Design for Safety (DfS) - Accidents can be prevented through design

HDB Design for Safety Sharing Session

Tong Tee Hui , Senior Assistant Director (OSH Inspectorate) OSHD, MOM

15 Aug 2017

MINISTRY OF MANPOWER

A Great Workforce A Great Workplace



There is a reason behind every accident

A Great Workforce A Great Workplace



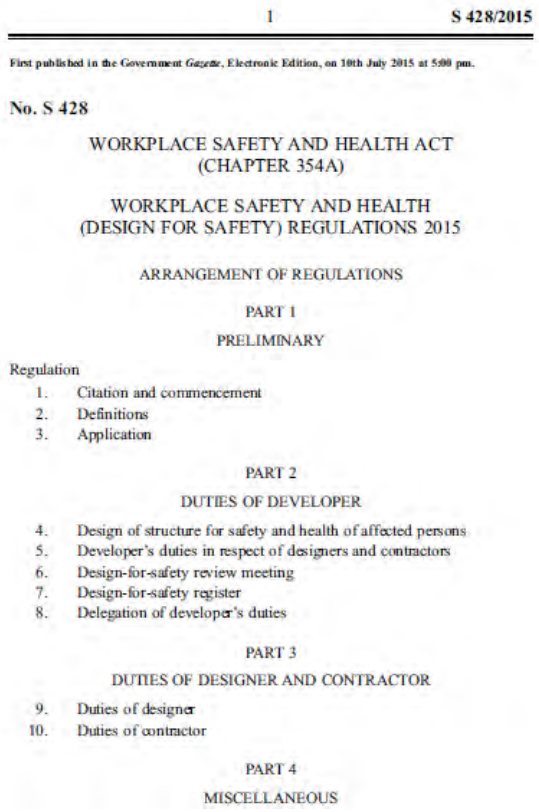
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WSH (Design for Safety) Regulations

- **Workplace Safety and Health (Design for Safety) Regulations 2015 was gazetted on 10 July 2015. The Regulation comes into operation on 1 Aug 2016.**
- The Regulations apply to a project that —
  - (i) is undertaken by a developer in the course of the developer's business;
  - (ii) involves or is intended to involve any construction work of a contract sum of $10 million or more; **AND**
  - (iii) involves development under section 3(1) of the Planning Act (Cap. 232);

  OR

  a project to modify a permanent structure, in respect of which a design for safety register has been kept under regulation 7, that involves development under section 3(1) of the Planning Act.
- These Regulations do not apply to a project in respect of which the developer has appointed a designer before ***1 August 2016.***



1 S 428/2015

First published in the Government *Gazette*, Electronic Edition, on 10th July 2015 at 5:00 pm.

No. S 428

WORKPLACE SAFETY AND HEALTH ACT
(CHAPTER 354A)

WORKPLACE SAFETY AND HEALTH
(DESIGN FOR SAFETY) REGULATIONS 2015

ARRANGEMENT OF REGULATIONS

PART 1

PRELIMINARY

Regulation

1. Citation and commencement
2. Definitions
3. Application

PART 2

DUTIES OF DEVELOPER

4. Design of structure for safety and health of affected persons
5. Developer's duties in respect of designers and contractors
6. Design-for-safety review meeting
7. Design-for-safety register
8. Delegation of developer's duties

PART 3

DUTIES OF DESIGNER AND CONTRACTOR

9. Duties of designer
10. Duties of contractor

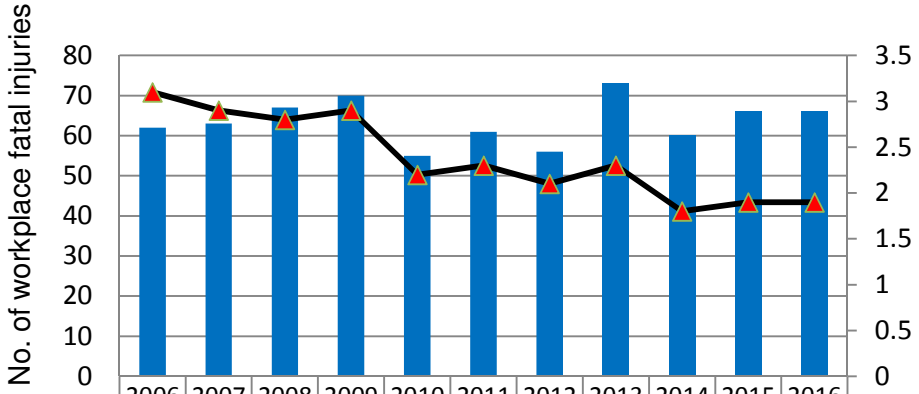
PART 4

MISCELLANEOUS

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2016 Statistics on Workplace Safety and Health

