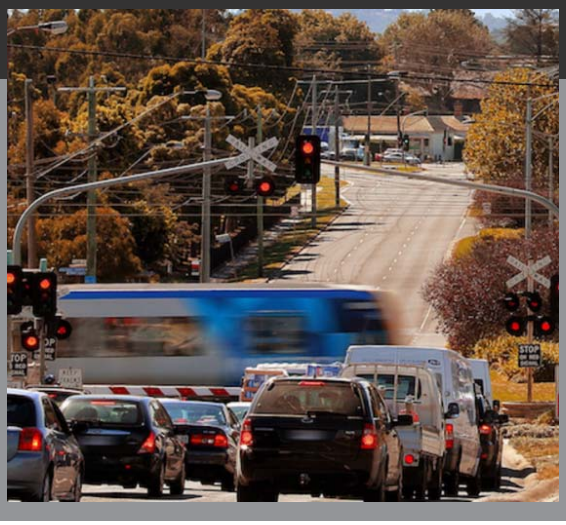
Research Perspectives & Comments on Managing Rail Grade Crossings in Melbourne

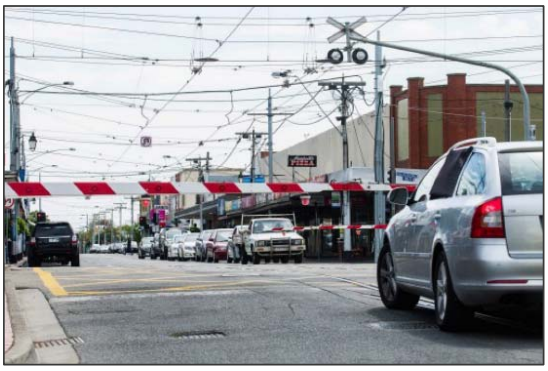
Professor Graham Currie
PUBLIC TRANSPORT RESEARCH GROUP
Institute of Transport Studies
Monash University, Australia

8th Victorian Transport Infrastructure Conference
Melbourne Convention and Exhibition Centre
28th April 2016



Agenda

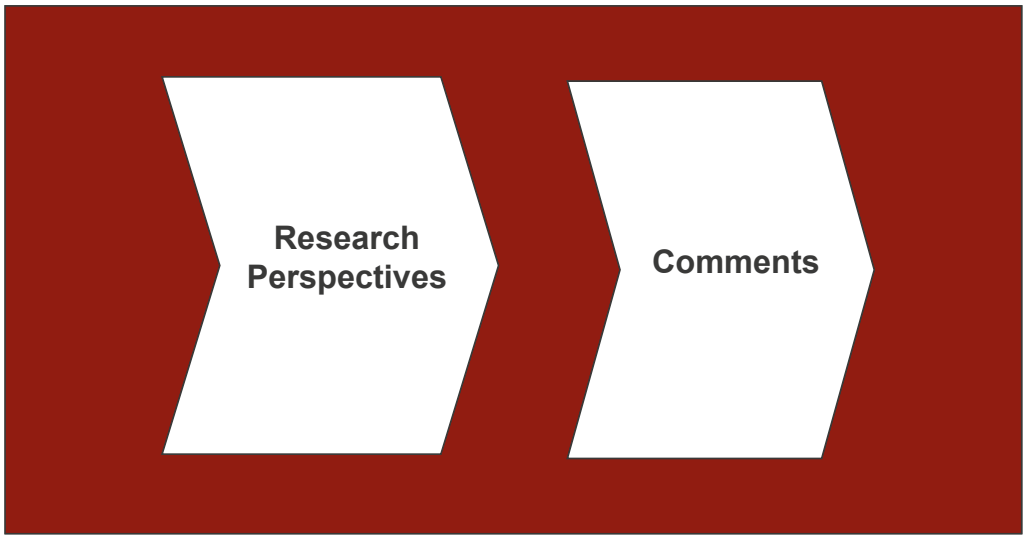
1. Introduction
2. Research Perspectives
3. Comments



This paper provides research input to the Skyrail / rail grade separation debate…

- In relation to rail grade crossings, PTRG at Monash has been focusing on:
  - An international review of research and practice evidence
  - Measuring and Modelling transport impacts
- This paper outlines some of our early findings and provides (informed?) comment on issues such as “Skyrail”

…divided into the following sections

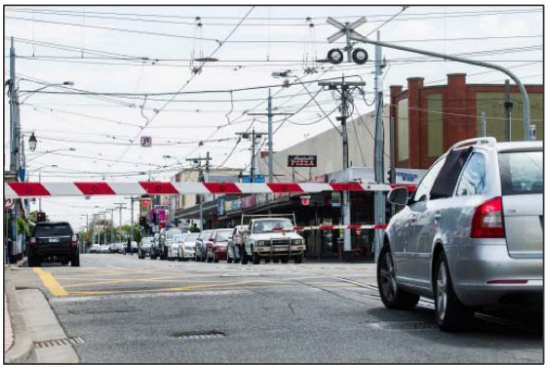


Agenda

1. Introduction

2. Research Perspectives

3. Comments



1. Research-practice review - urban rail-road crossings…

AIM:To develop a holistic understanding of rail-road crossing impacts and identify key knowledge gaps in the field

Consideration given to both at-grade and grade-separated crossings

Source:

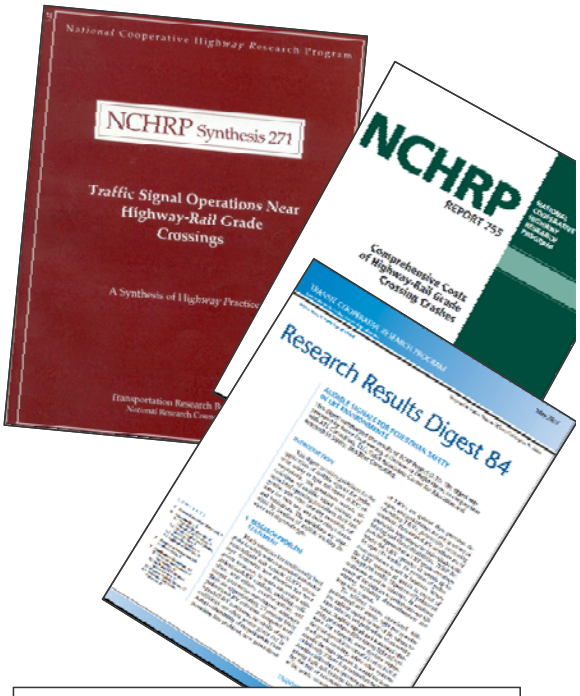
De Gruyter C and Currie G (Under review) 'Rail-Road Crossing Impacts: An International Synthesis' TRANSPORT REVIEWS submitted 16-11-2015

De Gruyter C and Currie G (2016) 'Impacts of Rail-Road Crossings: International Synthesis and Research Gaps' Transportation Research Board 95th Annual Meeting January 2016

…using a practice review methodology

Research method

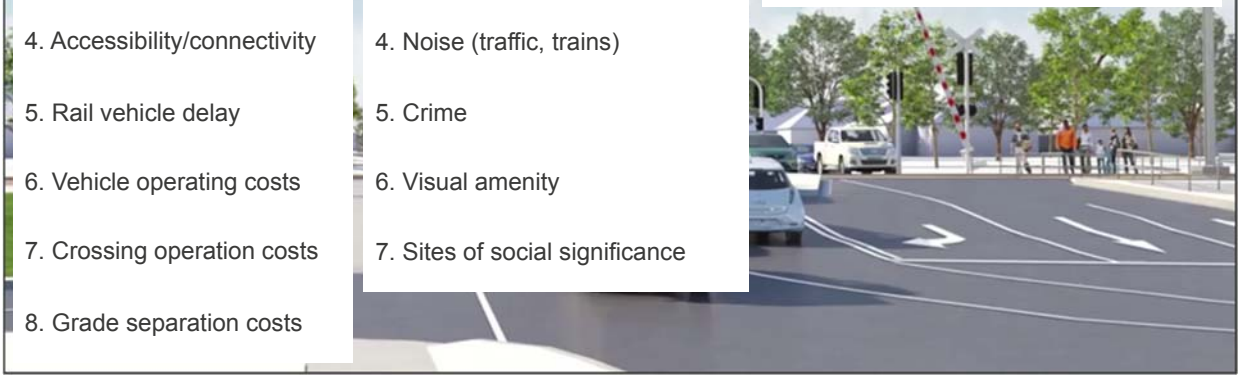
- Detailed literature review of academic papers and industry reports relating to rail-road crossing impacts
- Key search terms used in various databases (e.g. Scopus, SPARK):
  - ✓ Rail road crossing
  - ✓ Highway rail crossing
  - ✓ Level crossing
  - ✓ At-grade rail crossing
  - ✓ Rail grade separation
- Additional literature sourced through industry representatives & snowballing
- 70 publications relevant; 28 specific to rail-road crossing impacts



TRB Committee on Highway/Rail Grade Crossings (AHB60)

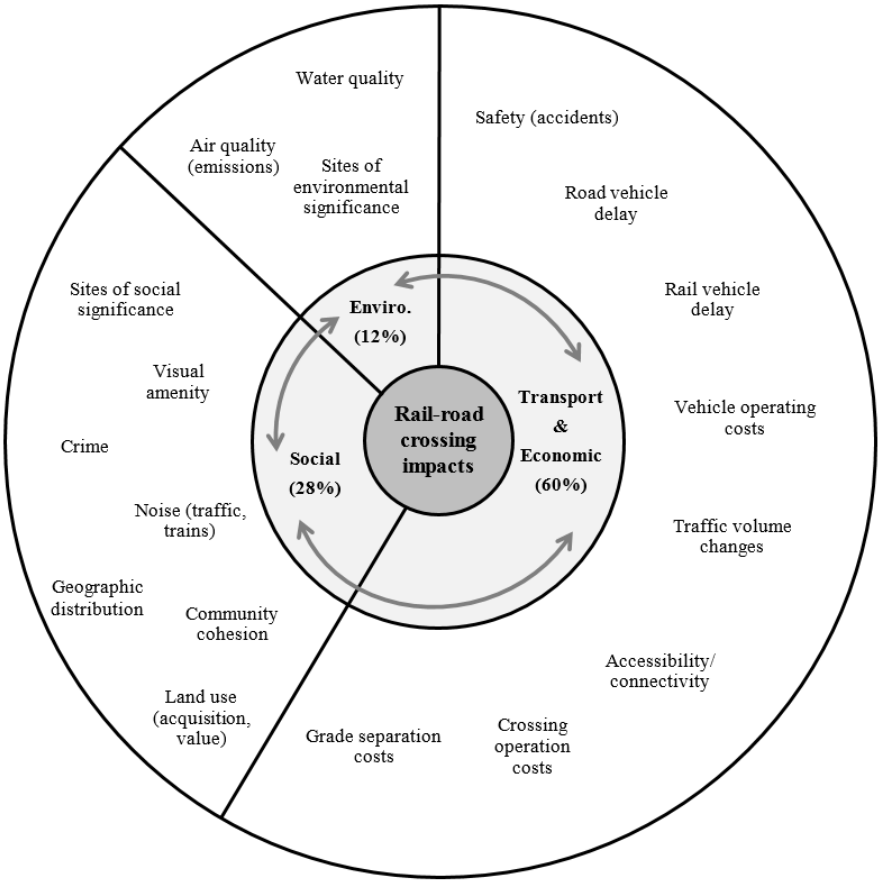
18 types of impacts identified in total

Transport & Economic	Social	Environmental
1. Safety (accidents)	1. Community cohesion	1. Air quality (emissions)
2. Road vehicle delay	2. Land use (acquisition, value)	2. Water quality
3. Traffic volume changes	3. Geographic distribution	3. Sites of environmental significance
4. Accessibility/connectivity	4. Noise (traffic, trains)	
5. Rail vehicle delay	5. Crime	
6. Vehicle operating costs	6. Visual amenity	
7. Crossing operation costs	7. Sites of social significance	
8. Grade separation costs		



