SR 0160 Wellersburg Truck Safety Improvement Project

Presented on April 12, 2022

About the Presenter/Firm

David Hoglund, PE

PA & OH

25 Years Experience

17 Years at RETTEW

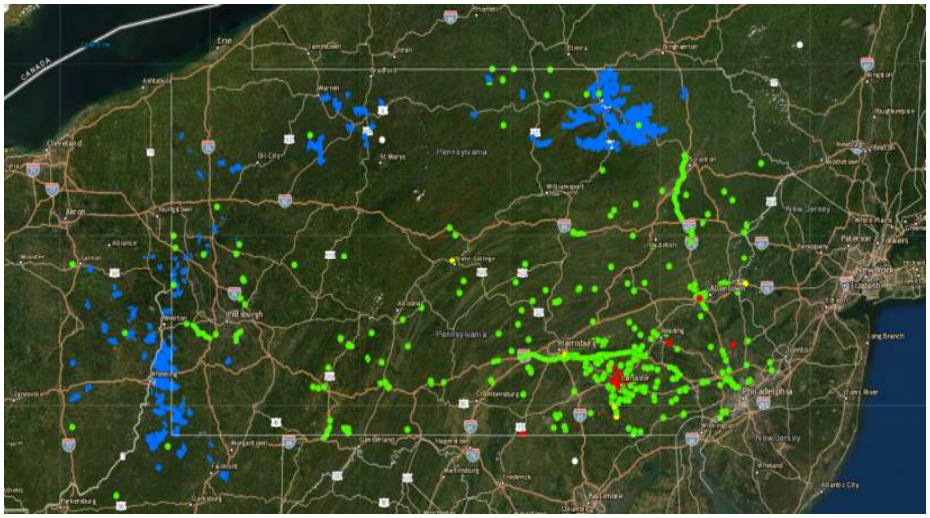
10 years in District 9-0

RETTEW Associates Inc

100% Employee-Owned Business

Since 1969 – 400 Employees

Full Service Civil Engineering Firm



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Goals

1. Learn about steep grade analysis. GSRS analysis.
2. Learn about different ITS technologies.
3. Lessons learned from the design and construction.
4. Learn about escape ramp design.

Project Location

Timeline

May 5, 2017 - Truck Hit the Mount Harmony United Methodist Church

June 1, 2017 – RETTEW NTP

June 21, 2018 – ECMS 48072 Let Date

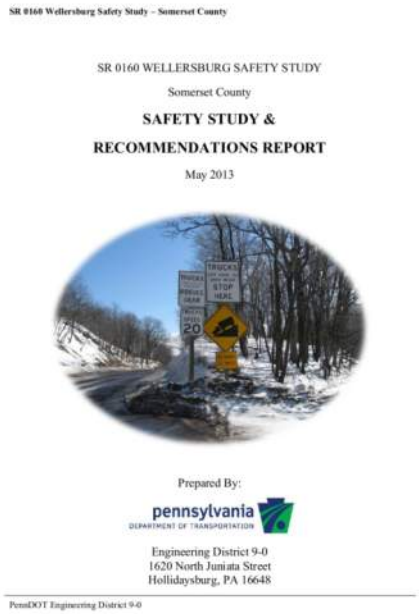
June 28, 2019 – Construction Complete

The Beginning

May 2013 – PennDOT studied SR 0160.

Recommendations:

- **Extend truck pull-off area**
- **Upgrade signs along corridor**
- **Delineators on guiderail strings**
- **Centerline raised pavement markings**
- **Investigate potential escape ramp**


SR 0160 Wellersburg Safety Study – Somerset County

SR 0160 WELLERSBURG SAFETY STUDY

Somerset County

SAFETY STUDY &

RECOMMENDATIONS REPORT

May 2013

Prepared By:

pennsylvania

DEPARTMENT OF TRANSPORTATION

Engineering District 9-0
1620 North Juniata Street
Hollidaysburg, PA 16648

PennDOT Engineering District 9-0

Crashes – "Too fast for conditions" – But why too fast?

