WRI INDIA
ROSS CENTER

Making public bus transit safer

Interventions to reduce blind spots in public buses

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Content

Foreword

Underwriters Laboratories (UL) is a nonprofit organization that is committed to making the world a safer, more secure, and sustainable place. Over the years, we have built long-standing partnerships with various Government bodies, research organizations and leading academic institutions to conduct rigorous independent research, share knowledge through safety education and public outreach initiatives, and develop standards to ensure safer environments across domains. In India, a large part of our focus has been on furthering education and demonstrating best practices in safety.

Ensuring road safety is now recognized as a need for sustainable development. India sees an alarmingly high rate of road fatalities every year. Government bus agencies operate as the largest organized mode of public transport in India, moving a significant number of people every day. In the year 2015-2016, 47 State Road Transport Undertakings (SRTUs) carried nearly 70 million passengers every day, traveling 2.1 billion kilometers, on an average. That year alone, there were 3,681 deaths and 14,295 injuries involving public buses.

In 2013, when UL took the decision to join the cause of Road Safety in India bringing with it, the approach of Safety Science, we were well aware that there will be considerable time before the results can be seen. Amongst the many areas that needed attention, we decided to focus on reducing public bus crashes in India through our partnership with World Resource Institute (WRI) a global research organization in India. During the year 2015 -2017, through this partnership we critically evaluated the reasons of crashes across 13 state transport undertakings and piloted evidence-based measures to reduce such incidents.

We are delighted to share the outcome of our combined efforts through this report. Apart from infrastructure changes on ground, through this partnership we have been able to bring in positive behavioral changes in the driver community. There needs to be a cumulative effort between the Centre, States as well as private players such as vehicle manufacturers, road traffic authorities, NGOs and corporates to come together and work towards attaining zero road fatalities. We believe that the success of such endeavors will enable law makers and concerned authorities to frame rational policies to prevent road-related fatalities. This publication can be used by policy makers, fleet owners, road safety authorities, professionals and other key stakeholders playing a significant role in moving the road safety agenda forward in India

We would like to sincerely thank WRI for spearheading this research and intervention initiative, the transit agencies that participated in this research and extended support in implementing some of the proposed solutions, bringing our vision of safer public bus transportation to fruition

Cara Gizzi
Vice President – Education and Outreach
Underwriters Laboratories

Lakshmi Nair
Program Manager – Public Safety Mission
Underwriters Laboratories

Foreword

Road traffic crashes are a significant public safety issue in India, claiming more than 150,000 lives every year. In urban areas, vulnerable road users such as pedestrians and motorcyclists comprise more than 70 percent of road deaths. A sizeable portion of pedestrian and motorcyclist deaths, especially in dense urban areas, are caused due to collisions with public buses, which are a predominant mode of transport for people in India. As per data reported by Association of Road Transport Undertakings, public buses were involved in 4050 fatal crashes during 2015-2016.

Analysis of public bus crashes in India within the framework of human, vehicle, and infrastructure factors can inform us of the needed short-term and long-term strategies needed for crash prevention and mitigation. This study in collaboration with UL was undertaken with the aforementioned objective in mind. In keeping with WRI's evidence-based approach of "count it, change it, and scale it", the project followed a systematic method of problem solving. At the outset, the project aimed at understanding the key patterns of crashes involving public buses by conducting crash data analyses. These findings were supplemented with assessments on the field to gain a practical understanding of the status quo and challenges at hand. Following these evaluations, WRI India worked with a few transit agencies to develop, test, and implement a few solutions within the capacity of transit agencies.

Addressing the problem of bus crashes in the long run requires sustained multi-sectorial efforts. Transit agencies should work towards improving the quality of their vehicles through better procurement and maintenance policies and practices. City authorities also have a major role to play. Road design and construction should be improved by building pedestrian-friendly infrastructure and safe bus bays and bus terminals. In the short-term, however, bus transit agencies can urgently pursue certain cost-effective measures to immediately address the problem. An example of such a measure could be improving quality of mirrors in their fleets through effective procurement and maintenance policies.

India currently leads the world in road crashes, contributing to nearly 10 percent of the global road deaths. The Indian government recently passed the Motor Vehicles (Amendment) Bill 2019 to showcase commitment to improve road safety in India. Enhancing safety of public buses is a necessary step in the direction of moving towards this goal. This report summarizes our learnings from working with a few transit agencies to reduce blind spots in buses. We hope that this resource can be useful to transit agencies and other government departments in their efforts to reduce road crashes in India and can spur some action towards this end.