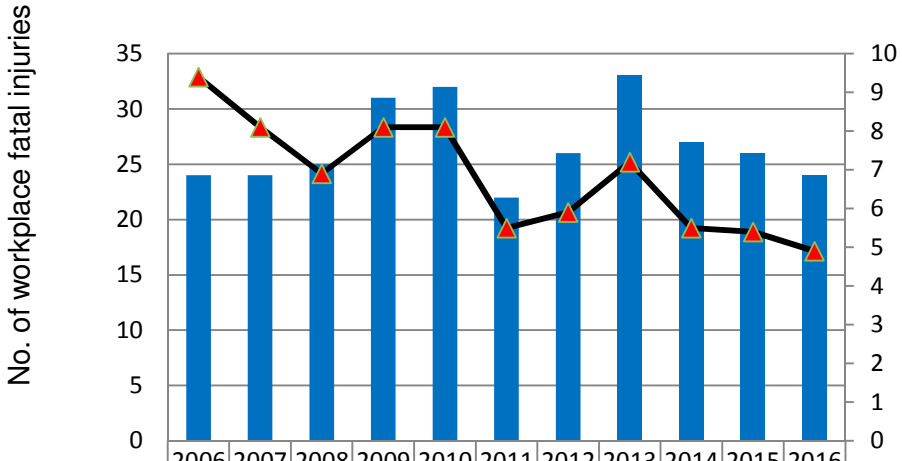
All workplaces



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
No. of Workplace Fatal Injuries	62	63	67	70	55	61	56	73	60	66	66
Workplace Fatal Injury Rate	3.1	2.9	2.8	2.9	2.2	2.3	2.1	2.3	1.8	1.9	1.9

Fatal injury number and rate remains the same at 66 fatalities and 1.9 per 100,000 employed persons in 2016

Construction



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
No. of Workplace Fatal Injuries	24	24	25	31	32	22	26	33	27	26	24
Workplace Fatal Injury Rate	9.4	8.1	6.9	8.1	8.1	5.5	5.9	7.2	5.5	5.4	4.9

Construction is the highest contributor with 24 fatalities (36%). This has improved from 26 fatalities in 2015.
Current rate is at 4.9, which is still a stretch from 1.8 by 2018.

Fatal injury rate per 100,000 workers

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Higher fines set for deterrence and to encourage proactive measures

TOP OF THE NEWS A3

SMRT fined $400k over fatal accident



Errant employers face higher fines for safety breaches

High Court reviews sentencing regime after agreeing that fines in past cases were too low

Selina Lum

High Court sets benchmark by imposing a fine of $250k on Construction firm over 2 deaths.

Builder fined $130k for repeated safety lapses

Firm had also been fined $10k, $19k in 2014 and 2015 respectively for unsafe practices

Lee Min Kok

Construction firm Kingsford Construction has been fined $130,000 under the Workplace Safety and Health Act for multiple safety lapses at a worksite, the Ministry of Manpower (MOM) said yesterday.

The firm, which was convicted and fined last Thursday, had been engaged to carry out construction works at Hillview Peak, a condominium development.

– of three residential blocks, two basement carparks, a swimming pool and other clubhouse facilities – found these safety failures:

- Open sides at eight locations were not covered or protected by effective guard rails or barriers to prevent fall from heights;
- Staircases were not provided with handrails, exposing persons to the risk of falling off the edge of either side of a staircase;
- Staircases were not provided with emergency lighting, exposing workers to the risk of tripping as some steps of the staircases were undergoing modification works;
- Poor housekeeping at multiple places in worksite, exposing workers to the risk of tripping; and
- The safety interlock of several passenger and material hoists at the worksite was not functioning properly, exposing persons to the risk of falling or coming into contact with moving parts of the hoists.

A full SWO was issued from June 8 to July 18 last year.

Given its repeated failures and recalcitrant attitude towards workplace safety and health, Kingsford was subsequently charged for its failure to take "reasonably practicable measures" to ensure the safety and health of its employees.

Mr Chan Yew Kwong, the MOM's director of Occupational Safety and Health Inspectorate, said: "MOM sought a heavy penalty because of Kingsford's blatant disregard for safety and its repeated failure to comply with our regulatory requirements.

"Companies must address all safety failures identified during a MOM inspection and put in place effective measures to prevent recurrence. They should not put their workers' lives at risk and wait for an accident to happen before taking safety seriously."

Statistics released by MOM and the Workplace Safety and Health Institute on Wednesday showed a plunge in workplace deaths and injuries in the first half of this year.

However, falls from height were one of the top two causes of workplace deaths. A total of 4,300 workplace safety and health violations were uncovered, with 28 companies ordered to stop operations. Fines totalling $500,000 were imposed on companies on the spot.

Kingsford Construction is wholly owned by Mr Cui Zhengfeng, who made the news in 2012 when his company Kingsford Development made its debut in the property market by outbidding six others and paying $243.2 million for a land parcel in Hillview Avenue to build condominium apartments, the same worksite where the MOM found safety lapses in the past three years.

Mr Cui also made the news in 2014 when he bought for $33 million a Sentosa Cove bungalow which is the registered address of his construction company fined by the MOM.

Attempts to reach him yesterday were unsuccessful. A staff member at his company, who gave her name as Ms Chan, said he is overseas and does not have a mobile phone.

mklee@sph.com.sg



Open sides without guard rails or barriers to prevent falls from heights at the Kingsford Construction worksite in Hillview Avenue. PHOTOS: MINISTRY OF MANPOWER

New Sentencing Framework

Guideline for fines

		Culpability		
		High	Medium	Low
Potential for harm	High	$300,000 to $500,000	$150,000 to $300,000	$100,000 to $150,000
	Medium	$100,000 to $150,000	$80,000 to $100,000	$60,000 to $80,000
	Low	$40,000 to $60,000	$20,000 to $40,000	Up to $20,000

NOTE: Culpability refers to the level of the offender's blameworthiness. Factors to assess culpability include the number of breaches; whether the breaches were systemic or isolated; whether the breaches were intentional, rash or negligent; whether the breaches were a minor departure from established procedures or a complete disregard of procedures

Potential harm refers to the harm that could potentially have resulted from the offender's actions. It may be assessed by considering, among other things, the seriousness of the possible harm and the likelihood of that harm arising.

