LIGHT RAIL TRANSIT.

egis

© Samuel Duplay

Montpellier LRT

Manuel Pierre,
Directeur Tramway Egis

NOTRE VISION

Leader des projets de tramway en France avec plus de 16 lignes nouvelles mises en service, nous sommes un acteur engagé unique portant toutes les compétences d'aménagement et de système de transport pour le développement des villes françaises.

Passionnés par les projets de transports en commun innovants et responsables, nous œuvrons chaque jour pour faire du Tramway un outil de transformation de la ville répondant aux enjeux actuels : une ville où les modes actifs reprennent la place centrale qu'ils doivent occuper, une ville où la nature pénètre et vit, une ville plus solidaire où les quartiers sont connectés par des lignes de tramway rapides, sûres et efficaces.

Notre mission est simple : répondre aux besoins de nos clients et leur offrir toute l'expertise nécessaire à la réalisation et à l'entretien de leurs réseaux tramway.

C'est en plongeant dans les racines de notre histoire que nous inventons le tramway de demain : finançable, éco-conçu et connecté. Nous développons ainsi projet après projet des approches complémentaires permettant de réduire la consommation des ressources naturelles utilisées dans les opérations de tramway aboutissant à des projets plus frugaux en ressources et en équipements.

Ceci permet de réduire l'impact carbone des projets et rendre le tramway accessible à de nombreuses villes de taille moyenne avec des tissus urbains variés. C'est pourquoi nous proposons une large gamme de tramways avec des coûts d'investissement optimisés.

Pour que les villes soient toujours plus accessibles, plus apaisées et plus durables, nous continuerons d'être toujours à vos côtés.

EGIS - A PIONEER AND LEADER IN LRT IN FRANCE AND INTERNATIONALLY

2/3 **of new-generation LRTs commissioned by EGIS**

At the forefront of the advent of modern tramways in the 1980s, Egis has become the leading LRT engineering firm in Europe, contributing technical skills and experience to bring excellence to all its projects.

Our experience amounts to

> 900 km

of custom-built LRT lines, spanning more than **40 years**

- Close client relations and attentive to client needs,
- Infallible commitment to ensure successful projects,
- Innovation supporting transition to the green economy, end users and operators,
- Capacity to bring together all necessary skills for a project,
- Expertise in complex projects,
- Technical expertise.

1980

- **Nantes** Line 1
- **Grenoble** Line A

1990

- **Grenoble** Line B - 1st and 2nd extensions of line A
- **Strasbourg** Line A and extension - Line D

2000

- **Nantes** Extension of line 1, and phase 1 of line 3
- **Lyon** Lines T1 and T2 and extensions of these - Line T3
- **Porto** Lines A, B, C and E
- **Grenoble** Extension of lines B and C - Line D
- **Montpellier** Line 1 and extension - Line 2
- **Paris** Line T3 a
- **Valenciennes** 1st Transville line and extension
- **Le Mans** Line 1
- **Marseille** Lines 1, 2 and 3
- **Strasbourg** Lines B, C, E and extensions of these
- **Cracovie** 1st and 2nd phase of the FastTram
- **Mulhouse** Extension of line 1

2010

- **Lyon** RhonExpress - Extension of T2
- **Grenoble** Line E
- **Toulouse** Line T1
- **Rabat** Lines T1 and T2
- **Paris** lines T3a and T3b
- **Besançon** Line 1
- **Dijon** lines A and B
- **Brest** Line 1
- **Montpellier** Lines 3, 4 and 5
- **Orléans -** Line 1
- **Constantine** Line 1
- **Aubagne** Line 1
- **Sidi bel Abbes** Line 1
- **Alger -** Line 1
- **Caen** Lines 1 and 2
- **St Etienne** Extension of line T3
- **Clermont Ferrand** Maintenance of line A
- **Valenciennes -** Line 2

2020

- **Nantes** Development of new LRT lines
- **Strasbourg** Network extension
- **Birmingham** Network extension
- **Paris** Extension of T4 - T9 T12 - T13 express lines
- **Marseille** North - South extension
- **Nice** Lines 2, 3, and T4
- **Casablanca** Lines 3 and 4
- **Alexandria** Upgrading of the Al Ramleh line
- **Luxembourg** Findel airport - Cloche d'Or line
- **Angers** Lines B and C
- **Lyon** T6 North and extension of T2
- **Brest** Line 2
- **Stockholm** Kista line
- **Dublin** Extension of the green line

ADAPTING TO THE ISSUES SPECIFIC TO EACH CITY

For over 40 years, we have been adapting our methods and designing innovative projects to meet our clients' requirements in terms of mobility, funding and urban integration.

Using the full range of expertise available at Egis, we create customised projects providing solutions to local and regional issues. Pushing back the limits of innovation to benefit both users and residents is a source of fulfilment for us.

Besançon LRT

Introduction of modern tramways
in France 1985, Nantes

Design of the first low-floor LRT
1987, Grenoble

First fully low-floor LRT
1994, Strasbourg

First developments to reduce motor vehicle traffic to prioritise the LRT
1994, Strasbourg

Re-use of a rail track bed
2006, Lyon T3

Design of the first short, cost-effective LRT
2012, Besançon

Integration of the first LRT with super-capacitor banks
2019, Nice T2-T3

UNE OFFRE GLOBALE DE L'AMONT À L'EXPLOITATION

Nous intervenons sur toutes les phases d'un projet de Tramway

CONSEIL ET ÉTUDES AMONTS

Étude des corridors de transport lourd, aide au choix du mode de transport, faisabilité économique et financière...

MAÎTRISE D'ŒUVRE

Réalisation des études de MOE, passation des marchés de travaux, direction de l'exécution des travaux.

© Serge Gounand

MANDATS ET AMO TECHNIQUES

Assistance aux MOA pour la réalisation de projets de tramway : passation des marchés de MOE, gestion administrative et financière des marchés, pilotage technique, communication, etc.

© G. Parent

EXPERTISES

Voie ferrée, plateforme, LAC, énergie, radio / télécommunication, billettique, signalisation ferroviaire, matériel roulant, centres de maintenance, insertions cycles et modes actifs, cybersécurité, amélioration de l'exploitation...


© Mario Renzi

GESTION DE PATRIMOINE

Diagnostic du réseau et analyse des obsolescences, stratégie de maintenance patrimoniale, plans d'investissements et d'entretiens à moyens et longs termes, interventions sur réseau exploité...

ZOOM SUR...

