Safety Management

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Common Goals of Construction Projects

- **Deliver projects**
  - Within budget / On schedule
  - With the required quality

- **Is Safety also a Goal?**
  - **Safety is FIRST!** Nothing can replace human life.
  - A serious jobsite accident can ruin a company
    - Indirect costs, Schedule delays, Poor quality
    - Its reputation

We choose to go to the moon in this decade …carrying all the equipment needed for propulsion, guidance, control, food and survival, on an untried mission, to an unknown celestial body, and **then return it safely to earth…** **(Rice Univ., Sep. 12 1962)**

<John F. Kennedy>

Accident Examples

Investigators probe Brisbane workplace accident

Posted January 17, 2009 13:08:00

An investigation is underway into a workplace accident at a construction site in inner-city Brisbane.

A 24-year-old man was taken to hospital in a critical condition after he was hit by an excavator at the Adelaide Street site yesterday afternoon.

Police say it appears the man fell and the excavator drove over his legs.

Workplace Health and Safety officers are investigating.

How Do Construction Workers Die?

- **Fall Accidents** account for 33% of the construction worker fatalities

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"An employee was cutting rafter tails on the flat roof of the covered outside walkway of a school that was undergoing renovations. He was standing on the end of a rafter to cut it when the rafter broke at the notch and he fell 12 ft 10 in. to the ground. He was wearing a safety harness and shock-absorbing lanyard, but it was not tied off to the lifeline." (OSHA Inspection #119633477, 2004)

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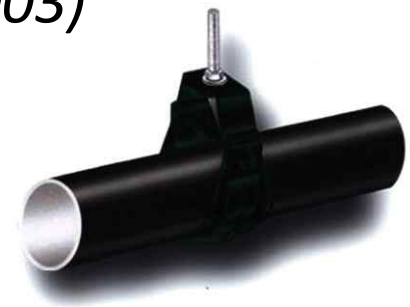
"An employee was installing utility piping in the lower levels of a high rise office building. The pipe hangers were installed into the concrete ceiling of the parking garage. One of the hangers pulled out of the concrete and the 3-in.-diameter steel pipe fell on the employee. The pipe struck him on the head, he did not wear an appropriate safety hat, resulting in a concussion and a fractured foot." (OSHA Inspection #300793882, 2003)



How Do Construction Workers Die?

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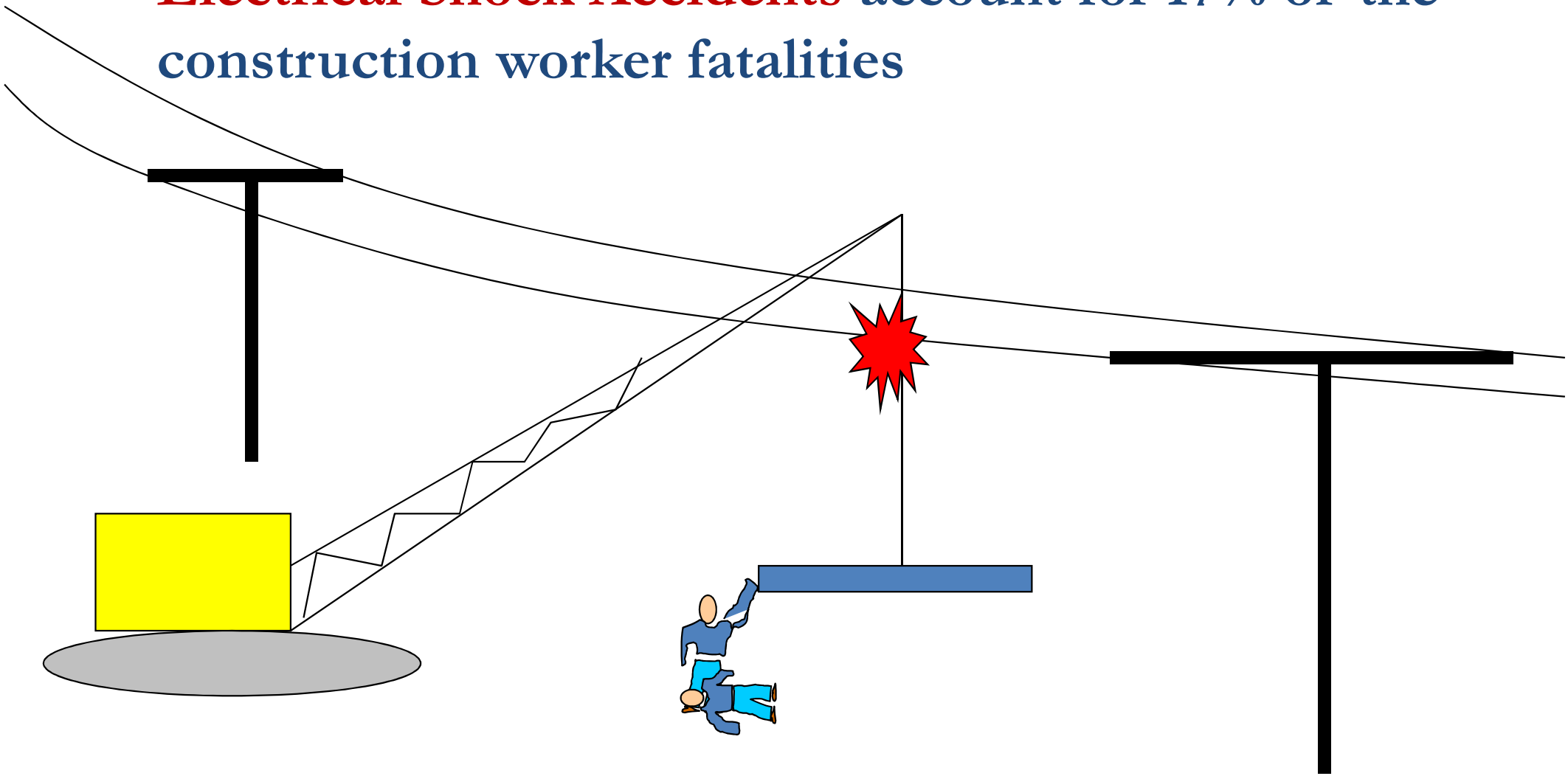
"An employee had started the two motors on a digger. This machine is used to bore holes for the installation of fencing. He left the operator's position to conduct a walk around inspection of the machine. While walking in front of the rotating auger, he slipped and fell. His gloved left hand was caught by the auger and he was pulled into the auger." (OSHA Inspection #307481002, 2004)

