Traffic Efficiency of a Non-Traditional Intersection Design: The Superstreet

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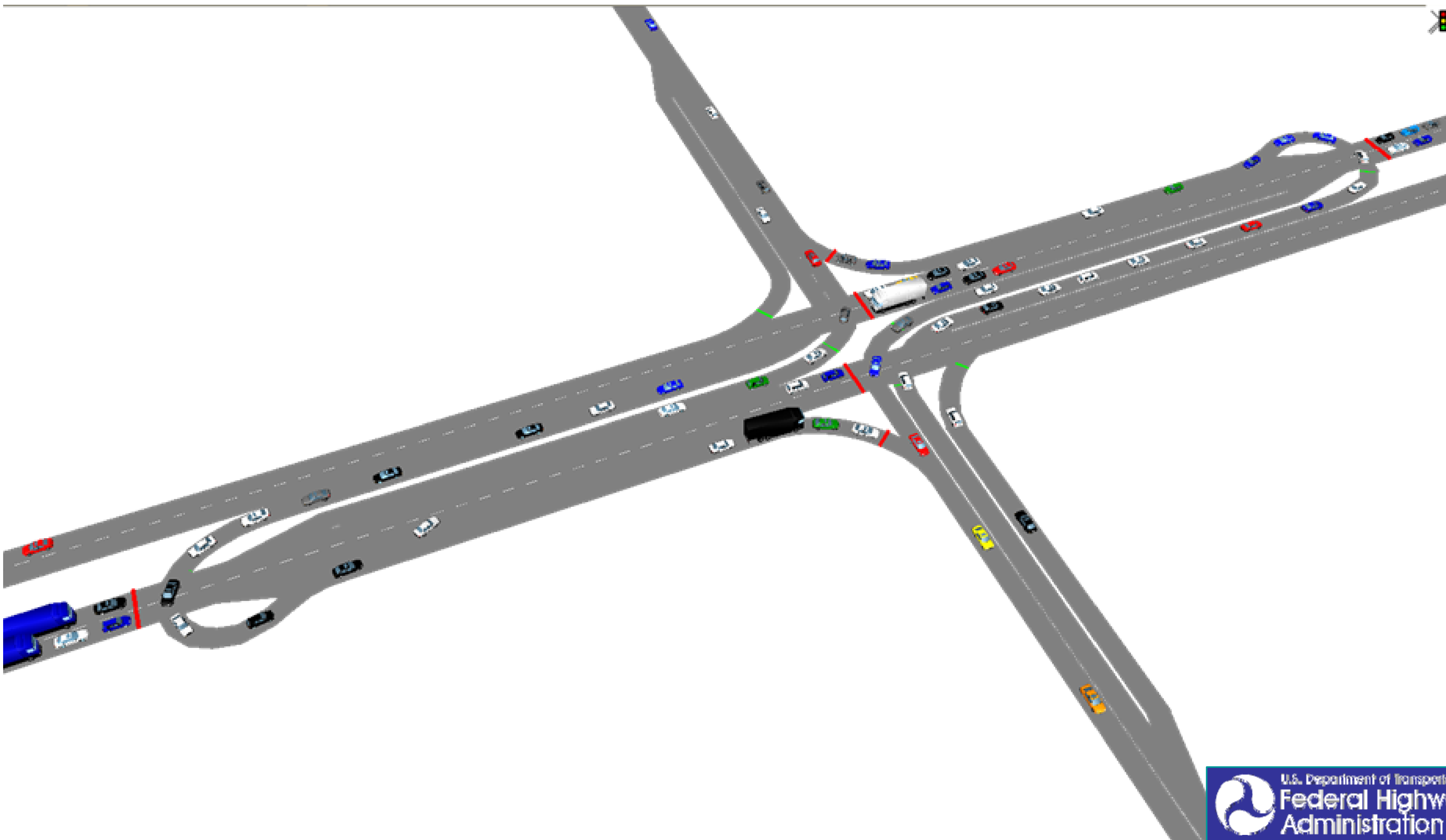
U.S. Department of Transportation
Federal Highway Administration