Source: De Gruyter C and Currie G (2016) 'Impacts of Rail-Road Crossings: International Synthesis and Research Gaps' Transportation Research Board 95th Annual Meeting January 2016

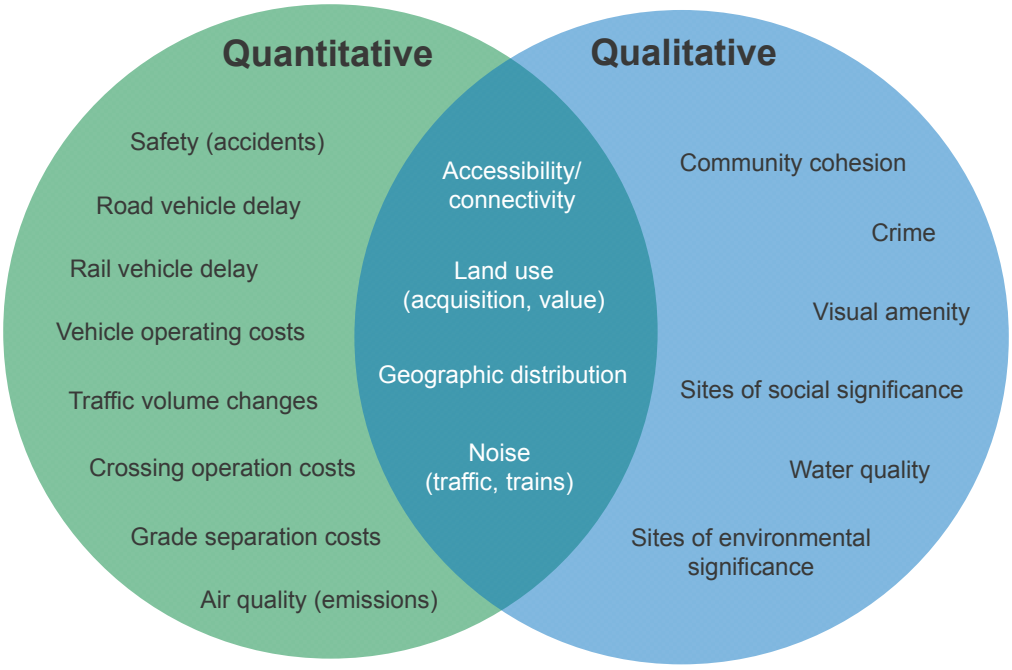
Transport & economic impacts have received the most research attention



Source: De Gruyter C and Currie G (2016) 'Impacts of Rail-Road Crossings: International Synthesis and Research Gaps' Transportation Research Board 95th Annual Meeting January 2016

MONASH University

But there is little quantitative understanding of social & environmental impacts



Source: De Gruyter C and Currie G (2016) 'Impacts of Rail-Road Crossings: International Synthesis and Research Gaps' Transportation Research Board 95th Annual Meeting January 2016

Take home messages

- Rail-road crossings generate a range of transport, economic, social and environmental impacts
- 18 types of impacts were identified through a detailed literature review
- Transport & economic impacts have received the most attention mostly road safety
- There is little quantitative understanding of social & environmental impacts, limiting their prominence in cost benefit analyses
- 10 key research gaps were identified to provide a clear agenda for future research into rail-road crossings

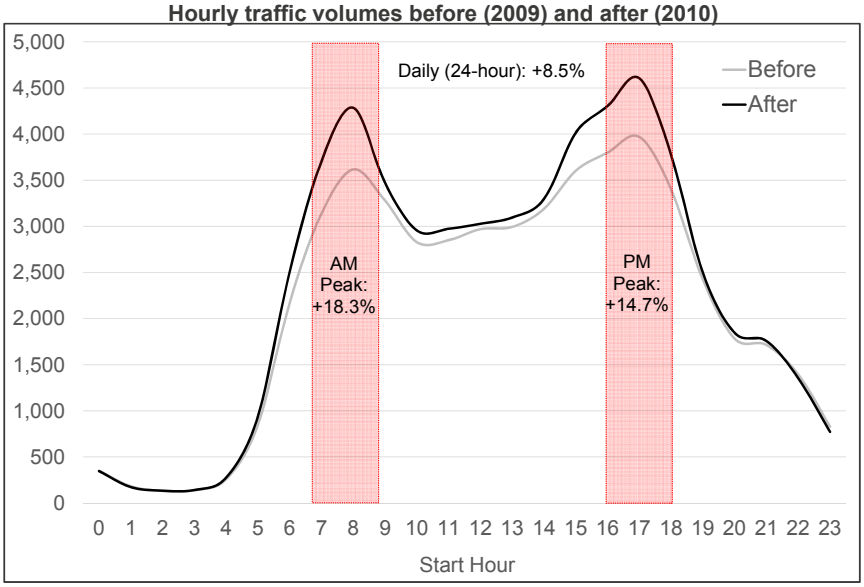
2. Measuring Impacts of Grade Crossing Removal

- Several projects in this area including
  - research by Dr Chris De Gruyter and VicRoads on the before and after effects of grade crossing removal on traffic
  - Also research by PhD Phuoc Quy Duy Nguyen who is studying how PT acts to reduces and also create traffic congestion in Melbourne
    - Including modelling of at grade rail crossing impacts on traffic

Before/after studies suggest 15-18% growth in traffic AFTER grade crossing removed…

