

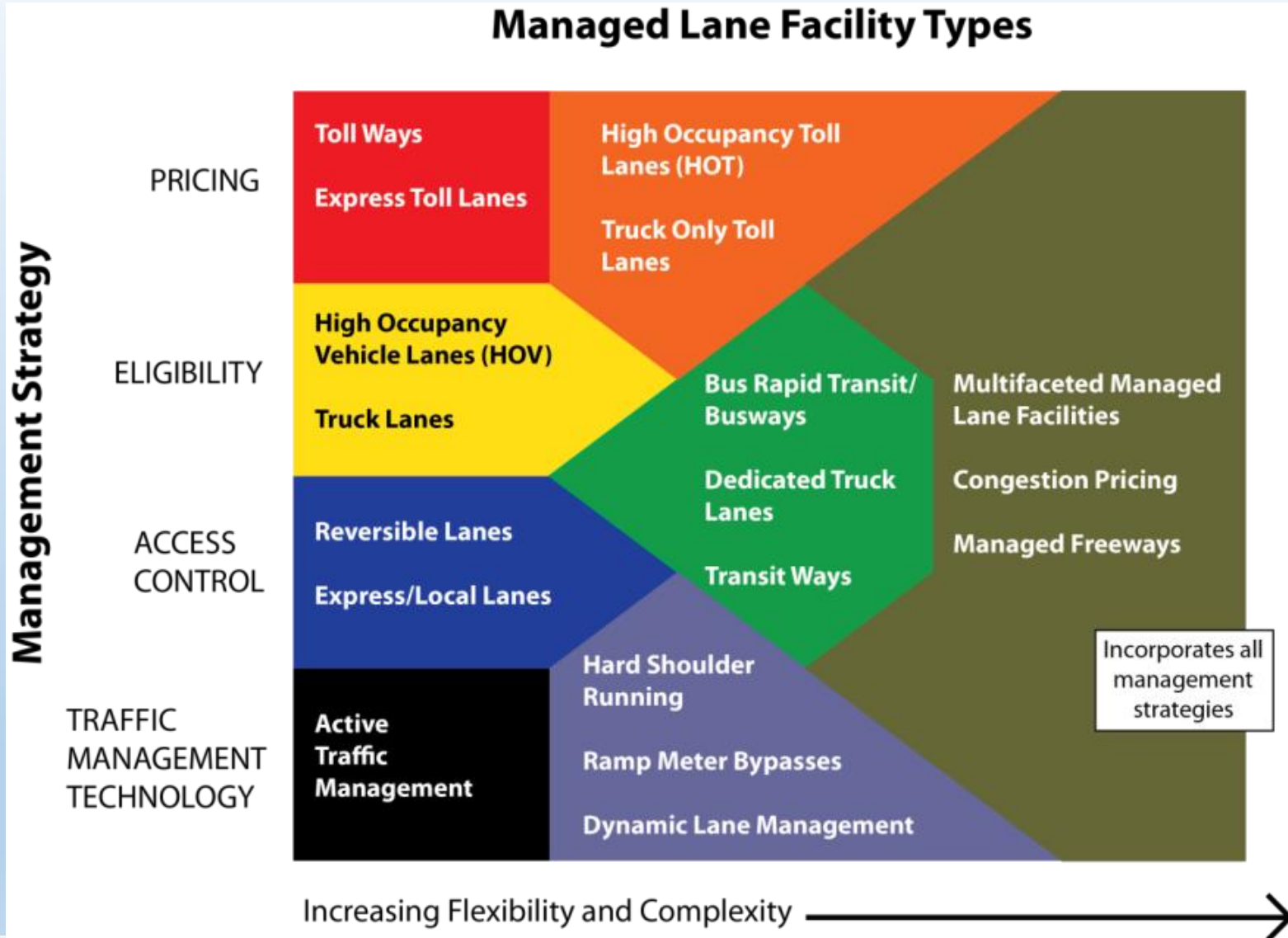
# Reversible Lanes and Integrated Corridor Management

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

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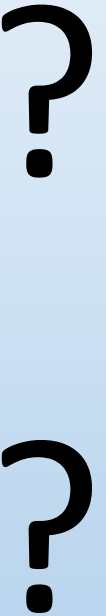
# Managed Lanes Take Many Forms



# Managed Lanes and Uncertainty

## Uncertainty: Volume Forecasts

- Volume forecasts
  - Mean error: 19%
  - Error range: -60% to +57%<sup>1</sup>
- Toll road volume forecasts
  - Error range: -85% to +50%<sup>2</sup>