Typical Superstreet Intersection Design



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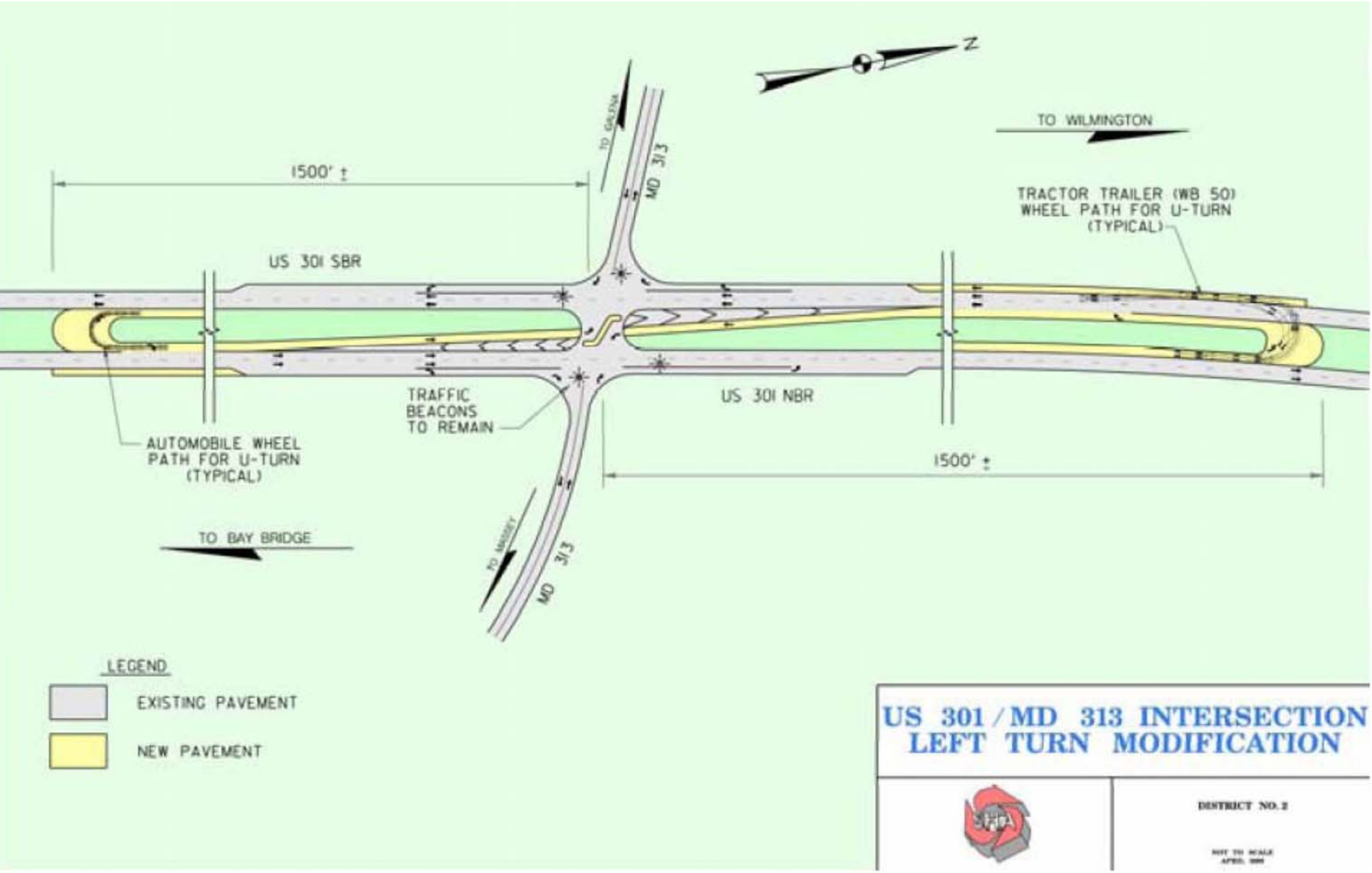
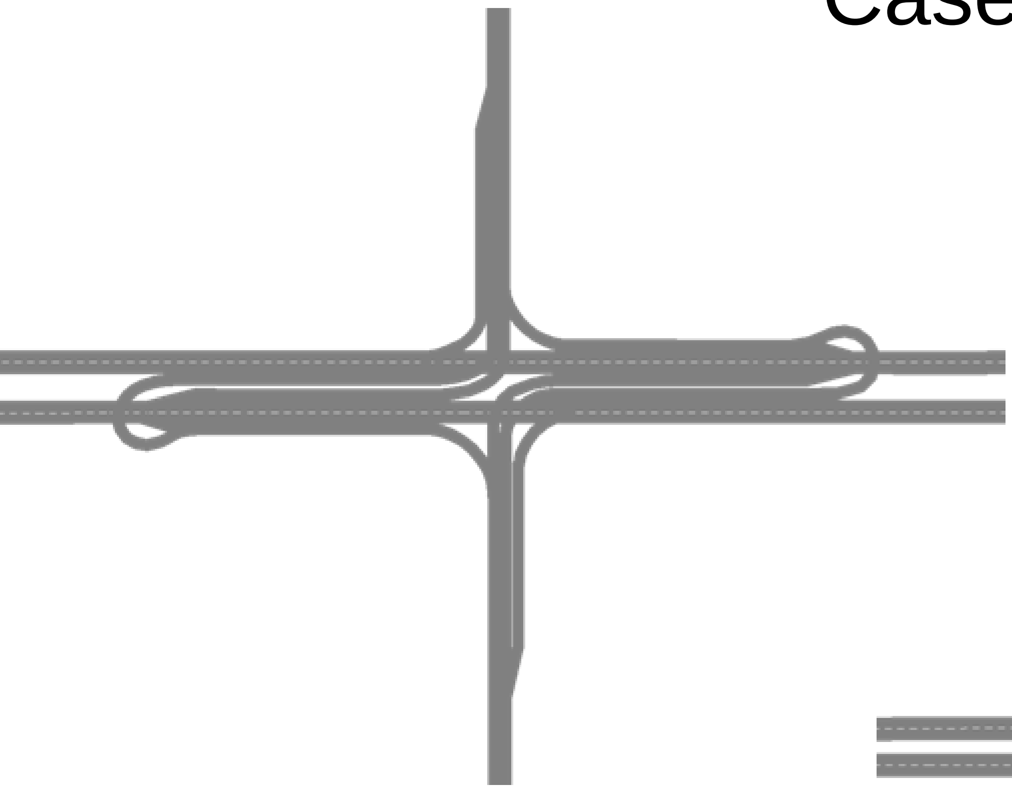
Background