LES MANDATS ET LES AMO TECHNIQUES

Notre maîtrise historique des projets de tramway en France nous permet d'accompagner nos clients dans le pilotage de leurs projets de tramway, que ce soit au travers de mandats de maîtrise d'ouvrage ou d'AMO Techniques.

Mandataires de maîtrise d'ouvrage, nous assurons pour le compte des maîtres d'ouvrage : le pilotage du projet, l'OPC général, la passation et le suivi des marchés de maîtrise d'œuvre, d'achat de matériel roulant, la gestion administrative et financière, la communication...

AMO, nous complétons, aux côtés du maître d'ouvrage, les compétences nécessaires au pilotage du projet : études générales, matériel roulant, expertise voie ferrée ou systèmes, planification...

Brest, 2020 - 2026
Tramway ligne 2, AMO Technique

Caen, 2013 - 2019
Mandat de maîtrise d'ouvrage
Renouvellement ligne 1 et création de la ligne 2

Orléans, 2007-2012
Tramway ligne 2, AMO Technique

Caen ligne 1

Work on a network in operation, Grenoble LRT

NETWORK MAINTENANCE AND RENEWAL

Assessment of the network and analysis of obsolescence, fleet maintenance strategy, mid- to long-term investment and maintenance plans, asset management, heavy works on operating networks, etc.

Our detailed knowledge of LRT system components makes us the ideal partner for long-term maintenance and adaptation of your LRT networks.

In addition to our expertise in design services and asset management, Egis is the leading provider of urgent interventions on operating networks, ensuring a rapid response with a low impact on operation and effective safety management with regard to the surroundings.

Renewal of the T1-T2 intersection
Lyon, Pont Gallieni - Quai Claude Bernard - Perrache

Creation of double junctions with network in operation
Strasbourg lines F-B I Valenciennes lines 1-2

Post-incident repairs
Express 72h operation involving prefabricated installations
Tours line 1

Assessment, upgrading and renewal of tracks and bed
Grenoble LRT, framework agreement since 2017

Maintenance of the complete transport system
Strasbourg network, framework agreement since 2012

WE DESIGN PROJECTS...

© Samuel Duplaix


CA

TO CREATE CITIES CENTRED ON ACTIVE MODES

LRT projects offer an opportunity to re-design a city and create highly versatile public spaces.

Through the choices made in transport mode integration, urban furniture, urban spaces development and the ease of interpretation of public areas, we draw up a more liveable, more desirable and more urban cityscape.

Bicycles, pedestrians and active transport modes are able to regain their rightful key status in our cities.

Dedicated infrastructure for active transport modes
Luxembourg line 1, Lyon T2 Montrochet, etc.

Calming of urban spaces
Luxembourg Place de la Gare, Lyon T2 Place des Archives, etc.

Elimination of transport flows
Besançon line 1, Luxembourg line 1, Angers lines B and C, Nice T4, Lyon T2 Montrochet, etc.

Implementation of priority for bicycles at traffic lights
Lyon C3

Besançon line 1, Place de la Révolution

Luxembourg line 1, avenue de la Liberté

Lyon, avenue Thiers, tree canopy, lines 1 & 4

Nice, avenue de la Californie, line 2

TO CREATE GREEN, PERMEABLE DISTRICTS

We are actors in creating more accessible, greener and livelier cities.

Our solutions include rainwater infiltration to create a permeable urban environment and reduce the pressure on networks.

We also strive to develop ecological connectivity with existing natural areas throughout our projects. This connectivity is fundamental in ensuring biodiversity returns to our cities.

By selecting appropriate finishings and creating overhead tree canopies, we are able to offer real solutions to reduce the urban heat island effect and develop a more pleasant, attractive city.

Water infiltration on the track bed
Nice lines 2 & 3, St-Etienne line 3, etc.

Tree canopies
Lyon avenue Thiers T1

Reintroduction of green corridors
Angers lines B and C, Nice lines 2 & 3, Lyon T3, etc.

Elimination of the heat island effect
Design by ScorelCU® Lyon T6 Nord, Nice T4

Reintroduction of biodiversity with Landboost® modules, an Egis concept
In the design phase for Lyon T6 Nord and Nice T4

Pooling of water resources for watering
Dijon line 1

Use of untreated groundwater
Grenoble line E

A permeable urban environment that nature can enter and live in

TO ACHIEVE A RESOURCE-EFFICIENT, FRUGAL LRT

Before beginning the design studies, we advise our clients that we aim for a resource-efficient and frugal design, by studying the structures or equipment that could be optimised or eliminated to avoid:

- Impacts on the biosphere and biodiversity in areas crossed by the LRT
- Inappropriate use of raw materials
- The use of materials with high GHG emissions in their overall life cycle

The optimisations are presented along with the corresponding carbon emissions, financial impact and impacts on the project.

Design choices can then be made by the project Owner and stakeholders will full knowledge of the benefits and impact on the project.

Re-thinking the LRT for an appropriate use of resources

Luxembourg LRT maintenance centre

Dijon Chenôve maintenance centre. Engineering: Egis - Architectural Design: Ferrand-Sigal


© Jaboticaba Fotos Shutterstock


© DR


© Daniel Plazanet


© Mario Renzi

TO ACHIEVE A LOW-CARBON CITY

Construction activities can no longer be envisaged without considering the resources available and the carbon emissions in a complete life-cycle approach.

Egis is a pioneer in the design of more energy-efficient projects using fewer resources, which reduces the carbon footprint of the infrastructure whilst maintaining its durability.

We incorporate this dimension into the design of maintenance and stabling facilities, and we design energy-positive buildings (extra thermal insulation, photovoltaic panels, geothermal sources)

Low-energy building and solar farm
Dijon line 1, Besançon line 1, Luxembourg line 1

Grass-covered, sliding formwork track
that reduces concrete volumes in exchange for more earth Besançon line 1

Single main cable duct
Besançon line 1

Asphalt in the foundations
Besançon line 1, Strasbourg depot, Dijon line 1

For the future...

Low-carbon concrete and biobased materials
for the track bed, station platforms, buildings along the line, depots and workshops, etc.

Reduction in track bed concrete volumes
by installing thin slab track systems, by modifying the thickness of foundation concrete depending on soil bearing capacity,

Cellular structure
for station platforms

Low-carbon concrete and biobased materials

TO ACHIEVE A DESIGN THAT MEETS NEEDS AND FUNDING CONSTRAINTS

Each local area has its own particular characteristics and projects must therefore be designed to take into account specific urban integration and investment requirements.

