# OVERVIEW OF SÃO JOSÉ DOS CAMPOS BRT AND ITS PROJECT

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*Abstract:* - The paper presents the basics of Intelligent Transport Systems (ITS) as an application in the field of road transport, highlighting the need to define an architecture for these systems in order to ensure the economy, interoperability and effectiveness of projects. It appears in the description of the main ITS applications that can be used in the short and medium term to improve traffic in the cities.

*Key-Words:* - São José dos Campos, Mobility, ITS, BRT, Standardization, Transportation

## 1 Introduction

With the current problems of urban mobility, the need for qualification of public mass transportation systems in order to be a fast, efficient, comfortable, built-in level control and information with other urban elements transportation such as transit is obvious and others transportation modes. For it will be imposed a dynamic that depends on process monitoring and control system using new techniques available automation and computer known as Intelligent Transportation Systems - ITS, which include, among many other features integrated in real time as the electronic ticketing, the monitoring of vehicles, adaptive traffic signal control and dynamic information to the user. The application of technology used to obtain concrete results and for this to happen, the focus of ITS systems aimed directly at improving the quality and efficiency of processes. [1][2]

The application of information technology, coupled with the telecommunications and electronics, in the planning, management, operation and control of urban transport has been configured as a viable alternative in terms of cost-effectiveness, as well as contribute to meeting the necessary sustainability features transport sector, among them the reduction of wasted time in traffic jams, traffic accidents, transport costs, energy consumption and environmental damage. This new science known as Intelligent Transport Systems (ITS) is booming in developed countries and begins to take its first steps in Brazil. The range of applications related to intelligent transport is extremely broad including: information systems for users, road management and public transport, traffic control and traffic light, emergency services management, automatic collection of fares in public transport, in the parking lots and tolls, tracking cargo vehicle fleets, public transport and emergency, automatic data collection, electronic surveillance, intelligent vehicles and roads, etc. [3][4]

Traditionally, solutions to urban transport problems based on the expansion of its infrastructure and / or its offer. However, this approach has not produced the desired effect or has not proven adequate, especially considering the high costs that, in most cases, involve solutions of this type, as well as their social and environmental costs. The advent of ITS, which translates into a massive application of telematics and management techniques and control of road transport, aims to integrate and connect managers, operators, users, vehicles and transport infrastructure. [5][6][7]

## 2 BRT Project of São José dos Campos

Based on demand forecasting models provided by the Municipality of São José dos Campos (SJC) has performed an evaluation of the current demand of urban lines and adapting the simulation network with the introduction of all runners of medium capacity to be implemented. [18]

Studies demand for designs of transport corridors need demand forecasting models, especially as regards network simulation with a high level.

The simulation network, EMME format used by SJC was provided for the realization of demand studies, presents the appropriate level of detail for the realization of demand studies.

Even knowing that SJC keeps updated simulation network, we opted for a complete revision of the model due to scope the network to be studied shown in Figure 1.

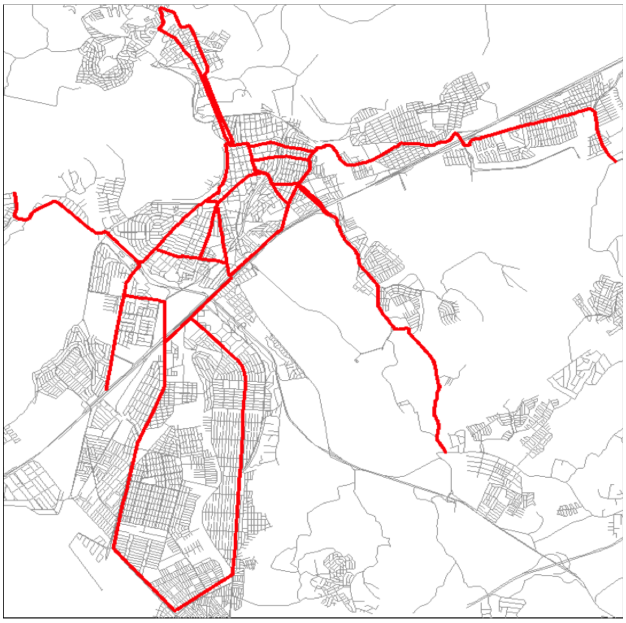

Fig.1: Average net capacity of SJC

The review of the public transport network was made based on data provided by the Municipal Transport and which were used by the technical staff as a reference source for the preparation functional design. It is fairly recent material, which allowed by supplementary survey, the precise identification of the physical situation, spatial and functional road system of the future Corridor surroundings.

