

Course Outline

- The Interstate Highways Congestion Policy
- Queue Analysis Basics
- Traffic Data: Obtaining & Adjusting
- Queue Analysis for Mainline Closures
- Detour Route Summary Analysis
- Rolling Slowdowns
- Preparing the IHCP Exception Documents
- The IHCP Exception Request Submittal Package
- Test and Evaluation



100

The IHCP | Outline

- Purpose of the Policy
- IHCP Website & Content
- Changes from the 2014 Policy
- Policy Basics
- Policy Exception Basics



101

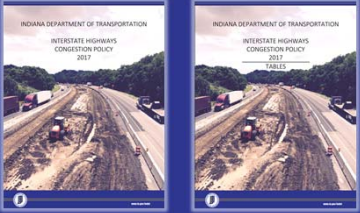
The IHCP | Outline

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102

2017 Interstate Highways Congestion Policy (IHCP)



Effective January 6, 2017

Referred to as the "IHCP" or the "Policy"



103

2017 IHCP

Purpose of the Policy

"...to ensure that work zones provide optimal safety for workers and all other users of the work zone. To achieve this goal, work zone restrictions [...] shall be scheduled to maximize efficiency by the appropriate selection of work hours [and by implementing] appropriate countermeasures [...] to provide the best level of service achievable for motorists..."

The intent is not to prevent work outside of policy criteria from happening; rather it is to make sure that alternatives have been considered and that the best times have been selected.



104

2017 IHCP

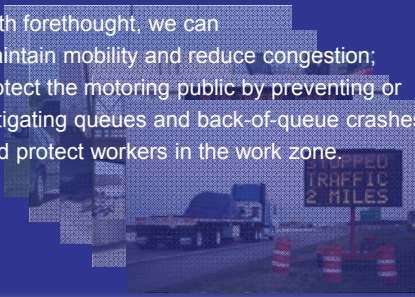
Purpose of the Policy (Restated)



105

2017 IHCP

With forethought, we can maintain mobility and reduce congestion; protect the motoring public by preventing or mitigating queues and back-of-queue crashes; and protect workers in the work zone.



106

The IHCP | Outline

- Purpose of the Policy
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107

2017 IHCP | Website www.in.gov/indot/3383.htm



108

2017 IHCP | Website www.in.gov/indot/3383.htm

Current Policy

- 2017 Interstate Highways Congestion Policy (2)
- (Signed January 6, 2017. Effective for RFC dates on or after March 7, 2017)
- 2017 Interstate Highways Congestion Policy Tables (2)
- Change Log
- Updates (Major updates to the policy will be posted here in the future.)
- Past Versions
- Sign up to receive email notifications about changes to the policy or website

Exception Requests

- Exception Request Form (38)
- Cover Letters and Exception Request Body Templates
- Analysis Tools
- District Contacts for Exception Request Submittals (2)
- Exceptions Work Flow Chart (2)
- INDOT Traffic Count Database System

Resources

- Queue Measurement Report Form (2)
- District and Non-District Traffic Restriction Reports

109

2017 IHCP | Mailing List

- Updates to the policy, tools, templates and the web site will be announced via a newly created mailing list.

→ Sign up for the mailing list via the link on the IHCP Web Site.

https://public.govdelivery.com/accounts/INDOT/subscriber/new?topic_id=INDOT_195

110

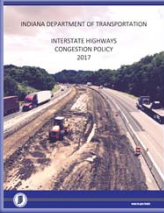
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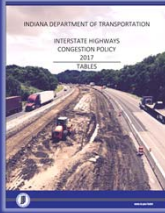
111

2017 IHCP | Changes from 2014 IHCP - Highlights

POLICY



TABLES



2 Parts
2 PDF's



112

2017 IHCP | Changes from 2014 IHCP - Highlights

- Role of the Work Zone Safety Section changes from Review to Q/A
 - New Exception Process: Changes to who reviews and approves exceptions
 - See Process Flow Chart on IHCP Web Site



113

2017 IHCP | Changes from 2014 IHCP - Highlights



114

2017 IHCP | Changes from 2014 IHCP - Highlights

- Role of the Work Zone Safety Section changes from Review to Q/A
 - New Exception Process: Changes to who reviews and approves exceptions
 - See Process Flow Chart on IHCP Web Site
- Simpler process for minor Policy updates
 - New Web Site & Mailing List



115

2017 IHCP | Changes from 2014 IHCP - Highlights

- Work zone lane capacities have increased by approximately 10%
- Appendix C was rewritten to clarify the exception process and requirements
- Change Log available on IHCP Web Site



116



2017 IHCP | Changes to Exception Process

- New Reviewers & Approvers:
Exceptions involving TMD-Managed Non-Contract Work of ITS Infrastructure:
- Reviewed by Work Zone Safety Section
 - Approved by the Traffic Management and District Support Director



117

2017 IHCP | Changes to Exception Process

New Reviewers & Approvers:

District Biennial Maintenance Exceptions:

- Reviewed by Work Zone Safety Section
- Approved by the Maintenance Management and District Support Director



118

2017 IHCP | Changes to Exception Process

New Reviewers & Approvers:

Exceptions during scoping or design (prior to letting)

- Reviewed by District Technical Services Division
- Approved by Statewide Technical Services Director



119

2017 IHCP | Changes to Exception Process

New Reviewers & Approvers:

Exceptions for Contract Work (Construction), Non-contract Work (Maintenance) & Permits

- Reviewed by District Technical Services Division
- Approved by the District Deputy Commissioner



120

2017 IHCP | Changes to Exception Process

EXCEPTION REVIEWERS

MUST submit a copy of
ALL approved exceptions to the
SUPERVISOR of the
WORK ZONE SAFETY SECTION
to complete the exception process.



121

The IHCP | Outline

- Purpose of the Policy
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- Policy Exception Basics



122

Policy Basics | Background

- The IHCP is the policy INDOT developed to address potential congestion issues due to temporary operations on an interstate so that they are not permitted without prior approval
- It satisfies Federal requirements outlined in Rule 23 CFR 630 Subpart J



123

Policy Basics | Seven Sections

- Policy Statement
- Purpose
- Administered by → TMD WZSS
- Terms and Definitions*
- Application of the Policy*
- Pre-reporting Requirements*
- Policy Approval*



124

Policy Basics | Five Appendices

- A – Emergency and Urgent Repairs*
- B – Preapproved Interstate Closure and Restriction Times*
- C – Policy Exceptions*
- D – Rolling Slowdowns*
- E – Queue Measurement and Reporting*



125

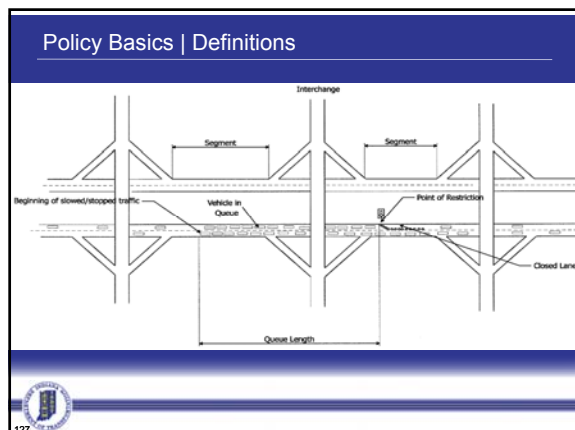
Policy Basics | Definitions

Congestion: when traffic volume > capacity

Queue: length of pavement occupied by (a) line(s) of closely spaced vehicles moving below 30 mph measured from the point of restriction towards oncoming traffic



126



Policy Basics | Definitions

PCE: Passenger Car Equivalent

$PCE = (\text{Passenger Cars}) + (2 \times \text{Trucks})$
where
 Passenger Cars = $\sum$ Categories 1 thru 3
 Trucks = $\sum$ Categories 4 thru 15

FHWA-Scheme F Classification																	Passenger Vehicle Total	Single Unit Truck Total	Combination Truck Total	Hourly Total		
Date	Begin Interval Time	(1) Motor Cycle	(2) Car	(3) Pick up	(4) Van	(5) 2A	(6) 2B	(7) 3A	(8) 3B	(9) 4A	(10) 4B	(11) 5A	(12) 5B	(13) 6A	(14) 6B	(15) 7A						

128

Policy Basics | Application of the Policy

This section of the Policy describes

- Who must follow the policy
- When it does & doesn't apply
- Where it applies
- How to seek an exception
- What data collection is required

Items above are further expanded upon in the Appendices

129

Policy Basics | Pre-Reporting Requirements

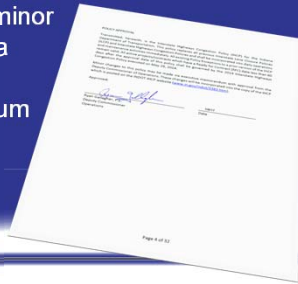
- Closures must be reported to TMC
- At least 3 business days prior
- Report includes...
 - Closure details
 - Contact information
- Primary Contact shall call TMC to confirm immediately prior to planned restriction



130

Policy Basics | Policy Approval

- Replaces previous Policies
- Grandfathers existing Policy Exceptions
- Allows for minor changes via executive memorandum



131

Policy Basics | Appendix A

Emergency & Urgent Repairs

- District Deputy Commissioners may declare
- Emergency – requires immediate closure
- Urgent – work to begin within 24 hrs during hours with lowest volume possible
- Such closures are documented by memo



132



133



134

TIME DESCRIPTIONS FOR SHOULDER PAIN



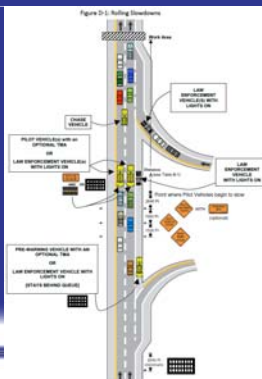
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Policy Basics | Appendix E

Queue Measurement & Reporting

- Queue measurements are required during lane shoulder and ramp restrictions
- Supported by CM 07-25 (10/30/07)
- Discusses when to perform measurements
- Report form posted on IHCP Web Site
- Measurements are intended to be used as feedback to aid in calibrating the Policy



139

The IHCP | Outline

- Purpose of the Policy
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140

Policy Exception Basics | Need

An Exception is needed when

- The Pre-Approval tables in Appendix B do not cover the planned closure or restriction (e.g. multi-lane closures, full closure of interstate, customized work hours, etc.)
- If applicable, the District Biennial Maintenance Exception does not cover the closure or restriction



141

Policy Exception Basics | Need

...and per the "Application of Policy" section

- Any operation on a ramp or intersecting roadway which causes queue on the interstate to exceed ½ mile must allow the queue to dissipate without an exception.
- Full closure of any interstate exit ramp for more than 10 minutes
- Full closure of any interstate to interstate ramp for any duration



142

Policy Exception Basics | Need

...also per Appendix C

- Restrictions with less than 11 ft. lane width (even if no lanes are being closed!)
Note: this is not a Design Exception
- Any closure planned to occur over a major holiday as defined in the Standard Specs
- Any closure on a segment of interstate designated as a detour/alternate route for another project/closure.



143

Policy Exception Basics | Need

Appendix C (cont.)

- Rolling slowdowns if
 - Pilot Vehicle speed < 20 MPH
 - Duration > 20 min
 - Traffic volume during hour of closure > 800 PCE
- Alternative methods to perform rolling slowdowns that differ from Appendix D



144

Policy Exception Basics

Purpose of an Exception

- To analyze traffic data to identify problems or concerns
- To select work times that will minimize those problems
- To plan mitigation to deal with those problems



145

Policy Exception Basics | Who Prepares?

IHCP Appendix C, Pg 10 of 32:

- It is responsibility of the person planning or proposing the restriction/closure to
 - Determine if a restriction/closure is within policy guidelines
 - And if not, to prepare an exception
- "He (She) who requests, oversees or manages the work, prepares the exception."



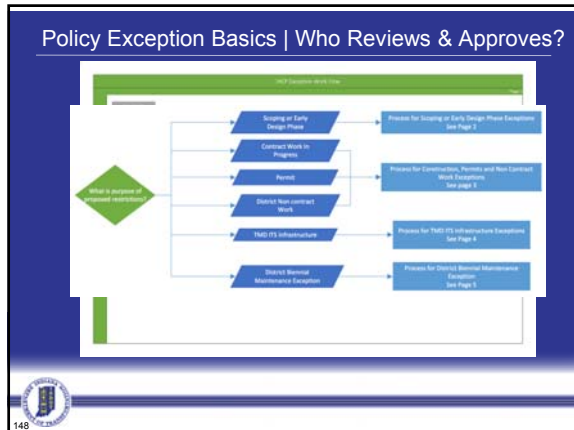
146

Policy Exception Basics | Who Prepares?

- For contracted activities, the designer of record or their designee is the person responsible.
- For INDOT Non-contract work, such as inspection, whoever manages the work is responsible for the preparation.



147



Policy Exception Basics

Purpose of an Exception

- Policy Exceptions force deliberate consideration of traffic impacts before work begins
- Again: the intent is NOT to prevent work from occurring
- Think before you leap!

149

Policy Exception Basics | Preparing an Exception

- Requests should be prepared as early as possible
- Submit requests no less than 10 business days before the start of work.
No guarantees otherwise!
- Include all closures needed for all phases and for transitions between phases
 - Saves time, fewer requests, less paperwork, fewer approvals needed

150

Policy Exception Basics | Preparing an Exception

Contract Work – 3 methods

- Formal IHCP Exception Request
- Exception Request based on the District Biennial Maintenance Exception IF the work is of a Short Duration AND Maintenance Nature
- Exception Request based on a previously approved exception (contact District TSD)



151

Policy Exception Basics | Preparing an Exception

Non-Contract Work

- Districts apply for a Biennial Maintenance Exception which is valid 2 years
- Otherwise, if closure not pre-approved by Appendix B, the District will need a formal Exception request

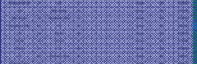


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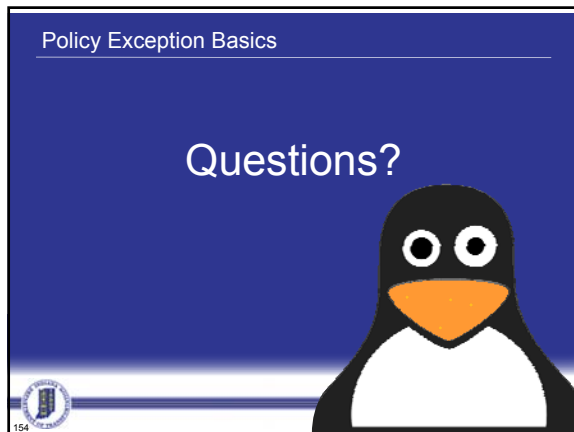
Policy Exception Basics | Preparing an Exception



Minimum Number of Lanes Open	Threshold (Rural)	Threshold (Urban)
All Travel Lanes Open, No Shoulder Work	Varies by # of Lanes	Varies by # of Lanes
All Travel Lanes Open, Shoulder Work Allowed	Varies by # of Lanes	Varies by # of Lanes
6 Lanes Open, Shoulder Work Allowed	10400 PCE/HR	11440 PCE/HR
5 Lanes Open, Shoulder Work Allowed	8600 PCE/HR	9460 PCE/HR
4 Lanes Open, Shoulder Work Allowed	6800 PCE/HR	7480 PCE/HR
3 Lanes Open, Shoulder Work Allowed	5000 PCE/HR	5500 PCE/HR
2 Lanes Open, Shoulder Work Allowed	3200 PCE/HR	3520 PCE/HR
1 Lane Open, Shoulder Work Allowed	1400 PCE/HR	1540 PCE/HR




153



Course Outline

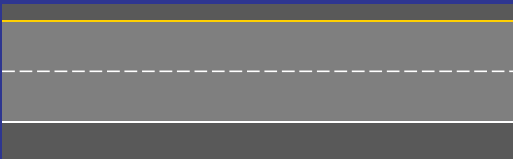
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155

Queue Analysis Basics

2 lane segment of Interstate (1 direction)
70 mph Speed Limit



What is its capacity?



156

Queue Analysis Basics

Table C-2: Capacities at Free Flow Speed

Free Flow Speed (MPH)	Volume at Capacity (PCEs/HR/Lane)
45	1900
55	2250
60	2300
65	2350
70	2400
75	2400



157

Queue Analysis Basics

2 lane segment of Interstate (1 direction)
70 mph Speed Limit

Capacity = 2400 PCE/HR/Lane x 2 Lanes
= 4800 PCE/HR



158

Queue Analysis Basics

2 lane segment of Interstate (1 direction)
70 mph Speed Limit

If during a particular hour,
the demand is 2000 PCE
would we anticipate congestion?

Capacity = 4800 PCE/HR



159

Queue Analysis Basics

2 lane segment of Interstate (1 direction)
70 mph Speed Limit

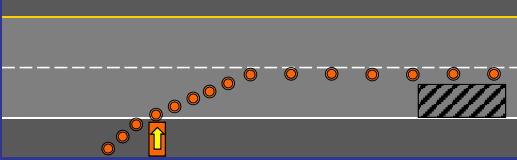
No, since the Volume (2000 PCE)
is less than the Capacity (4800 PCE/HR)



160

Queue Analysis Basics

2 lane segment of Interstate (1 direction)
Demand = 2000 PCE (during hour of interest)



What effect will this work zone have on congestion during the same hour?

161

Queue Analysis Basics

Table C-3: Lane Capacities in Work Zones

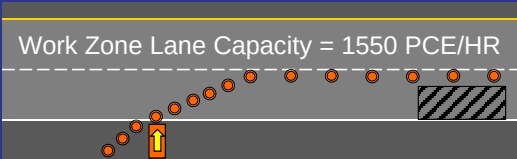
WZ Lane Configuration	Lane Capacity (PCEs/HR/Lane)		
	WZ Lane Width		
	11' to 12'	10' to 10.9'	9' to 9.9'
2 reduced to 1	1550	1400	1325
3 reduced to 2	1600	1450	1375
3 reduced to 1	1475	1350	1275
4 reduced to 3	1650	1500	1425
4 reduced to 2	1550	1400	1325
4 reduced to 1	1425	1325	1250

162

Queue Analysis Basics

2 lane segment of Interstate (1 direction)
Demand = 2000 PCE (during hour of interest)

Work Zone Lane Capacity = 1550 PCE/HR



Now the Demand exceeds Capacity!
During the hour, 450 PCE did not get through

163

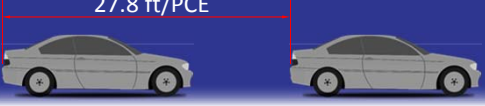
Queue Analysis Basics

How long is the queue if it contains 450 PCE?

Jam Density: the number of PCE in a single lane of 1 mile of queue.
190 PCE/mi/Lane, per IHCP

For 1 lane, $5280 \text{ ft/mi} \div 190 \text{ PCE/mi} =$

27.8 ft/PCE

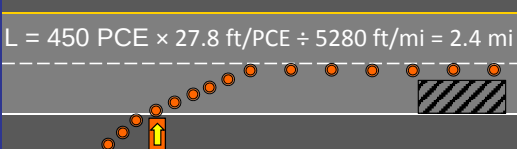


164

Queue Analysis Basics

2 lane segment of Interstate
450 PCE in queue; 27.8 ft/PCE

$L = 450 \text{ PCE} \times 27.8 \text{ ft/PCE} \div 5280 \text{ ft/mi} = 2.4 \text{ mi}$



Queue Length = $2.4 \text{ mi} / 2 \text{ lanes} = 1.2 \text{ mi}$

165

Queue Analysis Basics

Let's continue the analysis for a few more hours

Hour	Demand (PCE)	Capacity (PCE)	Queued (PCE)	Cum. Queued (PCE)	Queue Length (mi)
1	2000	1550	450	450	1.2

166

Queue Analysis Basics

Queuing calculation formula:

$$L = L_0 + \frac{(V - C) \cdot 1 \text{ hr}}{(k \cdot N)}$$

Where

- L (mi) = Length of Queue for Specified Hour
- L₀ (mi) = Length of Queue in the Hour Prior to Specified Hour
- V (PCE/hr) = Hourly Volume
- C (PCE/hr) = Hourly Capacity
- k (PCE/mi/lane) = Jam Density
- N (lanes) = Number of Storage Lanes Upstream of Restriction



167

Queue Analysis Basics

IHCP – Policy Limits (Appendix C)

- i. No queues of any length for either
 - 6 consecutive hours, or
 - 12 non-consecutive hours in a day
- ii. No queues > 0.5 mi for more than 4 consecutive hours
- iii. No queues > 1.0 mi for more than 2 consecutive hours
- iv. No queues > 1.5 mi



168

Queue Analysis Basics

Queue Summary

Hour	Demand (PCE)	Capacity (PCE)	Queued (PCE)	Cum. Queued (PCE)	Queue Length (mi)
1	2000	1550	450	450	1.2
2	1800	1550	250	700	1.8
3	1500	1550	-50	650	1.7
4	1000	1550	-550	100	0.3
5	800	1550	-750	0	0.0

This example fails Policy Criteria iii and iv.



