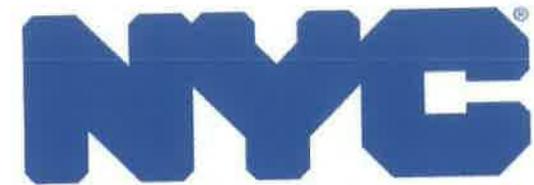




The National Transportation Systems Center



**Citywide Administrative
Services**

Large trucks and bicyclist-pedestrian safety



Advancing transportation innovation for the public good

October 23, 2014



U.S. Department of Transportation
Office of Research and Technology

John A. Volpe National Transportation Systems Center

Agenda

- ❑ Vision Zero charge
- ❑ Brief intro to Volpe
- ❑ Trucks in the pedestrian-cyclist safety context
 - Side underride
 - Sideguard solutions
- ❑ Sideguard specifications
- ❑ Next steps

The charge



- ❑ 63 recommendations
- ❑ Recommendation #58: “Recommend safety related devices and designs, such as high visibility vehicles, back-up cameras, and **rear wheel side guards**, for City vehicles and other vehicles under City regulation.”

Legislation and
Enforcement

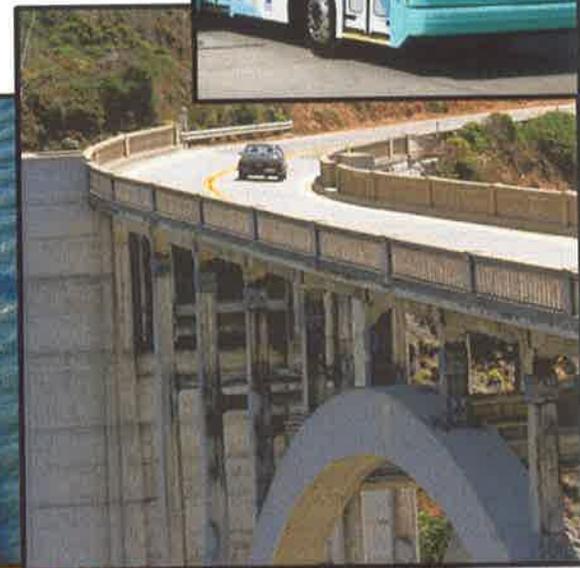
Education

Complete Streets
Infrastructure

Vehicle-based
Safety

Volpe, The National Transportation Systems Center

- ❑ Unique agency within U.S. DOT
- ❑ 100% fee-for-service
- ❑ All modes of transportation
- ❑ Cross-disciplinary
- ❑ 570 federal staff,
400 onsite contractors
- ❑ Based in Cambridge, MA



Volpe's Purpose

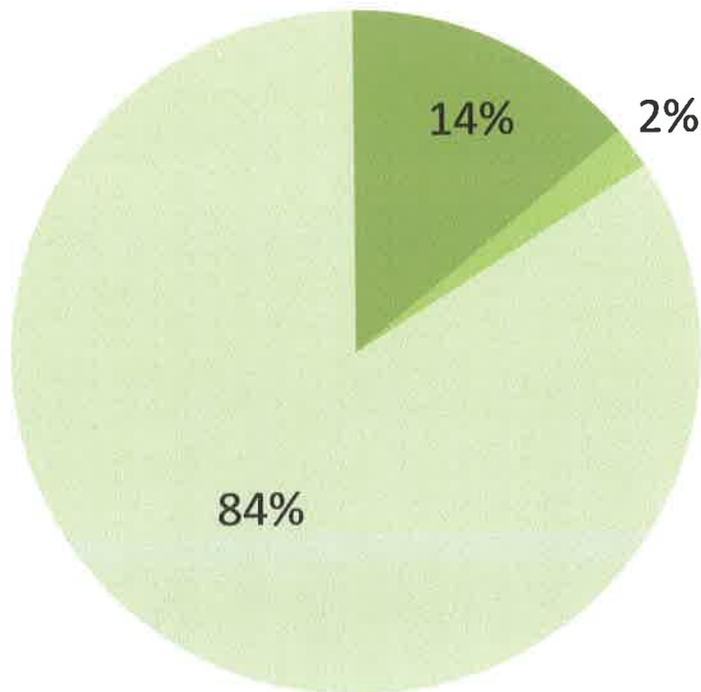
**“Advancing transportation
innovation for the public good”**

Agenda

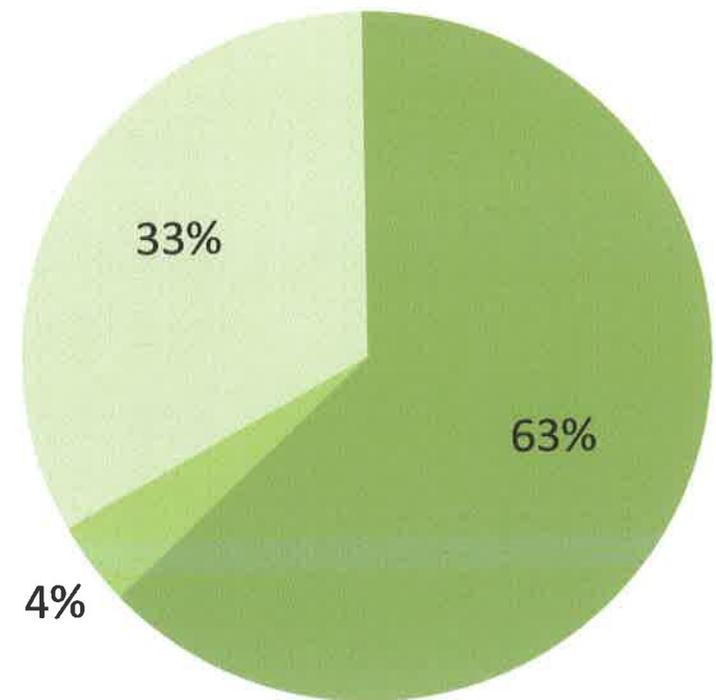
- Vision Zero charge
- Brief intro to Volpe
- Trucks in the pedestrian-cyclist safety context
 - Side underride
 - Sideguard solutions
- Sideguard specifications
- Next steps

High share of bicyclist/pedestrian fatalities in NYC

U.S., 2012



NYC, 2013



- Pedestrians
- Bicyclists
- Motorists

Vehicle-based safety: Trucks

Large truck design presents a major safety risk for pedestrian and cyclist fatalities

- 4% of vehicles in U.S. are large trucks
 - **11%** of cyclist fatalities
- 3.6% of NYC vehicles are large trucks
 - **32%** of cyclist fatalities
- 4% of London vehicles are large trucks
 - **53%** of cyclist fatalities

Key contributing factors include:

1. Large blind spots (Lack of visibility)
2. Side underride → collisions with pedestrians and cyclists under wheels in collisions

PEDESTRIAN/TRUCK IMPACT AREAS



613
Fatalities

Impact Area	Pedestrians	%
Front	354	58
Back	53	9
Right	97	16
Left	54	9
Other	55	9

CYCLIST/TRUCK IMPACT AREAS



193
Fatalities

Impact Area	Cyclists	%
Front	92	48
Back	6	3
Right	67	35
Left	17	9
Other	11	6

Significance of Side Underride

Percent of bike-truck and ped-truck fatalities with initial impact on left or right side of the truck

	Bicyclists	Pedestrians
Tractor-trailer	55%	29%
Single-unit	44%	25%

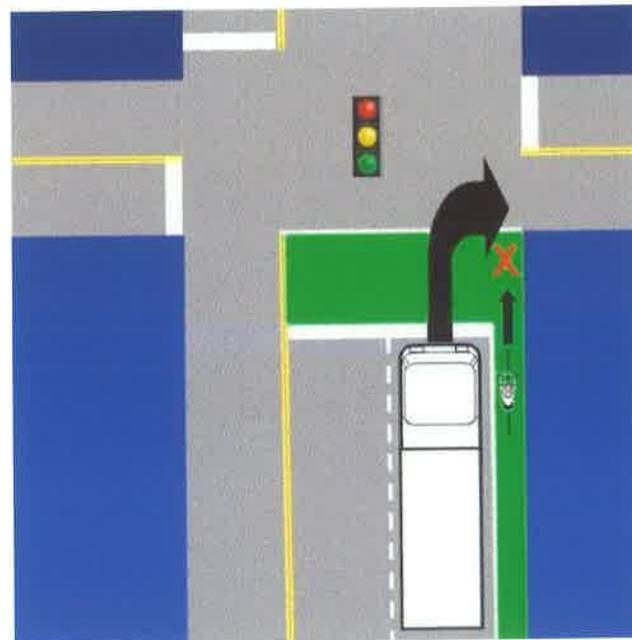
110+ such bike & ped fatalities per year in US



Side impact & side underride deaths can occur during turning maneuvers or when overtaking



Cyclist/pedestrian falls into space between the axles and is run over by rear wheels



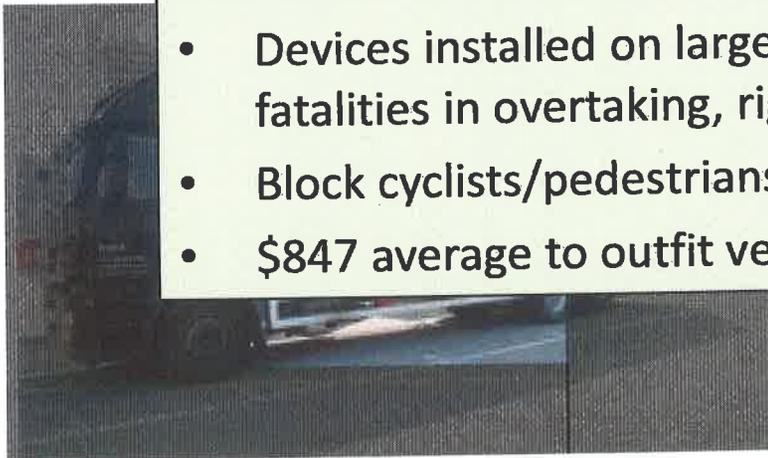
Vehicle-based countermeasure: sideguards

...for Class 3-8 trucks



Side underride guards ("sideguards") :

- Devices installed on large trucks to help prevent cyclist and pedestrian fatalities in overtaking, right-hook, and left-hook crashes
- Block cyclists/pedestrians from sliding under the rear wheels in a collision
- \$847 average to outfit vehicle in EU



Vehicle-based countermeasure: sideguards



International safety record—UK:

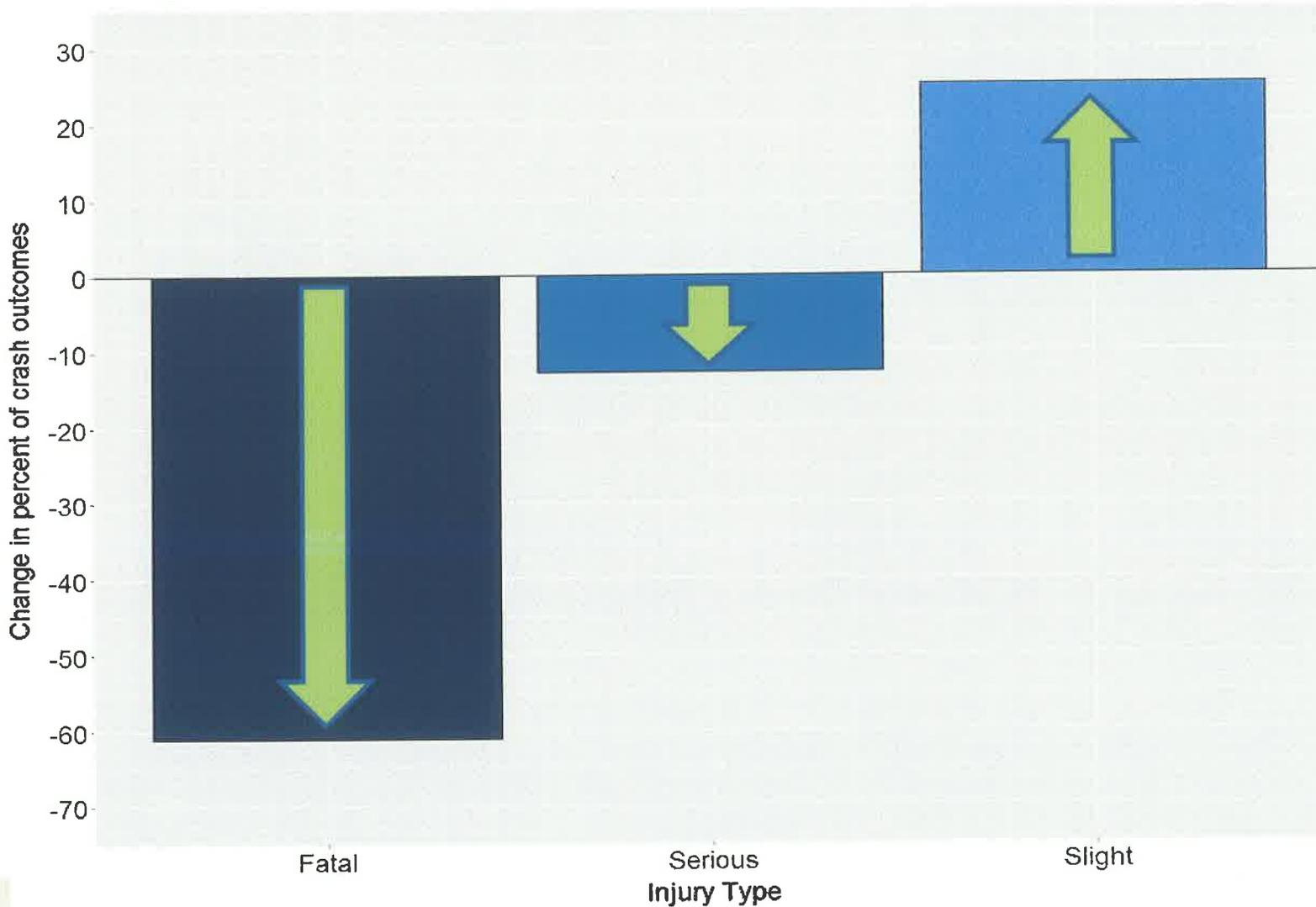
61% decrease in cyclist fatalities in side-impact crashes with large trucks

20% decrease in same types of pedestrian fatalities

UK sideguard effectiveness (2005 study)



Change in UK side-impact bicyclist-truck injury type distribution after 1986 sideguard law



UK sideguard effectiveness (2010 study)



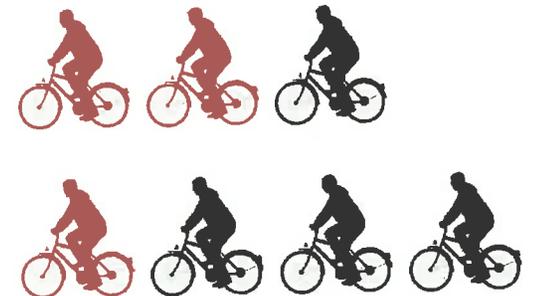
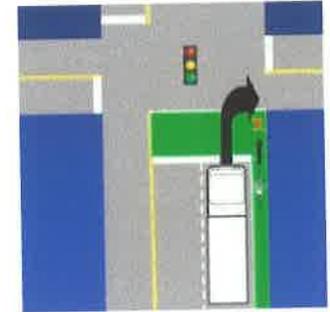
	Fatal	Serious	Slight	% fatal	% KSI
--	-------	---------	--------	---------	-------

Exempt
(no sideguard)

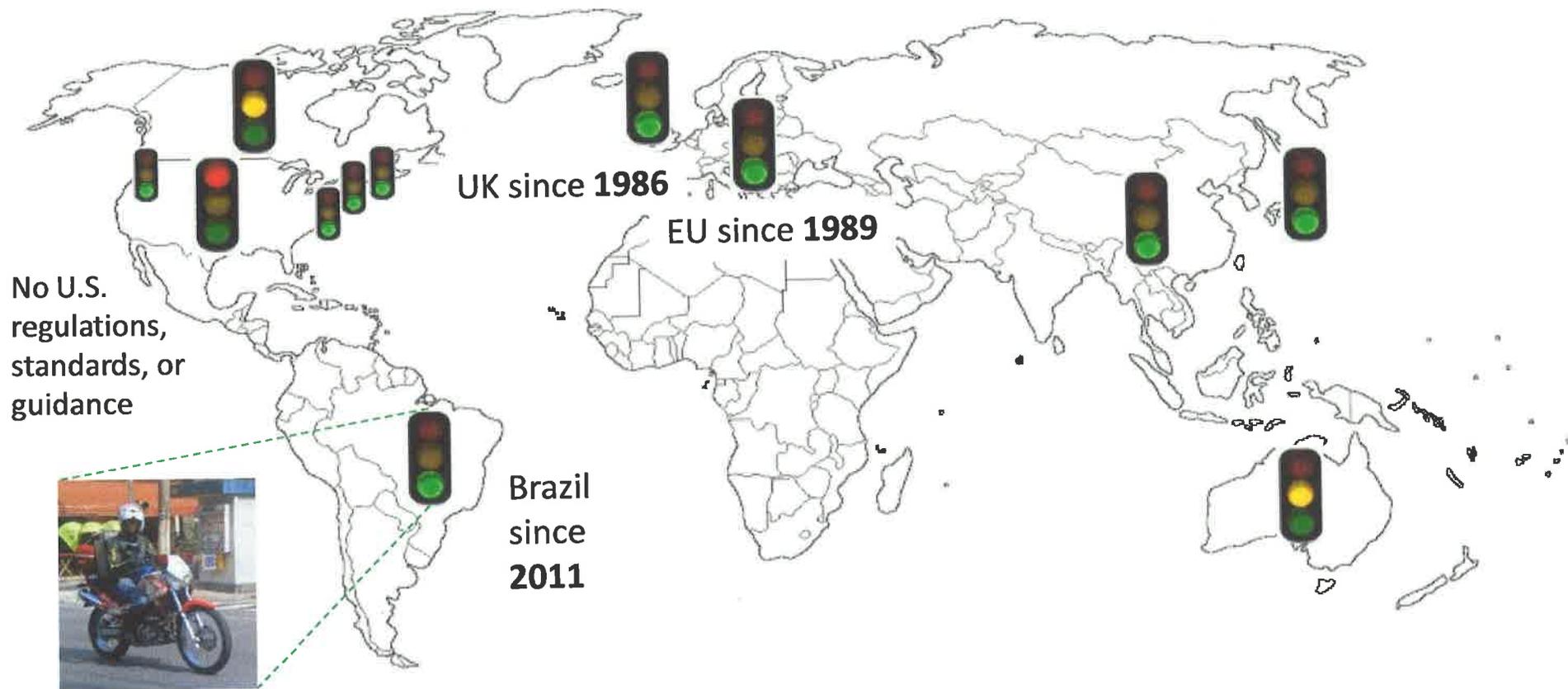
9 21 15 **20%** **67%**

Not exempt
(with sideguard)

7 8 44 **12%** **25%**



Truck Sideguard Implementation



□ Portland, OR

- 2008: City Council resolution

□ Washington, DC

- 2008: Bicycle Safety Enhancement Act

□ Boston, MA

- 2013: DPW pilot with Volpe/USDOT
- 2014: Ordinance

□ New York City

- 2014: DCAS study with Volpe/USDOT

NTSB large truck blind spot mitigation and sideguard recommendations



National Transportation Safety Board

Washington, DC 20594

Safety Recommendations

The
Act
Nat
US
Wa

Require that newly manufactured truck-tractors with gross vehicle weight ratings over 26,000 pounds be equipped with visibility enhancement systems to improve the ability of drivers of tractor-trailers to detect passenger vehicles and vulnerable road users, including pedestrians, cyclists, and motorcyclists. (H-14-001)

Require that newly manufactured trailers with gross vehicle weight ratings over 10,000 pounds be equipped with side underride protection systems that will reduce underride and injuries to passenger vehicle occupants. (H-14-002)

Require that newly manufactured truck-tractors with gross vehicle weight ratings over 26,000 pounds be equipped with side underride protection systems that will reduce underride and injuries to passenger vehicle occupants. (H-14-003)

Volpe

Agenda

- Vision Zero charge
- Brief intro to Volpe
- Trucks in the pedestrian-cyclist safety context
 - Side underride
 - Sideguard solutions
- Sideguard specifications
- Next steps

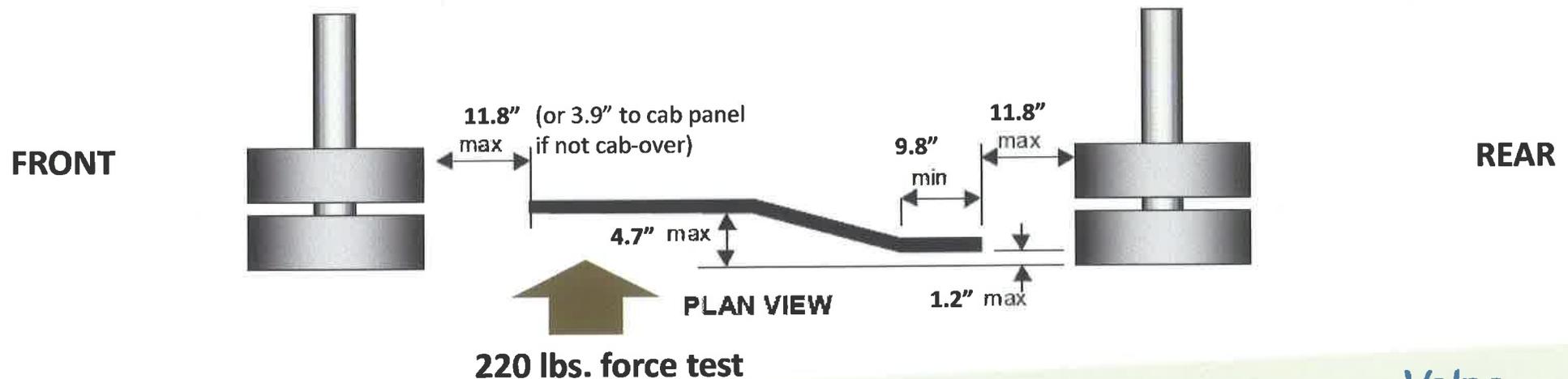
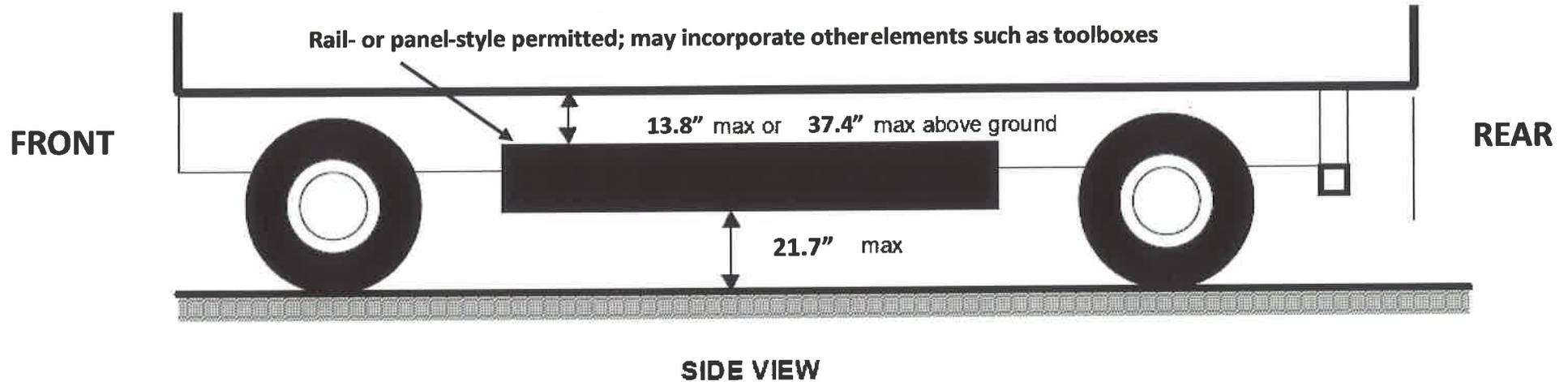
International sideguard standards and recommendations