They were identified new pathways that have relevance in the model, for it was only done some specific changes, to allow the correct encoding of bus lines registered.

The existing network encoded in EMME contained too many of us and to allow the same could be processed in a minor key ability, the number of nodes were reduced without changing the network breakdown.

The zones contained within the area of influence were divided in order to increase the accuracy of the model, expanding the range bordering travel the corridor under study. The subdivision of these areas can be seen in Figure 2.

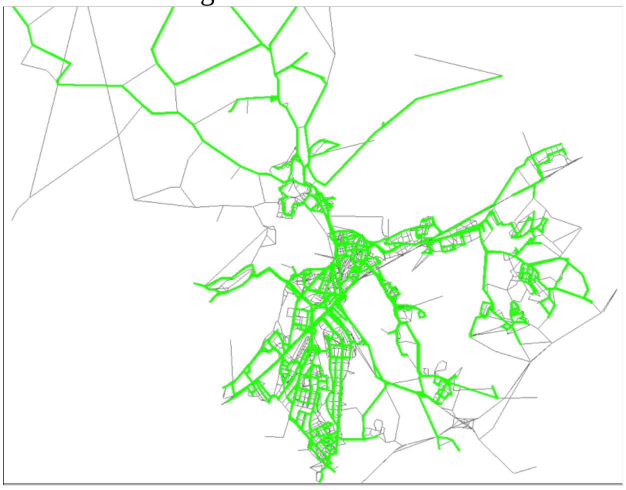

Fig.2: Simulation Base, network configuration - links and lines.

A priority network based on the analysis of the current demand of the bus lines and based upon bus services designed to meet current and future demand of the lines of medium capacity network extracted. Given the complexity of the project and the time needed for its preparation were not created future scenarios, and future demand was estimated using the geometric growth of population and jobs.

The network is all based on a trunk system powered buses with dedicated lanes and segregated throughout the structural network. Stations are constructed to allow external charging mode to make the passenger access faster, allowing a higher operating speed with a consequent reduction of the required fleet. This technology as known worldwide as Bus Rapid Transit - BRT, and had its origin in the city of Curitiba in Paraná state capital.

The BRT priority network of São José dos Campos will have 86 stations, with a very large part of them allow free and comfortable transfers between the services of the various corridors. See Figure 3.

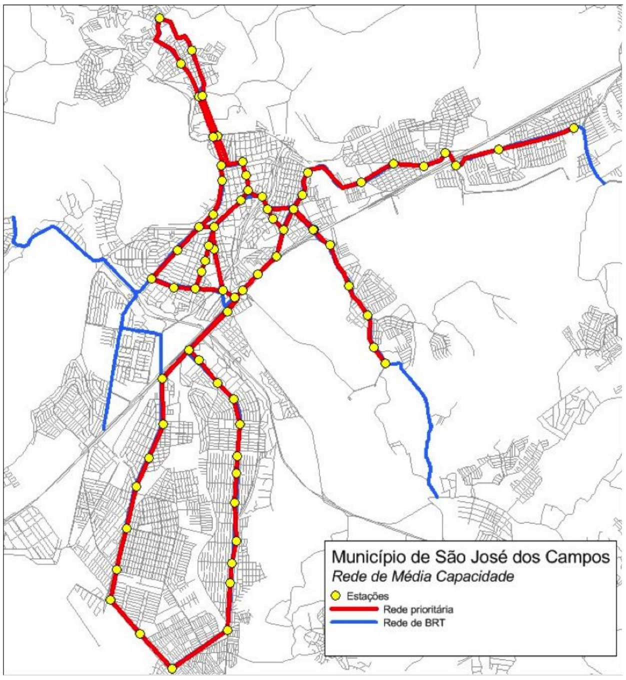


Fig.3: Priority Network

The next figures present the proposed BRT services, based on the priority network