- Increases in traffic volume on grade-separated road (up to 18% in AM peak)
- Decreases in traffic volumes on parallel (competing) routes
- Overall, slight increase in traffic volume (2-3%) across all sites in the local area
- Reductions in total travel times and travel time variability on key routes

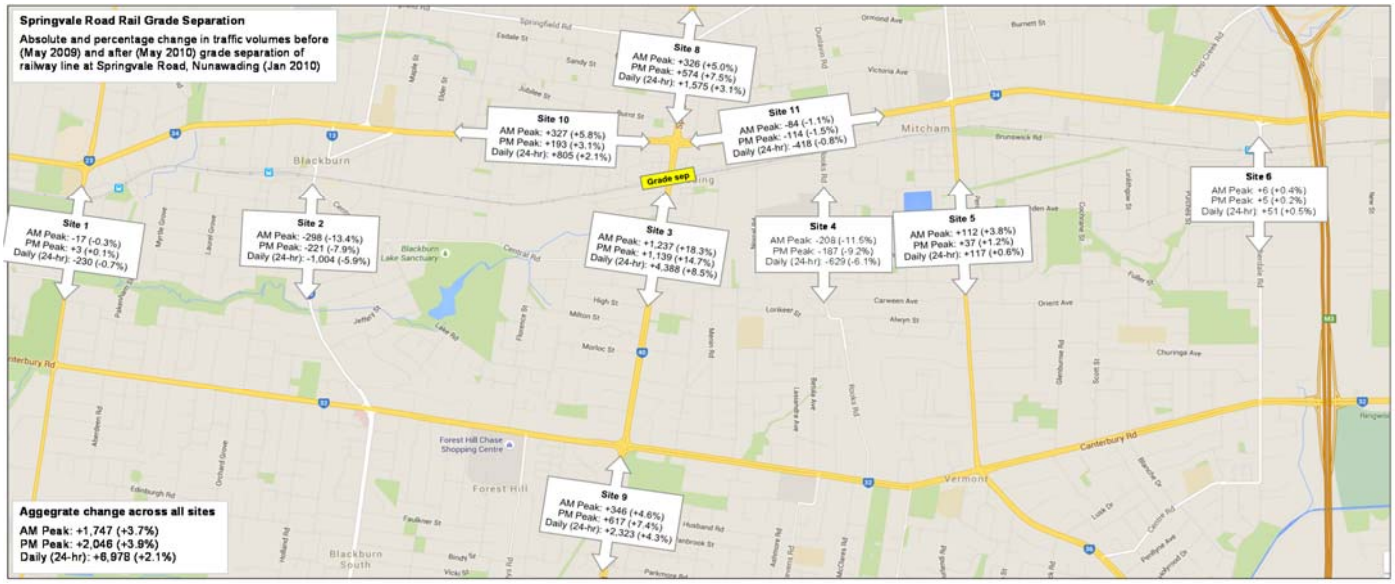
Springvale Road (Nunawading) grade separation: Hourly traffic volumes before (2009) and after (2010)



Data source: VicRoads (2010) *Nunawading Springvale Road Rail Separation Impact Study*

…impacts are network wide and involve much diversion from major roads

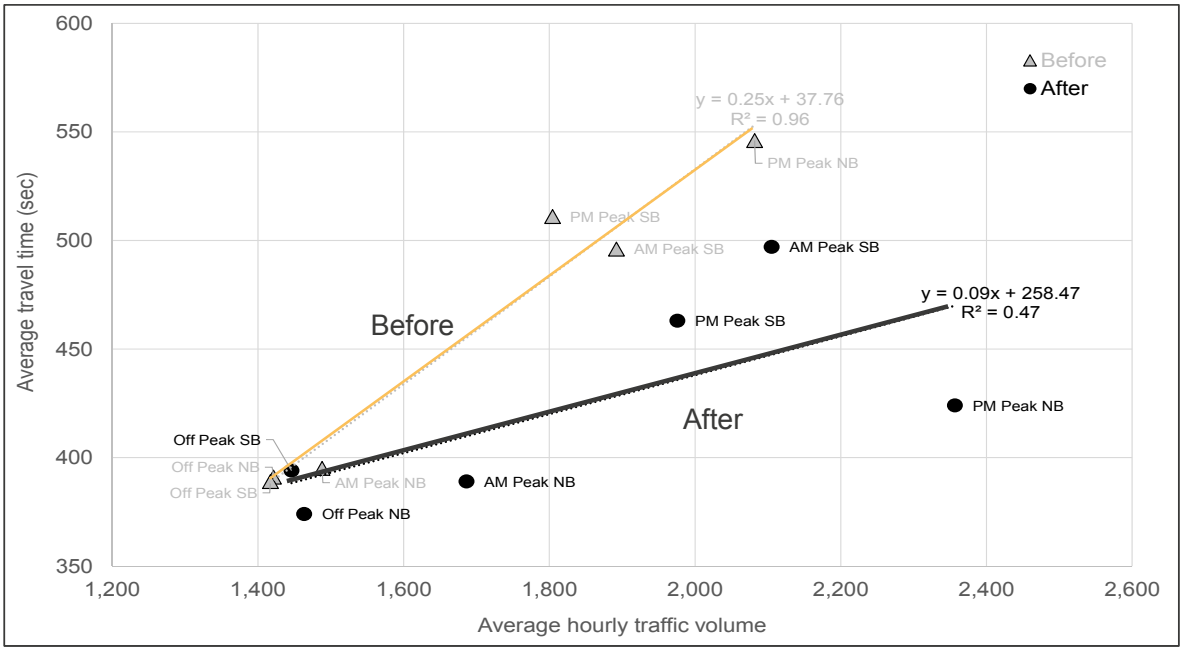
Figure 1: Changes in traffic volumes before (May 2009) and after (May 2010) grade separation of rail line at Springvale Road, Nunawading



Source: De Gruyter C (2015) 'Springvale Road Nunawading Grade Separation – Data Analysis Summary' Public Transport Research Group Working Paper 2 September 2015

