

FACTORS AFFECTING THE DIVERSION POTENTIAL OF CHANGEABLE MESSAGE SIGNS

Presented by

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The Transportation Challenge

CONGESTION

COST: \$100 BILLION PER YEAR IN THE U.S.

- 5.4 billion hours of delay
- 8.5 billion gallons of fuel

SAFETY: 30% of urban freeway crashes

Average Annual Delay per Motorist in Cities

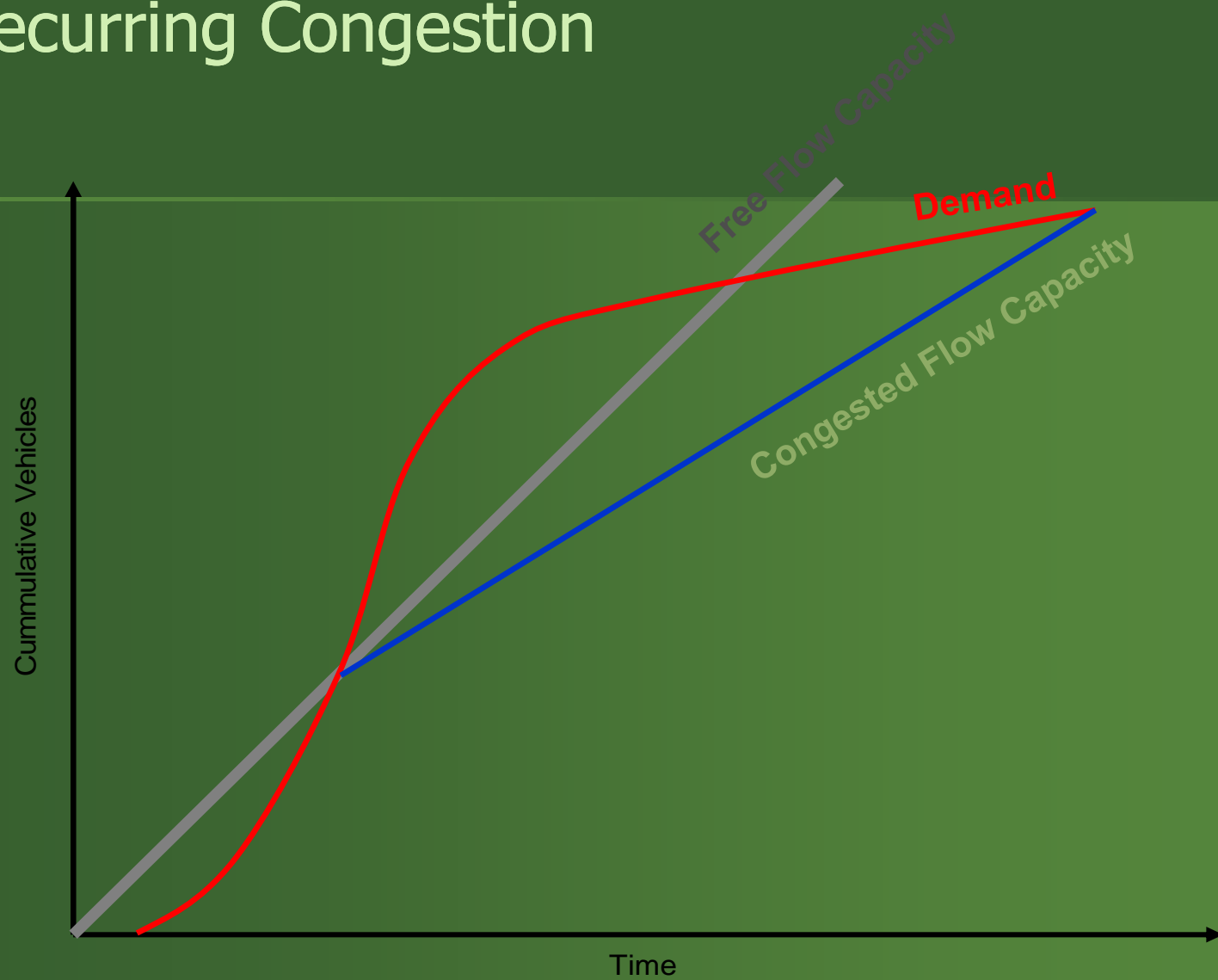
- Los Angeles 93 hours
- San Francisco 72 hours
- Washington D.C. 69 hours
- Atlanta 67 hours
- Houston 63 hours

