Land Transport Authority
We Keep Your World Moving

SAFETY news

37th Edition | ISSN 1793-1665 | March 2019

FEATURED articles

2 Highlights of Annual Safety Award Convention (ASAC) 2018

INTRODUCTION

The Annual Safety Award Convention (ASAC) is a prestigious award ceremony hosted yearly by LTA since 1999 to give due recognition to deserving contractors for their relentless effort in raising the safety, health and environmental standards at their respective worksites. This year, LTA held its 20th ASAC on 6th September 2018 at the Singapore Polytechnic Convention Centre with Mr. Chan Heng Loon Alan, Chairman of LTA as its Guest of Honour. Approximately 1200 guests, comprising of LTA staff, QP teams, contractors, sub-contractors, Public Transport Operators (PTOs), professionals from both the construction and public transport industries were present to grace the event.

Figure 1: Guest of Honour, Mr. Chan Heng Loon, Alan, Chairman of LTA, delivering his opening address

THEME OF ASAC 2018

The theme, **'Safety through Innovation and Technology'**, was chosen for the 20th ASAC to emphasize the importance of innovation and technology that enable works to be carried out safely and more productively in the dynamic construction industry. The use of innovative technologies can help to improve work processes, eliminate or reduce risks, increase workers' competency as well as to inculcate stronger safety culture. By leveraging on innovations and harnessing new technologies for the construction industry, we can transform the way we work for a safer and more productive outcome.

In his opening address, Mr. Chan also announced that LTA will introduce a new Construction Safety Innovation Award for next year's ASAC to encourage companies to adopt innovation and leverage on the use of technology for safety in construction sites.

NEW AWARDS FOR PUBLIC TRANSPORT OPERATORS

In expanding our recognition for outstanding safety performance beyond the construction industry, four new awards were introduced this year to recognise rail and bus operators who have demonstrated excellence in ensuring workplace and commuters safety. They are the 'Safe Rail Line of the Year' Excellence and Merit Awards, as well as the 'Safe Bus Operator of the Year' Excellence and Merit Awards.

THE ASAC COMPETITION

This year's ASAC competition saw a total of 47 contracts competing for the various safety awards across different categories. These contractors were assessed based on their Environmental, Safety and Security (ESS) assessments, safety performance statistics and a round of internal audit conducted by LTA's project management teams.

The four finalists, namely Contract T219 Penta-Ocean / Bachy Soletanche Joint Venture, Contract T225 Shanghai Tunnel Engineering Co (Singapore) Pte Ltd, Contract T226 Taisei Corporation and Contract ER397A Hwa Seng Builder Pte Ltd, were short-listed to compete against one another for the top award, the LTA Contractors Challenge Shield. As part of the final judging criteria, these finalists had to undergo a further audit by LTA's guest Panel of Judges and prepare a theme-based presentation on the actual day of the event.

PANEL OF JUDGES

The 20th ASAC Panel of Judges comprised of senior representatives from the Ministry of Manpower (MOM), Institute of Engineers Singapore (IES), Singapore Contractors Association Ltd (SCAL) and Singapore Institute of Technology (SIT). All of the judges were very impressed with the finalists' excellent Workplace Safety and Health management approaches during the site audits in July 2018 as well as their outstanding theme-based presentations on the event day. Chief Judge Er. Mohd Ismadi said in his speech: "There was little to separate the four finalists, making the job of the panel very difficult."

Figure 2: Panel of Judges (from left): Mr. Kenneth Loo (SCAL), Er. Mohd Ismadi (MOM), Dr. Lim Kok Hwa (SIT) and Mr. Vincent Ng (IES)

FINALISTS' PRESENTATIONS

On the event day, each finalist was given 15 minutes to showcase their site safety practices with a presentation and a theme-related skit. Contract ER397A Hwa Seng Builder Pte Ltd won the hearts of the audience with their interesting and humorous skit and achieved the 'Best Theme Presentation Award'.

Figure 3: Skit presentation by Contract ER397A Hwa Seng Builder Pte Ltd, showcasing their safety innovations and technologies

Highlights of Annual Safety Award Convention (ASAC) 2018

CONTRACTORS CHALLENGE SHIELD (ASAC CHAMPION)

Eventually, after much deliberation, Contract T225 Shanghai Tunnel Engineering Co (Singapore) Pte Ltd emerged as the champion for ASAC 2018. The company had successfully defended their championship title and once again walked away with the Contractor's Champion Trophy and the Challenge Shield.

Figure 4: ASAC 2018 Champion Contract T225 Shanghai Tunnel Engineering Co (Singapore) Pte Ltd with Chairman of LTA Mr Chan

ASAC EXHIBITIONS

For the very first time, exhibition booths were also set up by the four finalists as well as by participating external vendors to showcase how various innovations and technologies can greatly improve safety on our construction projects.

At Contract T219 Penta-Ocean / Bachy Soletanche Joint Venture's exhibition booth, the company demonstrated how the use of an exoskeleton can help redistribute the weight of heavy equipment carried by workers, thus reducing his risk of getting injured.

