Work Zone Safety & Maintenance of Traffic

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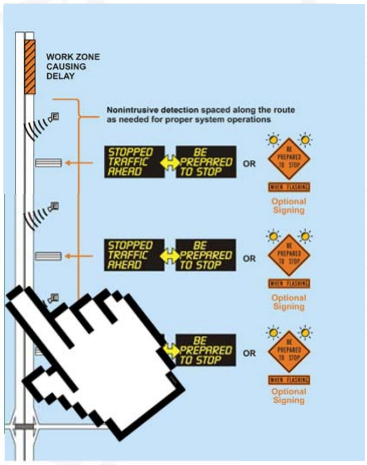
Work Zone Safety & Maintenance of Traffic

In this session, we will cover:

- WORK ZONE TYPE SELECTION
  To increase awareness of the need to make this crucial decision early
- INNOVATIVE COUNTERMEASURES IN WORK ZONES
  To encourage the use innovative technologies and practices
- MAINTENANCE OF TRAFFIC PRACTICE POINTERS
  To provide MOT plan designers feedback from the field



Source: Minnesota Intelligent Work Zone Toolbox, 2008 Edition.

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- Why is it so important?
- What are we trying accomplish?
- What does it involve?
- When should it occur?
- What should we consider?

Work Zone Type Selection

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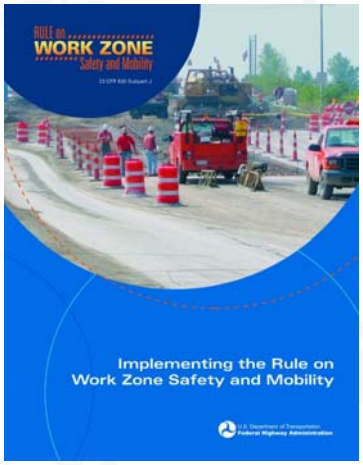
- § 630.1002 Purpose.
- Work zones directly impact the safety and mobility of road users and highway workers.
  These safety and mobility impacts are exacerbated by an aging highway infrastructure and growing congestion in many locations. **Addressing these safety and mobility issues requires considerations that start early in project development and continue through project completion.**



Safety and Mobility Policy

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- Systems Planning
- Preliminary Engineering
- Design
- Construction

Overall Work Zone Impact Assessment Flow Diagram

https://ops.fhwa.dot.gov/wz/resources/final_rule/wzi_guide/sec2.htm

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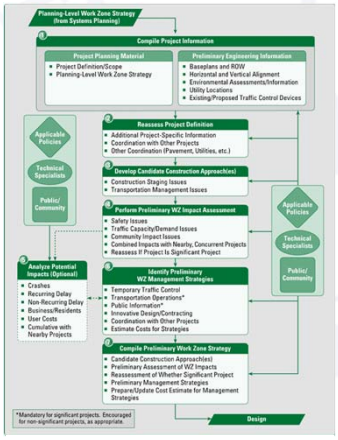
- Preliminary Engineering
  - Preform Preliminary Work Zone Impact Assessment
    - Safety Issues
    - Traffic Capacity / Demand Issues
    - Community Impact Issues
    - Combined Impacts with Nearby , Concurrent Projects
    - Reassess if Project is Significant Project



Source: FHWA Website

Important Decisions Prior to Design (or early in Design)

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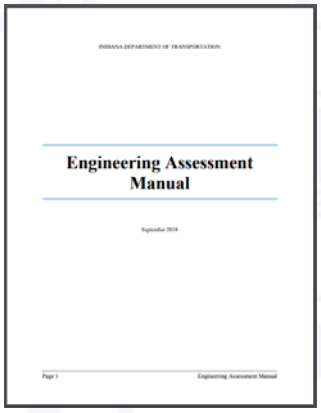
- 3-3.05(02) Maintenance of Traffic Plan
  - Do not defer selection of a conceptual maintenance of traffic plan until the design phase of the project.
- 3-3.03 Task 3 – Develop Project Alternatives (Complex)
  - Consider a Queue Analysis?
- 3-3.05(02) Maintenance of Traffic Plan
  - The Designer should evaluate the Engineering Assessment Manual Page 15 maintenance of traffic concept provided in the engineering assessment document to ensure relevance and completeness prior to developing the final maintenance of traffic plan.
  - Definitely a Queue Analysis.



