Land Transport Authority

SAFETY NEWS

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15TH ANNUAL SAFETY AWARD CONVENTION

FEATURED ARTICLES

Highlights of Annual Safety Award Convention (ASAC) 2013

INTRODUCTION

LTA hosted its 15th Annual Safety Award Convention (ASAC) at the University Cultural Centre on 4th September 2013. The Convention was graced by LTA Chairman, Mr. Michael Lim, and was attended by about 1000 guests comprising LTA staff, QP teams, contractors, sub-contractors and professionals from the construction industry. This annual convention was first launched in 1999 to give due recognition to deserving contractors for their relentless effort in raising the safety and health standards at their worksites. At the same time, it recognises their contribution to protecting the environment and the public.

Figure 1: Guest of Honour, Mr. Michael Lim, Chairman Land Transport Authority, delivering the opening address

THEME OF ASAC 2013

The theme for this year's Convention was "*Achieving Zero Accidents through H.E.Y.! - Heart, Eyes and You*".

Heart – Inculcating 'safety from the heart'
Eyes – Increasing supervision and peer observation
You – Empowering everyone to prevent harm

This theme was chosen to complement our corporate 5-pronged strategy to achieve zero accident. Inculcating safety from the heart is an essential part of fostering a safety culture in any organisation. This has become especially important as our multicultural workforce enlarges in tandem with our projects. At the same time, lack of standing supervision was also identified as a common cause for accidents that took place in 2012. Hence, there is also a need to focus on increasing standing supervision. Ultimately, empowering everyone on site to embrace and take personal responsibility for safety should be the end in mind in order to achieve zero accident.

NEW AWARDS

Two new awards were introduced this year; the *Innovative Noise Management Award* and the *QPS Safety Award*.

The Innovation Noise Management Award aims to recognise contractors' effort in developing innovative noise management methods and to encourage them to innovate and put forth more ideas in the reduction of noise from construction works. Contract 923 Samsung C&T Corporation and Contract 915 SK E&C Singapore Branch clinched the inaugural award this year with the use of inflatable noise barriers (Figure 2) and leveraging on eye catching noise barriers (Figure 3) as a form of community engagement respectively.

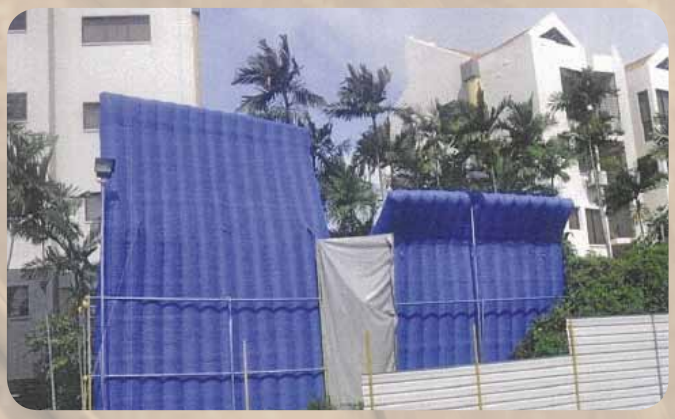

Figure 2: Contract 923 Samsung C&T Corporation "Inflatable Noise Barriers"

Figure 3: Contract 915 SK E&C Singapore Branch "Urban Art Gallery"

The inaugural QPS Safety Award was introduced to recognise QPS teams' proactive contributions towards addressing Workplace Safety and Health (WSH) issues and to encourage ownership of safety amongst QPS. CDM Smith (for Contract 937), and Tritech Consultants Pte Ltd (for Contract 921, Contract 929 and Contract 1686) clinched the inaugural QPS Safety award this year.

THE ASAC COMPETITION AND CHALLENGE SHIELD

The ASAC competition is divided into four categories:

Minor – Civil contracts with value below $20m
E&M – E&M contracts with value above $20m
Major – Civil contracts with value between $20m to $50m
Mega – Civil contracts with value above $50m

A total of 51 contractors participated in this year's competition. The contractors were scored based on their monthly Environmental, Safety and Security (ESS) assessments, safety performance statistics and a round of internal audit conducted by LTA's project management teams. Four finalists were subsequently short-listed from the Mega Category to compete for the Contractors' Challenge Shield. They were then audited by an independent panel of judges based on their site conditions, WSH practices and overall WSH management system. They also had to deliver a theme-related presentation at the convention. The scoring criteria were 80% based on the results of the site audit and 20% on the presentation at the convention.

The past winners of the Challenge Shield include Contract 909 Gammon Construction Ltd in 2010, Contract 916 McConnell Dowell South East Asia Pte Ltd in 2011, and Contract 920 Shanghai Tunnel Engineering Co. in 2012.

PANEL OF JUDGES

The Panel of Judges comprised senior representatives from the Ministry of Manpower (MOM), Building and Construction Authority (BCA), Singapore Contractors Association Ltd (SCAL), Professional Engineers Board (PE Board) and Shell Eastern Petroleum (Pte) Ltd.

Figure 4: Panel of Judges (from left): *Mr. Jeffrey Yu (SCAL), Mr. Thomas Wong (Shell), Mr. Kevin Teoh (MOM), Er. Lim Beng Kwee (BCA) and Er. Lim Peng Hong (PE Board)*

The Panel of Judges were impressed with the 4 finalists for their exemplary WSH management and site practices.

FINALISTS' PRESENTATIONS

This year's four finalists were from Contract 913 GS Engineering & Construction – Tiong Seng Construction Joint Venture; Contract 921 Ssangyong Engineering & Construction Co. Ltd; Contract 925A KTC Civil Engineering & Construction Pte Ltd and Contract 1688 Shanghai Tunnel Engineering Co. 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 voted for their preferred presentation through Short Message Service (SMS).

