

# SAFETY News

36<sup>th</sup> Edition | ISSN 1793-1665 | September 2018

## FEATURED ARTICLES

- 02 Near Miss Analysis
- 04 Environmental Highlights 2018
- 06 Design Provisions in Traction Power Systems for Safe Operation of Rapid Transit System
- 08 Silver Zone
- 10 Enhancing Road Safety With Roundabout



## INTRODUCTION

Near-miss reporting is an important mechanism that organisations should utilise to improve their safety performance.

In 2015, LTA transited to a new model (as shown in Figure 1) to recognise serious situations which have the potential to cause serious or life threatening injuries (e.g. amputation) or fatality. These situations also require investigation to identify the root causes of occurrence and implement mitigation measures to prevent a potential escalation into an accident.

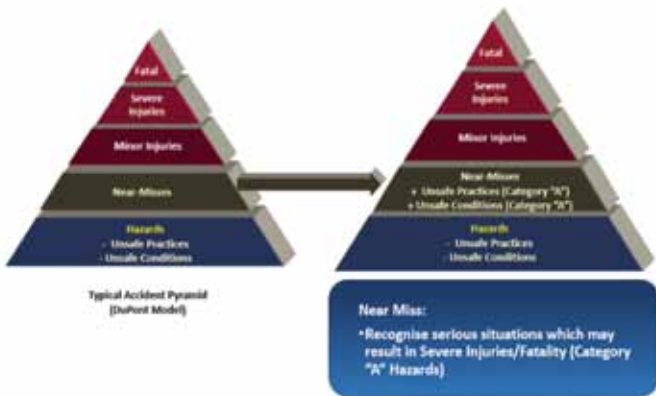


Figure 1: Typical Accident Pyramid (DuPont Model)

Recently, LTA Safety Division conducted two data analytics studies of near-miss cases reported in relation to the number of MOM reportable accidents for 2016 and 2017.

The outcome of these analyses shows a correlation between the increase in the numbers of reported near-miss incidents and the corresponding decrease in the number of MOM reportable accidents. This article will showcase the key findings of the near-miss analyses.

## NEAR-MISS TREND ANALYSIS

Description	LTA 2016	LTA 2017	% Change
Total Man-hours Worked	98.77 mil	101.78 mil	3.05
Near-Miss Reported	3,122	5,193	38.84
MOM Reportable Accidents	46	36	-21.74
Total Man-days Lost	26,143	7,490	-71.35
AFR	0.47	0.35	-25.53
SR	265	74	-72.08

Figure 2: LTA Safety Statistics for 2016 & 2017

Since 2016, the number of reported near-miss incidents have increased significantly, with a corresponding decrease in the number of MOM reportable accidents despite the higher man-hours clocked in our projects.

While major issues have been identified and rectified through near miss reporting, behavioural issues continue to dominate as a primary contributor towards workplace accidents. Hence, continual efforts on behavioural intervention programs and analysis to identify root causes of behavioural issues are also essential.

LTA Safety Division has since conducted thematic exercises on several critical work activities which included lifting operations, with the aim to increase awareness of associated hazards, and to identify good practices observed on our worksites. As more priority and attention are placed on these top five work activities, it is still prudent to look into other work activities with lower numbers of near-miss reported in order to identify whether there is a lack of reporting, or if new trends may emerge.

The analysis as shown in Figure 3 also identified the top five work activities with near misses, which remained the same for both years. Lifting operations had the highest number of near-miss reported, with 307 cases in 2016 and 430 cases in 2017.

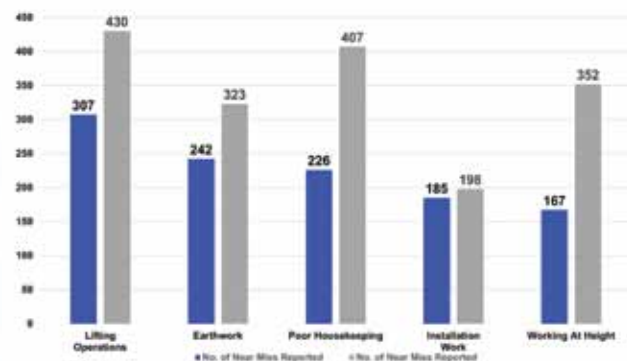


Figure 3: Top 5 work activities with Near-Misses reported for 2016 & 2017

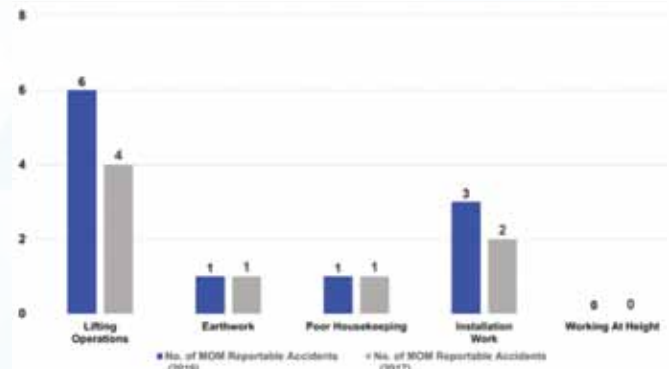


Figure 4: MOM reportable accidents compared to Top 5 work activities with Near-Misses for 2016 & 2017

