

SAFETY

News

33rd Edition / ISSN 1793-1665 March 2017



FEATURED ARTICLES

02 Highlights of Annual Safety Award Convention (ASAC) 2016

08 Safety Above All Else - The Samsung Way

10 Cultivating a Good Workplace Safety and Health Culture

12 LTA's Efforts Towards Reducing Carbon Emissions

14 Emergency Provisions in the New North-South East-West Line Trains

2

Highlights of Annual Safety Award Convention (ASAC) 2016

Introduction

The Annual Safety Award Convention (ASAC) is an event hosted yearly by the Land Transport Authority (LTA) to honour contractors for their relentless efforts in uplifting the safety and health standards at their worksites. Inaugurated in 1999, this year marks the 18th year of this prestigious event with Mr. Chan Heng Loon Alan, Chairman of LTA as its Guest of Honour. LTA staff, QP teams, contractors, sub-contractors and professionals from the construction industry numbering approximately 1000 guest were present to grace the event.



Figure 1: Guest of Honour, Mr. Chan Heng Loon Alan, Chairman of Land Transport Authority, delivering the opening address

Why Near Miss Reporting Matters

In efforts to inculcate a healthy near miss reporting culture in LTA, the theme of this year's Convention is "Near Miss – Report It, Act on It". Through this theme, LTA hope to once again reinforce the importance of near miss reporting on site as well as to promote a healthy culture of reporting near misses. This would in turn help to ensure that hazards and lapses are identified and mitigated in the early stages to prevent potential incidents or accidents from taking place.

Speaking at the opening ceremony on 21 September 2016, LTA Chairman Mr. Chan Heng Loon Alan encouraged all LTA contractors to embrace ownership of near miss reporting at all levels as it is an essential tool in helping to predict any shortcomings in the Safety Management System. To develop a healthy culture of near miss reporting, there has to be a change in mind-set. He reiterated that "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."

The ASAC Competition and Challenge Shield

This year's ASAC competition saw a total of 57 contracts competing for the various safety awards. Contractors are assessed based on their Environmental, Safety and Security (ESS) scores, safety performance statistics and a round of internal audit conducted by LTA's project management teams.

Three finalist were further short-listed from the group to compete against each other for the Contractors Challenge Shield. These finalist will have to undergo a further audit by LTA's guest Panel of Judges and prepare for a short presentation to

be showcased on the actual day of the event. The scoring of these two components are 80% and 20% respectively and will be used to determine the ASAC Champion.

The past winners of the Challenge Shield include Contract 920 Shanghai Tunnel Engineering Co., Ltd (2012), Contract 921 Ssangyong Engineering & Construction Co., Ltd (2013), Contract 923 Samsung C&T Corporation (2014), Contract 925 GS Engineering & Construction Corp (2015) and Contract 925A KTC Civil Engineering & Construction Pte Ltd (2015).

Panel of Judges



Figure 2: Panel of Judges (from left): Mr. Tan Chee Kiat (BCA), Professor Michael Chew (NUS), Dr. Goh Yang Miang (IES), and Er. Mohd Ismadi (MOM)

To ensure fair competition amongst the finalists, LTA's guest Panel of Judges comprises of senior representatives from the Ministry of Manpower (MOM), Building and Construction Authority (BCA), Institute of Engineers Singapore (IES) and National University of Singapore (NUS).

All four Judges were impressed with the three finalists for their exemplary WSH management and site practices observed during their site audits. They were also happy with the efforts each finalist had put in to ensure a healthy near miss reporting culture is created on site. In his speech, Chief Judge Er. Mohd Ismadi encouraged the contractors to continue to step up measures, share good practices and develop initiatives to raise workplace safety and health standards in the industry.



Highlights of Annual Safety Award Convention (ASAC) 2016

3

Finalists' Presentation

This year's finalists comprised of teams from the Thomson-East Coast Line (TEL) Project Contract T213 Samsung C&T Corporation, TEL Contract T216 Daewoo Engineering & Construction Co. Ltd and TEL Contract T225 Shanghai Tunnel Engineering Co (Singapore) Pte Ltd.

Each finalist was given 15 minutes to showcase their good practices based on the theme of the Convention with a presentation and a theme-related skit. At the end of the finalists' presentations, the audience also had the opportunity to vote for their preferred presentation through Short Message Service (SMS).



Figure 3: Skit presentation by TEL Contract T225 Shanghai Tunnel Engineering Co. on the near miss theme

All three finalists put up wonderful skits that showcased well thought through plots and characters in relation to the theme. They also wowed the audiences with their imaginative and entertaining performances. This was especially so for Contract T225 Shanghai Tunnel Engineering Co (Singapore) Pte Ltd. The company portrayed a colourful and lively depiction of a near miss scenario involving a locomotive operator who did not adhere to the safe operating procedures, and thus could have endangered the lives of his colleagues. Well mixed with a variety of songs and well-coordinated videos on the need to cultivate a good near miss reporting environment on site, Contract T225 ultimately won the audiences over and secured their spot for the Best Theme Presentation.

Contractors Challenge Shield (ASAC Champion)

Contract T213 Samsung C&T Corporation was crowned champion for ASAC 2016 and walked away with the Contractor's Champion Trophy and the Challenge Shield. In his speech, Er. Mohd Ismadi remarked: "The results of the scoring by the Panel of Judges was extremely close with only a point difference from the other finalists".

