CASE STUDY TRANSANTIAGO, SANTIAGO, CHILE

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SUMMARY

Transantiago is a citywide public transportation modernization plan, which includes the optimization of the bus routes and services, fare integration using advanced technologies; continuous bus fleet renovation; strong requirements to the companies delivering transit services, support infrastructure for buses (priority and exclusive lanes, bus stops, integration terminals, and user information and control systems), and expansion of the metro network. System commissioning happened on a single day for the whole Metropolitan Area on February 10, 2007, after 6 years of planning and implementation processes.

Bus service provision includes reorganization of routes in five trunk corridors using the main thoroughfares of the road network and ten local service areas to feed trunk and metro services and to provide transport within the areas. Each trunk corridor and service area is privately provided under concession contracts awarded through an open and competitive process. Administration of system funds is also a concession to a pool of banks, which are in charged of providing the integration technology (contact-less cards, points of sale and re-charge, validation on board buses, and transaction management). Control and user information systems are also privately provided, as well as selected infrastructures of the system (integration terminals). The Metro network is developed and operated by an autonomous public agency.

Things done well

- Citywide and systemic approximation for overall service improvements, including total integration of bus and metro services.
- Technical approximation to the solution of transport service provision, using state-of-the art planning tools and using the extensive Chilean experience in private participation in the provision of infrastructure and utilities.
- Open, competitive process to award concessions (bus operations) with flexibility to introduce changes and adequate support to the participants.
- High quality Metro expansions (45 Km), completed at a relatively low cost in a very short time.

1 This case study focuses on the planning and implementation process, with less discussion of operational issues than other case studies. Main aspects of the report and interviews were prepared before the system started operations in February 10, 2007. There are some discussions based on a web-based interchange with local academics and practitioners, as well as media reports during the first month of operations.
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- Use of the principle of authority to overcome the violent opposition of traditional transit providers (2002) and users (February-March 2007).
- Rapid adaptation and positive attitude to solve planning and implementation problems (February-March, 2007).

Things that perhaps should have been done differently

- The planning and implementation team had several changes both in leadership and its integration. This diminished its ability to coordinate the multiple activities required.
- The road based infrastructure did not receive enough financial priority; several components were not implemented or delayed. Lack of specialized infrastructure for optimized bus operations (segregated lanes, closed integration points for validation off-board) resulted in longer travel and transfer times than expected, and operational problems for bus operations.
- Emphasis on cost optimization (fleet and mileage reduction) and emissions reductions resulted in an operational design that increased walking, waiting and transfer times for the commuters.
- Transition phase (October 2005- February 2007) was poorly defined and resulted in several operational problems, financial losses for the operators and lost of public confidence in the Transantiago system.
- Planning delays generated the need for a very short implementation time table. Infrastructure and support systems were neither ready for the established date (October 2006), nor for the extended deadline (February 2007).
- There was not an open competitive process for the financial administration concession for the integrated system. This resulted in a single proponent with extraordinary leverage over the authorities (unbalanced contractual relations).
- Initial public perception of the system was bad, and there were even user protests due to the poor quality of services provided.

Critical positive enablers

- Transantiago plan was a priority for President Ricardo Lagos; he provided the leadership to give adequate momentum to the project and even solved intermediate crisis during the planning stages. Implementation became a priority to the government of President Michelle Bachelet after the operational difficulties in February 2007. A quick response team was formed to introduce changes and improve service delivery.
- Strong institutions and knowledgeable professionals supporting the decision making process, planning, implementation and oversight.
- Strong planning abilities of government institutions, local universities and consultants and availability of information (Origin-Destination Matrix 2001). The approximation was too theoretical though and could be enriched with a more practical approach.
Good economic conditions provided an adequate setting for long term concessions and direct foreign investment.

Large scope of the project (1,000+ new articulated buses, gradual replacement of 3,000 conventional units) was very attractive for bus manufacturers, which made a large effort to provide adequate conditions and to finance project participants.

Critical barriers

Lack of coordination among several government institutions. This was partially solved through the creation of a decision making ministerial committee and a technical secretariat (Transantiago). Still, differences in views and interests of different agencies and government officials resulted in large changes in project scope, definitions and funding.

Metro agenda. The officials in the Metro Company feared loss of corporate assets (fare definition, planning for expansions), and wanted to re-invest operational surpluses in Metro (extensions, expansions). This agenda prevailed, and large capital investments in Metro (USD 2,500) were approved and implemented. The bus component did not receive the same level of funding and had more implementation difficulties due to the intrinsic complexities of the bus sector institutional framework. Funding differences indicate the lack of political priority for the bus component.

Existing dispersed operations and lack of regulatory instruments. Partially solved with a good mix of incentives (guaranteed income, use of existing fleet), use of the principle of authority (violent protesters were brought to justice) and continued help from the project implementation team. Despite this, external providers were able to offer improved conditions (large financial deposits in the contingency fund), and most traditional providers were left out, staging new protests in 2006 and looking for mechanisms to continue their traditional operations.

User and public opinion information. Given the appalling service conditions transformation of the bus operations was perceived as a major requirement by the population at large. Nevertheless there was low credibility on government institutions on their ability to make large scale modifications of the transport industry (different than Metro expansions). This barrier was not removed when Transantiago got fully in operation and is still a large liability. The low quality services during the transition phase and large service deficiencies during the first month of full scale operations increased the negative public perception.
CITY CONTEXT

Greater Santiago includes 37 municipalities with a population is 5,456,326 (2002 Census), in an area of 64,140 ha (Density: 85.1 habitants/ha). Santiago is Chile’s most important city and the administrative and political centre of the country. It concentrates 37% of the population and 45% of the country’s GDP.

Each municipality has a government elected by popular vote, with responsibilities ranging from waste disposal, sidewalk and local streets construction and maintenance, enforcement of zoning regulations, among others. Metropolitan transport, infrastructure and urban development are in the hands of the National Government, through several ministries. National government is elected for six year terms.

The city is located in the Mapocho River Valley in the foot hill of the Andes Mountains. Most of the urban area is flat, with developments in hilly areas in eastern and southern parts of the city. Due to geographic characteristics and atmospheric conditions, especially in the winter months due to thermal inversion, Santiago has critical environmental conditions, with high levels of TSP, PM10, CO, and O3, and was identified as latent for NO2. Mobile sources have been regarded as the main contributors to air quality degradation.

According to the latest Origin-Destination Survey (EOD 2001), 40% of the households were below CHP 280,000/month (USD 455/month). Most of the lowest income population is located in the periphery, especially in the southern and northern parts of the city. Employment is located primarily in the extended CBD and the industrial areas in the south of the city. Motorization rate was 148.15 vehicles per thousand inhabitants in 2001, compared to 93.61 in 1991 and 59.79 in 1977.

Daily trips were estimated to be 16 million in 2001, 62.5% in motor vehicles (EOD, 2001). About 52% of the motorized trips were in public transportation and 39% in private vehicle (from previous figures of 20% in 1991 and 12% in 1977).

The Metro network, 38 Km long in 2001, carried 6.7% of the motorized trips (45% of them using other motorized mode of transport to complete the trip, especially buses and taxis). Metro has been expanded since to a a total of 64 Km and 69 stations by the end of 2006.

The buses carried 43% of the motorized trips in 2001; equivalent to 4.3 Million trips per day. Bus transit provision was delivered by more than 7 thousand vehicles owned by 3 thousand individuals, grouped into 120 organizations. There were 323 routes under permits (“Resolución”) or limited time concessions with the Ministry of Transport and Communications.
Despite the efforts carried out in the period 1990-1992 to regulate the service provision after ten years of complete deregulation of bus services in Chile (1980-1989), the regulatory framework was still very weak. With the start of regulation in 1991 there were important improvements such as fleet reduction\(^2\), vehicle renovation, minimum quality of service requirements, and the use of bidding process to assign routes.