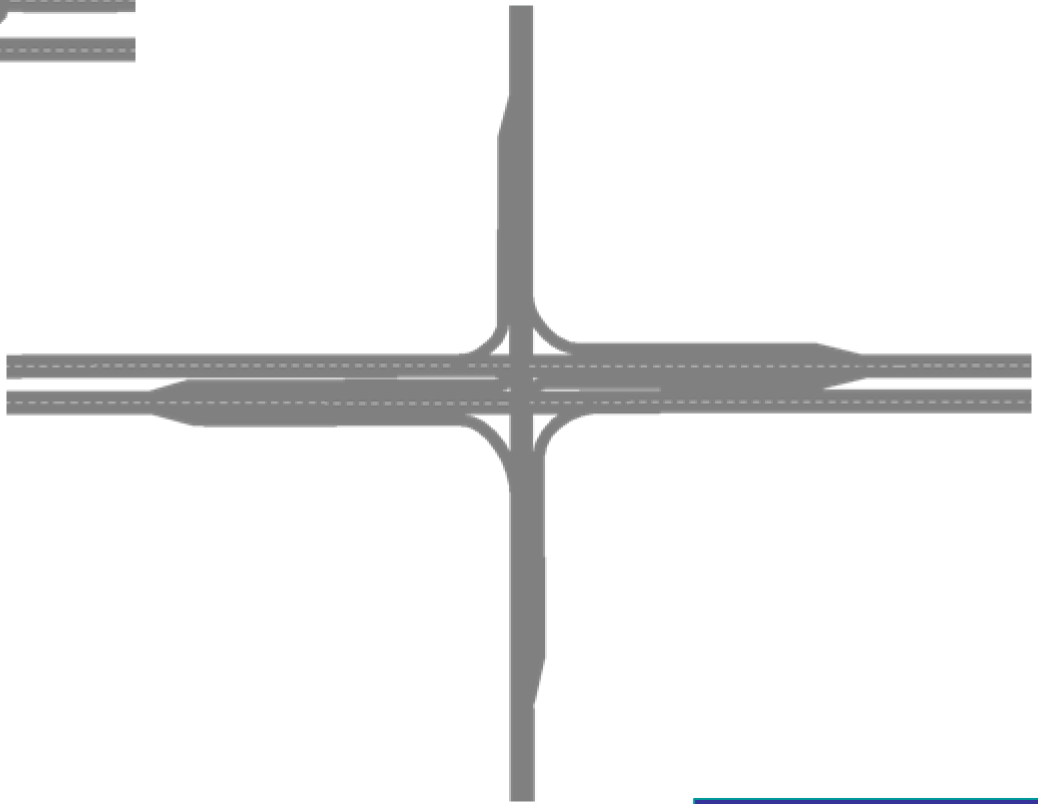
- First proposed by Richard Kramer in Alabama.
- Then studied by Hummer and Reid.
- Built in suburban MD as J-turn intersection with non-signalized u-turn channelization.
- Reduced crashes from 9 to less than 1 per year.