Awards Conferred During ASAC 2016

A total of 18 contractors were honoured for their excellent Workplace Safety and Health (WSH) practices. The following awards were presented during the Convention:

- **Certificate of Excellence** to 3 finalists from the Mega category, 1 from Minor category and 1 from E&M category.
- **Certificate of Merit** to 5 contractors from the Mega category for consistent good WSH performance over the assessment period.
- **WSH Officer Recognition Award** to 1 WSH Officer for his commendable dedication and contribution towards Workplace Safety and Health.
- **Project Safety Commendation Award** to the LTA Project Safety Committee with the best effort and WSH performance in ensuring and promoting excellent WSH standards at its worksites.
- **Best ASAC Theme Presentation** to the finalist of the Mega category for delivering the best theme presentation as voted by the audience.
- **Construction Environmental Excellence Award** to 3 contractors who have shown excellent environmental management at their worksites.
- **Construction Environmental Merit Award** to 3 contractors who have shown consistently good environmental management at their worksites.
- **Innovative Noise Management Merit Award** to 1 contractor who had shown good efforts in developing innovative noise management methods at their worksite.
- **Accident-Free Million Man-hours Recognition Award** to 6 main contractors with a considerable accident-free man-hour milestone without reportable accidents or major incidents.
- **QPS Safety Award** to 2 QPS teams with proactive contribution towards addressing Workplace Safety and Health (WSH) issues.
- **Sub-contractors' Safety Recognition Award** to 3 sub-contractors with significant contribution to good WSH performance.

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

Kevin Seet
Deputy Safety & Health Manager
Safety Division

Best ASAC Theme Presentation



Figure 4: Mega Category (Finalist) – TEL C4 Contract T225
– Shanghai Tunnel Engineering Co (Singapore) Pte Ltd

Certificate of Excellence



Figure 8: Mega Category (Champion) – TEL C2 Contract T213
– Samsung C & T Corporation

Project Safety Commendation Award



Figure 5: Project Safety Commendation Award
– Mr. Tan Kok Jin, Director (TEL C2)



Figure 9: Mega Category (Finalist) – TEL C3 Contract T216
– Daewoo Engineering & Construction Co., Ltd



Figure 6: Project Safety Commendation Award
– Mr. Chang Kin Boon, Director (DTL3 CT2)



Figure 10: Mega Category (Finalist) – TEL C4 Contract T225
– Shanghai Tunnel Engineering Co (Singapore) Pte Ltd

WSH Officer Recognition Award



Figure 7: WSH Officer Recognition Award –
Mr. Kelane M. Amin – TEL C2 Contract T213
– Samsung C & T Corporation



Figure 11: Minor Category – Roads Contract ER 483
– Hwa Seng Builder Pte Ltd



Figure 12: E&M Category – E & M Contract 953
– Siemens AG / Siemens Pte Ltd Consortium



Figure 16: Mega Category – TEL C1 Contract T206
– Shanghai Tunnel Engineering Co (Singapore) Pte Ltd

Certificate of Merit



Figure 13: Mega Category – DTL3 Contract 922
– Samsung C&T Corporation



Figure 17: Mega Category TEL C1 Contract T207
– Shimizu Corporation



Figure 14: Mega Category – DTL3 Contract 925
– GS Engineering & Construction Corp



Figure 18: Mega Category TEL C3 Contract T216
– Daewoo Engineering & Construction Co.,Ltd

Construction Environmental Excellence Award

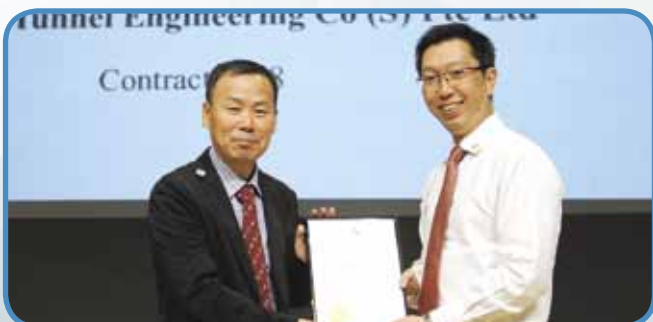


Figure 15: Mega Category –TWE Contract 1688
– Shanghai Tunnel Engineering Co (Singapore) Pte Ltd



Figure 19: Mega Category TEL C4 Contract T225
– Shanghai Tunnel Engineering Co (Singapore) Pte Ltd



Figure 20: Minor Category Roads Contract ER485 –
ECK Shen Construction & Trading Pte Ltd



Figure 24: TEL C3 Contract T216
– Daewoo Engineering & Construction Co., Ltd



Figure 21: Mega Category TEL C1 Contract T207
– Shimizu Corporation



Figure 25: Category 1 ((For Contracts \$120 million and above) that
achieved above 2 million accident free man-hours) – DTL3 Contract
922 - Samsung C&T Corporation



Figure 22: Mega Category TEL C2 Contract T213
– Samsung C & T Corporation



Figure 26: Category 2 ((For Contracts below \$120 million) that
achieved above 400,000 accident free man-hours) – Roads Contract
ER431 - Feng Ming Construction Pte Ltd



