

A REVIEW OF THE PROJECT MANAGEMENT SYSTEMS IMPLEMENTED FOR THE MATANGI EMU PROCUREMENT

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Summary

The Matangi EMU project has been established to replace the English Electric EMUs running on the Wellington suburban railway system and to increase the passenger-carrying capacity of the network. The project is the region's largest capital works project for some years and is also the largest project in GWRC's project portfolio. Successful project delivery is critical to the economic performance of the region and there are community expectations that the project must be delivered in a professional manner and that the new trains will provide a step improvement in transport for the Wellington public.

This paper reviews the procurement and project management processes used by GWRL for the procurement of the new fleet of Matangi EMU's.

The history of the project and the initial work done to identify the base performance requirements for the new trains is discussed.

The initial approach to the market for the procurement of the EMUs is reviewed and a summary of the tender process provided.

The formal project management structure is described along with the major roles of all parties in Wellington.

The compliance management and design review systems are discussed and the related rail infrastructure and maintenance depot upgrades are described.

An update of the progress of the project is provided with the projected dates for EMU delivery into Wellington.

Notation

GWRC – Greater Wellington Regional Council

GWRL – Greater Wellington Rail Ltd.

NZTA – New Zealand Transport Agency
(formerly LTNZ)

LTNZ- Land Transport New Zealand (now NZTA)

KiwiRail – formerly Toll NZ

KiwiRail Networks (formerly ONTRACK)

EMU – Electric Multiple Unit

Matangi – Maori name meaning wind

MMIS - Maintenance Management Information
System

RFT – Request For Tender

EOI – Expression of Interest

ARL – Above Rail Level

1 History of the Matangi project

Greater Wellington Regional Council in partnership with New Zealand Transport Agency is responsible for the specifying and funding of railway passenger services in the Wellington region.

These passenger services are operated on behalf of GWRC by KiwiRail. KiwiRail also provides rolling stock maintenance services.

The railway fixed infrastructure (permanent way, station platforms, signalling, power supply and communications) is owned and managed by KiwiRail Networks who provide track access to KiwiRail under a track access agreement.

During late 2004, a business case was agreed between Land Transport New Zealand and GWRC supporting the ongoing operation of passenger rail services in the

Wellington region and in particular authorised the procurement of a new fleet of electric multiple units (EMUs).

These new trains, following a public competition, were subsequently named the Matangi EMUs.

GWRL engaged Halcrow in December 2005 to provide technical and procurement advice for the project. In September 2006 Halcrow's role was amended to include project management of the procurement process through to contract award. In December 2007 Halcrow was appointed as GWRL's Project Director for the Supply Phase of the Matangi Project.

GWRL is a GWRC controlled Trading Organisation which was established as a vehicle to purchase and own the Matangi EMUs.

1.1 Business Case Matters

- Increase in experienced patronage growth
- Revised timetable
- Network extensions & augmentation
- Challenges of Johnsonville line track gradients and fixed infrastructure.

1.2 Project Timeline

During December 2005 the timeline adopted for introducing the new vehicles was established as:

- Release of EOI end 3rd quarter 2006
- Release of RFT January 2007
- Selection of Preferred Tenderer July 2007
- Commencement of revenue service before end June 2010
- Subsequent vehicle delivery rate of at least 6 vehicles per month

1.3 Project Risks

The gaining of funding approval to procure the fleet of new passenger trains did not mean the project would proceed. Other fundamental and project threatening factors requiring the integrated commitment of organisations outside of GWRL had to be achieved.

Firstly, how to achieve Supplier interest in the project given:

- the geographically remote location of New Zealand;

- the relatively small number of 58 vehicles with the possibility of a further 12 vehicles;
- the vehicle design challenge would be demanding requiring a bespoke solution
- the short delivery lead time desired
- the requirement for Supplier commitment to a presence in NZ after vehicle delivery to address any performance issue.

Secondly, the infrastructure network, owned by KiwiRail Network (formerly ONTRACK) had for some years suffered from lack of maintenance funding and preliminary studies had identified:

- the electrical power system required upgrading to provide sufficient capacity to support an expanded fleet and also to increase the systems reliability;
- the signalling system required replacement of at least one third of the track circuits to compatible with modern AC propulsion drive systems;
- the station platforms were not all at the same height above rail; and
- the Johnsonville line tunnels (7) severely restricted the vehicle envelope and if the new vehicles were to operate across the entire electrified network enlargement works were necessary.