Figure 5: Skit presentation by Contract 913 GS Engineering & Construction – Tiong Seng Construction Joint Venture

The skits were greatly enjoyed by the audience. Contract 913 GS Engineering & Construction – Tiong Seng Construction Joint Venture won the audiences over with their skit and was voted the Best Presentation. Contract 921 Ssangyong Engineering and Construction Co. Ltd was the overall winner of the Convention and won the Contractors' Challenge Shield.

CONTRACTORS' CHALLENGE SHIELD (ASAC CHAMPION)

Figure 6: Contract 921 Ssangyong Engineering & Construction Co. Ltd proudly receiving the LTA Contractors' Challenge Shield

AWARDS CONFERRED DURING ASAC 2013

The following awards were also presented during the Convention:

- *Safety Achievement Award* to a contractor who has shown consistent outstanding safety performance and has been an ASAC finalist for the past 3 consecutive years.

- *Certificate of Excellence* to four finalists from Mega category and one contractor from Major category for their outstanding WSH performance.

- *Certificate of Merit* to three contractors from the Mega category, one from Major category, two from minor category and three from E&M category for consistent good WSH performance over the assessment period.

- *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 one contractor who have shown outstanding environmental management at their worksites.

- *Construction Environmental Merit Award* to six contractors who have shown consistent environmental management at their worksites.

- *Accident-Free Million Man-hours Recognition Award* to main contractors who have achieved a considerable accident-free man-hour milestone without reportable accidents or major incidents. There were 17 main contractors receiving the award.

- *Sub-contractors' Safety Recognition Award* gives due recognition to sub-contractors who have made a significant contribution to good WSH performance. Altogether, 9 deserving sub-contractors were commended for their good WSH performance.

Lester Chan
Environmental Manager
Safety Division

The Winners of ASAC 2013

Safety Achievement Award Recipient

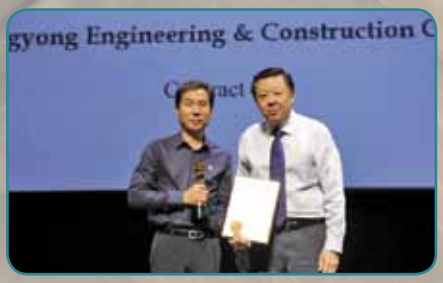

Figure 7: Safety Achievement Award – Contract 482: Ssangyong Engineering & Construction Co. Ltd

Best ASAC Theme Presentation Recipient

Figure 8: Mega Category (Finalist) – Contract 913, GS E&C – TSC JV

Project Safety Commendation Award Recipient

Figure 9: Project Safety Commendation Award – Mr. Chelliah Murugamoorthy, Director (DTL3 CT1)

Certificate of Excellence Recipients

Figure 10: Mega Category (Finalist) – Contract 925A – KTC Civil Engineering & Construction Pte Ltd

Figure 11: Mega Category (Finalist) – Contract 1688 – Shanghai Tunnel Engineering Co. Ltd

Figure 12: Mega Category (Finalist) – Contract 913 – GS E&C – TSC JV

Certificate of Merit Recipients

Figure 13: Major Category – Contract 1750 – Balfour Beatty Rail Projects Ltd & Gammon Pte Ltd

Figure 14: Mega Category – Contract 935 – Leighton Offshore Pte Ltd / John Holland Pty Ltd JV

Figure 15: Mega Category – Contract 936 – Sato Kogyo (S) Pte Ltd

Figure 16: Mega Category - Contract 923A – Shanghai Tunnel Engineering Co. Ltd

Figure 17: Major Category – Contract ER337 – McConnell Dowell South East Asia Pte Ltd

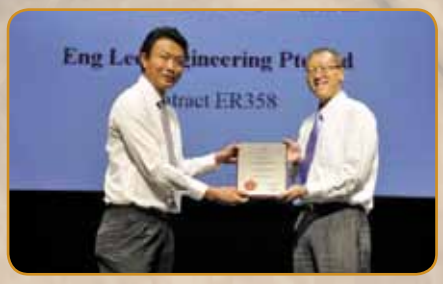

Figure 18: Minor Category – Contract ER358 – Eng Lee Engineering Pte Ltd

Figure 19 : Minor Category – Contract ER377 – Top Pave Pte Ltd

Figure 20: E&M Category – Contract 910 – Alstom Transport (S) Pte Ltd

Figure 21: E&M Category – Contract 910A – CTCI Corporation / CTCI Singapore Pte Ltd Consortium

Figure 22: E&M Category – Contract 465B – Tyco Fire, Security & Services Pte Ltd

Construction Environmental Excellence Award Recipient

Figure 23: Major Category – Contract 1750 – Balfour Beatty Rail Projects Ltd & Gammon Pte Ltd JV

Construction Environmental Merit Award Recipients

Figure 24: Mega Category – Contract 920 – Shanghai Tunnel Engineering Co. Ltd

Figure 25: Mega Category – Contract 921 – Ssangyong Engineering & Construction Co. Ltd

Figure 26: Mega Category – Contract 923A – Shanghai Tunnel Engineering Co. Ltd

Figure 27: Mega Category – Contract 935 - Leighton Offshore Pte Ltd / John Holland Pty Ltd JV

