The Railway Consultancy Ltd
Specialists in Planning Economics and Management

The Impact of Differing Door Widths on Passenger Movement Rates

COMPRAIL 2014, Rome

26/06/2014

Harris, Risan & Schrader

Railway Consultancy & NSB

Structure of this Presentation

1. The Problem: Background & Previous Work
2. Work in Norway
3. Wider Analysis
4. Hypothesis
5. Conclusions

The Railway Consultancy Ltd
Specialists in Planning Economics and Management

1 The Problem

- Increasing traffic puts pressure on capacity
- Urban rail capacity determined by station stops

- Many rail simulations make simplistic assumptions about station stops
- This paper demonstrates that an apparently-simple relationship isn't

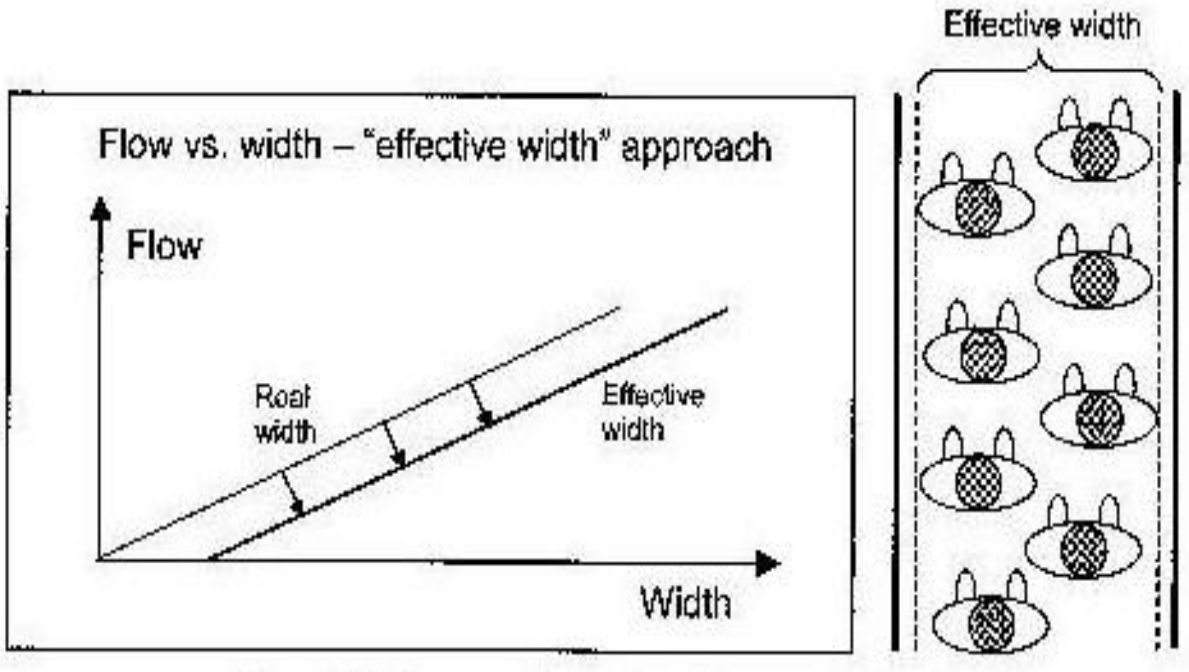
1 Factors Affecting Station Stops

- Detailed modelling undertaken
  - Harris, Graham, Anderson & Li (TRB, Feb 2014)
- Three types of variables
  - Passenger characteristics
  - Station characteristics
  - Rolling stock characteristics

The Railway Consultancy Ltd
Specialists in Planning Economics and Management

1 The Impact of Door Width: Literature Review

- Prof. Weidmann: Flow = f ($d^{-0.1}$)
- Heinz: different types of movement, subject to edge effects



The Railway Consultancy Ltd
Specialists in Planning Economics and Management

1 Previous Work: Data Available

- Ongoing multi-year joint RTSC/RCL project with c. 150 surveys
- Focussed at the critical door of metro and busy urban railways
- Each with 30 detailed observations of
  - Passenger movements
  - Passenger times
  - Times of other functions (e.g. despatch, door closing)
  - Train & platform characteristics

The Railway Consultancy Ltd
Specialists in Planning Economics and Management

1 Previous Work: Analysis

- Formal statistical analysis using multivariate fractional technique to avoid issue of non-linearity
- Despite expectations, *door width was not a significant variable*
- Analysis of residuals

