Independent oversight is the key to making transit safety the first priority.

The SW Baseline Road crossing in Beaverton, scene of four preventable deaths on Portland's MAX system.

My name is Chris Carvalho and I want to thank you for seeing me today. I'm here in support of this bill to create a TriMet Crash Advisory Committee. SB 1053

I've lived in Portland since 1981 and received an engineering degree from the University of California at Berkeley. I worked at Intel and Microsoft for 18 years in various capacities. I have a handicapped friend who uses MAX to get around and have accompanied him to stations on the system. We both have experienced dangerous situations that led me to look further into deaths on MAX. I started an investigation in August 2018 that continued until December that year. I looked at media accounts and reported fatalities through a public records request and researched how risks on the system impacted deaths and what could be done to reduce them. The conclusions were startling, and were published in the Portland Tribune on February 5th this year. (Exhibit 1)

Over the MAX system's 32-year history, 41 people have been killed in train collisions. The primary factor affecting non-passenger collision deaths on the MAX system is specific, highly unsafe locations. 37 percent of all fatalities happened at places where more than one death has occurred, and two locations, Gresham City Hall and the crossing of SW Baseline Rd. in Beaverton, are responsible for a fifth of all deaths. The east-west route shared by Blue and Red Line trains is the least safe segment of the system, chiefly due to being the busiest in terms of vehicle miles. It is responsible for 90.2% of all fatalities. Increased ridership appears to be the primary factor affecting the growth of fatalities over time, and efforts to improve safety are not bearing fruit. Secondarily, patterns in the nature of fatalities indicate operational and design changes throughout the system could reduce deaths by two thirds. The risk of death per vehicle or train mile for a pedestrian or cyclist by collision on the MAX system is 296 times higher than it is on a roadway around cars and trucks. Think about that for a minute. The system as it operates today is nearly 300 times more dangerous than city streets. That's inexcusable. Conclusions

from these findings indicate that new approaches are needed to address deaths, and could lead to a substantial reduction in the fatality rate with a minimum of cost.

Key Findings

Fatalities are continuing to increase, and are still happening at locations where recent safety upgrades have been installed. This indicates that upgrades are Band-Aid approaches and not best-practice improvements that have been demonstrated to increase safety on other cities' rail systems, such as in Boston, Pittsburgh, and Cleveland.

As we're seeing from the investigation into recent crashes of the Boeing 737 Max 8 aircraft, internal safety reviews can hide important information that has dire consequences for the operators, passengers, and families of those using transport. The truth about the jet's product design flaws and inadequate pilot training is only coming to light because independent oversight is finally happening.

TriMet says it cares about safety, yet it has knowingly withheld information from the public that can reduce injuries and deaths. Their history of interaction with the press, litigation with injured victims or families of people who were killed, and their internal culture exhibits a bias that the pedestrian is always at fault in a collision. They don't consider suicides to be a problem, even though a portion of them are preventable (Exhibit 5, Exhibit 6). Design and operational improvements to increase safety are ignored or delayed because compliance with industry standards is judged sufficient to satisfy its obligation to keep the public safe. Instead, standards compliance should be thought of as the bare minimum and a basis for more innovative efforts to deliver a safe system to the community. Only an independent review board such as the one in this bill can change the "business as usual" mentality that has failed to reduce death rates.

Funding for improved safety is not an issue. TriMet has always found money to expand the system, and since the Blue Line was built has raised 2.7 billion dollars to do it. The new lines carry only a quarter of total ridership, a poor return on this investment. With the vast majority of deaths happening on the Blue Line, the right priority is to first improve safety there and expand the system only after knowing how to do it in a safe manner. Otherwise, the cost of safety will balloon as more miles of unsafe track are built. In addition to the human cost of TriMet's poor attention to safety there's also a burden on taxpayers. In 2018 alone the agency's total of both industrial accident and public liability claims was $10.1 million (Exhibit 2). In Pittsburgh, a metro area with population comparable to that of Portland, their liability provision the same year was only $2.6 million, in a state where there's no cap on public liability damages (Exhibit 3).

One simple change that could reduce deaths is to stop trains at pedestrian crossings before they enter a station. Had this been done, in Ms. Sturdy's case her son would be alive today and another recent injury in Beaverton where Amy Laing's leg was severed wouldn't have happened.

