Application of the Upcoming HCM Managed Lane Procedure to Pylon-Separated Managed Lane Analyses

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INTRODUCTION

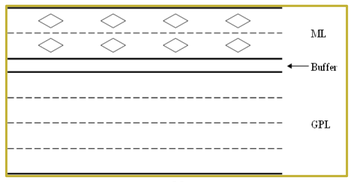
- Managed lanes can be defined as lanes that are proactively operated via pricing, access management, and occupancy restrictions to better utilize the existing capacity.
- The implementation of Managed Lanes (ML) has been accepted as a successful strategy to address traffic congestion problems.
- The impacts and operations of ML have to be thoroughly assessed before and after implementation.

OBJECTIVES

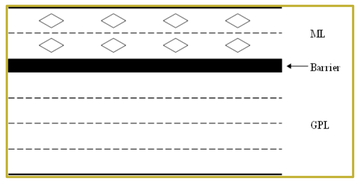
- Investigate the application of the upcoming HCM ML procedure to pylon-separated ML.
- Develop a speed-flow curve for pylon separated ML facilities based on local data from managed lanes on the I-95 facility in Miami, FL.

MANAGED LANE TYPES

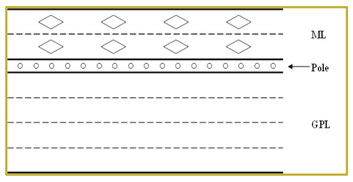
- Based on NCHRP report , Managed lanes are classified into five categories: continuous access, BF1,BF2, BR1 and BR2.
- I-95 managed lane is pylon separated which is not considered in the NCHRP report.



Buffer 2



Barrier 2

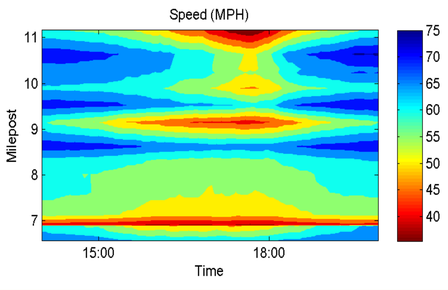


Pylon 2

METHODOLOGY

Identifying ML Bottleneck Locations

ML contour plot for identifying bottleneck location



ML Speed Flow Curve Development

Linear part of speed-flow curve

$$S' = FFS - C_1 v$$

where:
S': Speed (mph)
C_1: Linear coefficient
v: Flow rate (pcphpln)

Non-Linear part of speed-flow curve

$$S = SBP - C_1(v - BP)^{C_2}$$

where:
SBP: Speed at breakpoint (mph)
BP: Flow at breakpoint (pcphpln)
C_2 and C_1: Parameters

Objective Function Optimized using Genetic algorithm

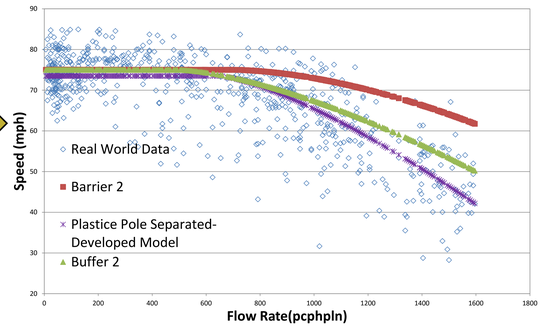
$$\min_{\theta} J = \sqrt{\frac{1}{N}\sum_{i=0}^{N}(S_{Real\ World_i} - (\theta_1 - \theta_2(v_i - \theta_3)^{\theta_4}))^2}$$

