ARCADIS RAIL
Delivering total mobility
Metro’s 17 Línea 3 stations, Santiago, Chile
CONTENTS

04. Introduction – total mobility concepts
06. About Arcadis
08. Infrastructure for the Megacentury
10. Our offering in rail
14. Our expertise
20. Case studies
  20. London Bridge Station, London, United Kingdom
  21. Metro’s 17 Linea 3 stations, Santiago, Chile
  22. California High-Speed Rail, California, United States
  23. Etihad Rail, United Arab Emirates
  24. Gold Coast Rapid Transit Light Rail, Queensland, Australia
  25. South Europe Atlantic (SEA) High-Speed Railway Line, France
  26. Where we are in the world
TOTAL MOBILITY CONCEPTS

Bas Bollinger
Transportation
Rail and urban transport
Arcadis is the leading global natural and built asset design and consultancy firm, covering the whole asset lifecycle. For over a 125 years we’ve been working in partnership with clients around the world to deliver exceptional and sustainable outcomes.

Our reputation is built on a deep understanding of client needs, combined with our knowledge and experience worldwide. With 28,000 people and €3 billion in revenues, we’ve built a global network that enables us to serve our local clients on a global basis.

The megatrends of the 21st century place increasing demands on clients worldwide. Rapidly increasing urbanization, shrinking budgets and environmental sensitivity require innovative approaches to deliver advanced infrastructure for the Megacentury.

With our expertise in rail and our transformational thinking, our clients rely on us to improve performance and connect communities across the globe.

We look forward to working with you.
ABOUT ARCADIS

Arcadis provides consultancy, design, engineering and management services in; infrastructure, water, environment and buildings. Established in the Netherlands in 1888, Arcadis now operates with 28,000 staff in over 40 countries worldwide.

We provide services throughout the entire value chain – from strategic advice, project management, planning, design and implementation, through to maintenance and total lifecycle operation. We offer our clients solutions that are robust in the long-term, viewed within the context of their business needs. Our experience shows that the challenges faced by our clients are rarely met through simply providing traditional professional services. It is our ability to understand the specific needs of clients, in their local context, and our innovative application of services that are new to the industry combined with traditional skills that delivers real results.

Arcadis has a global footprint. Our network enables us to bring our knowledge and experience of projects worldwide and apply that expertise to specific local situations and needs. Our mission is to improve the quality of life worldwide by creating assets of distinction and sustainable solutions that enhance the built environment. Sustainability is central to everything we do; in our work with clients, in the way our company is organized and in our approach to social responsibility. Arcadis supports UN-HABITAT with knowledge and expertise to improve the quality of life in rapidly growing cities around the world.

FACTS

Gross revenue by activity:

- Infrastructure: 24%
- Water: 15%
- Environment: 33%
- Buildings: 28%

Gross revenue €3 billion.
The mega trends of the 21st century will bring rapidly increasing levels of urbanization as the global population is set to reach nearly 10 billion by 2050. This demands advanced infrastructure across; roads, railways, ports and waterways, airports, energy resources and communication networks. There is increasing urgency for sustainable solutions to resolve the issues of; climate change, fragile environments and the scarcity of natural resources.

FACTS
Arcadis is a member of the World Business Council for Sustainable Development (WBSCD). It is actively involved in these work streams:
• Water Cluster
• Zero Emission Cities Sector Project
• Ecosystem & Landscape Management Cluster
• Redefining Value Cross Cutting Project/Natural Capital Protocol.
INFRASTRUCTURE FOR THE MEGACENTURY

THE TOTAL MOBILITY CHALLENGES
In mature markets, limited government ability to commit to new infrastructure and challenged budgets mean that more innovative ways are needed to manage existing infrastructure assets through to refurbishment and optimization programs. Emerging markets must also rise to the challenge by building new infrastructure in order to compete. Both require transformational thinking on; mobility, connectivity, safety, durability, aesthetics and sustainable solutions. This is infrastructure beyond the technical: this is Total Mobility.

