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Committee Transport & Access Committee
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Ganz Mavag Prototype Refurbishment

1. Purpose

The purpose of this paper is to describe the major features of the Prototype Refurbished Ganz Mavag (the prototype) unit and to compare it with the features on the new Matangi units.

2. Significance of the decision

The matters for decision in this report **do not** trigger the significance policy of the Council or otherwise trigger section 76(3)(b) of the Local Government Act 2002.

3. Background

The 88 car strong Ganz Mavag fleet was introduced into service in Wellington in the early 1980s. The fleet was given a minor refurbishment in the mid nineties. The fleet has been the mainstay of Wellington metro services and demand for capacity has required a very high level of vehicle availability. As the units have aged, a more intensive maintenance regime has been hampered by the required availability. The units are now relatively unreliable from both an ability to complete a service perspective and the ability to maintain all on board systems (ie. heaters). They are prone to parts obsolescence and generally look tired.

The 2004 Rail Business Case, which provided the justification for the Matangi trains and the accompanying wider rail upgrade, also provided for the refurbishment of the entire Ganz Mavag fleet.

Before proceeding with a full refurbishment programme it is essential that the viability and costs of a refurbishment programme be established to ensure that value for money can be achieved.

A detailed condition assessment performed as a component of scoping, designing and refurbishing a fully developed 2-car prototype will allow GW to:

- assess the condition of the prototype vehicle and likely overall fleet condition – and confirm the suitability of the GM fleet for a minimum 10 year life extension (structural integrity etc)
- determine and set the refurbishment scope
- determine the level of component replacement versus refurbishment and/or overhaul
- establish the post refurbishment performance targets
- determine the outturn cost of GM fleet refurbishment
- provide the best possible estimate of the costs and benefits of refurbishing the entire GM fleet.

To assist with the evaluation of the refurbishment proposal, GW has commissioned Queensland Rail¹ (QR) as the independent assessor for this programme.

Ultimately, the detailed condition assessment and the prototype unit will provide the variables for a robust cost benefit assessment pitting refurbishment of the entire Ganz Mavag fleet against purchase of additional Matangi units.

4. Regional Rail Plan preliminary cost benefit assessment

The business case driver for this work is contained within the relative life cycle cost analysis and Present Value (PV) calculations comparing refurbishment cost options against a “no refurbishment” (ie. all new replacement option).

Current fleet procurement planning assumes that a tranche of new rolling stock, comprising 44 x 2-car consist EMUs, will be acquired during 2018-24. This tranche would replace the last of the Ganz Mavag (GM) units but it would require the refurbishment of 88 GM cars in 2010-15. This is called the “base” option.

A possible alternative would see the 2018-24 tranche acquired at the same time as the current new tranche, removing the need to refurbish the GM. This is referred to as the “no refurb” option.

A preliminary assessment² reveals the following results (PVs have been calculated in accordance with NZTA procedures):

¹ QR have a wealth of experience on narrow gauge railways, and the procuring and refurbishing of EMUs. They operate a government owned vertically integrated railway giving an invaluable appreciation of rail engineering, infrastructure management, rolling stock asset management, freight and passenger operations, and funding realities.

² More detail is provided in Appendix J of the Wellington Regional Rail Plan July 2009.

- (a) If the GM unit cost is \$2 million per 2 cars then the costs of the two options are similar and the “no refurb” can be justified on the grounds of its additional benefits (ie. more modern train, higher performance, passenger amenity etc)
- (b) If the unit cost is \$1.1 million per 2 cars the “no refurb” option costs around \$29 million extra, almost twice the estimated additional benefits, so it cannot be justified
- (c) If the unit cost is \$1.5 million then the additional cost of the “no refurb” option is roughly equal to the estimated benefits.

It is clear that a robust understanding of the costs and benefits of a well considered GM refurbishment scope is required to ensure the best value for money of the allocated funding.

The outcome of the evaluation depends critically on the unit cost of GM refurbishment, and an updated unit cost of further new trains. Both of these numbers will be updated once the assessment of the prototype is complete.

5. Prototype refurbishment objectives and specifications

The criteria for determining the scope of work for the PRGM unit was based on the high level objectives endorsed by the Steering Group members on 22 October 2008.

The top three objectives require that the refurbishment programme must:

1. Provide sufficient capacity to meet current and future patronage.
2. Obtain the best value for money outcome for the remaining funding allocated to rolling stock from the 2004 Rail Business Case.
3. Represents practicality and efficiency from a life cycle cost perspective.

Put simply, to successfully meet the top three criteria the refurbishment must achieve a vehicle service life extension of at least 10 years, with improved reliability and optimised capital and maintenance costs.

Secondary objectives relate to improvements in safety and accessibility, passenger and crew amenities, and vehicle presentation.

On this basis the high level refurbishment specification in **Attachment 1** was developed.

