salvador. It is situated near Feira de São Joaquim and the marine terminal. It is in this neighborhood that is the most important railway station of the city that links the area to the Suburb / Paripe Neighborhood through the urban rail system. There is also an inclined plane connecting Calçada to Liberdade Neighborhood: the Liberdade-Calçada Inclined Plan.

1.1.3.1 History

The origin and name of the neighborhood is given through a path that was created between the current Avenida Jiquitaia and Bonfim, called "Calçada do Bonfim". Due to the creation of the railway station of Viação Férrea Federal Leste Brasileiro in place, trade in the neighborhood began to develop rapidly, and today has great importance in this region of the city.

1.1.3.2 Current Panorama of the Neighborhood

The region of Calçada Neighborhood is marked by housing, in addition to the Railway Station, an extensive and old retail area, in constant transformation. In the communication vector with the high city - Largo do Tanque, more precisely at Rua Nilo Peçanha, there is a concentration, already expressive of wholesale stores, or Big Wholesales.

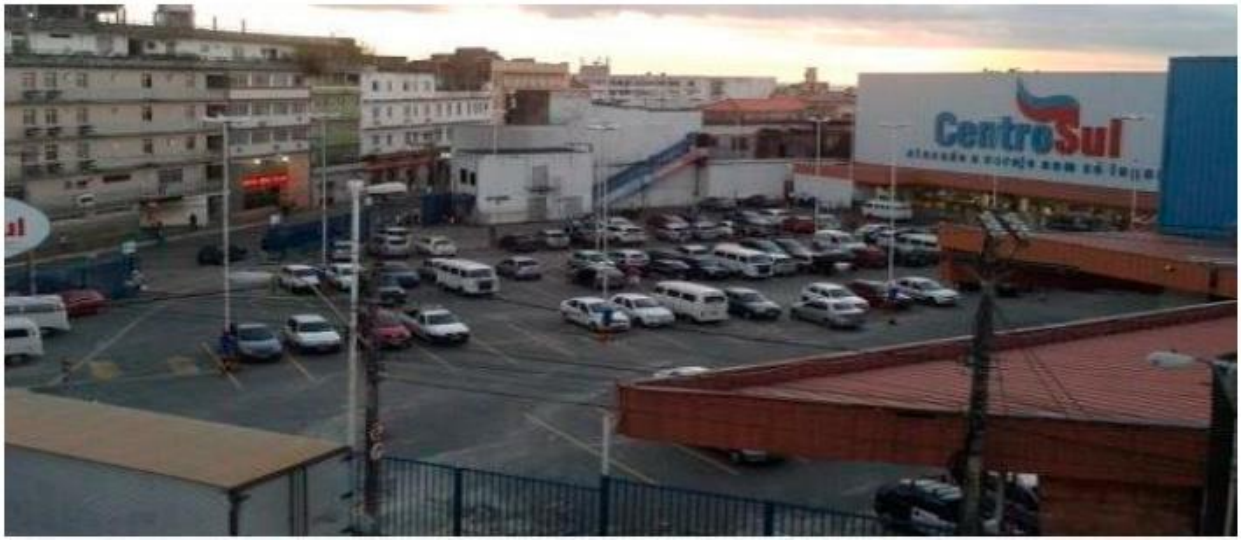

Figure 4 - Big Wholesales in Calçada neighborhood
Photo: Correio da Bahia.

Rua Nilo Peçanha has a large plot of land that housed huge sheds and warehouses in the past, which supported the production coming from the Recôncavo.

Figure 5 - View of the region surrounding Calçada neighborhood
Photo: Google Earth.

These big warehouses fell into decay and ruins, devalued the real estate market, but steadily they have been receiving new occupations without any discretion or land use control. However, because of its generous "cash", this street, together with the extensive empty area still has an enormous potential for a wide process of requalification and enhancement of uses.

Figure 6 - Suburban Railway
Source: Collection of the State's Public Library.

1.1.4 Suburban Railway

Suburban Railway covers 22 neighborhoods where are located 24,55% of the population of Salvador, that is, there are about 600 thousand inhabitants. Until 1970 the place was formed by villages, traditional fishing communities and vacationers who took advantage of the abundant fishing and the beauty of the beaches and coves covered by the calm waters of Todos os Santos Bay.

The railway line from the former Leste (Viação Ferroviária Leste Brasileiro), inaugurated in 1860, has meant that people knew more about this beautiful part of Salvador. Currently, and after the occupation of 1970 and 1980, the Suburban Rail is occupied mostly by residents of so-called popular classes.

After the construction of Av. Afrânio Peixoto (Av. Suburbana), there was a significant increase in informal occupations that have made this place of the city to be forgotten and left their formation to the spontaneity of the survival strategies of the people; no doubt, Alagados is a reflection of this abandonment and creativity to survive.

Thus, "A Suburbana" as it is known, has much of the popular communities of the city that faces the lack of employment, abandonment, urban violence, poor housing and poverty, parallel to the ancient history of the formation of Salvador, beautiful beaches and places and the rich folk culture portrayed, for example, in many capoeira groups, samba, music, terraces and candomblé houses, and in the natural symbolism of São Bartolomeu Park.

Unlike other neighborhoods located in the Suburban Railway of Salvador, which began to develop with the construction of Avenida Afranio Peixoto, the Lobato neighborhood came to prominence in 1939 when it was discovered the first well of Brazilian oil in Rua Amparo. It became more intensely populated in the seventies, after a heavy rain, which destroyed homes and displaced families living in regions close to this neighborhood. In order to resolve the situation of the homeless, the State Government built houses in Lobato and put the homeless people to the neighborhood.

1.1.4.1 Real Scenarios of the Deployment Universe of the LRV

The territory comprising the set of scenarios in the city of Salvador, on which the state government intends to implement the LRV System - Light-rail Vehicle - has undergone successive transformations over the past decades, as has been noted on its historical aspects.

These scenarios include, most prominently, much of the so-called Cidade Baixa, from Comércio Neighborhood, former Praia Neighborhood, to Calçada Neighborhood, which is situated in the former Railway Station, extending the edges of the sea of Todos os Santos Bay, on the edges characterizing the so-called Suburban Railway of Salvador.

In this universe, one can envision several aspects that emerge from changes in the urban context of this part of the town, many of them resulting from successive economic models installed in the country by the Federal Government and that are presented today in the drawings.

The territorial extension, which is currently part of Calçada Neighborhood to the Paripe Suburb, and currently has 10 stations of the train network, it will certainly be revalued with the implementation of the LRV, highlighting the expansion of this segment in over 11 stops, distributed at both ends and opposite directions: Calçada / Comércio and Paripe / São Luís.

Throughout this extension are highlighted, below, some of the points that characterize the future stops of the LRV, being in areas of interest to the design, both from an operational or functional point of view, as the dynamics of land use and occupation, projecting potential impacts and highlighting alleged scenarios as a result of the potential identified from investigative research and knowledge of the reality of these territories. This area has been, over the years, subject matter of plans, designs and intervention programs, always on the bias to promote physical and urban qualifications or restructuring capable of absorbing the changes imposed by the new economic models in force every time.

This LRV establishment context consists of three well delimited sections: Section 1: From Comércio Neighborhood (Port Authority) to the Railway Station, in Calçada Neighborhood. Section 2: From this same current Train Station towards the Suburban Trains to Paripe Stop. The Section 3 is the smallest one and extends this path to the end point of Avenida São Luís, giving name to the last system Stop.

1.1.4.2 Description of geology and geomorphology

The region is cut by the geological fault of Salvador, element separating the oil sediment from Recôncavo Basin, the Precambrian areas, which are structured on the sedimentary basin. The morphology is characterized by narrow valleys and steep slopes with topographies ranging between sea level and dimensions of 80 meters.

In the region, there are the following geological units: Barriers formation, Crystalline foundation, Group of Islands, fluvial deposits in areas close to the sea and mangroves. The Barriers formation consists of sandy clay sediment, which outcrop in dimensions over 70 meters and have a high propensity to erosion, especially when the vegetation coverage on slopes inclined at more than 30% is removed.

The Crystalline Basement and Group of Islands outcrop in lower dimensions to 70 meters and are particularly susceptible to landslides and earth flows.

The high plasticity of clay soils formed from the decomposition of Group of Islands makes problematic their use for residential purposes. The low permeability of the ground hampers the use of septic tanks, as a solution for the improvement of liquid waste.

The fluvial deposits made of sand and clay sediments and organic matter, covered by a hydrophilic vegetation extend along major waterways, particularly near the estuary of Cobre River, north of Cobre dam.

In the border areas of the Cabrito Cove there are mangroves, whose wealth of organic matter and specific physical-chemical conditions favor the development of mangroves, important food supply for local communities.

The hydrographic network of the Basin is formed by 49 waterways. Cobre River is the main body and is rise from Lagoa da Paixão, located 55 meters high. Its high course reaches the water dam, the middle part extends to the cascade of Cobre and the lower part to the Cabrito cove, in Todos os Santos Bay. Secondary courses are all small and medium-sized and major springs are located between Alto de Paripe and Alto de Periperi, Valéria and Pirajá.

2. BIOTIC ENVIRONMENT DIAGNOSIS

2.1 The Area Historical Occupation studied as Environmental Change

With the opening of the first section of the Calçada/Aratu railroad in 1860, with a length of 18 km, it was intensified the occupation of the area, because it has received a new boost with the creation of the stations. The occupation of mangroves in the direction of Uruguay, the consolidation of Cotegipe Baron toward the Seas, the expansion of Plataforma and the formation of Paripe town date from this time. (ROCHA, 2003)

According to Santos (2012), the expansion of the occupation of Comércio Neighborhood area and the modernization of the port of the city of Salvador were only possible due to the various landfills, which were carried out over the sea of the Todos os Santos Bay (MATTOSO, 1992; PINHEIRO, 2002; VASCONCELOS, 2002).

It should be noted the occupations on Itapagipe Bay, known as Stilt Houses, which interfered on their appearance, with successive landfills and the quality of their waters.

Figure 7 - Presence of the port of Salvador.
Source: Google Earth.

Figure 8 - Aspect of urban occupation in the study area.
Source: Google Earth.

Figure 9 - São Brás old factory, on Plataforma
Source: Google Earth.

Figure 10 - Urban occupation in the Tainheiros Cove - Itapagipe Bay.
Source: Google Earth.

Figure 11 - Urban occupation in Cabrito Cove - Itapagipe Bay.
Source: Google Earth.

2.2 Environmental Attributes and Local Diversity

The enterprise deployment area is in the urban area of Salvador and Seaboard of Todos os Santos Bay. The enterprise will be implemented, most of the section on an existing rail line, and the other areas are also in a high state of anthropization.

The main focus of the environmental point of view of the deployment of the enterprise concerns the proximity of the shoreline, and, in Cabrito cove, there is a section on marine area in existing railroad. With respect to possible interference with the vegetation coverage, there is no relationship between the enterprise and any fragment of importance. **Figure 16** shows that the future LRV is away from the main green areas of the city.

Originally, the region prior to the urban occupation had Rain Forest environments, marshes, mangroves and water bodies that sustained high biodiversity. Today, there are remnants of these environments, but a high degree of change. From an environmental point of view, the landscape of the deployment area of the future LRV and its surroundings can be classified as follows:

- Urban areas;
- Atlantic Forest Fragments; and
- Estuarine and marine environment.

It is noteworthy that even the Rain Forest fragments, estuaries and the marine environment are changed due to the lack of land use control, dumping of sewage, indiscriminate vegetation removal. In the region there are also mangroves, such as those associated with the mouth of Cobre River and Tainheiros cove, but these are far from the enterprise, out of reach of its potential impacts, and therefore do not impact the enterprise, except one existing border in Itapagipe bay, mentioned in specific sub-item on estuaries.

Figure 12 - The main green areas of the city of Salvador.

2.3 Disturbed areas dominate the landscape

From ancient occupation, most of the LRV section is located on disturbed areas and its surroundings is also in this same condition. Occupying the seaboard from the Nautical Center to the São Luís Neighborhood, the following description is presented on the disturbed areas.

From Calçada station, it will be used an area that has already composed the rail system of Salvador, which currently runs on a line distributed between the railway station of Calçada (**Figure 17**) and the Suburban Railway station (**Figure 18**).

Figure 13 - Railway station of Calçada

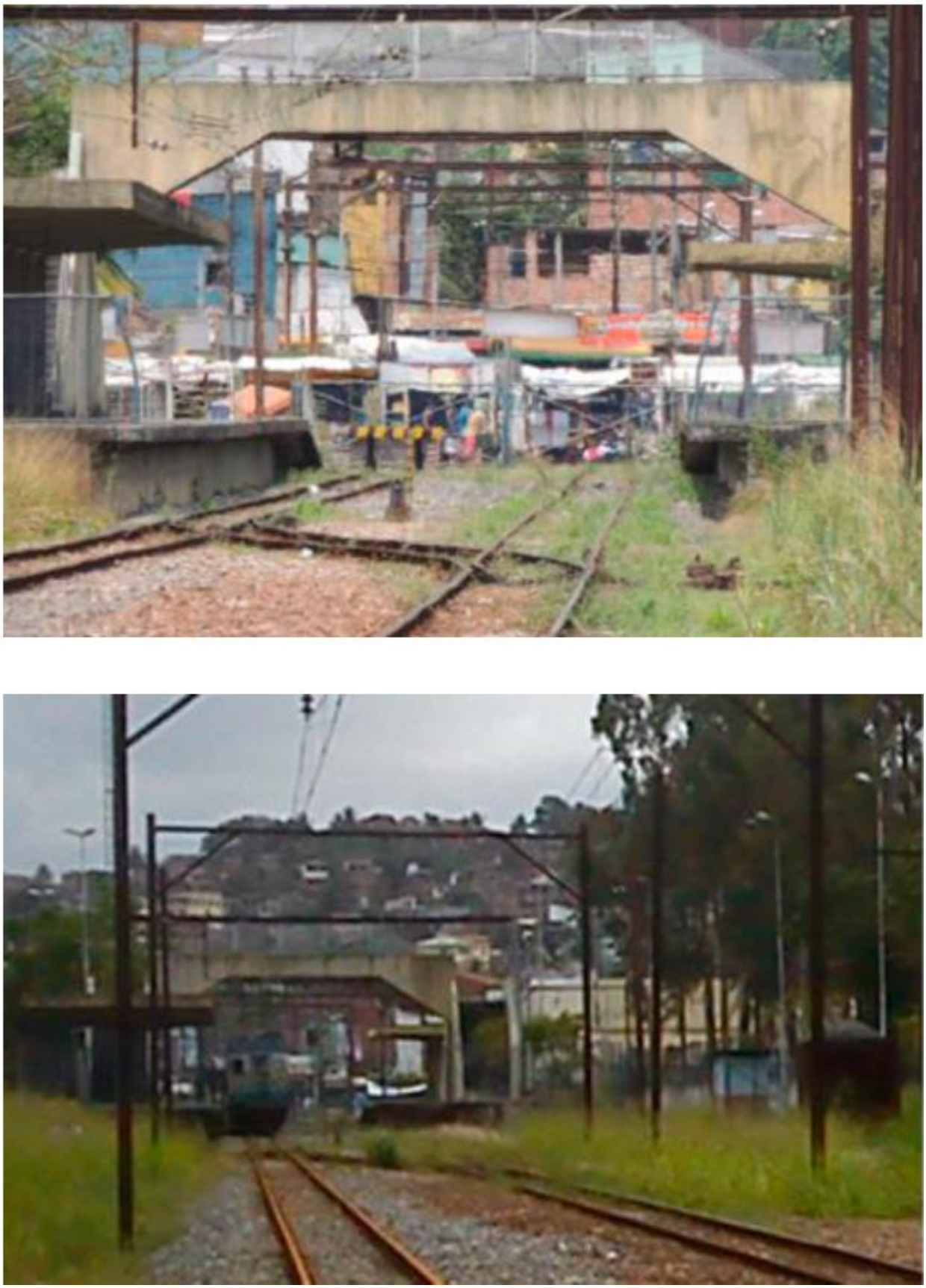

Figure 14 - Terminus of the Suburban Railway of Paripe.

The area from the railway station of Calçada (Calçada Stop), in the urban context of the city of Salvador, which is situated in the Suburban Railway. This area was exposed to a process of urbanization mainly dated from 1860, when it was deployed the 1st section of the railway between Salvador and Alagoinhas, first inter-city transport "system".

The railway started from Calçada Neighborhood, in Cidade Baixa, near the Port of Salvador, and served to drain the agricultural production from the Recôncavo. From the locations of its rail stations, in the second half of the nineteenth century, it was formed the first urban agglomerations according to those stops, which were located in the suburbs at this time.

This suburban space, at the time, remained as an area accessible only by train to the 70s, when it was deployed Av. Suburbana. This avenue has linked the various existing locations, resulting in a new vector of urban expansion of the city, whose economic policy context was marked by the conservative industrial modernization process, associated with the creation of the metropolitan area of Salvador (1973) and the deployment of the Petrochemical Complex of Camaçari (1978).

Over time numerous plans and urban designs and urban legislation have been drafted, but with no solid results. So, the city grew along two major growth vectors associated with Av. Paralela and BR-324, and the expansion vector in the surrounding communities of Todos os Santos Bay along Av. Suburbana grew haphazardly.

The section of the LRV tracks that start at França Stop follows an urbanized area on landfills conducted between the XVlII and XX centuries and goes to Calçada Stop, as shown in **Figure 19**. The latter, the tracks will use the areas in which today operates the train at the railroad suburb region.

Figure 15 - Section of the LRV in landfills performed between centuries XVIII and XX. Source: Google Earth.

From 1854, it began to draw up plans for the expansion and modernization of the port of Salvador. The beach in this section was grounded in the late 1960s, where today you have the container terminal of the Port of Salvador. **Figure 20** shows the Area of França's Terminal after the construction of the landfill. On the other hand, **Figure 21** shows the same view area of the upper city of Salvador before the construction of the landfill.

Figure 16 - França's terminal area before the landfill.
Source: http://www.salvador-antiga.com/agua-meninos/antiga-salvador.htm.

Figure 17 - França's terminal area after the landfill
Source: http://www.salvador-antiga.com/agua-meninos/antiga-salvador.htm

Figure 22 shows the area of Água de Meninos, before the start of landfills, whose urbanization intensified since 1920, when they started the construction of Av. Jequitaia. This, in turn, was only completed in the 1960s (**Figure 23**).

Figure 18 - Area before the start of works for the construction of Av. Jequitaia.
Source: http://www.salvador-antiga.com/agua-meninos/antiga-salvador.htm.

Figure 19 - Av. Jequitaia finished after 1960.
Source: http://www.salvador-antiga.com/agua-meninos/antiga-salvador.htm.

From the observation of **Figure 22**, it can be seen the natural environment of the area of the avenue before the beginning of the grounding work, in 1920. From this and **Figure 24**, there is the presence of intertidal zone and above coast, with the presence of a marsh ecosystem, non-existent today.

Figure 20 - beginning of the landfill for construction of Avenida Jequitaia in 1920
Source: http://www.salvador-antiga.com/agua-meninos/antiga-salvador.htm.

The section going from Calçada Stop to Lobato stop is shown in **Figure 25**. This section is characterized by being a human environment, which is below and parallel to the slope on the fault of Salvador. This, in turn, is a geological fault dating back to the period when there was the separation of the African continent from the South America. Currently the urban infrastructure of the area already includes public transport on rails, located in a perimeter following the marine subdivision Plain area.

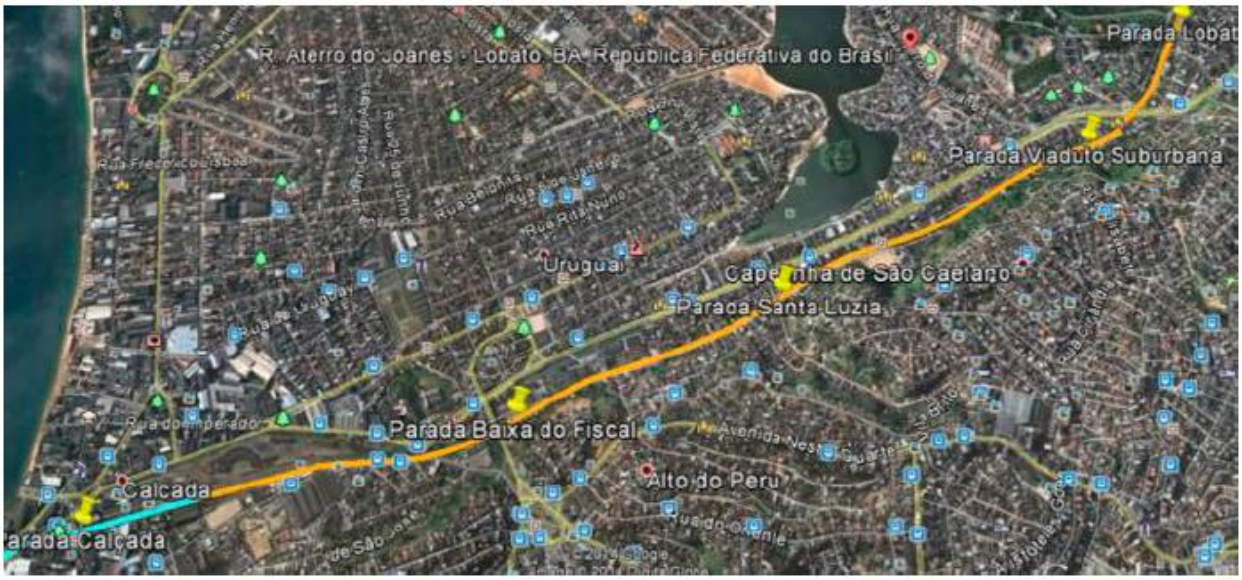

Figure 21 - Section of the LRV below the geological fault of Salvador.
Source: Google Earth.

Following the marine subdivision plain, the line will pass beneath Lobato viaduct (**Figure 26**), when it moves away from this plain and going to an area with height almost at sea level. The section between Lobato Stop (**Figure 27**) until União Stop, more precisely, in the vicinity of the cross street Alfredo Pereira, near the shipyard União Artesanal (**Figure 28**).

Figure 22 - Environment in the vicinity of the railway line passing through the bridge of the track Afrânio Peixoto in Lobato neighborhood.

Figure 23 - Lobato Stop.

The anthropized environment has an opportunistic psamófila plant community with mosaics with populations of specimens of Araceae family. This shows the presence of wet environment on the banks of the currently existing rails due to the drainage problems associated with the launch of domestic sewage and solid waste in the open air.

Figure 24 - section from Lobato Stop to União Stop.
Source: Google Earth.

From there begins the railway bridge of Plataforma, which goes to the vicinity of São João Stop. This section is shown in Figure 29 and is characterized by the influence of the structures on the marine area.

Figure 25 - section under the deck railway bridge located between União Stop and São João Stop.
Source: Google Earth.

Figure 30 shows the section of São João Stop and Paripe Stop. This section should be deployed in the areas already used for the current railway line of the suburb, which is located near the following beaches used by swimmers: Plataforma (**Figure 31**), São Brás, Itacaranha (**Figure 32**), Praia Grande and Periperi.

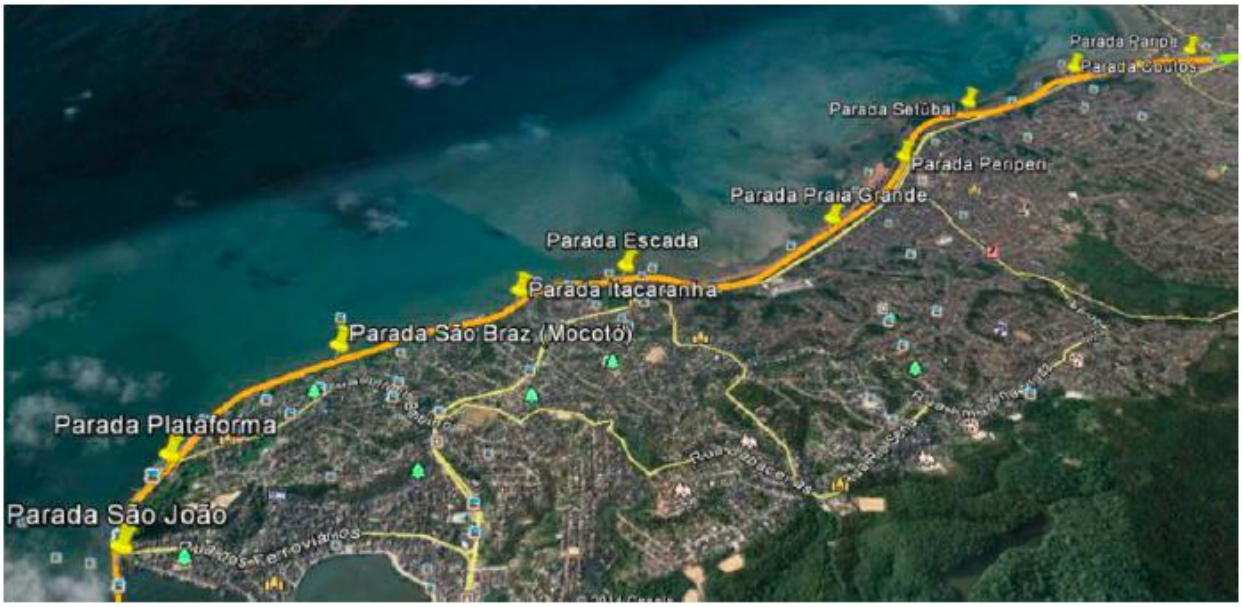

Figure 26 - section from São João Stop to Paripe Stop.
Source: Google Earth.

Figure 27 - Plataforma beach.

Figure 28 - Itacaranha beach.

Currently the stop named in the design as Paripe Stop is called terminal of the Suburban Railway. This one has no conservation (**Figure 34/35**), being an environment dominated by the typical invasive plants of anthropized environment. The section from Paripe Stop to São Luís Stop, will be implemented in an area parallel to Avenida São Luís. The area of the section is characterized by being anthropized, located along a disorderly placement started after implantation of an old train line (**Figures 33** to **35**).

The occupation is old and according to the locals, it was started by former employees of the railroad, and stopped working about 20 years ago. In the area there was the presence of rails in poor conservation next to houses containing solid waste disposed in the open air. Noting the figures, it can also verify the presence of invasive plants typical of degraded environments, it was found the presence of banana, mango, ficus trees, almond trees, "veccia" palm trees among other domestic plants or landscape character.

Figure 29 - Area defined for deployment of the LRV line along Avenida São Luís.

Figure 30 - vegetation present along Paripe Stop.

Figure 31 - vegetation present along São Luís Stop.

The area defined for installation of São Luís Stop is characterized by being a anthropized area, used by the old railway line, which cross the track of the Naval Base under the viaduct.

2.4 Fragments of Atlantic Forest

The Rain Forest is a biome that occupied most of the Brazilian coastal region and one of the most threatened in the world. The Atlantic forest, mangroves, marshes and wetlands are part of this biome.

Despite sustaining high biodiversity, the historic occupation of Brazil, on the coast-inner direction, it made the major cities and economic activities to be located in this biome. Today, the state of Bahia stand out from the region of Porto Seguro and Una/Ilhéus/Itacaré, even with high connectivity due to the agrosystem of Cabruca, the marshes of Maraú and Guaibim Peninsula, in Baixo Sul and Mata do Bu, on the north coast. In Todos os Santos Bay, it is still possible to find some fragments, especially of marshes.

In the city of Salvador, some fragments stand out, like the Metropolitan Park of Salvador, the remnants of Greenville, the region of the dams of Ipitanga river and closer to the enterprise, focus of this study, the remaining associated with Cobre River (Cobre Dam and São Bartolomeu Park). It is noteworthy, however, that these important remnants are located outside the range of possible impacts of the enterprise. **Figure 36** shows the remainder of Cobre River, according to mapping carried out recently by the Atlantic Center of the Public Ministry of Bahia.

Bahia (2013) also mapped one important fragment for the region, which is associated with that Naval Base of Aratú (**Figure 37**), which does not suffer direct interference of the design (**Figure 38**).

Contiguously to the enterprise there are few remnants, with low expression, isolated mainly situated on the slopes. All of these are classified as Tropical Rain Forest i Early Regeneration Stage and are described below.

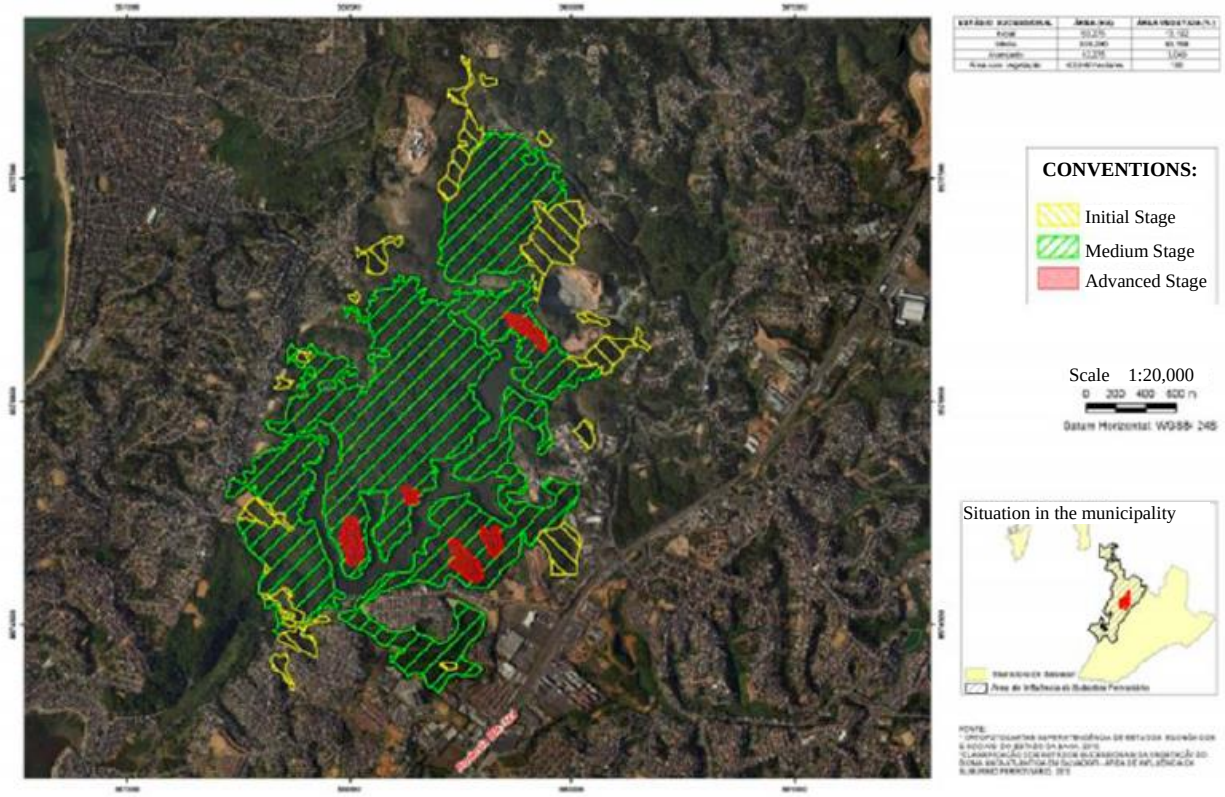

Figure 32 - Action of Atlantic Forest fragment - Cobre Basin.
Source: Bahia (2013).

Figure 33 - Location of Atlantic Forest fragment - Naval Base of Aratú
Source: Bahia (2013)

Figure 34 - Distance of the enterprise (in yellow) to fragment the Atlantic Forest of the Naval Base of Aratú.
Source: Google Earth.

2.4.1 Tropical Rain Forest Fragment Initial 1 - São Luís Stop

It is noteworthy an area already greatly changed until the final stop, São Luís. This fragment is being targeted by unplanned urban occupation. What clearly interferes with the condition of its water and natural resources.

2.4.2 Tropical Rain Forest Fragment Initial 2 - Coutos Stop - João Batista Caribé Hospital

Located behind the hospital, this fragment lies on the slope and has a predominance of exotic species. It has undergone reduction due to the disorderly occupation.

2.4.3 Tropical Rain Forest Fragments Initial 3 and 4 - Escada

Located on two slopes, with a predominance of exotic species. It has suffered reduction due to the disorderly occupation (**Figure 39**).

Figure 35 - Escada fragments.
Source: Google Earth.

2.4.4 Tropical Rain Forest Fragment Initial 5 - Plataforma Stop

Located on a slope, it has a predominance of exotic species. It has undergone reduction due to the disorderly occupation. During the field inspection, it had suffered a recent fire (**Figures 40** and **41**).

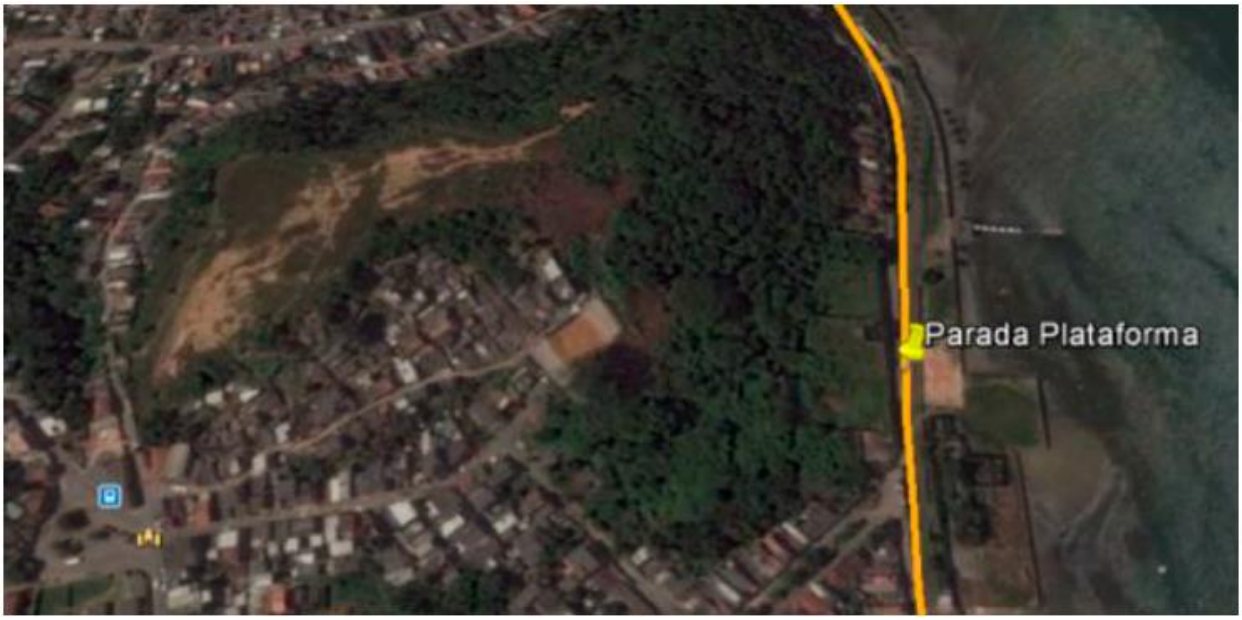

Figure 36 - Plataforma Stop fragments.
Source: Google Earth.

