Understanding the Wider Value of Honor Based Ticketing in Light Rail

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Light Rail 2016 – Transforming the urban transport landscape
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Agenda

1. Introduction
2. Research Context
3. Model Development
4. Results
5. Discussion and Conclusions
Melbourne, like most Light Rail systems, uses Honor Based or Proof-of-Payment (POP) fare collection

- Passengers must have valid ticket
- Random **ticket inspections** for enforcement
- Allows passengers to board and alight at any door

All door boarding and alighting in Melbourne, Australia

This is often criticised in the media/community because of high fare evasion rates

![Graph showing fare evasion and lost revenue](image)

Source: ITS (Monash) analysis of the Fare Evasion and Valid Concession Percentage Survey - 2011
An alternative is Pay-on-Entry (POE) fare control such as adopted in Toronto

- **Pay fare** to driver on boarding, or show valid pass, transfer etc.
- Allows close monitoring of fare payment
- Requires all passengers to board by the front door

Front Door Boarding on a Toronto Transit Commission Streetcar

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The trade-offs between POE and POP on LRT have not been fully explored

<table>
<thead>
<tr>
<th>Pay-on-Entry (POE)</th>
<th>Honor Based / Proof-of-Payment (POP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pay driver</td>
<td>Pre-purchase ticket</td>
</tr>
<tr>
<td>Longer boarding times</td>
<td>Shorter boarding times</td>
</tr>
<tr>
<td>Lower fare evasion</td>
<td>Higher fare evasion</td>
</tr>
</tbody>
</table>

Fare Revenue Increases?
Operational Costs / Savings?
Capital Costs?
Fare Evasion Losses?
Operational Costs / Savings?
Capital Savings?

**THIS RESEARCH:**
- Develops a model of the Melbourne Tram Network to directly compare the overall financial impacts of POE with POP, and
- Investigates how:
  - Reduced fare evasion under POE fare control; compares to
  - Costs due to slower boarding times compared to Honor Based/ POP system.

Trams in Melbourne have open access, while trains and buses have more control of fare payment

Melbourne Tram Network
- Enter by any door (open access)
- No interaction with driver
- Roving ticket inspectors

Melbourne Rail Network
- Barrier gates at central stations
- Roving ticket inspectors

Melbourne Bus Network
- Enter by front door only
- Validate smartcard in front of driver
- Some roving ticket inspectors
Melbourne’s trams use the “myki” smartcard system, with passengers required to “touch on” after boarding.

*Except in the FREE TRAM ZONE in the city center*

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**Fare Evasion Trends**

![Graph showing fare evasion trends in Melbourne](image-url)

*Source: Public Transport Victoria Victorian Official Fare Compliance Series May 2015*
Would Melbourne Trams have been better off with POE instead of the myki POP system?

The Age Newspaper: June 2010, October 2011 and June 2011

Melbourne trams vs Toronto streetcars

- Some of the largest streetcar systems in the world
  Melbourne = 167 kms (104 miles)  Toronto = 71 kms (44 miles)

- Different Fare Control Systems
  Melbourne = POP  Toronto = mostly POE
Melbourne vs Toronto

- **Melbourne**
  - Tickets **pre-purchased**
  - Validated during or after entry
  - **No interaction** with driver

- **Toronto**
  - Pay-on-Entry (POE) fare **paid to farebox** in front of driver
  - Pass or transfer must be shown to driver
  - **Front door boarding** only
  - Some Proof of Payment (POP) zones but on only a limited number of routes

Previous Research - Currie, Delbosc and Reynolds (2012)

- Melbourne and Toronto **dwell time** surveys
- **Regression models** developed including one with a factor for fare control type

\[
\text{Dwell time} = 3.7 + 0.9a + 0.7b + 13.4c - 6d + 3.4e + 9.8f
\]

Where:
- \(a\) = Number of boardings
- \(b\) = Number of alightings
- \(c = 1\) if 4 doors, else 0
- \(d = 1\) if platform stop, else 0
- \(e = 1\) if steps, 0 otherwise,
- \(f = 1\) if pay-on-entry, 0 otherwise