Field View/Stakeout

Result: Implement Recommendations

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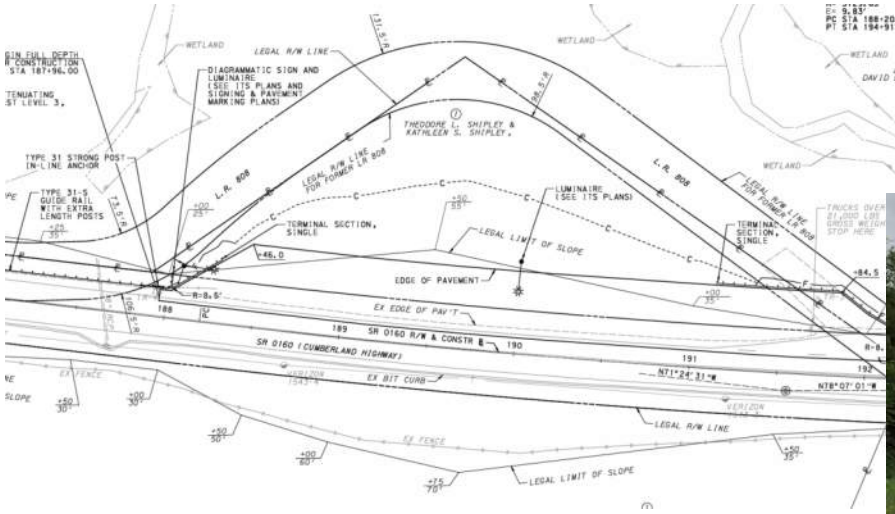
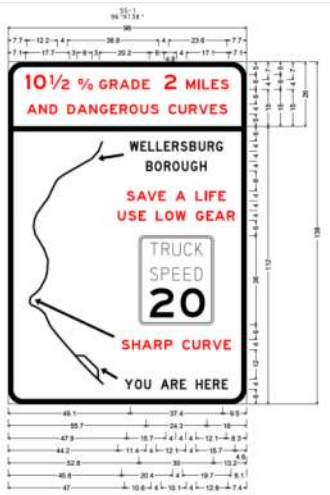
Starting design

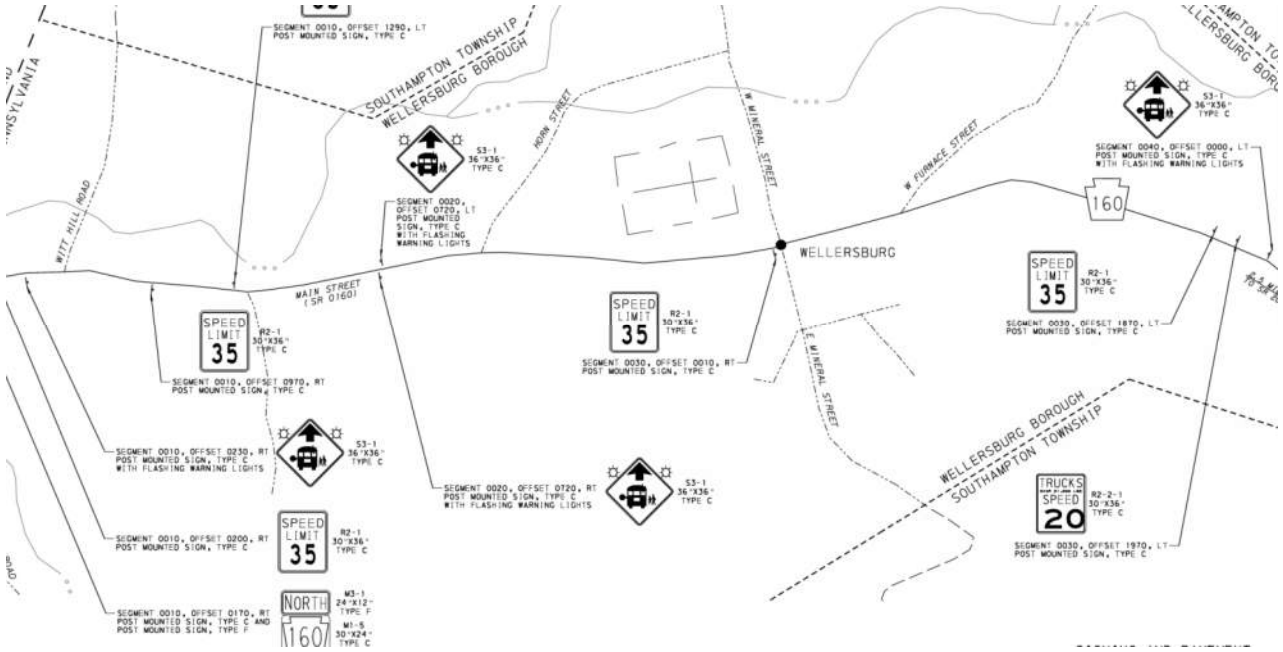
Larger Pulloff Area – Diagrammatic Signs, Cameras