Exhibits 7 and 8 show one of many locations where TriMet has known about a problem that causes injuries or deaths, yet continues to delay making changes that improve safety, cost little or nothing to do, and are easy to make. On August 6, 2018, a MAX train struck a teen crossing the tracks at the Merlo Road station in Beaverton. She was looking at her phone according to accounts, but that doesn't tell the entire story. TriMet had just finished making safety upgrades at the station. It knew that metal barriers called "swing gates" would force pedestrians to look both ways at crossings, but on the west side of the road they didn't install them. Worse still, when crossing gates for cars lower before a train's arrival or departure, the bells stop ringing after seven seconds. For an eastbound train arriving at the station, there is a full 26 seconds of silence before the train crosses the pedestrian's path on the west side of the road, and a hill limits visibility to the west where the train is coming from. The operation of the bells could easily be changed to sound them until the area is safe. There is no noise

abatement concern as it's not a residential area. TriMet's staff won't make changes not because they are costly; they do so because they are lazy and uncaring about human lives. Please review these videos and put yourself in the injured girl's situation. It didn't need to happen. It's simply negligent that known fixes aren't being implemented.

Findings from the safety review required in Senate Bill 829 have not been fully implemented in ten years. If it weren't for that bill and the results of my investigation, the public would still be in the dark about the unsafe conditions on MAX. I would hope that after hearing from Ms. Sturdy, Mr. Sale, and myself that you will consider going back to audit the work TriMet has done to be sure there is compliance with Senate Bill 829 because that does not appear to be the case. I have proposed a number of recommendations based on my investigation, included in your packet, which I hope the committee will consider.

Thank you very much for the opportunity to speak with you today. We can save many lives by giving safety on the MAX system the attention it deserves.

Recommendations

Two thirds of accidental deaths on MAX are preventable by implementing these recommendations, some of which are very inexpensive:

1. As mentioned above, stop trains at pedestrian crossings before entering stations, and then proceed into the station at a crawl.
2. Immediately decrease train speed limits at all sites with multiple fatalities until other safety improvements can be implemented.
3. Because the most significant relationship to fatalities is curved track, straighten curves or move curved segments underground.
4. Add more crossing gates, especially at sites with elevated fatality risk such as at angled or complex intersections.
5. Provide flashing lights and audible warnings at all pedestrian crossings that sound continuously until a train passes.
6. Evaluate signals that warn pedestrians of the direction of approaching trains to reduce the chance of an error in judgment or distraction making a person unaware of trains, especially when they are approaching from both directions.
7. Improve visibility by rerouting angled crossings and removing trees or other obstructions.
8. Begin a program of gradually moving tracks underground, elevating them, or building road underpasses or overpasses, starting at dangerous locations such as angled crossings or intersections.
9. Give Blue Line tracks highest priority for safety upgrades, with the Baseline Road crossing and Gresham City Hall station as the most critical locations.
10. Because of the strong historical correlation between ridership and fatality rate, efforts to improve safety should focus on the busiest sites and stations after places with multiple fatalities have been addressed.
11. Educate the public that train crossings are 300 times more dangerous than crossing in automobile traffic. Pedestrians, cyclists, and drivers have a false sense of security and a lack of appropriate caution around MAX stations and tracks because it's widely perceived that trains are less likely to cause deaths than cars.
12. Explore ways to limit access to restricted right-of-way including better fencing, tunneling, and motion-triggered cameras to detect trespassers.
13. Locate platforms so incoming trains are not braking from cruise speed while passing through intersections with pedestrian crossings.