Innovative Noise Management Award

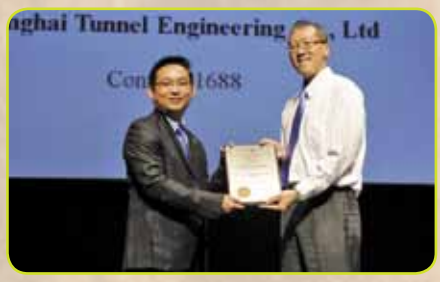

Figure 28: Mega Category – Contract 1688 – Shanghai Tunnel Engineering Co. Ltd

Figure 29: Major Category – Contract ER201 – Or Kim Peow Contractors (Private) Ltd

Figure 30: Contract 923 – Samsung C&T Corporation

QPS Safety Award

Figure 31: Contract 915 – SK E&C (Singapore Branch)

Figure 32: Contract 937 – CDM Smith

Figure 33: Contract 921 – Tritech Consultants Pte Ltd

Figure 34: Contract 929 – Tritech Consultants Pte Ltd

Figure 35: Contract 1686 – Tritech Consultants Pte Ltd

The Winners of ASAC 2013

Sub Contractors' Award Recipients

Figure 36: Chan & Chan Engineering Pte Ltd

Figure 37: Eng Lee Engineering Pte Ltd

Figure 38: Fuchi Pte Ltd

Figure 39: Kok Tong Construction Pte Ltd

Figure 40: Kori Construction (S) Pte Ltd

Figure 41: Leong Siew Weng Engineering Pte Ltd

Figure 42: Sambo E&C

Figure 43: Techniques Air-Conditioning & Engineering Pte Ltd

Figure 44: Tuksu Engineering & Construction Ltd (Singapore)

Accident Free Million Man-hours' Award Recipients

Figure 45: Category 1 (contracts $120 million and above and achieved above 2 million man-hours worked) – Contract 913 – GS E&C – TSC JV

Figure 46: Category 1 (contracts $120 million and above and achieved above 2 million man-hours worked) – Contract 912 – Lum Chang Building Contractors Pte Ltd

Figure 47: Category 1 (contracts $120 million and above and achieved above 2 million man-hours worked) – Contract 919 – Sembawang Engineers & Constructors Pte Ltd

Figure 48: Category 1 (contracts $120 million and above and achieved above 2 million man-hours worked) – Contract 920 – Shanghai Tunnel Engineering Co. Ltd

Figure 49: Category 1 (contracts $120 million and above and achieved above 2 million man-hours worked) – Contract 921 – Ssangyong Engineering & Construction Co. Ltd

Figure 50: Category 2 (contracts below $120 million and achieved above a quarter of 1 million man-hours worked) – Contract 1750 – Balfour Beatty – Gammon JV

Figure 51: Category 2 (contracts below $120 million and achieved above a quarter of 1 million man-hours worked) –
Contract 929 – China State Construction Engineering Corporation Ltd Singapore Branch

Figure 52: Category 2 (contracts below $120 million and achieved above a quarter of 1 million man-hours worked) –
ER343 – Hwa Seng Builder Pte Ltd

Figure 53: Category 2 (contracts below $120 million and achieved above a quarter of 1 million man-hours worked) –
ER 371 – Hwa Seng Builder Pte Ltd

Figure 54: Category 2 (contracts below $120 million and achieved above a quarter of 1 million man-hours worked) –
Contract 925A – KTC Civil Engineering & Construction Pte Ltd

Figure 55: Category 2 (contracts below $120 million and achieved above a quarter of 1 million man-hours worked) –
ER 337 – McConnell Dowell South East Asia Pte Ltd

Figure 56: Category 2 (contracts below $120 million and achieved above a quarter of 1 million man-hours worked) –
ER 368 – Or Kim Peow Contractors (Private) Ltd

Figure 57: Category 2 (contracts below $120 million and achieved above a quarter of 1 million man-hours worked) –
ER391 – Or Kim Peow Contractors (Private) Ltd

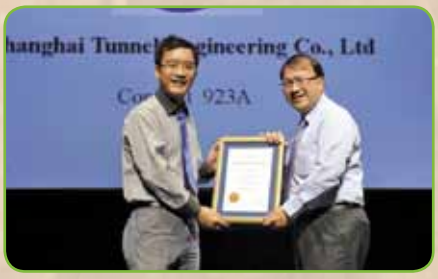

Figure 58: Category 2 (contracts below $120 million and achieved above a quarter of 1 million man-hours worked) –
Contract 923A – Shanghai Tunnel Engineering Co. Ltd

Figure 59: Category 2 (contracts below $120 million and achieved above a quarter of 1 million man-hours worked) -
Contract 937B – Singapore Piling & Civil Engineering Pte Ltd

Figure 60: Category 3 (for E&M Projects and achieved above a quarter of 1 million man-hours worked) –
Contract 910 – Alstom Transport (S) Pte Ltd

Figure 61: Category 3 (for E&M Projects and achieved above a quarter of 1 million man-hours worked) –
Contract 910A – CTCI Corporation/CTCI Singapore Pte Ltd Consortium

Ssangyong's Approach to Safety at Site

INTRODUCTION

At Ssangyong Engineering & Construction Co. Ltd (SSYENC), there has long been a culture of going beyond legal and contractual requirements, resulting in an exemplary safety record for the company.

It is this safety culture that has enabled Ssangyong to consistently excel in maintaining the highest safety standards on our worksites, resulting in Ssangyong being awarded several safety awards such as the MOM Sharp awards, UK ROSPA awards, Health awards from the Health Promotion Board and the latest – the prestigious Challenge Shield as winner of the LTA's Annual Safety Award Convention 2013.

