

# Design Exception Refresher

2023 INDOT Highway Design Conference

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INDOT Standards & Policy

# Why Do You Need a Design Exception? – Why # 1

- **Code of Federal Regulations** – 23 CFR 625 Design Standards for Highways
  - § 625.3(a) Applicable Standards
    - ...new construction, reconstruction, resurfacing, restoration, or rehabilitation...on the NHS
  - § 625.3(f) Exceptions
    - Approval ... may be given on a project basis to designs...which do not conform to the minimum criteria as set forth in the standards, policies, and standard specifications
    - design exceptions cannot be approved for general application to an entire corridor or geographic region
  - 1985 FHWA established 13 controlling design criteria, which were those geometric design elements judged to be the most critical indicators of a highway's safety and overall serviceability
  - 2016 FHWA revised the controlling criteria to 10 elements for high-speed facilities, and two elements for low-speed facilities
    - NCHRP 783 *Evaluation of 13 Controlling Criteria*



# Why Do You Need a Design Exception? – Why # 1

- **Indiana Design Manual**
- 40-6.0 Project Scope of Work
  - Reflects the basic intent of the highway project and informs which design criteria apply
- 40-8.02 – Hierarchy of Design Criteria
  - Level One = controlling design criteria
  - 2020 INDOT adopted revised controlling criteria. Design Memo 20-13
  - Formal documentation and approval (design exception) required for a level one design element that does not meet the applicable criteria.
- 40-8.03 – Design Exception Process
  - Applies to 4R, Partial 4R/3R Freeway, and 3R non-freeway projects
  - Specific applications to Partial 3R (Ch 56)
  - Not applicable to non-NHS HSIP, signing, pavement marking, traffic signal installation, or a traffic barrier project that has little or no roadway work \*
  - Not applicable to Preventive Maintenance \*



\* Do not interpret as a free pass to do nothing. Safety is paramount to our work and should be a consideration for every project. Work that degrades an existing geometric element may require a design exception, e.g. Vertical clearance where p.g. is increased or sight distance where guardrail is replaced with taller MGS guardrail

# Why Do You Need a Design Exception? – Why #2

- Limits to establishing design criteria
  - Roadways have a multitude of contexts
  - Not possible to establish design criteria for every context
- A good project strikes a balance
  - Safety and mobility
  - Impacts to the natural environment
  - Social or right-of-way impacts
  - Preservation of historic or cultural resources
  - Sensitivity to context and community values
  - Consideration of the needs of a wide variety of roadway users (all modes of transportation)
  - Construction or right-of-way costs