14. Add pedestrian crossing request signals at dangerous intersections or track crossings such as those along East Burnside that require train and/or car traffic to stop, and warn pedestrians if a train cannot stop safely in time. These are in use at the Tuality Hospital/SE 8th Ave. MAX Station in Hillsboro. People with handicaps depend on MAX and are everywhere on the system. It's not enough to accommodate them only at a hospital stop.
15. Highway noise can make it difficult for people to hear approaching trains. Place signal lights and audible signals along the I-84 track stretch to warn people on the tracks that a train is approaching.
16. At locations such as SE 193rd & Burnside where lack of a road shoulder eliminates safe space between the road and trackway, realign streets to create a pedestrian safety zone or move track underground.
17. Look at the time of day for fatalities to find out if the sun's position, weather, or inadequate lighting could be a factor.
18. Three systems in other states have fatality rates well under half that of MAX. Practices and design at these should be examined to learn if they can be adopted in Portland.
19. If weather conditions, lighting, or sun position is found to be a factor on particular track segments, consider adding precautionary train stops or lowered speeds at the times of year and of the day when they are needed. These could be programmed into automatic signaling and speed control so delays in service only happen when risk is highest. Upgrade night lighting if needed.
20. Track blood alcohol involvement for pedestrian and cyclist deaths to determine if it is a significant factor. If found to be true, encourage intoxicated riders to take a bus, taxi, or rideshare service or travel with a sober person.
21. Improve messaging about suicide prevention through public service announcements, signage, and advertising on trains and at stations offering help for people considering using the train system as a means of suicide.
22. Implement provisions of the US Department of Transportation's rail suicide prevention initiative: https://www.volpe.dot.gov/rail-suicide-prevention
23. Provide safety materials to the public through multiple avenues (ticket apps, online, printed brochures, broadcast advertising, etc.) that educate riders and anyone near tracks or stations about risks and how to reduce them. The TriMet website only has materials for schools, and links to another nationwide site (Operation Lifesaver, https://oli.org/) which isn't tailored to specific risks on MAX. Place safety messages on the sides of trains and buses.
24. MAX has several different train types. Accident frequency by train type should be examined to see if operator visibility, braking performance, or other factors might affect fatalities. If differences are found, train types with issues should be modified or retired.
25. Investigate enclosing stations to protect them from weather and make platforms safer by keeping them warm and dry, with interior design standards. Look at using sliding glass doors at platforms to keep passengers off of the tracks and away from trains, except when the train's doors are open for boarding. The protective doors are increasingly common overseas in cities such as London, Paris and Tokyo. They are also in trial use at AirTrain stops in Queens and New Jersey. The Las Vegas monorail is the only system using them in the USA currently.
26. Add pedestrian bridges crossing I-84 to reduce trespassing on tracks. Look into the reasons why people are on that track segment in more detail. Are they homeless campers? Are they using Union Pacific railcars as hobos? Are they local residents taking a shortcut?
27. Pay special attention to known risks on the Blue Line and apply lessons learned to the proposed Barbur Blvd. line, which is planned to run down the middle of the street in a dangerous configuration.

28. Design ticketing apps so they do not need any user intervention to ride the system, reducing the chance that riders will be distracted around stations.
29. Look at placing bus and rail transit in Portland's metro area under the Port of Portland, similar to what Pittsburgh does, or under the state's transportation department, as is done in Boston. These bodies have a focus on transportation and safety, and might provide an environment more conducive to safety as a priority.
30. The law that created TriMet (Chapter 267 — Mass Transit Districts; Transportation Districts) has some troublesome provisions such as ORS 267.245 (District exempt from right of way fencing requirements) and ORS 267.230 (Exemption from public utility or railroad regulation). These give the agency wide latitude to ignore or overlook industry safety best practices. The law and its provisions should be reviewed to determine if changes can be made to improve safety in mass transit districts.
31. Provide audible warning signals at all pedestrian crossings that sound continuously when a train is approaching from either direction, stopping only when it's safe to cross. If noise abatement is a concern, use flashing lights at night and an audible warning with lights during the day. Look at alternative warning approaches for night such as lighted strips in the pavement that flash when a train is near along with vibration that provides tactile feedback to feet, wheelchairs, or bicycles.
32. Report safety statistics for the WES system as a separate heavy-rail system to the National Transit Database. This will provide a more accurate interpretation of safety for both MAX and WES.
33. Because lawsuits are a form of independent review, audit all judgments against TriMet for findings that indicate safety failures and possible improvements.