### 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

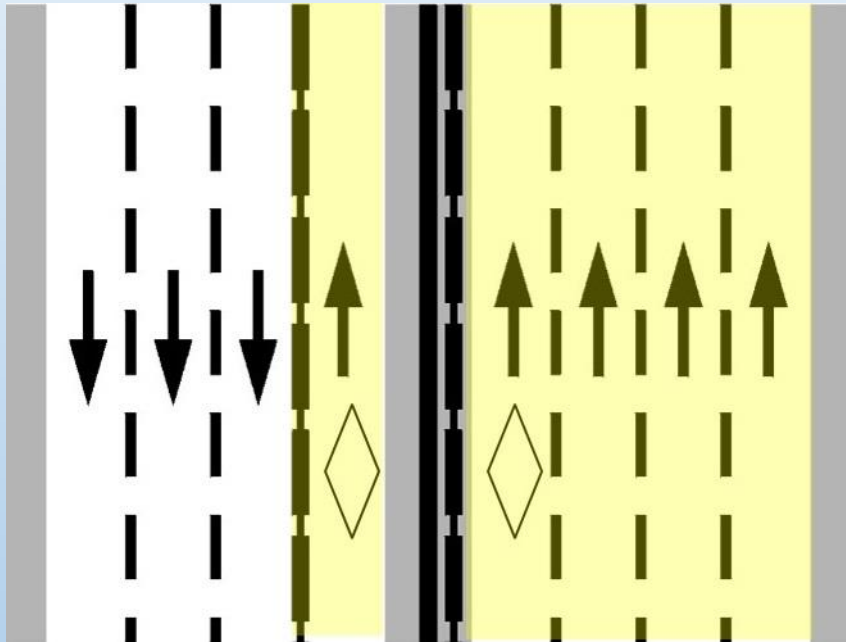
## Closing a contraflow reversible lane



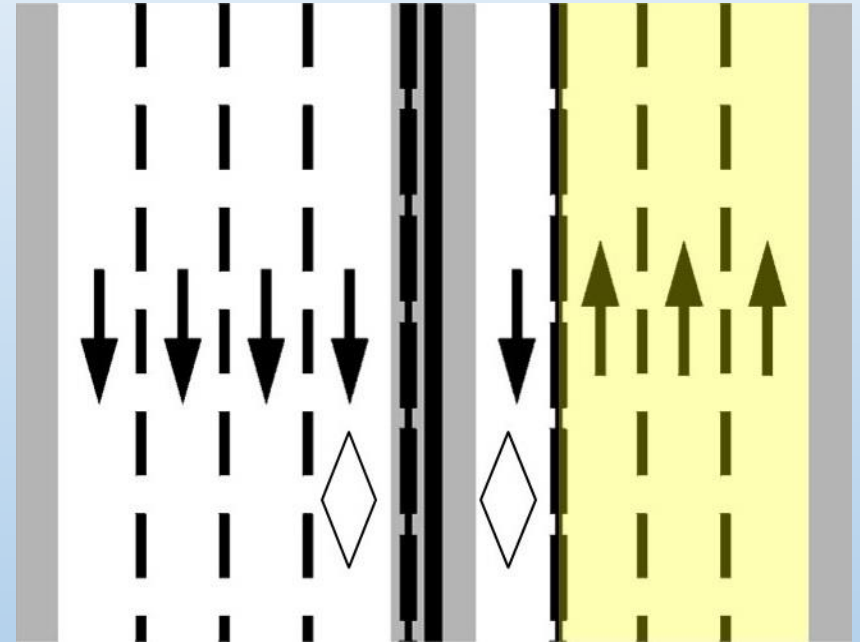
# Reversible Managed Lanes (cont'd)