Probably the most important improvement in the 1990s was the establishment of user fares through a predefined formula with automatic adjustment according to change in supply’s costs. Nevertheless, in spite of the initial requirement that only bus companies were going to be allowed as operators, the individual operation of the transport units remained as the most common characteristic of service provision.

Given the mentioned conditions, productivity of the bus services remained low and there were large overlapping of routes, especially in dense corridors such as Alameda Bernardo O’Higgins. There were also more units than required for efficient operations due to very long cycles.

As for cars, given the high levels of air pollution, car use restrictions where introduced since 1990 with the decree that paralyzed 20% of the car fleet daily according to the last digit of the license plate, a measure which is still applied at least for the old vehicles without catalytic converters. A law to authorize urban tolls was sent to Parliament in 1991 but after ten years of a very slow processing it was finally withdrawn by the Government in 2001.

The only enhancement over the next decade (1993-2000) was the environmental emergency network. Due to critical environmental conditions a large restriction to car use and bus priority measures (bus only streets and reprogrammed services) were strengthened in 1997 during ozone critical episodes. Large increases in public transport travel speeds were reported and the emergency network became a permanent feature (dedicated bus lanes in main roadways). Despite this, bus service conditions were considered appalling.

President Ricardo Lagos (2000-2006) promoted a large scale public works and transportation agenda for Santiago, which received the name of Transantiago. The project, continued under President Michelle Bachelet (2006-2010). The system started full scale operations in February 10, 2007 under the new route itineraries and frequencies. Several adjustments were required during the first weeks of operations.

\(^2\) 2,600 obsolete vehicles where removed from operation in 1991.
DESCRIPTION OF THE PROJECT

Transantiago is a citywide public transportation modernization plan, which includes the optimization of the bus routes and services, fare integration using advanced technologies; continuous bus fleet renovation; strong requirements to the companies delivering transit services, support infrastructure for buses (priority and exclusive lanes, bus stops, integration terminals, and user information and control systems), and expansion of the metro network. System implementation happens on a single process for the whole Metropolitan Area and is expected for February 10, 2007.

Metro network expansion includes the construction of 66 Km and 68 stations at a total cost of USD 2,400 Million\(^3\). 45 km were built between 2000 and 2006 for approximately 830,000 Million trips per day. Additional 21 Km are planed for implementation before 2009 to serve 254,000 additional trips. Santiago Metro has very high usage, especially Line 1, which is operating close to capacity in the peak hours. Metro management has been able to generate an operational surplus which has been used to partially support new capital investment (rolling stock and infrastructure for expansions).

The road based infrastructure of Transantiago includes (short term before February 2007):
- 18.8 Km of segregated corridors (Pajaritos and Santa Rosa)
- 4.6 Km of new road connections (Blanco Encalada-Arica, Suiza-Las Rejas)
- 62.7 Km of improvements in road geometry and pavements (in seven corridors, Alameda, Santa Rosa Sur, Gran Avenida, San Pablo, Recoleta, Independencia, Grecia) and improvements in intersections
- 70 bus stops along the main corridors, and
- Two intermodal stations (Quinta Normal and La Cisterna).

Total investment in this infrastructure has been estimated in USD 267 Million. About 45% of the investment will be raised through public private partnerships (concessions) using a fraction of the user fares and commercial space development (in integration terminals). The remaining infrastructure is founded by the Ministry of Housing and Urbanism.

The equipment of Transantiago includes\(^4\):
- About 1,200 New trunk low floor articulated buses
- About 1,500 conventional trunk buses (to be gradually replaced by new low floor buses)
- About 2,300 feeder buses

\(^3\) Cost calculated using an average cost of 36.45 Million/Km, extracted from notes in www.metrosantiago.cl (Line 2 Extension 5 Km, USD 200 Million; Line 5 13.5 Km USD 670 Million, Lines 4 and 4A, 33 Km USD 1,007 Million).

\(^4\) Values estimated from data available in www.transantiago.cl
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- Integrated financial system to sell, validate, consolidate and report transactions, using contact-less cards (off board sales, on board validation)
- Integrated information systems for operational control and user attention.

Private investment in bus fleet is estimated in USD 322 Million. Investment in support systems (fare collection, control, and user information) is estimated in USD 30 Million.

The Integrated Transport System is expected to carry 5 Million trips per day, with very high performance standards: trunk buses are planned to operate over 8 passenger boardings per bus-km.

Operations are under private concession contracts with the Ministry of Transport. There are five concessions for trunk operations, nine concessions for feeder services, one concessionaire for the financial administration of the system funds (includes fare collection system) and one contract for the Information and User Attention Services.

The main project milestones are summarized as follows:

- Election of President Ricardo Lagos in January 2000 for the 2000-2006 presidential period. President Lagos integrated a group of recognized professionals to prepare the technical basis for a transport plan for Santiago, which included Germán Correa and Sergio Gonzalez, former Minister and Deputy Minister of Transport in the nineties, respectively. The main idea was the need to recover the regulation of transport services with a technical balance between demand and supply, and apply the emerging concepts in bus operations (bus priority measures, information systems, electronic fare collection). The conceptual proposals were endorsed by the Chilean Society of Transport Engineers.

- Elaboration of the plan started in March 2000. Mr. Carlos Cruz, a key professional in the road concession program in Chile, was nominated Minister of Public Works, Transport and Communications, and formed a group to prepare and Urban Transport Integrated Plan for Santiago (“PTUS 2000-2010”). The Plan was prepared under the leadership of Germán Correa, with the participation of Sergio González, Sergio Solís y Eduardo Abedrapo, and included the technical support of SECTRA (transport modeling and transport engineering concepts). The Plan preparation included several workshops with professional groups (engineers, architects, planners, operators).

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6 The group was informally known as “the four wise men” (los cuatro sabios).
7 SECTRA is an inter-ministerial secretariat in charge of the evaluation and technical support of transport projects in Chile. It has developed state-of-the-art models for transport planning, optimization and evaluation since its creation in 1981.
PTUS 2000-2010 was released in August 2000. The Plan sought to create an Integrated Transport System, looking for reductions in the average trip length; better traffic flows, lesser time of travel, improved air quality from reduced emissions of air pollutants, improved access to public transport, and improved mobility. The Plan included 12 programs, ranging from public transport modernization and investments and improved regulation of all bus services within Greater Santiago and car use restrictions, to citizens’ participation and institutional aspects. Total public cost of the plan was then estimated in USD 250 Million, with additional private investment of USD 700 Million, without including Metro investments. The Plan considered minor extensions of the Metro network mostly geared at creating some intermodal exchange points in three specific points of the city.

In parallel, in August 2000 President Lagos announced the “Extension Project” for the Metro network in 6 Km, which included extensions of Line 5 (west, 2 stations) and Line 2 (north, 2 stations and south, 2 stations).\(^8\)

After the PTUS was approved in December 2000 by an Interministerial Commission (Transport, Public Works and Communications, Housing and Urban Development, Finance), SECTRA and the Transport Sub-secretariat initiated the technical preparation studies along with the Origin-Destination Survey 2001 (an already ongoing process). Total investment in preparation was around USD 4 Million, partially founded with technical cooperation funds from the IADB. Initial results of these preparatory studies were released in 2002.