Figure 4 shows the number of MOM reportable accidents for 2016 and 2017. From the chart, the number of MOM reportable accidents in 2017 had decreased or remained stable.

In general, these analyses demonstrated a promising trend of lowering MOM reportable accidents with higher numbers of near-miss reported. However, we also acknowledged that the overall reduction of MOM reportable accidents in 2017 is also contributed by leading indicators such as unannounced safety inspections, thematic exercises, safety training and promotional efforts to increase awareness.

Besides encouraging near miss reporting, it is important to keep in mind that all reported near-misses have to be investigated in depth to determine the root causes and implement appropriate controls to prevent any potential escalation into an accident.

## BENEFITS OF NEAR-MISS REPORTING

Near-miss reporting can reap benefits in many ways. It allows identification of potential hazards in the work activities and increase workers' awareness on worksites. It also exposes valuable information that otherwise might not be discussed. By tracking and analysing reported near misses, companies can learn from these zero-cost lessons and make improvements.

Near-miss reporting also enables identification of accident precursors through investigation so that hazards can be rectified immediately. This allows us to pro-actively resolve a hazard before any accident occurs. In addition, it creates better safety ownership outcomes, thereby strengthening the safety culture and mind-set in the organisation.

## CHALLENGES OF NEAR MISS REPORTING

To reap the benefits of near miss reporting, organisations must embrace it and remove the barriers that impede such reporting. Some of the common barriers are as listed below.

### a) Fear of getting reprimanded

Data shows that there are still low numbers of near miss reporting by general workers. This could be due to the fear of getting reprimanded or social stigma from fellow workers. We need to encourage and assure that the reporter would not be reprimanded when they report near misses. To encourage reporting, some organisations do incentivise their workforce through different schemes for truthful reporting of near misses.

As mentioned by Mr. Alan Chan, Chairman of Land Transport Authority at the Annual Safety Award Convention 2016, "Near-miss reporting should not be associated with punishment or reprimand. Instead, it is to be taken as a learning opportunity to correct substandard behaviours and practices."

### b) Poor understanding of Near Miss definition

Many workers are not aware that scenarios such as dropping of materials / tools, or nearly falling off an edge constitute as Near-miss as well. Workers tend to overlook such cases without reporting it as there is no injury or damage caused. Hence it is important that workers are trained on how to properly identify and recognise potential scenarios for near miss reporting.

Below are examples of Near Miss incidents:

Unsafe Condition:

- Open / unguarded edges
- Outriggers without steel plates for operating crane

Unsafe Practices:

- Standing under a lifted load
- Erecting scaffolds without body harness

### c) Delay in reporting of Near-Miss

A delay in near-miss reporting is a concern as important lessons learnt from near misses will not be disseminated timely and the data collected for analysis will be incomplete.

### d) Incorrect identification of root causes

It is important to address the root cause of the near-miss reported. Emphasis must be given to the importance for conducting proper investigations on all reported near-misses in order to find out the underlying direct and root causes of occurrences to successfully prevent near miss recurrences or escalation into an accident.

### e) Incorrect categorisation of work activity

Incorrect categorisation of work activity during near-miss reporting will lead to inaccurate identification of critical work activities of concern during data analysis. In order to obtain accurate data on critical work activity that requires attention, near-miss reporting of work activity should be based on the work carried out. It is important to ensure that the process for reporting near misses is straightforward, easy to understand and hassle-free, so that workers can report it easily and accurately.

## CONCLUSION

The sole aim of near-miss reporting is to avert workplace accidents which brings with it much pain not only to the victim but also the family members. Near-miss reporting can also avert other associated costs such as work injury compensation payments and medical expenses. Continual efforts to educate and encourage all workmen to open up towards reporting near-misses can produce a positive impact, thereby bringing everybody a step closer towards our goal of Zero Accident.



## INTRODUCTION

With the upcoming North South Corridor (NSC) and Jurong Regional Line (JRL), more projects are expected to commence soon. Good environmental management of our projects remains as important as ever, as we strive to minimise the impact of our work on the environment and stakeholders.

