



TOGETHER FOR  
**SAFER ROADS**

COMPANIES DRIVEN TO SAVE LIVES™

# Direct Vision Transition Guide

An operator's guide to  
transforming fleets for safety

SEPTEMBER 2024

# Letter from the Executive Director

From back-up cameras to 360 degrees sensors, from intelligent speed assist programs to vehicle data and telematics platforms, new technologies are emerging everywhere to help make our roads safer. This rapid pace of safety innovation requires a strong foundation and provides us with a unique opportunity to ensure that our vehicle design fundamentals are sound - that drivers can directly see the road, and all the people they share it with.

Direct vision trucks are a key part of that foundation. By starting with direct vision cabs, and layering on supportive technologies and tools, fleet operators and vehicle and technology manufacturers can create truly safer vehicles, leveraging intentionally redundant safety systems, to reduce roadway crashes, fatalities, and injuries.

As a global NGO, TSR works to leverage the insights, data, and experiences from our public and private sector members to make our roads safer. This Fleet Transition Guide demonstrates the unique role that TSR plays in supporting the public-private and cross-sector partnerships that are critical to solving some of our most difficult and important road safety challenges. From initial conversations about direct vision between road safety researchers, city staff, and fleet safety officers in the UK and the US, to the development of [TSR's 5-Star Direct Vision Rating Toolkit](#) at a one-day design sprint attended by CDL drivers, fleet operators, researchers, policy makers and vehicle and technology manufacturers; from refinement of that tool through direct testing in warehouses and truck yards across the country, to the generosity of TSR's members to provide interviews and content contextualization for this report, the guidance exemplifies the kinds of collaborations needed to improve safety on the road.

We hope that resources like this new guide empower and support the owners and operators of fleets, large and small, public and private, in their efforts to create the safest possible fleets. With direct vision truck cabs, the road ahead, and to the side, is clear, creating the foundation for a safer tomorrow.

**Peter Goldwasser**



Executive Director  
Together for Safer Roads

# Table of Contents

---

- 4 [Executive Summary](#)
- 5 [What is Direct Vision and How Can It Help Your Fleet?](#)
- 17 [Measuring and Evaluating Visibility](#)
- 27 [Transitioning to Direct Vision Fleets](#)
- 34 [What's on the Market](#)
- 40 [Looking Forward with Direct Vision](#)
- 42 [Additional Resources and Materials](#)
- 43 [References](#)
- 45 [Acknowledgments](#)

# Executive Summary

**Vehicle manufacturers and fleet operators have a unique opportunity to improve safety on our roads by improving truck cab design.** Tens of thousands of trucks travel on US roads each day. Improving truck cab design to increase what a driver can see can significantly improve safety outcomes for fleets, help organizations meet their safety goals, and increase driver comfort and satisfaction. Truck cabs with increased visibility, often called direct vision trucks are increasingly available and desired on the US market.

Direct vision vehicles provide substantial safety benefits and are proven to reduce crashes, injuries, and fatalities. Data from London, where trucks have been required to meet a direct vision standard since 2019, shows a **75% reduction in fatal crashes and a 64% reduction in crashes causing severe injuries** where vision was a factor. Research shows that **driving a conventional truck results in a 23% increase in pedestrian collisions** versus trucks optimized for direct vision. Incorporating direct vision vehicles into private and public sector fleet upgrade and transition planning is an integral part of a Safe Systems Approach to reducing traffic deaths and injuries.

**Improving driver visibility is essential to reducing roadway fatalities.** On average, approximately 40,000 people lose their lives on US roads each year, a rate well above that of any other industrialized nation. Of particular note, blindzone-related crashes are also increasing. While visibility from the driver's seat is not regulated federally, NHTSA data shows that **frontover fatalities have more than doubled in the past decade**. These crashes, where a driver hits and kills someone directly in front of them, have increased from 225 fatalities in 2012 to 543 fatalities, and over 10,000 injuries, in 2021. Blindzones pose a significant risk to people walking, biking, or using wheelchairs, as well as to the truck drivers themselves, and other drivers on the road.

**Fleet operators and manufacturers can reduce roadway fatalities and injuries by using the tools in this report to measure visibility from the driver's seat and transition their fleets to direct vision truck models.** This report, commissioned by Together For Safer Roads (TSR), provides a framework for incorporating direct vision vehicles into fleet transition plans, offering operators a guide to transforming their fleets for safety. It includes instructions for using TSR's 5-Star Vision Rating Tool which allows fleet operators to directly measure visibility, understand the visibility profiles of their existing fleet, and prioritize vehicles for upgrades and replacements. It also provides an overview of the safety benefits of direct vision vehicles, case studies from cities across the US and the UK, as well as information about the USDOT Volpe Center's Blindzone calculator and database, and current direct vision vehicles available on the US market.



# What is Direct Vision and How Can It Help Your Fleet?

Across the world, private and government fleet operators have recognized that improving driver visibility can help them meet road safety goals and increase driver satisfaction. Operators are embracing direct vision trucks (also known as high-vision trucks) which use a combination of cab design features - a lower cab height, removal or reduction of the hood or bonnet, and increased window sizes - to increase visibility from the driver's seat, remove blindzones, and reduce crashes. In addition, the lower cab height makes entry/exit easier and safer for drivers and the increased visibility reduces driving stress.



A direct vision truck operating in New York City. The driver can clearly see the road and people moving around the vehicle. Image: Kate Fillin-Yeh.

Direct vision trucks reduce the likelihood that a crash will occur because they give drivers more time to see and react to objects and conflicts on the road ahead. In London, where heavy goods trucks have been required to meet a direct vision standard since 2019, **fatal crashes where vision was a factor have decreased by 75%**.<sup>1</sup> Vision-related crashes causing severe injuries fell 64% from 2017 to 2021. In studies conducted by Transport for London, **professional drivers in a direct vision cab struck simulated pedestrians 80% less often than they did in a conventional low vision vehicle**.<sup>2</sup>

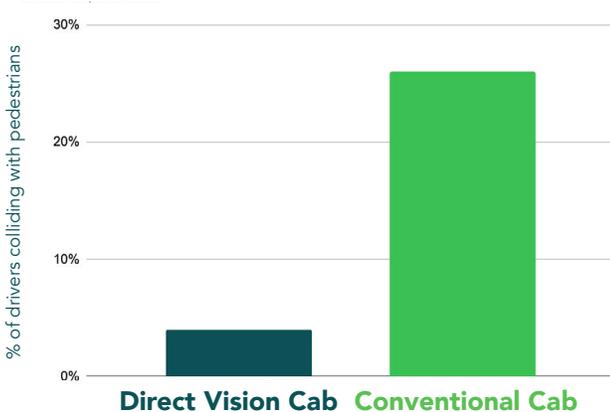
Vehicle designs that increase visibility – essentially cabs that give drivers back a fuller field of vision – can even help mitigate distraction-related crashes. In the UK studies, **distracted drivers in direct vision cabs reacted faster than drivers who were paying attention in conventional low-vision cabs**. Overall, studies found that **driving a traditional cab resulted in a 23% increase in pedestrian collisions versus trucks optimized for direct vision**.<sup>3</sup>



A conventional truck in Cambridge, MA. The design of this truck cab means that, even though the driver has stopped appropriately at the stop bar, they cannot see the people or cyclists in the crosswalk directly in front of them. Image: Alexander Epstein.

In the U.S., the issue of blindzones and visibility-related crashes is particularly acute as many commonly used trucks and SUVs, and many passenger vehicles, have increasingly large blindzones. A 2006 University of Michigan study found that **20% of truck-initiated crashes are linked to poor visibility from the driver's seat.**<sup>4</sup> In these cases, the crash occurred because the driver could not see the person, vehicle or object or could not see it with enough time to react and brake or avoid it. Similarly, a recent report from the USDOT Volpe Center which looked at heavy duty trucks in the Boston municipal fleet, identified numerous vehicles with front and side blindzones greater than 10'.<sup>5</sup> This means that drivers in these vehicles, when stopped legally 5' before the crosswalk, would be unable to see people in the crosswalk directly in front of them.

### Crashes are more likely in conventional cabs



### Crashes are more likely in conventional cabs... even when drivers are distracted



Source: Transport for London. Image: NACTO.

## Additional Safety Benefits

**In addition to increasing safety for people outside the vehicle, many of the design features of direct vision cabs, such as low-entry, also provide safety and comfort benefits to drivers.** These benefits, in turn, can translate into operational and financial benefits for organizations.