In May 2001 President Lagos announced the construction of Metro Line 4 a 33 Km, 27 stations extension of the Metro network with an investment of USD 1,007 Million. This line was not considered in the PTUS and its construction was strictly promoted by the Metro Company, since Line 1 was operating close to capacity. Line 4 was planned mostly to de-congest Line 1.

In August 2001 the Bicentennial Commission, under the leadership of Matías de la Fuente, Presidential Cabinet Chief, released a rail based public transport agenda with a total cost of USD 5,500 million. All the investment was expected to come from long term concessions. This plan was based on the PTUS, but shifted priorities towards Metro.

Metro de Santiago S.A. with an authorization issued by Minister Carlos Cruz, initiated in 2001 the process to develop a contact less fare card to be used as payment media of the integrated system. A bidding process in conjunction with “Banco del Estado” was carried out, but the project was not finished after Banco del Estado pulled out its support. Top proposals from Indra (Spain) and Siemens (Germany) were selected and contracted directly by Metro in May 2002 to develop a contact less fare card system (Multívía).

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\(^8\) Extension of Line 5 to the west and Line 2 to the south were included in the PTUS, while Extension of Line 2 to the north was not considered in the PTUS.
In January 2002, Minister of Transport and Communications Carlos Cruz was replaced by Javier Etcheberry, after a political crisis. Minister Etcheberry was instructed by President Lagos to contact Germán Correa to ask him to lead the implementation of PTUS. Correa was nominated by President Lagos as General Coordinator of Transport in Santiago, GCTS, (March 2002). President Lagos gave great display to the possession, as an indication of the importance of the transport improvement plan. The plan received the name of Transantiago and advanced rapidly using the extensive information already prepared by SECTRA and the Transport Sub-Secretariat (OD Data, public transport optimization model). The main challenges were the coordination of several national and local administrations and to deal with the natural opposition of the traditional transport providers.

The existing feeder bus service to the Metro (Metrobus) had to be renewed and a new bid took place during 2002. GCTS saw the opportunity to carry out this bid as a pilot project of Transantiago integration and regulation concepts. The process consisted in an open competition (no especial consideration was given to existing operators) and services were grouped into “packages” according to service areas. New buses had to incorporate the Multivia, the contactless card being used by Metro. Traditional transport companies did not participate in the process and protested the results in August 2002, by blocking key intersections in the city. Leaders of the opposition movement were formally processed by the authorities under the National Security Law and jailed. This was a very important precedent of the process, as the principle of authority was preserved -the Government sent the message that its intent to carry out the planned reform was real and strong.

Correa formed a strong technical group to prepare the overall design outlined in the PTUS and particularly the modernization of the public transport system. Preparation of the project was very well advanced in March of 2003, but serious divergences had been mounting between the General Coordinator and some of the members of the project committee, then including Ministries of Public Works, Transport and Communications, Housing and Urbanism and Finance, SECTRA, National Environment Commission, Metropolitan Mayor and the Metro S.A. president. Correa resigned as project coordinator due to his differences on technical issues with Metro as well as with several committee members on the way in which Transantiago infrastructure should be financed. He was then replaced by Aldo Signorelli (from SECTRA). Several professionals of the Ministry of Public Works, with extensive experience in concessions were assigned to the project (Gibrán Harcha, Andrés Silva, Alvaro Saavedra, among others), and started an extensive review of contract conditions.

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9 Dubbed by the media as Santiago “Transport Czar” (Interviews, 2006).
10 Correa’s preference was that financing should be from public funds, while some Committee members preferred private concessions using user fares (interviews, 2006).
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- In June 2003 an additional extension of the Metro system was announced by President Ricardo Lagos: Line 2 from Cerro Blanco to Americo Vespucio (5 Km, 5 stations at USD 200 Million).  
- Discussions on technical and financial issues continued until the project reached a standstill in May 2004. The main discussions were promoted by Metro de Santiago S.A., which feared loss of its authority on investment and fare policies. The crisis was solved by President Lagos by reforming the composition of the project committee and leaving the Metro president out of it.
- The Transantiago group had to prepare two versions of the bidding documents of the bus services, producing delays in the process. The first set was based on a mode or remuneration to bus operators based on bus/kilometers. Difficulties in the process led to the cancellation of the initial bidding process and a new set of bidding documents had to be prepared, this time considering remuneration based on transported passengers. The bidding process was re-opened for trunk corridors in October 2004 and closed in December 2004 and January and February 2005 for feeder areas, respectively. The process was open, with only two trunk concessions and one feeder area concession requiring new units. A total of 34 proposals by 15 different groups were received; at least two proposals per unit, with the exception of Feeder Unit 10 (Central Area) with none. A total of USD 180 Million was offered by the 9 winner groups for the contingency fund.
- The Transantiago group carried out also the bidding process for the Financial Administrator of the System which was opened in January 2005 and closed in March 2005. The concession was awarded to a pool of banks based in Chile (Chile, Estado, BCI and Santander-Santiago) and the companies CMR Falabella and Sonda (system integrator).
- The bidding process for the Information and User Attention System (SIAUT) contractor was initiated in May 2005 and finished in June 2005. The contract was awarded to the group Tata-Cormicron.

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11 The creators of PTUS, headed by Correa, had opposed the first extension to Cerro Blanco because they considered it a less desirable solution than buses operating on segregated lanes which also could result in less transfers. The further extension to Americo Vespucio was a result of the initial extension to Cerro Blanco, to make the line profitable and to give passengers a more reasonable solution (Interviews, 2006).
12 The participation of the Metro president had not been included in the original Committee, because Metro was considered just another transport operator with vested interests in what was going to happen with the transport system. Metro president insisted in being part of the Committee and was finally incorporated in 2002. The retirement of Metro president in 2004 helped solving the crisis of Transantiago in May 2004 (Interviews, 2006).
13 Proposals came from Chilean as well as from foreign firms including, two from Spain, two from Colombia and one from France (Interviews, 2006).
14 Concessionaries are Inversiones Alsacia S.A –Expres de Santiago Uno S.A. T1, T4; Subus Chile S.A. T2; Buses Gran Santiago S.A. T3, A5, A8; Buses Metropolitanos S.A. T5; Red Bus S.A. A1; STP Santiago S.A. A2, A4; Unitrans S.A. A3; Comercial Nuevo Milenio A6, A7; and Transaraucarias S.A. A9 (with information from www.transantiago.cl)
The implementation process contemplated two phases: transition phase (October 2005-October 2006) and operational phase (Starting October 2006 to the end of the concession contracts, variable from 4 years with existing buses to 15 years with clean technologies). Transition phase was extended two months and started in November 2005. The transition phase consisted of the existing routes being operated by the new concessionaries with new equipment (e.g. low floor articulated buses), as well as gradual retirement of obsolete fleet and former operators and change in colors of existing buses in good condition.

In November 2005 President Ricardo Lagos announced two additional extensions of the Metro Network: Line 1 from Escuela Militar to Los Dominicos (4 stations, 4 Km, USD 200 Million) and Line 5 from Quinta Normal to Maipú (13 stations, 13.5 Km, USD 670 Million).

In September 2006, the new Minister of Transport and Communications Sergio Espejo reprogrammed the start of the operational phase for February 10 2007. A large campaign to familiarize commuters with the new routes and services was launched.

New operations started in February 10, 2007. There were several operational difficulties due to incomplete infrastructure, systems (fare sales, validation and conciliation, fleet control) and bus fleet. Several adjustments were introduced to improve services.

In March 10, President Michelle Bachelet announced several measures to gradually improve bus and metro services, including improved infrastructure (segregated lanes, enclosed transfer stations), increased bus and metro fleet, and very strong oversight of the concessionaries.