Source: SUPREME COURT STRAITS TIMES GRAPHICS

"For future cases, the sentencing court should bear in mind that the legislative intent for the introduction of more severe penalties was to create a more palpable deterrent effect and encourage stakeholders to take more proactive measures to minimize the occurrence of accidents at the workplace"

Judicial Commissioner See Kee Oon

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News on Prosecution actions in UK under CDM

Construction client sentenced over multiple safety failings

Date:

22 October 2015

A Hertfordshire based care provider engaged in construction works, fined after it admitted unsafe working practices, including failure to re asbestos materials from the old buildings before demolition work.

The Health and Safety Executive (HSE) received a complaint in Mar from a member of the public living close to the former hospital site or Hill, Chesham, Buckinghamshire concerning activities going on at th premises.

Upon attending, HSE inspectors noted the former Chesham Commu Hospital buildings had been partially demolished by a contractor. Ho enquiring with the client, Chesham Care Ltd, it was discovered that r asbestos containing materials (ACM's) had not taken place prior to d

High Wycombe Magistrates' Court, heard Chesham Care Ltd, a prov nursing and rehabilitation services, was acting as the 'client' for the p as it had failed to appoint a principal contractor/construction design a management (CDM) co-ordinator in writing, by law it had assumed th associated legal duties and roles.

When HSE inspectors arrived, among the catalogue of failings, they works had been going on for around 2-3 months and observed asbe containing materials among demolished building debris, demolition arrangements not recorded in writing, the site not securely locked or relevant warning signs and no welfare facilities present on site.

SAFETY NEWS, SAFETY UPDATE

CLIENT PROSECUTED UNDER CDM 2015 FOR FAILING TO APPOINT A PRINCIPAL CONTRACTOR

JUNE 22, 2016 ROGER HART LEAVE A COMMENT

A company which failed to appoint a Principal Contractor under the CDM Regulations 2015 has been prosecuted and fined £50,000



Any client who has building work completed which falls under CDM must appoint a Principal Designer and Principal Contractor in writing – this is one of the key requirements placed on any client under the regulations.

The company was developing the New York Hotel in Porth when an investigation found that the company had failed to put in place appropriate measures to control risks from risk on site including fire, an Trading ply with

HSE conclude rare prosecution of designer under CDM Regulations

t 2013

Johnston and Partners LLP and Brims Construction Ltd en prosecuted under the CDM Regulations 2007 after a 2 rick archway collapsed injuring two workers. The incident d on a major refurbishment project at a former toffee in Newcastle, on 15 February 2011.

men were "shoring up" the arch after it become unstable he removal of masonry on one of the support pillars. One d a foot and the other injured his back in the incident.

tle Magistrates' Court heard that brick pillars adjoining the had been weakened after 'pockets' were created in the to hold steel beams, which were being installed as part of refurbishment of the former confectionary building.

rt was told the removal of the masonry caused the arch to unstable, as the pillar had acted as a buttress. The n of the arch was brought to the attention of Brims' site who instructed the two joiners to shore it up. A plan of as devised but it was not reviewed by Brims to check that it afe method of working.

pectors found that Cundall Johnston and Partners LLP had vided information in its designs to ensure those carrying out k would have known removing the masonry would cause way to become unstable. Brims Construction Ltd failed to d manage the work to deal with the unstable archway

gs must include 'sufficient information' on potential

Johnston and Partners LLP, of Newcastle pleaded guilty to a of Regulation 11(6)(c) and the company was fined £1,000 sts of £7,000. Regulation 11(6)(c) requires that a designer

Duty holders that fail to perform their duties under the CDM Regulations are taken to task for such failings

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Design Review and the GUIDE Process

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GUIDE 1: Concept Design Review

GUIDE 2: Detailed Design Review

GUIDE 3: Pre-Construction Design Review

GUIDE-1, 2 & 3 will be applied, where possible, at each stage of the design preparation process.

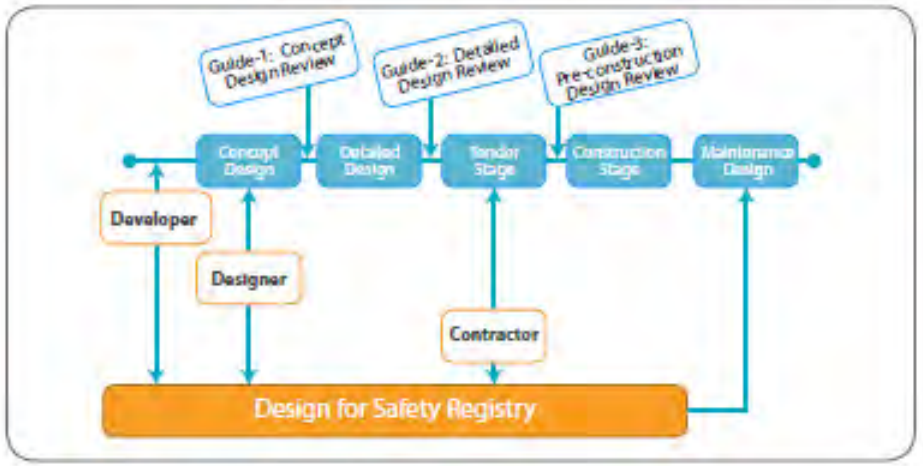


Figure 1: The GUIDE Process for typical contracts.