Figure 5: T219 Penta-Ocean / Bachy Soletanche Joint Venture demonstrating the use of exoskeleton

Another finalist, Contract T226 Taisei Corporation exhibited an innovative vibrating helmet, in which its functionality involves its wearer. In the event that the wearer of the vibrating helmet gets too close to a machinery, a signal will be received by the helmet which in turn causes it to vibrate, thereby warning the wearer that he / she is too close to the machinery.

Figure 6 and 7: The vibrating helmet, called Kizuna, was showcased at Contract T226 Taisei Corporation's booth

AWARDS CONFERRED DURING ASAC 2018

A total of 45 awards were presented during the Convention and some awards are further divided into four categories:

Category A – Civil Contracts with value $50 million and above
Category B – Civil Contracts with value between $20 million and $50 million
Category C – E&M contracts with value $20 million and above
Category D – Contracts with value below $20 million

- ***Contractors Challenge Shield*** *to the champion of the ASAC final competition.*
- ***Best ASAC Theme Presentation*** *to the finalist of Category A for delivering the best theme presentation as voted by the audience.*
- ***Certificate of Excellence*** *to 4 finalists from Category A and 1 from Category C for their outstanding WSH performance over the assessment period.*
- ***Certificate of Merit*** *to 3 contractors from Category A, 1 from Category B, 1 from Category C and 2 from Category D for their consistent good WSH performance over the assessment period.*
- ***Project Safety Commendation Award*** to 2 LTA Project Safety Committees with best effort and WSH performance in ensuring and promoting excellent WSH standards at its worksites.
- ***Construction Environmental Excellence Award*** to 2 contractors from Category A who have shown excellent environmental management at their worksites.
- ***Construction Environmental Merit Award*** to 4 contractors from Category A who have shown consistently good environmental management at their worksites.
- ***Accident-Free Million Man-hours Recognition Award*** to 8 contractors with a considerable accident-free man-hour milestone without reportable accidents or major incidents.
- ***QPS Safety Award*** to 4 QPS teams with proactive contribution towards addressing Workplace Safety and Health (WSH) issues.
- ***Sub-contractors' Safety Recognition Award*** to 7 sub-contractors with significant contribution to good WSH performance.
- ***Safe Rail Line of the Year Excellence Award*** to rail transport operators with outstanding performance in workplace and commuter safety.
- ***Safe Rail Line of the Year Merit Award*** to rail transport operators with good performance in workplace and commuter safety.
- ***Safe Bus Operator of the Year Excellence Award*** to bus transport operators with outstanding performance in workplace and commuter safety.
- ***Safe Bus Operator of the Year Merit Award*** to bus transport operators with good performance in workplace and commuter safety.

The winners of each category are showcased in the following sections.

4 The Winners of ASAC 2018

Certificate of Excellence

Figure 8: Category A (Finalist) – RID Contract ER397A Hwa Seng Builder Pte Ltd

Safe Bus Operator of the Year Excellence Award

Figure 12: PT211 Bedok Bus Package - SBS Transit Ltd

Figure 16: TEL (E&M) Project Safety & Environmental Committee Mr. Melvyn Thong, 2 Deputy Group Director

Figure 9: Category A (Finalist) – TEL C3 Contract T219 Penta-Ocean / Bachy Soletanche Joint Venture

Safe Rail Line of the Year Excellence Award

Figure 13: Downtown Line - SBS Transit DTL Pte. Ltd.

Certificate of Excellence

Figure 17: Category C – TEL E&M Contract T250 – CTCI Corporation / CTCI Singapore Pte Ltd Consortium

Figure 10: Category A (Finalist) – TEL C4 Contract 225 – Shanghai Tunnel Engineering Co (Singapore) Pte Ltd

Best ASAC Theme Presentation Award

Figure 14: Category A (Finalist) – RID Contract ER397A Hwa Seng Builder Pte Ltd

Certificate of Merit

Figure 18: Category A – TEL C1 Contract T203 – GS Engineering & Construction

Figure 11: Category A (Finalist) – TEL C4 Contract T226 Taisei Corporation

Project Safety Commendation Award

Figure 15: TEL C1 Project Safety & Environmental Committee Mr. Goh Kok Hwa, Director

Figure 19: Category A – TEL C2 Contract T213 – Samsung C&T

The Winners of ASAC 2018

Figure 20: Category A – TEL C5 Contract T305 – Shanghai Tunnel Engineering Co (Singapore) Pte Ltd

Figure 24: Category D – TEL C1 Contract T2209 – Tritech Engineering & Testing (Singapore) Pte Ltd

Figure 28: Category A – TEL C4 Contract T226 – Taisei Corporation

Figure 21: Category B – RID Contract ER478 – Hwa Seng Builder Pte Ltd

Safe Bus Operator of the Year Merit Award

Figure 25: PT201 Loyang Bus Package – Go-Ahead Loyang Pte. Ltd.

Construction Environmental Merit Award

Figure 29: Category A – TEL C1 Contract T202 – Penta-Ocean Construction Co., Ltd

Figure 22: Category C – TEL E&M Contract T260 – ST Engineering Electronics Ltd

Safe Rail Line of the Year Merit Award

Figure 26: Circle Line – SMRT Trains Ltd.

