Reversible lane: Exploring Lane Management Alternatives

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Outline

- Introduction
- Purpose Of Study
- Scope
- Approaches
- Conclusion

Introduction

- ***"The present roads are overbuilt for 18 hours a day and also the entire weekends"***
- Need of the hour -**Optimum utilization of existing infrastructure**
- **Lack of resources - land, money, impacting flow**

Reversible Lanes

- **Mitigation** - directional biased, peak-hour movement
- **Increase the capacity** of a roadway significantly
- **Minimal need of investment** in roadway or control infrastructure
- **Objective** - take advantage of underutilized lanes.

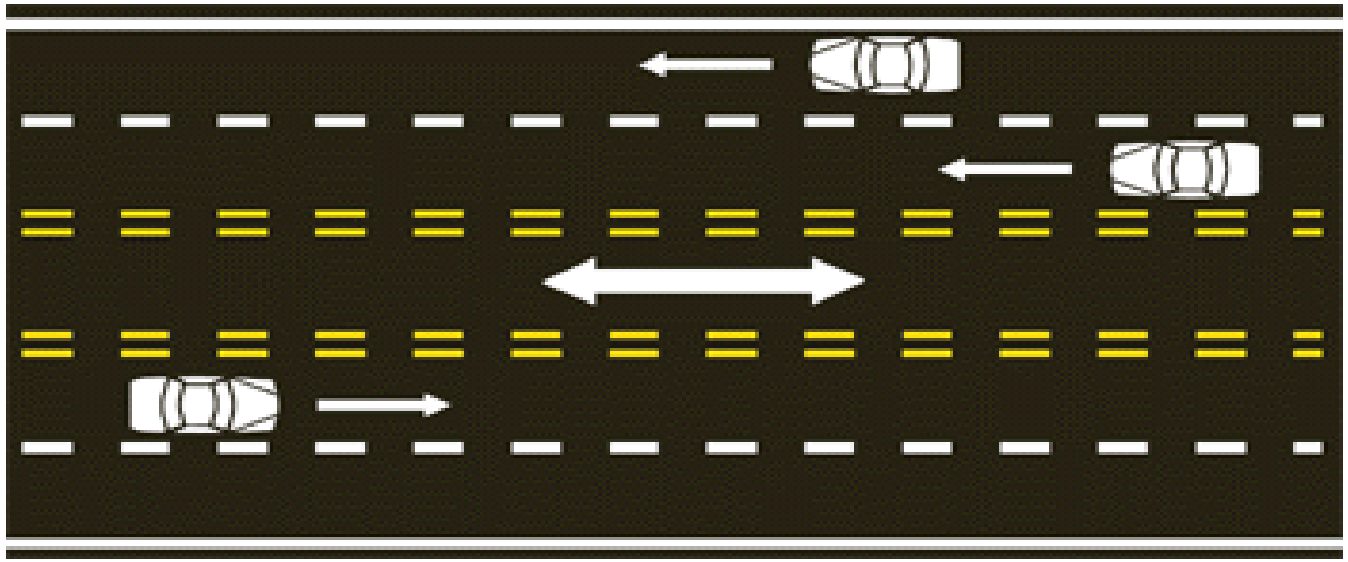
History

- Direction biased traffic
- In 1928 *Ralph T. Dorsey tested* it in Los Angeles
- Reversible lane concept was introduced
- Used metal-based stanchions initially.

- ***Hines center line*** concept- delineate traffic

A solid yellow line partitioning the roadway

- *Hines concept* - not appropriate for Reversible lane.



Depicting a reversible lane

(Contd.)

- Using variable sign boards – beginning of reversible lane
- Signs initially notifies driver - doesn't bind or remind to follow the unmarked centerline.

Other Name

- **Major hurdle – Safety Factor**

Protest against Reversible(*Suicide*) Lane

Literature Review

- "65 percentage or more traffic moving in a particular direction during peak hours *justifies* the application of Reversible lanes". - AASHTO
- Modern Advancement - **Dynamic Lane Reversal**
- Realigns lanes quickly and automatically - instantaneous traffic conditions

Literature Review (Cont'd)

- Matthew Hausknecht study - dynamic lane reversal - increase in efficiency by **72%**
- Lamberti and Wolshon study – low confidence levels in pertaining to reversible lanes
- Drivers comfort level – tailgating than going alone.

Literature Review (Contd.)