FULFILLING THE POTENTIAL, MEETING THE DEMAND
Rail is an increasingly important element in the evolution of 21st century infrastructure, with many countries placing it at the center of their transportation strategies. With our global presence, Arcadis has the expertise and experience to plan, design, build and manage even the most demanding of rail infrastructure. We have developed a deep understanding of regional, macro and micro-economic drivers that enables us to bring fresh perspectives, innovative thinking and solutions to complex problems. In doing so, we deliver Total Mobility to billions of people.

CONNECTING COMMUNITIES NOW AND INTO THE FUTURE
Arcadis responds to these challenges by working in partnership with the public and private sectors to deliver the intelligent transport systems that will connect communities now and into the Megacentury. All our activities embody the highest levels of safety, quality and effectiveness. Our designs are engineered to meet the world’s most rigorous safety standards; and when developing land we ensure there is balance with the natural habitat. Clients from a number of sectors look to us to help improve their passenger mobility and freight handling. Most importantly, Arcadis is able to optimize additional capacity minimizing the need for expensive build-outs.
Arcadis combines strategic advice with multi-disciplinary technical knowledge to help clients and partners plan and build sustainable Total Mobility concepts. We have been at the forefront of this expertise for over a century, ensuring the reliability and safety of rail networks worldwide.
Global rail travel is projected to double by 2050. To support this growth, global rail track kilometers need to increase by roughly 30% above 2010 levels by 2050.

DELIVERING TOTAL MOBILITY
The successful development of urban areas and wider regions depends on an efficient transportation infrastructure. Rail transportation is an effective and environmentally responsible means of moving large numbers of people and heavy loads. It is also a differentiator amongst cities vying to attract employers, employees and new residents.

Our track record of delivering complex rail projects is exemplary. It began over 70 years ago, Arcadis played a major role in overcoming the challenge of designing and supervising a rail network.

Today, as clients focus closely on reducing downtime and optimizing budgets, the challenge is about expanding, upgrading and maintaining networks without disruption to daily operations or to the communities through which the networks run. We have successfully applied best practices over the decades to client projects all over the world. Projection and analysis of passenger flows, for example, has become essential to assuring the smooth running of the network and the overall passenger experience. The ability to manage a crisis situation from a dangerous derailment is key to continued delivery across a vast freight rail network.

Our attention to both the desired end results and the detail means that right from the start of the planning phase we identify, mitigate and even avoid issues that could affect the smooth running of the transport system. With forward thinking, stakeholder alignment and excellence integrated into every phase of the project from planning to asset strategies and maintenance, clients trust our multi-disciplinary experts to deliver optimized mobility, connectivity, safety, durability and sustainability across the whole lifecycle of their systems.

LOCAL, GLOBAL AND INDEPENDENT
Our local presence helps us to maintain lasting relationships with our clients and to build in-depth understanding of local market conditions in the rail sector. Our global network enables us to use our vast expertise to provide the best value added services and technologies to multinational, regional and local clients.

By combining global expertise with local presence, the projects we deliver incorporate the highest levels of strategic consulting with the full range of technical services and solutions for the entire lifecycle of the transformation and buildings.

As an independent company, Arcadis is best placed to advise clients objectively on the most appropriate solutions and suppliers.
Operators need access to reliable rail engineering and consulting expertise that guarantees sustainable programs where health, safety, security and, above all, stewardship are critical success factors. With extensive global experience in the design, construction and asset management of railroads across; Asia, Australia, Europe, the Middle East and the Americas, Arcadis has the proven ability to deliver successful strategies for a range of rail and Total Mobility programs.

**OUR EXPERTISE**

**RELIEVING CONGESTION, OPTIMIZING PUBLIC TRANSPORT**
Connecting cities and linking urban hubs via rail is only part of the solution. It is equally important to guarantee the highest quality and safety standards, while reducing environmental impacts. Working collaboratively with the public and private sector, Arcadis delivers optimized solutions for today and tomorrow.