Figure 37 - Slope of the Plataforma Stop fragment.
Source: Google Earth.

2.4.5. Tropical Rain Forest Fragment Initial 6 - Viaduto Suburbana Stop

Located on a slope, it has a predominance of exotic species. It has suffered reduction due to the disorderly occupation (**Figure 42**).

Figure 38 - Viaduto Suburbana Stop Fragment.
Source: Google Earth.

2.4.6 Tropical Rain Forest Fragments Initial 7 - São Joaquim Stop

Located on a slope, it has a predominance of exotic species. It has suffered reduction due to the disorderly occupation (**Figure 43**).

Figure 39 - São Joaquim Stop fragment.
Source: Google Earth.

2.5 Estuarine and marine environment

The region known as Versant Todos os Santos Bay of Salvador extends from the Farol da Barra to the Naval Base of Aratú, boundary with the municipality of Simões Filho. The Todos os Santos Bay (**Figure 44**) has about 184 km of coastline (CRA, 2003) and is included in this area, much of the territorial unit called the Metropolitan Region of Salvador - RMS. The BTS carries internally three other bays: bays of Iguape, Aratú and Itapagipe. According to CRA (2003):

The Itapagipe bay, the smallest of the three internal bays, has a bar proportionally wider and shallower than the Aratú. Located on the East Region of Todos os Santos Bay, it is formed by Tainheiros and Cabrito coves, being inserted in the urban region of Salvador. It is occupied by residential neighborhoods, in which are installed small and medium industries, some already out of work, gas stations, auto repair shops of cars and for disassemble, body shops, etc. In Lobato area, adjacent to the bay, the first oil well was drilled in the region in 1950. The mangrove areas of Itapagipe Bay were occupied by intense urbanization, especially due to implementation of stilt houses, located in the region from the 50's. Currently in the area, urbanization designs have been executed. (CRA, 2003)

The coastal waters of these regions have their quality affected mainly due to the release of untreated domestic sewage and contributions of the rivers, also with high loads of nutrients as a result of sewage contamination.

In the case of Itapagipe bay, where Tainheiros and Cabrito coves are located, the water circulation is low as shown by the hydrodynamic studies of CRA (2003). This causes the occurrence of a low circulation and nutrients that reach the Itapagipe Bay, they largely remain in this bay, impairing it in several ways.

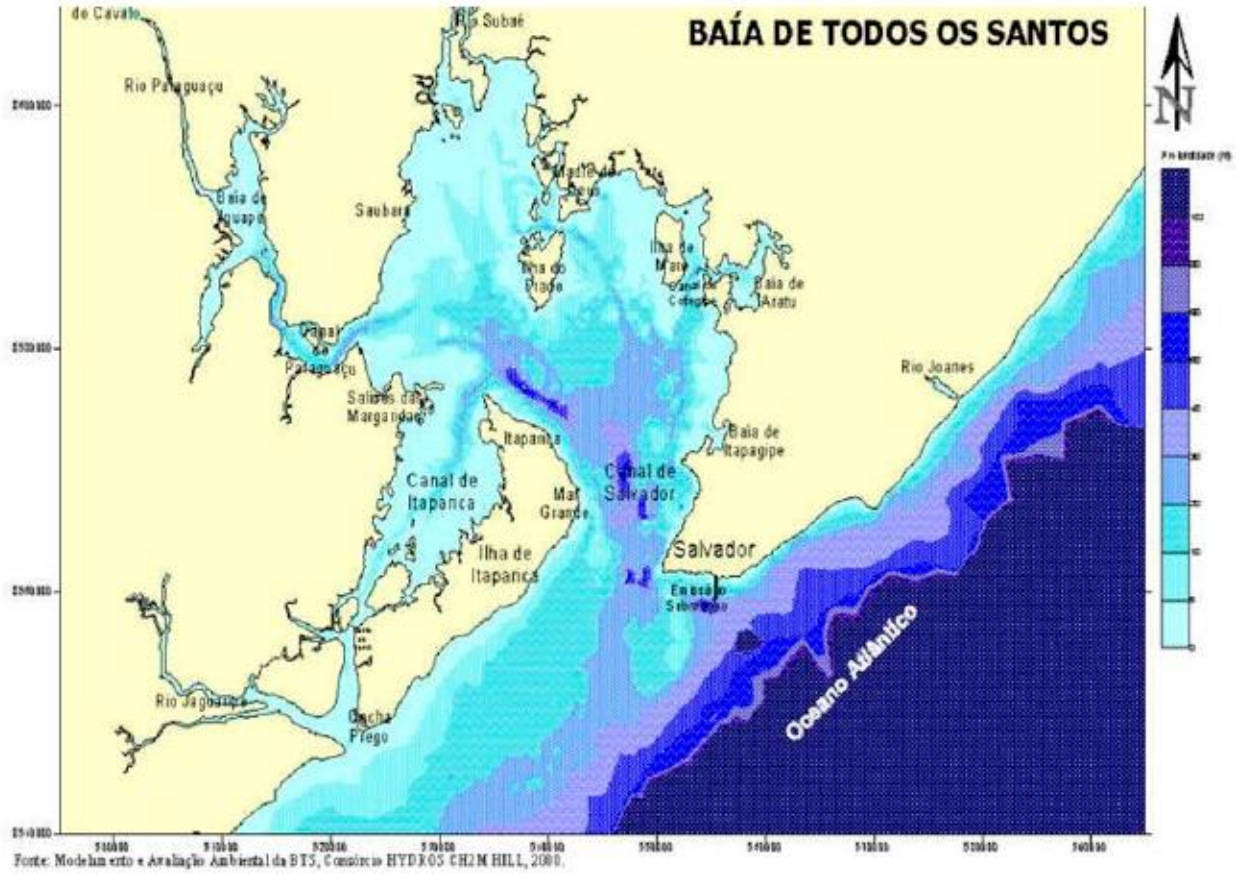

Figure 40 - Bathymetric map of BTS. Source: CRA, 2003.

One of the main environmental problems of Itapagipe Bay is related to environmental liabilities of Companhia Química do Recôncavo - CQR.

A technical study has shown high concentrations in sediment, water and gauge of Itapagipe Bay, and any intervention in the region should consider the risks involved, avoiding release of mercury to the water column.

The remaining areas of BTS side of Salvador, beyond the Itapagipe Bay, also suffer from similar problems, associated with the dumping of sewage and urban occupation. Some beaches are located adjacent to the enterprise, as shown in **Figures 45 to 48**. All of them have their bathing hindered most of the time.

Figure 41 - Almejado Beach, in Plataforma

Figure 42 - Itacaranha beach.

Figure 43 - Praia Grande.

Figure 44 - Peripe Beach.

The rivers that flow into this coastal region, before the urban occupations, made up an odd estuarine system, with the presence of mangroves. It stands out as the most important, Cobre River and Paraguari River. It is noteworthy that the enterprise crosses some dewatering points of these rivers in Todos os Santos Bay, but today there is already the intervention for installation of the existing rails (**Figures 49 to 51**). Along the section from São João Stop to Paripe Stop, the line passes through two rivers, which are important for the drainage of the suburban basins and other transformed into drainage channels. The drainage of the enterprise surrounding area is artificial, since the urban development of the Suburban Railway took place through embankment and drainage of wetlands, this is the result of poor conditions of the populations that inhabit the region. Thus, one should consider that it is a natural ecosystem. An example is Paraguari Lagoon, which is an important Retention Basin, despite currently this process being hampered by urbanization and housing interventions, which are being held inside the said lagoon, as a result of illegal occupation.

Figure 45 - river mouths adjacent to the enterprise.

Figure 46 - River mouths adjacent to the enterprise.

Figure 47 - River mouths adjacent to the enterprise.

The quality of water of these rivers is quite bad and the large amount of sewage released prevents the life of aquatic biota. Currently these rivers and natural drainage that suffer numerous interference over time may be considered to be channeled sewage channels and not rivers. **Figures 52 and 53** show the river mouth of Paraguari River with the presence of garbage, debris and pollution aspect.

Figure 48 - Aspect of the Paraguari river

Figure 49 - Aspect of the Paraguari river

Within the limits of the municipality of Salvador and Simões Filho you can find Macacos River, which has a concrete bridge existing within the interior of the right of way of the old route of the railway. It is noteworthy that the new enterprise will not reach the APP of that river.

It is also worth mentioning that there are crossings working in the vicinity of the track and that it is in operation, and the interventions will have only a maintenance purpose, thus the existing ecosystem will not be affected.

Figure 50 - mangrove edge after União Stop (left side).

2.6 Local Diversity

The biodiversity found in areas designated for redevelopment of this enterprise. It should be understood that the environment is now formed largely by artificial environments resulting in heterogeneous of environments and species.

Set in a suburban environment, the area focus of this study reflects the historical process of urban occupation planned, unplanned and controlled precariously.

Originally, it had an environment formed in the marine partitioning plain along the failure of Salvador, in the internal area of Todos os Santos Bay, with species similar to those occurring in the ecosystem of remaining in the seaboard of Salvador. Thus, it is evaluated that the now depleted environment has been extremely rich in appearances, of which few traces remain.

Currently, the environment is so modified, so that the remaining natural environments do not provide a representative picture of what this area was previously constituted. The rivers are polluted, the little mangrove rest is polluted or contaminated when ungrounded and the punctual Atlantic Forest (on the slopes) and at an early stage in the areas of the enterprise environment. The beaches are still used for bathing, despite the environmental agency alert the community about existing pollution.

Estuaries are very changed due to the channelling and the release of untreated domestic sewage. The result is eutrophic waters, reflecting on the balance of aquatic biota. However, in the rising tide still occurs penetration of species of fish and crabs in these areas, like sea basses, mullet and fugus. Some of these species are even captured by fishermen of communities around Tainheiros cove (**Figure 55**).

Figure 51 - Clam catchers in São João beach

2.7 Conservation Units

The creation, definition and management of Conservation Units in Brazil are regulated by the National System of Conservation Units - SNUC, created by Law No. 9985/2000. This law establishes the categories of Conservation Units, their functions, how its management will be made, among other information.

The Government of the State of Bahia, in turn, established the State System of Conservation Units - SEUC through Law No. 10431/08, in order to "contribute to the maintenance of biological diversity and genetic resources in the state territory, promoting respect for the principles and the adoption of nature conservation practices in the process of scientific, technological and socio-economic development of the State." It is part of this system, the Urban Parks category, not considered by the SNUC, defined as "open spaces for leisure, education, public health and the conservation of environmental resources, considering, for its creation, natural, cultural, social, historical, landscape and scenic attributes."

On the other hand, the Municipal Government of Salvador instituted by Law No. 7400/07, the Environmental and Cultural Value Areas System - SAVAM, in order to "make a decisive contribution to urban environmental quality through plans and management programs, planning and control, established by the Municipality, aimed at environmental and cultural protection in the city of Salvador."

There are no Federal Conservation Units located in the enterprise area. Two state Conservation Units of Sustainable Use

stand out in the region: the Environmental Protection Area - APA Todos os Santos Bay and the APA Cobre / São Bartolomeu Basin.

PA Todos os Santos Bay

The contour of the coastline of Todos os Santos Bay, including all its 54 islands, which are protected by the Decree No. 7595/1999, which created the Environmental Protection Area - APA of Todos os Santos Bay, with estimated area of 800 km^2.

The original suburban train route will be maintained and preserved in the new enterprise. Its route is located in the outer boundary of the said APA.

Figure 52 - Polygonal of APA Todos os Santos Bay.
Source: CODEBA.

2.7.1 APA Cobre / São Bartolomeu Basin and other associated CUs

In the area of Cobre River basin, but without interacting with the enterprise there are protected areas, but not all considered in the SNUC:

- Environmental Protection Area Cobre / São Bartolomeu Basin (State) (Decree No. 7.970 of 06/05/2001);
- São Bartolomeu Park (Municipal) (Decree No. 4.756 of 03/13/1975);
- Lagoa da Paixão Park (Municipal);
- Pirajá Metropolitan Park (State) (Decree No. 5.363, of 04/28/1978).

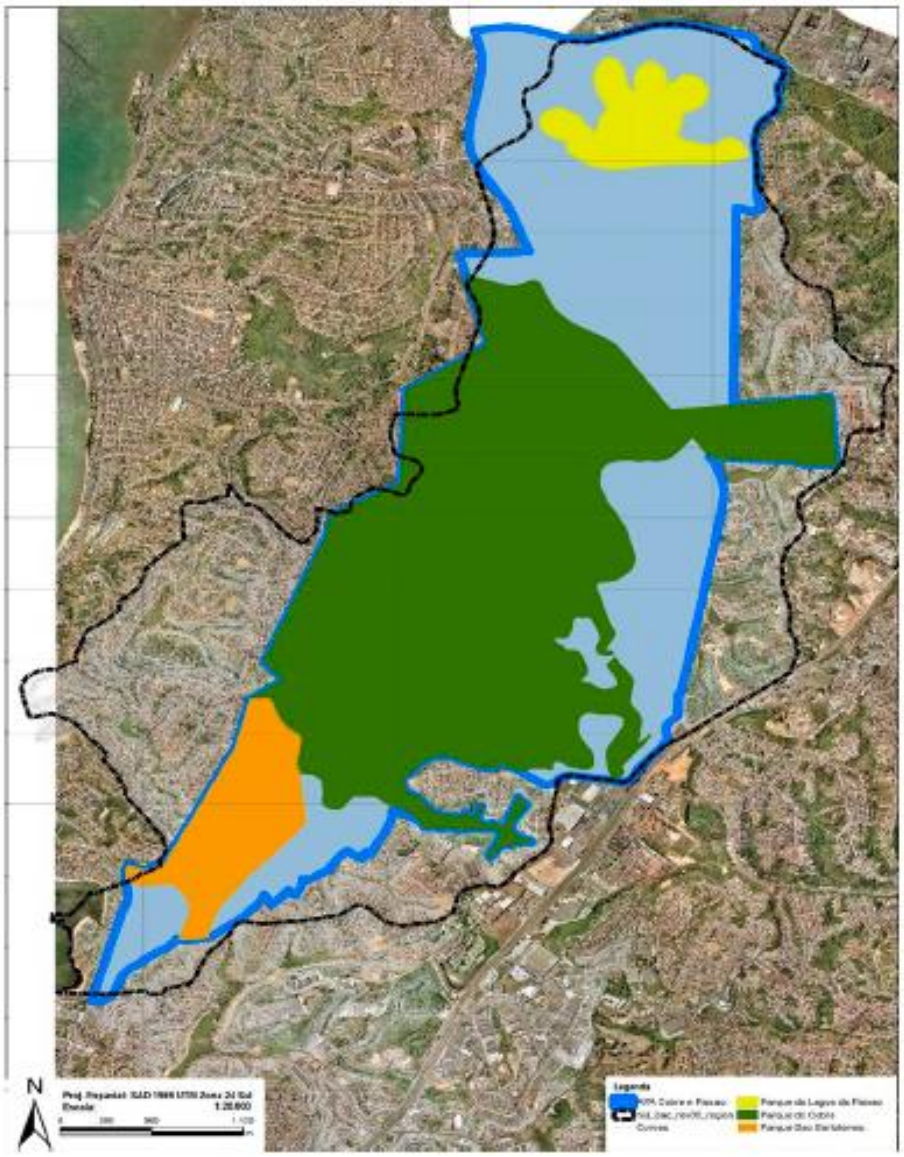

Figure 53 - Conservation Units in Rio do Cobre basin.
Source: FFA, 2009.

2.7.2 Areas Protected by SAVAM

The Environmental and Cultural Value Areas System of Salvador - SAVAM, established by Law No. 7.400/2008 of February 27, 2007, is composed of the Subsystem of Conservation Units and the Subsystem for Urban and Environmental Value, as shown in **Table 1**.

TABLE I - SUBSYSTEMS OF SAVAM

Subsystem	Description
Subsystem of Conservation Units	Consisting of areas of relevant ecological and socio-cultural value of great importance for the environmental quality of the Municipality, because they have rare, unique natural sites of outstanding scenic beauty and biological diversity, with protection functions to the sources and quality of water resources, erosion control, climate balance and conservation of specific flora and fauna species
Subsystem of Urban and Environmental Value	Consisting of areas whose natural values are partially uncharacterized with respect to its original conditions, but they contribute to the maintenance of soil permeability to the climate, audible and visual comfort in the urban environment, and also areas, which comprise elements, scenarios and benchmarks linked to the image, history, local culture, and even urbanized open spaces used for leisure and recreation of the population.

Source: PMS – Law No. 7400/08.

SAVAM subdivides the areas of urban and environmental value in:

- Natural Resources Protection Areas - APRN;
- Cultural and Landscape Protection Areas - APCP;
- Maritime Border Areas - ABM;
- Open Spaces for Recreation and Leisure - ERL;
- Wooded Areas - AA.

With interference on the enterprise, but not covered by the SNUC are located:

- APRN Aratu (**Figure 58**);
- APRN Cobre and Paraguari Basins (**Figure 59**); and
- APCP Historical Center of Salvador (**Figure 60**).

The APRN are Natural Resource Protection Areas and APCP are Cultural and Landscape Protection Areas, both categories belonging to the Urban and Environmental Value Subsystem (**Table 2**)

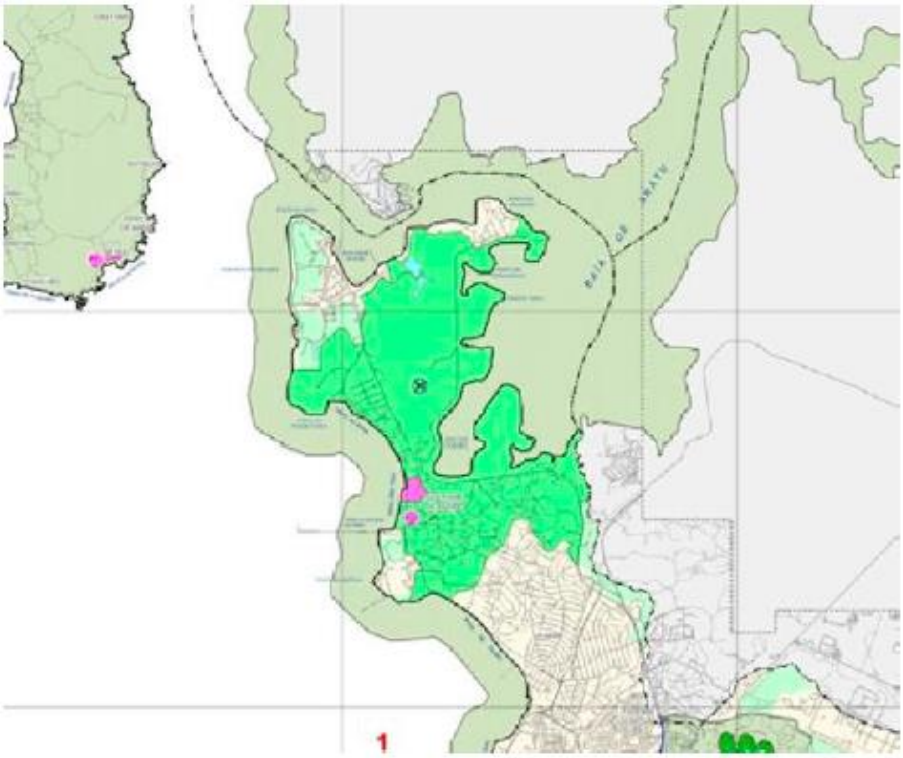

Figure 54 - APRN Aratu.
Source: PMS – Law No. 7400/08.

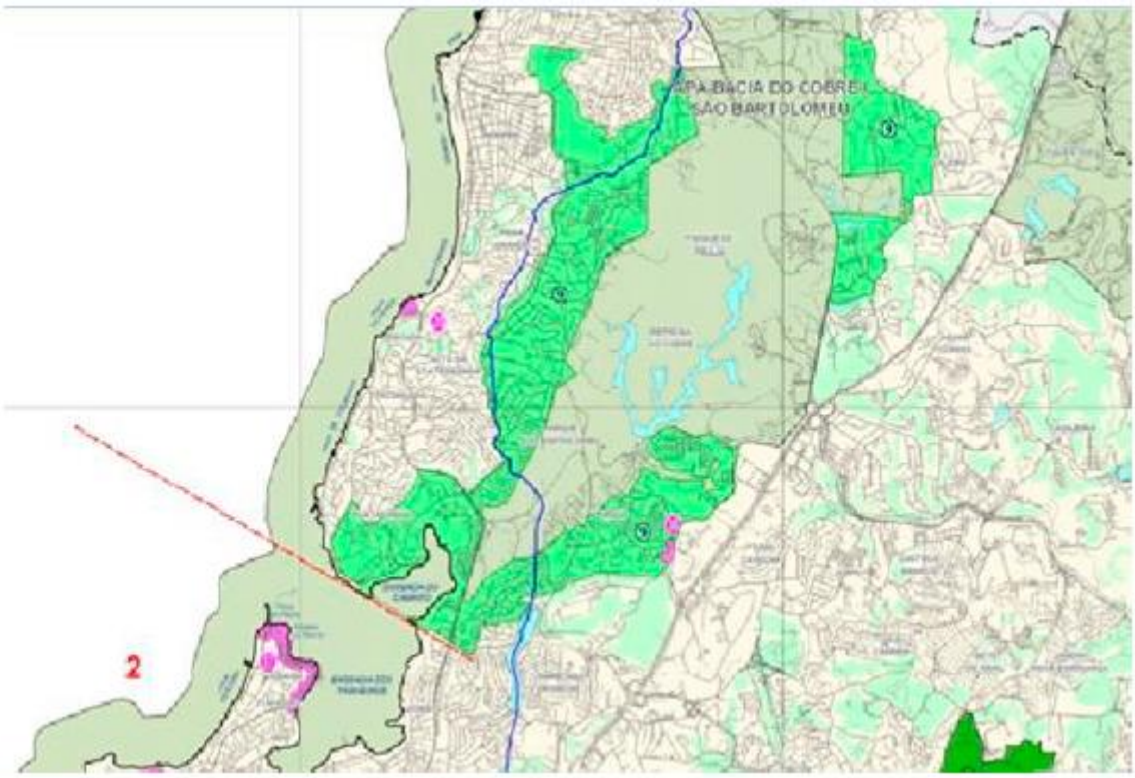

Figure 55 - Cobre and Paraguari Basins
Source: PMS – Law No. 7400/08.

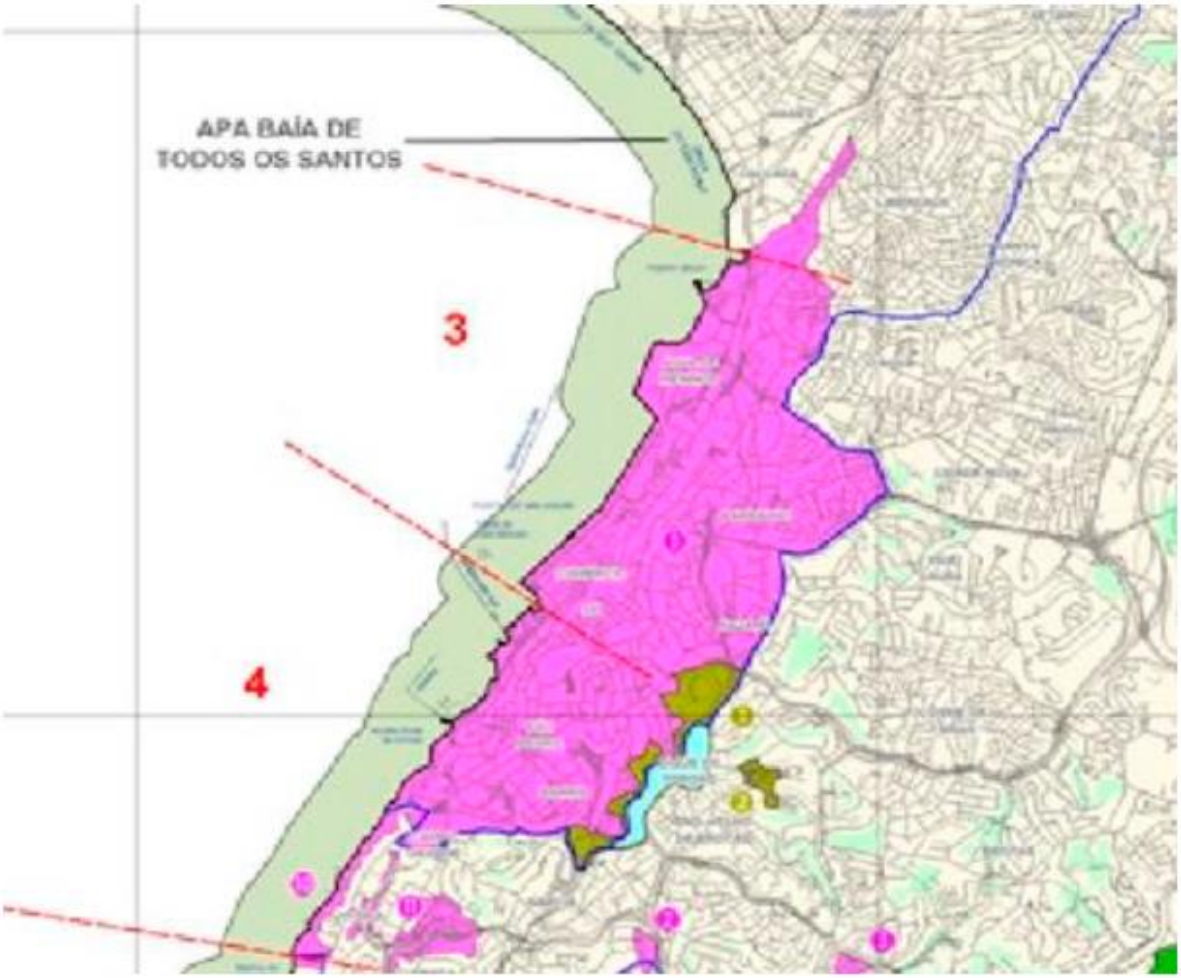

Figure 56 - APCP Historical Center
Source: PSM Law No. 7400/08.

TABLE 2 - SAVAM DESCRIPTION FOR APRN AND APCP

APRN	APCP
Areas for the conservation of significant natural elements to urban and environmental balance and comfort, comprising: I - areas generally of small extension, representing remaining natural ecosystems in the territory of the Municipality; II - areas whose natural values are partially uncharacterized relative to its original condition, but justifying protection due to the functions performed in the urban environment; III - areas located in the vicinity of Environmental Conservation Units, in which the intensity or the use characteristics and land use can affect the environmental balance of these Units;	Areas for the conservation of significant elements of the cultural point of view, associated with memory, plurality and diversity of manifestations and forms of expression of the identities of the local society, and for urban and environmental image, comprising: I - sites integrated by monumental sets or individual monuments and their surroundings, of historical and/or cultural value recognized by the Federal Government, the State or the Municipality; II - areas with buildings typologies and ambiences of symbolic and/or significant value for fixing the memory and culture of the city, or a particular social, religious or ethnic group;

APRN	APCP
IV - partially urbanized areas, or in the process of urbanization, which requires the use of specific criteria and restrictions in order to reconcile the use and land occupation with the preservation of existing environmental attributes.	III - areas of archaeological interest, consisting of segments of the physical environment modified by human action according to behaviors culturally determined and material demonstrations that have informative potential on past social and cultural relations and processes; IV - natural landscape elements, such as flora, geological and geomorphological formation, water mirrors or other natural conditions that constitute scenic and/or symbolic reference.

Source: PSM Law No. 7400/08.

The following are SAVAM guidelines for APRN of Cobre and Paraguari Basins:

- Establishing zoning for APRN, aligning it with the zoning of the Environmental Protection Area Cobre / São Bartolomeu Basin, and defining criteria and occupation restrictions for adjacent areas, not included in the polygonal of state APA;
- Delimitation of areas for permanent preservation, especially protection strips to the springs and banks of the Cobre River and its tributaries, and wetlands on the banks of Paraguari River;
- Definition of criteria for monitoring the mineral extraction in the Cobre dam vicinity, in order to reduce the resulting environmental damage of the activity;
- Establishing specific criteria and restrictions to control the density of housing areas included in the APRN, harmonizing land use with environmental protection;
- Preservation of Atlantic Forest in a compatible way using leisure of contact with nature, ecological tourism;
- And cultural and religious manifestations, especially in the area corresponding to São Bartolomeu Park, and as a reference center for environmental education

The following are SAVAM guidelines for APRN of Aratu:

- Zoning of APRN, with delimitation of permanent preservation areas and buffer areas, considering the use and occupation of the existing soil;

- Conducting environmental studies for institutionalization, such as Conservation Unit, the mangrove areas and dense forest associated with the Atlantic Forest domain being part of APRN, after met the criteria of the relevant legislation; definition of special criteria for use and occupation of land for urban areas or adjacent spontaneous occupation to the strict protection areas;
- And compatibility of industrial uses with environmental conservation.

The following are general guidelines for the Cultural and Landscape Protection Areas, APCP:

- I - Regulation, by specific legislation, of the areas indicated in this Law for institutionalization as APCP;
- II - Identification, mapping and delineation of new areas of the Municipality, subject to classification as APCP, to be institutionalized by specific law;
- III - Update, expansion and/or complement the existing municipal legislation, in partnership with government agencies from other levels of government with related expertise in the protection of cultural heritage, covering the areas of cultural and scenic interest in the Municipality;
- IV - Preservation and enhancement of the sites, monuments and its surroundings with respect to changes in morphology, volumes of buildings, internal and external appearance, ambience and urban silhouette;
- V - Development of urban designs, standards, specific procedures and intervention programs with community participation, prioritizing the use for recreational, educational, cultural and tourist activities;
- VI - Definition of infrastructure designs that can act as catalysts for development in areas under deterioration process of the urban structure, with an emphasis on housing issue;
- VII - Establishment of partnerships with public and private institutions for conservation, restoration and management of cultural property being part of APCP;
- VIII - For areas of archaeological interest:

a) completion of the current municipal legislation with a view to disciplinary research and interventions in the areas of archaeological interest;

b) requirement of Liability Declaration for enterprises licensing in archaeological sites;

c) control of the integrity of elements and areas of archaeological interest and recovery of those degraded.

2.8 Pressures on the environmental attributes

As discussed under "Environmental Attributes" item, the natural environments of the enterprise insertion area are changed due to the growth process of the city of Salvador, which directly reflects on its environmental quality.

Given the overall environmental mischaracterization of the intervention area, we sought to identify the widespread outbreaks of impacts in order to affirm that the area subject matter of the enterprise is fully anthropized and the remnants of the systems are out of it. And noting that the enterprise will not used in the areas adjacent to the right of way, already occupied by suburban train. Thus, the following forms have presented major environmental pressures in the incident area.

TABLE 3

Release of untreated sewage into rivers and estuaries
PRESSURE CHARACTERISTICS: The sewage system of the Municipality of Salvador, with uptake in dry weather implies, in the rainy season, in direct dumping of sewage into rivers without any treatment. In addition, there are connections that were not carried out in the sewage depletion system and some of these properties have made illegal connections to storm water drainage system. Thus, the water bodies of the basins of Macacos River, Paraguari River, Cobre River, Riacho Pirajá, Riacho Periperi, Riacho do Macaco and Cotegipe River due to high population density and amount of illegal connections, the estuary of Todos os Santos Bay continues to receive large amounts of household sewage. This pollution causes imbalance in species that inhabit the estuary.
POTENTIAL CONSEQUENCES OF PRESSURE: • Eutrophication of waters of rivers and estuaries; • Impairment of water quality; • Environmental balance, disappearance of aquatic fauna; • Proliferation of macrophytes (aquatic plants); • Loss of diversity of aquatic biota, loss of landscape potential; • Bad smell and pollution of beaches; • Contamination of water bodies; • Increased risk of incidence of waterborne diseases.

Figure 57 - Presence of Macrophytes in Riacho do Macaco and water with pollution aspect.

Figure 58 - Riacho Periperi downstream of the dam of riacho do Macaco.

Figure 59 - River catchment in dry weather.

TABLE 4

Occupation of Permanent Preservation Area - APP of Water Bodies
PRESSURE CHARACTERISTICS: The unplanned and uncontrolled urban occupation, and interventions for implementation of the automotive road and rail infrastructure on the banks of water bodies impaired the ecosystems. The rivers have lost their ecological functions by strangulation and silting of its meanders, removal of riparian vegetation and fill their marginal lagoons.
POTENTIAL CONSEQUENCES OF PRESSURE: • Impairment of water quality and volume; • Environmental imbalance; • Loss of diversity of aquatic biota; • Loss of landscape potential; • Increased risk of flooding.

Figure 60 - impairment of Paraguari river

Figure 61 - impairment of APP of Paraguari river

TABLE 5

Expansion of the urban structure and use of areas of Permanent Preservation
PRESSURE CHARACTERISTICS: The growing urban occupation and strategies to ensure urban development in the area adjacent the intervention of the enterprise, so that allowed the disorderly development and acts on marsh areas and beaches.
POTENTIAL CONSEQUENCES OF PRESSURE: • Impairment of water quality; • Environmental imbalance; • Loss of diversity of fauna and flora; • Loss of connectivity, with the creation of land with bare soil; • Loss of landscape potential; • Increased flooding occurrence trends, erosion and siltation processes.

Figure 62 - Beach areas for construction

Figure 63 - beach areas for construction

Use of beach areas for construction of the railroad, automotive track, bars and restaurants in the marsh and beach area in platform and houses built in the beach area along the railroad.

TABLE 6

Landfills and solid waste disposal in areas with tidal influence and mangrove
PRESSURE CHARACTERISTICS: The mangroves of the Cabrito cove is in the initial stage of recovery, but still very resilient, due to construction of landfills and dumping of sewage mixed to the water drainage system and disposal of domestic waste in open air Both landfills performed without any control with respect to the deployment of buildings that do not have any kind of health infrastructure, contribute to the degradation of natural resources there. The landfill of mangrove has always been a practice widely used by the people, for the occupation of the area of their domain. Suppression of mangrove areas occurred for a long time due to lack of knowledge of their productivity and importance, and then treated as unhealthy areas that should be eradicated.

POTENTIAL CONSEQUENCES OF PRESSURE:

- Impairment of water quality;
- Impairment of hydrodynamics;
- Loss of diversity of aquatic biota, including on endangered species;
- Environmental imbalance;
- Loss of appearance diversity to the Municipality;
- Accumulation of water and poor odor.

