The Chartered Institute of Logistics and Transport

Highway – Rail Crossing Safety

Presenters

Jeff Moller, FCILT, Association of American Railroads

Andrew Young, FCILT, US Chapter Chair

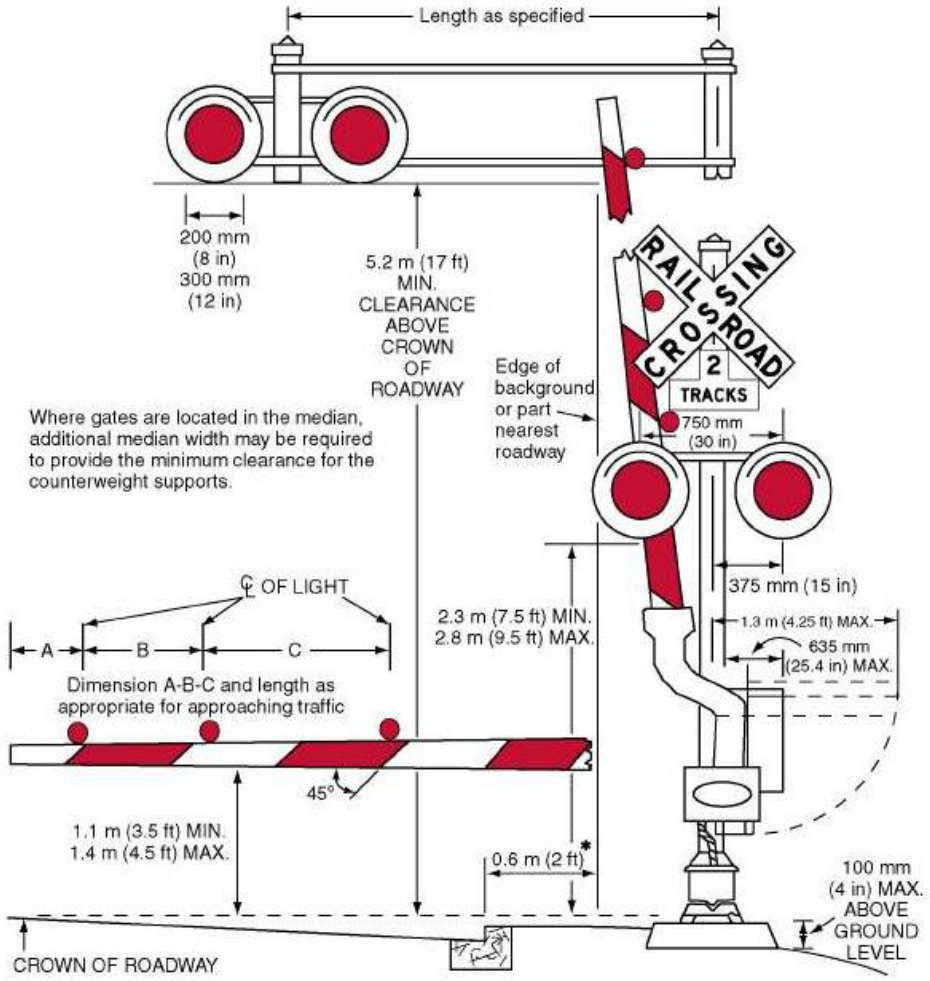
The Chartered Institute of Logistics and Transport

Agenda

- Railroad Safety and Grade Crossings
- Scale of the problem and the complexities
- Approaches to improve safety at grade crossings
  - New technologies (AI, Computer Vision)
  - Policy (FRA)
  - Community, Planning and Education
- Discussion