Amit Bhatt
Executive Director – Integrated Transport
WRI India

Executive summary

Public buses are a safer mode of commute as compared to private vehicles as they have a lower rate of crashes per passenger kilometer traveled; however, bus crashes impact vulnerable road users such as pedestrians and motorcyclists disproportionately. Besides, bus crashes also induce costs in terms of vehicle damages, loss of productivity, and victim compensation, impacting finances of the transit agency.

WRI India, in collaboration with UL, studied bus crashes involving fleets of 13 State Road Transport Undertakings (SRTUs) to critically evaluate the reasons of crashes and suggest evidence-based measures to reduce such incidents. The crash data analysis informed that, on an average, 65 percent of all bus-related road fatalities involved pedestrians and motorcyclists. Further, in the case of Bangalore Metropolitan Transport Corporation (BMTC), it was observed that 70 percent of all fatal pedestrian crashes involved an impact with the front portion of the bus, and 85 percent of all fatal motorcyclist crashes involved an impact with the sides of the bus. Subsequent field evaluations to study blind spots in buses informed that a majority of the buses were operating with substandard mirrors which greatly compromised the field of vision of the drivers.

The Central Motor Vehicle Rules (CMVR) 1989, which is the statute governing transport of motor vehicles in India, mandates that all vehicles have mirrors that are compliant to AIS-001 and AIS-002 standards. In the case of public transit buses, it was observed that all the buses that are newly procured come with mirrors that are compliant to the relevant standards; however, after a damage or breakage, these mirrors are replaced with substandard mirrors of smaller size, which do not comply to the standards. Currently, the procedure and standard for retrofitting mirrors or other vehicle parts in case of damage is not outlined by the statute. Due to this ambiguity, most of the part replacements, repairs, and services are being provided by inexperienced vendors, who provide low-quality products and services.

In 2017, WRI India ran a pilot with BMTC to test the impact of retrofitting standard mirrors on driving experience and largely on crash reduction. 46 buses which were operating with substandard rear view mirrors were chosen, and these mirrors were replaced with standard rear view mirrors, which improved the field of vision on both the driver and the passenger side. Following this, these 46 buses were monitored for any road crashes involving an impact with vulnerable road users in the side portions of the bus. Subsequently, in October 2017, WRI India also conducted driver surveys to evaluate if and how the standard mirrors have helped improve driving experience. These assessments informed that over 80 percent of the drivers felt that the standard mirrors improved driving experience and assisted them in averting crashes. In October 2018, after about 18 months of operation, BMTC conducted a survey to check the status of mirrors in these buses. It was observed that the mirrors were intact in only 19 (41 percent) of the 46 buses. In rest of the buses, it was found that at least one of the mirrors were damaged and replaced with low quality mirrors.

WRI India, then, conducted workshops and meetings with the drivers, technicians, mechanics and vendors to understand the operation and maintenance challenges pertaining to rear view mirrors in buses. These discussions brought to fore three challenges: frequent breakage of mirrors in buses, procedure for procurement of spare parts, and the installation procedure. In order to bring about a long-term change, these challenges have to be dealt with even as we work towards scaling up this intervention to other transit agencies.

In the past one year, WRI India has been working with bus transit agencies in Karnataka, Andhra Pradesh, and Tamil Nadu to assist them in improving the quality of mirrors in their buses. As a result of these efforts, in 2018, BMTC and Tamil Nadu State Transport Department issued tenders to procure standard mirrors for their buses. In the case of Tamil Nadu, the transit agencies have been successful in selecting a vendor for procurement and have already issued purchase orders to procure mirrors for 906 buses. However, the tender issued by BMTC in Bangalore had to eventually be cancelled as the price point offered by the qualified vendor for standard mirrors was not agreeable to the agency. This highlights the fact that limited financing is a factor that restricts bus agencies from implementing and sustaining such quality control measures at scale.

To effectuate and influence a large scale shift towards standardization of mirrors on public buses, it would also be important to analyze if the transit agencies have the economic means to shift to standard mirrors of higher quality, which are priced higher than the small, substandard mirrors. Grant assistance from the state and central governments can aid this process by reducing the financial burden on transit agencies. At the same time, capacities of transit agencies should be built to self regulate the quality of their buses by introducing and enforcing policies on procurement, installation, retrofitting, and maintenance of vehicle parts. Such capacity building should also include training the drivers and other agency staff to understand and comply to such policies.

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In 2017, 10,651 people were killed due to bus crashes in India.[2] A majority of these deaths involved vulnerable road users such as pedestrians and motorcyclists. Blinds spots in buses, largely resulting from the usage of substandard mirrors, puts pedestrians and motorcyclists at a high risk of crashes.