Figure 1: ASAC 2013 Champions

LEADERSHIP

Setting the standards for safety is Ssangyong's leadership. Ssangyong's Chairman and senior management staff are in the forefront for all operations with Environmental, Health, and Safety (EHS) as a topmost consideration. Chairman and senior management staff also lead by example, setting high standards in planning, designing, allocating of adequate resources such as manpower, and leveraging on best equipment and technology.

Figure 2: Safety Commitment Pledge Signing by Singapore Branch, Managing Director Mr. Ahn Kook Jin

At Ssangyong, the highest priority given to EHS is encapsulated in a mantra that is drilled into the minds of all staff. Drawn from the company's abbreviation itself, the mantra, **"SSYENC"**, distils the spirit of the company's belief in safety, health and environment.

S – Safety
S – Saves
Y – You &
E – Environment
N – Needs your
C – Care

This is clear even in the way Ssangyong chooses its contractors. Only those with exemplary safety record and who have demonstrated the required competency levels for the job are chosen by Ssangyong for its projects. The company also makes sure it sets reasonable time frames and deadlines for the safe completion of works.

Communication is given top attention by its management. All vital information from Method Statements, Risk Assessments and Safe Work Procedures are clearly communicated in various languages to all staff and workers. This ensures that they are ready and competent for the works ahead. Ssangyong also engages and involves the workers in safety by empowering them to stop any unsafe work practices. It also strongly encourages whistle blowing, not because it desires the creation of an in-house secret police, but rather to create an avenue for the reporting of any EHS problems its workers face in-confidence. To this end, it has set up a dedicated 24 hours hotline for any of its staff to call in and alert the company on any hazards observed on site.

Figure 3: Risk management meeting

SAFETY PROMOTION AND RECOGNITION

In addition to such measures, one of Ssangyong's winning formula is to promote EHS by recognising and rewarding personnel and sub-contractors for adhering to safe workplace procedures with attractive cash vouchers, awards, prizes, etc.

Figure 4: Safety Promotion (5 Million Accident Free Man Hours Celebration)

Figure 5: Recognition of staff for making safety their number one work priority

EMPHASIS ON SAFETY

Ssangyong places a high premium on enforcing safety requirements to ensure that there is never a need to resort to an emergency response plan. In addition to regular inspections by the management team from C921 project, Ssangyong's top management has set-up an EHS Leadership Committee which carries out regular safety checks on the ground to ensure that all safety measures are in place and are being adhered to. In addition to these scheduled site visits, Ssangyong's Chairman and other senior management staff from HQ also make regular unscheduled adhoc visits to make sure EHS matters are placed on the same level of importance as the progress of work.

Figure 6: Corporate EHS Inspections

ENHANCING THE SAFETY CULTURE

To spread the culture of safety to each and every Ssangyong's staff, it conducts regular mandatory safety training sessions for personnel at all levels. These training are further extended to the subcontractors as well. In addition, Ssangyong has a unique 'Meet the EHS Manager' session in place for workers. These sessions allow workers to report matters directly to the EHS Manager. All EHS matters, regardless whether it is a complaint or a concern, are recorded and escalated to management for resolution. Ssangyong's Project Director walks the site very frequently and also engages directly with the workers.

Figure 7: Project Director safety walks

GOING THE EXTRA MILE

Ssangyong also goes the extra mile in other aspects of its work. Bearing in mind that work sites are situated within residential areas and alongside busy roads, Ssangyong has introduced added measures to enhance the EHS of residents and motorists.

Ssangyong takes a hard-line approach in weeding out mosquito breeding grounds as there is a real risk that one can be infected with dengue. Daily checks are conducted in all work sites to make sure there are no hidden water receptacles that allow the breeding of mosquito larvae. In addition, C921 went all out in its community outreach efforts, re-emphasising the dangers of dengue and preventive measures that one can adopt. Visits to nearby residences and stakeholders, distribution of mosquito repellents and brochures on prevention of mosquito breeding are carried out regularly.

There was an incident where a huge tree had fallen outside C921's project boundary. With safety of the general public in mind, and in view of the dangers that the debris posed, the Project Director personally intervened and mobilised his team and machinery to assist in removal of the debris. With the hazards removed, it resulted in an increased level of safety for all.

Ssangyong also goes the extra mile by engaging all stakeholders. Interaction between Ssangyong staff and stakeholders is key. Dialogues are held, stakeholders are kept abreast on work progress, and feedbacks received on how Ssangyong can further improve and enhance EHS standards.

CONCLUSION

Ssangyong strongly believes that apart from establishing and enforcing stringent EHS requirements, a strong leadership, complemented with total commitment from staff including the subcontractors, are prerequisites in creating a strong safety culture that strives for an immaculate safety record. Ssangyong also recognises that going the extra mile for safety is not only good for its employees, it also makes good business sense.

T Suresh Kumar
Corporate EHS Manager
SSYENC

Safety Considerations in Tuas West Extension Project

INTRODUCTION

Tuas West Extension (TWE) is an extension of the East-West Line. Commencing from existing Joo Koon Station, the project involves the construction of 7.5 km of elevated rail and 4.8 km of elevated road viaducts, 4 stations and a depot. When completed in 2016, the project will be able to bring better connectivity to people working in the Tuas industrial area. Challenges faced in the project include the crossing of rail viaducts over the Pan Island Expressway and Ayer Rajah Expressway as well as the integration of the twin-track rail viaducts with the dual three-lane carriageway road viaducts. As construction takes place over busy roads, working at heights and heavy lifting operations form the bulk of construction activities here.

In this article, we will look at the various safety considerations associated with the project.