How Do Construction Workers Die?

- **Electrical Shock Accidents** account for 17% of the construction worker fatalities



How Do Construction Workers Die?

- **Electrical Shock Accidents account for 17% of the construction worker fatalities**

"An employee was installing a street light pole at a new bridge being constructed. The light pole contacted a 13,800 volt overhead power line, and he was electrocuted." (OSHA Inspection #313060675, 2009)

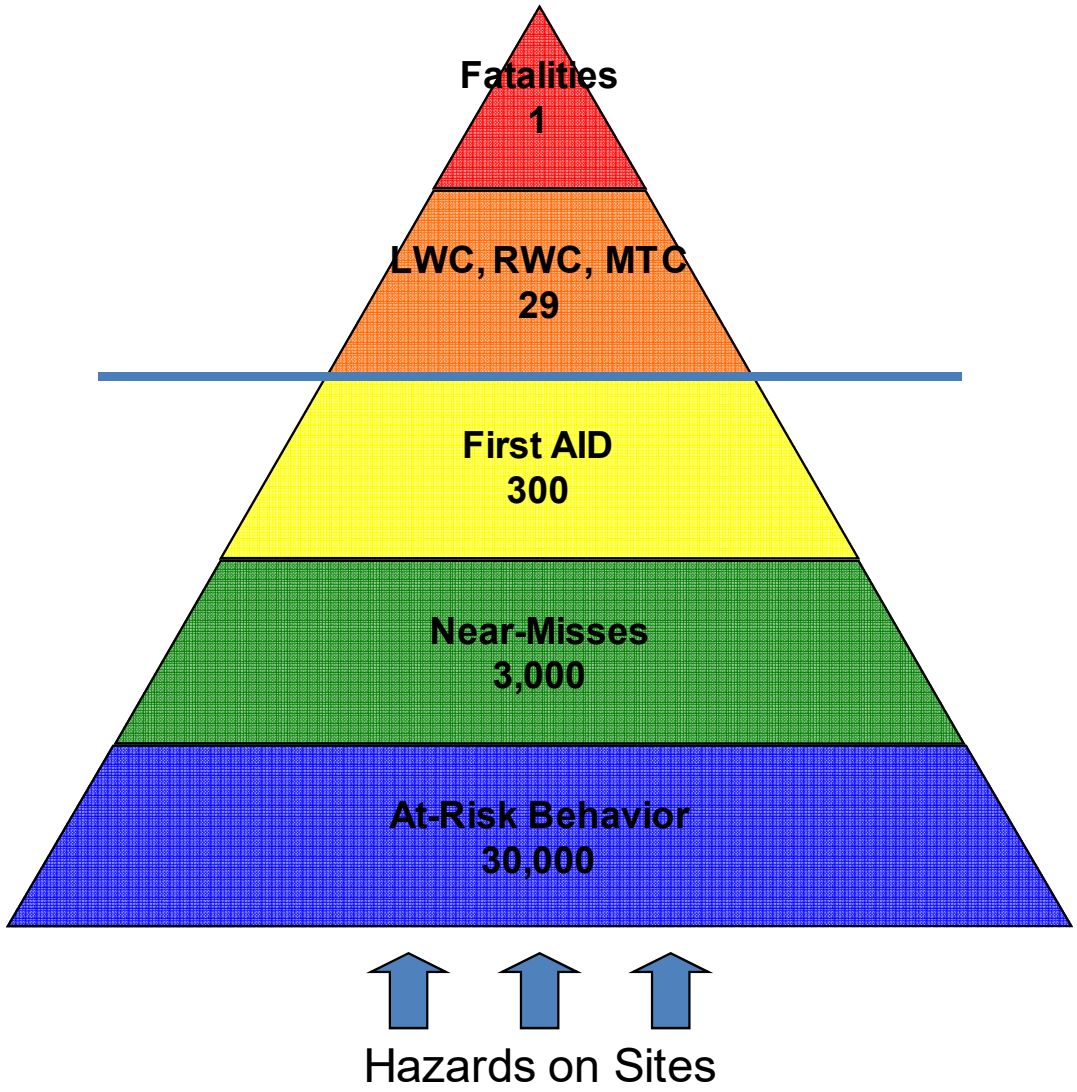
How Do Construction Workers Die?