Exhibits

TriMet must reduce MAX collision deaths

MYVIEW

By Chris Carvalho

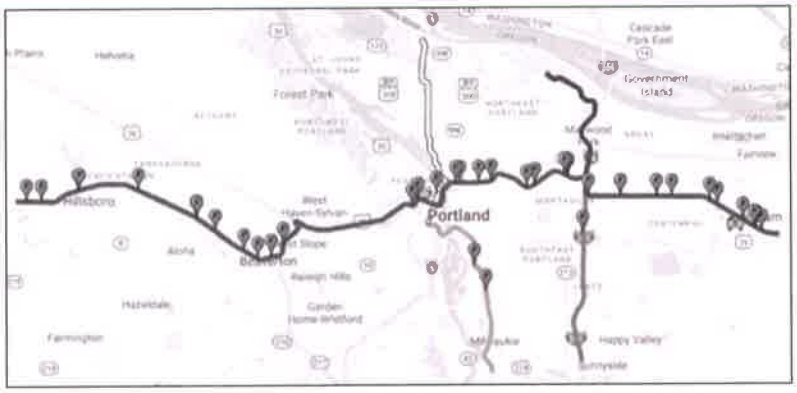
In early morning darkness on Dec. 20, a man died on the MAX tracks in Hillsboro near Northwest Cornelius Pass Road. It was the 41st death in the system's history. It might seem easy to overlook, but it fits in perfectly with TriMet's history of collision deaths.

CARVALHO

A review of these deaths shows most happen at a few highly unsafe locations. Thirty-seven percent of all fatalities happened at just five places where more than one death has occurred. Two locations — Gresham City Hall and the crossing of Southwest Baseline Road in Beaverton — are responsible for a fifth of all deaths.

The east-west route shared by Blue and Red Line trains, where the most recent death happened, is the most dangerous segment, by far. It's responsible for 90 percent of all nonpassenger fatalities.

Having spent a lot of time helping a wheelchair-bound friend navigate MAX and hearing his stories about close calls, I started to pay more attention to pedestrian deaths.



A map provided by Chris Carvalho showing the location of fatalities along the MAX lines since the first one opened 42 years ago.

The more I read about them in media accounts, the more similarities emerged. That led me to request records from TriMet about deaths from train collisions with people.

An inkling of suspicion turned into a three-month investigation, as my research revealed layer after layer of dangers underlying fatal crashes with pedestrians, and startling trends of similar problems nationwide. I quickly learned the public has a false sense of security and a lack of appropriate caution around MAX tracks.

Fatalities have quadrupled since the system's early years, and efforts to improve safety are not bearing fruit. Patterns indicate simple operational and design changes could reduce them by two-thirds. Nothing indicates train operators play a role in accident trends.

While we tend to think Portland's roads are unsafe compared to MAX, quite the opposite is true. The risk of death by collision per vehicle-mile for a pedestrian or cyclist on MAX tracks is nearly 300 times higher than it is on a roadway around cars and trucks.

TriMet officials haven't done enough to inform the public of how dangerous their tracks are. This safety problem is not limited to MAX; it is a nationwide one. Those who depend on the system the most, including the elderly, disabled and students, unfortunately, are in the most danger.

While transit officials are proud of MAX, its safety record is nothing to brag about. Out of 24 systems in U.S. cities with more than 5 million train-miles from 2002 through 2017, MAX has a fatality rate that's in the middle of the pack, ranking 11th in terms of safety. Pittsburgh's system has a fatality rate that's one-third that of ours. We can do better.

An inexpensive and highly effective solution is to have trains come to a stop before pedestrian crossings next to stations, then enter the station at a crawl. This one change would eliminate all deaths at stations where people cross the tracks, a 30 percent reduction.

At places with multiple fatalities away from stations, tracks could be moved underground or realigned. Other changes such as adding crossing gates, speed reduction and simplifying intersections near stations also can make the system safer.

We shouldn't call these deaths accidents; they're a failure of priorities. Before spending $2.7 billion on the Barbur Boulevard MAX extension, we should improve safety on the Blue Line route, which carries 73 percent of system traffic.

There's no excuse not to when we already know how to reduce deaths. By the time the new line is completed in 2027, 18 more people likely will be dead if nothing is done. That's an unacceptable price to pay.

Chris Carvalho is a photographer and chemical engineer who lives in Aloha. Contact him at 503 329-3916 or chris@lensjoy.com; You can find a link to his research in the online version of this column.

Exhibit 1. February 5, 2019 Portland Tribune editorial. The newspaper provided the map caption and gave an incorrect figure for the opening of the system. It should be 32 years ago.