Figure 64 - landfill and discharge of solid waste into water bodies and area of influence of the tide.

Figure 65 - Landfill and discharge of solid waste into water bodies and area of influence of the tide.

Figure 66 - Landfill and discharge of solid waste into water bodies and area of influence of the tide.

TABLE 7

Improper disposal of solid waste
PRESSURE CHARACTERISTICS: It was contacted the disposal of solid waste into water bodies, on the beaches; in the streets is common in the study area, in contribution basins and even within the railway company structures. The presence of the waste generates poor smell in the street or on the banks of the basin and the presence and proliferation of disease vectors.
POTENTIAL CONSEQUENCES OF PRESSURE: • Impairment of water quality; • Impairment of hydrodynamics; • Loss of diversity of aquatic biota, including on endangered species; • Environmental imbalance; • Accumulation of water and poor odor; • Loss of landscape potential; • Increased risk of incidence of waterborne diseases.

Figure 67 - Waste accumulation in Riacho Paripe and mouth of Paraguari river

Figure 68 - Waste accumulation in Riacho Paripe and mouth of Paraguari river

Figure 69 - Disposal of waste on the premises of the railway company in Periperi station and after Escada station

Figure 70 - Disposal of waste on the premises of the railway company in Periperi station and after Escada station

Figure 71 - Disposal of waste on the premises of the railway company in Periperi station and after Escada station

TABLE 8

Heavy metal contamination of Tainheiros bay

PRESSURE CHARACTERISTICS:

Tainheiros cove currently has two industries, properly licensed, running in their environment. They are the Fábrica de Gases Industriais Agro Protetoras FAGIP S.A. and Bom Brasil - Óleo de Mamona S.A. both had their effluents monitored by Bahia Azul Program and its pollution potential was considered low.

During the 70's and early 80's, CQR (Recôncavo Chemical Company) launched tons of inorganic mercury in the water. Depending on the local sediment characteristics, mercury is currently unavailable biologically.

The fact that Tainheiros cove has this "chemical bomb", it is not recommended the rebuilding of local mangroves as part of the recovery plan. This ecosystem is capable of changing the physical and chemical conditions of the sediment environment and these changes may also make available the heavy metals from sediment to the biota.

Studies conducted by CRA (2001) demonstrate the impairment of the sediments that make up the Tainheiros cove for lead, copper, mercury and zinc in sampling points evaluated in the vicinity of the community of Mangueira III.

The main sources of sediment contamination with these metals are domestic effluents that enter into the receiver body without any treatment, besides the environmental liabilities left by the company CQR (Recôncavo Chemical Company), responsible for contamination of the cove with mercury.

POTENTIAL CONSEQUENCES OF PRESSURE:

- Flora and fauna contamination;
- Loss of diversity of fauna and flora;
- Environmental imbalance.

Content of heavy metals in sediments in Tainheiros Cove

Parameters	Value of Unit	LDM	TI5200	TI5300	TI5400	Reference Parameters of GESAMP*
Cadmium	µg/g Cu	5	< 1	< 1	< 1	0.4
Lead	µg/g Pb	10	26.5	65.7	46.6	20
Copper	µg/g Cd	1	44.1	112.0	44.1	26
Iron	µg/g Fe	10	14,709	29,629	45,360	-
Mercury	µg/g Hg	0.2	0.64	0.54	0.48	0.1
Zinc	µg/g Zn	10	106	246	125	39

Source: Water Quality Assessment of Todos os Santos Bay. Technical Report / Environmental Assessment - Period 2001 - Salvador.

Notes: (*) - Value referred to environments free of contamination in the northern hemisphere by GESAMP (1974) - Group of Experts on the Scientific Aspects of Marine Pollution (IMCO/FAO/UNESCO/WMO/WHO/IAEA/UM).

TABLE 9

Introduction of exotic species
PRESSURE CHARACTERISTICS: Besides the suppression of native vegetation that fed the native fauna there is the habit of using in public areas plants that are not native to the area or even Brazil. They are usually introduced by means of landscaping designs, but can also occupy degraded ecosystem areas. In the area there are exotic species, especially grasses.
POTENTIAL CONSEQUENCES OF PRESSURE: • Loss of diversity of fauna and flora; • Erosion; • Loss of landscape potential; • Environmental imbalance.

Figure 72 - The introduction of exotic species.

Figure 73 - The introduction of exotic species

Indiscriminate deforestation of the areas surrounding Riacho Paripe to make room for exotic species such as the executioner (a) near Paripe terminus. In the same manner that the proper planting of exotic species contributes to a disturbance of fauna such as castor (b), observed in this same area.

TABLE 10

Use of explosive
PRESSURE CHARACTERISTICS: Tainheiros cove is one of the main areas where people use explosive to catch fish (CRA 2001). On site, the sale of mullets was found presenting large amount of body secretions, feature that enables their classification as fish killed by explosives.
POTENTIAL CONSEQUENCES OF PRESSURE: • Destruction of natural resources in the vicinity of about 500 m from the explosion; • Shaking and fell of stilt houses and houses on land located in the vicinity; • Disturbance and scare the locals; • Accidents occurring between the bombers, who are sometimes maimed or die.

3. SOCIAL AND ECONOMIC ENVIRONMENT

3.1 Initial Considerations

The analysis of the social and economic aspects of catchment areas through which will pass the current LRV - Light-rail Vehicle design in Salvador, considers the importance of the old train from the suburbs today CTB - Companhia de Transportes da Bahia, which runs from Calçada station to Paripe station to a length of 13.5 km, which was responsible for the current transformations in that territory.

The Municipal Government of Salvador in the publication of the Master Plan (PDDU, 2007) considers the subdivision of Salvador in 22 suburbs, which are subdivided into neighborhoods; in this subdivision, currently, the train passes in most neighborhoods of Administrative Region RA XVII - Suburb Railway of Salvador, and the following Stations: Calçada, Santa Luzia, Lobato, Almeida Brandão, Itacaranha, Escada, Praia Grande, Periperi, Coutos and Paripe being part of this scope.

The transformation of the current train from the suburbs to the Light-rail Vehicle - LRV aims to increase the current line to the south, to Comércio Neighborhood and to the north, to Rua São Luís.

The integration of current LRV covers transverse corridors that make up the new system and include other neighborhoods of Salvador, which are part of the social and economic analysis as areas of influence of the LRV.

3.2 Historical, Geographical and Tourism Aspects in the route of the LRV of Salvador

Currently the train route on the Railway Seaboard of Salvador called Suburb Railway or Administrative Region of the Suburb Railway of Salvador (PDDU, 2007) passes through towns whose stations may be considered tourist attractions. For almost all train journey there is a view of the most calm beaches of Todos os Santos Bay. A fine example is Itacaranha neighborhood, rich in mineral water and privileged beach and view.

According to IPAC, a spout of mineral water, the Source of Itacaranha, Baroque style, was built in the late seventeenth century (1685 and 1729). From crystalline waters to this day, the spout is proof of the existence of a large groundwater passing under the area.

Another historically interesting location is Lobato Neighborhood, which was the first in Brazil where it was discovered oil.

On the other hand, the railway station has the best views of the Bay.

Periperi neighborhood is the most commercial point of Suburb Railway, currently its station is the terminus of the line. It was known to be an important resort for summer and housing for retirees.

The locality of Coutos has a beautiful view of the sea, but today is one of the poor towns in the region. The town has a population made up of people coming mainly from small towns of the inland cities of Bahia, remnants of gypsy communities and a significant amount of people from Ceará and Sergipe.

3.3 Delimitation of the area of interest

The comparability of the latest information about the territory is more accurate if the geographical boundaries are kept in the temporal analysis. The results of the social and economic analysis with reliability of the information is available in Brazil by IBGE - Brazilian Institute of Geography and Statistics in 2000 and 2010 Demographic Censuses.

For statistical purposes, the Municipality of Salvador is officially constituted by a single district and 22 sub-districts and does not exist in current law, a precise definition concerning the delimitation of the "neighborhoods". The law divides the inner area of the Municipality of Salvador (and which is still in force) is the Municipal Law No. 1038 of June 15, 1960.

More recently, with the Demographic Census 2010, IBGE conducted a spatial definition of the neighborhoods for an analysis with UFBA, CONDER and environmental agencies of Bahia, where they analyzed the neighborhoods in social-environmental and demographic statistics, which allowed analysis thereof. However, specific letters of the sectors by neighborhood could not be set, i.e., temporal analysis were compromised between neighborhoods and census sectors, reason why it will be used as reference, but without offering the possibility of spatial distribution by neighborhoods for this current study of the LRV.

The information closer to the LRV Design would be the census sectors of IBGE, but in time, comparisons are compromised because each sector can change geographically and split up spatially (IBGE must ensure operational situations in the preparation of the Census).

It is concluded that the ideal spatial condition are still the Sub-districts, which are the geographical areas subject to temporal analysis. Thus, it will be analyzed the social and economic changes of its inhabitants, assuming that the area analyzed is constant over time.

These are the preliminary recommendations of a review of the last ten years between the Demographic Census of 2000 and 2010. You can get at IBGE website, data on households, population, average residents and social and economic characterization. Thus, nine sub-districts will be analyzed: Mares, Paripe, Penha, Periperi, Pilar, Pirajá, Plataforma, Santo Antônio and São Caetano. More specifically, in the LRV area there are six sub-districts, since the most distant ones are the sub-districts of Pirajá, Santo Antônio and São Caetano.

3.4 Area of Sub-Districts in 2000 - 2010

The nine sub-districts: Mares, Paripe, Penha, Periperi, Pilar, Pirajá, Plataforma, Pirajá, Santo Antônio and São Caetano are considered the area of influence of the LRV and interconnection with the mass transit system in Salvador. This area covers from the north, the end of Rua São Luís and to the south, the Comércio Neighborhood.

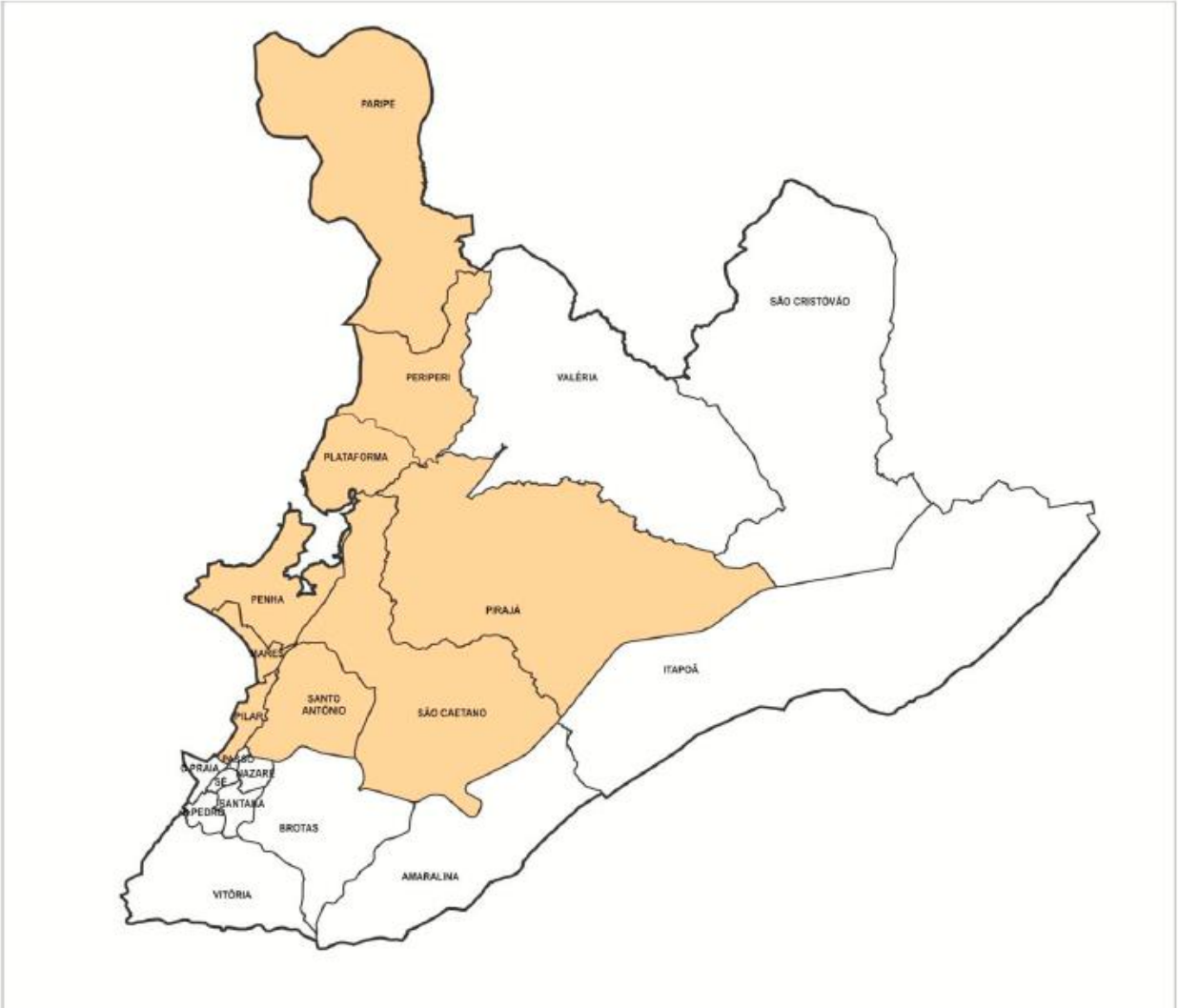

Figure 74 - Sub-Districts of Salvador in area of the LRV

3.5 Demographics

The region of sub-districts considered in the LRV study presented in 2010, a resident population of 1,509,061 inhabitants (IBGE, 2010 Census). The distribution of the population by age is presented as inverted pyramid, demonstrating what the demographers have found: the population is aging and there is a drop in the fertility of women, demographic phenomenon also observed nationally.

The general demographic trends in this region of the Suburb Railway of Salvador reflect only in part, those concerning the more general trends of the total population of Salvador, but are not applied in particular to the dynamics of these sub-districts, where growth rates are depressed expressing only partly vegetative growth of the population and in some areas a few migrations.

TABLE 11 - RESIDENT POPULATION IN HOUSEHOLDS IN THE COVERAGE AREA, 2000 AND 2010

Years	Population	Population in permanent private domiciles	Population in improvised domiciles	Population in collective domiciles
2000	1,397,097	1,389,462	3,518	4,117
2010	1,509,061	1,475,864	1,387	2,779
% Rate per year	0.77	0.61	-8.89	-3.85

Source: IBGE - Brazilian Institute of Geography and Statistics.

Demographic data indicate that in the last decade there has been a growing population of 0.77% per year below the average growth of the population of Salvador, which was 0.91% (Table 11). The suburban railway shows stabilized migration, but some regions are very dynamic such as Periperi and Pirajá whose population grew 1.36% and 1.50% per year, respectively. Plataforma and São Caetano increase the population, but they still receive migrations. Less dynamic regions lose population: Mares, which decreases 0.28% per year and Santo Antônio (-0.07% per year), while Penha (0.13% per year), Pilar (0.25% per year) and Paripe (0.36% per year) practically stopped growing.

TABLE 12 - RESIDENT POPULATION IN DOMICILES. SUB-DISTRICTS OF COVERAGE AREA IN 2000 AND 2010

Years	Population	Population in permanent private domiciles	Population in improvised domiciles	Population in collective domiciles
Mares				
2000	5,237	4,769	19	449
2010	5,093	4,896	494	61

Years	Population	Population in permanent private domiciles	Population in improvised domiciles	Population in collective domiciles
% Rate per year	-0.28	0,26	38.52	-18.10
Paripe				
2000	125,161	124,940	183	38
2010	129,805	129,481	83	324
% Rate per year	0.36	0.36	-7.60	23.90
Penha				
2000	148,978	148,173	206	599
2010	150,929	150,143	118	786
% Rate per year	0.13	0.13	-5.42	2.75
Periperi				
2000	73,278	73,012	228	38
2010	83,886	83,828	87	58
% Rate per year	1.36	1.39	-9.18	4.32
Pilar				
2000	1,287	1,174	78	35
2010	1,319	1,318	9	1
% Rate per year	0.25	1.16	-19.42	-29.92
Pirajá				
2000	340,646	337,043	1,147	2,456
2010	395,411	392,284	234	1,265
% Rate per year	1.50	1.53	-14.70	-6.42
Plataforma				
2000	63,738	63,492	238	8
2010	69,699	69,688	55	11
% Rate per year	0.90	0.94	-13.63	3.24
Santo Antônio				
2000	205,788	205,143	302	343
2010	204,368	204,206	133	147
% Rate per year	-0.07	-0.05	-7.87	-8.12
São Caetano				
2000	432,984	431,716	1117	151

Years	Population	Population in permanent private domiciles	Population in improvised domiciles	Population in collective domiciles
2010	468,551	468,286	174	126
% Rate per year	0.79	0.82	-16.97	-1.79

Source: IBGE. Demographic Censuses of 2000 and 2010 - Sectors Aggregate.

The population of the Suburb Railway showed improvement in housing conditions. The population in permanent private domiciles increased by 0.61% per year while fell significantly (-8.89% per year) the population in improvised and collective domiciles (-3.85% per year) (Table 12). Mares appears as an exception to these improvements, the population in improvised domiciles rose sharply in this decade (38% per year), which may indicate that there was a migration of the poor population from other regions to this sub-district that is made of slopes and are very small, but also increased the number of residents in permanent domiciles (0.26% per year).

The coverage area studied throughout its length has significantly improved the housing condition (Table 13). The number of permanent households grew 3.68% per year while the number of improvised domiciles fell 6.44% per year and the collective domiciles have virtually disappeared with a reduction of 25.5% per year

TABLE 13 - PRIVATE DOMICILES IN THE COVERAGE AREA, 2000 AND 2010

Years	Private domiciles	Improvised domiciles	Collective domiciles
2000	364,708	1,121	3,887
2010	523,604	576	198
% Rate per year	3.68	-6.44	-25.75

Source: IBGE - Brazilian Institute of Geography and Statistics.

The permanent private domiciles increased in all sub-districts analyzed, significantly more in Periperi (3.30% per year) and Pirajá (3.48% per year), mainly due to the growth of the population, but mainly by improvement of the housing (Table 14).

TABLE 14 - PERMANENT PRIVATE DOMICILES SUB-DISTRICTS - 2000 AND 2010

Sub-district	2000	2010	% Rate per year
Mares	1,263	1,371	0.82
Paripe	31,428	39,375	2.28
Penha	38,368	46,345	1.91
Periperi	18,575	25,689	3.30
Pilar	320	419	2.73
Pirajá	89,322	125,789	3.48
Plataforma	16,014	21,464	2.97
Santo Antônio	54,512	64,352	1.67
São Caetano	113,785	151,608	2.91

3.6 Characterization of the home ranges

Table 15 shows the composition per gender, resident population in the sub-districts as well as the responsible for the domicile. In sub-districts, dominated by the female population, however, the responsible for the domicile is predominantly male.

TABLE 15 - RESIDENT POPULATION PER DOMICILE PER GENDER IN SUB-DISTRICTS OF THE COVERAGE AREA IN 2010

SUB-DISTRICT AND GENDER	RESIDENT POPULATION	
	TOTAL	RESPONSIBLE FOR THE DOMICILE
Mares	**5,093**	**1,530**
Men	2,336	797
Women	2,757	733
Paripe	**129,805**	**39,420**
Men	62,096	21,589
Women	67,709	17,831
Penha	**150,929**	**46,487**
Men	69,590	23,495
Women	81,339	22,992
Periperi	**83,886**	**25,734**
Men	40,024	13,919
Women	43,862	11,815

SUB-DISTRICT AND GENDER	RESIDENT POPULATION	
	TOTAL	RESPONSIBLE FOR THE DOMICILE
Pilar	**1,319**	**423**
Men	684	228
Women	635	195
Pirajá	**395,411**	**125,899**
Men	189,097	69,709
Women	206,314	56,185
Plataforma	**69,699**	**21,490**
Men	33,155	11,617
Women	36,544	9,873
Santo Antônio	**204,368**	**64,422**
Men	93,732	33,138
Women	110,636	31,284
São Caetano	**468,551**	**151,705**
Men	219,825	82,312
Women	248,726	69,381

3.7 Literacy rates in Sub-Districts in 2000 - 2010

Literacy rates in the past decade increased from 93.04% to 95.56%. It is noted that the sub-districts have approximately the same literacy rates showing the effort and uniformity of the Literacy Program (Table 16).

TABLE 16 - 10 YEARS OLD PEOPLE OR OLDER, TOTAL AND LITERACY RATE PER GENDER IN THE COVERAGE AREA 2000 - 2010

Year	10 years old people or older								
	Total			Literate			People literacy rate (%)		
	Total	Men	Women	Total	Men	Women	Total	Men	Women
2000	1,141,469	535,686	605,783	1,061,989	502,005	559,984	93.04	93.71	92.44
2010	1,303,317	606,363	696,954	1,245,400	581,820	663,580	95.56	95.95	95.21

Note: Universe Data
Source: IBGE - Demographic Census

In 2010, literacy reaches nearly 97% in the sub-district of Santo Antônio and in the case of men this rate is already overcome. In Pilar and Paripe, the literacy needs to be accelerated to approximately 9% of illiterate women (Table 17).

TABLE 17 - 10 YEARS OLD PEOPLE OR OLDER, TOTAL AND LITERACY RATE PER GENDER IN THE SUB-DISTRICTS OF THE COVERAGE AREA 2010

Sub-district	10 years old people or older								
	Total			Literate			People literacy rate (%)		
	Total	Men	Women	Total	Men	Women	Total	Men	Women
Mares	4,546	2,047	2,499	4,298	1,949	2,349	94.54	95.21	94.00
Paripe	109,371	51,716	57,655	102,571	48,741	53,830	93.78	94.25	93.37
Penha	132,719	60,453	72,266	128,286	58,713	69,573	96.66	97.12	96.27
Periperi	71,373	33,695	37,678	67,824	32,074	35,750	95.03	95.19	94.88
Pilar	1,125	577	548	1,050	549	501	93.33	95.15	91.42
Pirajá	337,614	159,792	177,822	320,975	152,359	168,616	95.07	95.35	94.82
Plataforma	59,880	28,253	31,627	57,144	27,130	30,014	95.43	96.03	94.90
Santo Antônio	180,040	81,361	98,679	174,305	79,149	95,156	96.81	97.28	96.43
São Caetano	406,649	188,469	218,180	388,947	181,156	207,791	95.65	96.12	95.24

Source: IBGE - Demographic Census. Note: Universe Data

3.8 Permanent private housing in Sub-Districts in 2000 - 2010

By analyzing the sub-districts within the coverage area, it appears that in 2010 there was a predominantly horizontal urbanization. The permanent domiciles were mostly 86% houses, town houses and condominiums being in 2010 altogether 410 thousand units (Table 18).

TABLE 18 - PERMANENT PRIVATE DOMICILES ACCORDING TO TYPE OF DOMICILE AND OCCUPANCY CONDITION, SUB-DISTRICTS OF THE COVERAGE AREA 2010

Sub-district and Domicile occupancy condition	Type of Domicile				
	Total	House	Town house or in condo	Apartment	Housing in house of rooms and tenement.
Mares	**1,371**	**1,095**	**34**	**233**	**9**
Own property	946	799	17	128	2
Own property already paid	939	792	17	128	2
Own property being purchased	7	7	-	-	-
Rented	368	252	17	93	6
Given	45	34	-	11	-
Given by employer	5	4	-	1	-
Given in other way	40	30	-	10	-
Another condition	12	10	-	1	1
Paripe	**39,375**	**37,043**	**514**	**1,670**	**148**
Own property	32,941	31,237	307	1,302	95
Own property already paid	32,806	31,114	305	1,292	95
Own property being purchased	135	123	2	10	-
Rented	4,876	4,442	77	319	38
Given	1,310	1,125	129	43	13
Given by employer	153	36	116	-	1
Given in other way	1,157	1,089	13	43	12
Another condition	248	239	1	6	2
Penha	**46,345**	**40,066**	**644**	**5,432**	**203**
Own property	35,094	30,863	440	3,649	142
Own property already paid	34,565	30,665	309	3,449	142
Own property being purchased	529	198	131	200	-
Rented	9,304	7,469	190	1,609	36
Given	1,804	1,617	13	166	8
Given by employer	63	51	-	12	-
Given in other way	1,741	1,566	13	154	8
Another condition	143	117	1	8	17
Periperi	**25,689**	**23,461**	**141**	**1,359**	**728**
Own property	20,660	19,000	99	938	623
Own property already paid	19,618	18,062	96	837	623
Own property being purchased	1,042	938	3	101	-
Rented	3,871	3,384	36	386	65
Given	742	666	6	32	38
Given by employer	28	28	-	-	-
Given in other way	714	638	6	32	38

TABLE 18 - PERMANENT PRIVATE DOMICILES ACCORDING TO TYPE OF DOMICILE AND OCCUPANCY CONDITION. SUB-DISTRICTS OF THE COVERAGE AREA 2010

Sub-district and Domicile occupancy condition	Type of Domicile				
	Total	House	Town house or in condo	Apartment	Housing in house of rooms and tenement.
Another condition	416	411	-	3	2
Pilar	**419**	**363**	**6**	**47**	**3**
Own property	304	276	2	25	1
Own property already paid	294	267	2	24	1
Own property being purchased	10	9	-	1	-
Rented	84	65	2	17	-
Given	27	19	2	5	1
Given by employer	4	4	-	-	-
Given in other way	23	15	2	5	1
Another condition	4	3	-	-	1
Pirajá	**125,789**	**98,975**	**1,916**	**23,774**	**1,124**
Own property	100,853	79,432	1,439	19,145	837
Own property already paid	90,571	78,391	1,027	10,322	831
Own property being purchased	10,282	1,041	412	8,823	6
Rented	20,988	16,141	388	4,263	196
Given	3,419	3,000	62	285	72
Given by employer	160	135	7	17	1
Given in other way	3,259	2,865	55	268	71
Another condition	529	402	27	81	19
Plataforma	**21,464**	**20,671**	**133**	**476**	**184**
Own property	17,447	17,018	88	316	25
Own property already paid	17,239	16,842	88	284	25
Own property being purchased	208	176	-	32	-
Rented	3,077	2,899	36	141	1
Given	655	629	8	17	1
Given by employer	22	22	-	-	-
Given in other way	633	607	8	17	1
Another condition	285	125	1	2	157
Santo Antônio	**64,352**	**55,706**	**750**	**7,711**	**185**
Own property	46,960	41,488	452	4,952	68

TABLE 18 - PERMANENT PRIVATE DOMICILES ACCORDING TO TYPE OF DOMICILE AND OCCUPANCY CONDITION. SUB-DISTRICTS OF THE COVERAGE AREA 2010

Sub-district and Domicile occupancy condition	Type of Domicile				
	Total	House	Town house or in condo	Apartment	Housing in house of rooms and tenement.
Own property already paid	45,719	40,821	439	4,391	68
Own property being purchased	1,241	667	13	561	-
Rented	15,111	12,282	261	2,498	70
Given	1,994	1,738	28	217	11
Given by employer	90	81	2	7	-
Given in other way	1,904	1,657	26	210	11
Another condition	287	198	9	44	36
São Caetano	**151,608**	**126,957**	**1,545**	**22,663**	**443**
Own property	114,944	97,346	1,162	16,184	252
Own property already paid	110,945	96,480	1,142	13,072	251
Own property being purchased	3,999	866	20	3,112	1
Rented	31,854	25,554	303	5,826	171
Given	4,235	3,571	75	570	19
Given by employer	289	138	32	118	1
Given in other way	3,946	3,433	43	452	18
Another condition	575	486	5	83	1

Note: Universe Data

Residents in permanent private domiciles in the last ten years have changed with reduction of families and the expansion of individual residents. In 2010 all sub-districts analyzed had the highest rate with three people per domicile (around 25% of domiciles), the only exception in sub-district of Pilar with two residents. The vast majority of domiciles (65%) had one to three residents (in 2000 they were 45%) Table 19.

TABLE 19 - PERMANENT PRIVATE DOMICILES PER NUMBER OF RESIDENTS PERCENTAGE OF SUB-DISTRICTS OF THE COVERAGE AREA 2000 AND 2010

Number of residents	Mares		Paripe		Penha		Periperi		Pilar		Pirajá		Plataforma		Santo Antônio		São Caetano	
	Proportion of domiciles by number of inhabitants (%)																	
	2000	2010	2000	2010	2000	2010	2000	2010	2000	2010	2000	2010	2000	2010	2000	2010	2000	2010
1 resident	11.64	14.08	9.37	13.20	10.01	13.16	9.00	13.11	14.06	18.14	9.85	14.19	8.50	12.34	10.48	14.39	9.82	15.09
2 residents	17.50	24.14	14.55	21.18	16.70	23.01	15.12	21.29	19.06	25.30	16.66	23.59	14.39	22.22	17.31	23.30	16.78	23.63
3 residents	21.14	23.27	21.35	26.12	21.62	26.29	21.52	26.31	23.75	21.24	22.91	27.31	22.49	27.30	21.89	26.03	22.57	26.80
4 residents	20.27	20.64	21.80	20.39	21.17	19.67	22.57	20.67	15.31	15.27	21.73	19.35	22.06	20.42	21.43	19.24	21.88	19.22
5 residents	13.78	9.85	14.26	10.20	13.52	9.29	14.48	10.44	9.69	10.74	13.46	8.77	14.87	9.72	13.11	9.24	13.30	8.60
6 residents	6.18	3.87	8.11	4.61	7.38	4.33	7.58	4.45	9.69	4.77	7.18	3.64	7.97	4.32	7.10	3.97	7.24	3.61
7 residents	3.80	2.04	4.52	2.19	3.97	2.07	4.13	1.91	1.88	2.15	3.59	1.63	3.96	1.74	3.59	1.92	3.74	1.59
8 residents	2.22	1.02	2.62	1.05	2.32	1.01	2.44	0.99	1.56	1.19	2.05	0.77	2.54	1.02	2.04	0.91	1.96	0.73
9 residents	1.50	0.36	1.43	0.50	1.35	0.55	1.45	0.37	2.19	0.48	1.08	0.35	1.41	0.47	1.23	0.42	1.12	0.35
10 residents	0.79	0.29	0.92	0.22	0.74	0.30	0.71	0.22	1.88	0.24	0.64	0.19	0.82	0.22	0.70	0.29	0.70	0.18
11 residents	0.63	0.22	0.44	0.15	0.52	0.13	0.41	0.11	0.31	0.48	0.33	0.09	0.36	0.10	0.44	0.12	0.36	0.09
12 residents	0.32	0.07	0.33	0.07	0.28	0.08	0.23	0.05	-	-	0.24	0.06	0.32	0.05	0.29	0.07	0.23	0.05
13 residents	0.08	0.07	0.13	0.05	0.15	0.03	0.13	0.05	0.63		0.11	0.03	0.12	0.02	0.15	0.03	0.10	0.03

14 or more residents	0.16	0.07	0.18	0.06	0.28	0.08	0.22	0.03	0.00	0.00	0.16	0.04	0.19	0.05	0.23	0.07	0.20	0.04

Note: Universe Data.

Source: IBGE - Demographic Census.

3.9 Description of household garbage collection system

The urban cleaning services are present in almost all domiciles. Only in sub-district of Pilar, the collection service covered only 88% of domiciles and 10% thrown in wastelands. In the other sub-districts, the collection service presence exceeded 95% of domiciles (Table 20).

TABLE 20 - PERMANENT PRIVATE DOMICILES ACCORDING TO DOMICILE TYPE AND GARBAGE DESTINATION IN THE SUB-DISTRICTS OF THE COVERAGE AREA 2010

Sub-district and Garbage Destination	Type of Domicile					
	T.	House	Town house / Condo	Apartment,	House of rooms Tenement	% of total
Mares	**1,371**	**1,095**	**34**	**233**	**9**	
Collected	1,311	1,038	34	231	8	95.62
By cleaning service	1,219	952	33	226	8	92.98
Cleaning service bucket	92	86	1	5	-	7.02
Burned (on the property)	2	2	-	-	-	0.15
Buried (on the property)	-	-	-	-	-	-
Thrown in a wasteland or street	56	53	-	2	1	4,08
Thrown on river, lake or sea	-	-	-	-	-	-
Another destination	2	2	-	-	-	0.15
Paripe	**39,375**	**37,043**	**514**	**1,670**	**148**	
Collected	36,270	34,037	475	1,661	97	92.11
By cleaning service	19,943	19,087	385	395	76	50.65
Cleaning service bucket	16,327	14,950	90	1266	21	41.47
Burned (on the property)	303	294	1	-	8	0.77
Buried (on the property)	12	12	-	-	-	0.03
Thrown in a wasteland or street	2308	2224	37	5	42	5.86
Thrown on river, lake or sea	36	36	-	-	-	0.09
Another destination	446	440	1	4	1	1.13
Penha	**46,345**	**40,066**	**644**	**5,432**	**203**	
Collected	45,167	39,019	643	5,379	126	97.46
By cleaning service	38,416	33,302	473	4,550	91	82.89
Cleaning service bucket	6,751	5,717	170	829	35	14.57
Burned (on the property)	3	3	-	-	-	0.01
Buried (on the property)	-	-	-	-	-	
Thrown in a wasteland or street	918	863	1	46	8	1.98

Sub-district and Garbage Destination	Type of Domicile					
	T.	House	Town house / Condo	Apartment,	House of rooms Tenement	% of total
Thrown on river, lake or sea	210	139	-	2	69	0.45
Another destination	47	42	-	5	-	0.10
Periperi	**25,689**	**23,461**	**141**	**1,359**	**728**	
Collected	24,994	22,859	130	1,358	647	97.29
By cleaning service	15,232	14,260	93	480	399	59.29
Cleaning service bucket	9,762	8,599	37	878	248	38.00
Burned (on the property)	61	52	-	-	9	0.24
Buried (on the property)	4	4	-	-	-	0.02
Thrown in a wasteland or street	519	443	11	-	65	2.02
Thrown on river, lake or sea	7	7	-	-	-	0.03
Another destination	104	96	-	1	7	0.40
Pilar	**419**	**363**	**6**	**47**	**3**	
Collected	372	319	5	46	2	88.78
By cleaning service	148	114	2	31	1	35.32
Cleaning service bucket	224	205	3	15	1	53.46
Burned (on the property)	4	4	-	-	-	0.95
Buried (on the property)	-	-	-	-	-	
Thrown in a wasteland or street	42	39	1	1	1	10.02
Thrown on river, lake or sea	-	-	-	-	-	
Another destination	1	1	-	-	-	0.24
Pirajá	**125,789**	**98,975**	**1,916**	**23,774**	**1124**	
Collected	118,806	92,386	1,879	23,459	1082	94.45
By cleaning service	56,264	41,268	769	13,986	241	44.73
Cleaning service bucket	62,542	51,118	1110	9473	841	49.72
Burned (on the property)	339	332	-	1	6	0.27
Buried (on the property)	20	20	-	-	-	0.02
Thrown in a wasteland or street	6066	5750	34	250	32	4.82
Thrown on river, lake or sea	224	220	-	2	2	0.18
Another destination	334	267	3	62	2	0.27
Plataforma	**21,464**	**20,671**	**133**	**476**	**184**	
Collected	20,785	19,998	128	476	183	96.84
By cleaning service	13,348	12,973	87	288	-	62.19
Cleaning service bucket	7,437	7,025	41	188	183	34.65
Burned (on the property)	19	19	-	-	-	0.09

Sub-district and Garbage Destination	Type of Domicile					
	T.	House	Town house / Condo	Apartment,	House of rooms Tenement	% of total
Buried (on the property)	1	1	-	-	-	0.00
Thrown in a wasteland or street	626	622	4	-	-	2.92
Thrown on river, lake or sea	21	21	-	-	-	0.10
Another destination	12	10	1	-	1	0.06
Santo Antônio	**64,352**	**55,706**	**750**	**7,711**	**185**	
Collected	61,832	53,295	735	7,634	168	96.08
By cleaning service	41,114	34,772	545	5,766	31	63.89
Cleaning service bucket	20,718	18,523	190	1868	137	32.19
Burned (on the property)	8	8	-	-	-	0.01
Buried (on the property)	3	2	-	1	-	0.00
Thrown in a wasteland or street	2074	1969	15	74	16	3.22
Thrown on river, lake or sea	25	24	-	-	1	0.04
Another destination	410	408	-	2	-	0.64
São Caetano	**151,608**	**126,957**	**1,545**	**22,663**	**443**	
Collected	145,496	121,209	1,409	22,451	427	95.97
By cleaning service	83,227	67,688	966	14,418	155	54.90
Cleaning service bucket	62,269	53,521	443	8,033	272	41.07
Burned (on the property)	67	65	-	2	-	0.04
Buried (on the property)	11	11	-	-	-	0.01
Thrown in a wasteland or street	5,757	5404	136	202	15	3.80
Thrown on river, lake or sea	164	163	-	1	-	0.11
Another destination	113	105	-	7	1	0.07

Note: Universe Data.