The Chartered Institute of Logistics and Transport

Highway-Railroad Grade Crossing

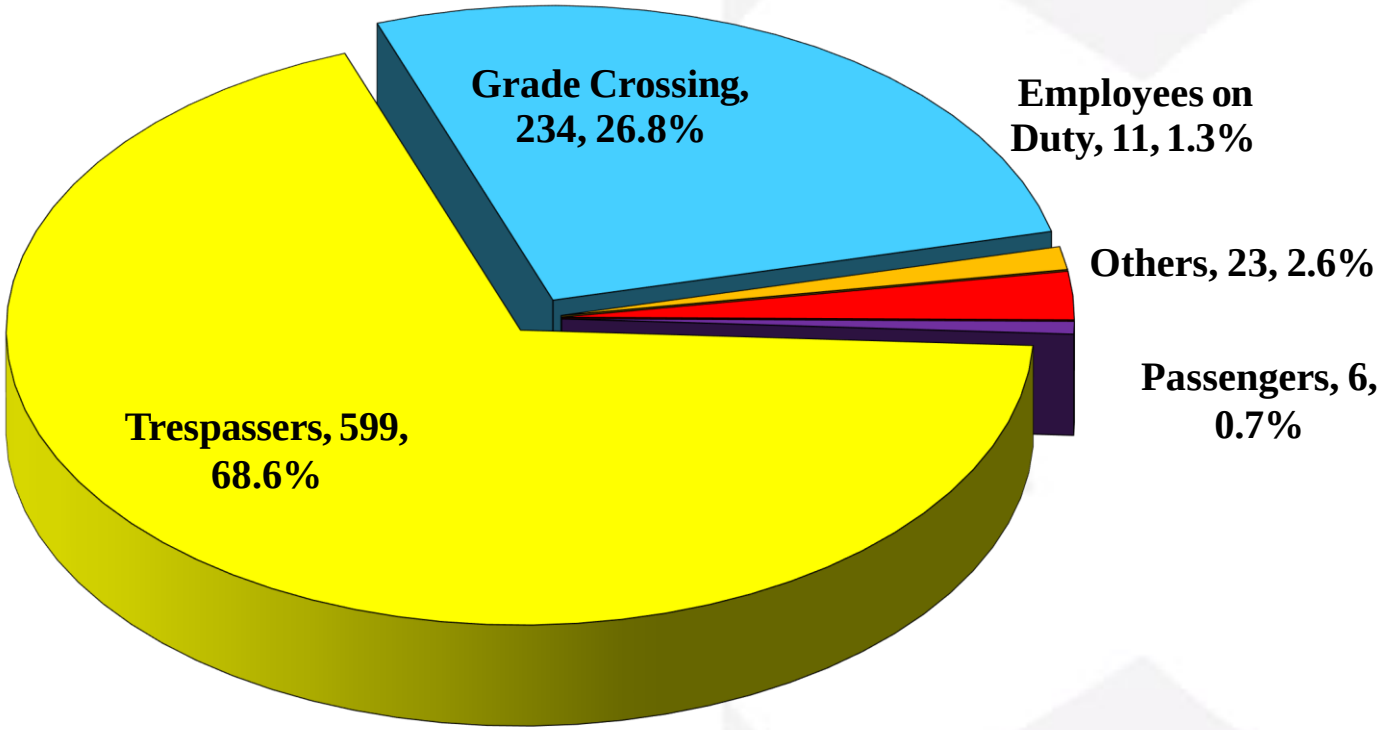


Images from US DOT and Railway Technology Magazine

The Chartered Institute of Logistics and Transport

Scale of the Problem

In 2021, over 95% of rail-related fatalities were grade crossing users or trespassers.

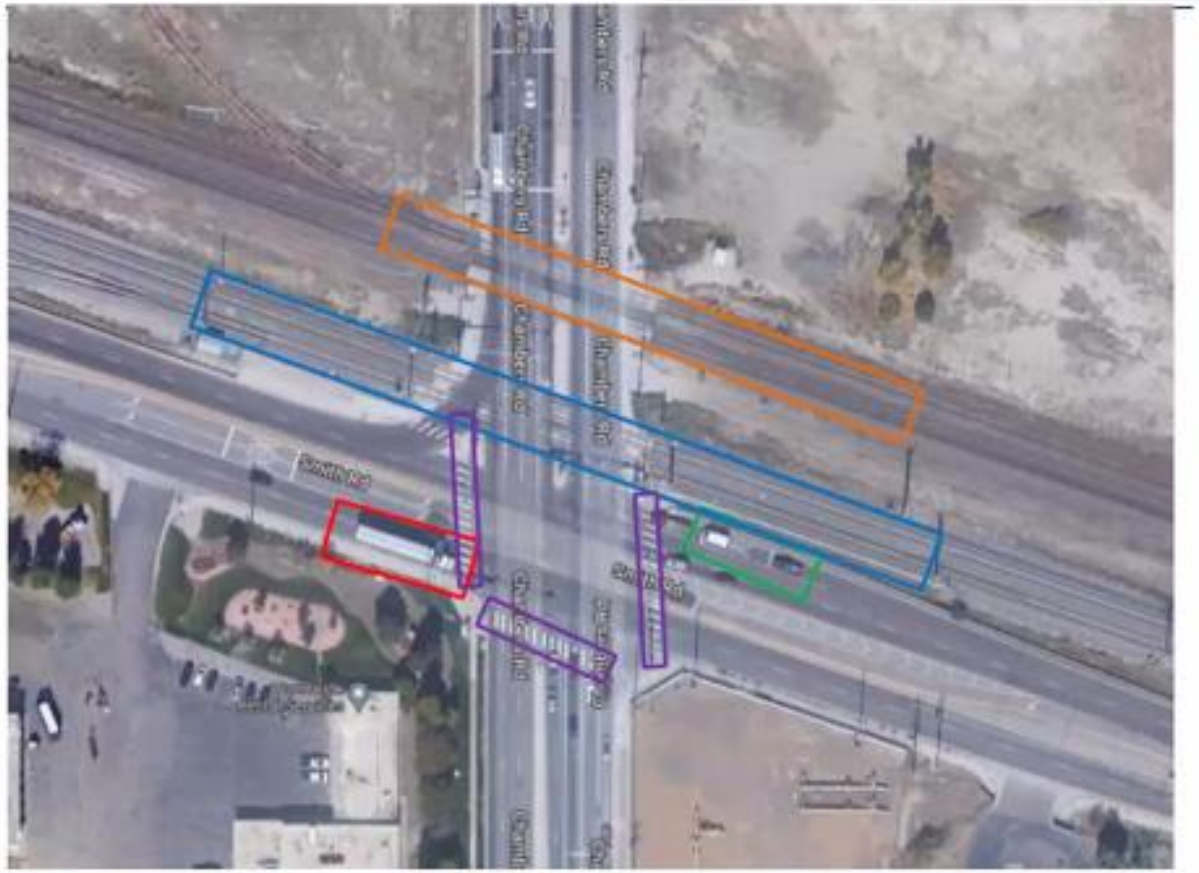


Source: FRA website (2021 data as of October 2022):
http://safetydata.fra.dot.gov/OfficeofSafety/publicsite/summary.aspx
Note: Data for 2021 are preliminary.