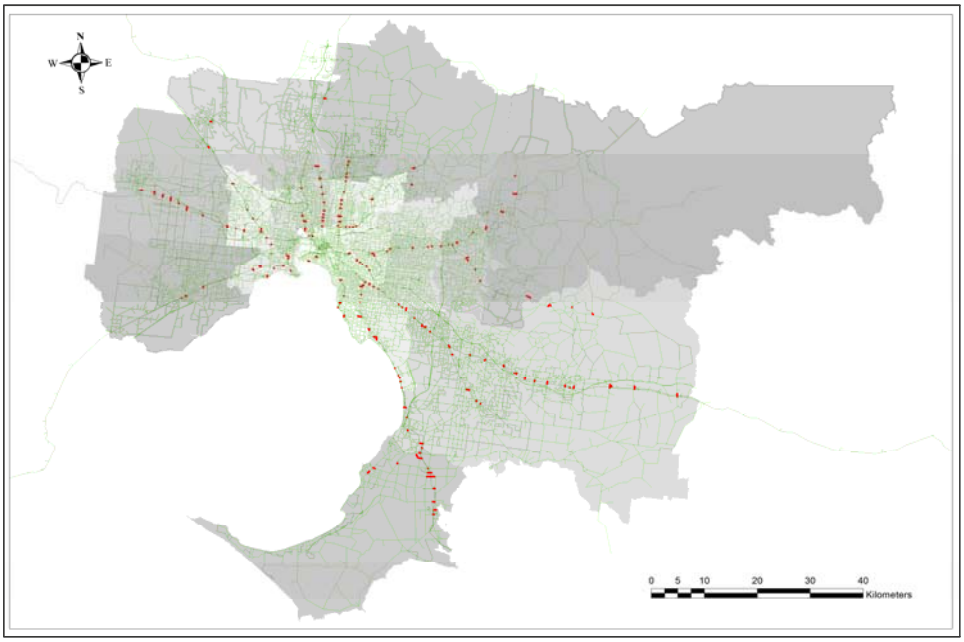
…but an overall improvement in travel time results

Figure 4: Relationship between travel times and traffic volumes before and after grade separation of the rail line



Source: De Gruyter C (2015) 'Springvale Road Nunawading Grade Separation – Data Analysis Summary' Public Transport Research Group Working Paper 2 September 2015

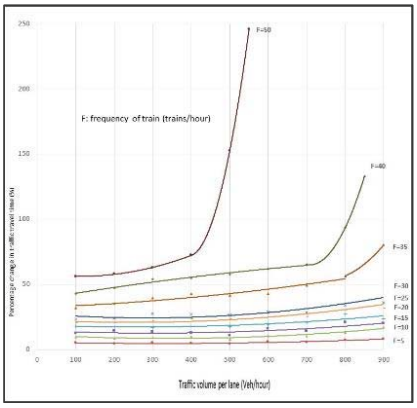
Modelling aims to understand delays to traffic from grade crossings using the Victorian Integrated Transport Model …and…



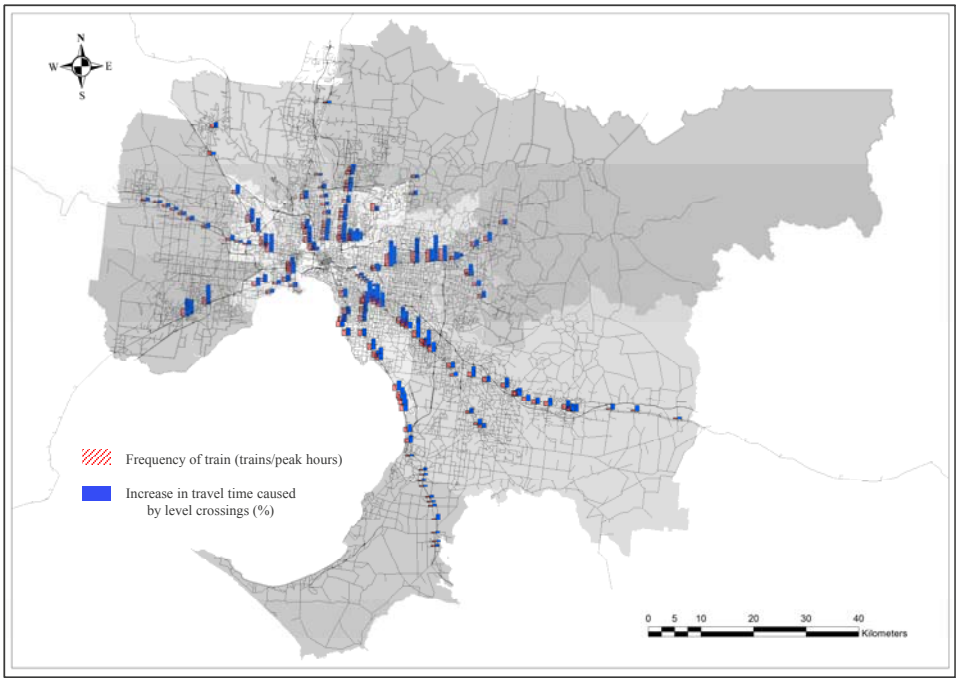
VITM road network & 177 crossings

Source: PhD research of Phuoc Quy Duy Nguyen

…Traffic Microsimulation Models…



Modelled change in traffic travel time by Rail service frequency at grade crossings



Localised variation in traffic travel time delay caused by at grade rail crossings