WORKING AT HEIGHTS

In 2012, all TWE's civil contractors set up dedicated Safety Training Centres aimed at providing regular in-house trainings to their workmen to better equip them with knowledge and necessary competency skills to work safely at heights.

Following Ministry of Manpower (MOM) announcement in 2012 of the introduction of a new Workplace Safety and Health (Work at Heights) Regulations in 1 May 2013, several Approved Training Providers (ATP) were engaged. Specific training package on 'Safe Working at Heights' was developed and the ATP conducted the training at the contractors' Training Centres to their workmen.

Figure 1: 'Safe Working at Heights' training conducted by ATP's trainer

The training packages included the following: -

- ***Safe Working at Heights Foundation Course for Workers***

This is a foundation level training course to equip workers with an insight on the statutory requirements to working safely at heights and the safe application of necessary fall protection equipments.

- ***Safe Working at Heights Course for Supervisors***

This course is to equip supervisory level staff the requirements and practices for working safely at heights. These include written and practical assessments.

Figure 2: Supervisory staff taking a written assessment

HEAVY LIFTING OPERATIONS

a) Cranes

Cranes carry out lifting of heavy equipment and materials on site. Prior to the actual lifting, a proper lifting plan prepared by the lifting engineer and endorsed by the relevant personnel ensures that the planning procedures are adhered to. Routine checks like crane boom-down checks, 6-monthly crane inspection ensure that the cranes are in serviceable condition. A recently implemented workflow for lifting operations by the Safe-Work Practice Committee adds an additional check to the lifting process.

Before carrying out lifting operations, steel plates are laid abutting one another, and placed on top of well compacted hardcore along crane access and designated parking position. This ensures that the cranes are rested on level and firm ground. During lifting operations, a proper demarcation of the crane working zone ensures that only authorised personnel are allowed to be in close proximity to the cranes. Members of the lifting crew can be easily identified by their safety helmets and vests. Cranes are also fitted with rear view cameras to ensure that blind spots of the cranes can be clearly seen by the crane operators.

A first in LTA worksites, data logger is installed in the crane cabin. This helps to track and record the lifting activities done by the cranes.

Figure 3: Data logger installed in crane

Data from the loggers can be downloaded locally by authorised personnel. In the graph shown, an overloading lasting 6 seconds was recorded on 4 October 2013. Further investigations revealed that site constraints were the cause

of the crane's overloading. This was acknowledged by the crane operator.

The information logged is beneficial. It not only records any overloaded lift, the data also serves as evidence for any non-conformity to lifting plan. The data can also be used for analysis. It allows the team to take the necessary steps and action to address any risky behaviour on the part of the crane operator.

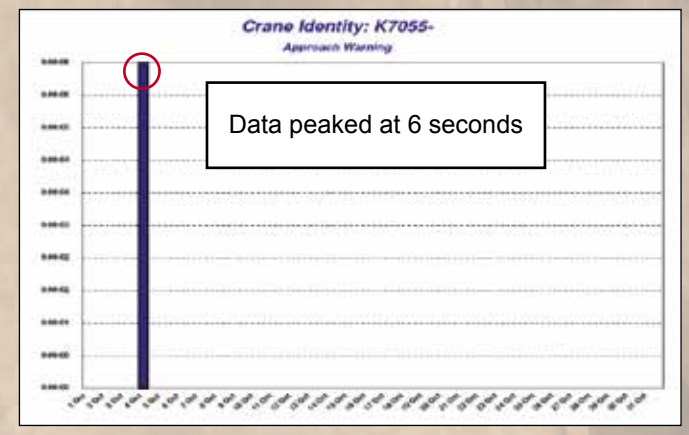

Figure 4: Overloading graph for month of October 2013

LTA, in collaboration with the MOM Occupational Safety and Health Specialist Division, have embarked on a pilot project in TWE since June 2013, to study the feasibility of implementing an industry-wide usage of data loggers.

b) Launching Girders

The Launching Girders (LGs) are an essential part of construction in TWE, these heavy lifting machines (weighting up to 400 tons) are used to hoist segments (about 40 tonnes each; 12 segments in 1 span) for the construction of road and rail viaducts.

Figure 5: LG at Joo Koon Circle with beam launched

Prior to the manufacture of the LGs, checks by specialist consultants ensure that the LGs can perform the lifting tasks under different situations, e.g.: going up and down slopes, manoeuvring around bends. Assembly of the LGs in the factories is done with the Independent Testing Agency (ITA) checking on welded joints of the members to ensure member integrity and strength.

Meanwhile, presentations to MOM and the Building and Construction Authority (BCA) keep the Authorities informed of these heavy lifting works. When delivered on site, the LGs are assembled in the presence of a Professional Engineer (PE) and a Certificate of Supervision (COS) is issued. Segments are lifted to test the LGs. When LGs are calibrated and tested, the MOM Registered Certificate of Test / Through Visual Examination of Lifting Equipment is issued by the Authorised Examiner (AE) who is a PE.

CERTIFICATE OF SUPERVISION

This is to certify that bridge erection launcher DP500 LG01,

Designed to,

1. FEM 1.001 (10 1998) Rules for the design of hoisting appliances
2. BS 5950-1 2000 Code of practice for design – Rolled and Welded Section (Connections)

verified to comply with,

SS 497 2011 Code of practice for Design, Safe use and Maintenance of gantry cranes, overhead travelling cranes and monorail hoists

Fabricated in Zhengzhou, Henan, of PRC by,

m/s Zhengzhou New Dafang Heavy Industries & Technology Co., Ltd

Constructed to drawings and technical specification audited by,

m/s YWL Engineering Pte Ltd

Material and Welding verified and test by ITA,

m/s SETSCO Services Pte Ltd

was satisfactorily fabricated and completed to relevant technical requirements.

