

DEPLOYING DRONE-ENABLED SENSING FOR AUTOMATED HIGHWAY RAIL GRADE CROSSING ASSESSMENT WITH THE CROSSING-I SYSTEM



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Additional team members: Michael Billmire (web portal dev), Chris Cook (UAS data analysis), Becky Lowe (GIS support)



Rail Transportation Program
Michigan Tech Transportation Institute • Michigan Technological University



**Michigan
Technological
University**

PROBLEM BEING SOLVED

- Loss of life and of property occur too frequently at rail crossings
- 130,000 public and 209,000 total crossings in the U.S.
 - 200+ annual fatalities
 - 2000+ annual injuries



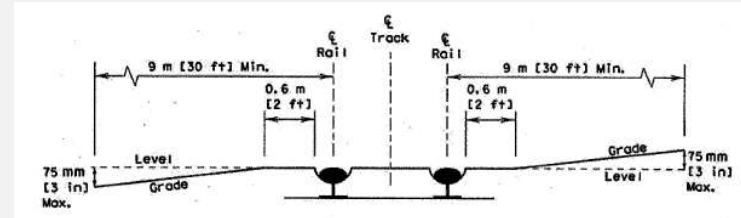
3/7/2017 Biloxi, 4 deaths, 38 injuries (50 total onboard, retirees)



10/16/21 Thackerville, OK: Amtrak train strikes semi-truck car hauler stuck on tracks; 5 injured

BEFORE MEASUREMENTS: DEFINE REQUIREMENTS

- Defined the requirements to measure grade crossings
 - Crossing profile measurement requirements: Based on AASHTO's "A Policy on Geometric Design and Streets" (Green Book) – 0.89% max grade for 30ft from ends of ties (3 inches over 28 ft; 75mm over 8.4m)
 - Rate of change critical to find locally problematic areas
 - Sight line requirements: Railroad-Highway Grade Crossing Handbook by the FHWA



Critical areas for 3D measurement of vertical highway profiles at grade crossings – 0.89% grade over 30' (9.1m) – AASHTO Green Book

Train speed (mph)	Case B: Departure from stop	Case A: Moving vehicle							
	Vehicle speed (mph)								
	0	10	20	30	40	50	60	70	80
	Distance along railroad from crossing, d_r (feet)								
10	240	146	108	99	100	105	111	115	126
20	450	293	212	195	200	209	222	236	252
30	721	489	315	297	300	314	333	355	375
40	961	585	424	396	401	419	444	473	504
50	1201	782	580	494	501	524	555	591	630
60	1441	875	686	598	601	628	666	709	756
70	1681	1024	742	692	701	733	777	825	882
80	1921	1171	845	791	801	838	885	946	1005
90	2162	1317	954	890	901	943	999	1064	1134
	Distance along highway from crossing, d_H (feet)								
		69	185	220	324	447	589	751	931

Table 32 Railroad-Highway Grade Crossing Handbook – helps determine distances needed for data collection along highways & railways

HANG-UP DETECTION VEHICLE STANDARDS



- ▶ Eck and Kang, 1991, update Clawson 2002, checked against current standards
- ▶ They also state that vehicles with ground clearance down to 2 inches have been observed
- ▶ Recommend use of 40 foot wheel base with 4 inch clearance (12.2m x 0.10m)
- ▶ We produce school bus, motorcoach, & low-boy trailer by default; can do any other, with alternative clearances & wheelbases

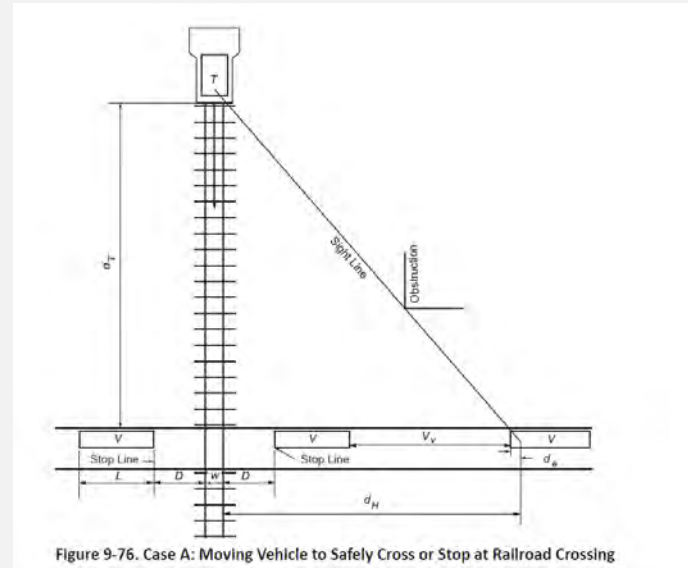
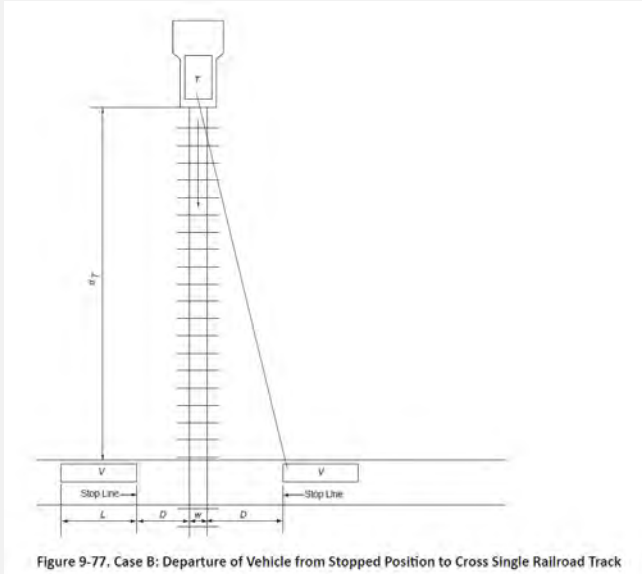
Table 4.1 – Design Vehicle Dimensions

Design Vehicles	Wheelbase (ft)	Overhang (ft)		Ground clearance (in)		
		Front	Rear	Wheelbase	Front	Rear
Single Unit Trucks –						
Single Unit Beverage Truck	24	--	10	6	--	8
Articulated Beverage Truck	30	--	--	10	--	--
Rear-Load Garbage Truck	20	--	12.5	12	--	14
Aerial Fire Truck	20	7	12	9	11	10
Pumper Fire Truck	22	8	10	7	8	10
Buses -						
Mini-Bus	15	--	16	10	--	8
School Bus	23	--	13	7	--	11
Single Unit Transit Bus	25	18	--	8	6	--
Articulated Transit Bus	22 / 26	--	10	10 / 10	--	9
Motorcoach	27	7.6	10	7	10	8
Trucks -						
Low-Boy Trailers < 53 ft	38	--	--	5	--	--
Double-Drop Trailer	40	--	--	6	--	--
Car Carrier Trailer	40	--	14	4	--	6
Belly Dump Trailer	40	--	--	11	--	--
Recreational Vehicles -						
Passenger Vehicle and Trailer – Private Use	20	--	13	5	--	5
Passenger Vehicle and Trailer – Commercial Use	27 (24 to hitch)	--	13	7	--	7
Recreation Vehicle	27	7.8	16	7	6	8

Clawson, Amy Lorraine, "Establishing design vehicles for the hang-up problem" (2002)

SIGHT DISTANCE

- Requirements from the 2018 Green Book are the same as 2011.



