



Capability Statement

Rail Infrastructure
Version 2016-C



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Company

Light Rail Consultants (LRC) Pty Ltd is a privately owned company that provides innovative engineering design and management services to all sectors of the Australian and New Zealand rail and light rail industries.

History

LRC was established in 2008 to capitalise on specialised expertise in the design of Overhead Line Equipment (OLE) and in Track for both railway and tramway projects.

Purpose

The mission of LRC is to be the leader in the market that we serve, to the benefit of our clients and their customers, the local transport authorities and the community who rely on their services.

LRC's objective is to consistently meet client demands and expectations for world class solutions, with high quality designs, delivered at competitive rates and to schedule.

Our strategy, through recruitment and training, is to provide professionals with proven experience in overhead wiring, track and civil design.

Value

LRC provides value, based on our specialist knowledge in overhead wiring systems and rail design, and by ensuring that complete information is included in the clients' requirements specification.

At LRC, we study industry trends and the latest innovations and techniques closely, so that we can better understand developments, to stay in the forefront of design, providing best-practice advice.

We keep familiar with relevant legislation, the authority engineering policies and publications and with the applicable Australian and International standards, to meet all our obligations.

Management Philosophy

People

Our management philosophy is to:

- Focus on people and their skills to position our team for their success
- Treat people with respect and honesty and communicate the expectations of the team and of management.
- Judge the quality of the outcome of the work, not just the amount of effort.
- Provide positive reinforcement to maintain team morale and work-drive, and
- Develop the team and management by continuously working at it.

LRC employs experienced design experts in civil, structural and electrical disciplines and engages with its partners to provide further expertise to complement other areas, ensuring LRC is well placed to manage complex engineering design projects.

Clients

We work closely with our clients to fully understand the engineering scope, schedule and budget.

Subsequently, we deliver high quality engineering design solutions and minimise the schedule and cost variations traditionally caused through rework from misunderstood design requirements, constructability and maintainability issues.

As an integral part of our philosophy, we include stakeholders as co-developers to ensure that they are up to date with the design developments and that the design intent is maintained.

Our approach to engineering is focused on achieving:

- Quality engineering project deliverables - on time and budget
- Practical designs to meet agreed project objectives
- Zero rework

Clients benefit from cost saving and practical, workable designs. LRC benefits from building long-term client relationships.

Risk Management

All aspects of health and safety, quality and environmental standards are considered under LRC's risk management approach, based on AS/NZS ISO 31000:2009 practices and guidelines. This allows us to develop comprehensive controls and treatment strategies, with emphasis on accountability and continuous improvement in risk management. Also, all decision-making includes consideration of risk management and is an important item at monthly and project review meetings.

Business

To achieve viable business benefit, LRC strives at all times to act with integrity to maintain high standards of business ethics and conduct. This principle is applied in our dealings with employees, partners, contractors, clients, suppliers, authorities, governments, competitors and the community. Our policies and procedures are consistent with this principle and are part of our framework to guide business operation.

Compliance

Monitoring compliance is encapsulated in our business systems, aligned to AS 3806-2006, including: legislative requirements, industry codes, risk management, governance, project audits, and within our culture of promoting awareness and maintaining transparency and honest reporting.

Policy

Health and Safety

LRC has a commitment in all its actions and undertakings to ensure the occupational health and safety of its staff, contractors and clients, and the safety and well being of the general public, through adherence to the Victorian Occupational Health and Safety Compliance Framework, in line with the standard AS/NZS 4801:2001.

Quality

Quality is managed at LRC through constant supervision, assessment and revision of all internal and external project processes and practices. Our current Quality Management System is aligned to the Australian Business Excellence Framework, consistent with the standard AS/NZS ISO 9001:2008, and implementation to achieve full accreditation is underway. Quality in all LRC designs ensures reliability, performance, ease of installation and maintenance.

Environment

At LRC, in our business and with our designs, we have a role to play in ensuring that environmental issues are addressed in all our projects. This begins with understanding the environment laws, regulations and standards, ensuring all LRC members are fully informed and accountable and that all reasonable steps are taken, in accordance with AS/NZS ISO 14001:2004, to achieve zero environmental impacts. Our designs focus on long life, low visual impact and the use of environmentally friendly materials.

Services

Our services include:

Overhead Wiring Design

We provide a comprehensive engineering design service comprising all elements of overhead wiring systems, making use of the latest design techniques, to deliver modern and innovative designs that are lighter and reduce visual impact.