Through its unique experience, enabling it to bring together all aspects of an LRT project ranging from urban development to the transport system components, Egis has developed various types of LRT project which allow for modularity depending on investment capacities.

Valenciennes line 1

Lyon: T3 / RhônExpress

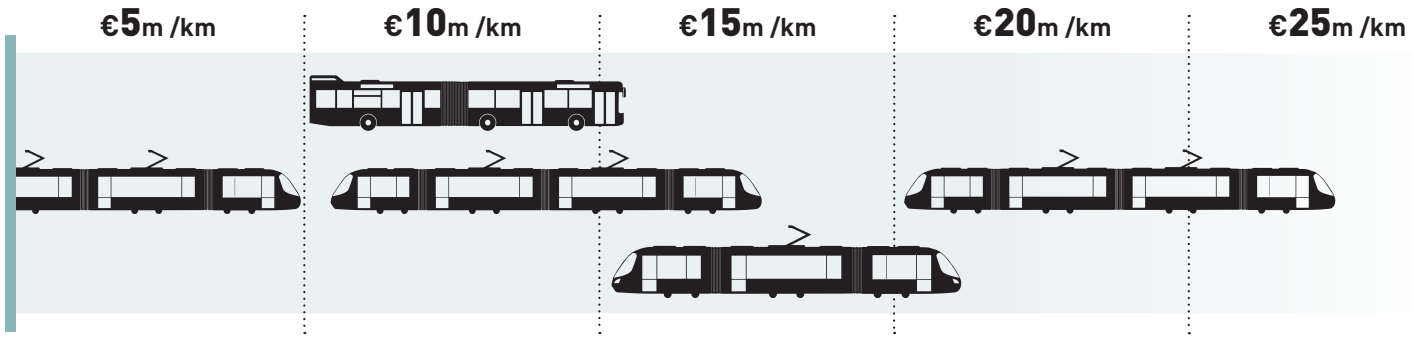
Besançon line 1

Express LRT - €8m /km
Valenciennes line 1

Cost-effective LRT - €13m /km
Lyon T3 / RhônExpress

Short LRT - €16.5m /km
Besançon line 1

Egis proposes a full range of investment costs allowing all urban areas with a population of more than 100,000 to benefit from an LRT.



Express LRT
€5m - 10m /km, long interstation distances and lower frequency, suitable for outlying suburbs

BRT
€10m - 16m / km

Cost-effective LRT
€12m - 18m /km
Economical in terms of systems and equipment

Short LRT
€16m - 18m /km
The size of an articulated bus

Classic LRT
€20m - 26m /km

Paris CCR line 1

Saint-Etienne augmented station line 3

TO INTEGRATE THE DIGITAL TRANSITION

IMPROVING THE USER EXPERIENCE

It is essential for passengers who wish to optimise transport connections or make the most of waiting times to have information available at the right time.

We have developed an augmented station concept which creates a link with the surrounding urban environment:

- Secure parking for bikes and kick scooters,
- Charging stations,
- Street library,
- Information on local services,
- ... there are infinite possibilities!

MANAGING DATA IN YOUR NETWORK

Your network data is key to maintenance, upkeep and providing passenger information.

We propose technical solutions to collect data from the CCR, structure it and make it available to the transport-managing authority.

This data can then be made available and used in the production of technical or passenger apps. We also use this data for customised asset management solutions.

Security of your network is fundamental in today's context. The cybersecurity solutions we propose guarantee that your installations are protected against computer piracy.

Augmented stations
Specific design, charging stations, street library, etc.
Saint-Etienne line 3

TO RESOLVE COMPLEX PROBLEMS

CROSSING MAJOR NATURAL FEATURES

Rivers, waterways, hills and steep gradients are part of the urban fabric of certain cities and represent major challenges in designing LRT projects.

Due to the diversity of its expertise, Egis is able to call on a team of in-house experts and architects and thus offer our clients the best technical, landscaping and urban integration solutions.

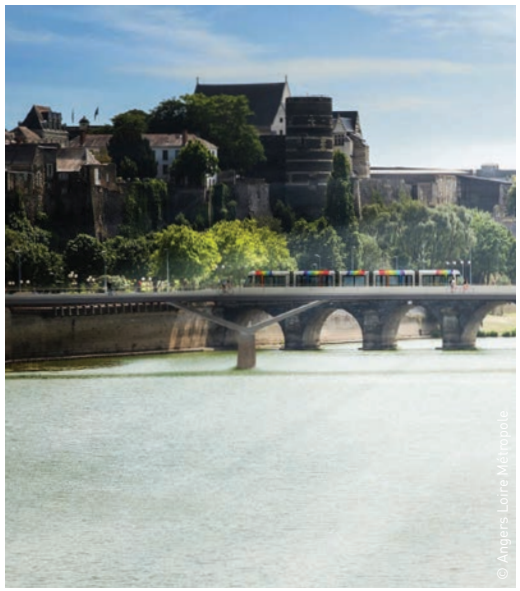
Egis possesses integrated technical expertise, and is therefore able to design and supervise works on unusual civil engineering structures, whether new or renovated.

Citadelle bridge - 2016 national prize for engineering
Strasbourg line D

Bridge across the river Maine
Angers lines B and C

Grand Duchesse Charlotte bridge (Pont Rouge)
above the Alzette valley
Luxembourg line 1

Strasbourg line D, Citadelle bridge across the Vauban basin



Angers line B and C, bridge across the river Maine

Luxembourg line 1, Pont Rouge

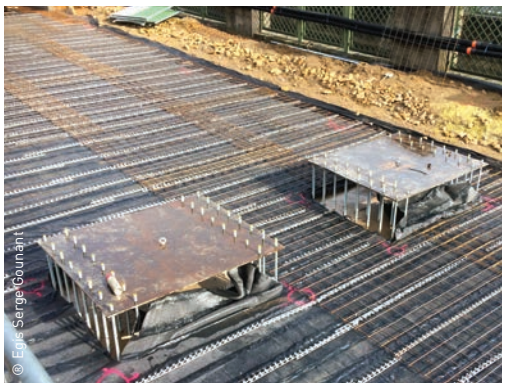
Innovative system for static ground-level recharging
Recharging of super-capacitor banks in 20 seconds at stations
Nice line 2

1.6 km of tunnel
passing under the Meudon forest
Paris region T6

3.2 km of tunnel passing under the city centre
Nice line 2

Viroflay LRT T6, Paris region

Nice line 2, underground section for optimal service provision in the city centre



Luxembourg line 1, installation of a track with spring vibration isolators

INTEGRATING LRT SYSTEMS IN DENSE URBAN ENVIRONMENTS

Integrating an LRT in a town centre or any other dense or historical urban environment can be a complex task.