## Contraflow lane configuration

AM Peak



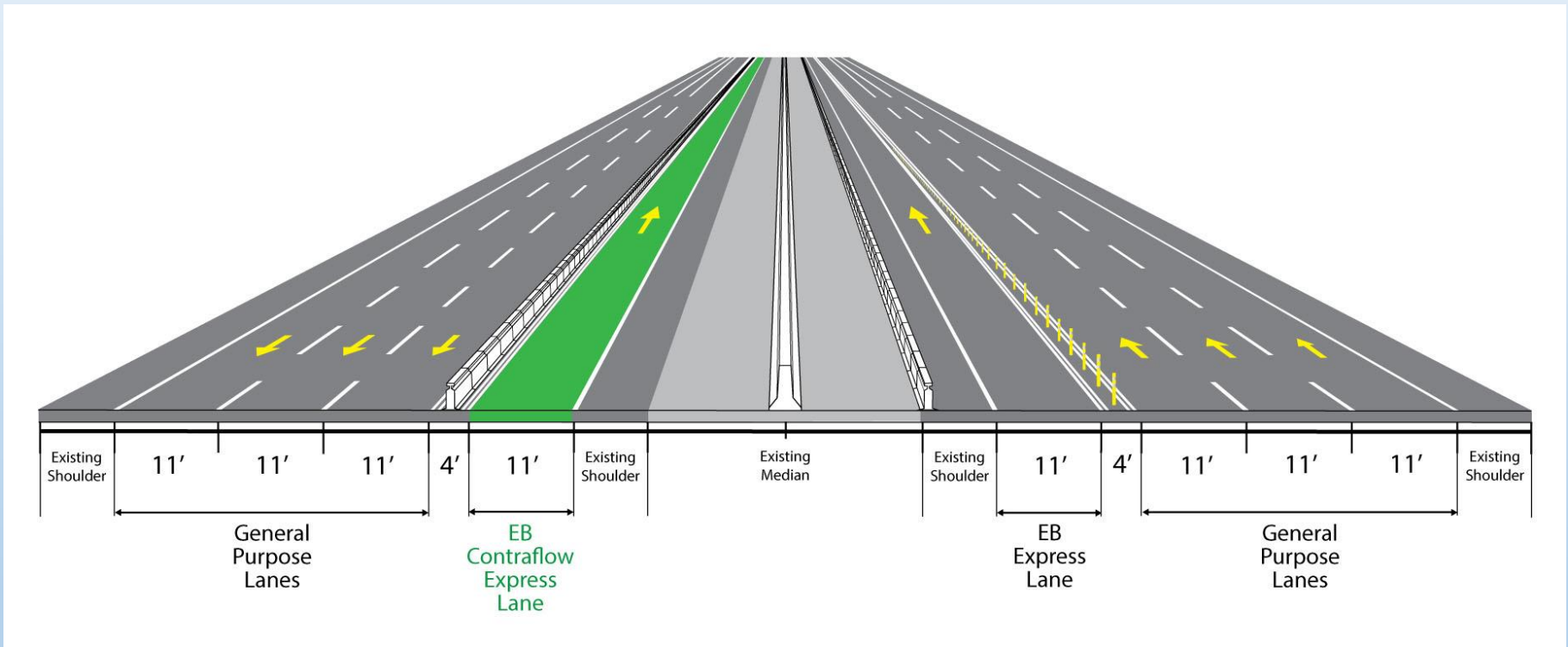
PM Peak





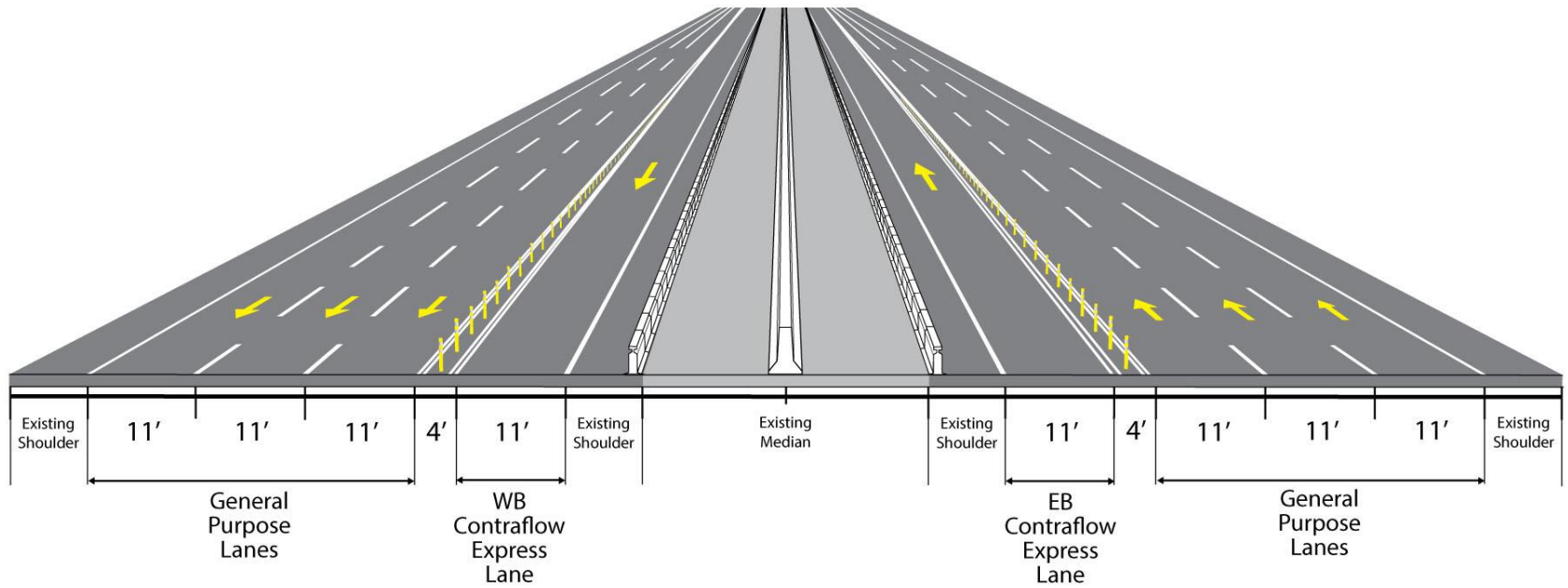
## Reversible Managed Lanes (cont'd)

# Contraflow lane configuration a.m. peak



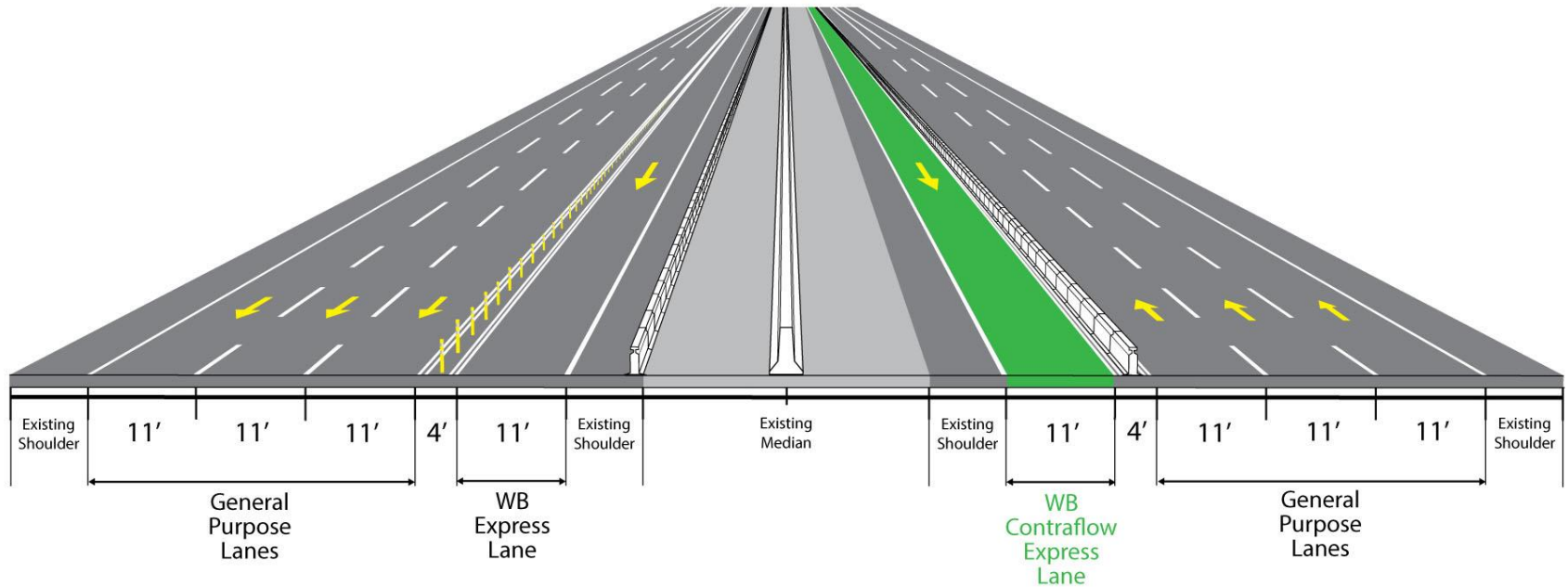
## Reversible Managed Lanes (cont'd)

