Department for Transport

Network Modelling Framework

Presentation to Rail Research UK

Whole system cost modelling workshop 13 December 2006

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NMF Background

- Rail White Paper requirement - focus on a model for the High Level Output Specifications (HLOS)

- Shared project between DfT, ORR, Transport Scotland and Network Rail to ensure that HLOS analysis is on the basis of common and agreed tools, data and assumptions.

- Requirements:
  - HLOS Metrics (pkms, safety, PPM, crowding, station footfall)
  - Estimate net costs and value for money of different investment packages
  - Feed into financial forecasts - affordability
  - Whole network coverage
  - Ability to analyse fairly easily and flexibly a number of different scenarios
  - Ability to run the model in DfT, ORR, TS and Network Rail

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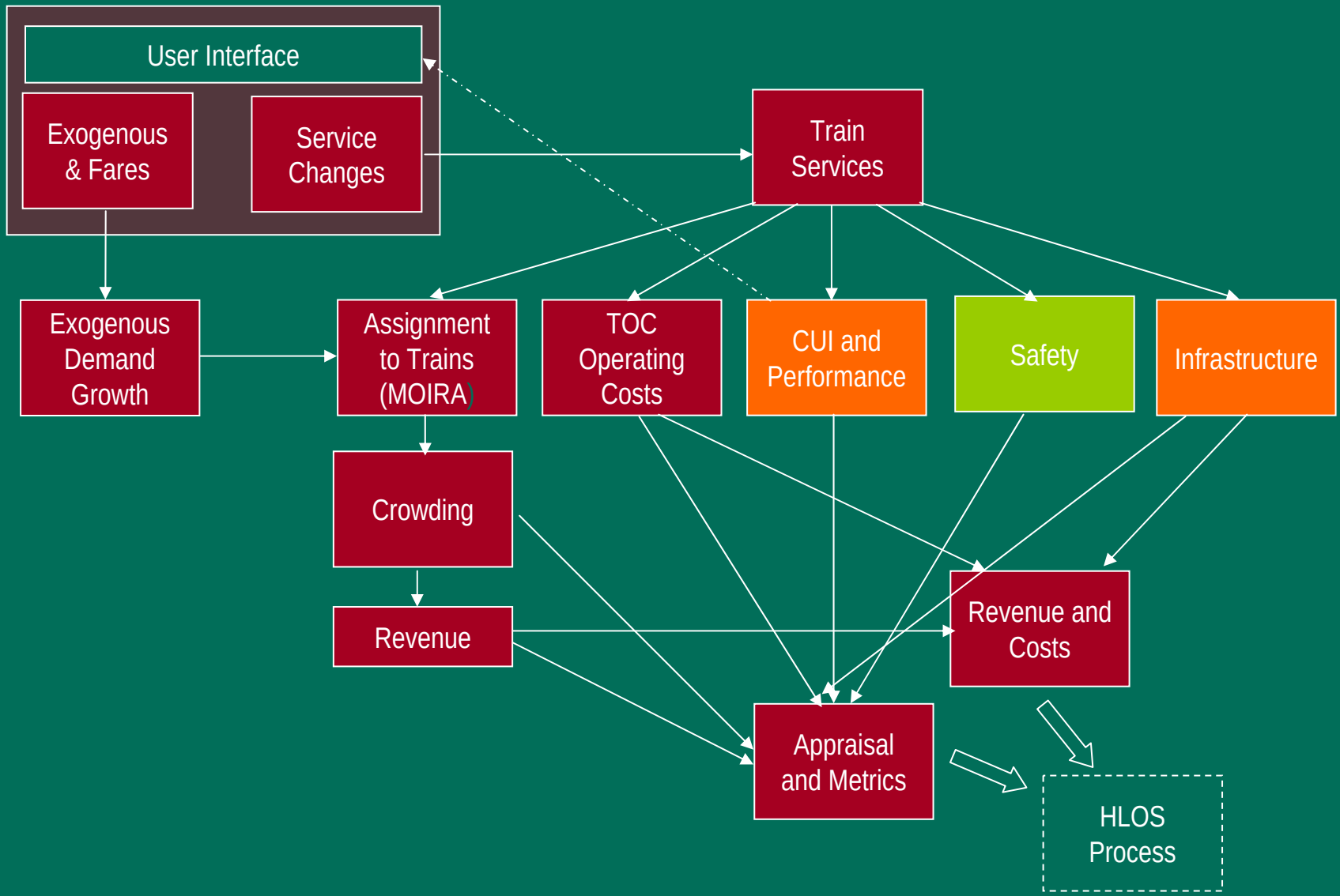
Main Tasks

