Using ITS to Measure and Mitigate Traffic Congestion at Railroad Crossings

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Presentation for
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We produce real-time railroad crossing blockage data.
We measure traffic impacts caused by blocked railroad crossings.
We provide ITS solutions to mitigate traffic impacts.
STAGE 1
Understand when & how long crossings are blocked

STAGE 2
Understand traffic impacts of blocked crossings

STAGE 3
Mitigate traffic impacts caused by blocked crossings
Understand traffic impacts of blocked crossings
Measures travel delay

Measures travel time

Measures blockages
Train crossing blockage and duration

Expected travel time without a train

Actual travel time with a train

Delay caused by train

\[ V_D = \left(\frac{1}{2}\right) \times \frac{qT_G^2}{(1 - q/d)} \]

- Conventional Method
- Modeled
- Measured
- Our Method
<table>
<thead>
<tr>
<th>Metric</th>
<th>Modeled</th>
<th>Measured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of blockages</td>
<td>3,185</td>
<td>3,422</td>
</tr>
<tr>
<td>Total blockage duration</td>
<td>148.6 hr</td>
<td>336.5 hr</td>
</tr>
<tr>
<td>Average veh-delay/blockage</td>
<td>19.9 min</td>
<td>86.7 min</td>
</tr>
<tr>
<td>Average delay per vehicle</td>
<td>2.4 sec</td>
<td>20.4 sec</td>
</tr>
<tr>
<td>Total vehicle-delay</td>
<td>40 days</td>
<td>365 days</td>
</tr>
</tbody>
</table>

* 91-day study period

9x higher
30% of delay caused by 15% of blockages

240 blockages lasted 10 min. & caused 80,000 min of vehicle-delay

1,385 blockages

23 blockages

Same delay
Mitigate traffic impacts caused by blocked crossings
WAVERLEY ST
- Major N/S arterial
- 30,000 vpd
- 4-lanes
- Signalized
- 35-45 mph
- 30+ trains/day
What we did

- Installed train detection and Bluetooth sensors
- Developed crossing blockage prediction profiles
- Developed travel time prediction profiles
- Developed DMS messages
Current messages to NB Waverley drivers

Without Train

With Train
Travel Time Recovery

Train Clears Crossing

Travel Time Recovery for 6 Minute Trains

Travel Time Recovery for 12 Minute Trains

Expected Travel Time

Travel Time (minutes)

Queue Recovery Time (minutes)
25% GHG emissions
Driver feedback...

“I’m much more relaxed and calm as I approach the railway crossing now that I know when it will be blocked.”

*Translation: Improved safety*

“Now that I can re-route [around blocked railway crossings] I don’t think an underpass is needed anymore.”

*Translation: Cost savings*

“I use the [roadside] sign every day to decide if I should re-route around the crossing.”

*Translation: Time savings*
CONCLUDING REMARKS
Measuring traffic delays at RR crossings much more accurate. Conventional modeling method can underestimate by 9x.

Grade separation is not always viable. ITS options are available as a cost-effective solution.

Many drivers just want information. They understand underpasses are not always possible.

Next generation of products being developed for CAVs. Testing Vehicle-to-Railroad (V2R) applications.
Safe and seamless mobility at railroad crossings

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