

Murphy's Law?

A perfect storm of circumstances

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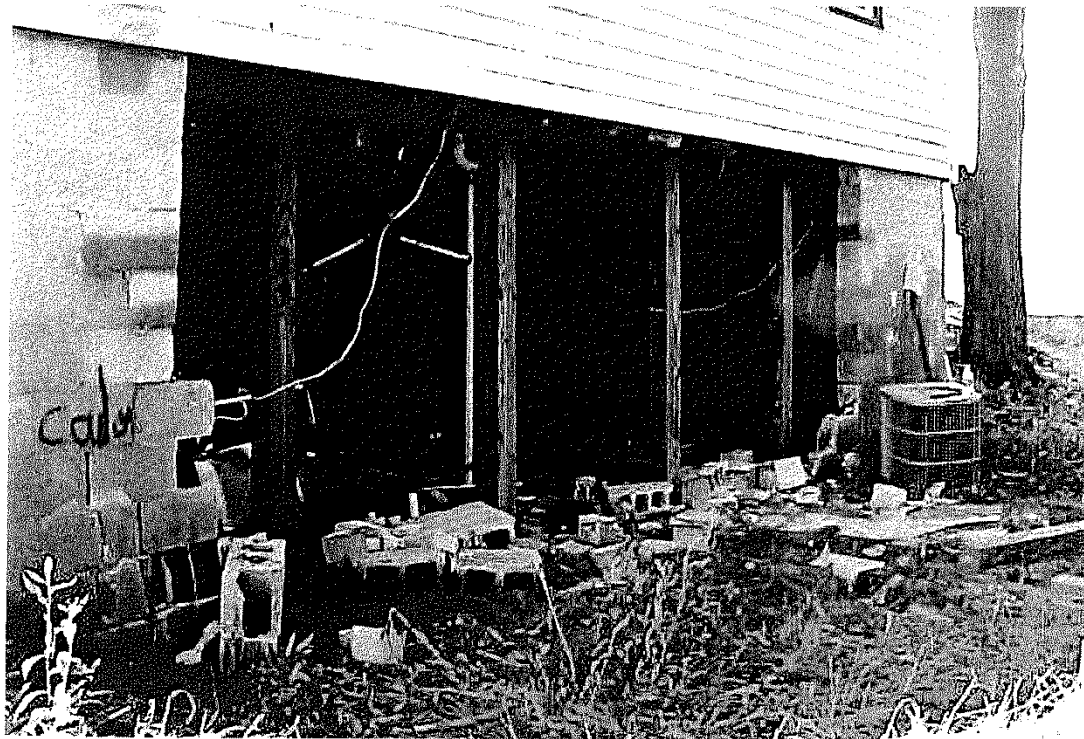


Murphy's Law (modern form):

Anything that can possibly go wrong, does.

This presentation is about a convergence of circumstances with disastrous results.





Old US 131@Old SR 62 Foundation Damage

Initial photos – provided by District Maintenance. Note that bricks are scattered outwards from the walk-in crawl space.



Old US 131@Old SR 62 Foundation Damage

Initial photos – provided by District Maintenance. Note that debris is scattered outwards from the walk-in crawl space. And that crawl space contents is included.



Old US 131@Old SR 62 Foundation Damage

Initial photos – provided by District Maintenance. Note that debris is scattered outwards from the walk-in crawl space. And that crawl space contents is included.



Old US 131@Old SR 62 Foundation Damage

Partial clean-up of debris. Note post and beam temporary support.



Old US 131@Old SR 62 Foundation Damage

Western most structure.



Old US 131@Old SR 62 Foundation Damage

Western most structure crawlspace damage. Foundation was pushed inwards at base.



Old US 131@Old SR 62 Foundation Damage

Looking east between foundations and R/W. Note height of R/W fence and retaining wall. Eyewitness report from one of residences affected said water level was above retaining wall.



Old US 131@Old SR 62 Foundation Damage

Looking east between foundations and R/W. More damage.



Old US 131@Old SR 62 Foundation Damage

Looking east between foundations and R/W. More damage & crawl space contents.



Old US 131@Old SR 62 Foundation Damage

Looking east between foundations and R/W. More damage.