- Design of appropriate model framework to deliver metrics and meet client objectives
- Development of existing models/modules
- Completion of new modules- ICM, safety
- Setting up and operating off common database
- Linking modules to show feed-backs

Main Innovations

- New Integrated Rail Model
- Common base, consistent assumptions, interactions on demand, revenues, appraisal
- New formulation of Rail Demand Model
- New strategic modelling of crowding
- Updated TOC operating cost module
- New ICM and strategic performance module (Network Rail)
- New safety module (RSSB)
- New working arrangements with Stakeholders

HLOS High Level Model Structure



Operating costs

- Module forecasts operating costs on a unit cost basis. Cost changes estimated in response to changes in outputs or scenarios appropriate to marginal but not step changes in costs.
- Use train service derived metrics (train miles, service hours, etc,) to drive changes in costs.
- By TOC and train/rolling stock type
- Main cost categories are:
  - staff, lease, maintenance, fuel, (vtacs and EC4T calculated in ICM)
- Assumptions based trends in costs

Infrastructure

- Infrastructure Cost Model (ICM) developed by Network Rail.
- ICM estimates the Operating, Maintenance and Renewal (OMR) costs for differing specifications of network usage.
- Basic functionality:
  - asset information (7 categories) + passage of time/traffic => activities * unit costs => O, M, R expenditure
- Modelling limited by knowledge of asset condition and characteristics, relationships between usage/asset condition and activity and unit costs.
- Enhancements dealt with off-line;ICM estimates additional traffic impact on existing network.

Performance

- Model developed by Network Rail.
- Modelling performance at a strategic level is significant challenge.
- Model is based around using the relationship between capacity utilisation and performance to understand how changes in network usage impact on performance.
- Aim to build in some relationships between:
  - Infrastructure model and performance
  - Types of train, crowding, station dwell times and performance
- Management response and action very difficult to model

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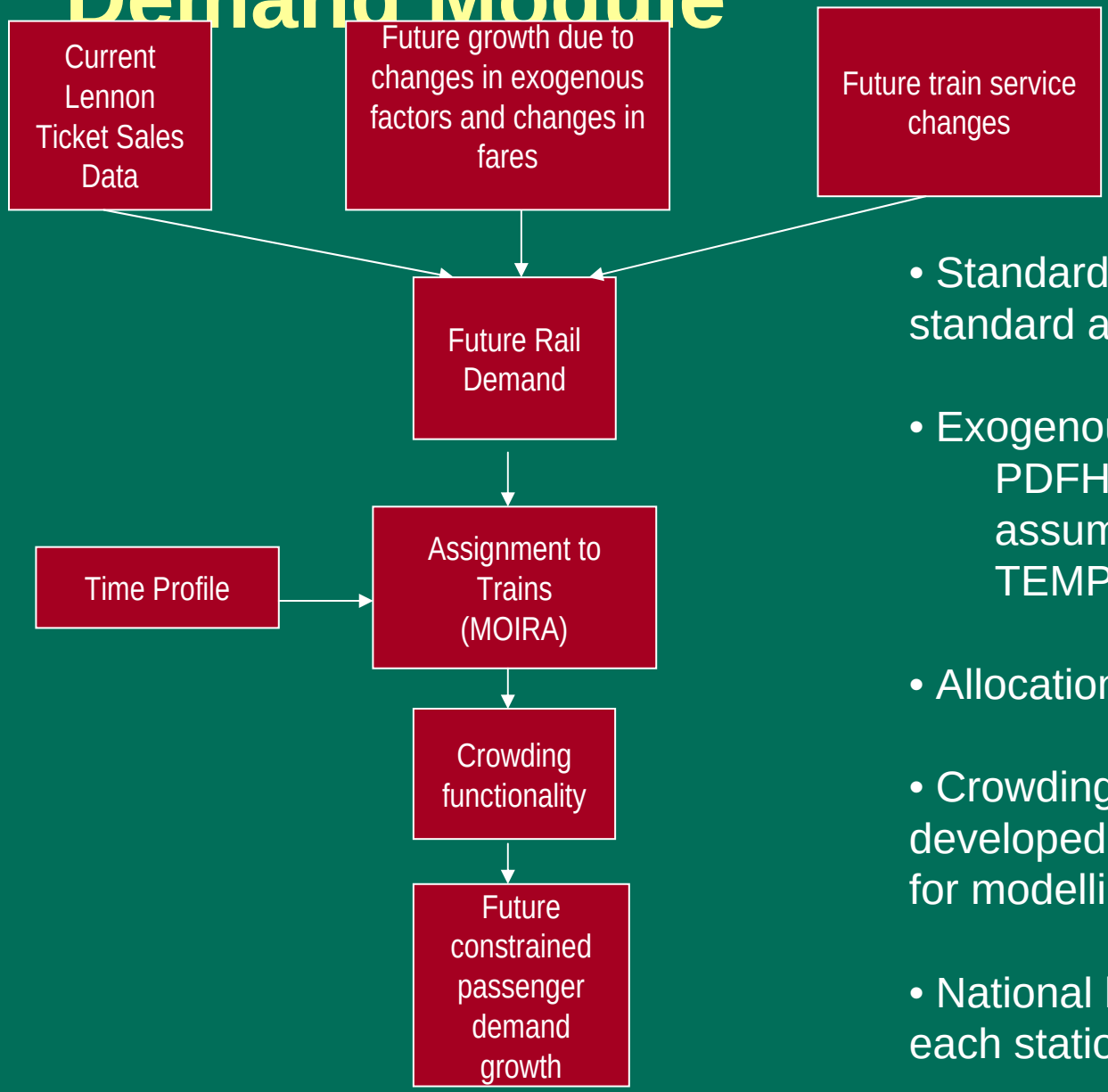
Safety

