



Metro de Santiago

WHERE THE CITY MEETS





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Metro de Santiago

Guaripola Guachaca Dióscoro Rojas recently described “the Metro is the most democratic and republican place we have in Santiago” this statement best describes the metro as a socio-economic melting pot that offers beyond a means of transportations to this great city.

RESEARCH BY *Joseph Philips*



When Business Excellence first visited Metro de Santiago, nearly 6 years ago at the end of 2013, its management was about to implement a plan for infrastructure improvements in the network. This was to involve the purchase of new train carriages, the modernization of older trains (which were to be fitted with positioning systems, in-carriage screens and air conditioning) platform extensions and improvements in technology.

However, the highlight of the US\$400 million investment was to be the construction

of lines 3 and 6, totalling 37 kilometres of track and 28 stations. Maintaining the same standards across the extended and new lines would be a challenge - Metro de Santiago system is renowned for its low waiting time for passengers. We were looking forward to seeing how everything shaped out in the intervening eight years.

Lines 3 and 6

As its name suggests, Line 3 of the Metro de Santiago system has a history which extends

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beyond our 2013 article. It was first conceived over 30 years ago but faced significant delays, largely due to the 1985 earthquake that shook Chile’s capital city. Its arrival is not only a valuable addition to the metro system - halving the journey times for many commuters in the city - but also, in some ways, symbolic: a sign that Santiago gets things done.

The metro features the same attention to design that commuters had become accustomed to with the existing lines. The passageways at the Universidad de Chile



station, resembling space-age tunnels are a particular highlight. No sooner had it arrived, in January 2019, than extensions were already planned. Such is the speed of change with this metro. It is being extended to the western outskirts of the city, adding three new stations and a total of 3.8 kilometres of track.

Line 6 was delivered in November 2017, and serves 10 stations between Los Leones and Cerrillos. It stands as a testament to Metro Santiago's commitment to modernity and technology: For example, it has forsaken traditional manned ticket offices for easy to use automatic machine (with a range of international language options to cater for visitors). The ticketing hall isn't the only part of this line which is unmanned: Its sleek new trains are also all driverless.

Line 6 also takes advantage of the most modern rolling stock in Latin America, known

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John Arandeda Novoa | jaraneda@solerpalau.com
Tel: +56 2 23063030 | Cel: +56 977921502
Av. Oceánica #9692, Pudahuel, Santiago - Chile
www.solerpalau.com



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implemented the control, logic and automation of the ventilation system, including the integration with other systems, tests, pre-commissioning and commissioning. Additionally, we are currently developing and performing the Predictive, Preventive and Corrective Maintenances for the Forced Ventilation System of this Project.

Among other worldwide projects, in Chile we developed the Forced Ventilation System for the subway lines 3 and 6 of Metro de Santiago. This Project included the design and engineering of the system, 1D and 3D simulation, manufacturing and supply of the equipment and the mechanical and electrical assembly in the tunnel. We also

The Forced Ventilation System of lines 3 and 6 is composed by 34 Axial Fans (model KTF2500) with a flow rate of 150 m³/s, sound attenuators of 45DB and 75 DB, ventilation grids, power and control panels, 2 servers, 9 Jet Fans (5 model KJF 1120 and 4 KJF 630) and air quality control system in tunnel and stations. The ventilation system acts based on different operation modes, designed accordingly to the state of air quality, delivering an automated system. ■



☎ (56 2) 23063030
☎ (56 9) 77921502
✉ jaraneda@solerpalau.com
✉ eloayza@solerpalau.com
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ARCADIS CHILE

Arcadis Chile participated in the design of the largest expansion in the history of the Santiago Metro

With almost three million passengers per day, the Santiago de Chile Metro is already one of the largest in South America.

In recent years, Metro de Santiago S.A has developed an important growth plan for its transport network which currently serves a growing population of more than five million people. The plan is to increase the network capacity by approximately 40%, through two new lines whose objectives are to decongest traffic in the city.

Since 2012 Arcadis has collaborated in the design engineering of project 63 (lines 6 and 3), and in two extensions of lines. Forming a Consortium with WorleyParsons, Arcadis participated in the basic engineering and environmental studies of the new Lines 3 and 6. Subsequently, and as part of the same Consortium, Arcadis was dedicated

to the engineering and supervision designs during its construction of the Line 3 in all its stages, including its subsequent extension, as well as the extension of Line 2.

For the development of the Metro projects, several professionals were included with experience in the design of underground works (tunnels), architecture, hydraulic, structural, mechanical and electrical works, programming and construction costs, among other specialties.

In this way, Arcadis has participated in the Detail Engineering of Tunnels, Fires and Galleries, in the Station Detail Engineering and in the Supervisions during the construction of the last Metro SA expansion projects.

info.cl@arcadis.cl
www.arcadis.cl



“Chileans have already taken to calling 2026, ‘the year of the metro’ because three new lines - lines 7,8 and 9 - will be delivered that year”

as AS-2014 (Acero Santiago 2014). The carriages also include ramps for wheelchair access and platform safety barriers for the safety of waiting passengers. In total, the line crosses about 15 kilometres and serves an estimated 1.1 million people. The 20 minutes that it takes to get from one end of the line to the other gives a strong indication of the efficiency of this operation.

