Land Transport Authority

SAFETY NEWS

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FEATURED ARTICLES

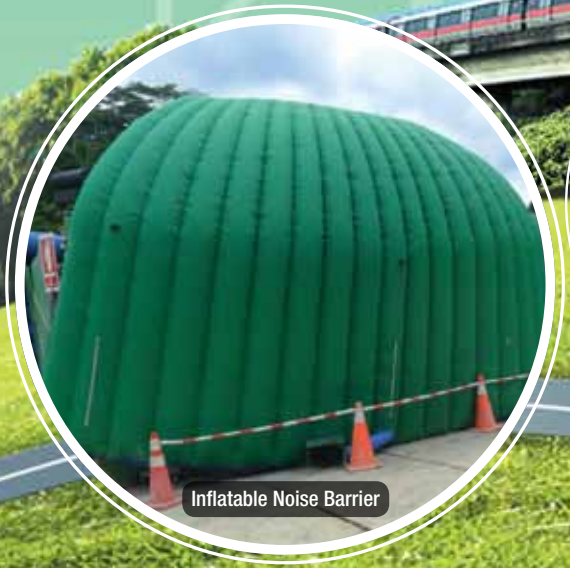

Telescopic Clamshell Excavator

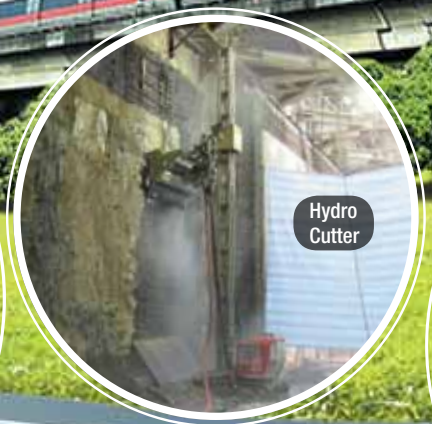

LED High Visibility Vest


Drum Dumper


Automated Vehicle Washing Bay


Bridge Crane


Inflatable Noise Barrier


Hydro Cutter


Robotic Traffic Controller

Reducing Hazards Through Innovation and Technology

INTRODUCTION

At the 31st Safety Workshop held on 19 May 2014, Mr. Chan Yew Kwong, Director, Occupational Safety & Health Inspectorate Division of the Ministry of Manpower (MOM), piqued the interest of the audience with a presentation provocatively entitled 'Construction Industry – the most dangerous industry in Singapore?'. The presentation painted a worrying picture of the construction industry with an increasing trend in fatal accidents as well as the MOM's enhanced enforcement measures to deal with this worrying trend.

On our part, with the implementation of the many initiatives from our ongoing Zero Accident Movement, is there more that we can do to complement MOM's efforts and to achieve a safer worksite on our LTA projects? The answer is a resounding YES! Besides our effort in inculcating a safety culture in our projects, we can harness the use of technology and innovative ideas to replace the use of manual labour for many of the hazardous construction work activities that contribute to many of the workplace accidents. By putting our workers out of harm's way, we can greatly reduce or even eliminate the number of accidents related to these work activities.

Construction technology and methodologies have evolved rapidly in recent years and this has resulted in improved buildability and productivity in the construction industry. The use of technology in certain construction activities has resulted in the reduced reliance on large amount of manual labour and in certain cases replaced them; reducing the amount of contact the workers have with these activities and thereby reducing the likelihood of injury. In this issue, we will highlight three construction activities that are using technology or an innovative idea to carry out the work safer and faster:

(i) Rebar Carpets;
(ii) Hydro Cutter; and
(iii) Self-Propelled Hydraulic Formwork System.

a) Rebar Carpets

Reinforcement-bars (rebars) are used extensively on our worksites for reinforced concrete to achieve their desired strength. These rebars are delivered to our worksites, either in their mill form, or are custom cut and bent to the required profiles where they will be manually placed and formed in accordance to design and detailing.

There are many hazards associated with rebar works, some of which are more apparent, such as being pinched, lacerated or impaled while others may not be so apparent, such as muscle-skeletal injuries due to long term exposure to poor ergonomic working postures.

While the use of precast components, which are extensively used in the building construction industry where similar precast components are repeated on every floor, may be able to reduce or eliminate the hazards associated with rebar works, their use on LTA's civil construction projects such as our underground MRT stations is not feasible. In addition, certain underground MRT stations are designated as Civil Defence (CD) Shelters and are hence designed to meet specific requirements for blast load and shock design resulting in massive reinforced concrete structures that can only be cast in-situ.

One approach to reducing the hazards associated with rebar works is for designers to consider the innovative idea of using rebar carpets. As its name implies, this involve using machines to pre-weld rebars to flexible straps and rolling them up, very much akin to rolls of carpet grass that can be found at nurseries, for easy handling and delivery to worksites. These rebar carpets are then positioned and unrolled on site at the designated areas.

This method substitutes the laborious conventional rebars tying process where workers are required to manually carry the rebar pieces and tying them manually. This significantly reduces the need for manual handling and consequently lowers the risk of hand and lower back injuries typically associated with rebar works.