We have developed several solutions in response to these issues, such as replacement of overhead power by super-capacitor banks with ground-level recharging in 20 seconds at stations.

On the strength of our expertise in building metro lines, we have unique experience in designing LRT tunnel sections. With one-off developments of this kind, lines can reach urban areas that cannot be served by overground systems.

DESIGNING AND INSTALLING SPECIAL TRACKS

Vibration risks can affect the surrounding built environment.

We have completed several designs using anti-vibration tracks, which mitigate the impact of vibrations on buildings and the immediate environment.

The design of a track with medium attenuation springs (4 Hz) for the Luxembourg LRT is a first in Europe.

Track with spring vibration isolators
In the vicinity of the theatre, Luxembourg line 1

Shock- and vibration-resistant fibre-reinforced concrete track
Birmingham, line 1

Very low frequency anti-vibration system
Pont Rouge, Luxembourg line 1

Antivibration track
Saint-Etienne, line 1

POUR DES CHANTIERS MAÎTRISÉS À FAIBLE IMPACT

Les chantiers de tramway modifient l'usage et la forme de l'espace public et ont un impact fort sur la vie des quartiers.

Derrière l'enthousiasme d'un bénéfice futur se dresse la crainte des perturbations liées à la mise en œuvre. Ephémères, mais néanmoins présentes, elles ne peuvent en aucun cas être ignorées. La concertation et l'implication des riverains dans le projet constituent un point essentiel pour emporter leur acceptation.

En phase études et en concertation avec le MOA, nous associons les riverains à des ateliers de travail thématiques en présentant plusieurs choix techniques, puis en présentant une analyse multicritères des solutions retenues par le public. Ensuite, les élus peuvent faire des choix éclairés par l'avis technique et l'avis des riverains.

Pour la phase chantier, nous avons développé l'appli *Travaux Connectés ® by Egis* avec la startup française Ubiplace.

Depuis la phase de conception et tout au long du projet, communiquer avec justesse pour créer une histoire commune

Conception participative
T6 Nord - Lyon

Lien avec les riverains par l'appli Travaux connectés
Nice T1-T2

© Christophe Ehanno

TRAVAUX CONNECTES by egis
powered by UBIPLACE

Appli de suivi de chantier permettant aux riverains de recevoir des alertes et signaler les problèmes. Le gestionnaire peut piloter les alertes, recevoir les signalements et demander une intervention à un acteur du chantier, suivre et valider les mesures correctives.

AMO stratégie de gestion patrimoniale réseau tram
Toulouse

Certification selon le référentiel ISO 55001
Londres, Docklands Light Rail

Conception 100% BIM
Marseille tramway ligne 3 « Nord-Sud »
Birmingham

Grenoble, travaux sur le réseau de tramway

Marseille, utilisation du BIM pour la conception puis la maintenance

POUR GÉRER LE PATRIMOINE À LONG TERME

L'ASSET MANAGEMENT

Fort d'une connaissance fine de l'ensemble d'un réseau tramway, nous accompagnons nos clients dans la mise en place d'une véritable stratégie de maintenance à long terme.

Nous intervenons sur 3 axes :

- Accompagner les AOM pour la mise en place de la démarche
- Participer à la gestion du patrimoine (inventaire, diagnostic, planification des interventions)
- Préparer la digitalisation de la gestion du patrimoine

LE JUMEAU NUMÉRIQUE

Avec l'offre « jumeau numérique », Egis met à profit son savoir faire en BIM Management, son implication dans l'évolution des normes BIM (MINnD, IFC Rail, ISO 19650) et son expertise dans la synthèse et la maîtrise des interfaces, au service des propriétaires ou des opérateurs d'infrastructures de transport qui souhaitent un inventaire fiable, à jour et facilitant la projection dans leurs installations pour :

- Optimiser le coût et la durée des interventions sur site
- Simplifier la gestion du patrimoine (asset management)
- Fluidifier le dialogue entre les services de secours, exploitants, riverains, usagers, etc.
- Accélérer et sécuriser le démarrage de projets neufs ou de modernisations
- Mesurer et visualiser l'empreinte carbone d'un chantier ou d'une exploitation
- Mieux garantir la sécurité des intervenants

TO ASSIST OUR CLIENTS WITH NEW SOLUTIONS

TURNKEY SOLUTIONS

Some projects may require contractual arrangements to be set up between engineers and contractors.

We are regularly involved in turnkey operations alongside contractors, whether to create specific equipment, build maintenance centres, or construct a complete LRT line.

Egis also has in-house expertise in building signalling facilities via its subsidiaries Sintra and Est Signalisation.

A partnership contract between the engineer, the contractor and the Project Owner,
Birmingham network extension

Addition of a station and a cross-roads in a turnkey contract entirely by Egis (design services & works phases)
Reims line 1

PPP contract for energy and data cabling aspects
Dijon line 1

Modification of railway signalling at the St-Priest maintenance centre
Lyon LRT network Luxembourg line 1

© Egis

OUR PROJECTS

NICE LINES 2 & 3, LINE 4

Design services
Statutory documents
Works supervision
Scheduling - OPC
Testing
LRT system
Urban development works
Maintenance - Stabling
Rolling stock

To meet passenger travel needs within its geographical area, Nice metropolitan authority commissioned Egis to extend its LRT network by creating lines 2 and 3.

This large-scale project with 16 km of new line is a melting pot of innovations, showcasing a new generation of LRTs even more successfully integrated into their urban environment.

In early 2021, Nice commissioned Egis and its partners to construct line 4 of the LRT network.

Project Owner
Nice Métropole Côte d'Azur

Dates	Length	Cost of works
2010 - 2020	16 km	€780m

SPECIAL FEATURES

- **4 km of tunnels** and **4 underground stations**
- 12 km section without overhead contact lines, using a **unique system of ground-level charging when stationary** (see insert opposite)
- **Completed in 3 years**, 2 years ahead of schedule
- **Greening:** 2500 trees planted
- 60% of the route with **green permeable track**
- **Innovative implementation in sections** allowing the client's objectives to be met.