Attributes
Vehicles covered
Exemptions
Strength requirement
Max. ground clearance
Height for top of sideguard
Gap between sideguard and wheels
Designs allowed
Other vehicle components
Requirement to be flush with vehicle and to present smooth outer surface

	EU and UK Standards	Japan Standard	Monash Univ. study recommendations	TRL study recommendations	Notes and questions for NYC DCAS
Vehicles covered	Trucks over 3.5 tons	Vehicles over 8 tons	Vehicles over 3 tons		Which truck classes should be covered?
Exemptions	Special purpose vehicles for which fitment is not feasible. Exemption for long-load vehicles (e.g. timber) has been repealed. UK provides additional exemptions for tipping and refuse trucks, military vehicles, and street sweepers.	Buses	Notes that most buses and carrier trucks would not need sideguards because of vehicle design with low ground clearance	Notes that most UK exemptions are not actually required for technical reasons; recommends reducing exemptions and considering adjustable/movable guards before exempting	Are exemptions or adjustable/movable guards needed for vehicles with special characteristics, e.g., equipment access needs or off-road use?
Strength requirement	1 kN (225 lbs.) horizontal static force, max. deflection of 30 mm (1.2 in.) in front of wheels, 150 mm (5.9 in.) elsewhere Note: 2 kN (450 lbs.) test in UK		Recommends 2 kN (450 lbs.) test		Any reason to deviate from the 1-2 kN (225-450 lbs.) test?
Max. ground clearance	550 mm (21.7 in.)	450 mm (17.7 in.) when vehicle unladen	Recommends 350 mm (13.8 in.); argues that 550 mm (17.7 in.) is too high to ensure that ped/cyclist is kept out of wheel path		Tradeoff between safety effectiveness and operational flexibility. Do some vehicles (e.g. for snow removal) require greater ground clearance?
Height for top of sideguard	No more than 350 mm (13.8 in.) below lower edge of vehicle body, or up to 950 mm (37.4 in.) [at least 1-1.5 m (39-59 in.) for UK] above ground level if vehicle has no load platform	At least 650 mm (25.6 in.) when unladen, and no more than 550 mm (21.7 in.) below lower edge of vehicle body			EU standard appears preferable to Japan and addresses different vehicle types
Gap between sideguard and wheels	Max. gap longitudinally is 250-500 mm (9.8-19.7 in.) in front, depending on vehicle type (typically 300 mm (11.8 in.)); for conventional cabs, EU max forward gap to cab panel is 100 mm (3.9 in.); in rear, max 300 mm (11.8 in.)				EU standard appears adequate and addresses different vehicle types. Need to qualify max distance from front tire for non-cab-over vehicles?
Designs allowed	Flush panel or rail-style. Rails must be less than 300 mm (11.8 in.) apart and each rail at minimum 50-100 mm (2-4 in.) in height.		Recommends only using flat panels due to possibility of ped/cyclist being caught on rails		Tradeoff between safety effectiveness and design flexibility/underbody access. Rail-style guards may be more amenable for retrofit and for DPF airflow.
Other vehicle components	OK to integrate vehicle components such as fuel tanks and toolboxes as long as dimensional requirements met. May not attach other components to a sideguard, however.		Cites this approach with approval		Many NYC vehicles already have fuel tanks, tool boxes, etc. -- Volpe team needs detailed info on dimensions and placement.
Requirement to be flush with vehicle & present smooth outer surface	Cannot increase overall width of vehicle. Outer surface of sideguard may be no more than 120 mm (4.7 in.) inboard of outermost plane of vehicle; and no more than 30 mm (1.2 in.) inboard for the rearmost portion (at least 250 mm (9.8 in.) of the sideguard. Note: UK requires 30 mm (1.2 in.) maximum inboard distance for entire guard. Specific requirements for rounded edges and overlapping sections. Gaps between sections allowed up to 25 mm (1 in.); 10 mm (0.4 in.) allowance for slightly protruding bolt/rivet heads.				EU standard is detailed in this area and appears suitable, but would need to be adapted to NYC fleet.

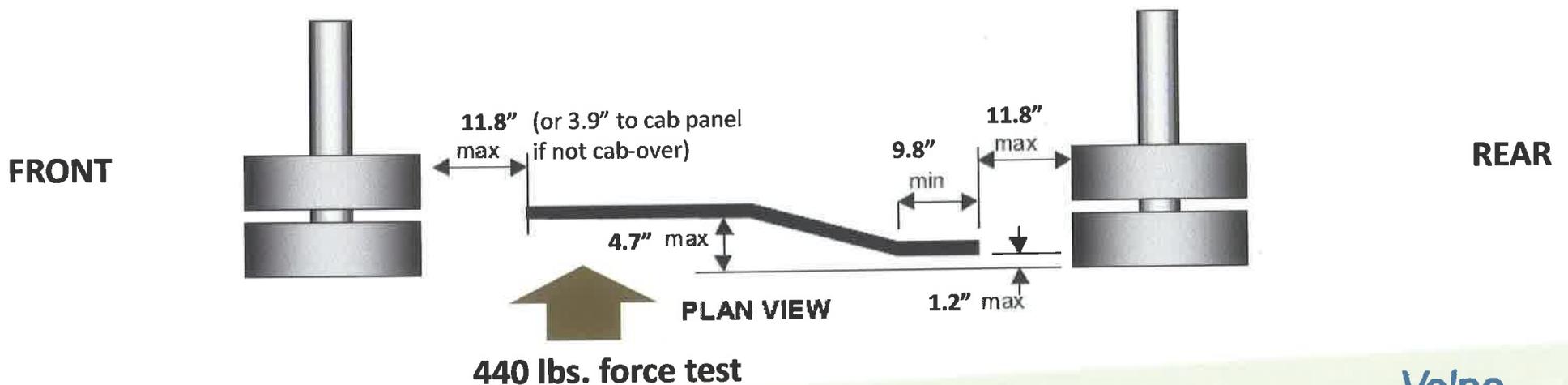
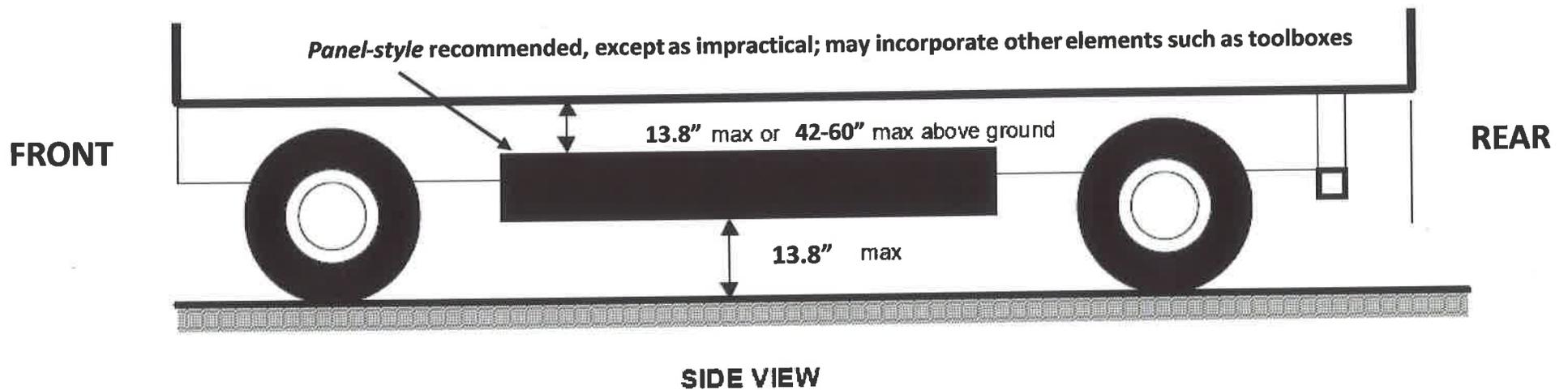
EU 73 schematic

Regulation No 73 of the Economic Commission for Europe of the United Nations (UN/ECE) — Uniform provisions concerning the approval of goods vehicles, trailers and semi-trailers with regard to their lateral protection (*)



Recommendation schematic

Based on EU and UK standards and on Monash Univ., Transport Research Lab and Volpe recommendations



Representative sideguard OEM

- ❑ Sideguards on sanitation collectors (EU and China)



Representative sideguard OEM

- ❑ Sideguards on sanitation collectors (EU and China)



Representative sideguard retrofits

- ❑ Sideguards with fuel tank and with stabilizer arm (UK)
- ❑ Mounted to frame rail



Representative sideguard retrofits

- ❑ Retrofit sideguards mounted to underbody by vertical stanchions (UK)



Representative sideguard retrofits

- Rack trucks (UK and China)