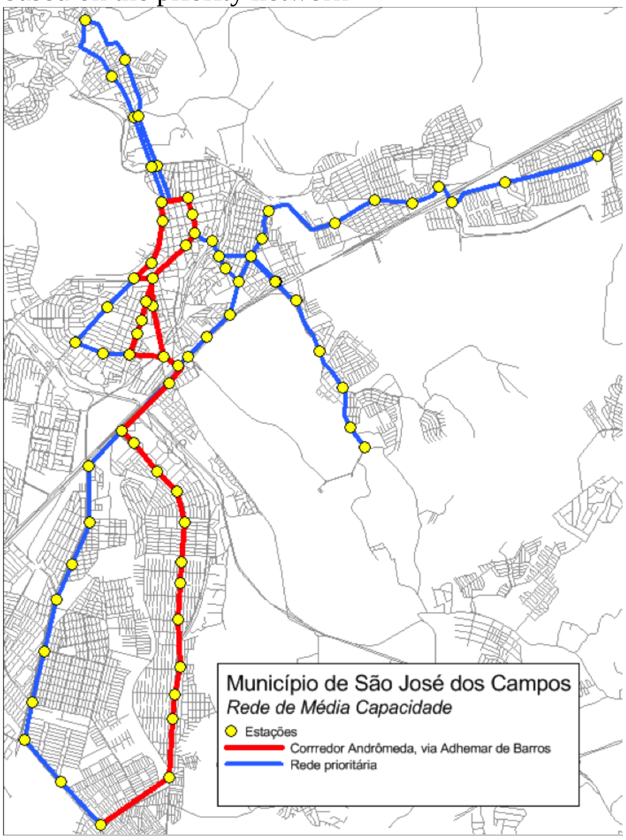


Fig.4: Andromeda Corridor - Service 1

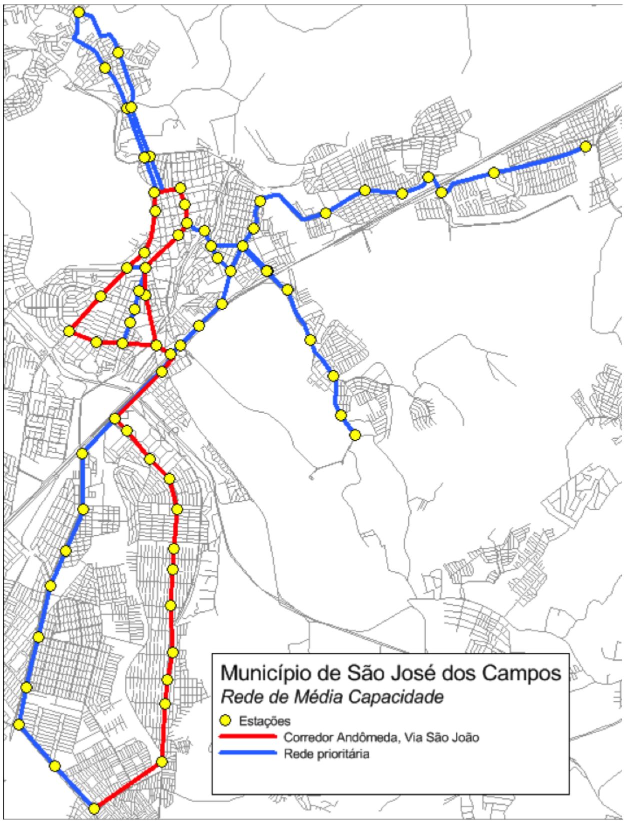


Fig.5. Andromeda Corridor – Service 2.