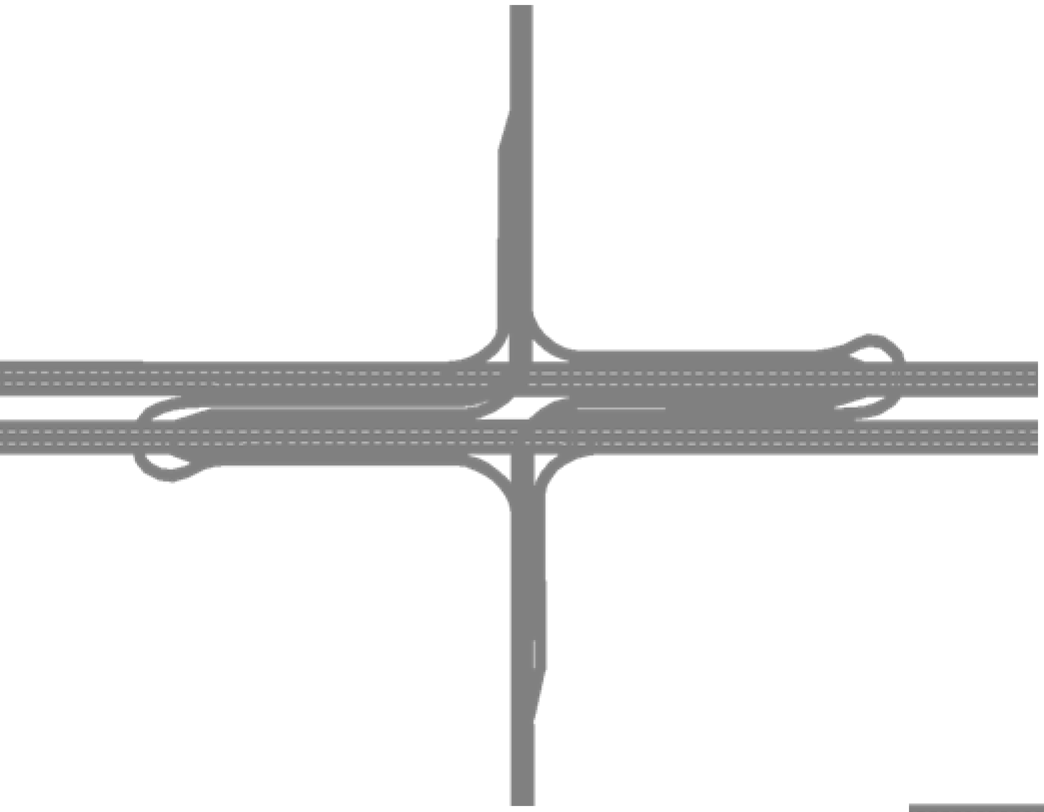
US 301 / MD 313 INTERSECTION
LEFT TURN MODIFICATION
TO WILMINGTON
TO BAY BRIDGE
1500' ±
1500' ±
MD 313
MD 313
US 301 SBR
US 301 NBR
TRACTOR TRAILER (WB 50) WHEEL PATH FOR U-TURN (TYPICAL)
AUTOMOBILE WHEEL PATH FOR U-TURN (TYPICAL)
TRAFFIC BEACONS TO REMAIN
LEGEND
EXISTING PAVEMENT
NEW PAVEMENT
DISTRICT NO. 2