To help enhance the proficiency of LTA staff in environmental management, Safety Division is working on two new training modules this year.

Firstly, an e-learning module will be developed to help our staff have a better grasp of the environmental protection measures that can be implemented on site. Despite multiple runs of the Construction Environmental Awareness Course (CEAC) being conducted every year, many colleagues are still unable to successfully register for the course due to the overwhelming response. As such, this e-learning platform will be able to reach out to a wider group of staff. It will also work conjointly with the CEAC to provide staff with a blended learning experience. The e-learning module will be launching in end 2018.

Secondly, a new course – Noise Control on Construction Sites – have been launched. This specialised course serves to equip project teams with in-depth knowledge in noise management, to better manage our sites that are closely located to stakeholders.

Besides raising the competency of our staff, LTA also demonstrated its commitment to environment management by being ISO14001 certified. This year, Certification International Singapore (CIS) conducted a surveillance audit across the board. This surveillance audit verified the preparation works finalised for the new ISO14001:2015 standards.

## E-LEARNING MODULE – ENVIRONMENTAL MANAGEMENT AT CONSTRUCTION SITES

As new staff join the LTA family, it is important to quickly equip them with an overview of environmental management on our construction sites. As such, the e-learning module will prepare our new hires with the necessary environmental knowledge, as they embark on a new journey at the project site. Through this course, participants will have an understanding of the regulatory and LTA's contractual requirements, as well as the appropriate measures that can be adopted to address environmental management issues.

This platform also provides a timely refresher for long serving staff who are transitioning from completed projects to new ones. As regulatory and contractual requirements get updated from time to time, some of these staff may not have been aware of the changes. As such, the e-learning module allows them to keep themselves updated to the latest requirement changes, and made aware of the best practices and innovations which some projects have come up with.

In the e-learning module, participants can learn about:

- Roles and responsibilities of various project partners,
- Environmental management in a project lifecycle,
- Noise management,
- Vector control,
- Water pollution control,
- Waste management and
- Air pollution control

Through informative in-module activities, participants will be able to enjoy an engaging learning experience. In addition, an assessment is also in place to ensure the participants' knowledge upon completion of the module.



Figure 1: E-learning Module – Environmental Management at Construction Sites

While e-learning may seem to be a quick and convenient way of acquiring knowledge, it is not a replacement of conventional classroom teaching methods. In fact, the e-learning module supplements the CEAC. With the acquired knowledge through e-learning module, staff have the pre requisites and will be able to better understand the technicalities taught in class.



Figure 2: Construction Environmental Awareness Course (CEAC) conducted in LTA HSO

## NOISE CONTROL ON CONSTRUCTION SITES

With many of our projects situated in close proximity to noise sensitive receivers such as residents, schools, hospitals etc., noise is a major concern. This is especially so when safety critical work activities (e.g. base slab casting, D-wall construction) cannot be temporarily halted and will continue late into the night. As such, it is imperative that the noise emitted from our sites are managed effectively, to minimise the disturbance caused to nearby stakeholders.

Staff can sign up for the newly launched course – Noise Control on Construction Sites in their Learning Road Map, which provides them with the know-how of effective noise management on site. The course is conducted by an accredited trainer with many years of experience, who also provides acoustic consultancy services to many LTA construction projects.



Through this course, participants will be able to have an understanding of basic acoustic principles, and learn about the relevant regulations and requirements for noise control. Useful topics such as how to carry out baseline survey, establish noise limits, conduct noise simulation and modelling will also be covered in detail during the course. Most importantly, the various types of noise control measures for site implementation will be taught as well.

In addition, participants will also have the hands-on experience in using portable noise meters that are used for noise monitoring on site. There will also be facilitated discussions where participants can share their experiences and challenges on the noise issues encountered, as well as the appropriate mitigation measures to address them.

The first run of the course was conducted on 12<sup>th</sup> and 13<sup>th</sup> July 2018, with 30 participants from rail and road project teams. A survey was conducted at the end of the 2 day course and the following positive feedback was received:

- *“The programme in its entirety is very useful and the innovation in particular is very interesting. The group discussions and sharing are also very useful and meaningful, as the exchange of knowledge and experiences can contribute to our individual workplace improvement and personal development.”*
- *“A better understanding on noise characteristics. Knowledge on the statutory regulation, mitigation (Plan, Select, Constraint etc.) are explored for the site.”*
- *“This course is very useful to learn and improve noise mitigation measures, while we are facing challenges on site.”*
- *“All the topics are very useful especially on the field, where we’re dealing with residents around the area.”*



Figure 3: Noise Control on Construction Sites Course conducted on 12<sup>th</sup> and 13<sup>th</sup> July 2018



Figure 4: Demonstration on noise measurement

## ISO14001: 2015 CERTIFICATION

In 2015, the International Organization for Standardization (ISO) revised the ISO14001 standards from ISO14001: 2004 to ISO14001: 2015 and companies worldwide were given 3 years to comply to the new standards.