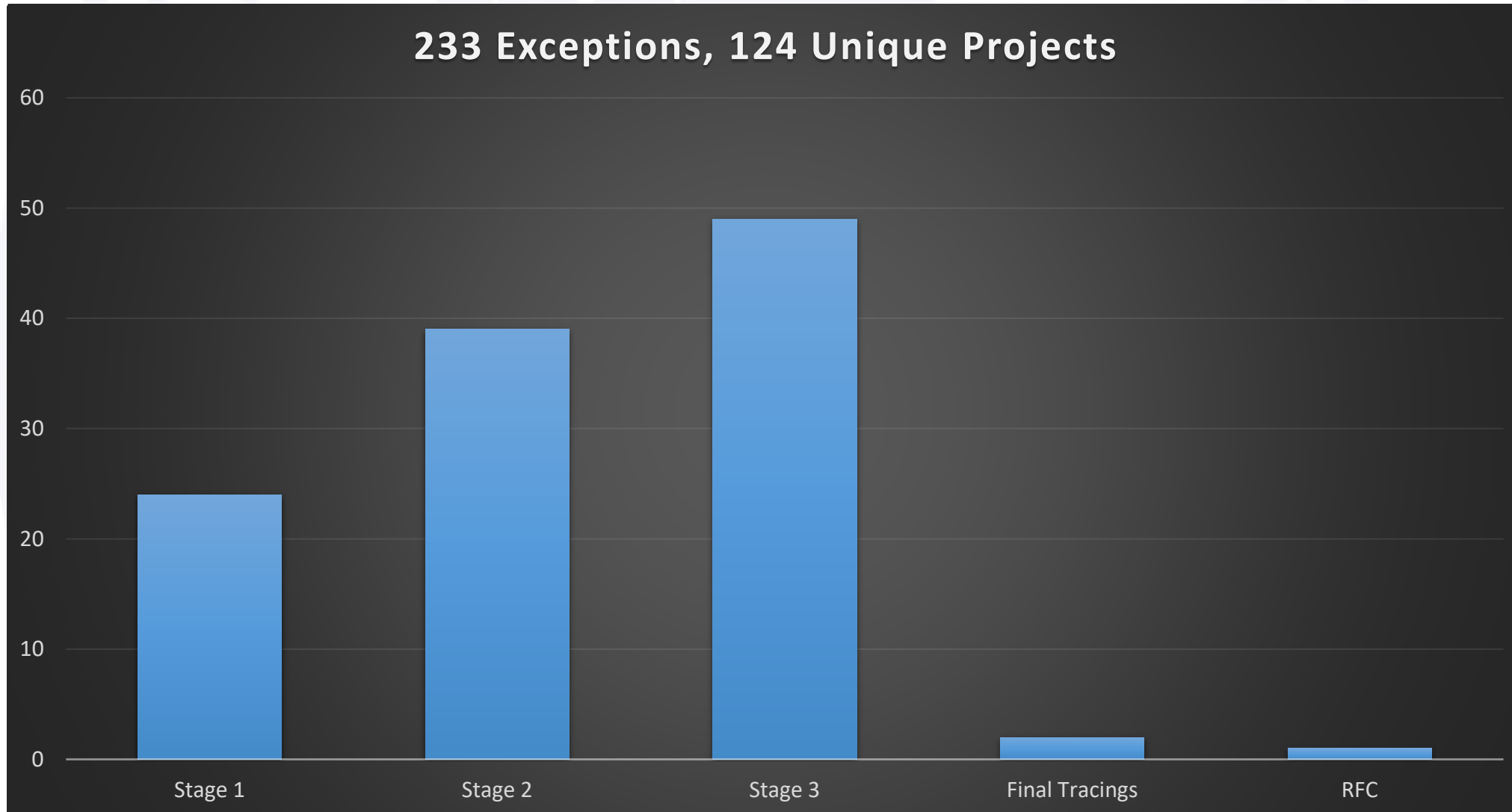


# Design Exception Procedural Resources

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- IDM 40-8.04(01) – Department Procedures
- Multiple design elements may be included in a single document, and each element should have its own cover letter.
- Coordinate cover sheet signatures with the PM prior to uploading to ERMS
- LPA design exceptions must be signed by the LPA
- Use the appropriate file naming convention (Lvl1Exc)
  - ERMS File Naming Convention document
- Submit at Stage 1 \*
- Design exceptions submitted at a later stage may put the project schedule at risk, if the exception is not approved.
- Design exception should be in final form when uploaded.
- Submittal stats (need improvement)

# Design Exception Submittal Stage (2021-present)



# Design Exception Procedural Resources

- Design Manual Editable Documents, under Design Submittal category  
<https://www.in.gov/dot/div/contracts/design/dmforms/index.html>

- ERMS File Naming Convention
- Level One Checklist
  - DM 20-13
- Design Exception Request
  - Coversheet revised
- 3R Design Exception Template
  - New

Category	IDM Ch.	EdDoc/ Figure	Document Title
Design Submittal	14	<a href="#">103-02-03</a>	Field Check Notification Letter (in house or consultant) <a href="#">Notification for Bridge Field Checks (added 06/27/19)</a>
Design Submittal	14	<a href="#">103-02-01</a>	Final Tracings Checklist (Rev. Oct. 2021, Jul. 2022) <a href="#">Final Tracings Additional Instructions (Rev. Jul. 2022)</a> <a href="#">Final Tracings Checklist (Excel format) (Rev. Oct. 2021, Jul. 2022)</a>
Design Submittal	14	N/A	<a href="#">ERMS Information</a> <a href="#">ERMS File Naming Convention (Rev. Oct. 2021, Jan. 2022, Jul. 2022)</a> <a href="#">Example Notification Email</a>
Design Submittal	40	<a href="#">40-8A</a>	SDDCTEA Interstate Vertical Clearance Exception Coordination (added 07/01/14)
Design Submittal	40	<a href="#">40-8B</a>	Level One Design Criteria Checklist and Instructions (Rev. 10/08/20) See Design Memo 20-13 for updates to Level One Controlling Criteria.
Design Submittal	40	<a href="#">40-8C</a>	Level One Design Exception Request - NHS or Non-NHS (Rev. 07/01/14, Jun. 2022) <a href="#">Template 3R Design Exception Documentation</a>
Design Submittal	51	N/A	<a href="#">Roundabout Review Checklist (Rev. Apr. 2022)</a>