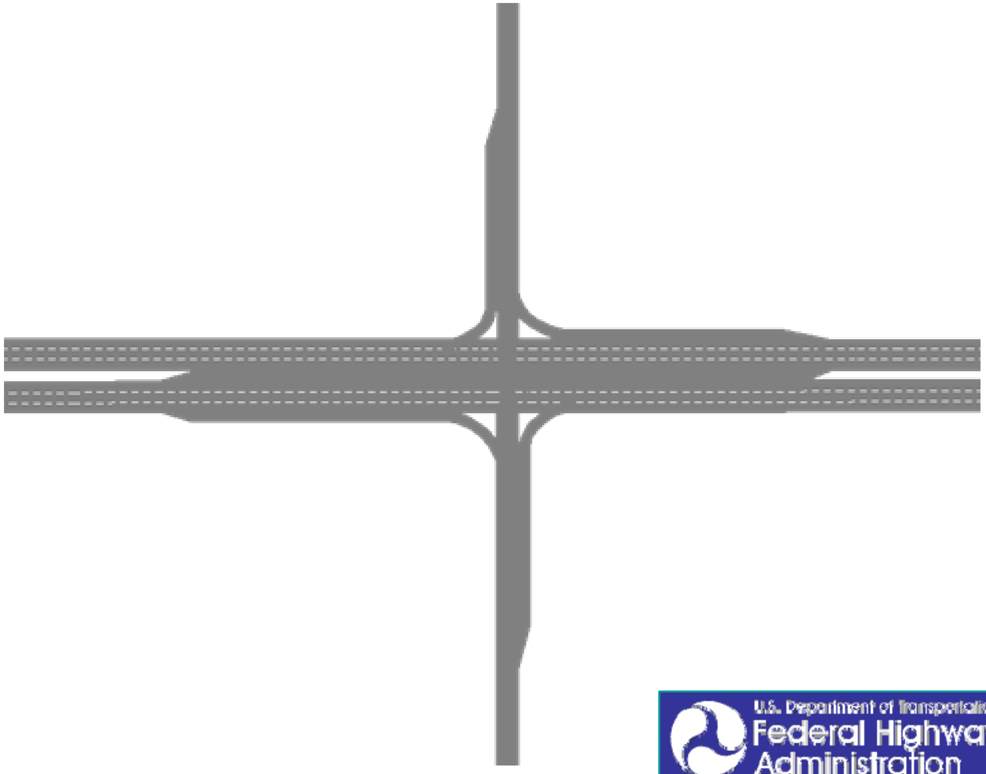
Comparisons of three case designs
Case 1