- Primary cause – driver's limitation of understanding
- ***"Driver is an outdated human with stone-age characteristics and performance who is controlling a fast, heavy machine in an environment packed with unnatural, artificial signs and signals."***

  - Reflected in Rumar's conclusion

Future of Traffic Management

- Solid yellow line was introduced in 1911 by Hines, and we are following it till now
- ***Future***: Controlling the **Solid Yellow line**
- Requires *remote*, *reliable* and *dynamic* turning on

Purpose of Study

- Propose - New concepts and strategies - manage directional flows - both freeways and urban roads,
- Attractive alternative - solving traffic congestion.

Scope

- Development of methods and strategies- Optimum utilization
- A proved alternative –Safety Enhancement

PROPOSED APPROACHES FOR REVERSIBLE LANE MANAGEMENT

- Using **Electro-luminescent paint,**
- Using **In-Pavement LED,**
- Using **Fully Automated Retractable Bollards.**

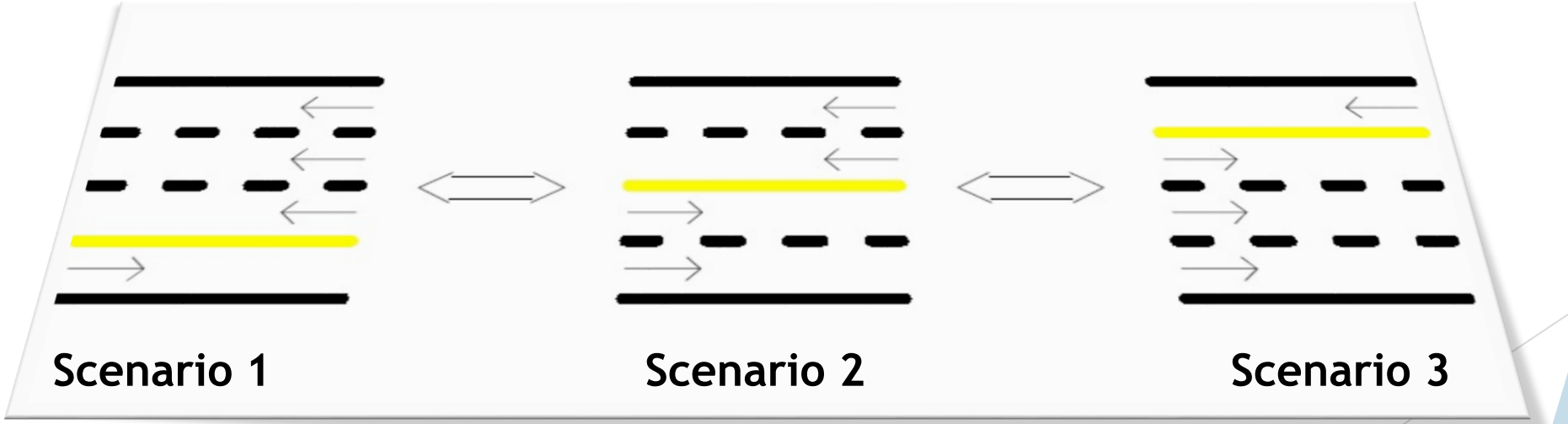
Electro-luminescent Paint

- Illuminates with passage of electric current
- Practical implementations ~motorcycle paint industry.

Painted on a motorcycle

Implementation

- Scenario 1: Heavy traffic - West bound - **1:3** ratio – 3 lanes favoring major direction
- Scenario 2: Near Equal Traffic - lane ratio **2:2**
- Scenario 3: Heavy traffic - East bound – 3:1 ratio