The Chartered Institute of Logistics and Transport

US - Each Mode's Independent Authority

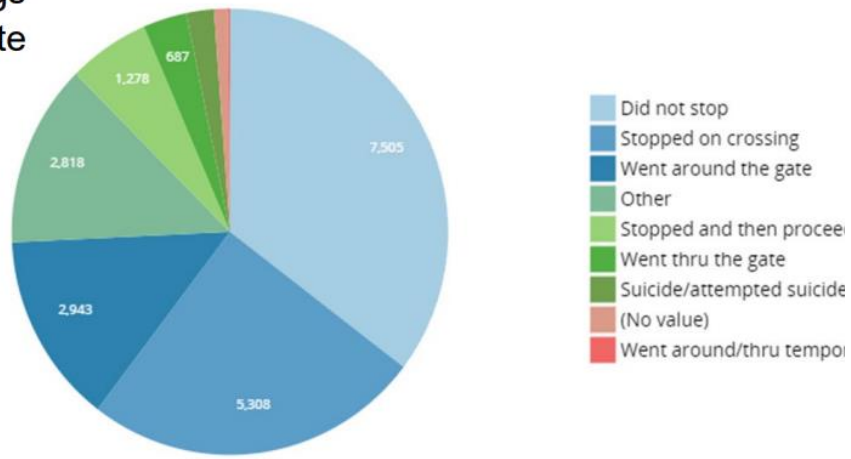
- FTA – Lite Rail
- FRA – Commuter Rail
- FMCSA – Trucking
- FHWA – Markings
- NHTSA – Vehicle Safety



The Chartered Institute of Logistics and Transport

How do Crashes Happen?

- **75% of all crashes**
  - Did not stop
  - Stopped on crossings
  - Went around the gate



Causes vs. Types of HRGC Warnings

- **Using the "hammer" solution of adding active warning devices, but….**
- **Active warning devices haven't eliminated crashes**
  - 40% of crashes at "Gates" locations
  - 55% of crash locations have active warning devices
- **Causes differ with Active vs. Passive Devices**
  - Did not Stop (Passive)
  - Went around, Stopped, Others (Active)
- **How are we responding?**
  - Another layer of warnings and detections (video/radar/li-dar)
  - *In-vehicle auditory alerts & Infrastructure -vehicle communication (RCVW)*
  - *Better understanding of risks (Crossing -i)*

Table 6. Distribution of HRI Incidents as a Function of Motorist Action and Warning Device, 2008–2017

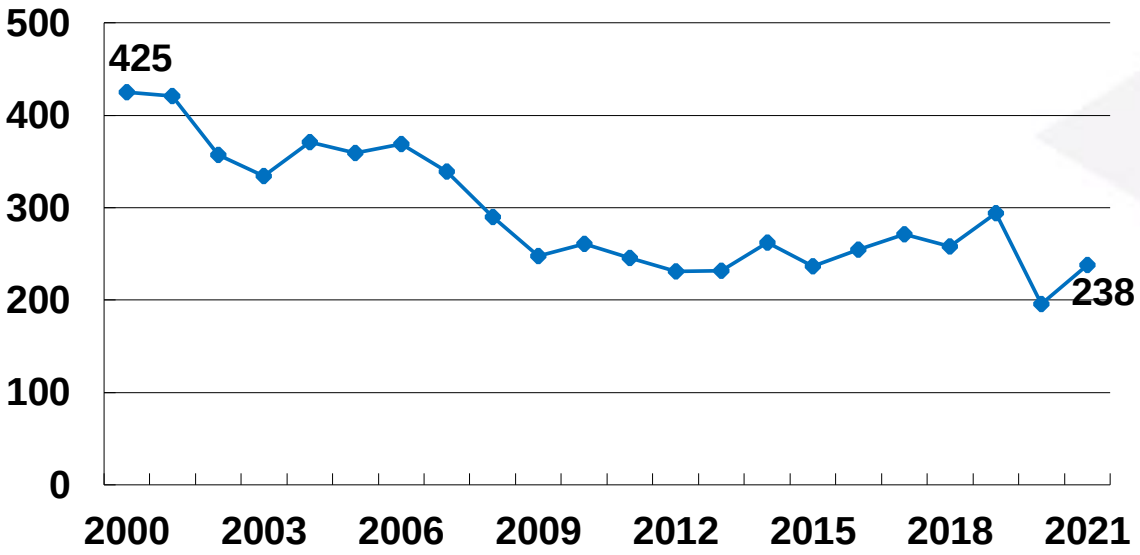
Warning Device	Motorist Action					
	Went Around/Thru Gates	Stopped and Proceeded	Did not Stop	Stopped on HRI	Other*	Totals
Gates	2,383	121	159	2,608	2,701	7,972
Active (FLS, WW, HTS, Bells)	0	311	1,980	606	77	2,974
Passive (CB, SS)	1	810	5,089	1,788	200	7,888
Other (Watchman, Crew)	0	22	97	36	7	162
Unknown	0	66	366	178	33	643
Totals	**2,384**	**1,330**	**7,691**	**5,216**	**3,018**	19,639

Pasi Lautala, PhD, PE , Associate Professor and Director ,Michigan Tech University