- System design consulting
- 600V to 1500V DC expertise
- Catenary design
- Power feeder and connection details
- Interlocking solutions and platform design
- Pole, mast and wall bracket design
- Overhead suspension and fitting solutions

Track & Civil Design

We undertake engineering designs for new installations and for upgrading operating facilities.

- System and concept design
- Horizontal and vertical design alignments
- Advanced 3D modelling
- Rail fabrication details
- Swept path analysis
- Railway pedestrian crossing
- Track drainage
- Structural design of stations, tram stops, depots and yards

Construction Services

We provide skilled individuals for engineering and project support, supervision and management to ensure planned, essential outcomes.

- Construction staging and technical support
- Design and supply of steel poles
- Consultation on purchasing Overhead Line Equipment
- Installation supervision
- Project management

Ancillary Services

We offer specialised engineering services, providing breadth of support to important aspects of project development and execution.

- Creating 3D physical models
- Infrastructural & interface management
- Asset management
- Environmental & remediation consulting
- Safety and OHS
- Community liaison
- Computer programming -
- Innovation - application of more effective solutions to meet new requirements

The LRC Team

Kevin Karamad

Kevin Karamad is a Civil Engineer with over 17 years' experience in the structural and civil design of rail and tram overhead systems. He has been Lead Overhead Design Engineer and Construction Supervisor on tramway projects in Australia and in New Zealand.

LRC was established in 2008 with Kevin as Director. In 2010, as its Senior Overhead Wiring Engineer, he assembled a team to expand services for railway projects, bringing as well process skills, business and project management expertise.

Kevin has also been a Senior Overhead Design Engineering Consultant to SKM/Jacobs, from 2004 to 2014. Prior to this, he was a Structural Engineer with Simonetto Consulting and as a Project Engineer with Construction Engineering and Development.



Qualifications

- Bachelor of Civil Engineering (Structural Design)

Certificates

- Project Management – Level 2
- Quality Assurance
- Yarra Trams – Overhead and Track Appreciation

Memberships

- Engineers Australia
- Railway Technical Society of Australia (RTSA)

Douglas Jowett

Doug is a Senior Civil Engineer with over 36 years' rail industry experience in tram overhead systems, structural design, project management, construction supervision and commissioning.

He has worked on many major tram projects in the Melbourne tram network since 1976, employed by the Public Transport Corporation until 1998 in various design and construction areas including: track and drainage, overhead structures, building design and maintenance design.

Doug was a Senior Design Engineer with SKM from 1998 until 2005, after which he became an independent contractor, working with various engineering firms in the rail and industry.



Qualifications

- Associate Diploma in Civil Engineering
- Associate Diploma Applied Science (Mathematics)

Certificates

- Metro - Train Track Safety Awareness – Level 3

Memberships

- Engineers Australia

Russell Conabere

Russell has over 35 years' experience as a Track Designer in light and heavy infrastructure works, and is responsible for the design of some of the most complex track configurations in the Melbourne tram network.

He has also designed complex heavy rail alignments, both in Melbourne and interstate.

As a Senior Track Designer, Russell specialises in both light and heavy rail alignment, with horizontal and vertical design and advanced 3D modelling.

Russell has also gained experience working with the Dublin Light Rail Project and with a mining railway project in Chile.

Qualifications

- Associate Diploma Civil Engineering

Certificates

- CAD and Drafting courses (numerous)

**Milan Piryaee**

Milan is a qualified Structural Engineer with more than 4 years of experience who is experienced in structural design of railway infrastructure with good understanding of safety requirements.

He also has sufficient skills in project management, construction supervision, estimation and drafting.

At LRC, he has responsibilities for overhead wiring design, compliance control, quality assurance, detailed drawing preparation (VRIOS) and stakeholder liaison.

Qualifications

- Master of Science degree in Civil-Engineering-Structures
- Bachelor of Science degree in Civil-Engineering

Certificates

- Yarra Trams – Overhead and Track Appreciation
- Metro – Train Track Safety Awareness – Level 1



Bert Qin

Bert is an Electrical Engineer with 10 years' experience, including 2 years working as an Associate Engineer with China Railways on metropolitan train systems.

His responsibilities at LRC include electrical design and drafting for overhead wiring, overhead feeders, underground power feeders, switching and interlocking layouts, pillar box and tram electrification system sectionalising.