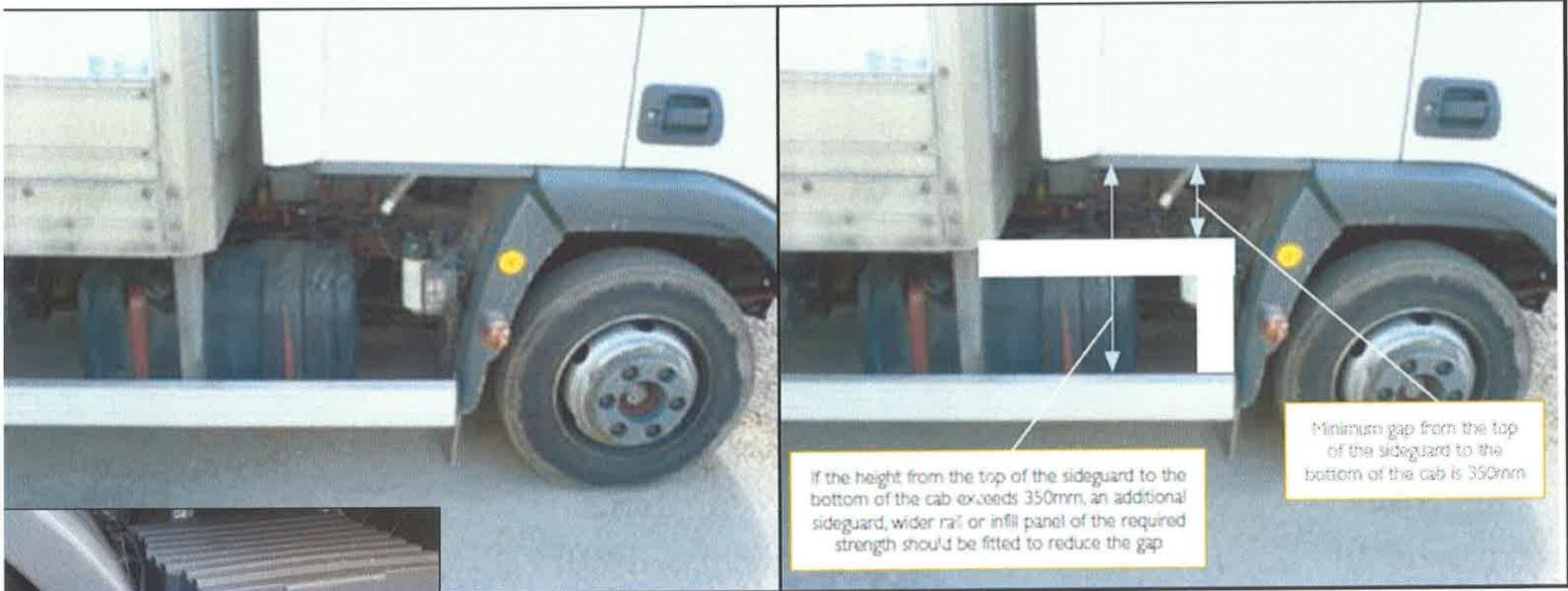


Representative sideguard retrofits

- ❑ Sideguards on snow plows (UK, EU)



Example implementation details



- ❑ From Freight Transport Association (FTA) compliance guide for UK fleets

Innovative sideguard OEM

- ❑ Sideguard with integrated toolboxes on RO-RO



Innovative sideguard retrofit

- ❑ Panel sideguard on cement mixer with flip-up rail sideguard for city operation; also includes sensor and alarm



North American sideguard deployment

- ❑ Sideguards on Boston Public Works vehicles (**not** EU/UK spec)



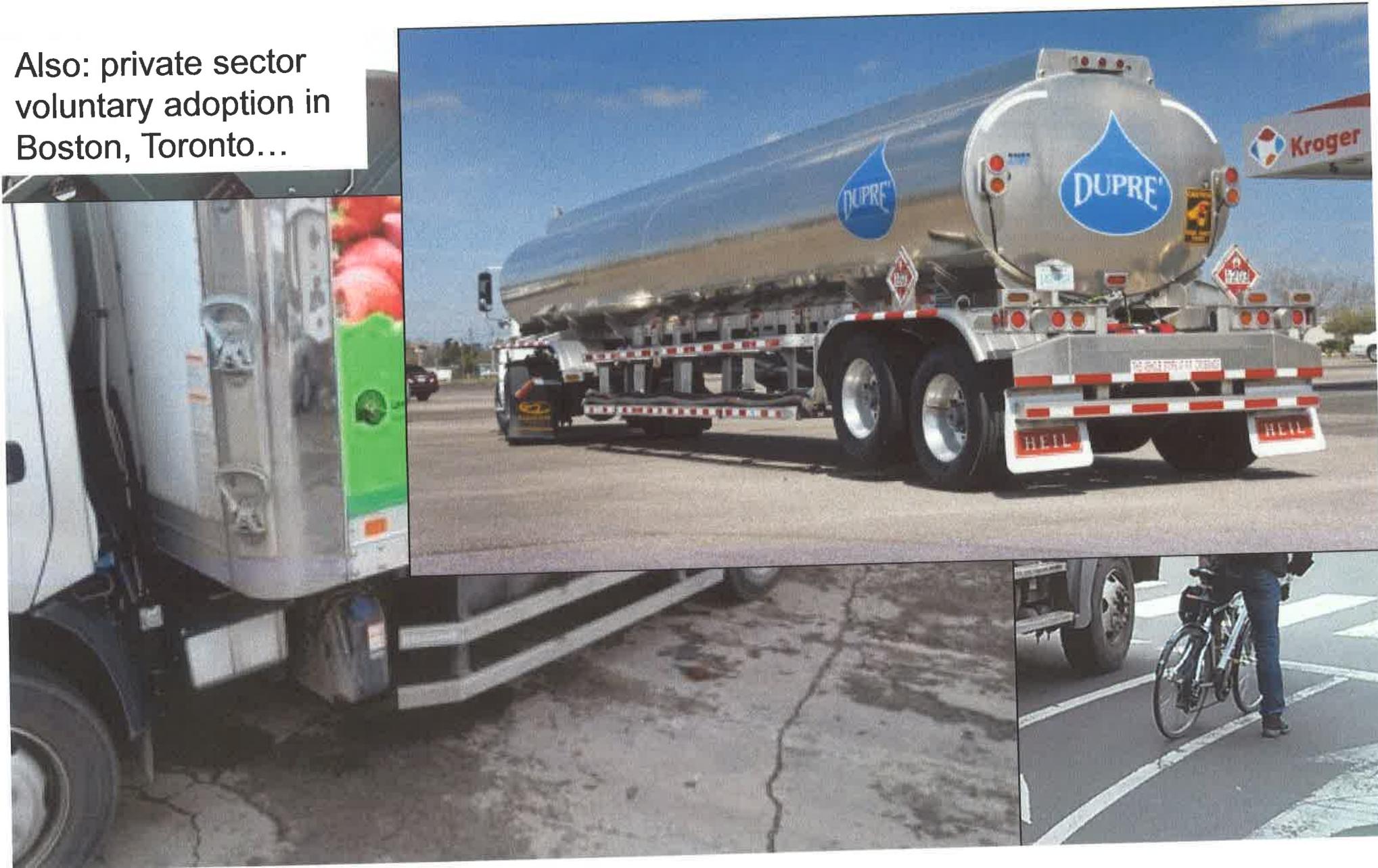
North American sideguard deployment

- ❑ Sideguards on Boston Public Works vehicles



North American sideguard private deployment

Also: private sector voluntary adoption in Boston, Toronto...



North American legislation

Mayor Walsh Wants 'Truck Side Guards' on All Vehicles Contracted by the City

The guards would keep cyclists from getting pulled under a vehicle's wheels in the event that a driver doesn't see them.

By [Steve Annear](#) | [Boston Daily](#) | September 9, 2014 10:13 am

Be it ordained by the City Council of Boston, as follows that the City of Boston Code be amended by adding the following ordinance:

SECTION 1. City of Boston Code, Ordinances, Chapter IV is hereby amended by inserting after Section 4-7 the following new section:--

4-8 AN ORDINANCE REQUIRING CITY VENDORS TO SAFEGUARD UNPROTECTED ROAD USERS.

4-8.1 Purpose.

Vehicles covered by this ordinance shall be so constructed and/or equipped as to offer effective protection to unprotected road users against the risk of falling under the sides of the vehicle and being caught under the wheels.

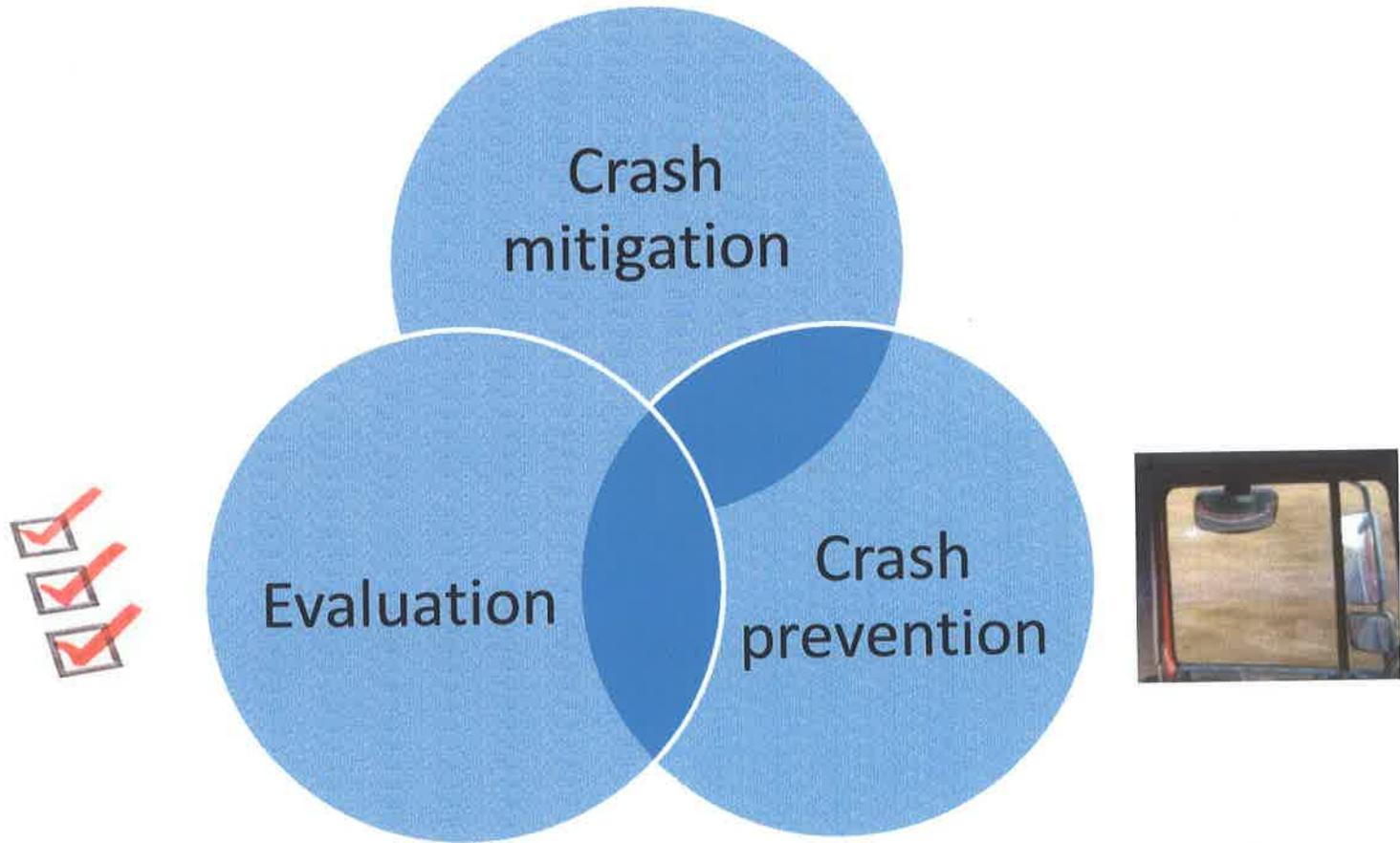
Additional issues Volpe considered

- ❑ Technically justified vehicle exemptions
 - **Very few:** street sweepers, fire engines, car carriers, “special purpose vehicles where impractical”
- ❑ Serviceability and operability requirements
 - **None of the designs impede vehicle function**
- ❑ Hazard scenarios
- ❑ Procurement flexibility to accelerate design innovation
- ❑ OEM coordination for new vehicles