US Crossing Safety Data

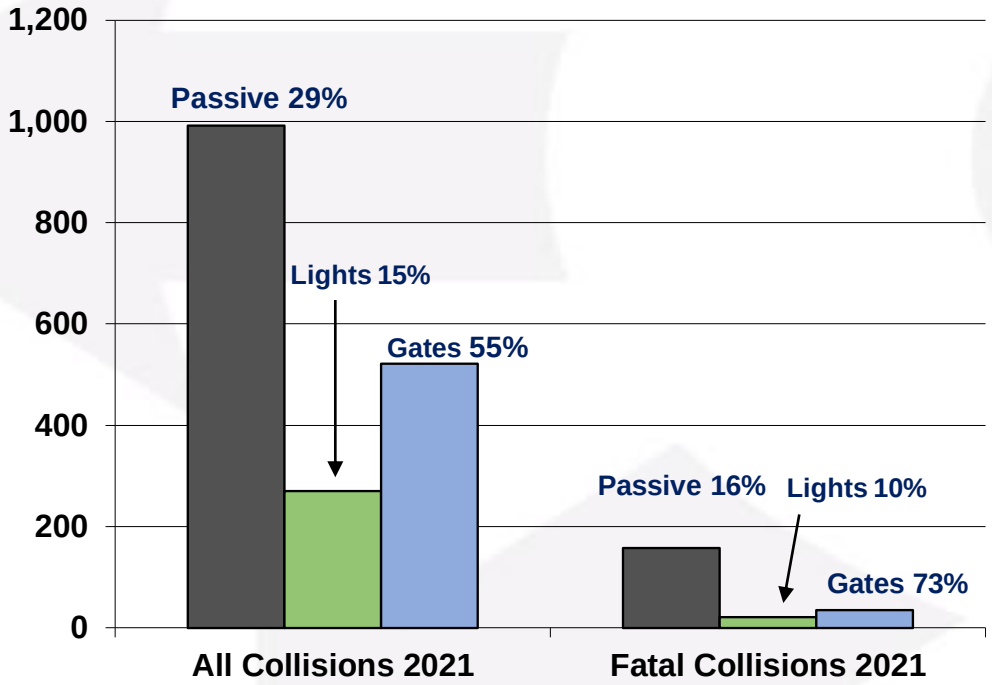
The Chartered Institute of Logistics and Transport

Grade crossing fatalities 44% lower
in 2021 than in 2020



Sources: http://safetydata.fra.dot.gov/officeofsafety/publicsite/summary.aspx
Note: Includes pedestrians, employees, passengers, and collisions at private crossings. Excludes documented suicides. Data for 2021 is preliminary, as of March 2022.

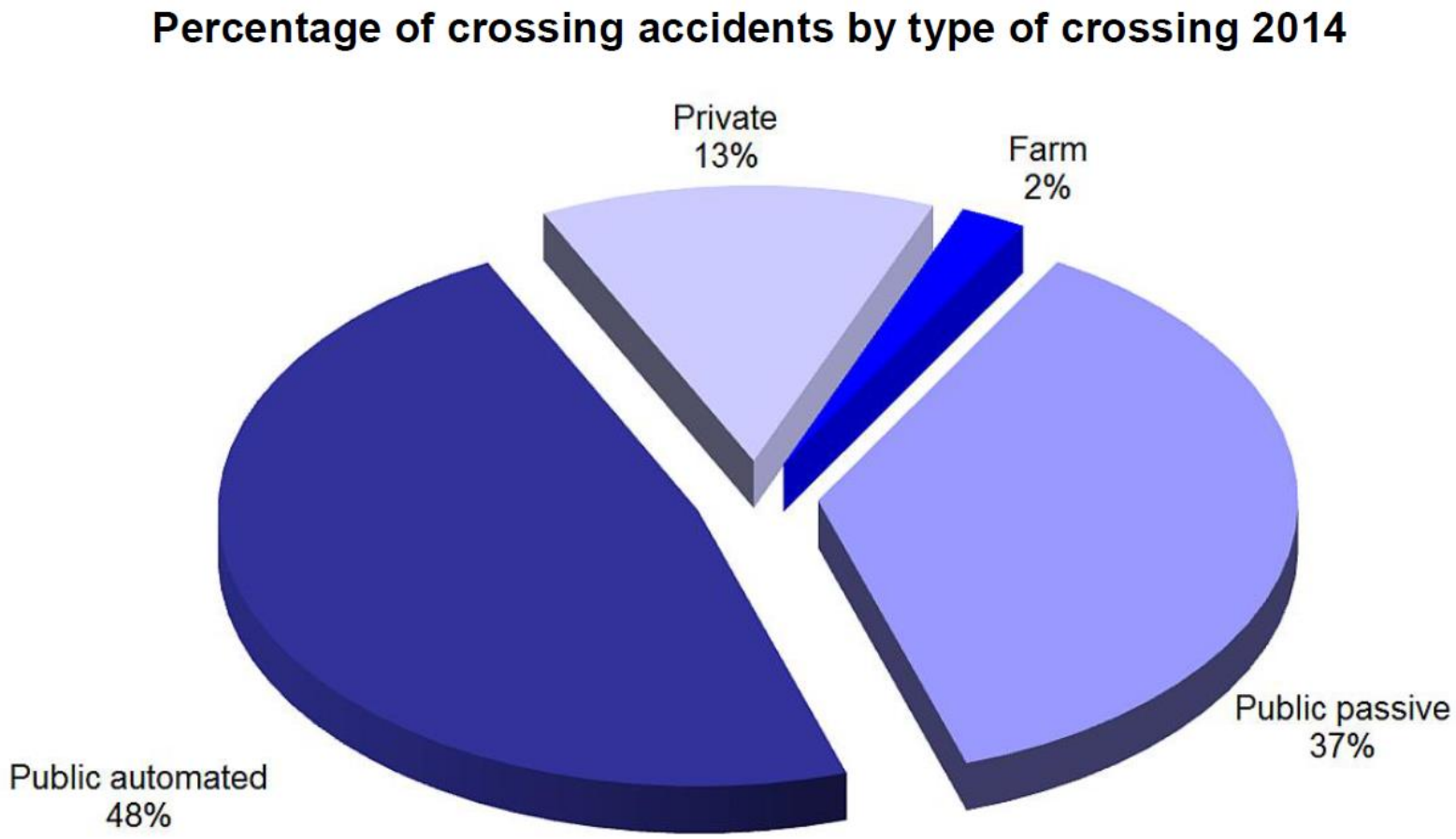
55% of all grade crossing collisions and 73% of all fatal grade crossing collisions
occurred at gated crossings in 2021



Sources: AAR Analysis of FRA Highway-Rail Crossing Incident Database as of March 2022. **Note**: All U.S. Railroads. All Collisions at Public Highway-Rail Crossings, including those with pedestrians. Percentages are rounded.