Bert's previous design experience included 27.5Kv traction substations and control systems / relay configuration. He is also familiar with main electrical equipment assessment and selection processes.

Qualifications

- Bachelor of Engineering (Electrical)
- Graduate Diploma of Electrical Engineering

Certificates

- Yarra Trams – Overhead and Track Appreciation

**Shervin Hosseini**

Shervin is a qualified civil engineer who has practical working experience in civil construction such as Substation's upgrade civil works.

After joining LRC, his involvement includes OHW design, drafting feeder & switching arrangement and liaison with clients. He has experience in estimation and act as site engineer in a few projects that he was involved.

Qualifications

- Bachelor of Engineering - Civil & Infrastructure (Honours)
- Diploma of Engineering Drafting

Certificates

- Yarra Trams – Overhead and Track Appreciation
- Metro – Train Track Safety Awareness – Level 1



David Donaldson

David is a Graduate Civil Engineer who joined LRC at the start of 2016. Since joining LRC he has been assisting the drafting and design team, with preparing drawings, completing AIS drawings, report writing and involved with carrying out initial investigations for projects.



Qualifications

- Bachelor of Engineering - Civil & Infrastructure (Honours)

Certificates

- Metro Academy - Train Track Safety Awareness
- Yarra Trams - Overhead and Track Appreciation
- Occupation Health and Safety Induction, White Card

Kamyar Karamad

Kam has 16 years' experience in Information Technology and drafting commencing in 1998 with Iran Development Projects where he achieved an Associate Diploma. After further training in IT from 2010 to 2011 at Visayas University, Kam undertook an Advanced Diploma (CSE) at TAFE in Melbourne.

Kam's responsibilities include: CAD design, drafting overhead wiring, IT support for computer systems, development for in-house software applications and managing QA and documentation aspects for the IT design environment.



Qualifications

- Bachelor of Science in Information Technology
- Advanced Diploma of Computer Systems Engineering – Computer Networking
- Diploma Business Administration – Information Technology
- Associated Of Science Degree (Computer Software)

Certificates

- Yarra Trams – Overhead and Track Appreciation
- Metro - Train Track Safety Awareness – Level 1
- AutoCAD – Level 2
- MCSE
- ACCPT (Microsoft)
- OH&S Construction Induction

Memberships

- Australian Computer Society

Key Clients and Alliances

Public Clients

As a major public client, Yarra Trams relies on LRC designs for many of its overhead and track upgrades at tram depots, stops, intersections and section runs.

Yarra Trams

Yarra Trams is the trading name of the Melbourne tram network, which is owned by the Victorian State Government. The current franchise is operated by the KDR Melbourne consortium, owned by Keolis and Downer Rail. As at May 2014, Yarra Trams operate 487 trams, across 26 tram routes, over 1,763 tram stops. With 250 km (155.3 miles) of double track. Melbourne's tram network is the largest in the world.



Consultant Clients

LRC work closely with leading Australian and major international consultancy organisations.

AECOM

AECOM is an international leader, providing integrated professional technical and management support services for: transportation, energy, water systems, architecture, engineering, construction, mining, environment, economics and government market sectors.



Coffey Rail (Opus Rail)

An Australian-based rail engineering consultancy, Coffey Rail formed in 2007 and in 2011, together with its related company Asia Pacific Rail Pty Ltd, was acquired by the global firm Opus International Consultants. The companies are now known as Opus Rail.



GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. GHD is also a contractor client of LRC.



Hyder Consulting

Hyder Consulting is an international design and engineering firm with a history of over 200 years in Europe, 110 years in the Middle East, 100 years in East Asia, and 70 years in Australia.



SKM

SKM, an Australian engineering consultancy firm, operated predominantly in Australia but also overseas. It was acquired in mid 2013 by the major international engineering, architecture, and construction firm, Jacobs Engineering Group.



Contractor Clients

Abigroup

Abigroup is one of Australia's leading and most diverse national contractors, with 50 years of experience delivering works in building, roads, rail, water, mining services, tunnels, bridges and telecommunications. Abigroup is part of Lend Lease Infrastructure, a division of the Lend Lease Group.



Activate

Activate was a Design and Construction Joint Venture between Coleman Rail (40%), John Holland Rail (30%) and John Holland Civil (30%). The joint venture, formed in 2012, completed works for the Regional Rail Link project, main track and engineering between Southern Cross Station and Moonee Ponds Creek.