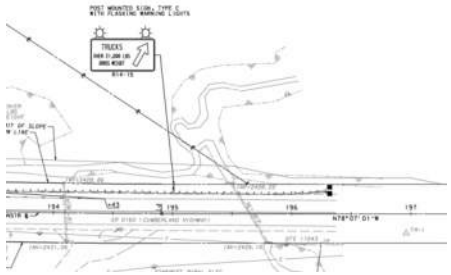


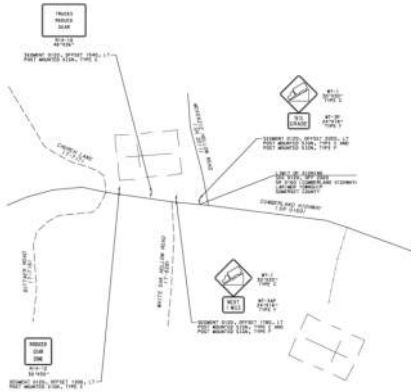


Starting design

Sign Improvements

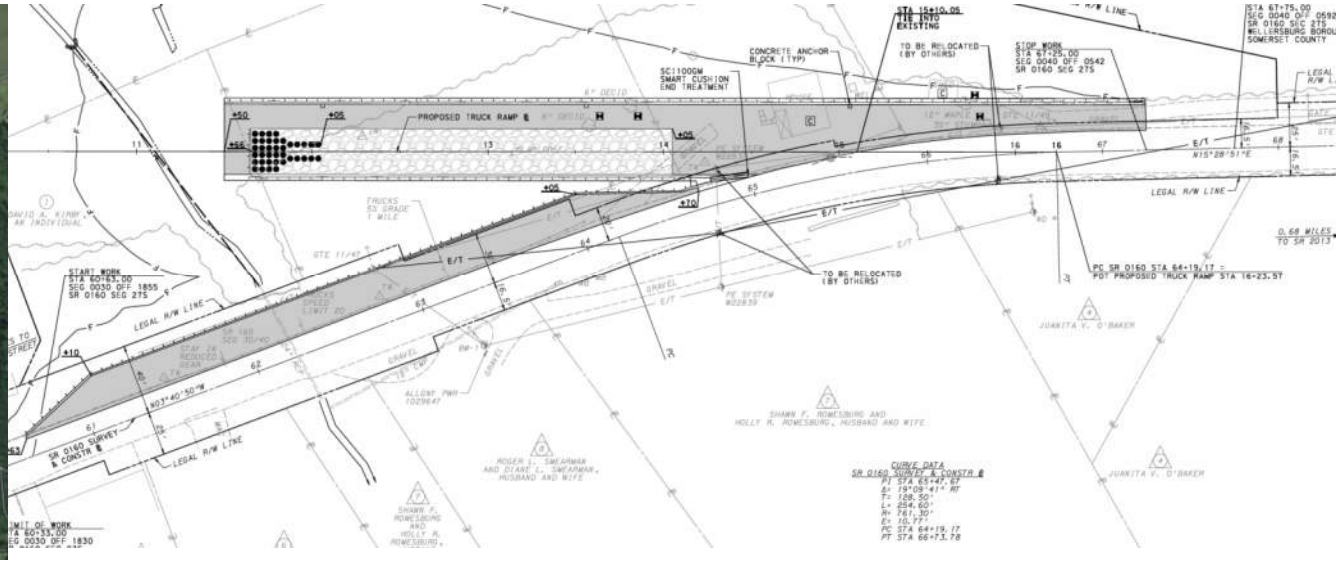






Escape Ramp – Where to put it?