- Addition of prerequisites to understand the needs and expectations of interested parties;
- Addition of requirement to address environmental risk and opportunities; and
- Increased emphasis on top management leadership and commitment.

As part of LTA’s ISO certification process, an external surveillance audit was conducted from 14<sup>th</sup> to 25<sup>th</sup> May this year. LTA took this opportunity to transit to the new requirements.

Contracts T228 and ER397 were selected for the audits on Safety & Contracts (S&C) group, Thomson - East Coast Line (TEL) and Rail Infrastructure Expansion (RIE) groups, and Road & Commuter Infrastructure Development group (RCID). The auditors commended on the exemplary site conditions during the audit. Overall, there were no major findings for all four groups (S&C, TEL, RIE and RCID) which were audited.

The LTA Safety, Health and Environmental Management (SHEM) manual was concurrently being updated to ensure compliance with the new ISO14001:2015 standards. The updated SHEM manual will be published upon management’s approval.



Figure 5: CIS auditors (right) summarising site findings to T228 project team after site walk

## CONCLUSION

As one of the largest developers in Singapore, it is in LTA’s interest to ensure that our construction sites cause minimal disturbance to the environment. This is done so by putting in place an effective environmental management system that meets international standards. In addition, Safety Division also introduces and develops new courses to enhance our staffs’ competency in environmental management.

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# Design Provisions in Traction Power Systems for Safe Operation of Rapid Transit System

## INTRODUCTION

In Singapore, the traction power system for Rail Transit System (RTS) is provided primarily by means of third rail system or overhead catenary system to power the trains. The main objectives of the traction design for a typical RTS are to achieve a safe, reliable and cost effective traction network to support the train operation scenarios.



Figure 1: Third Rail System in a tunnel

In Singapore, the Direct Current (DC) traction system is mainly adopted due to shorter inter stations' distances and to facilitate compatibility when a line is extended. The High Voltage (HV) network is converted to DC system through Traction Power Substations (TPSS), which consists of traction transformers, conventional diode rectifiers and DC switchgears for distribution of power to the third rail or overhead catenary system.

The TPSS is designed such that loss of a single TPSS will not affect the system performance. Tie-Breaker stations and Load Break Switches are located along the line to maintain the continuity of the traction supply in the event of a TPSS outage. Inverters are also installed at strategic location along the line to recover excess energy from train braking back into the 22kV system.



Figure 2: A typical DC Switchgear inside a Traction Power Substation

The running rails serve as the return paths for the traction current to flow back to the TPSS located along the RTS.



Figure 3: DC traction current flow for train operation

## SAFETY FEATURES TO PREVENT ELECTROCUTION

### a) Protection System

One of the main objectives of the traction power protection system is to isolate the faulty equipment from the network to ensure train service can continue with minimal operational impact. Due to the dynamic nature of the RTS, it is essential that the design of the protection system can distinguish between fault conditions and high loads caused by train operation. The main functions are:

#### (i) Direct Overcurrent

The protection device detects severe short circuits in the traction network.

#### (ii) Overcurrent

The protection relay detects the overload and short circuit current for a certain duration to protect the traction cables.

#### (iii) Rate of Change of Current with Respect to Time

The protection relay detects and distinguishes remote end faults from the sudden surge in current drawn by the trains.

#### (iv) Frame Fault Protection

The protection relay detects insulation failure within the DC equipment.

### b) Emergency Traction Tripping System (ETTS)

The Emergency Traction Tripping System (ETTS) is a Safety Integrity Level 2 (SIL2) system designed to isolate the traction power supply along the mainline during an emergency train evacuation, and to ensure the safety of the maintenance staff when accessing the tracks. The extent of traction power isolation is dependent on their locations and the type of emergency safety devices activated. The various emergency safety devices are briefly described below:

#### (i) Manual Control Key Switch

This key operated safety device allows the isolation of the respective electrical sections from each station's Passenger Service Centre (PSC).

#### (ii) Section Traction Authorisation

This key operated safety device allows control of the respective electrical sections from the Operation Control Centre (OCC).

#### (iii) Evacuation (EVAC) Zone Request Signal

The ETTS will receive this EVAC signal from the signalling system in the event of end detrainment door or side saloon door activation on-board the train. It will automatically switch off the power at pre-determined electrical sections to allow safe evacuation for passengers.