Source: PhD research of Phuoc Quy Duy Nguyen

…overall modelled impact of rail grade crossing removal is SMALL…

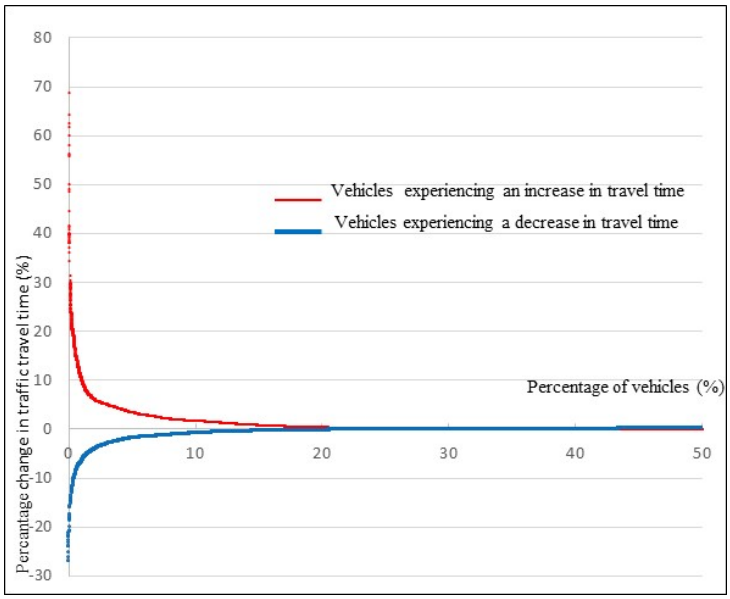
TABLE 4 Overall impact of at-grade rail crossings on Melbourne's road network weekday (7am-9am)

Measure	Base Case No at-grade rail crossing	Have at-grade rail crossing	Absolute change	Change (%)
Number of severely congested links (V/C>=0.9)	2,118.0	2,155.0	37	1.7
Number of moderately congested links (0.9>V/C>=0.8)	2,018.0	2,018.0	0	0.0
Length of congestion links (km)	1,181.7	1,189.8	8.1	0.7
Congested link (%)	9.2	9.3	0.1	0.1
Congested lane (%)	16.7	16.9	0.2	0.1
Number of vehicles experiencing congestion (millions)	16.83	16.96	0.13	0.7
Vehicle distance travelled (millions veh-km)	15.00	15.00	0	0.0
Vehicle time travelled (millions veh-hr)	0.380	0.381	0.001	0.3
Total delay on roadway (millions veh-hr)	22.62	22.68	0.06	0.3
Average travel time speed (km/h)	48.1	48.0	-0.1	-0.1
Actual travel time per km (min)	1.81	1.82	0.01	0.3

Source: PhD research of Phuoc Quy Duy Nguyen

…but a small number experience EXTREME DELAY removal

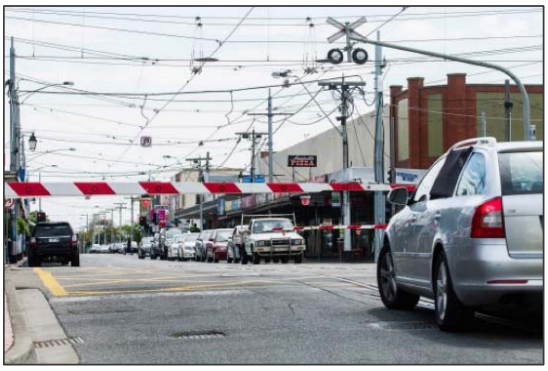
FIGURE 8 Distribution of travel time change of vehicles due to at-grade rail crossings



Source: PhD research of Phuoc Quy Duy Nguyen

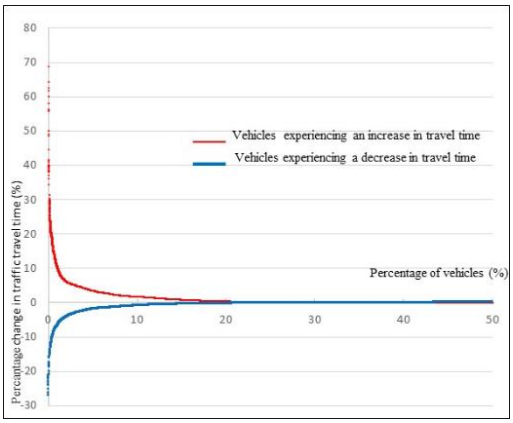
Agenda

1. Introduction
2. Research Perspectives
3. Comments



Current evaluation method doesn't work for grade separations and EXTREME DELAY

FIGURE 8 Distribution of travel time change of vehicles due to at-grade rail crossings



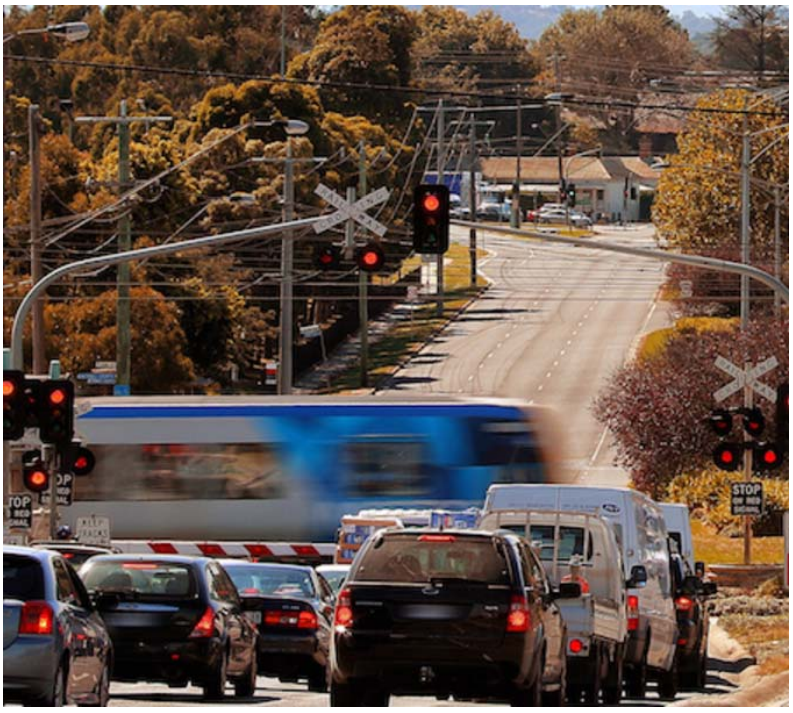
Source: PhD research of Phuoc Quy Duy Nguyen