169

Queue Analysis Basics

- Baseline Queue: queue that exists before the presence of a work zone. Hourly demand exceeds the free flow capacity of the roadway.
- Queue analyses must be done for an entire 24hr period not just the window of time the work is to occur.
- Queue analyses must include hours pre-approved in Appendix B.



170

Queue Analysis Basics

Queue Analysis Methodology

- Very simple and yields approximate results and estimates.
- Cumulative input/output provides a rough estimate of stopped queue.
- Appropriate for “sketch-planning”.
- Suitable for individual work zones and the analysis of the immediate area around it.

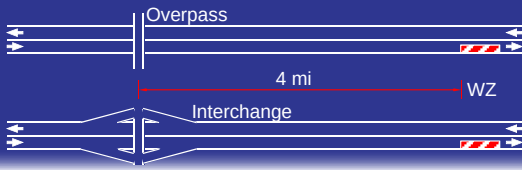


171

Queue Analysis Basics

Queue Analysis Methodology

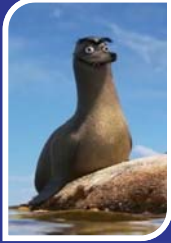
If a queue analysis estimates queue to be 5 miles, for which of the following corridors is the calculation more valid?



172

Queue Analysis Basics

Question?



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301

Traffic Data Adjustments

Six Traffic Data Adjustment Topics

- Example (Fictitious) Project Introduction
- Accessing TCDS Data (Demo)
- Data Table Adjustments (Demo)
- Weekend Conversion Factors (Demo)
- Manual Data Adjustments (Demo)
- Combining Counts (Demo)



302

Traffic Data Adjustments

• Example (Fictitious) Project Introduction

- Accessing TCDS Data (Demo)
- Data Table Adjustments (Demo)
- Weekend Conversion Factors (Demo)
- Manual Data Adjustments (Demo)
- Combining Counts (Demo)



303

Example (Fictitious) Project Introduction

DISCLAIMER:

The following information is intended for use as an exercise to train attendees on processes for preparation of IHCP Exception Request packages. The work zone safety section is not aware of any current plans and/or future proposals to complete the work proposed in this example.



304

Example (Fictitious) Project Introduction

Scope of Proposed Work:

- I-65 NB & SB directions – I-465 to I-865
- Widen mainline from 2 lanes to 3 lanes each direction
- Widen bridges over 71st Street
- Widen bridges over water ways



305

Example (Fictitious) Project Introduction

Scope of Proposed Work:

- Deep patching of concrete pavement below HMA surface
- Mill & replace X" surface of HMA
- Place inset pavement markings for lane lines
- Replace overhead sign structures



306

Example (Fictitious) Project Introduction

Closures Analyses Required:

- Left and/or right shoulder closures throughout project
 - widening
- Single lane closures throughout project
 - deep patching and widening
 - weeknights for pavement markings
- Ramp closures at 71st Street
 - deep patching and HMA overlay



307

Example (Fictitious) Project Introduction

Closures Analyses Required:

- Narrow lanes (10')
 - bridge widening
- Rolling slowdowns
 - sign structure work



308

Example (Fictitious) Project Introduction

Questions?



309

Traffic Data Adjustments

- Example (Fictitious) Project Introduction
- Accessing TCDS Data (Demo)
- Data Table Adjustments (Demo)
- Weekend Conversion Factors (Demo)
- Manual Data Adjustments (Demo)
- Combining Counts (Demo)



310

Accessing TCDS Data

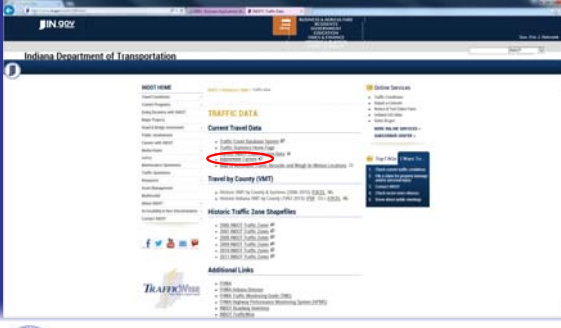


<http://www.in.gov/indot/2469.htm>
Or access INDOT Public Web Site and navigate to Resources>Traffic Data



311

Accessing TCDS Data

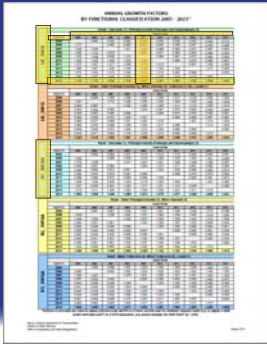


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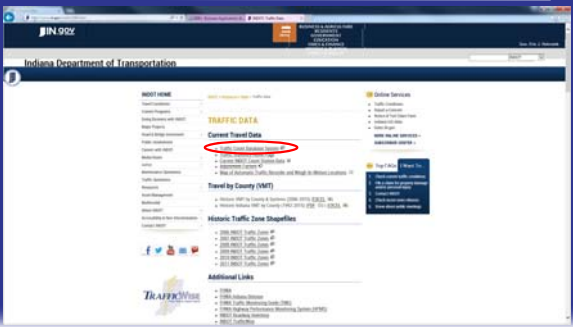
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Accessing TCDS Data



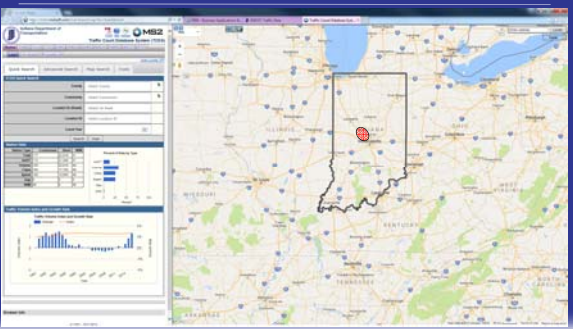
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Accessing TCDS Data

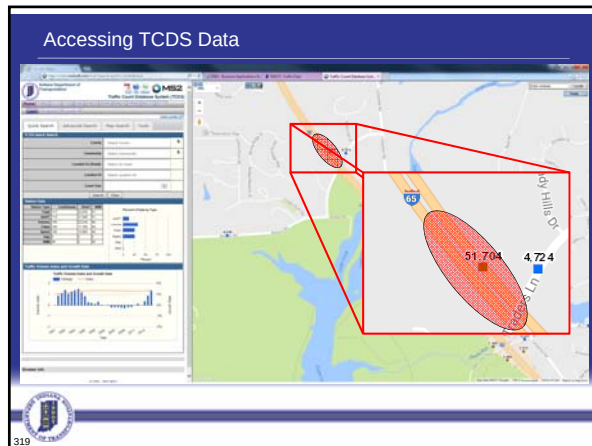


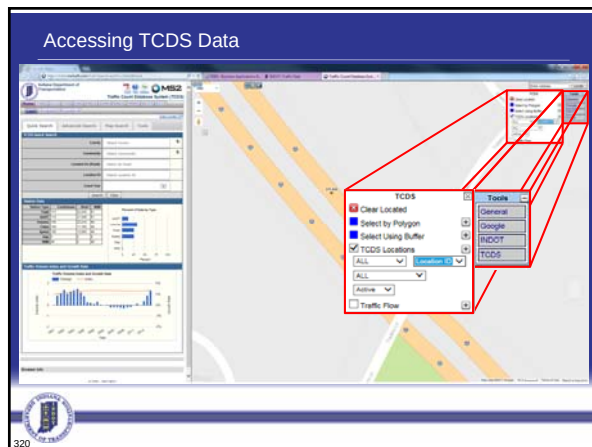
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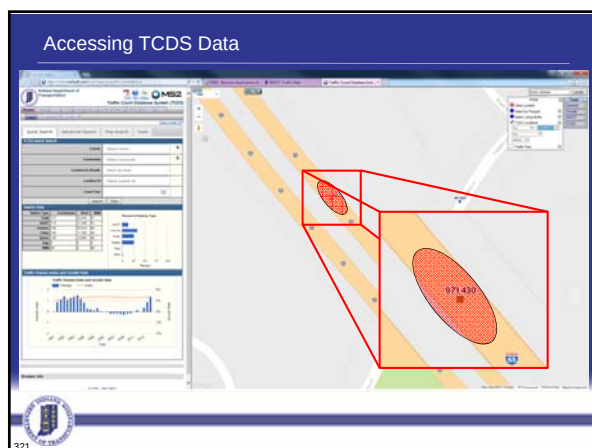
Accessing TCDS data

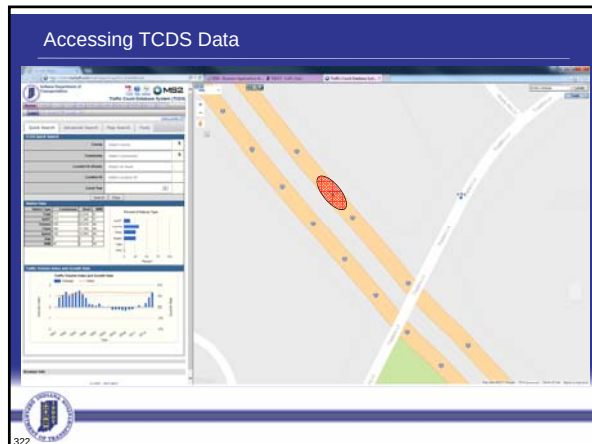


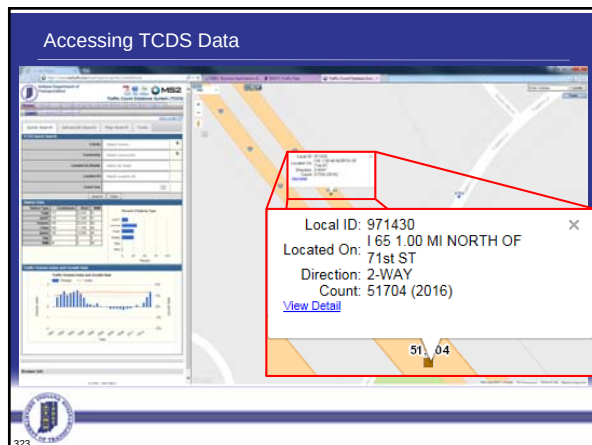
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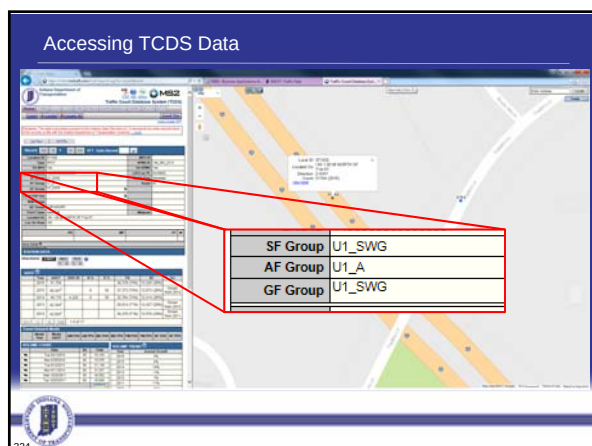












Accessing TCDS Data

CLASSIFICATION			
	Date	Int	Total
	Tue 6/21/2016	60	53,183
	Mon 6/20/2016	60	53,876
	Tue 8/12/2014	60	51,149
	Mon 8/11/2014	60	51,557
	Wed 10/26/2011	60	45,082
	Tue 10/25/2011	60	43,949

325

Accessing TCDS Data

Single Count
Class Report

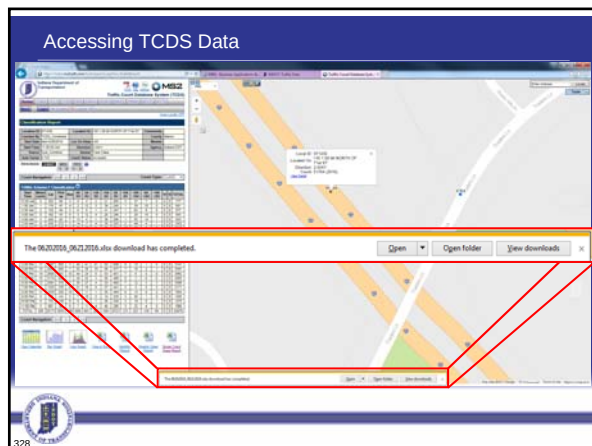
326

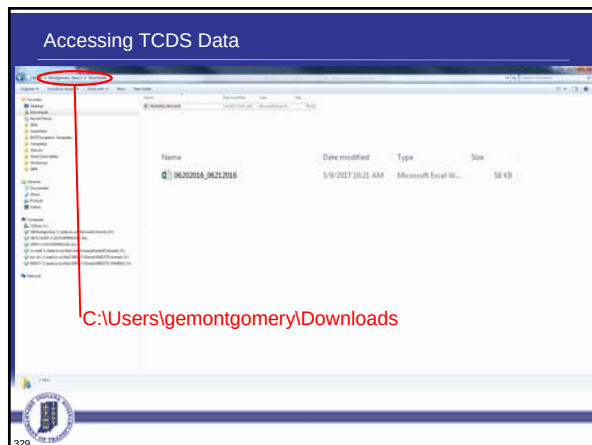
Accessing TCDS Data

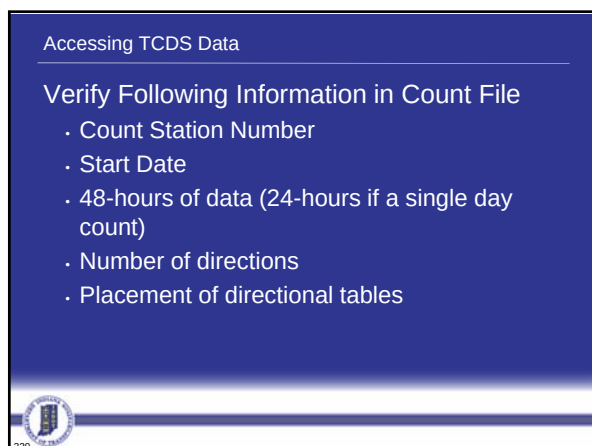
Do you want to open or save 9620016_96212016.xlsx (7.3 KB) from indot.ms2soft.com?

Open Save Cancel

327







Accessing TCDS Data

331

Accessing TCDS Data

332

Accessing TCDS Data

Questions?

333

Traffic Data Adjustments

- Example (Fictitious) Project Introduction
- Accessing TCDS Data (Demo)
- Data Table Adjustments (Demo)
- Weekend Conversion Factors (Demo)
- Manual Data Adjustments (Demo)
- Combining Counts (Demo)



334

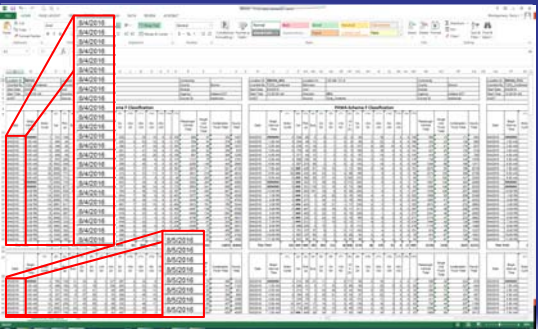
Data Table Adjustments

- Verify data table is in format compatible to analysis program
 - Summary tables on left
 - NEG direction tables in middle
 - POS direction tables on right
 - Tables for correct day of week at top
- Convert 24-hour data to 48-hour data
- Add comments to IHCP Request Body describing changes



335

Data Table Adjustments – Incorrect Start Day





336

Data Table Adjustments – Incorrect Start Day

337

Data Table Adjustments – Incorrect Start Day

338

Data Table Adjustments – Incorrect Start Day

339

**Data Table Adjustments –
Convert 24-Hour Data to 48-Hour Data**

Verify 1st hour of count data on 1st day is same hour as 1st hour of blanks on 2nd day

340

**Data Table Adjustments –
Convert 24-Hour Data to 48-Hour Data**

341

**Data Table Adjustments –
Convert 24-Hour Data to 48-Hour Data**

Yellow Highlight: Copy 2nd day tables

Green Highlight: Paste copy of 2nd day tables at bottom of spreadsheet – leave blank space between consecutive day tables

342

Data Table Adjustments –
Convert 24-Hour Data to 48-Hour Data

Yellow Highlight: Copy rows for hourly data only from 1st day tables

Green Highlight: Paste rows of hourly data copied above in blank rows of 2nd day tables

343

Data Table Adjustments –
Convert 24-Hour Data to 48-Hour Data

344

Data Table Adjustments

Questions?

345

Traffic Data Adjustments

- Example (Fictitious) Project Introduction
- Accessing TCDS Data (Demo)
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- Weekend Conversion Factors (Demo)
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- Combining Counts (Demo)



346

Weekend Conversion Factors

Concept for a specific count station:

$$\begin{bmatrix} \text{Hourly} \\ \text{Weekend} \\ \text{Day} \\ \text{Data} \end{bmatrix} = \begin{bmatrix} \text{Hourly} \\ \text{Weekday} \\ \text{Data} \end{bmatrix} \times \begin{bmatrix} \text{Hourly} \\ \text{Weekend Day} \\ \text{Conversion} \\ \text{Factor} \end{bmatrix}$$


347

Weekend Conversion Factors

Three Methods For Obtaining Weekend Conversion Factors

- Use factors from District Biennial Maintenance Exception (DBME)
- Obtain factors from INDOT Work Zone Safety Web Page
- Compute factors for a nearby count station that has Friday, Saturday and Sunday counts



348

Weekend Conversion Factors

To use factors from District Biennial Maintenance Exception contact District Technical Services/Traffic Office to determine if they are okay with use of factors they used in preparing District Biennial Maintenance Exception. If district is okay with use of these factors, request they send a table containing these factors for the count station you are analyzing.