Dated 11 May 2013

Figure 6: PE's Certificate of Supervision

A series of viaduct launching safety workshops were also conducted to review the risks and mitigation measures relating to launching operations. Most of the launching works are restricted to the night. In this manner, risks posed toward the general public are kept to a minimum.

OTHER TWE INITIATIVES

Weather forecast applications by National Environment Agency (NEA) have been used, and equipment (lightning detectors, wind gauges) were installed on site to warn workmen of inclement weather, allowing them timely evacuation to seek nearest shelter.

In addition, a TWE safety handbook, co-written by LTA Project Team and Safety Division together with the contractors and consultants, focusing on working at heights and heavy lifting operations has been produced and distributed to TWE staff.

CONCLUSION

While all construction activities come with risks, TWE team continuously strive to reduce all risks to as low as reasonably practicable. This is in line with our team's direction towards the achievement of zero accident.

Heng Jiang Li
Senior Project Engineer
Rail (Tuas West Extension) Division

Pedestrian Safety at Work Zone

INTRODUCTION

Traffic Police in the Annual Road Traffic Situation 2012 published that the number of fatalities involving pedestrians has declined in 2012 when compared with the statistics in 2011. The total pedestrian fatalities dropped from 49 in 2011 to 44 in 2012.

Despite the decreasing numbers of pedestrian fatalities recorded, the pedestrian fatalities still account for about 26% of the overall road fatalities and they are ranked the second most vulnerable group of road users after motorcyclists/ pillion riders. Therefore, pedestrian safety remains an important aspect to be accorded due considerations in the development of road projects.

With the current high volume of construction work activities in progress, apart from ensuring the pedestrian's connectivity around the work areas, it is also necessary that their safety is not compromised. This article will highlight some of the common issues relating to the safety of pedestrian identified along the designated pedestrian footpaths and crossings at traffic junction around the work zone.

AT TRAFFIC JUNCTION

The traffic junction is a location where there is an increase interaction between the pedestrians and vehicles. The likelihood of vehicle-pedestrian conflicts occurring is also higher than other locations. Some areas of concern observed at the junction beside a work zone:

• Inadequate standing space provided for pedestrian to wait at the junction crossing (Figure 1a).

• Misaligned pedestrian waiting area with crossing path (Figure 2a).

Figure 1a: Insufficient waiting space

Figure 1b: Sufficient waiting space

Adequate space should be created for pedestrians waiting to cross the junction so that they can keep themselves away from standing on the road pavement and being hit by vehicles (Figure 1b).

Crossing points created along the sidetable for the pedestrian to cross the road should be properly located in front of the pedestrian crossing path (Figure 2b). Misalignment or improper arrangement of the crossing facility would lead pedestrian to walk on the live traffic lane to reach the designated crossing path or jaywalk indiscriminately. Such arrangement will increase the pedestrians' exposure and risk of being hit by passing vehicles.

Figure 2a: Misaligned pedestrian crossing path with waiting area

Figure 2b: Aligned pedestrian crossing path with waiting area

ALONG THE TEMPORARY FOOTPATH

The temporary footpath provided around the work zone is not only for pedestrian's connectivity but also to safely separate them from the live traffic. Thus, the condition of the temporary footpath should not be compromised and give rise to potential hazards that cause injury to pedestrian.

Tripping Hazards and Uneven Surface

• The concrete base of the temporary traffic light pole is usually a tripping hazard when it is not visible to pedestrian, especially the young and elderly, under dark conditions. As far as practicable, the traffic pole could be installed into the ground or the kerb painted bright yellow and black to alert pedestrian of the hazard.

• Paint the uneven surface or hump created on the footpath for hunching utilities crossing underneath with luminary colour to warn pedestrian of the change in ground level to prevent them from stumbling over it.

Figure 3: Obstruction along the pedestrian footpath

Figure 4: Ramp or uneven surface painted with luminary colour to alert the pedestrian

Figure 6b: The surface of walkway is graded to prevent water ponding

Inadequate lighting facility

Adequate lighting in the night should be provided along the temporary footpath to enable pedestrian to follow the path properly to their destination without knocking into other pedestrians or going wayward.

Figure 5a: No lighting provided along the footpath

Figure 5b: Lighting facility provided at night along the footpath

Water ponding

Water ponding resulting in slippery surface along the temporary footpath is a common occurrence. Pedestrian could slip and fall when they walk in such conditions. Appropriate crossfall gradient and proper drainage along the footpath shall always be considered in the design to eliminate the water ponding issue.

Figure 6a: Water ponding due to uneven surface

Width of footpath

In many instances, temporary traffic signs or traffic control devices have been installed along the footpath leaving narrow gap or even site utilization constraint has resulted in limited width of the pathway for pedestrians to walk. The narrow footpath not only poses a challenge to wheelchair-bound road users but also encourage pedestrian to walk on the live carriageway thereby heighten the risk of being hit by passing traffic.

Generally, a minimum width of 1.5m shall be provided for the pedestrian footpath. However, in areas near to shopping centres, MRT stations, schools and commercial districts, the width of the footpath shall be widened accordingly to accommodate the higher volume of pedestrians.

Figure 7a: Insufficient width of footpath

Figure 7b: Sufficient width of footpath

CONCLUSION

Pedestrian safety should be one of the critical considerations in the design, review and implementation stages of the temporary road projects. Regular inspections of the site shall be conducted to identify hazards related to pedestrian safety and carry out rectification as soon as practicable to ensure that the vulnerable group of road users can travel through the work zone safely.