# Contraflow lane configuration off-peak



# Reversible Managed Lanes (cont'd)

## Contraflow lane configuration p.m. peak

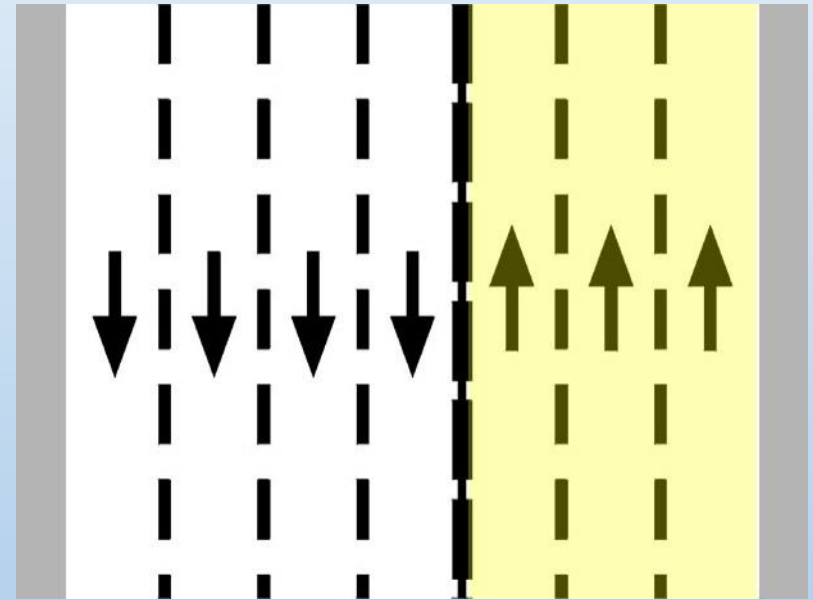
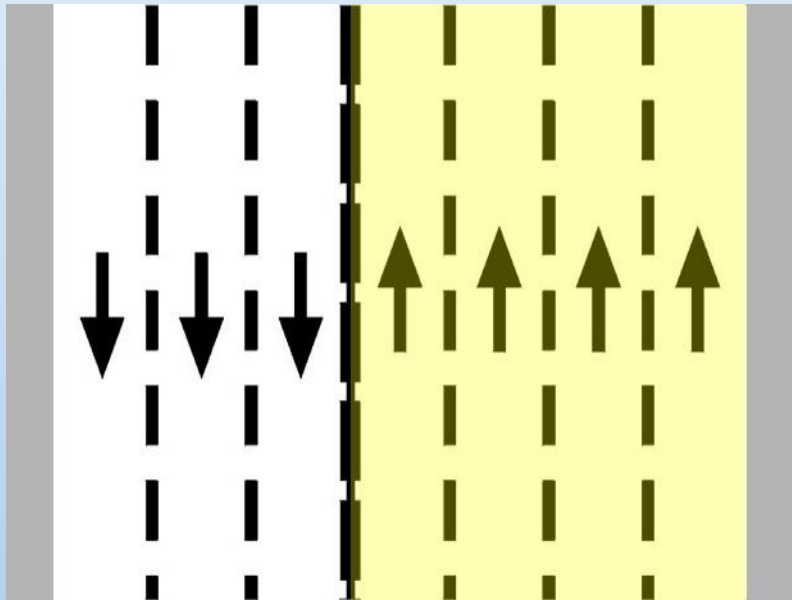


## Reversible Managed Lanes (cont'd)

# 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

## Reversible Managed Lanes (cont'd)

# Incident reduction due to moveable barrier

A TTI analysis<sup>1</sup> 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.*



<sup>1</sup>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

Number of Lanes	Percentage Traffic in Off-Peak Direction	Percentage Traffic in Peak Direction
4	33	67
6	40	60
8	43	57
10	44	56