349

Weekend Conversion Factors

INTERSTATE HIGHWAYS CONGESTION POLICY

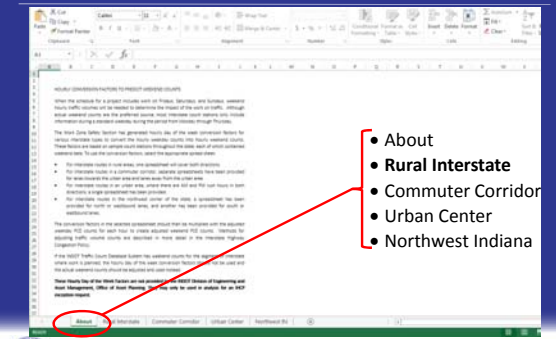
Analysis Tools

- [INDOT Queue Analysis Spreadsheet](#)
- [INDOT Detour Route Summary Spreadsheet](#)
- [QuickZone 2.0 Template](#)
- [Hourly Day of the Week Conversion Factors \(for use with IHCP Exceptions Only\)](#)
- [Sources of Information on Capacity](#)



350

Weekend Conversion Factors



- About
- Rural Interstate
- Commuter Corridor
- Urban Center
- Northwest Indiana



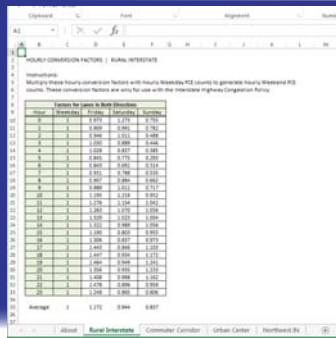
351

Weekend Conversion Factors

- Rural Interstate
 - All rural interstate segments
- Commuter Corridor
 - All urban interstate segments with directional AM (inbound)/PM (outbound) peak periods
- Urban Center
 - All urban interstate segments with AM/PM peak periods in both directions
- Northwest Indiana


352

Weekend Conversion Factors



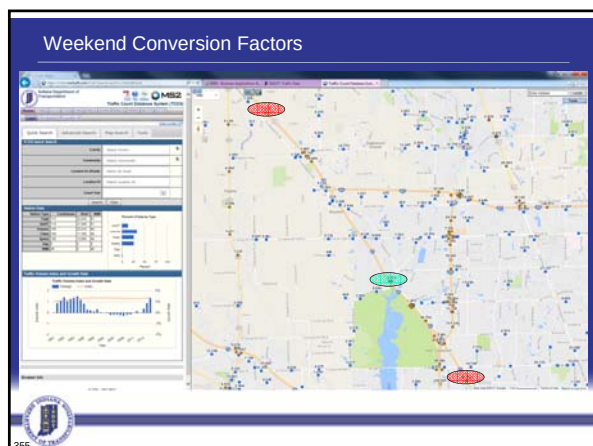

353

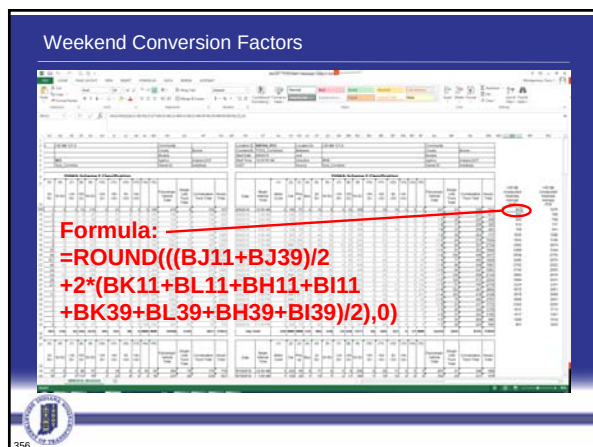
Weekend Conversion Factors

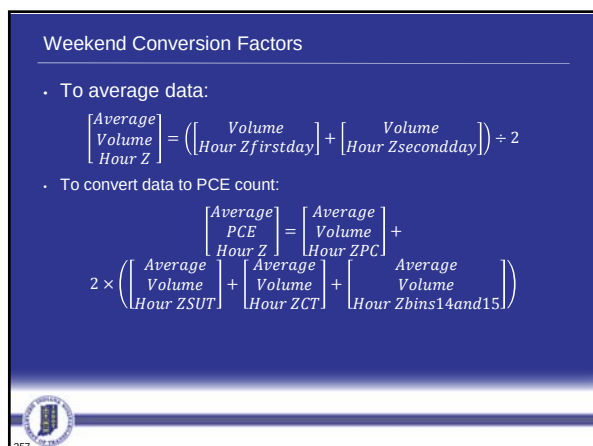
- Computing factors from a nearby permanent count station
 - Identify count station with similar weekend trends as station of interest
 - Obtain traffic count data for weekday and weekend days at this station
 - Convert to PCE counts and use following formula to compute conversion factors:

$$\left[\begin{array}{c} \text{Hourly} \\ \text{Weekend} \\ \text{Day} \\ \text{Conversion Factors} \end{array} \right] = \left[\begin{array}{c} \text{Hourly} \\ \text{Weekend} \\ \text{Day Data} \end{array} \right] \div \left[\begin{array}{c} \text{Hourly} \\ \text{Weekday} \\ \text{Data} \end{array} \right]$$


354







Weekend Conversion Factors

$$=ROUND((BJ11+BJ39)/2 + 2*(BK11+BL11+BH11+BI11+BK39+BL39+BH39+BI39)/2,0)$$

1-05 140	1-05 150
Unadjusted Weekend	Unadjusted Weekend
Average	Average
654	654
665	665
676	676
687	687
698	698
709	709
720	720
731	731
742	742
753	753
764	764
775	775
786	786
797	797
808	808
819	819
830	830
841	841
852	852
863	863
874	874
885	885
896	896
907	907
918	918
929	929
940	940
951	951
962	962
973	973
984	984
995	995

$$=ROUND((AN11+AN39)/2 + 2*(AO11+AP11+AL11+AM11+AO39+AP39+AL39+AM39)/2,0)$$

358

Weekend Conversion Factors

Formula:

$$=ROUND((BJ39+2*(BK39+BL39+BH39+BI39)),0)$$

359

Weekend Conversion Factors

- Since only one day of data for each weekend day will not be averaged
- To convert data to PCE count:

$$2 \times \left(\left[\frac{\text{Weekend Day Volume}}{\text{Hour ZSUT}} \right] + \left[\frac{\text{Weekend Day Volume}}{\text{Hour ZCT}} \right] + \left[\frac{\text{Weekend Day Volume}}{\text{Hour Zbins14and15}} \right] \right)$$

360

[illegible]

Traffic Data Adjustments

- Example (Fictitious) Project Introduction
- Accessing TCDS Data (Demo)
- Data Table Adjustments (Demo)
- Weekend Conversion Factors (Demo)
- Manual Data Adjustments (Demo)
- Combining Counts (Demo)



367

Manual Data Adjustment

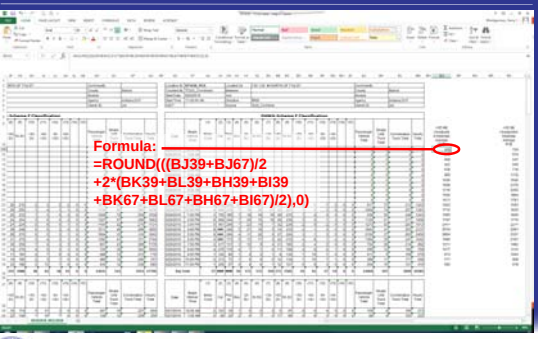
Steps to Manually Adjust Count Data For Use in Queue Analyses

- Average hourly count data and convert to PCE count
- Annualize hourly PCE count to current year
- Project hourly PCE count out to planned month/year



368

Manual Data Adjustment



Formula:
=ROUND(((B339+BJ67)/2
+2*(BK39+BL39+BH39+BI39
+BK67+BL67+BH67+BI67)/2),0)



369

Manual Data Adjustment

370

Manual Data Adjustment

Formula:
=ROUND(((B.J22+B.J50)/2
+2*(BK22+BL22+BH22+BI22
+BK50+BL50+BH50+BI50)/2),0)

371

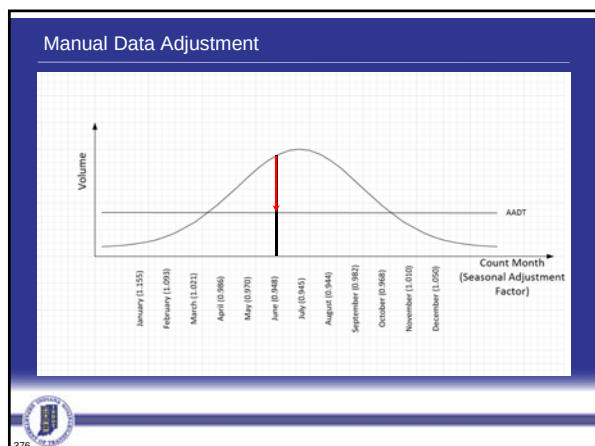
Manual Data Adjustment

- To average data:

$$\left[\begin{matrix} \text{Average} \\ \text{Volume} \\ \text{Hour Z} \end{matrix} \right] = \left(\left[\begin{matrix} \text{Volume} \\ \text{Hour Z firstday} \end{matrix} \right] + \left[\begin{matrix} \text{Volume} \\ \text{Hour Z secondday} \end{matrix} \right] \right) \div 2$$
- To convert data to PCE count:

$$\left[\begin{matrix} \text{Average} \\ \text{PCE} \\ \text{Hour Z} \end{matrix} \right] = \left[\begin{matrix} \text{Average} \\ \text{Volume} \\ \text{Hour ZPC} \end{matrix} \right] + 2 \times \left(\left[\begin{matrix} \text{Average} \\ \text{Volume} \\ \text{Hour ZSUT} \end{matrix} \right] + \left[\begin{matrix} \text{Average} \\ \text{Volume} \\ \text{Hour ZCT} \end{matrix} \right] + \left[\begin{matrix} \text{Average} \\ \text{Volume} \\ \text{Hour Zbins14and15} \end{matrix} \right] \right)$$

372



Manual Data Adjustment

- To Annualize PCE Count in Current Year:

$$\left[\frac{\text{Weekday Average PCE}}{\text{Unadjusted Weekday Average PCE}} \right] \times \left[\frac{\text{Seasonality Adjustment factor}}{\text{Annual Growth Factor}} \right] = \text{Annualized PCE}$$

377

Manual Data Adjustment

=ROUND (BO11*\$BQ\$1*\$BQ\$2,0)

Unadjusted Weekday Average PCE	Seasonality Adjustment factor	Annualized PCE
428	0.948	405
375	0.945	352
408	0.940	383
422	0.962	404
536	0.968	511
905	0.970	867
1036	0.970	1000
1668	0.970	1607
1716	0.970	1643
1602	0.970	1538
1611	0.970	1543
1662	0.970	1582
1712	0.970	1639
1588	0.970	1518
1797	0.970	1721
2001	0.970	1916
2010	0.970	1943
2064	0.970	1986
1945	0.970	1862
1211	0.970	1160
1077	0.970	1031
813	0.970	778
777	0.970	744
580	0.970	555

=ROUND (BS11*\$BQ\$1*\$BQ\$2,0)

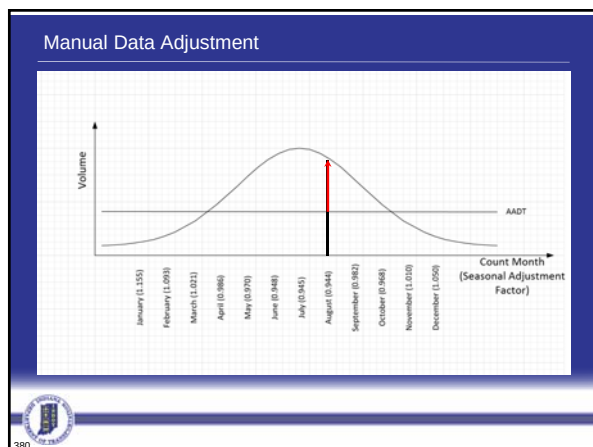
Unadjusted Weekday Average PCE	Seasonality Adjustment factor	Annualized PCE
724	0.948	685
574	0.945	541
547	0.940	524
509	0.962	487
718	0.968	687
1112	0.970	1065
1542	0.970	1472
2378	0.970	2277
2262	0.970	2168
1984	0.970	1895
1781	0.970	1705
1683	0.970	1625
1835	0.970	1757
1840	0.970	1762
1716	0.970	1642
2217	0.970	2123
2281	0.970	2184
2337	0.970	2238
2167	0.970	2017
1482	0.970	1419
1315	0.970	1259
1004	0.970	961
905	0.970	869
918	0.970	879

378

Manual Data Adjustment

Formula:
=ROUND(BP11*\$BT\$2/\$BT\$1,0)

379



Manual Data Adjustment

- To Project PCE Count to Planned Month/Year:

$$\left[\frac{\text{Weekday Average PCE}}{\text{Annualized to Current Year}} \right] \times \left[\frac{\text{Annual Growth Factor}}{\text{Planned Month/Year}} \right] \div \left[\frac{\text{Seasonality Adjustment Factor}}{\text{Planned Month/Year}} \right] =$$

381

**=ROUND
(BT11
*\$BT\$2
/\$BT\$1,0)**

382

Manual Data Adjustments

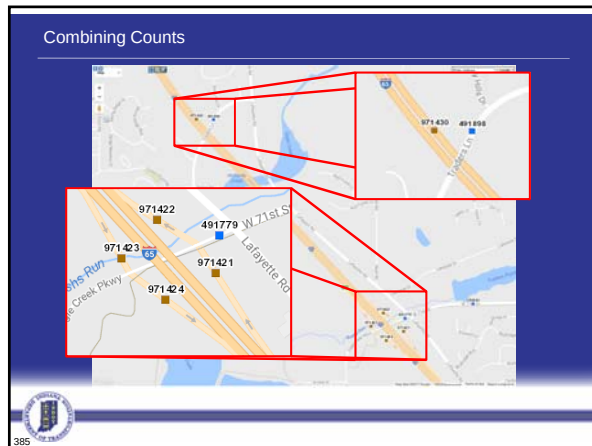
Questions?

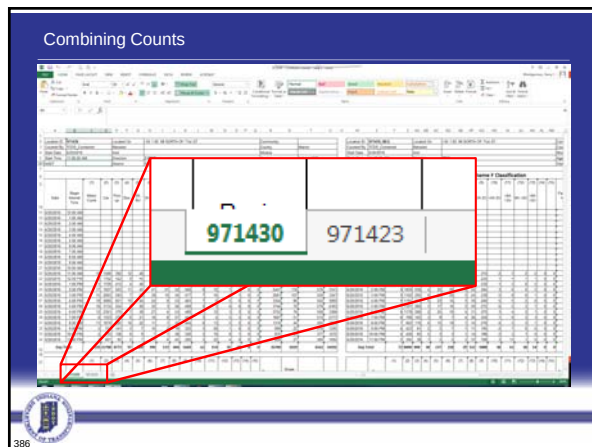
383

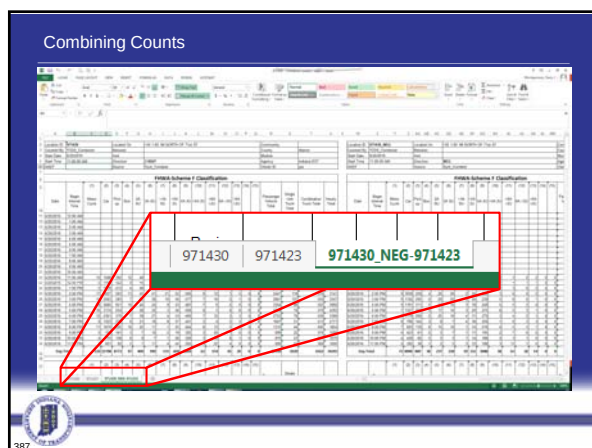
Traffic Data Adjustments

- Example (Fictitious) Project Introduction
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- Manual Data Adjustments (Demo)
- Combining Counts (Demo)

384







Combining Counts

388

Combining Counts

389

Combining Counts

390

Combining Counts

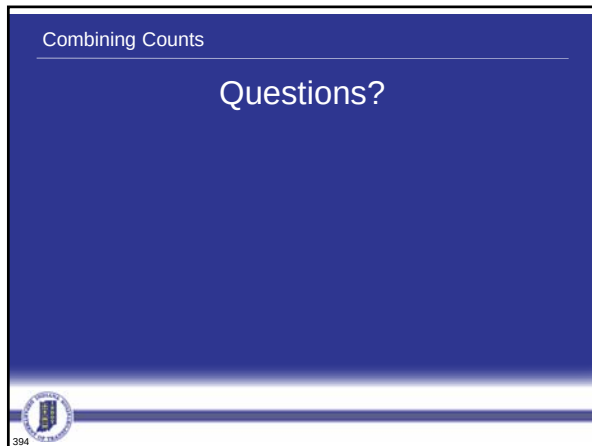
391

Combining Counts

392

Combining Counts

393



Course Outline

- The Interstate Highways Congestion Policy
- Queue Analysis Basics
- Traffic Data: Obtaining & Adjusting
- **Queue Analysis for Mainline Closures**
- Detour Route Summary Analysis
- Rolling Slowdowns
- Preparing the IHCP Exception Documents
- The IHCP Exception Request Submittal Package
- Test and Evaluation


400

<http://www.in.gov/indot/3604.htm> or
INDOT > Safety > Work Zone Safety > Interstate Highways
Congestion Policy > Analysis Tools




401

Queue Analysis Spreadsheet

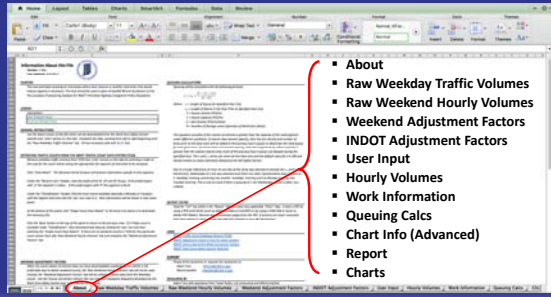
INTERSTATE HIGHWAYS CONGESTION POLICY

Analysis Tools

- **INDOT Queue Analysis Spreadsheet**
- [INDOT Detour Route Summary Spreadsheet](#)
- [QuickZone 2.0 Template](#) 
- [Hourly Day of the Week Conversion Factors \(for use with IHCP Exceptions Only\)](#)


402

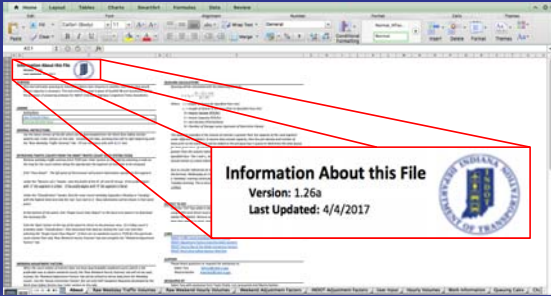
Queue Analysis Spreadsheet



- About
- Raw Weekday Traffic Volumes
- Raw Weekend Hourly Volumes
- Weekend Adjustment Factors
- INDOT Adjustment Factors
- User Input
- Hourly Volumes
- Work Information
- Queuing Calcs
- Chart Info (Advanced)
- Report
- Charts

403

Queue Analysis Spreadsheet



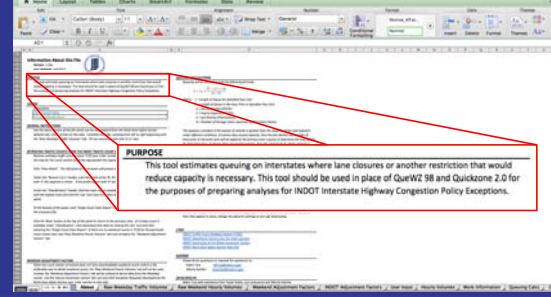
Information About this File

Version: 1.26a

Last Updated: 4/4/2017

404

Queue Analysis Spreadsheet



PURPOSE

This tool estimates queuing on interstates where lane closures or another restriction that would reduce capacity is necessary. This tool should be used in place of QueWZ 98 and Quickzone 2.0 for the purposes of preparing analyses for INDOT Interstate Highway Congestion Policy Exceptions.

405

Queue Analysis Spreadsheet

LEGEND

Instructions

User Entered Value

Formula-Derived Value

406

Queue Analysis Spreadsheet

GENERAL INSTRUCTIONS

Use the latest version of this file which can be downloaded from the Work Zone Safety Section website (see 'Links' section on this tab). Complete the tabs, working from left to right beginning with the "Raw Weekday Traffic Volumes" tab. Fill out necessary cells with BLUE text.

407

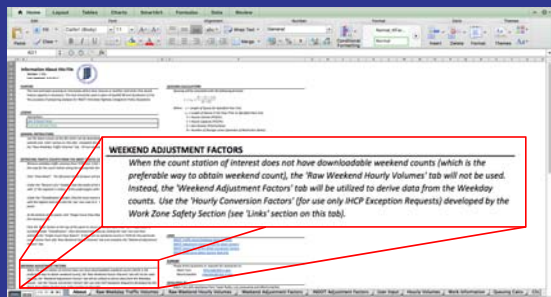
Queue Analysis Spreadsheet

RETRIEVING TRAFFIC COUNTS FROM THE INDOT TRAFFIC COUNT DATA SYSTEM (TCDS)

Retrieve weekday traffic volumes from TCDS (see 'Links' section on this tab) by selecting a node on the map for the count station along the appropriate the segment of interstate to be analyzed.

408

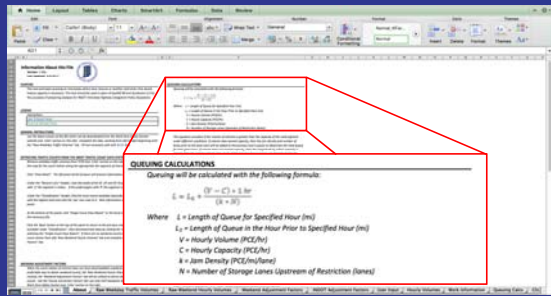
Queue Analysis Spreadsheet



WEEKEND ADJUSTMENT FACTORS
When the count station of interest does not have downloadable weekend counts (which is the preferable way to obtain weekend count), the 'Raw Weekend Hourly Volumes' tab will not be used. Instead, the 'Weekend Adjustment Factors' tab will be utilized to derive data from the Weekday counts. Use the 'Hourly Conversion Factors' (for use only IHCP Exception Requests) developed by the Work Zone Safety Section (see 'Links' section on this tab).