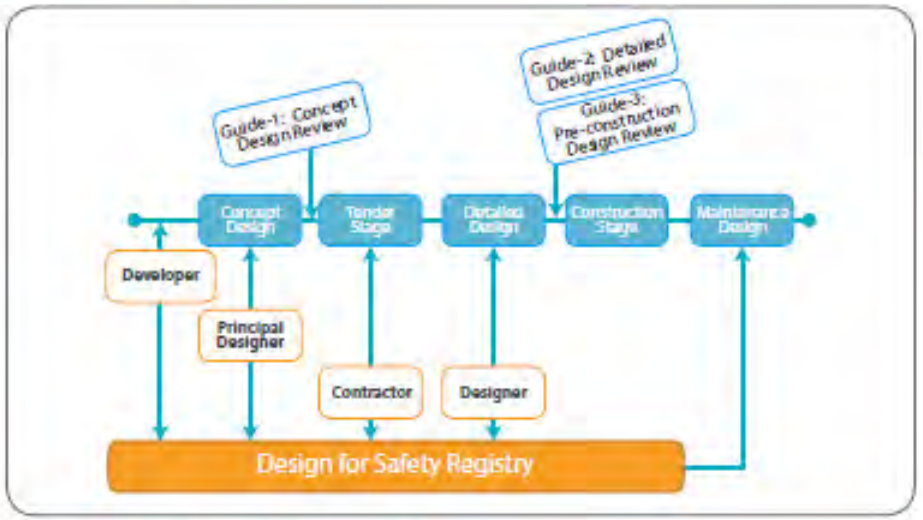


Figure 2: The GUIDE Process for D&B contracts.

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Case example



Kolkata Flyover Collapse (31/3/2016)

On 31 March 2016, part of the under Construction Vivekananda flyover in Kolkata India collapsed. 27 people were dead and more than 80 were injured in the accident.

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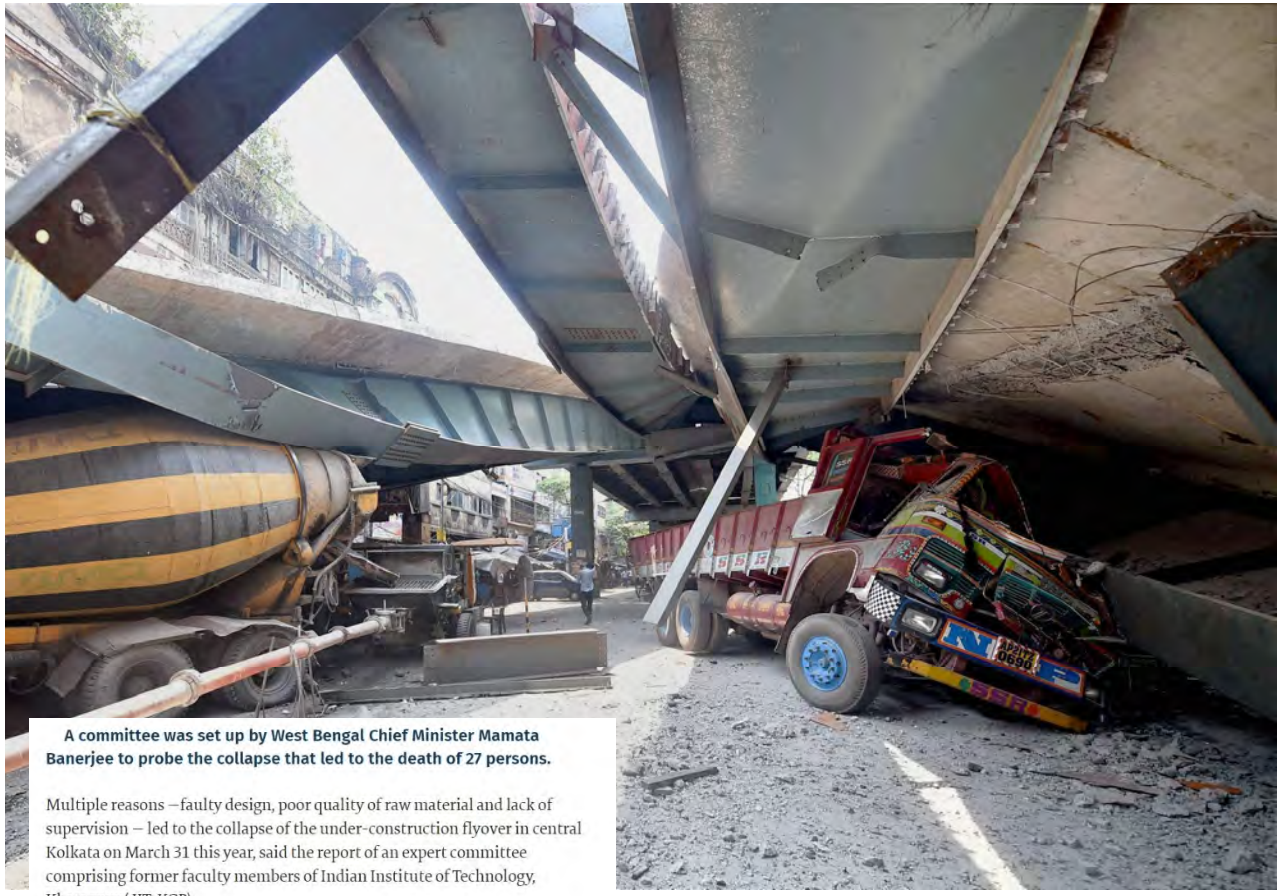
The construction of the 2.2km flyover was contracted in 2008 and work began in 2009. Construction was scheduled to complete in 2010, but overshot the deadline multiple times.