Nice, Avenue de Californie, line 2

Nice lines 2 & 3, Opportunity recharging system in stations

OPPORTUNITY CHARGING SYSTEM

The LRT runs for 12 km without overhead contact lines (except in tunnels) thanks to the new Alstom Citadis X05 carriages equipped with an on-board energy system: Lithium Capacitor super-capacitors - Alstom Citadis Ecopack© technology.

This system is installed at tram roof level and provides enough power for autonomous travel between stations. Recharging takes 20 seconds with the opportunity charging technique in stations: footings position themselves against the recharging rails under the carriage.

With this solution, overhead contact lines are no longer necessary, and their potentially unsightly presence in the urban area can be eliminated.

The project in Nice allowed Alstom to develop this technology known as SRS© (ground-based static charging system).

THE TUNNEL UNDER THE OLD TOWN

The works on line 1 had left a bad impression through their devastating impact on the city's funds and historical heritage.

To avoid a repeat of the previous pitfalls, an innovative tunnel solution was implemented by Egis and its partners.

Integrating this solution was a true technical challenge requiring management of many risks: flooding, coastal flooding, earthquakes, historic buildings, geotechnical aspects, exits in the old town, etc.

All these risks were managed to create a rapid transport system with a low impact on the city centre compared to a ground-level LRT.

Nice line 2

BESANÇON LIGNE 1

Design services
Statutory documents
Works supervision
Scheduling - OPC
Testing
LRT system
Urban development works
Maintenance - Stabling
Rolling stock

En 2009, la Communauté d'Agglomération du Grand Besançon pris la décision de s'inscrire pleinement dans une politique de développement durable.

Côté transport, cette volonté s'est exprimée par la commande à Egis et ses partenaires d'une première ligne de tramway écologique et économique, en commençant par les études préliminaires et de faisabilité, jusqu'à sa mise en service.

Besançon, place de la Révolution, line 1

Project Owner
Communauté d'Agglomération du Grand Besançon

Dates	Length	Cost of works
2003 (PS)	14.5 km	€230m
2009 - 2014 (design & supervision of works)		

SPECIAL FEATURES

- **Reduction in road traffic** for a calm city centre
- **Cost-effective LRT €16.5m /km** close to the cost of a BRT
- **Sustainable LRT** with a low carbon footprint using resource- and energy-efficient design choices
- **Short LRT, €23m,** adapted to the city constraints
- **Integration of roads up to 10m wide**
- **Commissioning in advance of schedule**

Design services · Statutory documents · Works supervision · Scheduling - OPC · Testing · LRT system · Urban development works · Maintenance - Stabling

LUXEMBOURG LINE 1

GLOBE LIGHT RAIL AWARDS WINNER 2018

Luxembourg, Boulevard Robert Schumann, line 1

The city of Luxembourg wished to create an LRT to optimise journeys and reduce road traffic, thus promoting active transport modes accessible for its residents and pedestrians.

In 2005, Luxtram commissioned the e-Tram consortium led by Egis and locals LuxPlan to perform a complete design services and works supervision assignment to create its first LRT line.

Project Owner
Luxtram

Dates	Length	Cost of works
2015 - 2020	16 km	€220m

SPECIAL FEATURES

- **Longest LRT bridge in Europe:** Pont Rouge, a 335m metal batter-post bridge
- **Innovative** energy capture system with **opportunity charging** along 3.6 km of line
- **ORTEC® anti-vibration system:** integrated into rails on the Pont Rouge and able to absorb very low frequencies (6 Hz)
- **Installation of spring-damped tracks:** Grundey spring vibration isolators ensuring exceptional damping (4Hz) to avoid propagation to the nearby theatre.

ANGERS LINE B

Design services
Statutory documents
Works supervision
Scheduling - OPC
Testing
LRT system
Urban development works

In 2015, Angers metropolitan authority commissioned Egis to create the 2nd line of its LRT network, including a section in common with the existing line. It includes a ground-level power supply section (APS system) of more than 1.3 km connected to the existing APS section.

Egis performed the feasibility studies and general design services and works supervision, integrating the engineering aspects of the new Pont des Arts et Métiers that features a mixed LRT-bus section and carries all sustainable transport modes.

Project Owner
Alter Public

Dates	Length	Cost of works
2015 - 2024	10 km	€145m

SPECIAL FEATURES

- **Ground-level power supply** in the vicinity of historic monuments and on the Pont des Arts et Métiers
- **80% of the layout consisting of green track**
- **Perfect compliance with operation interruption deadlines** during connection to the existing line
- **Innovative joint signalling for rail and traffic lights**

Angers LRT

Design services
Statutory documents
Works supervision
Scheduling - OPC
Testing
LRT system
Urban development works
Maintenance

PARIS REGION LINE T4

T4 Clichy-Montfermeil

Commissioned in 2006 and operated by the SNCF (French national railways), the T4 tram-train line connects Aulnay-sous-Bois to Bondy. In 2013, Ile-de-France Mobilités commissioned Egis to extend this LRT line to Clichy-sous-Bois and Montfermeil.

This project is part of the interconnection of districts on the Clichy-Montfermeil plateau and will in the long term connect to Metro line 16 planned for 2024.

Project Owner
Ile-de-France Mobilités

Dates	Length	Cost of works
2013 - 2020	6.5 km	€270m

SPECIAL FEATURES

- **Significant interfacing between the LRT project and urban renovation** in the districts it passes through
- **Connection to the existing rail network**

MONTPELLIER LINES 1 TO 5

Etudes · Dossiers réglementaires · Travaux · Planification - OPC · Essais · Système Tramway · Aménagements urbains · Maintenance - Remisage · Matériel Roulant

In 1995, Montpellier metropolitan authority selected Egis for construction of the first two lines of a modern, high-performance LRT. In 2005, Egis was again appointed for general design services and works supervision on lines 3 and 4. In 2011, Egis performed the preliminary studies and the preliminary and final design for line 5.

Today, the city's inhabitants benefit from one of the best LRT systems in France, in terms of service for residents and efficiency, serving 50% of the population of Montpellier and 57% of jobs.

Project Owner
Transports de l'Agglomération de Montpellier (TAM)

Dates	Length	Lines
1995 - 2020	79 km	4

SPECIAL FEATURES

- **Understanding and translating the metropolitan authority's political choices into projects,** made possible thanks to the long relationship between Egis and the Project Owner
- **Adaptation of projects** and the network to **mobility issues within the metropolitan area**
- **Numerous** examples of perfect management of **works carried out with the network still in operation**

© Samuel Duplaix

Montpellier, Saint Roch station

Montpellier, line intersections

Lyon, renewal of the T1-T2 Gallieni bridge intersection

WORKS ON NETWORKS IN OPERATION

Montpellier, Strasbourg, Lyon, Grenoble, Valenciennes, etc. Egis is regularly involved in works on networks in operation, whether to connect a new line, install track equipment or for network maintenance.