Context

Road traffic crashes are an eighth leading cause of death globally (WHO, 2018).[1] India contributes to about 10 percent of the global road deaths with nearly 150,000 people dying on its roads every year. The problem is acute in urban areas, which see high densities of population and roads with high degrees of heterogeneity in vehicle traffic. In 2017, 42 percent of all road crashes in India happened in urban areas, which cover just 3.4 percent of the land area and accommodate about 31 percent of the total population.[2]

Safe System approach to road safety, which shifts the responsibility of road crashes away from the victims and adopts a more holistic view of the road transport system, including interactions among road and roadsides, travel speeds, vehicles, and road users can help activate far-reaching changes. To that end, working with large fleet operators that service millions of kilometers every day presents a significant opportunity to test out solutions at the organizational level and make a case for wider replication.

In India, 47 major State Road Transport Undertakings (SRTUs) with a fleet of about 1,42,000 buses service nearly 70 million passengers every day, covering millions of kilometers. Public bus transit evidently plays a major role in connecting people to their places of employment, education, and day-to-day activities in both urban and rural areas. While bus crashes comprise a small percentage of the total crashes, they impact vulnerable road users such as motorcyclists and pedestrians disproportionately and also result in losses to the transit agencies. There is an opportunity to prevent such crashes, in the short term, through a few low-cost interventions that are easily realizable, and in the long term, by improving safety and fleet management practices of the transit agencies.

WRI India and UL launched a partnership in 2015 with an objective to study and reduce road crashes involving public transport buses. At the outset, WRI India sourced and studied records of fatal bus crashes in two cities—Bangalore and Mumbai. The crash data studies informed about the disproportionate vulnerability of pedestrians and motorcyclists and highlighted a few prominent crash patterns, which were common across agencies. It was noted that a large number of collisions involved impact with the sides and front portions of the bus. It was further observed that a majority of buses operated with small-sized substandard mirrors, resulting in blind spots for the bus drivers and, thereby, increasing the risk exposure of vulnerable road users.

WRI India, then, collaborated with Bangalore Metropolitan Transport Corporation (BMTC) to study how extensive blind spots are in their buses and further assisted the agency in replacing substandard buses with standard mirrors in 46 buses on a pilot basis. Since the installation of these mirrors, the buses were continuously monitored to check their involvement in crashes. Besides, the drivers of these buses were surveyed to evaluate how the mirrors impacted driving experience and safety. This document provides an overview and summary of the key steps taken, observations during trials, and learnings from the intervention.

Based on the success of this pilot intervention with BMTC, WRI India conducted similar crash data studies with state- and city-bus transit agencies in Karnataka, Andhra Pradesh, and Tamil Nadu. Since usage of substandard mirrors is a common problem among all the SRTUs, WRI India is assisting a few other transit agencies to overhaul sub-standard mirrors in their fleets. WRI India also recognizes that the replacement of substandard mirrors in buses with good quality mirrors is a needed interim solution to urgently attend to the rampant issue of blind spots in buses; however, a more sustainable, far-reaching change will involve working with the transit agencies and the regulators to overhaul the current procurement and maintenance processes needed to maintain the quality of mirrors used in buses. WRI India, through its partnership with UL, intends to continue working towards this end with a broader goal to reduce public bus crashes in India.

[1] *Global Status Report on Road Safety 2018, World Health Organization*

[2] *Road Accidents in India 2017, Ministry of Road Transport and Highways*

[3] *Review of the performance of State Road Transport Undertakings (April 2015 - March 2016), Ministry of Road Transport & Highways*

The problem

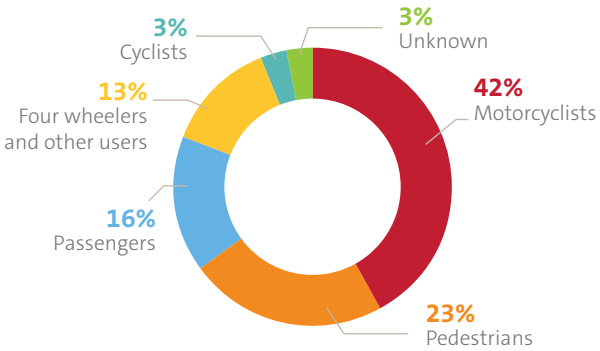
Identifying the problem: crash data analysis

Between 2015 and 2017, WRI India conducted an analysis of bus crashes associated with the following 13 SRTUs spanning 4 states: Karnataka, Tamil Nadu, Maharashtra, and Andhra Pradesh.