The company was given an 18 month deadline to complete the flyover by Feb 2016, but only 60% of the work were completed. As of March 2015, the contractor had a debt of US630mil.

On 31 Mar 2016, a 150m span of the bridge collapsed, trapping pedestrians and vehicles underneath.

- Were there issues with contractor evaluation?
- Were measures taken to ensure that persons appointed under the project had sufficient time and resources to perform their duties?
- Were design reviews carried out, and were issues relating to the design and construction of the structure addressed?
- Were there coordination meetings to allow persons to raise issues with regards to the design or construction?



A committee was set up by West Bengal Chief Minister Mamata Banerjee to probe the collapse that led to the death of 27 persons.

Multiple reasons – faulty design, poor quality of raw material and lack of supervision – led to the collapse of the under-construction flyover in central Kolkata on March 31 this year, said the report of an expert committee comprising former faculty members of Indian Institute of Technology, Kharagpur (IIT-KGP).

The committee was set up by West Bengal Chief Minister M
probe the collapse that led to the death of 27 persons.

"We have found defects in multiple aspects of the flyover co
design, the construction, the raw material and the supervisi
fault," Anandapran Gupta, former head of the department o
at IIT-KGP, told *The Hindu* on Thursday.

Along with Professor Gupta, another retired professor, Swapan Majumdar, from the structural engineering department of the IIT-KGP, was also probing the collapse, one of the worst civic disasters in the city. On August 10, the committee had submitted its report to the State government. The government had asked the panel of experts to decide on the future of the flyover – whether the State government should complete the work or dismantle the structure.

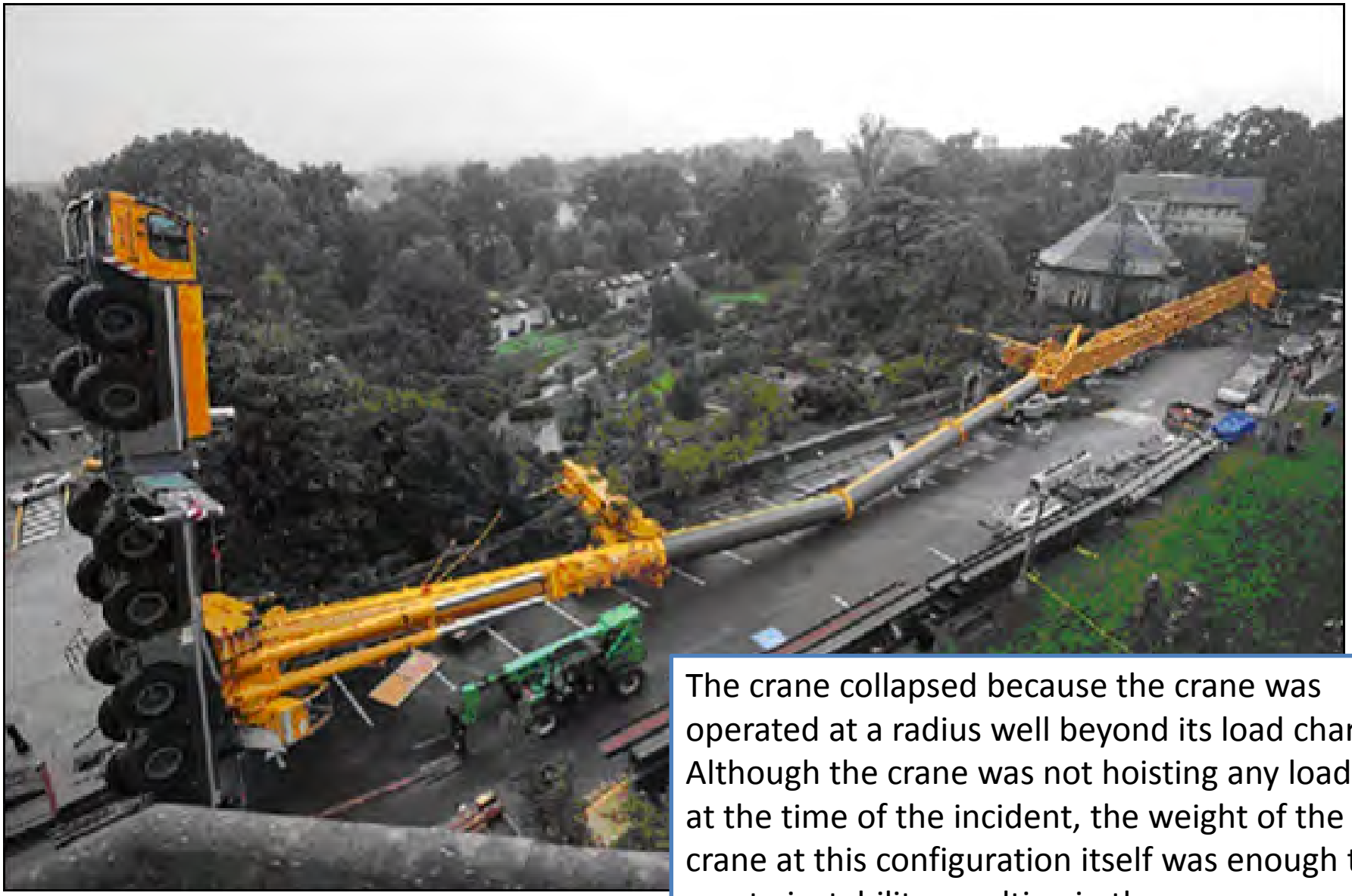
"The design, the construction, the raw materials and the supervisions, all were at fault"