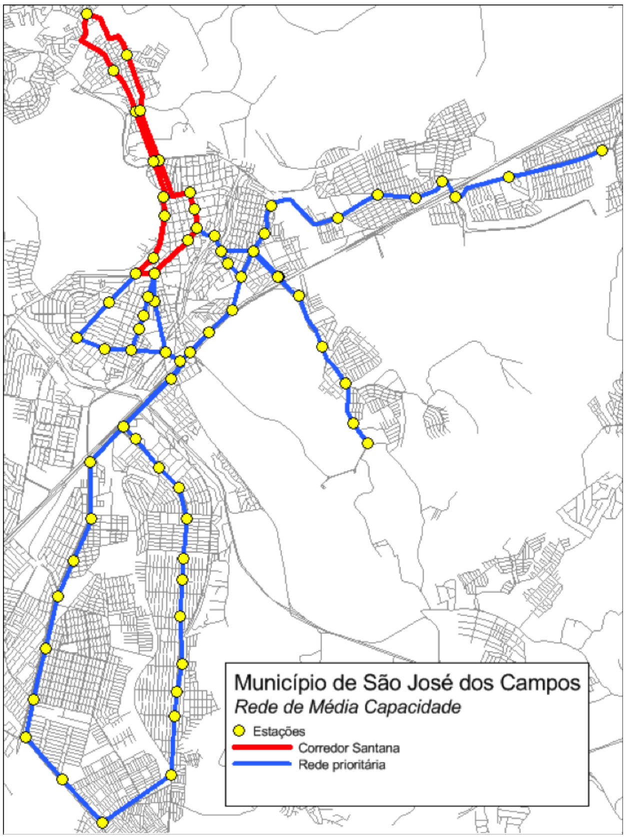


Fig.6. Santana Corridor

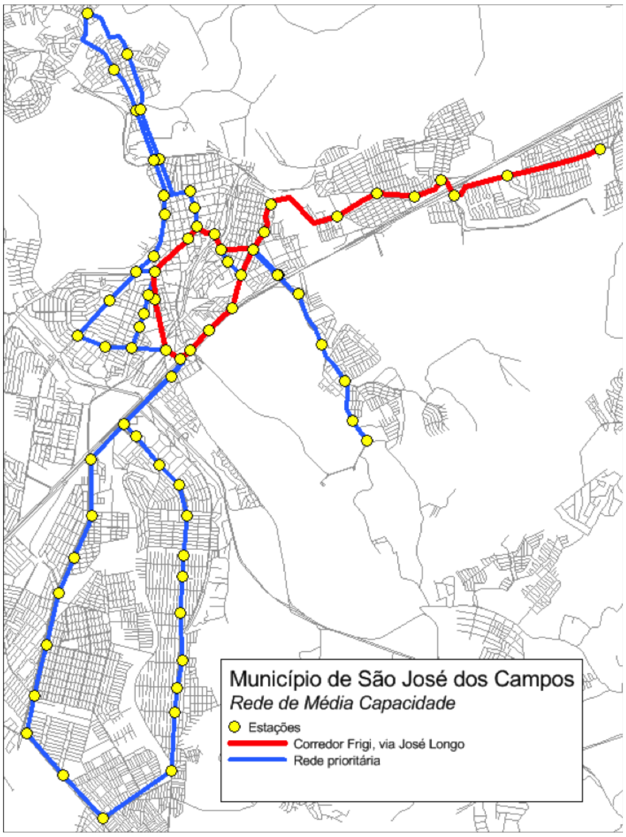


Fig.7. Fringi Corridor – Service 1

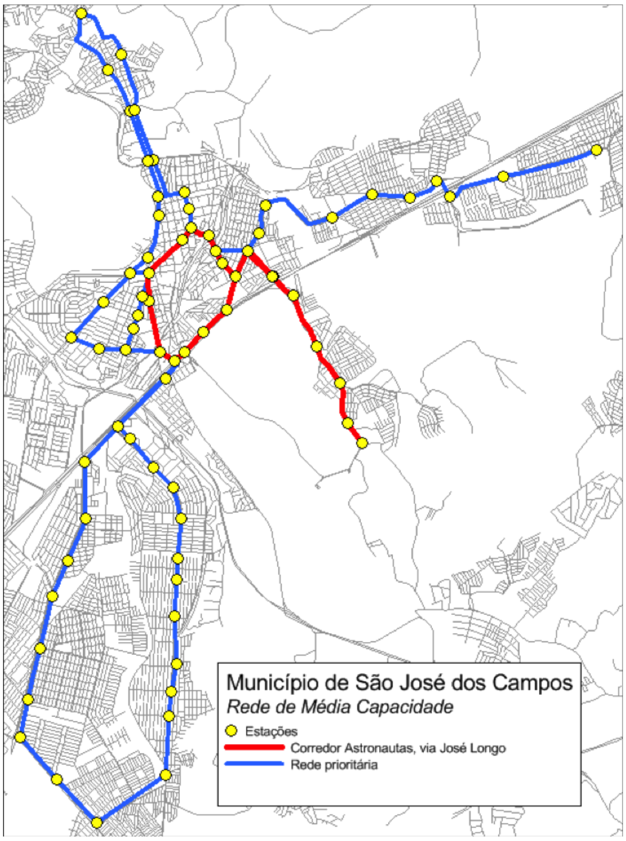


Fig.9. Astronautas Corridor – Service 1

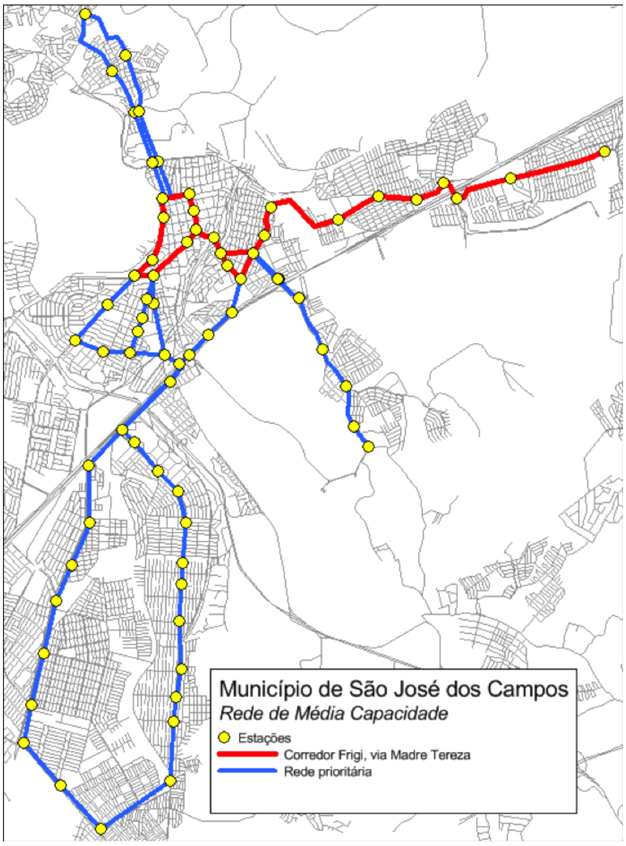


Fig.8. Fringi Corridor – Service 2

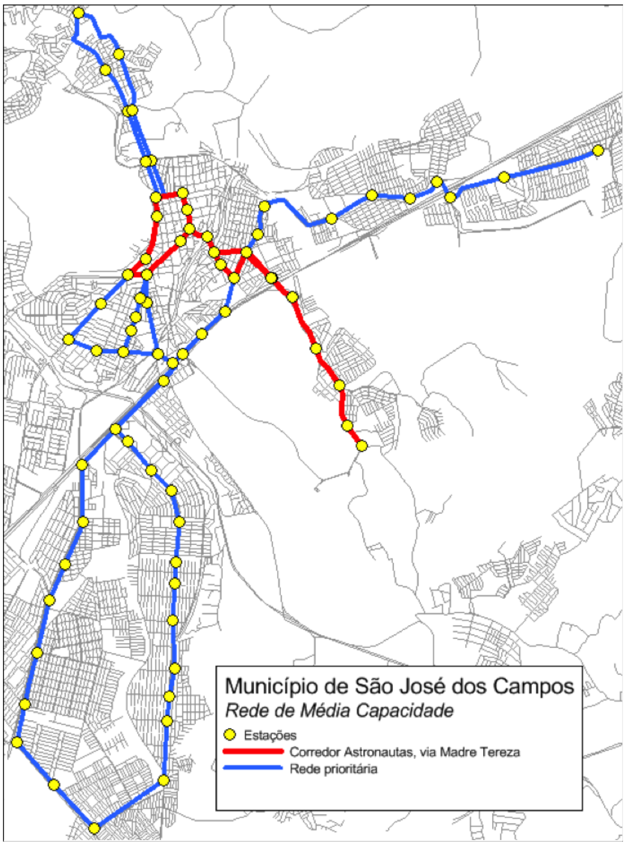


Fig.10. Astronautas Corridor – Service 1

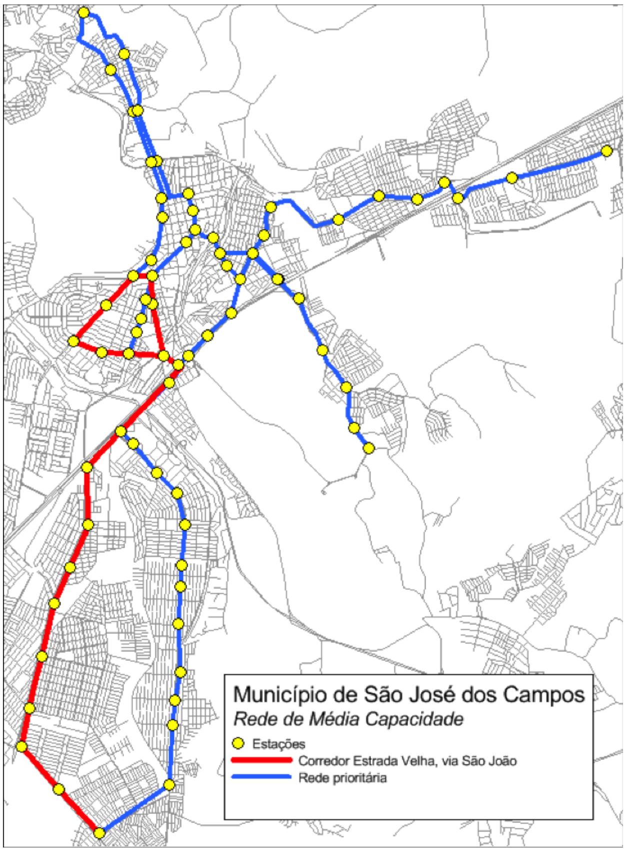


Fig.11. Estrada Velha Corridor – Service 1

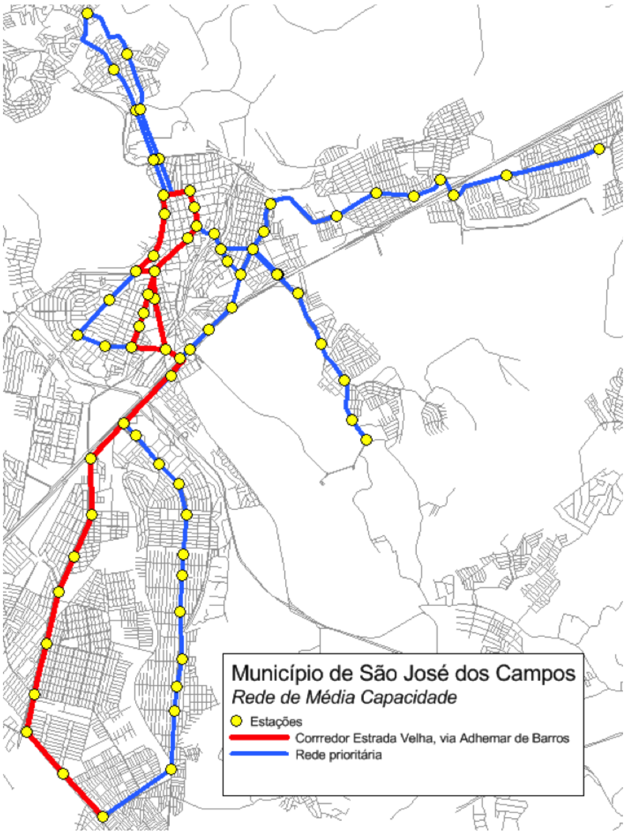


Fig.12. Estrada Velha Corridor – Service 2