We have extensive experience with works on networks in operation. **This renowned expertise is a guarantee for the Project Owner** that rapid, complex operations will be performed to **complete works efficiently and safely**.

These operations are performed within a very restricted time window, varying from a few days to a few weeks, focusing on a specific sector or structure involving a potentially serious risk for operations or in terms of disturbance to local residents.

Scheduling is prepared years in advance, to the nearest day and in coordination with many external participants.

Success in these operations depends in particular on working closely with the operator, from the start of the studies, to define in detail each party's working methods, and how the network is to be interrupted and put back into operation following trial runs.

To limit the impact on network operation, we deploy customised solutions, which may even include installation of prefabricated elements in the context of emergency operations (Lyon, Valenciennes, Strasbourg, etc.).

GRENOBLE COMPLETE NETWORK

Design services
Statutory documents
Works supervision
Scheduling - OPC
Testing
LRT system
Urban development works
Maintenance - Stabling
Rolling stock

Since the 1980s, the Grenoble urban area has been implementing an innovative mobility management process which resulted in the reintroduction of LRT networks in France.

Grenoble city council selected Egis to implement the 1st low-floor LRT in the world. Since then, we have constructed the 5 lines that serve the main residential, shopping and services districts. Today, this interlinked, large capacity LRT network has led to high frequency of use across the entire public transport network, transforming Grenoble into a sustainable transport capital.

Project Owner
Syndicat Mixte des Mobilités de l'Air Grenobloise (SMMAG)

Dates	Length	Lines
1984 - 2015	49 km	5

SPECIAL FEATURES

- **Reintroduction of the LRT in 1987**
- **Complete design** of an interlinked, developing **network**
- **Calming of the Cours Jean-Jaurès** by reducing car traffic and allocating more space for active transport modes
- **Many interventions on the network while in operation** in the context of a design services and works supervision contract in place since 2017 for track renewal

Grenoble, Rue de la Résistance, line E

Grenoble, Cours Jean-Jaurès, line E

STRASBOURG COMPLETE NETWORK

2016 NATIONAL PRIZE FOR ENGINEERING FOR THE CITADELLE BRIDGE

Design services
Statutory documents
Works supervision
Scheduling - OPC
Testing
LRT system
Urban development works
Maintenance - Stabling
Rolling stock

A pioneer of LRT renewal in the 1990s, the Strasbourg Eurométropole authority (EMS) commissioned the consortium Serue Ingénierie - Egis - Alfred Peter to construct the first LRT line and then the other 5 lines and extensions to them.

Thanks to this LRT network, Strasbourg now has an effective network serving several municipalities in the urban area, in addition to the German town of Kehl.

Project Owner
Communauté Urbaine de Strasbourg (CUS)

Dates	Length	Lines
1984 - 2015	70 km	6

SPECIAL FEATURES

- **Integrated Egis design of the Citadelle bridge** on the river Rhine with a 163m-long suspended curved deck
- **Design and works supervision interfaced with the operating SNCF network**
- **Emergency interventions on networks in operation** for heavy maintenance works
- **Management of interfaces with sensitive associated projects**
- **Unique know-how on the Strasbourg network** thanks to the stability of the consortium

Strasbourg line F, extension to Koenigshoffen

CITADELLE BRIDGE

A complex structure of elegant simplicity.

A team of engineers and architects from the Egis group was brought together for the original design of the Citadelle bridge on the Vauban basin in Strasbourg, allowing the LRT network to be extended towards Germany.

The 163m-long deck with its very thin continuous curved shape, contributes to its urban appearance. This is both an intentionally graceful shape but also the result of an analysis of the forces exerted, in order to optimise the use of resources, reflecting our approach to sustainable construction.

This world first was recognised by the 2016 national prize for engineering for its elegant simplicity, originality and clarity of form. The structure is the outcome of highly integrated design between architects and engineers at Egis.

The design process used a 3D digital model from the outset, allowing the engineering and architecture teams to discuss the outline designs produced, and in order to fully meet the Project Owner's expectations.

Design faults could be detected very quickly due to the 3D digital model and any imprecision in the project was avoided. At all design phases, the team sought to reconcile the requirements of the LRT, in particular a certain rigidity of the deck supporting the rails, with the flexibility of the hanging steel structure.

The Citadelle bridge across the Vauban basin linking Strasbourg to the German town of Kehl

LYON, T1, T2, T3 - RHÔNEXPRESS, T6 NORTH

Studies (preliminary, feasibility, design studies) · Statutory documents · Works supervision · Scheduling - OPC · Testing · LRT system · Urban development works · Maintenance - Stabling · Rolling stock

In 1997, SYTRAL commissioned Egis to create the first two lines of its LRT network; a true challenge with 20 km constructed in only 3 years between the start of the preliminary project and its commissioning in January 2001.

In 2002, construction of the T3-RhônExpress line required research and development of innovative solutions enabling the LRT to run on a former railway line and an urban LRT line to be operated simultaneously with an express line.

In 2020, Egis began the north extension of line 6, supported by an ongoing consultation process with local residents and elected representatives throughout the design phase.

Project Owner
Syndicat mixte des transports pour le Rhône et l'agglomération lyonnaise (SYTRAL)

Dates	Length	Lines
2002 - 2007	41 km	4

SPECIAL FEATURES

- Construction of a **permeable platform with longitudinal infiltration**
- **Completion of Design and Works in 3 years** (20 km, 41 stations and 1 depot-workshop)
- **Long welded rails:** adaptation of rail techniques to the urban environment
- **Creation of a mixed mode of operation** with two different line speeds and intersections equipped with barriers
- **Adaptation of stations to railway safety requirements**
- **Track on grass-covered embedded ballast bed** in an urban environment

Lyon T2, Cours Charlemagne

Lyon T3 - RhônExpress, embedded grass-covered ballast track, mixed urban and railway section

Lyon RhônExpress, ballast track, rail section

Design services · Statutory documents · Works supervision · Scheduling - OPC · Testing · LRT system · Urban development works · Maintenance

PARIS REGION T12 EXPRESS

TRAM-TRAIN

T12 Express, municipality of Ris-Orangis, Avenue Ambroise Croizat

T12 Express, Epinay-sur-Orge, rail bridge over the LRT

T12 Express, municipality of Ris-Orangis, Avenue Ambroise Croizat

In 2013, Ile-de-France Mobilité commissioned the consortium led by Egis to perform the studies and supervise works for all infrastructure and systems required to extend the T12 line. This 10.3 km extension includes 3 bridges over the A6 motorway and 2 bridges over local roads.