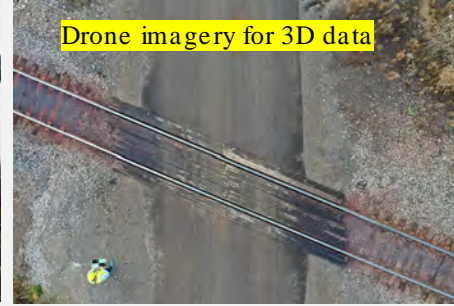
Need to consider vehicles starting from stopped position (left) or already moving vehicles (right)

* We calculate site line adequacy for approaching vehicles *

SBIR PHASE I, II, & FOLLOW-ON RESULTS FOR CROSSING SAFETY ASSESSMENT



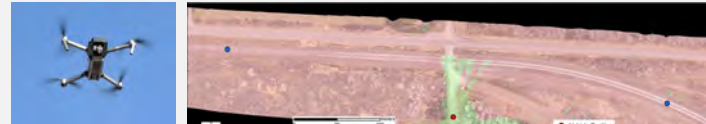
Standardized data collections



Drone imagery for 3D data



6 states, 51 crossings

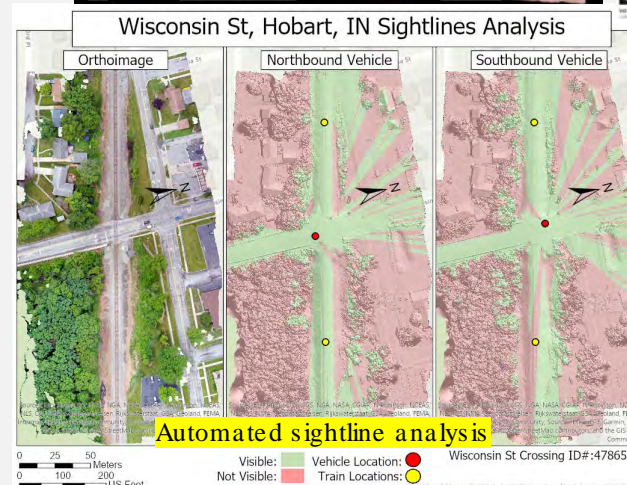
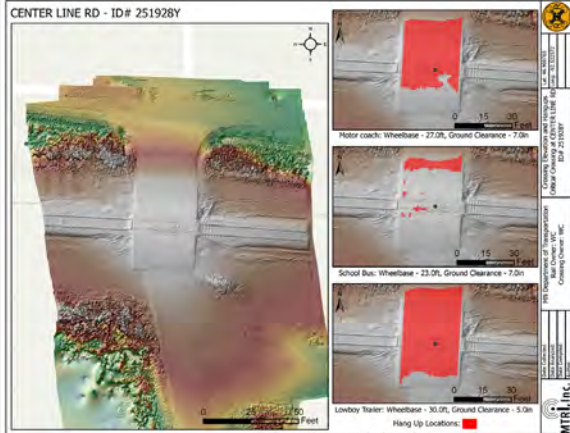


Drone & 360° ground videos

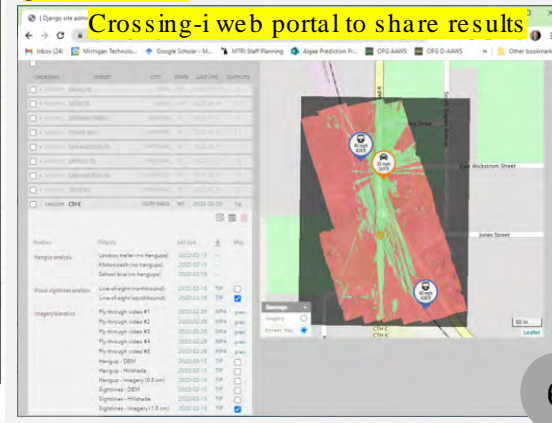


Automated sign ID

Automated humped crossing detection by vehicle type & Crossing-i reports



Automated sightline analysis



Crossing-i web portal to share results







TECHNOLOGY SOLUTION: CROSSING-I

- We have developed an advanced, practical, and available drone based technology to reduce life threatening accidents at railroad crossings.
- Developed under USDOT SBIR Phase I & II funding - partnership between MTU and MTRI Inc.
- Now being made commercially available



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 Photogrammetry High resolution photogrammetry and 3D model construction	 Automation Automated imagery analysis to identify hazards
 Low Clearance Identify hang-up risk by vehicle type	 Sight Line Identify sight line risk and potential obstacles
 Inventory Photo documentation of crossing and sign infrastructure.	 Portal Cloud application to access reports and imagery

<https://mtriinc.com/rail-crossing-assessment/>

TECHNOLOGY SOLUTION: CROSSING-I

- Crossing-i demonstrated in 34 crossings (five states), 2019-2021 (SBIR I & II funding)
 - MnDOT, WISDOT, MDOT, INDOT, ICC
 - Crossing survey planning & execution methods are well established & efficient
- MnDOT, St. Louis County (MN), Ohio Rail Development Commission (ORDC) partners for 2022-2023 projects
 - Collected 12 crossings near Duluth last week, Oct. 2022
 - 5 Ohio crossings, May 2023
- 30 crossings in MI – working with ENSCO to compare to train lidar system (DOTX 218)



15+ CROSSING-I PRODUCTS AVAILABLE FOR EACH CROSSING:

- Hang-up analysis (low ground clearance)
 - Lowboy trailer
 - Motorcoach
 - School Bus
 - Customizable to other vehicles
- Visual sight lines - are there sightline issues for vehicles approaching the crossing?
 - Active vs. passive crossings
 - Able to create dynamic (animated) sight lines
- GIS results
- Drone video
- 360° camera video (driver's point of view)
- Crossing-i report
- 3D environment

Analysis	Outputs	Last Upd.	Download	Map
Hangup analysis	Lowboy trailer	2023-03-28	TIF	<input type="checkbox"/>
	Motorcoach	2023-03-28	TIF	<input type="checkbox"/>
	School Bus	2023-03-28	TIF	<input type="checkbox"/>
Visual sightlines analysis	Line-of-sight (northbound)	2023-02-21	TIF	<input type="checkbox"/>
	Line-of-sight (southbound)	2023-02-21	TIF	<input type="checkbox"/>
Imagery/elevation	360 ground video	2023-03-29	LINK	
	Fly through video #1	2023-03-28	MP4	prev
	Hangup - DEM	2023-02-21	TIF	<input type="checkbox"/>
	Hangup - Hillshade	2023-02-21	TIF	<input type="checkbox"/>
	Hangup - Imagery (0.5 cm)	2023-02-21	TIF	<input type="checkbox"/>
	Sightlines - DEM	2023-02-21	TIF	<input type="checkbox"/>
	Sightlines - Hillshade	2023-02-21	TIF	<input type="checkbox"/>
	Sightlines - Imagery (1.5 cm)	2023-02-21	TIF	<input type="checkbox"/>
Full report	Full report	2023-03-29	PDF	
3D environment	3D environment	2023-03-29	LINK	

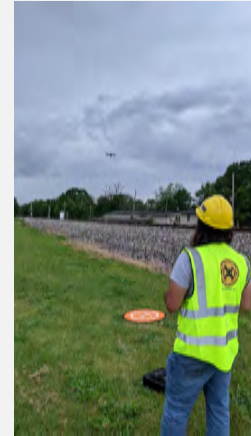
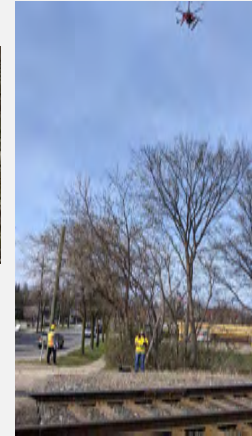
DRONE-ENABLED DATA COLLECTIONS

- ▶ Completed data collections for crossing assessments for SBIR funding
 - ▶ Completing up to 8 crossings per day, more possible (depends on proximity of crossings, FAA rules for flight operations)
 - ▶ Submitted whitepaper to FAA to enable Beyond Visual Line of Sight (BVLOS) operations for grade crossing assessment via drone
 - ▶ Crossing data typically collected within 45 minutes.