What Is Congestion

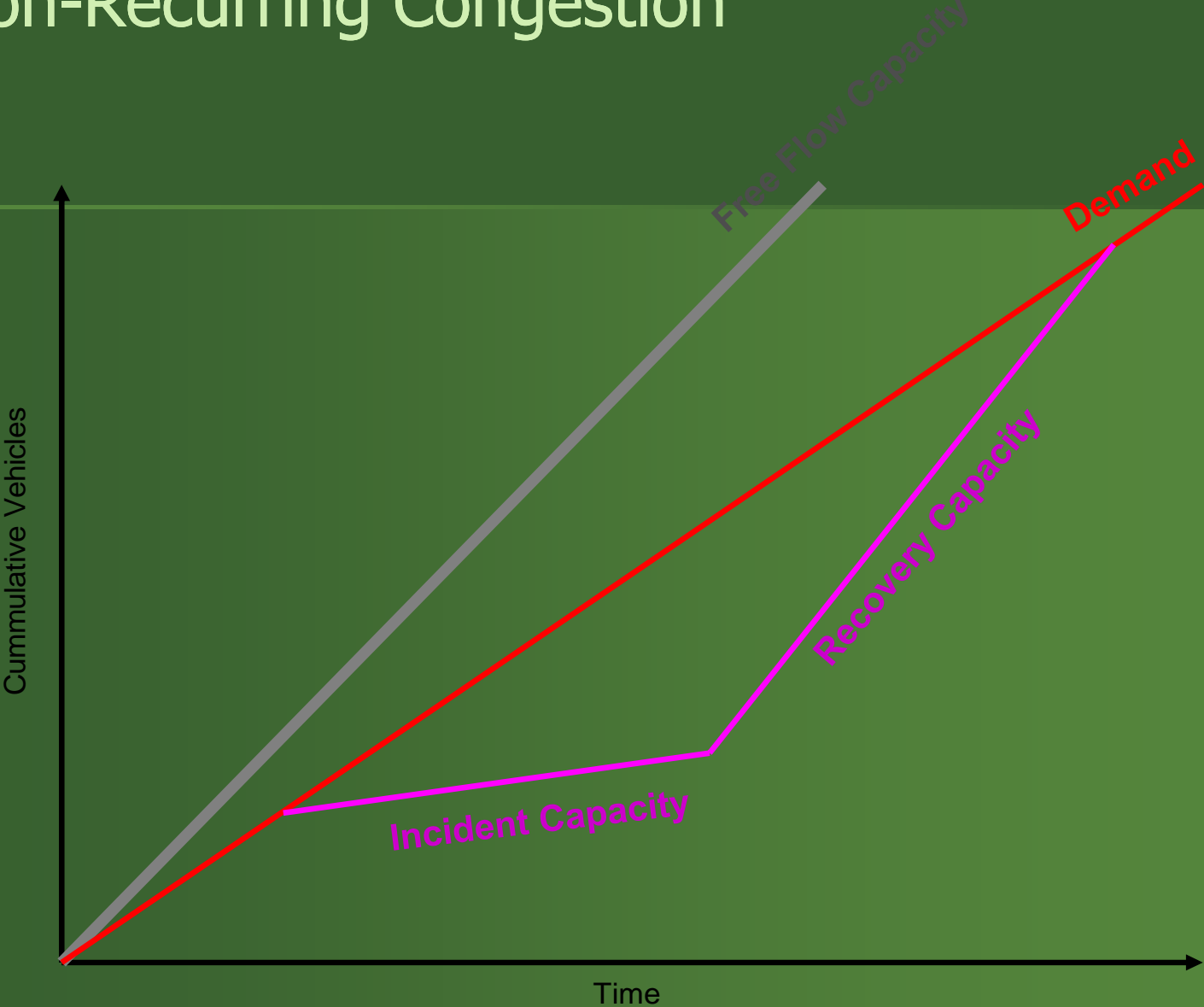
CONGESTION TYPES

- RECURRING
- NON-RECURRING

Recurring Congestion



Non-Recurring Congestion



To Relieve Recurring Congestion We Can

- A) BUILD ADDITIONAL LANES TO INCREASE CAPACITY
- B) INCREASE THE CAPACITY OF THE EXISTING LANES
 - BUS LANES
 - HIGH OCCUPANCY VEHICLE LANES
- C) REDUCE THE DEMAND
 - ENCOURAGE PEOPLE TO SHIFT MODES