## Contraflow Managed Lanes (cont'd)

# Considerations for the implementation of contraflow managed lanes

Directional split

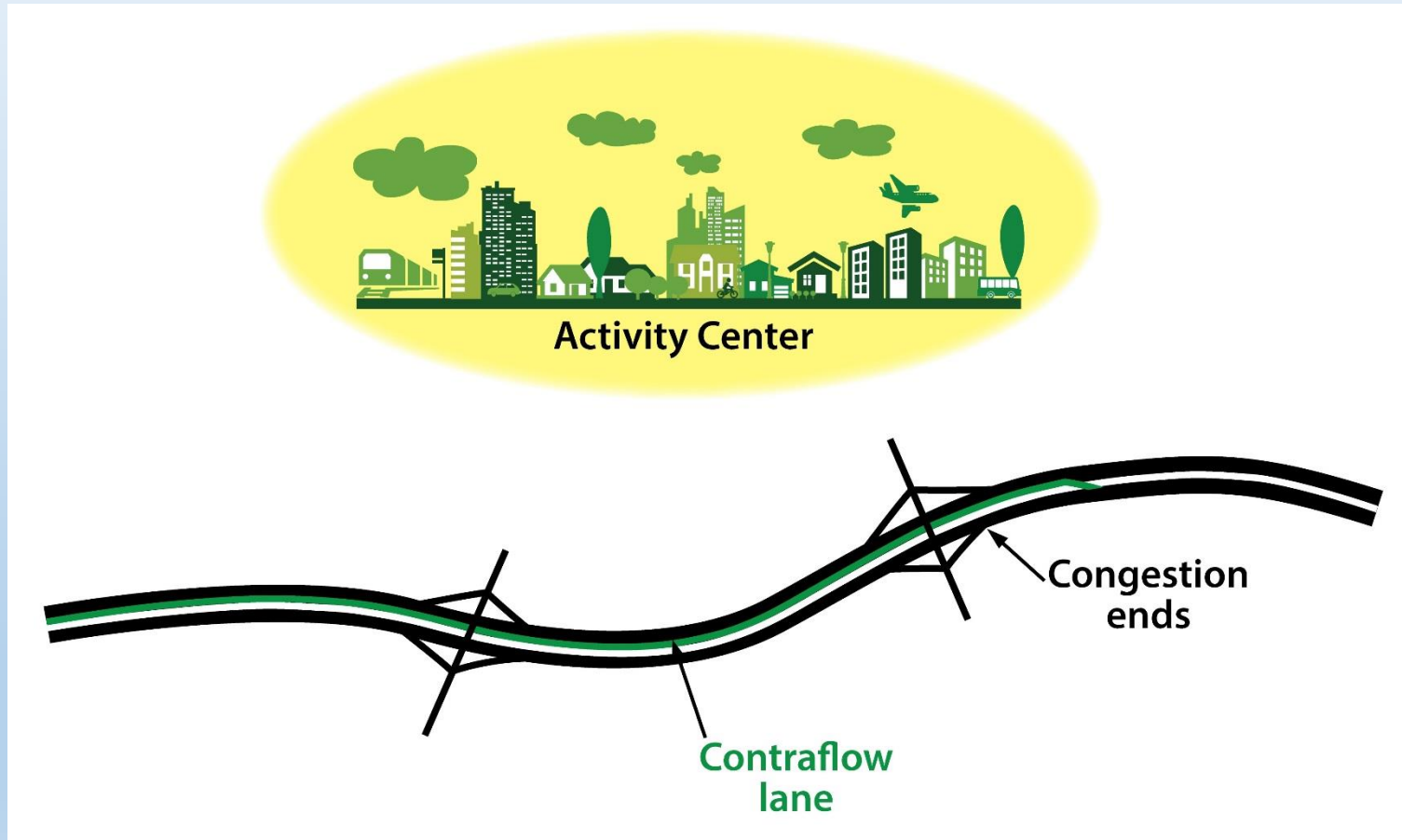
Left on- and off-ramps

Ability to bring contraflow lane