- **Other Accidents** account for 10% of the construction worker fatalities – **Explosions**

How Do Construction Workers Die?

- **Other Accidents** account for 10% of the construction worker fatalities – **Fires**

Accident Categories



Fatalities: Deaths by accidents

LWC (Lost Workday Case): Injuries by which workers cannot return to work

RWC (Restricted Work Case): Injuries by which workers are reassigned to other duties or cannot perform the full range of normal duties

MTC (Medical Treatment Case): Injuries requiring medical care beyond first aid

First AID: Injuries requiring first aid treatment only

Near-Misses/At-Risk Behavior: Dangerous conditions with no physical harm

Accident Categories

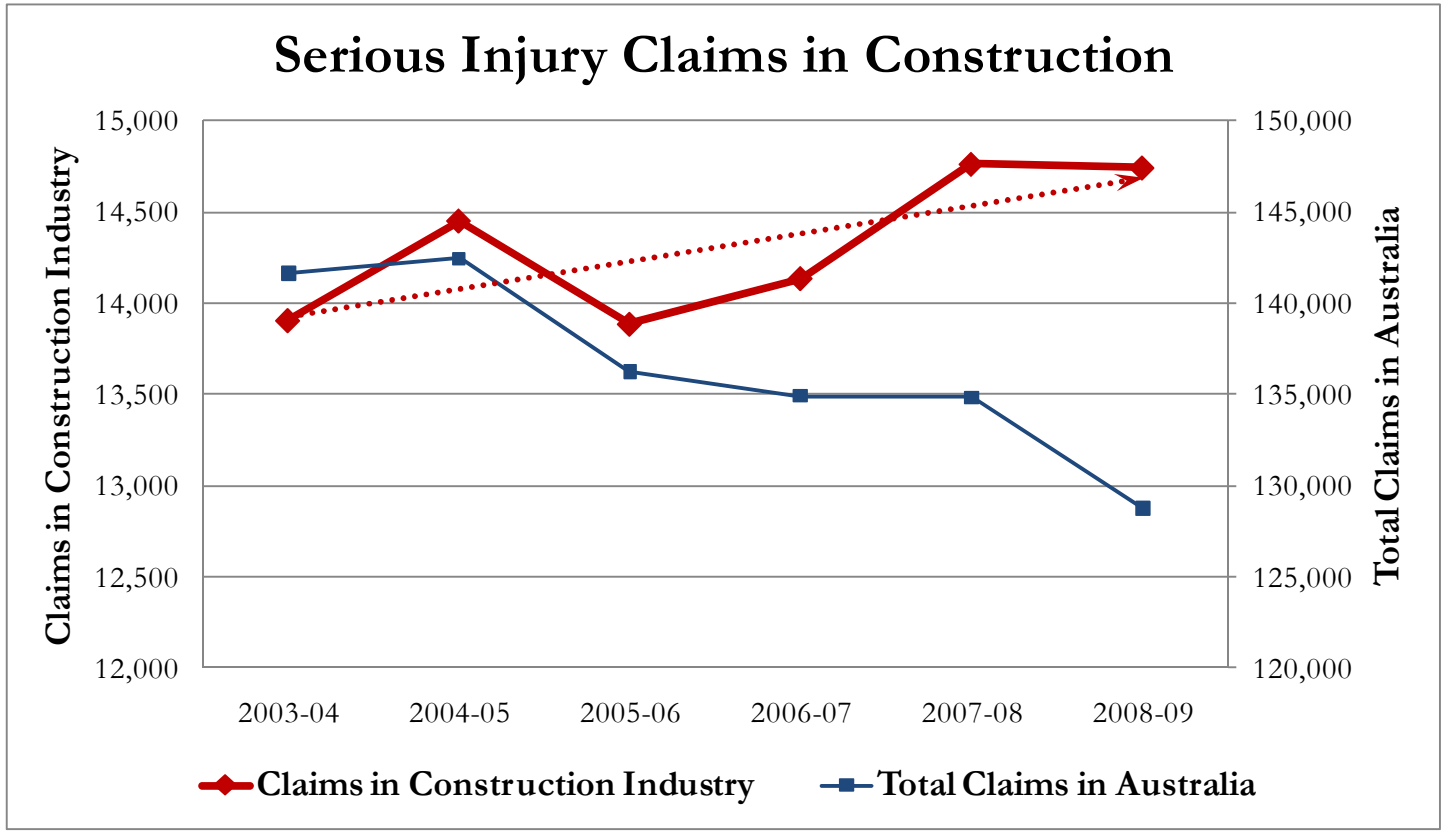
- **Recordable Injuries**
  - Injuries that require treatment by a physician
  - If a worker becomes unconscious at work
  - If a worker is injured and needs to be assigned to other work
  - All lost time injuries and fatalities
- **Not-recordable Injuries**
  - First aid cases, Near-misses, At-risk behaviour
  - X-Rays taken that confirm that a bone is not broken and the worker can continue to work.
  - Physician examines a worker but does not perform any treatment.

Safety Measurement

- **Injury Frequency**
  - Number of serious claims and fatalities
  - Recordable Incidence Rate (RIR) per 1,000 employees
  - Frequency rate per million hours worked
  - Time lost due to claims (working weeks)
  - Payment for claims (time lost, salaries, medical treatment)