Figure 1: Conventional way of fixing rebars for ground slab

Figure 2: Workers rolling out a bundle of the 'rebar carpet'

b) Hydro Cutter

Diaphragm wall (D-wall) is one of the common earth retaining system used to support deep excavations for the construction of MRT stations. In most cases, D-walls are also designed to form composite permanent wall of the station box and cut and cover tunnels. Couplers and shear bars are embedded in these D-wall panels, which will be subsequently exposed during reinforced concrete (RC) works for integration with the skin walls, slabs and beams.

The conventional way to expose the D-wall rebars require the use of scaffolding to allow workers to access and

manually hack off the covering concrete using pneumatic / electrical handheld breakers. The hazards associated with this work activity include falling from height, struck by concrete debris, exposure to excessive noise and dust, and vibration white finger (also known as hand-arm vibration syndrome (HAVS) or dead finger; an industrial injury caused by continuous use of vibrating hand-held machinery).

These hazards can be eliminated with the use of a remote controlled robotic hydro cutter machine. The hydro cutter machine uses high pressured water to cut the concrete; it is equipped with a rubber lined splashguard and can swivel and position the water-jet nozzles over any area of the concrete surfaces to be demolished. The depth of the concrete surface to be cut can be adjusted by varying the pressure of the water. Besides significantly reducing the number of workers required for the work, it also keeps the workers from being exposed to the typical hazards associated with this work. In addition, it can work continuously over an extended period of time with minimal supervision, resulting in increased productivity at minimal risks to the workers.

Figure 3: Conventional method of using scaffold and pneumatic breakers

Figure 4: Use of high pressured water jet to remove concrete layer to expose rebars for integration with skin wall, slab and beam

c) Self-Propelled Hydraulic Formwork

Conventional timber formwork and proprietary system formwork are commonly used for the construction of permanent lining for mined tunnels. These systems usually require the formwork to be constructed in a few stages; typically some for side walls and another for the tunnel crown, and they are required to be dismantled and re-erected for each advance along the tunnel length. The hazards associated with the use of such systems include falling from height and formwork structure failure.

The self-propelled hydraulic formwork system consists essentially of prefabricated steel-form panels fitted with hydraulic jacks. When extended, the hydraulic jacks hold the formwork in place and can be adjusted to fit the variable geometry of the final permanent lining of the tunnel. Fresh concrete is injected via a stationary pump to a network of discharge points to fill the mould. When the desired concrete strength is achieved, stripping of formwork becomes a breeze simply by retracting the hydraulic jacks to debond the formwork from the concrete surfaces. This formwork system is mounted on steel wheels and rested on rail tracks, and depending on the length of steel-form, it can be manually pushed or propelled by a pair of geared hydraulic motors to aid its advancement.

By minimising the need for workmen to carry out labour intensive works such as erecting and dismantling the required formwork structures, the risks of falling from height, fatigue, struck by falling objects, or limbs pinched between objects can be significantly reduced, if not totally eliminated.

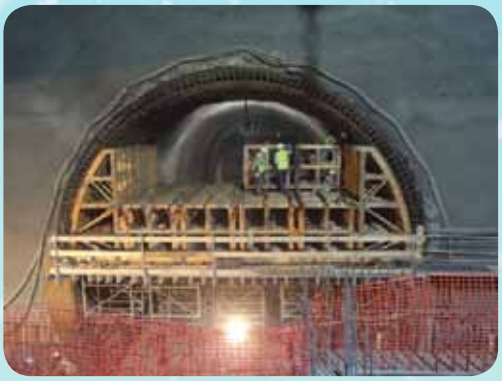


Figure 5: Conventional timber formwork system used for the construction of the permanent lining of a mined tunnel

Figure 6: A Self Propelled Hydraulic Formwork System

CONCLUSION

In order to achieve our goal of zero accident, we must move away from the conventional ways of construction that are over-reliance on manual labour and to embrace new innovation and technology in the construction of our road and rail projects. We must continue to scour the world for new ways of construction and harness the productivity and added safety these technology and methodologies can provide. Only then can we achieve our vision of a world class safety standard on LTA projects.

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Hand Injury Prevention

INTRODUCTION

Our hands are an intricate part of our daily lives. They are used in almost every activity we perform. We use them daily to grab, push, pull, lift, move and touch. The very fact that our hands are used so frequently also means that they have higher exposure and can be prone to many forms of injuries. Some common hand injuries include strains, sprains, punctures, lacerations, cuts, fractures, crushes and amputations, resulting in partial or total loss of use of our hands.

In LTA work sites, hand and finger injuries are the most frequently injured body part and constitute nearly 50% of all work site accidents.

This article highlights the common work activities that posed higher risks of hand injuries, a guide on how to prevent hand injuries, as well as the Dos and Don'ts for hand injury prevention for the common work activities.

