

# Maintenance Action Plan *for* Safety

*Resource Guidebook –  
Roadway Departure Crashes*



Local Technical  
Assistance Program



# Introduction

The HELPERS<sup>1</sup> Program at Indiana LTAP has developed this guide as a resource for roadway maintenance crews in the state. It highlights the most common issues seen on IN roadways; it is not intended to be a comprehensive manual. The scenarios illustrated in this guidebook are actionable maintenance tasks and low cost safety countermeasures that will improve safety and reduce crashes. These should be considered first steps – some roads may need additional attention beyond these maintenance tasks.

Funding for safety improvements may be available through the Highway Safety Improvement Program (HSIP).

For additional assistance in improving roadways or information applying for HSIP funds, contact the HELPERS Engineer at Indiana LTAP:

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<sup>1</sup>*HELPERS: Hazard Elimination Program for Existing Roads and Streets*

# Roadway Departure Crashes

## ***Crash Types:***

- Run Off Road
- Head-On
- Sideswipe (Opposite or Same Direction)
- Fixed Object
- Rollover

## ***Crash Severity:***

Can be **severe** on moderate- to high-speed roadways, especially if roadside hazards are present.



## **How to prevent:**

### ***Step 1: Keep vehicles on the road***

- Warn drivers of upcoming roadway changes through warning signs.
- Delineate road edges and changes in alignment (edge lines, post delineators, chevrons, etc.).

### ***Step 2: Provide forgiving roadside***

- Provide vehicle recovery room on outside of and after curves
- Remove potential roadside hazards where possible
- Use breakaway or yielding sign posts
- Mark potential roadside hazards with Object Markers

# Roadway Departure Crashes

## **Contributing Factors**

- Roadside Hazards                      Pages 6-10
- Narrow Roadways                      Page 11
- Shoulders                                Pages 12-13
- Drainage                                 Pages 14-17
- Vegetation                              Pages 18-19
- Roadway Surface                      Page 20
- Curves                                    Pages 21-24
- Hills                                        Page 25



# Roadside Hazards – Fixed Objects

*Roadside hazards can potentially increase the severity of a Roadway Departure crash. Local agencies should minimize roadside hazards, prioritizing objects that are repeatedly struck and those on the outside of curves or just after curves. Where practical, follow ordered Action list below.*

## What to watch for:

Hazardous fixed objects adjacent to roadway.

## Prioritized Actions:

1. Remove object
  2. Relocate object
  3. Shield object (guardrail)
  4. Install object markers or delineators
- If privately owned, advise owner of potential liability and request removal or redesign.



*Notify owners mailboxes should be crashworthy to avoid liability.*



*This old headwall is presents a potential hazard to motorists and should be replaced with a safer design.*

# Roadside Hazards – Fixed Objects

*It's not practical to remove every roadside hazard. Your agency can prioritize based on the following:*

- 1. Repeated strikes*
- 2. Outside of curves*
- 3. Largest potential hazards closest to roadway*

## **What to watch for:**

Problem areas with opportunities to fix.

## **Actions:**

Report repeated strikes and potential hazards to office.



*Boone County cleared back outside of this curve to provide a forgiving roadside, in addition to fixing pavement issues that were causing drivers to lose control at that curve.*

# Roadside Hazards – Fixed Objects

## What to watch for:

Roadside objects repeatedly struck at the same location.

## Actions:

1. Identify and fix why drivers are leaving roadway.
2. Repair damaged guardrail or signs, or remove damaged trees if there is threat of falling.



