Reversible Lanes and Integrated Corridor Management

Expanding the Applicability and Positive Impact of Managed Lanes with the Convergence of ICM and Reversible Lanes

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Managed Lanes Take Many Forms
Managed Lanes and Uncertainty

Uncertainty: Volume Forecasts

- Volume forecasts
  - Mean error: 19%
  - Error range: -60% to +57%
- Toll road volume forecasts
  - Error range: -85% to +50%

References
1. Inaccuracy in Traffic Forecasts, Bent Flyvbjerg, Mette Skamris Holm, and Søren L. Buhl
2. An Investigation of the Causes of Over-optimistic Patronage Forecasts for Selected Recent Toll Road Projects, GHD
Managed Lanes and Uncertainty (cont’d)

Uncertainty: Impact of CV/AV Technology

- Uncertainty about the adoption rate of AVs
- Uncertainty about the capacity impact of AVs
- Uncertainty about the increase in VMT due to AVs
Addressing Uncertainty

“As far as the laws of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality.”
— Albert Einstein

When there is uncertainty, cost-effectiveness and flexibility are outstanding attributes to have!
What is this presentation about?

Reversible managed lanes on freeways using moveable barrier technology

Adopting reversible managed lanes into Integrated Corridor Management (ICM)

Cost-effectiveness and flexibility through the provision of reversible managed lanes
Reversible Managed Lanes

Closing a contraflow reversible lane
Reversible Managed Lanes (cont’d)

Contraflow lane configuration

AM Peak

PM Peak

8
Reversible Managed Lanes (cont’d)

Contraflow lane configuration a.m. peak
Reversible Managed Lanes (cont’d)

Contraflow lane configuration off-peak
Reversible Managed Lanes (cont’d)

Contraflow lane configuration p.m. peak
Reversible Managed Lanes (cont’d)

Moveable median lane configuration

AM Peak

PM Peak
Reversible Managed Lanes (cont’d)

Further characteristics

- Number of applications are growing -
  - Permanent projects: 21
  - Construction projects: 250
- Implementation time: 10-12 months
- HPMS analysis: few hundred locations in U.S. meets directionality requirement
- High level of reliability. Example - one delay of 30 min. in reversing the direction of lanes 19,800 times (5 years) in Dallas
- Construction and operational cost typically 10% to 15% of project requiring the construction of managed lanes
Incident reduction due to moveable barrier

A TTI analysis\(^1\) of a moveable barrier-separated contraflow managed lane and a buffer – separated managed lane found the following: *No increase in injury accidents with moveable barrier, while buffer-separated managed lanes showed an increase in injury accidents.*

\(^1\)Crash Analysis of Selected High-Occupancy Vehicle Facilities in Texas: Methodology, Findings, and Recommendations, A. Scott Cothron, Stephen E. Ranft, Carol H. Walters, David W. Fenno, and Dominique Lord, Texas Transportation Institute, May 2004
## Contraflow Managed Lanes

### Minimum directional split requirement

<table>
<thead>
<tr>
<th>Number of Lanes</th>
<th>Percentage Traffic in Off-Peak Direction</th>
<th>Percentage Traffic in Peak Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>33</td>
<td>67</td>
</tr>
<tr>
<td>6</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>8</td>
<td>43</td>
<td>57</td>
</tr>
<tr>
<td>10</td>
<td>44</td>
<td>56</td>
</tr>
</tbody>
</table>
Contraflow Managed Lanes (cont’d)

Considerations for the implementation of contraflow managed lanes

- Directional split
- Left on- and off-ramps
- Ability to bring contraflow lane traffic back to the general purpose lanes
Contraflow Managed Lanes (cont’d)

Example Application 1
Contraflow Managed Lanes (cont’d)

Example Application 2
Contraflow Managed Lanes (cont’d)

Example Application 3
Incidents and Contraflow Managed Lanes

Delay due to all non-recurring incidents

Incidents*  →  60% of traffic congestion delay (FHWA)

*Includes: traffic incidents, work zones, special events
The role of contraflow managed lanes

“Dynamic lane reversal or contraflow lane reversal can address a severe imbalance in V/C conditions” ¹

Reference

How can contraflow managed lanes address a severe imbalance in V/C conditions?
Integrated Corridor Management

- Maximize corridor capacity through:
  - New institutional models
  - New technology
  - More dynamic operational strategies
- “Network” vs. Individual corridors
Contraflow Managed Lanes and Integrated Corridor Management

CML/ICM system
Contraflow Managed Lanes and Integrated Corridor Management (cont’d)

CML/ICM system corridor

- Add crossover
- Place barrier transfer machine
- Add T-Ramp with reversible ramps
- Add T-Ramp with reversible ramps
- Add crossover
- Place barrier transfer machine
- Overpasses
- Arterial
- Freeway
### CML/ICM system - incident response time

<table>
<thead>
<tr>
<th>Contraflow Lane Situation</th>
<th>Response Time To Ready a Contraflow Lane for use by Traffic Delayed by an Incident (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak period contraflow lane is in use</td>
<td>10*</td>
</tr>
<tr>
<td>Contraflow lane needs to be set up</td>
<td>30*</td>
</tr>
</tbody>
</table>

*Response time can vary, depending on the design of the CML/ICM system in terms of the spacing of crossovers, transfer machines, and T-ramps, and the location of the incident.*)
Contraflow Managed Lanes and Integrated Corridor Management (cont’d)

CML/ICM system – example decision support components

Initial Information Needs
- Location of incident
- Capacity reduction
- Estimated duration of incident

Decision Support System
- Status of contraflow lane – open or closed, direction
- Real time traffic operational information e.g. volumes, level of delay
- Capacity needs (one or two lanes?)
- Crossover locations to be used
- T-ramps to be used
- Total response time vs. duration of incident
- Go or no-go
Contraflow Managed Lanes and Integrated Corridor Management (cont’d)

CML/ICM System Summary

- Quick to implement – 10 to 12 months
- Cost-effective – 10% to 15% of cost to construct managed lanes
- Flexibility – addresses future uncertainty, recurring, non-recurring congestion
- Increased reliability, enhances ICM capabilities
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