Coleman Rail

Part of the Geotech Group of companies, Coleman Rail is a construction contractor in heavy and light rail infrastructure projects, offering design and construction, renewal, upgrade, maintenance and project management.



McConnell Dowell

Formed in 1961, McConnell Dowell is a major Australian engineering, construction, building and maintenance contractor, delivering engineering excellence in three key industry sectors of building, infrastructure and resources.



Partner Organisations

LRC works in partnership to bring additional expertise and oversight to improve designs integration.

Pitt & Sherry

Pitt and Sherry is a leading Australian engineering and multi-specialist infrastructure consultancy servicing the transport, industrial, mining, energy, food and beverage and community sectors. Pitt & Sherry provide their expertise to LRC in bridge and other structural design.



Traffic Group Australia

Traffic Group Australia specialises in the provision of traffic management services to local authorities, road maintenance providers, large utility/infrastructure companies and civil engineering contractors throughout Australia.



Alliances

Elektroline

LRC has a long-term alliance with Elektroline for design and installation support on the Overhead wiring and signalling systems in Australia. They have delivered many successful projects in Australia, Czech Republic, Italy, Germany, Turkey, Poland, Russia and other European countries.



Pražská Strojirna

LRC has established a partnership with Pražská Strojirna, providing them with support in Australia and Iran. They have delivered many successful projects in Australia, Czech Republic, USA, Italy, Germany, Turkey, Poland, Russia and other European countries.



In-House Systems

LRS

LRS (LRC Registration System) is an in-house developed, project system that supports office management. Its main purpose is to allow the company to run more smoothly.

LRS helps control project work including: documents, schedules, resources, contacts, timesheets, time costs, expenses, invoice billing, contracts, reports and transmittals.

The system provides better visibility and control of projects in a real-time, day-to day environment, improving work scheduling, productivity, timesheets and ensuring deadlines are met.

LRC-Developed Computer Software Design Tools

LRC has developed design tools based on MS Excel and MS Visual Basic, to reduce computation and checking time.

The design tools produce calculations for overhead line geometry, with result-checking, for wiring tensioning and swing parameters, curve loading and support spacing, stagger and pendulum height, across temperature differentials.

Elements of the LRC Design Tools are shown below.

The Auto-tension Swing program calculates stagger change and wire creepage for given lengths of auto-tensioned overhead wiring on cantilever supports, within a temperature differential.

The Curve Spacing program calculation ensures that trolley wire stagger is within the specified limits throughout the prescribed curve radius, with consideration of mid-span offset, to produce acceptable support span spacing and segment loading.

Auto-tension Swing

Initial Temp(°C)=	0
Final Temp(°C)=	50
Distance from MPA(m)=	500
Cantilever pivot length(mm)=	3000
Stagger Change(mm)=	30
Change in wire length(mm)=	425
<input type="button" value="Compute"/>	
All rights reserved.K.Karamad	

Curve Spacing

Curve Radius (m)	23
Outside Stagger (m)	0.23
Inside Stagger (m)	0.15
Curve Spacing (m)	8.4
<input type="button" value="Compute"/>	
Load is high, reduce the spacing to	
7.9	
All rights reserved - K Karamad	

The Pendulum Suspension program, shown below, checks the stagger and height of pendulum against the cross section temperature suspension height and stagger tables.

Pendulum Suspension Temperature Sag and Offset

Trolley Wire (mm)

Initial Tension (N)

Span (m)

Stagger (mm)

Angle of Deviation(deg)

Suspension Type

LRC-Pendulum Suspension

Initial Temp (°C)

Suspension Attachment From Track CL (mm)

Wire Temp (°C)	0	10	20	30	40	50
Tension(N)	10000	8385	6827	5380	4137	3191
Suspension Height(mm)	444	473.37	504.72	535.36	561.12	578.93
Angle(deg)to Vert.	50.9	45.9	40	33.5	27	21.4
Stagger(mm)	230	256	290	331	375	415

[Change Stagger](#) [Change Stagger](#)

These software programs, amongst others including Contact Wire Wear and Centre/End Throw calculations, are available to our design team members either in-house or online via the LRC web site.