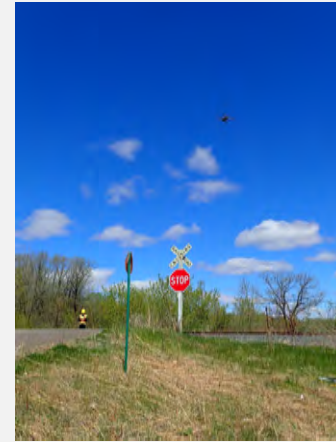
- ▶ Data collection workflow

1. Place ground control targets (now with Aeropoints)
 - 4 at the crossing for humped crossing
 - 2 further away from crossing for visual sight lines
 - Specific distance from crossing is determined by AASHTO Green Book calculations for sight line triangles
2. Fly larger UAS with high-res imaging for humped crossing analysis
3. Fly smaller DJI Mavic 2 Pro for visual sight lines analysis; can do all with larger UAS
4. Retrieve ground control targets

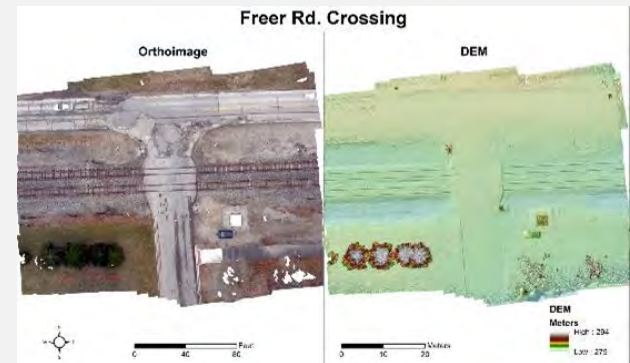
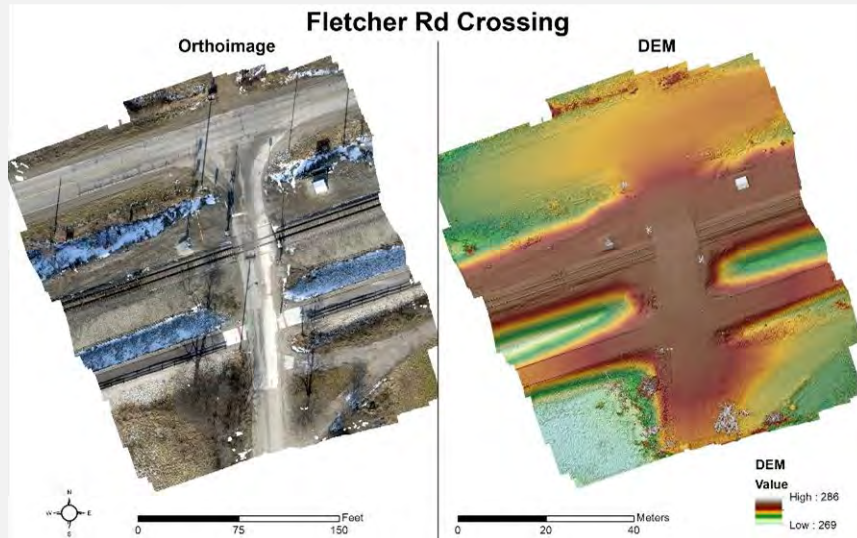
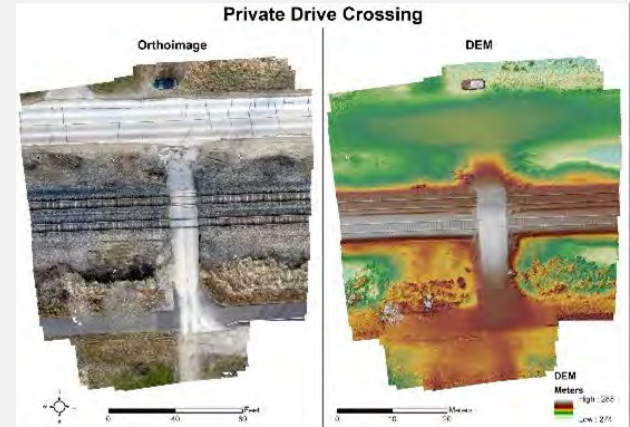


HIGH RESOLUTION IMAGES: USED FOR 3D DATA GENERATION WITH PHOTOGRAMMETRY

- Collected via drone, with flight plans
 - Higher-resolution for crossing profiles
 - Moderate resolution for larger site line analysis areas



HIGH RESOLUTION IMAGES & ORTHO OUTPUTS, INCLUDING DEMS



442ND ST, HARRIS, MN – 082750K

U. S. DOT CROSSING INVENTORY FORM

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION OMB No. 2130-0017

Instructions for the initial reporting of the following types of new or previously unreported crossings: For public highway-rail grade crossings, complete the entire inventory form. For private highway-rail grade crossings, complete the Header, Parts I and II, and the Submission Information section. For public pathway grade crossings (including pedestrian station grade crossings), complete the Header, Parts I and II, and the Submission Information section. For private pathway grade crossings, complete the Header, Parts I and II, and the Submission Information section. For grade-separated highway-rail or pathway crossings (including pedestrian station crossings), complete the Header, Part I, and the Submission Information section. For changes to existing data, complete the header, Part I items 1-3, and the Submission Information section, in addition to the updated data fields. Note: For private crossings only, Part I items 10 and Part II items 1, 4, are required unless otherwise noted. An asterisk * denotes an optional field.

A. Revision Date RUM/DO/YYYY 02 / 26 / 2018	B. Reporting Agency <input checked="" type="checkbox"/> Railroad <input type="checkbox"/> State <input type="checkbox"/> Transit <input type="checkbox"/> Other	C. Reason for Update (Select only one) <input checked="" type="checkbox"/> Change in Date <input type="checkbox"/> New Crossing <input type="checkbox"/> Closed <input type="checkbox"/> No Train Traffic <input type="checkbox"/> Quiet Zone Update	D. DOT Crossing Inventory Number 082750K
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Part I: Location and Classification Information

1. Primary Operating Railroad Crown Valley Railroad Company (SCVY)	2. State MINNESOTA	3. County CARLTON
4. City / Municipality HARRIS	5. Street/Road Name & Block Number 442ND ST	6. Highway Type & No. MN 15
7. Do Other Railroads Operate a Separate Track at Crossing? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, Specify RR:	8. Do Other Railroads Operate Over Your Track at Crossing? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, Specify RR:	9. Railroad Division or Region MINNESOTA
10. Railroad Subdivision or District SCVY RR	11. Branch or Line Name HINCK-FOREST LK	12. RR Milepost 0248.09
13. Line Segment 0214	14. Nearest RR Timetable Station NORTH BRANCH	15. Parent RR (if applicable) N/A SCVY
16. Crossing Owner (if applicable) N/A SCVY	17. Crossing Type <input checked="" type="checkbox"/> Highway <input type="checkbox"/> Pathway, Ped. <input type="checkbox"/> Station, Ped.	18. Crossing Purpose <input checked="" type="checkbox"/> At Grade <input type="checkbox"/> Under <input type="checkbox"/> RR Over
19. Crossing Position <input checked="" type="checkbox"/> At Grade <input type="checkbox"/> Under <input type="checkbox"/> RR Over	20. Public Access (if Priority Crossing) <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	21. Type of Train <input type="checkbox"/> Freight <input type="checkbox"/> Intercity Passenger <input type="checkbox"/> Commuter <input type="checkbox"/> Transit <input type="checkbox"/> Shared Use Transit <input type="checkbox"/> Trolley/Other
22. Average Passenger Train Count Per Day Less Than One Per Day	23. Average Passenger Train Count Per Day Less Than One Per Day	

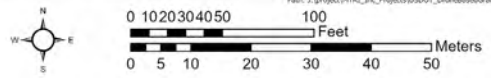


442ND ST. ORTHOS & DEMS

442nd St, Harris, MN – 082750K
 Orthophoto and hillshaded DEM results from 80ft (24.4m) crossing profile flights



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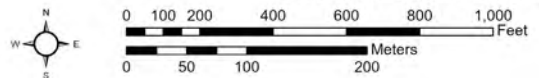


Crossing profile ortho resolution = 4.9mm pixel GSD (0.19"),

442nd St, Harris, MN – 082750K
 Orthophoto and hillshaded DEM results from 200ft (61.0m) sight line flights



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Crossing profile ortho resolution = 14.4mm pixel GSD (0.57"),

TECHNOLOGY SOLUTION – “HUMPED” CROSSINGS

Automated Profile Assessment Tool – specifies specific hangup locations for multiple vehicle types

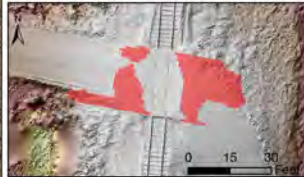
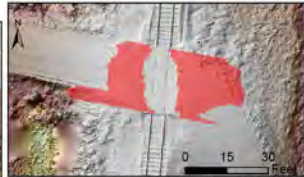
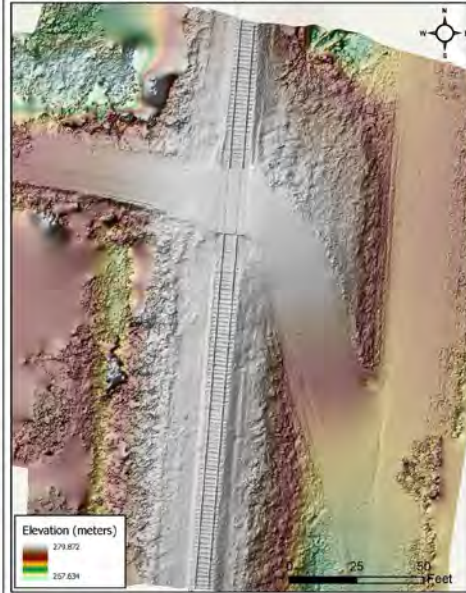
Wisconsin St, Hobart, IN Humped Crossing Analysis

