

# **Evaluation of the Cost-effectiveness of Freeway Service Patrol for Reducing Nonrecurrent Congestion**

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# INTRODUCTION



Departamento de Ingeniería Civil y Agrícola

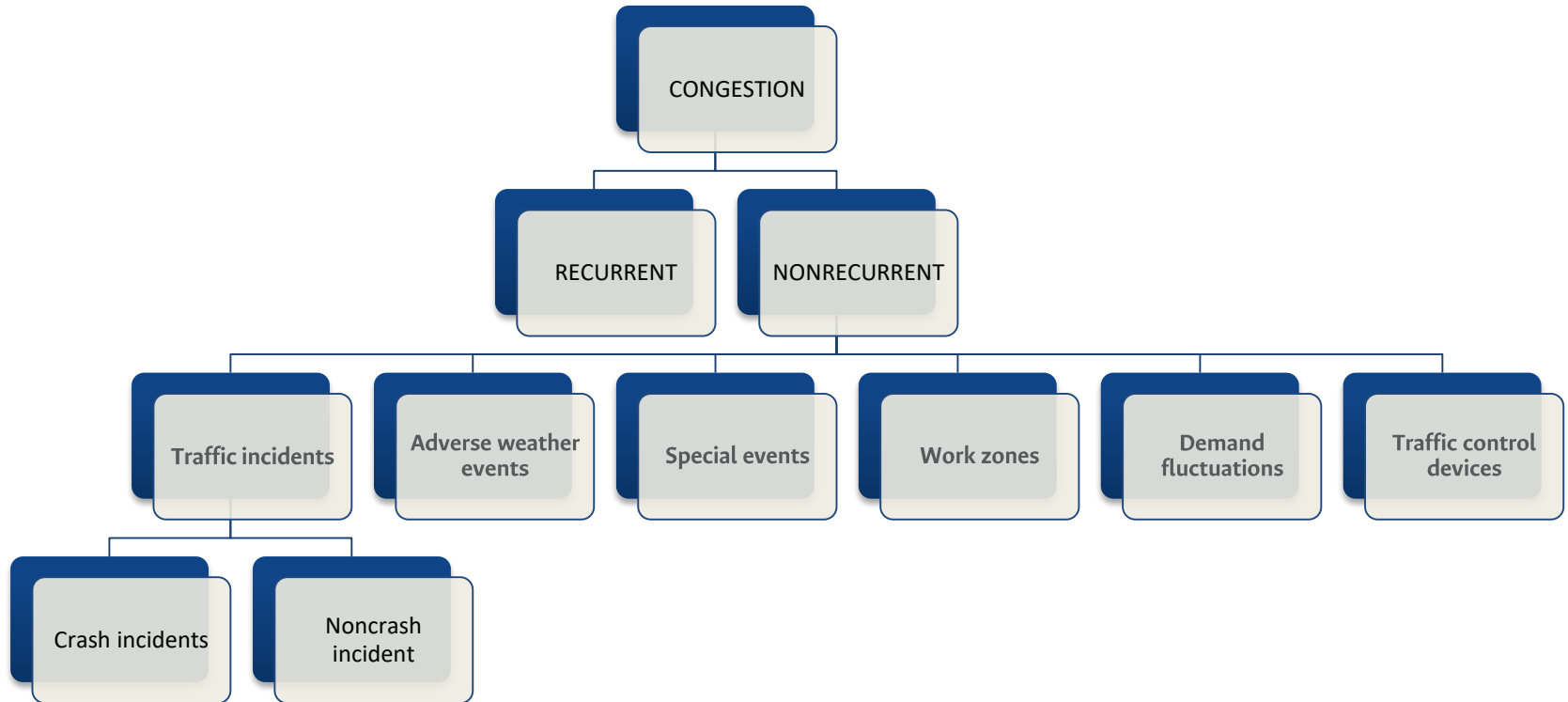


# INTRODUCTION



Source: Pixabay

# INTRODUCTION



# FREEWAY SERVICE TEAM



Source: FHWA



Identify incident location



Reduce incident duration time



Restore full freeway capacity



Reduce the risk of secondary accidents



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# PROJECT L07



Identification and Evaluation of the Cost-Effectiveness of Highway Design Features to Reduce Nonrecurrent Congestion

- VBA supported Microsoft spreadsheet where cumulative travel time index (TTI) for each hour of the day can be obtained.
- Allows users to compare TTI curves for a specific highway segment with and without treatment.

# EVALUATION OF THE FREEWAY SERVICE TEAM



- FST applied on I-41 in a work zone environment in 2016.
- From Lineville Road to Scheuring Road in Brown County.
- Service corridor length: 12-miles.

# DATA LIMITATION AND SOLUTION

Required Input	Data Source	Issues & Limitations	Solutions
Base Traffic Lane Capacity	MetaManager	Measured or estimated FFS is not available.	Used the HCM method and manually collected Interchange density from Google Map.
Traffic Demand	ATR Record	ATR_RATIO = 0	ATR_RATIO = 1
Crash Count	MV4000	---	Assuming crash count remains the same w/ or w/o FST.
Crash Duration	STOC: Event Manager	Crash severity is not available.	Crash severities were assigned from MV4000 based on time and cross-street.
	FST	---	
Crash Cost	KABCO	----	
Non-crash Incident Count	STOC: Event Manager	Only includes the incident calls received by STOC.	<b>Scenario 1</b> Used L07 default proportion to estimate non-crash incident count.
	FST	Only has the incidents logged by the FST provider.	<b>Scenario 2</b> Assuming incident counts remains the same w/ or w/o FST.
Non-crash Incident Duration	STOC: Event Manager	Very high incident duration (>4 hours).	<b>Scenario 1</b> Duration estimated excluding very high incident durations.
	FST	<ul style="list-style-type: none"> <li>Duration for incidents w/o FST is not available.</li> <li>4% of total incidents have duration &lt;5min.</li> </ul>	<b>Scenario 2</b> <ul style="list-style-type: none"> <li>Used L07 default incident durations as w/o FST.</li> <li>Duration estimated excluding very low incident durations (&lt;5 mins).</li> </ul>