- **Decreased Trip-and-Falls:** In 2020, the U.S. transportation and warehousing industry had over 16,000 non-fatal and 41 fatal falls, slips, or trips, many associated with climbing in and out of large vehicles.<sup>6</sup> In contrast to high-entry cabs where drivers have to worry about navigating multiple steps in all-weather conditions, the low-entry design of direct vision vehicles eliminates steps and reduces the height from which a driver could fall if they slip. In a working group of cities convened by the USDOT Volpe Center, participants mentioned “the lower the cab, the safer it can be for the [driver or] worker who needs to climb in and out (e.g. for garbage, pothole/sidewalk repair, tree watering, oil/gas delivery, etc.).”<sup>7</sup>
- **Increased Surrounding Conditions Awareness:** Direct vision truck dealers and operators also note that low-entry design of direct vision vehicles allows drivers to pay more attention to their surroundings when exiting the truck and choose the safer side of the vehicle to exit. In high-entry cabs, drivers typically can only exit on the busier “driver’s side” of the vehicle. In contrast, in most direct vision trucks, drivers can choose to walk-thru the cab and exit on the safer side instead of exiting directly into a moving travel lane.<sup>8</sup>
- **Decreased Driver Fatigue:** Drivers note significant decreases in driving fatigue when driving direct vision vehicles. This can be attributed to better sightlines as well as easier entry/exit because of the lowered cab height, and a variety of in-vehicle features such as reduced noise distraction, and increased cab comfort, in current direct vision cab designs. This decrease in driving fatigue can be linked to a reduction in the prevalence of crashes.<sup>9</sup> That reduction in crashes, in turn, can lead to reduced insurance costs, fewer liability claims, and less driver turnover. Already, major insurance companies are connecting indirect vision tools, like cameras, with lower premiums and, in some places, are denying coverage to companies that operate trucks without them.

By rethinking the vehicles they buy and operate, fleet operators have a unique opportunity to improve safety on our roads. And, with tens of thousands of trucks on the road each day, private and public sector fleets can make huge safety gains that will benefit everyone. Buying direct vision trucks, and introducing direct vision requirements into vehicle procurement practices and policies can encourage truck design improvements and increase the comfort and safety of drivers and the people on the road around them.



*The low-entry/cab-thru design of the new Amazon Rivian van makes it easier for drivers to get in and out of the vehicle safely. Image: Mliu92.*

# Looking Forward at Republic Waste Management

In 2019, safety policy makers at Republic Services, one of the nation's largest waste haulers, began to explore ways to continue to improve the safety of their vehicles for their 16,000 daily drivers. Video footage from their trucks showed that, despite best efforts, there were still significant areas of the road that drivers had difficulty seeing. Looking at efforts in the UK and Europe, Republic began shifting to cab-over design, adding peeper windows on the passenger-side door to maximize side vision, but soon decided that more could be done.

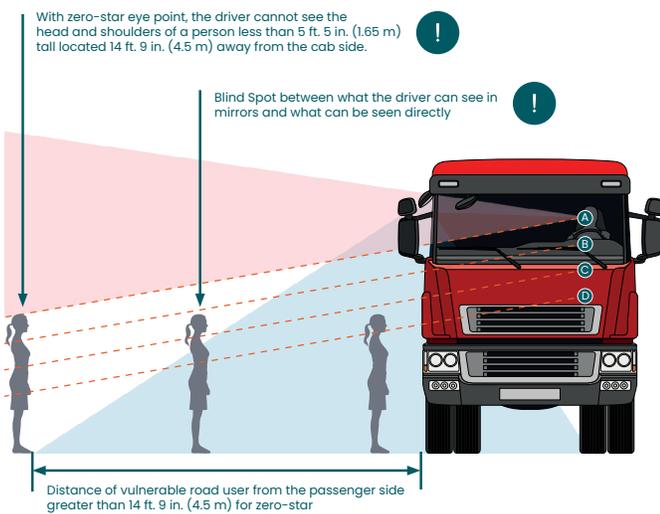


In an effort to achieve best in class visibility, Republic partnered with an established large truck manufacturer, to build an electric direct vision waste hauling truck. The design combines a lower cab with larger front and side windows. Side visibility is further augmented by peeper-style door windows. It scored 5 stars with the TSR Star Rating tool and has received rave reviews from Republic test drivers. In September 2023, Republic announced that 50 of the new trucks would be introduced to their fleet beginning in June 2024.<sup>10</sup>

# Regulating Vision

Despite the obvious importance of being able to see the road ahead, visibility from the driver's seat is not regulated federally in the US. As vehicle sizes increase, this gap in regulation can be associated with significant safety issues. Blindzones pose a significant risk to truck drivers and all other drivers on the road, as well as people walking and biking. NHTSA data shows that **frontover fatalities have more than doubled over the past decade**. These crashes, where a driver hits and kills someone directly in front of them, have increased from 225 fatalities in 2012<sup>11</sup> to 543 frontover fatalities, and over 10,000 injuries, in 2021.<sup>12</sup> On average, approximately 40,000 people lose their lives on US roads each year, a rate well above that of any other industrialized nation.

## HGV Star-rating Boundaries



Sight Line	Description
A	Zero-star eye point
B	One-star eye point
C	Two-star eye point
D	Three-star eye point

## Good Direct Vision



## Limited Direct Vision

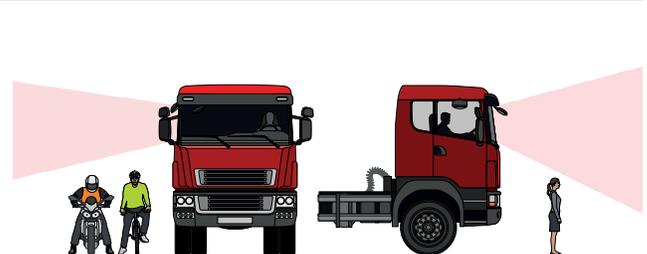


Image modifications for US driver-side context by MassDOT. Image: TfL.

In contrast to the US, ensuring driver visibility is increasingly part of international and European automotive regulatory programs. These new regulations can be associated with positive safety outcomes and are sparking innovation in truck cab design.

- In 2019, the Transport for London (TfL) began addressing the issue of blindzones by creating a **“Direct Vision Standard”** that applies to all heavy goods vehicles entering central London. Operators must evaluate the visibility of their vehicles based on TfL’s Direct Vision Standard and mitigate their spots by adding aftermarket visibility aids if their vehicles do not achieve a rating of 3-stars or higher.<sup>13</sup>
- The United Nations<sup>14</sup> and the European Union<sup>15</sup> have passed similar legislation in recent years. These regulations note the connection between vehicle design and blindzones and look to introduce regulations to improve direct vision and reduce roadway fatalities and injuries.
- In 2023, the **Euro NCAP** (new car assessment program) announced an expansion of their rating program to include trucks, with direct vision as a requirement starting in 2026.<sup>16</sup>
- In the US, New York City recently introduced **Executive Order 39** which requires either 360 degree camera technologies or direct vision cab design in all new City truck purchases.<sup>17</sup>
- In May 2024, at the request of US Representative Jamie Raskin, the Government Accountability Office (GAO) agreed<sup>18</sup> to conduct a **review of U.S. vehicle safety design standards** and their effects on the safety of pedestrians and bicyclists. The Congressman’s request<sup>19</sup> specifically asked the GAO to research “the relationship between the design of passenger and commercial vehicles—including their height, geometry, driver visibility and direct vision, and other design factors—and the increase in pedestrian and cyclist fatalities in the United States.”



*The “bus-style” passenger side door increases driver visibility. Image: Torque.*

# A Safe System Approach to Truck Cab Design

USDOT and road safety experts across the US and the world use a “Safe System” approach to reducing roadway crashes, fatalities and injuries. This approach provides key lessons for how manufacturers and fleet owners and operators can improve truck cab design. At the core of the Safe Systems approach is the understanding that humans make mistakes and thus surrounding contexts and equipment should be designed to “accommodate certain types and levels of human mistakes, and avoid death and serious injuries when a crash occurs.”<sup>20</sup> Safe System posits an overall safety culture using multiple redundant systems. For example, CDL-trained drivers drive in direct vision trucks with the best possible view of the road and surrounding conditions to avoid crashes. These trucks are also supported with aftermarket sensors, cameras, side guards, and low-profile/rounded hoods to minimize harm to people if crashes occur. Incorporating direct vision vehicles into private and public sector fleets is an integral part of a Safe System Approach to reducing traffic deaths and injuries.



As part of a Safe System, direct vision cab design works in tandem with aftermarket safety technology, e.g., cameras and sensors and other safety retrofits such as “peep windows” on driver and passenger-side doors. Cameras and sensors can provide drivers with additional cues that can help avoid crashes and can help them see in places where direct vision is impossible, for example directly behind. In addition, there are millions of conventionally-designed trucks currently on the road that have poor direct vision and can benefit from these types of aftermarket safety solutions. However, we do know that drivers who can see the road directly - *without the aid of cameras, mirrors, and sensors* - react up to 3/4 of a second faster than drivers relying on cameras, mirrors, and sensors.<sup>3</sup> Especially at higher speeds, heavy vehicles can travel significant distances even in a split second. Cab design that allows drivers to react sooner and faster can mean the difference between life and death.

## Designing Direct Vision Vehicles

**Direct vision is what a driver can see directly from the driver's seat, without using indirect vision tools such as cameras, mirrors, or sensors.**

In direct vision trucks, the truck cab is designed to increase what the driver can see from the driver's seat by reducing the number and size of blindzones.