#### (iv) Blue Light Station (BLS)

This safety device is provided as part of the communication system and installed at headwall, tailwall, traction substation, crossings, escape shafts and cross passages. An emergency plunger is incorporated into the BLS to switch off the power at respective electrical sections in an emergency scenario.

# Design Provisions in Traction Power Systems for Safe Operation of Rapid Transit System

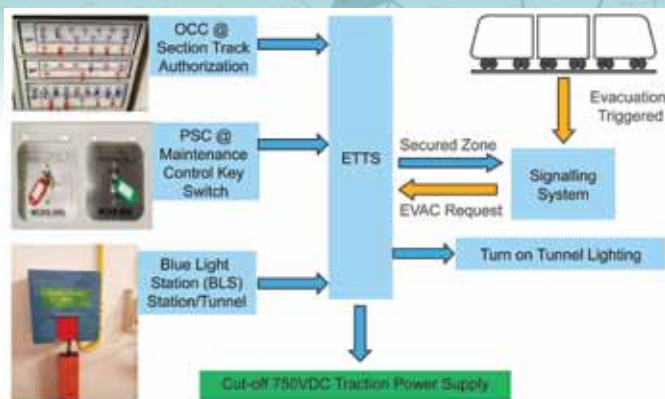


Figure 4: The safety devices interface of ETTS

## c) Voltage Limiting Device (VLD)

During train operation, traction return current flows through the running rails, which will exhibit voltage drops due to the running rail resistance. This voltage difference between the conductive parts namely running rails and structure earth, will result in Touch Voltage.

VLDs are implemented in RTS substations to mitigate the effect of impermissible touch voltage levels, by ensuring that the potential is equalised between the conductive parts whenever its threshold is exceeded. During operation hours, the VLD will be open. In the event that touch voltage level exceeds the threshold setting, VLD will be closed to ensure that potential is equalised between the conductive parts, for the safety of passengers and maintenance staff.

Figure 5 depicts a typical application of the VLD in the RTS. Platform Screen Doors (PSD) are connected to running rails such that the voltage between PSD and train body are at the same level. In the event that the voltage exceeds the preset value, the VLD will be activated.

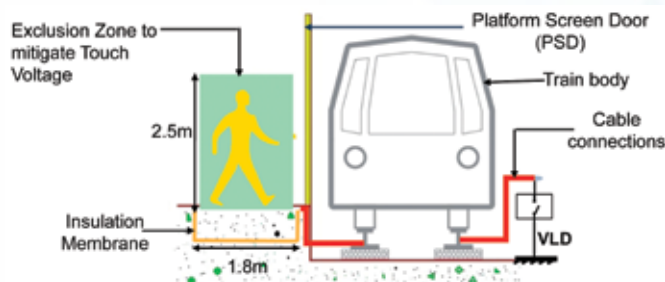


Figure 5: VLD application in RTS

## INNOVATION AND TECHNOLOGY

As part of the continuous effort to source for new technology in power system to enhance reliability, the following technologies have been introduced to the new RTS lines:

### a) Intelligent Fault Isolation System (iFIS)

In the DC traction system, the continuous return rails make it difficult to locate a fault in the traction power cables. With the iFIS, the first in the world with innovative software based analytical tool, it is able to identify the approximate fault location and isolate the faulty track section. It can also monitor and store running rail voltage and VLD status in real time. Rectification works can then be carried out during non-revenue hours.

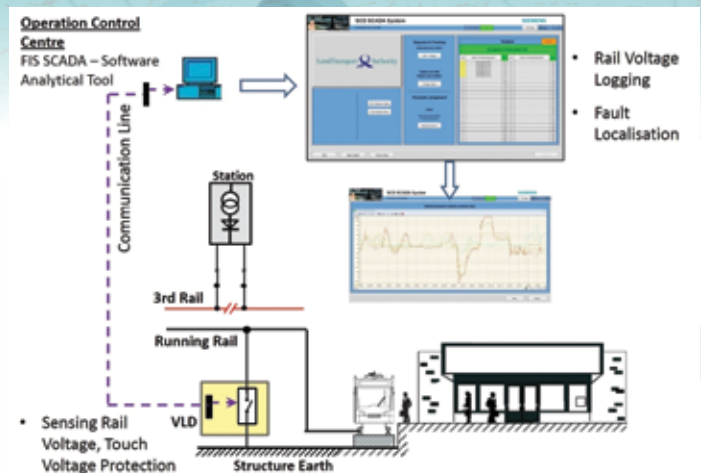


Figure 6: General Architecture of VLD-iFIS integrated system

### b) Double Converter

With advancement in power electronic technology, rectification and inverting functions can be integrated into a single equipment called Double Converters. In-lieu of conventional diode rectifiers and inverters, double converters were introduced to improve on energy efficiency during train regenerative braking and to reduce the space required for TPSS. Additionally, the double converter group configuration can enhance regulation of DC voltage supplied to the train.