Above the population center in Wellersburg

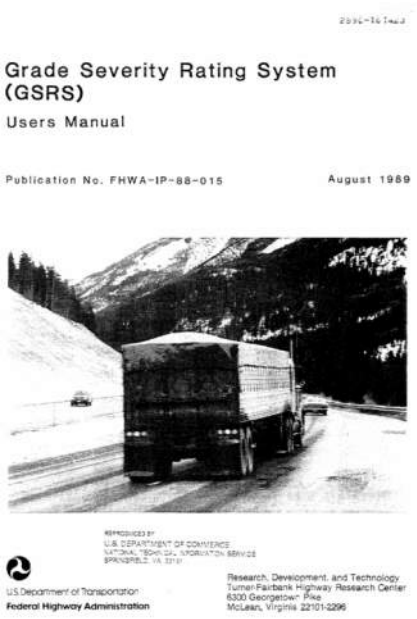


Grade Severity Rating System

Scientific method to determine where truck brakes fail.

Specified in many DOT manuals

Nobody seems to have it



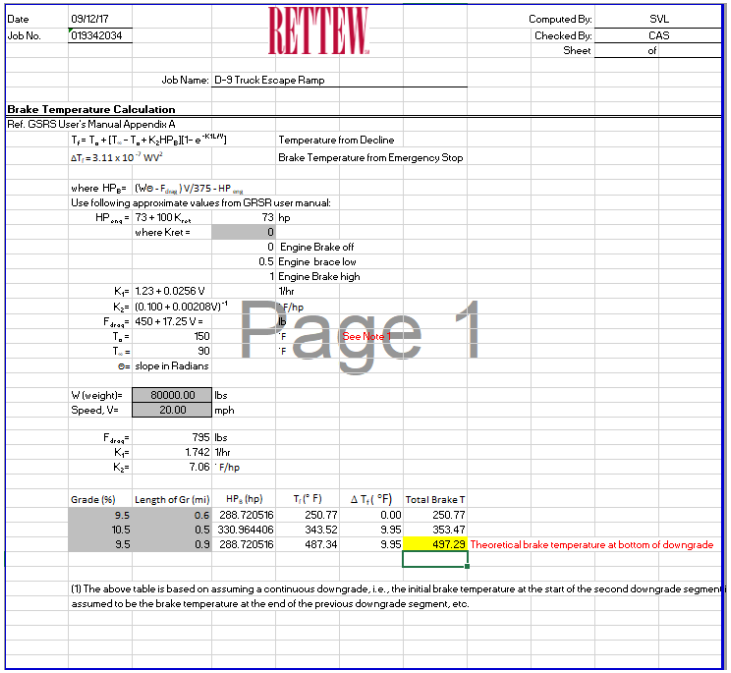
Grade Severity Rating System (GSRS)

Users Manual

Publication No. FHWA-IP-88-015 August 1989

U.S. Department of Transportation
Federal Highway Administration

Research, Development, and Technology
Turner-Fairbank Highway Research Center
6300 Georgetown Pike
McLean, Virginia 22101-2296



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Date 09/12/17 Computed By: SVL
Job No. 019342034 Checked By: CAS
Sheet of

Job Name: D-9 Truck Escape Ramp

Brake Temperature Calculation

Ref. GSRS User's Manual Appendix A

$T_f = T_a + [T_o - T_a + K_2 HP_B][1 - e^{-K1L/V}]$ Temperature from Decline

$\Delta T_f = 3.11 \times 10^{-7} WV^2$ Brake Temperature from Emergency Stop

where HP_B = $(We - F_{drag})V/375 - HP_{eng}$

Use following approximate values from GRSR user manual:

HP_{eng} = $73 + 100 K_{ret}$ 73 hp

where Kret = 0

0 Engine Brake off
0.5 Engine brace low
1 Engine Brake high

K_1 = 1.23 + 0.0256 V 1/hr
K_2 = $(0.100 + 0.00208V)^{-1}$ °F/hp
F_{drag} = 450 + 17.25 V = lb
T_a = 150 °F See Note 1
T_o = 90 °F
e= slope in Radians

W (weight)= 80000.00 lbs
Speed, V= 20.00 mph

F_{drag} = 795 lbs
K_1 = 1.742 1/hr
K_2 = 7.06 °F/hp

Grade (%)	Length of Gr (mi)	HP_B (hp)	T_f (° F)	ΔT_f (°F)	Total Brake T	
9.5	0.6	288.720516	250.77	0.00	250.77	
10.5	0.5	330.964406	343.52	9.95	353.47	
9.5	0.9	288.720516	487.34	9.95	497.29	Theoretical brake temperature at bottom of downgrade

(1) The above table is based on assuming a continuous downgrade, i.e., the initial brake temperature at the start of the second downgrade segment is assumed to be the brake temperature at the end of the previous downgrade segment, etc.