Motorcoach

School Bus

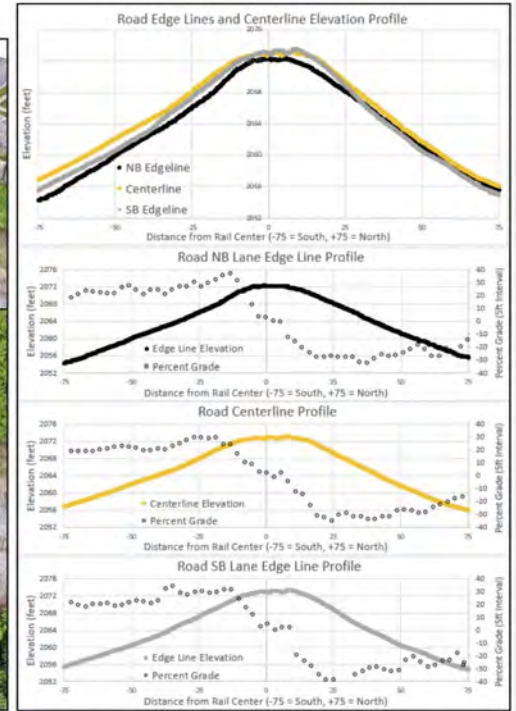
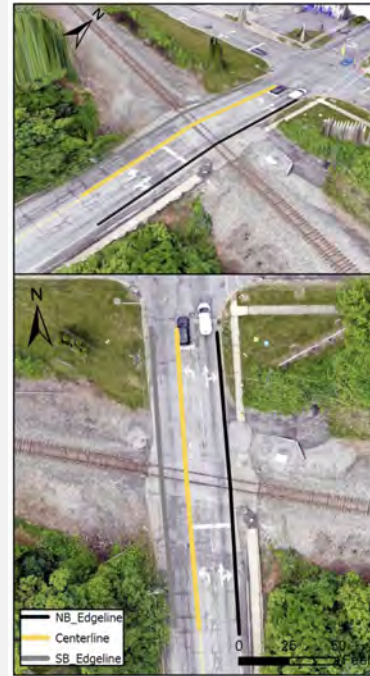
Low-Boy Trailer

442nd Street - DOT# 082750K



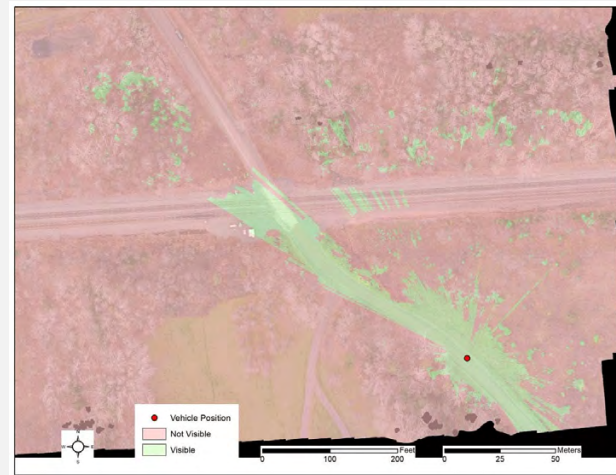
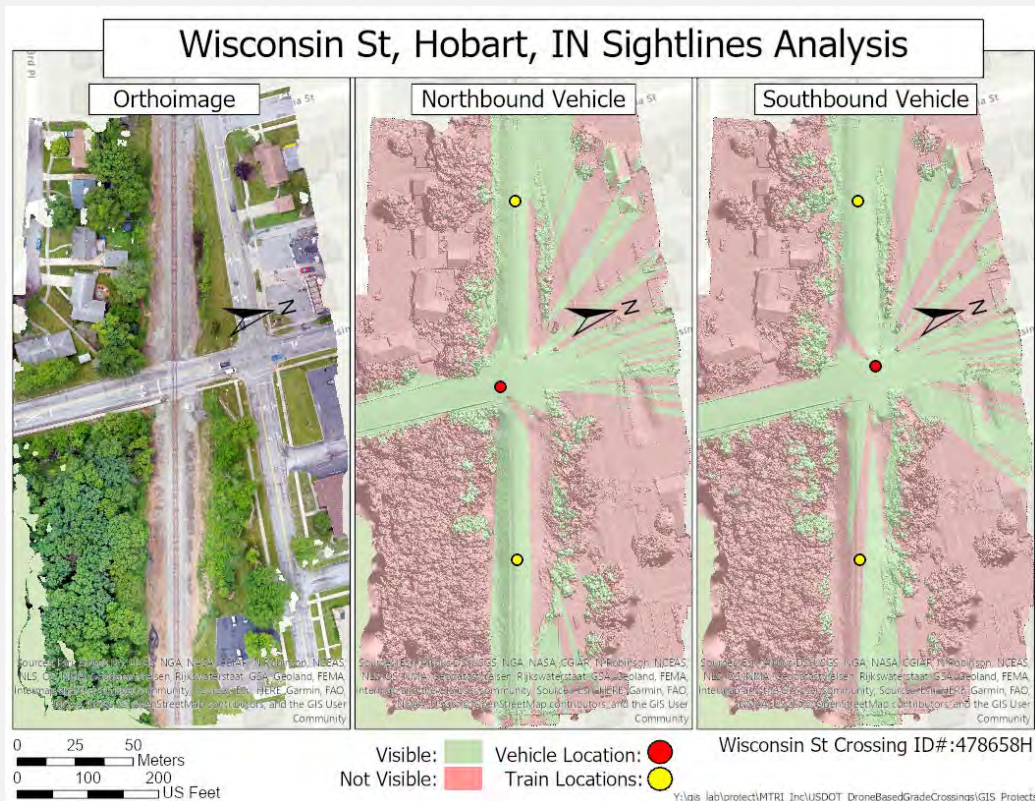
MISSISSIPPI DEPARTMENT OF TRANSPORTATION
 PROJECT: Wisconsin St, Hobart, IN
 DOT# 082750K
 MTR, Inc.
 Folder: Y:\gis_lab\project\MTR_Inc\USDOT_DroneBasedGradeCrossings\GIS_Projects\