### c) Screened Traction Cables

A metallic screen layer was introduced in the traction cables, which is located between the insulation and outer sheath, to allow for detection of insulation failure and failure of outer sheath. The detection would be picked up by the protection relay, and an alarm would be raised for planned rectification works by the maintenance team.

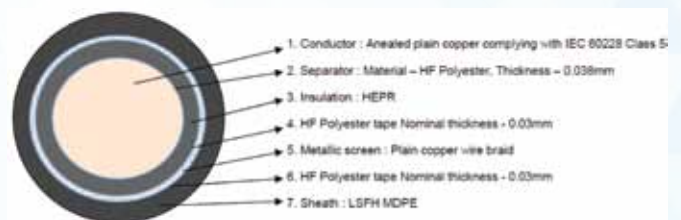


Figure 7: DC Cable Construction

## CONCLUSION

The power supply system is a key infrastructure in the RTS, without which a railway system would not be able to function and serve its intended purpose of a safe, reliable and cost effective traction network to support the train operation.

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## INTRODUCTION

The Silver Zone initiative forms a pillar of the Road Safety Engineering Unit's continuous efforts in improving road safety for vulnerable road users, in particular, our senior pedestrians. It is a national project that aims to drastically reduce the occurrence of senior-involved traffic accidents in selected estates, through the means of introducing measures to calm traffic speeds and provide safer, conducive and more comfortable crossing facilities.



Figure 1: Silver Zone Gateway (Bedok North Street 1)

The first Silver Zone was completed in 2014 along Bukit Merah View, and 15 Silver Zones have been completed as of 2017. A total of 50 Silver Zones island wide are planned to be completed by 2023.

## SELECTION OF LOCATIONS

The Silver Zone follows a strict criteria in selecting roads for implementation. Roads are selected for Silver Zone treatment based on the following criteria:

- i. Roads with relatively higher rates of traffic accidents involving senior pedestrians;
- ii. Residential estates with high senior resident population;
- iii. Roads with close proximity to amenities frequented by the seniors (e.g. hawker centres, community centres, medical centres etc).

Once confirmed, selected locations are announced to the public through media releases. Local Grassroots Advisers and Leaders are engaged to ensure that the proposed enhancements meet the community's requirements.

## SITE ASSESSMENT AND TRAFFIC STUDIES

Our road safety team conducts desktop studies, preliminary site walks and investigations in order to develop the scheme that best fits the local conditions of the selected road(s).

During this phase, preliminary proposals are also supported with statistical data from traffic and perception surveys conducted to obtain key information (e.g. traffic / pedestrians volumes, vehicular speeds, queue lengths, video surveys etc). Such data is usually obtained in the form of 'Before & After' studies, to justify recommended treatments and to evaluate the effectiveness of the Silver Zones after their completion.

Statistically, Silver Zones have been very successful in reducing traffic accidents and vehicular speeds. The project is also largely successful in terms of community acceptance, which could be attributed to immense support from the local Grassroots Advisers and Leaders.

## ENGAGEMENT WITH COMMUNITY & STAKEHOLDERS

Working closely with Community Partnership (CPN), engagement efforts begin as early as a year before its implementation. The Silver Zone team arranges discussion sessions and site walks with the Adviser, key grassroots leaders, merchant association representatives, educational institutions etc. to gather views and feedback pertaining to the proposed Silver Zone treatments. At this platform, the stakeholders also provide valuable knowledge of ground conditions and resident behaviour, which are invaluable in designing the Silver Zone.



Figure 2: Silver Zone project officers engaging the Singapore Association for the Visually Handicapped (left), and introducing the Silver Zone to the Adviser ESM Goh Chok Tong (right)

Publicity materials are also distributed or erected prior to commencement of construction works. These come in the form of banners, brochures, works notices etc., which are aimed at spreading awareness of the initiative as well as the impending works. Monthly constituency magazines and local community events are also occasionally leveraged upon to feature upcoming or recently completed Silver Zones for an even wider community outreach.



Figure 3: Silver Zone design engineer introducing the scheme at a media launch event of a recently completed Silver Zone

Due to the extent of works, other agencies are also consulted as some of the proposed measures encroach into areas beyond LTA's purview. These agencies include HDB, NParks and PUB.