Finally, the commitment of KiwiRail (at that time Toll NZ Consolidated Ltd, a private company) as the licensed operator and maintainer was required for:

- the gaining of the licensing approval from NZTA and track access rights from KiwiRail for the new vehicles;
- the increase in operating staff required to operate the proposed expanded services;
- the increase in maintenance staff required to maintain the expanded fleet and their retraining to the new technology requirements of the new vehicles;
- the expansion of the maintenance depot to support the expanded fleet and including a new underfloor wheel lathe and vehicle wash plant.

2 Wellington's existing EMU fleet

The system in Wellington is currently operated by a fleet of 124 EMU cars. Of this fleet, 36 cars were built by English Electric in the 1940s and 1950s and are due for replacement.

The remainder of the fleet (88 cars) was built by Ganz Mavag in the 1980s.

The 48 x 2 car Matangi EMUs will replace 33 operational English Electric cars and provide for further patronage growth and provide capacity for the cycling of the Ganz-Mavag EMUs through a refurbishment programme.



Figure 1: 1949 English Electric Unit (the Phoenix)



Figure 2: 1949 English Electric Unit



Figure 3: 6-car SW Express train with EO Loco

3 The Interim Rolling Stock Strategy

The requirement to follow a fair and competitive international procurement process, in conjunction with manufacturing timescales, dictated that the new EMUs would not be introduced to revenue service until 2010.

Several options were considered to maintain a viable service, in the face of increasing demand and a lack of capacity, before the delivery of the first Matangi EMUs. After much debate GWRC decided to:

- purchase, re-commission, and aesthetically upgrade one 2-car 1949 English Electric Unit (the Phoenix);
- lease, re-commission, and aesthetically upgrade one 2-car 1949 English Electric Unit (from the Ferrymead Railway Museum); and
- to purchase and refurbish one 6-car SW Express train to be push pulled by 2 leased electric EO locos.

4 The Procurement Approach

The procurement approach taken by GWRL considered 2 key elements.

The first being the intention of the Land Transport Management Act to deliver 'value for money' and the second that the chosen procurement model should consider the relevant contextual risks in the procurement and mitigate those risks through the method adopted.

GWRC initially undertook a market investigation visiting or contacting rolling stock manufacturers in Australia, Japan, South Korea, Switzerland, China and Germany. This exercise involved explaining the requirements for the new trains, the key stakeholders and project approach.

This generated some interest and understanding of the project within the marketplace and provided GWRC with a better understanding of the capability and track record of these organisations.

4.1 The Tender Process

A planned approach to the market was implemented using a 2 stage tender process.

The first stage was the Call for Expressions of Interest (EOI), which was intended to enable GWRC to draw up a shortlist of Pre-Qualified Tenderers.

The second stage comprised the issue of a Request for Tender (RFT) to, and the submission and evaluation of detailed tenders from, the Pre-Qualified Tenderers.

In the tender evaluation process, 'value for money' was not dictated solely by first off capital cost. It was determined to also include consideration of a balance of the:

- operating costs;
- maintenance costs; and
- operational performance of the fleet.

4.2 Development of the EOI Document

The first stage of the EMU supplier selection process was undertaken under an Expression Of Interest (EOI) stage. GWRL invited manufacturers, on a worldwide basis, to express their interest for the supply of 58 New Electric Multiple Unit (EMU) Vehicles configured as 29 off 2-Car EMUs on a design, build and support basis.

Following an evaluation of submissions received GWRL would pre-qualify a number of Interested Parties (to be known as the 'Pre-Qualified Tenderers') to receive a Request For Tender.

The EOI advised interested parties their interest submissions would be assessed based upon the following attributes:

- Previous Experience and Track Record;
- Financial Status;
- Interested Party Capability – EMU Supply;
- Interested Party Capability - Product Support; and
- Proposed new EMUs.

4.3 EOI Evaluation Process

Responses to the EOI were received from 12 Suppliers representing the majority of the traditional established vehicle suppliers from Australia, Europe and Japan and also the emerging international suppliers from Korea and China.