Figure 30: Category A – TEL C1 Contract T203 – GS Engineering & Construction

Figure 23: Category D – RID Contract ER508 – Megastone Holdings Pte Ltd

Construction Environmental Excellence Award

Figure 27: Category A – TEL C4 Contract T225 – Shanghai Tunnel Engineering Co (Singapore) Pte Ltd

Figure 31: Category A – TEL C3 Contract T217 – Sinohydro Corporation Limited (Singapore Branch)

6 The Winners of ASAC 2018

Figure 32: Category A – RLE Contract 158A – China State Construction Engineering Corporation Limited Singapore Branch

Figure 36: Category 2 (For contracts below $120 million that achieved above 400,000 accident free man-hours) – RLE Contract 158A – China State Construction Engineering Corporation Limited Singapore Branch

Figure 40: Category 3 (For E & M contracts that achieved above 250,000 accident free man-hours) – TEL E&M Contract T275A – Gammon Pte. Limited

Accident-Free Recognition Award

Figure 33: Category 1 (For contracts $120 million and above that achieved above 2 million accident free man-hours) – TEL C1 Contract T202 – Penta-Ocean Construction Co., Ltd

Figure 37: Category 2 (For contracts below $120 million that achieved above 400,000 accident free man-hours) – RID Contract ER478 – Hwa Seng Builder Pte Ltd

QPS Safety Award

Figure 41: QPS of TEL C1 Contract T203 – CKM Consultants Pte Ltd

Figure 34: Category 1 (For contracts $120 million and above that achieved above 2 million accident free man-hours) – TEL C1 Contract T203 – GS Engineering & Construction

Figure 38: Category 3 (For E&M contracts that achieved above 250,000 accident free man-hours) – TEL E&M Contract T250 – CTCI Corporation / CTCI Singapore Pte Ltd Consortium

Figure 42: QPS of TEL C3 Contract T218 – ECAS Consultants Pte Ltd

Figure 35: Category 1 (For contracts $120 million and above that achieved above 2 million accident free man-hours) – TEL C3 Contract T219 – Penta-Ocean / Bachy Soletanche Joint Venture

Figure 39: Category 3 (For E&M contracts that achieved above 250,000 accident free man-hours) – TEL E&M Contract T273A – Gammon Pte. Limited

Figure 43: QPS of TEL C6 Contract T301 – Ronnie & Koh Consultants Pte Ltd

The Winners of ASAC 2018

Figure 44: QPS of RID Contract ER397A – T.Y.Lin International Pte. Ltd.

Figure 47: McConnell Dowell South East Asia Pte Ltd

Figure 50: Yongnam Engineering & Construction (Pte) Ltd

Subcontractor's Safety Recognition Award

Figure 45: MEC Engineering Pte Ltd

Figure 48: HSL Ground Engineering Pte Ltd

Figure 51: Utracon Structural Systems Pte Ltd

Figure 46: CREC Construction Pte Ltd

Figure 49: Doo Ree Engineering & Trading Pte Ltd

Teng Wei Ling
Deputy Environmental Manager
Safety Division

8 STEC T225 – Driving Safety Through Innovation and Technology

INTRODUCTION

On 6th September 2018, at the 20th LTA Annual Safety Award Convention (ASAC), Shanghai Tunnel Engineering Co. (Singapore) Pte Ltd (STEC) Contract T225 won the LTA Contractor's Challenge Shield for the consecutive year. This is the 3rd time STEC had won the LTA ASAC Contractor's Challenge Shield since 2012.

Figure 1: Sharing the joy with workers for winning the LTA ASAC 2018 Awards

STEC'S WORKPLACE SAFETY & HEALTH BELIEFS

STEC strongly believes that Workplace Safety, Health & Environment (WSHE) is an integral part of its business and is also a measurement of its success, hence STEC's Safety Goal – **'Zero Accident and Zero Harm for Everyone'**. By integrating WSHE management into its planning, design and construction process, STEC aims to eliminate all workplace related injuries, environmental harm and ill health. When it comes to WSH, a top-down approach is important.

In STEC, workplace safety and health issues are seen as opportunities to improve ones' safety and wellbeing while at work, and STEC's top management has been pivotal in driving WSH messages and ensuring that WSH issues were addressed, well communicated and understood by the entire organisation.

Figure 2: Top Management's commitment – Annual Corporate WSHE Campaign 2018 – 'Take Time To Take Care'

INNOVATIVE SAFETY, HEALTH & WELFARE PROVISIONS

STEC Projects continue to improve its WSHE standards by implementing WSHE initiatives. Contract T225 Innovation Team came up with the idea to install a customised Height Limit Alarm Warning System affixed on the mandatory 4.5m height limit gantry. This served as an additional control measure to prevent overhead road structure collision caused by heavy vehicles.

Figure 3: Customised Height Limit Alarm Warning System

Another innovative idea was the installation of a light projection system on the forklift which projects a beam of brightly coloured light on the ground highlighting its intended movement path. This projected light is especially useful during the forklift's reverse manoeuvres as it supplements the forklift's existing audible reverse beeper with a visual indication of the danger zone to nearby workers.

Figure 4: Projection of bright coloured lights from the forklift

Contract T225 also uses drone to capture worksite images in areas not easily accessible by workmen. Instead of deploying workmen and placing them at risk, the process is substituted by using drones, which eliminates any risks posed to the workmen.