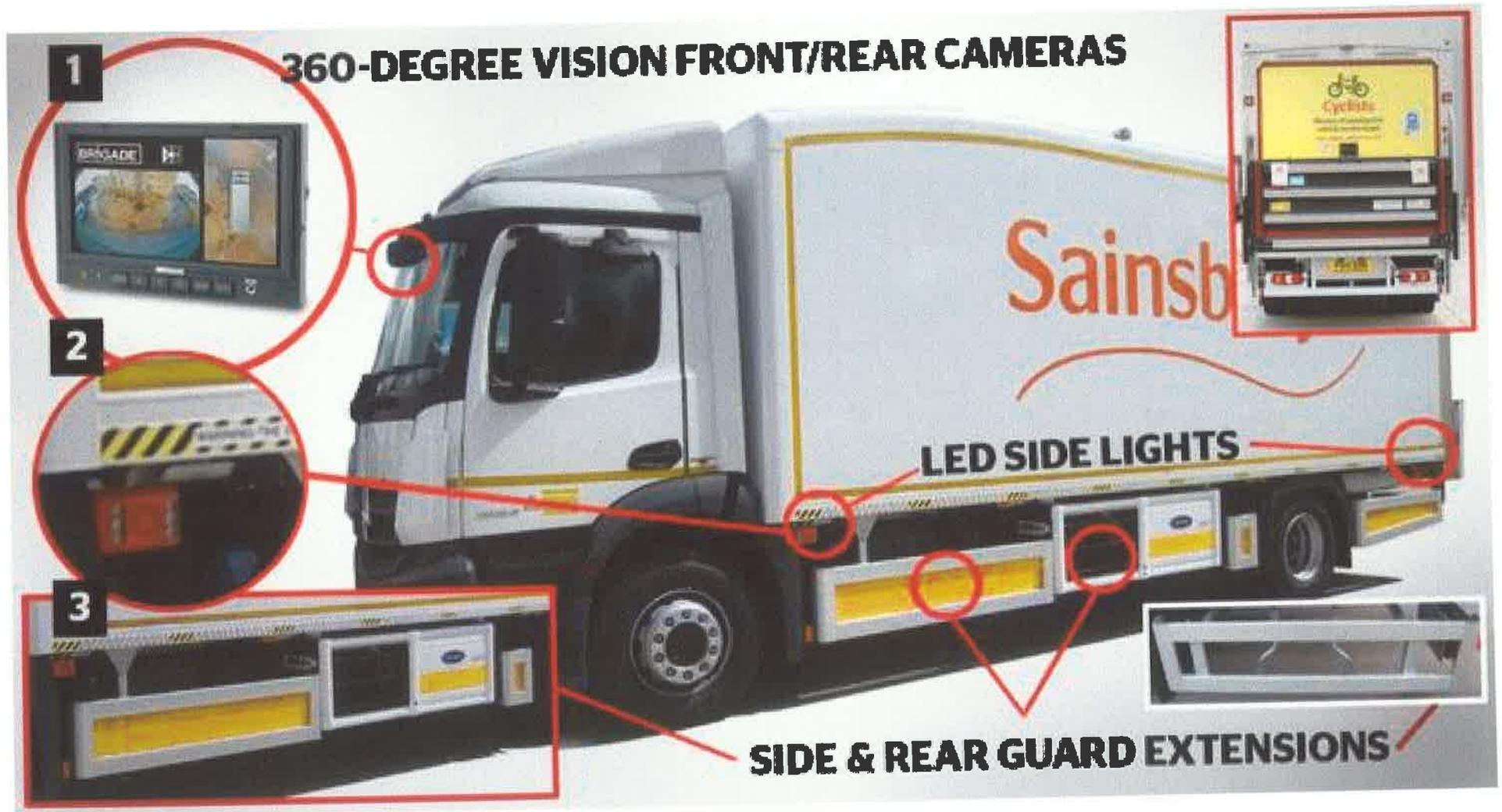
Agenda

- ❑ Vision Zero charge
- ❑ Brief intro to Volpe
- ❑ Trucks in the pedestrian-cyclist safety context
 - Side underride
 - Sideguard solutions
- ❑ Tailoring solutions to unique fleet needs
- ❑ **Next steps**

Comprehensive vehicle-based safety

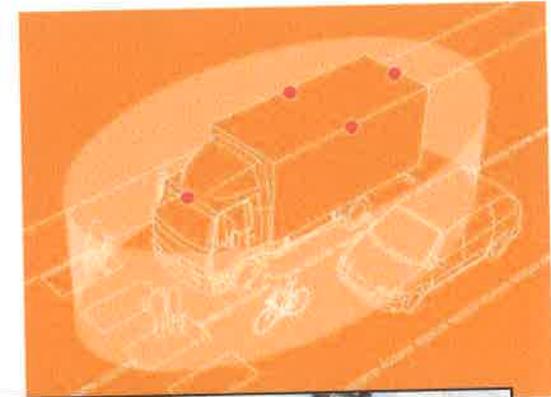
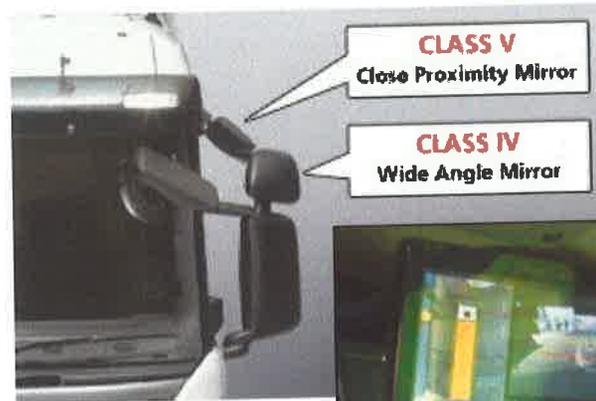


UK “all of the above” example



Evaluate and prioritize among technologies to save the most lives

- ❑ Different sideguard designs
- ❑ Blind spot mirrors
 - Front
 - Side
- ❑ Blind spot cameras
 - Directional
 - 360-degree
- ❑ Blind spot Fresnel lenses
- ❑ Blind spot bicyclist/pedestrian sensors
 - Ultrasonic, radar, etc.
 - Interior/exterior alerts
- ❑ Turn alarms (manual or automated)
 - Audible
 - Visual
- ❑ Human factor and operator training implications
- ❑ Educational messaging: external and internal



What's next?

- Lead U.S. cities and the nation in truck-based bicyclist and pedestrian safety
 - Pilot sideguards and other safety countermeasures
 - Transfer findings and best practices nationally
 - Potentially develop voluntary program for area truck fleets

Acknowledgments

- ❑ DCAS
 - Commissioner **Stacey Cumberbatch**
 - Deputy Commissioner and Chief Fleet Management Officer of NYC DCAS **Keith Kerman**
 - **Mahanth Joishy, Brent Taylor, and Sherry Lee**
- ❑ NYC DOT
 - **Stacey Hodge, Juan Martinez, Nevada Espinoza, and Daniel Malone**
- ❑ DSNY
 - **Bill Wehner, William Ricardo, Mike Matkovico, Tom DelGrosso, and Spiro Kattan**
- ❑ **Paris Apollon (DPR), Arthur Barnard (DOE), Richard Fosbeck (DOC), and Robert Balzani (NYPD)**
- ❑ City of Boston
 - **Kristopher Carter** (Mayor's Office of New Urban Mechanics) and Director of Central Fleet Maintenance **Jim McGonagle**
- ❑ **Joseph Dack (HDR, Inc.)**

Thank you

Alex Epstein, Ph.D. (Project lead)

Energy Analysis and Sustainability
(617) 494-2539
alexander.epstein@dot.gov

Sean Peirce

Economic Analysis

Andrew Breck

Organizational Performance

Eran Segev

Safety Measurement and Analysis

Coralie Cooper

Energy Analysis and Sustainability



Appendix

Review of EU/UK Exemptions

- ❑ Most existing EU/UK exemptions are **not** technically justified
- ❑ Many examples of vehicles in exempt categories identified that are still fitted with sideguards
- ❑ Innovative sideguard designs address particular vehicle types, e.g. with stowable guards

Vehicle Type	UK / EU Status	TRL Study Findings	Exemption Technically Justified?	Notes / Questions for NYC
Tractor for semi-trailer	Exempt from EU standard	Fuel tanks and other structures often fill the space between axles, but no real reason to maintain exemption. Flat panel sideguards would be beneficial.	No	Review NYC inventory for relevance
Special purpose vehicles where side protection is impractical	Exempt from EU standard	Catch-all category that is too open to subjective interpretation	Unclear	
Trailers designed for very long loads	Previous EU exemption has been repealed; UK exemption remains	Continued exemption warranted when distance between axles is extremely long. These vehicles also move at low speed, often with police escort.	Yes	Review NYC inventory for relevance
Low speed vehicle (max. 15 mph)	Exempt from EU standard	Exemption is not warranted based on speed alone (as distinct from vehicle type)	No	Review NYC inventory for relevance
Tipping / Dump Truck	Additional UK exemption	Exemption is generally not warranted . Sideguards do not interfere with hydraulics and vehicles seldom require extreme off road capabilities. Ground clearance is already limited by other vehicle components.	No	May want to consider designs with an extra, stowable lower panel that exceeds minimum requirements. This can be used while on-road and then stowed away during any off-road use (e.g. construction site).
Refuse / collection trucks	Additional UK exemption	Exemption is generally not warranted . Ground clearance is already limited by bodywork and equipment, so sideguards do not pose an issue and are generally compatible with operation.	No	Will need to review whether conventional sideguards make more sense vs. integrating underbody components.
Street sweepers	Additional UK exemption	Fitting sideguards could interfere with operations, though a stowable sideguard could work.	Unclear	Arguably not a high priority for sideguards due to their design and operations. Also typically low speed and conspicuous.
Military vehicles	Additional UK exemption	Continued exemption is warranted given the range of use for these vehicles, even though not always technically justified.	Yes	Likely not relevant to NYC (possible exception of some NYPD tactical vehicles)
Fire engines	Additional UK exemption	Typical design meets dimensional requirements. In cases where it does not, sideguards are indicated except when used off-road.	Unclear	Need to review vehicle design.
Car carriers	Additional UK exemption	Vehicle design generally already has very low ground clearance.	Unclear	Does NYC have these? What about flatbed tow trucks?