# Design Exception Documentation

- Documentation demonstrates informed decision-making
- [23CFR625] “...due consideration is given to all project conditions such as maximum service and safety benefits for the dollar invested, compatibility with adjacent sections of roadway and the probable time before reconstruction of the section due to increased traffic demands or changed conditions.”
- [FHWA] Documentation for design exception requests should describe:
  - Specific design criteria that will not be met
  - Existing roadway characteristics
  - Alternatives considered/variance from standard
  - Comparison of the safety and operational performance of the roadway and other impacts such as right-of-way, community, environmental, cost, and access for all modes of transportation
  - Compatibility with adjacent sections of roadway.
  - Proposed mitigation measures





# Design Exception Documentation

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- [IDM, 3R] Documentation for design exception requests should describe
  - Project Description – for context, not project justification or scoping
  - Design Feature(s) – geometric design element(s).
    - Required, proposed, existing.
    - Variance from the standard is part of consideration for approval
  - Crash Analysis – document that roadway is performing acceptably.
    - No crashes, RoadHAT ICC and ICF are  $\leq 0$ , or no pattern of crashes correctable by improving the substandard element
  - Plans for Expansion – due to increased traffic demand or overall corridor improvement
  - Compatibility with Adjacent Sections
  - Mitigation – strategies to counter safety or operational performance issues
  - ~~ADA Compliance~~

# Design Exception Approval

- Who approves?
  - Non-NHS → INDOT (Highway Engineering or Bridge Engineering Director)
  - NHS Non-Freeway → INDOT (delegated authority from FHWA\*)
  - Freeway/Interstate → INDOT *and* FHWA (Division Administrator or designee)



\* When FHWA delegates authority to INDOT, we must evaluate, approve, and document design exceptions as if they were approved by FHWA

# Use Tabular Format

## Design Exception Descriptions:

The design features that require Level One Design exceptions are the stopping sight distance for horizontal curvature, minimum horizontal curve radius, lane width and superelevation rate. Based on IDM Figure 42-1A, "Stopping Sight Distance for Passenger Car" and Green Book Collector Roads and Streets Table 6-3 "Design Controls for Stopping Sight Distance for Crest and Sag Vertical Curves" the required stopping sight distance for a 50 mph design speed is 425 feet. The proposed guardrail and bridge rail restricting line of sight on the north side of SR 58 limits the horizontal stopping sight distance to approximately 167 ft (26 mph). Existing bridge railing limits horizontal stopping sight distance in the westbound lane to approximately 133 feet (22 mph). The vertical alignment does not impact the stopping sight distance of the roadway. A design exception is requested for the horizontal stopping sight distance which is restricted by the existing horizontal alignment and proposed railing but exceeds the existing horizontal sight distance.

## Design Element

A Level One Design Exception is requested to address the following design element(s):

