

NEW SOUTH WALES NEWSLETTER



ENGINEERS
AUSTRALIA

RTSA

Railway Technical Society of Australasia
NSW Chapter
Mail: PO Box 6238, Kingston, ACT, 2604

AUGUST 2007

NEXT RTSA NEW SOUTH WALES CHAPTER MEETING

Wednesday 5th SEPTEMBER

at 12.00 in the

CENTRAL STATION CONCOURSE MEETING ROOM

(next to Lost Property, opposite the end of platform 2)

HUNTER VALLEY FLOOD RECOVERY



From almost any perspective the Hunter Valley railway line is the most critical in the state, conveying, as it does, around 2 million tonnes of export coal every week, as well as northern and western produce, fuel and minerals and a small number of passenger trains.

Exceptional storm activity in June brought sudden and severe flooding to the area which among other things wrecked parts of the main line, stopping all trains for around a week.

Tony Frazer, Bob Taylor and Clinton Crump from ARTC will tell us about the damage and how ARTC rose to the occasion and restored services within a commendably short time.

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JUST A REMINDER OF THE JOINT PWI, IRSE AND RTSA MEETING

This coming **THURSDAY, 23RD AUGUST**

At the **MASONIC CENTRE,**

Corner of **GOULBURN AND CASTLEREAGH** Streets, **CITY**

at **16.15** for **16.30** sharp

The PWI will be holding their annual AGM (anticipated to take around 15 minutes) following which will be two presentations:-

JOHN HOLLAND will give a presentation on

INSTALLATION, MAINTENANCE AND INNOVATION – INVOLVING HIGH SPEED TURNOUTS IN AUSTRALIA

Following which **ROB SMITH** of **ARTC** will present on

ARTC TRAIN CONTROL CONSOLIDATION IN NSW

LAST MEETING

Speaker : Mr Brian Luber, of Siemens.

Brian gave an entertaining speech which was accompanied by a Power Point presentation on the subject of the Siemens Combino Plus Tram, an example of which has been demonstrating in Melbourne until this month.

The earlier Siemens Combino Tram dates from 1996. These are articulated vehicles made from two body modules, i.e.

- four wheel power units &
- trailer units in between the power units (with no wheels at all) supported on articulation joints

There are currently 59 Combino trams in Melbourne; a mix of three and five section cars.

The Dept of Infrastructure (Victoria) is looking at additional vehicles to cope with increasing ridership.

A **Combino Plus** destined for Lisbon (Portugal) was brought to Australia in February this year as a demonstrator. It is part of an order for a new standard-gauge tram system in Lisbon, Portugal. The delivery of the four-module vehicles to the city was on time, but delays in deciding the route around an important monument in central Lisbon halted commissioning of the system. This delay provided the opportunity to send a vehicle to Melbourne for trials.

The track conditions in Melbourne are a little different to that prevailing in Europe which provided that manufacturer as much as the local operator with useful experience

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The Combino Plus was conceived to provide better mobility for the travelling public, and reduced maintenance and operating costs.

The Combino Plus consists of a number of units each with their own four-wheel swivelling bogie (swivelling to the extent of only a few degrees of twist). The Centre of Gravity is the same as the centre of rotation for each bogie. Thus the forces on the articulation joints are much less than on the earlier Combino units.

The result is lower track forces, less noise and less wear and tear on the vehicle and track.

They are normally double-ended, so the outer modules have a drivers' cab and there are doors along both sides.

Problems were caused by the hump-backed bridges in Amsterdam. (ie, such severe curvature in the vertical plane strained the articulation joints).

A special challenge is the large number of right-angle track crossings in Melbourne. The path of each wheel is raised as it passes through the crossings, resulting in movement of the vehicle in the vertical plane.

The bogies are allowed 4.5 degree of rotation on the Combino Plus. (The earlier Combino vehicles were rigid four-wheel modules separated by non-wheeled modules.)

The Combino Plus body is of Stainless Steel construction, not aluminium. It has two double door leaves on each side per module. This is an improvement on the current Combino vehicles, and should aid rapid loading and unloading. The wheelsets are further away from the articulation joints (which cannot be effectively soundproofed) so that less noise enters the vehicle interior than on the earlier Combino units. The axle load is 10.5 tonnes.

A thirty-year life is assumed. To avoid cracking and structural problems, stresses need to be kept low in the bodywork. Extensive strain-gauging has

been done in the development of the Combino Plus.