## 3 Conception of SJC BRT

The BRT system (Bus Rapid Transit) is in exclusive lanes, stations and high quality bus and may be hybrids, with passenger capacity similar to that of a tramway system, and with an operating cost and similar deployment that of a conventional bus system. [18]

Thereby, the adoption of the BRT system will permit the full implementation of the traces originally earmarked for the tramway system, with an approximate length of 95 km, as already mentioned, connecting all parts of the city. In all, seven planned lines will be deployed, as well as two new terminals and six transfer stations, which will allow the power of the BRT system by municipal bus lines. See Figure 13.

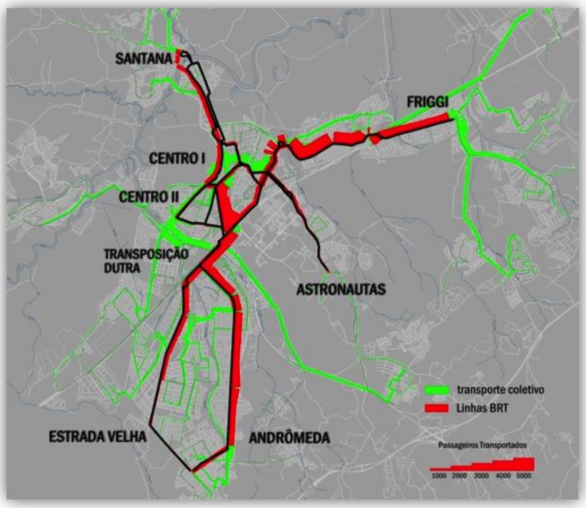


Fig. 13. Conception of SJC BRT Corridor

The figure 14 and figure 15 present the layout of infrastructure of BRT planned for SJC. It is possible to seen that the infrastructure is formed by exclusive BRT corridor and lanes for cars and pedestrians. This conception is associated with mobility plan of SJC and comply with necessities of City.