Potential technically justified exemptions for NYC DCAS

Vehicle Type
Special purpose vehicles where side protection is impractical
Trailers designed for very long loads
Street sweepers
Military vehicles
Fire engines
Car carriers

	EU and UK Standards	Japan Standard
Vehicles covered	Trucks over 3.5 tons	Vehicles over 8 tons
Exemptions	Special purpose vehicles for which fitment is not feasible. Exemption for long-load vehicles (e.g. timber) has been repealed. UK provides additional exemptions for tipping and refuse trucks, military vehicles, and street sweepers.	Buses
Strength requirement	1 kN (225 lbs.) horizontal static force, max. deflection of 30 mm (1.2 in.) in front of wheels, 150 mm (5.9 in.) elsewhere Note: 2 kN (450 lbs.) test in UK	
Max. ground clearance	550 mm (21.7 in.)	450 mm (17.7 in.) when vehicle unladen
Height for top of sideguard	No more than 350 mm (13.8 in.) below lower edge of vehicle body, or up to 950 mm (37.4 in.) [at least 1-1.5 m (39-59 in.) for UK] above ground level if vehicle has no load platform	At least 650 mm (25.6 in.) when unladen, and no more than 550 mm (21.7 in.) below lower edge of vehicle body
Gap between sideguard and wheels	Max. gap longitudinally is 250-500 mm (9.8 -19.7 in.) in front, depending on vehicle type (typically 300 mm (11.8 in.)); for conventional cabs, EU max forward gap to cab panel is 100 mm (3.9 in.); in rear, max 300 mm (11.8 in.)	
Designs allowed	Flush panel or rail-style. Rails must be less than 300 mm (11.8 in.) apart and each rail at minimum 50-100 mm (2-4 in.) in height.	
Other vehicle components	OK to integrate vehicle components such as fuel tanks and toolboxes as long as dimensional requirements met. May not attach other components to a sideguard, however.	
Requirement to be flush with vehicle & present smooth outer surface	Cannot increase overall width of vehicle. Outer surface of sideguard may be no more than 120 mm (4.7 in.) inboard of outermost plane of vehicle; and no more than 30 mm (1.2 in.) inboard for the rearmost portion (at least 250 mm (9.8 in.)) of the sideguard. Note: UK requires 30 mm (1.2 in.) maximum inboard distance for entire guard. Specific requirements for rounded edges and overlapping sections. Gaps between sections allowed up to 25 mm (1 in.); 10 mm (0.4 in.) allowance for slightly protruding bolt/rivet heads.	

	Monash Univ. study recommendations	TRL study recommendations	Notes and questions for NYC DCAS
Vehicles covered	Vehicles over 3 tons		Which truck classes should be covered?
Exemptions	Notes that most buses and car-carrier trucks would not need sideguards because of vehicle design with low ground clearance	Most UK exemptions are not actually required for technical reasons; recommends reducing exemptions and considering adjustable/movable guards before exempting	Are exemptions or adjustable/movable guards needed for vehicles with special characteristics, e.g., equipment access needs or off-road use?
Strength requirement	Recommends 2 kN (450 lbs.) test		Any reason to deviate from the 1-2 kN (225-450 lbs.) test?
Max. ground clearance	Recommends 350 mm (13.8 in.); argues that 550 mm (17.7 in.) is too high to ensure that ped/cyclist is kept out of wheel path		Tradeoff between safety effectiveness and operational flexibility. Do some vehicles (e.g. for snow removal) require greater ground clearance?
Height for top of sideguard			EU standard appears preferable to Japan and addresses different vehicle types
Gap between sideguard and wheels			EU standard appears adequate and addresses different vehicle types. Need to qualify max distance from front tire for non-cab-over vehicles?
Designs allowed	Recommends only using flat panels due to possibility of ped/cyclist being caught on rails		Tradeoff between safety effectiveness and design flexibility/underbody access. Rail-style guards may be more amenable for retrofit and for DPF airflow.
Other vehicle components	Cites this approach with approval		Many NYC vehicles already have fuel tanks, tool boxes, etc. – Volpe team needs detailed info on dimensions and placement.
Requirement to be flush with vehicle & present smooth outer surface			EU standard is detailed in this area and appears suitable, but would need to be adapted to NYC fleet.

International sideguard exemptions and recommendations

- ❑ UK exemptions
- ❑ EU exemptions
- ❑ TRL report recommendations
- ❑ Are the exemptions technically justified?
- ❑ How many DCAS vehicles fall under technically justified exemptions?

International sideguard exemptions and recommendations

Vehicle Type
Tractor for semi-trailer
Special purpose vehicles where side protection is impractical
Trailers designed for very long loads
Low speed vehicle (max. 15 mph)
Tipping / Dump Truck
Refuse / collection trucks
Street sweepers
Military vehicles
Fire engines
Car carriers

Representative sideguard retrofits

- ❑ Sideguards on sanitation collectors (EU and China)



> more details

olpe

Potential priority vehicles for retrofit

□ Based on DCAS inventory

Vehicle description	Quantity	Main Agencies	Notes
COLLECTION, REAR LOAD	1766	DSNY	
SWEeper, MECHANICAL	407	DSNY, Parks	Assess whether exemption for sweepers is warranted
COLLECTION, 25 CUYD	406	DSNY	
TRUCK, SALT SPREADER	400	DOT, Corrections	
DUMP TRK, 15+ CUYD	328	DOT, DSNY	
TRUCK, RACK BODY	203	DEP, DCAS, DOT	
PUMPER, 1000GPM/500GAL	139	FDNY	Fire vehicle – assess compatibility with sideguards
DOT HEAVY DUTY RENTALS	120	DOT	Variety of vehicles in this category including Mack 813 and Ford F-550
LADDER, 100FT/REAR MOUNT	116	FDNY	
TRUCK, CLOSED BODY	109	Parks, DCAS, Corrections	Unclear what this is or if it is a consistent / meaningful designation
TRUCK, TRACTOR	109	Parks, DSNY, DOT	Are there associated trailers?
PUMPER, 2000GPM/CMU	106	FDNY	Fire vehicle -- assess compatibility with sideguards
DUMP TRK, 4-4.5 CUYD	99	DOT, FDNY, Parks	
COLLECTION, FRONT LOAD	95	DSNY, Parks	Check configuration versus rear-load
DUMP TRK, UNDER FOUR CUYD	86	Parks, DSNY	
LADDER, 75FT/TOWER	68	FDNY	
DUMP TRK, 5-6 CUYD	59	Parks, DCAS, DEP	
RACK TRUCK W/ATTENUATOR	56	DOT	Rear-mounted attenuator shouldn't pose problem, but check
COLLECTION, ALLEY	52	DSNY	Check configuration versus rear-load
TRUCK, BOOM	31	DSNY, Parks	Check stabilizer locations
TRUCK, MOUNTED WELDER	30	DSNY	
SWEeper, HYDRAULIC	29	DOT, Parks, DCAS, DEP	Assess whether exemption for sweepers is warranted
DUMP TRK, 11-15 CUYD	28	DEP, Parks	
DUMP TRK, 7-10 CUYD	28	DEP, Parks	
DUMP TRK, BACKUP/REAR	28	DEP, Corrections	
TRUCK, FUEL TANKER	26	DOT, DSNY	Check on location of wetlines and other equipment
TRUCK, MOUNTED CRANE	23	Parks, DCAS, DEP	
COLLECTION, REAR 20CU YD	21	DOT, FDNY, Parks	
LADDER, 100FT TRACTOR TR	21	FDNY	
LADDER, 95FT TOWER	18	FDNY	
TRUCK, WATER TANKER	16	DOT, Parks	
TRACTOR TRUCKS	14	NYPD	
HYDRANT REPAIR TRUCK	12	DEP	Unclear what form factor
TRUCK, AC TANK/SPRAYER	12	DOT	
TRUCK, CARGO BODY W/LIFT	12	DOT	
PUMPER, CMYCX 1000GPM;500G	10	FDNY, Corrections	

Representative sideguard retrofits

- ❑ Sideguards on Boston Public Works vehicles (**not** EU/UK spec)



Representative sideguard retrofits

- ❑ Sideguards on Boston Public Works vehicles (not EU/UK spec)



Preliminary identified sideguard vendors

Company	Headquarters	POC
Air Flow Deflector*	Montreal, QC	Diane Houle
Laydon Composites	Oakville, ON	Andy Acott
Shu-Pak Corporation	Cambridge, ON	David Tanner

**confirmed attendance at NYC Truck and Equipment Show, May 22*

To date, U.S. pilot programs appear to have used low-volume, custom fabricated equipment, as well as tool boxes

Sideguards benefits and costs

Safety benefits evidence:

61% decrease in cyclist fatalities in UK in side-impact crashes with large trucks after national sideguard law enacted

20% decrease in same types of pedestrian fatalities

All current data is from outside U.S. → need for U.S. data collection

Costs:

Diverse ways to cover the danger zone:

- Off-the-shelf sideguards (\$600-\$2,000+ per vehicle)
- Custom-made sideguards (\$2,500 per vehicle, Boston)
- Toolboxes and fuel tanks (cost varies, Portland)

O&M costs?

Diverse designs



\$847 average to outfit vehicle in EU

Representative sideguard retrofits

- ❑ Sideguard over refrigeration unit (UK)



Representative sideguard retrofits

- Sideguards over fuel tanks (UK) and with Euro VI DPFs



NYC Fleet Federation: Tailoring the recommendations

11,772 medium or heavy duty units under DCAS

Likely sideguard candidates: 4,734+

Large trucks with high underbody clearance

- Refuse collection
- Dump trucks
- Flatbed and rack, etc.

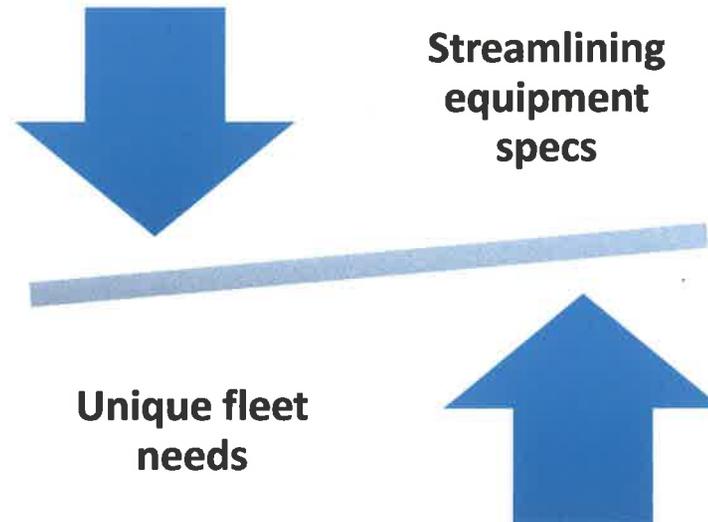
Unlikely sideguard candidates: 3,725+

MD/HD vehicles that don't seem to be good candidates for sideguards due to their design (no large underbody gaps)

- F-series pickups
- Econoline-type vans
- Sprinters, etc.