*Window placement, cab height, and hood size and shape all directly impact driver visibility. The driver in the DSNY Sanitation truck (front left), can see the road better than the driver of truck next to them, and can see the road significantly better than the driver of the orange truck (right). Images: Kate Fillin-Yeh.*

Direct vision cabs improve the design of the vehicle cab in three main ways:

- 1. Increasing window sizes and improving placement:** For example, increasing front and side window size, minimizing A-pillar intrusion, maximizing side view by shifting to “bus-style” doors or adding a lower window / “peep” pane.
- 2. Lowering the cab height** and the position of the driver's seat<sup>21</sup>: This makes it easier for drivers to make eye-contact with pedestrians and reduces the number of steps drivers must navigate to enter/exit the vehicle.
- 3. Reducing the size of the truck hood or bonnet or changing the hood shape** (increasing the slope) to increase visibility directly ahead: Many direct vision vehicles also have slightly sloped/rounded noses that “roll” pedestrians away and to the side if they are struck. The transition to electric trucks also provides new opportunities for direct vision trucks as electric trucks do not require a large engine block.

# Direct Vision Design Features

Hood Shape & Step-Up Height

Front Windshield Size

Passenger Side Window Size/Placement

Better

↑ VISIBILITY ↓

Worse



## Driver Experiences with Direct Vision Vehicles

**Across the world, drivers and fleet operators typically report that they prefer to drive direct vision vehicles.** In 2016, TfL conducted an [extensive trial surveying the visibility in large trucks](#) and gathered the views of drivers, operator's transport managers and senior management.<sup>22</sup> While most drivers expressed hesitancy before getting into the vehicle cab, their opinions quickly shifted to positive. As one driver put it, "The visibility on this vehicle is so good, I wouldn't want to go back to an old style vehicle." Managers also quickly recognized the importance and benefits of direct vision. One manager said, "You just need to sit in one of the old cabs then get in the new one and you realize how important this change is."

In the U.S., drivers are less familiar with direct vision vehicles but, when exposed to them, have similarly positive reactions. Commercial waste hauling companies, including Republic Waste, Waste Management, and Interstate Waste Systems, have been testing direct vision cabs in their fleets and routinely find that drivers like the direct vision design. According to Jim Olson, Vice President, at Republic Services, a major US waste management company which operates over 16,000 trucks on the road daily, "Drivers are surprised about how well they can see. At first, they felt more exposed but they quickly realized the benefits [of increased vision]." Similarly, Geoff Rigg, President of Dennis-Eagle says "Drivers are less fatigued because the vehicle is easier to drive. Once they've driven [a direct vision] truck, they don't want to go back."<sup>23</sup>



*A Dennis-Eagle ProView truck in operation in New York City. Image: Kate Fillin-Yeh.*

# “It’s a suicide mission to NOT have a direct vision vehicle.”

**Direct vision cabs typically use a “cab-over” design, where the driver sits on top of, instead of behind, the engine block.** This positions the driver closer to the front of the vehicle and increases visibility. However, this design feature, historically, can have a bad reputation among drivers who remember (or have been told about) discontinued cab-over designs from the 1970’s. Vehicle improvements since 1990’s, such as changes in metal/material, airbags, enhanced crumple-zones, and the introduction of seatbelts, have essentially closed this safety making cab-over trucks statistically as safe for their drivers, while providing significant safety benefits for others



Image: Kevin Clifford.

on the road. Especially for urban trucking, the benefits of increased visibility and reduced crashes, significantly outweighs any difference in the amount of forward crumple zone.

Another indicator that better vision results in increased safety and reduced crashes comes from Pittsburgh’s experience using the direct vision Dennis-Eagle ProView trucks for their garbage operations. When Pittsburgh bought 30 ProView trucks in 2020, an initial concern was the amount of glass in the truck cab. Drivers and fleet managers were concerned that they would see an increase in broken windows because drivers would hit tree limbs and signs during a normal drive. However, two years later, the city has not had to replace any windows in the ProView trucks. As a Dennis-Eagle representative explained it, “the guys can see and so they are not hitting stuff as much. The difference is that the driver can see. It’s a suicide mission to NOT have a direct vision vehicle.”<sup>8</sup>



# Measuring and Evaluating Visibility

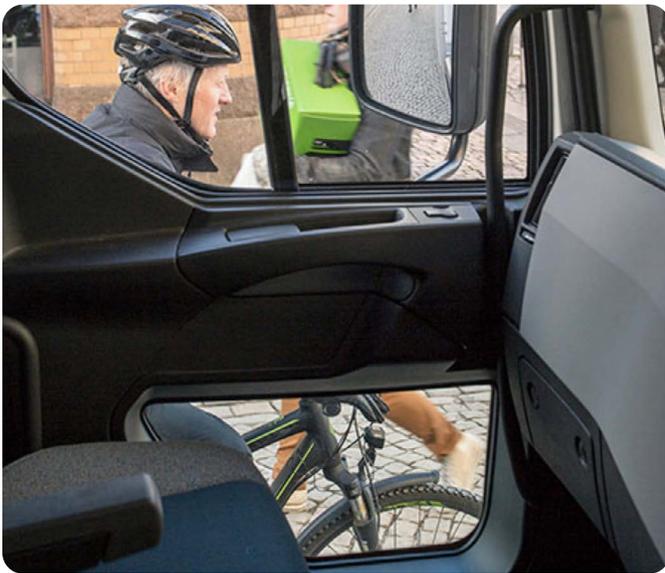
## Despite the obvious importance of being able to see the road, in the US, visibility from the driver's seat is not regulated by the federal government.

To address this glaring gap, Together For Safer Roads developed the [5 Star Rating Toolkit](#) that allows fleet operators to systematically assess what and where their drivers can see and rank their vehicles against other vehicles in their fleets or other vehicle model options on the market. Fleet operators and purchasers can combine the TSR Toolkit with the VIEW Blindzone Calculator and Database to help make the best informed decisions about what vehicles to purchase and where best to deploy them.

### The [TSR 5 Star Rating Visibility Toolkit](#) assesses driver visibility by combining two key measurements:

- The distance at which an average height driver can see a child directly in front of a vehicle
- The distance at which an average height driver can see a child or adult on the passenger side

TSR's 5 Star Rating Toolkit is complemented by the [Volpe Center's VIEW Calculator and Database](#). Both tools are based on the same concepts (side and front vision) but collect and display this information in different ways that are useful in differing situations. For example, a fleet operator might use the TSR 5 Star Rating Toolkit to measure visibility in their current vehicles to decide which ones should be replaced soonest, and then consult the VIEW Database to decide which new vehicle to purchase. The underlying measurements used in both the TSR and VIEW tools also underpin the UK "Direct Vision Standard" allowing users to cross-reference vehicles across the three tools and combine analyses.



*In a truck cab that meets TfL's Direct Vision Standard, a cyclist on the passenger side is clearly visible to the driver. Image: TfL.*



*Measuring front visibility with TSR's 5-Star Rating System. Image: TSR.*

## TSR 5 Star Rating Visibility Toolkit

### What It Does:

- Helps fleet owners quickly assess the visibility of vehicles currently in their fleet
- Provides a star-rating for visibility for each vehicle, based on measurements

### Best Application(s):

- Prioritization of fleet vehicle replacements or upgrades (e.g. which vehicles should be replaced or modified soonest because of underlying poor direct vision)
- Deployment decisions (e.g. which vehicles are best for use in urban settings or places with a significant number of pedestrians and cyclists)

### How It Works:

- Visibility measurements typically take 10 minutes and require a tape measure and a 4' measurement indicator<sup>24</sup>
- Measurements are translated into a star-rating via a paper scorecard

### Example Use Cases:

- A fleet owner looking to rank the visibility of vehicles in their fleet or to prioritize how they should be modified, replaced or deployed
- A fleet owner who is looking for a rapid assessment of visibility from their current or prospective future fleet vehicles
- A fleet owner who is looking for a simple evaluatory metric (stars) to use as a decision-making factor in a purchase or RFP

## VIEW Blindzone Calculator/ Database

### What it does:

- Helps vehicle purchasers understand the visibility limitations of current vehicles and compare visibility of vehicles of a similar class
- Supported by a database of vehicles that includes both VIEW-measured and crowd-sourced visibility measurements

### Best Application(s):

- Guide for new purchase decisions (e.g. which vehicle(s) might have better visibility than current vehicles in use in a fleet)
- Full risk analysis and understanding visibility limitations across multiple vehicle types
- Regulatory policy-making
- Creation of comparisons or "best-of" lists using the underlying database