The Chartered Institute of Logistics and Transport

Similar pattern in Canada



The Chartered Institute of Logistics and Transport

AI/ML Technology to the rescue?

Problem

- **Lack of automated detection capability** for currently available video feeds, both from stationary cameras and locomotive cameras

Objectives

- To **develop Artificial Intelligence–detection algorithms** for automated crossing violation

Results

- **Research underway**; collaboration with NJDOT and Rutgers on pedestrian detection using grade crossing data from Ramsey, NJ

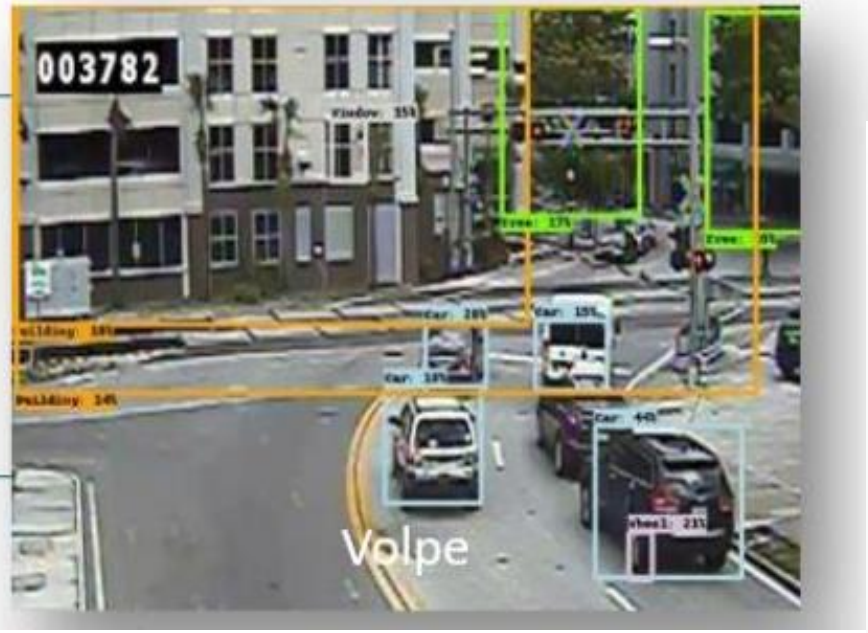
U.S. Department of Transportation
Federal Railroad Administration