Final Speed-Flow equation for pylon separated ML

$$75 - 0.0032 * (\mathrm{v} - 665)^{1.3}$$

Developed Speed-flow curve for Pylon separated ML

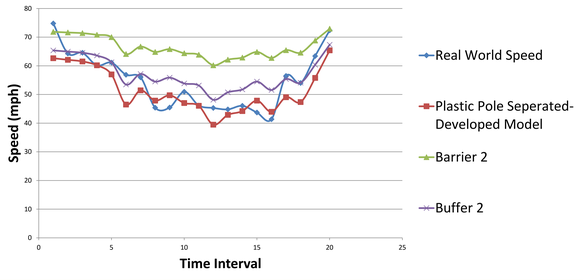
Developed Speed-Flow curve for pylon type and comparison with other separation types



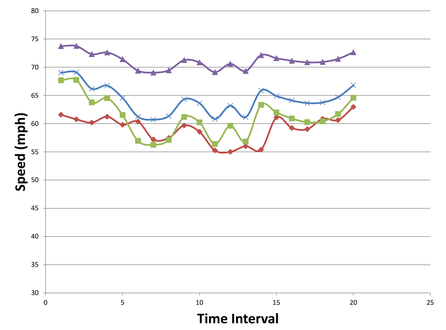
Model Validation

- The developed model was validated against two different locations at I-95

Validation at first location

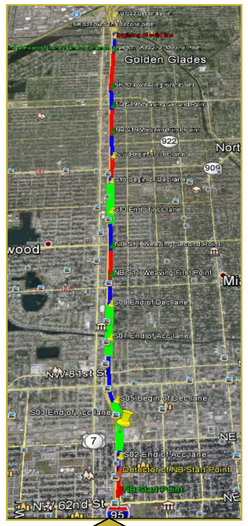


Validation at second location



FREEVAL-ML MODEL APPLICATION

- The developed curve was implemented in FREEVAL_ML
- A 5-mile stretch of I-95 NB was evaluated using the FREEVAL-ML model with the consideration of three different separation types (Buffer, Barrier and Pylon separated)



Coded network in FREEVAL-ML

Time Interval	Performance Measures								
	Speed (mph)			Density (pcpmpln)			LOS		
	Pylon 2	BF 2*	BR 2**	Pylon 2	BF 2	BR 2	Pylon 2	BF 2	BR 2
1	62.63	65.36	73.92	17.31	16.59	14.66	B	B	B
2	62.08	64.96	73.81	17.72	16.93	14.90	C	B	B
3	61.52	64.55	73.06	18.14	17.29	15.27	C	B	B
4	60.18	63.57	72.96	19.18	18.15	15.82	C	C	B
5	56.99	61.25	71.80	21.76	20.25	17.27	C	C	B
6	46.49	53.46	69.77	32.22	28.02	21.47	D	D	B
7	51.46	57.16	68.83	26.82	24.14	20.05	D	C	C
8	47.86	54.49	69.18	30.63	26.91	21.19	D	D	C
9	49.72	55.87	71.19	28.60	25.45	19.97	D	D	B
10	47.00	53.85	70.33	31.61	27.60	21.13	D	D	B
11	46.05	53.13	69.05	32.74	28.38	21.84	D	D	C
12	39.45	48.15	69.03	41.98	34.40	23.99	E	E	C
13	42.89	50.75	68.55	36.84	31.13	23.05	E	D	C
14	44.22	51.75	70.71	35.05	29.95	21.92	E	D	B
15	47.86	54.49	70.15	30.63	26.91	20.90	D	D	B
16	43.95	51.55	70.00	35.40	30.18	22.23	E	D	B
17	49.05	55.37	70.10	29.32	25.97	20.51	D	D	B
18	47.35	54.10	70.39	31.22	27.32	21.00	D	D	B
19	55.76	60.34	70.98	22.81	21.08	17.92	C	C	B
20	65.39	67.36	73.25	15.29	14.85	13.65	B	B	B

Results of running FREEVAL-ML with three different ML type: Pylon2 , BR 2 and BF 2

CONCLUSION

- Pylon separated type has a similar behavior as buffer separated.
- When data is not available for a pylon separated ML facility, the default curve for buffer separated can be used instead.
- Barrier separation can significantly improve the level of service compared to pylon and buffer separation