Along with Metro expansions expected from 2006 to 2009 the improvement of bus infrastructure will continue gradually. There are also large opportunities for route optimization with the introduction of new services, such as express routes and short loops; introduction of information devices; improvements in the distribution mechanisms of payment media, and further fleet renovation, among other elements. One interesting development will be the creation of an autonomous transport authority for Santiago.

**ASSESSMENT**

**Planning**

The project started as an initiative of a group of supporters of candidate Ricardo Lagos during the presidential campaign in 1999 and became part of the

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15 This second extension of Line 5 caused a dramatic fall in demand at the intermodal exchange station in Quinta Normal, which was already under construction by a private concessionary. The Government then had to pay the concessionary around 15 million dollars for the cancellation of the contract (Interviews, 2006). Benefits of this extension are reductions on transferes and travel time for the Maipú commuters.

16 Some operators did not provide the number of buses and services required.
government plan for the period 2000-2006. The project was initially envisioned as a large scale modification of public transport supply within the metropolitan area, having the bus system as the key component. The implementation of the project is estimated to have a great impact on air quality in Greater Santiago, contributing in around 85% of compliance of the Santiago Decontamination Plan when the new system becomes fully operational.

The initial proposals developed during the electoral contest in 1999 were transformed in the Urban Transport Plan for Santiago “PTUS 2000-2010” under the joint leadership of Germán Correa, Sergio Gonzalez, Sergio Solís and Eduardo Abedrapo. This initial conceptual framework was not capital intensive (total public cost was estimated in USD 250 Million). It was transformed gradually during its implementation to incorporate a very extensive and high quality expansion of the Metro network with total capital costs close to USD 3 Billion. The metro network was effectively expanded from 38 Km to 83 Km within six years, and expansion will continue through 2009 for a total of 104 Km, while investments in road based transport were around USD 300 million.

Planning for the Metro component was contracted and over sought by “Metro de Santiago”. SECTRA reviewed the socioeconomic evaluations and endorsed the extensions as each of the projects had positive social rate of returns due travel time savings and reduction in surface congestion. Other rail projects, such as the regional rail Melipilla-Santiago (Melitren) and the Independencia-Recoleta Light Rail, did not have positive socioeconomic indicators according to the evaluations made by SECTRA in 2002. Bidding for Melitren failed and the Light Train project was finally abandoned17.

After the approval of the PTUS 2000-2010 by a ministerial committee in November 2000, planning studies were continued by SECTRA and the Sub-Secretariat of Transport. Leadership was directly in the hands of Minister Carlos Cruz. In 2000-2002 SECTRA developed a Design Model for Public Transport Systems, which furnishes a basic physical design (routes) and operational design (frequencies, fleet, bus-kilometers) of urban transport system, given a certain demand, road network and user behavior principles18. Subsequent and numerous refinements of this basic design were required and were carried out by the Transantiago team. The Design Model was used for the technical definition of the bus components of the transit system. Other components of the plan (special infrastructure, terminals, and technological components) were developed by the Sub-secretariat of Transport.

17 Independencia-Recoleta Light Rail continued as a private project (no public funds assigned), but no proposals were received.
18 http://www.sectra.cl/contenido/modelos/transporte_urbano/diseno_sistema_transporte_publico.htm
Nomination of Germán Correa as Transport General Coordinator for Santiago in March 2002 gave the Transantiago project a boost. He formed a special team to prepare and deliver the project, as a special office of the Ministry of Transport and Communications. The project advanced rapidly and the data collected and tools developed in the previous two years (OD Matrix 2001, design model, preliminary infrastructure and technology concepts), were consolidated under the Transantiago Plan, which was completed within one year.

Planning efforts had to overcome several barriers (see Table).

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<th>Barrier</th>
<th>Barrier Details</th>
<th>Solution/Mitigation</th>
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<tr>
<td>Inter-agency coordination</td>
<td>Large scale reorganization of all transport services within Santiago required the participation of several government agencies</td>
<td>Creation of a special group (Transantiago) to coordinate the activities of the different agencies and conduct the process (preparation, bidding of the concessions, oversight). Nomination of an ex-minister with strong reputation to coordinate the efforts.</td>
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<td>Interference from agencies with different agenda</td>
<td>Metro company was most interested in expanding the metro network and retaining its capacity to plan system expansions and define user fares</td>
<td>Metro was integrated within the decision making committee (Ministerial), but rather than promoting integration this caused governance problems within the decision making body. The Metro agenda prevailed and large attention and resources were assigned to metro expansion.</td>
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<td>Opposition form traditional transport industry leaders</td>
<td>Industry leaders were not interested in the modification of the existing regulatory regime and opposed project implementation. No priority was initially given to existing operators in the bidding process</td>
<td>Use of authority: when transport leaders organized a blockage of the city to put pressure, they were processed under National Security laws. Even though no priority was given to existing operators, it was allowed to use existing vehicles (in their hands) for many of the concessions. This gave them strong leverage in the process, which later caused some implementation problems.</td>
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<td>Large scale reorganization of public transport services in a metropolitan area</td>
<td>Route reorganization is a complex technical problem (supply-demand balance for a social optimal)</td>
<td>SECTRA developed a state-of-the-art design model (routes-frequencies) to maximize net benefits to the society at large. Development of the design model took time and the participation of a skilled interdisciplinary team.</td>
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Probably the most important barrier was the resistance from the Metro company administrators to lose their ability to plan metro expansions, define the level of service and establish the user fares. After large discussions and tensions within the government, Metro became the backbone of the transit improvement plan for Santiago and the planning transferred to the Ministry of Transport. There were also difficulties in solving the integration issues and remuneration for metro

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19 The Transantiago group was institutionalized within the Ministry of Transport and Communications, but the initial coordinator (Germán Correa) resigned in 2003 due to discrepancies within government agencies. Presidential priority to the project allowed its continuation in 2004 (Interviews, 2006).
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services. One of the key discussions was the definition of the technology to use for fare collection, as Metro advanced in a the development and implementation of a contact less card for its system with the expectation of having it used for the integrated services.

Opposition from existing operators was extensive, but the Government, rather than giving them priority, conducted open processes with the principle that competition would provide the best value to the system users (lowest fares, highest quality)\textsuperscript{20}. Industry leaders strongly opposed open bidding and staged large scale protests in 2002 after the bidding process for Metrobús (metro feeders) was completed. Government brought to the judiciary system 5 industry leaders and they were jailed under the National Security laws. The participation of international operators generated implementation problems discussed thereafter.

Another important barrier was technical: how to determine the new transport network and its operational features. No previous experience on large scale route reorganization was available. The technical team in SECTRA as well as the Transantiago team developed, with the help of consultants and academics, an advanced design tool for transport networks (routes, frequencies), which included advanced passenger assignment procedures and seek social optimization. Given the complexity of the problem, developing this tool took several months (2001-2003). During system planning and implementation there were critiques to the optimization approach, as it resulted in large reductions in the number of buses, the kilometers run, and thus, the emissions, but resulted in longer walking and waiting times and increased transfers for the commuters\textsuperscript{21}.

Finally, public participation in planning was scarce. According to Correa (Interviews, 2006) the project was extensively discussed during the preparation of PTUS and the Transantiago Plan (2002-2003) but not afterwards. No special public consultation process was in place\textsuperscript{22}. There were, however, large efforts in public outreach and education for the implementation in late 2006 and early 2007, mostly for informative purposes and user education. After the initial difficulties in February 2007, the number of guides was increased and maintained.