From those who expressed an interest a short list of three suppliers was selected and asked to tender, as part of the second RFT stage.

The three shortlisted suppliers announced in December 2006 were:

- Rotem (South Korea) –Mitsui (Japan)
- CAF (Spain)
- Bombardier (Australia).

5 Development of the Matangi EMU Performance Specification

The goal of the purchase of the Matangi EMUs is to assist in the delivery of an affordable, integrated, safe, responsive and sustainable transport system for Wellington.

From a project performance output perspective, the key requirements for the new passenger fleet vehicles were as follows:

- High safety, reliability and availability;
- Predictable and ideally fixed maintenance costs for the life of the fleet;
- Low obsolescence risk;
- Good spares availability;
- Low Life Cycle Costs;
- Compatibility with infrastructure;
- Accessibility from platform level (680mm ARL) for end users across the full mobility range; and
- A two car EMU Unit capable of being configured up to a maximum 8 car train consist.

The Performance Specification documentation was developed with input from all the major stake holders and as such included their requirements, all end user requirements and public special interest requirements.

The major stakeholders included Greater Wellington Regional Council (GWRL & Halcrow), New Zealand Transport Agency, KiwiRail, KiwiRail Network and Audit New Zealand.

End User, community and public special interest requirements were identified and relevant input gained utilizing a consultative approach.

The listing of those identified to contribute included:

- Ara Tahi,
- Auckland Regional Transit Authority,
- Automobile Association,
- Centreport,
- Chamber of Commerce,
- Community Groups,
- Cycle Aware Wellington,
- Disability groups – blind, deaf, wheelchair, elderly,
- Emergency Services,
- Health Authorities,
- Industry Capability Network,
- Media, Passenger Groups,
- Political Parties,
- Railway trade unions,
- Territorial Local Authorities,
- Transport 2000.

A Performance Specification was determined to be the most effective way to describe GWRL's overall requirements without prescribing the detailed design of the EMUs as it enabled Suppliers to introduce their particular experience & expertise.

5.1 Development of the RFT Document

The project contract documentation was constructed to address the dominant project issues and facilitate the contribution of major stakeholders and end user groups.

Structurally the documentation consisted of a design and build contract including a post delivery technical support period (Principal & Supplier), supported by:

- a Technical Support Agreement (Principal, Supplier & KiwiRail (Maintenance))
- a Commissioning Agreement (Principal, Supplier & KiwiRail (Maintenance & Operations))

and conditional upon:

- execution of a Vehicle Lease Agreement and Vehicle Maintenance Agreement (Principal & KiwiRail); and
- model testing satisfactorily demonstrating sufficient clearance between the dynamic vehicle envelope and the structure gauge (essentially the Johnsonville tunnels).

The technical schedules of the main design and build contract included requirements of warranted in-service performance regarding availability, reliability and maintainability.

5.2 RFT Evaluation Process

The RFT responses received were evaluated taking into account the following issues:

- degree of compliance of the offered EMUs with GWRC's performance specification requirements;
- degree of compliance with the proposed EMU Supply Contract and schedule requirements;
- whole of life costs;
- adequacy of the tenderer's methodology for the design, build and support of the new EMUs; and
- other risks to time, cost or quality that had not been accounted for in the matters listed above.

Whole of life costs included:

- new EMU supply price;
- KiwiRail pre-service costs;
- KiwiRail Networks pre-service costs;
- KiwiRail operating and maintenance costs over 30 years;
- vehicle energy cost over 30 years;
- vehicle support cost over 10 years from execution of the supply contract;
- vehicle support cost over remaining 20 years extrapolated by GWRC; and
- vehicle track access fee over 30 years.

Evaluation of the tenderer's responses to the RFT by GWRL allowed the evaluation team to select a rolling stock supplier considered capable of delivering safe, reliable and cost-effective passenger EMU vehicles of the required quality.

Following the tender evaluation process, Rotem-Mitsui was announced as the Preferred Tenderer in July 2007.

5.3 Probity

To ensure fairness and impartiality; consistency and transparency; security and confidentiality; and a competitive process the highest standards of probity, documented in the Probity Plan, were applied to the project.

GWRL appointed Audit New Zealand as the probity auditor and Audit New Zealand observed and audited the various progressive stages of the project.