Page 1

Luckily it fits onto a one page spreadsheet

Public meeting – September 2017

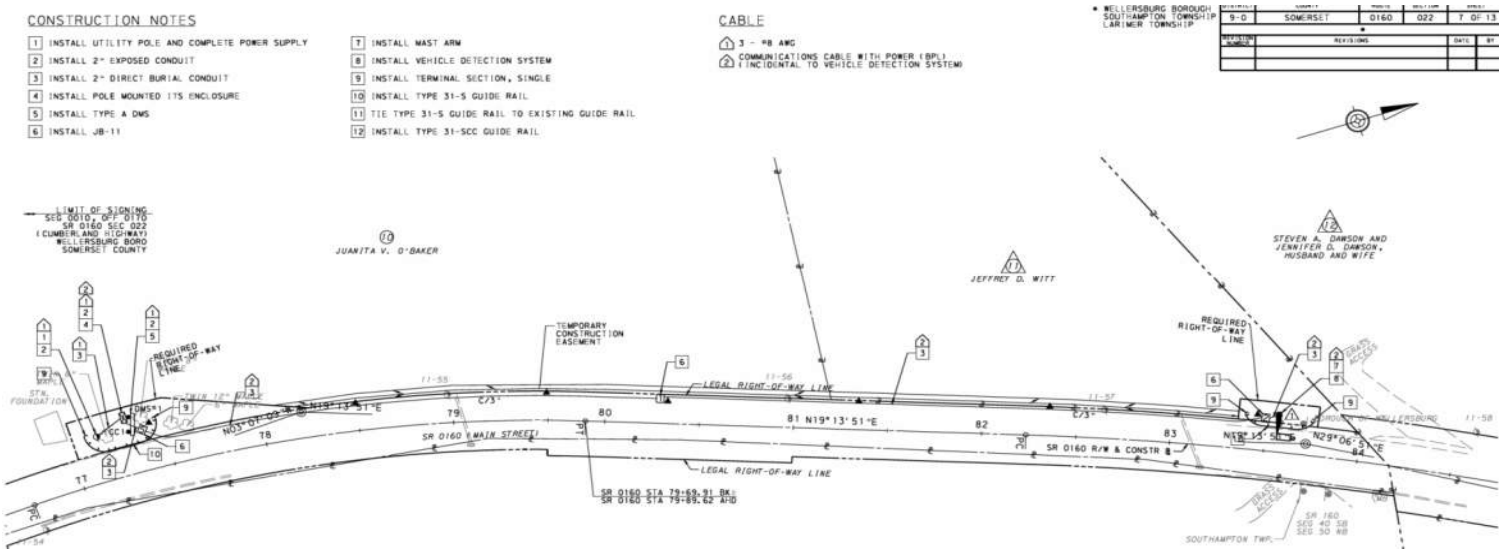
We needed to do more for this community than the recommended improvements.

ITS Inclusion October 2017

8 months to go to let date – Major project shift

Where do we put these? – Back out to the field

CE Re-eval, Cultural, Utilities, ROW, ITS, Signage, Electrical Plans



ITS Inclusion October 2017

What are these?

FLIR ITS Line of vehicle detection and sensor products. TrafiRadar cameras that detect speed and vehicle classification.