6. Major prototype refurbishment features

6.1 Structural integrity and life extension

6.1.1 Carbody

The refurbishment will restore the vehicle water tightness by replacing the corroded material and refreshing the corrosion protection system. It will also

inspect and restore as required the structural integrity of underframe mounting points, such that the vehicle bodies will be fit for service for at least the next 10 years.

6.1.2 Bogies

An extended Non-destructive Test (NDT) programme will be applied to the bogies as part of their overhaul such that any premature cracking can be detected and rectified. This is also to enable the minimum 10 year life extension target.

6.2 Reliability improvement

6.2.1 Traction control system

Full system overhaul and specific modifications will be made to restore and improve the functionalities of the traction control system. This will enable better control of wheel slipping during acceleration, and better traction control. This is designed to increase the reliability of the traction control system and reduce traction motor failures.

6.2.2 Auxiliary power supply

Full system overhaul and specific modifications will be made to restore and improve the functionalities and control of the Motor/Alternator (MA) set, which is the heart of the auxiliary power supply system. This is designed to increase the reliability of the MA set such that the occurrence of “cold trains” can be minimised.

The existing life expired standby batteries will also be replaced.

6.2.3 Brake system

The existing brake system will be fully overhauled and restored to mitigate brake related failures such as service brake sticking and park brake dragging, which contributes to 12% of the GM fleet failures.

The service brake cylinder pressures will also be fine tuned to mitigate wheel flat problems due to wheel sliding.

6.2.4 Passenger doors

The door system will be overhauled to be fit for on-going service. A number of modernised control features will be equipped to improve passenger safety and comfort while also creating a more consistent feel across the wider fleet. Major additional features include obstacle detection, passenger door controls, and timed close of opened doors.

6.3 Safety and accessibility improvement

6.3.1 Emergency brake over-ride

The emergency brake control system will be changed to allow the driver to decide the safest place to stop the train. The driver will have five seconds to

react before the system invokes an automatic stop once the passenger emergency stop lever is being activated. This is to have a consistent arrangement with the Matangi.

6.3.2 CCTV system

A CCTV system similar to the Matangi system will be installed.

6.3.3 Fire safety

Fire safety will be improved through the use of better fire performance materials in, among other things, the seat fabric and cushions, floor covering and side panel insulations. Smoke detectors will also be installed.

6.3.4 Emergency escape

Passenger emergency escape will be improved by the installation of break window hammers in saloon interior and door step-well lights.

6.3.5 Anti-climb device

The installation of anti-climb devices on the cabs improves passenger safety in the event of collision by reducing the risk of “over-riding” another unit.

6.3.6 Cab wind screen

The wind screens will be replaced with more modern versions with higher impact resistance and better visibility when broken.

6.3.7 Flip up seats & wheel chair spaces

New individual flip-up seat arrangements (2 blocks of 3 seats) will take up less space than the existing “one piece” 3 person flip seats. This will improve the space available for wheelchair parking, and other bulky items.

6.4 Passenger / train crew comfort and amenities improvement

6.4.1 Passenger Communications

A new integrated Public Address (PA) and Passenger Information Display (PID) system will be installed.

6.4.2 New passenger seats

All the existing seats will be replaced by new seats with Matangi style seat fabric. The new seats will have more leg room, while keeping the existing seating capacity unchanged.

6.4.3 Interior fitout

New floor coverings will have the same type and colour as Matangi. All wall panels around the windows will be replaced. All florescent light tubes will be replaced and more reliable inverters will be used for the emergency lighting. Passenger saloon windows will be fully refurbished.



Ganz artists impression



Matangi unit 1 (green floor is protective covering)

6.4.4 Driver Interface

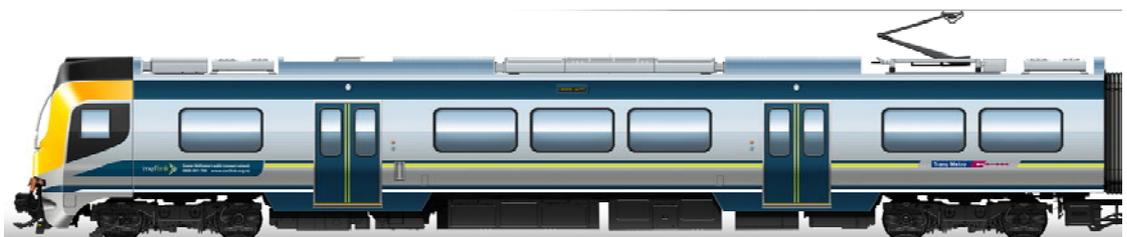
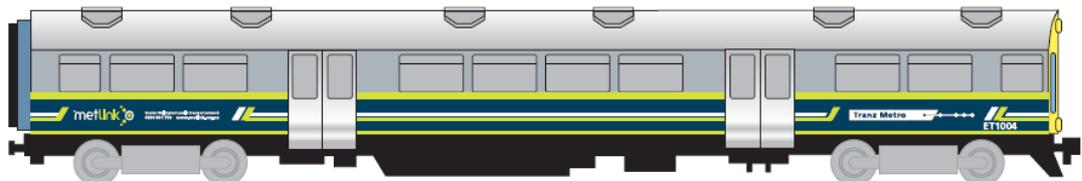
The existing pneumatic wiper will be replaced by an electric one. The drivers control panel will be tidied up to remove obsolete switches and will have some new controls installed.