- Bangalore Metropolitan Transport Corporation (BMTC)
- Brihanmumbai Electric Supply & Transport Undertaking (BEST)
- Karnataka State Road Transport Corporation (KSRTC)
- North-Eastern Karnataka State Road Transport Corporation (NEKRTC)
- Andhra Pradesh State Road Transport Corporation
- Metropolitan Transport Corporation (MTC) Chennai
- State Express Transport Corporation (SETC)
- Tamil Nadu State Transport Corporation (TNSTC) Coimbatore
- Tamil Nadu State Transport Corporation (TNSTC) Madurai
- Tamil Nadu State Transport Corporation (TNSTC) Villipuram
- Tamil Nadu State Transport Corporation (TNSTC) Tirunelveli
- Tamil Nadu State Transport Corporation (TNSTC) Kumbakonam
- Tamil Nadu State Transport Corporation (TNSTC) Salem

The study indicated that a majority of crashes involved motorcyclists and pedestrians and that the blind zones in buses could be a significant causal factor for such crashes since a majority of buses operated with substandard mirrors that reduced the field of vision of drivers. Refer Figure 1 for mode-wise distribution of fatalities.

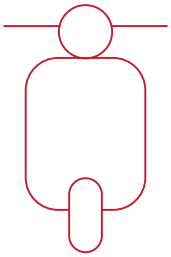
Figure 1: Mode-wise distribution of fatalities (percent)



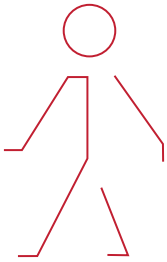
Further, to better understand the nature of crashes, the location of impact on the buses was analyzed for crashes involving pedestrians and motorcyclists. Figure 2 depicts the crash impact area for fatal crashes involving pedestrians and motorcyclists in BMTC (Bangalore) during the period of 2012-2015. It was observed that a majority of motorcycle and pedestrian fatal crashes involved an impact with the front or the side portion of the bus.

- 85 percent of fatal motorcycle crashes involved an impact with the sides of the bus
- 70 percent of fatal pedestrian crashes involved an impact with the front portion of the bus.

The fatal crashes were also analyzed as per the make and the type of mirrors installed in the buses. It was found that over 70 percent of all fatal crashes involved buses with small mirrors. Since data pertaining to quantum of buses plying with small mirrors in Bangalore was unavailable, conclusions could not be drawn on the cause-effect relationship of small mirrors and high number of crashes due to blind zones. However, given the significance of indirect vision devices in providing driver the visual assistance needed for preventing crashes, it can be assumed that small-sized mirrors, which result in blind spots, are a contributing factor to crashes involving buses.



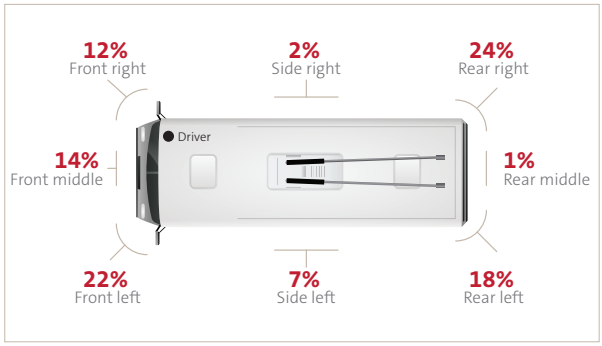
42% of all fatalities involved two-wheeler riders and pillions.



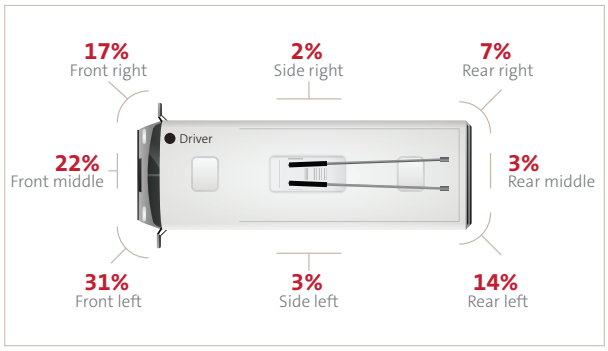
23% of all fatalities involved Pedestrians.

(These statistics pertain to a sample of 2930 fatal bus crash records, spanning 13 SRTUs (listed above). The data was obtained directly from the transit agencies, which maintain records of all fatal, major, and minor crashes involving their fleet)

Figure 2: Crash Impact Area: Motorcycle crashes and pedestrian crashes



Fatal crashes involving BMTC buses and motorcycles (2012-2015)



Fatal crashes involving BMTC buses and pedestrians (2012-2015)

(These statistics pertain to a sample of 309 fatal bus crash records obtained from BMTC during a four-year period between 2012 and 2015.)