409

Queue Analysis Spreadsheet

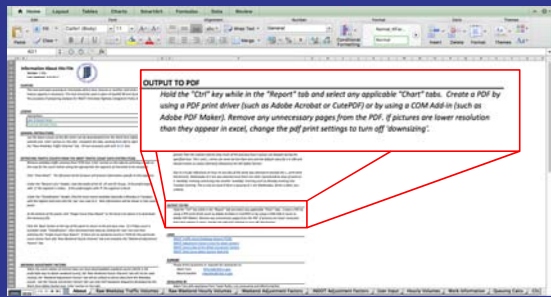


QUEUEING CALCULATIONS
Queueing will be calculated with the following formula:
$$L_q = L_0 \cdot \frac{C}{C - 1} \cdot \frac{1}{1 - \left(\frac{C}{C - 1}\right)}$$

Where:
 L_0 = Length of Queue for Specified Hour (mi)
 L_q = Length of Queue in the Hour Prior to Specified Hour (mi)
 V = Hourly Volume (PCE/hr)
 C = Hourly Capacity (PCE/hr)
 k = Jam Density (PCE/mi/lane)
 N = Number of Storage Lanes Upstream of Restriction (lanes)

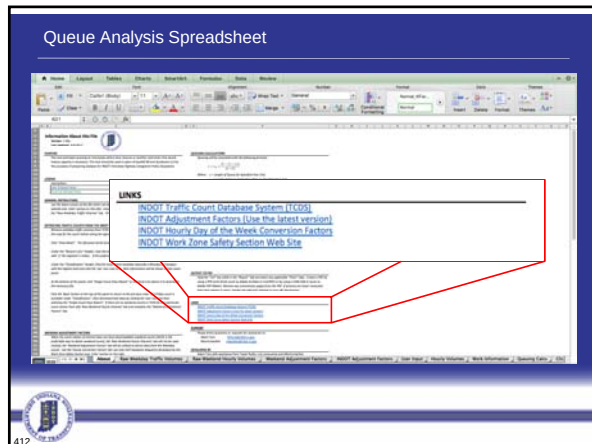
410

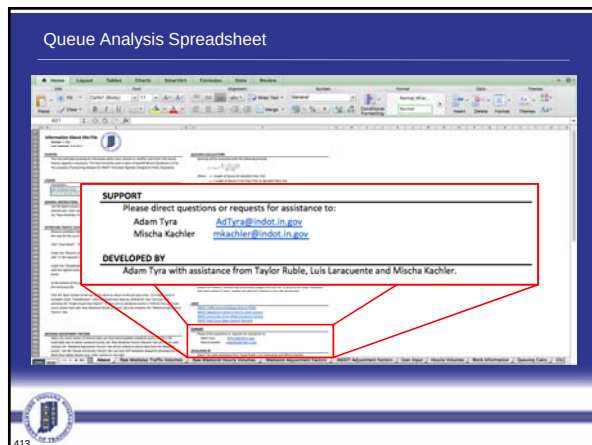
Queue Analysis Spreadsheet

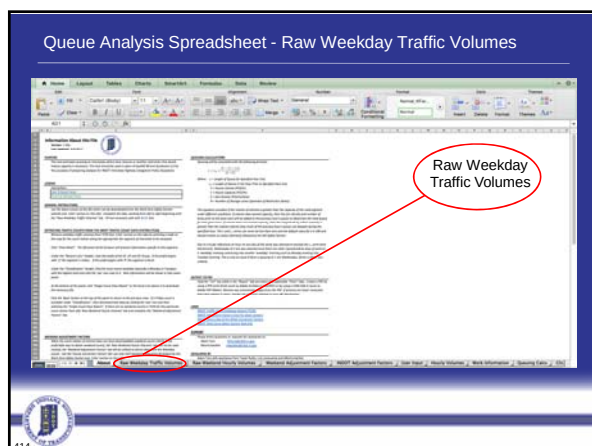


OUTPUT TO PDF
Hold the 'Ctrl' key while in the 'Reports' tab and select any applicable 'Chart' tabs. Create a PDF by using a PDF print driver (such as Adobe Acrobat or CutePDF) or by using a CDM Add-in (such as Adobe PDF Maker). Remove any unnecessary pages from the PDF. If pictures are lower resolution than they appear in excel, change the pdf print settings to turn off 'downsizing'.

411







Queue Analysis Spreadsheet – Raw Weekday Traffic Volumes

2-WAY NEG POS

INSTRUCTIONS:
See the "About" tab for instruction on accessing and downloading weekday traffic counts from TCDS.
From the downloaded file for Weekdays, Copy and Paste the TCDS Volumes (including header) for Weekdays into this tab.
Specifically: copy range A2:BM91 from the TCDS file into A2:BM91 of this file.

415

Queue Analysis Spreadsheet - Raw Weekend Hourly Volumes

Raw Weekend Hourly Volumes

416

Queue Analysis Spreadsheet - Raw Weekend Hourly Volumes

INSTRUCTIONS:
See the "About" tab for instruction on accessing and downloading weekend traffic counts from TCDS, if available.
If there are 241 weekend counts in TCDS for this particular count station then skip this tab and continue with the "Weekend Adjustment Factors" tab.
If there are weekend counts, Copy the TCDS Volumes (including header) from the downloaded file for Weekends and Paste into this tab.
Specifically: copy range A2:BM91 from the TCDS file into A2:BM91 of this file.

417

Queue Analysis Spreadsheet – Weekend Adjustment Factors

Weekend Adjustment Factors

418

Queue Analysis Spreadsheet – Weekend Adjustment Factors

Weekend Adjustment Factors

419

Queue Analysis Spreadsheet- INDOT Adjustment Factors

INDOT Adjustment Factors

420

Queue Analysis Spreadsheet – INDOT Adjustment Factors

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INDOT Adjustment Factors

INSTRUCTIONS:
Update the link to the most recent factors available (see "links" section on the "About" tab). If they are current, then no additional action is needed in this tab.

Seasonal Adjustment Factors (3 or 4 average)

Adjustment Factor Year: 2015

	Winter	Spring	Summer	Fall	Year
Adjust	1.10	1.00	0.90	1.00	1.00
Winter	1.10	1.00	0.90	1.00	1.00
Summer	0.90	1.00	1.10	1.00	1.00
Year	1.00	1.00	1.00	1.00	1.00

Seasonal Adjustment Factors are good long-term.

Annual Growth Factors

Adjustment Factor Year: 2015

Current Year: 2017

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Winter	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Spring	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Summer	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Year	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

[Home](#)
[About](#)
[Raw Weekday Traffic Volumes](#)
[Raw Weekend Hourly Volumes](#)
[Weekend Adjustment Factors](#)
[INDOT Adjustment Factors](#)

421

The screenshot shows the Microsoft Word 2010 application window. The title bar reads 'Microsoft Word - Information About the City of Houston.docx'. The ribbon is set to 'File' with the 'Save' tab selected. The status bar at the bottom displays various document statistics. A red circle highlights the text 'User Input' in the status bar, with a red arrow pointing to it from a larger red circle labeled 'User Input'.

Queue Analysis Spreadsheet – Contact & Route Information

User Input

INSTRUCTIONS:
*Fill in the cells with **BLUE** text.*

CONTACT INFORMATION

Requestor:	Jane Doe
Requestor's Position:	Project Manager
Analyst:	Manoj Sutaria
Analyst's Position:	Work Zone Safety Engineer

ROUTE INFORMATION

Route:	I-65
Milemarker(s):	MM 122.92 to MM 129.21
Rural/Urban (see 'About' tab):	Urban
Positive Direction:	North
Negative Direction:	South

The convention for the "Positive" and "Negative" directions are always in the ascending and descending directions of the mile markers, respectively. Typically, North or East are the "Positive" directions and South and West are the "Negative" but not in all cases (see portions of I-465).



Queue Analysis Spreadsheet – Contact & Route Information

Convention for the "Positive" direction on I-465

424

Queue Analysis Spreadsheet – Work Information

WORK INFORMATION

Work Type:

Contract Number (if applicable):

Work Description:

Provide a brief description of the nature of the work that will inform whether the requested times are appropriate and necessary.

Planned Month:

Planned Year:

(If the expected month of work is uncertain, select either August for Urban locations and July for Rural locations since those are the most conservative)

Permanent Speed Limit (mph):

Work Zone Speed Limit (mph):

Existing Lane Width (ft):

Work Zone Lane Width (ft):

Type of Channelizing Devices:

Typically Drums, Cones, or Barrier Wall.

Additional Information:

Enter pertinent additional information, such as a description of the segment being covered by this spreadsheet.

425

Queue Analysis Spreadsheet – Detoured Traffic

DETOURED TRAFFIC

Percent Reduction due to Detouring Traffic:

Reductions are no longer typically allowed. Detoured Traffic values shall be the default of 0%. Proposed diversions should be discussed with your reviewer prior to submittal.

Southbound Monday-Thursday:

Southbound Friday:

Southbound Saturday-Sunday:

Northbound Monday-Thursday:

Northbound Friday:

Northbound Saturday-Sunday:

426

Queue Analysis Spreadsheet - Alternatives

Queuing Calculations

Jam Density (K) [Default = 190]
If the Jam Density is changed from the default of 190, a justification needs to be included with the analysis.
 # Pre-work Lanes for SB Direction (N)
 # Pre-work Lanes for NB Direction (N)

ANALYSES

Number of Alternatives being analyzed:
 For each direction of each alternative, enter a brief description below for the closure that will distinguish it from the other alternatives, such as "Nighttime", "Weekend", or "No Work Fridays".

Description for Alternative 1 SB:
 Description for Alternative 1 NB:
 Description for Alternative 2 SB:
 Description for Alternative 2 NB:

427

Queue Analysis Spreadsheet – Hourly Volumes

428

Queue Analysis Spreadsheet – Hourly Volumes

Hourly Volumes

INSTRUCTIONS:
 Input the data for reasonable hourly volume results.

Count Information:
 Event Station Number: 107430
 Year of Count: 2017
 Month of Count: 6/06
 Annual Adj. Factor: 1.000
 Monthly Adj. Factor: 1.000

Planned Work Information:
 Planned Year: 2017
 Planned Month: 6/06
 Annual Adj. Factor: 1.000
 Monthly Adj. Factor: 1.000

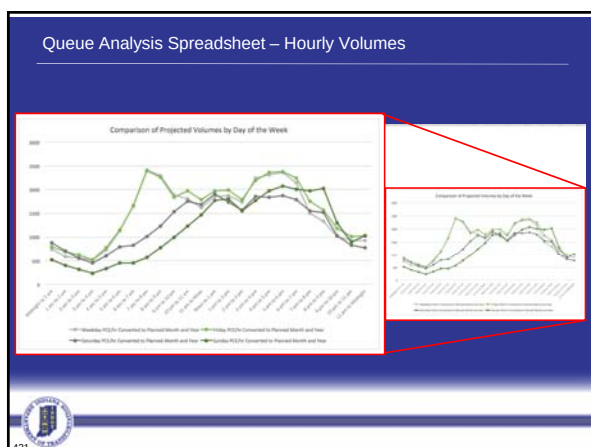
% Reduction due to Detouring Traffic:
 Southbound Monday Thursday: 0%
 Southbound Friday: 0%
 Southbound Saturday Sunday: 0%
 Northbound Monday Thursday: 0%
 Northbound Friday: 0%
 Northbound Saturday Sunday: 0%

429

Queue Analysis Spreadsheet – Hourly Volumes

Southbound Volumes

Time	Monday		Tuesday		Wednesday		Thursday	
	Actual Volume	Planned Volume	Actual Volume	Planned Volume	Actual Volume	Planned Volume	Actual Volume	Planned Volume
6:00 AM - 7:00 AM	100	100	100	100	100	100	100	100
7:00 AM - 8:00 AM	150	150	150	150	150	150	150	150
8:00 AM - 9:00 AM	200	200	200	200	200	200	200	200
9:00 AM - 10:00 AM	250	250	250	250	250	250	250	250
10:00 AM - 11:00 AM	300	300	300	300	300	300	300	300
11:00 AM - 12:00 PM	350	350	350	350	350	350	350	350
12:00 PM - 1:00 PM	400	400	400	400	400	400	400	400
1:00 PM - 2:00 PM	450	450	450	450	450	450	450	450
2:00 PM - 3:00 PM	500	500	500	500	500	500	500	500
3:00 PM - 4:00 PM	550	550	550	550	550	550	550	550
4:00 PM - 5:00 PM	600	600	600	600	600	600	600	600
5:00 PM - 6:00 PM	650	650	650	650	650	650	650	650
6:00 PM - 7:00 PM	700	700	700	700	700	700	700	700
7:00 PM - 8:00 PM	750	750	750	750	750	750	750	750
8:00 PM - 9:00 PM	800	800	800	800	800	800	800	800
9:00 PM - 10:00 PM	850	850	850	850	850	850	850	850
10:00 PM - 11:00 PM	900	900	900	900	900	900	900	900
11:00 PM - 12:00 AM	950	950	950	950	950	950	950	950
12:00 AM - 1:00 AM	1000	1000	1000	1000	1000	1000	1000	1000
1:00 AM - 2:00 AM	1050	1050	1050	1050	1050	1050	1050	1050
2:00 AM - 3:00 AM	1100	1100	1100	1100	1100	1100	1100	1100
3:00 AM - 4:00 AM	1150	1150	1150	1150	1150	1150	1150	1150
4:00 AM - 5:00 AM	1200	1200	1200	1200	1200	1200	1200	1200
5:00 AM - 6:00 AM	1250	1250	1250	1250	1250	1250	1250	1250
6:00 AM - 7:00 AM	1300	1300	1300	1300	1300	1300	1300	1300
7:00 AM - 8:00 AM	1350	1350	1350	1350	1350	1350	1350	1350
8:00 AM - 9:00 AM	1400	1400	1400	1400	1400	1400	1400	1400
9:00 AM - 10:00 AM	1450	1450	1450	1450	1450	1450	1450	1450
10:00 AM - 11:00 AM	1500	1500	1500	1500	1500	1500	1500	1500
11:00 AM - 12:00 PM	1550	1550	1550	1550	1550	1550	1550	1550
12:00 PM - 1:00 PM	1600	1600	1600	1600	1600	1600	1600	1600
1:00 PM - 2:00 PM	1650	1650	1650	1650	1650	1650	1650	1650
2:00 PM - 3:00 PM	1700	1700	1700	1700	1700	1700	1700	1700
3:00 PM - 4:00 PM	1750	1750	1750	1750	1750	1750	1750	1750
4:00 PM - 5:00 PM	1800	1800	1800	1800	1800	1800	1800	1800
5:00 PM - 6:00 PM	1850	1850	1850	1850	1850	1850	1850	1850
6:00 PM - 7:00 PM	1900	1900	1900	1900	1900	1900	1900	1900
7:00 PM - 8:00 PM	1950	1950	1950	1950	1950	1950	1950	1950
8:00 PM - 9:00 PM	2000	2000	2000	2000	2000	2000	2000	2000
9:00 PM - 10:00 PM	2050	2050	2050	2050	2050	2050	2050	2050
10:00 PM - 11:00 PM	2100	2100	2100	2100	2100	2100	2100	2100
11:00 PM - 12:00 AM	2150	2150	2150	2150	215			



The screenshot shows the Microsoft Word 2003 application window. The title bar reads 'Microsoft Word - Queue Analysis Spreadsheet - Work Information.doc'. The menu bar includes File, Edit, Format, Tools, Window, and Help. The toolbar contains various icons for file operations and formatting. The document content is a multi-page report with sections like 'Introduction', 'Methodology', 'Data Collection', 'Analysis', and 'Conclusion'. A red oval is drawn around the text 'Work Information' in the main text area. Another red oval is drawn around the 'Work Information' tab in the taskbar at the bottom of the window. A red line connects the two ovals, indicating the relationship between the document content and the active window.

Queue Analysis Spreadsheet - Work Information

Work Information

INSTRUCTIONS:
Enter the expected hourly capacities for the work zone for each segment/direction/alternative. Capacities must be converted from PCE/hr/ln to PCE/hr by multiplying by number of available lanes for a given alternative on a particular day and time. For capacities, refer to the tables at the right, which are based on Appendix C of the IHCP. The recommended non-work capacities have been derived below which can be deviated from, but justification will be necessary.

Permanent Speed:	65 mph	Recommended SB	5170 PCE/hr
SDN Urban Increase:	Yes	Non-work Capacity:	5170 PCE/hr
# Permanent Lanes SB:	2	Recommended NB	5170 PCE/hr
# Permanent Lanes NB:	2	Non-work Capacity:	5170 PCE/hr

433

Work Information – Capacities Tables

Non-Work Zone Capacities (PCE/hr/ln)

Permanent Speed (mph)	Capacity
45	1900
50	2075
55	2250
60	2425
65	2600
70	2775
75	2950

Work Zone Capacities (PCE/hr/ln)

# Pre-work Lanes	# Work Zone Lanes	EF-10'	10'-10.5'	10.5'-11'	11'-11.5'	11.5'-12'	12'-12.5'	12.5'-13'	13'-13.5'	13.5'-14'	14'-14.5'	14.5'-15'	15'-15.5'	15.5'-16'	16'-16.5'	16.5'-17'	17'-17.5'	17.5'-18'	18'-18.5'	18.5'-19'	19'-19.5'	19.5'-20'	20'-20.5'	20.5'-21'	21'-21.5'	21.5'-22'	22'-22.5'	22.5'-23'	23'-23.5'	23.5'-24'	24'-24.5'	24.5'-25'	25'-25.5'	25.5'-26'	26'-26.5'	26.5'-27'	27'-27.5'	27.5'-28'	28'-28.5'	28.5'-29'	29'-29.5'	29.5'-30'	30'-30.5'	30.5'-31'	31'-31.5'	31.5'-32'	32'-32.5'	32.5'-33'	33'-33.5'	33.5'-34'	34'-34.5'	34.5'-35'	35'-35.5'	35.5'-36'	36'-36.5'	36.5'-37'	37'-37.5'	37.5'-38'	38'-38.5'	38.5'-39'	39'-39.5'	39.5'-40'	40'-40.5'	40.5'-41'	41'-41.5'	41.5'-42'	42'-42.5'	42.5'-43'	43'-43.5'	43.5'-44'	44'-44.5'	44.5'-45'	45'-45.5'	45.5'-46'	46'-46.5'	46.5'-47'	47'-47.5'	47.5'-48'	48'-48.5'	48.5'-49'	49'-49.5'	49.5'-50'	50'-50.5'	50.5'-51'	51'-51.5'	51.5'-52'	52'-52.5'	52.5'-53'	53'-53.5'	53.5'-54'	54'-54.5'	54.5'-55'	55'-55.5'	55.5'-56'	56'-56.5'	56.5'-57'	57'-57.5'	57.5'-58'	58'-58.5'	58.5'-59'	59'-59.5'	59.5'-60'	60'-60.5'	60.5'-61'	61'-61.5'	61.5'-62'	62'-62.5'	62.5'-63'	63'-63.5'	63.5'-64'	64'-64.5'	64.5'-65'	65'-65.5'	65.5'-66'	66'-66.5'	66.5'-67'	67'-67.5'	67.5'-68'	68'-68.5'	68.5'-69'	69'-69.5'	69.5'-70'	70'-70.5'	70.5'-71'	71'-71.5'	71.5'-72'	72'-72.5'	72.5'-73'	73'-73.5'	73.5'-74'	74'-74.5'	74.5'-75'	75'-75.5'	75.5'-76'	76'-76.5'	76.5'-77'	77'-77.5'	77.5'-78'	78'-78.5'	78.5'-79'	79'-79.5'	79.5'-80'	80'-80.5'	80.5'-81'	81'-81.5'	81.5'-82'	82'-82.5'	82.5'-83'	83'-83.5'	83.5'-84'	84'-84.5'	84.5'-85'	85'-85.5'	85.5'-86'	86'-86.5'	86.5'-87'	87'-87.5'	87.5'-88'	88'-88.5'	88.5'-89'	89'-89.5'	89.5'-90'	90'-90.5'	90.5'-91'	91'-91.5'	91.5'-92'	92'-92.5'	92.5'-93'	93'-93.5'	93.5'-94'	94'-94.5'	94.5'-95'	95'-95.5'	95.5'-96'	96'-96.5'	96.5'-97'	97'-97.5'	97.5'-98'	98'-98.5'	98.5'-99'	99'-99.5'	99.5'-100'						
2	1	1150	1400	1550	1700	1850	1950	2050	2150	2250	2350	2450	2550	2650	2750	2850	2950	3050	3150	3250	3350	3450	3550	3650	3750	3850	3950	4050	4150	4250	4350	4450	4550	4650	4750	4850	4950	5050	5150	5250	5350	5450	5550	5650	5750	5850	5950	6050	6150	6250	6350	6450	6550	6650	6750	6850	6950	7050	7150	7250	7350	7450	7550	7650	7750	7850	7950	8050	8150	8250	8350	8450	8550	8650	8750	8850	8950	9050	9150	9250	9350	9450	9550	9650	9750	9850	9950	10050	10150	10250	10350	10450	10550	10650	10750	10850	10950	11050	11150	11250	11350	11450	11550	11650	11750	11850	11950	12050	12150	12250	12350	12450	12550	12650	12750	12850	12950	13050	13150	13250	13350	13450	13550	13650	13750	13850	13950	14050	14150	14250	14350	14450	14550	14650	14750	14850	14950	15050	15150	15250	15350	15450	15550	15650	15750	15850	15950	16050	16150	16250	16350	16450	16550	16650	16750	16850	16950	17050	17150	17250	17350	17450	17550	17650	17750	17850	17950	18050	18150	18250	18350	18450	18550	18650	18750	18850	18950	19050	19150	19250	19350	19450	19550	19650	19750	19850	19950	20050