U.S. Department of Transportation
Volpe Center

RUTGERS. UNIVERSITY FOUNDATION

Michigan Technological University

WI-TRONIX

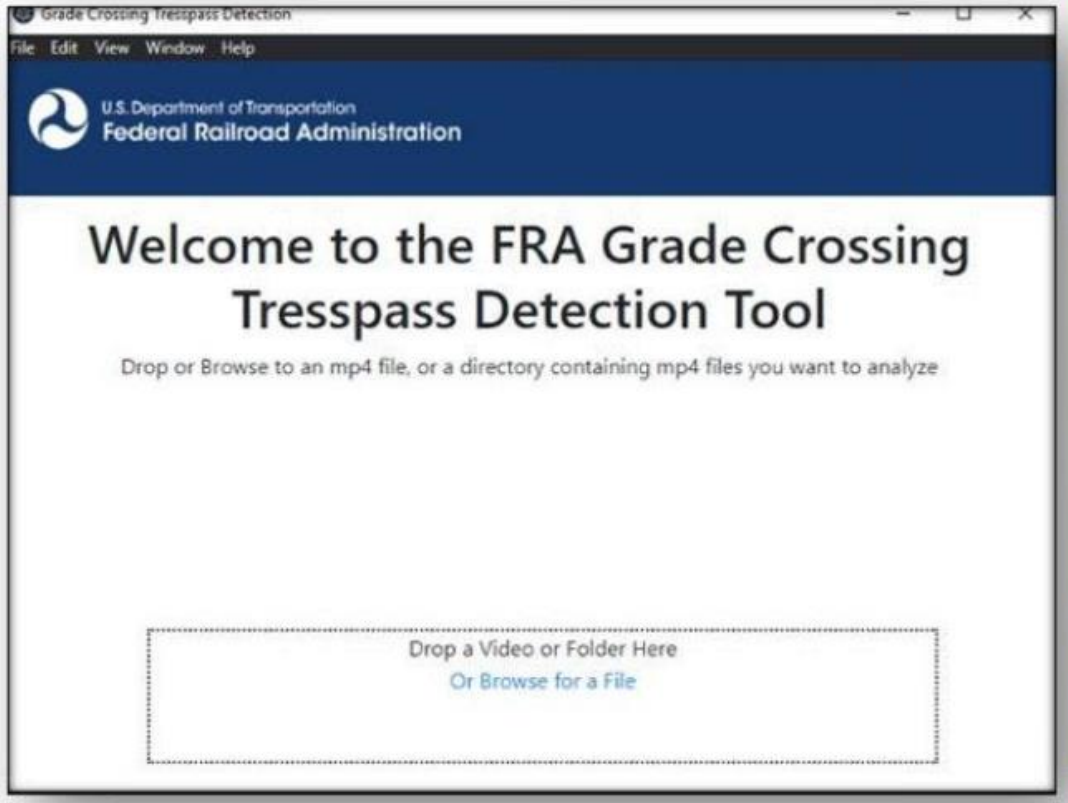

003782
Volpe

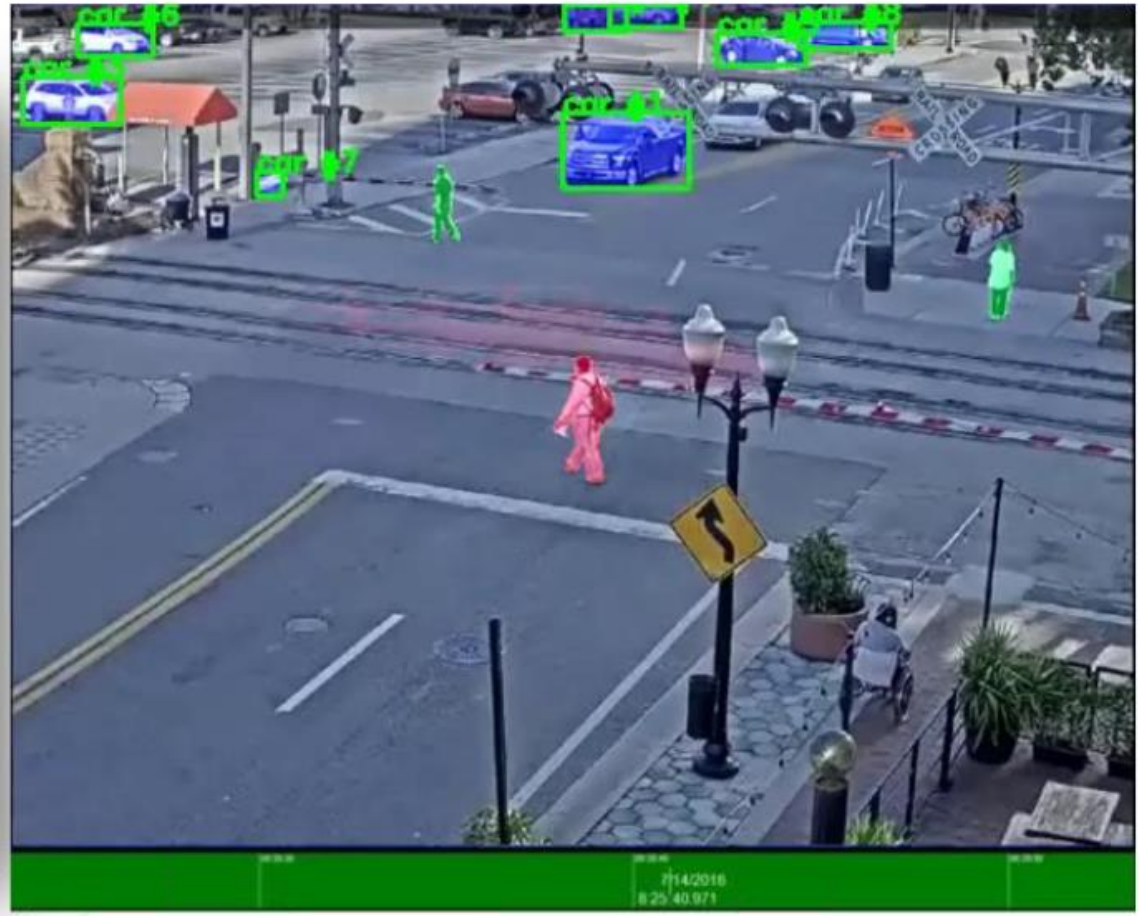

SW STREET
NW STREET
NW SIDEWALK
NW CORRIDOR
NE CORRIDOR
NE SIDEWALK
SW SIDEWALK
NW CROSSING
NE CROSSING
NE STREET
SW CROSSING
SE CROSSING
SE STREET
SW CORRIDOR
SE SIDEWALK
SE CORRIDOR
IP Cam

Volpe Computer Vision Tool

The Chartered Institute of Logistics and Transport

Computer Vision Tool





Heat maps for remedial action

The Chartered Institute of Logistics and Transport

Car

Day of Week	Hour of Day 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Grand Total
Monday	28	9	4	0	7	47	109	132	99	58	30	45	51	59	46	96	113	168	160	221	236	57	56	34	1,865
Tuesday	27	15	4	0	10	89	131	131	139	65	24	53	42	69	67	123	131	219	184	266	285	75	60	29	2,238
Wednesday	28	22	8	0	10	63	144	146	183	94	31	44	66	65	39	115	137	229	194	291	263	72	76	25	2,345
Thrusday	29	21	8	1	7	77	135	121	185	107	50	62	69	70	73	127	148	256	220	268	265	91	52	40	2,482
Friday	27	21	9	0	4	77	112	103	138	76	38	43	48	52	60	117	135	237	218	290	265	84	53	34	2,241
Saturday	37	39	10	0	2	16	41	76	77	26	48	19	35	61	49	19	92	84	106	109	80	32	93	40	1,191
Sunday	39	34	9	3	0	7	33	63	69	26	35	22	35	31	52	17	79	65	110	124	93	23	76	23	1,068
Grand Total	215	161	52	4	40	376	705	772	890	452	256	288	346	407	386	614	835	1,258	1,192	1,569	1,487	434	466	225	13,430