2026: The Year of the Metro

Chileans have already taken to calling 2026, ‘the year of the metro’ because three new

lines - lines 7,8 and 9 - will be delivered that year, in addition to extensions to lines 2,3 and 4. Line 7 will cross a total of 25 kilometres and will have 19 stations, running between Brazil and Estoril; line 8 will cross 20 kilometres and will have 14 stations, running between Renca and Estoril; finally, line 9, running north to south, will have 12 new stations spread across 17 kilometres.

Combined, the three new lines of the metro are expected to directly benefit between 3 and 4 million people in the city on a daily basis, in some cases halving the time required for their commute. All will feature the same technology

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More than ...

37 years of experience	413 tunnels designed	515 tunnels during construction phase	889 km of technical assistance during tunnel construction	1.185 km of tunnels designed
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GEOCONTROL

GEOCONTROL is a private engineering company established in 1982. Specialised in design of Underground Works, offers advanced engineering solutions through its own specific methodology (Active Structural Design) which is suitable throughout the entire lifecycle of an underground infrastructure. Until now, the company has participated in more than 413 tunnels, totalling over 1.185 Km. Regarding metro infrastructure, the company has designed more than 244 km of tunnels and 130 underground stations in Brazil, Chile, Spain and Peru.

GEOCONTROL develops services in Chile since 1998 and has carried out many civil underground projects for METRO DE SANTIAGO: Detailed Design for Line 6; Inspection of the State and Conservation Plan for Lines 1 and 2; Technical assistance during construction of Line 3 (Sections 1&2) and Line 6 (Sections 3&4); Basic Design for the extension of Line 2; Basic Design for

Line 7; Feasibility Study for Lines 8, 9 and 4 (Ext). GEOCONTROL is currently developing the Detailed Design for Section A Line 7, which will be constructed by means of TBM's.

With its vast experience designing underground infrastructures, GEOCONTROL's designs ensures to meet client's expectation at all stages of an underground infrastructure, delivering, for the construction phase, security, tight deadlines and reduced costs and, for the operation phase, high functionality.

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CEO - Ruben Alvarado

“Combined, Lines 7,8 and 9 will constitute an investment of over US\$5 billion and dramatically enhance mobility in the city”

that was seen with line 6 as well as introducing some new innovations. The extensions of line 2 (four stations and 5.2 kilometres) line 3 (three stations and 3.8 kilometres) and line 4 (three stations and 4.2 kilometres) will also include an updating of the technology in those stations and trains.

Combined, Lines 7,8 and 9 will constitute an investment of over US\$5 billion and dramatically enhance mobility in the city, bringing several underserved areas of Santiago into the metro network. This

includes the popular Brazil neighbourhood with its restaurants and bars which until now has relied on over ground transport despite having a massive student population. Furthermore, the lines set a new bar for metro systems globally. All three will be driverless, electric with unmanned, self-service stations creating an unprecedented level of efficiency.

The show must go on

It would be understandable if the aforementioned grand plans disrupted the

cultural agenda of the metro in some way over the next few years. However, that hasn't, and won't be the case with Metro de Santiago. Santiago is a city of museums - the square at Quinta Normal has five alone - and the metro is very much an extension of that culture. In addition to the permanent artworks, it continues its ongoing support of local artistic and cultural exhibits.

An example of this commitment to the arts can be seen in the June 2019 installation of a permanent exhibit of indigenous Chilean artist,

Antonio Paillafil. This latest art installation, under the title, "Los pasos de la vida por la Tierra" (the steps of life along the earth") can be seen on Line 6 - the most modern of all lines. It's also indicative of how Santiago de Chile (in general, and not just the metro) seamlessly mixes ancient culture with the state of the art.

Partners and Suppliers

The almost continuous development and improvements at Metro de Santiago have

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enabled it to maintain a team of partners and suppliers that it can depend on to deliver on time and on budget. First and foremost, these are the architects and engineers behind the extensions and new lines. PLH Arkitekter, a Danish firm, was the architectural team behind the new stations, while the extensive engineering works will be carried out by Geocontrol Chile, Arcadis Chile SpA, IDOM, Tapel Williamette. and Thales International.

Elsewhere, Colas Rail, the British firm and one of the oldest in its area, will provide much of the railway infrastructure (and has consulted with Metro de Santiago about the specific nature of the carriages required), Thyssenkrupp Elevadores S.A. will kit out each station with its elevators and escalators, Lamp Lighting will take care of lighting and much of the electrics, while Fischer Polska will take care of building logistics and materials.

A Path to Santiago's Future

When the latest phase of modernization to Metro de Santiago has been completed in 2026, the city that it serves will be just 16 years from celebrating its 500th birthday. Few cities in the world can claim to have preserved their heritage as well as Santiago while continuously looking forward. The metro is a vivid illustration of this. Having seen the progress it made in the 8 years since our last visit, we're already eager to see how its future evolves. **BE**

METRO DE SANTIAGO

- ☎ 22937 2000
- ✉ info@metro.cl
- 🐦 @metrodesantiago
- 🌐 www.metro.cl



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📞 22937 2000

✉ info@metro.cl

🐦 @metrodesantiago

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