Changes in the District's public liability and industrial accident claims liabilities (reported in **other liabilities** on the Statement of Net Position) are as follows for the years ended June 30, 2018 and 2017:

	2018		2017	
	Industrial accident claims	Public liability	Industrial accident claims	Public liability
Liability at beginning of year	$ 5,942	$ 4,189	$ 6,573	$ 4,496
Current year claims	2,370	115	2,091	617
Changes in estimates for claims of prior periods	427	1,690	622	321
Payments of claims	(3,208)	(1,864)	(3,344)	(1,245)
Liability at end of year	$ 5,531	$ 4,130	$ 5,942	$ 4,189

Based on historical experience, the District has classified $3,324 and $3,670 of the industrial accident and public liability claims liabilities as current liabilities, at June 30, 2018 and 2017, respectively.

Page 38

Exhibit 2. Liability costs (in thousands) from TriMet's 2018 financial report, https://trimet.org/pdfs/publications/2018-audited-financial-report.pdf

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COMPARATIVE SUMMARY OF REVENUES AND EXPENSES
(Unaudited)

	Month of June 2018			12 Month Year-to-Date		
	Budget	Actual	Variance	Budget	Actual	Variance
REVENUE :						
Passenger revenue -						
Bus, Light Rail & Incline Plane	$7,492,086	$7,481,904	($10,182)	$85,710,366	$90,488,477	$4,778,111
ACCESS program service	1,051,351	962,494	($88,857)	12,455,600	11,797,308	($658,292)
Advertising	220,834	145,584	($75,250)	2,650,000	2,822,827	$172,827
Interest income	49,000	134,515	$85,515	588,000	1,067,127	$479,127
Other income	40,851	23,239	($17,612)	490,161	748,067	$257,906
Total Operating Income	$8,854,122	$8,747,736	($106,386)	$101,894,127	$106,923,806	$5,029,679
EXPENSE :						
Wages & salaries	$14,439,857	$14,809,509	($369,652)	$159,523,564	$158,838,686	$684,878
Employee benefits	13,214,639	12,519,276	$695,363	154,126,603	148,493,092	$5,633,511
Materials & supplies	3,408,719	4,247,507	($838,788)	41,218,159	41,357,117	($138,958)
Provision for injuries & damages	$362,998	227,830	$134,998	4,654,000	2,608,950	$2,045,050
Purchased services	1,104,907	1,121,425	($16,518)	13,406,261	10,275,435	$3,130,826
Utilities	659,285	544,442	$114,843	8,515,676	7,228,995	$1,286,681
Other expense	731,897	832,771	($100,874)	9,275,783	7,473,939	$1,801,844
Interest	0	0	$0	0	0	$0
ACCESS program service	2,422,138	2,202,923	$219,215	29,065,700	27,230,401	$1,835,299
Total Expense	$36,344,280	$36,505,693	($161,413)	$419,785,746	$403,506,615	$16,279,131
Deficit before Subsidy	($27,490,158)	($27,757,957)	($267,799)	($317,891,619)	($296,582,809)	$21,308,810

Exhibit 3. Pittsburgh transit financial report shows $2.6 million liability cost in 2018:
http://www.portauthority.org/paac/Portals/0/2018budget/MonthlyIncomeStatementJune2018.pdf

The following letter was sent to Bruce Warner, the TriMet board member in my district. I never received a response. The data in the enclosed chart showed a pedestrian fatality rate that was 25 times worse for trains than for automobile collisions, a preliminary result that was later corrected to 296 times worse once my research included a more thorough examination of data. The original data used to prepare the enclosed chart was based on all urban motor vehicle deaths, including vehicle occupants. Pedestrian & bike fatalities are approximately 1/5 of total motor vehicle involved deaths. This error was corrected in my analysis published by the Portland Tribune.