Source: IBGE - Demographic Census

3.10 Description of the water supply system

The sub-district of Pilar in 2010 still had 6% of domiciles without water supply by the overall network. Being considered the most precarious sub-district in this item, the remaining sub-districts are attended by 98% of domiciles (Table 21).

TABLE 21- PERMANENT PRIVATE DOMICILES ACCORDING TO THE DOMICILE TYPE AND WATER SUPPLY FORM IN THE SUB-DISTRICTS OF THE COVERAGE AREA 2010.

Water Supply Form	Type of Domicile					Participation of the general network in total %
	Housing					
	Total	House	Town house / Condo	Apartment,	House of Rooms Tenement	
Mares	**1,371**	**1,095**	**34**	**233**	**9**	
General network	1,360	1,085	34	233	8	99.20
Well or spring on the property	4	4	-	-	-	
Well or spring outside the property	-	-	-	-	-	
Water wagon or rainwater	-	-	-	-	-	
River, pond, lake or stream	-	-	-	-	-	
Well or spring in the village	-	-	-	-	-	
Well or spring outside the village	-	-	-	-	-	
Other	7	6	-	-	1	
Paripe	**39,375**	**37,043**	**514**	**1,670**	**148**	
General network	38,588	36,328	498	1,622	140	98.00
Well or spring on the property	141	93	-	48	-	
Well or spring outside the property	49	45	3	-	1	
Water wagon or rainwater	19	19	-	-	-	
River, pond, lake or stream	9	1	8	-	-	
Well or spring in the village	-	-	-	-	-	
Well or spring outside the village	-	-	-	-	-	
Other	569	557	5	-	7	
Penha	**46,345**	**40,066**	**644**	**5,432**	**203**	
General network	46,043	39,790	642	5,411	200	99.35
Well or spring on the property	40	25	-	15	-	
Well or spring outside the property	6	5	1	-	-	
Water wagon or rainwater	9	6	-	2	1	
River, pond, lake or stream	1	1	-	-	-	
Well or spring in the village	-	-	-	-	-	
Well or spring outside the village	-	-	-	-	-	

Other	246	239	1	4	2	
Periperi	**25,689**	**23,461**	**141**	**1,359**	**728**	
General network	25,360	23,208	141	1,356	655	98.72
Well or spring on the property	67	64	-	2	1	
Well or spring outside the property	17	17	-	-	-	
Water wagon or rainwater	13	13	-	-	-	
River, pond, lake or stream	1	1	-	-	-	
Well or spring in the village	-	-	-	-	-	
Well or spring outside the village	-	-	-	-	-	
Other	231	158	-	1	72	
Pilar	**419**	**363**	**6**	**47**	**3**	
General network	393	338	6	46	3	93.79
Well or spring on the property	-	-	-	-	-	
Well or spring outside the property	14	13	-	1	-	
Water wagon or rainwater	-	-	-	-	-	
River, pond, lake or stream	-	-	-	-	-	
Well or spring in the village	-	-	-	-	-	
Well or spring outside the village	-	-	-	-	-	
Other	12	12	-	-	-	
Pirajá	**125,789**	**98,975**	**1,916**	**23,774**	**1,124**	
General network	124,224	97,547	1,905	23,718	1,054	98.76
Well or spring on the property	225	180	7	35	3	
Well or spring outside the property	93	88	-	3	2	
Water wagon or rainwater	57	53	-	4	-	
River, pond, lake or stream	10	9	1	-	-	
Well or spring in the village	-	-	-	-	-	
Well or spring outside the village	-	-	-	-	-	
Other	1,180	1,098	3	14	65	
Plataforma	**21,464**	**20,671**	**133**	**476**	**184**	
General network	21,048	20,411	133	476	28	98.06
Well or spring on the property	57	55	-	-	2	
Well or spring outside the property	26	26	-	-	-	
Water wagon or rainwater	4	4	-	-	-	
River, pond, lake or stream	4	4	-	-	-	
Well or spring in the village	-	-	-	-	-	
Well or spring outside the village	-	-	-	-	-	
Other	325	171	-	-	154	
Santo Antônio	**64,352**	**55,706**	**750**	**7,711**	**185**	

General network	**63,996**	**55,375**	**747**	**7,693**	**181**	**99.45**
Well or spring on the property	72	56	1	15	-	
Well or spring outside the property	32	32	-	-	-	
Water wagon or rainwater	9	9	-	-	-	
River, pond, lake or stream	-	-	-	-	-	
Well or spring in the village	-	-	-	-	-	
Well or spring outside the village	-	-	-	-	-	
Other	243	234	2	3	4	
São Caetano	**151,608**	**126,957**	**1,545**	**22,663**	**443**	
General network	150,574	125,959	1,544	22,634	437	99.32
Well or spring on the property	199	186	1	12	-	
Well or spring outside the property	190	185	-	4	1	
Water wagon or rainwater	49	49	-	-	-	
River, pond, lake or stream	6	6	-	-	-	
Well or spring in the village	-	-	-	-	-	
Well or spring outside the village	-	-	-	-	-	
Other	590	572	-	13	5	

Source: IBGE - Demographic Census.

3.11 Description of household electricity supply system

The electricity service in 2010 was present in 99% of permanent private domiciles in all sub-districts (Table 22).

TABLE 22 - PERMANENT PRIVATE DOMICILES ACCORDING TO DOMICILE TYPE AND THE EXISTENCE OF ENERGY IN THE SUB-DISTRICTS OF THE COVERAGE AREA IN 2010.

Sub-district and Existence of Electricity	Type of Domicile					
	Total	House	Town house / Condo	Apartment	Housing / Tenement	Participation %
Mares	**1,371**	**1,095**	**34**	**233**	**9**	
With	1,370	1,094	34	233	9	99.93
Without	1	1	-	-	-	
Paripe	**39,375**	**37,043**	**514**	**1,670**	**148**	
With	39,210	36,884	513	1,669	144	99.58
Without	165	159	1	1	4	
Penha	**46,345**	**40,066**	**644**	**5,432**	**203**	
With	46,267	39,998	643	5,429	197	99.83
Without	78	68	1	3	6	
Periperi	**25,689**	**23461**	**141**	**1359**	**728**	
With	25,626	23398	141	1359	728	99.75
Without	63	63	-	-	-	
Pilar	**419**	**363**	**6**	**47**	**3**	
With	416	360	6	47	3	99.28
Without	3	3	-	-	-	
Pirajá	**125,789**	**98975**	**1916**	**23774**	**1124**	
With	125,495	98690	1913	23773	1119	99.77
Without	294	285	3	1	5	

Plataforma	**21,464**	**20671**	**133**	**476**	**184**	
With	21,409	20616	133	476	184	99.74
Without	55	55	-	-	-	
Santo Antônio	**64,352**	**55706**	**750**	**7711**	**185**	
With	64,232	55595	748	7706	183	99.81
Without	120	111	2	5	2	
São Caetano	**151,608**	**126957**	**1545**	**22663**	**443**	
With	151,285	126641	1544	22661	439	99.79
Without	323	316	1	2	4	

Note: Universe Data.

Source: IBGE - Demographic Census.

3.12 Household monthly nominal income per capita

In the sub-districts analyzed, the household monthly income per capita of 50% of the domiciles was concentrated in the lower income classes between 1/4 to 2 monthly minimum wages. Paripe

concentrated the lowest income 44% of domiciles with per capita income up to ½ of minimum wage.

In the entire region only 10% of domiciles had per capita income above 5 minimum wages (Table 23).

TABLE 13 - PERMANENT PRIVATE DOMICILES IN MONTHLY NOMINAL INCOME CLASS PER CAPITA IN THE SUB-DISTRICTS OF THE COVERAGE AREA 2010.

Class of household monthly nominal income per capita	Mares	Paripe	Penha	Periperi	Pilar	Pirajá	Plataforma	Santo Antônio	São Caetano
Total	**1,371**	**39,375**	**46,345**	**25,689**	**419**	**125,789**	**21,464**	**64,352**	**151,608**
Up to 1/4 of minimum wage	52	6,516	4,406	3,374	54	13,570	2,722	5,303	14,387
From 1/4 to 1/2 of minimum wage	158	10,709	9,220	6,544	96	27,610	5,341	12,335	32,425
From 1/2 to 1 minimum wage	370	11,631	14,864	8,059	128	38,668	7,037	20,662	48,640
From 1 to 2 minimum wages	413	5,063	9,948	4,158	88	24,598	3,618	14,671	30,668
From 2 to 3 minimum wages	164	1,025	3,133	947	12	7,298	783	4,367	8,501
From 3 to 5 minimum wages	113	506	1,932	483	7	4,647	439	2,706	5,649
More than 5 minimum wages	55	181	888	172	1	1,890	121	1,163	2,795
No income	46	3,741	1,954	1,951	33	7,505	1,403	3,142	8,540

Notes:

1 - Data is from the Universe.

2 - Total category includes domiciles without declaration of household monthly nominal income per capita

3 - The No income category includes domiciles with monthly nominal per capita income only in benefits.

Source: IBGE - Demographic Census.

Table 24 describes the domiciles of the sub-districts in the analysis according to the existence of sanitary installations. The more precarious were the domiciles in Pilar where 1.91% had no bathroom or toilet, São Caetano (1.83%), Paripe (1.31%) and Periperi (1.09%).

TABLE 24 - PERMANENT PRIVATE DOMICILES ACCORDING TO THE EXISTENCE OF BATHROOM OR TOILET AND NUMBER OF BATHROOM FOR USE ONLY IN THE DOMICILE IN THE SUB-DISTRICTS OF THE COVERAGE AREA IN 2010.

Sub-district and Existence of bathroom or toilet and number of bathrooms for exclusive use of the domicile	Type of domicile					
	Total	House	Town house / Condo	Apartment	House of rooms Tenement	% of total
Mares	**1,371**	**1,095**	**34**	**233**	**9**	
They had bathroom for exclusive use in the domicile	1,350	1,083	34	233	-	98.47
1 bathroom	776	661	22	93	-	57.48
2 bathrooms	452	326	6	120	-	33.48
3 bathrooms	100	74	6	20	-	7.41
4 bathrooms or more	22	22	-	-	-	1.63
They had toilet	19	10	-	-	9	1.39
They had no bathroom or toilet	2	2	-	-	-	0.15
Paripe	**39,375**	**37,043**	**514**	**1,670**	**148**	
They had bathroom for exclusive use in the domicile	38,078	35,905	503	1,670	-	96.71
1 bathroom	32,618	30,708	347	1,563	-	85.66
2 bathrooms	4,810	4,595	118	97	-	12.63
3 bathrooms	524	481	33	10	-	1.38
4 bathrooms or more	126	121	5	-	-	0.33
They had toilet	782	656	10	-	116	1.99
They had no bathroom or toilet	515	482	1	-	32	1.31
Penha	**46,345**	**40,066**	**644**	**5,432**	**203**	
They had bathroom for exclusive use in the domicile	45,842	39,784	634	5,424	-	98.91
1 bathroom	33,404	29,577	522	3,305	-	72.87
2 bathrooms	10,126	8,109	98	1,919	-	22.09
3 bathrooms	1,768	1588	12	168	-	3.86

4 bathrooms or more	544	510	2	32	-	1.19
They had toilet	439	221	10	8	200	0.95
They had no bathroom or toilet	64	61	-	-	3	0.14
Periperi	**25,689**	**23,461**	**141**	**1,359**	**728**	
They had bathroom for exclusive use in the domicile	24,381	22,885	137	1,359	-	94.91
1 bathroom	20,217	18,825	117	1,275	-	82.92
2 bathrooms	3,584	3,490	17	77	-	14,70
3 bathrooms	460	452	2	6	-	1.89
4 bathrooms or more	120	118	1	1	-	0.49
They had toilet	1027	355	4	-	668	4.00
They had no bathroom or toilet	281	221	-	-	60	1.09
Pilar	**419**	**363**	**6**	**47**	**3**	
They had bathroom for exclusive use in the domicile	390	338	5	47	-	93.08
1 bathroom	334	299	3	32	-	85.64
2 bathrooms	50	35	2	13	-	12.82
3 bathrooms	6	4	-	2	-	1.54
4 bathrooms or more	-	-	-	-	-	-
They had toilet	21	17	1	-	3	5.01
They had no bathroom or toilet	8	8	-	-	-	1.91
Pirajá	**125,789**	**98,975**	**1916**	**23,774**	**1124**	
They had bathroom for exclusive use in the domicile	123,032	97,385	1,878	23,769	-	97.81
1 bathroom	103,270	82,318	1544	19,408	-	83.94
2 bathrooms	17,817	13,293	280	4,244	-	14.48
3 bathrooms	1,610	1463	48	99	-	1.31
4 bathrooms or more	335	311	6	18	-	0.27
They had toilet	1846	820	27	3	996	1.47
They had no bathroom or toilet	911	770	11	2	128	0.72
Plataforma	**21,464**	**20,671**	**133**	**476**	**184**	
They had bathroom for exclusive use in the domicile	21,006	20,402	130	474	-	97.87
1 bathroom	17,135	16,685	113	337	-	81.57
2 bathrooms	3,351	3,218	15	118	-	15.95
3 bathrooms	427	413	-	14	-	2.03
4 bathrooms or more	93	86	2	5	-	0.44

They had toilet	305	172	3	2	128	1.42
They had no bathroom or toilet	153	97	-	-	56	0.71
Santo Antônio	**64,352**	**55,706**	**750**	**7,711**	**185**	
They had bathroom for exclusive use in the domicile	63,755	55,317	744	7,694	-	99.07
1 bathroom	47,392	42,273	614	4,505	-	74.33
2 bathrooms	13,430	10,614	119	2,697	-	21.07
3 bathrooms	2,328	1,877	9	442	-	3.65
4 bathrooms or more	605	553	2	50	-	0.95
They had toilet	517	314	4	17	182	0.80
They had no bathroom or toilet	80	75	2	-	3	0.12
São Caetano	**151,608**	**126,957**	**1545**	**22,663**	**443**	
They had bathroom for exclusive use in the domicile	150,065	125,887	1521	22,657	-	98.98
1 bathroom	121,976	105,680	1206	15,090	-	81.28
2 bathrooms	24,406	17,501	226	6,679	-	16.26
3 bathrooms	2,988	2088	59	841	-	1.99
4 bathrooms or more	695	618	30	47	-	0.46
They had toilet	1150	685	23	6	436	5.36
They had no bathroom or toilet	393	385	1	-	7	1.83

Note: 1 - The category "They had toilet" included bathroom for common use for more than one domicile.

2 - Universe data.

Source: IBGE - Demographic Census.

Table 25 shows the population projections until 2020 in the nine sub-districts. On average, in the most dynamic sub-districts, it is expected an average growth of 0.61% per year, which corresponds to the growth in the region in the last ten census years. In less dynamic sub-districts, the growth pace very close to the vegetative remained the same. It is considered in these projections, there is still some migratory attractiveness to the region explained by the attractiveness of mobility that is created with the LRV. In the whole region, the population growth is projected to 0.45%.

TABLE 25 - POPULATION PROJECTION LIVING IN DOMICILES IN SUB-DISTRICTS 2010 - 2020.

Sub-districts	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Mares	5,093	5,093	5,093	5,093	5,093	5,093	5,093	5,093	5,093	5,093	5,093
Paripe	129,805	130,272	130,741	131,212	131,684	132,158	132,634	133,112	133,591	134,072	134,554
Penha	150,929	151,125	151,322	151,518	151,715	151,913	152,110	152,308	152,506	152,704	152,903
Periperi	83,886	84,398	84,913	85,430	85,952	86,476	87,003	87,534	88,068	88,605	89,146
Pilar	1,319	1,322	1,326	1,329	1,332	1,336	1,339	1,342	1,346	1,349	1,352
Pirajá	395,411	397,823	400,250	402,691	405,148	407,619	410,106	412,607	415,124	417,656	420,204
Plataforma	69,699	70,124	70,552	70,982	71,415	71,851	72,289	72,730	73,174	73,620	74,069
Sto Antônio	204,368	204,225	204,082	203,939	203,797	203,654	203,512	203,369	203,227	203,085	202,943
São Caetano	468,551	471,409	474,285	477,178	480,089	483,017	485,964	488,928	491,910	494,911	497,930
Total	1,509,061	1,515,792	1,522,563	1,529,374	1,536,225	1,543,117	1,550,050	1,557,024	1,564,039	1,571,096	1,578,194

Source: IBGE. Demographic Censuses of 2000 and 2010 - Sectors Aggregate.
Projections based on historical series.

3.13 Commerce and leisure equipment in the enterprise area

In the surroundings of the LRV Design there is hotel equipment, restaurants, services and worship places. The classification can be adopted to identify the areas for leisure and by adopting the classification contained in the PDDU of Salvador in 2007 are described the Urban-Environmental Value Areas and their subdivisions which are: I - Natural Resources Protection Areas, APRN; II - Cultural and Landscape Protection Areas, APCP; III - Maritime Border Areas, ABM; IV - Open Spaces for Recreation and Leisure, ERL; V - Wooded Areas, AA.

The main environmental and cultural attractions is *São Bartolomeu Park* located between Pirajá neighborhood and Cabrito cove, in the Suburb Railway of Salvador, houses four waterfalls, mangroves and the dam of Cobre River. One of the main points of the city with Atlantic Forest remnants in urban areas in Brazil, the park has value not only environmental, but also religious and historical. It is sacred site, including worship for the people of saint or Candomble.

The Park is located in the area of Cobre and São Bartolomeu Basin with 75 hectares that extend to the Municipality of Simões Filho, the Pirajá Historical Site (2,600 hectares) and Pirajá Metropolitan Park of 1,550 hectares. Aquatic environments are springs and dams of Cobre River, Nanã, Oshun and Oxumaré waterfalls and Lagoa da Paixão.

The *Lagoa da Paixão Park* is considered an Open Recreation and Leisure Space and identified in the area of influence of the LRV.

The *Todos os Santos Bay* and beaches where they delimitate and border the route of the LRV. Some beaches such as Itacaranha and São Tomé de Paripe are very frequented by the population of Salvador.

The Cultural and Landscape Protection Areas, APCP, surrounding the LRV Project are

1 - APCP - Historical Center of Salvador, established by Law No. 3289, September 21, 1983. The XVI - APCP of Penha/Ribeira; XVIII - APCP of Historical Park of Pirajá; XX - APCP of de Nossa Senhora de Escada and XXI - APCP of Sao Tome de Paripe.

The guidelines for the Border of Todos os Santos Bay (PDDU, SALVADOR, 2007) are the valorization and utilization of tourism potential and leisure of Salvador, to stimulate the development of nautical activities and those of support, as well as the implementation of complex or entertainment and leisure enterprises, and activities for culture, sport and tourism, such as hotels, marinas, restaurants, museums and theaters, protecting landscape characteristics and urban functions prevailing in each section. And the LRV will be a great vector of integration for the development of this region.

In the LRV region, the Canal de Cotegipe to Cabrito Cove received (PDDU Salvador, 2007) specific guidelines for economic development of the area, by creating conditions for the generation of agglomeration economies, having as axes the rehabilitation of the railway line, especially the bed and the stations, and the appreciation and use of direct contact spaces of Todos os Santos Bay.

Specific guidelines for the section of Tainheiros cove to Calçada include landscape preservation of Itapagipe Peninsula, ensuring the visualization of important historical places for the image of the City of Salvador, as example we have Colina do Bomfim, the beaches of Boa Viagem, Penha and Ribeira, and Ponta de Humaita.

3.14 Special areas

The Special Zones (ZE) are the areas that require the definition of specific criteria and restrictions for the planning and control of land use and occupation because of their social space and urban setting. They comprise two sub-categories: Special Areas of Social Interest (ZEIS) and Areas under Special Urban Regime (ZRE).

The Special Areas of Social Interest (ZEIS) are the areas for the implementation of urban, land and production regularization programs, maintenance or qualification of Social Interest Housing, HIS.

In the LRV Project coverage area there are 13 areas that make up the social interest and identified in the full extent of the LRV line. The Special Areas of Social Interest - ZEIS are: 27- Alagados Uruguai, 36 - Fazenda Grande, 56 - Lobato, 57 - Marechal Rondon, 65 - Novos Alagados, 66 - Ilha Amarela, 85 - Paraguarí, 86 - Nova Constituinte, 89 - Bate Coração, 110 - Pilar, 112 - Alto do Bom Viver, 115 - Pirajá, 116 - São Tomé de Paripe.

It also registered, in the PDDU - Salvador, 2007 a conceptual redefinition of the occupied ZEIS categories, which had been established from a single parameter: the question of ownership of the area - government or private. The new proposal considered important issues, especially environmental and cultural content, as the occurrence of precarious concessions in environmental preservation areas and areas of historical and cultural heritage of tourist interest, and where there is a predominance of traditional communities (fishing and Quilombo).

The following categories have been proposed:

- ZEIS 1 - precarious concessions located in lands belonging to the government or private entity in which there is a public interest in promoting urban and land regularization;

- ZEIS 2 - building or set of damaged buildings, occupied predominantly in the form of tenements or collective houses, located in areas with consolidated urban infrastructure in which there is a public interest in promoting building regularization, their reuse and regularization of the property of real-state units, used for the Social Interest Housing (HIS);

ZEIS 3 - unbuilt land and underutilized or unused buildings, and vacant buildings or in ruins, located in areas with infrastructure, suitable for occupation, where there is public interest in the implementation of Social Interest Housing (HIS);

- ZEIS 4 - precarious concessions occupied by low-income population located in areas of permanent preservation or inserted in protected areas where there is a public interest in promoting the means for land and urban regularization and environmental recovery, considering the current legislation;

- ZEIS 5 - settlement of remaining population of quilombos and traditional communities, linked to fishing and shellfish gathering, in public or private areas where there is a public interest in promoting land and urban regularization, environmental recovery and the measures necessary to maintain their traditions and culture.

3.15 The ZEIS in the coverage area of the LRV

Throughout the region of the Suburb Railway of Salvador there is a high population density. Various socio-environmental impacts that cause environmental degradation are identified (O Caminho das Águas em Salvador, 2010).

The identification of many Special Areas of Social Interest is justified by the disorderly occupation of the region, and the Paraguari River Basin, located in this suburb receives day and night on its path, the release of sewage. In this area, ZEIS - New Constituent has several buildings on the flood channel and buildings in areas occupied by Paraguari River.

The ZEIS of Lobato, in Tainheiros and Cabrito cove, suffered a disorderly occupation with the discovery of oil in 1939.

The Itapagipe Peninsula in the Itapagipe River Basin, in the last century was almost fully occupied and large areas of the sea were grounded in addition to construction of stilt houses, currently lies with many disorderly occupation marks and poor infrastructure.

Relevant issue is the contamination of water by mercury left by CQC - former Recôncavo Chemical Company industry. The Itapagipe Peninsula that is part of the Suburb Railway has the largest contamination by sewage and heavy metals of Todos os Santos bay.

The ZEIS of Uruguay, Alagados and Massaranduba is located in neighborhoods that arose in spontaneous occupation process, in swampy land and houses, mostly stilt houses built on mangroves. In the 1950s began urbanization, most recently it has been improved, but the slow urbanization process has brought great problems of ground and rubble.

The ZEIS - São Tomé de Paripe, in Drainage Basin with the same name, it has a mangrove located near the Quilombo de Tororó, whose quilombo descendants live from the variety of shellfish harvested in this mangrove, which was being hampered by the grounding of COCISA cement plant, which stopped working in 1990.

The descriptions of these special areas on the LRV path identify the major problems that still exist in the territory of the Suburb Railway of Salvador.

The environmental and economic degradation was significant in this region, calm beaches were being contaminated by the disorderly occupation in almost its entire length. The occupation of the most beautiful part of Todos os Santos Bay, unfortunately, occurred with strong environmental degradation and is now occupied by a population with income levels significantly lower than the rest of Salvador beach areas.

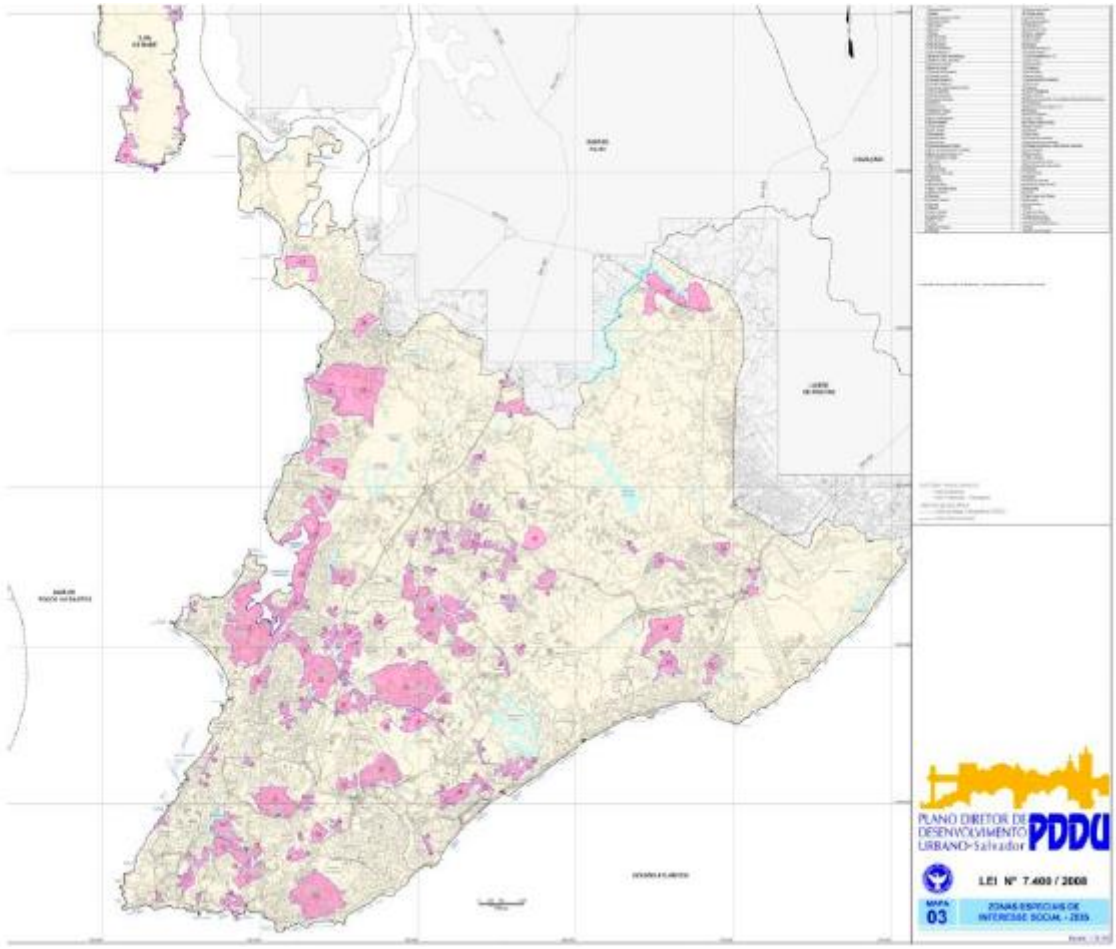

Figure 75 - ZEIS in Salvador according to PDDU

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4. LEGISLATIVE BASE

4.1 Federal Legislation

4.1.1 Historical and Cultural Heritage

Cultural heritage includes all "assets and rights of artistic, aesthetic, historical, tourist and landscape value."

All cultural property must have their essential characteristics preserved. When this is not respected, the MPF (Federal Prosecution Office) take the due measures, in or out of court.

As part of the historical heritage, there are two buildings of religious nature located in Escada and Ilha de Maré. The church Nossa Senhora da Escada has been listed by the Historical Heritage in 1953 and the church Nossa Senhora das Neves in 1962.

Despite its historical and architectural importance the church of São Tomé de Paripe is not an heritage listed. There are areas and remaining sheds at the right of way of the train, in Periperi, and other empty areas in the vicinity of Calçada Stop, Plataforma Stop, Escada Stop and Paripe Stop. These areas, already identified, will be the subject of future studies to implement social designs to revitalize the region.

From these areas, Escada, Praia Grande and Pátio de Periperi, were made available by the State Government, in agreement with CTB, for the implementation of the Nautical Tourism of the Department of Tourism - PRODETUR.

It operates, in the subjects listed below, when the asset is listed by IPHAN or when degradation or responsibility for the maintenance of the heritage is the responsibility of the Federal Government, local authorities and public companies, or when these ones are interested in its protection.

In the case of the region of Cidade Baixa of Salvador and Suburban Railway, one has to consider the limits of maritime borders, treated in this Volume.

4.1.2 Practice Areas in the Considered Universe

TABLE 26

Cultural Property	Listed personal properties and real state; architectural, urban, historical and scenic sets; illicit traffic in cultural property; documentary or archival heritage; archaeological heritage; intangible cultural heritage ("forms of expression, ways of creating, making and living"); cultural heritage in areas of environmental preservation; natural heritage within the preservation of cultural heritage ("outstanding natural landscapes", paleontological and speleological heritage); cultural heritage in the context of environmental licensing (assessment of impacts to cultural heritage in the Environmental Impact Assessment).
Water Resources	Protection of water sources; basins transposition; power generation; transport; agriculture (irrigation, pesticide use); drainage of streams; dredging; mining exploration; industrial pollution; public water supply and basic sanitation.
Fauna and Flora	Preservation of forest remnants (ecological corridors); endemic and endangered flora and fauna; biodiversity conservation: conservation units (land regularization, management systems in areas of direct use, indirect use and rights of traditional and indigenous populations; ordering the environment, the National System of Conservation Units / SNUG); Pressures of uses and occupation (urban sprawl, real estate and tourism enterprises, rural occupation, mining exploration, etc.); deforestation; logging exploration; biopiracy; traffic of wild animals; fires; desertification; Permanent Preservation Areas (riparian forests, mangroves, hills, slopes).
Coastal Area	Coastal management; pressures of urban sprawl; landfill of mangroves; coastal erosion; occupation and use of beaches; road, rail and port designs; industrial pollution; pollution from oil spills and other chemicals; sanitation in tourist resorts with floating population; estuaries, dunes and coastal lagoons; sustainable use of fisheries resources; biodiversity protection - coral bank; among other features.
Sanitation and Public health	Public supply; pollution by sewage; disposal of solid waste (domestic garbage, industrial waste, tires, batteries, PET, lamps, dangerous and toxic waste, etc.); urban drainage; vector and endemic diseases control; industrial pollution (supply for industry, generation of wastewater, industrial solid waste), Air pollution; noise pollution; water pollution; soil pollution.

4.2 Municipal legislation - Use and Occupation of Soil

4.3 Law No. 8.167/2012 (Effective)

LOUOS - Law for Planning Use and Occupation of Land in Salvador

Portions of the new LOUOS affecting the deployment area of the LRV and its immediate surroundings

CHAPTER IV - URBAN MOBILITY

Miscellaneous Section

Art. 187. It is understood as urban mobility moving of people or goods in the city space, using a displacement mode because of one or more travel reasons.

Sole paragraph. Urban mobility, through the Traffic and Transport System, fulfills the intra-urban and interurban joint function and is an important inducer of urban and regional development.

Art. 188. Urban mobility strategy defined in this law aims to integrate the various areas of the Municipality, providing accessibility to various regions, by defining a multimodal hierarchical road network, with traffic priority to collective passenger transport, and allows fluidity, comfort and safety to pedestrian traffic and vehicles in its different displacement needs.

Art. 189. The urban mobility is composed of the road system, as physical structure, combined to:

I - The operative modes;

II - The spatial coverage amplitudes;

III - The transport types, individual and collective;

IV - The passenger and cargo transport categories complemented by the connectors equipment;

V - The strength of systems, classified as low, medium and high.

§ 1 are considered operative mobility modes:

I - The foot mode, which is the displacement made by a person in his/her primitive way, walking;

II - The animal traction mode, corresponding to the displacement of persons or goods using animals, or vehicle pulled by animals;

III - The cycle-path mode, corresponding to the displacement of persons or goods using bicycle or tricycle;

IV - The road mode, corresponding to the displacement of persons or goods by means of vehicle on tires;

V - The rail mode, corresponding to the displacement of persons or goods by rail vehicle;

VI - The waterway mode, corresponding to the displacement of persons or goods carried by vessels;

VII - The air transportation mode, corresponding to the movement of persons or goods by aircraft, including helicopters, blimps and balloons;

VIII - The pipeline mode, corresponding to the displacement of goods through ducts;

IX - The funicular mode, corresponding to the movement of persons or goods through vehicle pulled by cables powered by stationary motor to overcome big height differences.