Location & Setting

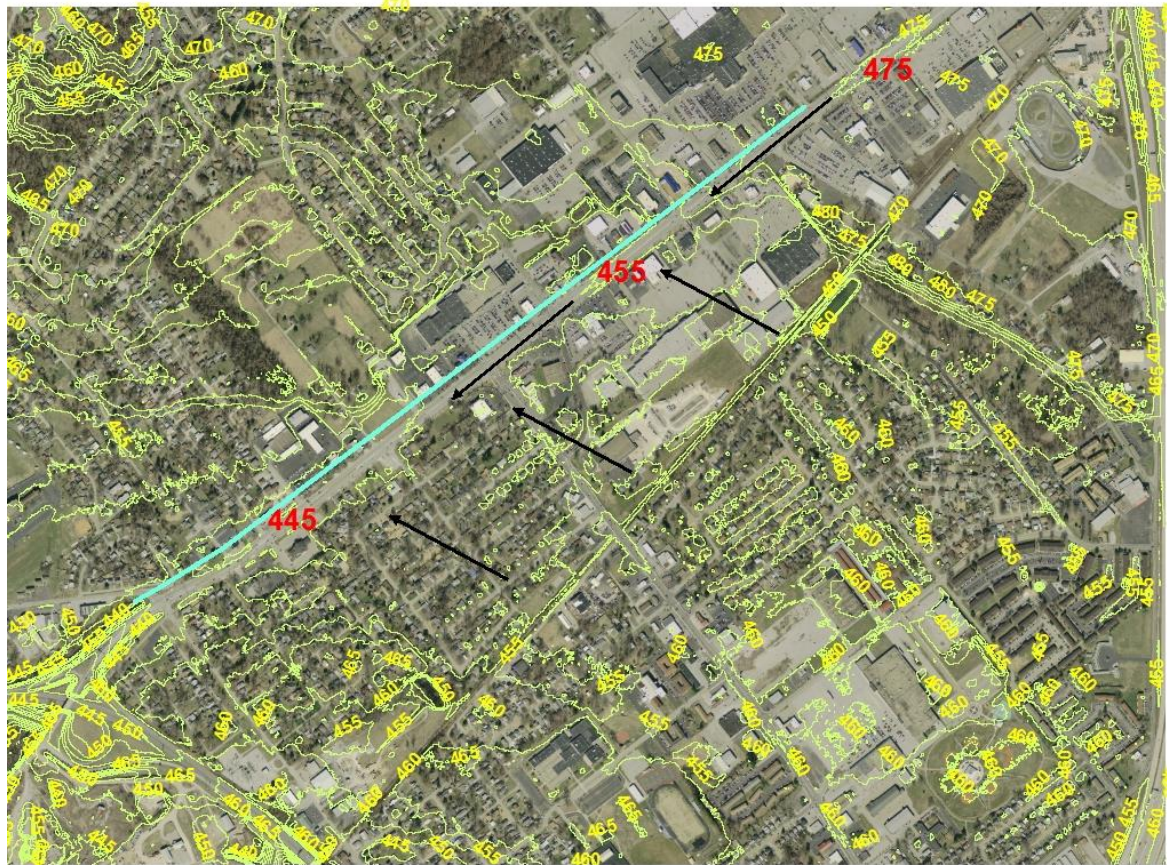
Old US 131 @ Old SR 62





Old US 131 @ Old SR 62 General Area Overview

Old US 131 slope is to SW, area SE of street drains to it, storm drains on NW side of street.



General Area Overview

Old US 131 slope is to SW, area SE of street drains to it, storm drains on NW side of street.



Detailed Site Overview

7 homes affected, storm drain outlets on other side of street, storm drain related construction ongoing.

Items of Consideration

- 1. Should the houses have been takes**
- 2. Slope failure/outlet blockage**
- 3. Storm drain**
 - a. Construction impacts**
 - b. Design standard/cross culverts**
- 4. Storm Intensity**



Should the houses have been taken?

- 1. Raised intersection acts as a dam**
- 2. Drainage relies on three 24 inch culverts**
- 3. The area drains to that location**
- 4. Culvert blockage sends flow to this location**





Old SR-131, Sunset Dr/McCulloch Pk extension

Old 131 on the right, Sunset/McCulloch on the left, the damaged houses in between.



Google Street View Clip

Old SR-131, Sunset Dr/McCulloch Pk extension

Old 131 on the right, Sunset/McCulloch on the left, the damaged houses in between.

Consideration of Apparent Slope Failure

**Old SR-131, Sunset Dr/McCulloch Pk
extension**





Old SR-62, Sunset Dr/McCulloch Pk extension

Note the damaged houses on the right.



Old SR-62, Sunset Dr/McCulloch Pk extension

Note the bare spot under guard rail



Old SR-62 @ Sunset Dr/McCulloch Pk extension

Evidence of slope failure repair by maintenance forces.



Old SR-62 @ Sunset Dr/McCulloch Pk extension

Time has pretty much eliminated visual aspects of former slide. Side ditch at toe of slope drains to the right where there are double 24 inch corrugated metal pipes (cmps).



Dbl 24" cmp downstream of slope failure

One culvert appears to be filled w/dirt, other culvert has inlet partially blocked w/various dirt, rock, and other debris.



Dbi 24" cnp downstream of slope failure

Note that there is a mixture of soil and rocks of various sizes. Not typical of siltation in culverts over a period of time. It is typical of what is seen in a mudflow.



Partially blocked 24" cmp

Dirt, rock, and other debris.