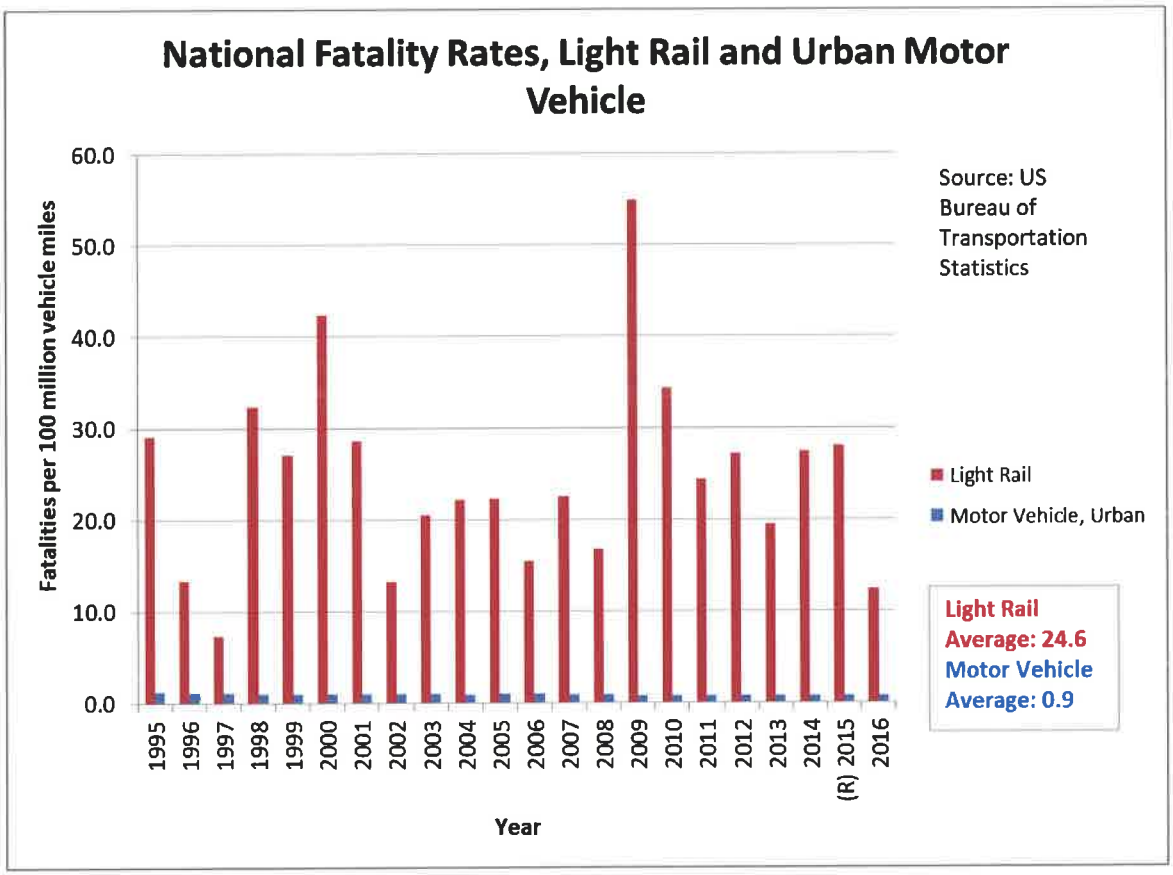
Exhibit 4. Letter to Bruce Warner, TriMet board member, outlining severity of fatality risk.

17717 SW Washington Dr.
Aloha, OR 97078
August 12, 2018

Mr. Bruce Warner
Tri-Met Board of Directors
1800 SW 1st Ave #300
Portland, OR 97201

Dear Mr. Warner:

On August 6, a teen was struck by a MAX train at Merlo Road. Earlier this year, there was a fatal train collision with a pedestrian at a marked crossing in Beaverton. Tri-Met doesn't publicly track MAX fatalities, but some data from the US Bureau of Transportation Statistics indicate that per vehicle mile, light rail nationwide has a fatality rate 25 times that of motor vehicles in urban areas. That's unacceptable for a system designed by engineers and run by professionals. Would we tolerate that from airlines?



There is a simple solution to these injuries and deaths. Trains should stop before entering the station at pedestrian crossings, and then proceed into the station at a crawl. This step would eliminate all injuries and deaths at these locations. It would add travel time, but the tradeoff would be worth it. Drivers on our roads have to stop for pedestrians; the same should be true for passenger trains at stations, where most of these incidents happen.

It might even be possible to make some improvements to tracks to allow trains to operate at higher speeds between stations, cancelling out any delay from stopping before entering the station.