§ 2 It is considered spatial range amplitudes of the mobility:

I - Local coverage, corresponding to displacements performed within a neighborhood;

II - Municipal coverage, corresponding to the displacement carried out between different regions of the Municipality;

III - Metropolitan coverage, corresponding to the movements made between Municipalities being part of the Metropolitan Region of Salvador, RMS;

IV - Mega-metropolitan coverage, corresponding to the movements carried out between Salvador and cities located outside its Metropolitan Region, which maintain high intensity flows with the state capital;

V - State coverage, displacements occurring between Salvador and any Municipalities of Bahia that are not part of the Metropolitan and Mega-metropolitan Region;

VI - Interstate coverage, corresponding to displacements between Salvador and cities of other States;

VII - International coverage, corresponding to displacements between Salvador and cities in other countries.

Section II - Road Structure

Art. 190. The road structure of the Municipality is guided by the definition of a hierarchical network of routes covering the whole territory, made compatible with the Brazilian Transit Code, CTB, and appropriate to the physical characteristics of the existing roads.

Art. 191. Comprises the road network of the Municipality of the following road types:

I - Roads for pedestrians;

II - Bike paths;

III - Roads for vehicles;

IV - Special roads;

V - Waterways.

Art. 192. For the purpose of ranking the road system of the Municipality, the following categories are considered:

I - Expressway, VE, with the main function of promoting the connection between inter-urban road system and urban road system, forming the urban penetration system in the Municipality and counting, necessarily, with segregated lanes for public transport, which will have priority over any other existing or designed use in the area for its implementation;

II - Arterial road I, VA-I, the main function of interconnecting the various regions of the Municipality, promoting intra-urban connections of medium distance, articulating with expressways and other of lower category, counting, necessarily with segregated lanes for public transport, which will have priority over any other existing or designed use in the area for its implementation;

III - Arterial road II VA-II, having the same function Arterial Road I, differing only by their geometric characteristics, due to the impossibility of implementing marginal road and counting, whenever possible, with unique or preferred ranges for public transportation;

IV - Marginal road, VM with complementary function to the expressway and arterial road system, it is developed parallel to those mentioned, providing access to neighboring properties as well as interconnection with hierarchically lower roads;

V - Collector connection road, VCN, with the function of articulate routes of different functional categories, any hierarchy, given preference to passing traffic;

VI - Collector road I, VC-I, the main function of collecting and distributing the local traffic volumes and passage in routes between neighborhoods;

VII - Collector road II, VC-II, with the main function of collecting and distributing local traffic volume of neighborhoods centers;

VIII - Local road, VL, used strictly for local traffic, serves to provide access to housing, commercial and service activities, industrial and institutional activities and parking lots, parks and the like.

Sole paragraph. The expressways and arterial roads I and II comprise the Structural Road System of the Municipality.

Art. 193. The classification of the routes belonging to the road network in the Municipality of Salvador in categories referred to in Art. 192 will be held by means of a specific law, which must be updated every course of two years, meeting the functional and geometric criteria set out in Tables 2 and 3, of Annex 2 of this Law.

Sole paragraph. The road network of the Municipality, prioritized according to the criteria mentioned in the preamble, is represented on Map 04, of Annex 3 of this Law.

Art. 194. These are guidelines for the road network of the Municipality:

I - Preparation and implementation of the Master Plan of the Road System, PDSV;

II - Consolidation, completion and promotion of integration into the urban road system network;

III - Structuring the road system, with the support of BR - 324 and Avenida Luís Viana Filho (Av. Paralela), and articulated to the highway BA-526 (CIA - Airport), comprising the highway system in the Municipality;

IV - Completion of the transverse connections between the Atlantic Seaboard and Seaboard of Todos os Santos Bay through the implementation of new arterial roads, continuing the existing road system;

V - Compatibility of requests for opening new streets to the existing road system, ensuring the continuity of roads in urban areas of expansion;

VI - Structure and adequacy of physical characteristics of the roads in consolidated areas in order to promote the operational improvement of transit;

VII - Definition of new connections and local and regional road sections required for the system structure;

VIII - Development of functional plans for expressways and arterial roads, comprising the structural road system, institutionalizing them through Decree;

IX - Development of functional plan for Port Road, understood as primary cargo transportation corridor, to consolidate special access to the Port of Salvador, from BR-324, ensuring uninterrupted flow of vehicles;

X - Definition of indicators for monitoring, evaluation and systematic control of the levels of pollution caused by the gas emission of motor vehicle;

XI - Implementation and maintenance of landscape in areas free of the structural road system;

XII - Ecological potential valorization in the road designs crossing or tangent to Conservation Units.

Sole paragraph. The main interventions to be performed in the road network of the Municipality, to adapt it to the physical and operational performance requirements required, are listed in Table 04 of Annex 2 of this Law.

Section V - Public Passenger Transport

Art. 198. The Integrated Public Transport, SITC, is structured in hierarchical network, which follows a multimodal operational logic and ensures accessibility through the physical and operational model.

Sole paragraph: The Integrated Public Transport System, SITC, comprises the following subsystems:

I - Structural subsystem corresponding to the regular service network for public passenger transport, comprising integrated trunk lines, auxiliaries and feeders, and conventional lines;

II - Complementary subsystem, which operates on routes not served by the Structural Subsystem, with the function to complement it;

III - Auxiliary Subsystem, whose function is to facilitate the foot displacement, enabling accessibility to all modes of transport operating in the other subsystems.

Art. 199. The following categories are considered for ranking purposes of Public Passenger Transportation System:

I - High Capacity Transportation, passenger transport mode that operates in segregated roads, powered by integration stations, meeting the demands above 35,000 (thirty five thousand) passengers / hour / direction;

II - Medium Capacity Transportation, passenger transport mode that operates in segregated roads or exclusive lanes, meeting demands between 12,000 (twelve thousand) and 35,000 (thirty five thousand) passengers / hour / direction;

III - Low Capacity Transportation, passenger mode, complementary to the high and medium capacity system, which operates and ensures the micro accessibility of the transport system, circulating in mixed traffic.

Sole paragraph. The public passengers transport corridors, ranked according to the categories of high, medium and low capacity, are those represented in Map 05 of Annex 03 of this Law.

Art. 200. The following are general guidelines for the public passengers transportation:

I - Preparation and implementation of Master Plan for Urban Passenger Transport, PDTU in accordance with the relevant legislation;

II - Implementation of the Integrated Public Transport System, SITC, resulting from a new operating physical model in the Municipality;

III - Definition of a ranked system of public transport corridors that will allow for the progressive growth in demand over time and modes of transport that can meet the growing demands by replacing its technologies;

IV - Ensuring operational planning, adapting the service offer to the demand by the use of measuring instruments;

V - Implementation of segregated roads of mixed traffic, unique to the movement of public transport in the corridors, compatible with the existing or future demand levels, as established in item III;

VI - Guarantee of preferential treatment for public transport service, in the road system designs;

VII - Compliance with the requirement, by public transport vehicles, the accessibility requirements in specific technical standards;

VIII - Articulation of metropolitan and local transport system, aimed at streamlining the movement of the lines, on the tracks, transfer stations and terminals of Salvador;

IX - Promotion of measures to improve the information system for the user of the public passenger transport;

X - Consolidation of the articulation of the port and airport passenger terminals to the Integrated Public Transport System, SITC;

XI - Definition and monitoring of landing, take-off and movement sites in urban airspace, helicopters, seaplanes and aerostatic vehicles;

XII - Encourage to technological modernization using intelligent transport control systems;

XIII - Definition and implementation of passenger transport policy for the islands of the Municipality, integrated with the continental urban system;

XIV - Implementation in the areas of regular waterway traffic, signs indicating transport routes, anchoring areas and areas with fishing and diving ban;

XV - Implementation of the new bus terminal station in order to meet the long-distance travel demands, integrated to the high-capacity transport network in the Municipality;

XVI - Use of current bus terminal station in order to meet the demands of inter-municipal medium distance travels.

Art. 201. The following are guidelines for the high capacity transport:

I - Deployment of Line 01 of the high capacity transport, Cajazeiras / Lapa, the construction has already started;

II - Deployment of Line 02 of the high capacity transport, Mussurunga / Fuzileiros Navais;

III - Implementation of the additional expansion Sections, Lines 01 and 02 of high capacity transport;

IV - Implementation of Line 03 of the high-capacity transportation, STIEP / Fuzileiros Navais;

V - Fostering the implementation of the regional train station from Calçada station;

VI - Implementation of segregated roads for the movement of public transport in the structural corridors, making them compatible with existing and future demands;

VII - Promotion of physical and operational efficiency measures in multimodal integration in connection equipment.

Art. 202. The following are guidelines for the medium capacity transport:

I - Implementation of Longitudinal Multimodal Corridor of the Seaboard of Todos os Santos Bay;

II - Implementation of Transversal Corridors linking the Seaboard of Todos os Santos Bay to the Atlantic Seaboard;

III - Implementation of Central Corridors connecting regions of the consolidated urban area;

IV - Adoption of measures that prioritize public transportation in the medium capacity corridors;

V - Promotion of renewable energy use in vehicles operating in transport corridors.

Art. 203. The following are guidelines for the low capacity transport**:**

I - Ensuring the physical and operational integration of the low-capacity transport in the Integrated Public Transport System, SITC;

II - Institutionalization and regulation of water transport in the SITC;

III - Supplementary public transportation regulations in the Municipality;

IV - Implementation of regular public transportation in the islands of the Municipality articulated to the SITC;

V - Implementation, expansion and consolidation of hydro-port facilities in the Municipality;

VI - Implementation, expansion and consolidation of the tourism and recreational navigation system.

Section VI - Cargo Transportation

Art. 204. The functional organization of cargo movement in the territory of the Municipality includes:

I - The structure and hierarchy of multimodal network for shared cargo transport with general traffic;

II - Priority of addressing the corridors of greater cargo flow and providing greater risks, enabling better operational performance and access to transfer points, reducing costs and negative effects on the community and the environment.

Art. 205. The following categories of corridors are considered for the purpose of ranking the cargo transportation system:

I - Primary Corridor, CPR, for the cargo traffic from 15 (fifteen) tons;

II - Secondary Corridor, CSE, for the cargo traffic between 04 (four) and 15 (fifteen) tons;

III - Tertiary Corridor, CTE, for the cargo traffic of up to 04 (four) tons, carried by light vehicles.

§ 1. The cargo transport in the Municipality of Salvador is structured according to the unique routes and tracks defined in Map 06, Annex 03 of this Law.

§ 2. Specific municipal law, based on the guidelines of this Master Plan, shall regulate the cargo transportation on the territory of Salvador.

Art. 206. The guidelines for transporting loads are:

I - Preparation of Master Plan for Cargo Transportation, PDTC;

II - Incorporation of risk management to the planning in the sector, involving assessment of damages, operation protocols for load, unload and transportation, monitoring, contingency and emergency plans;

III - Compilation, review and regulation of legislation relating to cargo transportation in the Municipality;

IV - Implementation of Port Road, new road access connecting the Port of Salvador to BR-324 highway, near the highway complex of Acesso Norte;

V - Definition and implementation of the Cargo Transportation Policy of the Municipality in an integrated manner to the Transport Logistics Plan, PELT;

VI - Revitalization of industrial facilities along BR-324 highway for use as a marine retro-port;

VII - Assurance of railway integration with the Port of Salvador, encouraging the expansion of import and export services with national and international coverage;

VIII - Assurance of transport integration of loads generated and/or used within the State of Bahia with the seaport and cargo airport terminal of Salvador, in line with the National Program for Sensitive Goods, PRONABENS;

IX - Update and adequacy of incident standards on transport operations of dangerous and special cargo;

X - Promotion of integration of the intermodal cargo transportation system, with the implementation of new terminals and transshipment points;

XI - Definition of break-bulk cargo distribution policy in the centers and municipal sub-centers, with the use of light and medium vehicles;

XII - Definition and structuring of additional equipment for support the cargo transportation systems, aiming at rationality of trips in the Municipality;

XIII - Regulation and intensive monitoring of the transport of dangerous goods in the municipal territory and update and adequacy of incident standards on the transport of dangerous and special cargoes operations in various modes.

Section VII - Connection Equipment

Art. 207. The following are considered connection equipment:

I - Terminals, equipment for the embarkation and disembarkation of passengers and/or cargo, located at the ends of the transport routes;

II - Transshipment stations, equipment for the embarkation and disembarkation of passengers and/or cargo, where converge the transport routes in order to allow the transfer of passengers and/or cargo from one travel direction to another;

III - Parking lots, public or private spaces for protection or extended stay of motor vehicles;

IV - Ascenders, equipment pulled by cables, used for the transport of passengers and/or goods, which enable the displacement on the vertical or inclined plane, interconnecting local altimetric different levels by means of a fixed structure;

V - Berths, equipment used for embarkation and disembarkation of passengers and/or cargo of waterway transportation;

VI - Hydro-port, equipment used for the embarkation and disembarkation of passengers and/or cargo of waterway transportation;

VII - Heliports and helipads, equipment used for embarkation and disembarkation of passengers and/or cargo of air transportation using helicopters;

VIII - Airport, equipment used for embarkation and disembarkation of passengers and/or cargoes of air transportation.

Art. 208. The following are guidelines for connection equipment:

I - Gradual adequacy of accessibility of connection equipment and its surroundings according to the criteria of universal drawing and promotion of the articulation of these, with transport modes;

II - Use of equipment and mechanisms to reduce the integration time at transshipment environments, ensuring comfort and safety to the user;

III - Implementation of road integration terminal linked to the integration stations of high and medium capacity lines.

Section III - Subsystem of Areas of Urban-Environmental Value

Subsection I - Miscellaneous

Art. 223. Areas of Urban-Environmental Value are areas of the Municipality, public or private, provided with relevant material and/or symbolic attributes from an environmental and/or cultural point of view, significance for the environmental balance and comfort for the conservation of the local memory, the cultural expressions and also the sociability in the urban environment.

Art. 224. The Areas of Urban and Environmental Value are subdivided in:

I - Natural Resources Protection Areas - APRN;

II - Cultural and Landscape Protection Areas - APCP;

III - Maritime Border Areas - ABM;

IV - Open Spaces for Recreation and Leisure - ERL;

V - Wooded Areas - AA.

Art. 225. The Natural Resource Protection Areas, APRN, and Cultural and Landscape Protection Areas, APCP, will be regulated by specific legislation based on this Act, which shall contain:

I - The definition of the area;

II - Zoning, when appropriate, establishing areas of strict protection and buffer areas;

III - The criteria for protection of natural elements and cultural property within the area;

IV - The criteria and restrictions due to the land use and occupation, including for subdivision, if applicable;

V - Guidelines for the implementation of Urban Policy instruments;

VI - Specific standards for urban and environmental permits that are necessary.

Sole paragraph. Once established, the Natural Resource Protection Areas, APRN, and Cultural and Landscape Protection Areas, APCP, are not likely the disaffection of the respective categories.

Subsection III - Cultural and Landscape Protection Areas

Art. 229. The Cultural and Landscape Protection Areas, APCP, are intended for the conservation of significant elements of the cultural point of view, associated with memory, plurality and diversity of manifestations and forms of expression of the identities of the local society, and for urban and environmental image, comprising:

I - Sites built by monumental sets or individual monuments and their surroundings, historic and/or cultural value recognized by the Federal Government, the State or the Municipality;

II - Areas with buildings typologies and ambiences of symbolic value and/or significant for the fixing of memory and culture of the city, or a particular social, religious or ethnic group;

III - Areas of archaeological interest, consisting of segments of the physical environment modified by human action according to behaviors culturally determined and material proofs that have potential information about past relationships and socio-cultural processes, including:

a) the areas where there is overlap of occupations;

b) groups of buildings with chronological and functional unit, only traces of one point of historical construction of the city or representatives of a particular social, religious or ethnic group;

c) sites identified or likely to exist indigenous material in the underground, based on documentary news and bibliographic documents of indigenous settlements, areas of degraded former colonial and post-colonial occupation, ruins, areas for elimination of proven traces;

IV - Natural landscape elements, such as flora, geomorphology and geological formation, water mirrors or other natural conditions that constitute the scenic and/or symbolic reference.

Sole paragraph. The Cultural and Landscape Protection Areas, APCP, shall contain, at the time of its regulation, the landscaped surroundings in which shall be preserved the specimen visual and/or set to be protected.

Art. 230. Notwithstanding the classification and delimitation of other areas by specific law, those areas defined in the Map 07 of Annex 3 are classified as Cultural Protection Areas and Landscape, APCP, being part of this Law:

I - APCP comprising the Historic Center of Salvador and other areas indicated, established by Law No. 3.289, of September 21, 1983;

II - APCP IIê Iyá Omin Iyámassê (Terreiro do Gantois) established by Law No. 3.590, of December 16, 1985;

III - APCP comprising the candomblés Ilê Axé Iyá Nassô Oká (Terreiro da Casa Branca do Engenho Velho), Ipatitió Gallo (Terreiro São Jerônimo), and Zoôgodô Bogun MalêRundô (Terreiro do Bogun) established by Law No. 3.591, of December 16, 1985;

IV - APCP Ilê Axé Opô Afonjá (Terreiro de São Gonçalo do Retiro), established by Law No. 3.515, of July 22, 1985;

V - APCP Ilê Asipá, established by Law No. 5.773, of August 23, 2000;

VI - APCP Nossa Senhora do Resgate, established by Law No. 5.860, of December 29, 2000;

VII - APCP of Morro do Gavazza;

VIII - APCP Ladeira da Barra / Santo Antônio da Barra;

IX - APCP of Morro Clemente Mariani;

X - APCP of Encosta da Vitória;

XI - APCP of Encosta do Canela;

XII - APCP of Encosta de Ondina/São Lázaro;

XIII - APCP of Rio Vermelho;

XIV - APCP of Monte Serrat;

XV - APCP of Colina e Baixa do Bonfim;

XVI - APCP of Penha/Ribeira;

XVII - APCP Terreiro de Candomblé do Bate Folha Manso Banduquemqué;

XVIII - APCP of Parque Histórico de Pirajá;

XIX - APCP Onzó Ngunzo Za Nkisi Dandalunda Ye Tempo (Terreiro Mokambo);

XX - APCP of Nossa Senhora de Escada;

XXI - APCP of São Tomé de Paripe;

XXII - APCP of Nossa Senhora das Neves, in Ilha de Maré;

XXIII - APCP of Nossa Senhora de Guadalupe, in Ilha dos Frades;

XXIV - APCP of Loreto, in Ilha dos Frades;

XXV - APCP of Bom Jesus dos Passos, in Ilha do Bom Jesus dos Passos;

XXVI - APCP Jardim de Allah;

XXVII - APCP of Praia dos Artistas;

XXVIII - APCP of Piatã.

Art. 231. The following are general guidelines for the Cultural and Landscape Protection Areas, APCP:

I - Regulation, by specific legislation, of the areas indicated in this Law for institutionalization as APCP;

II - Identification, mapping and delineation of new areas of the Municipality, subject to classification as APCP, to be institutionalized by specific law;

III - Update, expansion and/or complement the existing municipal legislation, in partnership with government agencies from other levels of government with related expertise in the protection of cultural heritage, covering the areas of cultural and scenic interest in the Municipality;

IV - Preservation and enhancement of the sites, monuments and its surroundings with respect to changes in morphology, volumes of buildings, internal and external appearance, ambience and urban silhouette;

V - Development of urban designs, standards, specific procedures and intervention programs with community participation, prioritizing the use for recreational, educational, cultural and tourist activities;

VI - Definition of infrastructure designs that can act as catalysts for development in areas under deterioration process of the urban structure, with an emphasis on housing issue;

VII - Establishment of partnerships with public and private institutions for conservation, restoration and management of cultural property being part of APCP;

VIII - For areas of archaeological interest:

a) completion of the current municipal legislation with a view to disciplinary research and interventions in the areas of archaeological interest;

b) requirement of Liability Declaration for enterprises licensing in archaeological sites;

c) control of the integrity of elements and areas of archaeological interest and recovery of those degraded.

Art. 232. For APCP of Vitória Slope, the following criteria and restrictions are applied on land use and occupation:

I - Within the limits of APCP, it will not be allowed to build, except for the construction of the pier type equipment, aerial railway and funicular, through environmental impact assessment by the competent agency;

II - The vegetation covering and the morphology of the land shall be preserved, unless its eradication is essential for the implementation of equipment listed in item I, according to the indications of the environmental assessment;

III - If authorized the eradication of trees, replanting of other on-site will be mandatory, in equal number and preferably of the same species, and is not allowed introduction of exogenous vegetation.

Art. 233. For APCP of Canela Slope, the following criteria and restrictions are applied on land use and occupation:

I- Preservation of the morphology of the land and vegetation covering;

II - In the case of authorization for the eradication of trees, obligatoriness of replanting others in place, and preferably the same number of the same kind, and should be avoided introducing exogenous vegetation;

II - The real estate with tested to Ruas Marechal Floriano and Basílio da Gama can only be accessed via these routes, and is not allowed direct connection with the valley.

Art. 234. The APCP of Ondina / São Lázaro Slope is deemed non-buildable area, being prohibited all forms of occupation or use, which may compromise the integrity of the site.

Subsection IV - Maritime Edge Area

Art. 235. The Maritime Edge Area, ABM is the strip of land in contact with the sea, between the waters and the limits behind the first line of hills or topographic masses, which stand on the mainland, in which is set the silhouette of the City.

Sole paragraph. For purposes of this Law, the Maritime Edge Area comprises two distinct environments, subdivided into sections represented in Map 07, Annex 03 of this Law:

1 - Edge of Todos os Santos Bay, comprising:

a) Section 1 - Cotegipe Channel to Cabrito Cove;

b) Section 2 - Tainheiros Cove to Calçada;

c) Section 3 - São Joaquim to the ramp of the former Mercado Modelo;

d) Section 4 - Conceição to Vitória Slope;

e) Section 5 - Ladeira da Barra Slope to the Farol da Barra;

II - Atlantic Edge, comprising:

a) Section 6 - Farol da Barra Beach to Centro Espanhol;

b) Section 7 - Ondina to the Beach of Moças Basin;

c) Section 8 - Alto da Sereia to Amaralina;

d) Section 9 - Pituba to Armação;

e) Section 10 - Boca do Rio to Jaguaribe;

f) Section 11 - Piatã to Itapuã;

g) Section 12 - Stella Maris to Ipitanga.

Art. 236. The following are guidelines for the Edge of Todos os Santos Bay:

I - Valorization and utilization of tourism potential and leisure of Todos os Santos Bay, to stimulate the development of nautical activities and those of support, as well as the implementation of complex or entertainment and leisure enterprises, and activities for culture, sport and tourism, such as hotels, marinas, restaurants, museums and theaters, protecting landscape characteristics and urban functions prevailing in each section;

II - Valorization and/or requalification of spaces and public use equipment and specific treatment for the use and occupation in the surrounding areas of architectural and/or historical monuments contained in each section of the Seaboard of the Bay;

III - Urban-Environmental restoration or relocation of occupations located in risk areas for human occupation, especially in cases of steep and unstable slopes, in areas of tidal influence, in wetlands and permanent preservation.

§ 1 The following are specific guidelines for the section from Cotegipe Channel to Cabrito cove:

I - Encouraging economic development of the area, by creating conditions for the generation of agglomeration economies, having as axes the requalification of the railway line, especially the bed and the stations, and the valorization and exploitation of spaces of direct contact with Todos os Santos Bay;

II - Implementation of programs for the installation of centers of culture, entertainment, leisure and tourism, like marinas, sports complexes and educational centers;

III - Regularization of occupations located in risk areas and urban-environmental recovery;

IV - Recovery of the environmental quality of Cabrito Cove.

§ 2 the following are specific guidelines for the section from Tainheiros Cove to Calçada:

I - Preservation of Itapagipe Peninsula, ensuring the visualization of important historical places for the image of the City of Salvador, as example we have Colina do Bomfim, the beaches of Boa Viagem, Penha and Ribeira, and Ponta de Humaitá.

II - Exploitation of nautical potential of Itapagipe Peninsula by incentive for implementation of marinas, docks and equipment to support activities related to the maritime economy;

III - Implementation of programs for the installation of culture and entertainment centers in the old existing industrial structures, like sports complexes and educational centers, functioning as attractiveness elements integrated to tourism and leisure circuits;

IV - Recovery and conservation of environmental quality of Tainheiros cove and regularization of precarious occupations in the areas of tidal influence;

V - Urban and landscape treatment of the existing rail network, favoring leisure, tourism and housing functions, avoiding the devaluation of the areas adjacent to the corridors.

§ 3 The following are specific guidelines for the section of São Joaquim to the ramp of the former Mercado Modelo:

I - Environmental restoration with revegetation and control of occupation throughout the area of influence of the Geological Failure, especially on the slope of the central and surrounding area, and valorization of areas of high portion, with requalification of viewpoints and improving accessibility;

II - Valorization of the Port area and requalification of Feira de São Joaquim, allowing visualization and expanding access to the sea;

III - Urban intervention and improvement of urban infrastructure, especially the Comércio area, with a view to recovery of the attractiveness of the area, creating comfortable conditions for the movement of pedestrians and vehicles.

§ 4 The following are specific guidelines for the section from Conceição to Vitória Slope:

I - Valorization of the section Conceição / Gamboa / Aflitos, ensuring accessibility to the beach, preserving the profile of the area and the occupation typology, and encouraging the use of buildings for mixed and public use activities, taking advantage from landscape resources in a sustainable manner;

II - Encouraging activities for culture and tourism, such as hotels, restaurants, museums and theaters, pointing out the features of the landscape and urban functions;

III - Control of the use and occupation of the slope and promotion of public access to the beaches.

§ 5 The following are specific guidelines for the section from Ladeira da Barra Slope to Farol da Barra:

I - Preservation of landscape, ensuring the visualization of important historical views for the image of the City, such as Colina de Santo Antônio da Barra, viewpoints of Iate Clube and Ladeira da Barra, Ladeira da Barra Slope, Morro de Clemente Mariani, fortifications in the waterfront and other buildings of cultural value;

II - Urban requalification in the area of Ladeira and Porto da Barra, with valorization of viewpoints, improving the circulation of pedestrians and renovation of damaged buildings, favoring the deployment of equipment that provide services supporting the culture, leisure and tourism.

Art. 237. The following are guidelines for the Atlantic Edge:

I - Encouraging service activities, with emphasis on leisure, culture and tourism, especially the hotel business;

II - Urban requalification in spaces ranging from the beach strip and the first built block, especially of public spaces, implementing on it, equipment and suitable furniture;

III - Height control of the buildings in the first blocks near the sea, limited by the possibility of shading the beach in the period from 8:00 (eight) a.m. until 04:00 (four) p.m., and safeguarding the ventilation of interior spaces;

§ 1 The following are specific guidelines for the section from Farol da Barra Beach to Centro Espanhol:

I - Incentives for replacement of damaged buildings and occupation of underutilized spaces located on the blocks next to the sea;

II - Expansion of seaside sidewalks, favoring the movement of people, bikers and sports.

§ 2 The following are specific guidelines for the section from Ondina to the beach of Moças Basin:

I - Improvement of housing conditions, with the regularization of occupation and control over the expansion of the occupations of São Lázaro, Alto de Ondina and Alto da Alegria;

II - Expansion of seaside sidewalks, favoring the movement of people, particularly people with disabilities or reduced mobility, cyclists and sports.

§ 3 the following are specific guidelines for the section from Alto da Sereia to Amaralina:

I - Adoption of road solution that will better integrate the area in the section between Paciência and Amaralina, creating spaces that allow free movement and interaction of people, according to the tourism and leisure potential;

II - Protection of benchmarks and landscape, contemplating the view and preservation of Paciência Beach, with its ancient balustrade, sites and buildings of cultural value, including Largo de Santana, Casa do Peso, the Viewpoints of Alto da Sereia and Alto da Enseada, the remaining architectural examples of the late nineteenth century and early twentieth century and scenarios of important events for the local culture, such as the traditional Festa do Rio Vermelho;

III - Incentives for implementation of new residential uses in the blocks next to the sea located between Av. Visconde de Itaboraí and Av. Otávio Mangabeira.

§ 4 The following are specific guidelines for the section from Pituba to Armação:

I - Extension of reurbanization designs to Avenida Otávio Mangabeira and Rua Minas Gerais and intensification of tree planting in public areas on the beach strip;

II - Incentives for the implementation of residential uses and enterprises focused on leisure and tourism.

§ 5 The following are specific guidelines for the section from Boca do Rio to Jaguaribe:

I - Review of land use patterns, favoring the replacement of damaged and underused structures by new residential uses and economic activities related to culture, leisure and tourism;

II - Landscape integration from Pituaçu Park to the Atlantic Seaboard, with the qualification of the space between the two traffic lanes.

§ 6 the following are specific guidelines for Section 11 - Piatã to Itapuã:

I - Urban and architectural requalification of circulation spaces and equipment located on the beach strip, favoring free access and view of the sea, especially in Piatã and Itapuã;

II - Creation of spaces for circulation of pedestrians and cyclists on the road between Av. Orlando Gomes to Av. Dorival Caymmi;

III - Control of new informal occupations and reurbanization of Itapuã downtown and surrounding of Farol de Itapuã and Lagoa do Abaeté.

§ 7 The following are specific guidelines for the section from Stella Maris to Ipitanga:

I - Incentive for the location of hotel enterprises, taking advantage of the area's conditions for the deployment of resorts and similar equipment;

II - Redefinition of the road system in land subdivisions Alamedas da Praia and Praias do Flamengo, in order to meet the current and future traffic demands, resulting from the implementation of tourism and leisure equipment.

Art. 238. The buildings to be implemented in the Maritime Border Areas are subject to the maximum height clearance restriction, according to Map 08, Annex 3, and other criteria established in this Law and the planning legislation of land use and occupation.

§ 1 In Atlantic Seaboard, the first blocks near the sea, respecting the maximum limit established in this article, the height of buildings in the Maritime Border Area is limited by a plane that forms an angle to the horizontal plane, with the vertex being the limit of the coastal road sidewalk to the beach strip.

§ 2 The angle referred to in §1 will be 38° (thirty eight degrees) for sections 6, 7, 8, and 21° (twenty one degrees) for sections 9, 10 and 11, according to the Map 08, of Annex 3 of this Law.

§ 3 The maximum height clearance in the maritime border area of section 8, between Rua Vila Matos and Rua Euclides de Matos, is limited to 12 m (twelve meters).

Art. 239. PROHIBITED.

Art. 240. In areas where the clearance is increased in relation to that one defined in Law No. 6.586/2004, it will be made the collection of compensation, in accordance with Articles 85, 86 and 87 of the Organic Law of the Municipality of Salvador, by the permissiveness created herein.

PARTS OF THE LAW RELATING TO THE NEIGHBORHOOD IMPACTS

SECTION III

Applicable to Enterprises and Activities with Potential Neighborhood Impact.

Art. 34. The enterprises and urban activities, for its capacity to attract traffic, and, depending on its coverage, for its interference in the vicinity traffic, may require a previous study, prepared by qualified professionals, from which they will depend, in order to get their licenses or authorizations from the Municipal Government for the construction, expansion or operation in the urban area.

Sole paragraph. The study referred to in the heading of this article, called the Neighborhood Impact Study - EIV, aims to assess the positive or negative changes produced by the enterprise or activity, the economic, social and environmental aspects in the area of influence of the enterprise and indicate the mitigating measures of these impacts.

Art. 35. It is established the following classification for the EIV according to the degree of impact of enterprises and activities in the urban structure:

I - EIV-1: designed for activities and enterprises that by their nature are causing medium impact, have regional coverage and can be deployed on local roads in predominantly residential areas;

II - EIV-2: designed for activities and enterprises that by their nature are causing great impact and have municipal coverage.

Sole paragraph: The study referred to in item I of this article, called EIV-1, will only be required for enterprises or activities allowed in the Collectors Routes of Predominantly Residential Areas may occur in Local Routes of these Areas.

Art. 36. The activities and enterprises for which the EIV's are needed are those contained in Table V.7 of Annex 5 and must meet the requirements established therein for the category that they fall, in addition to other provisions of this Law.

§ 1 The approval of enterprises and licensing of activities requiring EIV-2, located in any area of the city and EIV-1, located in Predominantly Residential Areas, specific AOP request issued by the Municipal Planning and Administration agency shall be mandatory.

§ 2 The Activities and Enterprises to be implemented in lots being part of land subdivisions regularly approved from the effective date of this Law are exempt from conducting Neighborhood Impact Studies - EIV-1.

§ 3 The enterprises classified as E-7, according to Table III.1 of Annex 3 of this Law shall be subject to special analysis by the competent agency.

Art. 37. The competent agency of the Municipal Administration shall require from the person responsible for the approval request of the Enterprise and/or Activity subject to Neighborhood Impact Studies borne all expenses of research, specific studies and logistics that are necessary for the analysis of the design, to be performed, at its expense, improvements and public works or services related to mitigation of the impact arising from the implementation of the enterprise or activity, especially in the road system operation aimed at EIV, covering the following aspects:

I - For EIV-1 may be required:

a) geometric adaptation to the surrounding road system;

b) horizontal and vertical road signaling for regulation, warning, guidance and traffic signal;

c) adjusting the structural road system, inserted in the area of influence;

d) mitigation of visual and environmental impacts possibly indicated in the studies;

II - For EIV-2 may be required:

a) geometric adaptation to the surrounding road system;

b) horizontal and vertical road signaling for regulation, warning, guidance and traffic signal;

c) adaptation to structural road system, inserted in the area of influence, completion or implementation of the road system and equipment needed for the circulation in the surrounding of the enterprise or activity;

d) deployment of system and support equipment to public transportation;

e) deployment of system, and

e) deployment of monitoring system and equipment and traffic management;

f) mitigation of visual and environmental impacts indicated in the studies.

Art. 38. The Neighborhood Impact Study will be referred to a committee composed of representatives of agencies of the Municipal Administration, listed below:

I - 1 (one) member representing the municipal Planning agency, the chairperson;

II - 1 (one) representative member of the municipal agency responsible for licensing of Enterprises and Activities;

III - 2 (two) members representing the municipal agency responsible for traffic and transportation system;

IV - 1 (one) representative member of the municipal agency responsible for the environment;

V - 1 (one) representative member of the municipal agency responsible for culture.

Sole paragraph. The operating standards of the committee referred to in this Article shall be defined by the Municipal Administration planning agency.

Art. 39. The Municipal Executive Order shall set the procedures routines to analyze and issue an opinion regarding the approval requests for enterprises and activities that are necessary Neighborhood Impact Study - EIV.

4.3.1 PARTS OF THE LAW RELATED TO ADEQUACY IMPACTS SECTION IV

Applicable to the Enterprises and Activities in function of their Adequacy for Use and Surrounding Infrastructure - Locational Compatibility Criteria.

Art. 40. Locational Compatibility Criteria are those contained in Tables VI.1 and VI.2 of Annex 6 of this Law.