Rail Infrastructure Design and Maintenance Software Suite

The proprietary design software suite employed by LRC includes state-of-the-art features, including, amongst others:

- Generates preliminary 2D plans and realistic 3D models for concept analysis and visualisation against prerequisite parameters, alternative layouts and design options.
- Accommodates hybrid systems that involves merging of old and new technologies
- Includes a user configurable and updatable suite of integrated design rules and checks, to optimise the design and guide and alert designers when tolerances are reached and exceeded.
- Provides full connectivity that allows project engineers to apply their skill and judgement to refine and optimise designs prior to construction, or to capture as-built changes after construction.
- Has parametric templates containing variations and dependencies, supports changes in track geometry and spacing, curvature, cant, wire height and stagger, which simplifies and automates the design process, providing consistency, productivity improvements and cost savings.
- Can facilitate templates to provide an evolving OLE library for client, project or corporate future use as standards or for rework in other projects.
- Produces fully annotated project drawings and deliverables including: design check sheets, reports and schedules: asset lists, cost estimates, delivery schedules, construction pick lists and site set out
- Incorporates restricted 'fixed zones' and clearances to avoid obstacles such as over-track distributions, tunnels, crossings, bridges, structures and underground utilities,
- Maintains complete information for use, not only with the current project, but for future use in operations, maintenance and rehabilitation works to sustain the network.
- Caters for to a range of configurable international standards for global infrastructure projects.
- Addresses both horizontal and vertical track geometry, and also station, yard and depot layouts, as well as earthworks and track ballast.

Projects

Project Name: Removing of four Level Crossing
Location: Furlong-Main-Blackburn-Heatherdale, Vic
Client: Aurecon Australasia/Hyder/Leighton
Period: 2015 - today
Scope: 1500V dc Overhead Wiring Design support and drafting services; Assisting Aurecon OHW team with the design and drafting. Preparing design report.



Project Name: Removing of Burke Rd Level Crossing
Location: Burke Rd, Vic
Client: KBR
Period: 2015 - today
Scope: Tramway 600V dc, Overhead Wiring Design; providing design and consultation services for tram OHW design.



Project Name: Preston Workshops
Location: Melbourne, Vic
Client: AECOM and Coleman Rail
Period: 2014 - today
Scope: Overhead Wiring Design and Construction Supervision; part of a redevelopment of the workshops to accommodate and maintain 50 new E-Class trams.



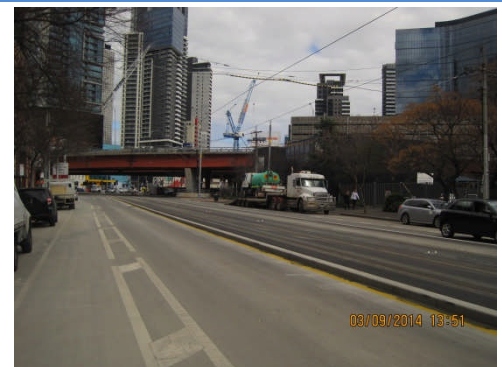
Project Name: **Park-Domain Intersection**
Location: Melbourne, Victoria
Client: Yarra Trams
Period: 2014 - 2015
Scope: Intersection upgrade, improving **Track** alignment and adopting elastic suspension for the **Overhead wiring**. Including **Traffic signal plan** upgrade.



Project Name: **Nicholson Street Upgrade (Route 96)**
Location: Melbourne, Victoria
Client: GHD and Argo Consultants
Period: 2014 - 2015
Scope: Tender consisted of 9 packages. Light Rail is contributing to packages 1, 3, 4 and 7, providing **Overhead Wiring Design**. GHD is undertaking packages 1 and 7, and Argo Consultants are responsible for packages 3 and 4. The modernisation project provides level access tram stop platform design, in compliance with the Disability Discrimination Act (Comm. 1992).



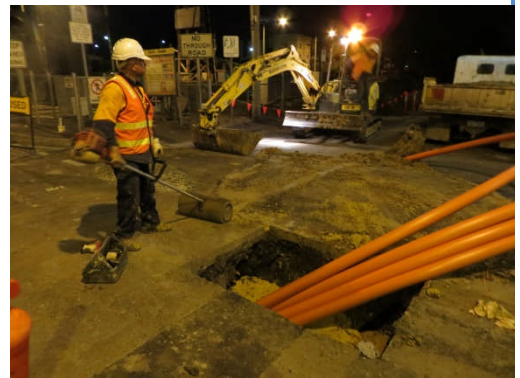
Project Name: **Queensbridge Street Upgrade**
Location: Melbourne, Victoria
Client: Yarra Trams
Period: 2014 - 2015
Scope: Stage 1 – City Road to Power Street, LRC provided **track and overhead wiring design, consultation and coordination**. Stage 2 – Power Street to Flinders Street, LRC supplied **Track & Overhead Wiring Design**. LRC worked closely with Jacobs for the civil and **DDA platform** construction works. LRC also provided **Traffic engineering, Hydro Study and bridge assessment** design through our partners.