## ROAD SAFETY ENGINEERING MEASURES

### Traffic Calming

A key thrust of the Silver Zone is traffic calming; that is, to keep vehicular speeds low within the boundaries of the zone. This is achieved via a plethora of methods, including lane narrowing, physical and visual measures, additional crossing facilities etc. The idea is to keep motorists traversing through the Silver



Zone constantly reminded that they are still within a 'special' zone and should be more alert to their surroundings. This is where the aspect of drastically reshaping the street comes in, as motorist behaviour is gradually influenced.

Physical speed calming measures range from common features like centre dividers and humps, to more unique treatments like Chicanes (horizontal deflections in the shape of an 'S') to Roundabouts and Pinch Points.



Figure 4: Chicane along Bukit Merah View (top); 2-to-1 lane Pinch Point along Marine Terrace (bottom)

Visual speed calming measures, though not as harsh as their physical counterparts, also help to keep motorists within their travelling lanes and drive slowly. Some examples of these measures are Traffic Calming Markings (TrCM) (pairs of triangular shaped markings on both sides of the lane), chevron markings and lane markings (e.g. double yellow lines, edge line etc).



Figure 5: Traffic Calming Markings along Bedok North Street 1

### Pedestrian Safety & Walkability

Pedestrian safety is of top priority within Silver Zones and there are various measures in place for this cause. Apart from the existing designated crossings, prevalent unmarked crossing points are also carefully examined and if feasible, barrier-free features are provided. Our design philosophy understands that though pedestrians are always encouraged to use designated crossing points, it is natural for pedestrians to want to cross the road where it is convenient. Unless situated at locations deemed more dangerous to cross the road, or nearby (50m) designated crossings, safety provisions can be considered for better connectivity. Footpaths are also widened where possible, to provide a wider and more comfortable walking environment, especially for wheelchair-bound seniors.



Figure 6: Kerb-cut ramp with railings and landscaping along Lorong 8 Toa Payoh

To ensure pedestrian safety when crossing the road, measures are also in place to keep them visible to approaching motorists. Such unmarked crossing points are kept free of any obstruction by street furniture (e.g. vehicular impact guardrails, over-ground boxes etc.) and greenery. At night, adequate lighting is also necessary so that crossing pedestrians are clearly visible. Railings are a key measure channelising pedestrian crossing activities so that they are more visible to motorists.

### CONSULTATION AND AWARDS

Since 2014, delegates of various countries (e.g. ASEAN Nations, Hong Kong, South Korea and Japan) have visited Singapore to learn about the Silver Zone design and philosophy. The prestigious Prince Michael International Road Safety Award (PMIRSA) was also presented to LTA in 2016 for the Silver Zone project.



Figure 7: Silver Zone design engineer sharing the design philosophy of the zone to delegates from Myanmar

### CONCLUSION

Thus far, Silver Zones have proven to be an effective initiative in enhancing road safety not only for senior pedestrians, but all road users. However, this is only possible with harmonious working relationships with involved divisions and agencies, as well as the community and stakeholders.

Moving forward, Road Safety Engineering Unit (RSEU) endeavours to continue working closely with the relevant divisions and community representatives to ensure the continued success of the Silver Zone project.



## INTRODUCTION

As part of our SAFER, BETTER and COST EFFECTIVE initiative, the Land Transport Authority (LTA) has recently completed the construction of a new mini-roundabout at the junction of Chai Chee Street and Chai Chee Drive.



Figure 1: New roundabout at Chai Chee Street / Chai Chee Drive junction

## IMPAIRED VISIBILITY AT THE JUNCTION OF CHAI CHEE STREET / CHAI CHEE DRIVE

Chai Chee Street and Chai Chee Drive are connected at an acute road bend that leads to LTA Bedok Campus main access. Motorists entering the Campus from Chai Chee Street have to position their vehicles in the turning lane to look out for oncoming traffic from the left before proceeding. This view can be momentarily obstructed whenever a larger vehicle (e.g. public bus) passes alongside them on their left (Figure 3), affecting the drivers' clear line of sight. This situation can create anxiety for some motorists, as they are uncertain whether to proceed into Bedok Campus after they have initially assessed that it is safe for them to do so.



Figure 2: Location Plan of the new mini-roundabout



Figure 3: Before the implementation of a Roundabout. Drivers' view were often blocked by larger vehicles

## BENEFITS OF ROUNDABOUT

Roundabout is useful in regulating the approaching traffic speed and its circulating speed as compared to a give-way junction in a localised road environment. Motorists waiting to enter a roundabout would only need to look out for oncoming traffic in a single direction. This is less onerous as compared to a give-way junction, where vehicular traffic can flow from different directions.