Case example



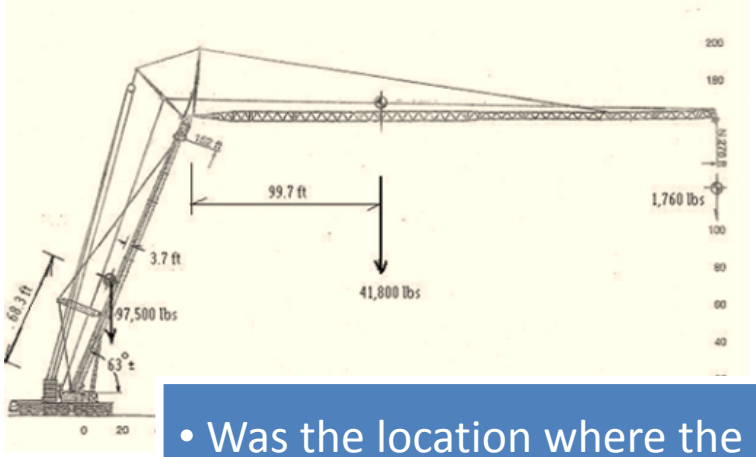


On Sep 7, 2011, a 500-ton mobile crane collapsed at the **National Cathedral at Washington D.C.** The crane had been working on securing the cathedral building after earthquake damage. The crane tipped, overturned and fell its full length. It damaged 3 parked vehicles and a historic structure. Fortunately there were no fatalities.



The crane collapsed because the crane was operated at a radius well beyond its load chart. Although the crane was not hoisting any load at the time of the incident, the weight of the crane at this configuration itself was enough to create instability resulting in the crane overturning.