The vehicles are modular with a unit length of 9m. A maximum of eight modules is possible. (ie, 72m)

In Melbourne, a maximum of 30m is used with the existing Combino units (five section cars).

Body widths available are 2.3, 2.4 & 2.65m. The former two are for Europe and the latter for Melbourne & Adelaide (and USA?), which allows four-across seating plus an aisle.

The articulation joint gangway is wide enough for a standard baby stroller to pass through.

Combino Trams are possible for track gauges less than Standard, but the gangway through the articulation joint will be correspondingly narrowed.

For US applications, a Buff Force of 400kN is necessary to meet regulations.

Maximum speed is 70 km/h. (Option for 80 km/h).

Voltage – normally 750 V DC, can go up to 1500V DC.

Traction motors are mounted low-down and longitudinal. Every axle is motored and the unsprung mass is low. There is no conventional axle – each wheel is quite independent (which is why there is no mention of axles in this story!)

The vehicle is 100% low-floor. Siemens sees future orders as specifying this and the market for vehicles with mixed low/high floors will diminish. Indeed, the older high-floor trams in Melbourne are expected to be phased out in the coming years.

Doorway entrance height is 320 to 350mm (depending on wheel wear). Many busy tram stops in Melbourne are the so-called 'super stops', which allow level boarding from a slightly raised kerb. The next generation of vehicles will have automatic ramps at the doors for street-level loading.

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Passenger loading is normally reckoned to be 4 passengers per square metre. (crush load)

A slide was shown of the Budapest system, which is the most intensively used tram system in the world. Here they use six-module Combine Plus vehicles (54m - the longest in the world). Melbourne would normally use 30m vehicles max on the busiest routes.

The Combino Plus body shell is standardised (apart from width as mentioned above) but the front mouldings can be customised, as can the colour scheme. For minor vehicle accidents, the front mouldings are designed for easy and inexpensive repair and minimum down-time. Of course, they are also designed to minimise injury to pedestrians.

The ride quality of the Combine Plus is claimed to be the highest of all low-floor trams.

The speaker answered a number of questions from the floor, and the company brochures concerning the Combino Plus were eagerly sought by the attendees.

One interesting question concerned the stability of a vehicle where modules could articulate, yet every module was allowed to swivel on its bogie. The answer lies in the hydraulic damper system applied to these cars

Reporter: Malcolm Cluett

THE OBSERVATION POST

After many years of persistent effort it seems that the proposed Inland route between Melbourne and Brisbane might be on the agenda. The states alone were never going to achieve anything on this particular issue (more on this later) while the Feds were conspicuously silent – at least until recently. Their first overt foray in support of the Inland Route was a substantial study last year which highlighted a number of possible corridors (not

routes – that is for later) and the viability of each. Their conclusion was twofold – that the western corridor (inland – hence the name Inland Route) was the preferred location for the new route, and that it was unlikely that the private sector would be interested in building the new line due to the marginal financials and the fact that it (or any serious rail project) is a long lead time prospect which doesn't rate well with the quick return brigade in the financial world.

To the extent that the report's preferred corridor is the same as the one long proposed by the indefatigable Everal Compton and more recently other luminaries such as Vince O'Rourke suggests that the outcome in that regard is probably rather robust. Now the Feds are putting up the where-with-all to do a detailed study, at some considerable cost, to determine the route and refine the costs.

In fact rail track exists between Melbourne and near the Queensland border that would allow a 'poor man's' route to be created at least that far with little more than track upgrading. Some sections of this route are likely to be part of any future route due to their strategic nature while other sections remain as candidates for by-passing with alternate routes, the major reason for which is either traffic potential or avoidance of difficult and indirect alignments.

Between Seymour and somewhere on the Cootamundra – Parkes line is one such candidate while a cut off line between the Coonamble area and the Narrabri area is another. In addition there is a need for a new SG route in Queensland from the border somewhere near Goondiwindi to Toowoomba (probably via Millmerran to avoid the circuitous and difficult existing NG route east of Inglewood) and the new line between Toowoomba and Brisbane, probably in dual gauge. The alignment for the latter has largely

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been reserved except for a critical section between Rosewood and the existing SG line south of Acacia Ridge.

The whole route between Melbourne and Toowoomba runs through productive agricultural land and some substantial coal reserves which are anticipated to generate significant volumes of on line traffic, although the key justification for the line remains through traffic between Melbourne and Brisbane.