Understanding the problem: reviewing industry standards

Devices of indirect vision, such as mirrors, in vehicles should be tested as per AIS-001 and AIS-002 standards and type approvals should be obtained for the relevant class of mirrors. Central Motor Vehicles Rules (CMVR) 1989 Rule 125 (Clause 2) specifies that the all motor vehicles should be equipped with rear view mirrors that comply to the afore-mentioned standards.

All the mirrors that are fitted on the bus at the time of manufacturing should have a type approval under AIS-001 Part 1 (Rev 1):2011 and AIS-002 Part 1 (Rev 1):2011 for the required Class. Public transport buses that are currently being used in Bangalore generally fall under the M3 category, which are defined as vehicles that are used for passenger transport with a seating capacity of 9 or more (excluding the driver seats) and with a Gross Vehicle Weight (GVW) of more than 5 tons. All vehicles of the M3 category are required to have two types of mirrors: Class II (main rear view mirrors) on both driver and passenger side and Class VI (front mirror). The standard defines the field of vision requirements for each class of mirror. Table 1 represents the mirror specifications and field of vision requirements for M3 category of vehicles.

Once the type approval is obtained for the sample or the prototype, the buses can be manufactured as per the declared specifications. Subsequently, Conformity of Production (COP) tests are done on a regular basis to check if the manufacturing of buses is happening as per the specifications. Further, CMVR makes it mandatory for all the vehicles to obtain a fitness certificate from the transport department to establish road worthiness before plying on the roads. The fitness certificate is renewed every few years, and as per Section 62 of CMVR, the fitness test involves a check of the quality of the mirrors installed.

Currently, the procedure and standard for retrofitting mirrors or other vehicle parts in case of damage is not outlined by the statute. Due to this ambiguity, most of the part replacements, repairs, and services are being provided by inexperienced vendors, who provide low-quality products and services.

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Currently, the procedure and standard for retrofitting mirrors or other vehicle parts in case of damage is not outlined by the statute. Due to this ambiguity, most of the part replacements, repairs, and services are being provided by inexperienced vendors, who provide low-quality products and services. Also, adequate tests are not being done at the time of renewal of the fitness certificate, resulting in sub-standard and unchecked replacement of damaged vehicles parts. In this specific case, this has resulted in the usage of small mirrors that do not comply to the afore-mentioned standards. Consequentially, a majority of the buses on the road are now being operated with these small mirrors.

Table 1: ARAI mirror specifications for M3 category.[4]

Vehicle category	**Interior mirror**	**Exterior mirrors**				
	Interior mirror class 1	**Main mirror (large) Class II**	Main mirror (small) Class III	Wide-angle mirror Class IV	Close-proximity mirror Class V	**Front mirror Class VI**
M3	Optional (no requirements for the field of view)	**Compulsory 1 on the driver's side and 1 on the passenger's side**	Not permitted	Optional 1 on the driver's side and / or 1 on the passenger's side	Optional 1 on the driver's side and 1 on the passenger's side	**Mandatory**

[4] Automotive Research Association of India, AIS 002 (Part 1) (Rev.1):2011

What the law says

Statue / Law
Motor Vehicles Act 1988 and Central Motor Vehicles Rules (CMVR) 1989 regulate safety of motor vehicles

Rules for testing of mirrors
Central Motor Vehicles Rules (CMVR) 1989, Rule 125 (Clause 2) specifies that all motor vehicles should be equipped with rear view mirrors of the relevant standards

Fitness certificate
CMVR mandates obtaining a fitness certificate to establish road worthiness before plying on the roads. As per Section 62 fitness test involves a check of the quality of the mirrors

Renewal of fitness certificate
Fitness certificate has to be renewed every few years

What the standard says

Standard
AIS standard AIS-001 and AIS-002 are used for checking compliance

Vehicle category of public buses
Public buses generally fall under the M3 category, passenger transport vehicles with a seating capacity of 9 or more and with gross vehicle weight of > 5 tons

Standard specification of mirrors on public buses
Class II (main rear view mirrors) on both driver and passenger side and Class VI (front mirror) are mandatory

Field of vision requirements
Field of vision requirements for main rear view mirrors and front mirror are specified in AIS 002 Part 1

Procudure for testing and certification

Testing and certification
Type approval and Conformity of Production are required for testing and certification of mirrors

Type approval
These are tests done on a prototype or sample to ensure compliance to standards