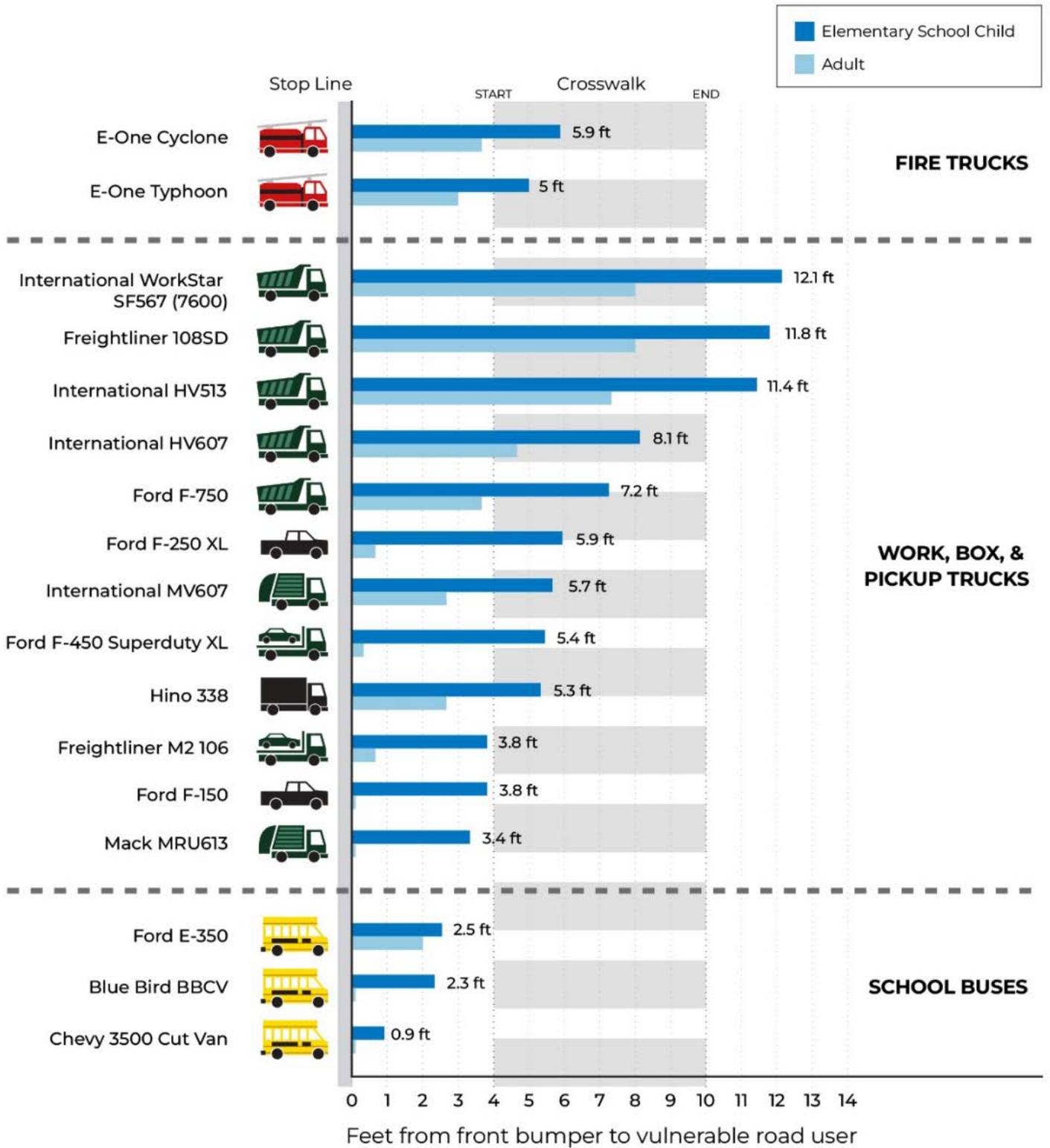
### How it works:

- Visibility measurements typically take 15-20 minutes and require a LiDAR-capable (Pro) iOS device (iPhone 12 Pro/iPad Pro 4th gen or newer), 2 tape measures, and removable tape
- Measurements are uploaded to VIEW's Blindzone Calculator and included in the database

### Example use cases:

- A fleet owner who is looking for an in-depth assessment of visibility from their fleet vehicles
- A policy-maker who is looking for understand the visibility limitations of vehicles or fleets, potentially as a basis for rule-making on visibility from the driver's seat

# Front Visibility in Commonly Used Fleet Vehicles



A comparison of front visibility from common vehicles in the Boston municipal fleet.  
 Image: Boston Blindzone Safety Initiative Report, 2023.

# “In the Field” Measurement Tips



*Dennis Eagle safety technicians utilizing the TSR Visibility Kit.*

- **Keep your “driver” height consistent.** The height of the driver affects how much they can see. To ensure that the final measurements are consistent across vehicles, make sure the “driver” is the same height for all vehicles.
- **Measure with a “at-or-below average height” driver.** The average American male is 5’9”. To best understand the safety profile of a fleet, measure your vehicles with an at-or-below-average height driver. The resulting visibility profile will err on the side of caution, with the majority of drivers being able to see slightly more than is measured.
- **Keep it level, keep it clear.** To ensure accurate consistent measurements, make sure that the vehicle you are measuring is parked on level ground and that there are no obstructions (e.g. buildings or objects) around you.

# TSR 5-Star Rating Visibility Tool Instructions

**TSR's 5-Star rating tool is based on the distance from which the average elementary school child can be seen by a driver.** Measurements are taken directly in front of the vehicle and on the passenger side. The child is assumed to have a shoulder height of 36". A five star front rating is achieved when a child is in view at a distance of less than 4ft from the front of the truck. A five star side rating is achieved when a child is in view at a distance of less than 3ft on the passenger side of the truck. A short instructional video showing how to take measurements and rate vehicles is available on TSR's website.

## Materials Needed

- 12' measuring tape
- 1 telescoping monopod with tape marks at 3ft and 4ft
- Measurement card

**Instructions** (you will need two people to complete the measurements)

### Step 1 – Set Up

1. Park the truck on level ground and have one person (the "driver") sit in the driver's seat.
2. The other person should fully extend the monopod, confirming that there is a clear marker at both 3ft and 4ft.
3. Record the vehicle VIN #, make, model, and year on your scorecard.

### Step 2 – Take Measurements

- **Measurement A (front visibility)**
  1. Align the monopod with the center of the front bumper of the truck and place it on the ground directly in front of the truck.
  2. Move the monopod toward or away from the truck until the 3ft tape mark is barely visible to the driver. If you can only see the top of the 3ft tape mark, you have positioned it correctly.
  3. Record the distance, in feet, from the monopod to the front bumper of the truck as Measurement A.
- **Measurement B (passenger side visibility – 4ft mark)**
  1. Align the monopod with the center of the passenger side door and place it on the ground.
  2. Move the monopod toward or away from the truck until the 4ft tape mark is barely visible to the driver. If you can only see the top of the 4ft tape mark, you have positioned it correctly.
  3. Record the distance, in feet, from the monopod to the passenger side door of the truck as Measurement B.

- **Measurement C (passenger side visibility 3ft mark)**

1. Align the monopod with the center of the passenger side door and place it on the ground.
2. Move the monopod toward or away from the truck until the 3ft tape mark is barely visible to the driver. If you can only see the top of the 3ft tape mark, you have positioned it correctly.
3. Record the distance, in feet, from the monopod to the passenger side door of the truck as Measurement C

- **Measurement D (Driver Height)**

1. With the driver standing outside of the vehicle, measure their height in inches.

### 3. Calculate the Star Rating of the vehicle

- **Front Visibility Rating:**

1. Consult the Star Rating Diagram using Measurement A.

- **Passenger Side Visibility Rating:**

1. Starting with Measurement C, consult the Star Rating Diagram to determine the appropriate Star Rating. If the distance is 3ft or less, this is a 5-Star rating.
2. If the distance is greater than 3ft, **STOP** using Measurement C and use Measurement B for the rest of the side visibility rating assessment.
3. Take a photo of your card and email it to [DVratings@togetherforsaferroads.org](mailto:DVratings@togetherforsaferroads.org).

### Sample Measurement Card

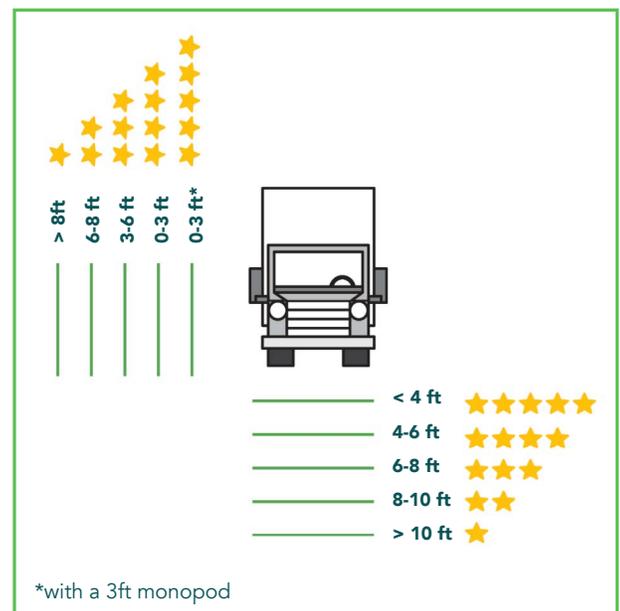
**Direct Vision Measurement Card**

Fill in fields A-D in inches, shade in your star rating, and take a photo of this card. Email it to [DVratings@togetherforsaferroads.org](mailto:DVratings@togetherforsaferroads.org).