Almost inevitably not everyone is happy with the outcome to date. Various proponents in the New England high country continue to argue that the route should be via the original inter-state route between Werris Creek and Warwick (a distance of 485 km and ascending to a summit of almost 1400 metres, with 315 km of track in need of total reconstruction) before then finding a route of between 160 and 200 km of new track to get to Brisbane. It has been pointed out on more than one occasion that for this route to achieve preferred status it would be necessary to have significant on line traffic opportunities that not only exceed the traffic value of the western corridor but also cover the additional operating cost of lifting all traffic over the 1400 metre summit.

A rather different, and in many ways less rational approach has come from no less a personage than an honourable gentleman in Macquarie St. Speaking recently at the Rail Summit the Minister suggested that by passing Sydney, which is the major traffic hub on the east coast, would be foolish and would not solve the freight problems of Sydney (see what I mean about relying on the states to sort things out!). Quite apart from the fact that Sydney is NOT the major traffic generator on the east coast, (assuming the east coast extends beyond NSW) it has been the obtuse obsession of a succession of NSW

governments with peak hour passengers, coupled with the complete absence of any interest in extension of the goods lines that has contributed to the political viability of the current Inland route proposal.

The goods lines were established in their current location in the mid 1920's at a time when electric train services were just starting and the centre of gravity of the suburban network was well inboard of the goods line fringes. It was not until well after WW 2 (in fact in the mid 1950's) that the electric network started growing outward, yet in the 50 years since that time not one bit of freight infrastructure has been provided that has been effective in alleviating the creeping cancer of freight curfews.

At the same time electrification has been extended to the rest of N-S-W (that is Newcastle, Sydney, Wollongong not the state of NSW) yet nothing was done there either to provide for passage for freight trains during quite substantial parts of the day. Modern refuge facilities and some critical alignment improvements would have gone a long way to easing the curfew constraints while in some cases improving the journey times for passenger trains.

I well remember one of the Minister's predecessors standing up at Transport Research Forum Conference and giving a keynote speech ranging over transport across the state, which finished up with words along the lines of 'what I really want to see each morning is that the morning trains have been on time'. Not only has that attitude been at the root of some very unfortunate incidents over the years but it has not engendered one nanosecond of real effort to finding an equitable and lasting solution to the Sydney freight issue. As long as the simple and facile takes precedence, then it is hardly

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unreasonable if the Inland Route starts to look attractive to those who don't live in N-S-W. (come to think of it the Inland Route should gladden the hearts of many inside N-S-W since it would remove some of the impediments to on time train running in the suburban area).

The Minister should perhaps divert his zeal for curfews into placing truck curfews on Sydney roads during peak periods – after all the majority of urban journeys are undertaken by car rather than public transport and trucks are a major hindrance to the free flow of cars at peak times. Or maybe to make a point he should redirect Newell Highway truck traffic (which at present handles the majority of Melbourne – Brisbane freight traffic) through Sydney to display a truly even handed approach.

Fortunately at this stage the issue is mainly words – predictable given the proximity of a Federal election. But should it turn to something more at some later stage there is likely to be a strong and quite stinging response from those not wedded to a 'centre of the universe' philosophy, which would more than likely divert focus and resources from the real issues that Macquarie Street is supposed to deal with.

Clear thinking is a great attribute. Try it!

FUTURE MEETINGS

The list of coming meetings is now in tabular form as the second last page of the Newsletter. This allows for more information and is more easily updated as events unfold. Basil Hancock has taken charge of this aspect of our services, and it can be seen he has been very busy in the last few weeks filling voids well into the future.

Anyone with inspirations or bright ideas for future meetings should contact Basil at Basil.Hancock@railcorp.nsw.gov.au. Railways are an integrated mix of technology, operations and business, so potential topics from any or all of these disciplines would be most welcome.

It will be noted that we will have our regular meeting at Central on Wednesday 7th November, and a joint event with IEE at Chatswood on Thursday 8th. In effect this is a bonus that comes from our move to Central. It is hoped that those members who are interested in both topics will be able to get a 'leave pass' – after all it is all part of professional development (and can be claimed on your CPD record).

MEETING VENUE – HOW TO GET THERE

For the time being meetings are on the 1st Wednesday of the month at 12.00 in the large meeting room off the main concourse of Sydney Central (Steam) Station. The new time and place for our meetings is designed to make these more accessible to members and friends. The venue can be found in the North West corner of the main concourse opposite platform 2, next to the Lost Property Office.