Figure 23: Major Category Roads Contract ER403
– Sato Kogyo (S) Pte. Ltd



Figure 27: Category 2 ((For Contracts below \$120 million) that
achieved above 400,000 accident free man-hours) – Roads Contract
ER432 - Eng Lee Engineering Pte Ltd



Figure 28: Category 2 ((For Contracts below \$120 million) that achieved above 400,000 accident free man-hours) – Roads Contract ER458 – Or Kim Peow Contractors (Pte) Ltd



Figure 32: TEL C4 Contract T226 – WorleyParson Pte Ltd



Figure 29: Category 2 ((For Contracts below \$120 million) that achieved above 400,000 accident free man-hours) – Roads Contract - ER459 Samwoh Corporation Pte Ltd



Figure 33: HSL Ground Engineering Pte Ltd



Figure 30: Category 3 ((For E & M Contracts) that achieved above 250,000 accident free man-hours) – E & M Contract 953 - Siemens AG / Siemens Pte Ltd Consortium



Figure 34: Multibase Construction Pte Ltd

QPS Safety Award



Figure 31: TEL C1 Contract T203 – CKM Consultants Pte Ltd (A Bureauveritas Group)



Figure 35: Sambo E & C Company







Introduction

At the LTA 18th Annual Safety Awards Convention (ASAC) held on the 21st September 2016, Samsung C&T Corporation emerged as champion among the ASAC finalists. Samsung also secured the LTA's Contractors Challenge Shield for Contract T213 Thomson East Coast Line Caldecott Station. This is the 3rd time Samsung C&T has won the LTA Challenge Shield at the LTA ASAC.

In the area of safety, Samsung C&T has given their utmost efforts to upkeep workplace safety at all times. "Safety is a fundamental part of our company, and a core value that is non-negotiable. We are responsible for protecting every single employee on site", says Mr. Chi Hun Choi, CEO of Samsung C&T Corporation. We will be sharing some initiatives implemented by Samsung C&T in Contract T213.

Importance of Near Miss Reporting

At project T213, a pictorial near miss reporting form with brief description of the hazards was created to aid near miss reporting. The pictorial form (Figure 1) helps workers to have a better understanding of the various types of potential near misses. Suggestion boxes, together with the near miss reporting forms, are placed on site to encourage spontaneous reporting. These suggestion boxes are opened daily and the collated near misses are brought up for discussion by both the project safety and construction team during daily coordination meetings.

NEAR MISS INFORMANT DETAILS				Date:
Name	WPIC No.	Company Name	Contact No.	Signature
Reported by				
Witnessed by 1				
Witnessed by 2				
NEAR MISS DETAILS				
Date	Time	Location	Company Name	
Pictorial	Description	Please tick (✓) Write the description of incident		
	Unsafe lifting, Lifting failure, Unauthorized lifting operation			
	Unsafe hot works, possible fire or Explosion.			
	Falling objects, Throwing of materials from height			
	Machinery failure, Unauthorized operation of machinery			
	Maintenance of machinery carried out along access way			
	Improper material handling, Pinch points, body part caught in between objects			
Others	Any other items, which are not mentioned here.			

Note: You are encouraged to report any near miss and there won't be any fine on the near miss case. We will treat all reports confidentially and investigate separately. Rewards will be given to valuable near miss report. Do not make any false report and it will be treated very seriously.

Figure 1: A sample of the pictorial near miss reporting form

The Knox Messenger

Samsung C&T have assembled a dedicated team at its Head Quarters in Seoul to analyse all reported near miss cases worldwide. Essential information are disseminated to all projects worldwide on a daily basis through the Samsung C&T's "Knox Messenger" software (Figure 2), installed in every employee's desktop computer and smart mobile phone. The "Knox Messenger" will alert all employees with a brief description of the reported near miss cases (Figure 3). With that, respective projects will implement relevant preventive measures to avoid any future occurrence. Near miss cases are also further shared daily during Tool Box Meetings and coordination meetings.



Figure 2: Near miss analysis and information sharing system

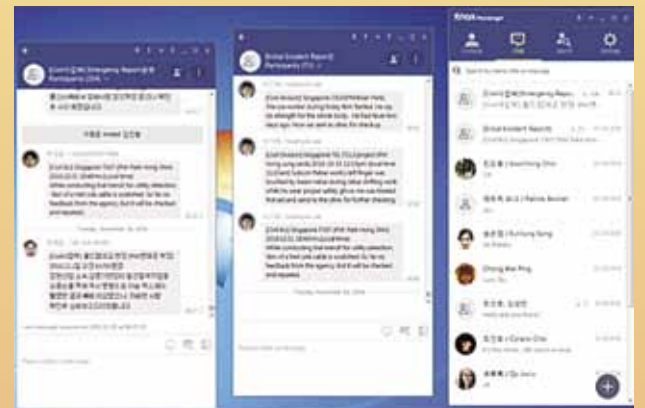


Figure 3: A screenshot of Samsung C&T's Knox Messenger pop-out box which notifies employee on reported near miss cases

HSE Workshops

To upkeep safety standards across all projects, Samsung C&T conducts monthly Civil Project HSE Workshops, where site management staff and workers will discuss safety concerns / issues, identify areas for improvements and develop possible control measures. New measures discussed at the workshops are communicated to all projects for common implementation. These workshops also allow workers to anticipate any site challenges they might be facing.