Side Rating	☆☆☆☆☆
Front Rating	☆☆☆☆☆

VIN		A	Front to 3 ft monopod	
Make		B	Side to 4 ft monopod	
Model		C	Side to 3 ft monopod	
		D	Driver Height	

### Star Rating Rubric



# Case Study: Prototyping A Rating System

In the early spring of 2023, Together for Safer Roads hosted a one-day Design Sprint in New York City to establish a tool to rate visibility from the driver's seat. Focusing on the people who would be the prime users of the tool, the Design Sprint included drivers, fleet managers, and policymakers, including representatives from Boston and New York City governments, as well as private sector operators like AB-InBev, City Harvest, Interstate Waste Services, Republic Waste Services. In addition, automotive and safety experts from Transport For London and the USDOT Volpe Center also participated.



At the Design Sprint, the group discussed and then prototyped a rating system to measure and star-rate trucks according to the size of their blindzones. The resulting tool combined both front and passenger side visibility measurements, similar to best practice measurement guidance from the Volpe Center and Transport for London, and then added an evaluation score (stars) to help users rank and sort vehicles. Following the Design Sprint, TSR created a simple measurement kit and digital instruction manual, which was sent out to almost two dozen public and private sector fleet managers to measure and rate the vehicles in their fleet.

# VIEW Blindzone Calculator & Database Instructions<sup>25</sup>

The VIEW Blindzone calculator uses LiDAR scans of a vehicle, along with vehicle and eye point measurements, to calculate and visualize blindzones. Once the scans and measurements are collected, they can be uploaded to the VIEW Blindzone Calculator website for processing. The full instructions for collecting measurement and uploading them are available on the [VIEW website](#).

## Materials Needed

- A LiDAR-capable (Pro) iOS device (iPhone 12 Pro/iPad Pro 4th gen or newer)
- Polycam app (download on the [App Store](#))
- Selfie stick
- Two 8' or longer tape measures
- Removable tape (e.g. painter's tape)

## Instructions

### Step 1 – Measuring the Driver's Seat Positioning

To create accurate LiDAR scans in the VIEW Blindzone measurement tool, the first step is to measure the upper and lower bounds of the driver's seat adjustment in relation to the front of the vehicle and the ground. Having two people will simplify the measurement process.

- **Measurement A:** front of vehicle to frontmost position of seat
- **Measurement B:** front of vehicle to backmost position of seat
- **Measurement C:** seat depth
- **Measurement D:** seat center
- **Measurement E:** highest position of seat
- **Measurement F:** lowest position of seat

### Step 2 – Collecting a LiDAR Scan

The second step of collecting data is to use a mobile device to create a 3D LiDAR scan of the vehicle.

- Use the PolyCam app, to scan the vehicle, starting at the rear wheel. Move slowly up and down while walking around the car, making sure to fill in any blue gaps.

### Step 3 – Upload Measurements and LiDAR Scan

- Following the [prompts on the VIEW website](#), upload Measurements A-F and the LiDAR scan for inclusion in the VIEW database.

# Case Study: Measuring Visibility in Boston

In 2022, The Boston Public Health Commission (BPHC) and Boston Transportation Department (BTD), commissioned the USDOT Volpe Center to assess the blindzone sizes of Boston's fleet vehicles as well as the blindzones of alternative vehicle models. This effort came about in recognition of the fact that "poor direct vision of certain vehicles [has] contributed" to pedestrian and cyclist fatalities in the city of Boston and had two main goals: to establish a baseline for understanding visibility in Boston's existing fleet and to create a simple, actionable ratings tool that could be used to guide future procurement decision-making.<sup>5</sup>

Work in Boston began by measuring the visibility from the driver's seat of 21 of Boston's most common large fleet vehicles, mostly serving Boston's Public Schools, Fire, and Public Works departments. The Boston/Volpe team took front and passenger-side visibility measures, and ranked the vehicles using a ratings framework informed by the 2019 Transport for London Direct Vision Standard and the 2023 Together For Safer Roads Direct Vision Rating System.



Image: Boston Blindzone Safety Initiative Report, 2023.

The background of the slide is a teal-tinted photograph of a city street. In the foreground, a white truck is parked, with its side and rear visible. The truck has some text on it, including a phone number '212-651-7273' and a logo that partially shows 'C'. In the background, a multi-story building is under construction, with several floors of windows and a large crane or scaffolding structure extending upwards. The overall scene is urban and industrial.

# Transitioning to Direct Vision Fleets

**Including driver visibility as a factor in vehicle procurement selection is an important way for companies and governments to improve the safety of the vehicles they operate.** While fleets aren't replaced overnight, organizations can phase-in direct vision vehicles through on-going purchase decisions.

Operators can begin to see the benefits of direct vision vehicles immediately. An initial purchase of even a few direct vision vehicles can give managers and drivers time to pilot or test new equipment. This gives drivers the opportunity to see for themselves what they cannot see from the cab of a conventional truck and gives leadership the data they need to understand that they can reduce risk by using direct vision vehicles. By requesting direct vision vehicles and/or asking for driver visibility specifications when making purchases, buyers can further influence the market, making it clear to manufacturers increasing direct visibility is a priority.



*Drivers testing the Dennis Eagle ProView.*

When phasing in direct vision trucks, organizations can also leverage other information, such as performance data, crash data, vehicle specs and purchase year, and other telematics to decide where direct vision vehicles should be deployed first. Ultimately, a simple requirement that all vehicles operated by, or on behalf of, an organization must meet a direct vision standard is an essential step toward increased safety for all road users.

## Operator Tips

- **Reach out to TSR to request your 5 Star Visibility Rating Toolkit and start measuring your fleet.** A clear, quantifiable way of measuring the visibility from the drivers seat for current and prospective vehicles is the first step to improving safety. By using TSR's Toolkit and related visibility measurement systems and databases, operators can create a clear profile of the visibility of the vehicles in their fleets and gather information on how to sequence vehicle replacements, and what direct vision vehicles exist to meet their organization's needs.



*Demonstration of the Dennis Eagle ProView at the 2023 NYC DCAS Vision Zero Fleet Show. Image: Kate Fillin-Yeh.*

- **Connect with your peers.** Connect with direct vision truck dealers, join TSR, or attend safety-focused trade shows such as the NYC DCAS Vision Zero Fleet Forum to learn more about specific makes and models available on the market.
- **Host a demonstration so your stakeholders can see for themselves the benefits of direct vision.** Fleet operators from around the world report that simply sitting in the driver's seat of a direct vision vehicle can be a mind-changing experience for drivers, managers, and administrators alike. Pilot programs, tests, and demonstrations are a great way to build internal support for direct vision vehicles. By creating opportunities for all stakeholders to see for themselves the advantages of direct vision cab design, safety managers can build support and enthusiasm for safer vehicles in their organizations.
- **Invite union and other employee representatives into the conversation.** Many operators have found that bringing drivers and unions into direct vision discussion, especially during the demonstration and testing phases, can help address and alleviate driver concerns early in the process.
- **Find your safety champions.** Drivers, managers, policy makers, unions, insurers, stockholders, procurement teams, leadership, consumers, manufacturers...safety matters to everyone. Finding champions for direct vision vehicles is key. Connecting early with key stakeholder groups and finding internal champions can help smooth the path.

# Case Study: Piloting Cameras at Interstate Waste Systems



**In 2015, safety managers at Interstate Waste Systems (IWS) began a pilot program to add cameras to their refuse collection fleet.** They had noticed a pattern of right-hook crashes, typically with cars, and wanted to understand why they were occurring, who was at fault, and what efforts they might need to undertake to reduce them. The initial pilot program added cameras, after-market, to a small group of trucks.<sup>26</sup>

The pilot program proved invaluable to convincing two key constituents at IWS - drivers and leadership. For leadership, the video footage allowed leadership to see for themselves what situations were occurring and gave them the information they needed to make decisions about staffing and insurance claims. As a result of the pilot, IWS now only buys vehicles with cameras and has increased the number of managers in the field to support their drivers.

Drivers were initially skeptical of the cameras, anticipating that the footage would be used to penalize them. However, in reviewing the video footage, safety managers found that the drivers were often at fault less than expected and were able to use the video footage to support drivers in insurance claims when appropriate. Increasingly, IWS is finding that drivers are unwilling to drive unless cameras are included as standard equipment. As one potential driver put it, "If you don't have cameras, I don't want to work here."

In part, stemming from their experience with the camera pilot, safety executives at IWS point to another, often-overlooked, key constituent in the effort to reduce truck crashes and related fatalities and injuries - insurance companies. Increasingly they find that insurance companies are unwilling to insure companies that operate without cameras or other safety equipment.

## Private Sector Operators

For most private sector operators, the technical aspect of updating procurement practice is relatively simple: leadership and/or safety executives can stipulate that all vehicles purchased by the organization must meet a direct vision standard, such as receiving 5 stars in TSR's Rating tool. Getting to that decision point can be the challenge. In particular, private sector fleet operators who have introduced direct vision vehicles into their fleets stress the importance of getting both leadership and drivers, and their unions, on board with changes.