Light rail isn't equivalent to freight trains. Light rail trains are smaller, carry passengers, stop frequently, and operate in close proximity to pedestrians, handicapped people, the elderly, and cyclists. The operator is responsible for the lives of both passengers and people near the tracks. The intention of light rail is to safely transport passengers. Right now, MAX is failing horribly in meeting this goal. The rules for operating light rail need to reflect these critical differences. While personal responsibility is certainly a factor in some deaths, it's not always the case. We also know that young people, the elderly, and the handicapped depend on transit yet are less able to be watchful around trains due to sensory and cognitive differences that are no fault of their own. They shouldn't be at risk of death as a consequence. In a region with a Vision Zero campaign to eliminate pedestrian deaths, light rail is not exempt. It's time to put in place a common-sense solution to stop deaths on the MAX system that are entirely preventable.

Sincerely,

Chris Carvalho

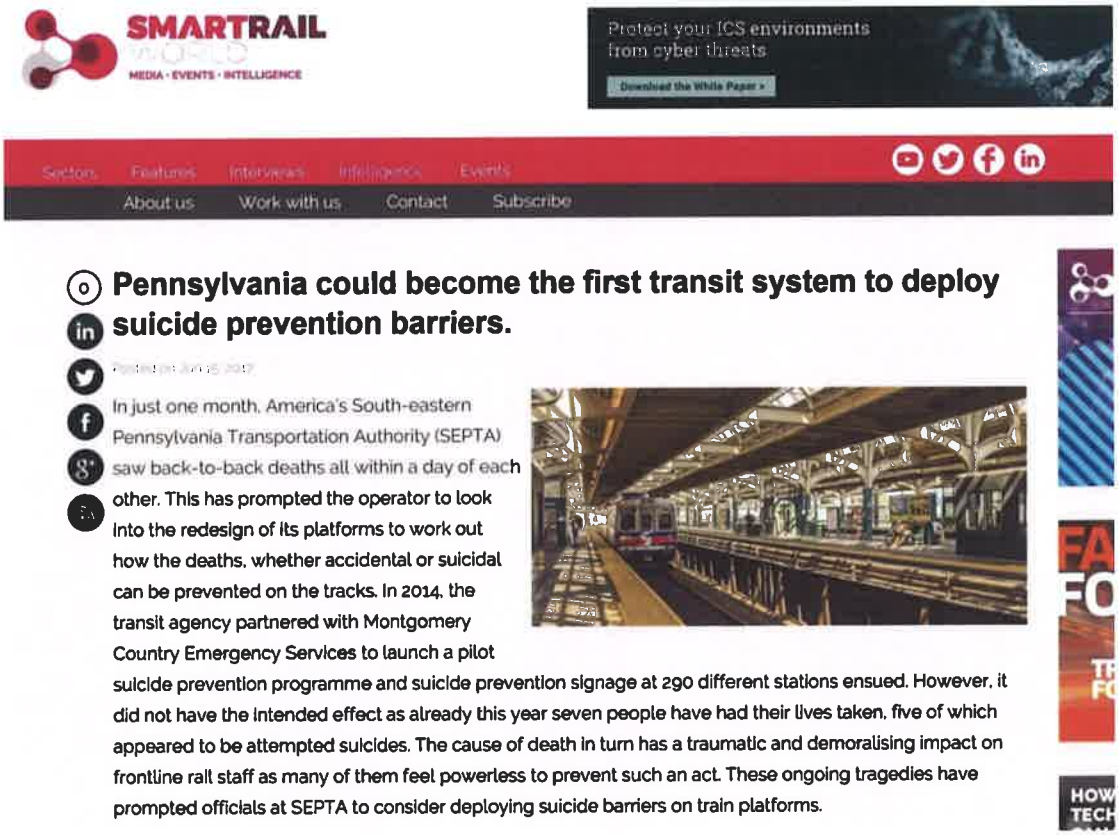
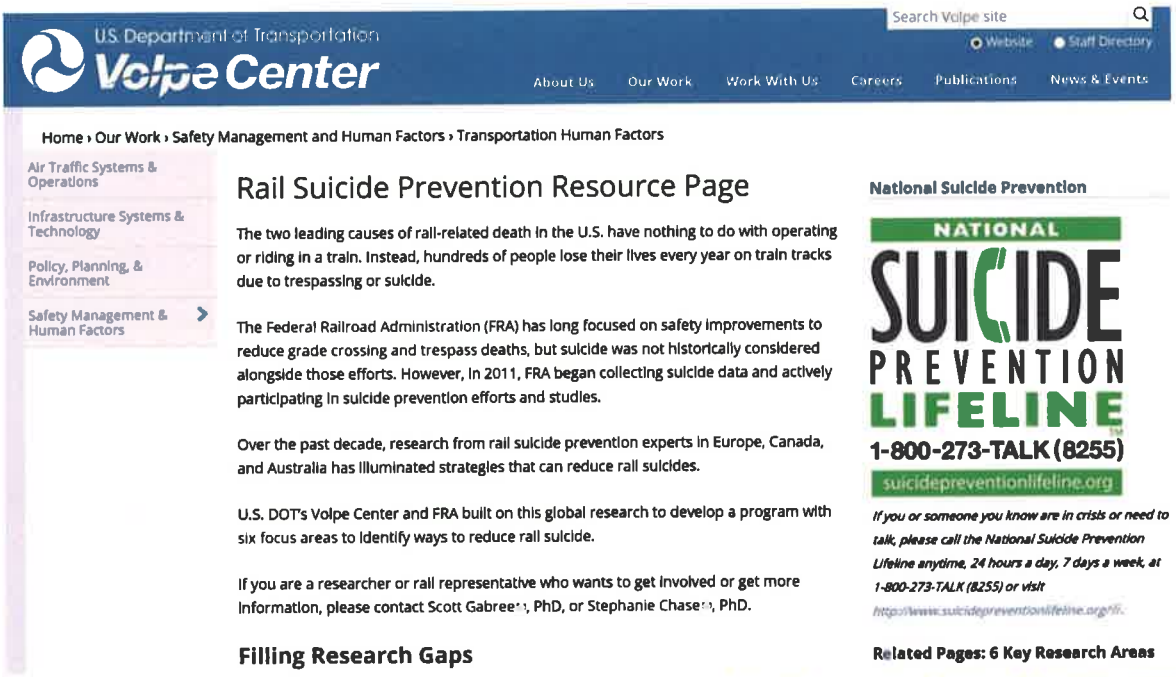