Conformity of production (COP)
COP tests are done on a regular basis to check the if the manufacturing is as per the specifications

Field assessments and pilot

Blind spot assessments

Based on field observations and interviews, it was noted that all newly procured buses come with standard-sized mirrors, which comply to the specifications outlined in the AIS 001 and AIS 002 standards. However, after a breakage or damage, these mirrors are replaced with small-sized mirrors that do not comply to the relevant AIS standards. Such low-cost replacements of poor quality are mostly unique to non-AC buses and go by the following specifications:

- Size of the mirror (outer casing) – 90 mm X 130 mm
- Reflective Surface: Flat mirror (77 mm X 117 mm)
- Aluminum back and casing

Small mirror *Main mirror* *Twin mirror*

WRI India conducted experiments to assess blind spots in buses with small mirrors. The field of vision was measured and evaluated for buses with small mirrors and buses with standard-sized mirrors. It was found that, in the case of buses with small mirrors, the blind spots were prominent on the left-hand side and front portions of the bus. With the installation of standard-sized mirrors, the volume of visibility increased significantly, reducing the blind spots.

© Photo by WRI India

Piloting standard-sized mirrors in 46 buses

WRI India assisted BMTC in running a pilot of replacing small mirrors with standard sized mirrors on 46 buses plying on the most accident prone route—401 series. Two types of rear-view mirrors, which met the specifications outlined in AIS-001 (Part 1) and AIS-002 (Part 1) were procured. A twin convex mirror with a wide-angle view was retrofitted on the LHS of the bus and a single convex mirror was retrofitted on the RHS of the bus. The dimensions of the mirrors are specified below:

For the right hand side, near the driver, a single convex mirror of the following specification was fitted:

- Radius of Curvature: SPH- 1850 + 200mm
- Size of the mirror (outer casing): 380mm x 190 mm;
- Reflectance: 80 percent minimum
- Distortion: 5 percent max as JIS D 5705
- Glass: 2.5 mm thick ± 0.5 mm and is coated with aluminium to reflecting surface.
- Glass of mirror: float quality
- Casing for the sample: Black colour poly propylene back cover with right rounded locking rubber. The back cover with holding clamp for fitment in the bracket with screws, to install.

For the left hand side, a twin convex mirror assembly of the following specifications was fitted:

- Size of the mirror: 435mm X 180 mm with clear size of the big mirror being 300mm X 160mm and small mirror being 100mm X 150mm.
- The radius of curvature and assembly details are same as those of the single convex mirror (detailed above).

Monitoring impact

WRI India has been monitoring the safety performance of these 46 buses since the time of retrofitting these mirrors in February 2017. So far, there have been zero fatal crashes involving these buses. However, there have been three minor crashes, all of which involved collisions with a car. Based on an assessment of the crash records, none of these three crashes could be attributed to blind spots in buses. The details of the 3 minor crashes are provided below in Table 2.

Table 2: Attributes of 3 minor crashes involving buses with new mirrors

	Incident 1	Incident 2	Incident 3
Crash Date	30/6/2017	15/8/2017	16/2/2018
Crash Time	11:15 am	7:15 am	11:50 pm
Other Vehicle Type	Car	Car	Car
No. of fatalities	0	0	0
No. of injuries	1 Passenger	0	0
Type of collision	Front-rear collision	Head-on collision	Front-rear collision

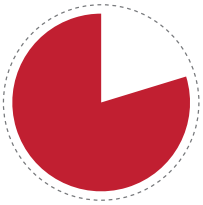
Zero
fatal crashes involving buses with new mirrors since the installation

Driver Feedback

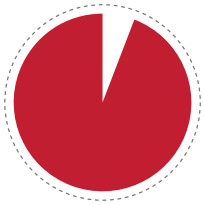
49 drivers were surveyed by WRI India in the month of October 2017 to assess their preference and evaluate the impact of new mirrors on their driving experience. There was an overall positive feedback from the drivers. The results of the survey are presented in Figure 4.

Subsequent surveys conducted by BMTC have revealed that the drivers opined that the new mirrors are helpful to drive in the Bangalore city traffic as they allow for greater visibility on the LHS and RHS and helps them prevent crashes. However, some issues were raised regarding the installation of the mirrors. The Allen screws used to fit the mirrors loosened very frequently, causing the mirrors to vibrate, impacting the vision of drivers. Through this survey, it was learnt that the quality of installation of mirrors on buses is also of high importance and that installation should be done as per the standard protocol to maximize the results of this intervention. These learnings will be employed for future retrofitting of mirrors.

