New era of rail innovation – how various generations look at the future of railway

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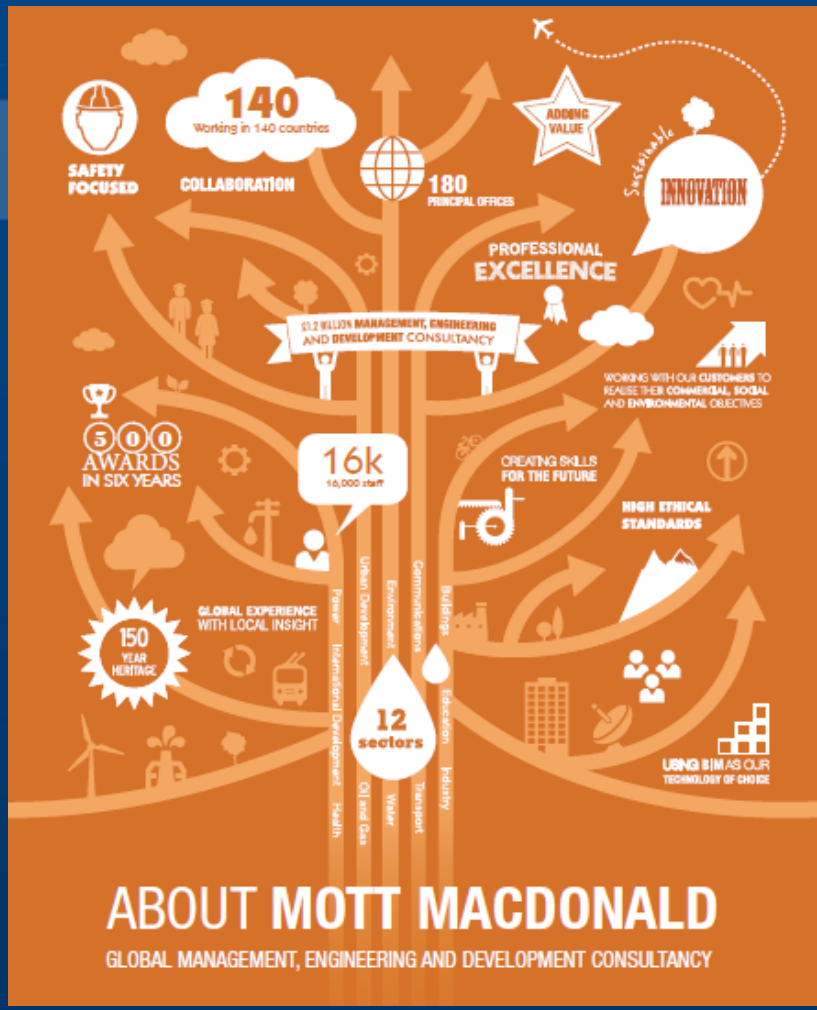
About Mott MacDonald

- 1,6 bln Euro Management, Engineering and Development Consultancy
- 17.000 staff
- 180 offices worldwide
- Operating in 140 countries
- 12 various sectors including transportation (including roads, railways, urban transport, aviation)



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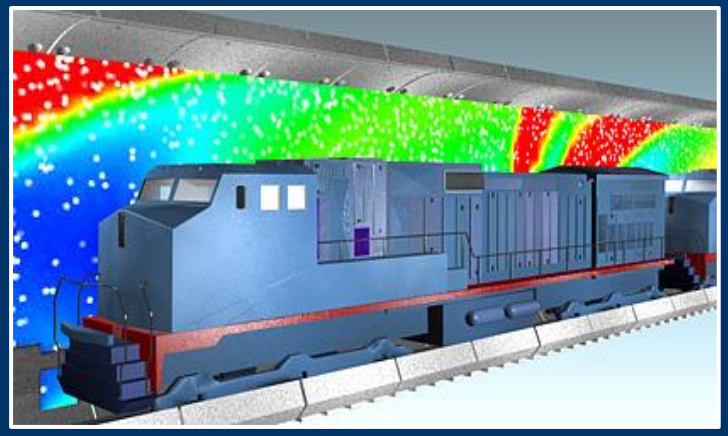
What is Innovation