*If drivers are repeatedly running off the road at the same location, as evidenced by multiple strikes on trees, guardrail, signs, etc., this indicates there may be a problem with the roadway at that location.*



# Roadside Hazards - Guardrail

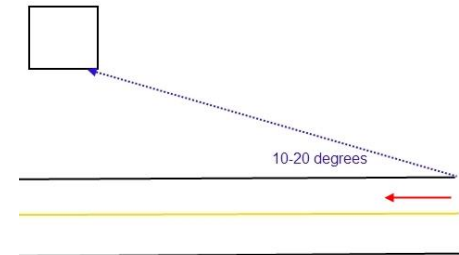
## **Guardrail Basics**

*Guardrail should only be used when hitting the roadside hazard would be more severe than hitting guardrail.*

*Guardrail is designed to be hit at a shallow angle and will redirect vehicles back to the roadway to recover. Damaged guardrail may not work properly and should be replaced.*

*Out-of-control vehicles leave the roadway at a shallow angle (10-20°), so guardrail must start upstream of the hazard to shield it.*

*The average vehicle departure angle is shallow, around 10-20°.*



*This guardrail is ineffective because it does not provide proper length upstream to shield vehicles from hazard.*

# Roadside Hazards

**Guardrail Basics, continued**  
*Guardrail needs energy-absorbing end treatments to be safe for the traveling public.*



*Turndown guardrail ends (angled down into ground) as shown above can launch vehicles airborne, so should not be used. If guardrail is kept level, it can be anchored into a back slope.*



*This guardrail is a potential hazard since it has no end treatments.*



*This is the safest way to bury guardrail ends.  
Picture courtesy of WSDOT.*

# Narrow Roadways

*When combined with other factors, narrow roadways can contribute to roadway departure crashes.*

## **What to watch for:**

Can opposing vehicles safely pass each other?

## **Actions:**

1. Provide and maintain shoulders in case vehicles need to get over.
2. Install warning signs if a bridge or underpass is one-lane (16 feet or less; 18 feet or less with high truck traffic).



*A warning sign is needed on each approach for this narrow, one-lane bridge.*

# Shoulders – Edge Drop-Off

*Shoulders provide room for vehicles to avoid a crash or avoid other vehicles.*

*Both vehicles and water can erode shoulders quickly, causing a potential hazard to motorists.*

*Determine and fix the cause of the erosion before fixing the shoulder.*



## **What to watch for:**

Shoulder edge drop-off of 3" or more. When vehicle wheels drift off pavement, drivers can overcorrect trying to get back on pavement and lose control.

## **Actions:**

1. Look for and fix any issues causing the shoulder erosion.
2. Fill & compact shoulder (see picture next page).



# Shoulders - Offtracking

## What to watch for:

Tire tracks in the shoulders and damaged pavement edges show off-tracking at intersection corners and insides of curves.

## Actions:

1. Fill & compact shoulder.
2. Consider adding stronger shoulder material or pavement to accommodate off-tracking vehicles.



*A filled and compacted stone shoulder is a low cost way to prevent crashes.*



*Trucks and farm equipment are the typical vehicles to drift off the pavement, usually due to too small of a turning radius and/or too high a speed.*



# Drainage – Water on Roadway

*Water on the roadway presents a significant hazard to motorists and will eventually damage pavement and shoulders.*

*Roadway surfaces, shoulders, ditches, and culverts are all designed to carry water off and away from the roadway but all need regular maintenance to work properly.*

*Clogged drainage devices, shallow ditches, overgrown shoulders, or loss of center crown of road surface can prevent water from leaving the roadway.*

*Standing water on pavement today is tomorrow's pothole.*

## **What to watch for:**

Water ponding on roadway during and after rainfall.

## **Actions:**

Fix blockage so water can leave roadway. If a temporary fix, notify office a permanent solution is needed.



*Drivers can easily hydroplane in standing water, lose control and crash.*

# Drainage – Water on Roadway

*Water crossing the roadway is a hazard to motorists and can cause shoulder erosion and eventual pavement damage.*



*Water crossing a roadway can cause drivers to lose control and crash.*

## **What to watch for:**

Water streaming across roadway.

Dirt trail across roadway during or after rainfall shows where water is crossing roadway.

## **Actions:**

1. Look upstream of water crossing location for anything blocking water flow away from roadway and fix.
2. Notify office of any locations where there's not an obvious fix.

# Drainage – Shoulder Height

## What to watch for:

Shoulders higher than roadway surface.

## Actions:

Blade shoulder to remove buildup. Some agencies have a “berm cutter” just for this purpose.