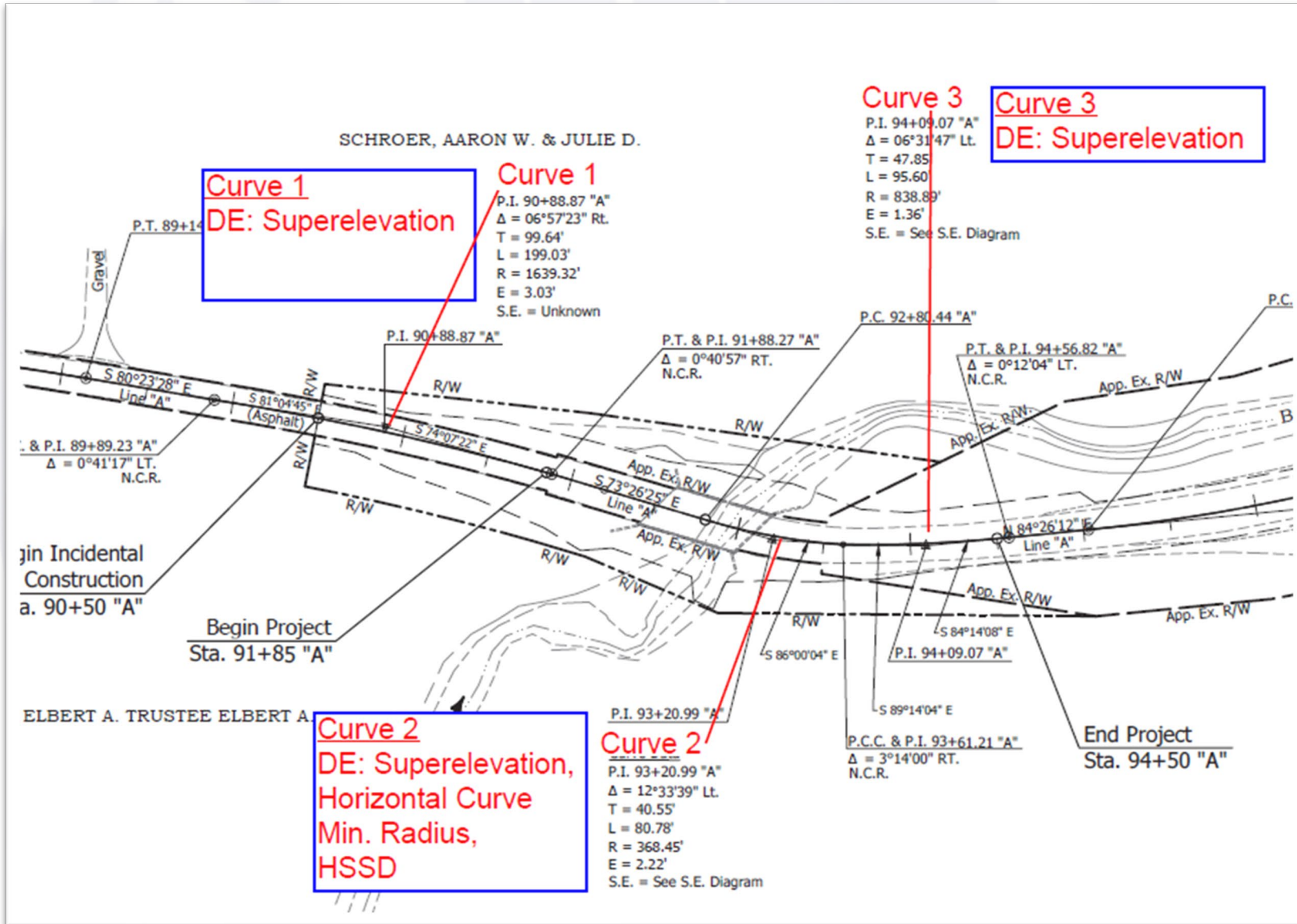
Design Element	Required Value	Proposed Value	Existing Value
Horizontal Stopping Sight Distance, curve 2	425 ft	167 ft	133 ft
Horizontal Curvature, Minimum Radius, curve 2	758 ft @ $e_{max} = 8\%$	368 ft	368 ft
Lane Width	11 ft	10 ft	10 ft
Superelevation Rate, curve 1 (Rt)	5.8% @ R=1639 ft	2.7%	2.7%
Superelevation Rate, curve 2 (Lt)	8% @ R=368 ft	2.5%	2.5%
Superelevation Rate, curve 3 (Lt)	7.9% @ R=839 ft	5.5%	5.5%

