Executive Summary

The number of pedestrians and cyclists on our roadways is expected to continue in an upward trajectory as millennials increasingly reject vehicle ownership. Combined with the continued increase in transit ridership, more pedestrians and cyclists on roadways will lead to increasing challenges, especially in larger metropolitan areas. The recipe for increasing numbers of incidents and fatalities is obvious. The most recent statistics from the National Highway Traffic Safety Administration (NHTSA) show that roadway fatalities continue to be a national epidemic.

In 2014, 32,657 people lost their lives on U.S. roads. And annually there are 35 pedestrian fatalities and seven bicyclist fatalities involving transit buses. While these numbers may appear relatively small, just one fatality is too many. NHTSA believes that innovation and technology can save more lives.

Statistics soon to be released by NHTSA indicate that the number of lives lost was higher still in 2015.

And while the transit industry is working with bus manufacturers to constantly make adjustments and improvements through bus design, it is not being done as a concerted effort.

For example, there is much debate in the industry about the safety of high- vs. low-mounted mirrors, flat vs. convex mirrors, A-Pillar construction, bus operator training, pedestrian/cyclist responsibility, etc., but little scientific research and few studies are being conducted to arrive at universal conclusions that could be applied across the country.

Additionally traffic engineering in major metropolitan areas often takes place without collaboration with transit agencies. More standardization and cooperation is needed.
Background

Driving a city bus in a major metropolitan area may be among the most stressful, difficult jobs in the country. Bus operators are responsible for maneuvering a 30,000-pound machine around multiple obstacles, managing riders and their sometimes erratic behavior, taking bus fare, responding to questions, keeping passengers safe and staying on schedule – all while remaining keenly aware of other road users around them. Their work has become more challenging in recent years due to the explosion of motorists, cyclists and pedestrians who are distracted by smart phones and other amenities and pay more attention to them than the traffic they navigate.

Added to this new dynamic, ironically, are complicated multi-modal street designs that accommodate bike lanes, but make travel patterns less predictable and add to the complexity of bus lanes and curbside boarding. Traffic engineering in major metropolitan areas is often conducted without transit agency collaboration and bus operators’ needs are not considered. Bikes and buses are sometimes expected to share lanes.

Finally, reliance on public transit, biking and walking is only expected to increase as app-based ride-sharing services and other options make it easier than ever to live without a car. Indeed, trends show that millennials are not interested in driving or even obtaining a driver’s license.

An early 2014 study by The Rockefeller Foundation and Transportation for America¹ found that many millennials want access to better transit options such as buses and trains, better walking and biking opportunities, and the ability to be less reliant on a car.

All of this adds up to the potential for increasing bus/pedestrian and bus/cyclist collisions, which transit and transportation agencies across the country are concerned about and proactively investigating.

While serious injuries and fatalities from traffic collisions (involving all vehicle types) have been decreasing nationally over the past decade or more (notwithstanding an expected increase to be recorded soon for 2015), pedestrians and bicyclists still account for a disproportionate number of traffic fatalities².

¹ The Rockefeller Foundation and Transportation for America 2014 Study; https://www.rockefellerfoundation.org/about-us/news-media/access-public-transportation-top/

According to the Fatality Analysis Reporting System (FARS) – a census of fatal motor vehicle crashes in the United States– from 2010-2014, there were an average of 35 pedestrian and seven bicyclist fatalities annually involving transit buses.

Also, according to FARS data, the majority of pedestrians and bicyclists killed by being hit by a bus occurred when the vehicle was traveling in a straight line. Here are the findings:

- In 48 percent of pedestrian fatalities nationwide, the bus was going straight
- 26 percent involved a left turn
- 11 percent involved a right turn
- 15 percent of incidents involved pre-crash maneuvers

- For bicyclist fatalities:
  - 67 percent of the buses were going straight
  - 15 percent were making a left turn
  - 10 percent were making a right turn
  - 8 percent of incidents involved pre-crash maneuvers

This data is relevant because as we continue to gather data and explore bus travel patterns as well as behaviors of bus operators, passengers, motorists, pedestrians and cyclists at the time of an incident, we can better determine needed changes to avoid these outcomes in the future.

**The Challenge**

While 42 pedestrian/cyclist deaths across the U.S. per year due to collisions with transit buses doesn’t seem like an overwhelming number compared to transit miles traveled, the National Highway Traffic Safety Administration (NHTSA) and the Federal Transit Authority (FTA) remains convinced that they are preventable.

The only acceptable goal, according to NHTSA, is zero fatalities.

“At the current rate, it would take decades and decades to reach that goal,” said NHTSA Administrator Mark Rosekind, Ph.D. “We will never reach zero fatalities if we [the transit and transportation industry and manufacturers] continue doing what we are doing, working on solutions in a vacuum and hoping the cumulative effect works. So we know the answer is not just doubling down on what we’ve already done.”