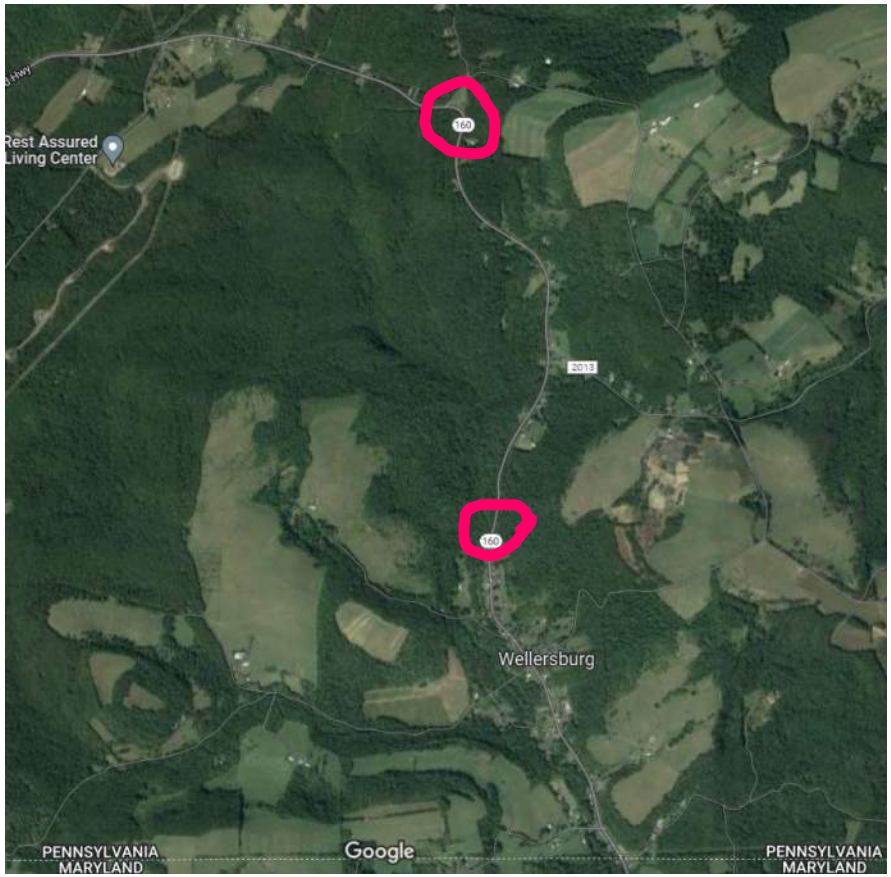
Vanguard DMS signs provided by Daktronics.

If speed limit exceeded and vehicle is a truck, DMS illuminates with a warning about the road ahead for the truck driver.

2 Areas Identified

What we are looking for:

- Spot in advance of a hazard
- Adequate sight distance & reaction time
- Lower one could also double as an escape ramp alert sign. Needs to be beyond 500 degree spot plus reaction distance.



Due to schedule, it would be nice if:

- It was in existing/old ROW
- Near utilities
- Didn't impact already approved CE

2 Areas Identified

Only one of the “nice things” happened. Missed a cultural resource by a couple feet.

Still needed ROW and utility coordination.

Electric not in ROW. Met with 2 utility companies, hashed out a plan.

Crash History/Near Misses

July 2016 - At Church

April 2017 – At Hairpin

May 2017 – Into Church

August 2017 – Brakes on Fire

October 2017 – Brakes on Fire

April 2018 – Truck in pulloff

May 2018 – Fatality in MD

June 2018 – Truck rollover above town

Crash History/Near Misses

July 2018 - Crash in Town

July 2018 – Hot Brakes

July 2018 – Hot Brakes

July 2018 – Hairpin Pickup Crash

November 2018 – Church Destroyed

January 2019 – Truck Restriction Implemented

Construction

Tree clearing – Unlimited height through the project

Truck pulloff – Physical roadway constructed in fall of 2018. Rest of project completed in 2019.

Electric companies decided to feed sites from other locations than agreed to during design phase. Required wiring redesign during construction.