WORK ACTIVITIES THAT PRESENT HIGHER RISKS OF HAND INJURY

A detailed analysis of accident data that was conducted for all LTA work sites between 2010 and 2014 revealed that certain work activities are prone to cause hand and finger injuries than others.

The top 4 types of work that contribute to hand and finger injuries are:

- Rebar fabrication and installation works
- Lifting operations
- Installation works
- Drilling works

To prevent hand and finger injuries, it is vital to place greater attention on these work activities. These work activities often have similar contributing factors which predispose the workmen to injuries such as pinch points, hot spots, rotating parts of machines, and automated machines. Greater awareness on personal safety is needed when the workmen are working with or within the vicinity of these hazards.

GUIDE TO PREVENTING HAND INJURIES

With deeper appreciation of the hazards and total committment to working safely, hand injuries are preventable.

The following are ways to reduce the risk of hand and finger injury:

- Familarise with the work area.
- Ensure that workman has been trained on the proper use of tools or equipment.
- Check the tools and equipment to ensure that are in good working condition.
- Never use hands or fingers directly when hazard is unknown. Instead, use push sticks, pliers, poles, etc.
- Follow all safe work practices and use the appropriate Personal Protective Equipment (PPE).
- Treat all electrical tools and equipment as live.
- Always check with your supervisor if in doubt.

When elimination, substitution, engineering control, and administrative controls are not feasible then proper PPE must be used.

The selection of the correct type of PPE is very important as the wrong type can create a new hazard to the worker. For hand protection, different type of gloves provide different forms of protection. It is therefore essential to know the work to be carried out and to use the appropriate gloves for the work.

The table below shows the type of gloves and the type of protection they provide:

Glove type / material	Protection from
Neoprene, rubber or vinyl	Most chemicals
Heavy leather	Welding, rough surfaces
Nylon, rayon, wool, glass	Heat
Cotton and terry cloth	Abrasions, cuts
Gloves with rough finish	Handling of slippery material
Lead-lined	Radiation
Metal mesh	Knife blades, other sharp instruments
Insulated material, often rubber worn under leather gloves	Electric shock, burns, vibration

Table 1: Different types of gloves offer different forms of protection

DOS AND DON'TS FOR HAND INJURY PREVENTION[1]

Rebar / Steel Works

Do:

- Always wear suitable and fitting gloves to protect your hands.
- Always use the correct tools for the work, e.g., crowbars to push rebars into position whenever necessary.
- Use wrenches to re-position the load to reduce any chances of knocks and bruises to your hands / limbs.
- Stack up all rebars bundles orderly and safely.
- Wear suitable gloves when tying rebar cages.

Don'ts:

- Don't use bare hands when handling any steel or sharp materials.
- Don't stack up rebar bundles haphazardly. They may roll over and cause injury.
- Don't place your fingers in-between rebars. Use appropriate tools instead.

Figure 1: Wear suitable gloves when handling rebars

Figure 2: Do not use bare hands when handling steel or sharp materials

[1]Source: LTA Hand Injury Prevention Brochure

Lifting Operations

Dos:

- Ensure that rebar bundles are stacked with (timber) spacers to allow room for rigging them up to the lifting gears.
- Ensure that the rigging is rigidly secured and firmed before the load is to be lifted. Where needed, use a crow bar or timber to make the adjustment.
- Use tag lines to control the load to prevent abrasion injury.
- Wear suitable leather gloves when handling the loads and lifting gears.
- Always keep a safe distance away from lifted loads.

Don'ts:

- Don't place hands onto the slings (lifting gears) or the load while waiting for the crane to lift or release the load line. Fingers can easily get pinched in between the load line and the lifted loads.

Figure 3: Tagline used to control of swing of load

Figure 4: Timber spacers between stacked rebar for easy rigging

Manual Handling (Rebar Bending / Cutting)

Dos:

- Inspect all tools / machinery prior to start of work to ensure that they are safe for use.
- Keep hands away from the machinery before activating the start switch.
- Wear suitable gloves to protect your hands.

Don'ts:

- Don't place hands in the path of any rotating parts.
- Don't remove any machinery guarding except during repairs / maintenance work and only after the power source is disconnected.
- Don't use hands to hold down materials during operation. Use a clamp / timber instead.

Figure 5: Use timber planks to wedge rebars

Figure 6: Do not place hands in the path of moving parts at all times

Formwork Construction

Dos:

- Practice good housekeeping. Stack materials orderly and safely.
- Remove all protruding nails and smoothen out any sharp edges before handling the materials.
- Wear suitable gloves to protect your hands.

Don'ts:

- Don't stack materials too high / haphazardly.
- Don't handle / lift large piece of formwork alone; always ask for help.
- Don't handle materials with exposed nails or sharp edges.

Figure 7: Do not stack materials at the edge to prevent tipping

Figure 8: All exposed nails should be removed / made safe

CONCLUSION

Hand injury continues to be one of the most frequently occurring injuries in LTA. Hand injuries will occur when we compromise safety by not assessing the risk properly, taking shortcuts, and circumventing safety procedures. Extra precaution and focus should be maintained when working around equipment, proper PPE and tools should be selected for each task performed. It is important to note that successful hand injury prevention requires commitment, participation and communication from all parties. Keep a look out of impending risks especially where your hands are at all times. Safety is a personal responsibility. Safety is in your hands.