Safety Measurement

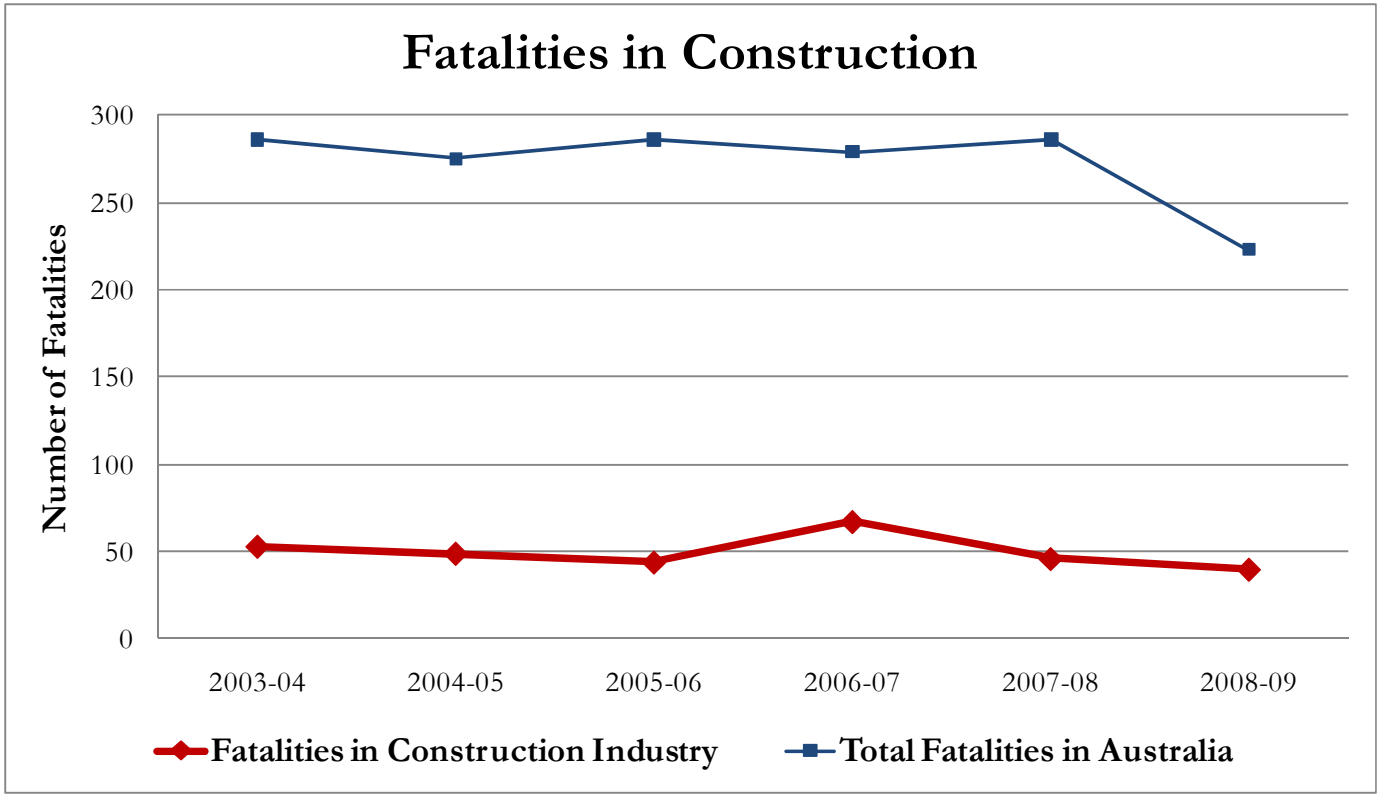
- **Number of Serious Claims**



– In 2008-09, every working day, an average of 40 construction workers got injured at construction sites!