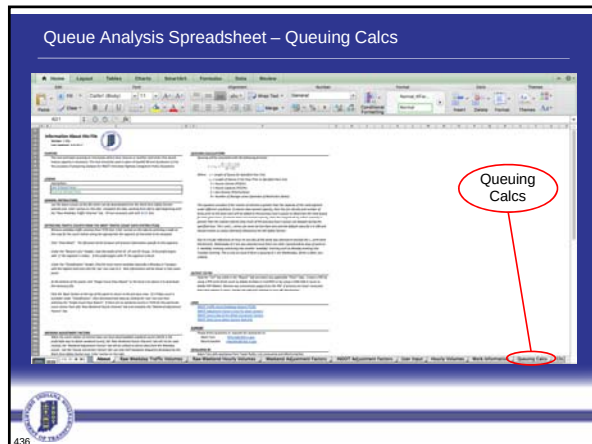
434

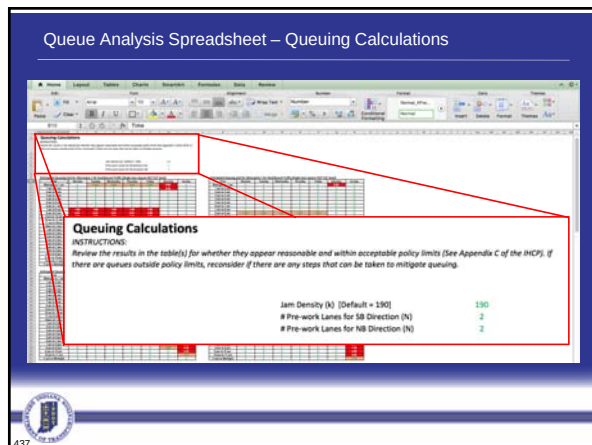
Work Information – Capacities for Alternative

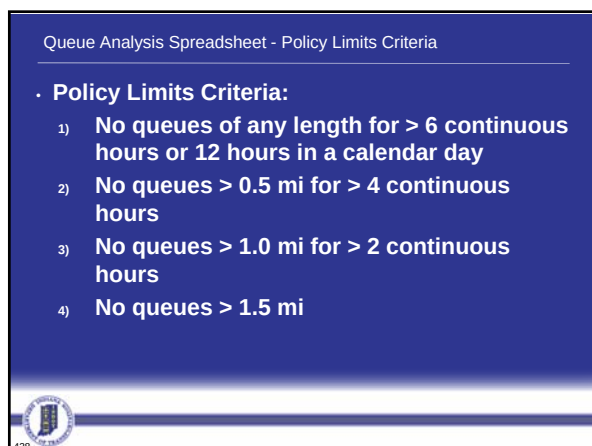
Capacities for Alternative 2 for Southbound (Nighttime during weekdays & weekend)

Time	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Midnight to 1 am	1705	1705	1705	1705	1705	1705	1705
1 am to 2 am	1705	1705	1705	1705	1705	1705	1705
2 am to 3 am	1705	1705	1705	1705	1705	1705	1705
3 am to 4 am	1705	1705	1705	1705	1705	1705	1705
4 am to 5 am	1705	1705	1705	1705	1705	1705	1705
5 am to 6 am	1705	1705	1705	1705	1705	1705	1705
6 am to 7 am	1705	1705	1705	1705	1705	1705	1705
7 am to 8 am	1705	1705	1705	1705	1705	1705	1705
8 am to 9 am	1705	1705	1705	1705	1705	1705	1705
9 am to 10 am	1705	1705	1705	1705	1705	1705	1705
10 am to 11 am	1705	1705	1705	1705	1705	1705	1705
11 am to Noon	1705	1705	1705	1705	1705	1705	1705
Noon to 1 pm	1705	1705	1705	1705	1705	1705	1705
1 pm to 2 pm	1705	1705	1705	1705	1705	1705	1705
2 pm to 3 pm	1705	1705	1705	1705	1705	1705	1705
3 pm to 4 pm	1705	1705	1705	1705	1705	1705	1705
4 pm to 5 pm	1705	1705	1705	1705	1705	1705	1705
5 pm to 6 pm	1705	1705	1705	1705	1705	1705	1705
6 pm to 7 pm	1705	1705	1705	1705	1705	1705	1705
7 pm to 8 pm	1705	1705	1705	1705	1705	1705	1705
8 pm to 9 pm	1705	1705	1705	1705	1705	1705	1705
9 pm to 10 pm	1705	1705	1705	1705	1705	1705	1705
10 pm to 11 pm	1705	1705	1705	1705	1705	1705	1705
11 pm to Midnight	1705	1705	1705	1705	1705	1705	1705

435







[illegible]

Queue Analysis Spreadsheet

- Alternative 1:

442

Queue Analysis Spreadsheet

- Alternative 2: "Nighttime during weekdays & weekend"
 - Single lane closure
 - Nighttime during weekdays & weekend
 - 12' lane width
 - Free Flow Capacity : 5170 PCE/hr
 - Work Zone Capacity:
 - Work Zone Lane Width = 12'
 - 2 lanes reduced to 1
 - 10% Urban increase applies
 - Base Capacity = 1550 PCE/hr/ln
 - Work Zone Capacity = 1550 PCE/hr/ln x 1ln x 1.1 = 1705 PCE/hr

443

Queue Analysis Spreadsheet

- Alternative 2:

444

Queue Analysis Spreadsheet

- Alternative 3: "2, 10' lane"
 - Lane width restriction only (No lanes closed)
 - Continuous (24/7)
 - 10' lane width
 - Free Flow Capacity : 5170 PCE/hr
 - Work Zone Capacity:
 - Work Zone Lane Width = 10'
 - 10% Urban increase applies
 - Base Capacity = 1400 PCE/hr (lane by shoulder, Tbl C-6)
+ 1450 PCE/hr (2nd lane, Tbl C-3)



445

Queue Analysis Spreadsheet

Table C-3: Model Parameters for Working Hour Capacities
Passenger Car Equivalents per Hour per Lane (PCEs/HR/Ln)

Work Zone Type	Lane Width		
	12'-11"	10'0" to 10'9"	9'0" to 9'9"
2 lanes reduced to 1 lane	1550	1400	1325
3 lanes reduced to 2 lanes	1600	1450	1375
3 lanes reduced to 1 lane	1475	1350	1275
4 lanes reduced to 3 lanes	1650	1500	1425
4 lanes reduced to 2 lanes	1550	1400	1325
4 lanes reduced to 1 lane	1425	1325	1250

Table C-6: Open Lane Capacities for Shoulder Closures
Passenger Car Equivalents per Hour per Lane (PCEs/HR/Ln)

Work Zone Type	Capacity
For the lane adjacent to a closed shoulder	1400
For the next lane over	1600
For the next lane over	1800
For every other lane	2000



446

Queue Analysis Spreadsheet

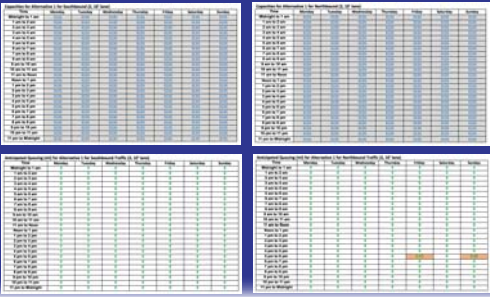
- Alternative 3: "2, 10' lane"
 - Lane width restriction only (No lanes closed)
 - Continuous (24/7)
 - 10' lane width
 - Free Flow Capacity : 5170 PCE/hr
 - Work Zone Capacity:
 - Work Zone Lane Width = 10'
 - 10% Urban increase applies
 - Base Capacity = 1400 PCE/hr (lane by shoulder, Tbl C-6)
+ 1450 PCE/hr (2nd lane, Tbl C-3)
= 2850 PCE/hr
 - Work Zone Capacity = 2850 PCE/hr x 1.1
= 3135 PCE/hr



447

Queue Analysis Spreadsheet

- Alternative 3:



448

Queue Analysis Spreadsheet

- Alternative 4: "2, 10' lane, No Urban 10% Factor"
 - Lane width restriction only (No lanes closed)
 - Continuous (24/7)
 - 10' lane width
 - Free Flow Capacity : 5170 PCE/hr
 - Work Zone Capacity:
 - Work Zone Lane Width = 10'
 - 10% Urban increase DOES NOT apply*
 - Base Capacity = 2850 PCE/hr (as in Alternative 3)
 - Work Zone Capacity = 2850 PCE/hr

* Since the lane is reduced to 10', let us assume that drivers will not drive more aggressively. Hence, we are not increasing volume by 10%.

449

Queue Analysis Spreadsheet

- Alternative 4:



450

Queue Analysis Spreadsheet

- Alternative 5: "Single Shoulder Closure"
 - Shoulder closure only (No lanes closed)
 - Continuous (24/7)
 - 12' lane width
 - Free Flow Capacity : 5170 PCE/hr
 - Work Zone Capacity:
 - Work Zone Lane Width = 12'
 - 10% Urban increase applies
 - Refer to 2017 IHCP Table C-6



451

Interstate Highways Congestion Policy 2017 Tables

Table C-6: Open Lane Capacities for Shoulder Closures
Passenger Car Equivalents per Hour per Lane (PCEs/HR/Ln)

Work Zone Type	Capacity
For the lane adjacent to a closed shoulder	1400
For the next lane over	1600
For the next lane over	1800
For every other lane	2000



452

Queue Analysis Spreadsheet

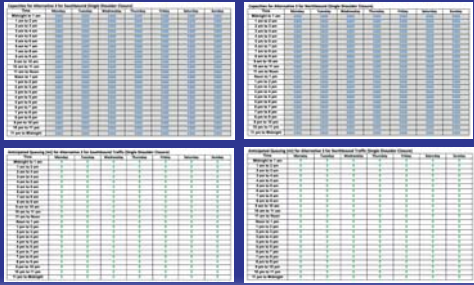
- Alternative 5: "Single Shoulder Closure"
 - Shoulder closure only (No lanes closed)
 - Continuous (24/7)
 - 12' lane width
 - Free Flow Capacity : 5170 PCE/hr
 - Work Zone Capacity:
 - Work Zone Lane Width = 12'
 - 10% Urban increase applies
 - Refer to 2017 IHCP Table C-6
 - For the lane adjacent to closed shoulder, Capacity = 1400 PCE/hr
 - For the next lane over, Capacity = 1600 PCE/hr
 - Base Capacity = 1400 + 1600 = 3000 PCE/hr
 - Work Zone Capacity = 3000 PCE/hr x 1.1 = 3300 PCE/hr



453

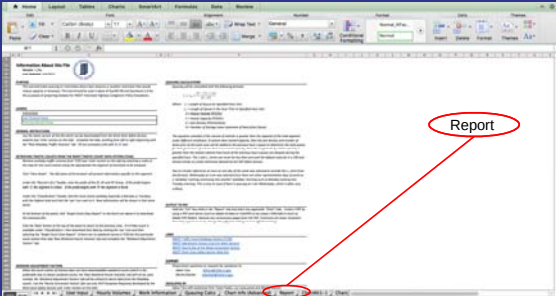
Queue Analysis Spreadsheet

- Alternative 5:



454

Queue Analysis Spreadsheet – Report



455

Queue Analysis Spreadsheet - Report

Prepared by: **Mamad Sutoria**
Prepared for: **Jane Doe**

Position: **Work Zone Safety Engineer**
Project Manager: **Project Manager**

Report for IHCP Queuing Analysis

Work Zone Information

Route:	I-45
Mile marker:	MM 122.92 to MM 129.21
Positive Direction:	North
Contract:	R-12345
Work Year:	2017
Work Month:	AUG
Work Type:	Construction
Work Description:	Added Travel Lanes
Permanent Speed Limit:	65 mph
Work Zone Speed Limit:	45 mph
Workzone Lane Width:	10 ft
Channelizing Devices:	Construction Drums / Barrier Wall

Additional information: The details of this project were made up for the use in IHCP Exception Request Preparer Training. This is not a real project and these analyses should not be used for any future IHCP Exceptions.

456

Queue Analysis Spreadsheet - Report

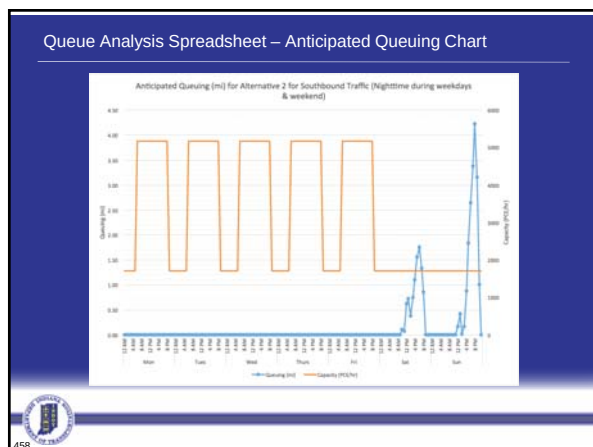
Summary of Alternatives

Southbound Alternative 1 (2, 10' lane): Alternative 2 (2, 10' lane, No Urban 10% Factor): Alternative 3 (Single Shoulder Closure):	Within Policy Limits Within Policy Limits Within Policy Limits
Northbound Alternative 1 (2, 10' lane): Alternative 2 (2, 10' lane, No Urban 10% Factor): Alternative 3 (Single Shoulder Closure):	Within Policy Limits Within Policy Limits Within Policy Limits

Policy Limits Criteria:

- i) No queues of any length for > 6 continuous hours or 12 hours in a calendar day
- ii) No queues >0.5 mi for > 4 continuous hours
- iii) No queues >1.0 mi for > 2 continuous hours
- iv) No queues >1.5 mi

457



Report – Output to PDF

Report for IHCP Queuing Analysis

Prepared for: Mary Schulte Prepared for: Jane Doe	Position: Work Zone Safety Engineer Position: Project Manager
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Work Zone Information

Route: 143 Mile marker: MM 122.82 to MM 129.21 Position Direction: North Contract: R 12345 Work Year: 2017 Work Month: April Work Type: Construction Work Description: Added Travel Lanes	Permanent Speed Limit: 45 mph Work Zone Speed Limit: 45 mph Workzone Lane Width: 10 ft Channelizing Devices: Construction Drums / Barrier Wall
--	---

Additional Information: The details of this project were made up for the use in IHCP Exception Preparer Training. This is not a real project and these numbers should not be used for any future IHCP Exception Preparer Training.

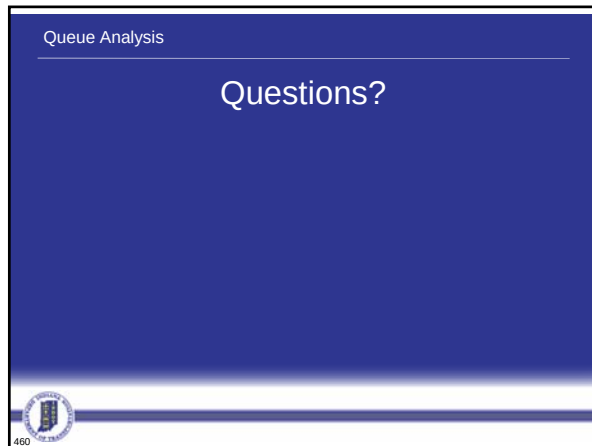
Queuing Formula

$$Q = L \times \left(\frac{1}{1 - \frac{V}{C}} \right) - 1$$

Where:
 Q = Length of Queue for specified road link
 L = Length of Road Link
 V = Volume of Traffic
 C = Capacity

[Report](#) / [ChartM1-1](#) / [ChartM1-2](#) / [ChartM1-3](#) / [ChartM1-4](#)

459



Course Outline

- The Interstate Highways Congestion Policy
- Queue Analysis Basics
- Traffic Data: Obtaining & Adjusting
- Queue Analysis for Mainline Closures
- **Detour Route Summary Analysis**
- Rolling Slowdowns
- Preparing the IHCP Exception Documents
- The IHCP Exception Request Submittal Package
- Test and Evaluation



500

Course Outline

- **Detour Route**
 - Concept and Analysis
 - Detour Map
 - Detour Route Summary



501

Detour Route Summary- Concept

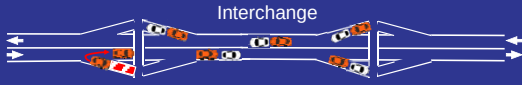
- Exit or Entrance ramp closed
 - Traffic must be routed different way
 - New route is burdened by traffic from ramp
- Detour Route consists of numerous links
 - Link: part of the interstate burdened by detoured traffic
 - Link capacities are determined by the speed limit and number of lanes
 - Add a link when traffic is added from an interchange or ramp, speed limit or number of lanes change



502

Detour Route Summary- Analysis

- Detour Route Summary Examines
 - PCE on an hourly bases for each day of the week
 - Each links normal demand
 - Adds the Burden from the closed ramp to links
 - Compares
 - Existing Maximum Demand
 - Theoretical Capacity
 - Turning Movement (usually left turn)

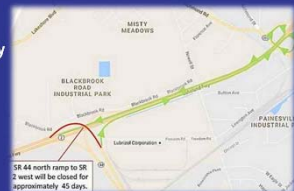


Interchange

503

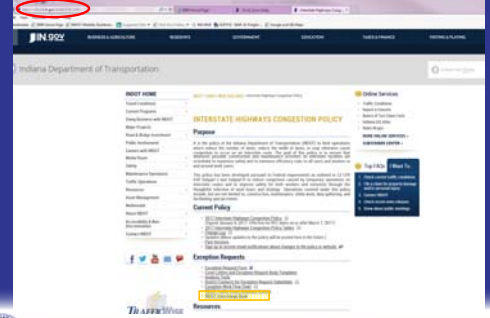
Course Outline

- Detour Route
 - Concept and Analysis
 - Detour Map
 - Detour Route Summary

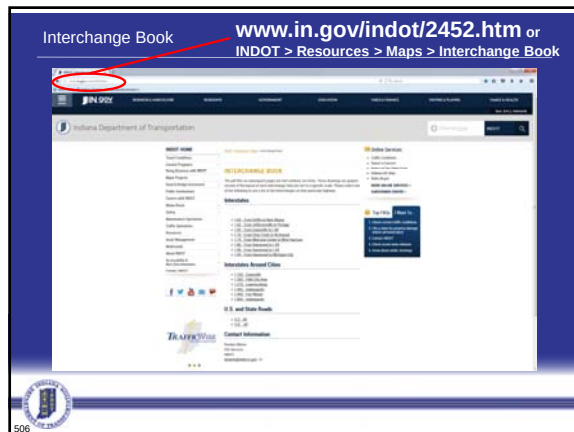


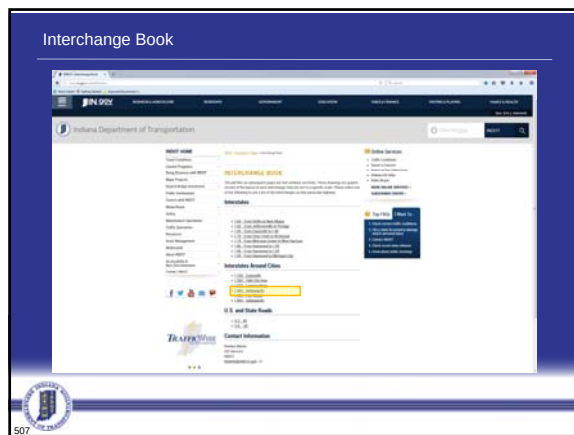
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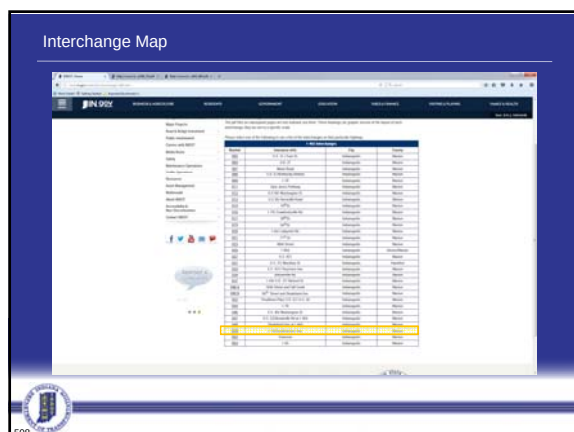
Interchange Book www.in.gov/indot/3383.htm or
 INDOT > Safety > Work Zone Safety > Interstate
 Highways Congestion Policy