Case 2





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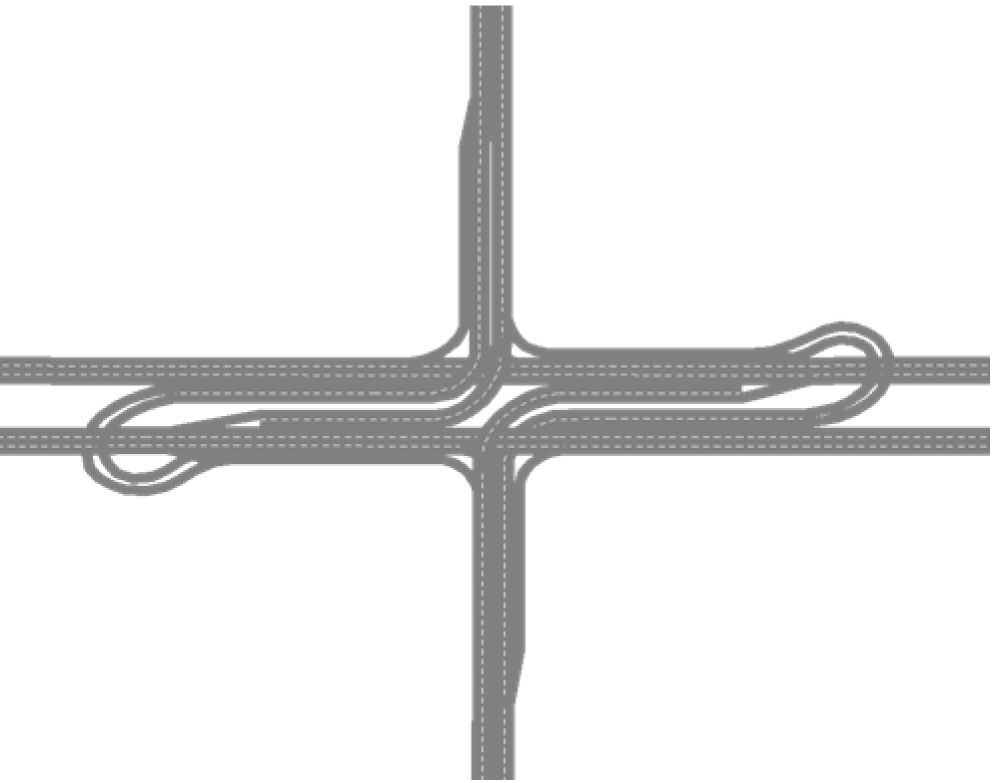