Wisconsin St - DOT# 478658H



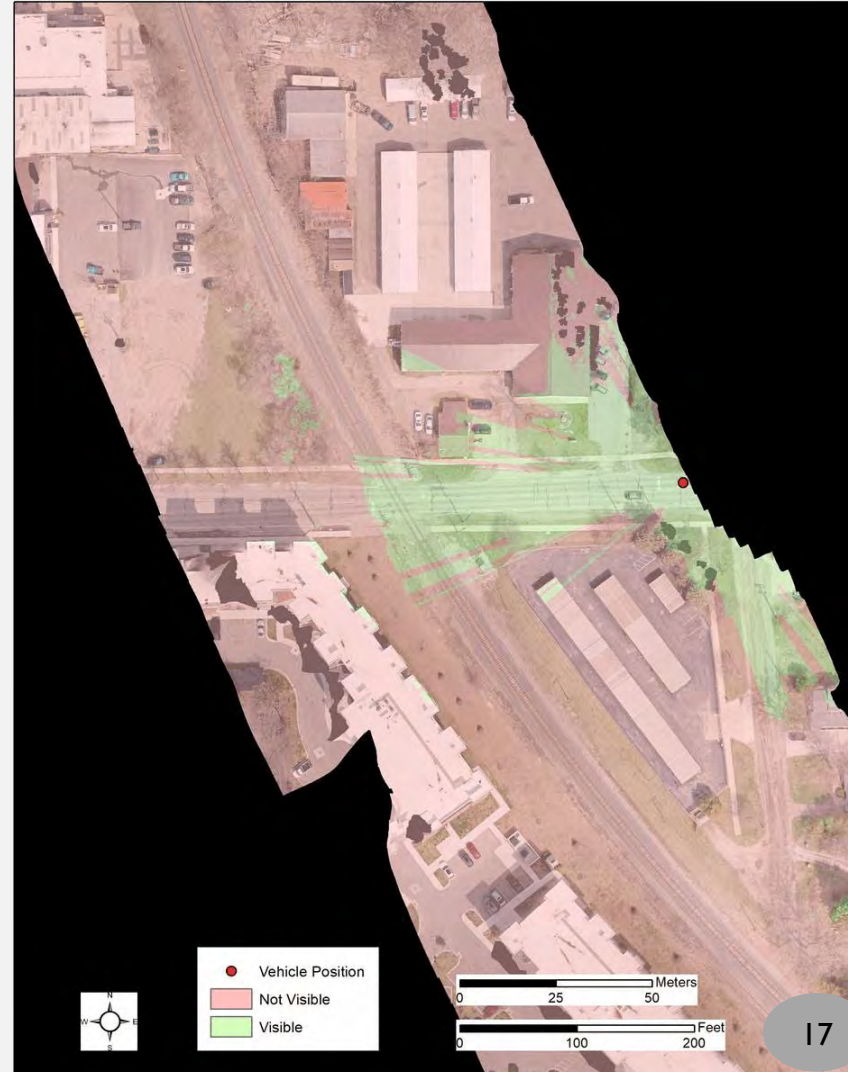
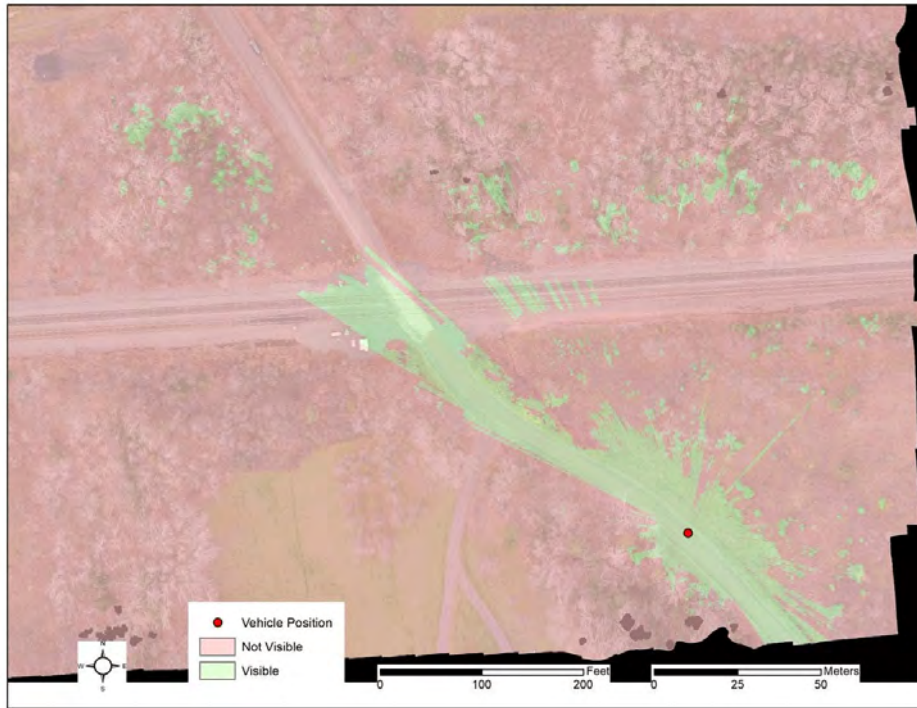
TECHNOLOGY SOLUTION – VISUAL SIGHT LINES

Railroad Grade Crossing Viewshed Tool Results – with dynamic results available



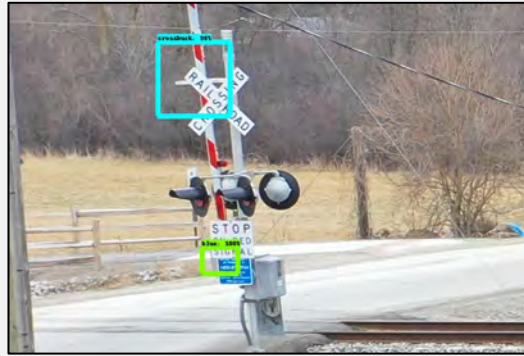
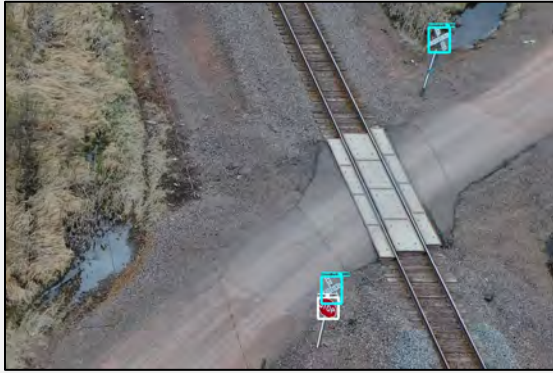
TECHNOLOGY SOLUTION

Dynamic Viewshed Tool Results



AUTOMATED SIGN IDENTIFICATION

Automated Sign Identification Using Machine Learning Tool Results



CROSSING-I REPORTS – 5-PAGE PDF FOR EACH SITE

NORTH WEST STREET - Crossing ID# 532712V
LIMA, OH
ALLEN County

Sheet Index

- Title Sheet
- Existing Grade Crossing Report & Photos
- Crossing Elevation and Hangup Locations
- Approach Sightline Conditions
- Road Lane and Centerline Profiles

1. Location Map




NORTH WEST STREET ID# 532712V

Item	Description	Notes
1	Approach Sightline Conditions	See Photos
2	Crossing Elevation and Hangup Locations	See Profile
3	Road Lane and Centerline Profiles	See Profile
4	Approach Sightline Conditions	See Photos
5	Road Lane and Centerline Profiles	See Profile





NORTH WEST STREET - ID# 532712V



Motor coach: Wheelbase - 27.0ft, Ground Clearance - 7.0in

School Bus: Wheelbase - 23.0ft, Ground Clearance - 7.0in

Lowboy Trailer: Wheelbase - 30.0ft, Ground Clearance - 5.0in

Hang Up Locations: ■

NORTH WEST STREET - ID# 532712V

Orthoimage | Northbound Vehicle | Southbound Vehicle

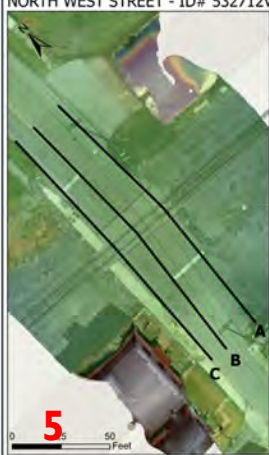
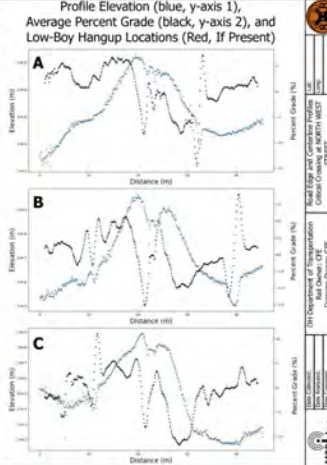


Visible: ■ Vehicle Location: ●
Not Visible: ■ Train Locations: ●

1. Max 10' beyond all train at Crossing; 40ftg
2. Max 10' beyond all train at Crossing; 40ftg
3. Max 10' beyond all train at Crossing; 40ftg
4. Max 10' beyond all train at Crossing; 40ftg
5. Max 10' beyond all train at Crossing; 40ftg

NORTH WEST STREET - ID# 532712V

Profile Elevation (blue, y-axis 1), Average Percent Grade (black, y-axis 2), and Low-Boy Hangup Locations (Red, If Present)

