Research Perspectives & Comments on Managing Rail Grade Crossings in Melbourne

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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

- Research Perspectives
- 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:
...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

18 types of impacts identified in total

<table>
<thead>
<tr>
<th>Transport &amp; Economic</th>
<th>Social</th>
<th>Environmental</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Safety (accidents)</td>
<td>1. Community cohesion</td>
<td>1. Air quality (emissions)</td>
</tr>
<tr>
<td>2. Road vehicle delay</td>
<td>2. Land use (acquisition, value)</td>
<td>2. Water quality</td>
</tr>
<tr>
<td>5. Rail vehicle delay</td>
<td>5. Crime</td>
<td></td>
</tr>
<tr>
<td>7. Crossing operation costs</td>
<td>7. Sites of social significance</td>
<td></td>
</tr>
<tr>
<td>8. Grade separation costs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Transport & economic impacts have received the most research attention

But there is little quantitative understanding of social & environmental impacts

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

2. Measuring Impacts of Grade Crossing Removal

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

...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


2. Measuring Impacts of Grade Crossing Removal

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

Source: PhD research of Phuoc Quy Duy Nguyen
2. Measuring Impacts of Grade Crossing Removal

...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

2. Measuring Impacts of Grade Crossing Removal

...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)

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

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

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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

<table>
<thead>
<tr>
<th>Rail line</th>
<th>Road</th>
<th>Suburb</th>
<th>Maximum minutes</th>
<th>Boom gates are down between 7:00-9:00am weekdays</th>
<th>Percentage of peak period that boom gates are down</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cranbourne -</td>
<td>Grange Road</td>
<td>Caulfield East</td>
<td>55</td>
<td>45.8%</td>
<td></td>
</tr>
<tr>
<td>Pakenham</td>
<td>Koong Road</td>
<td>Carnegie</td>
<td>87</td>
<td>72.5%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Murrumbeena Road</td>
<td>Murrumbeena</td>
<td>75</td>
<td>62.5%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Forest Road</td>
<td>Highton</td>
<td>72</td>
<td>60%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Elwood Road</td>
<td>Clayton</td>
<td>82</td>
<td>88.3%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Centr Road</td>
<td>Clayton</td>
<td>75</td>
<td>62.5%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Corrigan Road</td>
<td>Noble Park</td>
<td>72</td>
<td>60%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Heatherton Road</td>
<td>Noble Park</td>
<td>73</td>
<td>60.8%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chandler Road</td>
<td>Noble Park</td>
<td>67</td>
<td>55.8%</td>
<td></td>
</tr>
<tr>
<td>Frankston</td>
<td>North Road</td>
<td>Ormond</td>
<td>50</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>McKinnon Road</td>
<td>McKinnon</td>
<td>48</td>
<td>40%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Warragul Rd</td>
<td>Bayswater</td>
<td>32</td>
<td>31.6%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Barwon Rd</td>
<td>Geelong</td>
<td>60</td>
<td>32.3%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Elwood Rd</td>
<td>Warragul Rd</td>
<td>54</td>
<td>45%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Heatherton Rd</td>
<td>Ringwood</td>
<td>66</td>
<td>58%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Furloong Rd</td>
<td>St Albans</td>
<td>35</td>
<td>29.1%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Main Rd</td>
<td>St Albans</td>
<td>65</td>
<td>54.1%</td>
<td></td>
</tr>
</tbody>
</table>

Source: PhD research of Phuoc Quy Duy Nguyen


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

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

Melbourne development is reducing biodiversity – 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

www.worldtransitresearch.info
Also:
NEW PTRG WEBSITE
PTRG.INFO

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