- Probability based model developed by RSSB
- Trains operated and potential hazards
- This uses fault trees (hazardous events, occurring at a certain probability) and event trees (different scenarios within each event, with a probability and predicted number of casualties).
- Output is changes in Fatalities and Weighted Injuries per Year

Demand Module



- Standard industry approach with standard assumptions
- Exogenous growth driven by:
  - PDFH parameters and input assumptions mainly based around TEMPRO
- Allocation to trains - via MOIRA
- Crowding off – bespoke curves developed but similar to work done for modelling of franchises
- National level model – not modelling each station individually

Exogenous Growth

- Impact of exogenous growth by journey purpose and market segmentation
- Purely forecast exogenous growth – no crowding off and no timetable impacts.
- 566 Demand zones
- Key input assumptions:
  - Agreed DfT TEMPRO V 5.2 population, employment and GDP – main drivers
  - Fares of RPI+1

Estimates of Constrained Growth

- After background growth is taken into account the NMF needs to allocate exogenous growth in demand to services using MOIRA.
- Generalised Journey Time for each opportunity to travel between Os and Ds
- Profile of demand across the day
- Growth also needs to take account of crowding by applying crowding curves
- Impact of timetable and other GJT changes on baseline and on investment package options.
- This gives us constrained growth This constrained growth can be shown at a number of different levels of detail, from a national level down to a Strategic Route Section level.

PACKAGE OF INVESTMENT IN LONDON AND SOUTH EAST

NMF has modelled a package of peak train lengthening on 8 radial London routes. This does not include Thameslink which has not been modelled in the NMF.

PV benefits:	~£2bn	crowding relief
	~£0	time savings
	>£1m	performance
	~£50m	safety
	~£0.5bn	generated rail revenue
PV costs:	~£350m	operating costs (NR and TOCs)
		Investment costs not calculated by NMF

Costs in 2002 prices discounted present values appraised from 2009/10 to 39/40

Effect on passenger km HLOS metric

	Baseline	**With Package**
passenger km:	30bn paxkm	+70million paxkm

NEXT STEPS

- Develop HLOS Scenarios
- Review further applications
  - high level scoping model
  - financial forecasts, initial franchise vfm assessment
  - scenario model: fuel prices, road user charging
- Sharing of model with Stakeholders
- Following DfT's programme of research and research by other stakeholders, improve and update model.