



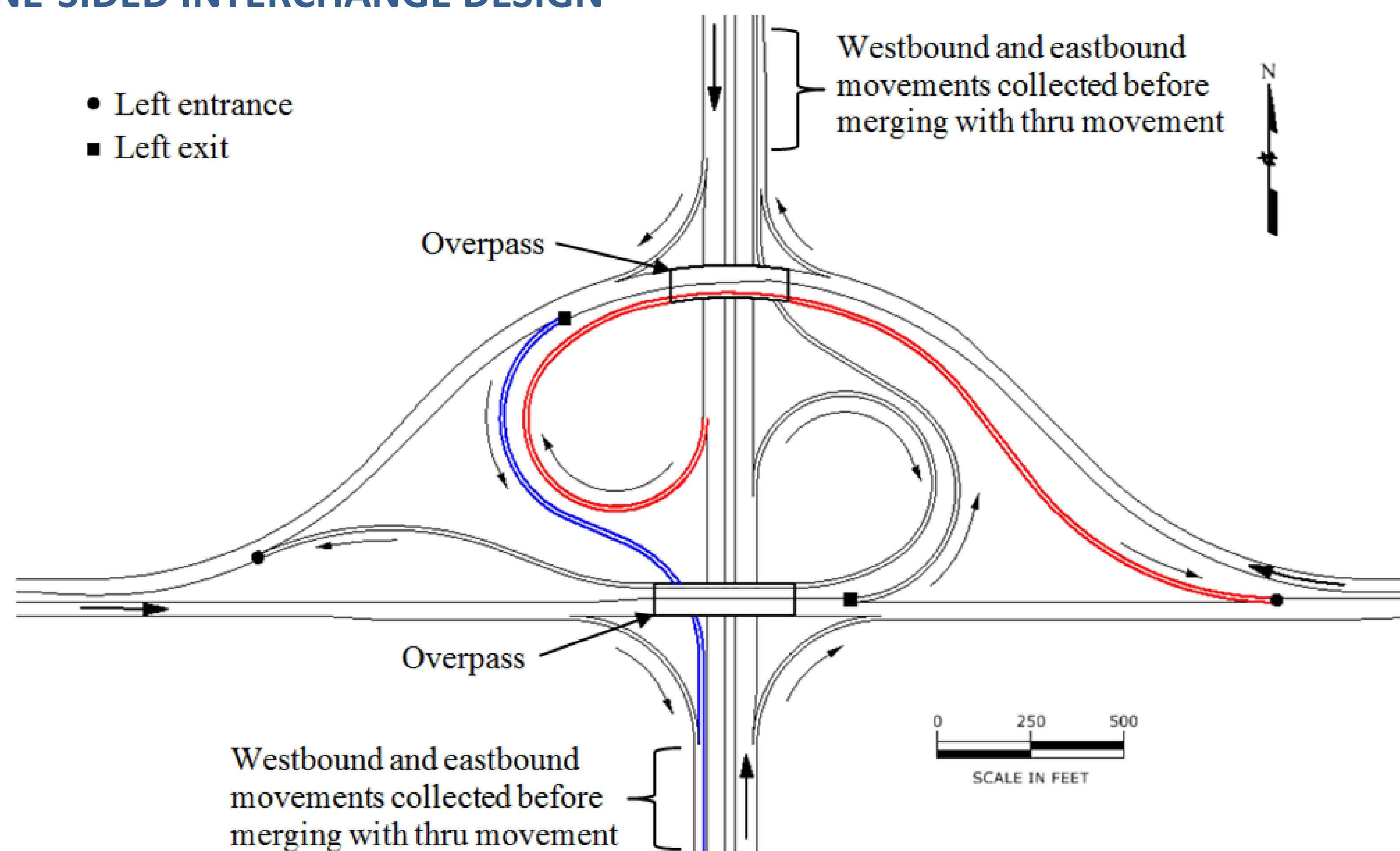
Operational and Safety Attributes of an Alternative Design, Space-Efficient One-Sided Interchange

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ABSTRACT

This study presents the one-sided interchange: an alternative, all-directional system interchange design that emphasizes land savings. Operational and surrogate safety characteristics of the interchange are analyzed using microsimulation and simulation-based safety software. A sensitivity analysis is conducted on several unique geometrics of the design. These variations are evaluated and compared to an equivalent cloverleaf interchange.

ONE-SIDED INTERCHANGE DESIGN



Area by Quadrant, acre	Cloverleaf (Traditional)	Cloverleaf (Case Network)	One-Sided	Difference
Northeast	24.7	15.8	25.8	+63%
Northwest	24.7	15.8	26.6	+68%
Southeast	24.7	15.8	2.06	-87%
Southwest	24.7	15.8	1.28	-92%
Total Area, acre	98.7	63.2	55.7	-12%
Length of Interchange, ln-mi	6.35	7.91	5.40	-32%
Surface Area of Bridge(s), ft ²	55,100	55,100	60,900	+11%

METHODOLOGY

Performance was evaluated under three volume scenarios. High volume consists of 5,500 vph, directional on the three-lane east-west corridor and 8,000 vph, directional on the four-lane north-south corridor. Medium volume consists of 4,500 vph east-west and 7,000 vph north-south, and low volume 3,500 vph east-west and 6,000 vph north-south. A full hour of traffic data was collected during simulation.

The safety analysis was conducted using the Surrogate Safety Assessment Model (SSAM) software. SSAM utilizes trajectories outputted from microsimulation – examining vehicle-to-vehicle interactions to determine the number and type of potential conflicts.

RESULTS

Base Case Comparison – Operational and Surrogate Safety Performance

Operational and Safety Characteristics	High Volume			Medium Volume			Low Volume		
	Cloverleaf	One-Sided	Difference	Cloverleaf	One-Sided	Difference	Cloverleaf	One-Sided	Difference
Total Travel Time (hr)	928	952	+3%	764	762	0%	608	614	+1%
Total Delay (hr)	110	138	+25%	78	68	-13%	42	40	-5%
Throughput (veh)	27,071	27,014	0%	23,057	23,053	0%	19,030	19,023	0%
Rear-End Conflicts (#)	230	567	+144%	101	98	-3%	39	48	+23%
Lane-Changing Conflicts (#)	495	737	+49%	259	379	+46%	131	202	+54%

Extended Left Entrances – Operational and Surrogate Safety Performance

Operational and Safety Characteristics	High Volume			Medium Volume			Low Volume		
	Cloverleaf	One-Sided	Difference	Cloverleaf	One-Sided	Difference	Cloverleaf	One-Sided	Difference
Total Travel Time (hr)	928	921	-1%	764	760	-1%	608	612	+1%
Total Delay (hr)	110	106	-4%	78	65	-17%	42	39	-7%
Throughput (veh)	27,071	27,043	0%	23,057	23,055	0%	19,030	19,021	0%
Rear-End Conflicts (#)	230	185	-20%	101	83	-18%	39	42	+8%
Lane-Changing Conflicts (#)	495	608	+23%	259	360	+39%	131	199	+52%

Bolded items indicate characteristics that are significantly different.

CONCLUSION

- One-sided design could save **43 acres** compared to a typical cloverleaf interchange (if connector ramps are not tightened).
- With left entrance extensions, operational performance is comparable between the one-sided and cloverleaf designs.
- One-sided design may be useful in locations with limited turning movements, limited right of way, and where multi-level directional interchanges are infeasible.
- Further research is needed regarding costs and constructability.