Green Book Table 5K - Minimum Radius for Design Superelevation Rates, Design Speeds, and  $e_{max} = 8\%$  - the required superelevation rate for the three horizontal curves within the project limits and incidental construction would vary between 5.8 and 8.0 %. The first curve to the right at P.I. Sta 90+88.87 "A" has a radius of 1639.32 ft and would require a superelevation rate of 5.8%. The second curve to the left (first portion of compound curve) at P.L. Sta 93+20.99 "A" has a substandard radius of 368.45 ft that require the maximum 8 % superelevation rate. The third curve to the left (second portion of compound curve) at P.I. Sta 94+09.07 "A" has a radius of 838.89 ft and would require a superelevation rate of 7.9%. The existing pavement cross slopes within the project limits varies from 2.7% down to 0.6% up for the eastbound lanes and from 1.8% down to 5.5% down for the westbound lanes. The pavement within the project limits will be sloped at essentially the same rates as the existing pavement and will match into the existing pavement at the project limits. A design exception is being requested to build the proposed pavement to match the existing cross slopes. The proposed project will maintain the existing horizontal alignment, pavement width and pavement slopes throughout the project and incidental construction limits.

# TOP 10

# Annotate Plans for Clarity

# TOP 10



# Site Photos Recommended and Appreciated



SOUTHEAST QUADRANT  
LOOKING SOUTH



APPROACH LOOKING SOUTH  
TOWARDS STRUCTURE

# TOP 10

SR 8 (RP 67+00)  
Small Structure Replacement



# RoadHAT – Use the right settings/right input

- Default is Indiana Local Settings. Change to Indiana State Settings for State Routes.
  - Settings affect the  $I_{CC}$  and  $I_{CF}$  results
  - Use all the crashes, not just those “related” to the design element.
  - Animal strikes can be omitted.

**TOP**10



# RoadHAT – Explain the Results (and do it correctly)

- If Form 1 included, provide brief explanation of  $I_{CC}$  (crash cost, measure of crash severity) and  $I_{CF}$  (crash frequency)
- Any value greater than 0 is performing worse than expected compared to similar roadways in Indiana.
- No value of  $I_{CC}$  or  $I_{CF}$  should be interpreted as a warrant to take specific action.
- Results cannot inform specific remediation – narratives are needed to identify crash patterns.
- INDOT Designers webpage for *RoadHAT Practice Pointers for Design Exceptions*

**TOP**10

RoadHAT 4D		Index of Crash Frequency and Cost - Form F1		Page 1/2
Settings: Indiana state settings		Version: Version 4.1		
Location	SR 15/CR 18			
GIS				
Post				
Analyst	CMB			
Date	11/17/2022			
<b>INPUT</b>				
Road Facility Type	Unsignalized Rural State Intersection			
Busiest Road AADT (veh/day)			11447	
Crossing Road AADT (veh/day)			2737	
T Intersection Indicator (1 if present, 0 otherwise)			0	
First Year with Crash Data (yyyy)			2019	
Last Year with Crash Data (yyyy)			2021	
Number of Crashes (crash/period)				
Fatal and Incapacitating Injury Crashes			6	
Non-Incapacitating and Possible Injury Crashes			1	
Property Damage Only Crashes			11	
Route or Road Type	Unsignalized Rural State Intersection			
Average Crash Costs (\$)				
Fatal and Incapacitating Injury Crashes			2335800	
Non-Incapacitating and Possible Injury Crashes			389500	
Property Damage Only Crashes			32200	
Crash Cost Year (yyyy)			2017	
<b>OUTPUT</b>				
Expected Crash Frequency (crash/year)				
Fatal and Incapacitating Injury Crashes			0.589	
Non-Incapacitating and Possible Injury Crashes			0.33	
Property Damage Only Crashes			2.70	
All Crashes			3.62	
Index of Crash Frequency			<b>0.78</b>	
Index of Crash Cost			<b>1.28</b>	

# Watch Your Words

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- Preferred terminology is “crashes” rather than “accidents”
- Avoid words that can create unintended liability
  - “narrow shoulder not likely to cause injury or death”
  - “signs will warn drivers there’s a dangerous curve”

Avoid words that are vague, subjective, or inaccurate

- “...it was determined that the roadway geometrics were not a concern for safety.”
- “no evidence that the geometry caused the crash”
- Use objective terminology
  - frequency and severity of crashes
  - Pattern of crashes correctable/not correctable by improving the substandard element



TOP 10



# Crash Data - Extents

- Pare down the county data, define the extents, and only include that data
- Recommended limits of crash data are 500-1000 feet either side of the project
- Too short of a segment.
  - Police officers generally "eye-ball" the location of a crash if it is not immediately inside the intersection or a known point.
  - Getting accurate results for crashes located inside a small segment can be difficult and unreliable.
- Too long of a segment
  - Will not account for the variation that occurs in the roadway characteristics or the likely presence of intersections.