1. Elevation (ft)

2. Percent Grade (%)

3. Distance (ft)

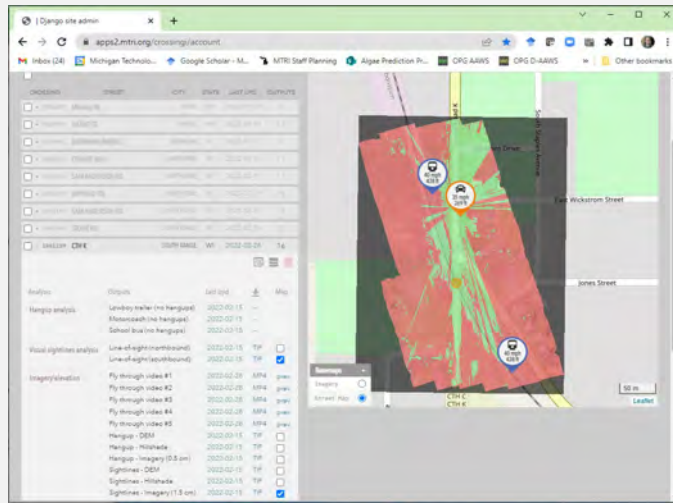
CROSSING-I PORTAL

- Customer Access Point
- Crossing-i Analytics Reports
- Fly-Through Videos
- 360° ground videos
- Crossing-i GIS Outputs
- Recording of standard crossing survey data

Added examples of 3D panoramic viewing of results to help with Virtual Diagnostic surveys

* Upgrades completed under Michigan Economic Development Corporation MTRAC program

- Helpful for virtual diagnostics

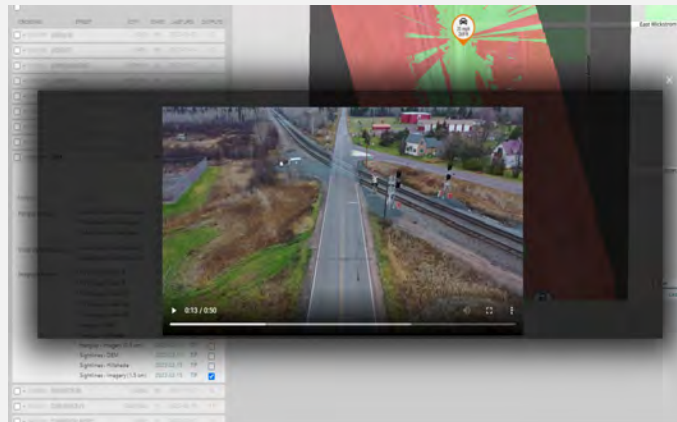


GIS data viewing

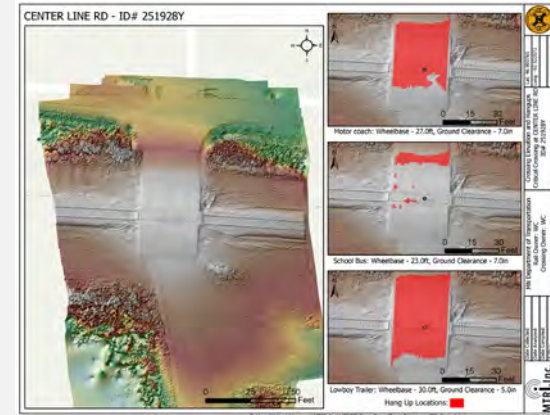
Crossing Inventory database information for ID: 186115J

CrossingFeature	Field	Description	Value
HighwayTrafficControl	BlockNum	Block number	
	DevletTypID	1=Open space, 12=Residential, 13=Commercial, 14=Industrial, 15=Institutional, 16=Farm, 17=Recreational, 18=Road	11
LocationClassification	Highway	Highway type & No.	RD
	HicorID	Hicor corridor ID	-1
PhysicalCharacteristics	HayCont	State contact (telephone No.)	6882661168
	Latitude		-46.576563
	Longitude		-91.91878
ReportInfo	LLSource	Labeling source, 1=Actual, 2=Estimated	2
	MultiFresLad	Do other railroads operate a separate track at crossing? 1=Yes, 1=No	2
	Nearest	Turnout, Drive, 1=Hwy	1
	OpenPub	Public access (if private crossing), 1=Yes, 2=No	...
	PolCont	Emergency notification telephone No.	8004659239
	PolKing	Crossing position, 1=45 deg, 2=90 under, 3=45 over	1
	Railroad	The code associated with the primary operating railroad	MC
	SourceOfData	Source of data, 1=Crossing-i, 2=Other	1

Standard FRA report updating



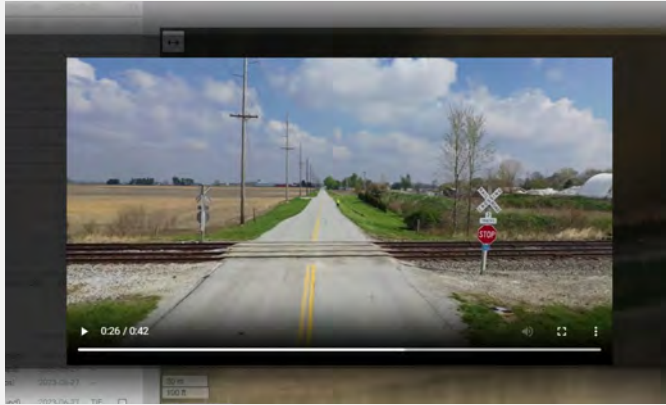
Video viewing



Access Crossing-i PDF reports

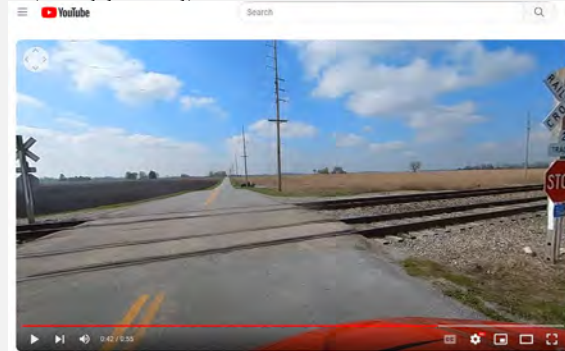
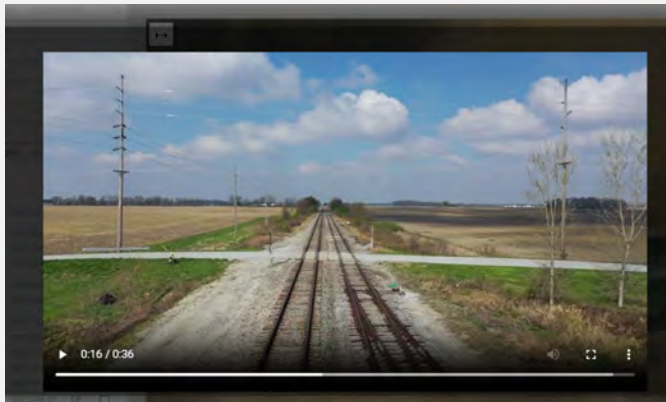
DRONE FLY-THROUGH VIDEOS AND 360° GROUND VIDEOS

CR-110B (532625S) - Upper Sandusky, OH



CR-110B Road-Rail Grade Crossing [1], Wyandot County, OH (April 2023)

<https://www.youtube.com/watch?v=K9VPWWRtWgE>



https://www.youtube.com/watch?v=f_ir3JpkE4E (southbound)

Drone videos - road, track; can be viewed on site & downloaded

Insta360 ground videos from moving car - can be rotated, paused

POTENTIAL IMMEDIATE ROI - “VIRTUAL DIAGNOSTICS”

- Based on inquiry/suggestion from DOTs
- To reduce complexities and resources needed for diagnostics meetings
- Use resources demonstrated today
- Quantifying the true value/benefits

Parameter	Virtual Diagnostics	Traditional Diagnostics
Time Commitment	Low and consistent	High and variable
Coordination Complexity	Medium (no travel)	High (travel and meeting time)
Meeting Cost	Low (only time cost)	High (travel, lodging, time)
Stakeholder absence	Later review of recordings	Requires new time
Documentation	Reports (Crossing-i) & Recording	Create after meeting
Safety	High (office)	Low (live traffic)
Access to data	Any time (portal)	Meeting only (marked)

CROSSING-I PORTAL DEMO (TIME PERMITTING)

The screenshot displays the 'Crossing-I' portal interface. At the top, there's a navigation bar with 'Home' and 'Log out' links. Below that, a welcome message reads 'Welcome, Demo user!'. The main content area is divided into two sections: a table on the left and a map on the right.