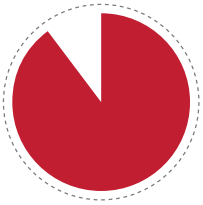
Figure 4: Results of driver survey, Oct 2017



79.6%
say that their driving experience has improved since the new mirrors have been installed



93.9%
say that the new left rare view mirror improved the visibility on the left side of the bus



89.8%
say that the new right rear view mirror improved the visibility on the right side of the bus

97.9%
say that the installation of new mirrors improved visibility during rain / fog

Current status of mirrors in buses and key challenges

In October 2018, BMTC did a survey to assess the status of the newly installed mirrors. It was found that both the LHS and RHS rear view mirrors were intact only in 19 of the 46 (41 percent) buses. In 13 (28 percent) buses, only the LHS mirror was intact, and in only 2 (5 percent) buses, only the RHS mirror was intact. In 12 (26 percent) buses neither of the mirrors were intact.

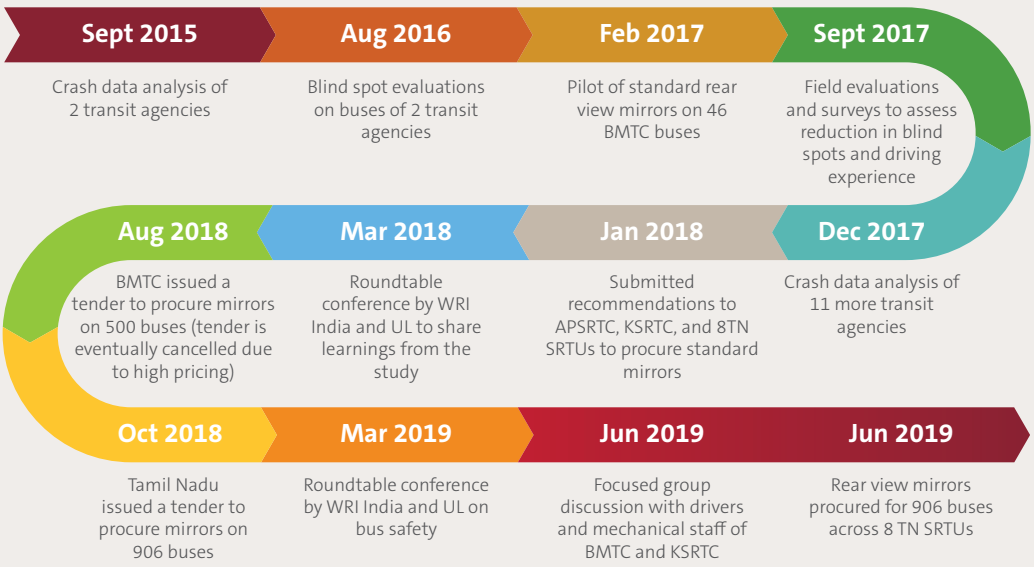
In June 2019, WRI India also organized a focused group discussion to evaluate the reasons of damage of mirrors in buses and understand the current procurement and maintenance practices at transit agencies in Karnataka. The discussion was attended by drivers and mechanics from KSRTC and BMTC and by vendors who supply indirect vision devices to vehicle manufacturers and fleet operators. This discussion brought to the fore a few key challenges which are listed below.

1. Breakage of mirrors: it was found that a large number of mirror damages happen at the depot while the buses are being washed using the washing apparatus. The brush rollers of the washing equipment impact the mirrors, resulting in breakage. Such instances can be reduced by ensuring that the buses are carefully maneuvered through the washing apparatus by the driver. Besides, drivers and mechanics also opined that installation of side mirrors that are foldable, which a few vendors supply, could reduce the probability of impact with brush rollers. These mirrors can be tested out to check if instances of breakage can be minimized.
2. Replacement of mirrors: it was found that, in case of damage, the buses are still being retrofitted with small mirrors of poor quality that do not comply with the AIS standards. Therefore, to address this issue there is a need to upgrade the procurement and vehicle maintenance policies of transit agencies, to disallow retrofitting of substandard mirrors.
3. Installation procedure: the procedure for installation of mirrors is extremely important as this can have a huge impact on field of vision and driving experience. Our current regulations do not define the standard protocol for mirror replacement in the case of a damage. Therefore, the quality of installation for most mirror replacements does not comply to the relevant AIS standard.

A large number of mirror damages happen at the depot while the buses are being washed using the washing apparatus.