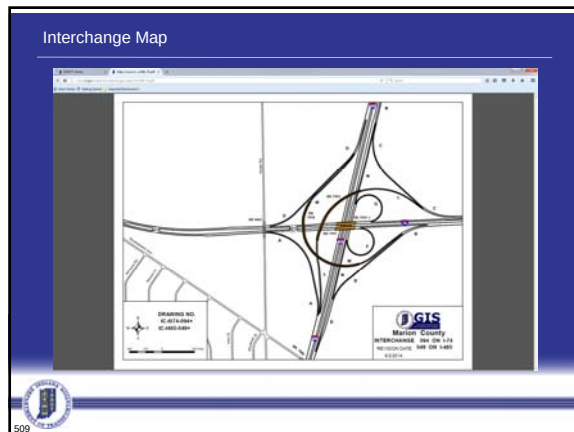


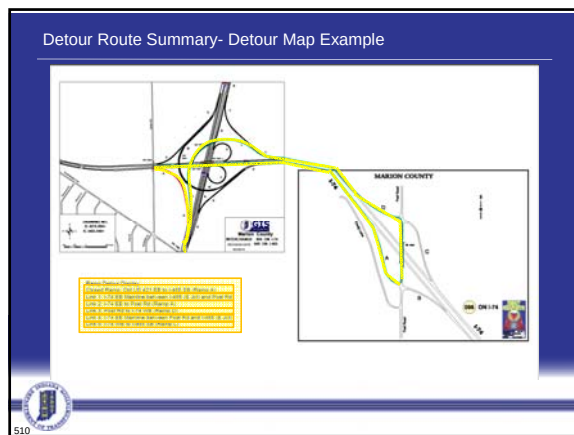
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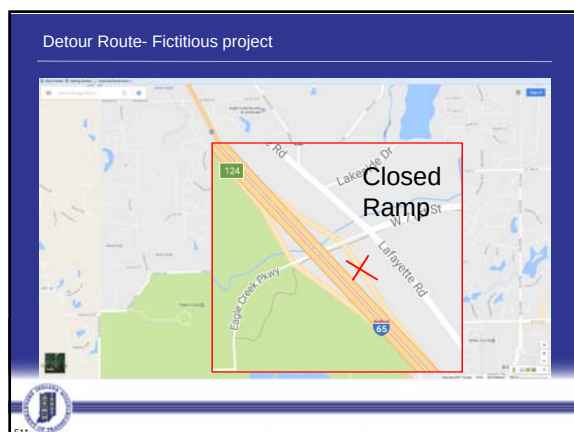


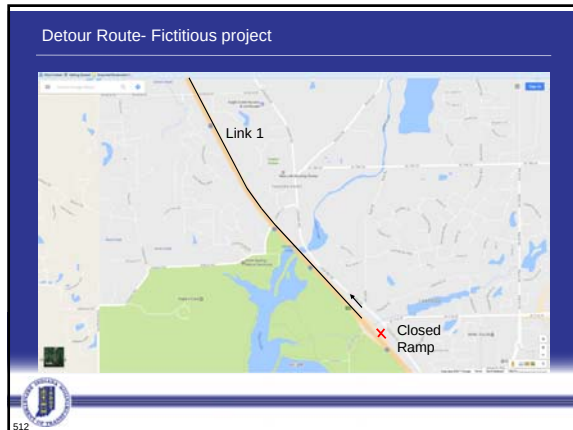


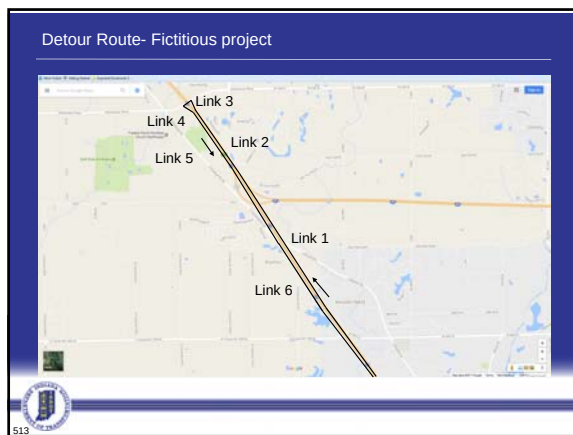


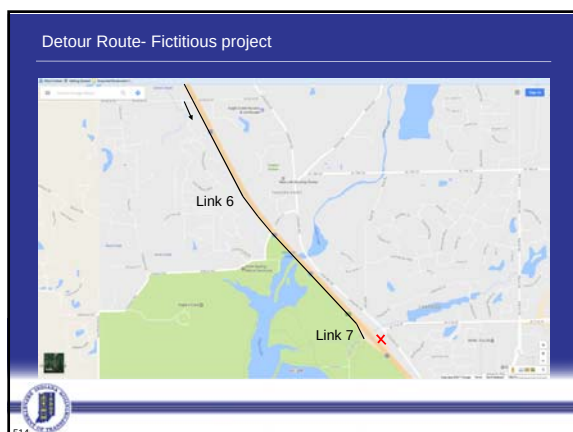












Course Outline

- Detour Route
 - Concept and Analysis
 - Detour Map
 - Detour Route Summary



515

INDOT Detour Route Summary Spreadsheet

INDOT > Safety > Work Zone Safety > Interstate Highways Congestion Policy > Interstate Highways Congestion Policy

INTERSTATE HIGHWAYS CONGESTION POLICY

Analysis Tools

- [INDOT Detour Analysis Spreadsheet](#)
- [INDOT Detour Route Summary Spreadsheet](#)
- [QuickZone X.V. Template](#)
- [Hourly Day of the Week Conversion Factors \(for use with IHCP Exceptions Only\)](#)
- [Sources of Information on Capacity](#)

IHCP Links

- [INDOT Interstate Highways Congestion Policy](#)
- [INDOT Work Zone Safety and Mobility Policy](#)
- [INDOT Work Zone Safety](#)

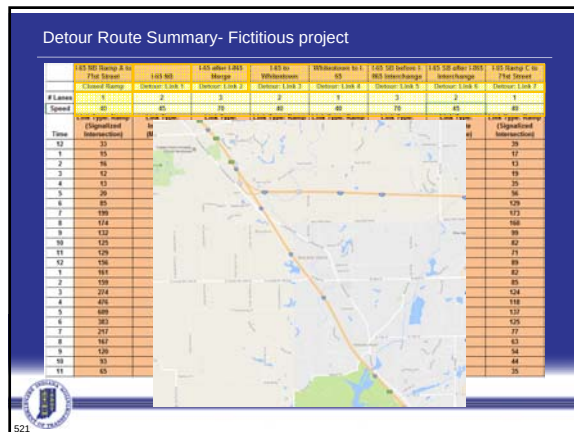


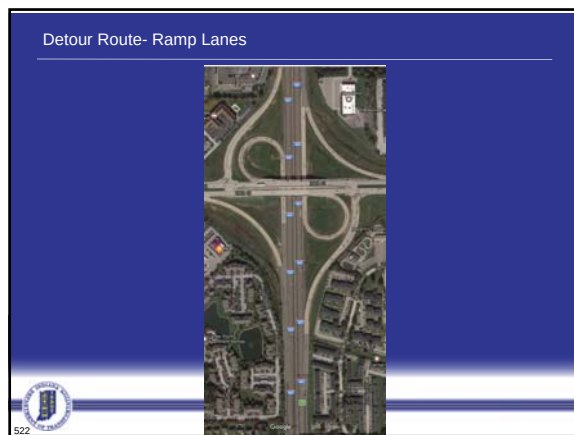
516

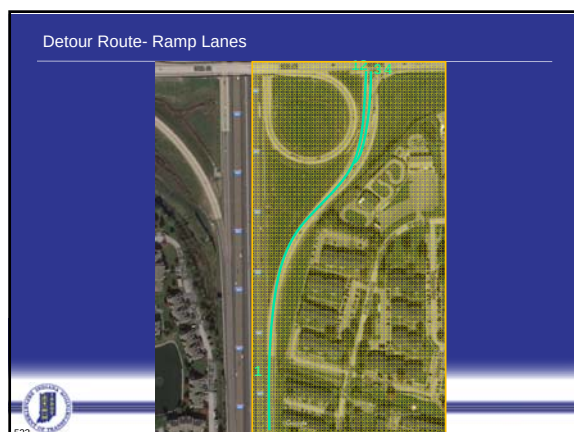
Detour Route Summary- Fictitious project

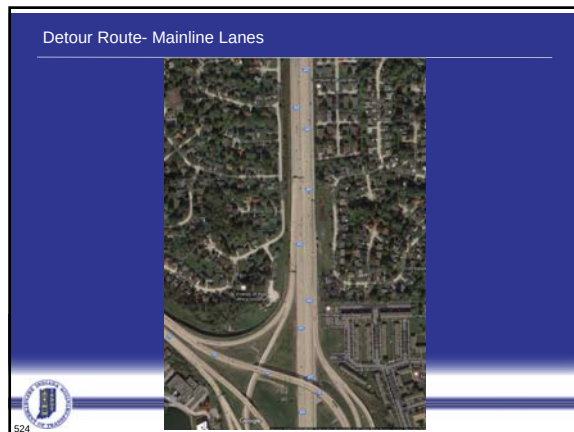



517











Detour Route Summary- Fictitious project

	145 NB before A to Flat Street	145 NB 145 NB	145 after 145 Merge	145 to Whittemore	Whittemore to 145 145 NB before 145 145 NB	Whittemore to 145 145 NB	145 NB after 145 145 NB	145 NB after 145 145 NB	145 NB after 145 145 NB	145 NB after 145 145 NB
	Current Route	Detour Link 1	Detour Link 2	Detour Link 3	Detour Link 4	Detour Link 5	Detour Link 6	Detour Link 7	Detour Link 8	Detour Link 9
# Lanes	1	2	3	3	3	3	3	3	3	3
Speed	40	45	30	40	40	30	45	40	45	40
	Link Type: Intersecting (Signalized Intersection)	Link Type: Intersecting (Signalized Intersection)	Link Type: Intersecting (Signalized Intersection)	Link Type: Intersecting (Signalized Intersection)	Link Type: Intersecting (Signalized Intersection)	Link Type: Intersecting (Signalized Intersection)	Link Type: Intersecting (Signalized Intersection)	Link Type: Intersecting (Signalized Intersection)	Link Type: Intersecting (Signalized Intersection)	Link Type: Intersecting (Signalized Intersection)
Time										
1	33	434	792	108	105	1042	274	39		
2	15	389	496	15	27	111	342	17		
3	16	413	496	43	40	715	354	13		
4	12	428	714	30	54	737	510	19		
5	13	446	1023	39	121	1079	720	26		
6	26	1017	1403	279	279	1026	1120	50		
7	85	1358	2119	414	783	2702	1403	129		
8	189	1632	2747	171	1206	4009	2411	173		
9	124	1740	2743	423	1063	3633	2293	108		
10	132	1523	2748	366	752	2946	1691	88		
11	125	1635	2947	485	520	2832	1886	62		
12	129	1636	3067	505	535	2635	1615	71		
13	136	1736	3070	552	577	2947	1867	88		
14	161	1688	3043	638	549	2949	1863	62		
15	189	1623	3270	682	592	2717	1739	85		
16	214	2038	3449	127	639	2946	2149	104		
17	416	2546	4304	1098	716	3451	2314	118		
18	689	2844	4448	1414	637	3448	2317	137		
19	383	4972	3323	853	689	3296	2117	125		
20	217	1279	2750	363	354	2291	1563	77		
21	167	1062	1564	433	283	2022	1334	63		
22	120	824	1545	288	199	1611	1018	54		
23	93	788	1364	213	159	1381	921	44		
24	63	588	1013	127	106	1121	721	35		

526

Detour Route Summary- Link 1 Data

Detour Route Summary- Route Information

Detour Route Summary- Work Information

Planned Events

Planned Month: Planned Year:

If the expected month of work is uncertain, select either August for urban locations and July for Rural locations (see Phase and the map)

Work Zone

Permanent Speed Limit (mph):
 Work Zone Speed Limit (mph):
 Existing Lane Width (ft):
 Work Zone Lane Width (ft):

Type of Characterizing Description
 Typically Shows, Closes, or Barrier Shift:

Additional Information
 Enter a description:

DETOURING TRAFFIC
 Planned Reduction due to Detouring Traffic:

Detouring Traffic

Detouring Traffic	Detouring Traffic
100%	100%

DETOURING TRAFFIC
 Planned Reduction due to Detouring Traffic:

Detouring Traffic

Detouring Traffic	Detouring Traffic
100%	100%

DETOURING TRAFFIC
 Planned Reduction due to Detouring Traffic:

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Detouring Traffic	Detouring Traffic
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 Planned Reduction due to Detouring Traffic:

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 Planned Reduction due to Detouring Traffic:

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 Planned Reduction due to Detouring Traffic:

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 Planned Reduction due to Detouring Traffic:

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 Planned Reduction due to Detouring Traffic:

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 Planned Reduction due to Detouring Traffic:

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100%	100%

DETOURING TRAFFIC
 Planned Reduction due to Detouring Traffic:

Detouring Traffic

Detouring Traffic	Detouring Traffic
100%	100%

DETOURING TRAFFIC
 Planned Reduction due to Detouring Traffic:

Detouring Traffic

Detouring Traffic	Detouring Traffic
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533

534

535

[illegible]

Theoretical Capacity

- Non-Work Zone Capacity
 - 45 MPH = 1900 PCE/Hr/Ln
 - 2 lanes
 - $1900 \times 2 = 3800$ PCE/Hr
- Urban Factor 10% increase
 - $3800 \times 1.1 = 4180$ PCE/Hr
- A Work Zone
 - Not taken into account
- Manually calculate Theoretical Capacity

Non-Work Zone Capacities (PCE/Hr/Ln)

Permanent Speed (mph)	Capacity
45	1900
50	2075
55	2250
60	2425
65	2600
70	2775
75	2950
80	3125

Example 1: Highway Capacity Analysis

Link	Link Type	Link Length (mi)	Link Speed (mph)	Link Capacity (PCE/Hr/Ln)	Link Demand (PCE/Hr/Ln)	Link Utilization (%)
1	Freeway	0.5	70	2950	1500	51%
2	Freeway	0.5	70	2950	1500	51%
3	Freeway	0.5	70	2950	1500	51%
4	Freeway	0.5	70	2950	1500	51%
5	Freeway	0.5	70	2950	1500	51%
6	Freeway	0.5	70	2950	1500	51%
7	Freeway	0.5	70	2950	1500	51%
8	Freeway	0.5	70	2950	1500	51%
9	Freeway	0.5	70	2950	1500	51%
10	Freeway	0.5	70	2950	1500	51%
11	Freeway	0.5	70	2950	1500	51%
12	Freeway	0.5	70	2950	1500	51%
13	Freeway	0.5	70	2950	1500	51%
14	Freeway	0.5	70	2950	1500	51%
15	Freeway	0.5	70	2950	1500	51%
16	Freeway	0.5	70	2950	1500	51%
17	Freeway	0.5	70	2950	1500	51%
18	Freeway	0.5	70	2950	1500	51%
19	Freeway	0.5	70	2950	1500	51%
20	Freeway	0.5	70	2950	1500	51%
21	Freeway	0.5	70	2950	1500	51%
22	Freeway	0.5	70	2950	1500	51%
23	Freeway	0.5	70	2950	1500	51%
24	Freeway	0.5	70	2950	1500	51%
25	Freeway	0.5	70	2950	1500	51%
26	Freeway	0.5	70	2950	1500	51%
27	Freeway	0.5	70	2950	1500	51%
28	Freeway	0.5	70	2950	1500	51%
29	Freeway	0.5	70	2950	1500	51%
30	Freeway	0.5	70	2950	1500	51%
31	Freeway	0.5	70	2950	1500	51%
32	Freeway	0.5	70	2950	1500	51%
33	Freeway	0.5	70	2950	1500	51%
34	Freeway	0.5	70	2950	1500	51%
35	Freeway	0.5	70	2950	1500	51%
36	Freeway	0.5	70	2950	1500	51%
37	Freeway	0.5	70	2950	1500	51%
38	Freeway	0.5	70	2950	1500	51%
39	Freeway	0.5	70	2950	1500	51%
40	Freeway	0.5	70	2950	1500	51%
41	Freeway	0.5	70	2950	1500	51%
42	Freeway	0.5	70	2950	1500	51%
43	Freeway	0.5	70	2950	1500	51%
44	Freeway	0.5	70	2950	1500	51%
45	Freeway	0.5	70	2950	1500	51%
46	Freeway	0.5	70	2950	1500	51%
47	Freeway	0.5	70	2950	1500	51%
48	Freeway	0.5	70	2950	1500	51%
49	Freeway	0.5	70	2950	1500	51%
50	Freeway	0.5	70	2950	1500	51%
51	Freeway	0.5	70	2950	1500	51%
52	Freeway	0.5	70	2950	1500	51%
53	Freeway	0.5	70	2950	1500	51%
54	Freeway	0.5	70	2950	1500	51%
55	Freeway	0.5	70	2950	1500	51%
56	Freeway	0.5	70	2950	1500	51%
57	Freeway	0.5	70	2950	1500	51%
58	Freeway	0.5	70	2950	1500	51%
59	Freeway	0.5	70	2950	1500	51%
60	Freeway	0.5	70	2950	1500	51%
61	Freeway	0.5	70	2950	1500	51%
62	Freeway	0.5	70	2950	1500	51%
63	Freeway	0.5	70	2950	1500	51%
64	Freeway	0.5	70	2950	1500	51%
65	Freeway	0.5	70	2950	1500	51%
66	Freeway	0.5	70	2950	1500	51%
67	Freeway	0.5	70	2950	1500	51%
68	Freeway	0.5	70	2950	1500	51%
69	Freeway	0.5	70	2950	1500	51%
70	Freeway	0.5	70	2950	1500	51%
71	Freeway	0.5	70	2950	1500	51%
72	Freeway	0.5	70	2950	1500	51%
73	Freeway	0.5	70	2950	1500	51%
74	Freeway	0.5	70	2950	1500	51%
75	Freeway	0.5	70	2950	1500	51%
76	Freeway	0.5	70	2950	1500	51%
77	Freeway	0.5	70	2950	1500	51%
78	Freeway	0.5	70	2950	1500	51%
79	Freeway	0.5	70	2950	1500	51%
80	Freeway	0.5	70	2950	1500	51%
81	Freeway	0.5	70	2950	1500	51%
82	Freeway	0.5	70	2950	1500	51%
83	Freeway	0.5	70	2950	1500	51%
84	Freeway	0.5	70	2950	1500	51%
85	Freeway	0.5	70	2950	1500	51%
86	Freeway	0.5	70	2950	1500	51%
87	Freeway	0.5	70	2950	1500	51%
88	Freeway	0.5	70	2950	1500	51%
89	Freeway	0.5	70	2950	1500	51%
90	Freeway	0.5	70	2950	1500	51%
91	Freeway	0.5	70	2950	1500	51%
92	Freeway	0.5	70	2950	1500	51%
93	Freeway	0.5	70	2950	1500	51%
94	Freeway	0.5	70	2950	1500	51%
95	Freeway	0.5	70	2950	1500	51%
96	Freeway	0.5	70	2950	1500	51%
97	Freeway	0.5	70	2950	1500	51%
98	Freeway	0.5	70	2950	1500	51%
99	Freeway	0.5	70	2950	1500	51%
100	Freeway	0.5	70	2950	1500	51%

537

Detour Route Summary- Fictitious project

Detour Route Summary- Fictitious project

The screenshot displays a detailed traffic analysis spreadsheet for a fictitious project involving the closure of I-20 EB Ramps. The spreadsheet is organized into five main columns, each representing a different detour route scenario. The columns are color-coded with blue headers and green sub-headers. The first column is highlighted with a yellow box. Each column contains a list of vehicle types (e.g., Single Unit Trucks, Double Unit Trucks, Buses, etc.) and their corresponding counts for various detour scenarios. The spreadsheet is color-coded with blue headers, green sub-headers, and yellow data cells. A yellow box highlights the first column. A small logo is visible in the bottom left corner.