Ped

Day of Week	Hour of Day 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Grand Total
Monday	3	2	2	0	0	12	36	27	37	15	14	17	28	20	31	47	40	99	70	76	63	17	10	5	671
Tuesday	5	2	0	1	1	6	34	39	31	16	11	12	15	28	22	54	40	94	90	102	50	29	16	12	710
Wednesday	2	4	1	0	0	15	32	42	54	21	14	10	18	34	37	58	66	91	112	90	70	19	12	11	813
Thrusday	3	5	2	3	4	13	34	32	44	19	13	28	21	31	27	56	71	127	85	84	67	28	17	13	827
Friday	2	2	4	1	1	9	24	31	37	22	10	23	17	35	30	53	48	99	88	95	61	27	18	14	751
Saturday	6	10	2	0	0	0	2	16	22	8	20	3	19	21	34	9	43	32	36	39	25	6	35	19	407
Sunday	19	6	7	0	0	2	6	17	27	23	23	15	28	24	36	10	38	29	30	31	34	7	17	3	432
Grand Total	40	31	18	5	6	57	168	204	252	124	105	108	146	193	217	287	346	571	511	517	370	133	125	77	4,611

Truck

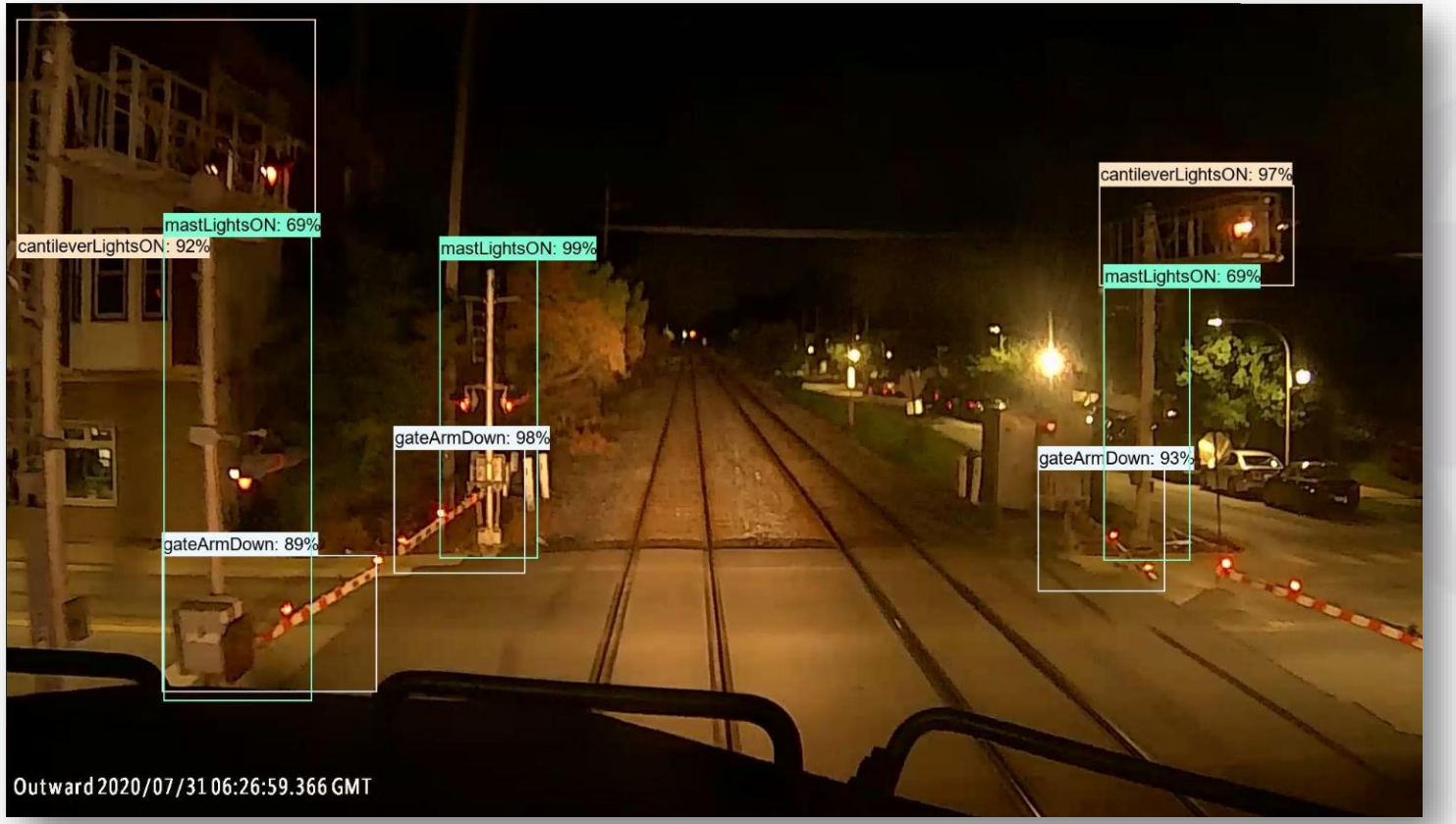
Day of Week	Hour of Day 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Grand Total
Monday	0	0	0	0	0	4	29	26	25	16	5	13	7	11	4	15	13	17	19	20	14	3	3	3	247
Tuesday	2	0	0	1	0	7	40	43	16	19	8	9	14	18	7	14	11	21	11	32	17	5	2	3	300
Wednesday	0	0	1	0	1	8	34	35	25	14	13	12	12	16	17	18	21	24	17	20	18	0	4	2	312
Thrusday	1	0	1	1	0	7	25	30	28	16	11	13	12	11	19	17	18	30	31	21	15	4	3	2	316
Friday	1	4	2	0	0	7	41	34	19	19	9	11	8	10	5	16	23	24	32	25	7	3	2	0	302
Saturday	1	1	0	0	0	5	13	29	13	13	17	3	13	9	14	1	17	8	3	8	1	0	1	0	170
Sunday	0	0	1	0	0	3	4	11	8	5	1	3	3	1	7	2	13	5	7	11	3	2	4	1	95
Grand Total	5	5	5	2	1	41	186	208	134	102	64	64	69	76	73	83	116	129	120	137	75	17	19	11	1,742