 - ENCOURAGE PEOPLE TO SHIFT TIMES OR ROUTES
 - RAMP METERING
 - CONGESTION PRICING
 - VALUE PRICING

To Relieve Non-recurring Congestion

THERE ARE FEWER OPTIONS
BECAUSE THE PEOPLE ARE ALREADY
ON THE FREEWAY, AND WE WANT
TO ENCOURAGE THEM TO EXIT
PRIOR TO REACHING THE
CONGESTED SECTION

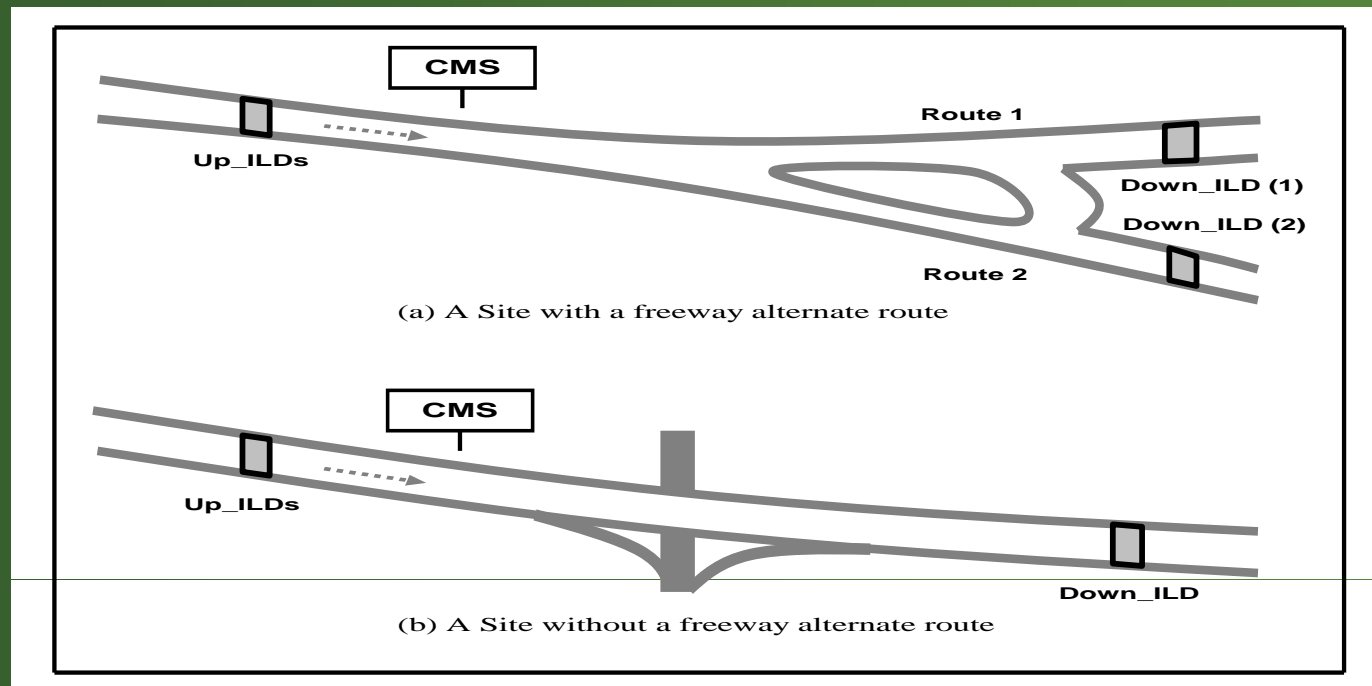
- A) DYNAMIC CONGESTION PRICING
- B) CHANGEABLE MESSAGE SIGNS (CMS)

