Traffic and Trams – The Edinburgh Experience

Scott M. Ney, MIEAust CPEng, PE, CEng MICE

PARSONS BRINCKERHOFF

Presentation Overview

- Introduction to the Edinburgh Tram Network
- Overview of objectives and technical criteria
- Models and their relationships
- Results of modelling
- Recommendations for Mitigation
- Conclusions and Summary

PARSONS BRINCKERHOFF

Overview of Edinburgh Tram Network

"The objective is to provide a high quality tram system for Edinburgh that embraces the best practice demonstrated in other European cities, and is of a standard appropriate to the city's world renowned status." – Tram Design Manual

PARSONS BRINCKERHOFF

Key Message for Design

"the city must strive for the standard which reflects the site, both in the maintenance and in the enhancement of the public realm and seek to support actions and initiatives that mitigate the negative impacts of vehicular traffic."

- The Old and New Towns of Edinburgh World Heritage Site Management Plan

PARSONS BRINCKERHOFF

Objectives of Traffic Modelling

Strategic Objective

- Optimise tram progression whilst minimising delay to traffic and pedestrians

Process Objectives

- Assess impact of design on individual signal junction capacities and potential blocking-back
- Assess tram progression and reliability
- Calculate tram detector positions to mitigate progression/reliability issues

Key Technical Criteria

- 225 second 'double cycle'
- Department for Transport (DfT) guidance on signal operation
- Peak service operations in AM and PM peaks modelled
- Local Bus Services will be altered
- "Green Wave"
- Right turners are not allowed to cross in front of an approaching tram
- No stage skipping

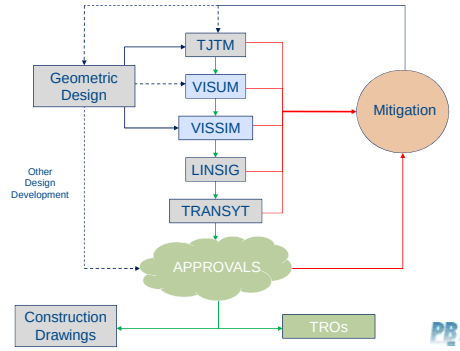
Simulation Models

Tram Journey Time Model	LINSIG
• Very detailed parameters • No traffic impact • Assumptions on tram stop dwell times	• Individual junction assessment models • Optimises traffic signal operation and quantifies capacity (PRC) and queue lengths
VISUM/VISSIM	**TRANSYT**
• 4 VISSIM models covering City Centre • Careful work to optimise tram progression • Suggested some changes to stage sequences	• Impacts on adjacent junctions • Identifies blocking-back to upstream junctions • Effects of reducing time to tram related stages when tram is not present

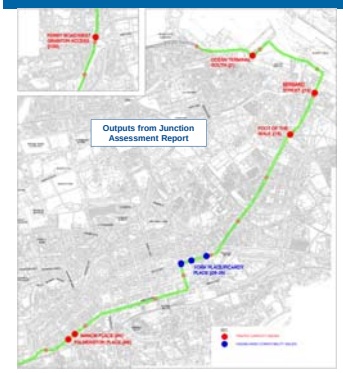
Interdependence of Outputs

- Operations Simulations
  - describe tram journey time model (TJTM) from geometric design
- Junction Assessments
  - individual junction LINSIG outputs
  - Used turning movements from VISSIM, which were in part determined by TJTM times
- Strategic TRANSYT Reporting
  - linking together of junctions
  - used timings from LINSIG
- Effect of Traffic on Tram Journey Time
  - outputs come from VISSIM
- Tram Detection Position Designs
  - TJTM times and
  - LINSIG outputs on queue lengths

Traffic Modelling in the Design Process



Results - LINSIGS



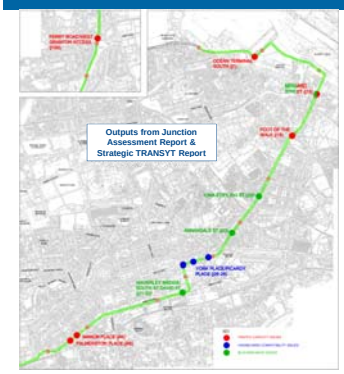
Ocean Terminal South
- Intergreens
- Tram time through junction