Terence Lee Kian Boon
Assistant Road System Safety Manager
Safety Division

Signalling System Safety for Downtown Line

INTRODUCTION

Downtown Line (DTL) is a bi-directional transit line consisting of 34 stations over approximately 42 km of underground railway, supplied with 73 driverless trains and 14 locomotives. The complex task of ensuring the trains move and arrive safely on schedule falls on the signalling system. The line is controlled, monitored and regulated by the signalling system to ensure smooth and safe train rides for all passengers.

SIGNALLING SUB-SYSTEMS

The signalling system is made up of three main sub-systems, namely the CBI (Computer Based interlocking), the ATC (Automatic Train Control) and the ATS (Automatic Train Supervision). These three systems work together to operate the line.

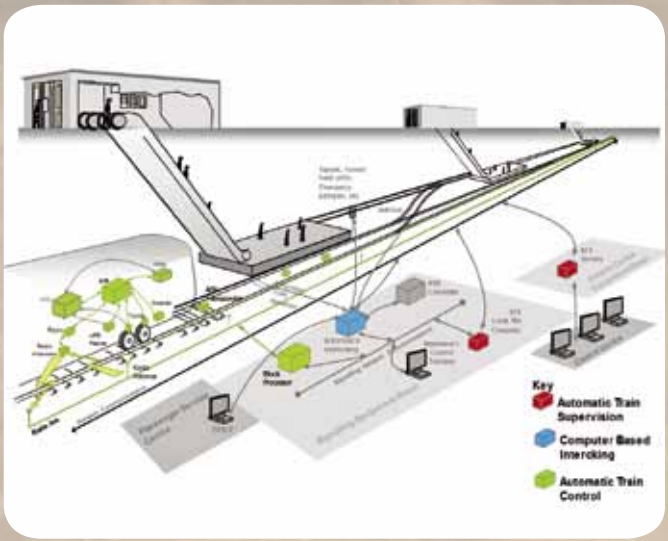

Figure 1: Signalling System Overview [1]

The CBI manages the safety of train routes, ensuring that there are no conflicts in routes and that elements within routes are locked and checked via their various detection means. The CBI is a Safety Integrity Level (SIL) 4 system, designed with redundancies and fail-safe considerations. These ensure that failure rates are kept at its lowest, and that in the rare event of a failure, the system will fall to its most restrictive and hence, safe state.

The ATC manages movements of the trains and their safe separation. While keeping with the performance requirements on headway between trains, train collisions are prevented via immediate alterations to the movement authority and train speed. Similar to the CBI, the safety functions performed by the ATC are designed to SIL 4 standards, with redundancies designed into its architecture. In the rare event of a system failure, the ATC will halt the train immediately via the application of emergency brakes.

The ATS helps the operator in supervising train movement, as well as alarms, icons and state of the railway. As a key tool to assist the operator's reaction to incidents, the ATS also provides the interface to the operator in the scenario they wish to manually issue commands to the system.

[1]Source: System Overview Design

The ATS is a SIL 2 system and designed with redundancies. In the event the ATS at the Operation Control Centre (OCC) fails, the control and monitoring of the line is handed down to the respective Passenger Control Centre (PSC) of the station.

SAFETY CONSIDERATIONS IN THE DESIGN

Safety is always of foremost importance in the signalling design. In the endeavour to achieve the required functions, every aspect of the functional design is analysed, from the architecture of the systems to the individual functions, to ensure that there is no failure that could result in a hazardous scenario. The results of all these analyses are compiled into a hazard log and traced till their mitigating measures are validated.

In the system architecture, redundancies are designed (as far as possible) into critical elements to bring down the failure rates and hence, the down-time of the system. Figure 2 shows an example where critical elements in the CBI system such as IOM (Input / Output Module) are designed with additional module(s) as a redundancy measure. In the event where the primary module fails, the redundant module will take over to ensure that operations are not affected. FMEA (Failure Mode Effect Analysis) are performed to ensure there is no single point of failure that could lead to a critical consequence.

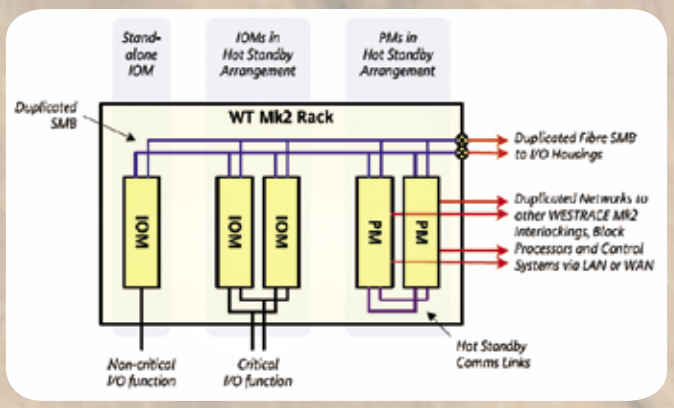

Figure 2: CBI Architecture with redundancy design

Fail-safes are designed into the sub-systems. For example, in the event that both active and redundant CBI units fail, the system would revert to its most restrictive state and no routes would be set for train movement. The signalling system also employs diverse channels in its key software processes for defence against systematic faults. For example, two diverse algorithms have been developed to calculate the braking profile of the ATP (Automatic Train Protection).

In addition to software integrity, the design also considers hardware aspects to help achieve comprehensive system integrity. Vital circuits that convey important signals between equipments are double-cut to mitigate the possibilities of a single short in the circuit alternating the proper behaviour of the input.