**MERGING URBAN TRANSPORT STREAMS SAFELY**
Rail transport systems in major metropolitan areas, cities and conurbations integrate the use of tramways, subway lines, light rail or conventional railway lines and other modalities. Arcadis advises on the merging of transport streams via high quality analysis and connections in and around some of the world’s busiest transport hubs, based on our Mobility Oriented Development environment (MODe) approach, helping clients to improve logistical efficiency and creating maximal value.
OUR CLIENT’S CHALLENGE
For many years the North London Line had been an overcrowded and crumbling asset. The opportunity to improve it came when London was awarded the 2012 Olympics. The 40km long route included platform extensions at 20 stations, three major station refurbishments, bridge replacements and installation of 4-tracking – while a Victorian sewer was being replaced and new roads built.

OUR APPROACH
As lead designer, Arcadis was responsible for overall coordination of the multi-disciplinary design team.
- Our design reduced costs significantly by elimination of piling works and avoiding masonry works on site.
- Modified platform extension designs and innovative use of precast concrete units speeded up critical aspects of the construction program.

THE OUTCOMES FOR THE CLIENT
- Delivered on time to a very challenging timeframe; collaborative working between all parties on the NLRIP project was the biggest single success of the project, avoiding unnecessary delay and time spent during review and approvals.
- NLRIP won the “Best Large Project” at the National Rail Awards in 2011.

CASE STUDY
MORE EFFECTIVE ASSET MANAGEMENT THROUGH A STRATEGIC ALLIANCE THAT BENEFITS ALL STAKEHOLDERS
Project: North London Lines, London, United Kingdom
Date won/completed: 2009 / 2011
Client: Carillion Rail
ENSURING EFFICIENT OPERATION OF TRANSPORT HUBS
Asset owners expect to run multi-modal transport hubs and systems that increase in value while generating income. We are leaders in the specialized, integrated and innovative disciplines that guarantee these outcomes. With proven experience of phasing – managing and completing complex transformations while transport systems remain in operation – Arcadis is able to offer all-round support and management in conceptualizing, the planning, development and optimization of transport hubs and its urban environment.

INTEGRATING PASSENGER DEDICATED AND HIGH SPEED LINES
Efficient rail networks can have a significant impact on society and boost economic development. Passenger dedicated lines reduce travel time between countries and cities, with high-speed lines providing safe, comfortable and sustainable alternative to short distance flights. Crucially, Arcadis can draw on national and regional expertise to ensure that cross-border concerns are addressed through the most efficient and technologically appropriate solutions when enhancing existing networks.

KEEPING FREIGHT TRAFFIC RUNNING SMOOTHLY
Freight rail engineering is a specialized field requiring a deep understanding of the business of freight railroading just as much as the engineering. Arcadis is one of the few firms with the multi-disciplined knowledge and experience of every aspect of freight, from construction and compliance management and asset engineering to Positive Train Control and incident rapid response.

PUBLIC PRIVATE PARTNERSHIPS
Limited public funding means that public rail owners and operators around the world are looking towards private sector funding to meet the needs to provide more mobility. At the same time, investors are increasingly interested in assets that deliver a long-term guaranteed return.
Arcadis identifies and scopes the possibilities for Public Private Partnerships (PPP), assesses the value of assets and structures the outsourcing of operations to private parties. We also contribute to the formation of PPP and Build Operate Transfer (BOT) projects, bringing our management and technical expertise into consortia or support investors.
OUR CLIENT’S CHALLENGE
The client – ProRail, the infrastructure owner – wanted to change from traditional activity-based railway maintenance to performance-based maintenance contracts. They were looking for a more effective performance-based maintenance supplier and also wanted to increase competition among their service providers. Their ambition is to become the best European rail infrastructure manager.

OUR APPROACH
Arcadis partnered with Dura Vermeer and Imtech to set up Asset Rail, a new asset management service organization. We applied our engineering and lifecycle delivery knowledge into the organization, and created an innovative streamlined process that continues to meet the demands of the client.