The Railway Consultancy Ltd
Specialists in Planning Economics and Management

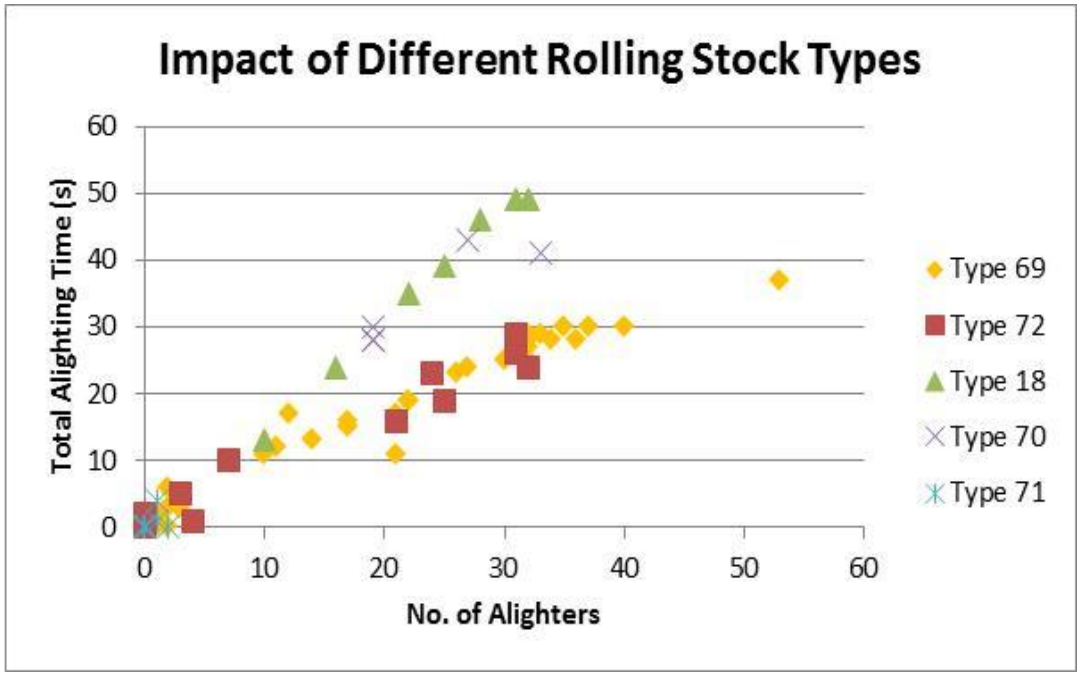
2 Work in Norway

- NSB runs up to 20tph through Oslo tunnel
- Commercially-critical part of their operation but punctuality lower than desired
- A mix of train services doesn't help

The Railway Consultancy Ltd
Specialists in Planning Economics and Management

2 Work in Norway

- Initial analysis showed that rolling stock clearly was a determinant of passenger movement rates
  - But was this door width and/or other features?



The Railway Consultancy Ltd
Specialists in Planning Economics and Management

3 Wider Analysis

- NSB argued that door width alone was perhaps not a simple determinant of flow
- Supported by one of Heinz's hypotheses

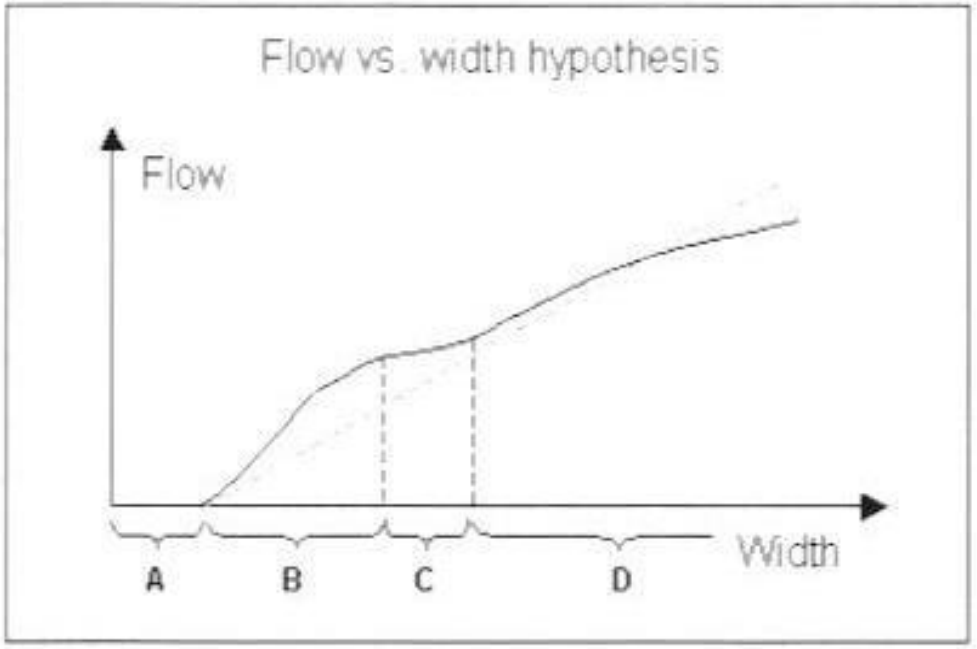
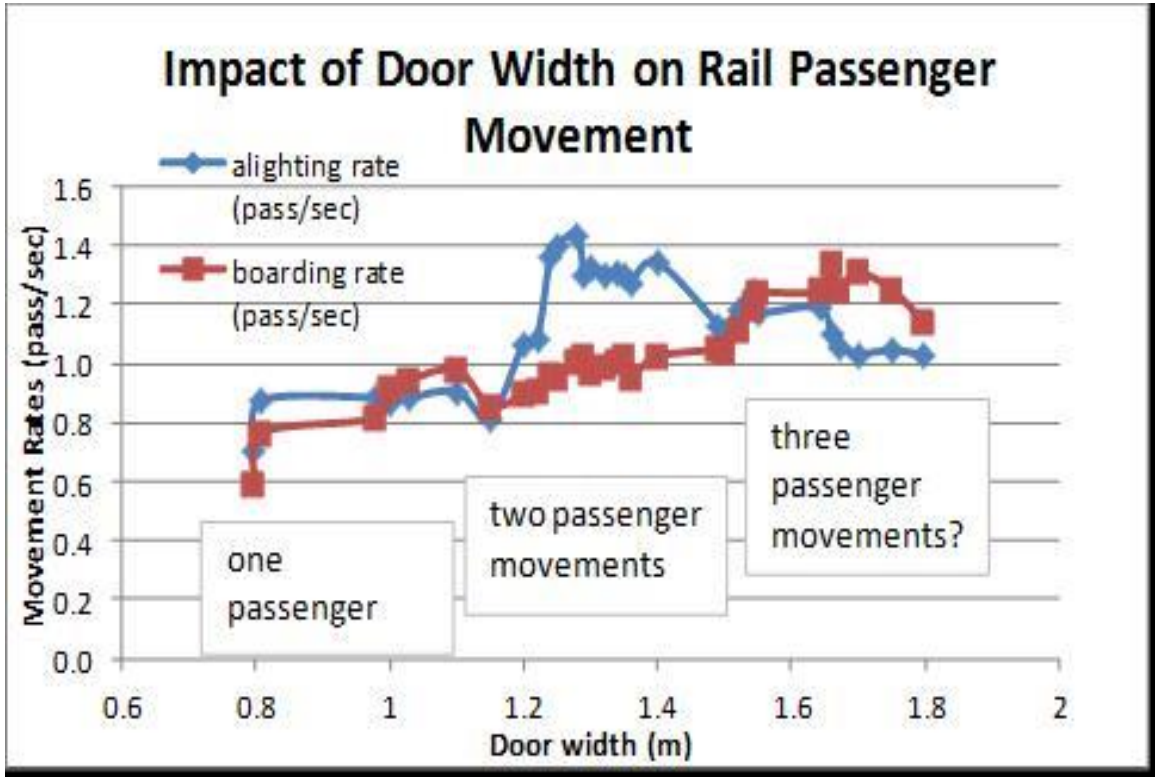