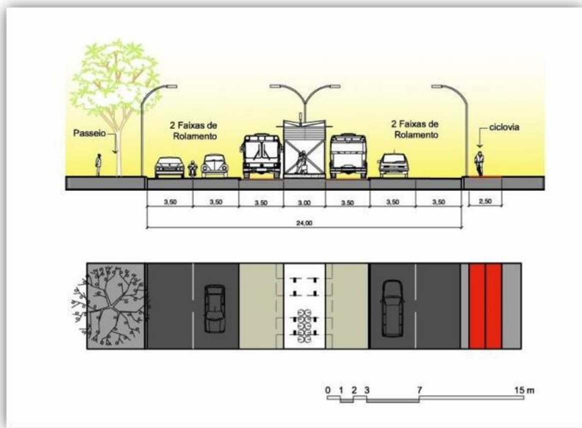


Fig. 14. Infrastructure of BRT (layout 1)

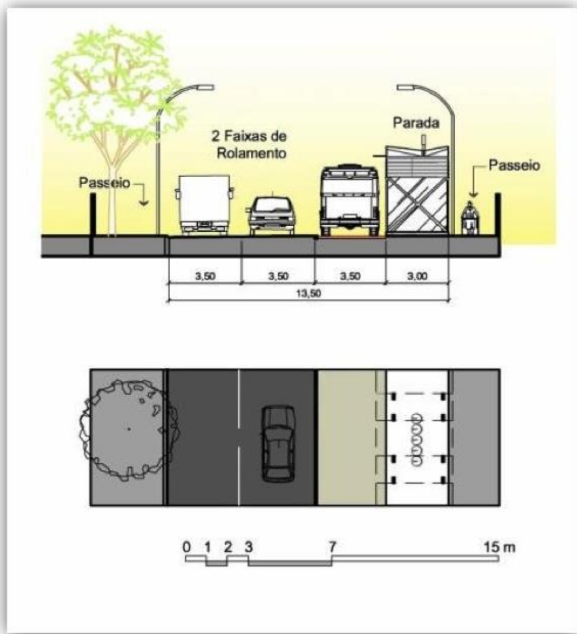


Fig. 15. Infrastructure of BRT (layout 2)

## 4 Planned ITS for SJC BRT

The numerous technological innovations currently available in the market, associated with the harassment of vendors proclaiming their "technological marvels" have led some agencies to wrong investments or projects that do not enable, causing frustration and mistrust between experts and with users. Most often, the reason for failure is the lack of planning and lack of technology. What remains is to research, train and plan, because only in this way can achieve the desired results in an efficient and sustainable manner. [8] [9]

The planning of ITS is based on the definition of an architecture or a master plan for implementation of these technologies. ITS relate primarily information gathering, sharing, processing and redistribution of information in order to better move people and goods. These concepts are already practiced in the airline industry, where technology and information management are used to optimize services, fleet, costs and inform users.[10][11][12]

An ITS architecture is a comprehensive framework that sets limits, stakeholders and strategies for this information management process, which, in turn, leads us to set standards and which results in efficiency, economies of scale, compatibility and interoperability. [13][14][15][16][17]

The development of the ITS architecture requires several steps, as the items described below:

1. Public Discussion of the benefits of ITS to its various users and defining the scope of the ITS program.
2. Description of the goals of the ITS program;
3. Defining the basic architecture of the system, involving the description of the functions and information required and the physical components required to implement the functions and information exchange;
4. Consideration of practical issues related to the implementation, such as restrictions (economic, social, institutional, etc.), cost analysis, perspective and feedback from users;
5. Establishment of a coherent scenario for the ITS in the future: master plan and recommendations to speed deployment;
6. Definition and Description of standards and requirements and training programs and training of human resources.

The ITS architecture is based on the interaction of three "layers" of infrastructure:

- Transport layer: consists of the physical infrastructure of STI, containing users, vehicles, control centers and road equipment.
- Communication Layer: is composed of the information infrastructure that connects all elements of the transport layer. It is the layer that gives the characteristic of "system", providing coordination and sharing of information between systems and people. The architecture carefully describes what types of information and communication needed to the various ITS services; how the data shared and used by which physical entities (subsystems); and what types of standards needed to facilitate this sharing.
- Institutional Layer: is comprised of our organizations and social rules that define the institutional boundaries and the roles of government agencies, private companies, user associations and other participants in the context of ITS services. The activities of this level include the development of a local policy, the ITS funding and creating partnerships that drive the development of ITS. In this case, the architecture recommends who connected to whom and what types of information to exchange.