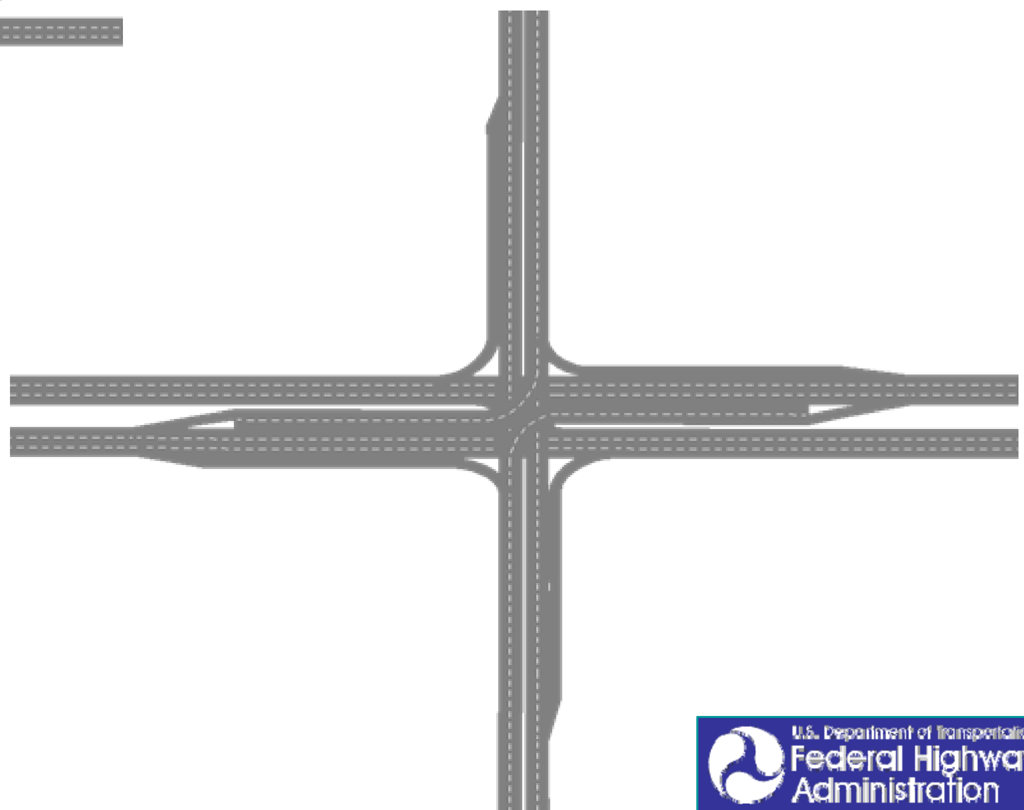
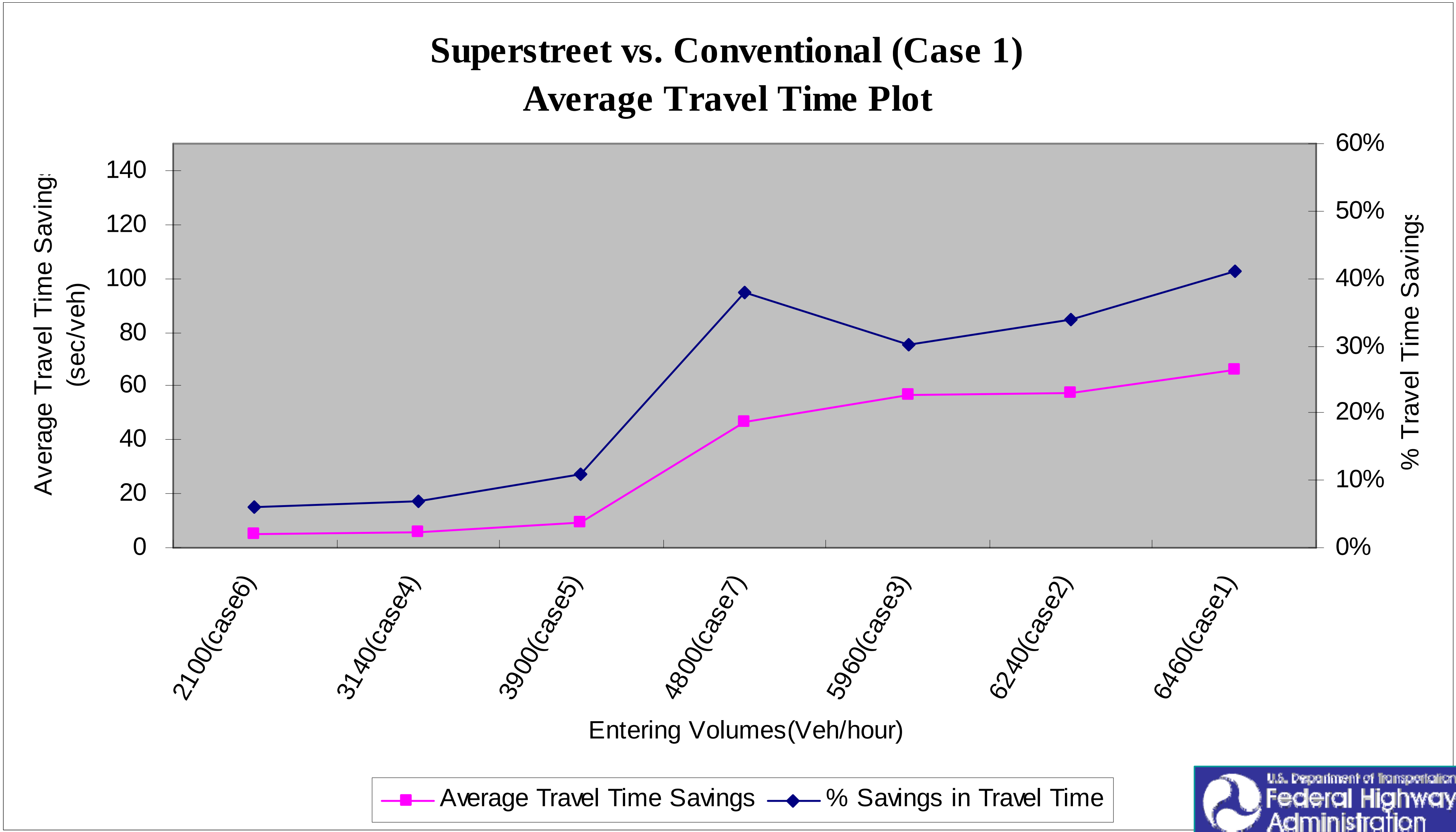
Case 3