Safety Measurement

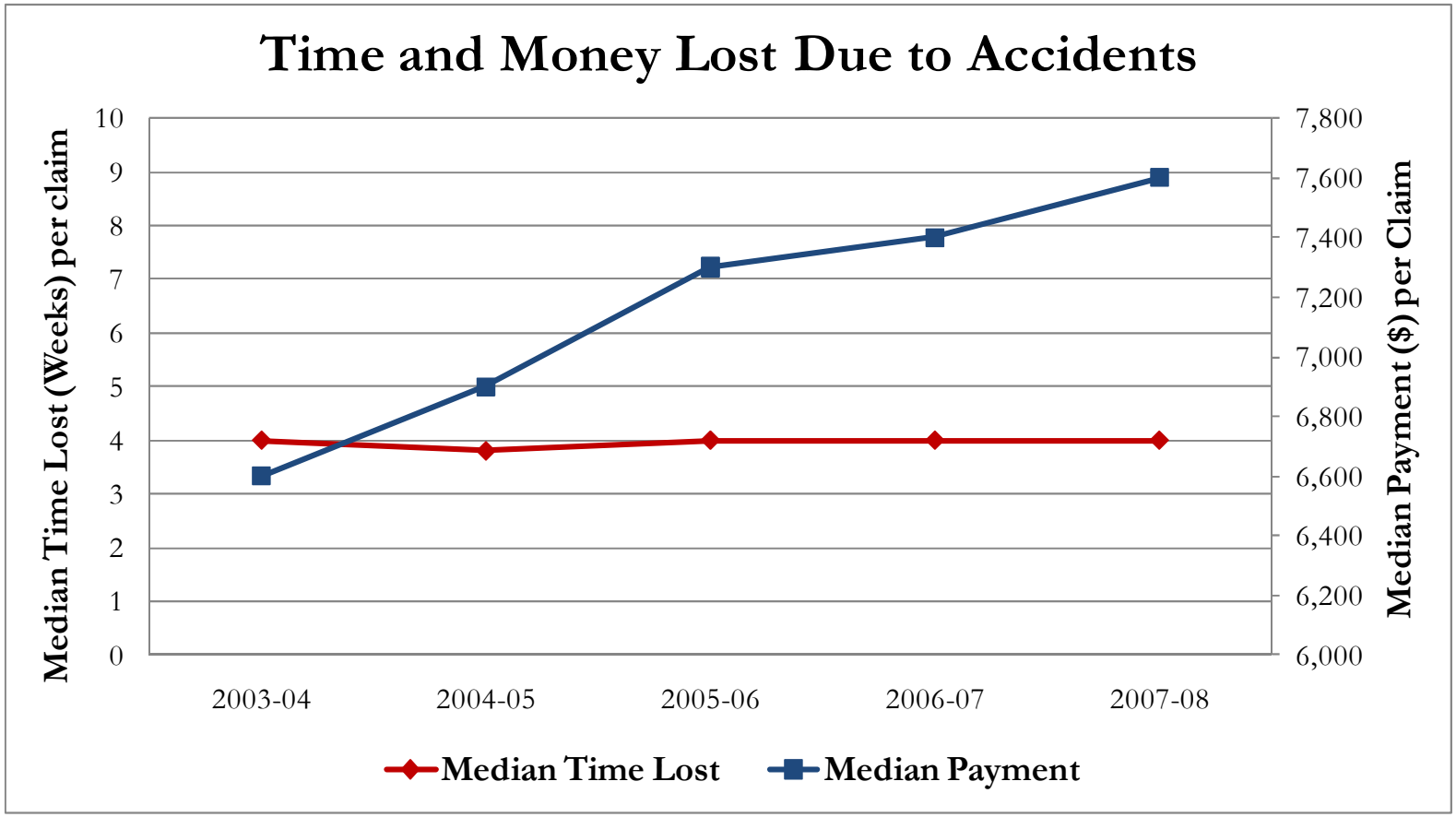
- **Number of Fatalities**



- In 2008-09, the Construction industry employed 926,400 people representing **9%** of the Australian workforce.
- Yet, about **18%** of the industrial fatalities occurred in construction!

Safety Measurement

- **Median Time Lost and Payment**



– In 2007-08, $7,600 × 14,760 claims = **$112 million**

Safety Management – Three "E"s

- **Education**
  - Safety planning meetings
    - Think through construction process
    - Anticipate safety risks and problems
    - Take actions to address them and perform work safely
    - Pre-project: safety goals, project risks, safety person and responsibility → Site-specific safety plan
    - Pre-task: job hazard analysis

Safety Management – Three "E"s

- **Risk Identification**
  - "An employee was using an extension ladder to paint and apply sealer to a house. He was beginning to move the fully extended ladder to a different location when it tipped over and contacted the overhead power line. Subsequent investigation found that his failure to retract the ladder before moving made it top-heavy and was the probable cause of its overturning." (OSHA Investigation Report #305493470, 2002)

Safety Management – Three "E"s

- **Risk Identification on Workplaces**
  - Possible environmental risk factors
    - Flying objects, overhead moving/falling objects
    - Gas, vapor, mist, fume, smoke, dust
    - Material handling equipment
    - Temperature or tolerance level
    - Working surface, site layout condition
    - Illumination
    - Noise level
    - Weather condition
    - Others

Safety Management – Three "E"s

- **Risk Identification on Workplaces**
  - Possible human risk factors
    - Misjudgment of hazardous situation
    - No or lack of PPE used
    - Safety device removed or inoperated
    - Inappropriate equipment operation
    - Inappropriate work procedure
    - Inappropriate material handling procedure
    - Distracted by others
    - Neuro/Muscular system malfunction
    - Others

Safety Management – Three "E"s

- **Risk Identification on Highway Work Zones**
  - Driver at fault
  - Illumination
  - Weather condition
  - Road surface condition
  - Road geometric alignment
  - Speed limit
  - Work zone safety equipment
  - Signage failure
  - Others