The Service Oriented Architecture involves the deconstruction of an application in common offices "reusable", which can be used by other internal applications the organization or external, independently of the applications and computing platforms adopted the company and its partners. With this approach, companies can assemble repeatedly these services based on open standards in order to extend and improve collaboration between existing applications, create new opportunities and stimulate creativity at every point in the value chain.

The service-oriented approach simplifies communications among IT systems, to the extent that it makes no difference that particular "service" resides in their own computers or on their external partners. In essence, SOA delivers the IT systems owners of its verticality and rigidity, adapting them, so the user's needs. An SOA approach applied to systems integration requires an elaborate project jointly between business and technology. Among the main benefits of this approach, the most obvious is that it gives more flexibility to the business, but one should also highlight that promotes the construction of new capacity in less time and at a lower cost.

Moreover, as the services are separated from the applications used to deliver them, companies can extend the life of existing applications and integrate more easily various types of applications and platforms. SOA provides a framework based on standards, in which every participant inserted in the process can connect to each other regardless of a specific solution, personalized and point-to-point. Increasing the level of communication, connectivity and flexibility between the systems, SOA unlocks the potential of services and print streamline the system.

ITS as deployment strategy should define the situation to be reached, with reference to the best practices in the world. This assessment can be carried out considering the eight areas of ITS to follow BRT:

- Information for Users: services designed to support users' decisions before and during their displacement.
- Traffic Management: services required for the management of traffic flows in the corridor.
- Demand management: services needed to reduce congestion on the roads and in urban areas.
- Advanced service to the driver: automatic systems to improve vehicle performance and driver and make driving safer.
- Financial transactions electronically: Services that provide automated fare collection.
- Fleet management: support service necessary to the management of public transportation passenger service fleet.
- Public Transport Management: includes services necessary to optimize the public transportation of passengers in terms of convenience and performance.
- Instances of service: services needed to meet the occurrences of accidents and other emergencies.

The logical framework below is intended to help the cities, regions and countries in the future to take the course of a smarter transportation infrastructure, and guide the relevant sectors of the public throughout the different stages of identification, design, implementation and deployment an ITS project. This matrix, in its most basic level of detail, divided into three pillars:

1. ITS evaluation: The first pillar of the pattern, which is divided into three different phases, aims to analyze the current transport infrastructure in the city, region or country in question and form active groups to monitor the ITS process in two pillars three.
2. ITS System Project Design: After the analysis of the current situation, the next step is to draw the ITS system. This pillar is divided into two phases, namely the definition of the ITS system will do and how to do it.
3. Implementation and deployment of ITS: The third pillar of the pattern proposal is to implement the ITS project designed in the second pillar, implementing the projected infrastructure, or reusing the current, so that the ITS system can meet the needs identified in the pillar project design.

The analysis of the INSS cost-benefit ratio is, together with the definition of the system architecture, the most important activity to develop by the project design team at this stage. Use the analysis of cost-effectiveness as input for the next stage - the preparation of the Basic Project and Executive Project. Arrive at an estimate of the cost-benefit ratio is not a difficult task, however, it is a necessary analysis for the ITS matrix, so that we can identify, measure and evaluate how the proposed activities will influence the transport infrastructure existing as well as to justify the investment and the costs involved in implementing this activity. From this analysis, the Project Design Team will propose Performance Indicators for each activity, among which the most appropriate be chosen in the next phase. Studies estimate that the overall cost-effectiveness of ITS systems is approximately 9 to 1, well above the values that obtained by adding capacity to a road in the conventional way, whose cost-benefit ratio is 2.7 to 1.

The following are some of the expected benefits of running an ITS project:

- Shorter duration of displacement (travel time).
- Increased capacity and flow.
- Reduction of operating costs.
- The travel cost reduction.

- Raising the level of user satisfaction.
- Increased safety.
- Reduction of emissions.
- Lower incidence of traffic violations.
- Gains in efficiency in public transport.
- Improvements in logistics and security.
- Greater accessibility to users.

## 4 Conclusion

The SJC BRT project is based on best market practices and seeks to bring to the public a quality service with adequate capacity for the city. With other initiatives in the urban mobility area, the city of SJC are solving their problems in a creative and innovative way.

## 5 Acknowledge

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