Chapter IV

Restrictions on Use and Occupancy Applicable as a Result of the Nature of the Enterprise and Activity and its insertion in Areas or Properties being part of the Architectural Heritage Listed by the Institute of National Historical and Artistic Heritage - IPHAN in Ranges of the Infrastructure Systems Domain, Protection Areas of the Surrounding of Military Buildings, Airports Protection Areas, Aerodromes and Heliports and Spaces being part of the Environmental and Cultural Value Areas System - SAVAM, or in Areas with Specific Designs.

4.3.2 PARTS OF THE LAW RELATED TO USE RESTRICTIONS SECTION I

Restrictions on Use and Occupation Applicable to Enterprises and/or Activities located in Areas or Real State being part of the Architectural Heritage Listed by the Institute of National Historical and Artistic Heritage - IPHAN.

Art. 90. The Enterprises and Activities located in areas or real state being part of the architectural heritage listed by the Institute of National Historical and Artistic Heritage - IPHAN are exempted from the requirements of this Law, in what those requirements are contrary to the provisions of this agency and may be licensed after prior approval of SPHAN, subject also to the provisions of Law No. 3.289/83 and other listing laws in state and federal level.

Sole paragraph. The general standards for the preparation and presentation of these designs will be provided by each agency, according to its competence.

Art. 91. The enterprises on land located in the listed architectural complexes have their recesses, height clearances, agency of facades and roofs treatment conditioned by the requirements of IPHAN, according to the specific standards established by this Law.

Art. 92. In the areas surrounding real state or listed architectural complexes, up to a distance of 500 m (five hundred meters), clearances and facade agency will be established by IPHAN agency, subject to the other specific requirements of this Law, unless the property is part of APCP, which already has been subject matter of regulation.

SECTION II

Restrictions of Use and Occupancy Applicable to Enterprises and or Activities located in Right of Way of Infrastructure Systems, Protection Areas Surrounding Military Buildings, Airports Protection Areas, Aerodromes and Heliports.

Art. 93. The relevant agencies should be consulted and in compliance with the relevant legislation, subject to the other requirements of this Law.

SECTION III

Restrictions of Land Use and Occupation to Maritime Border Area

Art. 94. Buildings in the Maritime Border Areas are subject to clearance restrictions set in Plant No. 02 in Annex 8 of this Law.

Art. 95. In lands being part of the areas with fixed clearance, bounded on plant No. 02 of Annex 8 of this Law, the standards established in this Section relating to recesses, Occupation Indices and garages, take precedence over the other standards established by this Law and the following provisions should be noted:

I - Garage in underground may occupy any land area, respecting the minimum permeability index established for the Area in which is situated, except as provided in subitem "d" of item II of art. 46 of this Law;

II - The side recess are applied to both sides of the land and is not allowed to abut in any of the boundaries, except in the case of buildings with height clearance up to 12.00 m (twelve meters);

III - The front, side and back recesses of the buildings located in sections 04 to 12 of the Maritime Border Area, according to Map 08 of Annex 3 of Law No. 7.400/08, must meet the following criteria:

a) for buildings higher than 12 m (twelve meters) observed a minimum of 5.00 m (five meters), the front recess will result from the formula:

RFP = 0.60 m + 5.00 m x [(N - 6.00 m) * 3.00 m], wherein:

RFP - is the progressive front recess, set in meters;

N - is the maximum height clearance of the building, set in meters;

b) observing the minimum of 2 m (two meters) of RLP, in lands with tested below 20 m (twenty meters); minimum of 3 m (three meters) of RLP, on tested land between 20 m (twenty meters) and 49 m (forty-nine meters) and minimum 7.0 m (seven meters) of RLP in the land with tested over 49 m (forty-nine meters), the side recesses are resulting from the application of the formulas:

b.1. Lands with tested below 20 m (twenty meters);

RLP = 0.30 m + 2.00 m x [(N - 12.00 m) * 3.00 m];

b.2. Lands with tested between 20 m (twenty meters) and 49 m forty-nine (meters);

RLP = 3.00 m + 0.30 m x [(N - 12.00 m) * 3.00 m];

b.3. Lands with tested above 49 m (forty-nine meters):

RLP = 7.00 m + 0.30 m x [(N - 12.00 m) * 3.00 m], wherein:

RLP - is the Progressive Side Recess defined in meters;

N - is the maximum height clearance of the building, set in meters;

c) Bottom recess shall be at least 3.00 m (three meters);

IV - For buildings located in sections 01 to 03, the Maritime Border Area according to the Plant 2 of Annex 8 of this Law, the front, side and bottom recesses are those established in this Law for the zone in which it is located;

V - All facades to be coated with durable and impermeable materials.

Sole paragraph. The Progressive Side Recess is also used with respect to both side boundaries of the land.

Art. 96. Enterprises up to 12 m (twelve meters) high, located in the Maritime Border Area will be subject to the recesses established for the area in which are located, respecting the minimum main front recess of 5 m (five meters), assuming that the secondary front recess, where appropriate, meets the respective zonal front recess.

5. INVESTMENT'S REASONS

5.1 Needs Program

The State of Bahia, by recently incorporates CTS - currently CTB, assumes the responsibility to provide, regular, order, dispose, arrange and promote, intending with it to push, working to advance and foster a Need Program and Functional Plan adequate and consistent with mobility for the installation and operation of a Metropolitan Rail Transport System.

This System, fully integrated with Road, Rail and even Maritime Urban Modals, is supported by principles and assumptions of a *Planning Process* and a Mobility Needs Program, complementing the attitudes that has been taken to plan and start building in the City of Salvador, a series of corridors aimed at better structuring the road modal for urban mobility and now the completion and operation of the Subway System, revised operationally and expanded to meet to the urban center of Lauro de Freitas, passing through the Airport and, in the other bias, future installations of the New Bus Station in Águas Claras.

The difficulties to face this proposition are immense, ranging from the need for requalification, modernization of devices and implementation of safety and security structures, to the conditioning of acquiring timely spare and repair parts of the permanent track, existing and in precarious operation, among the unique sections still in traffic; i.e., Calçada - Paripe. This system, which has electrified double line, is currently operating in a section, in only one of them, due to a landslide that cut, for quite some time, one side of the line.

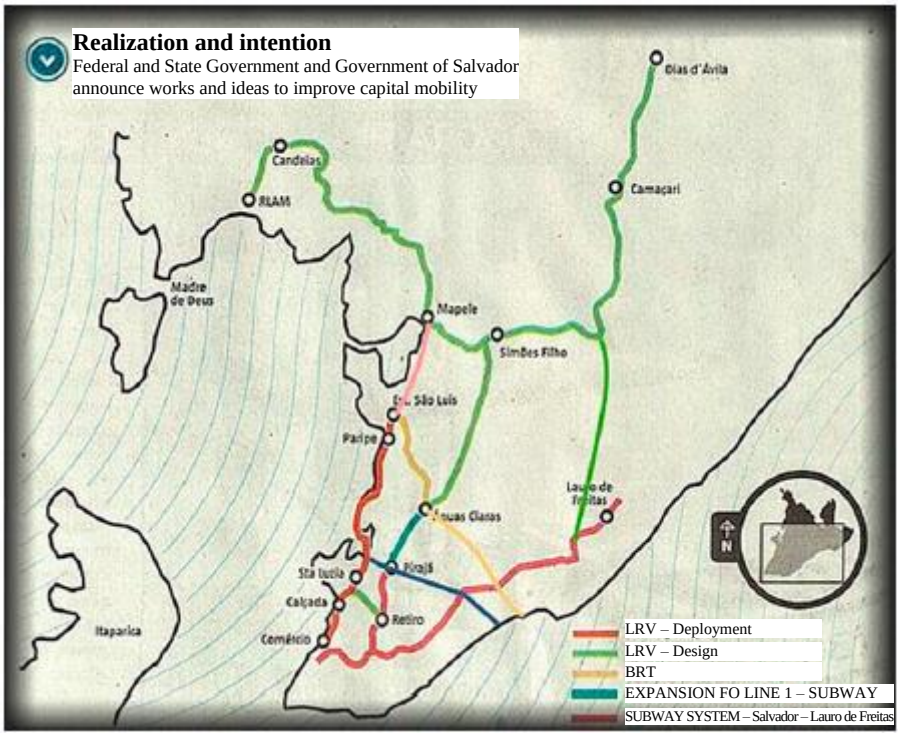


Figure 76 - Map of the rail plan.

The assessment made by the Government's technicians after the assumption of CTB points to the need for the road requalification in this section, in order to suit a transport fleet - LRV, which despite being lighter is faster, requiring geometric corrections from the permanent route in the superstructure and grid correction for regulatory classification of the clearance, in order to prevent derailment accidents.

Since the purpose of the government is to install a rail transport corridor with comfort, fast and possible frequency between Comércio Stop, passing through Calçada and reaching São Luís, it was started a series of assessment procedures of the conditions for the implementation of an extension of the Permanent Route, which could reach the Comércio center, as close as possible of the Mercado Modelo, Lacerda Elevator, Plano Inclinado and Maritime Stations of Passenger and Tourism, in order to support the formation of decisions and the temporal direction of the required activities.

In order to carry out this Enterprise, the State Government relied on a Needs Program as the basis of a planning process, structured in the traditional objectives, guidelines and goals.

The main objectives are listed below:

- Re-qualify the permanent electrified track and in double track, of the existing connection and operation of the section Calçada - Paripe;
- Extend the section Calçada - Paripe through the implementation of a new Permanent Track, connecting the Comércio Center, near the Lacerda Elevator and Plano Inclinado up the Calçada Station, using Light-Rail Vehicle - LRV;

- Implementation of a new Extension of Permanent Track connection the Comércio Stop (LRV) to Lapa Station, creating an access to the Subway to the population of the Suburb Railway.

Guideline 01: Requalification of Permanent track in the existing section connecting Calçada Stop and São Luís Stop throughout the Suburb Railway.

Guideline 02: Upgrading the existing Calçada Stop to Paripe Stop, involving reconfiguration of platforms, maneuvering yards, workshops, operational control areas, waiting rooms, lock control devices, parking lots and external tracks for road access.

Guideline 03: Requalification of the existing Stops of Santa Luzia, Lobato, Itacaranha, Escada, Praia Grande, Periperi and Coutos involving reconfiguration of platforms, lock control devices, improvements in the external tracks for access and, where possible structure, stops spaces and parking lots of passenger vehicles.

Guideline 04: Implementation of new Standardized Stops, in locations of Baixa do Fiscal, Viaduct under the Suburbana, União de Lobato, São, Plataforma, São Brás - Mocotó and Setúbal, equipped with platforms on both sides of the track, blocking control devices, track crossing and for internal connection to both sides of the Stop, improvements of the the external access tracks and, where possible, structure stops spaces and parking lots of passenger vehicles.

The main goals were:

- Formalizing protocol of intent with the Municipal Government of Salvador, for interventions and land use conditions, particularly with road access systems;
- Formalization of intervention preliminary design along with the Ministry of Transport;
- Request the environmental licensing release with the INEMA in accordance with CONAMA Resolution No. 349, of August 16, 2004, Published in the Official Gazette No. 158 of August 17, 2004;
- Structuring mechanisms and integration forums between the technicians who are developing the intervention design and the Municipal Government of Salvador, in order to assess the progress of the design, and its inclusion on the local road system and integration modals, as well as ensuring the appropriate traffic conditions and accessibility;
- Choose, local time and conditions and size of the stops and even amount of required passages of PNs level and AMVs operational deviations;

- Structuring the conditions for construction of the sections in directional sequence, in order to allow the minimization of impacts on the continuity of trains circulation along the path that is not in the works.

5.2 Previous Designs

In 1983, the Master plan of Valéria were developed by CONDER, the Urban Industrial District (DINURB), by the State Secretariat of Industry and Commerce and the Corridor Study of TRENSURB by CONDER.

These designs aimed at structuring the area with road system, transportation and sanitation, boosting its economic potential so far focused on allocating industries and housing of workers of local industries and Poles in the Metropolitan Region.

In 1988, it was designed the Urban Plan of the Administrative Region XVI - Suburb Railway, which deepens studies of the area, in the various sectors of activities / needs and prepare again its functions identifying their trends; a neighborhood sub-center in Periperi, promoting a new internal dynamics; integrated transport by three modes: road, rail and waterway; environmental treatment with creation of collective spaces like Parque das Lagoas; relocation of the population in risk areas; induction of occupation through housing of the empty spaces from south to north and west to east, improving the pre-existing urban infrastructure.

From 1991, CONDER in partnership with an Italian NGO (AVSI), carried out the design: New Alagados. Aimed at environmental restoration and social development of marginalized urban areas, establishing concepts, methods and alternative technologies for improved housing and infrastructure, urbanization and implementation of social facilities.

Furthermore, it was performed for the Suburb Railway, through the PMS, related designs involving interventions on macro and micro drainage, road macro structure, paving, environmental recovery of the area, implementation of social support facilities that are interrelated through the process of preparing the Urban Plan of Suburbia.

Other private enterprises were planned for the area such as the Center for Recreation in Paripe, a Marina in Periperi, for sightseeing, and another in Plataforma proposed by the Ribeira Azul Design, which would connect the Itapagipe Peninsula to Tainheiros Cove and Suburb, by waterway.

Initiatives that have joined the Design of Boating Route, consisting of a waterway circuit from Porto da Barra to Ribeira, prepared by the Coordinator of Special Designs of the Municipal Government of Salvador, a member of the Nautical Polo Development Program of Salvador that involved physical, environmental, socio-cultural and institutional actions, covering a wide range of interventions in the areas of transport, communications, construction and shipbuilding, urban planning and landscaping, extending from Todos os Santos Bay, connecting the City, Suburb and Islands.

It should be noted, several urban interventions planned for the improvement of the Suburb Railway, due to the Recovery Program of Todos os Santos Bay and the Integrated Transport Plan held through joint actions between the Municipal Government of Salvador (PMS) and the State Government. Among them, there are the plans and designs listed and briefly described below in the following topics:

- Pirajá São Bartolomeu Metropolitan Park, Municipal Department for Planning, Environment and Economic Development and Mário Leal Ferreira Foundation (SEPLAM/FMLF), September/97;
- Bahia Azul Program, Department for Water Resources, Sanitation and Housing of the State of Bahia, May/98;
- Recovery of Suburban Passenger Train, Coordinator of Special Designs (CPE), October/98;
- Integration of Rail / Road Subsystem, November/98.

5.2.1 Pirajá / São Bartolomeu Metropolitan Park

The proposed environmental restoration and use of Pirajá / São Bartolomeu Metropolitan Park is within the set of actions implemented through a partnership between the Municipal Government and the State Government, in order to meet the Tourism Development Program (PRODETUR) . To that end, the SEPLAM-PMS through FMLF and other entities, prepared in September/97, the Pirajá / São Bartolomeu Metropolitan Park Design, which aimed at consolidating its basic functions of environmental protection, protecting the water source of Cobre and preservation of religious and cultural activities and scientific research, and leisure and recreation activities.

It is noteworthy that this Park is one of three pilot areas of the Biosphere Reserve of the Atlantic Forest of Bahia, chosen during the United Nations Conference on Environment and Development - ECO92. Park situated in the region of the Suburb Railway has a natural reserve with a set of waterfalls integrated into the forest with a mangrove and beach, as well as religious significance for the realization of African cults, for what is considered sanctuary of secular rituals.

The implementation of environmental recovery design and Park infrastructure helped to improve the quality of life for the population, with the installation of the various scheduled activities.

5.2.2 Bahia Azul Design

The Department of Water Resources, Sanitation and Housing of the State of Bahia developed the Bahia Azul design that aimed to improve the standard of living and public health and environmental preservation through actions in sanitation and environment.

Its investments were concentrated in the sewage and water supply, improvement of services for the collection and disposal of solid waste, intensification of environmental pollution control, health and environment education. This program was also part of the Tourism Development Program - PRODETUR.

In the area of Suburban Railway, it contributed to the decontamination and restoration of the ecological balance of Todos os Santos Bay.

Recovery of Suburban Passenger Train

Studies for Recovery of Suburban Passenger Train were part of the Integrated Transport Plan, prepared by CPE - Coordinator of Special Designs. They included on such designs, institutional studies for transferring the management of CBTU - Companhia Brasileira de Trens Urbanos (Brazilian Urban Train Company) to the Municipal Government of Salvador, in development since February/98, in addition to the operational designs of the trains that were refurbished. According to data obtained in meetings with the technicians of CPE, the new passenger train operated between Paripe and Calçada with the following characteristics:

- Headway of 10 minutes;
- Demand designed for approximately 60,000 passengers/day;
- Average travel time of 35 minutes, with two transfers;
- Integrated demand of LRV line with metropolitan buses and complementary subsystem;
- Vocation to meet the tourist demand;
- Physical, operational and tariff integration using *smart card;*
- Segregated Lane;
- Train with 25 years-old, completely renovated, including having air conditioning;
- Partnership for grant of urban equipment.

5.2.3 Integrated Transport Plan - Rail / Road Subsystem

The Integrated Transport Plan envisaged joint action by the Municipal Government of Salvador with the State Government for the implementation of modal integration of public transport. This preliminary technical document, prepared in September/98 by SMTU - Municipal Department for Urban Transport and STP - Superintendent of Public Transport, is the first step of the Rail Subsystem providing for the integration of train from Paripe to Calçada with the municipal bus lines in the short term.

The operating model for this first operation phase of the train proposed the restructuring of the municipal bus lines of the Suburb Railway region with:

- Creation of 15 feeder lines in the suburb region in exchange for extinction of 15 existing lines;
- Maintenance of 29 existing direct lines;
- Creation of 4 trunk lines added to the existing GC1 and GC2 lines, for integration in Calçada.

The metropolitan bus lines and the complementary operated transport subsystem are provided for integration with the train in this first phase of operation.

5.3 Project Design

Title: Rehabilitation and construction of public transport system.

Description: Preparation of basic and executive design, construction of civil works, installation of equipment for operation of the public transport system and certification of facilities by the competent agencies.

Product: Public transport to the suburban population of Salvador connecting to Comércio. The region in question is lacking in mobility vectors.

Unit of Measure: The design aims to serve 60,000 passengers/day.

The design of the intervention project, for better understanding, was structured as follows:

- Desired line;
- Locational Route Alternatives;
- Technological alternatives.

The comparative analysis of the above were made and used as a comparison methodology in a matrix listing the positive and negative values and finding the best alternative.

5.3.1 Desire Line

The desire line established in the Needs Program for Metropolitan Train Design, in the section Comércio - Calçada, is actually a natural extension of the route of the majority of passengers who currently runs the suburban train in the route Paripe - Calçada. This guide complements the desire to travel of those who go towards Comércio or everywhere looking for some place of Cidade Alta.

The table below shows the comparison between modals, the number of passengers transported per day and the classification resulting from this analysis. Where 10.0 represents the modal that carries the most passengers. 0.1 represents the modal that carries the lowest number of passengers. In this case the chosen modal was the Subway, which can carry up to 130,000 passengers per day, which can carry up to 130,000 passengers per day.

Modal type	Transported passengers	Score
BRS Bus	9,000	0.7
BRT Bus	17,000	1.3
LRV	60,000	4.6
Subway	130,000	10.0

Table 1

5.3.2 Route locational alternative

Alternative 1: The spaces available for deployment of this complementary line are restricted to shared use of Av. Oscar Pontes with road traffic currently in direction Calçada - Comércio and Avenida Jequitaia, whose circulation direction is from Comércio to Calçada. Another possible route would be the coming from Comércio Calçada by Av. Jequitaia and returning - Calçada - Comércio by Avenida Oscar Pontes and Avenida da França.

It appears as possible route, but high cost and with significant geomorphological complications, a path by the foot from the slope that separates Cidade Baixa from Cidade Alta.

Since the intermediate points to be achieved along the route are always the same, and few, the desire line is confused with the possible location alternatives of the route, except in the case of option through slope, which due to geomorphological and occupational conditioning gets fully away from the desire these points, so being away from the purpose of this requirement.

For each of the routes, the technological alternatives to be used in the implementation of permanent track would be different because the section of the slope would imply in high or partly underground permanent track, because of topographic movement, or in mixed condition through elevations along the route with tunnels, which would involve more sophisticated construction processes, especially considering that this route is confused with the line of the Geological Fault of Salvador, responsible for the characterization of Cidade Alta - Cidade Baixa.

The use of the Desire Line, along the routes of Av. Oscar Pontes, Av. Jequitaia or both, using the latter case in one way, would be possible, but in the last section would imply in serious interference problems with existing service networks and disorders in the opportunity of construction with local businesses and the very movement of pedestrians, in this final section (Salvador Mill - Lacerda Elevator), which allows other, alternative route with fully differentiated permanent route deployment requirements, especially if we consider the electrification of the railway network overhead. Thus, the possible Desire Lines considered in the design were:

Alternative 2: Rail corridor with right of way of 8.00 m along the existing median strip where it used to pass the old railway connection with the Port of Salvador, between Av. Oscar Pontes and Av. Jequitaia, to the premises of the Cesta do Povo, in front of Feira de São Joaquim, continuing from there with three optional locations: next to the left or right side, or implanted in the center of Av. Oscar Pontes, to the facilities of the Salvador Mill, opening in two alternatives, one by Av. da França and the other by Av. Jequitaia.

Alternative 3: Rail corridor with right of way of 8.00 m along the existing median strip where it used to pass the old railway connection with the Port of Salvador, between Av. Oscar Pontes and Av. Jequitaia until the facilities of Cesta do Povo, in front of Feira de São Joaquim, proceeding thereafter with permanent track into two branches each with a 4.00 m of right of way, in one direction through Av. Oscar Pontes and Avenida da França and other back, circling Mercado Modelo using space of Rua Portugal, other streets of Comércio and Av. Jequitaia to the meeting place with Cesta do Povo.

It is presented in sequence a plant with the routes of "Alternative Path - General Plant" and another with the "Desire Line", selected for the design, in confrontation ratio subsidized by constraints and technical and social-economic requirements.

Figure 77 - Alternative 2

Figure 78 - Alternative 1 and 3

The table below shows the comparison between the route alternatives, the percentage amount of expropriation in relation to the total cost of the work, the percentage amount of works for interventions to the road in relation to the total cost of the work, the percentage amount of interference with public networks of concessionaires in relation to the total cost of the work and the classification resulting from this analysis. Where 10.0 represents the cheapest alternative. 0.1 represents the most expensive alternative. In this case the alternative chosen was the second, which is the cheaper route and the lowest number of works.

Route	Expropriation (%)	Road intersections (%)	Networks interference (%)	Score
Alternative 1	2	1	1	6.0
Alternative 2	0	1	1	7.0
Alternative 3	3	2	2	3.0

Table 2

5.3.3 Technological Alternative 1.

In a diesel-electric locomotive, it has primary diesel engine which drives an electric generator that will transmit power to the drive motors. There is no mechanical connection between the primary engine and the drive wheels. Conceptually, this type of locomotive is a hybrid vehicle that incorporates its own power station, designed to operate in areas where the permanent track is not electrified.

The electric locomotives are fed externally, either through overhead line or a third rail. Although the cost of electrification of a line is very expensive, the operation of the electric trains is significantly cheaper than diesel, in addition to having an acceleration and braking capacity, which makes them ideal for passengers transportation in dense population areas. Virtually all high-speed trains use electric locomotives because it would not be easy to transport onboard the amount of energy required for such high performance.

The table below shows a comparison between the drive types:

- Lower maintenance costs for electric locomotives, in a ratio of 34 to 100 compared to diesel locomotives;
- For the same level of power an electric locomotive is 65% lighter than its equivalent diesel;
- Electricity is cheaper than that generated by diesel, and the difference may reach 88%;

- Electrical energy can be generated in a more flexible manner through hydroelectric, thermoelectric or nuclear plants, while the diesel oil is obtained exclusively from petroleum;
- There is less need of facilities for storage of spare parts and is not necessary to keep tanks for oil storage;
- Pollution is much smaller, both in thermal, acoustic and emissions terms.

Drive type	Maintenance Cost (%)	Weight (%)	Fuel cost (%)	Score
Diesel	6.6	6.5	8.8	2.7
Electric	3.4	3.5	1.2	7.3

Table 3

In this case, the alternative chosen was the electric drive, which is the best choice.

5.3.4 Technological Alternative 2.

The VBV System with low noise and vibration, in which the two concrete blocks for fixation of the rails are inserted into specific concrete niches, surrounded by rubber overshoes on micro cellular cushioning tie pads. The use of innovative technology means less maintenance and better standard and safety for the traffic of trains. This system is intended to absorb and reduce the dynamic noise from the wheel-rail contact.

Until the 60s the ballast of railways were built with crushed stone or gravel, which was replaced every 15 or 30 years, and whose maintenance services were performed every 3 or 5 years. The maintenance and renewal works of the ballast are performed under severe conditions at intervals between successive trains, usually at night, and the time available for maintenance or restoration is typically less than 3 hours to 5 hours.

The increased flow of trains has resulted in an increase in maintenance costs compared to those spent on tracks with conventional traffic. Although the crushed stone ballast has appropriate mechanical characteristics (high transverse strength besides low voltages and settling).

It is important to note that the crushed stone ballast has high flexibility, lower construction costs, possibility to easily correct defects on track or in differential settling, and provide better absorption of dynamic effects.

Track type	Maintenance (%)	Safety (%)	Noise (%)	Transverse Resistance (%)	Stress (%)	Settling (%)	Score
VBV	1	2	1	2	2	1	9.0
Conventional	2	1	2	1	2	2	10.0

Table 4

The alternative chosen will depend on several factors such as land type, shared area and segregated area. In this case, the conventional stood in front, but the ideal is a hybrid solution where the VBV may be used in the section between Comércio Stop to Calçada Stop and conventional between Calçada Stop to São Luís Stop.

5.3.5 Choice

Desire line		Locational route alternative		Technological Alternative 1.		Technological Alternative 2.		Total
Bus BRS	0.7	Alt. 1	6.0	Diesel	2.7	Conventional	10.0	19.4
				Electric	7.3	Conventional	10.0	24.0
		Alt. 2	7.0	Diesel	2.7	Conventional	10.0	20.4
				Electric	7.3	Conventional	10.0	25.0
		Alt. 3	3.0	Diesel	2.7	Conventional	10.0	16.4
				Electric	7.3	Conventional	10.0	21.0
Bus BRT	1.3	Alt. 1	6.0	Diesel	2.7	Conventional	10.0	20.0
				Electric	7.3	Conventional	10.0	24.6
		Alt. 2	7.0	Diesel	2.7	Conventional	10.0	21.0
				Electric	7.3	Conventional	10.0	25.6
		Alt. 3	3.0	Diesel	2.7	Conventional	10.0	17.0
				Electric	7.3	Conventional	10.0	21.6
LRV	4.6	Alt. 1	6.0	Diesel	2.7	VBV	9.0	22.3
						Conventional	10.0	23.3
				Electric	7.3	VBV	9.0	26.9
						Conventional	10.0	27.9
		Alt. 2	7.0	Diesel	2.7	VBV	9.0	23.3
						Conventional	10.0	23.4
				Electric	7.3	VBV	9.0	27.9
						Conventional	10.0	28.9
		Alt. 3	3.0	Diesel	2.7	VBV	9.0	19.3
						Conventional	10.0	20.3
				Electric	7.3	VBV	9.0	23.9
						Conventional	10.0	24.9
Subway	10.0	Alt. 1	6.0	Diesel	2.7	VBV	9.0	27.7
						Conventional	10.0	28.7
				Electric	7.3	VBV	9.0	32.3
						Conventional	10.0	33.3
		Alt. 2	7.0	Diesel	2.7	VBV	9.0	28.7
						Conventional	10.0	29.7
				Electric	7.3	VBV	9.0	33.3
						Conventional	10.0	34.3
		Alt. 3	3.0	Diesel	2.7	VBV	9.0	24.7

Desire line		Locational route alternative		Technological Alternative 1.		Technological Alternative 2.		Total
						Conventional	10.0	25.7
				Electric	7.3	VBV	9.0	29.3
						Conventional	10.0	30.3

Table 5

The matrix states that the best transport is the Subway with 34.3 points and the second is the LRV with 28.9 points. The logical choice would be the Subway to justify the passenger demand. Another point that prevents the Subway to the study concerned is that the cost of deployment is 50% higher. The conclusion is that the LRV has the best benefit-cost ratio for the subject matter concerned: **Requalification and system construction to serve the public transport vector connecting Comércio to São Luís.**

6. TRANSPORT SYSTEM DESIGN

6.1 Urban Party

6.1.1 Comércio to Calçada

The intervention was a sharing concession of road space, by the Municipal Government of Salvador, for implementation of the railway modal, which it planned, for the occasion and opportunity to transfer from Salvador Transportation Company - CTB to the State under the designation of CTB - Transport Company of the State of Bahia. This assignment would involve only the permission to pass a continuous space ranging from 8.00 m to 12.00 m width between Comércio Stop and Calçada Stop defining space and location including side trips for accessibility with 2.00 m wide, ranging size and side depending on the intersections of the radii with dynamic clearance. The Urban Party of the surroundings and the remaining areas is the institutional competence of the PMS, and in principle, would be affected by the implementation of the LRV because the sharing terms agreed between the Parties.

6.1.2 Calçada to São Luiz

The space to be occupied by the enterprise domain area, with respect to the institutional aspects, begins at the Calçada Station Yard, covering a section of 14.9 km along the Suburban Seaboard and within this right of way belonging to the Federal Government, on an existing permanent track, on double track and in operation with passenger transport, with a width of 15.00 m, for each side of the billet of the external tracks.

This track has been operational used for more than a century.

The Needs Program resubmitted herein provides documentation in the form of text, photos and drawings throughout the track, in order to facilitate such description.

It was not changed anything in the route, which remains the same a hundred years ago, both in plan and in profile. Originally the left side of the track was limited by the coastline of Todos os Santos bay, in the Suburb, with no occupation. Today, much of the strip between the outer boundary of the railway right of way, is occupied by housing invasions.

The occupation in the right side did not change in the qualitative aspects, but it deified and expanded, reaching today a state of saturation.

This expansion is now contained by the natural limitation of the slope formed by the Geological fault of Salvador that defines the separation of city in High and Low and that is formed at a distance substantially constant throughout the route.

This form of occupation continues in every direction of the route, with the same typology, but presenting progressive pronounced degradation. It is a linear rail corridor, lengthwise with few intersections of accessibility due to the slope and the sea establishing the outer limits of this vector.

6.2 Route Geometry

6.2.1 Section 1 with the same physical characteristics

Aiming to geometrize through georeferencing procedures, the route of the rail connection Comércio to Calçada, for the section concerned was used in the past by railway to connect Calçada - Port of Salvador Facilities. The rails still exist and are partially covered by urban debris or some unique buildings. Where possible, such material should be removed, cataloged and receive the due care from CTB.

The rest of the section will be deployed directly over the existing asphalt layer of Av. Oscar Pontes and Av. da França, serving as sub-ballast for the new Permanent Track.

In the section where the superstructure will be supported on the floor of the existing track, equalization of the horizontal and vertical geometric positioning was made. The designed ramps and radii fall completely under current legislation, mainly considering the characteristics required by LRV - Light-rail Traffic, which will be used and have milder geometric requirements.

It means establishing georeferenced *axis* for tracks that may serve as guidance to the desired direction, in a succession of straight and curved sections that make up its representation in plan and profile, as well as the definition of cross sections suitably spaced along this axis to ensure that the movement of vehicles on it is smooth and safe. It is significantly conditioned by the physical and operational characteristics of the vehicles that will be used on it.

6.2.2 Section 2 with the same physical characteristics

The section of the rail connection from Calçada to Paripe, the Permanent Track, in this passage does not present utilization conditions and should be completely removed, and this material should be removed, cataloged and given to the care of CTB.

There is no evident route alternatives, since the existing one features excellent geometric characteristics, with respect to the curves and their corresponding minimum radii or even maximum ramps.

The sub-bed can be utilized in much of the section, needing a general cleaning within the entire right of way with removal of the existing grid (sleepers and rails) of topsoil (40 cm thick) and in some cases the existing ballast for soil stability services. In this sense, the purpose is to perform the ultimate topographic location of the axis of the railway, after completion of the cleaning of the construction site, promote the removal and settlement of the sub-bed in the sections where there was superstructure of the old railroad, adding material where necessary and implement a sub-ballast layer using the "crushed stone" (final crushing product).

The geometric realignment of the track with the necessary corrections in the horizontal and vertical routes will be made by incorporation of new radii and superelevation required for every radius amplitude related to the design speed and operation speed.

6.2.3 Section 3 with the same physical characteristics

The route of the rail connection from Paripe to São Luís, the Permanent Track, in this passage does not present utilization conditions and should be completely removed, and this material should be removed, cataloged and given to the care of CTB.

There is no evident route alternatives, since the existing one features excellent geometric characteristics, with respect to the curves and their corresponding minimum radii or even maximum ramps.

The sub-bed can be utilized in much of the section, needing a general cleaning within the entire right of way with removal of the existing grid (sleepers and rails) of topsoil (40 cm thick) and in some cases the existing ballast for soil stability services. In this sense, the purpose is to perform the ultimate topographic location of the axis of the railway, after completion of the cleaning of the construction site, promote the removal and settlement of the sub-bed in the sections where there was superstructure of the old railroad, adding material where necessary and implement a sub-ballast layer using the "crushed stone" (final crushing product).

6.3 Road Interventions

This report presents the preliminary views of the intersections to be employed in the LRV design of Salvador. Along the LRV route. There are 11 intersections with road traffic and several pedestrian crossings, because it is a hybrid section, with segregated areas and not segregated areas for vehicles and this setting is explained below.

The LRV will be installed at the level of the pedestrian sidewalk. This height difference will be 20 cm above the floor of the streets, creating multiple points of interference. The solution adopted will agree the plan of the permanent track of the LRV with the streets, taken a slope of no more than 2%, in the form of a "diamond". The floor will be executed in interlocked floor, highlighting the points where there will be the intersections as shown in the drawing.