- Model implies that average dwell time for POE is **9.8 seconds higher per stop** than for POP

Model Structure - Outline

- Compares POE fare control impacts with the (existing) POP across 22 of the 26 tram routes in Melbourne
- Determines operational, ridership and fare payment impacts
- Calculates capital cost and annual revenue / cost impacts
- Uses a Discount Cash Flow Analysis to calculate a BCR of switching to POE
Overall model - Detail

Key
- Operational Impacts
- Ridership and Fare Payment Impacts
- Capital Cost Impacts
- Anticipated Revenue Cost Impacts

Pay-On-Entry (POE) fare control vs Proof-of-Payment (POP) fare control

- Longer Dwell Times - Reduction in Fare Evasion - Fewer Ticket Validation Machines
- Longer Vehicle Journey Times - Increased Fare Payment - Less Maintenance
- Increased Vehicle Requirements - Decrease in Fines Levied - Increased Revenue
- Longer Passenger Journey Times - Decreased Ridership - Decreased Revenue
- Decreased Vehicle Journey Times - Increased Operating Costs - Decreased Capital Costs
- Decreased Ridership - Better Financial Performance
- Decreased Revenue - Decreased Operating Costs
- Increased Operating Costs - Decreased Capital Costs

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Impact of Conversion – Honor/POP vs POE

Savings Resulting from Pay the Driver Ticketing

Costs Resulting from Pay the Driver Ticketing

Open access saves $29M p.a. operating costs & $210M in Capital – increases ridership 10% and saves 49 LRVs

Melbourne – Open Access; Proof of Payment Ticketing

Toronto – Pay the Driver Ticketing

## Aggregate Results

### Financial Analysis

<table>
<thead>
<tr>
<th></th>
<th>Annual</th>
<th>Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>POE Benefits ($AU)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduced fare evasion losses</td>
<td>8.1m</td>
<td></td>
</tr>
<tr>
<td>Reduced staffing costs</td>
<td>15.8m</td>
<td></td>
</tr>
<tr>
<td>Reduced maintenance of validation machines</td>
<td>3.1m</td>
<td></td>
</tr>
<tr>
<td>Fewer ticket validation machines</td>
<td></td>
<td>65.5m</td>
</tr>
<tr>
<td><strong>POE Costs ($AU)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower fare revenue</td>
<td>17.4m</td>
<td></td>
</tr>
<tr>
<td>Lower fine revenue</td>
<td>9.2m</td>
<td></td>
</tr>
<tr>
<td>Increase vehicle operation costs</td>
<td>29.8m</td>
<td></td>
</tr>
<tr>
<td>New vehicles</td>
<td></td>
<td>276.0m</td>
</tr>
<tr>
<td><strong>Total ($AU) Benefits – Costs</strong></td>
<td>-29.4m</td>
<td>-210.5m</td>
</tr>
</tbody>
</table>

### Discount Cash Flow Analysis

- BCR
  - 30 years at 6% discount rate 0.44

### Route Based Results

- BCR of POE goes **down** as stops per kilometre goes **up**
- BCR of POE goes **up** as ridership increases
- However $R^2$ is < 0.2
Sensitivity Analysis

Most Sensitive to Dwell Time

Least Sensitive to Ridership and Fare

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Findings

- Melbourne trams have worse financial performance under POE than POP
  - $AU27.0m annual benefits and $AU65.5m capital savings
  - But $AU56.4 annual costs and $AU276.0m capital expense
  - BCR of only 0.44
- Costs associated with longer stop dwell times far outweigh the benefits of POE for reducing fare evasion and staffing costs
- Lower levels of ridership, increased fleet size and operating costs are significant financial penalties of operating a POE fare system

Toronto – should stop using POE!...

Front Door Boarding on a Toronto Transit Commission Streetcar
... AND THEY HAVE
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