OBJECTIVE OF THE STUDY

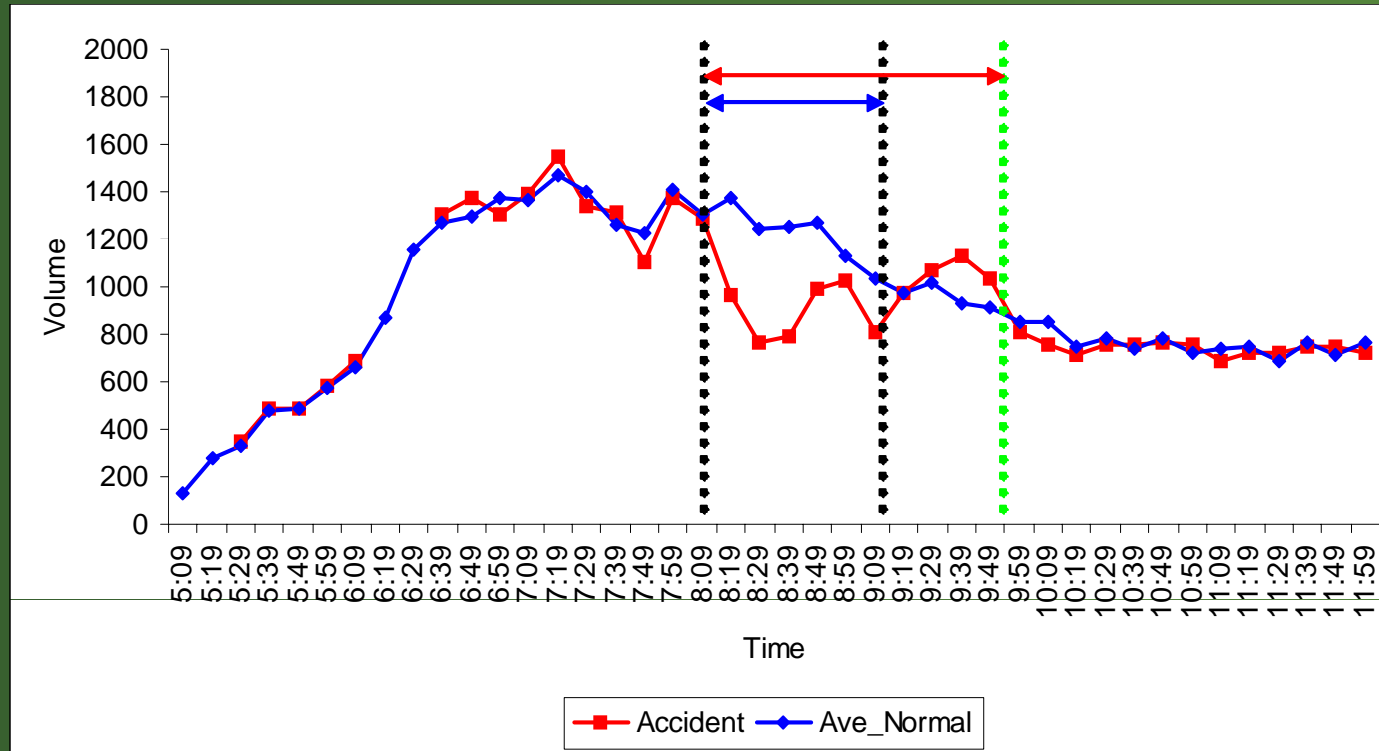
- TO MEASURE THE PERCENTAGE OF DRIVERS THAT DIVERTED FROM THEIR NORMAL PATH WHEN PRESENTED WITH A MESSAGE INDICATING THERE WAS AN ACCIDENT AHEAD
- TO DETERMINE THE CHARACTERISTICS THAT AFFECT THIS DIVERSION PERCENTAGE

ILD Traffic Data Collection

- To measure the diversion ratio, ILD traffic data were collected at upstream and downstream locations.