One time-tested way for building support is by providing stakeholders with opportunities to experience direct vision vehicles for themselves, through equipment pilots, tests, ride-alongs, and demonstrations. Because it is often difficult for people to understand how much they can't see from the cab of a conventional truck, pilots, demonstrations, ride-alongs and other "see-for-yourself" - style events are often particularly illustrative and persuasive.

In addition to demonstrations, vehicle manufacturers are also often interested in real-world feedback from potential purchasers and fleet managers can often leverage partnerships with manufacturers to test direct vision vehicles. For example, in 2020, Interstate Waste Management tested a small fleet of Freightliner-branded direct vision Econic refuse trucks in a few of their west coast depots. The trucks were very positively received by managers and drivers alike and Interstate Waste Management is now looking to purchase more.



A fleet of Dennis-Eagle ProView trucks operated by Veolia.  
Image: Keith Clifford.



Product demonstrations at the 2022 NYC DCAS Vision Zero Fleet Forum. Image: Kate Fillin-Yeh.

# Case Study: “If It Weren’t For the City” – Introducing Sideguards in New York

New York City’s experience introducing regulation around truck sideguards provides an illustrative example for municipalities looking to better regulate visibility. Sideguards have long been recognized as an important safety feature on large trucks, especially those operating in urban environments. Sideguards are key because they can prevent pedestrians, bicyclists, motorcyclists, and even small cars, from going under trucks in side collision.



However, until recently, most trucks operating in U.S. cities have not had sideguards, nor have they been required to install them. In 2015, this began to change as the City passed Local Law 56 which required side-guards on City fleet and commercial waste trucks and DCAS began adding sideguards.<sup>27</sup> By the end of 2015, sideguards had been added to over 1,500 City trucks. In 2021, based on the success of this effort, NYC adopted a law requiring all vehicles in the City Fleet and City contracted vehicles be equipped with safety enhancing sideguards by January 1, 2023.

## Public Sector Operators

**Public sector actors can increase the number of direct vision vehicles on the road through the vehicles they buy and through requirements placed on the vehicles used by contractors on City jobs.**

In most cases, public sector agencies find it easiest to first set internal policy on what they themselves can buy, and then expand policy to apply to the equipment used by contractors doing business with the City, such as waste hauling, food delivery, paving and street work, and utilities. For example, in New York, the City's internal policy mandating sideguards on City-owned trucks has recently been expanded, through rule making, to apply to *City-contracted vehicles* as well.

At a technical level, including driver visibility specifications as a standard component of vehicle purchases is relatively easy. In Boston, for example, the Volpe researchers identified three options for simple changes to Boston's standard vehicle procurement materials that would allow procurement teams to assess the visibility of the vehicles they buy. By using one of these options, and specifying an established measurement standard, Boston has developed a replicable framework for including visibility into purchase decisions. In New York, DCAS has developed a Safety Fleet Transition Plan that guides purchasing decisions. New York City's recent Executive Order 39 mandates that all new truck purchases either have 360 degree cameras or use direct vision cab designs. This Order will significantly increase the number and profile of direct vision vehicles in the city, presumably paving the way for private operators to follow suit.

In addition, depending on jurisdictional authority, municipal governments can sometimes regulate what kinds of vehicles operate on city streets or in certain areas. In 2019, for example, Transport

for London (TfL), established a visibility standard for all heavy goods vehicles driving in Central London. Under the regulation, trucks must meet the visibility standard or mitigate their lack of visibility through other measures such as mirrors, cameras, and door retrofits. As of October 2024, the minimum star rating needed to operate a truck in Central London will increase to three stars.<sup>28</sup> Vehicles with fewer than 3 stars will need to add additional safety features. This regulation has significantly reduced truck crashes in London and has influenced vehicle purchases across the country.



*A NYC Department of Sanitation truck, operating in Manhattan. In New York City, updating vehicle procurement policies to improve driver visibility has been part of municipal policy since the at least 2014 (as part of the [City's Vision Zero Action Plan](#)). Image: Kate Fillin-Yeh.*



# What's on the Market

**As fleet operators increasingly ask for better vehicles, the market for direct vision vehicles also grows.** Already a wide array of direct vision trucks (electric, CNG, and diesel) are in operation in the European and Asian marketplaces, and multiple models, from established manufacturers, are now for sale in North America. This market is further spurred by a variety of new regulations, such as Tfl's Direct Vision Standard<sup>13</sup>, as well as related regulations passed by the UN<sup>29</sup> in 2023 and EU<sup>30</sup> in 2019, and changes to the General Safety Regulations of the Euro NCAP<sup>31</sup> (new car assessment program). New entrants to the European market include: Volvo's FM Low Entry<sup>32</sup>, DAF's New Generation XD<sup>33</sup>, and Renault's Low Entry Cab electric D E-Tech.<sup>34</sup>

In the US, the market is smaller but growing. By requesting visibility specifications in purchasing processes, companies and governments can harness purchasing power to increase safety and meet workplace performance goals. As one procurement specialist put it, "don't be afraid to make your automotive specialists do their research and find the vehicles you want."

The increasing focus on electric vehicles also offers new opportunities for direct vision design because electric trucks do not require a large engine block that typically is placed under the bonnet, reducing forward visibility. Fleet owners and operators can combine fleet electrification efforts (and funding) with safety by adding visibility requirements into electric vehicle procurement specifications. Already, many manufacturers offer electric versions of fully direct vision trucks and there are a number of electric direct vision trucks in the development stages.

#### **As of early 2024, direct vision trucks available on the US market include:**

- **Dennis Eagle Pro-View**<sup>35</sup>
- **Mercedes/Daimler Eonic & e-Eonic**<sup>36</sup> (often marketed in the US under Freightliner)
- **McNeilus® Volterra™ ZSL™** (currently in initial production)

#### **Electric direct vision trucks currently in the development stage include:**

- **REE P7 Electric**<sup>37</sup>
- **Volta Zero**<sup>38</sup>

Finally, especially in the garbage/recycling and sanitation truck arena, there are a number of trucks with improved, but not fully direct vision. These trucks offer improvements to forward vision but are typically limited in side visibility and may lack some of the driver-focused features (such as low-entry, reduced noise, improved driver comfort, and walk-thru design) that can further reduce driver fatigue and crashes. Some commonly purchased models include:

- **Battle Motors Low Entry Tilt**<sup>39</sup>
- **Mack MRU613**
- **Hino Cabover models**
- **Isuzu NPR Low Cab Forward**<sup>40</sup>

## Direct Vision Trucks on the Market Now

As of early 2024, there are two fully direct vision trucks available on the US market and one in the initial stages of production and commercial release.

### Dennis Eagle Pro-View



The Dennis-Eagle ProView is a best-in-class direct vision truck currently in use in the US. It features low-entry, walk-thru with a variety of driver comfort features such as noise-reduction, and significant vision improvements to the front and side. Some models include a “bus-style” passenger-side door which increases side visibility even further. Notably, the ProView is in use in Pittsburgh, PA as a staple of its sanitation fleet and was recently introduced into Century Waste Hauling’s fleet in New York City. The ProView is also recommended by dealers for road striping or concrete mixing applications.

#### Product overview and technical specifications:

- [ProView](#)

### Mercedes/Daimler Eonic



Typically branded as Freightliner in the US, the Mercedes/Daimler Eonic is a best-in-class direct vision truck currently in use in the US. Available as all electric or with a conventional engine, the Eonic was developed specifically

for municipal operations, trash/refuse-collection and short-radius distribution, but can be used for a wide variety of applications. It features low-entry, walk-thru cab design, enhanced forward and side vision, and high-comfort ergonomics. The Eonic is used by Waste Management in a number of its West Coast facilities.

#### Product overview and technical specifications:

- [Eonic](#)
- [eEonic](#)

## McNeilus® Volterra™ ZSL™

Currently in the initial stages of production and release, the McNeilus® Volterra™ ZSL™ is an all-electric, built-for-purpose refuse truck that includes many features of direct vision design, such as low 15" step height, increased interior cab space for drivers and crew, a 5-Star Direct Vision rating under the UK standard, and standard installation of ADAS systems.<sup>41</sup> In addition, the Volterra is certified zero emission by the California



Air Resources Board (CARB). In September 2023, McNeilus announced that Republic Services purchased 50 vehicles with delivery beginning in June 2024.<sup>10</sup>

### Product overview and technical specifications:

- [Volterra](#)

## In Development

In recent years a number of electric direct vision trucks have made their debut at automotive shows across the US. These vehicles are available for purchase in the US but not yet in widespread production.



### REE P7 Electric<sup>37</sup>

REE Automotive offers a high visibility, low-entry cab. The company uses a modular platform base that can be configured for a variety of urban and last-mile delivery uses.



### Volta Zero<sup>38</sup>

The Volta Zero provides a low-entry cab with high visibility on all sides. The Volta Zero is meant for urban and last-mile applications.

## Other Trucks of Note

There are a number of trucks with improved, but not fully direct vision. These trucks provide some of the benefits of the fully direct vision trucks but typically are limited in their passenger side visibility. These trucks may also lack some of the driver-focused features (such as low-entry, reduced noise, improved driver comfort, and walk-thru design) that can further reduce driver fatigue and crashes.