traffic back to the general purpose lanes



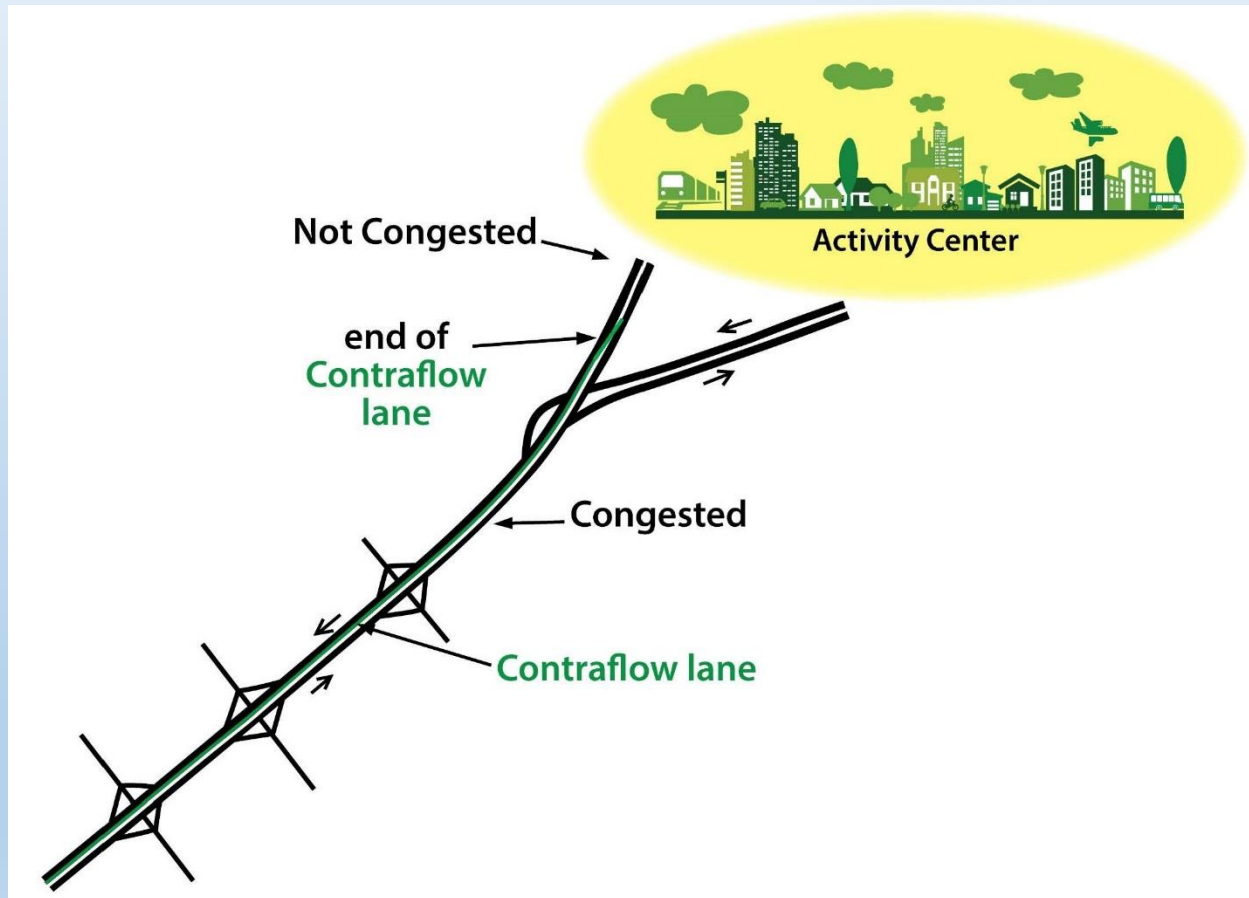
# Contraflow Managed Lanes (cont'd)

## Example Application 1



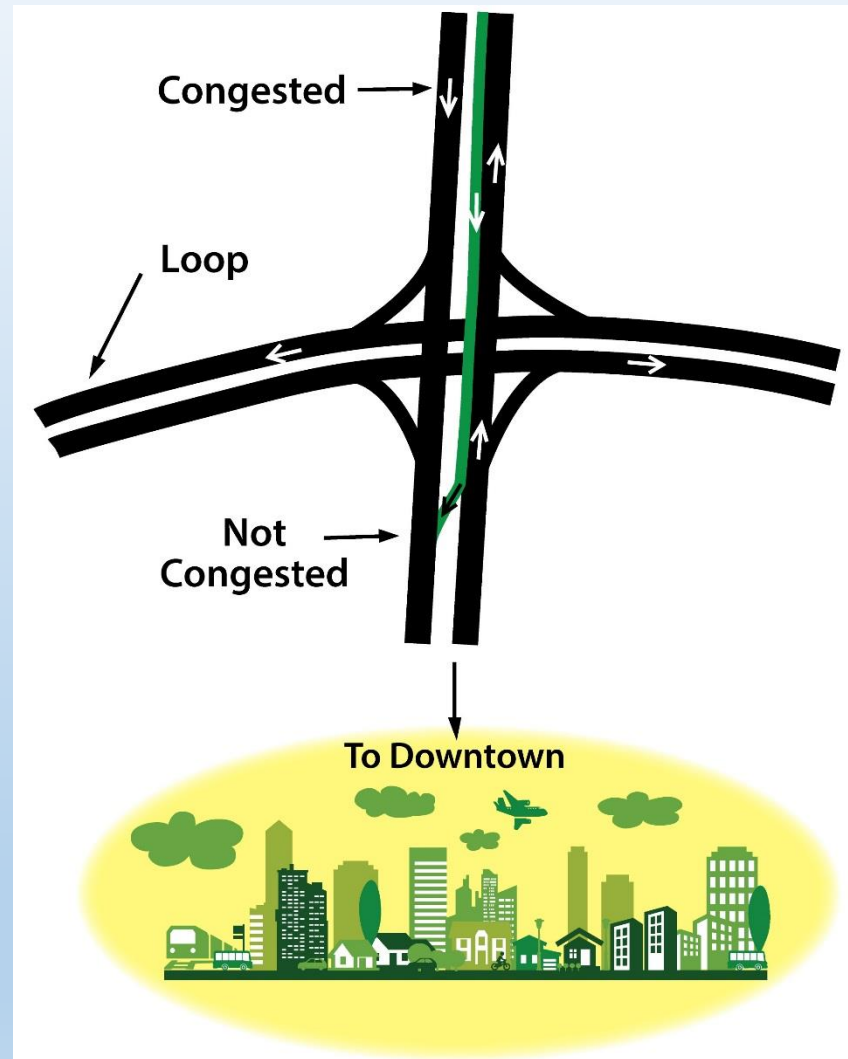
# Contraflow Managed Lanes (cont'd)