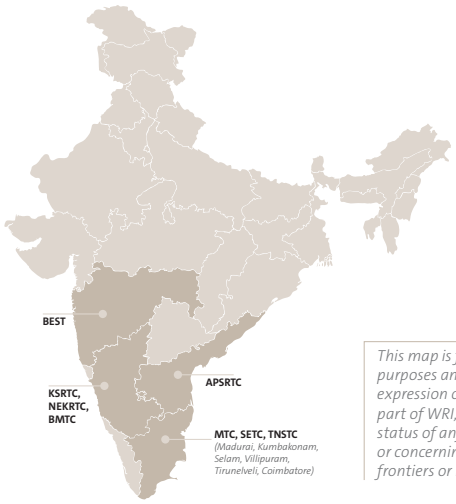
The above listed challenges have to be dealt with even as we work towards scaling up this intervention to other transit agencies.

Timeline of actions to reduce blind spots in buses



Scale up and way forward

WRI India, in the past one year, has been working with bus transit agencies in Karnataka, Andhra Pradesh, and Tamil Nadu to assist them in improving the quality of mirrors in their buses. Specifically, WRI India submitted recommendations to BMTC, KSRTC, NEKRTC, APSRTC, and Principal Secretary, Transport Department, Tamil Nadu State to issue tenders to procure standard-sized mirrors on a large scale and to test out their impact on driving experience and crash reduction.



This map is for illustrative purposes and does not imply the expression of any opinion, on the part of WRI, concerning the legal status of any country or territory or concerning the delimitation of frontiers or boundaries.

As a result of these efforts, in 2018, BMTC and Tamil Nadu State Transport Department issued tenders to procure standard mirrors for their buses. This was followed by evaluation of samples from various vendors to determine their quality, and cost-effectiveness and to select the lowest bidder. However, the tender issued by BMTC in Bangalore had to eventually be cancelled as the price point offered by the qualified vendor for standard mirrors was not agreeable to the agency. This highlights the fact that limited financing is a factor that restricts bus agencies from implementing and sustaining such quality control measures at scale. In the case of Tamil Nadu, the transit agencies have been successful in selecting a vendor for procurement and have already issued purchase orders to procure mirrors for 906 buses. MTC and each of the 6 TNSTC agencies are procuring 100 sets of rear view mirrors each, where as SETC has placed an order for 206 sets. This was made possible through a grant assistance of INR 1.05 Crore from the state government.

During our meetings with the transit agencies, it was observed that all the transit agencies recognized blind spots in buses (due to usage of substandard mirrors) as a significant issue that hampers drivers' performance, and thereby safety. While the transit agencies showed commitment to improve the quality of mirrors in their fleets, they faced issues with respect to financing and capacities to enable a complete transition to standard mirrors.

To effectuate and influence a large scale shift towards standardization of mirrors on public buses, it would also be important to analyze if the transit agencies have the economic means to shift to standard mirrors of higher quality, which are priced higher than the small substandard mirrors. Grant assistance from the state and central governments can aid this process by reducing the financial burden on transit agencies. At the same time, capacities of transit agencies should be built to self regulate the quality of their buses by introducing and enforcing policies on procurement, installation, retrofitting, and maintenance of vehicle parts. Such capacity building should also include training the drivers and other agency staff to understand and comply to such policies. These measures can help reduce crashes involving vulnerable road users such as pedestrians and motorcyclists, who comprise a majority of bus-related road traffic deaths. Further, it can also assist drivers on the road, who often drive in dense and multimodal road traffic environments.

At a larger level, it is important to understand the significance of maintaining safety standards of buses plying on the road to save lives and enable improvements in road safety. This necessitates a commitment from transit agencies to prioritize safety over cost savings and ensure adherence to the standards. At the same time, the state- and central- governments should enable these processes by not only enforcing stringent safety standards, but also providing financial means to transit agencies to maintain these standards.

In the next one year, WRI India, in partnership with UL, intends to support bus transit agencies in resolving issues related to blind spots in their buses. Such a support will involve assisting transit agencies in improving quality of mirrors in their current fleet, reducing the instances of mirror damage, improving the current procurement and maintenance practices at the agency, and accessing grants from state and central governments for implementing safety measures. However, in the long term, there is a need to overhaul our current regulations and enforcement practices to mandate and sustain the usage of standard mirrors on buses. Such a policy change will necessitate advocacy and engagement with the regulatory bodies such as ARAI and enforcement agencies at the national, state, and city-levels.

"Blind spots are a huge problem, and we want to do everything to fix this to reduce crashes. Our drivers also prefer the bigger mirrors. We plan to soon roll this out on all our buses"

– Mr. M N Srinivasa
Chief Mechanical Engineer, BMTC

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