When joint meetings and special events are at different locations, or for those odd months when meetings are not being held, suitable advice will be given in advance.

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COMING EVENTS

AusRAIL Plus 2007: see later in this Newsletter for comprehensive details of this event.

CORE 2008 will be held in Perth between 7th and 10th September 2008. Themes will be around high volume bulk freight and the integration of rail as part of the export supply chain, and rail in an urban environment and the issues of integrated planning of land use and transport as the core of successful public transport. Register your interest by going to www.CORE2008.org

RAIL INDUSTRY WORKFORCE PLANNING

ARA is partnering with Infohrm to run regional forums on the topic above as part of the Human Capital Strategy Project for the rail industry. These forums are to do with workforce planning issues and in particular gathering workforce planning data as part of the big picture project being run by ARA.

The Sydney forum is booked for Thur 13th September

Any organisation or company who feels that they would benefit from being a participant and who is not already registered, or who desires more information about the project or forum should contact Lynley Shearer at lynley.shearer@infohrm.com.au.

PROGRAMS IN ENGINEERING

The University of Wollongong has two new post graduate courses in Rolling Stock Engineering. These have been developed by Rail CRC in response to a requirement by the rail industry to overcome a shortage of rolling-stock engineers.

The courses are Graduate certificate in Rolling-Stock Engineering (one year part time) and Master of Rolling Stock Engineering (two years part time).

A flyer about these courses is included at the end of this Newsletter.

TAIL PIECE

Axioms of the Internet

1. Home is where you hang your @
2. The e-mail of the species is more deadly than the mail.
3. A journey of a thousand sites begins with a single click
4. You can't teach a new mouse old clicks.
5. Great groups from little icons grow.
6. Speak softly and carry a cellular phone.
7. C: is the root of all directories.
8. Don't put all your hypes in one home page.
9. Pentium wise; pen and paper foolish.
10. The modem is the message.
11. Too many clicks spoil the browse.
12. The geek shall inherit the earth.
13. A chat has nine lives.
14. Don't byte off more than you can view.
15. Fax is stranger than fiction.
16. What boots up must come down.
17. Windows will never cease.
18. In Gates we trust.
19. Virtual reality is its own reward.
20. Modulation in all things.
21. A user and his leisure time are soon parted.
22. There's no place like home.com!
23. Know what to expect before you connect.
24. Oh, what a tangled Web site we weave when first we practice.
25. Speed thrills.
26. Give a man a fish and you feed him for a day; teach him to use the Net and he won't bother you for weeks.

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FUTURE MEETINGS PROGRAM: Meetings in black are confirmed; in red are tentative.

DATE	SPEAKER	TOPIC	LOCATION	TIME
Thursday 23 rd August 2007	Michael O'Rourke and Kerry Christie from John Holland Rail Rob Smith, ARTC Train Control Project Manager	Joint Meeting with PWI and IRSE Turnouts & Innovations ARTC Train Control Consolidation in NSW	Masonic Centre, Castlereagh and Goulburn Street corner, Sydney	16.00 for 16.30
Wednesday 5 September 2007	Tony Frazer, Corridor Manager Hunter Valley, ARTC Robert Taylor, Assistant Corridor Manager, ARTC Clinton Crump, Delivery Manager, ARTC	Hunter Valley Flood Damage and Track Repairs	Central Station Concourse Meeting Room	11.30 for 12.00
Wednesday 3 October 2007	Max Michell	Metro: What's in a Tunnel?	Central Station Concourse Meeting Room	11.30 for 12.00
Wednesday 7 November 2007	Morgan Noon Logistics Manager – Sydney Ports Corporation	Minto - Enfield - Port Botany Freight Shuttle Services	Central Station Concourse Meeting Room	11.30 for 12.00
Thursday 8 November 2007	Jerry Jirasek Downer EDI Rail	25 kV Electrification in Queensland and Western Australia	IEAust, 8 Thomas Street Chatswood	17.30 for 18.00
December 2007	No meeting due to AusRail Conference in Sydney			
January 2008	No meeting			
February 2008	Michael Cain, RailCorp			

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AusRAILPLUS2007 CONFERENCE & EXHIBITION



4th, 5th & 6th December, 2007 ~ Sydney Convention & Exhibition Centre

AusRAIL PLUS 2007 is *the* comprehensive rail event of the year; it is the largest and most prestigious rail event in the Asia-Pacific region. Held biennially, the previous AusRAIL PLUS attracted over 3000 trade visitors per day to the exhibition and in excess of 800 senior executives and experts to the conference. The official dinners filled to capacity and were a resounding success. AusRAIL PLUS 2007 will be as successful and popular as ever. This year's event includes a three day conference with plenary sessions and technical streams, a major exhibition, exhibitor and product demonstrations, two official dinners, and a delegate and exhibitor networking evening.