Samsung Safety Training Center

In line with its core value of putting 'Safety First', Samsung C&T has invested heavily by building an on-site safety training centre in project T213. The first of its kind in Singapore at the time of implementation, the training facility provides quality, practical and hands-on workshop experience to ensure that trainees understand the safety requirements, and acquire

specific safety practices in Samsung C&T projects. The facility consists of real props to simulate actual work scenarios faced on site. The following sections describe some of the safety modules at the Samsung Safety Training Center where workers receive hands-on experience for different work trades.

a) Personal Protective Equipment (PPE) Training



Figure 4: Falling Object Simulator demonstrates the importance of wearing PPE

The PPE training consists of a falling object simulator where workers can experience how it feels when a falling object hits their helmet or falls near their vicinity. This creates awareness among workers the hazards of falling objects and the importance of wearing their PPE.

b) Fall From Height Training



Figure 5: Fall from Height Simulator

The falling from height simulator allows workers to experience the effects of a fall and the feeling of being suspended with a safety harness. Workers would appreciate the importance of wearing their safety harness when working at heights. Additionally, workers will also learn how to put on their safety harness the right way.

c) Firefighting Training



Figure 6: Firefighting training on the use of fire extinguisher

The firefighting simulator creates controlled flame and smoke effect to emulate an actual fire scenario. Workers will be trained on the correct usage of fire extinguishers and hose reels. Workers are also taught on the different types of fire extinguishers usage for different fire situations.

d) Mobile Scaffold Training



Figure 7: Mobile scaffold simulator

The mobile scaffold simulator is designed to showcase to workers the correct and wrong way of working on a mobile scaffold. This simulator is fitted with mechanical devices which enables workers to experience how it is like when the mobile scaffold topples and under what circumstances the mobile scaffold will topple.

e) Lifting Equipment Training



Figure 8: Lifting equipment simulator

The Lifting Equipment simulator serves to equip lifting supervisors and riggerman / signaller on the basic principles of lifting operation such as safe rigging methods, wire / sling inspection, understanding safety signages and securing methods. Workers get to experience hands-on rigging experience using different types of lifting gears (e.g. spacing lifting slings at the correct angles).

Conclusion

Samsung C&T believes that investing in training is one important way to improve work productivity and safety on site. Moving forward, it aims to achieve zero accident at its project sites by building a positive safety culture and carrying out activities to improve its safety management systems. When safety becomes a company-wide culture, everybody benefits.

Kelane Mohd Amin
Safety Manager
Samsung C&T T213 Project

Monthly Lunch Box Meeting



Figure 9: Engaging workers in monthly lunch box meeting with site management team

Additionally, the Samsung C&T site management team organises a monthly lunch box meeting with the workers and supervisors. This platform encourages the sharing of WSH issues and work challenges which the latter faced during their course of work. It also allows the management to keep in touch with front-line staff and better understand employees' concerns.

Introduction

WorleyParsons is currently engaged by LTA as the Qualified Person for Supervision (QPS) for the construction of Shenton Way and Marina Bay stations and its associated tunnels. As a QPS, we undertake site supervision of structural works to ensure that the works are carried out according to the relevant statutory and contractual requirements. We work together with contractors and the LTA Project team to ensure that the safe implementation of the construction works are in line with the proposals, and that the safety and health of workers is also not compromised.

WorleyParsons' Safety Culture is cultivated through many years of improving its Health, Safety and Environmental (HSE) System. Our safety journey starts from the moment we are on board WorleyParsons, with the introduction of our core values and beliefs. Each and every one of us are empowered and accountable for achieving Zero Harm.



OneWay™ is WorleyParsons enterprise-wide integrity management framework. It consists of simple expectations that align our entire business on a path towards zero harm. It applies to every single person that works for WorleyParsons, regardless of the project location or his / her appointment.

OneWay™ is not a process. It is a frame of reference that we use in every location, on every project and in our day to day work, to systematically assess whether our performance meets acceptable standards, and identify areas that we need to improve. OneWay™ is supported by a comprehensive set of processes, systems, policies and standards that are described in detail what needs to be done.

OneWay™ consists of 12 Elements and each element has a Champion. On the very top of these elements is about Leadership and Governance. WorleyParsons has a top down approach where the leader in our organisation will be the one leading in HSE.

OneWay™ Moment is always used before the start of a meeting, where a topic will be presented based on the 12 Elements of OneWay™:

1. Leadership and Governance
2. Risk Management
3. Caring for our People & the Environment
4. Selection and Competency
5. Working with Our Customers
6. Engineering
7. Working with the Supply Chain
8. Field Activities
9. Management of Change
10. Critical Incident Avoidance, Response and Recovery
11. Incident and Behavior Analysis
12. Assessment and Improvement

The following are some of the activities that we expect our staff to enforce, participate and manage safety while they are on site.