Any vehicular collision that may occur within a roundabout is likely to be a merging type crash. Its accident outcome is usually less severe as compared to head-on collision arising from a give-way junction.

Since motorists are only allowed to move in a single direction around a centre island, traffic flow is smoother and continuous as compared to other alternatives, for e.g. signalised junction. One can also consider a roundabout as a series of right turns along a one-way street. For intersection with very high traffic load, signalised junction may still be the most effective means of managing traffic flows.

The new mini-roundabout at Chai Chee Street / Chai Chee Drive also helps to regulate traffic movement as well. Vehicles from all the three approaches are required to slow down and give way to circulating traffic within the roundabout. The visibility of oncoming traffic from the give-way line of all approaches is unobstructed. This eliminates the impaired visibility at the bend of Chai Chee Street / Chai Chee Drive.





Figure 4: A driver's view after the implementation of a roundabout. The new single lane roundabout eliminates obstruction caused by vehicles, giving drivers a clear line of sight



Figure 5: New bus friendly hump and crossing point along Chai Chee Drive

It would have been desirable for the roundabout's centre island to be bigger for better visibility. However, due to site constraints and the need for long vehicles (e.g.: public buses) to manoeuvre, a smaller roundabout circle was introduced

## ADDITIONAL ENHANCEMENTS FOR PEDESTRIANS SAFETY

Prior to the implementation of the roundabout at Chai Chee Street / Chai Chee Drive, pedestrians used to cross directly at the road bend. This posed a concern as the visibility for motorists at the road bend was limited. Moreover, motorists were also not obliged to slow down as their movements from Chai Chee Street to Chai Chee Drive or vice versa were uninterrupted.

To facilitate a safer and more conducive crossing experience for pedestrians, railings are now installed to channel them to the new crossing points located further away from the roundabout. Motorists approaching the roundabout are also required to slowdown as they are currently being regulated by the give-way line before the roundabout.

## QUOTES FROM USERS

*"The newly implemented roundabout has simplified vehicular movements and dampened travel speeds, making the area outside Bedok Campus much safer than before!"*

*"The humps are effective in slowing down approaching vehicles."*

*"It's safer for pedestrians because it's easier to spot the turning vehicles"*

Road safety enhancement in the form of bus friendly humps are also constructed on both the approach lanes along Chai Chee Street and Chai Chee Drive to further reduce the speed of vehicles (Figure 5). Additionally, it also creates extra traffic gaps for pedestrians to cross the road safely, and for motorists entering the roundabout from the give-way line.



Figure 6: Conceptual Plan of the roundabout traffic scheme

## WHAT TO DO WHEN APPROACHING A ROUNDABOUT?

Follow the general rules listed below to help you navigate a roundabout safely, especially those with multiple lanes.

1. Always slow down when approaching a roundabout and give way to the traffic on your right.
2. Make use of the traffic signs and road markings to help direct you into the correct lane when approaching a multi-lanes roundabout.
3. Decide early which exit you need to take and give clear signals showing your intention in good time.

**Remember** to exercise caution at all times. Show consideration to the other road users in the interest of road safety.



# EDITORIAL PAGE

## ISO 45001: 2018 – Occupational Health and Safety Management Systems

### What is ISO 45001?

The ISO 45001 is a new global standard providing organisations with the framework to manage Occupational Safety and Health (OH&S) risks, and to prevent work-related injury and ill health to workers. It will replace the former OHSAS 18001. Besides the notable enhancements, the new standard requires top management to have stronger leadership and accountability towards OH&S management system.

ISO 45001 was launched in March 2018 to increase global consistency in making workplaces safer and healthier for all. Organisations with the existing OHSAS 18001 have 3 years to adopt the new standard.

The setting of ISO 45001 is similar to other standards (e.g.: ISO 9001 and ISO 14001) as it uses a quality approach based on PDCA cycle (Plan, Do, Check and Act).

### What are the major differences between OHSAS 18001 and ISO 45001?

The OHSAS 18001 focuses on managing OH&S hazards and other internal issues, while the ISO 45001 concentrates on the interaction between the organisation and its business environment. Besides that, the new standard also diverges in several other ways:

- ISO 45001 is process-based, while OHSAS 18001 is procedure-based;
- ISO 45001 considers not just risk but also opportunities;
- ISO 45001 includes the views of interested parties (e.g. workers).

Although the two standards differ in their approach, a Safety Management System established in accordance with OHSAS 18001 can be revised for transition to ISO 45001. LTA will be revising its Safety and Health Management System for conformance to the new standard, so as to achieve its intended outcomes and to maintain organisational compliance.

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