THE OUTCOMES FOR THE CLIENT
• Arcadis’s subsidiary Asset Rail has realized maintenance costs reduction up to 40% compared to previous maintenance contracts, raising availability (+40%) and safety levels without lowering the remaining life span
• We are now the best performing service provider, setting a benchmark. ProRail uses Asset Rail as an exemplar to change the service provider landscape for all other contracts.

“Arcadis was proud to share their maintenance concepts and bring them to practice with Asset Rail. The combination of Asset Rail’s practical knowledge and Arcadis’ asset management knowledge are beneficial to both and brings practical asset management to the next level. Sharing of knowledge is vital for a powerful organization. Therefore, Arcadis and Asset Rail will keep co-operating extensively in the future, considering continuous developments in the maintenance market and technical possibilities. We can only maintain our pole position in asset management by sharing knowledge, not only internally, but also with our principals, suppliers and other markets.”
Pieter Ahsman, CEO of Asset Rail
OUR CLIENT’S CHALLENGE

Whampoa Station is part of MTR’s Kwun Tong Line Extension. It will be built 25m beneath the busy streets of Hong Kong’s second largest private housing estate; very challenging space constraints in a heavily developed urban area plus complex geophysical conditions.

OUR APPROACH

We were responsible for the detailed design and for design support to MTR during the construction period.

• The station design has a single platform, two concourse areas and a 100m long connecting platform tunnel.
• The traffic deck system keeps everything running smoothly throughout the construction works.
• The expert assessment of tunnel and station excavation impact to local tower blocks is crucial to the delivery of the project.

THE OUTCOMES FOR THE CLIENT

• Our partnering approach enabled rapid design decisions during the extremely tight design program.
• The original scheme has been streamlined, thus minimizing construction waste, reducing construction work on site and reducing the overall footprint of the station.

CASE STUDY

CONNECTING COMMUTERS IN DENSELY DEVELOPED URBAN AREA

Project: MTR Whampoa Station, Hong Kong, China
Date won/completed: 2009 / 2015
Client: MTR Corporation Limited

ACHIEVING EXCELLENCE IN RAIL SAFETY AND TRAFFIC MANAGEMENT

Safety is crucial to all rail infrastructure, so our rail systems, relays and program logic controllers are engineered to the highest ERTMS standards. Arcadis manages all the issues around; rail traffic management and signalling communication, overhead lines, electric substations, relays houses and other rail related elements, integrating the design of the complete asset portfolio from start to finish. We can also act as an Independent Safety Assessor, performing extensive risk and safety analysis and determining the requisite safety measures.

ADDING VALUE TO THE WHOLE ASSET LIFECYCLE

Our unique combination of civil engineering and rail systems expertise means we can provide the most efficient integrated solutions and offer added value for asset management and renewal programs for functional upgrading. We are also able to provide program, project and cost management for capital expenditure projects. In more mature markets, our Built Asset Solutions ensure that clients are equipped with the most important elements for operational success.
station redevelopments in the UK to date, involving the complete phased demolition and reconstruction of the existing London Bridge Station to create a street-level concourse, and completely reconfiguring the track layout to increase through capacity while ensuring the station remains fully operational throughout.

OUR APPROACH
Arcadis and WSP signed a joint venture contract to deliver the detailed design and support for main contractor Costain to significantly increase passenger flow through central London as the last major part of Network Rail’s Thameslink Project.

- Arcadis/WSP’s design involved the transformation of access into and around the station to enhance passenger experience, including a new concourse at street level to accommodate retail and commercial units.
- The design also involved alteration of the platform configuration, from the current nine terminating platforms and six through platforms, to six terminating platforms and nine through platforms. When completed the concourse will be two-thirds larger than before.
- The team has reduced project risks, providing Network Rail with increased certainty that the project will be delivered safely, on time and to budget while meeting the aspirations of its major stakeholders and the travelling public.
- Arcadis has also ensured that the design stages incorporated the need for the station to remain fully operational and safe for passengers, station and contracting staff.