*Left untreated, this ponding water will eventually damage the pavement.*



*Both paved and unpaved roads need shoulder maintenance. Water cannot leave this unpaved road above so will likely cause eventual damage.*

*Blading the shoulder allows water to flow freely off the roadway. Ideally slope back to ditch.*



# Drainage – Clogged Inlets

## What to watch for:

Blocked or clogged drainage devices.

## Actions:

Clean away debris so water can flow freely.



*Storm debris or fall leaves often clogs drainage devices.*



*Dirt, vegetation, and other debris can partially or fully block drainage devices, preventing water from draining properly.*

## What to watch for:

Roadside ditches too shallow to handle stormwater runoff.

## Actions:

Deepen ditch.



# Vegetation

*Cutting back overgrown vegetation is a regular maintenance activity that improves safety on the road by improving sight distance of the roadway, other vehicles and road users, and also animals approaching the road.*

## **What to watch for:**

Trees, shrubbery, or other vegetation that blocks sight distance or grows too closely to roadway.

## **Actions:**

Cut back vegetation.

*This hedge row has overgrown into the roadway, causing a potential hazard to pedestrians, cyclists, and motorists.*



*Tippecanoe County uses a knuckle boom mower to cut back overgrown vegetation.*



# Vegetation

*Uncontrolled vegetation can block a driver's view of a sign either at the sign or on the approach.*



*This Yield sign is completely covered so drivers do not know the other road has right of way.*

## **What to watch for:**

Vegetation blocking view of signs.

## **Actions:**

1. Cut back vegetation.
2. Consider relocating signs away from problem areas, if feasible.

*An approaching driver cannot see this Stop Sign (circled in red) in enough time to stop because of the vegetation.*



# Roadway Surface - Pavement

*(Note: This guidebook does not cover pavement structural issues as there are plenty of other resources available in that area.)*

*Excess aggregate, debris, or sand on a paved roadway can cause drivers to lose control. The lack of friction makes it hard to stop and hard to accelerate into traffic. Pay particular attention to intersection approaches and curves.*



*Sand on the roadway can interfere with vehicle braking and acceleration into traffic.*

## **What to watch for:**

- Loose aggregate after chip & seal operation
- Stormwater debris after rainfall
- Sand after winter operations or hazardous spills

## **Actions:**

Sweep or otherwise remove debris from roadway.

# Curves

*Crashes are 3 times more likely to occur in horizontal curves. Curves can be unexpected, especially after hills or long straight sections, so drivers may need warning beforehand and guidance through the curve.*

*This includes intersections that operate as curves (see page 24).*



## What to watch for:

- Curves where drivers frequently run off the road.
- Unexpected curves after hills or long straight sections.

## Actions:

1. Determine appropriate advisory speed of curve (ask LTAP for assistance if needed).
2. Install curve warning signs and/or delineators.

*Sharp curves like this one are unexpected to drivers unfamiliar with area. Warning signs before and at the curve would be helpful here.*

# Curves – Sight Distance

*Sight Distance refers to a driver's ability to see potential conflicts ahead on the road or on approaching side streets. This is especially important where there are driveways after a curve and where cyclists and pedestrians are using road.*