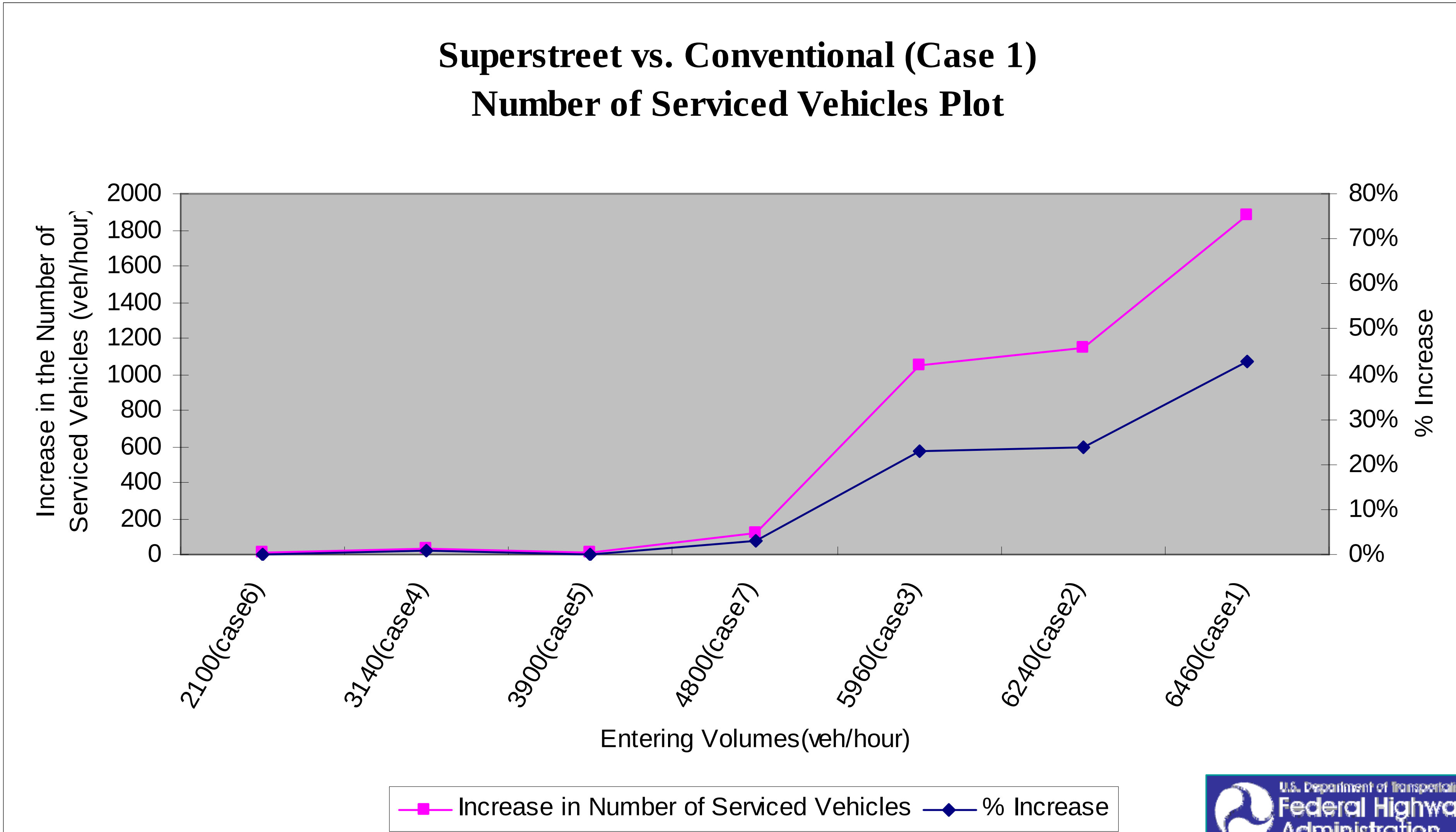




Travel Time Savings



Throughput increase



Near Saturation Flow Volumes for Case 1

Scenario	Southbound (1 lanes)			Northbound (1 lanes)			Eastbound (2 lanes)			Westbound (2 lanes)		
	R	TH	L	R	TH	L	R	TH	L	R	TH	L
1	**120**	**100**	**100**	**120**	**100**	**100**	**350**	**2300**	**260**	**350**	**2300**	**260**
2	**150**	**140**	**140**	**150**	**140**	**140**	**350**	**2000**	**340**	**350**	**2000**	**340**
3	**150**	**180**	**180**	**150**	**180**	**180**	**350**	**1800**	**320**	**350**	**1800**	**320**

Case 2 results are comparable to case 1

CASE 3 comparison

Scenario	Intersection	Delay (sec/veh)	Queue (ft)	No. of Stops	**Serviced Vehicles**	**Average Travel Time (hours/veh)**	Average Speed (mph)
1	Conventional	81.9	202.1	1.6	7419	0.037	14.87
	Superstreet	49.4	218.0	1.2	8121	0.029	19.77
	Improvement	40%	8%	26%	**9%**	22%	33%
2	Conventional	90.4	229.1	1.7	7354	0.039	13.88
	Superstreet	51.9	202.4	1.2	8261	0.029	19.17
	Improvement	43%	12%	29%	**12%**	25%	38%
3	Conventional	97.3	271.3	1.8	7277	0.042	13.18
	Superstreet	47.2	152.3	1.2	8174	0.029	20.00
	Improvement	52%	44%	36%	**12%**	31%	52%

Surrogate Safety Assessment Model Results for 1 U-Turn Lane

	Crossing Conflicts		Rear End Conflicts		Lane Change Conflicts		**Total Conflicts**	
	Conv.	Super.	Conv.	Super.	Conv.	Super.	Conv.	Super.
Mean	0.40	0.00	100.70	0.00	24.60	27.00	125.70	27.00
Variance	0.93	0.00	360.01	0.00	28.49	35.11	501.57	35.11
t-test value (95%)	1.312	1.812	16.783	1.812	-0.952	1.812	13.473	1.812
Improvement	100.00%		100.00%		-9.76%		**78.52%**	
Result	Not significant		Significant		Not significant		Significant	

Surrogate Safety Assessment Model Results for 2 U-Turn Lane

	Crossing Conflicts		Rear End Conflicts		Lane Change Conflicts		**Total Conflicts**	
	Conv.	Super.	Conv.	Super.	Conv.	Super.	Conv.	Super.
Mean	0.00	0.00	15.00	27.20	18.70	32.70	33.70	59.90
Variance	0.00	0.00	12.22	21.07	14.90	34.68	41.12	71.88
t-test value (95%)	0.000	1.812	-6.687	1.812	-6.288	1.812	-7.794	1.812
Improvement	0.00%		-81.33%		-74.87%		-77.74%	
Result	Not significant		Significant		Significant		Significant	

Conclusions

- The performance of the superstreet design is better than a conventional intersection primarily for one u-turn lane and at high volumes. Travel time was reduced by 30 to 40%, and throughput (serviced vehicles) increased by 22 to 40%.
- Highest throughput were obtained when the green time on the minor road is 20% of the major road green time for the one u-turn lane cases 1 and 2.
- For the two u-turn lanes case (case 3), smaller increase in throughput was obtained (ranging from 9 to 12%).
- SSAM results show a significant crash reduction for one u-tutn lane design only.