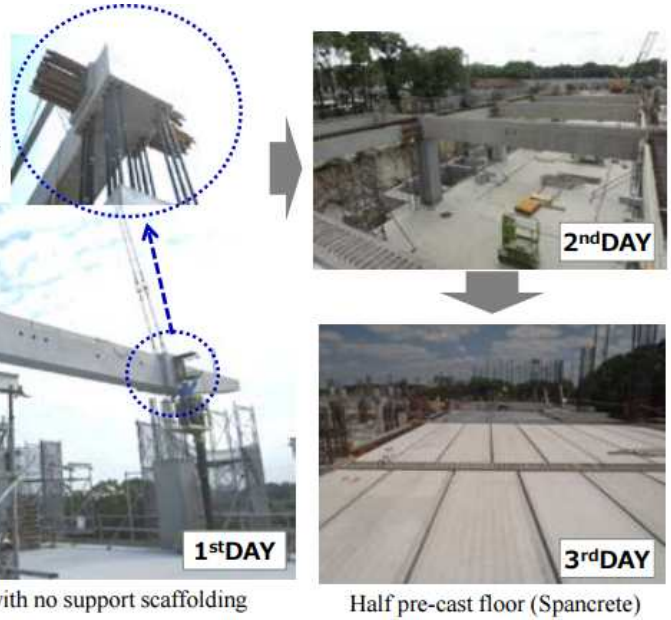
Safety Management - Engineering

Fig.18 Overview of upper stand making in 2.5month

Pre-cast pile cap

Installation of pre-cast pile cap

Overview of pre-cast foundation

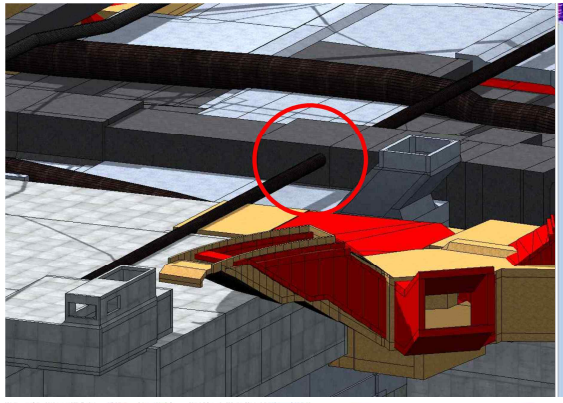


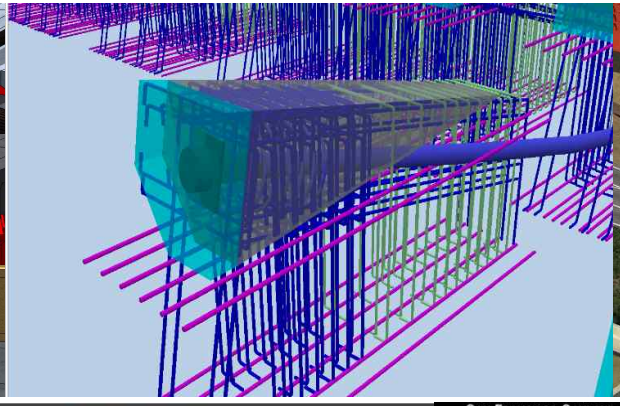
PRC beam installation with no support scaffolding

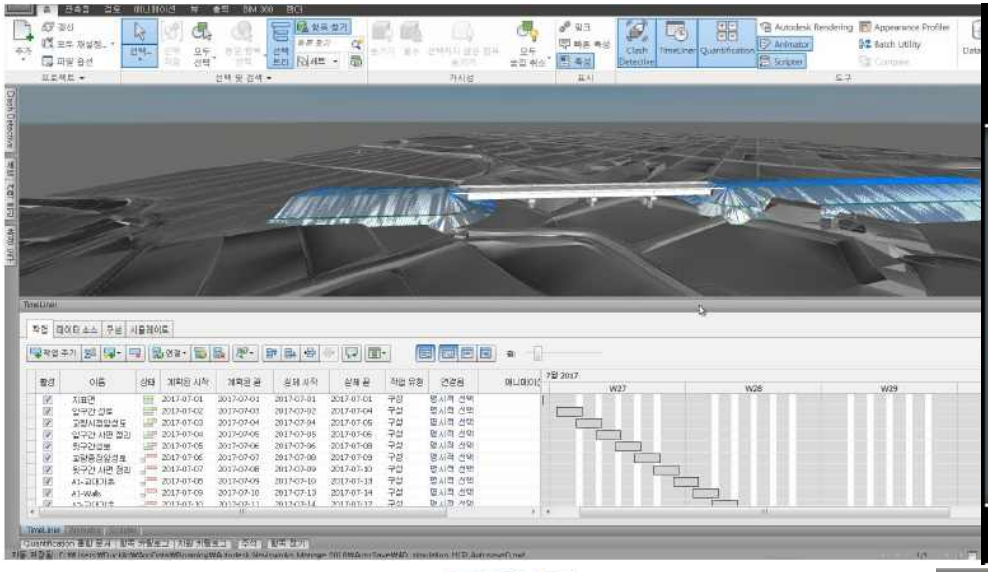
Half pre-cast floor (Spancrete)