Traffic Analysis of Detours and Detour Routes as a Result of Closing of I-20 EB Ramps I-20 I-24 Project - 2016

I-20 EB Ramps to I-20 Detour Route		I-20 EB Ramps to I-24 Detour Route		I-20 EB Ramps to I-20 and I-24 Detour Route		I-20 EB Ramps to I-20 and I-24 Detour Route		I-20 EB Ramps to I-20 and I-24 Detour Route	
Vehicle Type	Count	Vehicle Type	Count	Vehicle Type	Count	Vehicle Type	Count	Vehicle Type	Count
Single Unit Trucks	100	Single Unit Trucks	100	Single Unit Trucks	100	Single Unit Trucks	100	Single Unit Trucks	100
Double Unit Trucks	50	Double Unit Trucks	50	Double Unit Trucks	50	Double Unit Trucks	50	Double Unit Trucks	50
Buses	20	Buses	20	Buses	20	Buses	20	Buses	20
Passenger Cars	1000	Passenger Cars	1000	Passenger Cars	1000	Passenger Cars	1000	Passenger Cars	1000
Motorcycles	10	Motorcycles	10	Motorcycles	10	Motorcycles	10	Motorcycles	10
Tricycles	5	Tricycles	5	Tricycles	5	Tricycles	5	Tricycles	5
Other	10	Other	10	Other	10	Other	10	Other	10
Total	1180	Total	1180	Total	1180	Total	1180	Total	1180

539

Detour Route Summary- Fictitious project

Traffic Analysis of Routes on Detour Routes as a Result of
Closure of I-88 from I-88 to I-88, Detour Route Summary

Detour Route	Volume	Volume per Hour	Volume per Day	Volume per Week	Volume per Month	Volume per Year	Volume per Decade
Detour Route 1	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 2	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 3	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 4	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 5	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 6	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 7	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 8	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 9	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 10	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 11	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 12	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 13	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 14	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 15	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 16	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 17	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 18	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 19	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 20	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 21	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 22	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 23	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 24	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 25	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 26	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 27	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 28	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 29	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 30	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 31	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 32	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 33	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 34	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 35	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 36	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 37	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 38	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 39	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 40	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 41	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 42	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 43	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 44	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 45	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 46	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 47	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 48	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 49	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 50	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 51	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 52	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 53	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 54	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 55	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 56	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 57	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 58	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 59	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 60	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 61	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 62	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 63	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 64	1000	41.67	1000	7000	21000	252000	2520000
Detour Route 65	1000	41.67	1000	7000	21000	252000	2520000
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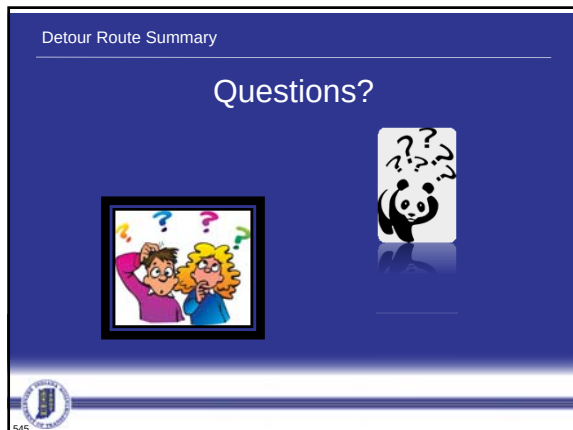
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Detour Route Summary- Fictitious project

[illegible][illegible]



Course Outline

- The Interstate Highways Congestion Policy
- Queue Analysis Basics
- Traffic Data: Obtaining & Adjusting
- Queue Analysis for Mainline Closures
- Detour Route Summary Analysis
- Rolling Slowdowns
- Preparing the IHCP Exception Documents
- The IHCP Exception Request Submittal Package
- Test and Evaluation



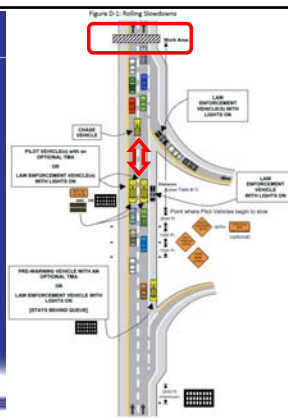
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Rolling Slowdown

- Full Closure of Interstate for up to 20 minutes.
- Work occurs between Chase and Pilot Vehicles once Chase Vehicle passes through Work Area



601

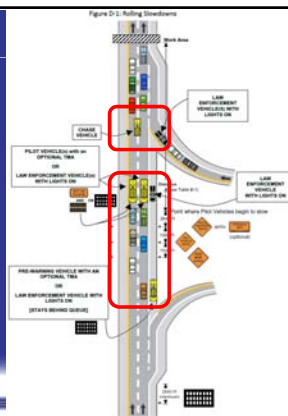


Rolling Slowdown

- Chase Vehicle travels at speed limit.
- Traffic and Pilot Vehicles slow to 20 MPH at a Point located Distance A from Work Area.



602



Rolling Slowdown | Distance A

APPENDIX D – ROLLING SLOWDOWNS

Minimum distance from work area where Pilot Vehicles begin to reduce speed to the designated speed for a given posted speed limit (Pilot Vehicle speed shall be 20 MPH unless otherwise approved by Policy Exception)

Speed of Pilot Vehicle ↓	20 Minute Clear Time							
	Posted Speed Limit							
45 MPH	5.2 Miles	5.0 MPH	5.0 Miles	60 MPH	4.9 Miles	65 MPH	4.8 Miles	70 MPH
10 MPH	8.3 Miles	5.0 Miles	5.0 Miles	60 MPH	4.9 Miles	65 MPH	4.8 Miles	70 MPH
15 MPH	8.3 Miles	5.0 Miles	5.0 Miles	60 MPH	4.9 Miles	65 MPH	4.8 Miles	70 MPH
20 MPH	12.7 Miles	11.9 Miles	7.7 Miles	7.5 Miles	7.4 Miles	10.4 Miles	10.2 Miles	

603

Rolling Slowdown

Law Enforcement is involved

- To close off ramps
- On mainline shoulder
- As Pilot Vehicles
- As Pre-Warning Vehicle at Back of Queue

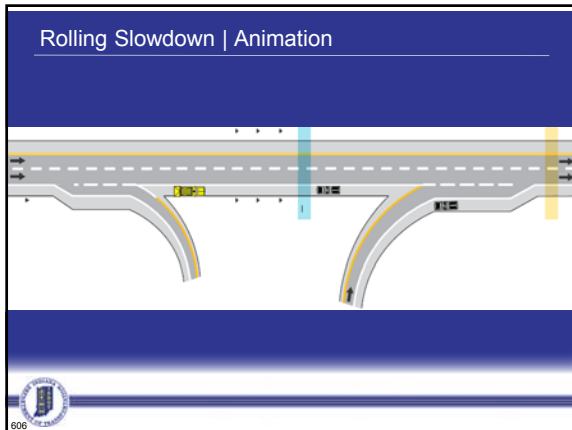
LEO = Law Enforcement Officer

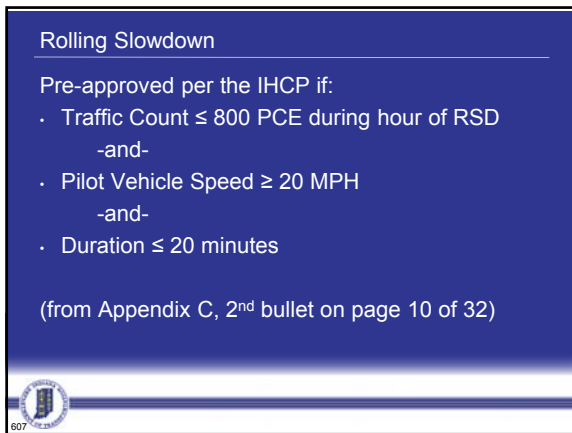
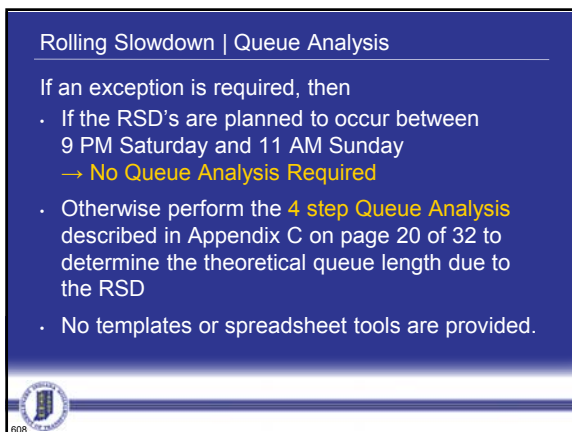
604

Rolling Slowdown

Queues must be allowed to dissipate (for 20 min minimum) prior to starting the next rolling slowdown.

605



[illegible]

Rolling Slowdown | Queue Analysis

4 Steps:

1. Determine traffic volumes (PCE/hr) using TCDS and the INDOT Queuing Analysis spreadsheet.

2. Determine the Approaching Volume, V_A (PCE)

$$V_A = \left[\frac{\text{Traffic Volume}}{\text{During Hour (PCE/hr)}} \right] \times \left[\frac{1 \text{ hr}}{60 \text{ min}} \right] \times \left[\frac{\text{Duration}}{\text{(min)}} \right]$$

3. Determine the Approaching Volume per Lane, V_{AL} (PCE/Ln)

$$V_{AL} = \frac{V_A \text{ (PCE)}}{\text{Number of Lanes}}$$



609

Rolling Slowdown | Queue Analysis

4. Determine Queue Length, Q (mi)

$$Q = \frac{V_{AL} \text{ (PCE/Ln)} \times [27.8 \text{ ft./PCE}]}{5280 \text{ ft./mile}}$$

Combining steps 2 – 4 into a single equation:

$$Q \text{ (mi)} = \frac{\text{PCE}}{\text{hr}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{\text{Dur. min}}{\text{\# of Lanes}} \times \frac{27.8 \text{ ft.}}{1 \text{ PCE}} \times \frac{1 \text{ mi.}}{5280 \text{ ft.}}$$



610

Rolling Slowdown | Queue Analysis Example

20 minute Rolling Slowdowns, 2 Lane Interstate

Hours During which Rolling Slowdowns are Planned	Adjusted Traffic Volumes
8:00 – 9:00 AM	625 PCE/hr
9:00 – 10:00 AM	775 PCE/hr
10:00 – 11:00 AM	800 PCE/hr

Select hour with highest volume.

$$Q \text{ (mi)} = \frac{\text{PCE}}{\text{hr}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{\text{Dur. min}}{\text{\# of Lanes}} \times \frac{27.8 \text{ ft.}}{1 \text{ PCE}} \times \frac{1 \text{ mi.}}{5280 \text{ ft.}}$$

$$Q \text{ (mi)} = \frac{800 \text{ PCE}}{\text{hr}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{20 \text{ min}}{2} \times \frac{27.8 \text{ ft.}}{1 \text{ PCE}} \times \frac{1 \text{ mi.}}{5280 \text{ ft.}} = 0.7 \text{ mi}$$



611

Rolling Slowdown

Items to include in Exception request:

- Hours (Times) of Closures
- Adjusted Traffic Data
- Queue length (if applicable)
- MOT Plan Details. (Ensure that any ramps within Distance A will have LEO's blocking them.)
- The Abbreviated TMP should have detailed instructions on how the RSD will be performed (based on Appendix D of the policy).



612

Rolling Slowdown

Questions?



613



Course Outline

- The Interstate Highways Congestion Policy
- Queue Analysis Basics
- Traffic Data: Obtaining & Adjusting
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- Detour Route Summary Analysis
- Rolling Slowdowns
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- The IHCP Exception Request Submittal Package
- Test and Evaluation



700

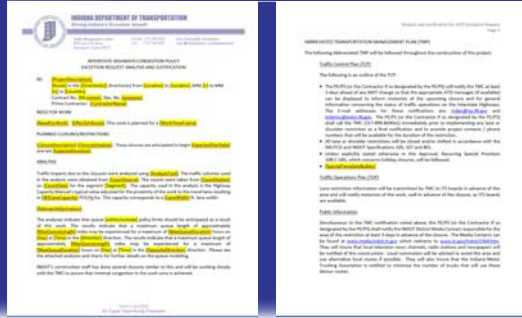
Course Outline

- Preparing the IHCP Exception Documents
 - Body
 - Cover Letter



701

Body





702

May 2017

Body- District Information

706

Body- Governor, Commissioner

707

Body- Subject

708

INDIANA DEPARTMENT OF TRANSPORTATION
Building Indiana's Economic Future

Home About IDOT Safety Construction **Permitting** Programs Partners Contact Us

INDEPENDENT HIGHWAYER CONSTRUCTION POLICY
SECTION REQUEST NUMBER AND APPLICATION

Permitting

Section 1.0 - General Information

Section 2.0 - Application Process

Section 3.0 - Construction

Section 4.0 - Maintenance

Section 5.0 - Safety

Section 6.0 - Environmental

Section 7.0 - Historical

Section 8.0 - Other

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IHCP Exception Preparer Training

Preparing the IHCP Exception Documents

Exception Request Body

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Body- Analysis

[illegible]

May 2017

May 2017

Body- Fourth page of filled out body

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Body- Prepared by and Reviewed By

725

Body

Questions?

726

Preparing the IHCP Exception Documents

- IHCP Request Body
- Cover Letter



751

Cover Letter



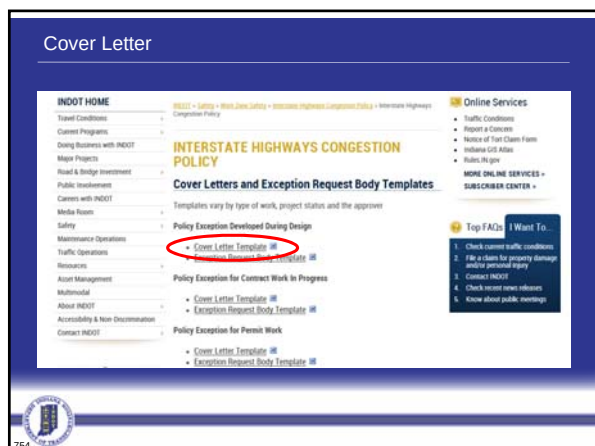

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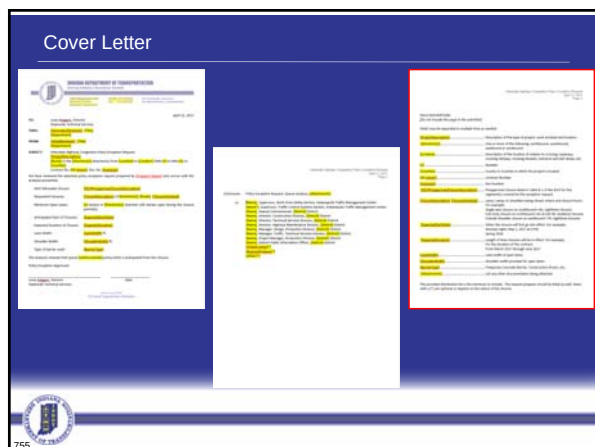
Cover Letter

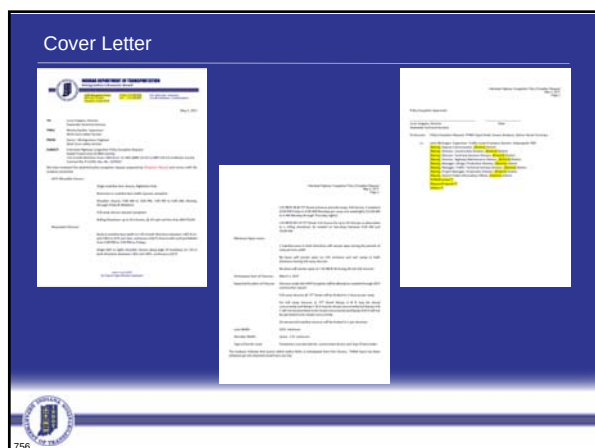
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 INDOT > Safety > Work Zone Safety > INDOT Interstate Highways
 Congestion Policy > Cover Letters and Exception Request Body Templates



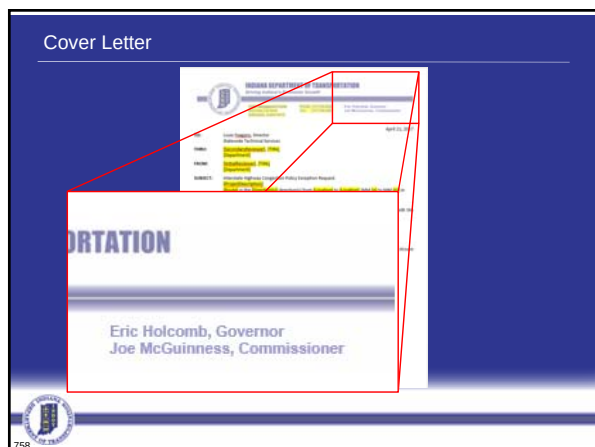

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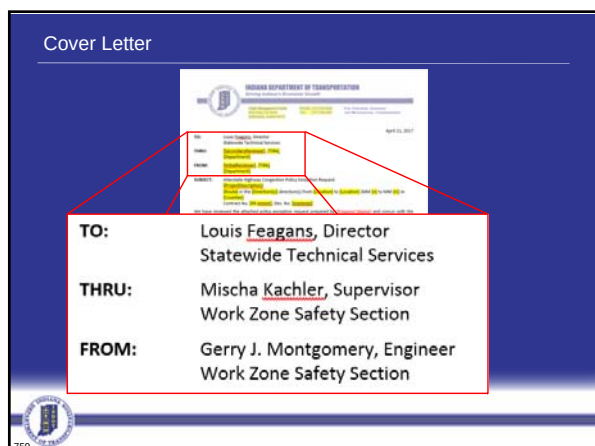












Cover Letter

INDIANA DEPARTMENT OF TRANSPORTATION
 Division of Transportation Planning

To: [Name], Director
 Indiana Department of Transportation

From: [Name], [Title]
 [Organization]

Subject: Interstate Highway Congestion Policy Exception Request
 Added Travel Lanes & HMA Overlay
 I-65 in both directions from I-465 N Jct. to I-865 (MM 122.92 to MM 129.21) in Marion County
 Contract No. R-12345, Des. No. 1234567

We have reviewed the attached policy exception request prepared by [Preparer's Name] and concur with the analyses presented.

IHCP Allowable Closure: [IHCPPreapprovedClosureDescription]

Requested Closures: [ClosureDescription] of [Direction(s)] [Route], [ClosureSchedule]

Minimum Open Lanes: [N] lane(s) in [Direction(s)] direction will remain open during the closure period(s).

Anticipated Start of Closure: [ExpectedStartDate]

Expected Duration of Closure: [ExpectedDuration]

Lane Width: [LaneWidth] ft.

Shoulder Width: [ShoulderWidth] ft.

Type of barrier used: [BarrierType]

The analyses indicate that queue [Left/Right/Outside] policy limits is anticipated from this closure.