Running primarily on the national rail network, the T12 extension is a tram-train line continuing from the existing line between Epinay and Evry, which in the long term will replace the C8 branch of the RER C regional express.

Project Owner
Ile-de-France Mobilités

Dates	Length	Cost of works
2013 - 2024	10.3 km	€270m

SPECIAL FEATURES

- **Design adaptation** for creation of an LRT **on an existing railway track bed**
- **Technical interfaces relating to operation of an LRT on a railway line:** power supply, track equipment, rolling stock
- **Land tenure in a highly restricted environment:** motorway, very dense built environment, rail track, etc.

CAEN, TRANSFORMATION OF THE GLT INTO A RAIL LRT

PROJECT OWNER ASSIGNMENT

From its first years in operation, serious problems arose with the GLT (rubber-tyred metro technology) regarding reliability, availability and saturation, which in the short term threatened the operation of the entire Caen LRT. The Caen la Mer urban area then launched the "2019 LRT" operation in 2012 to transform the existing GLT line into 3 standard LRT lines on rails.

The Caen la Mer urban community commissioned Tramcités (consortium of Egis - SEM Normandie aménagement) to manage the 2019 LRT project on its behalf via a project owner assignment.

Project Owner
Communauté urbaine Caen la Mer

Dates	Length	Cost of works
2013 - 2019	16.2 km - 3 lines	€275m

SPECIAL FEATURES

- **Management of the entire project:** deadlines, cost, quality
- **Optimisation of construction period:**
  > 18 months to transform and extend line 1
  > 11 months to build the maintenance centre (13 months faster than usual).
- **Management of investment costs**
- **Management of continuity of service:** use of 50 articulated buses to replace the GLT during the works, as near as possible to the track layout and keeping pace with the progress of works.
- **Transformation of a guided light transit (GLT) system into a rail LRT**

Caen joint section, Place Saint-Pierre, lines 1, 2 and 3

© Agglomération Caen la mer, Solveig de la Hougue

DESIGN OF EXTENSIONS TO THE MIDLAND METRO SYSTEM

A series of network extensions to the existing Midland Metro Line 1 (opened 1996) was proposed and is being delivered by Transport for West Midlands (TfWM), as the passenger transport executive for the West Midlands Combined Authority (WMCA), to improve connectivity and generate economic development within the wider metropolitan region of the West Midlands.

Egis is the lead designer and majority shareholder (50%) in a design joint venture formed of Pell Frischmann and Tony Gee. The design JV is a Non-Owner Participant in the Midland Metro Alliance formed by TfWM (Owner) and Colas Rail, the delivery Non-Owner Participant.

Project Owner
West Midlands Combined Authority (WMCA)

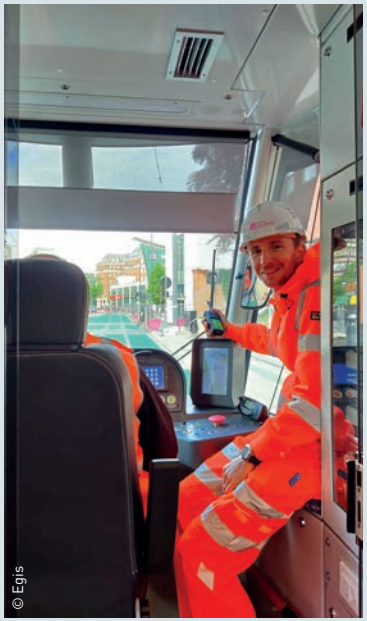
Dates	Length	Lines
2016 - 2026	34 km	6

SPECIAL FEATURES

- Reduced carbon footprint
- Through the use of fibre reinforced concrete trackform, rather than traditional steel reinforced concrete
- Some complex technical challenges were overcome by the Egis team, including resolution of very difficult track geometry initially produced but not completed by a preceding designer for the Birmingham Eastside Extension.

TRAM, Birmingham

ADDED VALUE



INNOVATION

Egis proactively helped the WMCA and their tram operator, Midland Metro Limited, develop dynamic OLE and static charging points to support use of battery operated trams as part of the catenary-free Centenary Square Extension (CSQ) scheme through Birmingham city centre to reduce visual impact in this historical location and other heritage critical locations on the wider network. This was the first use of battery operated trams in the UK. This resulted in an **infrastructure capital cost reduction estimated at £9.24M** for the CSQ scheme alone. I believe the saving would be in this area but don't have direct access to the numbers

Digital Solutions. To improve system integration capability, Egis developed INMASYST: a web-based tool to manage complex interfaces, using open-source data (ISO AP 239). INMASYST links seamlessly to other software systems like ProjectWise, ArcGIS, Primavera and BIM/GIS. This helped us move away from a basic interface management approach to manage interfaces effectively accurately between design disciplines and wider stakeholders. This helped to clarify who was responsible for various activities and what each party would need to provide to another to improve design efficiency.

Shared-knowledge. Using the Engineering Management Team's experience, produced a matrix of detailed roles and responsibilities for all members of the MMA relating to design; led Safety by Design seminars to share general design best practice; lessons learnt activities;

Delivering Social Value. By working with the Institute for Apprenticeships & Technical Education (IfATE) we introduced a new apprenticeship programme in Tramway Construction in 2019, where over 50 local people have qualified since. We have also promoted the use of local SMEs to reach the target of 80% reliance on local businesses within the supply chain.

PARRAMATTA LIGHT RAIL

The Parramatta LRT project is part of the major development program of Greater Parramatta. Over the next 20 years, Parramatta will see its population growing by 72.000 inhabitants and a doubling of the population density by 2050. Parramatta is to become a 2nd node of connectivity in Greater Sydney, such as the CBD now, notably with the Parramatta LRT and the Sydney Metro West.

Great River City, the consortium formed by Transdev and CAF to deliver the System Operation and Maintenance (SOM) contract for stage 1, appointed Egis to perform critical early activities on the project. In particular, Egis perform the operability and maintainability design review on behalf of Transdev, prepared the Concept of Operation and Maintenance to be used as a O&M handbook by all designers on the project (system and civil) and participate to design review meetings on behalf of the operator to ensure operator requirements were well taken into accounts.