Exhibit 5. Pennsylvania plan for suicide prevention: https://www.smartrailworld.com/pennsylvania-could-become-the-first-transit-system-to-deploy-suicide-prevention-barriers



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- Air Traffic Systems & Operations
- Infrastructure Systems & Technology
- Policy, Planning, & Environment
- Safety Management & Human Factors

Rail Suicide Prevention Resource Page

The two leading causes of rail-related death in the U.S. have nothing to do with operating or riding in a train. Instead, hundreds of people lose their lives every year on train tracks due to trespassing or suicide.

The Federal Railroad Administration (FRA) has long focused on safety improvements to reduce grade crossing and trespass deaths, but suicide was not historically considered alongside those efforts. However, in 2011, FRA began collecting suicide data and actively participating in suicide prevention efforts and studies.

Over the past decade, research from rail suicide prevention experts in Europe, Canada, and Australia has illuminated strategies that can reduce rail suicides.

U.S. DOT's Volpe Center and FRA built on this global research to develop a program with six focus areas to identify ways to reduce rail suicide.

If you are a researcher or rail representative who wants to get involved or get more information, please contact Scott Gabreen, PhD, or Stephanie Chasen, PhD.

Filling Research Gaps

National Suicide Prevention

NATIONAL SUICIDE PREVENTION LIFELINE™
1-800-273-TALK (8255)
suicidepreventionlifeline.org

If you or someone you know are in crisis or need to talk, please call the National Suicide Prevention Lifeline anytime, 24 hours a day, 7 days a week, at 1-800-273-TALK (8255) or visit
https://www.suicidepreventionlifeline.org/#/.

Related Pages: 6 Key Research Areas

Exhibit 6. US Department of Transportation rail suicide prevention initiative: https://www.volpe.dot.gov/rail-suicide-prevention

Exhibit 7. Still frame of pedestrian crossing walkthrough video on west side of Merlo Road. https://tinyurl.com/y53on8ll

Exhibit 8. Video of crossing gate and bell operation at the Merlo Road MAX station, on west side of Merlo Road with 26 seconds of silence before train's arrival and hill to west limiting visibility for operators and pedestrians. https://tinyurl.com/y53on8ll