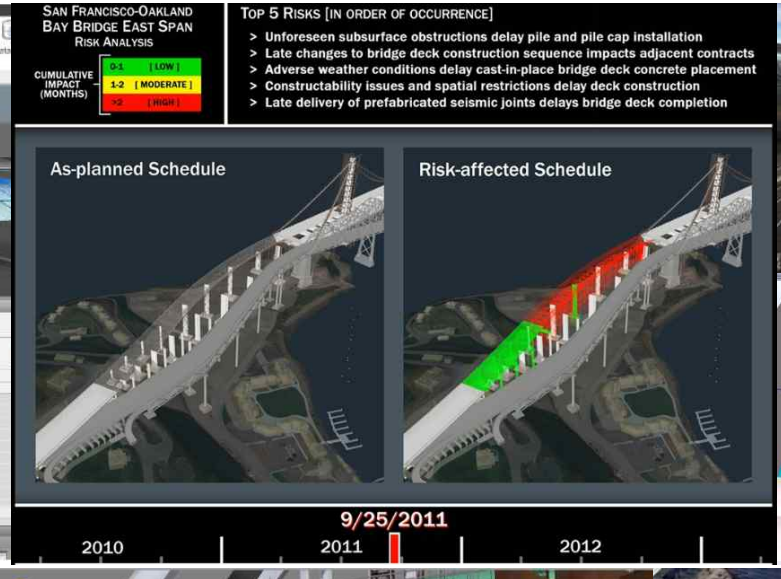
출처: Susumu Matsuo(2017), The International Conference of Construction Project Delivery Methods(Takenaka)

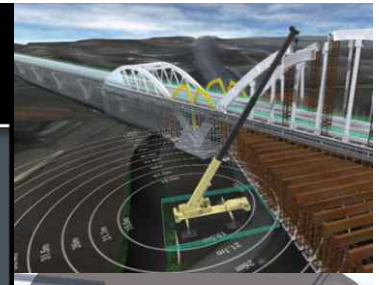
BIM

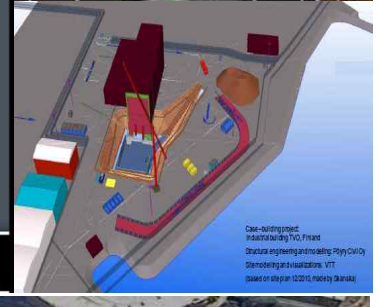


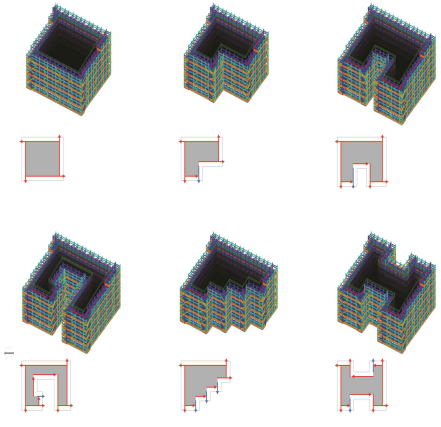


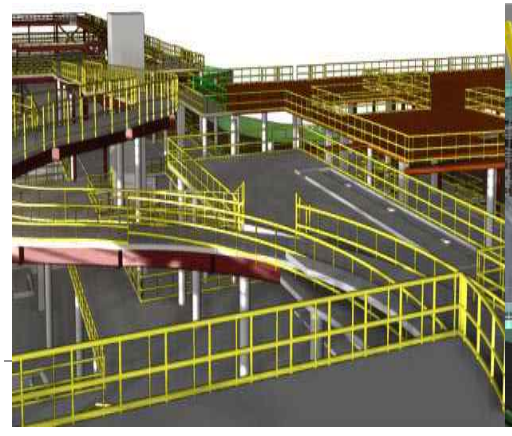



San Francisco-Oakland Bay Bridge East Span Risk Analysis
Cumulative Impact (Months)
0-1 [LOW]
1-2 [MODERATE]
>2 [HIGH]
Top 5 Risks [in order of occurrence]
> Unforeseen subsurface obstructions delay pile and pile cap installation
> Late changes to bridge deck construction sequence impacts adjacent contracts
> Adverse weather conditions delay cast-in-place bridge deck concrete placement
> Constructability issues and spatial restrictions delay deck construction
> Late delivery of prefabricated seismic joints delays bridge deck completion
As-planned Schedule
Risk-affected Schedule
9/25/2011
2010
2011
2012







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