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Final Product

Lessons Learned

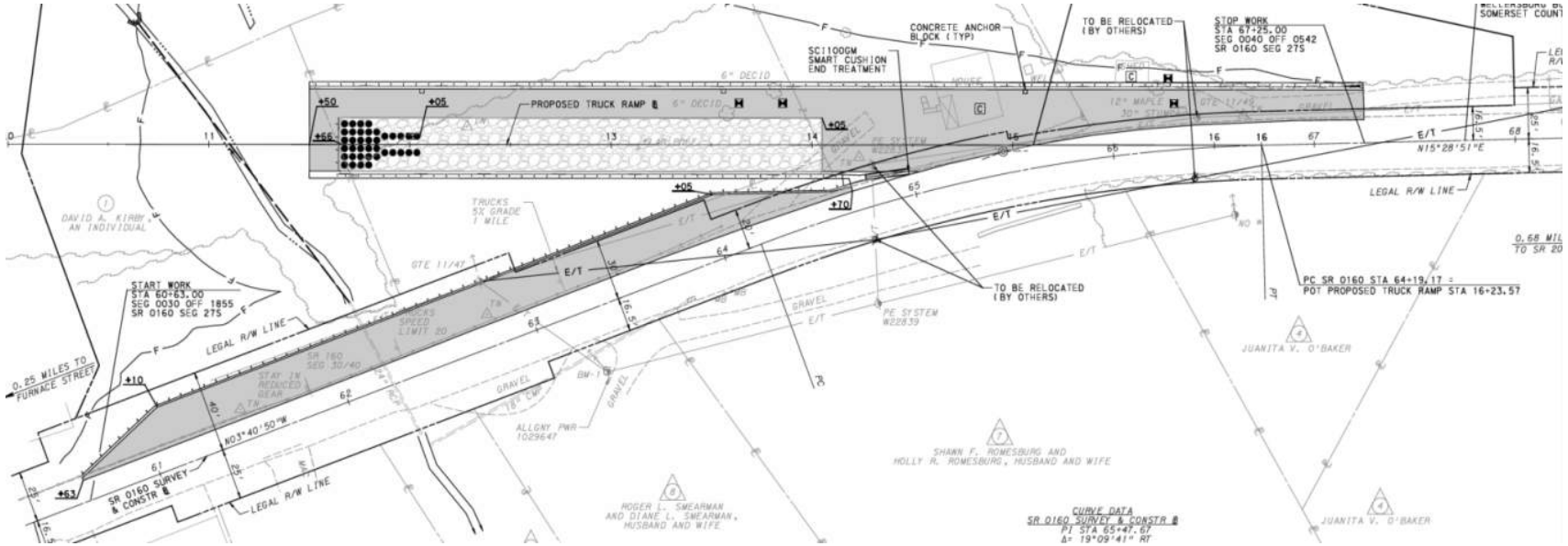
Don’t underestimate field engineering – Looking at something and asking yourself if it makes sense or will work. Then back it up with science.

When meeting with utilities on a tight schedule, make sure the people doing the utility construction are also at the table during design.

When doing electrical design, don’t assume everything in the field is to code. Bring an electrician.

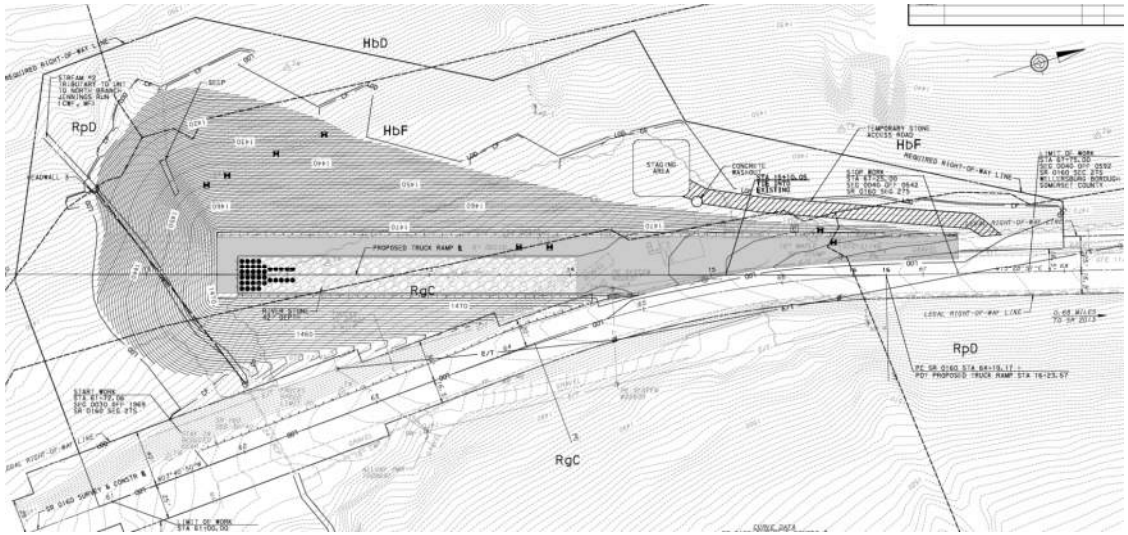
Truck Escape Ramp Design

After bids were opened, Phase 2 started. RETTEW was asked to design the truck escape ramp in the event that truck crashes would continue to occur in the future.