Example of Downstream Volume Data between Accident and Ave. Normal



**DIVERTED VEHICLES = ΣV from 8:09
to 9:59 on a normal day minus ΣV
from 8:09 to 9:59 on the accident day**

Factors Included In The Study

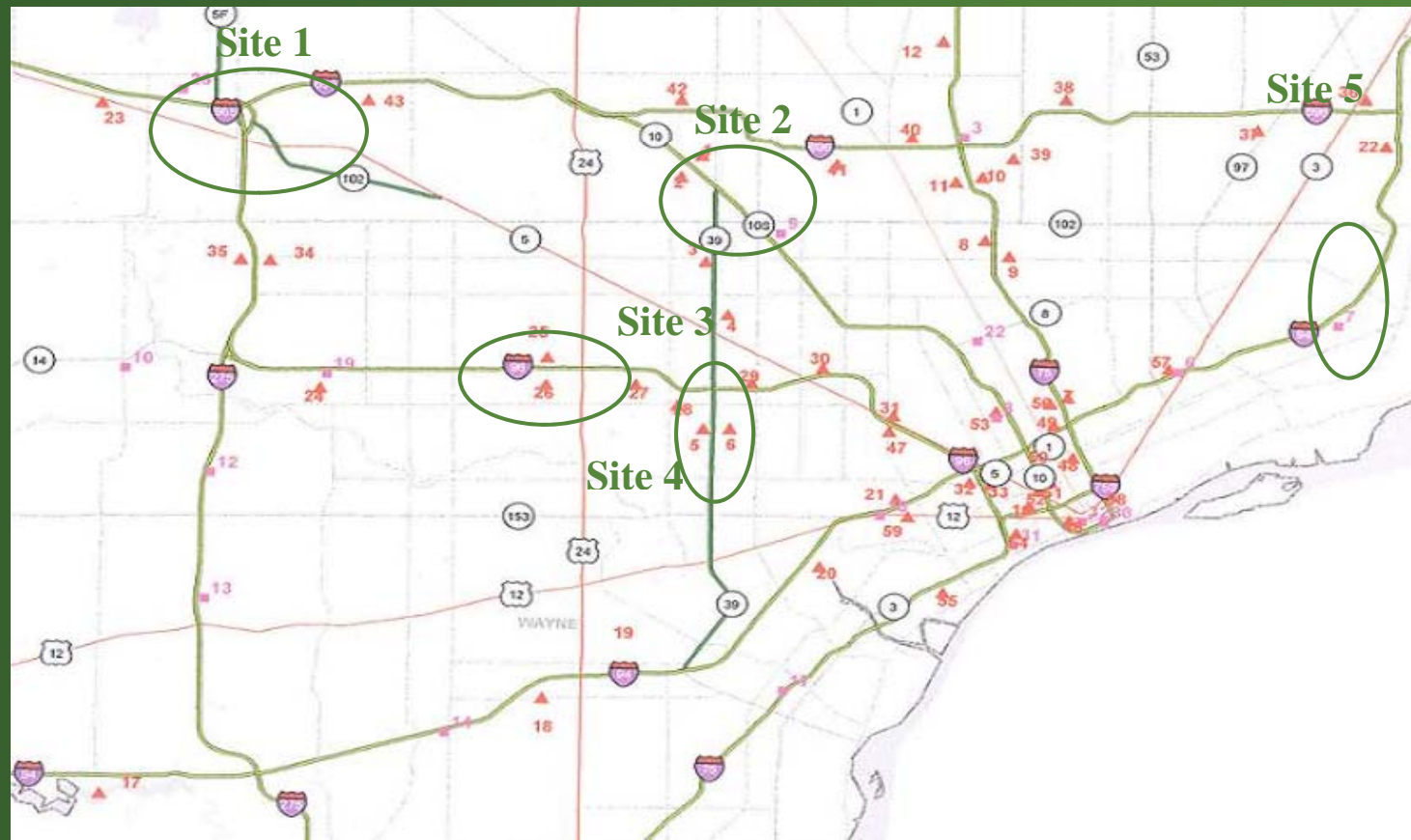
- TIME OF DAY (FAMILIARITY)
- CHARACTERISTICS OF THE ALTERNATE ROUTE
 - FREEWAY – ARTERIAL ROAD
 - CONGESTED- NON-CONGESTED
- LENGTH OF THE QUEUE (VISIBILITY)