NYC Fleet Federation:

Unique vehicles, same safety priorities



- ❑ Solutions should balance cost-effective streamlined safety specs with the uniqueness of each fleet's vehicles and mission
- ❑ Account for special operational requirements: breakover angle, snow, rough terrain, hydraulics
- ❑ A recommended approach may be **"pilot and program evaluation"**:
 1. Install multiple equipment designs/configurations across multiple vehicle types
 2. Evaluate performance, cost, O&M compatibility
 3. Finalize specs and standards

Synergy? Safety + Fuel Economy

Could address two problems if equipment design were optimized:

- **Fuel economy and emissions reduction**
 - Depends on drive cycle, up to 7%
 - Applicable if part of a vehicle's drive cycle is highway
- **Cyclist & pedestrian safety**
 - Depends on vehicle route

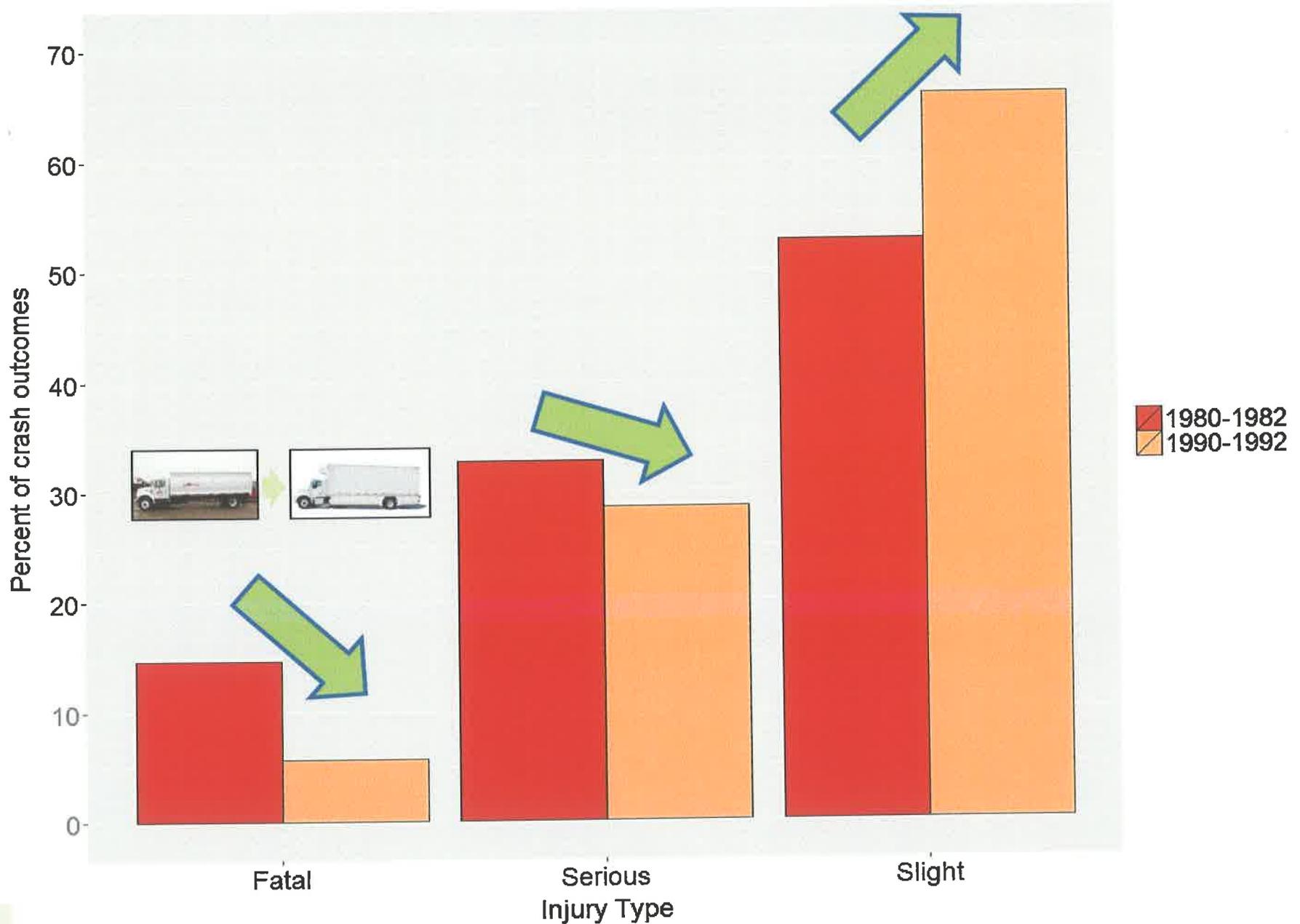


One aerodynamic sideskirt manufacturer (Laydon) already claims its product prevents bicyclist/pedestrian underride

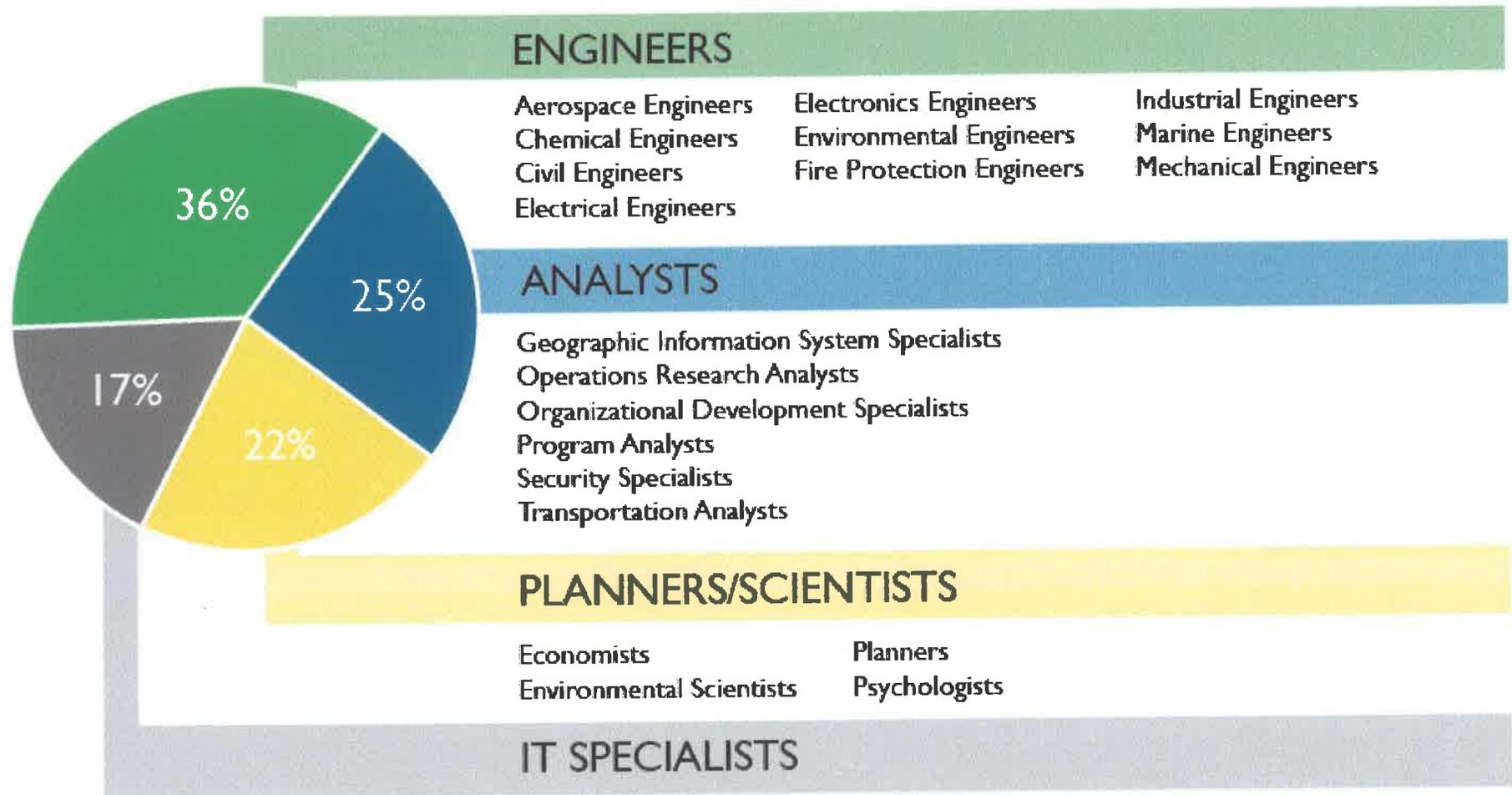


Sideguard effectiveness (2005 study)

Distribution of UK side-impact bicyclist-truck injury types before/after sideguards

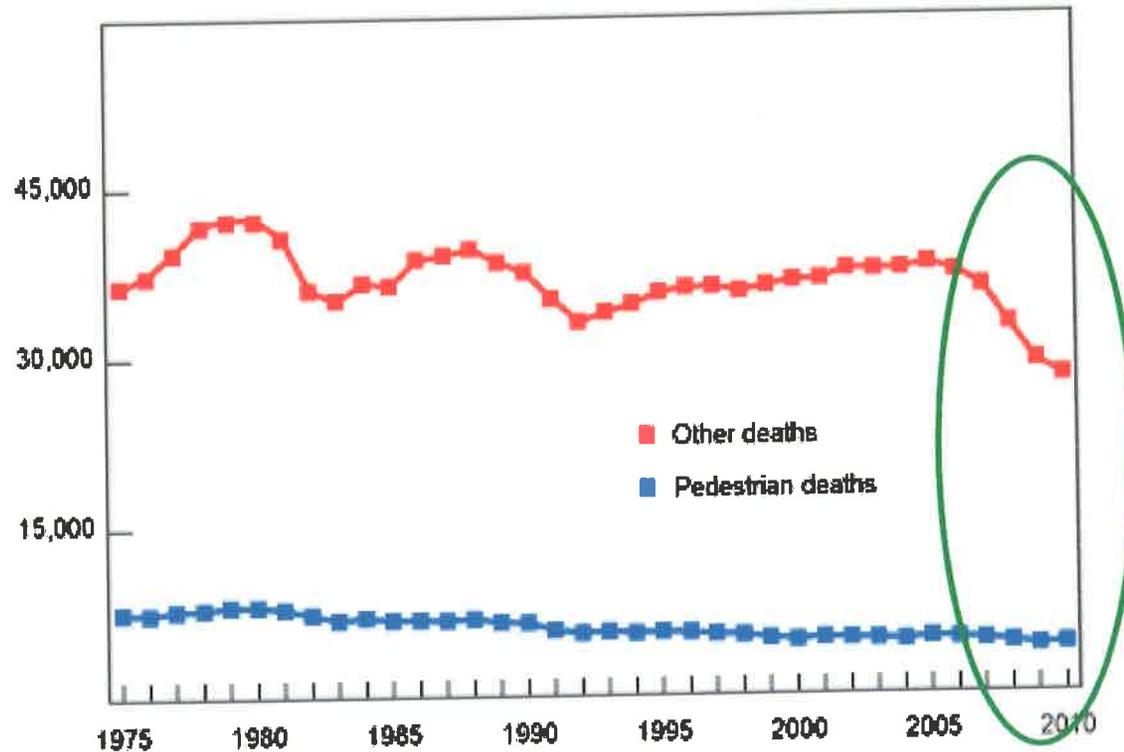


Our Staff: Multidisciplinary and Multimodal



Progress gap in U.S. road safety

Pedestrian/cyclist deaths and other motor vehicle crash deaths, 1975-2010



- Nonmotorists were **16.4%** of 2011 fatalities, **up from 13.6%** in 2001

Spec Committee Sideguard Briefing

- ❑ International sideguard standards and recommendations
- ❑ Diagrams of EU/UK standard
 - Volpe high-level recommendation
- ❑ Typical and innovative sideguard installations
- ❑ International sideguard exemptions
- ❑ Priority vehicles for sideguard retrofit
- ❑ OEMs and next steps

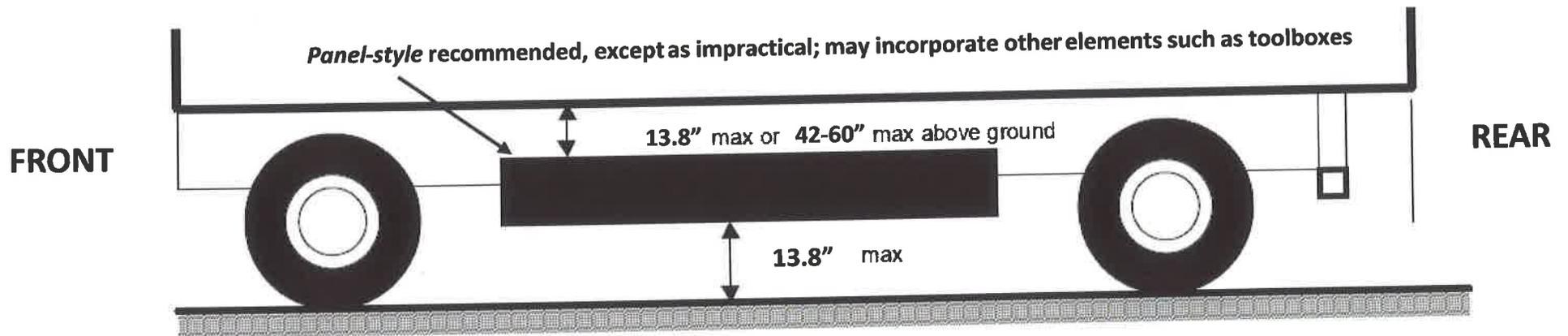
Goal: frame DCAS sideguard specification development and receive fleet input