Figure 5: Using drone to capture worksite images

Contract T225 is located next to a high-rise commercial building fitted with a 15m height glass façade. During the construction of diaphragm walls, cranes, boring rigs and heavy machineries were required to operate next to the building, with the closest being 1m away from the glass façade. To restrict the movement of machineries and lifted load beyond a set boundary, photo-electric beam sensors and visual indicators were installed along the boundary to alert the operation teams when they were straying near the boundary limits.

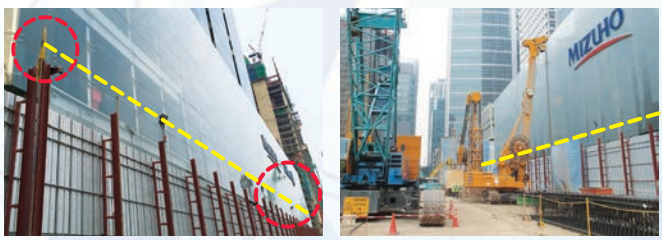

Figure 6: Photo-electric beam sensors and visual indicators

STEC T225 – Driving Safety Through Innovation and Technology

During the tunnelling works between Marina Bay and Shenton Way Stations, oscilloscope sensor was installed at the Tunnel Boring Machine's (TBM) bulkhead. The oscilloscope works by detecting any metallic object (e.g.: H pile) in its path, which posed as an obstruction. With electrical signals sent and received over time, the device is able to display and record signals in a graphical manner. The oscilloscope aids tunnelling works as it can pick up obstruction in advance. Its usage in-turn facilitated the smooth and safe tunnelling activities while undercrossing 23 sensitive stakeholders.

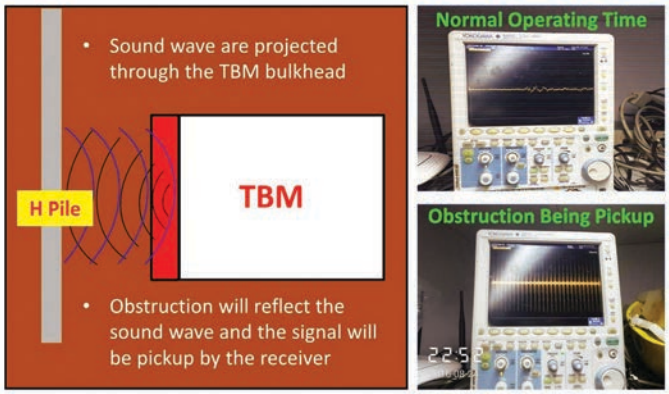

Figure 7: Use of oscilloscope to detect obstruction during tunnelling

In STEC, to address hazardous conditions expeditiously, time is essential in its Near Miss reporting as it prevents the propagation of unsafe activities / conditions. In facilitating timely Near Miss reporting, full tunnel WiFi is required, so that the observer can capture any unsafe activity and its image sent to their superiors. Specific instruction can then be sent to the observer and / or relevant party to address the unsafe activity / condition. In addition, educational messages can also be sent timely to all for learning purposes.

Figure 8: Workman rewarded for timely Near Miss reporting using WhatsApp

Figure 9: Full WiFi provided in tunnels for efficient communication

ENHANCING WSHE TRAINING WITH VISUALISATION TECHNOLOGY

STEC Projects went the extra mile in ensuring its workers' safety competency by training and equipping them with proper WSHE knowledge and skills for every job undertaken. In line with its core value of putting safety as its top priority, STEC invested heavily by providing on-site WSHE training centres for all projects.

Figure 10: Contract T225 WSHE Training Centre – 'Video Animation Room'

To add a new dimension to workplace safety training, Contract T225 set up a Virtual Reality (VR) training centre which allows site personnel to familiarise themselves with dangerous site specific situations without the actual risks involved. Simulated site specific topics include tunnel safety and emergency, working safely at heights, electrical safety, lifting safety, hot work safety, shaft collapse etc. Workmen can then learn and equip themselves with specific safe work procedures to carry out the task safely.

Figure 11: Contract T225's VR training centre

CONCLUSION

Innovations and technologies can help to reduce human errors resulting in undesirable workplace accidents. Moving forward, STEC will continue exploring the latest innovative technologies and methodologies to make its worksites safer for all.

Thant Zaw
WSHE Manager
STEC Contract T225

10

Rodent Control on Construction Sites

INTRODUCTION

Rodents are one of the five main vectors in Singapore, and can transmit diseases such as Plague, Rat Bite Fever, Leptospirosis, Salmonellosis and Murine Typhus. They are agile and can squeeze through holes that may appear too small for their size. They can also give birth four to seven times a year, producing six to twelve pups each litter. If left uncontrolled, a pair of male and female rodents can be responsible for a population of more than 1,300 rodents during its lifetime as its young can reach sexual maturity in a few weeks.

Figure 1: Roof rat is one of the common rodents in Singapore[1]

Apart from spreading diseases at construction sites, rodents can also cause damage to electrical wires, pipes, and wooden structures by gnawing on them.

The three main factors for rodents to thrive are food, water and shelter. Therefore they are most likely to infest places such as canteen, workers' rest areas and waste disposal areas. In addition, sites located near food establishments or bin centres are also more susceptible to rodent infestation.