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Safety Considerations in System Enhancement for BPLRT

INTRODUCTION

Bukit Panjang Light Rapid Transit (BPLRT) is an elevated LRT system with 19 automated Bombardier Innovia APM 100 vehicles currently in service since 1999. It has a total route length of 7.8km and 14 stations with connectivity to North-South Line (NSL) via Choa Chu Kang station.

Once the Downtown Line (DTL) 2 station at Bukit Panjang station connection is completed, ridership is expected to increase significantly. As part of rail network enhancement programme on the existing system, 13 new additional Innovia APM 100 vehicles will be added to BPLRT. Hence, the existing fleet size would be increased to a total of 32 vehicles.

Prior to a capacity increase for BPLRT, an assessment was carried out on various critical design elements of the system, covering both physical and performance standpoints in ensuring optimum system performance.

The two main objectives of this assessment were to:

(i) Understand underlying problems that might be magnified by the enhancement works carried out.

(ii) Determine if the performance level of the hardware and software in the existing system can accommodate the 13 additional vehicles.

The maintenance tracks in the depot will not have sufficient space to accommodate the stabling of 32 trains once the current fleet size is expanded. Hence, an essential feature of remote sleep and wake feature was incorporated into the design of new vehicles. With this new feature, the new vehicles can now be outstabled in the mainline of BPLRT.

THE CHALLENGES

During the enhancement programme, 3 main challenges were faced:

1) Maintaining zero system downtime during the enhancement work was critical as BPLRT is an automated line, running on driverless vehicles and the train stations were unmanned.

2) The enhancement works could only be carried out during engineering hours (1.30am – 4.00am). As compared to MRT lines, BPLRT had shorter engineering hours, which translated to lesser time for enhancement works to be carried out.

3) Complexity in integrating the new and existing systems as a result of technological advancements and obsolescence of equipments. Hence, more effort was required during the design phase to ensure optimum system performance, integration and overall safety of the system.

RADIO COMMUNICATION SYSTEM

The Radio Communication System will be upgraded due to IDA's request to migrate out of existing frequencies.

As BPLRT stations are unmanned, the Radio Communication System plays a critical role in ensuring the flow of information between commuters and Operator via the Public Announcement and Passenger Emergency Communication in the event of an emergency.

Unlike new MRT / LRT lines, the migration of new radio system needs to be executed carefully to ensure performance of the existing system remains unaffected. As existing and new radio systems use different frequencies, the radio migration was executed over 2 stages:

Stage 1: Simultaneous operation of both new and existing way side radio systems
Stage 2: Retrofit vehicle radio kit in existing vehicles

Figure 1: New ORS (Operational Radio System) PC installed during Stage 1 Radio Migration

At stage 1, new radio equipments were commissioned progressively. A thorough coverage test before installation and commissioning of the new radio equipments was conducted to serve as a baseline. After the commissioning of the new radio equipments, another coverage test was conducted to ensure that introduction of new radio equipments did not interfere with the performance of the existing radio system.

Figure 2: Testing the newly retrofitted kit and antenna during Stage 2 Radio Migration

At stage 2, extensive functional testing was carried out on the vehicle with retrofitted radio kit. Subsequently, the

vehicle was tested in the mainline before being released as part of revenue service trains. Stability of the retrofitted radio kit was monitored prior to the commencement of fleet-wide installation.

CENTRAL CONTROL COMPUTER SYSTEM (CCCS)

A new software version was deployed for the Central Control Computer System software to register new vehicles, to enhance flexibility in changing operation modes, and to allow sleep and wake functions of the vehicles remotely.

The software was embedded with additional safety feature to ensure the operator is only able to execute the remote sleep and wake functions when the affected vehicle provides zero speed code signal (an indication that the vehicle is stationary). In addition, precautionary steps were performed prior to putting the vehicle to sleep, i.e checking that the vehicle is clear of commuters.

VEHICLE SYSTEM

The vehicle structure element was strengthened using huckbolts, in line with the new international standard on Automated People Mover (APM) ASCE 21-98. The vehicle body was strengthened by having the side post sandwiched to steel plates, which in turn, huckbolted to the vehicle's frame.

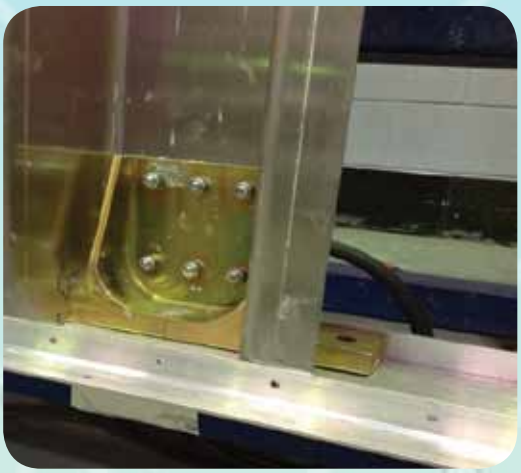

Figure 3: Huckbolted side post, complying with ASCE 21-98

Although both existing and new vehicles are of the same model, there have been improvements to the design of the new vehicle. A 3-phase 650VAC lightning arrestor has been installed to ensure that there will be uninterrupted continuation of power supply to the vehicle in event of loss of traction power due to lightning strike. This will in turn minimise the probability of the vehicle stalling along the tracks.