### Battle Electric

#### Product overview and technical specifications:

- [Electric/CNG/Diesel](#)



### Mack LR Electric

#### Product overview and technical specifications:

- [Mack LR Electric](#)



### Hino Cabover

#### Product overview and technical specifications:

- [Hino 155](#)
- [Hino 195](#)



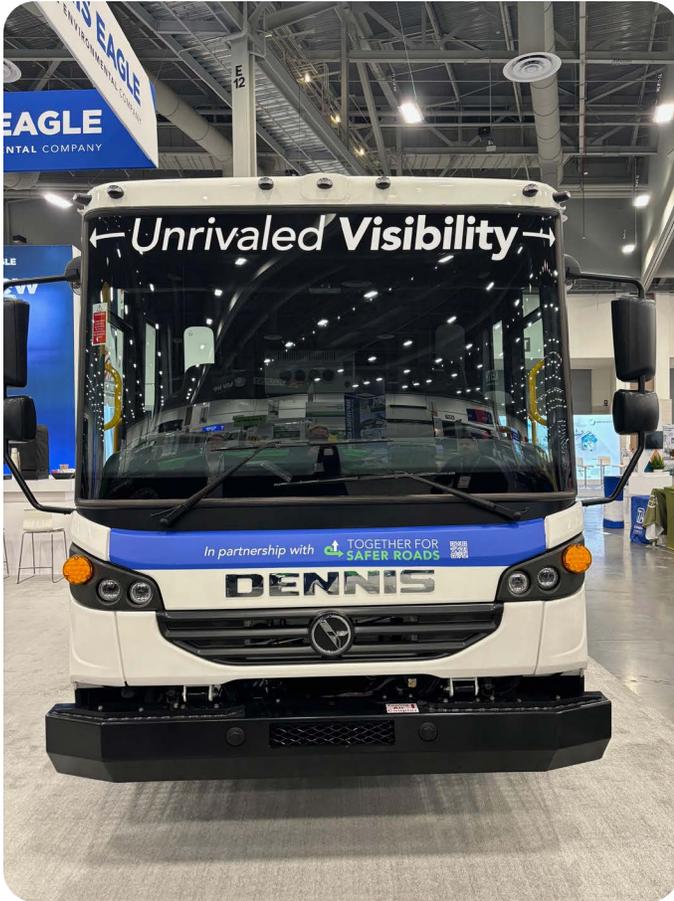
### Isuzu NPR Low Cab Forward

#### Product overview and technical specifications:

- [Isuzu NPR series](#)



# Looking Forward with Direct Vision



**Transitioning public and private sector fleets to direct vision trucks is an immediate step that fleet managers and owners can take to increase safety, improve driver comfort, and reduce tragic and costly crashes.** A combination of market demand, increased awareness of the issues of road safety and limited visibility, and new, safety-focused regulatory programs in Europe and select US cities, is sparking innovation in truck cab design, ensuring an increasingly wide array of makes and models to choose from. Concurrent pushes toward, and funding for, fleet electrification make this an ideal time to pursue direct vision fleet transition efforts.

TSR's 5 Star Visibility Rating Tool and the related visibility measurement systems and databases provide a simple, effective resource for safety-minded fleet operators.

This tool simplifies measurement and offers a clear standard that everyone, from manufacturers to operators to drivers, can use to understand what they can see from the driver's seat, and make choices about future purchases. By using the 5 Star Rating Tool and the case studies and other resources detailed in this report, fleet owners and operators can begin today to transform their fleets for safety.

Begin by requesting your 5 Star Visibility Rating Toolkit from TSR and start measuring your way to safety today.

## Additional Resources and Materials

- [TSR Direct Vision Rating Guide \(2023\)](#)
- [VIEW Blindzone Calculator](#)
- Transport For London
  - [Research & Tools](#)
  - [Exploring the Road Safety Benefits of Direct Vision](#) (TfL/ARUP/University of Leeds PAC Lab)
  - [Heavy Goods Vehicles: New Vehicle Research](#) (TfL)
  - [TfL's Direct Vision Experience](#)
- [Boston Blindzone Safety Initiative: Current Fleet Analysis, Market Scan, and Proposed Direct Vision Rating Framework](#) (USDOT Volpe Center/City of Boston 2023)
- [Massachusetts Direct Vision Study](#) (MassDOT)
- [Optimizing Large Vehicles for Urban Environments](#) (USDOT Volpe Center/NACTO 2018)
- International Regulations
  - UK - [Direct Vision Standard and HGV Safety Permit Scheme - Transport for London](#)
  - UN - [R167e](#)

# References

- <sup>1</sup> Transport for London. 2023. "TfL and London Councils Progress Plans to Further Improve Lorry Safety in London." Transport for London. June 13, 2023. [https://tfl.gov.uk/info-for/media/press-releases/2023/june/tfl-and-london-councils-progress-plans-to-further-improve-lorry-safety-in-london#:~:text=Transport%20for%20London%20\(TfL\)%20and](https://tfl.gov.uk/info-for/media/press-releases/2023/june/tfl-and-london-councils-progress-plans-to-further-improve-lorry-safety-in-london#:~:text=Transport%20for%20London%20(TfL)%20and).
- <sup>2</sup> Epstein, Alexander, and Rebecca Kiriazes. 2018. "Safe Fleet Transition Plan Best Practice Technologies and Processes." [www.nyc.gov/assets/dcas/downloads/pdf/fleet/Safe-Fleet-Transition-Plan-Update-2018.pdf](http://www.nyc.gov/assets/dcas/downloads/pdf/fleet/Safe-Fleet-Transition-Plan-Update-2018.pdf).
- <sup>3</sup> Transport for London, Arup, and The University of Leeds PAC Lab. n.d. "'Exploring the Road Safety Benefits of Direct Vision.'" <https://content.tfl.gov.uk/road-safety-benefits-of-direct-vs-indirect-vision-in-hgv-cabs-summary.pdf>.
- <sup>4</sup> Reed, Matthew P., Daniel Blower, Michael J. Flannagan, International Truck and Engine Corporation, and University of Michigan Transportation Research Institute. 2006. "Prioritizing Improvements to Truck Driver Vision." ROSA P. March 1, 2006. <https://rosap.ntl.bts.gov/view/dot/20427>.
- <sup>5</sup> Brodeur, Alyssa, Eric Englin, Alexander K. Epstein, and Alessandra Vennema. 2023. "Boston Blindzone Safety Initiative: Current Fleet Analysis, Market Scan, and Proposed Direct Vision Rating Framework." Edited by John A. Volpe National Transportation Systems Center (U.S.). Safety Management Systems Technical Center. ROSA P. August 1, 2023. <https://rosap.ntl.bts.gov/view/dot/68730>.
- <sup>6</sup> U.S. Bureau of Labor Statistics. 2022. "Transportation and Warehousing, 2016-2020." Bureau of Labor Statistics. January 5, 2022. <https://www.bls.gov/iif/snapshots/isn-transportation-and-warehousing-2016-20.htm#Fatal%20Occupational%20Injuries>.
- <sup>7</sup> Chiarenza, Jonah, Margo Dawes, Alexander Epstein, Donald Fisher, and Katherine Welty. 2018. "Optimizing Large Vehicles for Urban Environments Downsizing." National Association of City Transportation Officials. [https://nacto.org/wp-content/uploads/2018/12/2018USDOTVolpe\\_Downsizing\\_FINAL\\_updated12-21-18.pdf](https://nacto.org/wp-content/uploads/2018/12/2018USDOTVolpe_Downsizing_FINAL_updated12-21-18.pdf).
- <sup>8</sup> Interview with Kevin Clifford, Quality Truck Center, February 2023.
- <sup>9</sup> CDC. 2024. "Driver Fatigue on the Job." CDC. May 16, 2024. <https://www.cdc.gov/niosh/motor-vehicle/driver-fatigue/index.html>.
- <sup>10</sup> McNeilus Trucks and Manufacturing. 2023. "McNeilus Reinvents Parts Brands to Better Meet Replacement Parts Needs for All Fleets - McNeilus." McNeilus Garbage Trucks. September 25, 2023. <https://mcneilusgarbagetrucks.com/news/mcneilus-announces-first-order-of-fully-integrated-electric-rcvs-with-republic-services>.
- <sup>11</sup> Singh, S. Traffic Safety Facts Crash – Stats Non-Traffic Surveillance: Fatality and Injury Statistics in Non-Traffic Crashes. NHTSA's National Center for Statistics and Analysis, Aug. 2016, [crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812311](https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812311).
- <sup>12</sup> National Center for Statistics and Analysis. 2024. "Non-Traffic Surveillance: Fatality and Injury Statistics in Non-Traffic Crashes in 2021." National Highway Traffic Safety Administration. <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813539>.
- <sup>13</sup> Transport for London. "Direct Vision Standard and HGV Safety Permit." Transport for London, [tfl.gov.uk/info-for/deliveries-in-london/delivering-safely/direct-vision-in-heavy-goods-vehicles](http://tfl.gov.uk/info-for/deliveries-in-london/delivering-safely/direct-vision-in-heavy-goods-vehicles).
- <sup>14</sup> The UN Regulations states "This UN Regulation asks for commercial vehicles that meet certain minimum standards of direct vision, in order to maximize the chances of a driver recognising and quickly reacting to the presence of a VRU in critical situations during low speed maneuvering." UN Regulation No. 167 Uniform Provisions Concerning the Approval of Motor Vehicles with Regard to Their Direct Vision R167e (2).pdf ([unece.org](http://unece.org))
- <sup>15</sup> The EU regulation states "the high position of the driver led to an increased -spot area and poorer direct visibility around the truck cab. This is a major factor in truck accidents involving vulnerable road users. The number of casualties could be reduced significantly by improving direct vision. Requirements should therefore be introduced to improve direct vision to enhance the direct visibility of pedestrians, cyclists and other vulnerable road users from the driver's seat by reducing to the greatest possible extent the spots in front and to the side of the driver." Regulation (EU) 2019/2144 of the European Parliament and of the Council. Regulation - 2019/2144 - EN - EUR-Lex ([europa.eu](http://europa.eu))
- <sup>16</sup> Euro NCAP. "Safer Trucks: On the Road to Vision Zero 2023 and Beyond." [cdn.euroncap.com/media/77173/2304-euro-ncap-safer-trucks-on-the-road-to-vision-zero.pdf](http://cdn.euroncap.com/media/77173/2304-euro-ncap-safer-trucks-on-the-road-to-vision-zero.pdf).