Bernard St/Baltic St and Foot of the Walk (FOW)
- Volume of west/east traffic
- Volume of Waterfront traffic
- Constrained capacity at FOW

Manor Place and Palmerston Place
- Volume of north/south traffic
- West Maitland St kept clear for bus and tram
- Queues iterate between the two

Ferry Rd
- Intergreens

Results - TRANSYT



Bernard St/Baltic St
- Blocking-back beyond Tower Street and Queen Charlotte Street in PM peak

Iona St/Pilrig St
- Volume of east to west traffic in both peaks

Annandale St/Montgomery St
- Volume of west to east traffic in AM peak

South St David St/ Waverley Bridge
- Volume of traffic between the two junctions (both directions in PM peak)

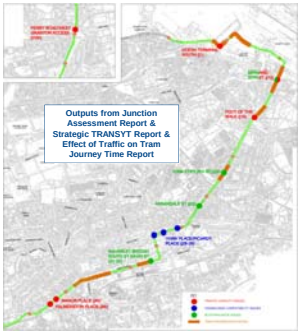
Results – Tram Journey with Traffic

- Increase in average tram journey times as follows:

Northbound		
Tram Journey Time Model	VISSIM AM peak	VISSIM PM peak
21 mins 9 secs (nb. 4 mins 12 secs at tram stops)	26 mins 15 secs	27 mins 30 secs

Southbound		
Tram Journey Time Model	VISSIM AM peak	VISSIM PM peak
21 mins 41 secs (nb. 4 mins 30 secs at tram stops)	24 mins 56 secs	27 mins 6 secs

Results (Tram Progression)



Bernard St

- problems northbound affect progress through to Ocean Terminal

Ocean Terminal South

- Limited tram related stage time.

FOW

- Limited tram related stage time and southbound arrives just after northbound

Iona St/Pilrig St

- Blocking-back issue

South St David St/Waverley Bridge

- Blocking-back issue

West end Princes St and Shandwick Place

- Limited tram related stage time

PARSONS BRINCKERHOFF

Results (Combined)

- Capacity issues arising from long intergreens and/or number of stages
- Capacity issues related to traffic volumes
- Possible blocking back
- Tram progression issues

Different issues at a few key locations...

PARSONS BRINCKERHOFF

Recommendations and Mitigation Measures

Ocean Terminal South

- consider stage skipping in absence of tram

-FOW and Ferry Rd

- consider stage skipping bus stage

-Blocking-back issues

-put queues onto side roads and leave tram route clear eg. Manor Place/ Palmerston Place; Iona St/Pilrig St; Annandale St/Montgomery St

In addition, **tram detection system** should mitigate progression issues on west end Princes St/Shandwick Place; Iona St/Pilrig St; Ocean Terminal North

PARSONS BRINCKERHOFF

Final Condition

Remaining Issues (Final Condition)

Bernard St/Baltic St

- traffic volumes and junction capacity affect tram progression.
- Affects tram through to Ocean Terminal.

South St David St/Waverley Bridge

- traffic volumes affect tram progression

PARSONS BRINCKERHOFF

Conclusions

- The model outputs provided good validation of the results from previous stage models
- The model outputs, when viewed together, provided a map to the mitigation measures required and potential carry-on effects.
- Impacts to travel time in AM peak due to the effects of traffic ranged from 15% (SB) to 24% (NB)
- Impacts to travel time in PM peak due to the effects of traffic ranged from 25% (SB) to 30% (NB)

PARSONS BRINCKERHOFF

Summary

- The challenge was to integrate the models and provide sensible and realistic solutions to the issues arising
- Design issues, such as historic restrictions, tram stop placement, and geometry had an impact on the overall traffic operations solution
- Strategic alterations to bus and traffic patterns introduced with tram implementation were desirable and required for current and future 'placemaking' considerations
- Overall volume of traffic predicted in City Centre requires substantial other considerations to alleviate remaining issues (which cannot be resolved by tram design)
- The use of the various models in a strategic and sequential manner provided a progressive manner in which to resolve issues without encountering significant rework.

PARSONS BRINCKERHOFF

Thank You!

PARSONS BRINCKERHOFF