# INPUTS

Geometric Attributes	Brown County
From	Lineville Rd
To	Scheuring Rd
Length	12 miles
Terrain	Level
Urban/ Rural	Urban
No. of Lanes	2
Lane Width	12 feet
Right-side Lateral Clearance	10 feet
Interchanges per mile	0.7
Base FFS	75.4 mph (default)
Lane Capacity	2400 pc/hr/ln (default)

# SCENARIO 1

Using Incident Duration from WISDOT's TMC-Event Manager Database

Incident	W/O FST		With FST	
	Count <sup>1</sup>	Average Incident Duration <sup>2</sup> (min)	Count	Average Incident Duration <sup>2</sup> (min)
<b>Crash Incident</b>				
PDO	12	29	Same as "before"	20
Injury	4	52		36
Fatal	2	45 <sup>3</sup>		NA (35) <sup>4</sup>
<b>Non-Crash Incident</b>				
Disabled-Lane Blocking	22% of all incidents are crashes <sup>3</sup>	56	22% of all incidents are crashes <sup>3</sup>	13
Disabled-Non-Lane Blocking		65		27
Other		NA		NA

1. The crash count is the five-year annual average from 2011 to 2015. Use annual average is to overcome the limitation of random fluctuation due to one-year observation.
2. Crash/ Non-crash incident duration is averaged over both NB and SB direction.
3. 3L07 default value.
4. Assumed value.



# SCENARIO 2

Using Incident Duration from FST Database

Incident	W/O FST		With FST	
	Count	Annual Incident Duration (min) <sup>1</sup>	Count	Annual Incident Duration (min)
<b>Crash Incident</b>				
PDO	12	28	Same as "before"	17
Injury	4	40		20
Fatal	2	45		NA (35) <sup>2</sup>
<b>Non-Crash Incident</b>				
Disabled-Lane Blocking	Same as "after"	20	292	11
Disabled-Non-Lane Blocking		26	251	14
Other		23	39	12

1. L07 default duration.

2. Assumed value.



# BENEFIT ESTIMATION

Particulars	NB	SB	Total
Annual Delay Reduction (veh-hr)	1,454,240	1,082,085	2,536,325
Std. Dev. Change Indicator <sup>1</sup>	39.9	27.3	
<b>Annual Operational Benefit (AOB) in \$</b>			
Delay Component	\$22,802,488	\$16,967,100	\$39,769,588
Reliability Component	\$1,487,034	\$1,016,942	\$2,503,976
<b>Total AOB</b>	<b>\$24,289,522</b>	<b>\$17,984,042</b>	<b>\$42,273,564</b>
<b>Annual Safety Benefit (ASB) in \$</b>			
<b>Benefit due to congestion reduction</b>			
Fatal/ Major Injury	\$55	\$57	\$112
Minor Injury	\$155	\$123	\$278
PDO	\$746	\$263	\$1,009
<b>Benefit due to treatment effect</b>			
Fatal/ Major Injury	\$0	\$0	\$0
Minor Injury	\$0	\$0	\$0
PDO	\$0	\$0	\$0
<b>Total ASB</b>	<b>\$957</b>	<b>\$443</b>	<b>\$1,400</b>
<b>Total Annual Benefit</b>	<b>\$24,290,476</b>	<b>\$17,984,485</b>	<b>\$42,274,961</b>

1. Change in Std. Dev. of Travel Time Index (TTI) due to treatment.



# BENEFIT ESTIMATION

Particulars	NB	SB	Total
Annual Delay Reduction (veh-hr)	2,476,171	2,558,266	5,034,437
Std. Dev. Change Indicator	31.4	32.1	
<b>Annual Operational Benefit (AOB) in \$</b>			
Delay Component	\$38,826,367	\$40,113,607	\$78,939,974
Reliability Component	\$1,173,149	\$1,198,936	\$2,372,085
<b>Total AOB</b>	<b>\$39,999,516</b>	<b>\$41,312,543</b>	<b>\$81,312,059</b>
<b>Annual Safety Benefit (ASB) in \$</b>			
<b>Benefit due to congestion reduction</b>			
Fatal/ Major Injury	\$2,775	\$1,073	\$3,848
Minor Injury	\$577	\$502	\$1,079
PDO	\$197	\$221	\$418
<b>Benefit due to treatment effect</b>			
Fatal/ Major Injury	\$0	\$0	\$0
Minor Injury	\$0	\$0	\$0
PDO	\$0	\$0	\$0
<b>Total ASB</b>	<b>\$3,550</b>	<b>\$1,796</b>	<b>\$5,346</b>
<b>Total Annual Benefit</b>	<b>\$40,003,066</b>	<b>\$41,314,339</b>	<b>81,317,405</b>

# CONCLUSIONS

- The tool provides operational and safety benefits separately along with travel time reliability performance measures.
- The reliability benefit output obtained from the test run is low compared to the delay benefit.
- The L07 reliability outputs need to be compared with existing conditions to evaluate the tool accuracy.