Project Owner
Great River City Consortium : Transdev Australasia Pty Ltd & CAF Rail Australia

Dates	Length	Total Project cost
2019 - 2023	12 km	1,475 B€

SPECIAL FEATURES

- Providing Operability & Maintainability Design Review
- Preparation of the Concept of Operation for the project
- Preparation of the Concept of Maintenance for the Rolling Stock and the Depot
- Assistance to project management during the delivery of the first phase of the project (participation to meetings, acting on behalf of GRC during design review meetings, management of interfaces between subcontractors of GRC)

© Hugh Llewelyn

The Parramatta LRT

PORTO – 4 LRT LINES

The design, construction and operation of four LRT lines: such was the project launched in 1998 by the city of Oporto, which wanted a modern and attractive transport system by 2009.

This project marked the beginnings of transformation for the city of Oporto. The system comprised a total of 68 km of lines (including 40 existing kilometers to renovate and double), 8 km of tunnels to be built.

Egis' assignment was to Design Build Operate and transfer of the line A, B, C and D

Project Owner
Metro do Porto

Dates	Length	Total Project cost
1998 - 2009	68 km	2 Md€

SPECIAL FEATURES

- Capacity to work within the framework BOT
- Smart blend if three technologies: regional, urban light rail and underground metro
- Underground metro/ LRT as the historical city centre classed as UNESCO
- Unique ability to efficiently drive all the different group members towards the same goal of time and budget compliant commissioning.
- Meet the deadlines for :
  - The election for European capital of culture 2001
  - The European Football Cup Euro 2004

A FIRST PROJECT IN SWEDEN FOR EGIS: THE KISTA TRAMLINE

Region Stockholm is expanding its tramway network called "Tvärbanan" in the northern part of Stockholm. Storstockholms Lokaltrafik (SL) has appointed Gülermak through a Design & Built contract. The project is named KG40 Kistagrenen.

As sub-contractor of the design & build project, Egis with its first contract in Sweden, is in charge of the following topics :

- project management associated to the design,
- alignment, tracks and multiducts,
- Power Supply,
- Overhead Contact Line,
- low voltage systems and telecoms,
- tram stops,
- internal interfaces management.

On its role of designer Egis is supported by its Swedish partner Tyréns which is in charge of civil part.

THE PROJECT PECULIARITY

- presence of many structures which represent 15% of the linear (with 3 viaducts and a trench)
- The light rail line is expanded from Bromma Airport via Sundbyberg and Kista, to Helenelund. The extension will run on 6,8 km of new infrastructure with 8 tram stops. It will go beside the famous Solvalla horse racetrack, a residential area before running through an on-going development area in Rissne, then Kista Centrum to finally end nearby commuter train station Helenelund.

EGIS ADDED VALUE :

SL has asked for this project to implement a **slab track** as most of the existing network is built with ballasted tracks. With its experience in numerous worldwide tram projects on slab track, Egis brings its high expertise to this project.

With its important part of the stretch on structures, KG40 constitutes a challenge regarding **technical interfaces between tracks and structures.** Especially it led to accurate Rail Structure Interaction studies, to additional studies to locate Rail Expansion Devices and to detailed profiles to optimize the loads.

SL and municipalities have prepared a part of the stretch. These **anticipated works** that went up to urban planning and kerbs brought constraints but was successfully handled with the good collaboration between all parties involved.

RABAT – SALÉ

Infrastructure
Various facilities
Urban and landscape engineering
Trackside and on-board equipment
Rolling stock
Workshop/ depot
Utilities relocation coordination

To meet the needs of a growing population and a region undergoing considerable change, the city of Rabat started up the construction in 2007 of the first two light rail lines in the Rabat-Salé metropolitan area.

Egis was asked to carry out the design and construction project management for this project.

Egis was also in charge of the general management and coordination of the project.

Today the first line is 11.7 km long and the second 9.6 km. They come together for 2.6km where they cross the river Bouregeg, which separates Rabat from Salé. Together, the lines have 31 stations spaced 60m apart on average. Headway is at 8 minutes (4 minutes on the joint stretch) and the fleet purchased consists of 23 high-capacity vehicles measuring 60m in length.

Project Owner
City of Rabat

Dates	Length	Project budget
2007 - 2011	20.5 km	11 k€


© Egis - Christophe Tatcher


© Egis Rail Alain Rousseau

ENSURING THE FEASIBILITY OF AN EXCEPTIONAL BRIDGE

Egis carried out all the calculations for the Société Générale des Travaux du Maroc (SGTM) for the Hassan II bridgeHassan II bridge designed by Marc Mimram. On the basis of these calculations and the architect's design, the execution studies (1500 plans and 120 notes) took exactly 3 years, from February 2008to February 2011.

The execution study contract awarded to Egis concerned the main Bouregreg crossing structure as well as a very sophisticated auxiliary structure called the «Base Nautique Bridge», crossing a crossroads on the Rabat side. The latter work was subcontracted to the Swiss design office T-ingénierie.

For the other two parts of the crossing built by SGTM, called Culée Creuse and Rampe

tramway ramp, Egis Jmi supervised the execution studies carried out by the Rabat design office, Team Maroc.

The Hassan II bridge consists of three parallel decks, each 330 m long:

- 2 decks dedicated to road traffic (11.1 m wide for 3 lanes, and 14.6 m wide for 3 lanes and 1 pedestrian lane)
- 1 deck 14.5 m wide is used for tramway traffic, pedestrians and cyclists.

DUBLIN – 2 LRT LINES

Dublin is both the capital of Ireland and the country's largest city. In the 1990's, its economic growth occurred together with similarly rapid and continuous population growth. This led the public authorities to plan the construction of a three-branch light rail network, with two of the lines entering into revenue service at the beginning of the 2000's.

Egis was appointed to carry out the engineering, procurement and and T&C of the first two lines of Dublin's LRT system, comprising 25 km of track, 14 tram sets of Citadis 401 40m range, 26 tram sets Citadis 301 30m range 36 stations, 1 main depot (Redcow), line depot at Sandyford.

Project Owner
CIE (Córas Iompair Éireann), then RPA (Railway Procurement Agency)

Dates	Length	Total Project cost
1994 - 2004	25 km	€12.293million

SPECIFICITIES

- Technical design of a comprehensive range of the system's
- Supervising the manufacture of the rolling stock and T&C
- Assistance to establishement maintenance contract with rolling stock manufacturer

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