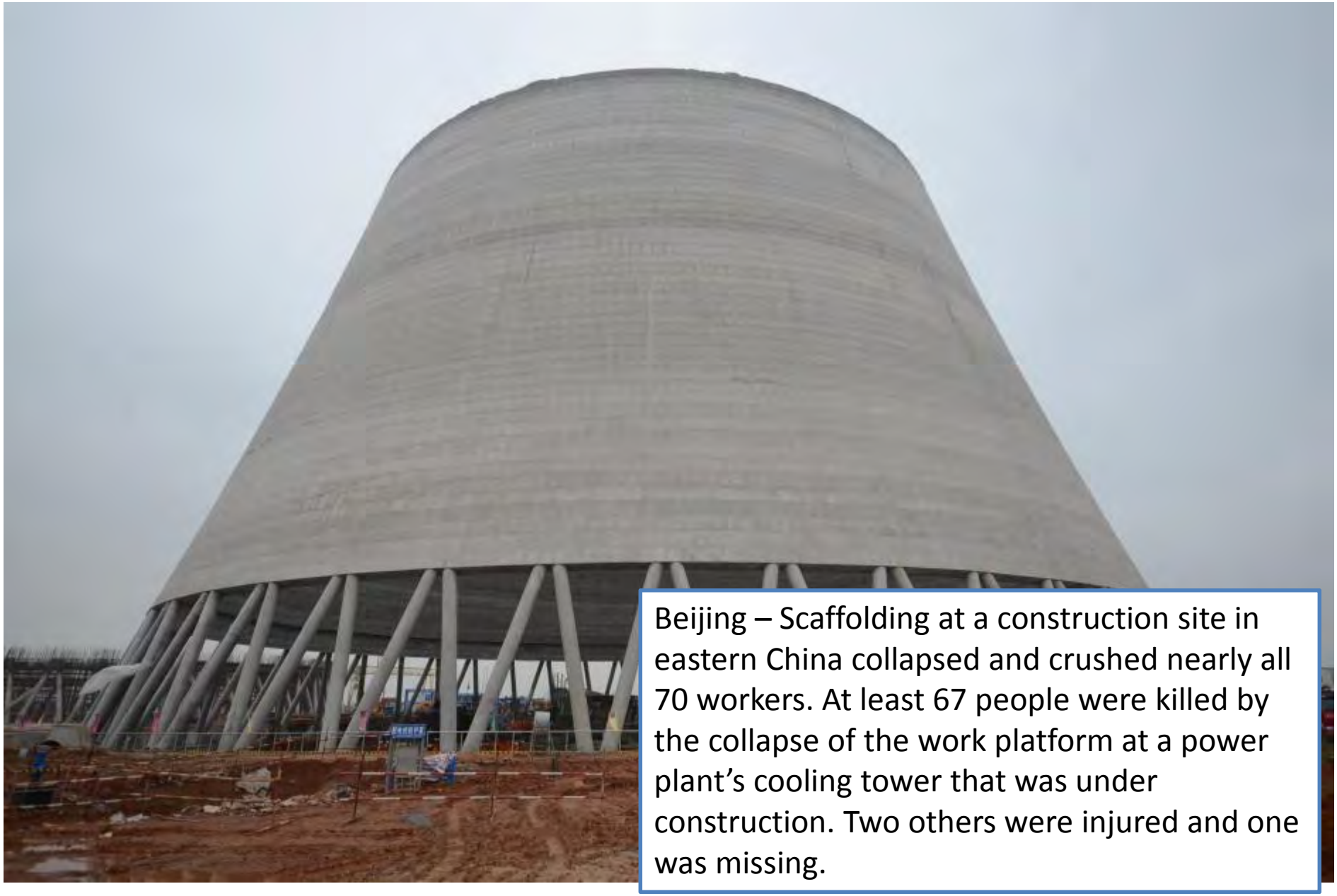






- Was the location where the crane was to be parked taken into account in assessing the load capacity of the crane?
- Could other means of lifting be employed?
- Is the ground condition properly assessed prior to lifting?
- Was the lifting operations adequately planned prior to commencement?

Case example



Beijing – Scaffolding at a construction site in eastern China collapsed and crushed nearly all 70 workers. At least 67 people were killed by the collapse of the work platform at a power plant's cooling tower that was under construction. Two others were injured and one was missing.


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- Was the temporary platform adequately designed for?
- Were checks carried out to ensure that the platform was properly erected?
- Was a PE engaged to assess the adequacy of the temporary structure prior to use?



Issues during Maintenance



Issues during Maintenance



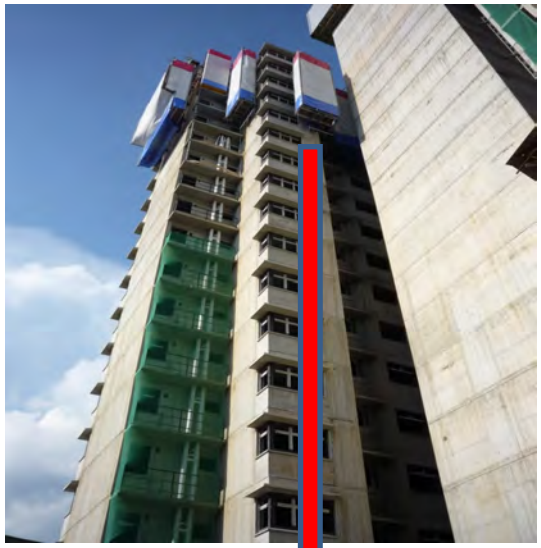
- How do you access the aircond ledge?
- Is the recessed area adequate for access?
- Is there an anchorage point for workers?

- Does the raised floor reduce the effectiveness of the parapet?
- Can railings be built up to address this?



Issues during construction

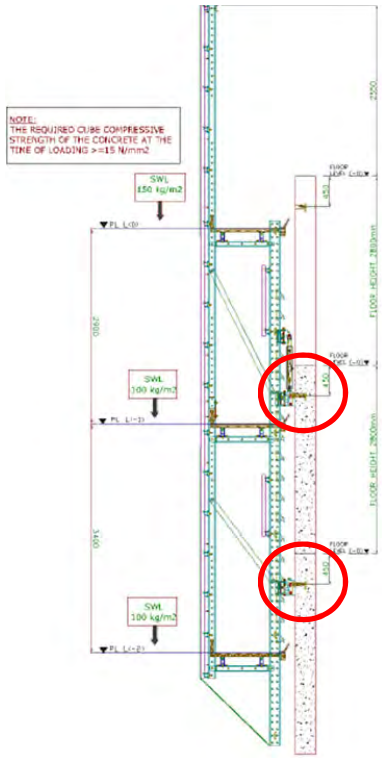
On 08 April 2015, at around 1330hrs, a safety screen collapsed from 16th storey to ground level, after it was installed. There were no injuries or property damage.