The table lists various crossings with columns for 'CROSSING', 'STREET', 'CITY', 'STATE', 'LAST UPD.', and 'OUTPUTS'. The data is as follows:

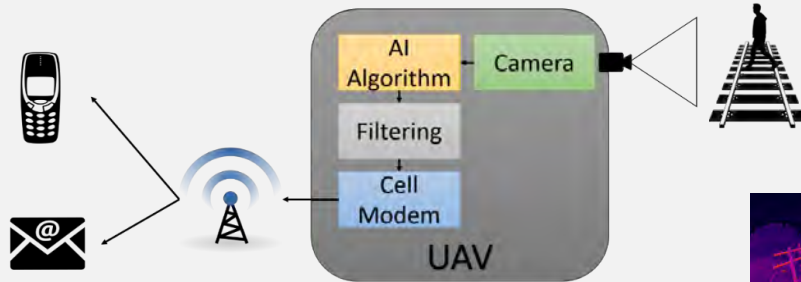
CROSSING	STREET	CITY	STATE	LAST UPD.	OUTPUTS
<input type="checkbox"/> + 0612361	Eklund Rd	BROOKSTON, MN	MN	2023-05-03	14
<input type="checkbox"/> + 0612378	Duluth Saint Vincent Rd	BROOKSTON, MN	MN	2023-05-03	17
<input type="checkbox"/> + 0764194	Pennings Dr	ASKOV, MN	MN	2023-04-30	6
<input type="checkbox"/> + 0764208	Mulling Rd	ASKOV, MN	MN	2023-04-30	9
<input type="checkbox"/> + 076421X	Root Rd	ASKOV, MN	MN	2023-04-30	10
<input type="checkbox"/> + 076422E	Starch Rd	BRUNO, MN	MN	2023-04-30	9
<input type="checkbox"/> + 0764260	Pine St	BRUNO, MN	MN	2023-04-30	10
<input type="checkbox"/> + 076420V	T 892	BRUNO, MN	MN	2023-04-30	5
<input type="checkbox"/> + 076437U	Erickson Rd	KERRICK, MN	MN	2023-04-30	15
<input type="checkbox"/> + 076438B	Old MN 23	KERRICK, MN	MN	2023-04-30	9
<input type="checkbox"/> + 076439H	Old Hay 23	KERRICK, MN	MN	2023-04-30	6
<input type="checkbox"/> + 076440C	1913	KERRICK, MN	MN	2023-04-30	6
<input type="checkbox"/> + 0764413	1914	KERRICK, MN	MN	2023-04-30	9
<input type="checkbox"/> + 082750K	442nd St	HARRO, MN	MN	2022-01-14	12
<input type="checkbox"/> + 163649L	BURNHAM AVENUE	BURNHAM, IL	IL	2022-01-17	5
<input type="checkbox"/> + 186113V	COUNTY RD V	HAWTHORNE, WI	WI	2022-02-15	11
<input type="checkbox"/> + 186115J	SAM ANDERSON RD	HAWTHORNE, WI	WI	2022-02-15	12
<input type="checkbox"/> + 186117X	BAYFIELD RD	HAWTHORNE, WI	WI	2022-02-28	15
<input type="checkbox"/> + 186118E	SAM ANDERSON RD	SOUTH WAUGE, WI	WI	2022-02-28	15

The map on the right shows a geographical view of the region, with orange dots indicating the locations of the crossings listed in the table. The map includes labels for major cities like Saint Paul, Minneapolis, Chicago, and Detroit, as well as bodies of water like Lake Superior and Lake Michigan. A scale bar at the bottom left of the map shows 100 km and 100 mi. The map interface also includes a 'Basemaps' dropdown menu and a 'Street View' icon.

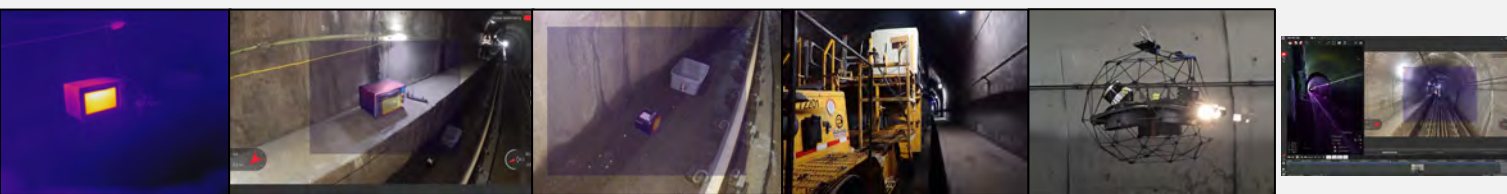
● <https://apps2.mtri.org/crossing-i/account>

RAILROAD ARTIFICIAL INTELLIGENCE INTRUDER LEARNING SYSTEM (RAILS)

- Drone-based automated detection of trespassers at sites of interest
- Detection can take place in real-time w/ onboard AI/ML detection algorithm
- System can automatically send email or text message to interested party
- Report on RAILS prototype available - FRA
- Next steps: demonstrate with tethered & longer-duration drones



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734-604-4196 (mobile)
with Eric Vega (PI)



PHASE III CROSSING-I SBIR: DATA COLLECTION RELATED TO THE STRUCTURAL INTEGRITY AND SAFETY OF TRANSIT TRACKS

- FTA funding through USDOT Volpe
- Demonstrating Flyability Elios 3
- Working with Enspect Engineering
- Demonstrating at Chicago Transit Authority tunnel
- Plans for TTC demo (ENSCO) in CO

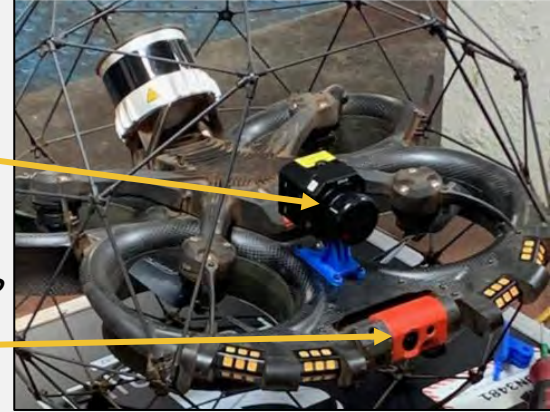


Thermal Data Comparison & Analysis

- Detection of thermal anomalies - equipment & people
 - Oven, space heater, researcher, and warm electrical infrastructure clearly visible
 - FLIR Vue Pro R (640x512 pixels) has much greater pixel resolution relative to Integrated FLIR Lepton 3.5 (160x120 pixels)
 - Focal Statistics use ful for automated

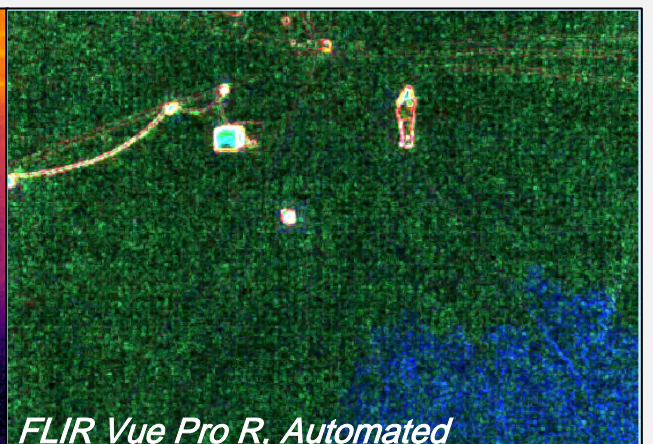
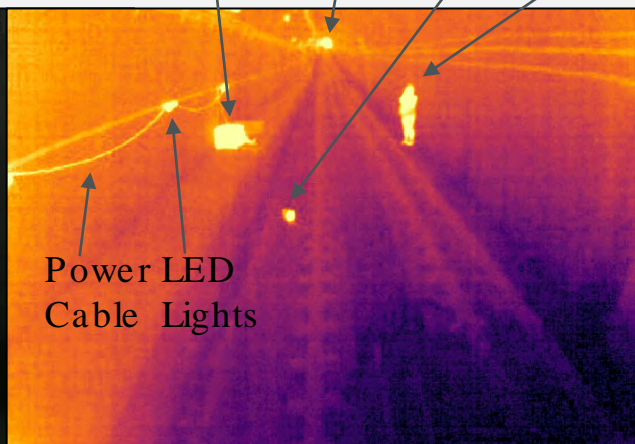
FLIR Vue Pro R (Payload)