Limitation

- Needs development to attain durability, to withstand repetitive passes from

  1) Vehicular traffic,

  2) Varying weather conditions

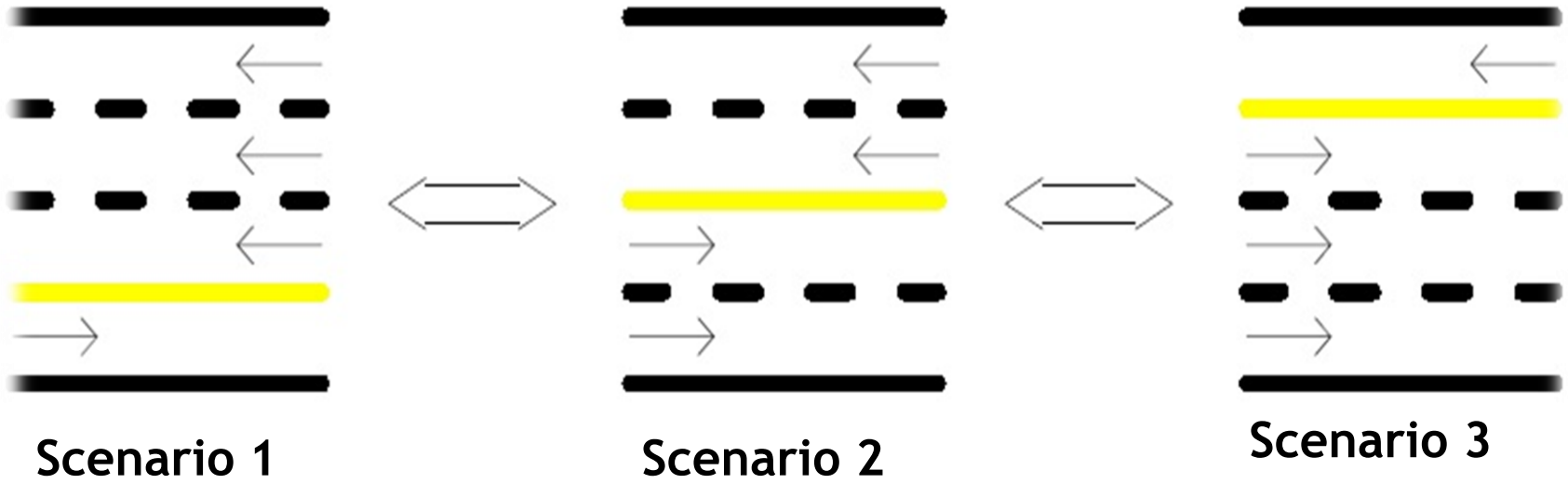
- Demand to integrate with traffic signal controller.

In-pavement LED markers

- Usage - smart crosswalks, lane delineation, route guidance on ramps, lane curvatures, pavement edges.
- Alternative - separate traffic flow based on real-time traffic demand.

Night view of In-Pavement LED markers

Implementation



Limitations

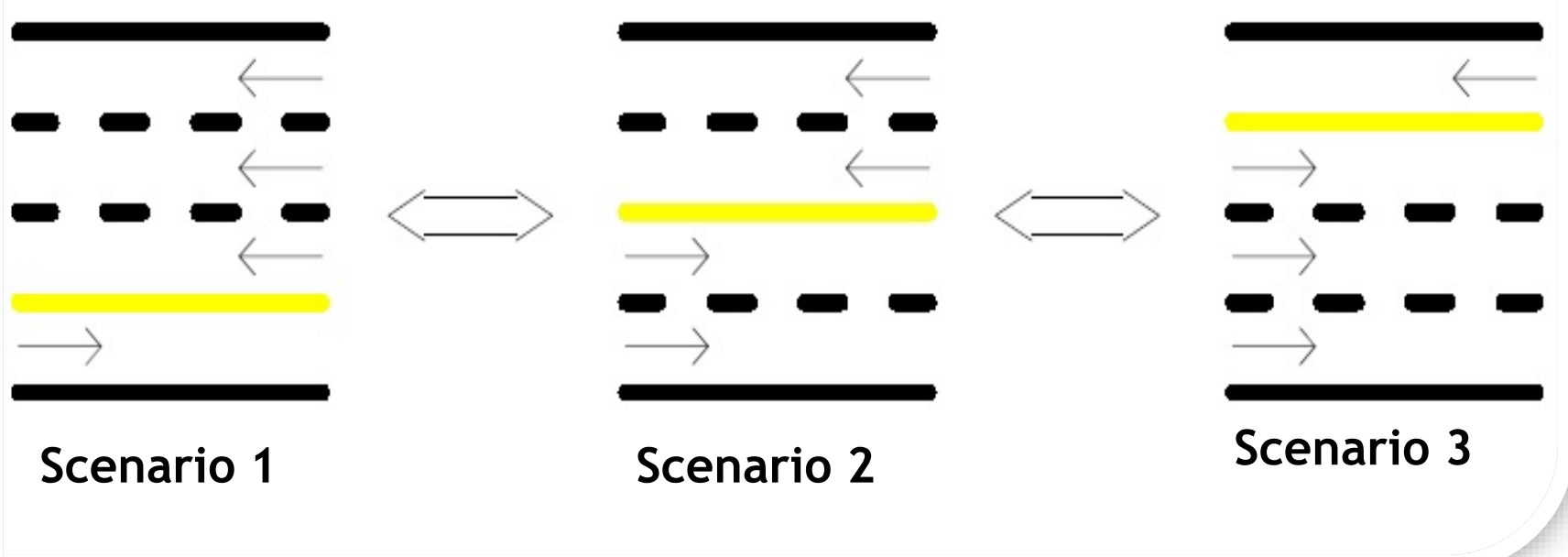
- LED markers - closely spaced during daytime - Discomfort
- Reliable operation of LED's – integrating to controller is a challenge.