Class	Total Traffic	Total Grade Crossing Violations	Grade Crossing Violation Rate Per Thousand
Car	3,142,767	14,019	4.5
Person	545,703	5,065	9.3
Truck	485,040	2,033	4.2
Bicycle	56,318	285	5.1
Bus	3,102	5	1.6

RUTGERS® UNIVERSITY FOUNDATION

Crossing Equipment Failure Monitoring

The Chartered Institute of Logistics and Transport



U.S. Department of Transportation
Federal Railroad Administration

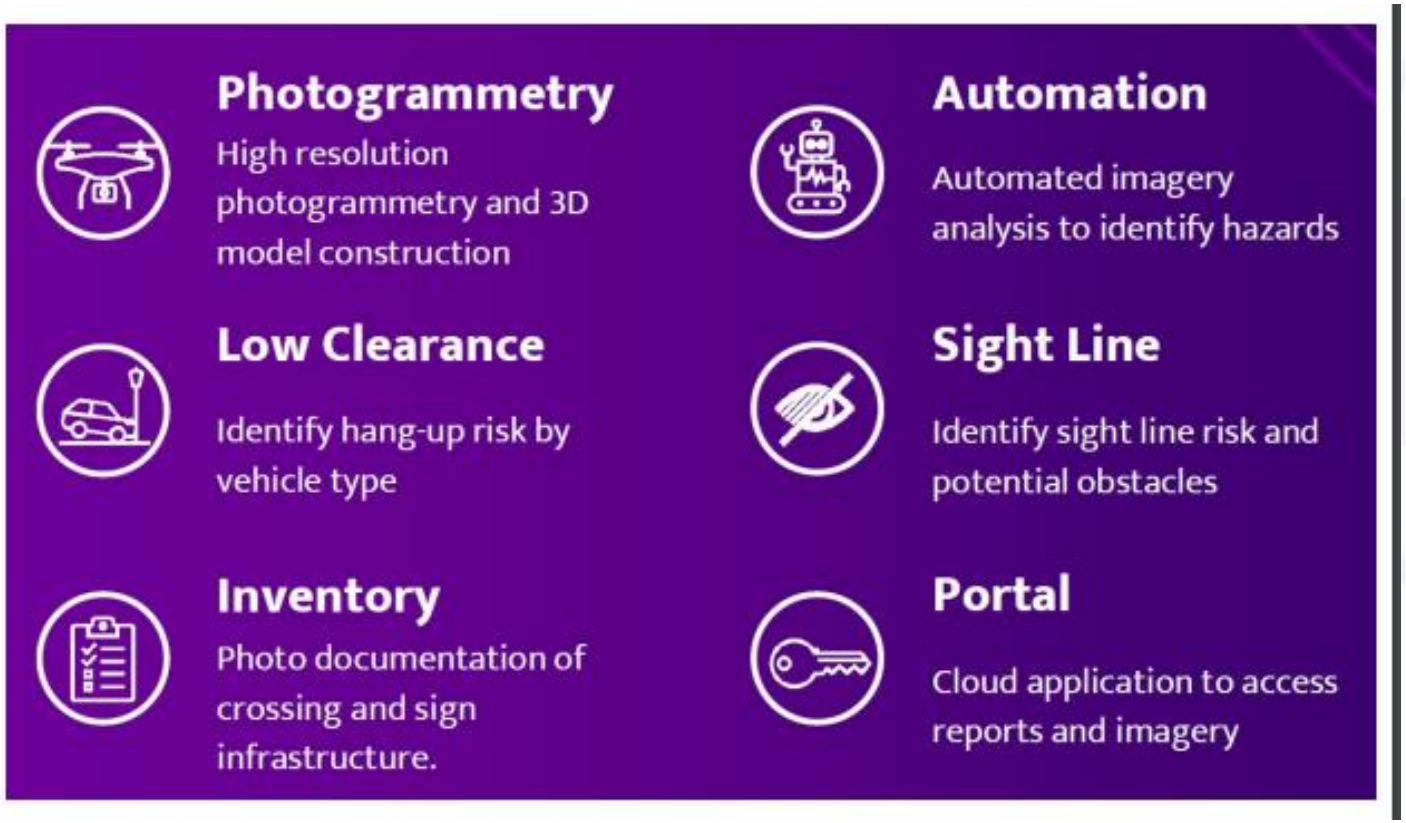
WI-TRONIX

Video: https://www.youtube.com/watch?v=r-ltr1so1h4

AI for Trespass Video:
https://www.youtube.com/watch?v=tykjSM_0Aes

Spatial risk identification

The Chartered Institute of Logistics and Transport



U.S. Department of Transportation
Federal Railroad Administration

Michigan Technological University

Technology is a new tool – not the remedy

Technology will assist in building more information on the classification of safety incidents, location, frequency, time of day and some causes.

BUT data will not generate results – it requires action

- Using heatmap and data to BETTER targeting of mitigating investments (fences, audible alerts, re-routed traffic routes)
- Education and Awareness campaigns (Operation LifeSaver etc)
- Better grade design – road and urban planning
- Policies at Federal, State and Local levels - Crossing Closure Programs (but practicalities and huge investment in time to get local community support)

The Chartered Institute of Logistics and Transport

Conclusions / Discussion

- Multi-faceted solutions
- Faster trains, quieter trains, longer trains= new dangers
- Other trespass – the next frontier to hit

QUESTIONS / COMMENTS