Storm Drain Construction

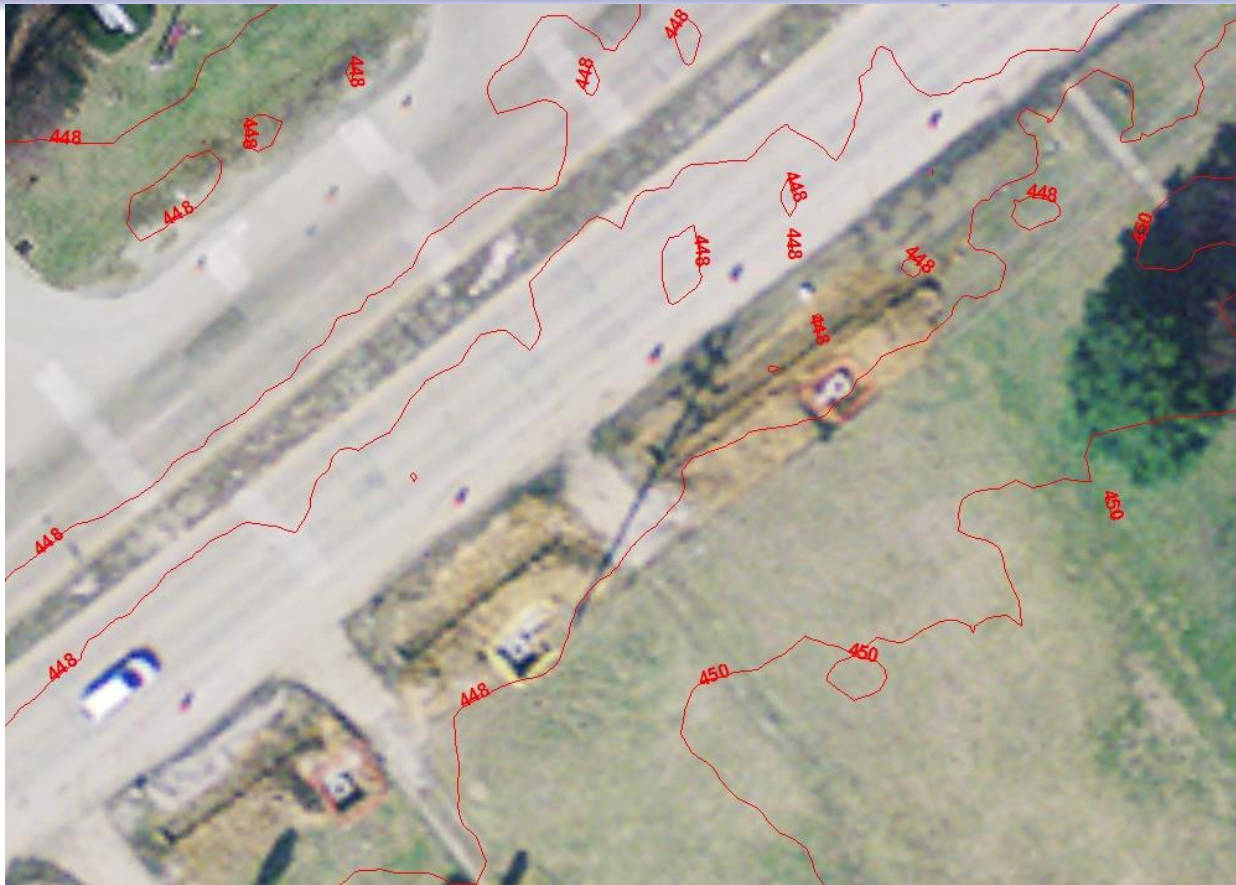
Old SR-131





Storm Drain Under Construction – 2005 Aerial Photo

Note cones and fenced area. Typical of storm drain construction and road improvements, paving lifts may be in phases so that water bypasses inlets.



Storm Drain Under Construction – 2005 Aerial Photo

Note cones and fenced area. 2005 aerial photo w/2011-13 Indiana Map elevations.



Former ditch location on right - Google Streetview clip

Beehive inlet by bush in front of fence, next to drive.



Former ditch location on right - Google Streetview clip

Beehive inlet by bush in front of fence, next to drive.

Storm Drain Impacts

- 1. Existing ditches were filled replacing storage with shallow swales and ditch drains.**
- 2. System was designed to a 10 year standard.**
- 3. Cross culverts were designed for larger event (estimated at 25 year or greater).**
- 4. Storm drain connections limited flow at culvert connections to 10 year design.**
- 5. Water that couldn't get into system had no where to go but to the flooded location.**



Storm Intensity and Modeling

1. Modeling procedure
2. Conclusions



Modeling Procedures

- 1. Used TR-20 – detention basin and triangular hydrograph.**
- 2. Storms modeled: 2hr 100 yr, 25 yr, 10 yr, and 6 inches in 2 hrs (anecdotal report).**
- 3. Var scenarios of blocked inlets were tried.**
- 4. Depths produced from site watershed alone were less than 5 feet for all scenarios.**



Conclusions

- 1. Only the Anecdotal storm scenarios began to approach the eye witness report of water above the retaining wall which would have been more than 6 feet of depth.**
- 2. Increased depth in the basin requires significant increase in water volume.**
- 3. To produce the depth reported required more than 100 year storm, culvert blockage and bypass from storm drains.**



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Anything that can possibly go wrong, does.



So What Did Go Wrong?

- 1. No decision made to take the houses when raised interchange constructed.**
- 2. Slope Failure/pipe blockage.**
- 3. Storm Drain construction that restricted flow resulting in bypass to impacted area.**
- 4. Intense storm that likely was much larger than the 1% annual exceedance probability.**





The End
Any Questions?