WorleyParsons Safety Assessment

Safety Assessment is a very integral part of WorleyParsons. We will perform an internal Risk Assessment before the start of any project. We will then brief the Contractors and Site Supervisors on issues relating to site supervision of critical structural works, highlighting the critical areas for construction to ensure that a safe construction is carried out. A risk register is then developed, with mitigation measures set in place which will be cascaded to all project staff.



Figure 1: Risk assessment meetings conducted at site office

Our QPS team on the project also attend risk workshops and assessment meetings. A detailed review of Method Statements and Safe Work Procedures is carried out prior to commencing activities to ensure that no associated risks are overlooked by contractors.

Monthly Project Review

The Senior Management are kept abreast on various subjects relating to the project where they will review it on a monthly basis.

Subjects include the following:

- HSE issues
- Review project progress
- Review on schedule

Senior Management Site Visit



Figure 2: Senior Management site visit

To further demonstrate WorleyParsons's commitment to improve the safety culture, its Senior Management makes frequent site visits to ensure that site hazards are being managed in appropriate ways.

Before the actual site visit itself, our QPS team will list the top 5 risks that the project is currently facing, and with the key controls in place. Once the Management is on site, they will be briefed and they will counter check if these controls are adhered to.

To allow employees to have a broader view of the work activities on site, our Human Resource and Finance Managers are also encouraged to participate in the Senior Management site visit.

Site Safety Enforcement



Figure 3: Checking on the PTW system

Our QPS Team will carry out site safety enforcement works as follows:

- Participate in Monthly and Weekly Day / Night Planned General Inspections;
- Check on the Permit To Work (PTW) and ensure that gases and temperature in confined spaces are within acceptable ranges, and mechanical ventilation is in working condition;
- Monitoring the quality of Earth Control Measures (ECM) and Vector Control;
- Ensuring that the Workplace Safety and Health regulatory requirements are adhered to;
- Advise contractors on the relevant safe work practices (e.g. precautionary measures to take while working at heights);
- Report unsafe practices and near misses via LTA-QPS-Contractor Safety WhatsApp group chats;
- Cascade HSE information / alerts to comply with Workplace Safety and Health Regulations and LTA requirements; and
- Stop and rectify unsafe act or conditions immediately.



Figure 4: Measures for Work at Height in place



Figure 5: Ensure risk assessment briefing to work crew before high risks works commence

Our Commitment

Our QPS team will continue in its commitment towards safety and assist the Client in achieving Zero Harm for the project through the following:

- Technical discussion prior to commencement of permanent and temporary works addressing safety lapses in the course of work.
- Assuring safety provision on site are in place by the contractors following the approved plan.
- Lead by example and walk the talk.
- Ensuring high risk activities have full time standing supervision by RTO.
- Contribute at least 1 unsafe observation per day for contractor to improve on workplace safety.

Conclusion

Setting up a Safety system is easy, but maintaining the right safety mindset to achieve Zero Harm takes time and effort. By working as a team, we have been able to reinforce our core values and beliefs, exemplified in each and every individual day-to-day work in return. OneWay™ Zero Harm has since become our way of life.

Chew Chiang Fei, Gregory
HSE Manager – South East Asia
WorleyParsons HSE Department

Climate Change Agreement in Paris



Figure 1: Paris 2015 Climate Change Conference

At the Paris climate conference (also known as COP21¹) held in December 2015, 195 countries adopted the first ever universal, legally binding global climate deal now known as "The Paris Agreement".

In this Agreement, the governments of the world agreed on the following key elements:

- Keeping the increase in global average temperature to **well below 2°C** above pre-industrial levels²;
- Aiming to limit the increase to **1.5°C**, since this would significantly reduce risks and the impacts of climate change;
- **Global emissions to peak as soon as possible**, recognising that this will take longer for developing countries;
- Undertaking **rapid reductions thereafter** in accordance with the best available science.

This signals a new course in the global climate change effort, with all nations uniting towards a common cause to take ambitious efforts to combat climate change and adapt to its effects.

LTA's Carbon Management and Concrete Abatement

LTA has been well aware of the major concerns regarding climate change issues and launched our very own carbon management system in 2009 to assess the carbon footprint of our major projects which would help direct our focus in searching for low-carbon solutions.

As pioneers in Singapore's construction industry with regards to having a carbon management system, BCA even invited our inputs when they were looking into incorporating carbon footprinting into their greenmark criteria.

Much time and effort was invested to engage our staff as well as with our contractors on the need to account for our carbon emissions and over the past years we have used the data to inform and drive initiatives to reduce LTA's carbon footprint.

Analysis of LTA's Carbon Emissions

The data collected from our construction sites was analysed using the Carbon Calculation Framework which follows the internationally-recognised Greenhouse Gas Protocol (GHG)

The Paris Agreement also required all Parties to put forward their best efforts through "nationally determined contributions" (NDCs) and to strengthen these efforts in the years ahead. All Parties are also required to report regularly on their emissions and on their implementation efforts.

Singapore's Contribution

Although Singapore accounts for only 0.11% of global emissions, it has committed to international efforts to address climate change. Singapore's "nationally determined contribution" in 2015 is to reduce its greenhouse gas emissions per GDP dollar by 36% (from 2005 levels) by 2030. To do that, Singapore will build on its past and ongoing efforts to achieve economic growth in a carbon efficient way.