BPLRT stations are closely spaced, resulting in a higher frequency of station door opening-closing cycle. Large amount of warm ambient air rushes into the vehicle each time the door is opened for passenger exchange at the station. The frequent escape of cool air made it difficult to cool the vehicle because of the short cooling period for the air-conditioning, before the start of next door opening cycle.

To address this problem, without compromising passenger comfort, fresh air intake was reduced to lower the heat load on evaporator unit, thus allowing a cooler output from the air-conditioning.

With the reduction of fresh air intake, a comprehensive assessment was conducted to ensure that cabin has sufficient oxygen in the event of emergency operation, and this is in line with ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) requirements.

Figure 4: Offshore static and dynamic testing in Pittsburgh

Intensive offshore static and dynamic tests were performed on the performance of the new vehicles in Pittsburgh, USA, prior to them being shipped to Singapore. In addition, vehicle endurance test of 5000km had to be done prior to revenue service running.

INSTALLATION, TESTING AND COMMISSIONING

Close coordination with Operator ensured that routine preventive and corrective maintenance for the existing system was not compromised due to installation and testing works.

With constraints of 3 hours per engineering shift, contingency procedures and time required to fall back to existing system had to be put in place.

High-risk work was identified as well. For instance, uninterrupted power supply for new radio system was tapped from existing power distribution board. Therefore, a qualified LEW (Licensed Electrical Worker) was engaged to endorse design calculations and conduct termination of new radio system in a safe manner.

CONCLUSION

The system enhancement of BPLRT is by no means a straight forward project that only involves additional new vehicles into the existing fleet. The integration of the new systems as well as the simultaneous operation of both new and existing radio systems need to be thoroughly evaluated and carefully executed. Maintaining zero system downtime during the enhancement work and shorter engineering hours to carry out the enhancement work added to the complexity of the project. It is only after the establishment of comprehensive risk assessments and preventive / mitigating measures, a safe new system can be delivered while safeguarding the safety of the existing operations.

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Safety Considerations at Traffic Junctions

INTRODUCTION

A traffic junction is an intersection of roads with conflicting traffic streams of motor vehicles and movement of other road users such as pedestrians and cyclists. It has been widely recognised that a substantial percentage of the total number of road accidents occur at junctions. In view of this concern, much safety consideration has to be given to the design of a junction and followed through in its improvement and maintenance programmes.

Some safety provisions at a road junction to ensure safe and efficient movement of all road users will be considered in this article.

PROPER LANE ALIGNMENT ACROSS JUNCTION

Traffic will generally follow the approaching lane alignment to travel across a junction. In the event that the junction layout is skewed, motorists would require guidance to manoeuvre across the junction and continue into the receiving lanes properly. Unfamiliar motorists travelling through a junction with inadequate lane alignment often result in lane encroachment which leads to potential sideswipe collisions.

Proper alignment between the approaching and receiving lanes across a junction is necessary to ensure safety of the motorists. If there are any site constraints to do so, mitigation measures such as provision of guidelines or chevron marking to align the lanes across the junction could be adopted.

Figure 1a: The approaching lanes do not align with the receiving lanes at the junction

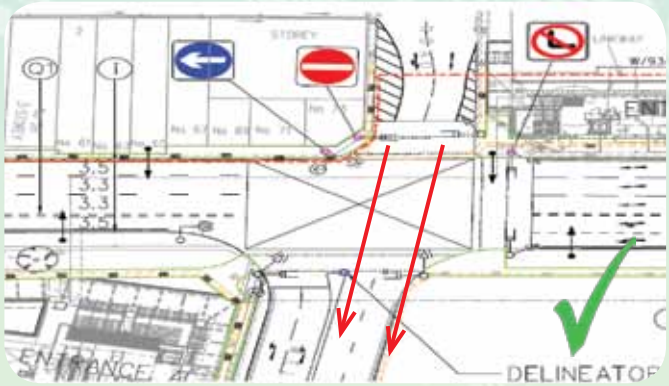

Figure 1b: In order to improve the alignment, chevron marking has been added to guide motorists across the junction

ADEQUATE SIGHT VISIBILITY AT JUNCTION

Sight visibility at a junction plays an important part in ensuring that motorists travel across the zone of potential conflicts safely. Generally, motorists approaching a junction will carry out these vital tasks among others: read the traffic signs, check the traffic signals and look out for pedestrians at the crossings. Therefore, motorists should have adequate sight visibility of the traffic signs, signals and pedestrians at a junction.

a) Unobstructed View of Traffic Sign

Visibility of directional signage installed on the sidetable should not be obscured by street furniture, structures or plantings.