The initial operational difficulties in February 2007 span a planning effort to find ways to improve services. Minister Espejo called recognized professionals and researchers to make recommendations to the Transantiago team\textsuperscript{23}. Many of them were adopted immediately, such as the introduction of enclosed areas for

\textsuperscript{20} Bidding processes in the early 1990s were assigned to existing operators only; but changes in improvement in management practices did not happen as expected.

\textsuperscript{21} See for example the presentation of Luis Willumsen – Steer Davies Gleave, to the Chilean Association of Transport Engineers in November 2006 (e.mail interchange February 2007).

\textsuperscript{22} A community based NGO “Viva la Ciudadania” lead by Lake Sagaris has been very vocal about this issue (e-mail interchange February 2007).

\textsuperscript{23} Personal communication with Prof. Juan de Dios Ortúzar, from Universidad Catolica.
off-board validation and access through several doors in critical integration points. Others were left for gradual implementation (infrastructure, increased buses and trains, improvement of the institutional capacity for control).

**Decision process**

The project was part of the presidential agenda of Ricardo Lagos. It received his support along with other transport initiatives. A dual vision (rail based – bus based) of different government teams generated difficulties during system planning and implementation (lack of consensus, lengthy discussions, and changes in decision making and implementation teams). There were several leaders during the process: Ministers Carlos Cruz (2000-2001), Javier Etcheberry (2002-2006) and Sergio Espejo (2006-); Project Coordinators Germán Correa (2002-2003), Aldo Signorelli (2003-2005), Danilo Núñez (2005-2006), Fernando Promis (2006-); as well as changes in the ministerial decision group and the implementation team.

The main decision was the scope and components of the project. Early in the process it was decided not only to make a citywide transformation of all public transport services but also to carry out the overall change in just a single movement, with no transition in between. This was dubbed by Correa as “the big-bang” approach. The rationale behind this approximation was the belief among involved individuals that it was not possible to optimize transport services using a corridor-by-corridor approach as services for areas not covered would remain sub-optimal and would interfere with the new system in several negative ways, endangering the whole process. It was also considered that the main changes should took place within the same National Administration to assure political continuity. Implementing such extensive reform within a 6 year period required very strong leadership and good coordination among several agencies.

The main decisions for project implementation were on the role of Metro within the system and the definitions within the bus components. These decisions are commented on below.

**Rail Component**

A very important dilemma was the participation of the Metro system in the project. It was clear from the beginning that fare integration with Metro was a keystone of the project, but it was not clear whether the Metro would have large expansions or not. PTUS 2000-2010 did not include large expansions of the Metro system, but there were already on-going projects for Line 2 (north and south) and Line 5 (west). The Bicentennial Project, a parallel Presidential initiative, on the other hand, envisioned a large expansion of the metro network.

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24 Ministries of Transport and Communications, Housing and Urbanism, Finance, Public Works, SECTRA and Metro de Santiago S.A. Metro de Santiago was retired from the inter-ministerial committee in May 2004.
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(100+ Km worth USD 5,500 million). At the end, the concept of having the Metro network as the backbone of the system prevailed, and 66 km additional kilometers were approved for the 2000-2009 period (45 km of them were completed before the end of 2006).

Several factors compounded in the decision to expand the metro network beyond the PTUS 2000-2010 original plans:

1. Public perception: Santiago Metro was very successful in delivering a high quality service (fast, reliable, efficient) over several years, and Metro was regarded as the best public transport service available. Buses on the other hand, had traditionally delivered a poor quality service (slower, unreliable, inefficient). Decisions to expand the metro network have been always very well received by the public opinion regardless of the costs.

2. Institutional framework: Santiago Metro Company is an anonymous society fully owned by government with a charter to plan, develop, operate and maintain the metro system. The company is very independent and has been managed by a very professional staff. Good management practices have generated operational surpluses, which the Metro Company officials wanted re-invested in Metro expansion. The bus system, on the other hand, operates on the general infrastructure of the city funded and delivered by various government agencies; is owned by several companies and individuals; and operates under precarious regulation. From the institutional perspective, given availability of funds, it was easier to implement Metro extensions and new lines, than to reorganize bus services and to provide road based infrastructure. As a matter of fact Metro was expanded 45 Km in six years while the bus reorganization was only introduced in February 10, 2007. Moreover, decision making for Metro was institutionalized within the Metro company (Board of Directors), while the bus system required the consensus of an inter-ministerial committee.

3. Leadership: Metro champion was Fernando Bustamante, President of the Board of Metro de Santiago, which persuaded key figures in the national government (mainly President Lagos) to approve a large scale expansion, and was successful in delivering a high quality, relatively low cost Metro system (as compared with other systems in the world), in a very short time. Mr. Bustamante vision was that the Metro should be the backbone of the integrated system in Santiago, but he was reluctant to relinquish some corporate assets as the ability to plan for expansions and to define the user fare. The Metro agenda was sometimes an obstacle for a faster advancement of Transantiago.

On the other hand PTUS 2000-2010 (Transantiago) did not have a continuous head. Initial champion was Germán Correa, which delivered
an integration plan for all services in Santiago in August 2000; but there was no visible project head over the next 18 months. Germán Correa was nominated project coordinator just in March 2002, but stepped aside a year later after several clashes with the rail based vision and other concepts (funding of public infrastructure using fares, development of the fare card system by Metro, distribution of risks, payment mechanisms).

The next leader of the project was Aldo Signorelli, and he had difficulties in negotiating conditions with the Santiago Metro Company (remuneration of transport services and reimbursement of the investment in the development of the fare card Multivía). By May 2004, Metro indicated that was no willing to support the Transantiago Plan. President Lagos did not want the project to fail and made changes in the decision making process (Metro was no longer part of the inter-ministerial committee). A group of technocrats within the Ministry of Public Works, Transport and Communications (under the coordination of Gibrán Harcha) continued the preparation of the contracts and managed the bidding process during 2004. According to Correa (Interviews, 2006), a business view (how to make bidding packages attractive for private participation) predominated over a transport view (how to make the transport system to function better for users’ and the operators’ sake).

4. Political agenda: President Lagos wanted to deliver results within his administration. Metro was able to deliver results, while the several agencies in charge of road based transport under a changing leadership were not able to complete the implementation of the complex bus reorganization program on time. Moreover, while there were successive announcements of Metro expansions in 2000 (5 Km), 2001 (33 Km), 2003 (7 Km) and 2006 (21 Km), in the case of the road based system there were only postponement announcements. The last part of the Metro expansions included a section of a recently completed “Pajaritos” busway to Maipú, and was made after the presidential elections first round.

Bus Components

Decisions regarding bus components include issues regarding bus operators; fare collection; planning, control and supervision; technical aspects; accessibility and financial issues.

Bus Operators

The decision made was to choose the operators through an open bidding process, without priority to existing operators. A separated bidding process was organized for trunk operations (5 concessions) and for feeder areas (10

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25 No candidate obtained the required votes to clinch the elections, and a second round with the two forerunners was required (Interviews 2006).
concessions). The main objective of the implementation group was to assure competition, both from bus operators and bus manufacturers. This required the concessions to be attractive to the participants. As a result several mechanisms to guarantee the revenues of the participants were designed and implemented in the contracts.

Two important decisions regarding bus operators were extensively discussed: the required profile of the operators and the remuneration mechanism (assignment of the commercial risk). The existing operators in Santiago wanted mechanisms either to assure that the bidding process was closed (only they could participate) or to have high priority in the contract awarding mechanism. The decision was to conduct an open bidding process with no priority to the existing companies or groups of operators. Nevertheless, they had some advantage over other participants as it was allowed to use existing vehicles in the new concessions (up to 5 year old units). This created a financial barrier to external participants, and generated an implementation problem if the concessionaires were not associated with local operators.