AusRAIL PLUS 2007 will give you access to the latest insights into rail policy and will allow you to debate and discuss the direction for rail with the leading influencers in the sector. The conference will feature addresses from:

- The Hon John Watkins, MP, **Deputy Premier, Minister for Transport and Minister for Finance, NSW**
- The Hon Martin Ferguson AM, **MP, Shadow Minister for Transport, Roads and Tourism**
- Phil Reeves **MP, Parliamentary Secretary to the Minister for Transport, Queensland**
- The Hon. Tim Fischer, **Company Director including APT FreightLink**

The CEO's Forum on the second day of the conference is a rare opportunity for you to see the heads of major players in the rail industry together in an open discussion. Bring your questions to the table and find out where these leaders stand and how they are planning for the future. The panel on the CEO's Forum will include:

- Don Telford, CEO, **Pacific National** and COO, **Asciano**
- John Fullerton, CEO, **Freightlink**
- David Marchant, CEO, **ARTC**
- Reece Waldock, CEO, **Public Transport Authority, WA**
- Bill Watson, General Manager, **TransAdelaide**
- John Cleland, CEO, **WestNet Rail**
- Bruce Farrar, CEO, **Rail Infrastructure Corporation**
- David Jackson, CEO, **Toll NZ**
- Rob Barnett, CEO, **V/Line**
- Tony Braxton-Smith, CEO, **Great Southern Railway**
- Stephen Cantwell, Chief Operating Officer, **QR**

The conference includes a wide range of international speakers bringing best practice, new technologies and project updates from around the globe. These include:

- Joanna Gilligan, Programme Manager, Sustainable Development, **Rail Safety & Standards Board, UK**
- Cliff Mackay, President and CEO, **Railway Association of Canada**

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- John Samuels, President, **Revenue Variable Engineering, USA**
- Bob J Good, Vice President of Special Projects, **Bombardier Transportation, USA**
- Steve Cox, Director – Technical Development, **Pandrol Rail Fastenings, UK**
- Prof. Peter Winter, Senior Advisor, **SBB Consulting Group, Switzerland**
- Charles Mosimann, Business Development Manager, **Hasler AG, Switzerland**
- Peter Boom, Principal Consultant, **Lloyd's Register Rail Europe BV, The Netherlands**
- Richard Hilldrup, Project Director, **Ansaldo STA, Botswana**
- Rainer Wenty, General Manager Marketing & Technical Sales, **Plasser & Theurer, Austria**
- Hubert Rhomberh, Managing Director, **Rhomberg Group, Austria**
- Dr Wolfgang Schoech, Manager External Affairs, **Speno International SA, Switzerland**
- Alexander Bernhard, Head of Product Marketing, **ABB Switzerland**
- Paul Cheeseman, Global Technical Director, **Lloyd's Register Rail, UK**

The AusRAIL PLUS 2007 conference offers a full compliment of technical streams organised by the RTAA, IRSE and RTSA, allowing your whole team to benefit from in-depth sessions, case studies and updates specific to their area of expertise. The technical streams include:

Day 1:

- Sleepers and technology
- Rollingstock updates & case studies
- Signalling the next generation
- Innovations in track technology
- Asset management
- Signalling the level crossing

Day 2:

- Track maintenance
- Human & asset management
- Signalling projects & technology
- Track projects of note
- Environment & rail
- Signalling: a changing environment

For general enquiries, to book your place, or for more information about the **AusRAIL PLUS 2007** conference, exhibition

or dinners please contact our customer service team on:

- Email: enquiries@informa.com.au
- Telephone: (+61 2) 9080 4307
- Website: www.usrail.com

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Andrew McKay	Committee	Malcolm Cluett	Committee
Bob McCotter	Committee	Eddie Hawes	Committee
John Watsford	Committee	Tomas Magyla	Committee

CONTRIBUTIONS TO THE SYDNEY NEWSLETTER

Part of the function of RTSA is to keep members in touch with what is going on in the industry and with each other and to that end we are only too happy to publish items of interest. Articles or editorial comment for Newsletter are very welcome. We have several hundred members locally some of whom have stories, events or developments of interest that could make an interesting item for Sydney Newsletter.