Instead, Rosekind said, we need to take a new approach to the problem that consists of:

1) Preventing crashes altogether

2) Focusing on helping motorists make the right choices
3) Embracing the potential of automated vehicle technology

“We should be looking at changes in bus manufacturing that make operator visibility a priority, and look at cross-view mirrors that give bus operators the best forward visibility,” he said. “But we should also be looking at advanced technologies, like cameras and Pedestrian Crash Avoidance Mitigation systems that have the potential for exponentially increasing pedestrian protection.

“There is no silver bullet,” Rosekind said. “Road safety takes a community to solve.”

In keeping with the Vision Zero national effort to eliminate traffic fatalities, NHTSA and the FTA have tasked bus manufacturers, transit and transportation agencies to find new ways to counteract the number of bus/pedestrian/cyclist incidents with the goal of reaching zero fatalities.

The Metropolitan Transportation Authority (MTA) recently took the lead in exploring ways to achieve that goal by hosting a Bus Safety Symposium for more than 100 researchers, representatives from major bus manufacturers and safety experts from federal transportation agencies and transit agencies around North America to discuss bus and pedestrian safety issues. Held at MTA’s New York City headquarters on May 10th, the Symposium delved into critical bus/pedestrian safety issues and participants made collective recommendations for next steps needed to improve bus/pedestrian safety around the world.

Officials from MTA New York City Transit, New York State and City Departments of Transportation, transit unions, and bus agencies for metro areas such as Philadelphia, Chicago, Toronto, Miami, Washington, D.C., Montreal and Los Angeles weighed in on best practices, new bus design, operator training, pedestrian/cyclist education and technology – all with the common goal of getting to zero.

**Outlining Opportunities**

Here are some examples of new bus design and technology that is currently underway as presented and discussed at the Symposium:

- **The Federal Transit Administration** is conducting a study to review all safety standards for transit buses and will be examining the issue of blind spots (FAST Act).
- **NYC Transit’s** safety goals rely on critical data on vehicular and pedestrian usage, flow and traffic as well as other research provided by NYC DOT. Safety initiatives and changes that have been implemented following data shared between the two agencies include the introduction of bus-only lanes, relocations of bus stops, bulbs and traffic islands, directional changes on major streets and installations of pedestrian plazas.
- **NYC Transit** is currently testing new safety technology on a small group of buses, with the goal of gathering operations and efficiency data for larger pilot programs next year. The first is a collision avoidance system, which uses smart cameras to pro-actively warn bus operators, audibly and visually, of a potential collision happening in the front or the sides of the bus. This will be available on 100 buses by the end of 2017. The second technology, a pedestrian turn warning system, automatically alerts pedestrians audibly at a crosswalk when buses nearby are making right or left hand turns. It will be installed on 200 buses within the same time period.

- **New Flyer** is examining a high visibility window on their Xcelsior buses that they believe provides greater line of sight for the operator, which is only available as a non-egress option. Some agency specifications require egress-type operator windows.

- **Société de transport de Montréal (STM)** added front-view cameras, which gives a wide angle forward that can be recorded and downloaded. This will allow STM to analyze collisions in an effort to reduce future incidents. They’ve introduced different changes to the bus design by adding a high visibility driver window to reduce the B pillar width, and increasing the height of the right-hand side mirror. In 2016, they will continue conducting pedestrian collision simulations to better understand pedestrian trajectory and the impact to the field of view, while introducing a pilot project for collision avoidance technology.

- **Connecticut Transit’s BRT – CTfastrak** – opened in 2015, and seven stations had basic side platforms where potential collisions with passengers waiting at the platform for at-level boarding could occur. In response, CT added flashing lights to their curbside mirrors.

**Recommended Next Steps**

Following presentations, panel discussions and question and answer sessions, Bus Safety Symposium leaders and participants compiled this list of collective recommendations to continue to stimulate meaningful dialogue and make changes to ultimately improve bus/pedestrian safety around the world:

- The Federal Transit Administration should assemble a cross-functional team to determine what a bus operator should be able to see in each mirror. The FTA should then conduct a study to recommend and establish performance standards (i.e., ECE R46) for bus side view mirrors as it relates to their placement (high or low mount) and type of mirrors (flat vs. convex).

- The Federal Transit Administration should conduct a study to establish performance guidelines for pedestrian collision warning systems based on the circumstances surrounding conflicts, technology validation, bus operator feedback, bus vehicle control reaction, and unintended consequences of technology.
- A study also should be conducted on Leading Pedestrian Interval (LPI) and the overlap with the crossing light. In the LPI scenario, pedestrians are given a seven-second head start to cross the street, then the traffic light changes for buses and other vehicles to turn. With most current crossing designs, vehicles and pedestrians get the green light and walk signal simultaneously.

- The industry must re-examine the definition of a blind spot as an object that “cannot be seen with the naked eye or the equipment provided” (i.e., directly behind the bus.) A-pillars provide temporary obstructions, but bus operators are required to “move around” these obstructions.