It was possible for the Government of Chile to proceed with an open bidding process due to local circumstances: the bus operators had very bad reputation and did not have support by the community at large; protests in 2002 to the Metrobus bidding process resulted in imprisonment of the industry leaders under the National Security laws; stability in the institutions (government, judiciary system, congress) and the growing local economy facilitated the participation of international operators.

The discussion on the remuneration mechanism was associated with the assignment of risk and level of participation of government institutions on service planning and oversight. Two options were discussed: payment per bus-km (SECTRA’s position) and payment per transported passenger (GCTS’position). In “payment per bus-km” full commercial risk was borne by the supervising institution (Ministry of Transport and Communications) as well as large responsibility in service provision, as detailed operational planning was in hands of this supervising institution. This option was promoted by SECTRA as it allowed permanent social optimization of service delivery, but required passing a law to create the opportunity of providing subsidies.

In “payment per passenger” full commercial risk was borne by the private operator and no subsidies were required, while government was in charged only of supervising level of service (maximum bus occupation, minimum frequency). This option was promoted by the Transantiago team and the Ministry of Transport and Communications, with the support of the Ministry of Finance, and prevailed in the design of the contracts, but just after the first bidding process, based on payment per bus/kilometer, failed. One important design feature of the

26 Manuel Navarrete, a leader of the local transport industry achieved a compromise of the existing owners of not selling their units to foreign operators (Interviews, 2006).
mechanism of payment based on transported passenger was the elimination of parallel services of different providers to reduce on street competition.

**Fare Collection**

One important design element was the separation of bus operation from the administration of the payment media and its validation. The roles of the Financial Administrator are (www.transantiago.cl):

- Emission, administration and commercialization of the access media (contact less fare cards)
- Provision of a commercialization network to sell and recharge the access media.
- Collection, management and distribution of the system funds (user fares).
- Provision and maintenance of the validation and passenger control equipment on board of the buses (fare card validators, automatic passenger counting devices).
- Management of the technical reserve.
- Financial Clearing
- Provision and maintenance of the automatic vehicle location (AVL) equipment (GPS + Dead Reckoning).
- Operation of the transactional switch (interface of all the information flows).
- Implementation and operation of complementary uses of the contact-less fare cards (e-money).

Priority in the selection process was given to financial institutions authorized in Chile. The financial institutions were responsible of selecting the technology and systems integration provider and no technical framework was established fo such a decision. At the beginning of the selection process there was a limitation on the share of the local financial market, but this limitation was raised during the bidding process. As a result, there was no competition (only one bidder, a group of the most important banks in Chile made a proposal. Implementation of the system to manage the level of transactions required in Santiago is a mayor undertaking, and has caused some delays in completion.

One additional difficulty in this process was the fact that Metro de Santiago, with the express authorization of the Minister of Transport and Communications, developed a contact less card (Multivía) with the purpose of advancing on the definition of a single payment media for Santiago. Development of this card was assigned by the Metro Company to Indra and Siemens in May 2002, already contractors for other IT components of Metro expansions. Metro officials wanted the costs of development reimbursed, and the discussion with other government authorities was on the amount of reimbursement. Along with other discussions

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27 For instance, proven and concrete experience in dealing with a number of transactions as that expected in Transantiago, around 7 million a day.
with the Metro Company (remuneration of the metro services), this argument caused delays and even a crisis in 2004. The technology was offered to the financial administrators as part of the contract, but not necessarily used, as it was not designed for the needs of the Transantiago system but the needs of Metro (enclosed stations, reduced number of transactions, less safety and security requirements). The development cost of Multivía contact-less card (hardware, software) was to be paid by the financial administrator and increased the capital costs of this concession in USD 15 Million.

**Planning, control and supervision**

System planning, control and supervision were assigned to a special unit within the Ministry of Transport and Communications: Transantiago, with the support of SECTRA. This unit was the technical secretariat of a decision making body made up by the Ministers of Transport and Communications, Housing and Urbanism and Finance, SECTRA and, during some time, the Santiago Metro Company\(^28\).

Operational planning is in hands of the concessionaries given certain minimum levels of service requirements (maximum bus occupation, minimum service frequency).

Control of the system is distributed, using automatic vehicle location and information and communications technology (voice, data). Each operator is in charge of controlling its own fleet, but reports all the data to a central location through a specialized IT contractor (SIAUT system awarded to Tata-Cormicron). The reporting has two purposes: user information systems (variable message displays, internet, kiosks, and mobile devices), and data reporting (to assure minimum service provision reducing the need of on-street supervisors).

For the supervision of the system, the Transantiago office within the Ministry of Transport and Communications was institutionalized.

Although among specialists the creation of a Metropolitan Transport Authority for Santiago has been widely valued as an important element of the implementation of the new Integrated Public Transport System, discussion to create such an authority is just currently underway\(^29\). In fact, Minister Sergio Espejo announced that he will be sending next May 2007 to Congress the law allowing the creation of such a Metropolitan Transport Authority. Passage of the law seems rather difficult, though (Interviews, 2006).

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\(^28\) Santiago Metro Company was considered equivalent to other operators after a crisis in May 2004.

\(^29\) The creation of such an authority was proposed in PTUS 2000-2010 since August 2000.
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**Technical Aspects**

The focus of the reorganization of public transport in Santiago was to provide integrated services, reduce bus fleet and bus-km, reduce user fares and reduce harmful emissions. Strong importance was given to the application of BRT concepts to increase bus speeds: the new system has priority lanes on the main streets of Santiago (heritage of the environmental emergency network) and short sections of busways, as well as interchange facilities (metro-bus; feeder bus-trunk bus) and improved bus stops (raised curb, shelters, passenger information systems). Operations are planned to be improved gradually, with the construction of segregated busways, stations with prepayment, introduction of special services (express, short cycle), during the operation of the system.

Capacity problems and queues were expected in the main corridors, but the actual operation was more chaotic than anticipated. Some problems of the initial operations resulting from these technical choices are commented thereafter.

**Accessibility Aspects**

All new vehicles in the system are low floor and have designated areas for wheel chairs and priority seats for the elderly, pregnant women and people with disabilities. Old buses will be gradually replaced by low floor fleet. Curbs in bus stops are raised to match the floor levels of the buses and provide direct access.

**Financial Aspects**

The payment to the bus operators (per transported passenger) is predefined in the contracts and has adjustment formulas for variations in input costs and demand.

User fares, on its part, include the following components:

- Payment to the bus operators (per passenger, according to the winning bids in each business unit)
- Payment to support services (financial administration and IT, according to the winning bids for each service)
- Payment for infrastructure (terminals, road extensions, maintenance)
- Technical reserve (deposit to cover contingencies, also funded with direct payment of the bus operators and financial administrator).

