Performance-based Decision-Support Framework for Developing Grade Separation Program in Southern California

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Outline

- Objectives
- Background
- Overview of Performance-based Decision-Support Framework
- Data and Models for At-Grade Crossing Performance Evaluation
- Criteria and Considerations for Grade Separation Program
- Application to Southern California
- Conclusions
- Future Work
Objectives

- Describe a performance-based decision-support framework that can:
  - Evaluate Performance of At-Grade Crossings
  - Select At-Grade Crossings for Grade Separation Program

- Describe “Train Builder” model and “At-Grade” model that constitute framework; and

- Present Case Study Results – Southern California
Background

Issues with grade separation investments

» Growing rail and highway traffic increases at-grade crossing conflicts

» Grade separation projects are costly, requiring major financial commitments

» Funding for grade crossing separations and other improvements beyond automated equipment is scarce

» On a purely economic basis, grade separations are difficult to justify
Background

Common methodologies for evaluating grade separation projects

» Focus primarily on safety-related aspects (U.S. DOT’s Accident Prediction Model and Field Diagnostics)

» Multiple measures analysis
  • Benefit-cost analysis (FRA’s GradeDec.NET)
  • Performance-based but with scoring or ranking (Riverside County Transportation Commission’s Grade Separation Strategy)
  • Performance-based but without scoring or ranking

» Do not readily incorporate effects of alternative scenarios for future rail traffic development
Data and Assumptions for At-Grade Crossing Performance Evaluation

Data

» Average annual daily vehicular traffic
» Time of day distributions
» Daily train volumes by train length and type
» Truck percentages
» Accident data
» Average idling emission rates

Forecasting Assumptions
“Train Builder” Model

- Dynamically estimates train volumes based on traffic projections and train operating characteristics
- Current capability – Intermodal train volumes in Southern California
“At-Grade” Model

- Incorporates highway and rail traffic data to estimate impacts of rail-highway traffic conflicts
- Current capability – At-Grade Crossing Delays in Southern California – LA to Barstow in North & Indio in East

\[ V = \left( \frac{1}{2} \right) \frac{qT_G^2}{(1 - q/d)} \]
## Example Criteria for Grade Separation Program

<table>
<thead>
<tr>
<th>Performance Measure</th>
<th>Criterion or Threshold Value for Each At-Grade Crossing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. Average Annual Daily Traffic</td>
<td>1,000 vehicles / day</td>
</tr>
<tr>
<td>Min. Daily Train Volumes</td>
<td>10 trains / day</td>
</tr>
<tr>
<td>Current Daily total vehicular delays</td>
<td>25 Vehicle-hours / day</td>
</tr>
<tr>
<td>Future Daily total vehicular delays</td>
<td>50 Vehicle-hours / day</td>
</tr>
<tr>
<td>Crash rate</td>
<td>5 crashes per 100 million vehicle-train conflicts per year</td>
</tr>
<tr>
<td>Current Annual Emissions related Damage Costs (in 2010$) for Criteria Pollutants (NOx, ROG, PM2.5 and CO)</td>
<td>$500 / year</td>
</tr>
<tr>
<td>Current Annual Emissions related Damage Costs (in 2010$) for Criteria Pollutants (NOx, ROG, PM2.5 and CO)</td>
<td>$1,000 / year</td>
</tr>
</tbody>
</table>
Other Considerations for Grade Separation Program

- Proximity to noise-sensitive receptors and emergency responders
- Engineering feasibility and costs
- Equity
- Local factors
Application to Southern California

- About 2,360 public at-grade crossings
- Roughly only 20% of these meet the minimum traffic criteria
- On 5 freight rail mainlines, about 90 satisfy the minimum traffic criteria as well as one of the other selection criteria, benefits of grade separating these 90 at-grade crossings
  - ~2,000 daily veh-hrs of delay can be avoided in 2010
  - ~7,800 daily veh-hrs of delay reduction by 2035
  - ~77 highway-rail accidents between 2006-2010 could have been avoided
  - ~$211,000 emissions related damage cost reduction by 2035
Application to Southern California

- Grade Separation Program in the 2012-2035 RTP/SCS consists of 71 crossings – completed prior to full framework development.
- 50 of the crossings satisfy the set criteria and rest cannot be evaluated.
Conclusions

- Multiple measures based framework developed for evaluation of at-grade crossings performance and selection for grade separation program, but done without ranking.

- Implemented “Train Builder” and “At Grade” models to compute vehicle hours of delay at all at-grade crossings between downtown Los Angeles and Barstow to the north and Indio to the east for 2010 and 2035.

- Framework can be readily adapted to other regional and local transportation plans after data acquisition.
Future Work

- Incorporate a risk based model for safety
- Develop and integrate estimation of non-intermodal and passenger train volume forecasts within the “Train Builder” model
- Develop and incorporate prioritization or ranking procedure