Figure 31. A hypothesis for a new flow-width relationship

The Railway Consultancy Ltd
Specialists in Planning Economics and Management

3 Wider Analysis

- Investigation of the full international dataset showed a step function in the impact of door width



The Railway Consultancy Ltd
Specialists in Planning Economics and Management

3 Wider Analysis

- Platform management measures can be implemented e.g. boarders to stand aside
- But international nature of dataset showed that problems were also arising in “well-behaved” environments e.g. Taiwan

The Railway Consultancy Ltd
Specialists in Planning Economics and Management

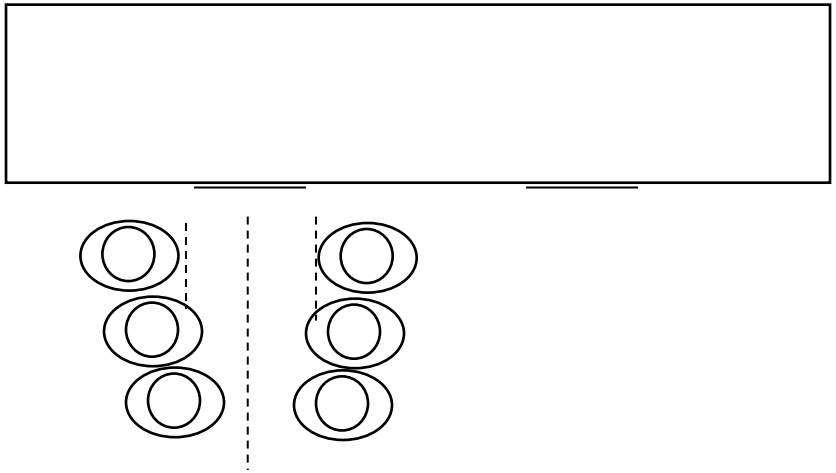
4 Hypotheses: 1

- Threshold door width values are important in determining flow:
  - 0.75m enables one movement
  - 1.25m enables two movements
  - 1.7m enables three movements
- …but standbacks are more important

The Railway Consultancy Ltd
Specialists in Planning Economics and Management

4 Hypotheses: 2

- Detailed observations led to a different hypothesis:
- Door width is not critical because the gap left by boarding passengers is narrower than the door



The Railway Consultancy Ltd
Specialists in Planning Economics and Management

5 Summary

- Door width has generally been assumed to be a linear determinant of passenger flow on/off trains
- Despite variations in culture, it is *not*
- A stepped function is appropriate in forecasting movement rates
- But these may not be achieved if boarding passengers do not keep back

The Railway Consultancy Ltd
Specialists in Planning Economics and Management