There was an important discussion on whether or not user fares should partially cover infrastructure. At the end the point of view of the Ministry of Finance prevailed, and part of the infrastructure, even road extensions for general traffic, is paid by the bus users. This may have an impact on public transport demand, affecting perhaps the financial equilibrium of the operators’ contracts (Interviews, 2006).
One important purpose of the system is to transfer to the users a portion of the operational savings resulting from reduced fleet and bus-km, while maintaining an attractive business to the operators and Metro. The following table compares expected fare ranges before and after system implementation:

<table>
<thead>
<tr>
<th>Fares before Transantiago</th>
<th>Expected Fares with Transantiago</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local bus (Metrobus)</td>
<td>Average CHP 345 (USD 0.59)</td>
</tr>
<tr>
<td>Bus</td>
<td>260-280</td>
</tr>
<tr>
<td>Metro</td>
<td>290-410</td>
</tr>
<tr>
<td>Metrobus-Metro</td>
<td>530-580</td>
</tr>
<tr>
<td>Bus-Bus</td>
<td>680</td>
</tr>
<tr>
<td>Bus-Metro</td>
<td>730</td>
</tr>
<tr>
<td>Average CHP</td>
<td>345</td>
</tr>
<tr>
<td>Expected Fares with Transantiago</td>
<td>Average CHP 331 (USD 0.57)</td>
</tr>
<tr>
<td>Local Bus</td>
<td>300</td>
</tr>
<tr>
<td>Main (trunk bus or metro)</td>
<td>340</td>
</tr>
<tr>
<td>Local-Main</td>
<td>370</td>
</tr>
<tr>
<td>Local-Main-Local</td>
<td>400</td>
</tr>
</tbody>
</table>

Source: Transantiago, 2005. Note: Actual Fare in February 2006 was 380 flat (including integration)

Average fare is expected to be reduced in 4%. Savings will be very large for integrated services: Bus-Bus (-45%), Metro-Bus (-49%) and Metro users (peak hour -17%). This will benefit the most the low income population living in the periphery, currently requiring one or more transfers to complete a trip. Reduced fare for students (35% of normal fare) will be maintained. Integration will have time and direction limitations. Benefits of cost reductions were not perceived by the majority of the users during the first month of operation, as the integrated fare was set in CHP 380 (same fare than before the system was implemented).

**Implementation approach**

Transantiago was implemented in a single process for the whole metropolitan area ("big-bang"). The only component with gradual implementation was metro, which gradually implemented a 45 Km expansion (2000-2006) and will complete 21 additional kilometers before the end of 2009.

There was a transition phase from November 2005 to February 2007, which consisted of the operation of the new concessionaries on the old routes. As part of the fleet was new, this included the operation of these new buses on existing routes. No visible improvement resulted from the transition phase, and rather created a bad image to the Transantiago program, as users did not perceive any benefit but rather some inconvenience (larger waiting times and lack of information on provisional services).

Citywide implementation brings several advantages, but encompasses a very large technological, organizational and communications challenge. Theoretically,

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30 This expected fare chart was not initially applied. A flat fare of CHP 380 (USD 0.76) was used; the same fare charged by local buses and Metro. Under this scheme 15% of the commuters currently using Bus-Bus and Bus/Metrobus-Metro will perceive savings of up to 50%.
citywide transformation will bring the benefits of organized operations to all commuters at the same time (fare reduction and improved service delivery, safety and security), as well as reductions in congestion and harmful emissions for users and non-users alike. A single regulatory scheme will be applied for all services at the same time, avoiding the dual operations that challenge sustainability in cities like Bogotá and Quito, where organized services and chaotic operations are delivered at the same time.

On the down side, citywide implementation requires all the support systems (infrastructure, financial administration and control) to be ready for very large scale operations in a single attempt.

Implementation

Transantiago started full scale operations in Saturday, February 10, 2007. This date was five months after the expected date in October 2006, to give time to complete infrastructure and technological components of the system. The new date was also convenient as it was in the middle of the summer season with many students and workers in vacation.

Route itineraries were modified for the entire city under the integrated trunk-feeder scheme proposed. A CHP 380 (USD 0.76) flat fare was established, which was the same fare than previously charged by the city buses, but included integration. This implied an implicit reduction in travel cost for those users that used two or more vehicles to complete their trip up to that time. The number of buses on the street was substantially reduced, resulting in reduction in congestion and emissions. Nevertheless, several problems were observed during the first weeks of operation:

- Excessive walking and waiting times (less coverage and reduced frequency)
- High occupation of buses and metro rail cars (less frequency)
- Non coordinated transfers - benefits of the integration have not been perceived by the users
- Inadequate facilities – small bus stops and transfers
- Incomplete user information on routes and frequencies (maps are difficult to understand).

Problems had different causes and can be divided in design, infrastructure, support systems, operations, and user education. Government has given priority to the solution of the observed problems. Some of them were gradually solved.

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during the first weeks; others will require more time and resources. It is evident that the new scheme will stay, with several adjustments.

**Design Issues**

The design of the route itineraries and the required fleet was aimed to minimize all the costs of to the society. Costs to the society include capital costs in buses, operational costs, user travel times and emissions. An operational scheme of long itineraries with relatively low productivity (excessive fleet and mileage) was replaced by a trunk feeder scheme with higher occupation and very high productivity per bus and per kilometer. Nevertheless, this design implied increased walking and waiting time and reduced comfort for the commuters.

Probably the minimum cost (maximum efficiency) approach used could be subjected to a quality of service constraint (e.g. generalized user time, including walking, waiting, transfer and travel times less or equal than existing generalized user time). Cost efficiency would be less under this type of approach, but most of the user inconveniences avoided.

It is possible to say that the expected commercial speed of the buses was too optimistic. Lack of specialized infrastructure (segregated lanes, enclosed stations with pre-payment), access to the buses through a single door, and operation on the curbside (which has the friction of other vehicles) caused reduced travel speeds and very long dwelling times. As a result the expected balance between supply and demand was not achieved. Many of these things were recommended throughout the process but not included in the final design and implementation (Interviews 2006, Repots 2007).

Finally, the occupation standards adopted for peak hour are probably too high for the tradition in Santiago. Both Metro and Buses were designed to operate at 6 pax/m². High occupation in metro cars and buses has resulted in large user dissatisfaction.

**Infrastructure**

Even though infrastructure for Transantiago was rather simple (bus stops, integration stations), completion faced normal delays of public works (expropriations, contracting, implementation, permits by different authorities). As a result some elements were not completed on time (some bus stops, signs and signals).

 Additionally, as indicated above, the infrastructure allocated to support integration and bus operations was insufficient. This was especially critical in transfer points, where the lack of enclosed facilities caused severe operational problems (very long dwell times resulting from entrance and validation through a
single door). Lack of segregated lanes also generated problems to bus operations.

Emergency response was to introduce temporary facilities, which will be gradually replaced by permanent structures in 30 points throughout the network. Validation in these facilities is off-board, allowing for direct access to the buses through several doors (four in articulated, two in conventional buses).

Support Systems

Systems integration of the fare collection system for the level of transactions in Santiago (around 7 Million per day, including sales, recharge, validation, integration) is a mayor undertaking. It was the main cause behind the postponing of the due date from October 2006 to February 2007. Despite the additional five months fare collection and validation systems were not completed on time (several buses were not properly equipped and systems were not fully tested). As a result, free operations were allowed the first week.

Control systems were also delayed requiring extensive manual supervision. Not all the fleet was required to have real time positioning systems (GPS). The Ministry of Transport did not have the required man power and resources to supervise operations. Some operators did not deliver service as expected, but there was not enough capacity to enforce contract compliance.

Government has also given priority to this issue, and announced institutional strengthening, as well as the creation of a transport metropolitan authority for Greater Santiago. The government policy is also of “cero tolerance” with service providers, regarding the stipulations in their contracts.

User Education

A large scale media campaign was launched in November 2006 to create the expectation of change, and was complemented with several communication devices: Internet, Call Center, Information Kiosks, Direct Mail, Monitors. Information was widely available in the Metro system as well, which expected a large increase in demand as a result of reduced fares for integrated trips and the peak hour, as finally occurred.