RODENT PROBLEMS AT CONSTRUCTION SITES

Throughout the entire project lifecycle, rodent infestation can occur at different phases:

1) **Site clearance phase**
   Sites located within forest areas, and / or near food establishments may have pre-existing rodents infestation.

2) **Construction phase**
   As the activities in the worksite intensify, general site conditions may deteriorate due to poor waste management and / or housekeeping. These provide the ideal environment for rodents to thrive.

Figure 2: Overflowing waste bins attract rodents

SIGN OF INFESTATION

An infestation may be identified with the following indicators:

- **Droppings**
  Rodent droppings give indication of their presence and also reveal the type of species, the size of infestation and the areas where they are active. Depending on the size and type of rodents, one rat can produce 40 to 100 droppings a day. If substantial amount of droppings are found on site, NEA may deem that an infestation is present.

Figure 3: Rodent droppings spotted on site[2]

- **Burrows**
  An active burrow has its surrounding clear of vegetation, and its entrance will appear compacted and smooth. Burrow is considered a sign of rodent infestation on site.

Figure 4: Rodent burrow[2]

[1] *Wikimedia Commons*
[2] *Keep Places Clean and Free of Rats, National Environment Agency*

Rodent Control on Construction Sites

- **Gnaw marks**
  Rodents need to gnaw to keep their teeth in check, and they gnaw on items such as bricks, metal sheets and cabinets etc.

Figure 5: Rodent gnaw marks[2]

REGULATORY REQUIREMENTS

The control of rodents is governed under the Control of Vector and Pesticides Act (CVPA) and its subsidiary regulations. It prohibits the creation of conditions favourable to vectors, and stipulates the penalty for person who contravenes its provisions.

Under Section 23 of the Act, the accused upon conviction can be liable to a fine up to $20,000 or imprisonment for a term up to 3 months, or both. And in the case of a second or subsequent convictions, the accused may face a fine up to $50,000 or imprisonment for up to 6 months, or both.

In 2017, during the inspections by NEA, rodent droppings were found at the workers' rest area and materials storage area of two LTA work sites. These two contractors were subsequently fined for having rodent infestation on their work sites.

RODENT CONTROL MEASURES

The most effective ways to control rodents are to remove food sources and areas of harbourages, so as to deter nesting and breeding. The following measures can be looked into:

Eliminate Food Sources

- **Food Storage**
  Food shall be properly stored in rodent-proof containers with close-fitting lids in designated food storage areas.

Figure 6: Food properly stored in containers in designated areas with well-maintained lidded bins

- **Food Waste**
  Lidded garbage bins shall be provided for disposal and its refuse cleared daily from site.

Eliminate Shelter and Harbourage

On construction sites, rats make their nests in enclosure such as stacks of plywood, beams, concrete barriers, container site offices, piles of rubbish, fallen trees and overgrown vegetation etc. It is important to carry out regular housekeeping to eliminate shelters for rodent infestation, including sealing up cracks and holes that enable rats to ingress.

Figure 7: Grass trimming

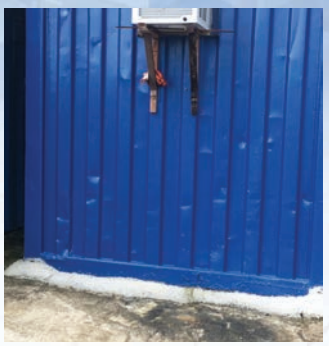

Figure 8: Bottom of site office properly sealed up

Eliminate Water Source

Stagnant water on site shall be cleared regularly, as well as other water sources such as plumbing leaks fixed.

Trapping & Rodenticides

Rodent traps should be introduced by the the contractors' in-house pest control team to trap rodents on site. These traps can be strategically placed at worker's rest areas, materials storage areas, or near vegetated grounds where rodents are likely to appear.

Figure 9: Rodent trap placed behind a material storage area

Licensed Pest Control Operator (PCO) can also apply rodenticides during their inspections to aid in rodent control. However, these should be handled and applied by competent operators as rodenticides are classified under "restricted use".

For areas with pre-existing conditions, contractors are to engage a PCO to conduct a baseline survey to determine the area's vulnerability to vector infestation (e.g.: proximity of forests, eateries and food establishments) prior to the commencement of construction. All observations should be communicated to the respective NEA regional offices and followed by PCO's treatment.

CONCLUSION

Rodent control on construction sites is challenging, as site conditions are everchanging, leading to nooks and crannies in every corner. The key strategy in eliminating rodent infestation is to tackle the three factors of survival for rodents i.e. food, water and shelter. It can be achieved through good housekeeping, waste management, conducting regular checks and treatment. With sustained efforts, our construction sites can be kept rodent free.

Wan Lijia
Deputy Environmental Manager
Safety Division

12

Safe Use of E-Scooters in Singapore

INTRODUCTION

Ask any e-scooter user why they chose to ride one, and you may have heard one of these reasons: “I won’t perspire as much as compared to walking or cycling under the hot sun”, “It’s cheaper than owning a car”, or “It’s fun to ride it!”.

Couple these benefits with an array of affordable options, there is little wonder why Personal Mobility Devices (PMDs), such as e-scooters have quickly grown in popularity in Singapore over the past few years. Many riders used their e-scooters to run errands or make short trips around the neighbourhood. Organisations and businesses have also adopted e-scooters for delivery services, patrolling duties or site checks.

