POSITION OF VEHICLES WITHIN A MANAGED LANE

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Objective

- To identify the relationship between vehicle position and cross-section dimensions, including the type of buffer separating the managed lane (ML) from the general-purpose (GP) lanes.

Site Selection

- Variability in lane, shoulder, and buffer widths
- One managed lane per direction
- Geographic diversity
- Different types of access

Figure 1. Example of vehicle position within managed lane

Data Collection

- Driving vehicle data (3355 points)
  - Los Angeles/Orange County, California
  - Dallas, Texas
  - 161 center miles recorded
- Video data (28 sites, 5005 points)
  - Houston, Texas
  - San Jose, California
  - Minneapolis/St. Paul, Minnesota
  - Orillia/Kent, Washington
- Geometric measurements
  - Aerial photos
  - On-site where possible

Figure 2. Set-up for instrumented vehicle

Figure 3. Picture from instrumented vehicle camera

Figure 4. In-field installed cameras in Houlton, TX

Figure 5. Video footage from field cameras

Data Analysis

- Mixed-effects model
- Developed prediction equation

Figure 6. Lateral positioning of vehicle

Data Reduction Variables

- Lateral position of the vehicle within the lane (either to right or to left, depending upon available view)
- Type of vehicle (e.g., car, bus, motorcycle, etc.)
- Vehicle in the next lane?
- GP lane 10 mph slower than ML (technician opinion)?
- Is vehicle on tangent, curve to left, curve to right?

Equation for Left Lateral Position

$$
\begin{aligned}
LP\_Lf = {} & 3.14528 + 0.0(TpVeh{=}PC) - 1.23188(TpVeh{=}B) - 0.39833(TpVeh{=}EM) \\
& + 1.92241(TpVeh{=}MC) - 0.27951(TpVeh{=}PT) + 0.09272\,(TpVeh{=}V) \\
& - 0.31771(Veh\_GP{=}Yes) - 0.92541(Pylons{=}yes) + 0.03180(BW)^2 \\
& - 0.13387(14-LW)^2 + 0.00361(19-SW)^2 + 0.0(Hor{=}Tan) \\
& - 1.69920(Hor{=}LC) + 0.44487(Hor{=}RC) + 0.03796(BW)^2 \times (Hor{=}LC) \\
& - 0.01289(BW)^2 \times (Hor{=}LC) + 0.00357(19-SW)^2 \times (Hor{=}LC)
\end{aligned}
$$

LP_Lf =	Left lateral position within the managed lane (ft)
TpVeh=PC =	1 when the vehicle type is a passenger car, 0 otherwise
TpVeh=B =	1 when the vehicle type is a bus, 0 otherwise
TpVeh=EM =	1 when the vehicle type is an emergency vehicle, 0 otherwise
TpVeh=MC =	1 when the vehicle type is a motorcycle, 0 otherwise
TpVeh=PT =	1 when the vehicle type is a pickup truck, 0 otherwise
TpVeh=V =	1 when the vehicle type is a van, 0 otherwise
Veh_GP=Yes =	1 when vehicle is present in GP lane next to the ML vehicle, 0 otherwise
Pylons=yes =	1 when pylons are present in the buffer, 0 otherwise
BW =	Buffer width (ft)
LW =	Lane width (ft)
SW =	Shoulder width (ft)
Hor=Tan =	1 when the horizontal alignment is a tangent, 0 otherwise
Hor=LC =	1 when the horizontal alignment is curve to the left, 0 otherwise
Hor=RC =	1 when the horizontal alignment is curve to the right, 0 otherwise

Graphs

- Used equation to illustrate findings
- Range of curves represents range of geometric measurements

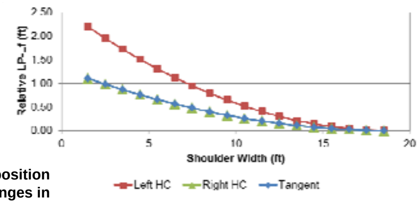

Figure 7. Lateral position relative to changes in shoulder width

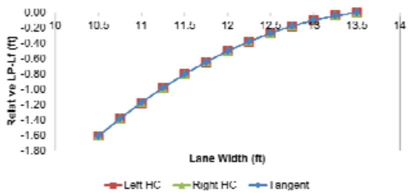

Figure 8. Lateral position relative to changes in lane width

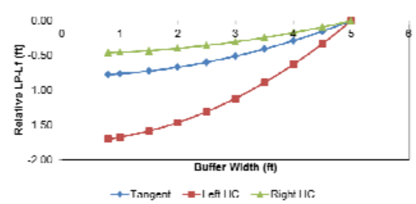

Figure 9. Lateral position relative to changes in buffer width

Findings

- The practice of **reducing the lane width by 1 ft** (from 12 ft to 11 ft) and providing that ft of width to the buffer is appropriate.
- Drivers are shying away from the **concrete median barrier**. Use of minimal width for left shoulder results in ML drivers closer to GP veh.
- Use of **pylons** affects lateral position. Using the pylons within a wider buffer can offset the impacts on lateral position.
- As expected, driver's lateral position is **affected by horizontal curvature**.
- **Neighboring GP lane vehicles** result in ML vehicle shifting closer to shoulder.
- **Access** (continuous versus limited access) was found to be not significant.
- Impact on **lateral position is greater within minimal values** for shoulder, lane, and buffer widths.

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