Contact details are –

The Editor, Max Michell, e-mail to samrom@bigpond.com, phone 02 9331 5662 or post to P.O.Box 279, Potts Point, NSW, 1335.

For all other matters relating to RTSA Sydney Chapter contact Bill Laidlaw (Secretary) or Andrew Honan (Chairman) as above.

CPD CREDITS

Engineers Aust members who attend RTSA meetings and events will qualify for CPD credits as per the Engineers Australia criteria. Members are responsible for recording their own CPD for audit.

NOTICE TO MEMBERS RECEIVING RTSA NEWSLETTER BY EMAIL

If you should receive this Newsletter by post but would prefer to get it by e-mail (quicker and more reliable) then please let the Canberra know (address in the page header). E-mail saves time for you and costs for RTSA, which in the end can only mean better service to our members

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Subject Details:

The following subjects address the first learning objective for the course as a whole, (be able to use established predictive methods)

ENGG925 Rail motive power

Diesel electric locomotives, electric locomotives, diesel hydraulic locomotives, integrated EMU, locomotive structure, locomotive configurations, locomotive performance, locomotive control systems, locomotive bogies, locomotive engines, locomotive traction generation, locomotive auxiliary systems, locomotive maintenance considerations. Elements of a traction system: interfaces with other systems, interactions between elements, limitations on tractive effort, traction control, basic traction technologies and their design, operation and maintenance characteristics: electric, diesel hydraulic, diesel, railcars, EMU, safety and environmental issues, performance criteria and measurement.

ENGG926 Rail vehicle design

Types and application of passenger rolling stock, passenger rolling stock configurations, passenger rolling stock structure, passenger rolling stock performance, passenger rolling stock traction and control systems, passenger rolling stock human interfaces, passenger rolling stock bogies, passenger rolling stock brakes, passenger rolling stock auxiliary systems, passenger rolling stock maintenance considerations, freight wagon types and applications, freight wagon standards, freight wagon life-cycle, freight wagon structures, freight wagon configurations, freight wagon coupling systems, freight wagon brakes, freight wagon bogies, freight wagon performance, freight wagon auxiliary fittings, freight wagon loading and unloading systems, freight wagon dangerous goods.

ENGG927 Rolling stock safety and braking systems

Rail safety systems and the interface with train braking systems, historical development of train brakes, train brake fail-safe concepts, train brake types, components and applications, compressed air systems, train brake control and controllers, train brake system performance and design – parking, normal and emergency operation, train brake examination and testing, deadman and vigilance control, investigation of incidents where brake system failure may have been a factor.

ENGG928 Rolling stock dynamics and bogies

Wheel-rail interface and resulting dynamic forces applied to bogies, wind loadings on vehicles, forces arising from abnormal conditions, modes of vibration, control of longitudinal dynamics, control of lateral dynamics, control of vertical dynamics, suspension design, stability of wagons, passenger cars, locomotives and trains.

The following subjects address the second learning objective for the course as a whole, (be able to provide input into established predictive methods).

ENGG924 Railway and rolling stock environment

Rail within a transport industry context, historical perspective on railways development, business structures for rail organisations, rolling stock interfaces, safety considerations, design drivers, system design specification, rolling stock system (operations, servicing, maintenance), component interfaces, train types and applications, rolling stock operation and asset management, railway cost perspectives, technological development trends in rolling stock.

ENGG929 Rolling stock construction maintenance and design

Integration of factors governing rolling stock design including safety, dynamic performance, structural integrity, environmental and social impact, crashworthiness. Rolling stock types and configurations, rolling stock construction methods and techniques, couplers and draft gear, air and water piping, electrical cabling, internal fit out, auxiliary systems, passenger car door mechanisms, wagon loading and unloading design. Maintenance strategies, rolling stock maintenance techniques, rolling stock maintenance facilities, life-cycle considerations in design.

ENGG940 Dissertation

A project based on a problem in the broad field of rolling stock engineering. The student would normally be required to do a literature survey, analysis, and develop suitable solutions to a selected problem. This will allow the students to apply the knowledge and skills acquired in the structured course-work and thus gain valuable confidence in their ability to tackle practical problems in rolling stock engineering

Faculty of Engineering

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<http://www.uow.edu.au/eng/prospective/postgraduate/pgengmgmt.html>