## 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



## Incidents and Contraflow Managed Lanes (cont'd)

# The role of contraflow managed lanes

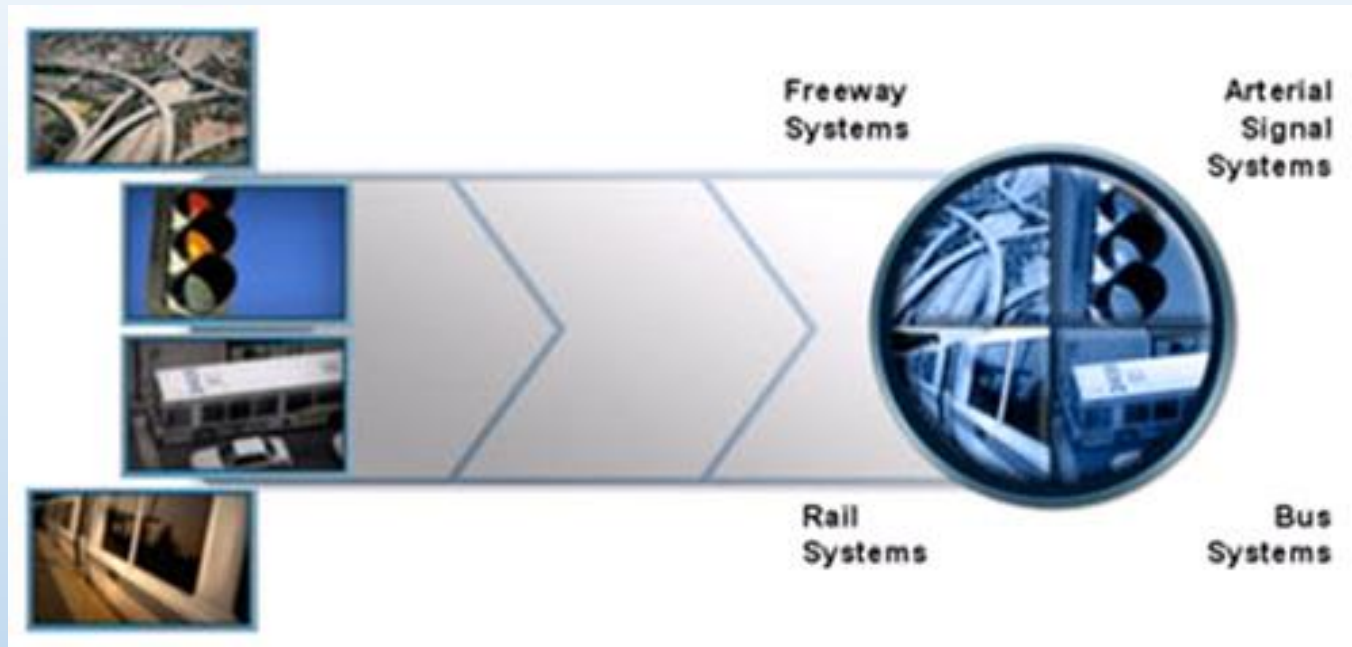
“Dynamic lane reversal or contraflow lane reversal can address a severe imbalance in V/C conditions” <sup>1</sup>

### Reference

1. Guide for Highway Capacity and Operations Analysis of Active Transportation and Demand Management Strategies, Richard Dowling, Richard Margiotta, Harry Cohen, Alexander Skabardonis (for FHWA)

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

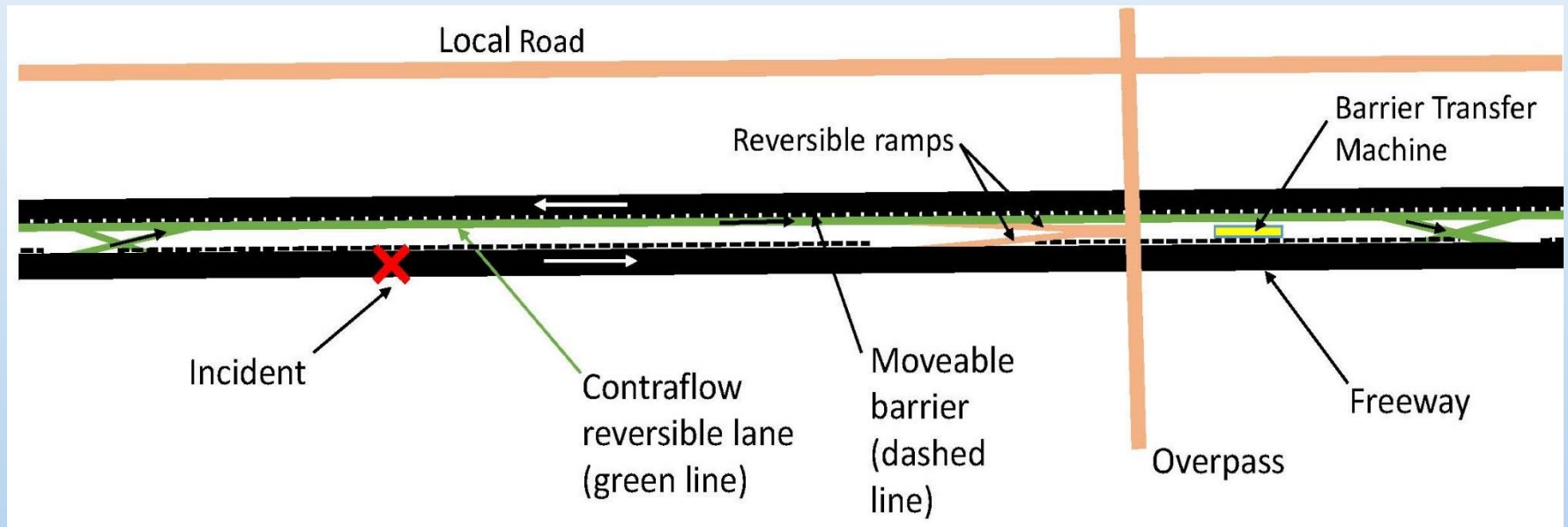
# Integrated Corridor Management



- **Maximize corridor capacity through:**
  - New institutional models
  - New technology
  - More dynamic operational strategies
- “Network” vs. Individual corridors