Integrated FLIR Lepton 3.5 Thermal



Toaster Oven Tunnel Entrance Space Heater
Researcher

Power LED
Cable Lights



Elios 3 Integrated Thermal

FLIR Vue Pro R Thermal

FLIR Vue Pro R, Automated Standard Deviation Focal Statistics

An Integrated and Automated Decision Support System for Ground Hazard Risk Mitigation for Railways using Remote Sensing and Traditional Condition Monitoring Data

PIs: Thomas Oommen (now at OleMiss), Pasi Lautala, Colin Brooks

Program Manager: Hugh Thompson, FRA



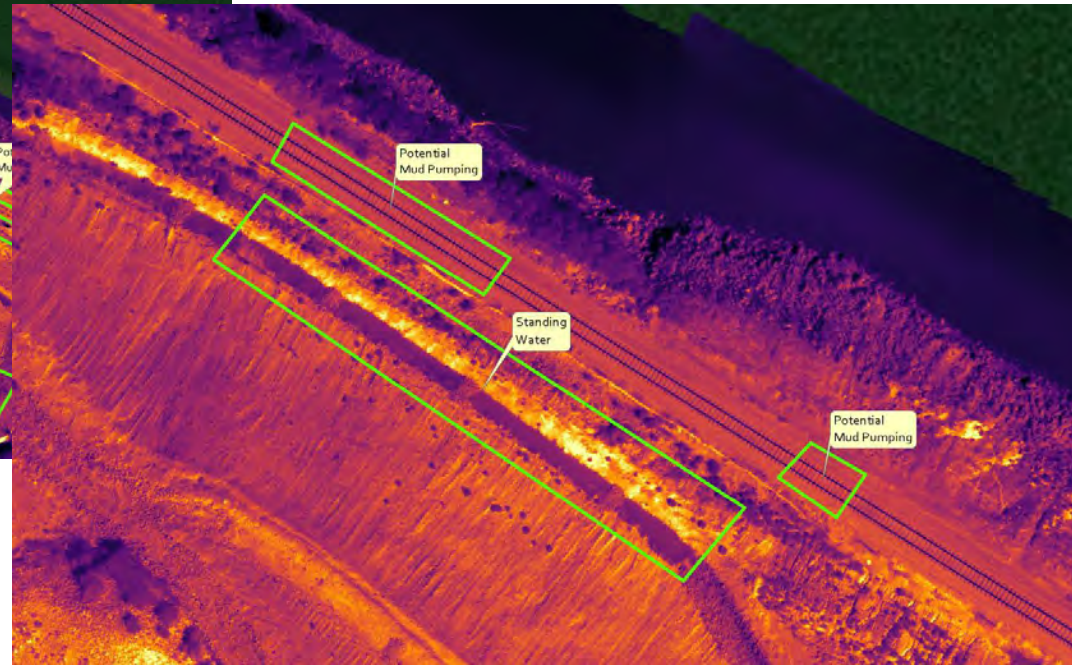
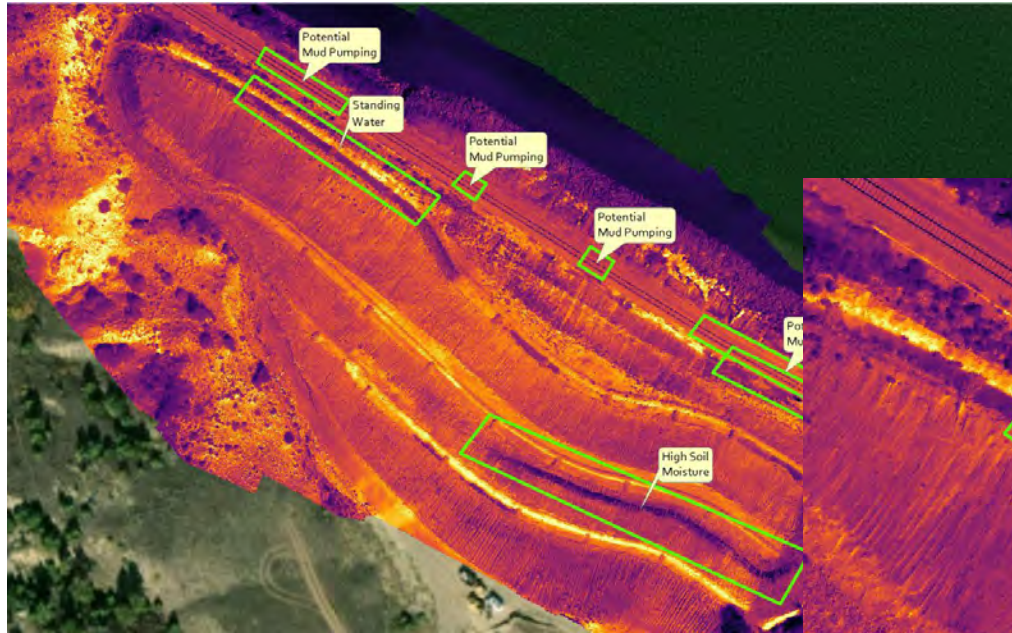
Rail Transportation Program
Michigan Tech Transportation Institute • Michigan Technological University



Michigan
Technological
University

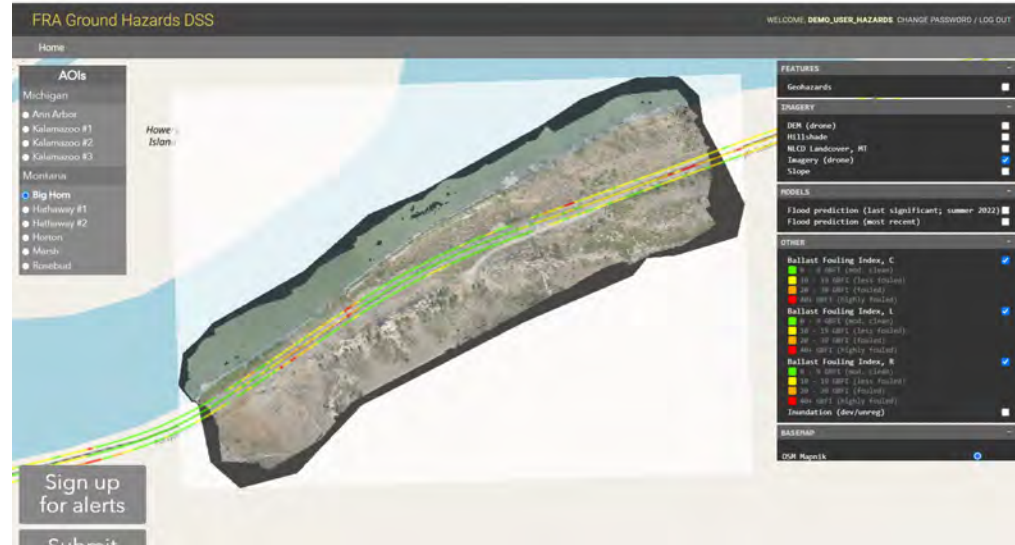


Analysis of Field Data Collected



Decision Support System

- The decision support system is being built for this project to provide a database structure to manage all the data acquisitions and serve as a platform for deploying all machine learning models.



Decision Support System

NEXT STEPS FOR DRONE-ENABLED RAIL GRADE CROSSING ASSESSMENT WITH CROSSING-I:

- Technology exists to assess all or nearly all crossings in the U.S. that might have low-ground clearance / humped problems – airborne (Crossing-i), complements train-mounted LiDAR systems as well (DOTX 218)
 - Crossing-i is useful for crossings that train-mounted LiDAR systems cannot easily be deployed at
 - Can be deployed at will unless near towered airports
- Technology is now available & ready for use
 - Currently for line-of-sight high resolution 3D assessment
 - Improved for 360° virtual crossing diagnostics, newest data for MN, OH, & MI
 - Can work with local drone data collection teams (rail companies, transportation agencies, drone services & engineering firms)
 - Able to create cost estimates for end-users

Crossing-i ready for commercial use

*Interested in working with engineering & drone firms as well
Colin Brooks, Ph.D.*

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734-604-4196 (m)