As shared by Mr Masagos Zulkifli, Minister of the Environment and Water Resources, "This is a very huge commitment and it requires the whole of government as well as the economy to realign, to look at ways to bring down our business-as-usual emissions."

As a nation, Singapore has four strategies to reduce emissions through the use of low-carbon solutions:

- reducing energy use by being more energy efficient;
- constructing more green buildings;
- promoting public transport and;
- harnessing more clean energy such as solar.

LTA is undoubtedly a major player in Singapore's Climate Action Strategy to promote the use of public transport and active mobility to reduce the carbon emissions from the transport sector. However, LTA is also looking into how to apply the other three strategies to further reduce carbon emissions.

Corporate Standard. The framework considers emissions that are associated with both direct and indirect emissions. Direct emissions are those from within the physical boundaries of the construction site while indirect emissions are those that have been generated during the upstream production process due to resource demand on site.

LTA CO₂ Emissions from Construction (2015)

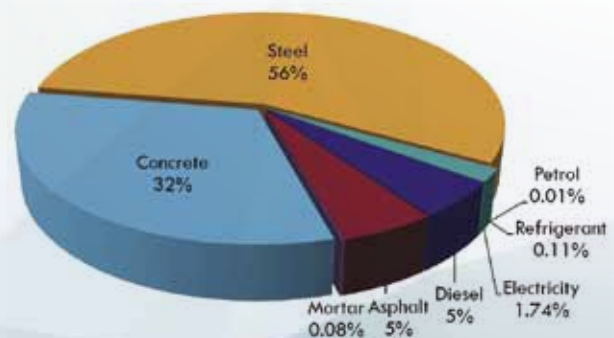


Figure 2: LTA CO₂ emissions from construction projects

¹ COP stands for Conference of the Parties, referring to the countries that have signed up to the 1992 United Nations Framework Convention on Climate Change. The COP in Paris is the 21st such conference.

² Pre-industrial level refers to global temperatures between years 1850–1900.

In 2015, it was calculated that 560,000 tons of carbon dioxide was emitted due to LTA construction projects. Putting this number into perspective, it is equivalent to the annual emissions from almost 120,000 passenger vehicles.

Based on the statistics in Figure 2, steel and concrete were identified as the major contributors due to the large amount of carbon dioxide emitted during their production phase. With further analysis on the feasibility of low carbon solutions for both materials, LTA decided to look into the use of green concrete for our public transport infrastructure.

Green Concrete



Figure 3: Concrete casting of basement at facility building

Concrete is one of the most durable building materials and is used more than any other man-made material in the world. Its use is prevalent in LTA's construction projects, from the tunnel segments and rail station box to the pavements and surfaces in road projects.

Concrete is made out of 3 main elements:

- **Aggregate** (sand, gravel, crushed stone), which makes up the bulk of the mixture
- **Cement**, which acts as a binder for the aggregate and
- **Water**.

From the data collated from LTA's Carbon Management System, concrete was found to be the second highest emitter of carbon dioxide, contributing 32% of the total carbon emissions from our Construction Projects. This is mainly due to the chemically pollutive and energy intensive process involved in the manufacturing of Ordinary Portland Cement (OPC) normally used in concrete.

Therefore, to reduce carbon emissions, green concrete is adopted for sustainable construction and one of the most commonly used methods is to use industrial waste by-products, such as Ground Granulated Blast-Furnace Slag (GGBS) produced from iron to partially substitute the OPC mixture used in producing concrete.



Figure 4: GGBS and OPC

As seen in Figure 5 and Table 1, with GGBS being a recycled product, there are no process emissions and also requires very little energy to manufacture, hence it has a carbon footprint of 20kgCO₂/ton, almost 40 times smaller than OPC.

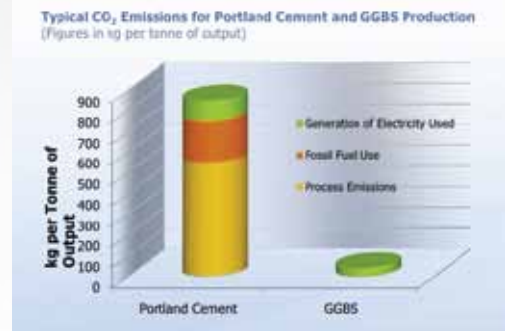


Figure 5: CO₂ emissions for OPC and GGBS

Material	kgCO ₂ /ton material
OPC	750
GGBS	20
Aggregate	90
Water	0.3

Table 1: Carbon emissions of elements in concrete

In terms of international engineering requirements, under the European Standard BS EN 197-1:2011 Cement: Composition, Specifications and Conformity Criteria for Common Cements, the maximum replacement limit of OPC by GGBS is 95%. A replacement at this limit, could reduce the carbon emissions by up to 60%.

Apart from the environmental aspect, GGBS is a common material within the construction industry. It is used for high performance concrete as it enhances material properties such as durability, chloride resistance and heat of hydration. Within LTA, this high performance GGBS concrete is often used for the station structure for increased resilience against the elements.

However, as part of the climate change efforts, Safety Division, together with Infrastructure Design and Engineering Group is working to extend the scope of usage of GGBS cement in future rail and road projects, by specifying a replacement level of GGBS of 36% - 65% for all concrete structures. This move will help to reduce the carbon emissions of concrete by 20% - 40%.