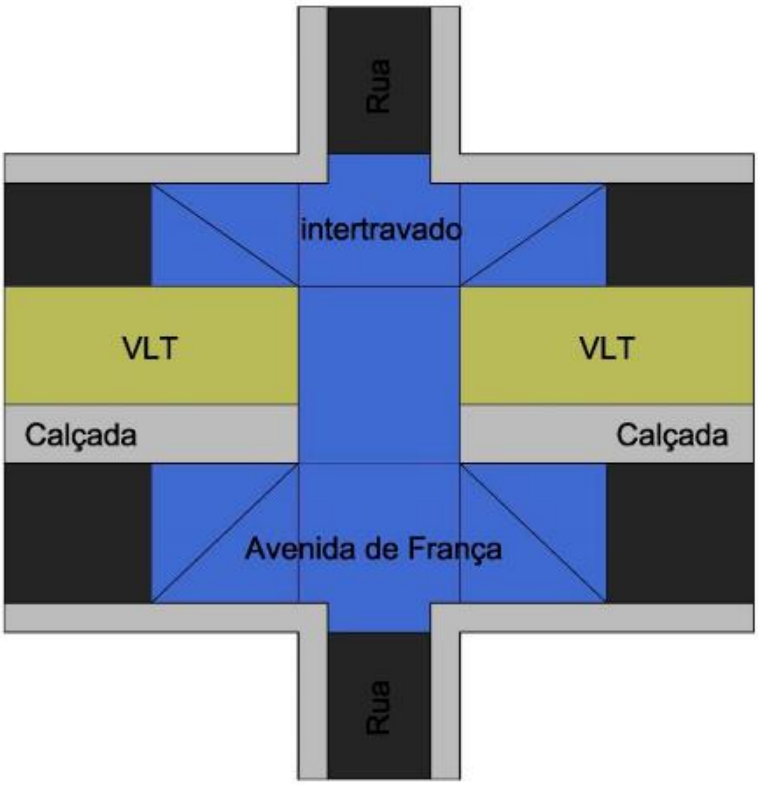


Figure 79 - Schematic drawing of how the intersection will be

For delimiting the signaling steps to be employed in intersections, The CTB (Brazilian Traffic Code) specifications and TCRP (Transit Cooperative Research Program) data were used for completion of interaction data between LRV (Light-Rail Vehicle) and motor vehicles.

The route of the LRV of Salvador between the milestones 0 and 170, representing the urban section, between Comércio Stop and Calçada Stop, has high interference with the local road system. In fact, the urban section between Comércio and Calçada, the implementation of the LRV requires a greater number of intersections in level, since it will be built over an existing and very busy corridor in Salvador's downtown. In addition to the various pedestrian passages, which are distributed along the section. In this section, it was identified accesses to local companies and 11 intersections.

The route of the LRV of Salvador in the remaining route path, which includes the suburban section, between Calçada Stop and São Luís Stop, presents segregated area and have 2 interference with the local road system. In the following pages we will detail these accesses and intersections.

Below are detailed these intersections, and they will follow towards Comércio - São Luís in the direction of São Luís.

6.3.1 Access and road intersections on Avenida de França, Eng. Oscar Pontes and Avenida Jequitaia.

Figure 80 - General location of accesses

Figure 81 - General location of accesses

CAPTION:

- Intersection 1: Av. da França and Rua da Holanda;
- Intersection 2: Av. da França and Rua da Noruega;
- Intersection 3: Av. da França and Rua da Suécia;
- Intersection 4: Av. da França before Porto Stop;
- Intersection 5: Av. da França and Rua do Estado de Israel;
- Intersection 6: Av. Eng. Oscar Pontes and Viaduto dos Operários;
- Intersection 7: Av. Eng. Oscar Pontes and da Av. Jequitaia;
- Intersection 8: Av. Eng. Oscar Pontes and da Av. Jequitaia;
- Intersection 9: Av. Jequitaia and Largo da Calçada;
- Intersection 10: Av. Jequitaia and Largo da Calçada;
- Intersection 11: Av. Jequitaia and Largo da Calçada.

The geometry to be used in these intersections will be input/output type with identified strip and traffic light strip.

Some of the side streets to Avenida de França will be provided with left-hand traffic and median strip. This would drastically decrease the number of conflicts in the intersections, enabling more efficient timing and thereby reducing the waiting time at traffic lights.

Details can be viewed in the road intervention drawings in Volume III.

6.3.2 Intersection 1

Stake 20 of the first staking, between the intersection height of Avenida da França and Rua Holanda, this intersection will allow access to the buildings of the Port of Salvador. It shall have traffic light synchronized with the LRV flow in order to minimize conflict with the permanent track.

Figure 82 - Plot Plan

Figure 83 - Current situation

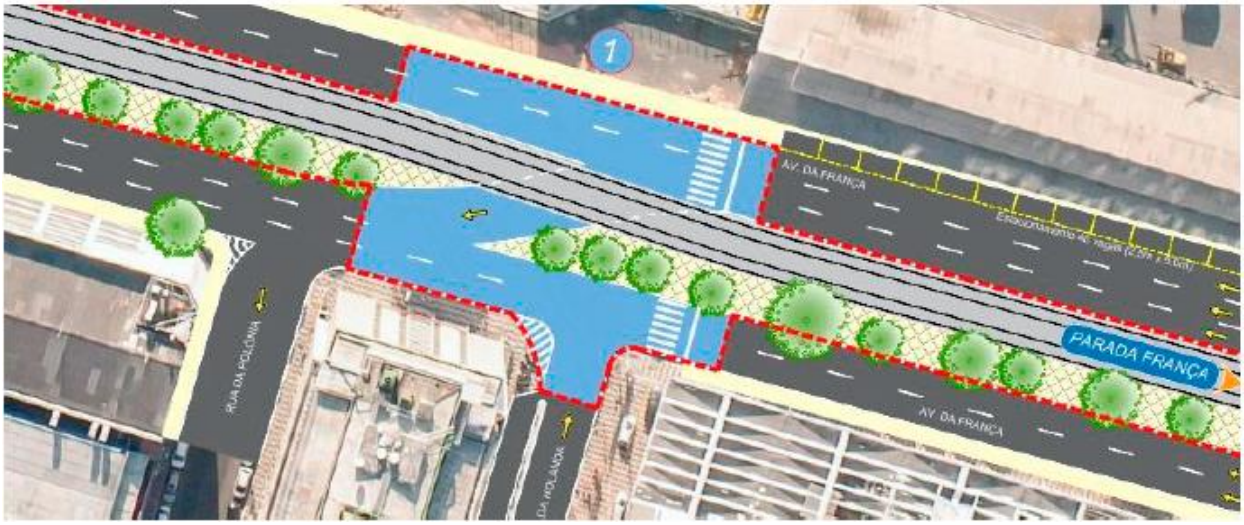


Figure 84 - Design.

Figure 85 - Designed situation.

6.3.3 Intersection 2

Stake 32 of the first staking, around the intersection with Avenida da França and Rua da Noruega, just before "França Stop". This intersection will allow access to buildings of the Port of Salvador. See figure below.

Figure 86 - Plot Plan.

Figure 87 - Current situation.

Figure 88 - Design.

Figure 89 - Designed situation.

Figure 90 - Designed situation.

6.3.4 Intersection 3

Stake 41 of the first staking, around the intersection with the port entrance, the section where Avenida da França are aligned with Rua da Suécia. This access is the main access to the Port of Salvador.

Figure 91 - Plot Plan.

Figure 92 - Current situation.

Figure 93 - Design.

Figure 94 - Designed situation.

Figure 95 - Designed situation.

6.3.5 Intersection 4

Stake 52 of the first staking, needle intersection in Avenida de França before Porto Stop. Currently in this section there is a small median strip.

Figure 96 - Plot Plan.

Figure 97 - Current situation.

Figure 98 - Design.

Figure 99 - Designed situation.

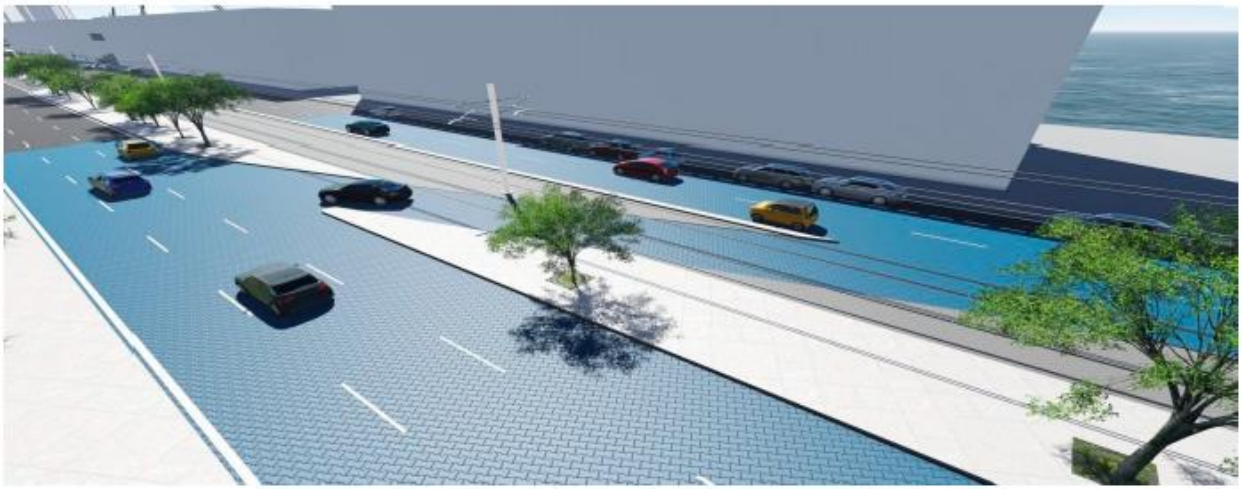


Figure 100 - Designed situation.

6.3.6 Intersection 5

Stake 71 of the first staking, intersection of Avenida da França and Rua do Estado de Israel;

Figure 101 - Plot Plan.

Figure 102 - Current situation.

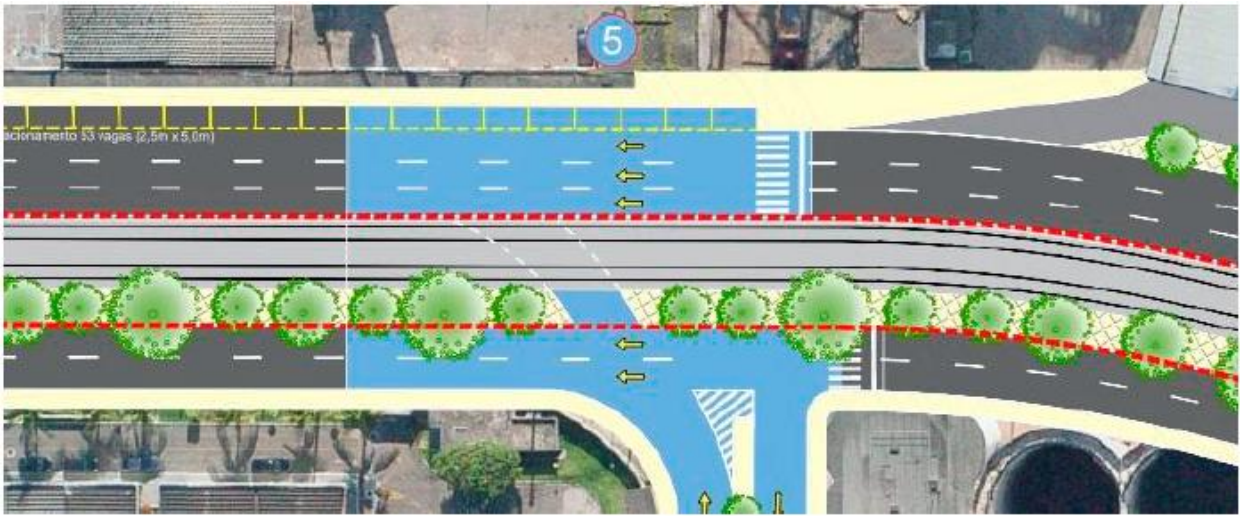


Figure 103 - Design.

Figure 104 - Designed situation.

Figure 105 - Designed situation.

6.3.7 Intersection 6

Stake 104 of the first staking, intersection of Avenida Eng. Oscar Pontes and Viaduto dos Operários.

Figure 106 - Plot Plan.

Figure 107 - Current situation.

Figure 108 - Design.

Figure 109 - Designed situation.

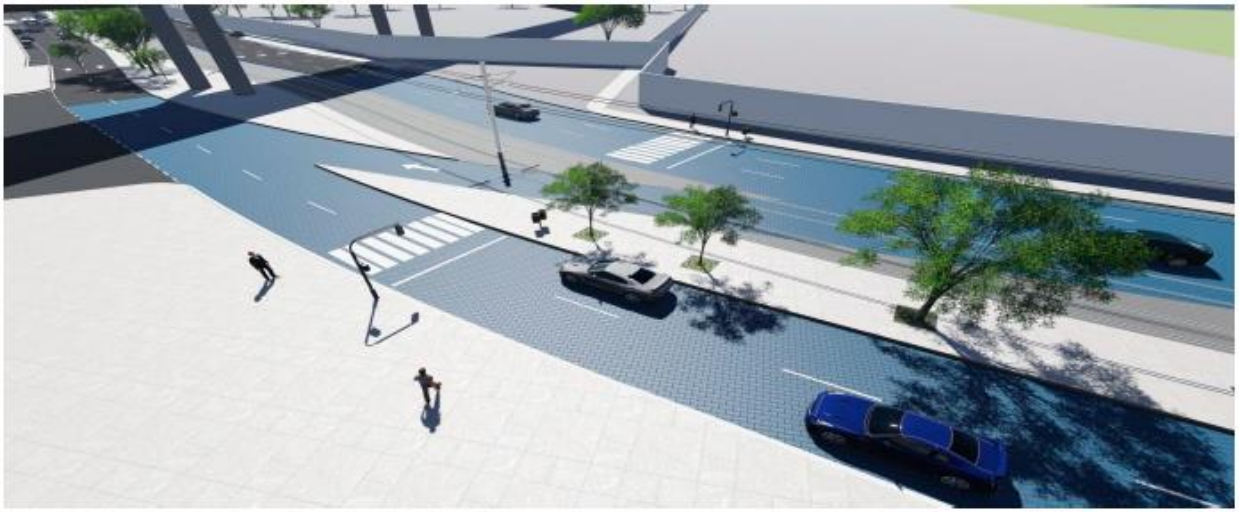


Figure 110 - Designed situation.

6.3.8 Intersections 7 and 8

Stake 132 of the first staking, intersection with the access to Avenida Jequitaia, before reaching São Joaquim Stop. It consists of passing the permanent track on the left side of Av. Engenheiro Oscar Pontes to the right side in the return of Av. Jequitaia. The biggest problem of this crossing is the angle complement imposed by route.

As a solution, it will be used at this intersection the traffic light intersection and continuity of pedestrian crossing laterally to the permanent track, at this point, in order to avoid conflicts with pedestrians.

Figure 111 - Plot Plan.

Figure 112 - Current situation.

Figure 113 - Design.

Figure 114 - Designed situation.

Figure 115 - Designed situation.

6.3.9 Intersections 9, 10 and 11

Stake 161 of the first staking, intersection of Avenida Jequitaia, stake 164 of the first stake staking, intersection with Largo da Calçada and stake 168 of the first stake staking, intersection with Largo da Calçada. This is the most complicated intersection due to the angle complement made by the route, but the solution used kept lanes and urban furniture that was before the interventions. In this square there are two conflicts with the permanent track, indicated in yellow circles in the image below.

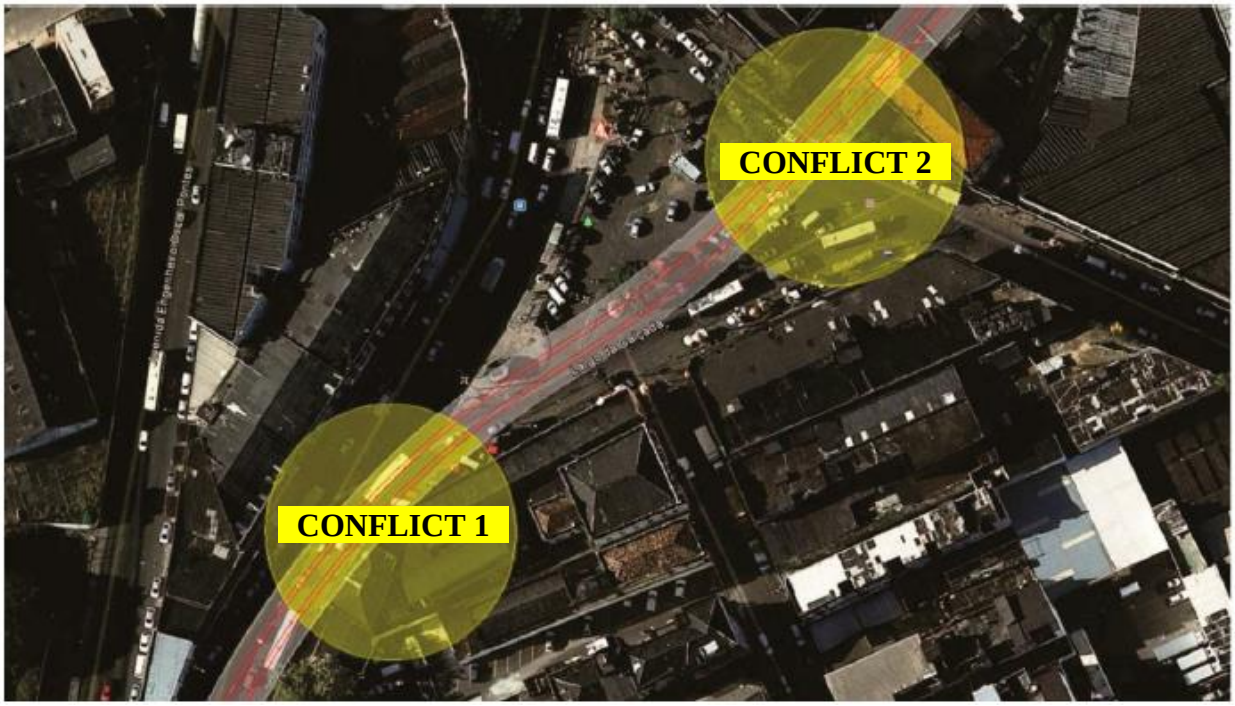


Figure 116 - Plot plan conflicts between the permanent track and urban tracks.

The first conflict refers to the passage of the permanent track on the left side to the right side of Avenida Jequitaia and the access to the square via conversion to the right. The second conflict is a "X" cross of the permanent track with Rua Artur Catrambi.

In order to make the crossing feasible, with no impact on the road flow, it was planned to implement a road viaduct at these points of conflict, as can be seen in Volume III of Annex 04.

Figure 117 - Plot Plan.

Figure 118 - Current situation.

Figure 119 - Design.

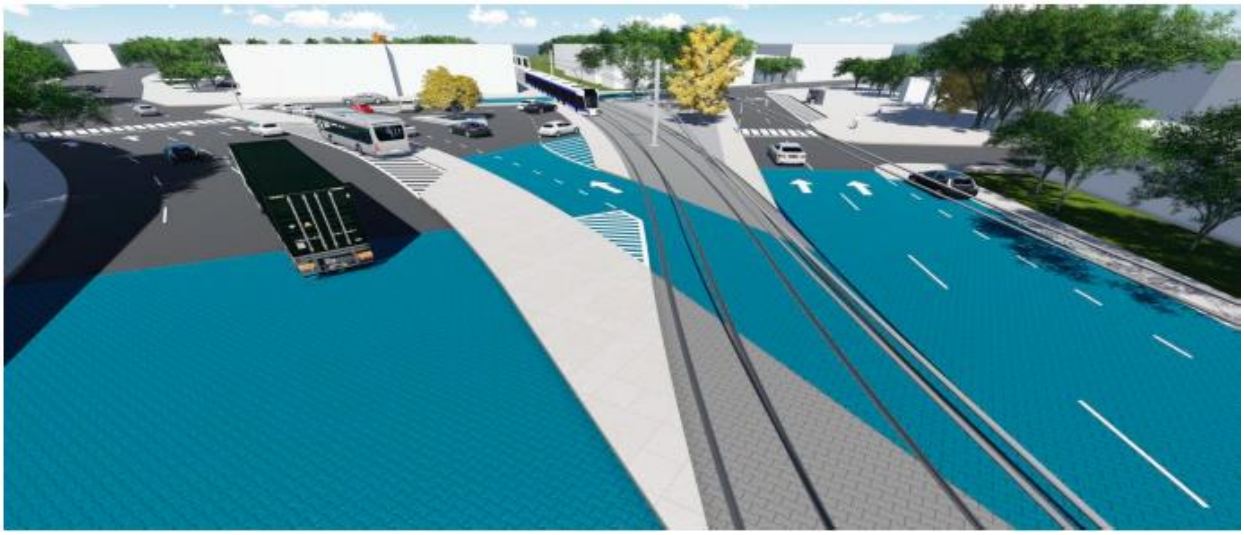


Figure 120 - Designed situation.

Figure 121 - Designed situation.

Figure 122 - Situation designed for Access 7

6.3.10 Intersection 12

In the suburban section, between Calçada and São Luiz, the existing railroad is segregated, a situation that will change when checking the implementation of the LRV. In this section, the need for deployment of level intersections is reduced. The intersection that are located next to Coutos Stop with Travessa da Lagoa at the stake 617 of the second staking.

Figure 123 - Plot Plan.

Figure 124 - Current situation.

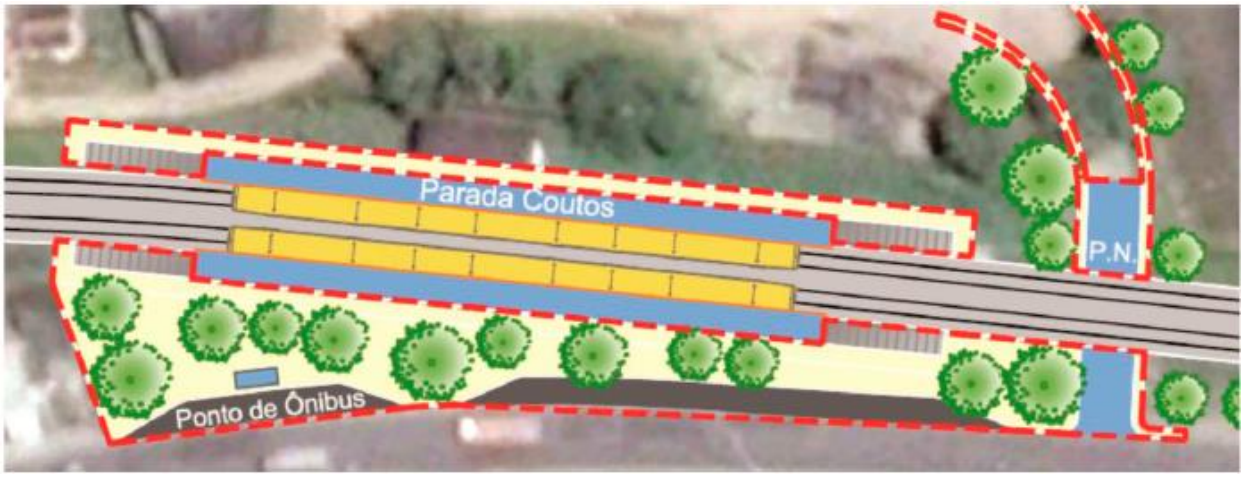


Figure 125 - Design.

Figure 126 - Designed situation.

Figure 127 - Designed situation.

6.3.11 Intersection 13

On Paripe Stop at the intersection with Rua Dr. Eduardo Dotto. In stake 1 of the third and final staking.

Figure 128 - Plot Plan.

Figure 129 - Current situation.

Figure 130 - Design.

Figure 131 - Designed situation.

Figure 132 - Designed situation.

6.4 Road System to Access the Stops

It was planned the adequacy and requalification of the road access to the stops to be built / upgraded within LRV scope, especially in the suburban section, i.e., from Calçada (exclusive) to São Luís (inclusive).

These accesses are currently impaired now due to the installation of a LRV. The need for access to the stops. They will undergo paving and urbanization interventions. It will allow the road connection in good condition to Avenida Afrânio Peixoto. On the other hand, Paripe Stop and São Luís Stop, this connection will be made through Rua da Estação and Avenida São Luís, respectively.

In addition to paving the street itself, it sought to establish a functional model with the stops, so that operations for arrival / exit of vehicles in the accesses are carried quickly and securely, with minimal interference in the road traffic of the region.

This theme was conceptualized together with urbanization and landscaping items, ensuring harmonization with the surroundings, so that pedestrians appropriate access conditions are guaranteed, which are materialized in sidewalks and squares arrangements, adding value to the urban context and reducing the visual impact of constructions. Increasing where possible green area to the set, through vegetation planting compatible with the environmental system of the region.

It should be noted that these local accesses are important not only for access to LRV stops, as well as improving conditions in places where the stops will be inserted, as in some cases, some streets that will undergo intervention, are in poor driving conditions within communities. Nevertheless, despite having been given due importance to this issue, the purpose was to keep the paving areas in a minimum, in order to cheap the cost of the enterprise of the LRV.

In the step of basic and executive designs, field and topographic surveys may bring a more accurate diagnosis, and consequently, the access may undergo some modifications in order to bring the best and most appropriate solutions.

Thus, we obtain a total of 16 stops whose envelope is revitalized by improving the road access system, namely:

Stop	**Paving (m^2)**	**Urbanization and Landscaping (m2)**
Baixa do Fiscal	2,142	1,150
Santa Luzia	890	437
Viaduto da Suburbana	2,210	690
Lobato	1,910	1,225
União	5,350	2,830
São João	1,210	1,005
Plataforma	450	610
São Brás	1,440	620

Itacaranha	0	420
Escada	1,820	950
Praia Grande	580	650
Periperi	1,710	2,440
Setúbal	1,485	1,135
Coutos	245	1,260
Paripe	705	810
São Luís	1,120	1,100
Total	**22,058**	**17,332**

Table 7

In the appropriate design, Volume III, you can check the implementation of the places that will undergo the paving works to improve the road access system to the stops.

6.5 Galleries

The galleries will be used especially for the run-offs lead to the outflow point of the receiving body. Preference is given to the adoption of tubular galleries, due to ease of implementation and convenience in maintenance.

In areas, or sections, where this solution is feasible due to insufficient of coverage height, there should be implemented gallery of rectangular section.

The galleries are carried out through manholes to allow inspection and cleaning of the system.

6.5.1 The sizing of the galleries came from the following assumptions:

- Speeds

Maximum speed = 5.0 m/s

Minimum speed = 1.0 m / s

6.5.1.1 Tie rod

Maximum filling ratio (Y/D) ≤ 0.85

6.5.1.2 Minimum Depth

The minimum depth for sitting the tubular gallery must be calculated to ensure a minimum covering to the pipe. The following formula is used for this sizing:

$$h = \phi + \frac{\phi}{2} + 0{,}40$$

Wherein:

- **h** = depth in meters;
- **ø** = pipe diameter in meters.

The rectangular section galleries have no necessity of minimum covering and have conditions to withstand load acting thereon from the upper slab of the device.

6.5.2 Minimum dimensions for gallery

According to Road Drainage Manual of the DNIT, for tubular galleries are recommended a minimum diameter of 0.40 m for both branches of stormwater drain or drain box for galleries.

The pipe will be used in shackles of reinforced concrete.

The galleries of rectangular section, will be in reinforced concrete and adapted to the needs of low coverage allowed for the elevation of the streets. The dimensions are always obtained by using the Manning formula and the equation of continuity.

6.6 Maintenance Yard

The Maintenance Complex includes inside the LRV's parking lot yard, the workshop and the OCC building, within the administrative and operational center, as well as the buildings for: Daily inspection, storage, auxiliary building and substation and a front gate. They also include all other complementary works, such as implementation of permanent track, drainage, respective overhead network and AMV's, among others.

For workshops and maintenance facilities, the foundation type, side closure, covering and building and industrial premises (specific systems for LRV) are very similar with the finishes for construction of an industrial facility, respecting the proper proportions.

For the train yard, there are permanent tracks in crushed stone ballast, power lines (catenaries), drainages and access to the various sectors.

The administrative building follows the same finishes of a commercial building. The differential of the OCC is that it requires a large component, relating to facilities for the receipt of equipment and systems.

The cost of all these structures is added and divided by the total area of the Maintenance Complex, resulting in a price per square meter (m^2), which is the reference unit for this item.

6.7 Adopted Party

The term "station" is generally related to the transport, service and passenger accommodation. In the case of railway stations, this concept extends by the need for elevated platforms, wide enough for transit and embarkation and disembarkation of passengers and length suitable to allow passenger's entrance and exit, along the full length of the train of the transport unit.

The vehicles will operate in segregated and/or shared tracks with cars and other road vehicles.

The height of boarding platforms will be 30 cm above the top of the head of the rails. The height difference between the top of the head, which coincides with the top of the slab (because the rail is soaked), is at the same level of the pedestrian sidewalk. But the height difference between the pedestrian sidewalk and the street (road) is 0.20 m.

The distance between stations varies from approximately 520 m to 1,740 m, depending on the demand in the region. The average distances are 930 m. The LRV system provides electric power in the whole section by tension overhead network.

The vehicles will be provided to rotate in permanent track with clearance of 1,435 m. The uptake of electric power from the catenary will be made by pantograph installed on the roof of the trains.

The rolling stock will have mask, interior and exterior of vehicles, banks, grab bars, special areas (wheelchair / bikes / strollers). The floor of the passengers' room will be 100% low and flat, thus, allowing the movement of wheelchairs. The vehicle shall be composed of 6 modules and can reach up to 7. The vehicle will be bidirectional with a driving cab at both ends.

Figure 133 - Existing stations.

For the designed stops, the main components required in a Needs Program will be:

- E_01 Geometric conditioning;
- E_02 Design of accessibility devices;
- E_03 Installation of electrification and lighting;
- E_04 Facilities for prevention and fire fighting;
- E_05 Furniture for accommodation of passengers and staff;
- E_06 Sound communication facilities;
- E_07 Visual communication facilities;
- E_08 communication facilities with the operating center.

For compliance with the section of Permanent Track, between two contiguous stops, the following Control and Management Operation Systems will be installed:

- G_01 Systems and electrical supply facilities of the permanent track;
- G_02 Electrification systems of the permanent track at an appropriate time;
- G_03 Safety systems and devices;
- G_04 Signaling systems and devices;
- G_05 Communication systems and devices;
- G_06 Operating systems and devices;
- G_07 Maintenance systems and devices;
- G_08 Lighting systems and devices.

The architectural design of the stops, due to the bidding requirements - RDC, is the responsibility of bidders, and evidently approval of the Principal or Government, however, we give some suggestions such as using the theme of inspiration, metal structures with distribution similar to profiling an old railway bridge. Some railway stations used in Vitória, capital of Espirito Santo, have this format.

They present other forms of design, including Crato - CE, which due to its rounded shape restrict the width of the boarding platform, which is not convenient.

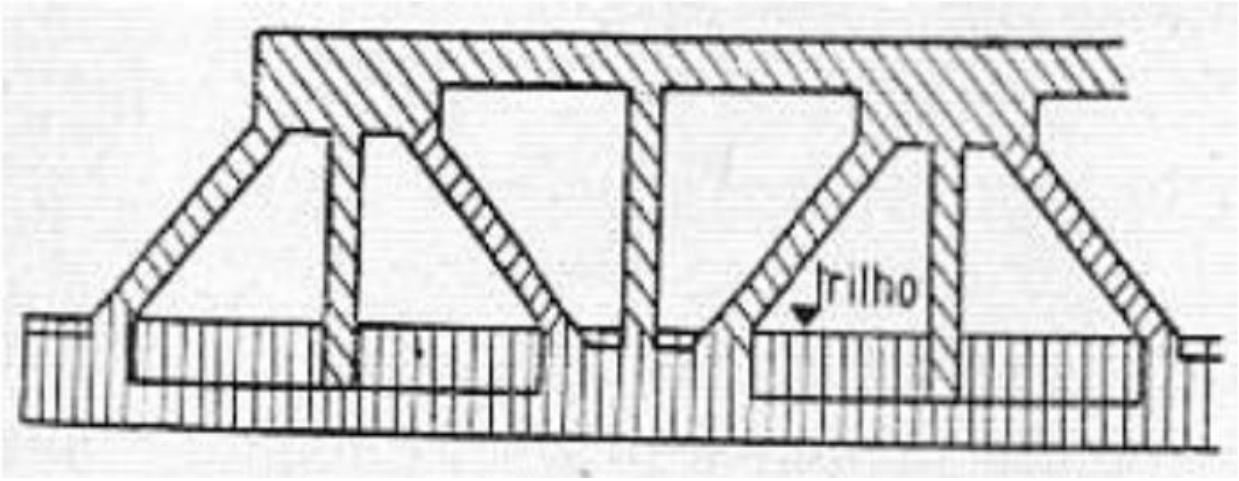


Figure 134 - The shape of truss of the bridges.

Figure 135 - Former São José bridge.

Figure 136 - Stops design.

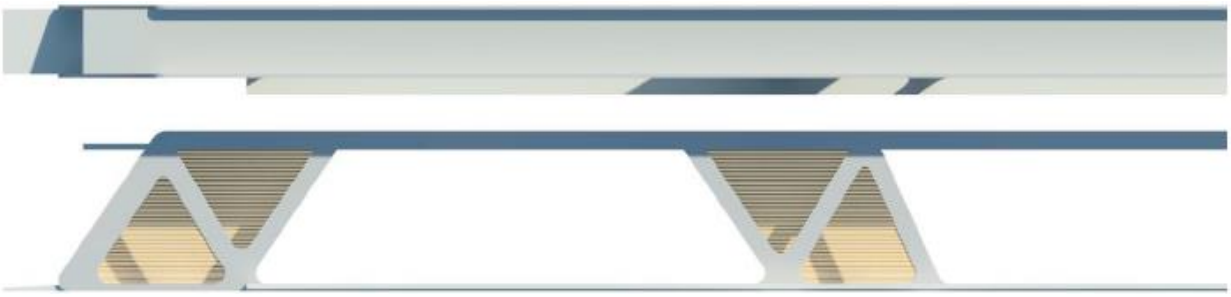


Figure 137 - Stop design

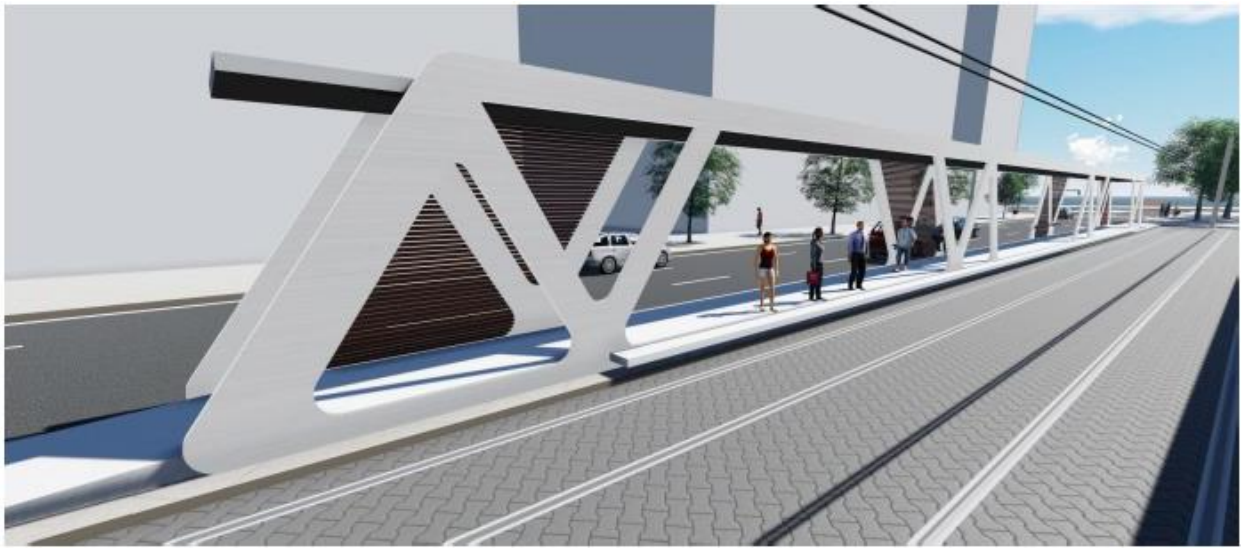


Figure 138 - Perspective of stop.