When motorists are able to read the directional and confirmation signs clearly, they can make decisions early in order to move into the correct lane that leads them to their destination. This will minimise last minute weaving as the motorists approach the junction.

Figure 2a: Directional sign is obstructed by tree and street lighting pole

Figure 2b: Directional sign is unobstructed by trees or street furniture

b) Unobstructed View of Traffic Signal Aspects

At signalised junctions, traffic signals perform the role of controlling vehicular and pedestrian movements. In order to reduce the potential conflict between the different road users, it is important that motorists and pedestrians alike are able to have an unobstructed view of the traffic signals as they approach a junction.

For this purpose, the provision and placement of the primary, secondary and tertiary traffic signal aspects at a junction should take into consideration the presence of any street furniture nearby such as street lighting poles, trees or traffic signs as well as maintain a proper offset from the road edge.

Figure 3a: Traffic signal pole is obstructed by street lighting pole that is located on the same traffic island

Figure 3b: Street lighting pole is located away from traffic signal pole to ensure unobstructed visibility of the traffic signal pole

Advance Warning Light is normally provided upstream where there is a vertical crest curve or a sharp horizontal bend in advance of the junction to alert oncoming motorists of the traffic signal downstream turning red lest their view of the traffic signal aspects ahead is limited. This measure could help to reduce the risk of running the red light.

Figure 4: Providing Advance Warning Light along a bend helps to forewarn motorists of the changes in traffic signals in the junction ahead

c) Unobstructed View of Pedestrians at Crossing

At signalised road junctions, adequate visibility should continue to be provided at all corners of a junction. The arrangement gives motorists a good view of the pedestrian crossing and minimises the potential of motorists driving straight into pedestrians who might be starting to cross from the corner of a junction. It is essential that motorists are given adequate time to react appropriately.

Figure 5a: The overgrown shrubs at the roadside verge of the junction is obstructing the motorists' visibility of the pedestrians crossing this junction

Figure 5b: The overgrown shrubs have been replaced by a low planting strip to provide clear visibility of the pedestrians utilising the crossing

ADEQUATE SIGN AND LANE GUIDANCE

Adequate information on the lane arrangement and layout at a junction will guide motorists to travel in the correct lane and across the junction safely. The use of lane indication sign for multi-lane junction and providing proper lane markings to define various lane use are some of the measures that could be taken.

Figure 6: Motorists are informed of the exclusive turning lanes and adequately guided at a junction by providing a lane indication sign

PROPER ALIGNMENT OF PEDESTRIAN CROSSING LINES

Pedestrian crossing lines are provided to guide pedestrians to keep within a designated zone while crossing the road so that they would not walk too close to the traffic stream moving alongside them. Thus, all pedestrian crossing lines provided at the junction shall extend and terminate between kerb to kerb with appropriate offset from the traffic lane so as to lead pedestrians to stay on the traffic island or sidetable as they wait for their next stage of crossing.

Such an arrangement is likely to mitigate the risk of pedestrians being hit by passing vehicles by preventing pedestrians from standing on the live carriageway while waiting to cross the road.

Figure 7a: Pedestrians are seen waiting on the carriageway as the pedestrian crossing lines are painted outside the physical traffic island

Figure 7b: The pedestrian crossing lines are painted within the traffic island, thus preventing pedestrians from waiting outside the island

ADEQUATE DRAINAGE AT TRAFFIC ISLANDS

Waterponding at the junction will occur if drainage provision is poor, especially at the traffic islands. Accidents arising from aquaplaning and skidding could happen if a vehicle were to travel through the pond of water at a high speed. To address the concern, there is a need to provide sufficient drainage outlets along the edge of the traffic islands to ensure that surface runoff from heavy downpour is drained off adequately.

Figure 8a: Waterponding occurs due to inadequate drainage at the traffic island

Figure 8b: Drainage inlets have been provided along the edge of the traffic island to channel away surface runoff adequately

CONCLUSION

The key safety issues at traffic junction discussed above shall be adequately considered at the design stage as well as during the upgrading and maintenance works to enhance its safety performance. With adequate safety provisions and appropriate behaviour of all road users at the traffic junction, all potential conflicts at an intersection would likely be kept to a minimum at all times.

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Year 2013 Environmental Performance

INTRODUCTION

Despite the increasing work complexities (due to change of phases in DTL3) and demand for higher standard of environmental performance by residents, LTA was still able to achieve a commendable level of environmental performance in 2013. The Annual Environmental Report 2013[1] can be accessed from LTA's Intranet under Safety Division tab. This article summarises the environmental performance and highlights the key areas of concern regarding project environmental management.