Boom gate down time

Rail line	Road	Suburb	Maximum minutes boom gates are down between 7.00-9.00am weekdays	Percentage of peak period that boom gates are down
Cranbourne - Pakenham	Grange Road	Caulfield East	55	45.8%
	Koornang Road	Carnegie	87	72.5%
	Murrumbeena Road	Murrumbeena	75	62.5%
	Poath Road	Hughesdale	72	60%
	Clayton Road	Clayton	82	68.3%
	Centre Road	Clayton	75	62.5%
	Corrigan Road	Noble Park	72	60%
	Heatherton Road	Noble Park	73	60.8%
	Chandler Road	Noble Park	67	55.8%
Frankston	North Road	Ormond	30	25%
	McKinnon Road	McKinnon	48	40%
	Centre Road	Bentleigh	38	31.6%
Glen Waverley	Burke Road	Glen Iris	40	33.3%
Belgrave	Blackburn Road	Blackburn	54	45%
	Heatherdale Road	Ringwood	66	55%
Sunbury	Furlong Road	St Albans	35	29.1%
	Main Road	St Albans	65	54.1%

Source: Daniel Andrews Media Release "Data on Victoria's Worst Level Crossings Revealed" Thursday 7 May 2015

We can be a lot smarter in managing existing grade crossings

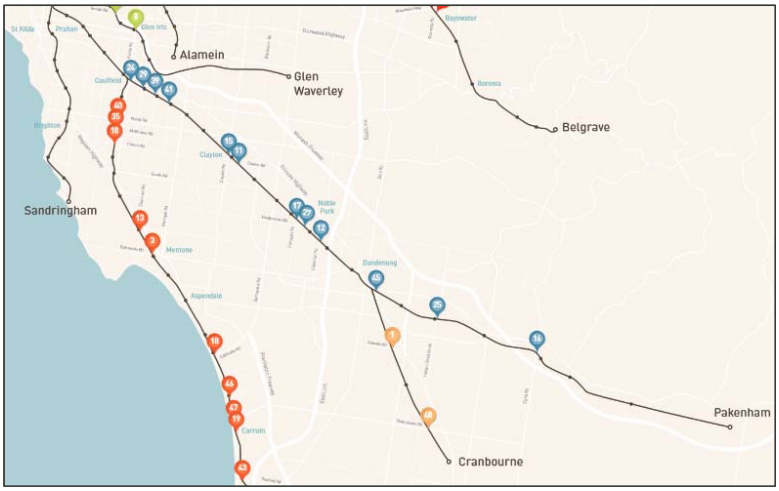


We don’t understand social, crime, streetscape and planning impacts – critical project issues

Figure 8: Dunn Street, Cremorne: grade-separated (rail over road)

Grade crossing removal is an opportunity to revolutionise Melbourne rail reliability

Instrumented Freight Rollingstock & Track

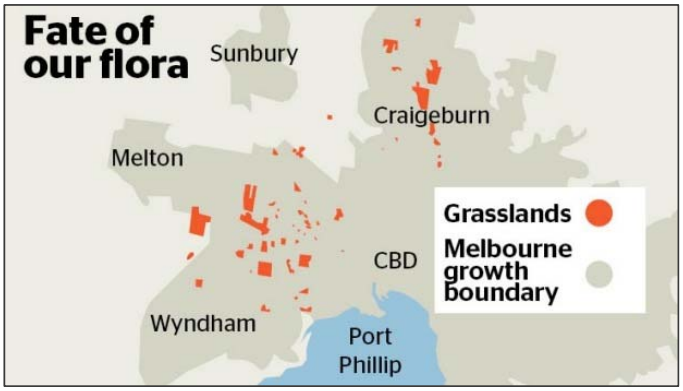


Significant Rebuilding of Track Sections Throughout Melbourne

‘Skyrail’ is ugly – no wonder some don’t like it

Its time to have an ecological & attractive solution

Swimming in Port Phillip Bay – not likely in future due to Melbourne Urban Water Quality

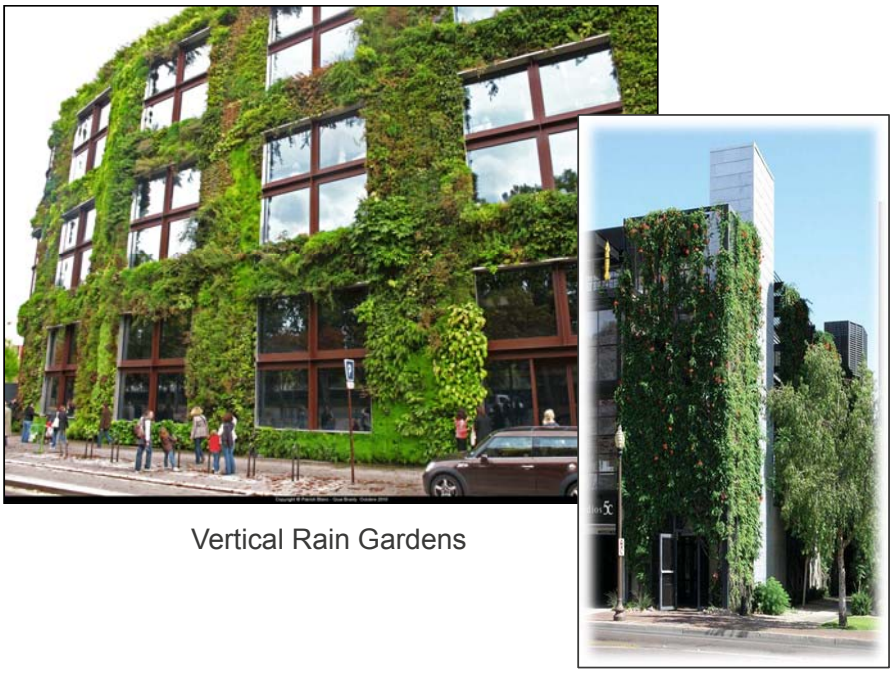


Melbourne development is reducing bio-diversity – a major challenge to future liveability