Project Name: **Flinders & Spencer Street Intersection**
Location: Melbourne, Victoria
Client: GHD
Period: 2014
Scope: Renewal of track and overhead wiring with LRC providing **Overhead Wiring Design**, based on a semi-rigid design system.



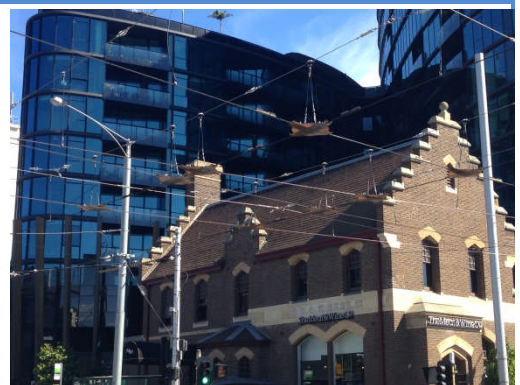
Project Name: **Power Upgrade Projects**
Location: Various – Melbourne Victoria
Client: Yarra Trams
Period: 2014 – 2013
Scope: Provide design drawings, for construction by contractors, of underground power and **overhead feeds, including aerial switch and pillar box details**.



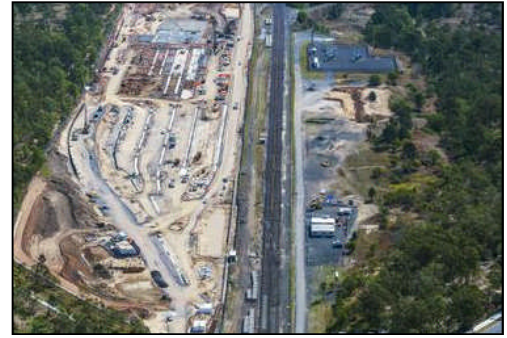
Project Name: **Brunswick Depot**
Location: Melbourne, Victoria
Client: AECOM
Period: 2013
Scope: LRC provided the **Overhead Wiring Designs**, for the design and construct Brownfield, redevelopments of the light rail and maintenance facilities.



Project Name: **‘H’ Crossing Upgrades**
Location: Six ‘H’ crossings in Melbourne CBD and suburbs.
Client: Yarra Trams
Period: 2013
Scope: Provide **Kudisc overhead wiring suspension design**.



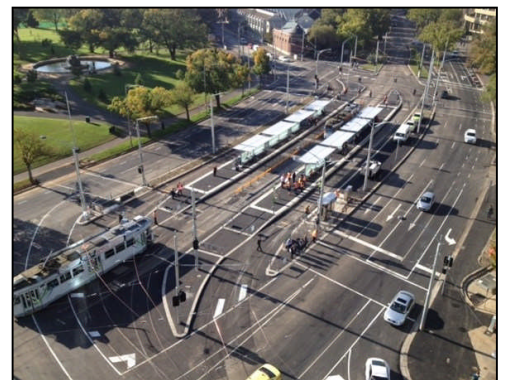
Project Name: **Wulkuraka**
Location: Wulkuraka, Ipswich West, Queensland
Client: Hyder Consulting
Period: 2013
Scope: Provide **Overhead Wiring concept Designs** for the construction of a rail maintenance centre, catering for the New Generation Rolling-stock project (NGR) for the Queensland Government.



Project Name: **Sydney & Moreland Roads Intersection**
Location: Melbourne, Victoria
Client: Yarra Trams
Period: 2013
Scope: Provide **Overhead Wiring Design.**
 The improvements works, along Moreland and Sydney Roads Coburg, were completed in August 2014.



Project Name: **Domain Interchange**
Location: Melbourne, Victoria
Client: GHD
Period: 2012
Scope: **Overhead wiring elastic system design.**
Independent Track checker.
 Track, traffic signalling and overhead interface.
 Construction staging models, including 3D and perspective.