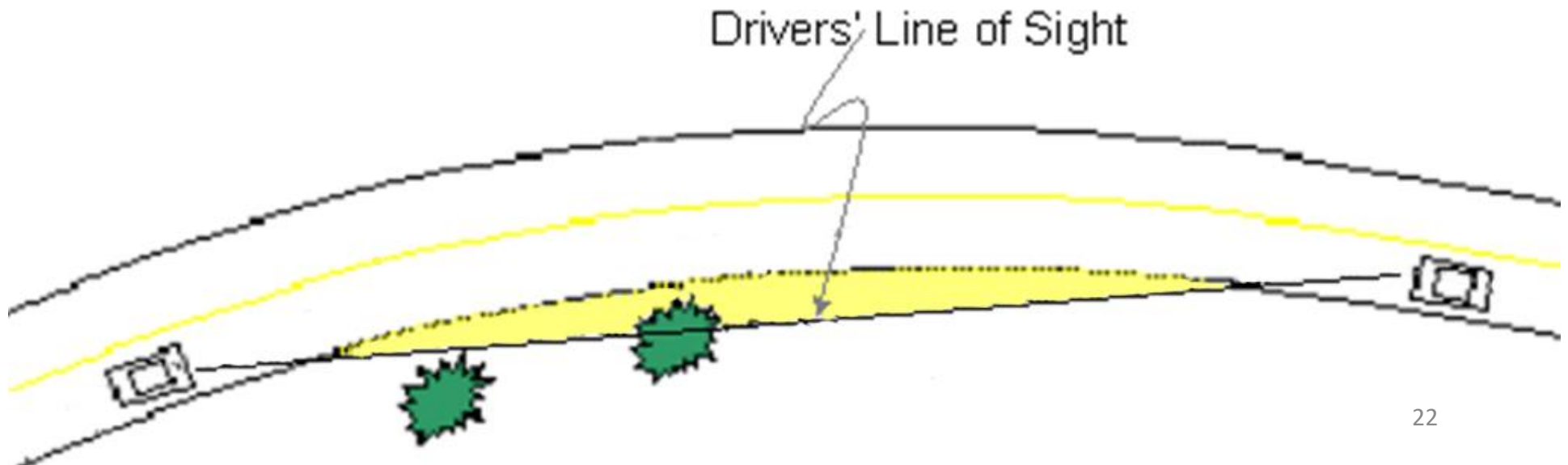
## **What to watch for:**

Opportunities to clear inside of curves to increase sight distance, especially before intersections and driveways.

## **Actions:**

Clear what's blocking sight distance where practical.

*The yellow shaded area below shows how clearing back inside of a curve can impact how far a driver sees down the road.*



# Curves - Sight Distance

*Curves can block a driver's view of what's ahead. If a road is narrow, drivers may sideswipe each other if they don't stay in their lane around a curve.*



*Overgrown vegetation on the inside of this curve blocks a driver's view of potential hazards and creates drainage issues.*

## **What to watch for:**

Can drivers see down the roadway enough to avoid opposing vehicles around curves? At 55mph, drivers should be able to see 500' in front of them to avoid crashes. At 35mph, drivers should be able to see 250'.

## **Actions:**

1. Clear vegetation and any visual obstacles on the inside of curves to increase sight distance around curve.
2. Add a short section of centerline on each approach where pavement is at least 18' wide.
3. If the pavement isn't wide enough, a warning sign may be appropriate.

# Curves at Intersections

*IN has many intersections that operate as curves (i.e. the main traffic flow turns without stopping) and should be signed as such. These intersections are very confusing to drivers and can lead to crashes.*



*A driver going “straight” ahead actually has to yield here since they are making a turn across traffic. Centerlines and curve signs can warn confused drivers and prevent crashes.*

## **What to watch for:**

Curves at intersections where drivers can get confused.

## **Actions:**

1. Add centerline pavement markings approaching & through the curve in both directions where pavement is wide enough.
2. Install curve warning signs before and at curve.



*Drivers at this curved intersection have more information to avoid crashes.*



# Hills – Sight Distance

*Steep hills can block a driver's view of what's ahead. If a road is narrow, drivers may sideswipe each other if they don't stay in their lane over the hill.*

## **What to watch for:**

Can drivers see down the roadway to avoid opposing vehicles over hills (55mph=500', 35mph=250')?

## **Actions:**

Add a short section of centerline on each approach where pavement is at least 18' wide.

## **What to watch for:**

Intersections or driveways after steep hills.

## **Actions:**

Add an appropriate warning sign telling drivers what's ahead and how far (e.g. Intersection Ahead, 200 FT)



*What's over this hill? Remind drivers to stay in their lane with a short centerline on each approach.*

# *Roadway Departure Crash Checklist*

## Potential Hazard

## Roadway Location

- Narrow Roadway:

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- Shoulder Issue:

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- Drainage Issue:

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- Roadway Surface Issue:

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- Roadside Hazard:

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- Sight Distance Issue:

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- Other Issue:

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