Policy Exception Approval

John [Name], Director
 Indiana Department of Transportation

Date: [Date]

760

Cover Letter

INDIANA DEPARTMENT OF TRANSPORTATION
 Division of Transportation Planning

To: [Name], Director
 Indiana Department of Transportation

From: [Name], [Title]
 [Organization]

Subject: Interstate Highway Congestion Policy Exception Request
 Added Travel Lanes & HMA Overlay
 I-65 in both directions from I-465 N Jct. to I-865 (MM 122.92 to MM 129.21) in Marion County
 Contract No. R-12345, Des. No. 1234567

We have reviewed the attached policy exception request prepared by [Preparer's Name] and concur with the analyses presented.

IHCP Allowable Closure: [IHCPPreapprovedClosureDescription]

Requested Closures: [ClosureDescription] of [Direction(s)] [Route], [ClosureSchedule]

Minimum Open Lanes: [N] lane(s) in [Direction(s)] direction will remain open during the closure period(s).

Anticipated Start of Closure: [ExpectedStartDate]

Expected Duration of Closure: [ExpectedDuration]

Lane Width: [LaneWidth] ft.

Shoulder Width: [ShoulderWidth] ft.

Type of barrier used: [BarrierType]

The analyses indicate that queue [Left/Right/Outside] policy limits is anticipated from this closure.

Policy Exception Approval

John [Name], Director
 Indiana Department of Transportation

Date: [Date]

761

Cover Letter

INDIANA DEPARTMENT OF TRANSPORTATION
 Division of Transportation Planning

To: [Name], Director
 Indiana Department of Transportation

From: [Name], [Title]
 [Organization]

Subject: Interstate Highway Congestion Policy Exception Request
 Added Travel Lanes & HMA Overlay
 I-65 in both directions from I-465 N Jct. to I-865 (MM 122.92 to MM 129.21) in Marion County
 Contract No. R-12345, Des. No. 1234567

We have reviewed the attached policy exception request prepared by [Preparer's Name] and concur with the analyses presented.

IHCP Allowable Closure: [IHCPPreapprovedClosureDescription]

Requested Closures: [ClosureDescription] of [Direction(s)] [Route], [ClosureSchedule]

Minimum Open Lanes: [N] lane(s) in [Direction(s)] direction will remain open during the closure period(s).

We have reviewed the attached policy exception request prepared by [Preparer's Name] and concur with the analyses presented.

IHCP Allowable Closure:

- Single mainline lane closure, Nighttime Only
- Reduction in mainline lane width requires exception
- Shoulder closure, 9:00 AM to 3:00 PM, 7:00 PM to 6:00 AM, Monday through Friday & Weekend
- Full ramp closure requires exception
- Rolling Slowdown up to 20 minutes, @ 20 mph and less than 800 PCE/hr

Policy Exception Approval

John [Name], Director
 Indiana Department of Transportation

Date: [Date]

762

Cover Letter

APPENDIX B - PREAPPROVED INTERSTATE CLOSURE AND RESTRICTION TIMES
 Table B-1. 2017 IHCP Tables

Section	Start East	End East	Length (mi)	Single Lane Closure Designation	Urban Designation	Shoulder Closure Only Designation
21st Street to I-405 (N Jct.)	115	123	8	Weekend or Nighttime Only	Urban	SA to 3P, 7P to 6A, M-F & Weekend
I-405 (N Jct.) to SR 32	123	140	17	Nighttime Only	Urban	SA to 3P, 7P to 6A, M-F & Weekend
SR 32 to SR 205	240	248	8	Nighttime Only	Urban	SA to 3P, 7P to 6A, M-F & Weekend
SR 205 to SR 205	248	255	7	Shoulder Closure Only designated as a Shoulder Closure Only	Rural	Anytime
SR 205 to SR 205 (Green Point)	255	267	12	Nighttime Only	Rural	SA to 3P, 7P to 6A, M-F & Weekend

21st Street to I-405 (N Jct.) 115 123 8 Weekend or Nighttime Only Urban SA to 3P, 7P to 6A, M-F & Weekend

I-405 (N Jct.) to SR 32 123 140 17 Nighttime Only Urban SA to 3P, 7P to 6A, M-F & Weekend

Page 2 of 10



763

Cover Letter

We have reviewed the attached policy exception request prepared by [Preparer's Name] and concur with the analyses presented.

IHCP Allowable Closure: [IHCPPreapprovedClosureDescription]

Requested Closures: [ClosureDescription] of [Direction(s)] [Route], [ClosureSchedule]

Minimum Open Lanes: [n] lane(s) in [Direction(s)] direction will remain open during the closure

Requested Closures:

Reduce mainline lane width on I-65 in both directions between I-465 N Jct. and I-865 to 10 ft. per lane, continuous (24/7) closure with work prohibited from 3:00 PM to 7:00 PM on Fridays

Single (left or right) shoulder closure along edge of travelway on I-65 in both directions between I-465 and I-865, continuous (24/7)

I-65 NB & SB @ 71st Street entrance and exit ramps, full closure, 1 weekend (9:00 PM Friday to 6:00 AM Monday) per ramp and weeknights (12:00 AM to 6:00 AM Monday through Thursday nights)

I-65 NB & SB S of 71st Street, Full closure for up to 20 minutes as alternative to a rolling slowdown, As needed on Saturdays between 6:00 AM and 10:00 AM

The



764

Cover Letter

We have reviewed the attached policy exception request prepared by [Preparer's Name] and concur with the analyses presented.

IHCP Allowable Closure: [IHCPPreapprovedClosureDescription]

Requested Closures: [ClosureDescription] of [Direction(s)] [Route], [ClosureSchedule]

Minimum Open Lanes: [n] lane(s) in [Direction(s)] direction will remain open during the closure period(s).

Anticipated Start of Closures: [ExpectedStartDate]

Expected Duration of Closure: [ExpectedDuration]

Minimum Open Lanes:

2 mainline lanes in both directions will remain open during the periods of reduced lane width

No lanes will remain open on I-65 entrance and exit ramps in both directions during full ramp closures

No lanes will remain open on I-65 NB & SB during 20 min full closures



765

Cover Letter

We have reviewed the attached policy exception request prepared by [Preparer's Name] and concur with the analyses presented.

IHCP Allowable Closure: [IHCP Approved Closure Description]

Requested Closures: [Closure Description] of [Direction(s)] [Route], [Closure Schedule]

Minimum Open Lanes: [In] lane(s) in [Direction(s)] direction will remain open during the closure period(s).

Anticipated Start of Closures: [Expected Start Date]

Expected Duration of Closure: [Expected Duration]

Lane: Anticipated Start of Closures: March 1, 2017

Shoulder: Expected Duration of Closure: Closures under this IHCP Exception will be allowed as needed through 2017 construction season

Type: Full ramp closures @ 71st Street will be limited to 2 closures per ramp

The analyses indicate that queue [within/outside] policy limits is anticipated from this closure.

For full ramp closures at 71st Street Ramps A & B may be closed concurrently and Ramps C & D may be closed concurrently but Ramps A & C will not be permitted to be closed concurrently and Ramps B & D will not be permitted to be closed concurrently

20 minute full mainline closures will be limited to 2 per direction

766

Cover Letter

We have reviewed the attached policy exception request prepared by [Preparer's Name] and concur with the analyses presented.

Lane Width: 10 ft. minimum

Shoulder Width: varies - 2 ft. minimum

Anticipated Start of Closures: [Expected Start Date]

Expected Duration of Closure: [Expected Duration]

Lane Width: [Lane Width] ft.

Shoulder Width: [Shoulder Width] ft.

Type of barrier used: [Barrier Type]

The analyses indicate that queue [within/outside] policy limits is anticipated from this closure.

767

Cover Letter

We have reviewed the attached policy exception request prepared by [Preparer's Name] and concur with the analyses presented.

Type of barrier used: Temporary concrete barrier, construction drums and Type III barricades

Requested Closures: [Closure Description] of [Direction(s)] [Route], [Closure Schedule]

Minimum Open Lanes: [In] lane(s) in [Direction(s)] direction will remain open during the closure period(s).

Anticipated Start of Closures: [Expected Start Date]

Expected Duration of Closure: [Expected Duration]

Lane Width: [Lane Width] ft.

Shoulder Width: [Shoulder Width] ft.

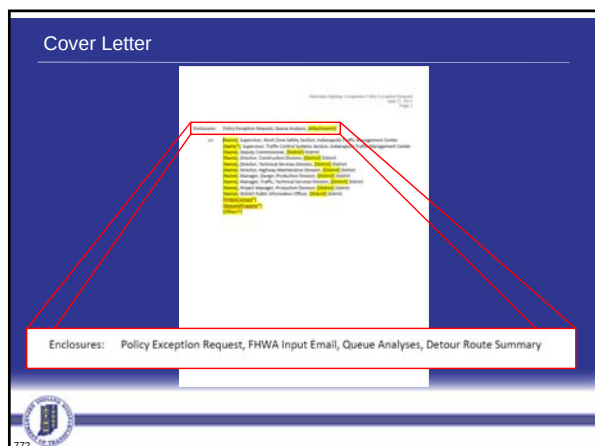
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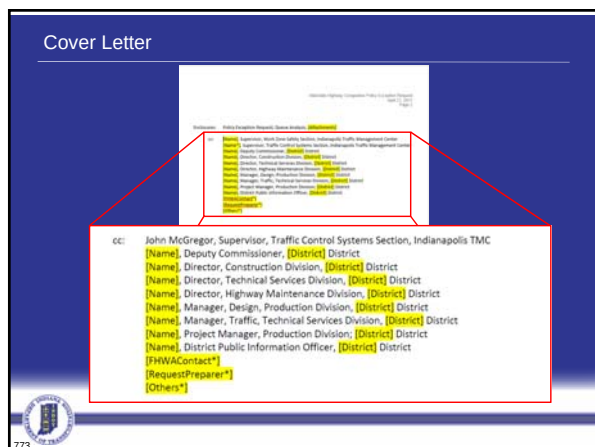
The analyses indicate that queue [within/outside] policy limits is anticipated from this closure.

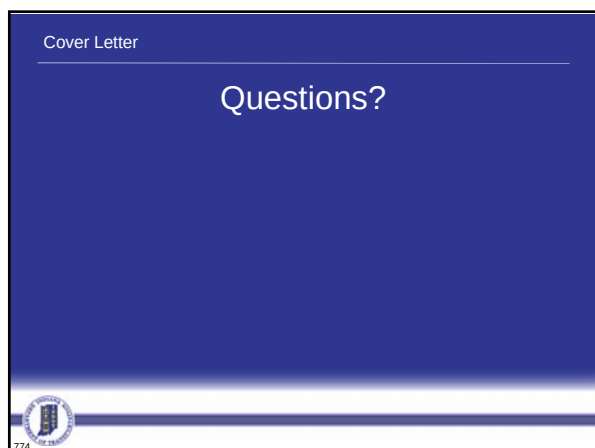
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769

MSRP (Manufacturer's Suggested Retail Price)	\$2,999.99
Required (Optional)	Standard (Optional)
Minimum (Open Lines)	16 (24) 32 (48) 64 (96) 128 (192) 256 (384) 512 (768) 1024 (1536) 2048 (3072) 4096 (6144) 8192 (12288) 16384 (24576) 32768 (49152) 65536 (98304) 131072 (196608) 262144 (393216) 524288 (786432) 1048576 (1572864) 2097152 (3145728) 4194304 (6291456) 8388608 (12582912) 16777216 (25165824) 33554432 (50331648) 67108864 (100663296) 134217728 (201326592) 268435456 (402653184) 536870912 (805306368) 1073741824 (1610612736) 2147483648 (3221225472) 4294967296 (6442450944) 8589934592 (12884901888) 17179869184 (25769803776) 34359738368 (51539607552) 68719476736 (103079215104) 137438953472 (206158430208) 274877906944 (412316860416) 549755813888 (824633720832) 1099511627776 (1649267441664) 2199023255552 (3298534883328) 4398046511104 (6597069766656) 8796093022208 (13194139533312) 17592186044416 (26388279066624) 35184372088832 (52776558133248) 70368744177664 (105553116266496) 140737488355328 (211106232532992) 281474976710656 (422212465065984) 562949953421312 (844424930131968) 1125899906842624 (1688849860263936) 2251799813685248 (3377699720527872) 4503599627370496 (6755399441055744) 9007199254740992 (13510798882111488) 18014398509481984 (27021597764222976) 36028797018963968 (54043195528445952) 72057594037927936 (108086391056891904) 144115188075855872 (216172782113783808) 288230376151711744 (432345564227567616) 576460752303423488 (864691128455135232) 1152921504606846976 (1729382256910270464) 2305843009213693952 (3458764513820540928) 4611686018427387904 (6917529027641081856) 9223372036854775808 (13835058055282163712) 18446744073709551616 (27670116110564327424) 36893488147419103232 (55340232221128654848) 73786976294838206464 (110680464442257309696) 147573952589676412928 (221360928884514619392) 295147905179352825856 (442721857769029238784) 590295810358705651712 (885443715538058477568) 1180591620717411303424 (1770887431076116955136) 2361183241434822606848 (3541774862152233910272) 4722366482869645213696 (7083549724304467820544) 9444732965739290427392 (14167099448608935641088) 18889465931478580854784 (28334198897217871282176) 37778931862957161709568 (56668397794435742564352) 75557863725914323419136 (113336795588871485128704) 151115727451828646838272 (226673591177742970257408) 302231454903657293676544 (453347182315485940514816) 604462909807314587353088 (906694364630971881029632) 1208925819614629174706176 (1813388729261943762059264) 2417851639229258349412352 (3626777458523887524118528) 4835703278458516698824704 (7253554917047775048237056) 9671406556917033397649408 (14507109834095550096474112) 19342813113834066795298816 (29014219668191100192948224) 38685626227668133590597632 (58028439336382200385896448) 77371252455336267181195264 (116056878672764400771792896) 154742504910672534362390528 (232113757345528801543585792) 309485009821345068724781056 (464227514691057603087171584) 618970019642690137449562112 (928455039382115206174343168) 1237940039285380274899124224 (1856910078764230412348686336) 2475880078570760549798248448 (3713820157528460824697372672) 4951760157141521099596496896 (7427640315056921649394745344) 9903520314283042199192993792 (14855280630113843298789490688) 19807040628566084398385987584 (29710561260227686597578981376) 39614081257132168796771975168 (59421122520455373195157962752) 79228162514264337593543950336 (118842245040910746390315925472) 158456325028528675187087900672 (237684490081821492780631850944) 316912650057057350374175801344 (475368980163642985561263701888) 633825300114114700748351602688 (948737960327285971122527403776) 1267650600228229401496703205376 (1897475920654571942245054807552) 2535301200456458802993406410752 (3794951841309143884490109615104) 5070602400912917605986812821504 (7589903682618287768980219230208) 10141204801825835211973625643008 (15179807365236575537960438460416) 20282409603651670423947251286016 (30359614730473151075920876920832) 40564819207303340847894502572032 (60859228460946302151841753841664) 81129638414606681695789005144064 (121718456921892603503683507683328) 162259276829213363391578010288128 (243436913843785207007367015366656) 324518553658426726783156020576256 (486873827687570414014734030733312) 649037107316853453566312041152512 (9







Course Outline

- The Interstate Highways Congestion Policy
- Queue Analysis Basics
- Traffic Data: Obtaining & Adjusting
- Queue Analysis for Mainline Closures
- Detour Route Summary Analysis
- Rolling Slowdowns
- Preparing the IHCP Exception Documents
- The IHCP Exception Request Submittal Package
- Test and Evaluation



800

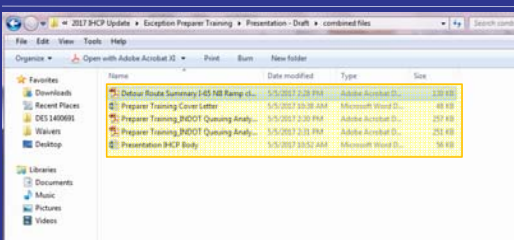
Combining files into PDF

- Combined files include:
 - Cover letter
 - Body
 - Queue Analysis
 - Detour Map (if needed)
 - Detour Route Summary Analysis (if needed)
 - Rolling Slowdown (if needed)
 - FHWA Concurrence
 - Any other documents to support request, such as:
 - Maps
 - MOT Plan Sheets
 - MOT Special Provisions

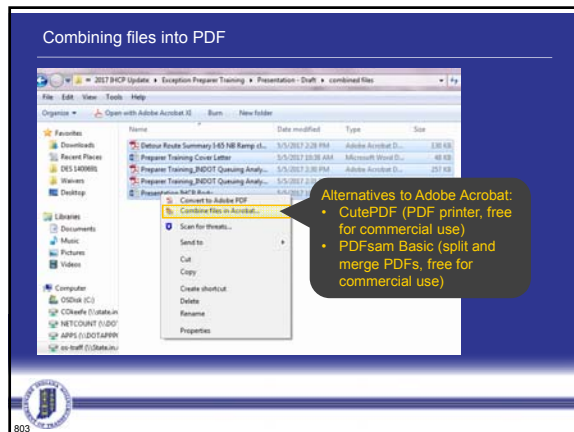


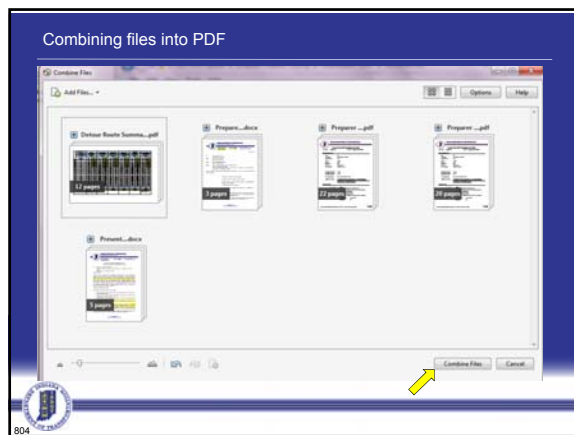
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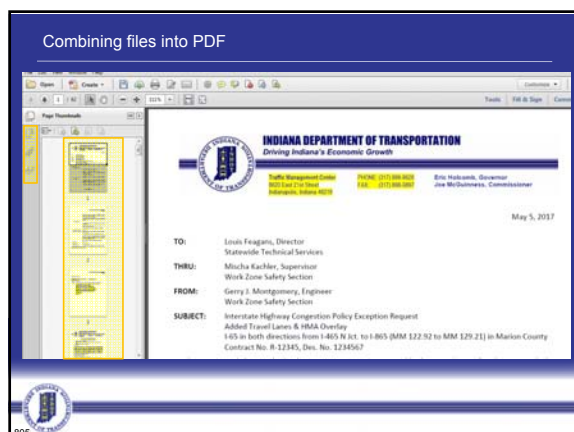
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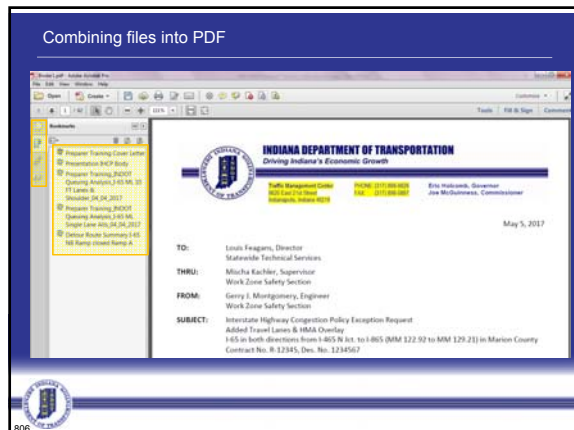


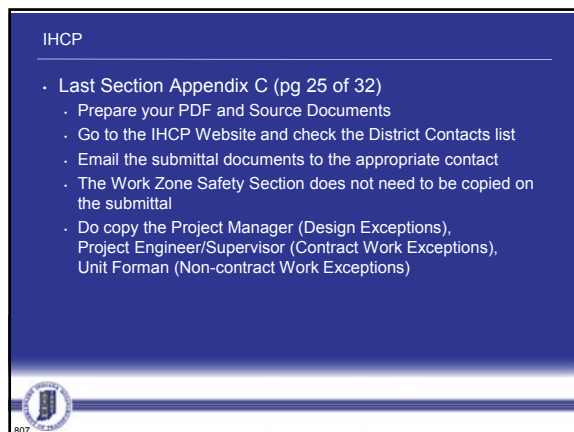
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Work Zone Safety Section Staff

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809