- A-Pillar design should be examined to find if it's possible to reduce the size of the A-Pillar and the seal holding the windshield to reduce bus operator sight obstructions, while maintaining bus structural integrity. Consistent vehicle visibility measurement guidelines should be applied, which are relevant to bus operator seating position, for example SAE J941 (Appendix E) and SAE J1050 (Appendix C).

- FTA and/or NHTSA should review the stringent school bus visibility, (referenced in FMVSS 111), specifications for possible application of similar standards for transit bus design.

- Chief Training Officers and lead bus operator instructors along with bus design engineers should be given the opportunity to sit behind the wheel and drive a bus during the bus design development and testing phases. This could be provided via funding from the American Public Transportation Association (APTA) or through the Transportation Research Board’s IDEAS program, which funds research into promising but unproven innovations for highways, transportation safety, and transit.

- Transit bus operators should be encouraged to provide feedback and should be invited to participate in the operator compartment review. Their unique perspectives can offer solutions on perceived bus operating challenges. Some transit agencies already are soliciting feedback from a select group of bus operators when considering new equipment and technology.

- Standardized transit bus operator safety training is needed with a set number of days established for a candidate to either qualify or be dismissed from the program. By starting with “behind the wheel training,” unqualified drivers are quickly identified. The industry needs a more uniform curriculum that offers an opportunity for trainers and instructors to be tracked. Transit companies also need to be discerning in their hiring process.

- Transit properties should be invited to participate when traffic engineering decisions are being made or when groups are advocating for streetscaping changes. Bus operators’ needs must be taken into consideration and standardization is needed.

- The United States is the preeminent leader on traffic incident data collection, but there can still be impediments. Past experience has demonstrated that a wealth of
information can be collected at a transit/pedestrian/bicycle accident site when a transit safety expert is on site at the accident. The industry in conjunction with NHSTA and FTA should develop a standardized data collection model for all agencies to follow. Operators also need to understand “standard operating procedure,” when an incident occurs and document the scene immediately with fresh recollection to assist investigators.

- Efforts should be made to exchange data and ideas with Europe and Asia on bus safety innovations, bus design guidelines as well as statistics on incidents, injuries and fatalities.

- The industry should explore the possibility of creating a strategic partnership with Google or other technology companies to explore funding for demonstration projects, on how technology can be used to improve transit/pedestrian and bike safety.

- An educational and personal responsibility campaign is needed so pedestrians and bicyclists are encouraged to pay attention to their surroundings as they navigate the sidewalks/bike paths and especially at the intersection with roadways. Bus safety success depends on a partnership with pedestrians, bicyclists, bus riders and bus operators.

- Strategic partnerships with Apple/Android hardware and operating system manufacturers should be explored to create early warning system alerts for pedestrians and bicyclists who are in imminent danger of approaching buses or at-grade crossings. This would not only have application to transit safety, but would improve overall pedestrian and bicycle safety as well.

- Mobile apps that provide these traffic alerts to pedestrians and cyclists entering roadways should be developed and deployed.

- This symposium focused on bus safety issues, but BRT, light rail and other transit options have separate concerns such as at-grade crossings, warning systems, etc., and should be examined in future explorations of transit safety.

**Summary**

The 2016 Metropolitan Transportation Authority Bus Safety Symposium was intended to kick-start dialogue about the importance of continuous and concerted improvements in bus/pedestrian/bicyclist safety among key industry leaders. Because of the interest expressed during and after the forum, it likely will become an annual event and will include international participants in 2017. Additionally, a core working multi-disciplinary team will be assembled to continue the dialogue over the course of the next year. Dedicated and shared data, research, experience, safety, training and technology enhancements can only lead to better outcomes for transit agencies and the traveling public.
About the MTA:
The Metropolitan Transportation Authority is North America's largest transportation network, serving a population of 15.2 million people in the 5,000-square-mile area fanning out from New York City through Long Island, southeastern New York State, and Connecticut. MTA subways, buses, and railroads provide 2.73 billion trips each year to New Yorkers – the equivalent of about one in every three users of mass transit in the United States and two-thirds of the nation's rail riders. MTA bridges and tunnels carry more than 285 million vehicles a year – more than any bridge and tunnel authority in the nation.

About MTA Bus Company:
The MTA Bus Company was created in September 2004 to assume the operations of seven bus companies that operated under franchises granted by the New York City Department of Transportation. MTA Bus is responsible for local and express bus operations of the seven companies, consolidating operations, maintaining current buses, and purchasing new buses to replace the aging fleet currently in service. MTA Bus operates 47 local routes in the Bronx, Brooklyn, and Queens, and 35 express bus routes between Manhattan and the Bronx, Brooklyn, or Queens. It has a fleet of more than 1,200 buses, the 11th largest bus fleet in the United States and Canada.