Nevertheless, information was not necessarily tailored to the individuals’ needs. Many users did not reach the numerous channels of information provided. As a result, most commuters were disoriented and frustrated during the first days of implementation. There were even violent protests in certain areas of the city. This was compounded by the fact that some providers did not allocate the required fleet, and the reduced number of buses caused additional waiting times and high occupation.
Conditions regarding information changed rapidly, especially for repetitive trips, as commuters learned how to use the new scheme of operations. Difficulties remain for non-frequent users or non-frequent trips, and with natural changes in operations (e.g. modification in route itineraries to match actual demand patterns, change of platform in bus stops for different services)

**SERVICE ADJUSTMENTS**

During the first weeks of operation there were several adjustments aimed to improve service provision. Some of these measures were:

- Free trunk services during a full week of operations, due to difficulties with the fare collection system integration.
- Extended schedule – An additional half an hour was added to the Metro operations, which have to initiate service at 6:00 am (not 6:30 am).
- Implementation of pre-payment areas at 15 critical points with temporary facilities ("corralitos"). Prepayment areas allow for simultaneous access to the buses through several doors, reducing dwell time.
- Full fleet incorporation totaling 5,600 buses for February 26th, 2007, to provide service to the students that initiated classes that day. The system started operations with 4,500 buses.
- Free trips for students were allowed from February 26th to February 28th. Student demand was estimated in 400,000 trips per day.
- New routes were introduced to provide extended coverage in the periphery, specially west and south (low income areas).
- Night services were extended to have service at least every half an hour.

In March 10, 2007, President Michelle Bachelet announced a large package of measures to solve the transit service crisis in Santiago:

- Short term (immediately to one month)
  - Extension of integration window from 90 minutes to 120 minutes.
  - Extension of routes to cover areas poorly served.
  - Integration of collective taxis in the periphery.
  - Express services with fixed schedule.
  - Parallel bus services to the metro lines operated directly by Metro de Santiago ("metro clones"), operating 24h per day.
  - New rail cars to increase metro capacity (already ongoing process)
  - Extended metro schedule from 6:00 to 23:00.
  - Expansion of the security guards in metro (230 security guards)
  - Expansion of temporary pre-payment areas from 15 to 30.

32 “Los múltiples ajustes que se han realizado al Transantiago a un mes de su puesta en marcha” La Tercera, Domingo 11 de marzo de 2007.
33 [www.transantiago.cl](http://www.transantiago.cl), and “Las repercusiones que tendrán los anuncios para el sistema de transporte”, La Tercera, Domingo 11 de marzo de 2007.
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- Strong supervision on the service supply, requiring a minimum of 5,600 buses.
- Increased night services.
- Keep 750 guides for an additional month.
- Creation of user attention kiosks to receive complaints in all the neighborhoods (comunas).

- **Medium term (one month to one year)**
  - Creation of an autonomous metropolitan transportation authority.
  - Creation of an operational unit to plan and supervise service provision.
  - Presentation of a law project to allow early termination of concession contracts and nomination of a temporary administrator.
  - Bus driver training to provide better service.
  - Construction of segregated lanes.
  - Designation of more kilometers as exclusive lanes.
  - Replacement of temporary pre-payment facilities by high quality definitive structures (a minimum of 30 integration points).
  - Completion of 2,500 bus stops throughout the network.

There is a strong commitment of the national government to work-out the different issues and improve the quality of services provided, with very strong supervision to the contractors and even announcements of early termination of contracts.

**RECOMMENDED IMPROVEMENTS**

The package of measures announced by the national government of Chile to improve service provision (March 10, 2007) seems to be aimed in the right direction. In the medium and long term some of the main areas of improvement could be:

- Evaluation and development of high capacity BRT applications to reduce dwell time and improve commercial speeds on trunk-ways and selected sections of feeder zones:
  - strong longitudinal segregation through the construction of barriers, banning taxi cabs and enforcing misuse of the dedicated lanes,
  - use of median lanes and median bus stops/stations to reduce friction in curbside lanes,
  - increased prepayment (enclosed stations, and paid areas in integration points),
  - continuous adjustment of services taking advantage of the intrinsic flexibility of buses, for example through the introduction of express
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or accelerated services and short loops (for heavy loaded sections)

- Inclusion of emergency response systems to deal with contingencies. Current oversight scheme, even with the announced strengthening, seems to be restrictive, and may not provide enough flexibility to perform operational actions in case of incidents (very common on road based systems, such as public protests, heavy rain, accidents, etc.)
- Consolidation of the institutions to provide better coordination of different agencies, especially Metro, which will remain as the most important operator in Santiago (now also operating surface services through the “clone buses” to the metro lines). Metro expansions may continue to generate business model changes for the system concessionaries. Probably these effects may require consideration in alternatives analysis and socio-economic evaluations.
- Expansion of the enforcement ability of the Ministry of Transport and Communications, either through the creation of a special purpose Metropolitan Transport authority (under discussion) or through the growth of resources (human, technology) of the Transantiago Group (already underway).
- Introduce user charges to car users using the funds to improve quality of services of transit without increasing user fares. This idea was included in the original PTUS (2000-2006), but has not received further discussion.\(^{34}\)
- Document and share the experiences gathered during planning and implementation, and continuously measure performance and user satisfaction.

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\(^{34}\) See for example F. Martínez “Transantiago y tarificación por congestión”, El Mercurio, Martes 20 de febrero de 2007
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Andrés Silva – Transantiago, Ministry of Transport and Communications.
Daniel Shwarz – SECTRA
Gibrán Harcha – Former Leader for Transantiago Project Planning and Implementation Team (2004-2005), Ministry of Transport and Communications, currently with Inversiones Alsacia-Express de Santiago (trunk operators)
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  Private Sector and Infrastructure Latin America and the Caribbean
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A Critical Look at Major Bus Improvements in Latin America and Asia: 
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Exhibit 1 – Transantiago System Map

Exhibit 2 – Zone Distribution

Source: Sectra, 2006

Source: www.transantiago.cl
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Exhibit 5 – Downtown Area Services Map

Source: www.transantiago.cl
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Exhibit 4 – Profile Alameda Bernardo O´Higgins
(Downtown Santiago)

Exhibit 5 – Profile Av. José Maria Cano (Parallel to Costanera Norte – Downtown Santiago)

Photo: D. Hidalgo, November 2006

Photo: D. Hidalgo, March 2006
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Exhibit 6 – Pajaritos Busway (Maipú)

Exhibit 7 – Trunk Buses Circulation Through Downtown Area

Photo: D. Hidalgo, November 2006
Exhibit 8 – Typical Bus Stop (Alameda Bernardo O'Higgins)

Exhibit 9 – Bus Stop Pajaritos Busway (Isalnd Bus Stop for Trunk Services, Curbside Bus Stop for Local Services)

Photo: D. Hidalgo, November 2006
Exhibit 10 – Temporary Integration Facility
“Corralito” (Estación Cal y Canto)

Photo: D. Hidalgo, March 2007

Exhibit 11 – Waiting Lines at a Typical Downtown Station (Saturday Night)

Photo: D. Hidalgo, March 2007
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Exhibit 12 – Passengers Accessing Trunk Bus
Single Door – Low Floor – On Board Validation

Exhibit 13- User Information Panels (With Temporary Route Change Announcements)

Photo: D. Hidalgo, March 2007

Photo: D. Hidalgo, March 2007
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Exhibit 14 – Non Designated Bus Stop (Estación Cal y Canto)

Exhibit 15 – Alameda Busway during Transition Phase

Photo: D. Hidalgo, March 2007

Photo: D. Hidalgo, November 2006
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Exhibit 16
Shared Taxis (Colectivos) in Maipú

Exhibit 17
Santiago Metro (San Joaquin Station)

Photo: D. Hidalgo, November 2006

Photo: D. Hidalgo, November 2006