- The process of translating an idea or invention into a product or service that creates value or for which customers will pay.
- To be called an innovation, an idea must be replicable at an economical cost and must satisfy a specific need.
- Innovations are divided into two broad categories:
  - Evolutionary innovations (continuous) that are brought about by many incremental advances in technology or processes
  - Revolutionary innovations (discontinuous) which are often disruptive and new



Example of Innovation:

CFD (Computational Fluid Dynamics) to solve a range of fluid dynamics and engineering problems relating to Ventilation and Heat Transfer, Fire and Smoke Spread, Water, Wind, explosion and blast in tunnels

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Rail innovation – yesterday and today

- Rail innovation is a continuous process (175 years) caused by:
  - Obsolescence of older technologies
  - A drive to make a better railway (e.g. higher speed, capacity)
  - New technical / technological possibilities
  - New demands of the users

  and more recently:
  - Economic drivers (life cycle costs, asset management)
  - Digitalisation processes (design, communication, control)

Source: wikipedia

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Rail innovation – yesterday

- In 1950ties - UIC railways started a common research organisation (ORE / ERRI) to co-ordinate railway research and innovation in Europe
- Industry activities within UNIFE
- Since 1997 railway research & innovations coordinated by European Commission - the Framework Programmes (e.g. FP 6, FP 7) of the EC, combining efforts of main sector stakeholders

PBKA project:

Thalys train - was showing the need for a common European signalling systems , today the train is using ETCS, however a number of antennas for classical Class B ATP systems are still on-board.

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Rail innovation –today – Shift2Rail

Shift2Rail is a joint undertaking of major railway sector partners will focus on 5 innovation programmes, covering:

- IP1: Cost-efficient and Reliable Trains, including high capacity trains and high speed trains;
- IP2: Advanced Traffic Management & Control Systems;
- IP3: Cost-efficient, Sustainable and Reliable High Capacity Infrastructure;
- IP4: IT Solutions for Attractive Railway Services;
- IP5: Technologies for Sustainable & Attractive European Freight.

(source: Shift2Rail)

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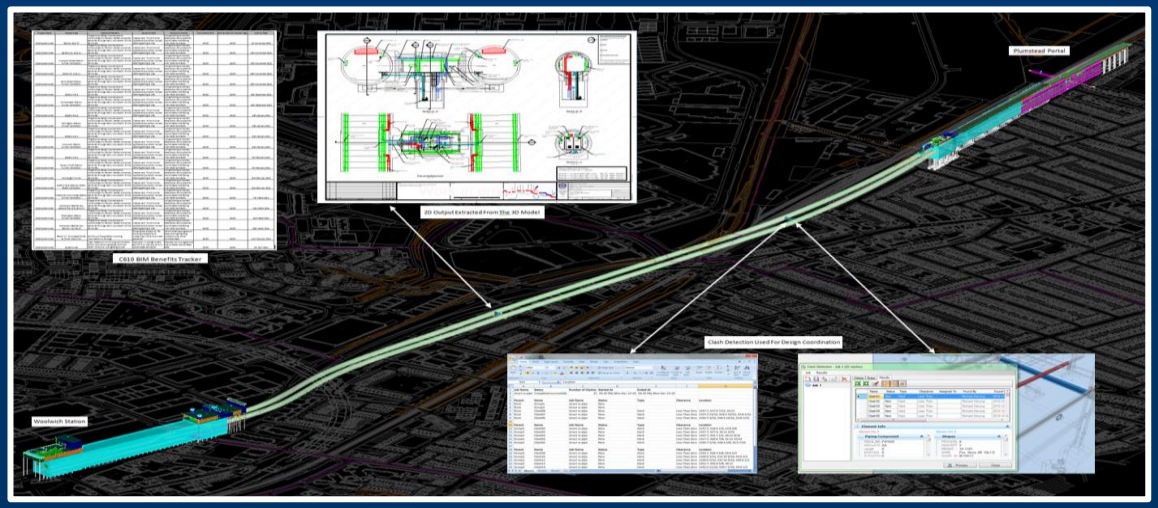
Rail innovation from the perspective of a single engineering company