THE OUTCOMES FOR THE CLIENT
- Working collaboratively was critical to the success of this phase of the project and reflects the client’s vision for ‘one project team’. This was achieved by the 160 staff working as one focused team, co-located on-site to ensure clear communication and to maximize everyone’s respective areas of expertise. The result has been increased efficiency, reduced duplication of effort and greater outputs, minimizing waste and unnecessary expense.
- By the end of the construction phase, there will be a significant improvement in train frequency, with trains to increase from 16 to 24 per hour, greatly improved facilities and providing space for 66% more passengers than the station handles today.
OUR CLIENT’S CHALLENGE

Metro is the Chilean company that is developing two new lines as part of the Santiago’s subway network, adding over 40km of network to connect five new districts of the Metropolitan Region of Chile. The client’s particular challenges were to preserve the historic center of Santiago, minimize disruption to passengers during construction, improve safety and accessibility, and future-proof the design to allow further stations to be added later.

OUR APPROACH

Our role in this project, in consortium with WorleyParsons was to:

• Develop the detailed engineering design for each of the 17 stations that make up Metro Line 3
• Finish the design of the detailed engineering for all Metro Line 3’s tunnels and underground shafts.

We incorporated important innovations, such as platform doors at all stations to increase safety, and eliminating the need to electrify the lines by providing power supply via high lines.

Particular attention was paid to phasing the construction work to enable continuous passenger flow, especially at the intersections with existing stations, and to protecting the heritage buildings and green spaces (parks and piazzas) in Santiago city center.

THE OUTCOMES FOR THE CLIENT

• Teaming up with the Arcadis consortium meant that the client was supported throughout with project management and multidisciplinary expertise.
• Proposed optimizations to the designs of the stations will enable improved flow of mobility for future passengers.
• In addition to protecting heritage sites and open spaces, the Arcadis consortium proposed significant improvements in the areas of access to future stations so that they are consistent with their environment.
OUR CLIENT’S CHALLENGE
The California High-Speed Rail Authority is responsible for planning, designing, building and operation of the first High-Speed Rail system in the USA. California High-Speed Rail will connect the mega-regions of the state, contribute to economic development and a cleaner environment, create jobs and preserve agricultural and protected lands. Our client’s challenge is that High-Speed Rail is complex, far more demanding than conventional rail networks, and there is no experience of this kind of project in the USA. Specialist expertise will be vital to success.

OUR APPROACH
Arcadis’s USA team is working collaboratively with our Rail Center of Excellence in Europe and our experienced UK team. Arcadis is responsible for:
• Providing project and construction management (PCM) services to oversee the Design-Builder for Construction Package 2-3 of the California High-Speed Rail System
• Serving as the client’s “eyes and ears on the ground” in the Central Valley. Arcadis’ team members, working with the client, will provide assurance that technical and contract requirements, including costs, are met for CP 2-3.

THE OUTCOMES FOR THE CLIENT
With specialist expertise in high-speed rail, Arcadis is helping the client to understand how to effectively manage multiple large contracts required to deliver the First Construction Segment:
• CP 2-3 construction project work will bring thousands of jobs to the Central Valley, an area with one of the highest unemployment rates in the USA
• The state-wide high-speed rail modernization will result in higher regional employment and significant benefits for local businesses, contributing to sustainable economic growth far into the future.
OUR CLIENT’S CHALLENGE

The UAE needs rail infrastructure to support the national economy by enabling rapid transportation of passengers and goods. Etihad Rail (previously Union Railway) will cover a network of up to 1,500km stretching across the UAE to Saudi Arabia via Ghweifat City in the West and Oman via Al Ain in the East. This national railway network will be the UAE’s first railway and will link to the six countries of the Gulf Corporation Council (GCC).

The client required a team to focus on creating a freight railway, while looking at a passenger service that links all seven emirates and links with the GCC. As part of their planning they needed expert help to understand the likely freight demand.

OUR APPROACH

Arcadis was able to draw on our knowledge and experience of freight transportation and economic and social drivers to forecast the future demand. We partnered with Wilbur Smith Associates to deliver the freight data collection and analysis element of a passenger and freight traffic study providing demand forecasts to inform project and system planning for the proposed rail network.