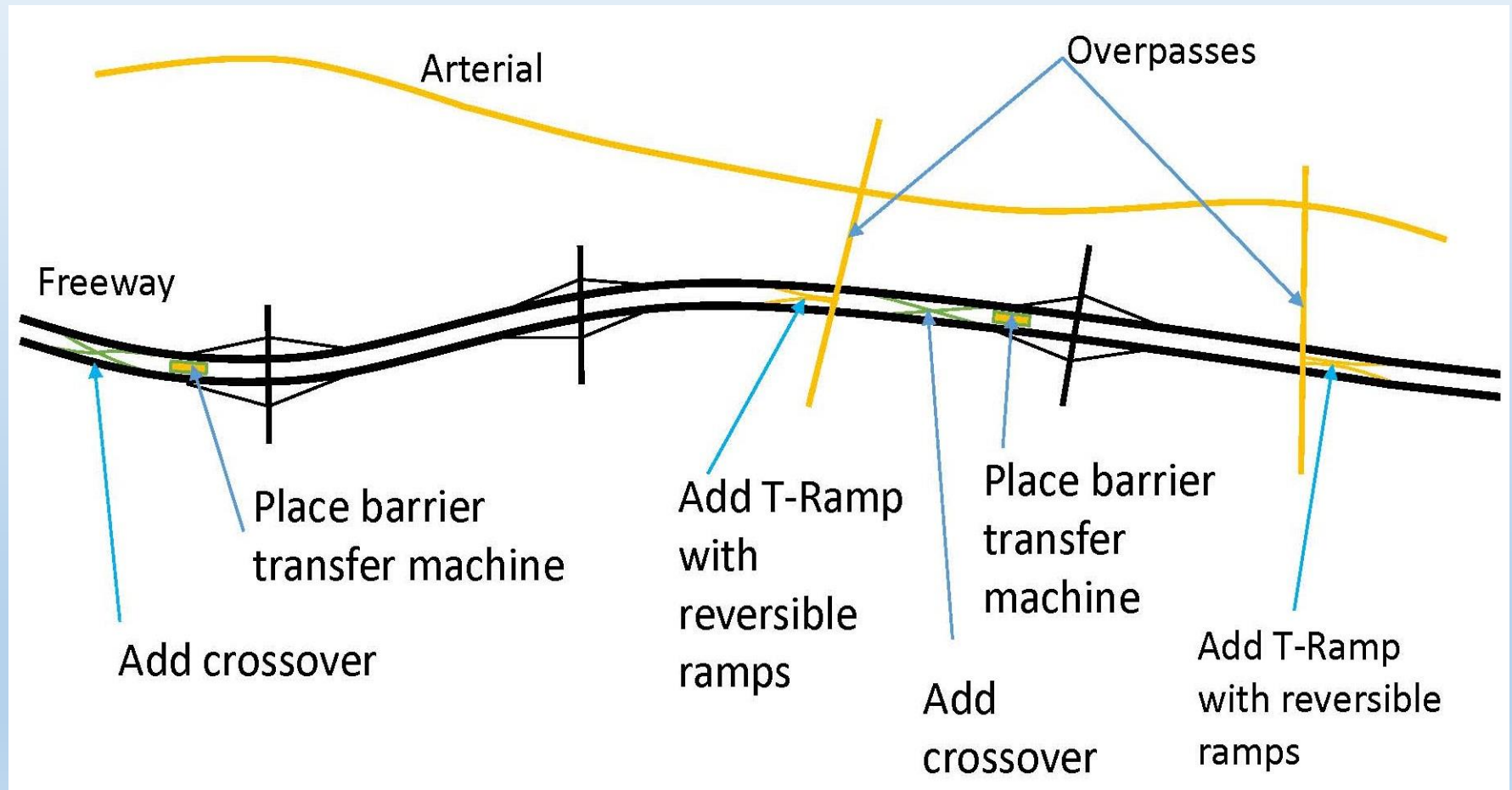
# Contraflow Managed Lanes and Integrated Corridor Management

## CML/ICM system



# Contraflow Managed Lanes and Integrated Corridor Management (cont'd)

## CML/ICM system corridor





# Contraflow Managed Lanes and Integrated Corridor Management (cont'd)

## CML/ICM system - incident response time

Contraflow Lane Situation	Response Time To Ready a Contraflow Lane for use by Traffic Delayed by an Incident (minutes)
Peak period contraflow lane is in use	10*
Contraflow lane needs to be set up	30*

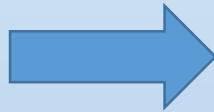
\*Response time can vary, depending on the design of the CML/ICM system in terms of the spacing of crossovers, transfer machines, and T-ramps, and the location of the incident.)

# 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

# Contact information

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