Conceptual MOT Plan During Scoping per 2018 Engineering Assessment Manual

https://www.in.gov/indot/files/Engr%20Assessment%20Manual%20Final%201809%20Signed.pdf

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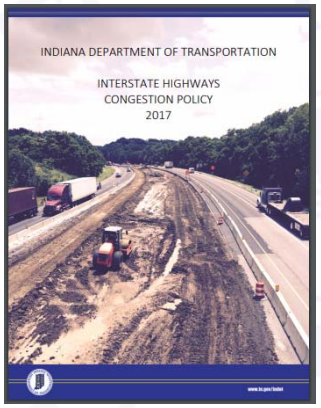
- 1st Step in Verifying Conceptual MOT.
- Addresses a significant *unknown* factor affecting design.
- Consider Options to MAINTAIN traffic flow during construction.



Address IHCP as Early as Possible – Early in the Design Process

https://secure.in.gov/indot/3383.htm#

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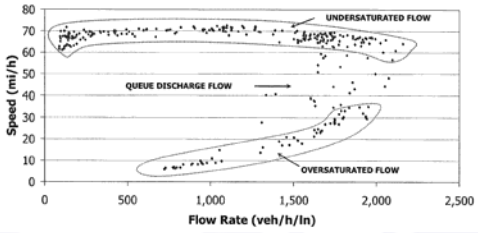
- Optimal Speed to Maximize Throughput
  - 45-55 MPH
- Oversaturated Flow becomes unstable as speeds drop below 40 to 45 MPH with high traffic demand.

Highway Capacity Manual: A Guide for Multimodal Mobility Analysis

Exhibit 12-3
Three Types of Flow on a Basic Freeway Segment



Speed-Density Diagram

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- Remove Edge Line Rumble Strips When Appropriate
- Consider replacing shoulders with full depth pavement for cases where MOT plans required traffic flow on shoulders.
  - Allow traffic to straddle right Edge Line Rumble Strips while rebuilding left shoulder as 1st Phase.
- Consider wider shoulders to help trucks stay on the road.

Addressing Edge Line Rumble Strips

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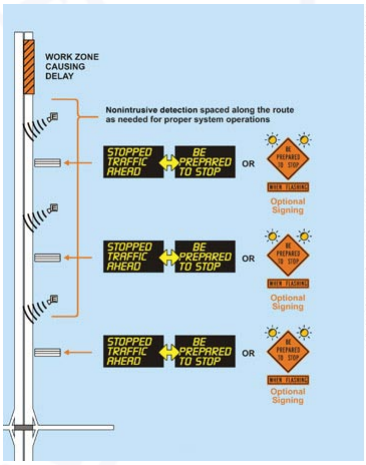
Innovative Countermeasures in Work Zones



Source: Minnesota Intelligent Work Zone Toolbox, 2008 Edition.

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Smart Work Zones

- Turn-Key Approach.
- Managed Remotely.
- Good for Locations where Congestion is predictable and repeating -- bridges perhaps.

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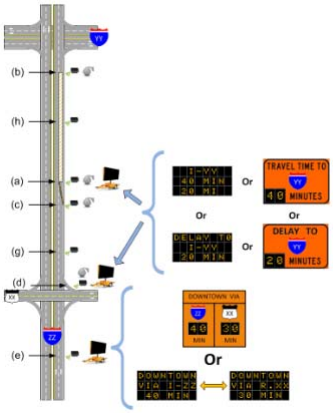
VER-MAC®



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Protect the Queue

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- More Stable Than Portable Temporary Rumble Strips. (+)
- Less Destructive to Pavement than Durable Rumble Strips. (+)
- Not as loud as Durable Rumble Strips. (-)

Removable Rumble Strips

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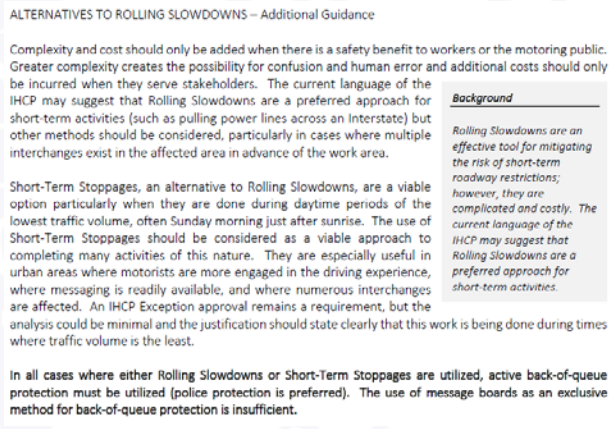
- Rolling Slowdowns are complex and expensive.
- Concerns exist about lack of braking from 75 MPH down to 10, 15, or 20 MPH.



ALTERNATIVES TO ROLLING SLOWDOWNS – Additional Guidance

Complexity and cost should only be added when there is a safety benefit to workers or the motoring public. Greater complexity creates the possibility for confusion and human error and additional costs should only be incurred when they serve stakeholders. The current language of the IHCP may suggest that Rolling Slowdowns are a preferred approach for short-term activities (such as pulling power lines across an Interstate) but other methods should be considered, particularly in cases where multiple interchanges exist in the affected area in advance of the work area.