DEGRADED AND EMERGENCY SCENARIOS

The Signalling System is comprehensively studied and designed for a multitude of scenarios besides the normal operating modes, with safety as a key consideration. These scenarios can be grouped into two categories, degraded and emergency scenarios.

Degraded scenarios involve the failure of particular equipment and its function, which could prohibit train movement. However, to prevent unnecessary blockages to the line and impact to revenue service, degraded scenarios may allow train movement if safety is assured.

Emergency scenarios involve reasonably foreseeable events unrelated to system faults, such as a passenger-initiated evacuation from the train. Designers recognise that such events could also lead to a multitude of possible scenarios, depending on the location of the event. In the scenario of train evacuation, their extensive studies produced a solution, whereby the signalling system would trigger the evacuation process if the incident train was detected stationary in the tunnel. This would result in the cutting of traction power and a global hold on the entirety of the line, to ensure passenger safety and to prevent train bunching onto the incident site. Additional safety measures such as timers for detrainment doors ensure that sufficient time has lapsed to allow the surrounding trains to stop and traction power to be completely tripped before allowing passengers onto the track.

SIGNALLING SYSTEM VALIDATION AND TEST STRATEGY

A thorough verification and validation process is adopted for the Signalling System from the design stage to the final commissioning of the system as shown in Figure 3 below.

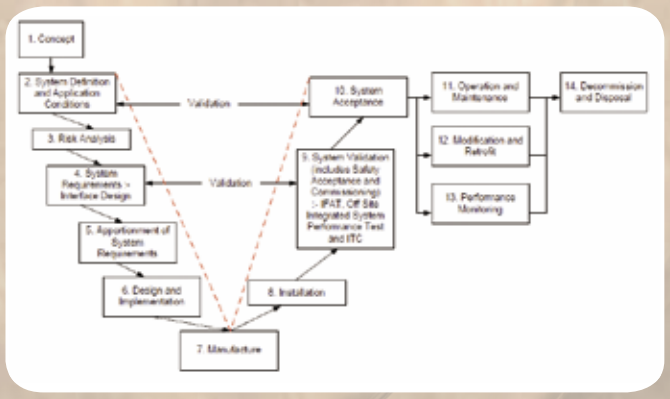

Figure 3: Project "V" Lifecycle[2]

During the testing phase, the Signalling System adopts an incremental validation strategy. Starting from the installation phase, wirings and installations are checked to ensure that they are put in place as per the design drawings. For example, bell tests are performed to ensure that the wirings are connected correctly. In parallel to the site test activities, those system data and logic, independent of site and interface variables, are tested in the laboratory. This saves time as these tests can be conducted in parallel to the site test activities. One example is the CBI data which is comprehensively tested in the laboratory to ensure that the logic is correct before on-site installation.

[2]Source: DTL Interface & Integration Management Plan

Following the installation checks and tests, the set-to-work tests of the individual equipment are carried out to ensure that the installed equipment can be powered on, communicating and functioning as required. For example, track circuits are individually tested to ensure that they are able to detect shunts within the required resistance ranges as shown in Figure 4 below.

Figure 4: Track Circuit Shunt Test

After the individual equipment is set to work, the Signalling System is tested for its functions against the designed performance. In the figure below, the trainborne ATC is being tested using a simulator for rolling stock inputs & outputs. Interface tests with other systems (e.g. power systems, rolling stock) are also conducted to ensure that the integrated systems can perform the relevant functions correctly.

Figure 5: Static Routine Test of the Trainborne Signalling Equipment using simulator for rolling stock inputs & outputs

Each signalling equipment comes with its own generic product safety case, assessed by an independent assessor according to the necessary EN (European) standards for railway applications. These safety cases, together with the tests performed both on-site and in laboratories, are then compiled to create a specific application safety case. Ultimately, with all project-concluding tests completed, the specific application safety case, assessed by an independent assessor, will build an argument to justify the safe application of the Signalling System for revenue service with passengers.

Gan Wei Aun
Senior Project Engineer
Rail Systems

Editorial Page

LTA 30th Safety Workshop and 19th Construction Staff Award Ceremony

The 30th Safety Workshop organised by Safety Division was held on 18th November 2013 at HSO Auditorium. It was attended by more than 100 officers from Rail, Road Projects and Engineering Groups. The workshop served as an excellent platform for project teams to share the safety challenges they faced and how they were overcome.

There were four presentations given by four LTA officers and one guest speaker from Access & Scaffold Industry Association (ASIA) Singapore. The topics were:

1. Sharing on Good Practices and Learning Points in Temporary Road Works for LTA Projects By Manager Roads System Safety Mr. Chris Loh Kok Fah

2. Beam Launching at Pan Island Expressway by Executive Engineer Mr. Dexter Bay

3. Construction Risk Management at Tuas West Extension by Senior Project Engineers Ms. Yang Xue and Mr. Sam Chong

4. Updates on Work at Heights Safety by Mr. Jonathan Wan, Access & Scaffold Industry Association (ASIA) Singapore

Figure 1:
Manager Roads System Safety
Mr. Chris Loh Kok Fah

Figure 2:
Executive Engineer
Mr. Dexter Bay

Figure 3:
Senior Project Engineer
Ms. Yang Xue

Figure 4:
Senior Project Engineer
Mr. Sam Chong

Figure 5:
Guest Speaker
Mr. Jonathan Wan from
Access & Scaffold Industry
Association Singapore

Figure 6:
Winners of the Construction Safety and Environmental Awards

Project staff who have gone the extra mile in ensuring high safety and environmental standards were recognised at the event. A total of 10 staff received the construction safety award, and another 5 were presented with the environmental award.

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