- Business process improvements – faster, better and cheaper
- Leading through innovations – BIM based design
- Taking Clients needs into account – shorter delivery times



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Rail innovation from the perspective of a single engineering company

Client attitudes + management + commercial relationships + trust → INNOVATION

- Challenge Constraints:
  - Tradition
  - Lack of awareness/expertise
  - Risk aversion
  - Desire for “certainty”
  - Pressure on delivery

- Save time
- Save materials
- Reduce costs
- Manage uncertainty
- Improve safety
- Attitudes/motivation of project team

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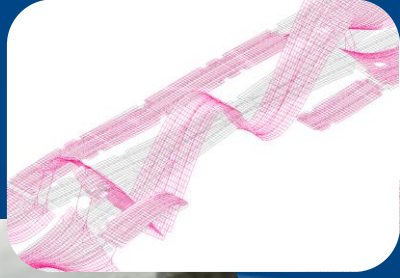
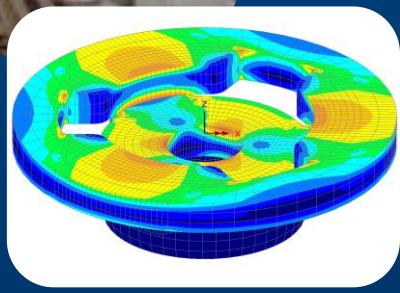
Taiwan Floating Slab Track





- MRT – Taipei to airport
- Slab Track – viaducts, cut/cover and bored tunnels

But noise and vibration concerns

- Use of floating slab track – but conventional steel sprung units: expensive and difficult maintenance
- Dynamic Modelling – bespoke in-house software created: faster modelling
- Innovative Design – discrete rubber bearings, plus rubber strips

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Rail innovation and other transport modes or business sectors

- Large complexity of the stakeholders and standards negatively impacts speed of innovation in rail
- Smaller countries often dependent on larger players (industry, railway undertakings)
- Implementation of technologies from other sectors is slowed down by (old) approval procedures
- Other transport sectors (automotive) are introducing business oriented innovations and set lower thresholds to accept innovative ideas

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Rail innovation takes too long

- European Train Control System was specified by railways and industry in the period 1990-1997
- The change from old technologies to ETCS takes more than 20 years – parts of the original ideas are almost obsolete from technology point of view (GSM-R vs. latest generations of mobile communication)

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Innovation – rail vs other transport modes or business sectors in last few years

- Google car but no Google train
- GPS navigation for cars widely implemented – virtual balise concept for railways – validated but not in place
- 4G mobile technology available for individual users – railways continue to use GSM-R
- ITS applications for cars available – digital railway concept only evolving

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Innovating for the railway of the future experience versus a fresh look

experience	fresh look
Complex systems need time to innovate	Change of mind-set is necessary to be able to innovate
Evolutionary innovation offers steady progress	Revolutionary innovation offers quick progress
Railway environment is specific, no easy transfer of solutions from other sectors is possible	Technologies from other sectors can offer a new approach to old problems
Removing national rules is not easy	Necessary simplification of rules to stimulate innovation
Economies of scale are needed to pay back costs of innovation	There are various ways of funding innovations

Network Rail – Digital Railway concept: In an age of iPads and social media, we must modernise the way the railway works and is seen. Technology exists, the challenge is business change.

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Future rail system – innovation driven?

experience	fresh look
Innovations driven by railways and industry	Passenger experience should be key driver for innovating railway
Railway is an expensive asset – and therefore innovations need to be adjusted to the life cycle of existing systems	New concepts can change the role of railway as a mean of transport: example - “Swiss metro”: concept
S2R covers well most emerging challenges of railways until 2050	There must be a place for alternative concepts and solutions
Rail innovation well established	Younger experts will elaborate alternatives faster
Large countries and the EU will lead innovations	Smaller countries should make a better use of EU innovation funds

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Conclusions

- To stay competitive rail sector should speed-up the innovation processes
- There must be place for ‘out of the box’ ideas to change the perception that rail is an old fashion transport system
- Smaller countries – should be in a lead of implementing innovations – scale is smaller and can be used as best practice
- A good mix of experience and new ideas should offer a better sustainable rail system in the future

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