Prior to awarding the contract to Rotem-Mitsui, Audit New Zealand confirmed to GWRL that they were entirely satisfied the procurement process had been robust and complied with the Probity Plan.

6 Development of the Project Structure

Following contract award to Rotem-Mitsui in November 2007, GWRL established a project organisation structure which:

- enables commitment to an agreed scope of work;
- represents project participation in accordance with the business interests of GWRL, KiwiRail and KiwiRail Networks;
- maintains sound governance principles; and
- eliminates potential conflicts of interest.

6.1 Project Stakeholders

The major stakeholders in the project are:

- GWRL who are the vehicle owners;
- KiwiRail who are the Operator and vehicle maintainer; and
- KiwiRail Networks who are the Infrastructure owner.

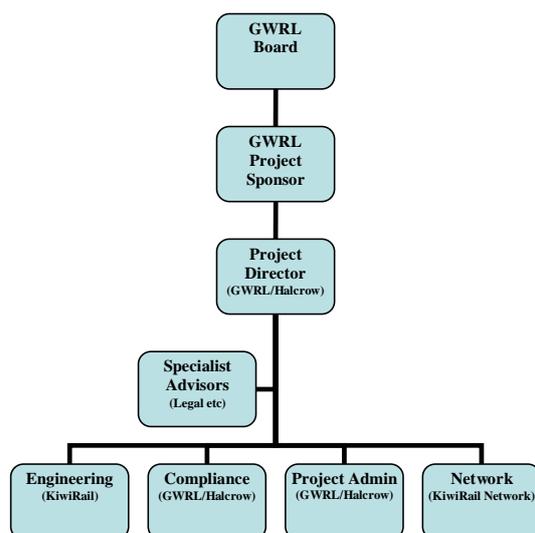


Figure 4: Project stakeholders

6.2 Stakeholder's responsibilities

A brief summary of the responsibilities of the team members is described below.

GWRL provide the project and process management functions and are responsible for the overall cost control and timely delivery of the project. GWRL manage the compliance processes which includes the verification and validation processes, supplier inspections and audits.

KiwiRail are responsible for delivering the Thorndon maintenance depot upgrade and assisting Rotem-Mitsui in developing the Maintenance and MMIS systems.

KiwiRail will hold the operating and maintenance licence which must be accepted by the New Zealand Transport Agency as the Safety Regulator. KiwiRail are therefore responsible for providing the engineering design review functions for all major train subsystems. KiwiRail will also assist with the vehicle commissioning and witness the vehicle verification testing.

As the Operator, KiwiRail are responsible for the Operations, Timetabling and Transition In/Out Plans

KiwiRail Networks are responsible for granting track access and managing the delivery of assets they will own such as the track, platform and power supply systems.

KiwiRail Networks are responsible for satisfying themselves that the interfaces between the Matangi EMU and the track, signalling, platforms, power systems, stabling depots and tunnels are controlled. KiwiRail Networks are responsible for managing several infrastructure upgrades and for interface compatibility testing.

7 Project Management & Systems Assurance Systems

A project management and systems assurance system was implemented to ensure that the vehicle design satisfies the Specification. This involves GWRL's engineering staff in Wellington and on-site in Korea to monitor the quality systems and performance of the manufacturer and the major system suppliers.

7.1 Technical Compliance

GWRL has implemented a 'best practice' requirement for preparation of a comprehensive Design Verification and Validation Plan. The purpose of this specified requirement is to adopt the "Right First Time" principle to ensure the Supplier will verify the design progressively over the design, manufacturing and installation phases, thus avoiding costly and time-consuming modifications later.

Rotem-Mitsui are required to develop project plans detailing how they will manage and perform the design. These plans will be audited by GWRL throughout the design phase.

Design verification will be required to be performed continuously through review of the mock-up and design calculations, First Article Inspection, Type Tests and review of previous test reports for identical designs.

7.2 Design Review Process

The design process comprises four stages:

- System Design Review (SDR);
- Preliminary Design Review (PDR);
- Critical Design Review (CDR); and
- System Verification Review (SVR).

This process is iterative, in that it takes the design development from concept, through a detailed design stage and to final design sign off.