**TOP** 10

# Crash Data - Narratives

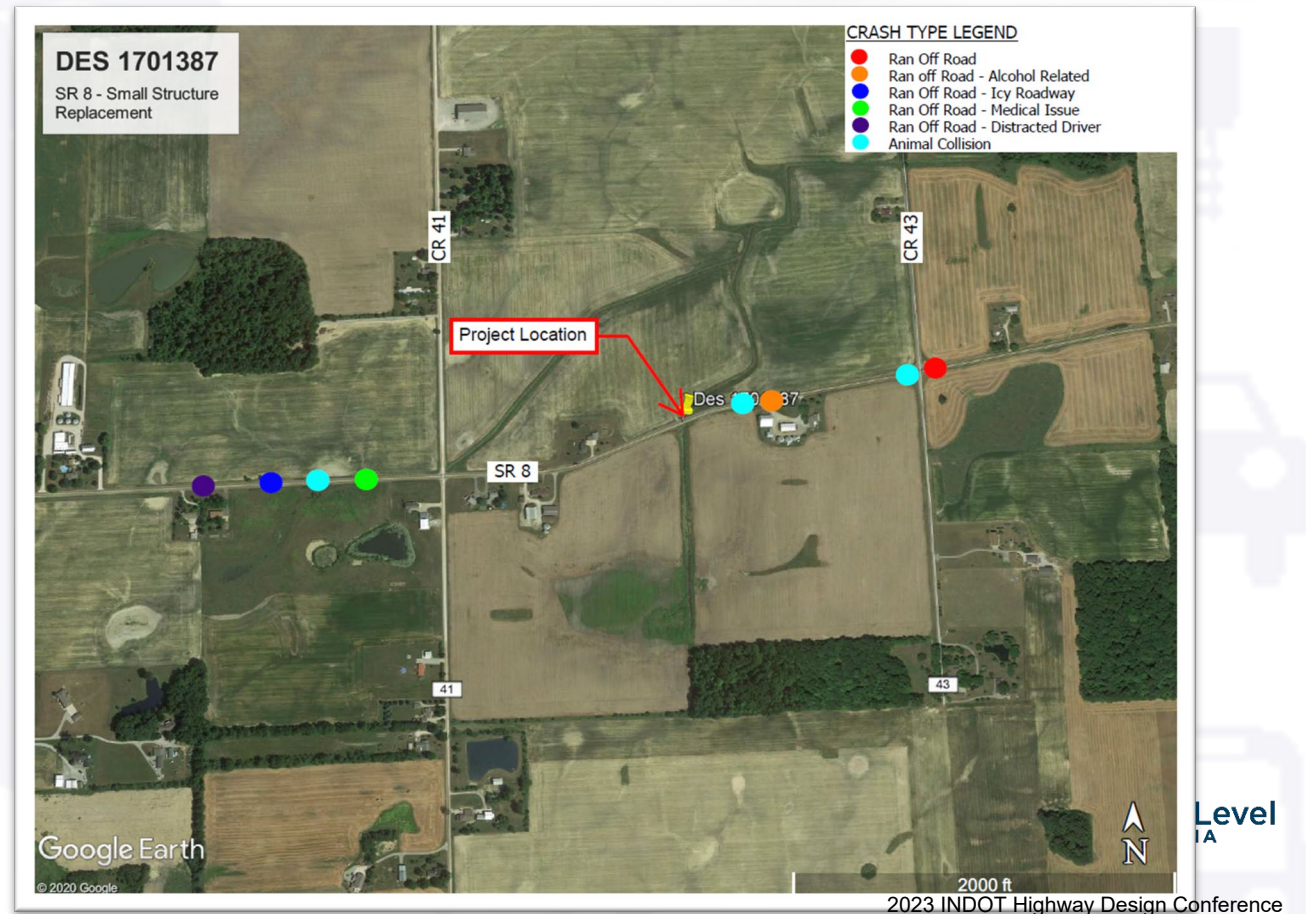
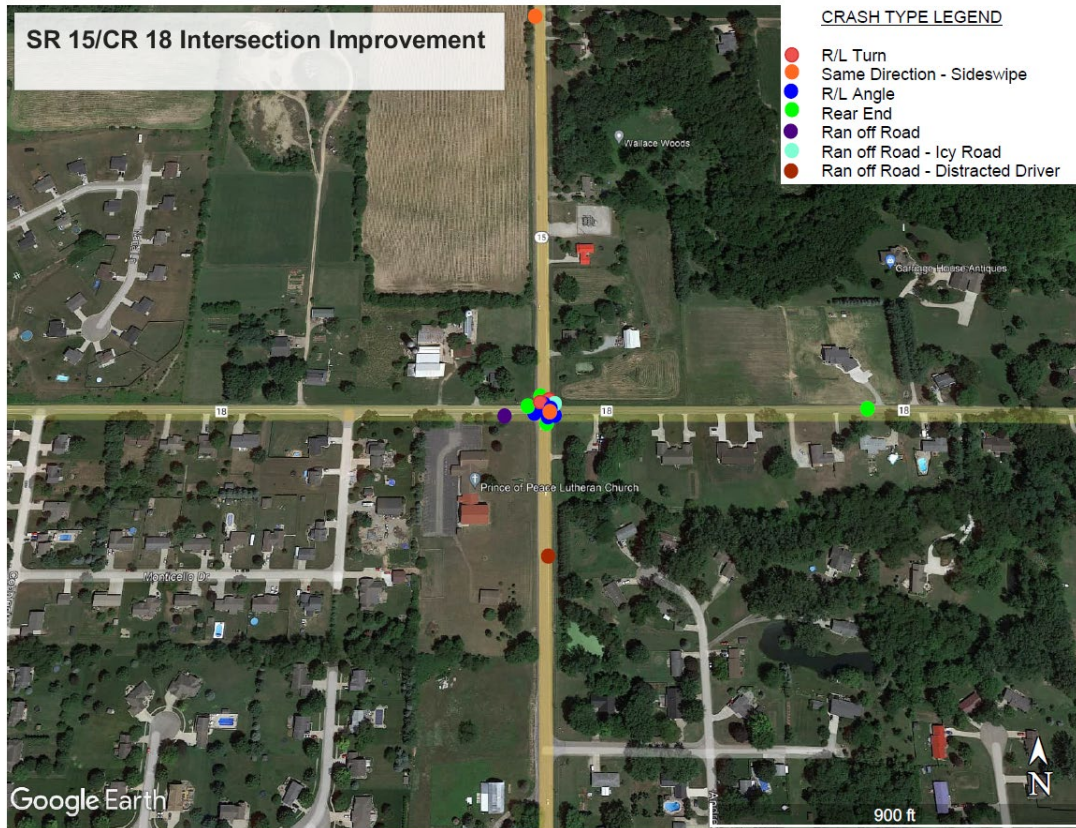
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- Do not include verbatim narrative from crash reports with the documentation
- May contain personal information that is not intended to be public information.
- Summarize the information as appropriate

**TOP** 10

# Crash Maps (Recommended and Appreciated)

# TOP 10



# Mitigation Measures

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- List the mitigation measure that are included in the project
- Don't recommend or suggest mitigation for INDOT to consider
- It's ok not to have mitigation. Consider the extent of the deviation and the existing roadway performance.
- Guardrail is not a mitigation measure.

**TOP** 10

# Design Exceptions – Top 10 Comments

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**TOP**  
10

1. Tabular format
2. Annotate the plans
3. Site photos (recommended and appreciated)
4. RoadHAT – use the right settings/input
5. RoadHAT – explain RoadHAT results (and do it correctly)
6. Watch your words
7. Crash Data – Extents
8. Crash Data – Narratives
9. Crash Maps (recommended and appreciated)
10. Mitigation measures



General Questions  
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