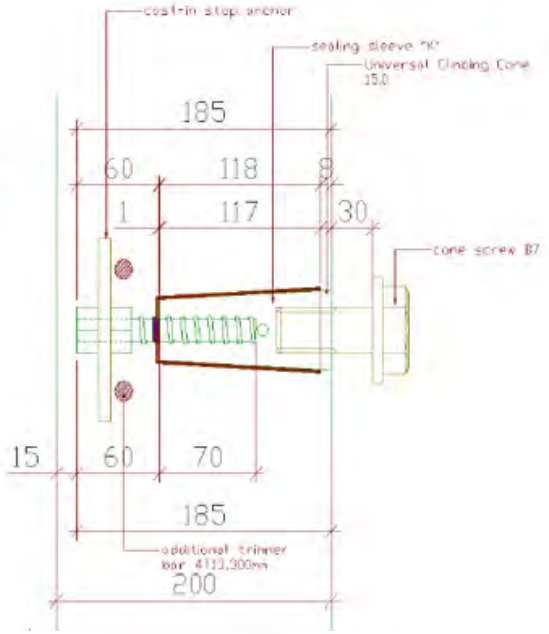


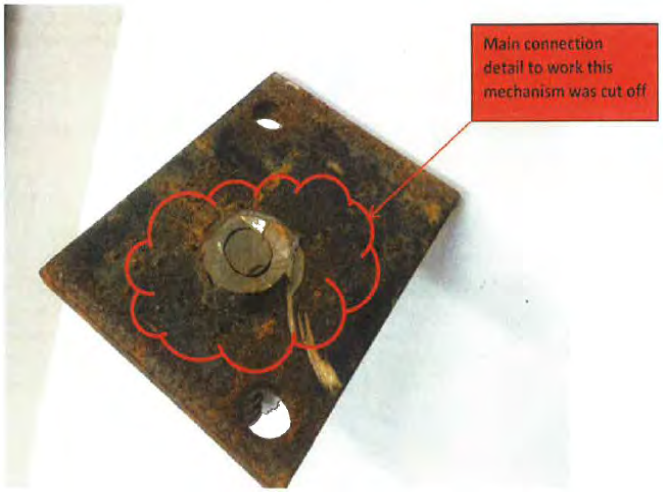




Anchor points

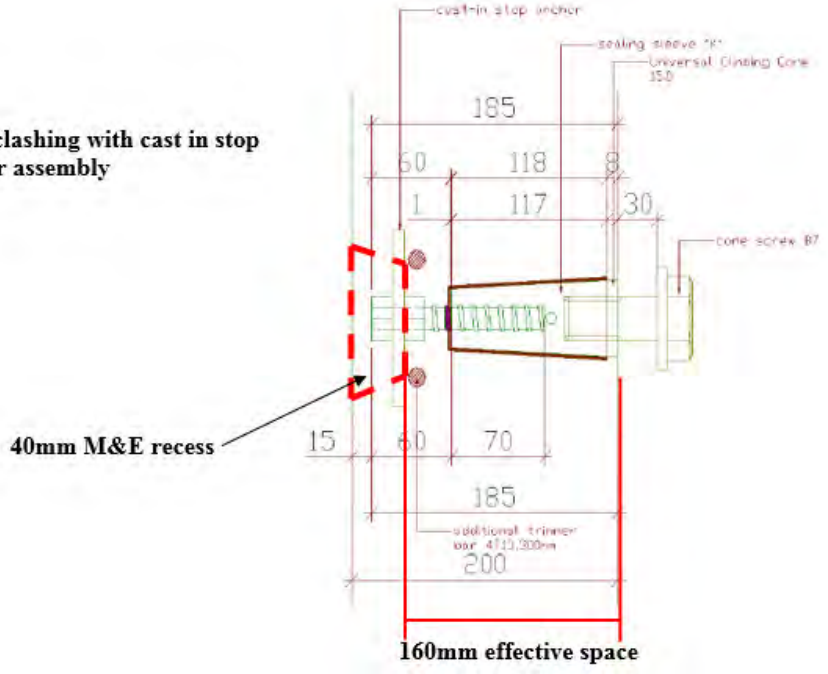
Cast in stop anchor assembly without 40mm M&E recess





40mm round nut behind the anchor plate was found to be deliberately cut off

40mm M&E recess clashing with cast in stop anchor assembly





WSH BULLETIN
WSH Alert

01 April 2016, Ref: 1516125

Dangerous Occurrence: Hanging Scaffold collapsed from 16th storey

On 08 April 2015, a hanging scaffold (safety screen system) with modified anchors which had been installed for about 10 minutes collapsed from 16th storey to ground level at a construction worksite located at Bukit Batok Street 21. The collapse could have resulted in the loss of lives.



Figure: Hanging scaffold collapsed from 16th storey

Recommendations

Persons in control of similar workplaces and work activities such as occupiers and employers are advised to consider the following risk control measures to prevent similar accidents:

Adequate Design

- Ensure that hanging scaffolds used are adequately designed to perform its intended functions.
- Ensure that installation, dismantling and modifications are in accordance to the manufacturer's method and design.

Supervision

- Provide adequate supervision by a competent person for all work activities to ensure that workers adhere to the safe work method at all times.
- Ensure that workers report issues immediately to their supervisor and do not carry out modifications to the hanging scaffold's components.

Maintenance Regime

- Establish a preventive maintenance programme in accordance with the manufacturer's recommendations. The regime should also be based on the environment and severity of use of the hanging scaffold where shorter intervals between maintenance than the recommended duration

- Are issues of incompatibilities or clashes in requirements resolved during DfS review meetings?
- Can reliance on supervision and visual verifications to ensure that anchor points are properly installed be replaced with better means of engineering control?

Study on accident cases in 2012

• Construction accident investigation reports for fatal accidents that occurred in the year of 2012 in Singapore were used in the analysis.
• A total of 25 cases in the construction industry were assessed.

Accidents that may have been prevented if design for safety elements were incorporated during design and construction stages (a)		Accidents that could have been mitigated if proper measures were implemented during construction (b)	Accidents that cannot be assessed due to insufficient information or could not be prevented even if proper design or measures were taken
44%		44%	12%
Design stage	**Construction stage**		
24%	20%		

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Conclusion

Accidents can be prevented if we work together in:

(i) Improvements to upstream processes where efforts would yield the highest returns in improvements to safety and health

(ii) Getting all stakeholders to be aware of their responsibilities and to take responsibility in safety and health





Thank you for your attention!

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