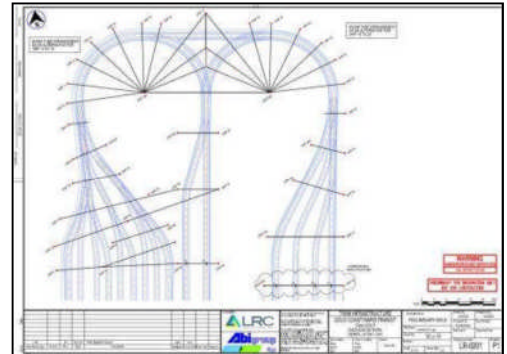
Project Name: **Victoria Harbour Extension**
Location: Melbourne, Victoria
Client: GHD
Period: 2012
Scope: **Track and overhead design** for a 315 metre extension, including a scissor crossing.
 Work also included clearance checking and terminus design.



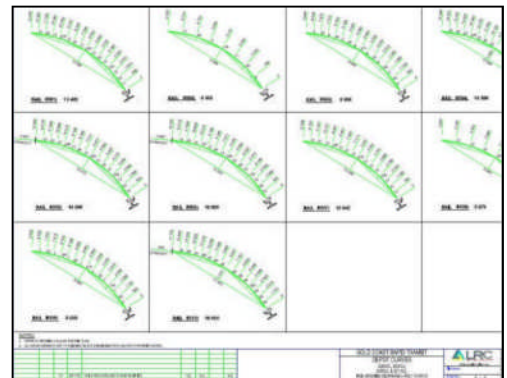
Project Name: **East Preston Depot Upgrade**
Location: Melbourne, Victoria
Client: Yarra Trams
Period: 2012
Scope: **Track design** for Roads 1 to 10, including: rail plan, rail bending diagrams, drainage and track bonding.



Project Name: **Gold Coast Rapid Transit**
Location: Gold Coast, Queensland
Client: Abigroup and Yarra Trams
Period: 2012
Scope: **Concept design and preliminary systems** design for 13 kilometres of light rail track.
 Designs were provided for the end-client, Bombardier, a member of the successful consortium, GoldLinQ.



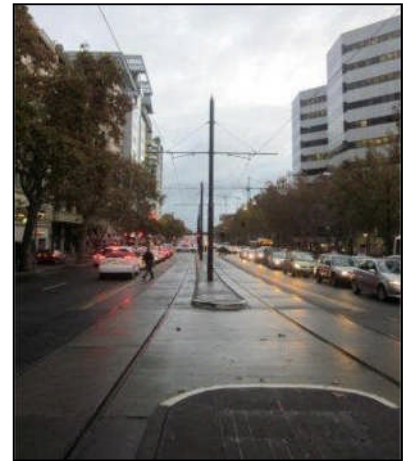
Project Name: **Gold Coast Rapid Transit**
Location: Gold Coast, Queensland
Client: McConnell Dowell
Period: 2012
Scope: **Rail bending details** and rail plans for the 13 kilometre light rail corridor sections of the Gold Coast Rapid Transit project.



Project Name: **Tram Route 1 Overhead Upgrade**
Location: South Melbourne, Victoria.
Client: Yarra Trams
Period: 2012
Scope: Detailed design of 8 curves on section from South Melbourne to Southbank Boulevard, to upgrade the **overhead wiring** to the new elastic suspension system.
 Provided technical consultancy services to the client regarding trial use of the new products.



Project Name: **Adelaide - North Terrace Duplication**
Location: Adelaide, South Australia
Client: Wilko Solution
Period: 2012
Scope: Provided preliminary design options for both **track and overhead**, followed by detailed design for a new crossover, for the new dual track alignment. The overhead consisted of centre poles with boom tubes and elastic suspension. Designs also included horizontal and vertical alignments.



Project Name: **Regional Rail Link – Work Package A**
Location: Melbourne, Victoria
Client: Activate – A consortium of Coleman Rail and two John Holland Divisions.
Period: 2012
Scope: Independently reviewed the complete **overhead design** work.



Project Name: **Derby, Princess, Waverley Sections**
Location: Melbourne, Victoria
Client: Yarra Trams
Period: 2012
Scope: Designs for the complete upgrade of existing fixed **overhead** to a new elastic system.



Project Name: **South Bank Depot**
Location: Melbourne, Victoria
Client: Yarra Trams
Period: 2011
Scope: Upgrade and extend **overhead wiring system** incorporating elastic suspension and minimising the number of spans.



Project Name: **Travancore – Mt Alexander Road**
Location: Melbourne, Victoria
Client: Cardno
Period: 2011
Scope: Upgrade of **auto tension overhead wiring to an elastic system**, due to road widening and tram track realignment.