Figure 139 - Stop design.

Figure 140 - Perspective of stop.

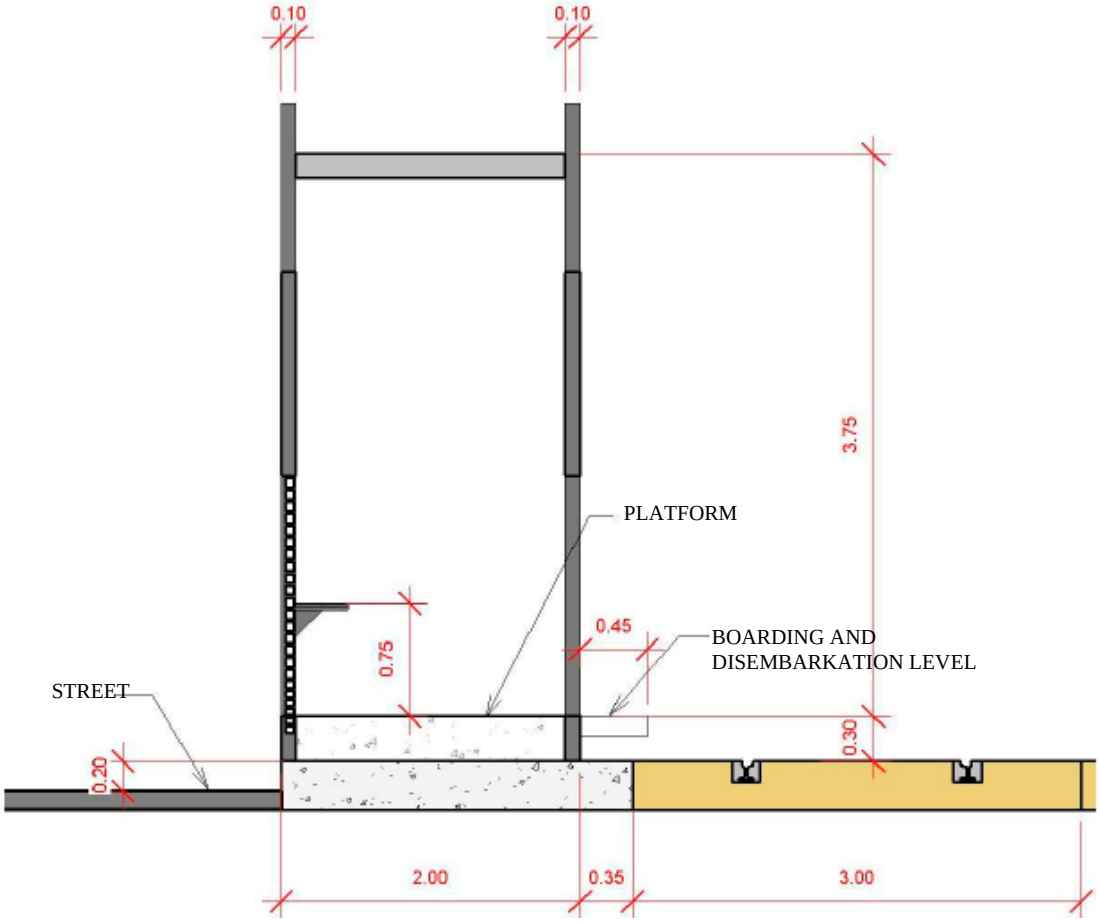


Figure 141 - Typical section.

Figure 142 - Perspective of stop.

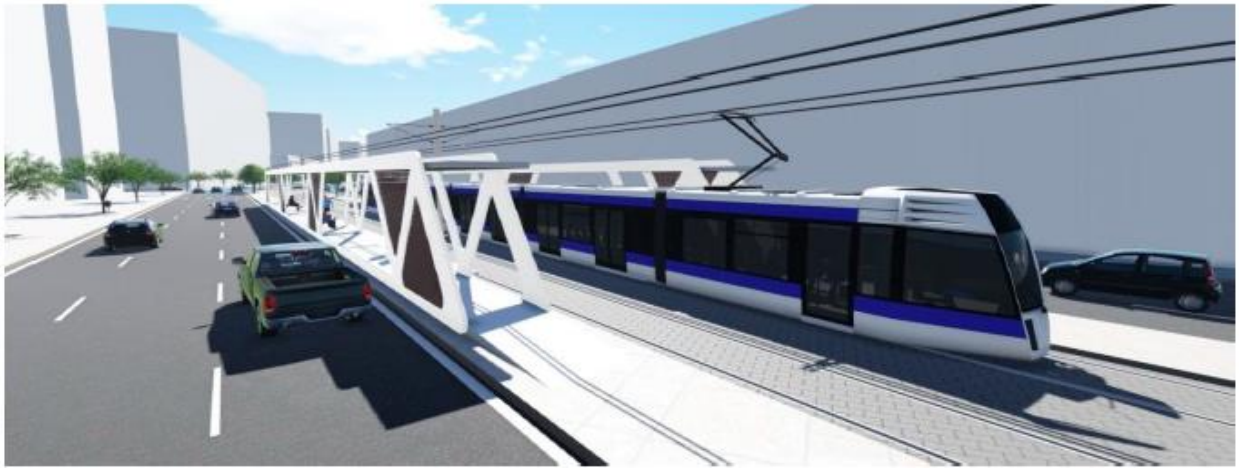


Figure 143 - Perspective of the entrance of the stop.

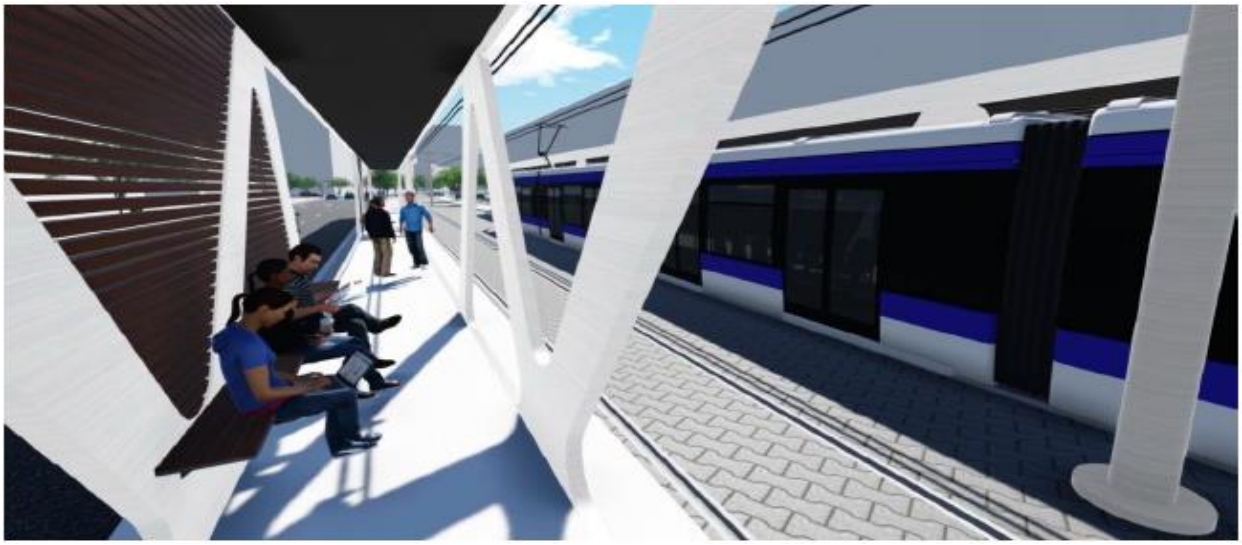


Figure 144 - perspective of the internal part of the stop.

Figure 145 - Perspective of stop.

6.8 Systems

6.8.1 Description of the systems

For a condition of efficient and comfortable safe movement, it is necessary to acquire relevant operating systems, which complement each other and can interact with those that will be installed in the vehicles.

With respect to rolling stock, permanent track, stops and operational centers, there are processes and procedures for reporting, controlling, signaling, warning and message transmission or control signals that require the interaction of a specific set of independent systems, properly connected and adjusted to promote and ensure safety and even emergency conditions.

The main systems to be purchased and installed complementarily matched, in order to make possible the control of the Operating Control are:

- Overhead electric drive system;
- Telecommunication system;
- Ticketing and collection system;
- Signaling system and centralized control;
- Traffic light system;
- Electric power supply system.

This system will be implemented in due course, in the future, if any vehicle is delivered.

Rectifier substations connected to the Local utility company networks, at 13.8 kv, located in the inner maneuvers yard of Calçada Stop and throughout the section.

The rectifier substations, with a forecast of one substation for each 2 stops, receiving power at medium voltage, and shall meet an average distance of 1,500 meters between them, so that it is possible to provide the reliability and availability required for mass transport.

The dimensioning is done to support the load at peak time and tensile stress to be used is 750 V.

6.8.2 Overhead traction network

Overhead traction network is mainly composed of utility poles, triangles and catenary. It should be prepared the design of an overhead network that will be responsible for traction electrical power of the LRV system.

The contact overhead network services include construction, supply, installation and check of the air network system. The overhead network is comprised of a contact wire supported by consoles to one or two-way or gantries, in the case of areas with turnout, stations and Maintenance Yard.

6.8.3 Telecommunications systems

The Telecommunication Systems for LRV are needed to provide security, functionality and comfort to passengers that use the LRV as a means of transport.

The telecommunication systems consist of the following subsystems: IP telephony, UHF radio communication, digital tunked TDMA, transmission - Backbone BTN, sound, electronic monitoring, CCTV, multimedia (including SIU - User Information System), Wireless, global integration for order and supervision. Due to centralization of systems, the telecommunication system is also controlled by the OCC. However, the peripherals are on the stops.

- Telephony;
- Rolling stock radio communication, stops, operations center and integration terminals;
- Chronometry;
- Information to passengers in the terminals, stops and rolling stock;
- Sound - stops, rolling stock and terminals;
- Recording images in rolling stock, terminals, stops and permanent track;
- Voice recorder;
- Ticketing and collection system.

It should be made compatible in the future with the integrated system of collection used by Public Transport of Salvador.

It should be operated in the Metropolitan Area, according to the concession model adopted.

It should be used vending machines, validity installed in the boarding platforms of the stops.

It should allow the use of various types of student tickets, gratuity, transportation vouchers, cards, common unit pass, common multiple pass, night pass, integrated pass.

6.8.4 System for billing and collection

The basic purpose of the Electronic Ticketing System will be allowing control of passenger access to the LRV of Salvador. Allowing the user access control, since the registration of information for statistical and planning purposes, to the tariff collection resulting from its use.

This system will consist of devices that constitute a natural barrier of separation between the free and paid areas of the boarding and disembarkation platforms, as well as vending machines and ticket query machines.

The Electronic Ticketing System operates with an open systems architecture in computing client-server model and meets capacity requirements, connectivity and modularity specified, to ensure the future development of the system.

6.8.5 Signaling system and centralized control

This is the identification system of the conditions of operation of the LRV. It detects the position of the compositions, in order to prevent conflict of routes and perfect alignment of routes in the maneuver yards through interlocks, detection equipment, manoeuvring switches, turnout (AMV) and side signals operating in an integrated manner. In addition to being connected to the traffic light system of the intersections.

The signaling system is divided into field signal (installed along the track), embedded devices (installed in vehicles) and equipment that make the collection and transmission of data installed at stops along the track and in the Operational Control Center - OCC. The OCC Control System includes equipment and engineering, centered on the appropriate building. The OCC Control System is thus an interface to other systems and which is carried their integration to the full control of the functional processes of the LRV. The data processing of signaling is done in the OCC.

Detect the position of the vehicles circulating in conflicting conditions in a particular section of the track. The maneuvers zones contain an equipment package, including, Interlock, detection and manoeuvring switches. Turnout - AMV and side signals, which seamlessly are responsible for aligning the tracks. Driving, on sight, obeying the side signposts and light and sound signals at the intersections.

6.8.6 Traffic light system

The Traffic Signal Control System, also called Traffic Control System in Area - CTA is of paramount importance for proper operation of the LRV.

Along the section where the LRV will be deployed, it can be seen a large volume of vehicles and pedestrians, including cars of all sizes, buses and trucks of various tonnages, interacting with the LRV in various ways, such as metaphorized crossings, roads parallel to the axis, conversions and crossing.

The subsystem is responsible for controlling road traffic around the LRV, providing interface with the Control and Signaling System of the LRV integrating opening times and traffic lights closure to provide the prioritization system to the LRV, key for operation and which determines the forecast of trains travel time.

The Traffic Signal Control System will have as primarily function control the movement of LRV trains with the road system, allowing the passage thereof by crossing regions so as not to harm the flow of road vehicles, ensuring the safety of both users, and those indirectly involved (drivers of other vehicles and pedestrians).

The operation of each LRV vehicle is performed by the driver, who is responsible for all commands for acceleration, braking, opening and closing of doors of the LRV. Thus, the Traffic Signal Control System must be developed in a way that ensures high availability and reliability. The LRV will transit with traffic signal priority, which means it will have priority in the intersections of level with the road.

6.8.7 Power system

They called as power systems the set of substation (which in LRV systems perform the lowering of power and transformation in direct current, normally at 750 V DC - volt in direct current) and power supply distribution network.

Moreover, it was also considered in this item the UPS system. The uninterruptible power supply - *UPS*, aims to provide uninterrupted electricity, stable and centralized to the various Telecommunication Systems, Special Systems, Traffic Light System and Signaling System, installed on the stops and substations and OCC, thus protecting the equipment from any variation or lack of energy from the local power utility company.

6.9 Stops

The architectural arrangement of the stops is based on the most current and modern models, with some differences regarding the side seal, which in some European cities, due to the sharply cold weather, have side closure. For the City of Salvador, the stops will be partially opened to facilitate the circulation and ventilation.

The stops will consist of a raised platform, about 30 cm above the finished floor of the permanent track and will have granite based monolithic floor finish. On the platform floor boundary with the train, there will be identification track, in yellow, in order to prevent possible accidents. Special floor will be placed for guidance of people with special needs The structure is made of steel with square tubular profile and special paint. The coverage will be made with trapezoidal thermal-acoustic metal tile improving the thermal comfort of the stop.

The stops will be 60 m long, sufficient size to contain a train, up to 7 car, i.e., a model that does not exceed the limit of the boarding platform.

Figure 146 - Perspective of stop.

The stops provide for the installation for digital panel for broadcasting operational and tourist information, advertising space, dumps, statistics panels for communication to the passenger on the transport network and urban reference of the environment, in addition, video cameras connected to the OCC.

The passenger stops include boarding platform, visual programming and indicative signs and facilities in general.

6.10 Contentions

The current line of the suburban train of Salvador in the section Calçada-Paripe, between the stakes 360 to 480 and 560 to 645, is very close to the coast. In these sections, land containment structures were built such as retaining wall of mortared stone or tie-up wall.

As shown in the following pictures, these contentions are impaired in various parts basically undermining the base of the wall due to the action of the sea, in the case of the stone walls, or by oxidation of the tie rods and and erosion of the material contained, in the case of tie-up wall.

In this section, it will be necessary timely interventions for bridges and gully holes recovery.

6.11.1 Structures to be recovered:

6.11.1.1 Mortar stone wall (height ranging between 3.0 and 5.0 m).

Figure 147 - General view of the wall

Figure 148 - Undermining the base of the wall

Figure 149 - Damaged grout mortar

Proposed solution: Retaining wall

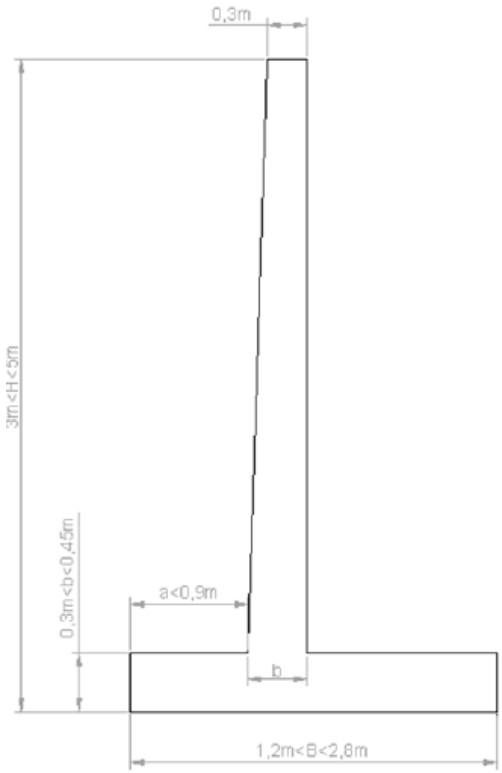
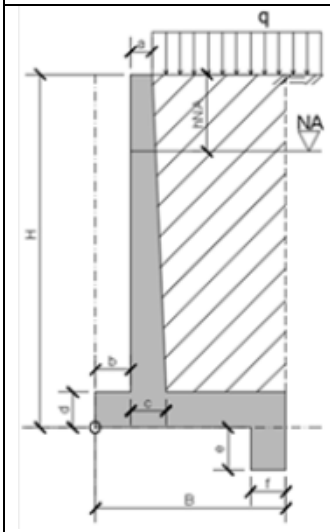


Figure 150 - Typical section of the retaining wall

Wall stability check.

The check was done considering a sandy soil with the presence of water at dimension -1.00, as follows:

Stability Check of the Retaining Wall



Data		Sizing	
H = 5.00		Acting Loads	Resistant Loads
B = 2.80 m		Q.q = 2.77 kN/m	Pm = 45.50 kN
a = 0.30 m		Q.s = 5.94 kN/m	Psl = 219.77 kN
b = 0.10 m		Q.st = 60.46 kN/m	Psp = 31.50 kN
c = 0.50 m			Pac = 3.75 kN
d = 0.45 m		Thrust	GC height
e = 0.50 m		E.q = 13.86 kN	Xm = 0.30 m
f = 0.30 m		E.s = 2.97 kN	Xsl = 1.65 m
hNA = 1.00 m		E.st = 132.80 kN	Xsp = 1.40 m
q = 8.40 kN/m			Xac = 2.65 m
Yn = 18.00 kN/m^3		GC height	Resulting
Ysat = 21.00 kN/m^3		Y.q = 2.50 m	Mi = 425.86 kN.m
Ka = 0.33		Y.s = 4.33 m	N = 319.00 kN
Kp = 3.00		Y.st = 1.45 m	T = 125.26 kN
μ = 0.55			Passive Thrust
		Active Thrust	E0 = 24.37 kN
Checking		M.e = 240.43 kN.m	Ye0 = 0.18 m
Tipping:	Slipping:	E.e = 149.63 kN	Safety Factor
FS = 1.77	FS = 1.40	Y.e = 1.61 m	FSt = 1.77
FS > 1.5 → old	FS > 1.3 → old		FSd = 1.40

Calculation of Thrust					
Dimension	Gv	u	G'v	G'h	Gh
1.00 m	18	0	18	5.94	5.94
5.00 m	102	40	62	20.5	60.46

Gv = Total vertical stress Gh = Total horizontal stress

G'v = Effective vertical stress G'h = Effective horizontal stress

Table 14

Caption
Q.q = Horizontal pressure due to overloading
Q.s = Horizontal pressure due to the weight of dry soil
Q.st = horizontal pressure due to the saturated soil weight
E.q = Thrust due to overload
E.s = Thrust due to the weight of dry soil
E.st - Thrust due to the saturated soil weight
Y.q = Height for applying the equivalent force (overload)
Y.s = Height for applying equivalent force (dry soil)
Y.st = Height for applying equivalent force (saturated soil)
M.e = Total momentum due to the active thrust
E.e = Horizontal load due to the active thrust
Y.e = Height for application of equivalent force (active thrust)
Pm = Wall dead weight
Psl - Weight of the soil on the shoe
Psp = Dead weight of the shoe
Pac = Dead weight of the tooth
Xm = Distance for application of equivalent force (wall)
Xsl = Distance for application of equivalent force (soil)
Xsp = Distance for application of equivalent force (shoe)
Xac = Distance for application of equivalent force (tooth)
Mi = Total resistant momentum
N = Total normal load
T = Total horizontal load
E0 = Horizontal load due to passive thrust
Ye0 = Height for application of equivalent force (passive thrust)
FSt = Safety factor to tipping
FSd = Sliding safety factor
Yn = Specific weight of the natural soil
Ysat = Specific weight of the saturated soil
Ka = Active side thrust coefficient
Kp = Passive side thrust coefficient
μ = Coefficient of friction between the soil and the structure

Table 15 - Retaining Wall Stability Check.

6.11.1.2 Tie-up wall (height ranging between 5.0 and 8.0 m).

Figure 151 - Tie-up wall (height ranging between 5.0 and 8.0 m)

figure 152 - Oxidized tie rod

Figure 153 - Undermining the base of the wall

Figure 154 - Collapsed wall

Figure 155 - Wall frameworks between buttresses and oxidized buttresses.

Proposed solution: Wall with buttresses

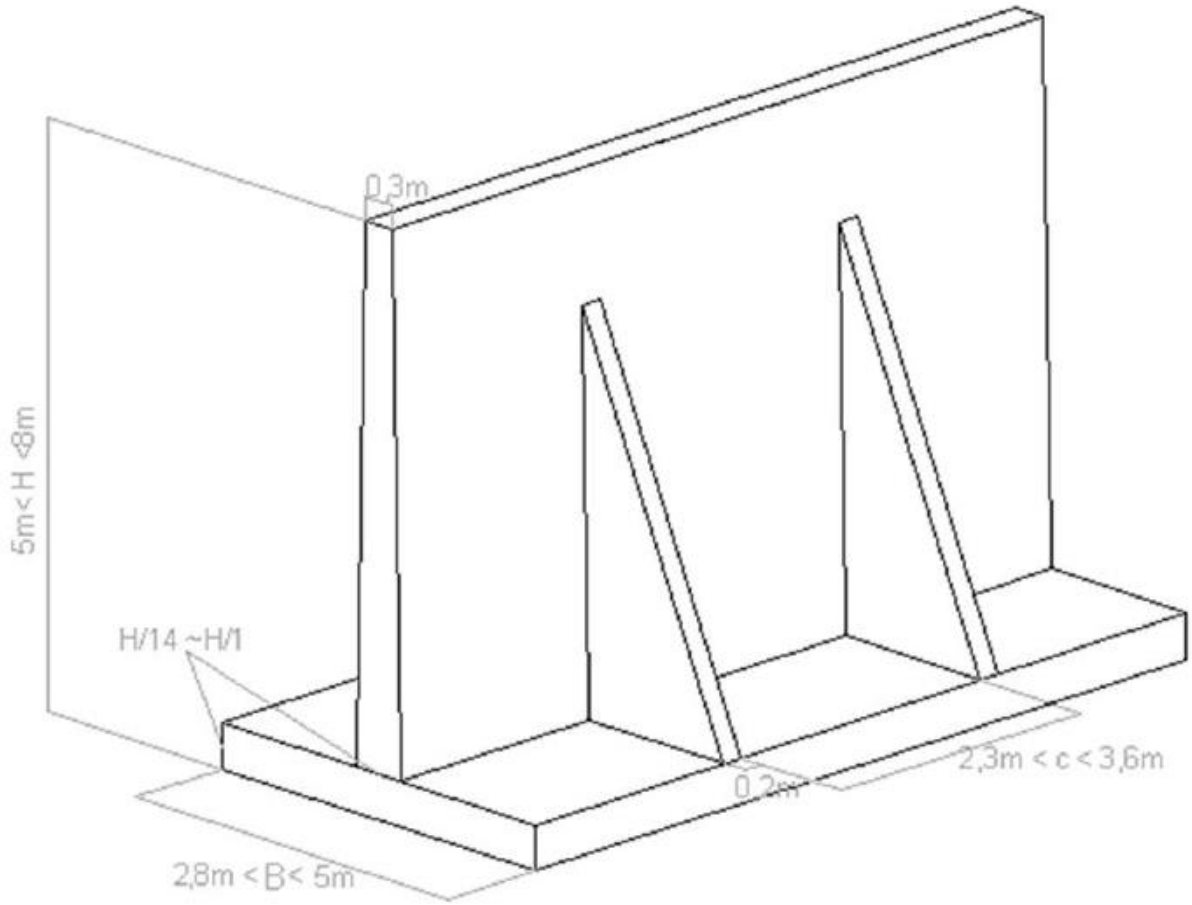
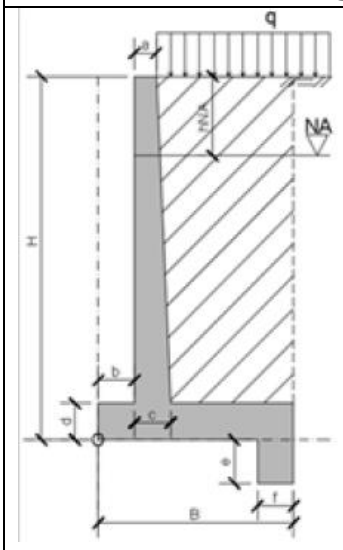


Figure 156 - Wall with buttresses

Wall stability check.

The check was done considering a sandy soil with the presence of water at dimension -1.00, as follows:

Stability Check of the Retaining Wall				
	Data		Sizing	
	H = 8.00 m		Acting Loads	Resistant Loads
	B = 5.00 m		Q.q = 2.77 kN/m	Pm = 75.00 kN
	a = 0.30 m		Q.s = 5.94 kN/m	Psl = 708.75 kN
	b = 0.10 m		Q.st = 101.35 kN/m	Psp = 62.50 kN
	c = 0.50 m			Pac = 3.75 kN
	d = 0.50 m		Thrust	GC height
	e = 0.50 m		E.q = 22.18 kN	Xm = 0.30 m
	f = 0.30 m		E.s = 2.97 kN	Xsl = 2.75 m
	hNA = 1.00 m		E.st = 375.52 kN	Xsp = 2.50 m
	q = 8.40 kN/m			Xac = 4.85 m
	Yn = 18.00 kN/m^3		GC height	Resulting
	Ysat = 21.00 kN/m^3		Y.q = 4.00 m	Mi =2,141.55 kN.m
	Ka = 0.33		Y.s = 7.33 m	N = 886.96 kN
	Kp = 3.00		Y.st = 2.46 m	T = 373.66 kN
	μ = 0.55			Passive Thrust
			Active Thrust	E0 = 27.00 kN
	Checking		M.e = 1,035.20 kN.m	Ye0 = 0.17 m
	Tipping:	Slipping:	E.e = 400.66 kN	Safety Factor
	FS = 2.07	FS = 1.31	Y.e = 2.58 m	FSt = 2.07
	FS > 1.5 → old	FS > 1.5 → old		FSd = 1.31

Calculation of Thrust					
Dimension	Gv	u	G'v	G'h	Gh
1.00 m	18	0	18	5.94	5.94
8.00 m	165	70	95	31.4	101.35

Gv = Total vertical stress Gh = Total horizontal stress

G'v = Effective vertical stress G'h = Effective horizontal stress

Table 16

Caption
Q.q = Horizontal pressure due to overloading
Q.s = Horizontal pressure due to the weight of dry soil
Q.st = horizontal pressure due to the saturated soil weight
E.q = Thrust due to overload
E.s = Thrust due to the weight of dry soil
E.st - Thrust due to the saturated soil weight
Y.q = Height for applying the equivalent force (overload)
Y.s = Height for applying equivalent force (dry soil)
Y.st = Height for applying equivalent force (saturated soil)
M.e = Total momentum due to the active thrust
E.e = Horizontal load due to the active thrust
Y.e = Height for application of equivalent force (active thrust)
Pm = Wall dead weight
Psl - Weight of the soil on the shoe
Psp = Dead weight of the shoe
Pac = Dead weight of the tooth
Xm = Distance for application of equivalent force (wall)
Xsl = Distance for application of equivalent force (soil)
Xsp = Distance for application of equivalent force (shoe)
Xac = Distance for application of equivalent force (tooth)
Mi = Total resistant momentum
N = Total normal load
T = Total horizontal load
E0 = Horizontal load due to passive thrust
Ye0 = Height for application of equivalent force (passive thrust)
FSt = Safety factor to tipping
FSd = Sliding safety factor
Yn = Specific weight of the natural soil
Ysat = Specific weight of the saturated soil
Ka = Active side thrust coefficient
Kp = Passive side thrust coefficient
μ = Coefficient of friction between the soil and the structure

Figure 157 - Retaining wall stability check

6.11.1.3 Mortar stone wall (heights of up to 3.0 m).

Once the wall is in poor condition needing to be replaced, please use the following section:

Proposed solution: Cyclopean concrete weight wall.

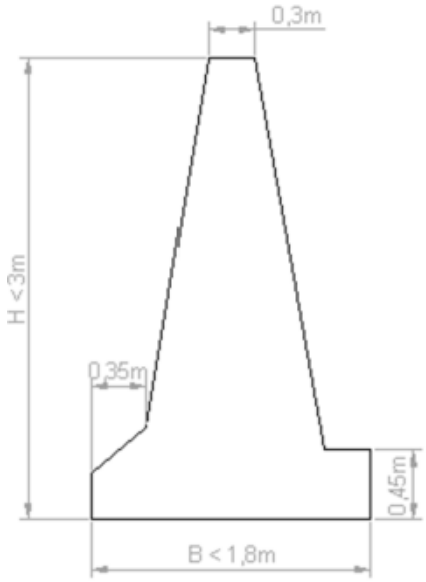


Figure 158 - Mortar rock wall (heights of up to 3.0 m).

Figure 159 - Oxidized slab framework and barefooted joints.

6.11.1.4 Overhead passage.

The entire structure must be demolished and replaced by a overhead passage as detailed below:

Proposed solution: Overhead passage

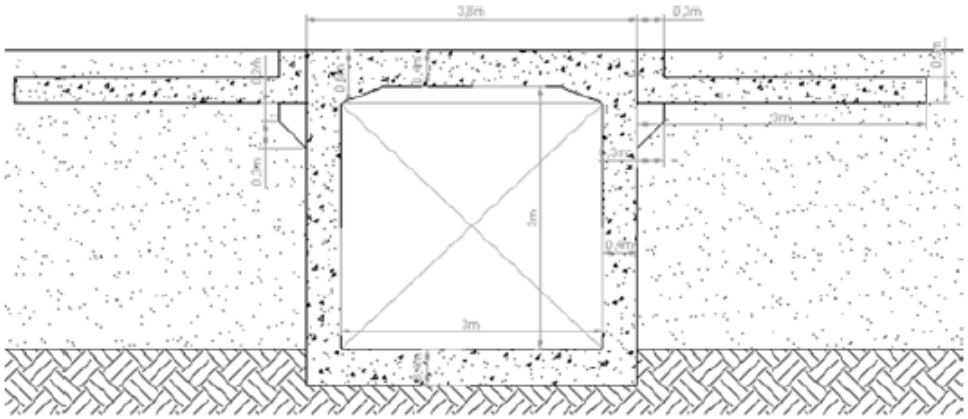


Figure 160 - Overhead passage

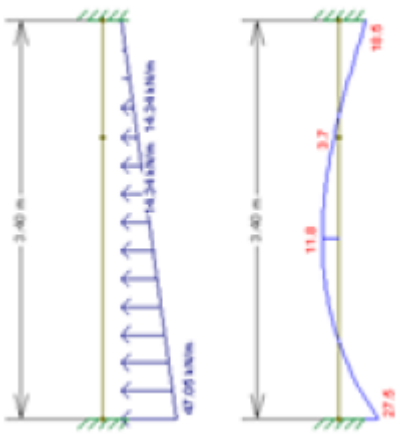
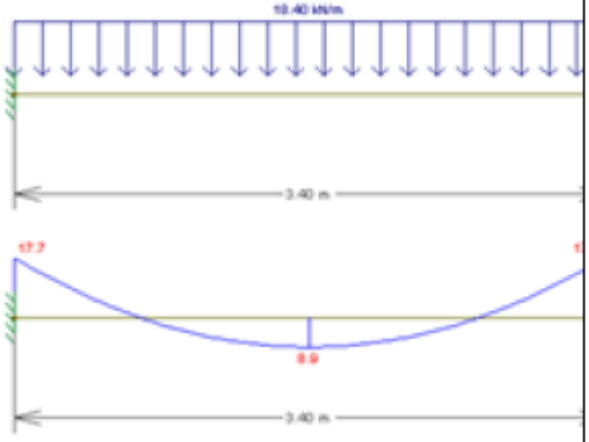
The checking was done considering a beam with a width of 1 m and 40 cm high.

Calculation of Thrust					
Dimension	Gv	u	G'v	G'h	Gh
1.00 m	18	0	18	5.94	5.94
3.40 m	68.4	24	44.4	14.7	38.652

Figure 161 - pushing calculation.

Checking the section of the overhead passage.

Load due to the train - q = 8.40 kN/m. Dead weight of the coverage slab = 0.40 m x = 25 kN/m^3 x 1.00 m = 10 kN.

Wall	Coverage
	
Bending Momentum Diagram	Bending Momentum Diagram

Wall

$$KMD = \frac{Md}{bw \times d^2 \times fcd} \rightarrow KMD = \frac{14 \times 27.5}{1.0 \times 0.355^2 \times {}^{40000}/_{14}} = 0.011$$

Laje de Cobertura:

$$KMD = \frac{Md}{bw \times d^2 \times fcd} \rightarrow KMD = \frac{14 \times 17.7}{1.0 \times 0.355^2 \times {}^{40000}/_{14}} = 0.007$$

$$KMD < KMD\ LIMITE\ (0{,}320) \rightarrow OK!$$

Table 17 - Sizing of the Overhead Wall.

Gully Hole and Overhead Passage

Figure 162 - Damaged passage floor

The floor will be replaced with precast concrete slabs for walls and slab of overhead passage, a recovery design should be done which should include at least the following items:

- Scarify the concrete
- Sand and paint the exposed armor
- Inject cracks
- Design new concrete previously applying structural adhesive based on epoxy resin.