Study Area



- Metropolitan Detroit Area, Michigan.
 - 180 total freeway miles with a traffic monitoring system.
 - 59 Changeable Message Signs (CMS).
 - 61 Ramp meters.
 - 2260 Inductive Loop Detectors (ILD)

Selected Study Sites



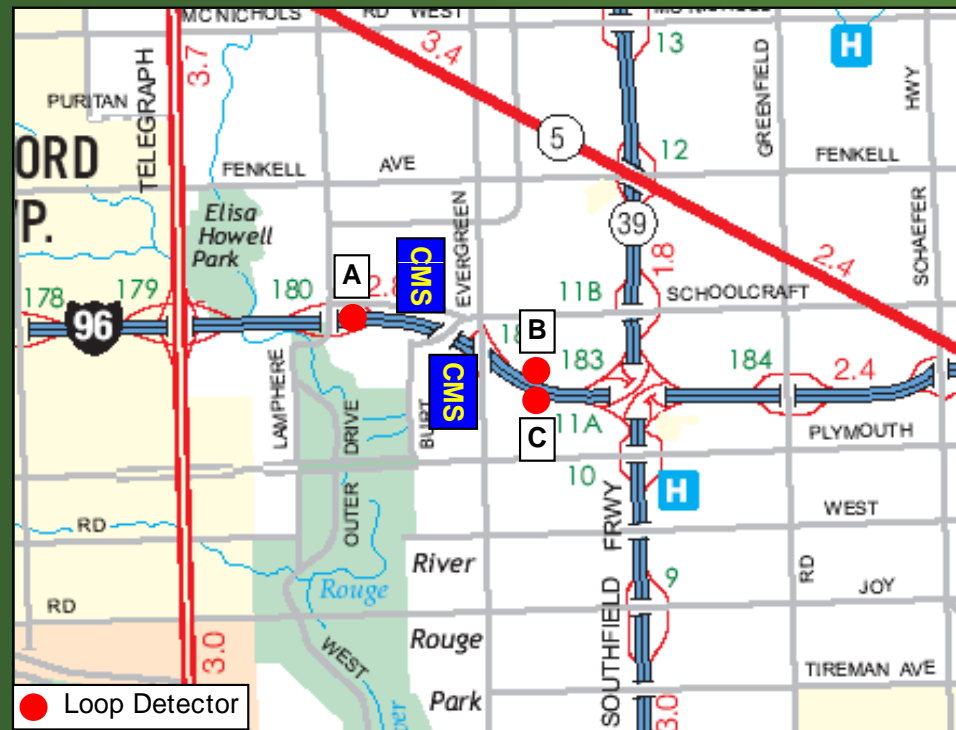
Site 1 Location



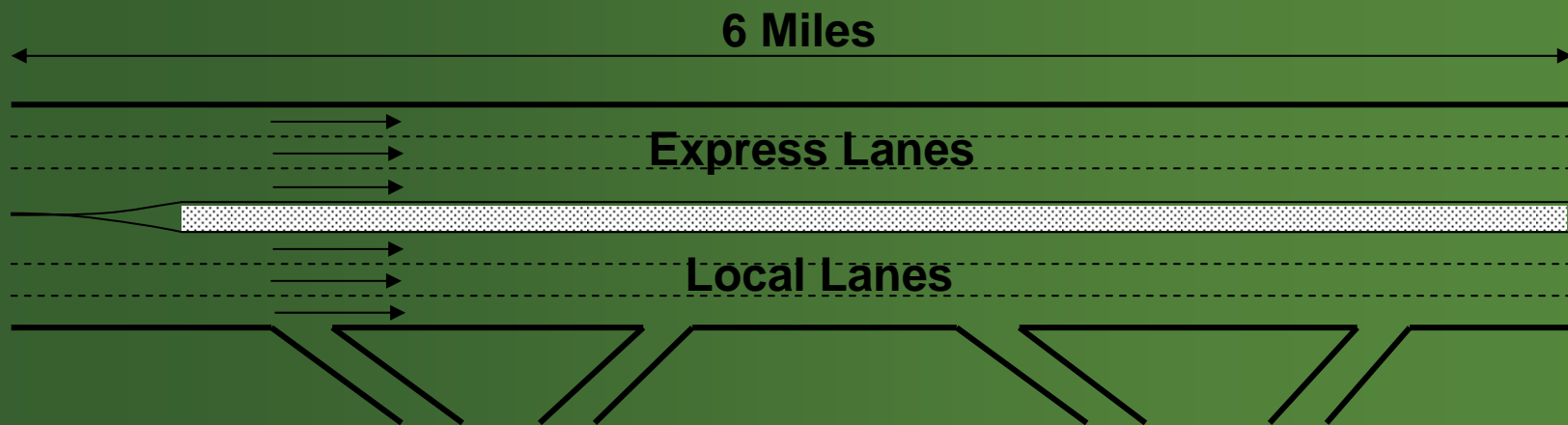
Site 2 Location



Site 3



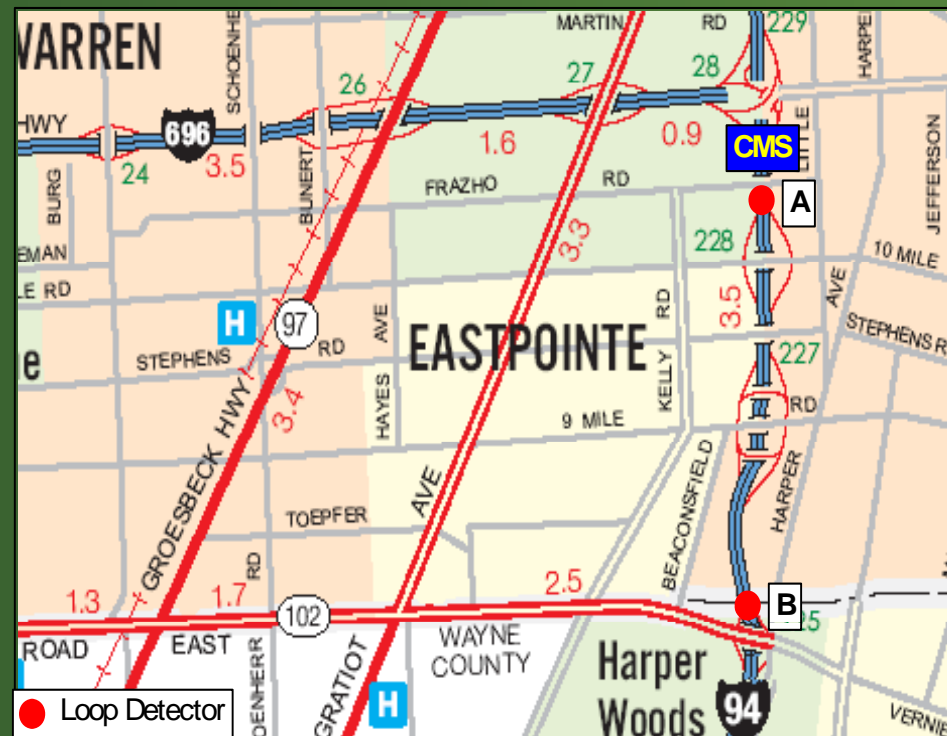
Lane Configuration at Site 3



Site 4



Site 5



SUMMARY OF IMPACTS (% DIVERTED)