The drivers seats will be replaced by a more reliable type which is currently being used in all mainline locomotives.

6.5 Vehicle presentation

6.5.1 Painting and branding

The refurbished unit will be painted new to ensure weather tightness. Co-branded livery will be fitted to create a consistent feel with the Matangi fleet. *Note the final design of the branding is still being finalised for both GM and Matangi.*



7. Specification comparison

The table below compares specifications, some performance characteristics and passenger saloon features between a Matangi 2-car unit and a Ganz Mavag 2-car unit. The shaded cells highlight specific changes between a refurbished and unrefurbished Ganz Mavag unit.

		Matangi			Ganz		
Common Name							
Manufacturer		Hyundai-Rotem			Ganz Mavag		
Year Built		2010-2011			1982-1983		
Designation		FP - Motor FT - Trailer			EM - Motor ET - Trailer		
Track Gauge		1,068mm			1,068mm		
Normal OH Operating Voltage		DC 1300V - 1800V			DC 1400V - 1700V		
Unit Length over Couplers		43,060mm			43,060mm		
Car Width		2,730mm			2,730mm		
Car Height		3,640mm ARL			3,606mm ARL		
Bogie Centre Pivot		15,300mm			15,300mm		
Bogie Wheel base		2300mm			2500mm		
Floor Height	Low level Floor	730mm ARL			N/A		
	High Floor	1,100mm ARL			1,106mm ARL		
	Door Footstep Height	730mm ARL			815mm ARL		
Unit Weight	AW0(empty)	MC	42.1 tonne		37.6 tonne		
		TC	34.8 tonne		34.5 tonne		
		Total	76.9 tonne		72.1 tonne		
	Full Loaded	MC	55.2 tonne		47.5 tonne		
		TC	48.5 tonne		45.5 tonne		
		Total	103.7 tonne		93 tonne		
Bogie Design Axle Load		14.3 tonne			13.2 tonne		
Power Rating	Traction Motor	4 x 170 kW			4 x 109 kW		
Maximum Service Speed		110 km/hr			95km/hr		
Maximum Acceleration Rate		0.84 m/s/s			-		
Passenger Capacity	Car Type	MC	TC	UNIT	MC	TC	UNIT
	Seating	76	71	147	70	78	148
	Max Standing	109	121	230	70	78	148
	Total	185	192	337	140	156	296
Accommodation	Wheelchairs	-	2	2	2	-	2
	Bicycles	-	3	3	2	-	2
Door motor		Electric			Pneumatic		
Wheelchair ramp		Integrated foldable			Portable type		
Emergency detrainment		Emergency detrainment ramp			Wooden ladder		
Intercar connection		Open gangway			Car end doors locked. Train crew only.		

Airconditioning	Yes	Roof ventilators/saloon hopper windows
Door Obstacle Detection	Yes	No - <i>post refurb Yes</i>
Door control	Open on demand, time close	<i>Matching - post refurb</i>
Seat fabric	Matangi pattern/colour	<i>Matching - post refurb</i>
Floor covering	Matangi pattern/colour	<i>Matching - post refurb</i>
Emergency brake over-ride	Yes	No - <i>post refurb Yes</i>
CCTV	Yes	No - <i>post refurb Yes</i>
Smoke detectors and fire extinguishers	Yes	No - <i>post refurb Yes</i>
Anti-climb devices	Yes	No - <i>post refurb Yes</i>
PA	Yes	No - <i>post refurb Yes</i>
PIDS	Yes	No - <i>post refurb Yes</i>

8. Refurbishment programme

The Ganz Mavag refurbishment programme has been developed in five discrete stages. Each stage requires successful resolution and approval before the next stage can be started.

Stage 1: Planning & Project Definition (completed June 2009)

Stage 2: Prototype refurbishment proposal (including design) (accepted mid March 2010)

Stage 3: Prototype construction, cost & performance verification (April 2010 to June 2011)

Stage 4: Decision / funding approval (mid 2011)

Stage 5: Fleet refurbishment (2011 to 2015 if justified and funding available)

9. Communication

No communication is required.

10. Recommendations

That the Committee:

1. *Receives the report.*
2. *Notes the content of the report.*

Report prepared by:

Report approved by:

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Attachment 1: Ganz Prototype Refurbishment Specification