Unfortunately, inconsiderate and reckless use of e-scooters have endangered the safety of the general public, and made media headlines for the wrong reasons.

If e-scooters are to continue to have a place in our transport system, new measures have to be put in place for safer and more responsible use of these devices. Read on to find out what measures have been put in place to inculcate the safe behaviour of riders, as well as to ensure the longer term sustainability of this useful mode of commute.

REQUIREMENTS FOR SAFE USAGE OF E-SCOOTERS

1. Mandatory e-scooter registration

From 2 January 2019, all e-scooters need to be registered with the Land Transport Authority (LTA) before they can be ridden on public paths. This registration regime will accord greater responsibility to riders for its safe usage, as each registered device will need to be affixed with marks carrying a unique identifier.

For those who currently own an e-scooter, there is a need to register it as soon as possible, as riding an unregistered device on public paths will soon be considered an offence. For more details about registration, registrants can visit www.onemotoring.com.sg/escooter.

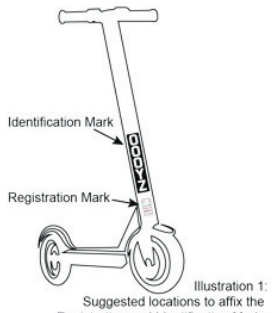

Illustration 1: Suggested locations to affix the Registration and Identification Marks

Registered e-scooters will need to be affixed with both the LTA Registration Mark and the Identification Mark.

It will be an offence to ride an e-scooter on public paths without displaying both marks from 1 July 2019.

2. Device criteria for e-scooters

Under the Active Mobility Act, all e-scooters used on public paths have to comply with the following 3 criteria to ensure safer journeys for all. See Figure 1.

Owners of e-scooters are also required to declare that their device meets these 3 criteria as part of the registration process.

Figure 1: Device criteria for e-scooter

Riders who have been caught using non-compliant e-scooters may have to pay fines and their e-scooters impounded. To stay on the right side of the law, prospective buyers are advised to purchase the device from a reputable retailer, or check the device specifications thoroughly before making an online purchase.

Figure 2: Photo of ‘super long’ e-scooter

To further enhance public safety and minimise fire incidents, all PMDs used on public paths will need to be certified to the UL2272 standard[1] by 1 January 2021. Therefore, as part of the registration process, owners will be required to declare whether their e-scooter is UL2272 certified.

For owners who currently own a non-UL2272 certified e-scooter, they can still register it if it is purchased before 1 July 2019. However, do note that their e-scooter will be automatically de-registered on 1 January 2021, when non-UL2272 certified PMDs are no longer allowed on public paths.

3. Safe riding on shared paths and footpaths

To ride safely, always stay on shared paths and footpaths. Shared paths include dedicated cycling paths and Park Connector Networks (PCNs).

Figure 3: Example of a shared path

[1] *The UL2272 standard specifies a set of safety requirements covering the electrical drive train system including the battery system, other circuitry and electrical components of motorised PMDs such as e-scooters.*

Figure 4: Example of a footpath

Never ride an e-scooter on roads. Not only it is an offence, it is dangerous to riders as well as other road users. Riders who have been caught had to pay hefty fines and their devices impounded.

When riding on footpaths, riders are reminded not to exceed the speed limit of 10km/h. It has been lowered from 15km/h to reduce the risks of accidents and the severity of injuries in the event of collisions.

For shared paths, the speed limit of 25km/h remains. However, in the interest of preventing a collision between various users, riders are advised to slow down when approaching crowded areas and / or blind spots for the safety of all.

4. Always stop and look out at traffic crossings

While riders do not need to dismount and push their device at road crossings, they will have to stop and look out for oncoming vehicles before riding their device across.

Figure 5: Safety campaign launched in November 2018 by the Active Mobility Group, in partnership with Traffic Police and Singapore Road Safety Council, to remind e-scooter riders and motorists to be safe around road crossings

Taking these few seconds to "Stop. Look. Cross" may seem inconsequential, but it can save lives.

Visit www.lta.gov.sg to learn more on the rules and best practices to make e-scooter journeys safer for everyone.

CONCLUSION

E-scooters are definitely a convenient and fun addition to our transport modes when used safely and considerately. Regulations are required in the short term to correct errant behaviours, but it is our hope that a culture of graciousness and understanding between active mobility users and pedestrians will take root on our paths.

With that in mind, we would like to leave everyone with a checklist of safe scooting tips. Keep calm and scoot safe!

Checklist for safe scooting

- ✔ Always slow down and give way to pedestrians
- ✔ Walk your device in crowded areas
- ✔ Avoid weaving through pedestrians
- ✔ Gently alert others before overtaking
- ✔ Always slow down at bus stops and / or intersections of public paths
- ✔ Keep left on paths
- ✔ Always ride on shared paths or bicycle crossings when available

Kevin Seet
Deputy Manager, Active Mobility

Teo Hui Shan
Assistant Manager, Active Mobility

14 Rapid Transit System (RTS) Safety Through Maintenance Quality

INTRODUCTION

Safety management seeks to minimise the occurrence and mitigate the severity of unplanned events with safety impact, while quality management seeks to minimise the variability in product standards or process effectiveness. In our Rapid Transit System (RTS), safety is achieved not only through safe design, but also through quality maintenance practices and processes, to ensure that our infrastructure and systems can operate safely throughout their service life. In other words, quality maintenance is crucial to the safety of our RTS.