The outputs from the CDR process are developed into manufacturing details, drawings and testing requirements which are verified during the SVR stage.

7.3 Manufacturing Compliance

GWRL have employed a full time on-site representative in Rotem's manufacturing facility in Korea to continually review that the manufacturer is following the manufacturing plans and its own QA procedures.

7.4 Systems Compliance

GWRL will perform process audits on the manufacturer and its system suppliers to ensure they have the necessary systems in place to satisfy the Specification.

7.5 Key outcomes from the Compliance Management System

During the design phases significant developments were achieved with the supplier, as described below:

7.5.1 Low Floor Area

The specification required each EMU to be configured so at least one doorway each side provides platform level (680ARL) access.

As the design progressed, the low floor area in the trailer car was significantly increased. This doubled the low floor boarding access and doubled the area available for wheel chairs, bicycles and children's buggies. This marked a significant improvement in service to these particular user groups and the process to achieve this represented one of the most thorough inclusive design development processes – involving disability support groups, operating staff, politicians, cyclists and buggy users.

Rotem-Mitsui commissioned Transport Design International (TDI) to build two mock-ups in New Zealand which were invaluable in assessing the human factors, ergonomics and train accessibility of the design. The mock-ups have proved invaluable for the visualisation of design options, and have been critical to developing such a comprehensively supported design.

7.5.2 Other Notable design developments

- Development of the Kinematic Envelope to meet the challenging infrastructure requirements of the Johnsonville tunnels;
- Development of a wheel chair ramp
- The simplification of the brake control system to integrate a more standard Electro-Pneumatic brake with Brake Pipe back-up system;
- Compliance with Fire requirements for the extended single compartment vehicle design with permanently open inter-car access between the two cars; and
- Optimising the propulsion system capability relative to the timetable requirements.

8 Infrastructure Upgrades

In parallel with the EMU procurement, there are a series of rail infrastructure upgrades necessary to support the larger fleet of

modern EMUs and to match the reliability and safety levels of the new vehicles.

8.1 Maintenance Depot

In order to maintain the Matangi EMUs, modern facilities will be required to accommodate the many new features and a new maintenance regime. As such, a thorough review took place of the maintenance requirements for all of the Wellington passenger rolling stock. The result of this review showed that the current Thorndon EMU depot required substantial redevelopment. In order to accommodate this it was found necessary to relocate the carriage maintenance to the existing Wagon shops. A new wheel lathe and Carriage Wash Machine will also be required, as well as substantial track and overhead line remodelling.

8.2 Electrical Power upgrade

The capability of the existing power system to meet the power demand of the increased fleet size, and the requirement to provide "N-1" reliability levels, required investigation and augmentation works.

8.3 Signalling

One third of the signalling system required substantial upgrading to be compatible with the AC traction system of the new EMUs.

8.4 Johnsonville Tunnels

Tunnel and track modifications are required to ensure that the new EMUs will be able to operate on this line.



Figure 5: Johnsonville Tunnels infrastructure modifications

9 Transition arrangements for the Matangi EMUs

The Matangi EMUs will bring a step change in rail technology into Wellington and as such the maintenance requirements are being reviewed by a Maintenance Committee comprising members from GWRL, KiwiRail and Rotem. The Maintenance Committee is responsible for defining the maintenance regime, identifying spares and special tools and specifying the structure and contents of the supporting manuals.

The Project Team is also coordinating other Transition-In requirements including staff training, publicity and marketing, and arrangements for Testing and Commissioning.

10 Review of Project Progress to date

The project is delivering to target and the first vehicles are due to arrive in Wellington in the early part of 2010. On completion of commissioning activities for the rolling stock and infrastructure upgrades, they will enter revenue service in mid 2010.

Three recent artists' impressions of the Matangi EMU are shown below.



Figure 6: Artists' impression of the Matangi EMU



Figure 7: Artists' impression of the Matangi EMU saloon layout



Figure 8: Artists' impression of the Matangi EMU seating layout

11 Influence of the current NZ political situation on the Matangi project

Despite proposed changes to the ownership structure for rolling stock in New Zealand, the structure of the Matangi project remains intact and is delivering against targets.

GWRC will fund and manage the project through to completion, supported by Halcrow, KiwiRail Networks and KiwiRail.