Project Name: **Queensbridge Feeder & Track Design**
Location: Melbourne, Victoria
Client: Yarra Trams
Period: 2011
Scope: Design of the aerial tram **feeder** relocation to underground.
 Upgrade of the **overhead wiring** system and electrical network.



Project Name: **Clyde Road Railway Level Crossing**
Location: Berwick, Victoria
Client: Coffey Rail
Period: 2011
Scope: Detailed design for the upgrade of the **overhead wiring** system and pole relocation, due to the planned widening of the crossing.



Project Name: **High Street – Route 86 – Phase 2**
Location: Melbourne, Victoria
Client: GHD
Period: 2011
Scope: Detailed design for the **overhead wiring** system upgrade at High Street Northcote, using an auto tensioning system and improving the overall wiring network.



Project Name: Brunswick, Essendon, Kew, Malvern & Glen Huntly Depots Planned Upgrades

Location: Various Suburbs, Melbourne, Victoria

Client: Yarra Trams/SKM

Period: 2010 to 2012

Scope: Provided detailed design of the integrated **overhead network** based on elastic system. Scope included materials schedules and construction specifications.

LRC conducted site inspections to identify user requirement issues and service conflicts and worked with supplier to finalise installation information.

Conducted community consultation regarding the Glen Huntly tram depot upgrade.

Challenges included: unfavourable site conditions, tight yard layouts, pole loading, limited available land for new stabling, together with the existing infrastructure.

Conducted liaison with multiple stakeholders during preliminary and final construction phases.



Project Name: Spencer Street Intersections

Location: Melbourne CBD, Victoria

Client: Yarra Trams

Period: 2010 – 2011

Scope: Detailed design and upgrade to the **overhead wiring** infrastructure at Bourke Street, Collins Street and Flinders Street intersections, minimising the number of support wires.



Project Name: William, Flinders and Market Streets

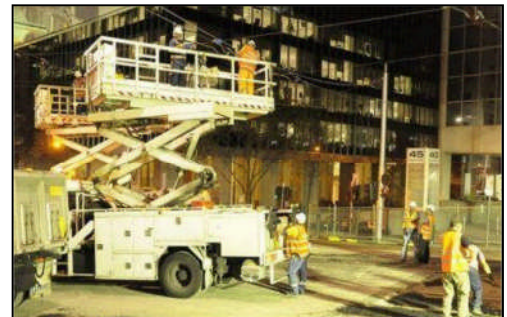
Location: Melbourne CBD, Victoria

Client: SKM

Period: 2010

Scope: Pole relocation and **overhead wiring** system improvement.

Detailed designs included structure positioning and conductor profiling.



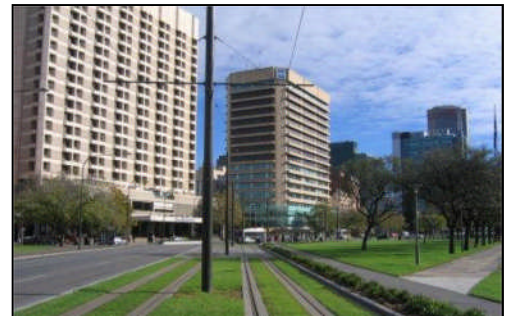
Project Name: Spring, Collins and Flinders Streets
Location: Melbourne CBD, Victoria
Client: GHD
Period: 2010
Scope: Detailed design of the overhead wiring network, using elastic suspension. Deliverables included construction specifications and full materials schedules.



Project Name: Adelaide 11 Km Upgrade
Location: Adelaide, South Australia
Client: SKM
Period: 2009
Scope: Overhead wiring system upgrade for 11 kilometres of dual track. Lead Design Engineer role, working closely with the client and the contractor.



Project Name: Adelaide 1.6 Km Extension
Location: Adelaide CBD, South Australia
Client: SKM
Period: 2008 – 2009
Scope: Extension of 1.6 kilometres of tramway from Victoria Square to North Terrace, including a complete review of the overhead wiring methodology, desktop studies and technical support during installation. Further work included rehabilitation of the depot.



Project Name: Harbour, Esplanade – Footscray Road
Location: Melbourne, Victoria
Client: GHD
Period: 2008 – 2010
Scope: Detailed design for new overhead wiring using elastic suspension, requiring both dual and pantograph operation. The scope also included boom tube arrangement and curve design.



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