Background

Rolling Slowdowns are an effective tool for mitigating the risk of short-term roadway restrictions; however, they are complicated and costly. The current language of the IHCP may suggest that Rolling Slowdowns are a preferred approach for short-term activities.

Short-Term Stoppages, an alternative to Rolling Slowdowns, are a viable option particularly when they are done during daytime periods of the lowest traffic volume, often Sunday morning just after sunrise. The use of Short-Term Stoppages should be considered as a viable approach to completing many activities of this nature. They are especially useful in urban areas where motorists are more engaged in the driving experience, where messaging is readily available, and where numerous interchanges are affected. An IHCP Exception approval remains a requirement, but the analysis could be minimal and the justification should state clearly that this work is being done during times where traffic volume is the least.

In all cases where either Rolling Slowdowns or Short-Term Stoppages are utilized, active back-of-queue protection must be utilized (police protection is preferred). The use of message boards as an exclusive method for back-of-queue protection is insufficient.

Rolling Slowdowns: Stoppage is Sometimes Preferred to *Textbook* Rolling Slowdowns

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- ISP Patrols planned for 2020.
  - IMPD Patrols to supplement IMPD Likely.
- LEO RSP to Standards Committee.
  - Working to Clarify Role.
    - Leo Works for the Engineer – not the Contractor.
    - Protecting the Queue is Priority.
    - Shall Maintain Flow rather than hinder it.

LEO, ISP, and IMPD Patrols

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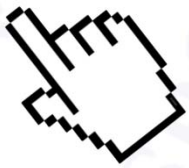
Maintenance of Traffic Practice Pointers



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General Considerations

- Human Factors
  - Perception-Reaction Time
  - Motorists Age
  - Familiarity (area, work zone)
  - Typical Motorist Behavior
- Provide clear positive guidance
  1. Alert motorists
  2. Inform motorists
  3. Instruct motorists

- Basically:
  - Don't overload motorists
  - Provide smooth transitions
  - NO SURPRISES!

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Work Zone Entrance Transition Areas

- Use the upstream Existing (Established) Speed Limit → Results in longer tapers
- Provide at least the minimum required sign spacing & SSD-Based Buffer Spaces
  - If needed, use reduced speed limit for remainder of work zone

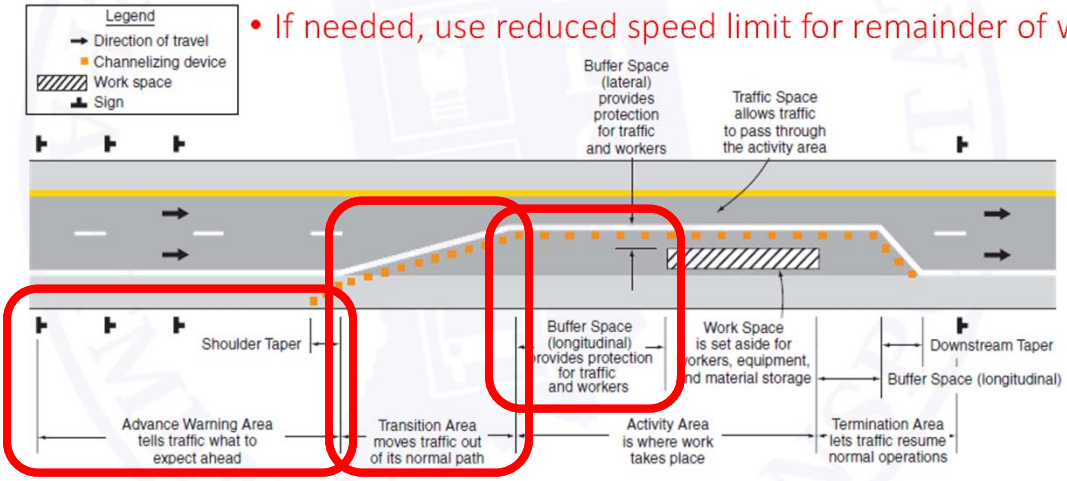

Figure 6C-1. Component Parts of a Temporary Traffic Control Zone

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Always Provide an SSD-Based Long. Buffer Space*

* Unless there is a justifiable reason for not doing so

- Often not provided in MOT plans or of insufficient length
- IMUTCD 6C.06 and Table 6C-2

Table 6C-2 Stopping Sight Distance as a Function of Speed	
Speed (mph)	Distance (ft)
20	115
25	155
30	200
35	250
40	305
45	360
50	425
55	495
60	570
65	645
70	730
75	820