Fully Automated Retractable Bollards

- Commonly used - safety barrier
- On freeways, opposing traffic separated- dividers
- Replaced by Retractable Bollards

Retractable bollards in a parking lot

Implementation



Limitations

- Requires modification to its design parameters

  1) Deal with high speed car impacts,

  2) Ease in lowering and uplifting it,

  3) Controlling its operations remotely.

- Imbedding into the pavement - new constructions

Switching the Lane Alignment

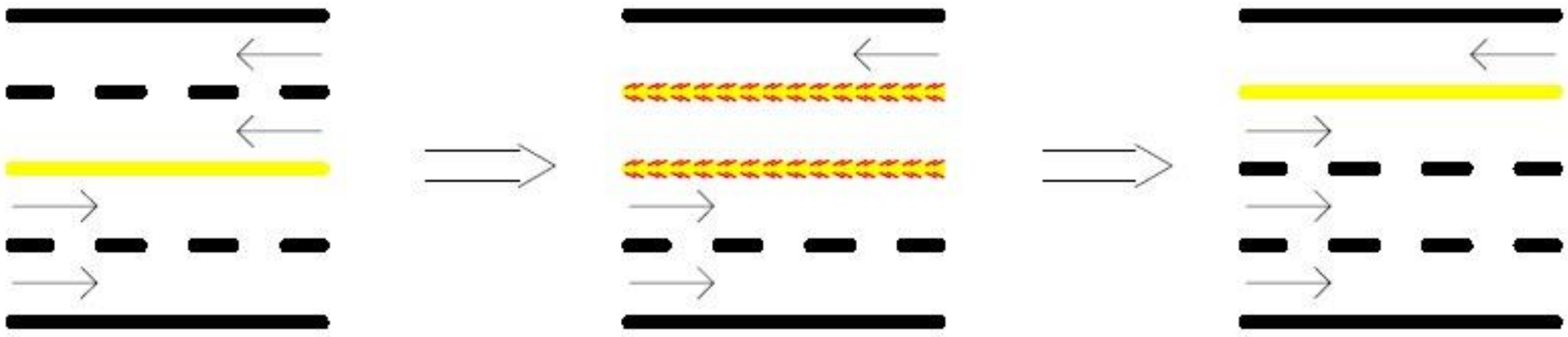
- Movement of traffic changes - **Time**
- Re-orientation of Lane(s) - **Traffic demand**

Switching the Lane Alignment

Stage 1: Monitor the Traffic

Stage 2: Flash, lights for certain amount of time

Stage 3: Turn on lights



Stage 1 Stage 2 Stage 3

Switching the Lane Alignment

- For Retractable bollards, embedded pavement lights should be mounted on top of them.

Switching the Lane Alignment

- Commuters have to be educated extensively in this regard.
- Also care has to be taken during the transition phases like

  1) Allotting more time for flashing lights, and

  2) Checking no occupancy on the reversing lane.

Comparison of Proposed Approaches

	Electro-luminescent paint	In-pavement LED markers	Fully Automated Retractable Bollard
Areas of Application	Urban Areas (no dividers)	Urban Areas (no dividers)	Freeways (alternate to dividers)
Development	Very Futuristic	Can be implemented right away	Can be implemented using present technology with major modifications
Cost	Not yet certain as it requires further research	Best alternative economically	Very expensive as it requires bollards assembly and control mechanisms, and re- paving of roadways
Limitation	Development of this kind of paint to handle wear and tear of the roads is a major challenge	To achieve high intensity light LED markers have to be closely spaced which may result in discomfort for the driver while changing lanes.	This requires relaying the pavement to accommodate the retractable bollards so appropriate for new roads

Conclusion

- Using the proposed technologies - improves traffic safety
- Paving a viable solution for dynamic lane management system.
- Innovative way to optimize the use of existing infrastructure

Questions