Its time to GREEN the grade separation program and 'Skyrail' in particular

Passive Urban Water Treatment Technologies

Urban Street Raingarden – Research suggest they substantially increase home values – a financially viable project



Vertical Rain Gardens

WORLD TRANSIT RESEARCH

Home About FAQ My Account

About World Transit Research

World Transit Research (WTR) is designed to help public transport practitioners and researchers get easier access to quality research in the field of public transport planning. WTR is a free repository of research papers, reports, research abstracts and links to research findings from leading research journals indexed and searchable to ensure easier access to topics of interest. The site is developed and run by the Public Transport Research Group at the Institute of Transport Studies, Monash University.

Browse Research

Subject Areas
Authors
Titles

www.worldtransitresearch.info

At a Glance

Top 10 Downloads
All time

Recent Additions
20 most recent additions

Paper of the Day

A case study of flexible solutions to transport demand in a deregulated environment
Jenny Brake and John D. Nelson

3,430 papers to date | full-text downloads to date | downloads in the past year

Enter search terms:
Search
in this repository
Advanced Search
Notify me via email or RSS

Browse
Subject Areas
Authors
Titles

Newsletter
Sign Up for Newsletter
Enter email here
Sign Up

Links
Related Sites

Author Corner
Author FAQ
Submit Research

Home | About | FAQ | My Account | Accessibility Statement
Disclaimer | Privacy | Copyright

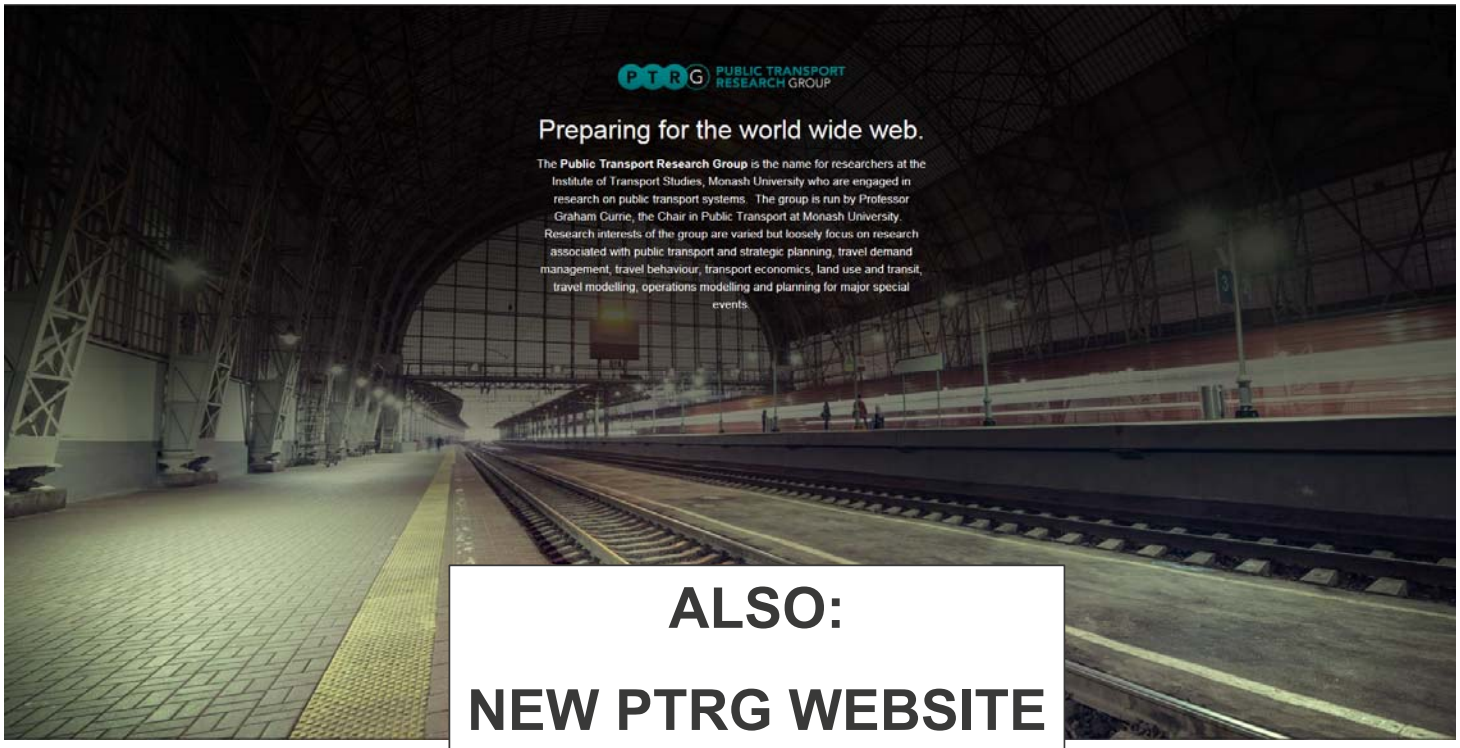
Institute of Transport Studies (Monash)
The Australian Research Council Key Centre in Transport Management

MONASH University

PTRG PUBLIC TRANSPORT RESEARCH GROUP

2025=PTx2

Showcase Award Winner



ALSO:

NEW PTRG WEBSITE

PTRG PUBLIC TRANSPORT RESEARCH GROUP

PTRG.INFO

Join the **ITS (Monash)** LinkedIn group to keep informed of our activities

Linked in

ITS (Monash)