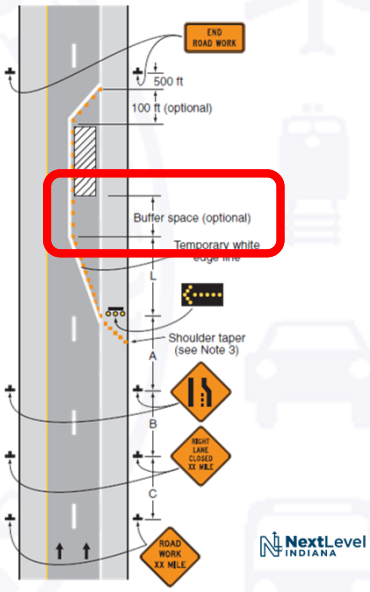

Figure 6H-33. (TA-33)

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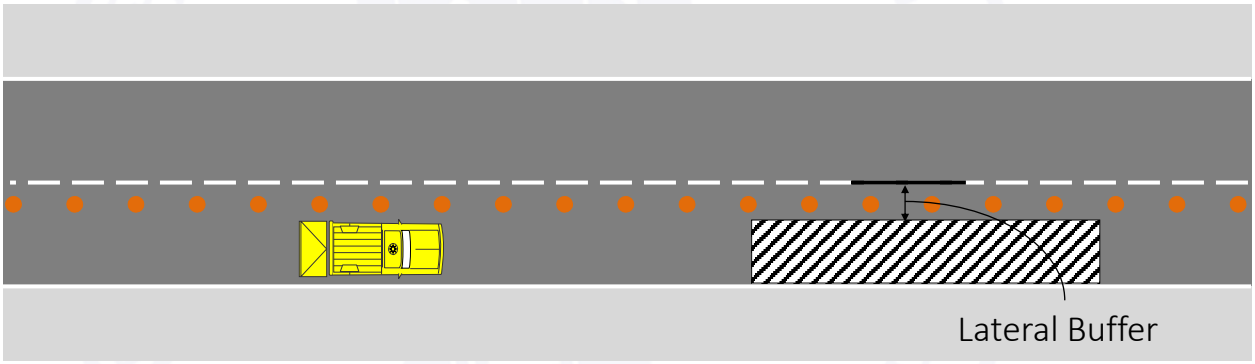
Provide Realistic Lateral Buffers

- Often plans show idealized work areas and buffers…



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Provide Realistic Lateral Buffers

- But reality often looks quite different…

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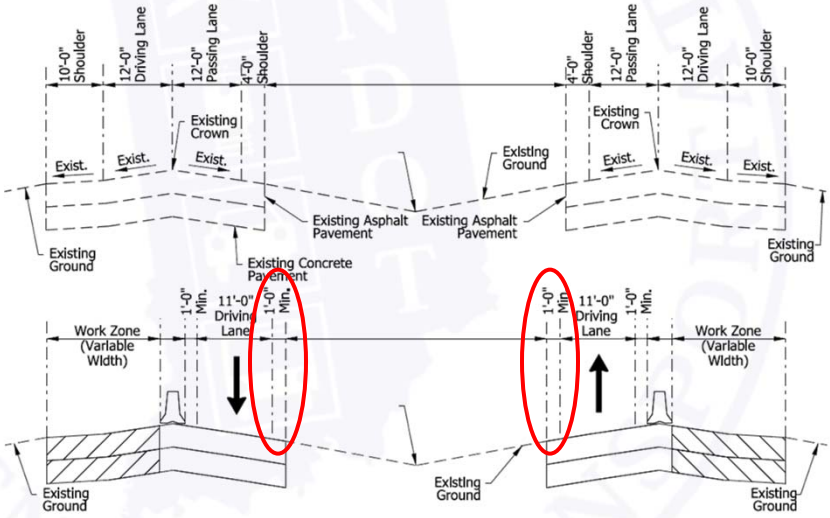
Realistic Typical MOT Cross Sections

- Typical Sections and MOT Typical Sections for one phase as seen in plans:



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Realistic Typical MOT Cross Sections

- Actual work zone.
- How was this modeled in terms of IHCP queue analysis?
- Would this require a design exception?