TIME OF DAY					
	Site 1	Site 2	Site 3	Site 4	Site 5
PEAK HOUR	8.47	7.06	1.78	3.31	0.78
NON-PEAK	1.47	3.89	2.23	1.71	0.09

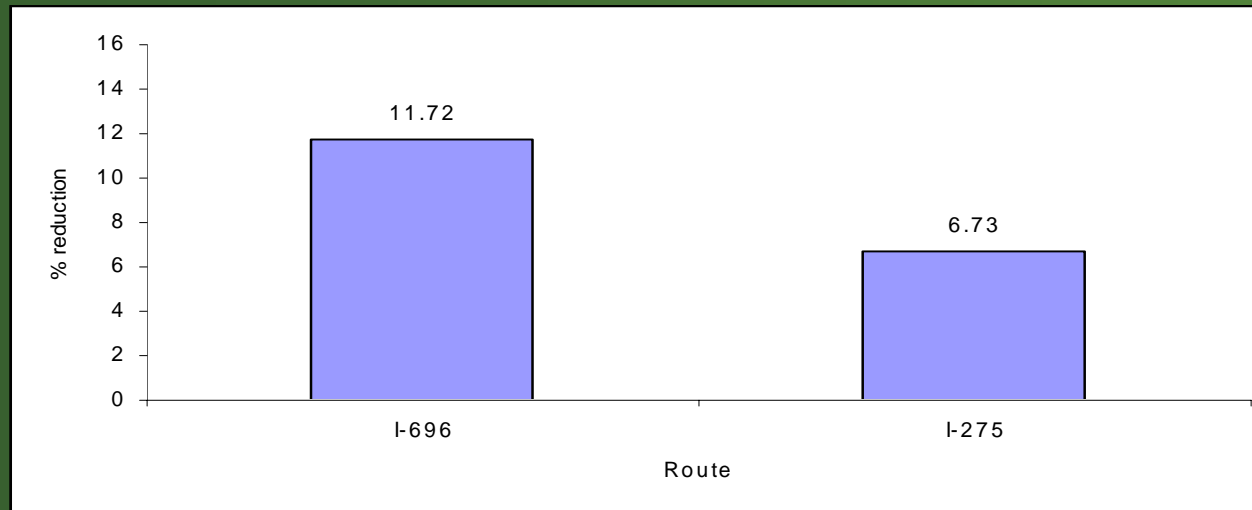
TRAFFIC CONDITION	
SITE 1 – to non-congested alternative	11.72
SITE 1 – to congested alternative	6.73

QUEUE VISIBILITY		
	SITE 1	SITE 5
QUEUE IS VISIBLE	13.26	1.65
QUEUE IS NOT VISIBLE	4.66	0.34

TYPE OF ALTERNATE ROUTE	
FREEWAY PEAK HOUR	9.08
NON-FREEWAY NON PEAK	1.96

Sensitivity Analysis (EXAMPLE)

- Traffic Condition Sensitivity



Is This Significant?

EXAMPLE

A 3-LANE FREEWAY VOLUME UNDER NORMAL CONDITIONS HAS A CAPACITY OF 6000 vph

AT A CONGESTED SPEED OF 20 MPH, THE VEHICLE DENSITY IS 70 vpm

DIVERTED VEHICLES = $6000 (.117) = 702$ veh
OR APPROXIMATELY 10 LANE MILES OF REDUCED CONGESTION

Conclusions

- DRIVER FAMILIARITY, CHARACTERISTICS OF THE ALTERNATE ROUTE, AND THE VISIBILITY OF THE QUEUE ALL HAVE AN IMPACT ON ROUTE DIVERSION
- THE DIVERSION RATIO RANGED FROM A LOW OF 0.47% TO A HIGH OF 16.44% ACROSS THE 5 SITES

Recommendations

- CMS should be selectively located to maximize their effectiveness and minimize the system cost.
- The detector spacing is critical in determining system effectiveness.