LTA ENVIRONMENTAL PERFORMANCE

The environmental performance of LTA projects is assessed through (i) environmental fines received by the project in each calendar year and (ii) the Environmental Safety and Security (ESS) Assessment. The monthly ESS Assessment evaluates LTA projects' environmental performance based on 6 environmental aspects, namely noise pollution control, earth control, water pollution control, vector control, air pollution control and solid waste management.

Figure 1: Overall environmental fines received by LTA. Data extracted from SIMS as at 25 Feb 2014, based on date of fine received

Figure 1 shows the number of environmental fines received by LTA projects for the past three years. Even with an increase in the number of LTA projects, a decreasing trend is observed in the total number of fines received. This could be attributed to the improved implementation of environmental management on sites due to more stringent requirements on site and greater co-operation with relevant authorities.

PERFORMANCE OF VARIOUS LTA PROJECTS

As shown below, a comparison was made between Year 2012 and Year 2013 for the number of environmental fines received and the average environmental ESS scores obtained by various projects.

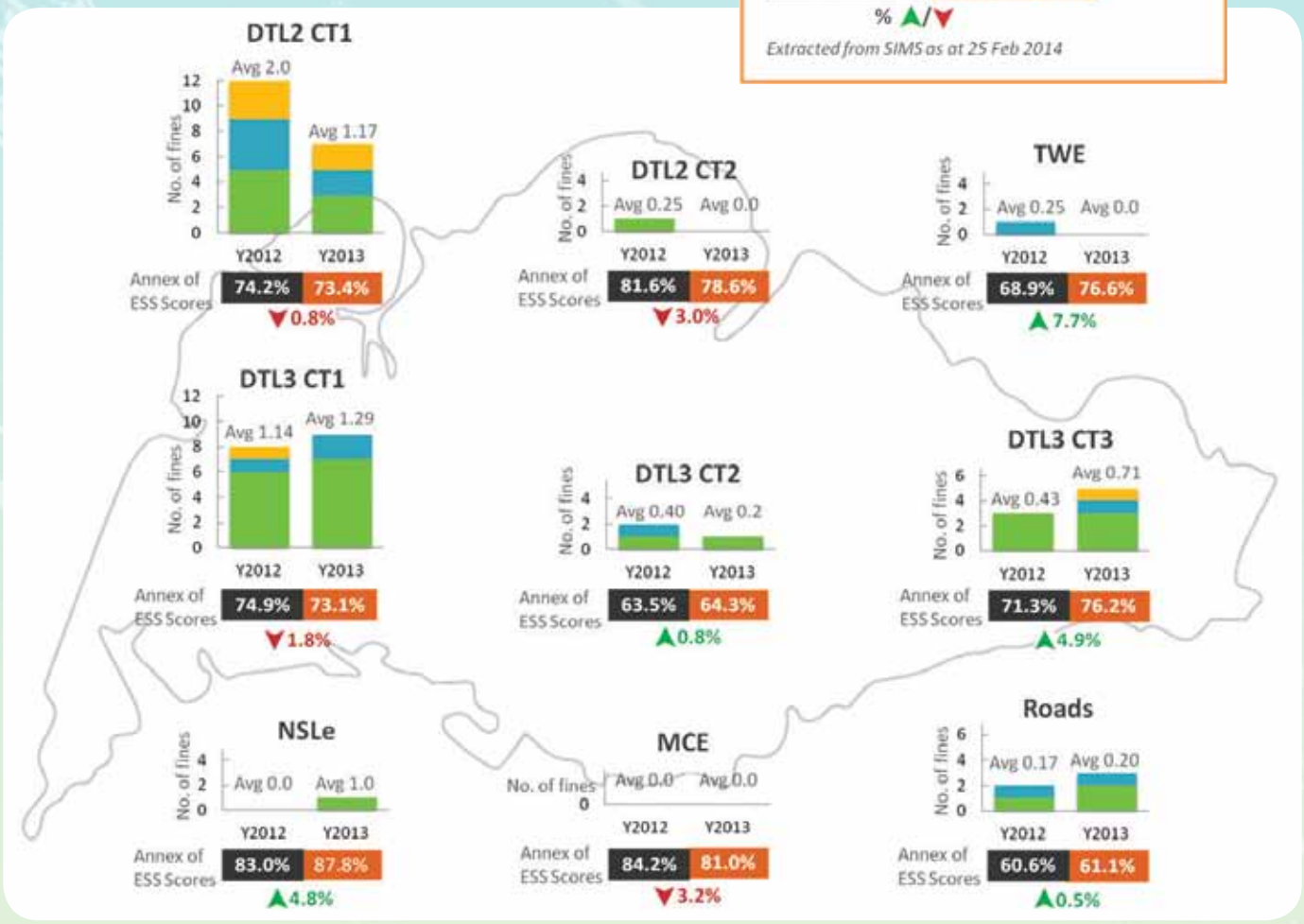

Figure 2: Comparison of environmental performance of LTA projects in 2012 and 2013

1. Source: http://ltaweb/safety/env/New_downloads_files/LTA%20Annual%20Environmental%20Performance%20Report%202013.pdf

KEY AREA OF CONCERNS IN 2013

a) Construction Noise

In recent years, residents are more forthcoming in voicing their opinions and are demanding for a quieter living environment.