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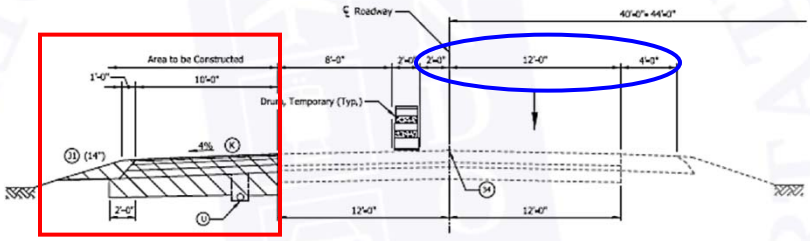
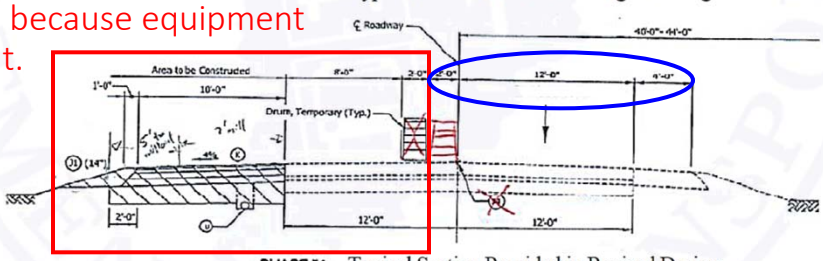
Realistic Typical MOT Cross Sections

- Original plan was to work in 10’ shoulder area, providing 8’ buffer.



PHASE IA Typical Section Provided in Original Design

- Revised because equipment didn’t fit.



PHASE IA Typical Section Provided in Revised Design

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Realistic Construction Drum Placement

- Actual work zone:

- Construction Drums encroach both work and traffic areas
- Shoulders corrugations were left unaddressed
- Width beyond corrugations is narrow (no widening)
- Potential for generating unanticipated queuing
- Potential for overturned trucks

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Take Care of Existing Shoulders

- Address existing shoulder corrugations
- Strengthen existing shoulder used as temporary pavement
  → Don't rely on signage to keep trucks off existing shoulders
- Provide sufficient shoulder width beyond travel lane
  → Especially in tight situations where there is TTB on left but no barrier on right

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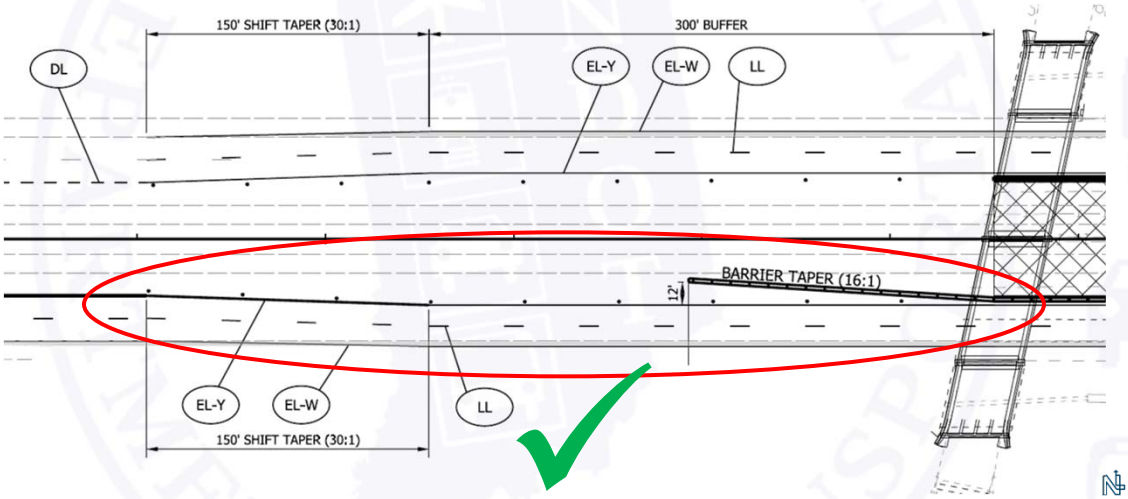
Delineation at Temporary Traffic Barrier Flares

- Lane Shift Taper in advance of TTB as seen in plans:



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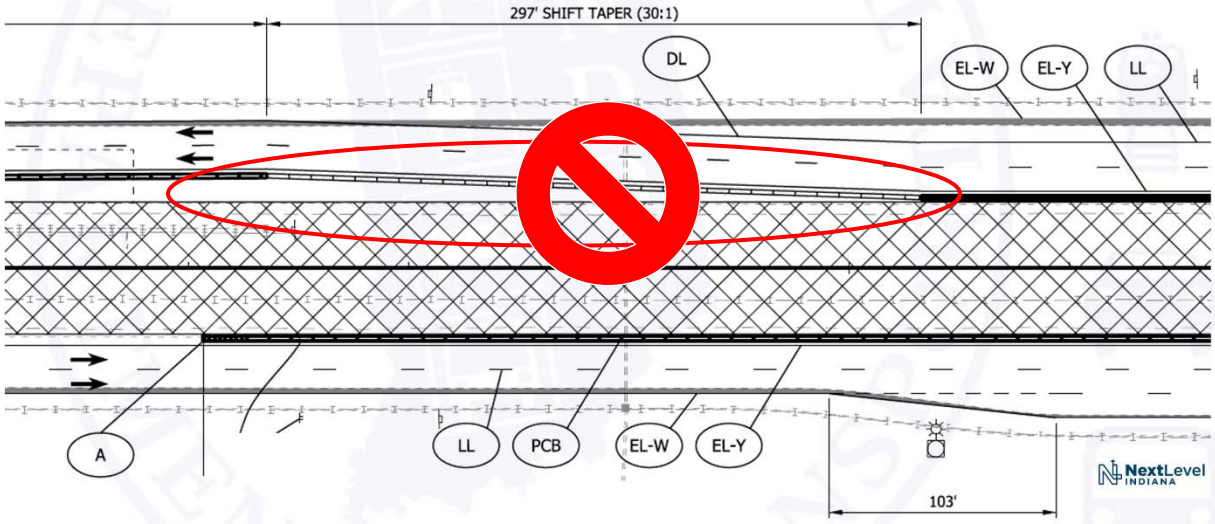
Delineation at Temporary Traffic Barrier Flares

- Lane Shift Taper in advance of TTB as seen in the same plans as prior slide:



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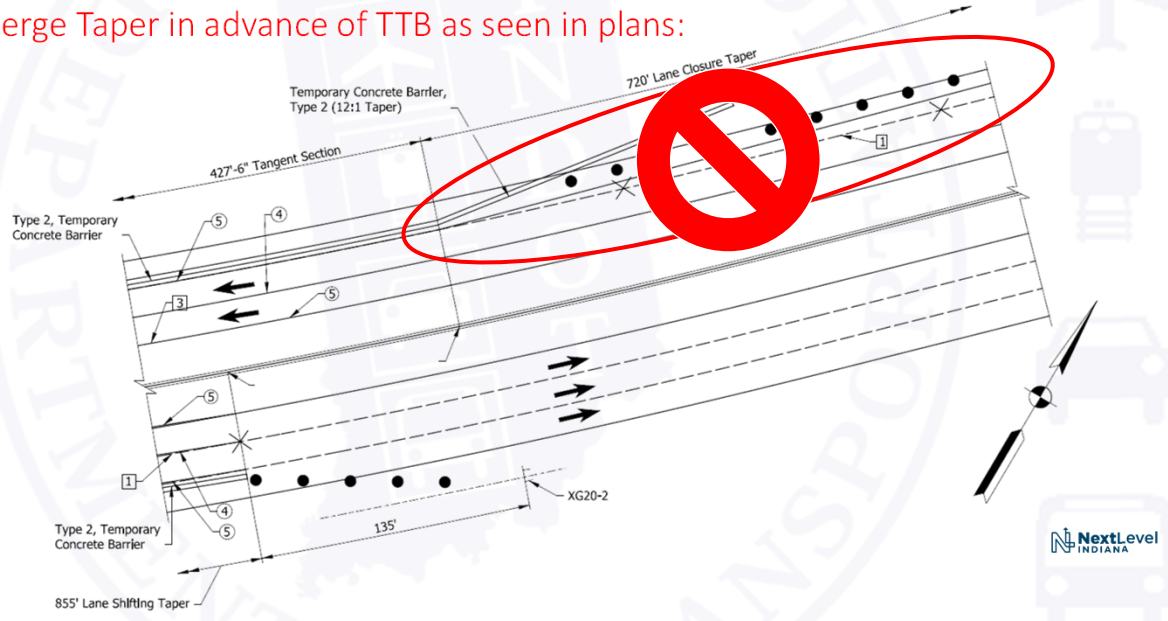
Delineation at Temporary Traffic Barrier Flares

- Merge Taper in advance of TTB as seen in plans:



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Delineation at Temporary Traffic Barrier Flares

- Lane Shift Taper in advance of TTB as seen in the field:

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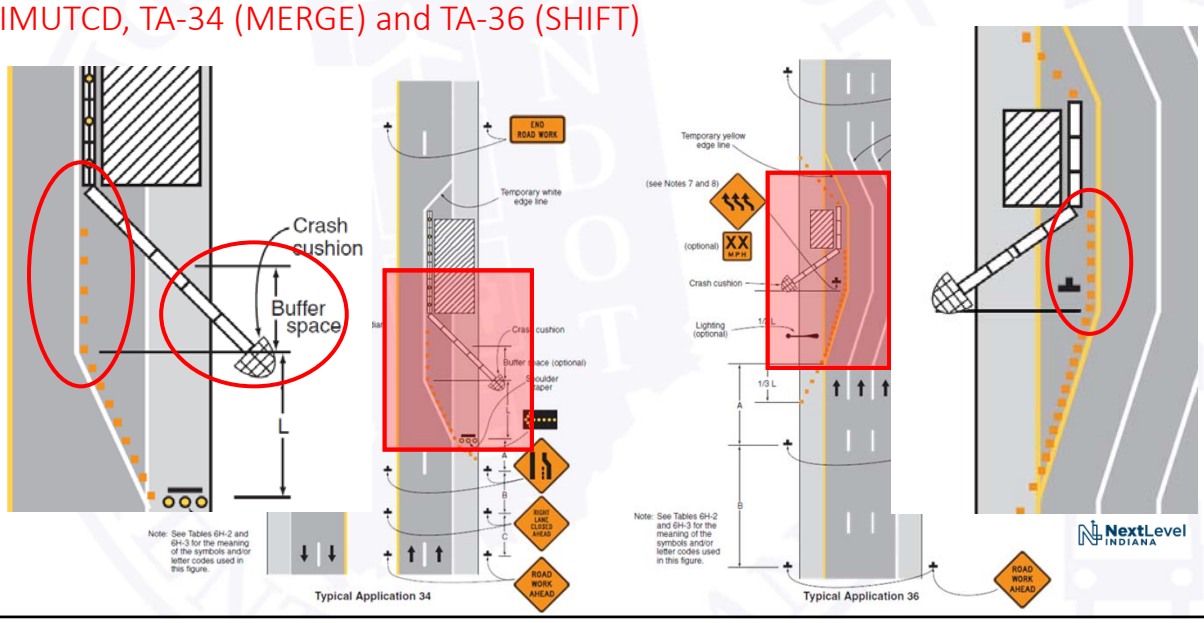
Delineation at Temporary Traffic Barrier Flares

- IMUTCD, TA-34 (MERGE) and TA-36 (SHIFT)



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Separate Merge and Lane Shift Tapers

- Provide a tangent length between successive tapers:
  → 2L tangent for a merge taper followed by a merge taper. (IMUTCD TA-37)
  → ½L tangent for a merge taper followed by a lane shift. (IMUTCD TA-32)

- Do not combine:
  A merge and lane shift taper.
  Even worse: merge + shift + lane width reduction!
  Even worse: merge + shift + lane width reduction ending at end of TTB flare

- Remember: multi-lane lane shifts require temporary lane markings, regardless how short the duration

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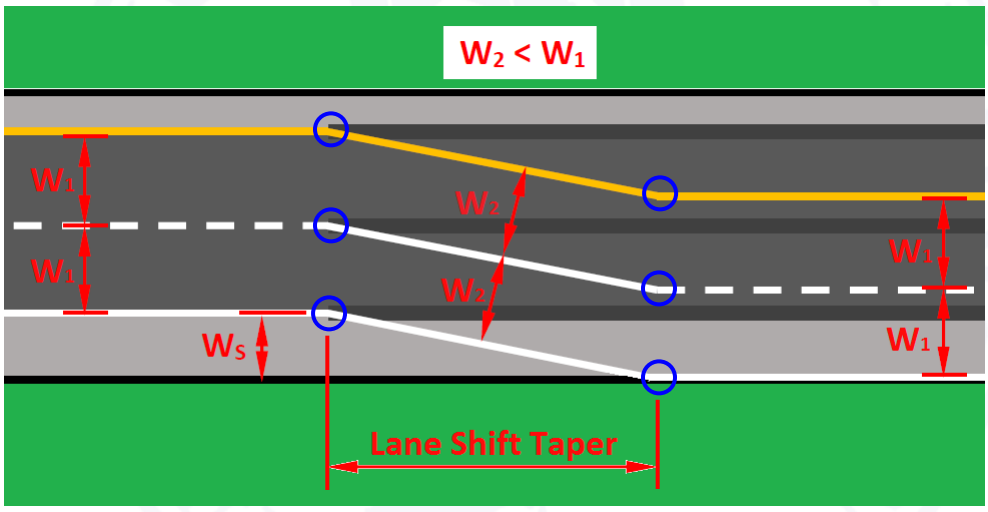
Widen Lanes through Shifts by Staggering the Start

- If all lanes start at same station, lane width decreases through shift!