Conclusion

Climate change is a global issue which requires everyone to play a part to help stabilise our emissions and reduce our emissions intensity. To do that, we need to be aware of our own carbon footprint so that we can discern viable solutions that enable us to build a sustainable and livable city for current and future generations. LTA is committed to this process and will continue to look into ways to drive sustainable development for our nation.

Eng Woon Chong, Shawn
Assistant Environmental Manager
Safety Division



Figure 1: New trains for NSEWL and TWE

New Trains for North-South East-West Line

Contract 151B was awarded to Kawasaki / Sifang Consortium in May 2009 to supply 35 new trains for the existing North-South East-West Line (NSEWL) and Tuas West Extension (TWE). The trains are designed by Kawasaki Heavy Industries (KHI) of Japan and manufactured by CRRCC Sifang Co., Ltd. in Qingdao, China.

The emergency features in these new trains are designed to be similar to the existing NSEWL trains to maintain consistency across train fleets and for passengers familiarity in emergency applications. The following gives an overview of the emergency features in the new trains.

a) Passenger Detrainment Door

The emergency detrainment door is fitted at both ends of each train. Its main function is to facilitate passenger evacuation, in the event of a stalled train during an emergency e.g. on-board fire. The 3rd rail power supply has to be manually shut down first by Operation Control Centre (OCC) before passengers are allowed to detrain. This ensures no live power supply when passengers detrain onto the tracks and thereby eliminating any possibility of electrocution. The train attendant have to seek authorisation from OCC before the detrainment door is deployed to facilitate passenger evacuation.

There are two operating modes for the detrainment door:

- i. "Fold Down Mode" enables passengers to detrain onto the tracks; and
- ii. "Slide Aside Mode" enables passengers to transfer to a rescue train using a Portable Bridging Device.

Figures 2 and 3 illustrate the operating procedures for the detrainment door deployment.

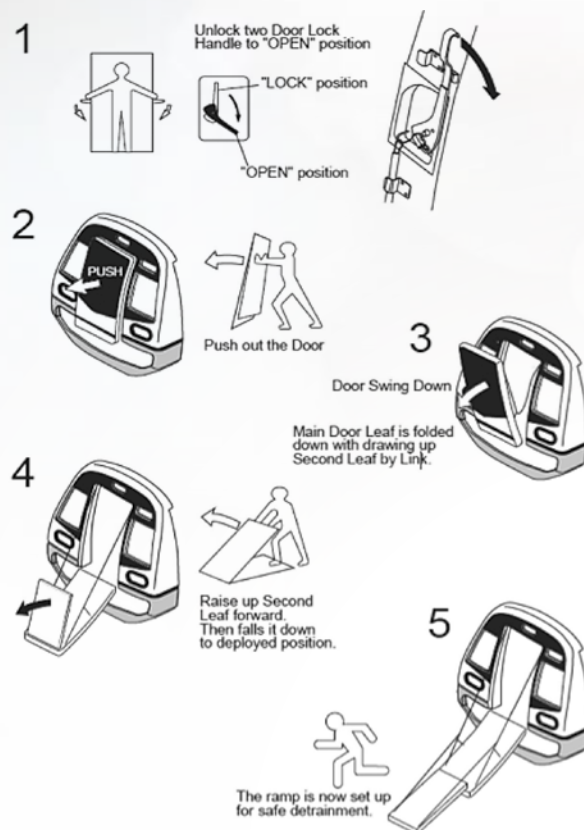


Figure 2: Operating procedure of emergency detrainment door (Fold Down Mode)

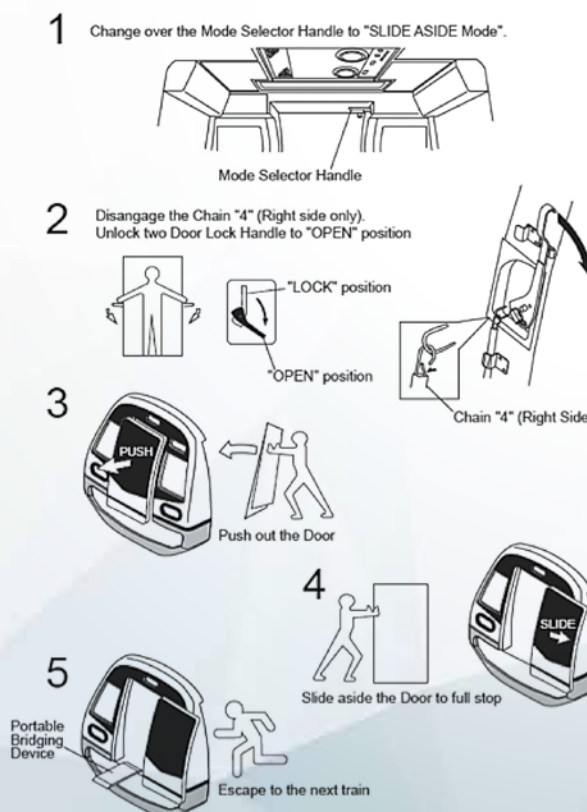


Figure 3: Operating procedure of emergency detrainment door (Slide Aside Mode)

To verify the operability of the detrainment door, type tests are conducted to demonstrate unimpeded deployment and the amount of time taken to detrain a full train load of passengers. The detrainment time has to be within 30 minutes.