Intuitively, one can appreciate that if a train, a tunnel ventilation fan, an escalator or any RTS safety critical asset is not well maintained or upkeep in good condition, it can result in undesired consequence, jeopardising the safety of our commuters and workers.

How then can quality maintenance be achieved? In our view, it comes from a combination of an effective maintenance regime (i.e. a defined system, scope and plan) and a strong maintenance quality system, to ensure consistent and disciplined execution of the process. The two aspects are akin to the proverbial "Doing the right thing" and "Doing things right", and they form the foundation to good maintenance.

ASSURING RTS MAINTENANCE QUALITY

In LTA, a small team of maintenance auditors in the Maintenance Standards Assurance (MSA) Division of Rail Asset, Operation & Maintenance (RAOM) Group works closely with our Rail Operators (SMRT and SBST) to improve the maintenance quality, standards and culture of our RTS lines. We aim to ensure that our RTS assets are well maintained to provide the public with safe, reliable and comfortable commuting experience as illustrated in Figure 1.

Figure 1: Strategy Map of MSA

To achieve this outcome, MSA conducts 3 types of inspections / audits, namely:

- Asset Condition Inspections to verify the health-state of key RTS assets and the outcome of existing maintenance regime,
- Maintenance Inspections to validate the consistency and compliance of maintenance execution to stipulated instructions, and
- Maintenance Audits to identify gaps and improve existing maintenance standards and effectiveness.

PRIORITISING OUR INSPECTIONS

Given the number of RTS lines and the vast range of assets, safety is one of our key considerations that determines the focus of our Asset and Maintenance Inspections. We prioritise our inspections based on safety criticality and failure rate of systems as shown in Figure 2. Preventive Maintenance (PM) that is relevant to the identified asset will be selected for inspection across all lines. Priority is also given to 'dormant' systems placed on 'standby', such as flooding or fire protection systems, which are not activated during daily operation. This is to build confidence that their functions will not be compromised in the event of an emergency. When we identify possible inadequacies or issues in the maintenance regime of a particular maintenance practice, we will conduct Maintenance Audits to uncover systemic flaws and identify possible areas for improvement.

Figure 2: Priority of Inspection: Risk Analysis, Safety Critical Asset, Safety Critical Asset with High Failure Rate

IMPROVING MAINTENANCE REGIME AND QUALITY

A good example for case study was the failure of a point machine between Jurong East and Clementi in September 2018, where the detector of the point machine became displaced. A maintenance audit and regime review was subsequently conducted as a follow-up to this incident. Over the next 3 months, maintenance auditors performed condition and maintenance inspections on a sizable pool of identified critical point machines to verify conditions and to validate the Rail maintenance procedures prescribed by the Operator. Together with the Operator, we enhanced the maintenance procedure to include dimension checks, torque requirement for the detector lock-body bolt, the use of a lock-tab and the application of Loctite and torque strip on the bolt as illustrated in Figure 3. These additional measures have helped prevent the loosening due to vibration. In addition, it has aid visual inspection / detection of a loosened bolt during routine inspection. We also recommended to the Operator to monitor vibration levels around and on the point machine. This was to establish the acceptable vibration limits of the point machine, so that proactive measures could be taken to detect and arrest any incidence of excessive vibration that could cause the point machine to malfunction.

Another example was the escalators from two different MRT lines. The escalators had generated uncanny 'knocking' noise during its operation. The team conducted an audit on the maintenance instructions and servicing records to assess the differences in the maintenance regimes between the two different types of escalators. MSA also worked with colleagues in Mechanical & Electrical Systems, Rail Systems Projects and RAOM to review the current escalators design and maintenance regime to identify components that could potentially cause the 'knocking' noises. The approach led to the establishment of an effective and comprehensive preventive maintenance regime to arrest the worn components early.

Rapid Transit System (RTS) Safety Through Maintenance Quality

Figure 3: Point Machine Condition Inspection

During our maintenance inspections, besides surfacing procedural deviations, our auditors also constantly looked into ways to improve the effectiveness of maintenance tasks and efficiency of the maintenance teams. A notable example is our recommendation to use an infrared thermometer or a thermal imaging camera to check for poor quality electrical termination (illustrated in Figure 4) instead of the current visual means. The recommendation was adopted by the Rail Operators in identifying bad electrical joints before it could contribute to equipment failure and service disruption.

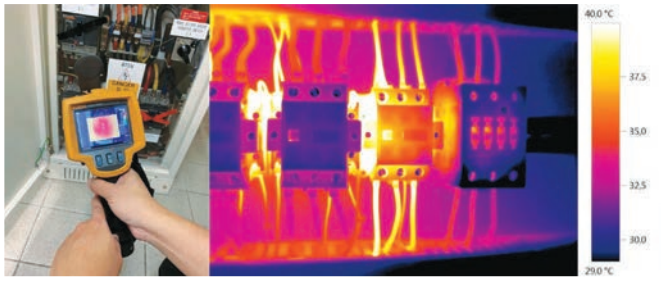

Figure 4: Inspecting with thermal imaging camera[1]

In addition, our maintenance auditors carried out inspections on the same system according to their specialisation across all RTS lines. This enables us to observe and share good maintenance practices between the two Rail Operators. MSA regularly review the maintenance practices of both Operators on similar systems, identifying best practices for sharing. The approach has help elevated the maintenance quality and standards. One example was the standardisation of practices to clean scupper drains and debris after rail grinding in the tunnels across all lines.