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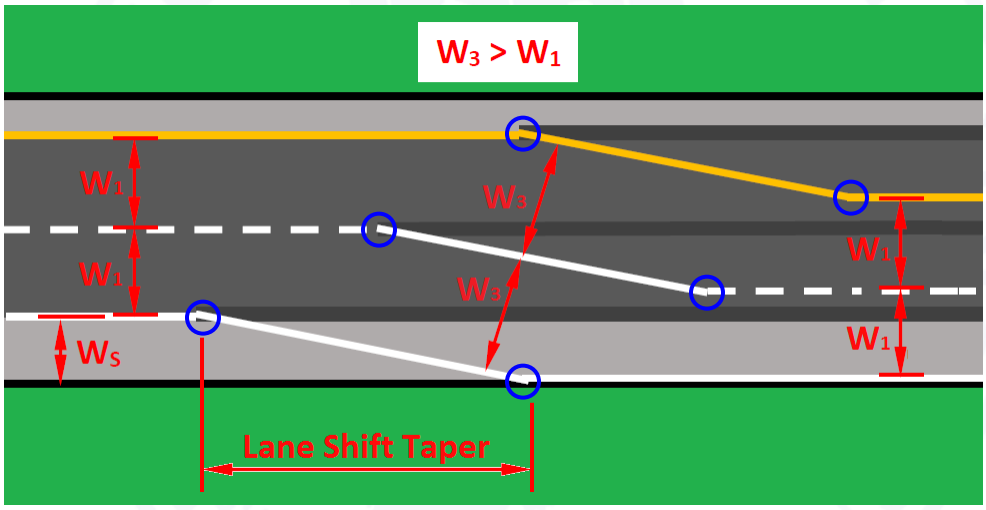
Widen Lanes through Shifts by Staggering the Start

- To ensure wider lanes through shifts, stagger the start of the lane shift lines.



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Construction Zone Design Speed & Speed Limits

- IDM 503-3.04(01) Construction Zone Design Speed
- Construction Zone Design Speed: the speed for which MOT geometric elements are designed
- Construction Zone Design Speed should desirably **match or exceed the established posted speed limit**; if reduced, desirably, not by more than 10 MPH. (IMUTCD 6C.01)
- Posted speed limit during construction should take into account the selected Construction Zone Design Speed for the work zone
- Work zone speed limit (via Official Action) or Worksite speed limit (via CM 14-06) should not exceed the Construction Zone Design Speed
- Consult District Traffic office to determine Construction Zone Design Speed and speed limit during construction.

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Common Issues with Speed Limits in Work Zones

- Temporary Worksite Speed Limit (TWSL) requirements:
  - Speed Limit MUST be reduced by at least 10 MPH [IC 9-21-5-11(b)]
  - Speed Limit reductions greater than 15 MPH MUST be done in 2 increments
  - All TWSL Assemblies (TWSLA) must have the "WORKSITE" plaque
  - TWSLA's required on both left and right sides if multiple lanes
  - Provide TWSLA's at a maximum spacing of 2 mile intervals (ISP prefers 1 mi)
  - Reestablish the existing (established) speed limit by placing sign(s) 500 ft downstream of "END CONSTRUCTION" sign
  - Reestablish the truck speed limit (65 MPH) for rural interstates

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Common Issues with Speed Limits in Work Zones

- Continuous TWSL requirements:
  - No warning lights or flashing strobes on continuous type TWSLA
  - Cover or remove any existing (established) speed limit signs within TWSL
- Intermittent TWSL requirements:
  - Must have Flashing Strobes and "WHEN FLASHING" plaque
  - Place TWSLAs by existing (established) speed limit signs or cover them
- Combination Continuous + Intermittent TWSL requirements:
  - Must separately stage the first 2 TWSLA's to accomplish the 2 steps: continuous first, then intermittent
  - After first 2, downstream continuous and intermittent TWSLA's may be placed together

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References on Reduced Speed Limits in Work Zones

- IDM 503-7.01(02) Regulatory Signing
- Construction Memo CM 14-06
- Standard Drawings E 801-TCDV-10, -11, -12
- Standard Specifications 801.15(c)
- IC 9-21-5 (Title 9 – Motor Vehicles;
  Article 21 – Traffic Regulation;
  Chapter 5 – Speed Limits)

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Remember to…

- Enhance Work Zone Entrance Transition Areas by using the upstream established speed limit for design computations.
- Utilize longitudinal and lateral buffer spaces wherever possible.
- Develop realistic typical MOT cross sections.
- Model queuing using realistic typical MOT cross sections.
  → Incorporate any required queue mitigation strategies as part of an approved IHCP Exception into the plans and contract documents.
- Take care of existing shoulders (thickness, width, corrugations).
- Delineate tapers with construction drums and pavement markings, not TTB.
- Keep merge and shift tapers separate.
- Widen lanes through shifts by staggering the start of each lane line.

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Questions

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