During the manufacturing phase of the detrainment doors, stringent inspections are also carried out to ensure that the door components and assembly are constructed to a high level of precision and also of good workmanship and quality.

Upon train delivery to Tuas Depot, routine deployment tests are carried out for each train to ensure the operability of the detrainment doors. Figure 4 illustrates the deployment test performed by LTA Engineers at Tuas Depot.



Figure 4: Detrainment door deployment test

b) Emergency Ventilation System

Apart from the passenger detrainment door, the trains are also equipped with an emergency ventilation system to ensure a tenable environment for passengers. It is designed to operate automatically upon activation of fire / smoke detectors installed in trains or upon driver's initiation during emergency scenarios.

The ventilation system consists of three types of air damper:

- i. Return Air Damper - Recirculates the air within the train cabin
- ii. Fresh Air Damper – Induces fresh air into train cabin from train exterior; and
- iii. Exhaust Air Damper – Extracts exhaust / stale air from train cabin.

During normal operating mode, fresh air dampers and return air dampers are opened while exhaust air dampers are closed.

Depending on whether the fire / smoke is detected within the train cabin or at the train's exterior, the air dampers' positions are switched automatically:

- i. Fire / smoke detected within train cabin - fresh air dampers are opened to induce fresh air into cabins and exhaust air dampers permit egress of smoke from train cabins. The return air dampers are closed to prevent recirculation of smoke.

- ii. Fire / smoke detected on train exterior or tunnel fire - fresh air dampers and exhaust air dampers are closed to prevent smoke from entering the train cabins. Return air dampers are opened to circulate the air in the train cabins.

c) Emergency Lighting System

In the event of loss of the 3rd rail power along the track, one-third of the lights within the train car will still be operational and function as emergency lighting. In addition, the ventilation system will operate at a higher speed to draw in higher volume of fresh air from the train's exterior environment into the train car. On-board train battery power is designed to supply power for vital functions such as emergency ventilation and lighting for a minimum of 60 minutes. The arrangement of emergency lights within a train car is illustrated in Figures 5 and 6.



Figure 5: Train car emergency lighting location (in red)



Figure 6: Train car lighting condition during a simulated emergency scenario

Conclusion

The above-mentioned safety features are examples of the safeguards put in place in the new trains to address any emergency scenarios. The key consideration is to ensure the safety of the passengers.

Koo Yan Xin
Executive Engineer
Rolling Stock and Depot Systems Design Division

EDITORIAL PAGE

LTA SAFETY WORKSHOP 2016

LTA hosted its 35th Safety Workshop and 22nd Construction Staff Award Ceremony on 16th December 2016 at the HSO Auditorium. Started since 2000, safety workshops are held bi-annually for LTA staff to share site safety challenges and accident prevention measures implemented in LTA projects. A total of 24 LTA staff also received the Construction Staff award at the Safety Workshop in recognition of their proactive attitude towards WSH and Environmental protection.

In the opening address delivered by LTA Chief Executive Mr. Ngien Hoon Ping, he stressed that "Safety is a top priority for the organisation and should be in our D.N.A.". Safety is now imbedded into LTA's core values to underline its significance to the organisation. As LTA strives towards zero accident, he urged all staff to walk the ground regularly to better appreciate and deal with site challenges.



LTA Chief Executive,
Mr Ngien Hoon Ping



MOM Head of Surveillance,
Ms Adeline
Chang Huay Ying



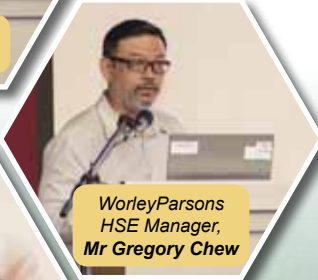
LTA PM, Mr Jerry
Mak Kum Hoong



LTA SPE, Mr Arthur
Tan Yee Siang



LTA PM, Mr Yap Wee Yeow



WorleyParsons
HSE Manager,
Mr Gregory Chew

A total of five topics were shared at the Safety Workshop:

- WSH Performance in Construction Industry 2016 by Ms Adeline Chang Huay Ying, Head of Surveillance, Ministry of Manpower
- Lessons learnt from recent accident: Fatal accident at T201 on 3 Nov 2016 by LTA Senior Project Engineer, Mr Arthur Tan Yee Siang
- Safety Challenges in Downtown Line Works Train Operations by LTA Project Manager, Mr Jerry Mak Kum Hoong
- Safety Challenges in Monorail Underpinning works for Sentosa Gateway Tunnel Project by LTA Project Manager, Mr Yap Wee Yeow
- Sharing of QP(S) Safety Culture at WorleyParsons by HSE Manager (SEA), Mr Gregory Chew

Editorial Committee

Advisor

Corporate Safety Committee

Editors

Phoa Hock Lye, Patrick
Liu Weng Keong, Ian
Lee Yu Qi, Jocelyn

Circulation Officer

Zhuo Shumei

Contributing Writers

Kevin Seet
Kelane Mohd Amin
Chew Chiang Fei, Gregory
Eng Woon Chong, Shawn
Koo Yan Xin

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