Our auditors in MSA also played an active part in strengthening the maintenance quality system of our Rail Operators. Through our maintenance inspections, we have emphasised the importance of keeping Work Instructions updated to reflect the latest equipment configuration or work procedures, and the need to adhere strictly to established Work Instructions. We also stressed the importance of using calibrated tools and measuring devices to ensure maintenance tasks are executed safely and correctly. The Rail Operators have responded and initiated their own internal review to validate their maintenance Work Instructions, and improved their maintenance quality system and enforcement regime.

[1] *Testo Pty Ltd*

HARNESSING TECHNOLOGIES TO IMPROVE MAINTENANCE

In view of Singapore's limited resources to maintain our expanding RTS network, the need to harness the vast potential of technologies that would allow our maintenance activities to be carried out in a safer, better and more cost effective manner, is paramount.

RAOM is exploring the use of drones to carry out viaduct bearing inspection autonomously. Its success would reap the benefits of reduced manpower / logistics, shortened inspection process and enhanced efficiency. Substantial cost-savings could also be derived.

Figure 5: Unmanned Vehicle for Rail Fastening Bolt Inspection

Another example is the use of an unmanned vehicle shown in Figure 5 to detect missing fasteners, cracks on sleepers and tunnel, water leakage, water ponding on track bed and thinning of rail fastening bolts in MRT tunnels. The unmanned vehicles would not only increase the productivity of inspections, it also ensured consistency and reduced manpower demands significantly.

CONCLUSION

Effective maintenance regimes and a strong maintenance quality system, are fundamental to achieve a high standard of maintenance. They have a direct impact on the safety and reliability of our RTS lines. While our Rail Operators are focused on achieving these, LTA play a crucial role by providing an independent perspective to highlight areas of improvements and provide a platform to cross-share good practices. Besides ensuring that the Operators comply with stipulated maintenance requirements, the asset condition inspections, maintenance inspections and audits RAOM conduct contribute to these objectives as well. Our efforts to harness technologies for RTS maintenance will also significantly improve RTS maintenance quality and efficiency for both Operators. Collectively, all these measures taken led to a strengthening of collaboration between LTA and Rail Operators, thereby bringing a safe and reliable rail network to our commuters.

Tay Wei Chong
Executive Engineer,
1 Maintenance Standards Assurance

Kartikeyan Nadarajan
Engineer,
1 Maintenance Standards Assurance

EDITORIAL PAGE

37th Safety Forum

LTA hosted the 37th Safety Forum on the 24th August 2018 at the HDB Hub Convention Centre. For the first time, LTA's Safety Forum has been expanded to cover safety operations and maintenance by the Public Transport Operators (PTOs). This is in line with LTA's Safety Policy, as safety is paramount in all aspects of our work, from construction, to operation and maintenance.

Mr Ngien Hoon Ping
LTA Chief Executive

Mr Jacky Wan
Deputy Safety & Health Manager, LTA

Mr Teo Yoke Koon
Senior Manager, Vehicle Approval & Control, LTA

Prof. Chia Kee Seng
School of Public Health, National University of Singapore

Mr Esen Sze
Deputy Project Manager, 2 Tunnelling Division, LTA

Mr Yeo See Peng
Senior Vice President (Bus Support Division), SBS Transit Ltd

A total of five topics were shared during the Safety Forum:

- Total Workplace Safety and Health and the War on Diabetes, by Professor Chia Kee Seng, School of Public Health, National University of Singapore
- Sharing on LTA Annual Safety & Environmental Performance in year 2017, Mr Jacky Wan, Deputy Safety & Health Manager, LTA
- Ground Freezing for Thomson-East Coast Line Contract T226 Marina Bay Station, Mr Esen Sze, Deputy Project Manager, 2 Tunnelling Division, LTA
- Use of Technology to Enhance the Safety of Bus Operations, Mr Yeo See Peng, Senior Vice President (Bus Support Division), SBS Transit Ltd
- Safety Requirements for Heavy Vehicles, Mr Teo Yoke Koon, Senior Manager, Vehicle Approval & Control, LTA

Editorial Committee

Advisor
Corporate Safety Committee

Editors
Phoa Hock Lye, Patrick
Liu Weng Keong, Ian

Circulation Officer
Zhuo Shumei

Writers
Teng Wei Ling
Thant Zaw
Wan Lijia
Kevin Seet
Teo Hui Shan
Tay Wei Chong
Kartikeyan Nadarajan

Contributions or feedback to:
Land Transport Authority
Safety Division
No. 1, Hampshire Road, Blk 5, Level 4, Singapore 219428
Tel: (65) 6295 7392 **Fax:** (65) 6396 1188
Email address: ian_LIU@lta.gov.sg

Safety News is also available online at
http://www.lta.gov.sg/content/ltaweb/en/industry-matters safety-andhealth-and-environment/construction-safety-and-environment/safetynews.html

or scan