<sup>17</sup> City of New York. 2024. "Mayor Adams Fulfills Major Street Safety Commitment by Making City Vehicle Fleet Safer." The Official Website of the City of New York. February 15, 2024. <https://www.nyc.gov/office-of-the-mayor/news/128-24/mayor-adams-fulfills-major-street-safety-commitment-making-city-vehicle-fleet-safer>.

<sup>18</sup> Comer, James. Letter to Jamie Raskin. 2024. June 4, 2024. [https://raskin.house.gov/\\_cache/files/9/8/980c5ede-8e80-4a6b-8469-2723a85fea17/2C36987C37F32A28E32E8E885C5F4C6E.raskin-240729a.pdf](https://raskin.house.gov/_cache/files/9/8/980c5ede-8e80-4a6b-8469-2723a85fea17/2C36987C37F32A28E32E8E885C5F4C6E.raskin-240729a.pdf).

<sup>19</sup> Raskin, Jamie. Letter to Gene Dorado. 2024, May 30, 2024. [https://raskin.house.gov/\\_cache/files/f/2/f25f9581-a221-47b0-81e5-2587c59cc141/5113365AB8F386ADC58E3286F6723BBC.2024-05-30-rep.-jamie-raskin-request-to-gao-comptroller-dorado-regarding-vehicle-safety-design.pdf](https://raskin.house.gov/_cache/files/f/2/f25f9581-a221-47b0-81e5-2587c59cc141/5113365AB8F386ADC58E3286F6723BBC.2024-05-30-rep.-jamie-raskin-request-to-gao-comptroller-dorado-regarding-vehicle-safety-design.pdf).

<sup>20</sup> USDOT. 2022. "What Is a Safe System Approach?" USDOT. October 13, 2022. <https://www.transportation.gov/NRSS/SafeSystem>.

<sup>21</sup> Lowering the cab height, also known as "cab-over" design does not, on its own, create a direct vision cab. While most cab-over designs provide better forward vision than conventional cab design, they can still have limited visibility to the sides.

<sup>22</sup> Transport for London. 2016. "HGV Evaluation." <https://content.tfl.gov.uk/hgv-evaluation-new-vehicle-research-future-thinking.pdf>.

<sup>23</sup> Remarks given at the NYC DCAS Vision Zero Fleet Forum 2023.

<sup>24</sup> To facilitate fleet measurement, TSR has created and shares with members a "Visibility Toolkit" that contains a measuring tape, a 4' telescoping monopod, Measurement Card, and complete usage directions.

<sup>25</sup> Alex Epstein, USDOT Volpe Center.

<sup>26</sup> Sal Mastriani, Interstate Waste Systems.

<sup>27</sup> Kerman, Keith. 2024. "Improving Truck and Fleet Safety Local Law 108 of 2021 and Mayoral Executive Order 39 of 2024." NYC DCAS. <https://www.nyc.gov/assets/dcas/downloads/pdf/fleet/dcas-presentation-to-tany-and-contractors-on-fleet-safety-july-18-2024.pdf>.

<sup>28</sup> Transport for London. 2023. "Direct Vision Standard: Guidance for Operators." <https://content.tfl.gov.uk/tfl-dvs-guidance-for-operators-2023-acc.pdf>.

<sup>29</sup> United Nations. 2023. "Concerning the Adoption of Harmonized Technical United Nations Regulations for Wheeled Vehicles, Equipment and Parts Which Can Be

Fitted And/or Be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of These United Nations Regulations." <https://unece.org/sites/default/files/2023-12/R167e%20%282%29.pdf>.

<sup>30</sup> "EUR-Lex - 32019R2144 - EN - EUR-Lex." n.d. Eur-Lex. europa.eu. <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32019R2144>.

<sup>31</sup> Euro NCAP. 2023. "Safer Trucks: On the Road to Vision Zero 2023 and Beyond." <https://cdn.euroncap.com/media/77173/2304-euro-ncap-safer-trucks-on-the-road-to-vision-zero.pdf>.

<sup>32</sup> Volvo Trucks. 2024. "Volvo Introduces Its First Ever Electric-Only Truck – Optimized for Cleaner and Safer City Transports." Volvo Trucks, 31 Jan. 2024, [www.volvotrucks.com/en-en/news-stories/press-releases/2024/jan/volvo-introduces-its-first-ever-electric-only-truck-optimized-for-cleaner-and-safer-city-transports.html](http://www.volvotrucks.com/en-en/news-stories/press-releases/2024/jan/volvo-introduces-its-first-ever-electric-only-truck-optimized-for-cleaner-and-safer-city-transports.html).

<sup>33</sup> DAF Global. n.d. "New Generation DAF XD." DAF Global. <https://www.daf.global/en-us/trucks/new-generation-daf-xd/safety-xd>.

<sup>34</sup> Transport Operator UK. 2023. "DVS Developments from Renault Trucks." Transport Operator. September 25, 2023. <https://transportoperator.co.uk/2023/09/25/dvs-developments-from-renault-trucks/>.

<sup>35</sup> Dennis Eagle. n.d. "Proview Chassis: Designed to Perform Better." Dennis Eagle. <https://www.dennis-eagle.com/proview-chassis/>.

<sup>36</sup> Mercedes Benz Trucks. n.d. "Econic: The Safe and Efficient Low-Entry Truck." Mercedes Benz Trucks. <https://special.mercedes-benz-trucks.com/en/econic.html>.

<sup>37</sup> REE. n.d. "P7 Chassis: EV Chassis for Trucks & Commercial Vehicles." REE. <https://ree.auto/p7-chassis/>.

<sup>38</sup> Volta Trucks. "Volta Trucks." n.d. Volta Trucks. <https://voltatrucks.com>.

<sup>39</sup> Battle Motors. "Let 2 EV." Battle Motors, <https://battlemotors.com/pages/let2-ev>.

<sup>40</sup> Isuzu. n.d. "Home of Isuzu Commercial Vehicles." Isuzu CV, <https://isuzucv.com/en/index>.

<sup>41</sup> Oshkosh Corporation. 2023. "McNeilus Announces First Order of Fully Integrated Electric RCVs with Republic Services." Oshkosh Corporation. September 26, 2023. <https://www.oshkoshcorp.com/news/2023/9-26-23-mcneilus-volterra-zsl-first-order>.

# Acknowledgments

In addition to the following experts, Together for Safer Roads would like to thank the report's principal author, **Kate Fillin-Yeh**, Senior Transportation Associate, Stantec Consulting Services Inc.

**Kristopher Carter**, Chief Possibility Officer, MassDOT

**Kevin Clifford**, CEO Quality Truck Center

**Alex Epstein**, Safety & Sustainability Senior Engineer, USDOT Volpe Center

**Bryan Fenster**, Republic Services

**Ella Blythe Froggatt**, formerly Boston Public Health Commission

**Alex Johnson**, CEO, Cities Reimagined

**Keith Kerman**, Deputy Commissioner, NYC DCAS

**Sal Mastriani**, VP of Risk Management, Interstate Waste Services

**Kelsey Porter**, CSP, Global Director, HS&E Commercial and Fleet, Mondelez, formerly Global Director, Safety Logistics and Sales, Anheuser-Busch InBev

**William Rasanen**, Lead Mechanic, Waste Management

**Eric Richardson**, Deputy Chief Fleet Management Officer, NYC DCAS

**Geoff Rigg**, President, Dennis Eagle LTD

**Lee Rowland**, Sales & Marketing Manager, Dennis Eagle LTD

**Jaclyn Youngblood**, Deputy Chief of Possibility, MassDOT

And the Together for Safer Roads Board of Directors Member Companies: **Anheuser-Busch InBev, UPS, Republic Services and VisionTrack**