- We generated hard data and layered summary views on top of this detailed data.
- The information was combined into a mathematical scenario model.
- Forecasts of potential rail freights and rail passenger movements will be generated and used to assist in the design of rail facilities for each specific Emirate across the GCC.

Arcadis established the data and forecast freight demand to inform the future proposed rail network and possible tariffs to be charged while providing data on the benefits of rail versus methods of freight transportation.

THE OUTCOMES FOR THE CLIENT

Arcadis’s expert insight and opinion was used to inform the scenario modelling and projection of freights flows for the UAE in 2020 and 2030. This enabled the client – with no previous experience of a rail network – to make reliable decisions based on the likely volume of rail freight traffic.
OUR CLIENT’S CHALLENGE
This light rail project traverses 13 kilometers of the Queensland Gold Coast, with 16 stations to serve the fast growing urban precincts. The client had a tight timeframe to construct the project. To facilitate this, they formed a design build and operate public-private partnership with operator franchisee, GoldLinQ Pty Ltd. This was to be Queensland’s first light rail project, so the client needed experienced help. They required an Independent Verifier and Certifier with a solid reputation for proactive and collaborative service provision.

OUR APPROACH
Arcadis joined long-term associate APP Pty Ltd to form a team of specialists in light rail, ITS, control systems and program delivery under the project specific CERT-TRAM banner. This separate entity facilitated the provision of value for money seamless Independent Verification and Certification services over the full project duration.

- They developed an iPad based surveillance application, which used a database to manage design review comments and made looking for issue trends across zones and disciplines practical. It enabled the team to manage both design package certificates and design limitations in live, statused registers and made it easy to produce design certificates as standard forms.
- Design review costs were reduced by collaboration between the Independent Verifier’s representative, Design Certification Manager and Document Controller in closing out all design review activities.

THE OUTCOMES FOR THE CLIENT
The CERT-TRAM team assured outstanding success of one of the biggest public transport projects in Australia and Queensland’s first light rail project.
During a client audit it was stated that “traceability of the design feedback, issues, resolution between many parties was excellent “as instigated by the Independent Certifier.
overloaded with traffic volumes, mainly on the roads. The new South Europe Atlantic High-Speed Line will offer a solution to these growing transport needs, both for passengers and for freight.

This project is vast, currently the largest infrastructure project underway in Europe. It involves the construction of a new 302km-long high-speed link between Tours and Bordeaux, and 38km of connecting lines to the existing rail network.

OUR APPROACH

Under a consortium contract with VINCI, Arcadis:

• Managed the group of designers involved in this part of the project, coordinating the final infrastructure design for two of the 15 geographical segments of the line, including a rail link of 40 km
• Managed the design of seven concrete main bridges, handling associated administrative procedures, geotechnical investigations and the execution of drawings approvals
• Undertook the design and external control of more than 250 main bridges, as well as the design of two segments of earth and civil works including earthworks, access restoration, hydraulics and environmental work, and two railway connections for about 60 kilometers.

THE OUTCOMES FOR THE CLIENT

Arcadis ensured the services were delivered on time, while integrating the optimizations that arose from discussions with the constructor and consultations with the local stakeholders and authorities. Delivering high quality on time within a challenging timeframe is a major goal for the purpose-built companies responsible for designing, building, operating and maintaining this new high-speed line.
We have people and offices around the world. Our global network enables us to bring our knowledge and experience of projects worldwide and apply that expertise to specific local needs and situations. We are based in:

Australia, Bahrain, Belgium, Brazil, Brunei, Canada, Chile, China, Czech Republic, Dubai, France, Germany, Hong Kong, India, Indonesia, Italy, Jordan, Kazakhstan, Korea, Macau, Malaysia, Mexico, Mozambique, Netherlands, Oman, Peru, Philippines, Poland, Qatar, Romania, Russia, Saudi Arabia, Serbia, Singapore, Slovakia, Spain, Switzerland, Taiwan, Thailand, Turkey, United Arab Emirates, United Kingdom, United States, Vietnam.
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