International sideguard standards and recommendations

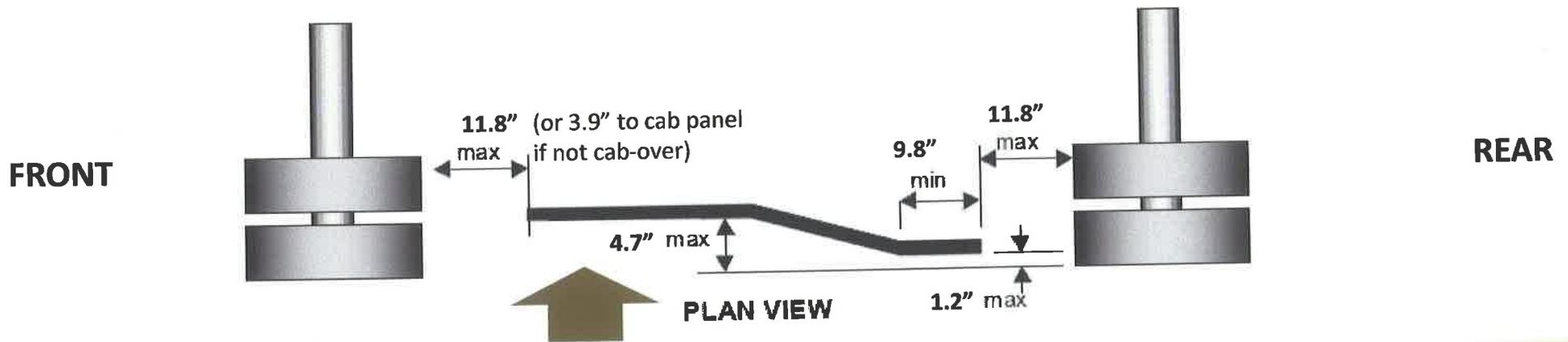
Attributes
Vehicles covered
Exemptions
Strength requirement
Max. ground clearance
Height for top of sideguard
Gap between sideguard and wheels
Designs allowed
Other vehicle components
Requirement to be flush with vehicle and to present smooth outer surface

Recommendation schematic

Based on EU and UK standards and on Monash Univ., Transport Research Lab and Volpe recommendations



SIDE VIEW



440 lbs. force test

Example sideguard specifications

Regulation No 73 of the Economic Commission for Europe of the United Nations (UN/ECE) — Uniform provisions concerning the approval of goods vehicles, trailers and semi-trailers with regard to their lateral protection (*)

6. REQUIREMENTS

6.1. General

6.1.1. Vehicles in categories N₂, N₃, O₃ and O₄ must be constructed and equipped in such a way as to offer, throughout their length, effective protection to unprotected road users against the risk of falling under the sides of the vehicle and being caught under the wheels. This requirement will be considered satisfied either:

6.1.1.1. if the vehicle is equipped with a special lateral protective device (sideguards) in accordance with the requirements of paragraph 7; or

6.1.1.2. if the vehicle is so designed and/or equipped at the side that, by virtue of their shape and characteristics, its component parts can be incorporated and/or regarded as replacing the lateral protective device. Components whose combined function satisfies the requirements set out in paragraph 7 below are considered to form a lateral protective device.

Example specification

Regulation No 73 of the Economic Commission for Europe of the United Nations (UN/ECE) — Uniform provisions concerning the approval of goods vehicles, trailers and semi-trailers with regard to their lateral protection (*)

7. TECHNICAL SPECIFICATIONS FOR LATERAL PROTECTIVE DEVICES

- 7.1. The lateral protective device shall not increase the overall width of the vehicle and the main part of its outer surface shall not be more than 120 mm inboard from the outermost plane (maximum width) of the vehicle. Its forward end may be turned inwards on some vehicles in accordance with paragraphs 7.4.3 and 7.4.4. Its rearward end shall not be more than 30 mm inboard from the outermost edge of the rear tyres (excluding any bulging of the tyres close to the ground) over at least the rearmost 250 mm.
- 7.2. The outer surface of the device shall be smooth, and so far as possible continuous from front to rear; adjacent parts may however overlap provided that the overlapping edge faces rearwards or downwards, or a gap of not more than 25 mm measured longitudinally may be left, provided that the rearward part does not protrude outboard of the forward part; domed heads of bolts or rivets may protrude beyond the surface to a distance not exceeding 10 mm and other parts may protrude to the same extent provided that they are smooth and similarly rounded; all external edges and corners shall be rounded with a radius not less than 2,5 mm.

Example specification

Regulation No 73 of the Economic Commission for Europe of the United Nations (UN/ECE) — Uniform provisions concerning the approval of goods vehicles, trailers and semi-trailers with regard to their lateral protection (*)

7.3. The device may consist of a continuous flat surface, or of one or more horizontal rails, or a combination of surface and rails; when rails are used they shall be not more than 300 mm apart and not less than:

— 50 mm high in the case of N₂ and O₃;

— 100 mm high and essentially flat in the case of N₃ and O₄;

combinations of surfaces and rails shall form a practically continuous sideguard subject, however, to the provisions of 7.2.

7.6. The lower edge of the sideguard shall at no point be more than 550 mm above the ground.

Example specification

Regulation No 73 of the Economic Commission for Europe of the United Nations (UN/ECE) — Uniform provisions concerning the approval of goods vehicles, trailers and semi-trailers with regard to their lateral protection (*)

7.8. Sideguards shall be essentially rigid, securely mounted (they shall not be liable to loosening due to vibration in normal use of the vehicle) and, except as regards the parts listed in paragraph 7.9, made of metal or any other suitable material. The sideguard shall be considered suitable if it is capable of withstanding a horizontal static force of 1 kN applied perpendicularly to any part of its external surface by the centre of a ram the face of which is circular and flat, with a diameter of $220 \text{ mm} \pm 10 \text{ mm}$, and if the deflection of the guard under load is then not more than:

— 30 mm over the rearmost 250 mm of the guard, and

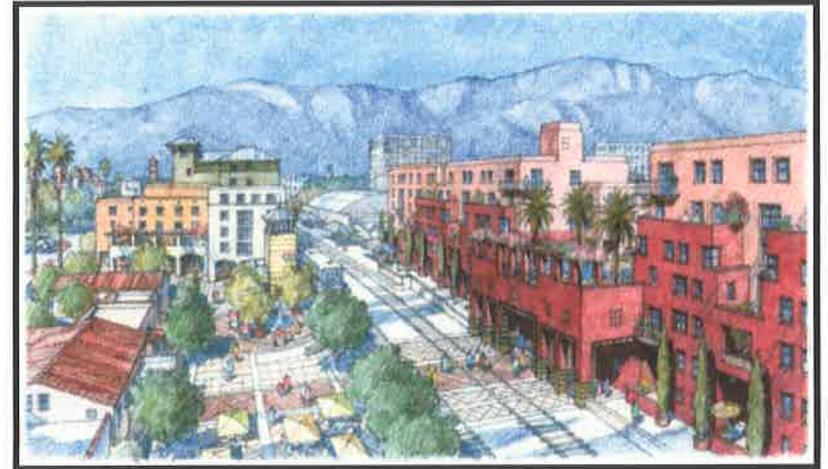
— 150 mm over the remainder of the guard.

Compliance with this requirement can be verified by calculation.

Transportation Policy and Planning

Focus

- ❑ Transportation policy and economic analysis and research that contribute to a compelling vision of transportation
- ❑ Guidance that helps decision makers make smart investments in the planning, development, management, operations, and financing of transportation systems and agencies



Example projects

- ❑ Transportation planning for national parks and public lands – *FHWA, FTA, National Park Service*
- ❑ Implementation of Strategic Highway Research Program initiatives – *FHWA*
- ❑ Understanding effects of policies and economics on traveler behaviors – *FHWA, ITS JPO*

Safety Management and Human Factors

Focus

- ❑ Acquisition, maintenance, distribution, and analysis of safety data
- ❑ Development of large-scale IT solutions to support safety inspection and enforcement
- ❑ Internationally recognized human factors research and development capabilities supporting all modes of transportation



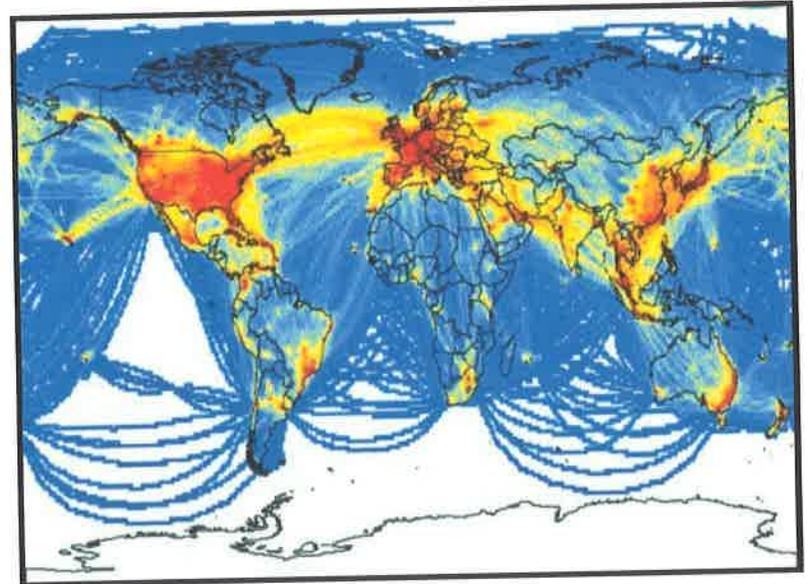
Example projects

- ❑ Safety Performance Analysis System (SPAS) – *FAA*
- ❑ Compliance, Safety, Accountability (CSA) program – *FMCSA*
- ❑ Vehicle defects reporting and tracking (safercar.gov) – *NHTSA*
- ❑ Confidential Close Call Reporting System – *FRA*
- ❑ Improving safety culture in rail – *FRA*
- ❑ Human system interaction and cockpit displays – *FAA*

Environmental and Energy Systems

Focus

- ❑ Measurement, analysis, and modeling of energy consumption, climate variability, air quality, and noise
- ❑ Research and analyses of data to provide scientific basis for energy and environmental policy



Example projects

- ❑ Aviation Environmental Design Tool (AEDT) – *FAA, NASA*
- ❑ Fuel economy research, analysis, and modeling (CAFE) – *NHTSA*
- ❑ Environmental compliance – *FAA, EPA, NPS, PHMSA*

Contact us

- ❑ Phone: 617-494-2000
- ❑ Web: www.volpe.dot.gov
- ❑ Questions: askvolpe@dot.gov