Truck Escape Ramp Design

RETTEW cleared the PE phase in just 2 months. How? We compared survey data throughout the previous project with LIDAR contours, saw they were close, and designed the entire ramp site and made design submittals with LIDAR contours while real survey was taking place. When real survey came in, we overlaid it, tweaked design, and made final submissions.



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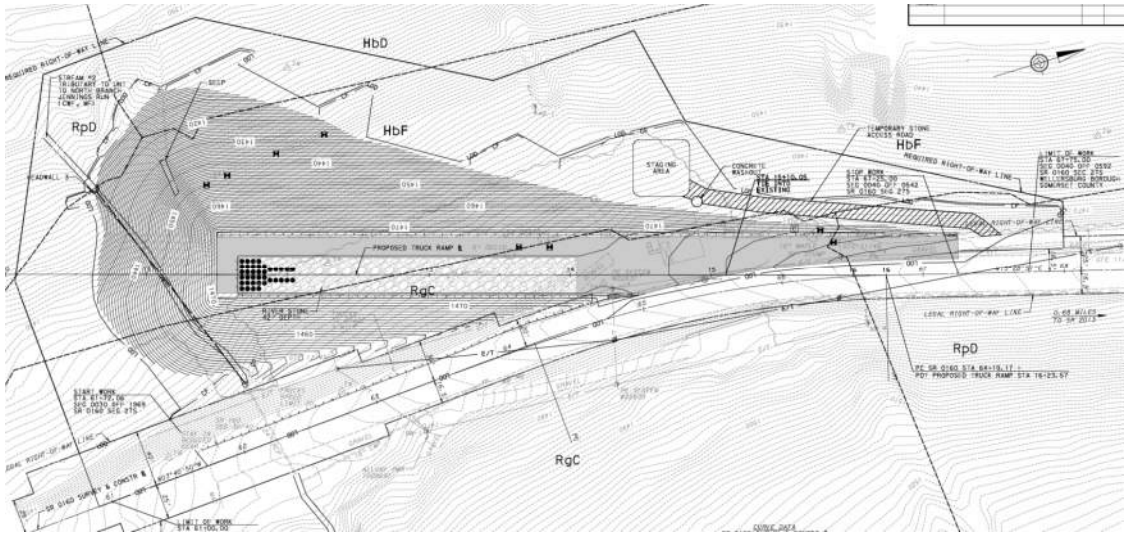
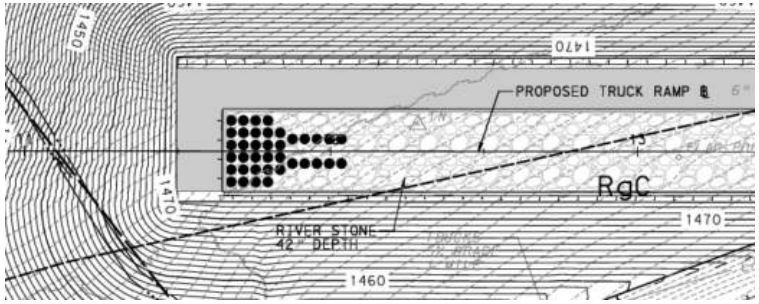


Truck Escape Ramp Design

Couple Things:

1. **Length greatly depends on grade and material used for bedding. Wellersburg was on the dropoff side of a mountain, so it was level with river stone.**
2. **Barrels at end are a combination of fully filled and half-filled barrels of water. Can't fill them all or G-forces are too great for driver.**
3. **Provide a paved path along the side so rescue vehicles can get the truck out.**



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Thank You!

PennDOT District 9-0

Gibson Thomas

Markosky

Any questions?