Noise complaints received by NEA, which are related to LTA projects are directed to Safety Division for the necessary mitigations measures required.

Through the complaints, trends were analysed. However, not all complaints received from residents were specific. Certain complainants did not provide details of the noise they experienced but gave feedback that the site was "noisy". Such complaints were summed under the general heading of "Complaints of Noise in General" in Figure 3.

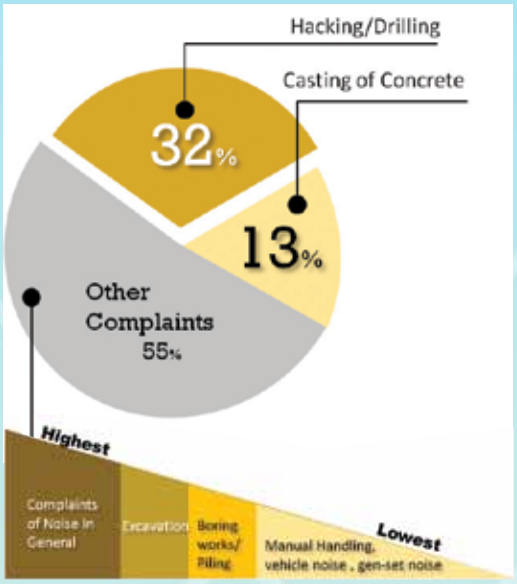

Figure 3: Breakdown of activities that lead to noise complaints

Furthermore, in the analysis of the timing when a complaint was lodged, it was found that the majority of complaints received were between 10pm-7am, Mondays to Saturdays. This could be due to the fact that it is a resting period, and the least the public wants to hear is unwanted noise. Noise complaints received at night were also noted to be more frequent than complaints made during daytime. Hence, contractors should schedule their works and avoid noisy activities during these sensitive periods.

b) Dengue Fever

In 2013, Singapore had its worst-ever outbreak of dengue fever thus far, which led to 8 local fatalities and infected more than 22,000 people.

A total of 125 actual breeding grounds were found in LTA sites by both in-house vector control and NEA enforcement teams last year. Out of these mosquito breeding grounds found in LTA sites (refer to Table 1), materials storage, waler and strut, ground depression and damp ground are the top three common places. Hence, it is important that contractors focus their mosquito control efforts on these areas. Source reduction and good housekeeping remain as the top priorities in vector control. Contractors should also allocate sufficient manpower for in-house vector control and increase dengue prevention awareness among the workers.

Common Breeding Grounds	No. of Breeding Grounds
Material storage	38
Waler & Strut	18
Ground Depression & Damp Ground	16
Unused Materials & Machinery	14
Construction equipment & Machinery	13
Drainage & Sump Pit	13
Discarded Receptacles	12
Others	1

Table 1: Breakdown of actual breeding grounds reported

c) Water Pollution

A notable finding that arose from the Year 2013 Thematic Exercise conducted by Safety Division was the practice of treating tunnelling wastewater in ECM facilities. In some of the sites, this tunnelling wastewater is currently being channelled to the ECM facilities. However, ECM is not the appropriate system to treat the chemicals present in the wastewater, thus it is eventually discharged into public drain without undergoing effective treatment. Such discharges also contravened the Environmental Protection and Management Act.

Moving forward, tunnelling wastewater should be separated from surface runoff and should not be channelled to ECM treatment plant nor be discharged into any watercourse. Contractor should engage a licensed waste collector to dispose such chemical laden water.

With this finding, Safety Division will also be working with project teams and PUB in developing a procedure for the control of chemical waste, which will be included in LTA's Safety, Health and Environmental Management System.

Figure 4: Tunnelling wastewater was channelled to holding pond leading to ECM treatment plant

Being one of the largest developers in Singapore, LTA projects inevitably cause impacts to the environment. As expectations for environmental care and higher quality of living continue to rise, LTA is moving in tandem with these expectations so that our projects can be delivered on time with minimal impact caused to the environment.

Teng Wei Ling
Assistant Environmental Manager
Safety Division

Editorial Page

WSH Day 2014

On the backdrop of an increase in the number of workplace accidents, notably hand and finger injuries, LTA held its first ever Workplace Safety & Health Day on 20th June 2014. On that day, all LTA projects implemented a safety time-out session with their respective workforce with a refreshed focus on Behaviour Based Safety (BBS), sharing of lessons learnt and small group discussions on preventing hand and finger injuries. The active participation of both contractors' senior management and their respective workforce made the inaugural WSH Day a great success.

Contractors' Safety Forum 2014

In conjunction with LTA's inaugural WSH Day, a Contractors' Safety Forum was held on 24th June 2014. In the forum, contractors shared on the lessons learnt from recent accidents as well as good WSH practices that they could adopt on their worksites. MOM was also invited to share on the present WSH situation and performance in the construction industry as well as their enhanced enforcement initiatives to help the industry improve on its safety performance.

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