



The Cooper Union

Safety In Construction
SPRING 2020

Ray Master

[constructionriskpartners.com](https://www.constructionriskpartners.com)

Agenda

- Overview
- Accident Investigation
- Technical and Sociotechnical Elements of Safety
- Safety Management vs. Safety Leadership

Putting People in the Picture

| | SUBJECTIVE | OBJECTIVE |
|--|---|--|
| I N D I V I D U A L | <u>INTENTION</u> VALUES ATTITUDE COMMITMENT RESPONSIBILITY EXPERIENCE | <u>BEHAVIOR</u> PLANS ACTIONS DECISIONS PERFORMANCE ACCURACY |
| G R O U P | <u>CULTURE</u> SHARED VALUES ETHICS MORALE MYTHS AND LEGENDS JUSTICE FAIRNESS COVENANTS | <u>SYSTEMS</u> ORGANISATIONAL STRUCTURES WORK PROCESSES POLICY AND PROCEDURES SHARED METRICS CONTRACTS |

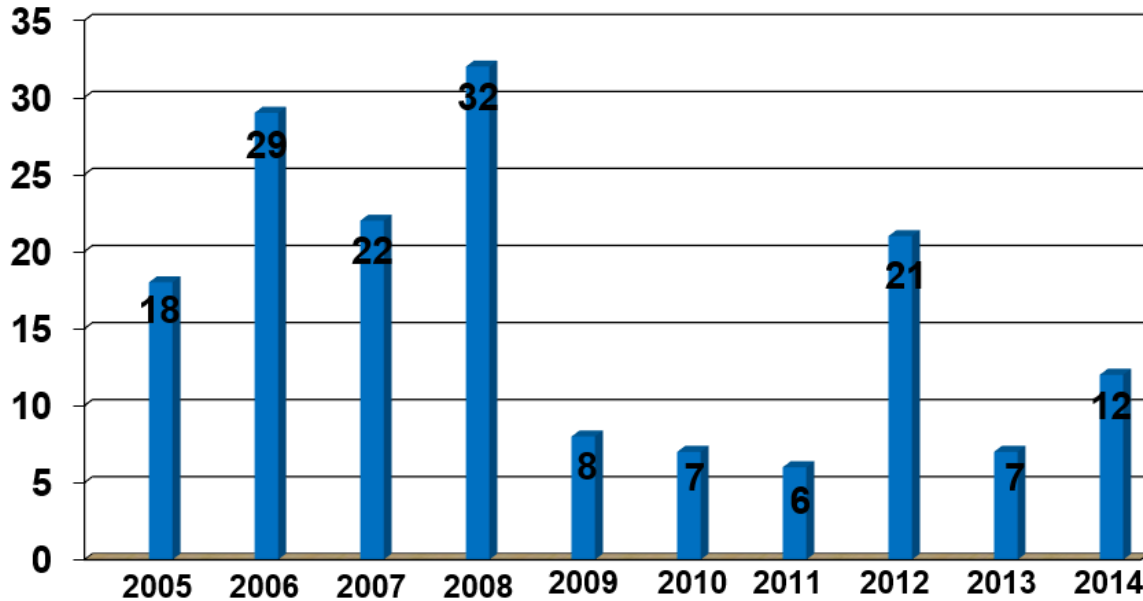
An Integral Approach to Safety

© JMJ Associates 1998

(Adapted from a model created by Ken Wilber)

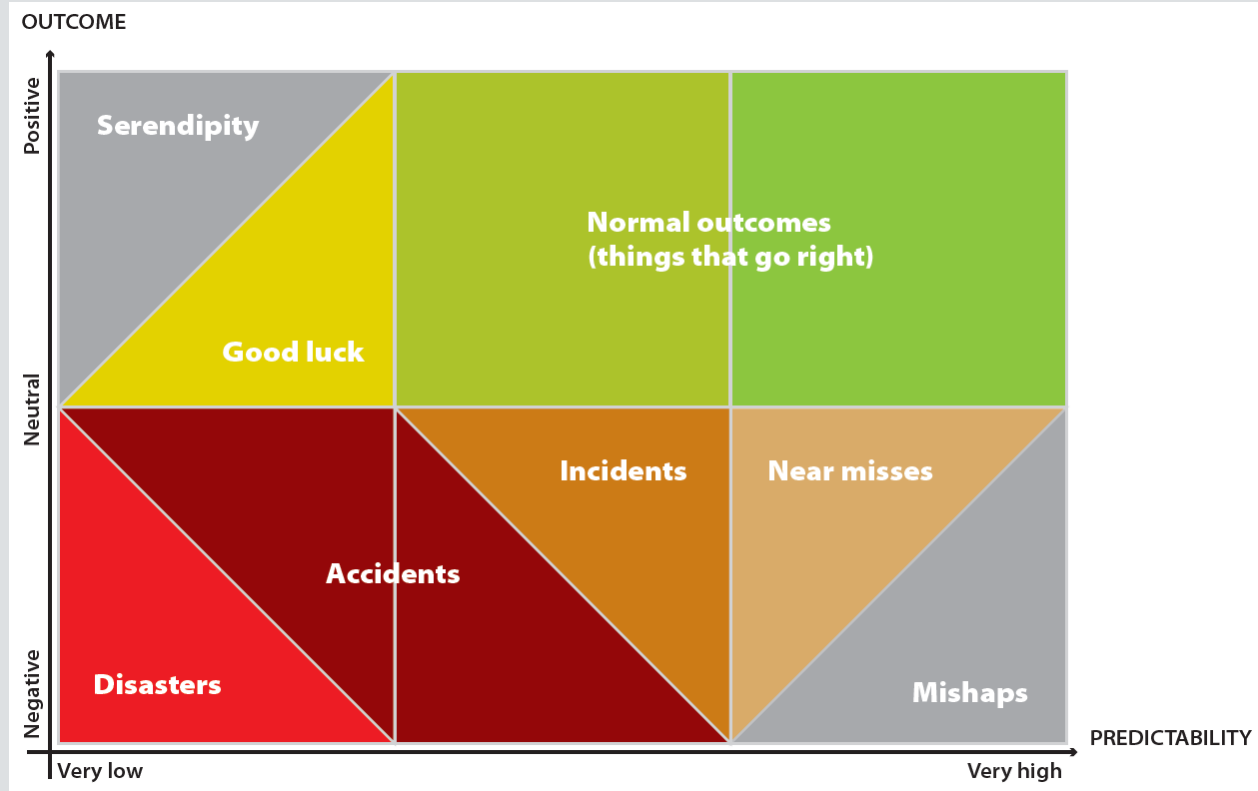


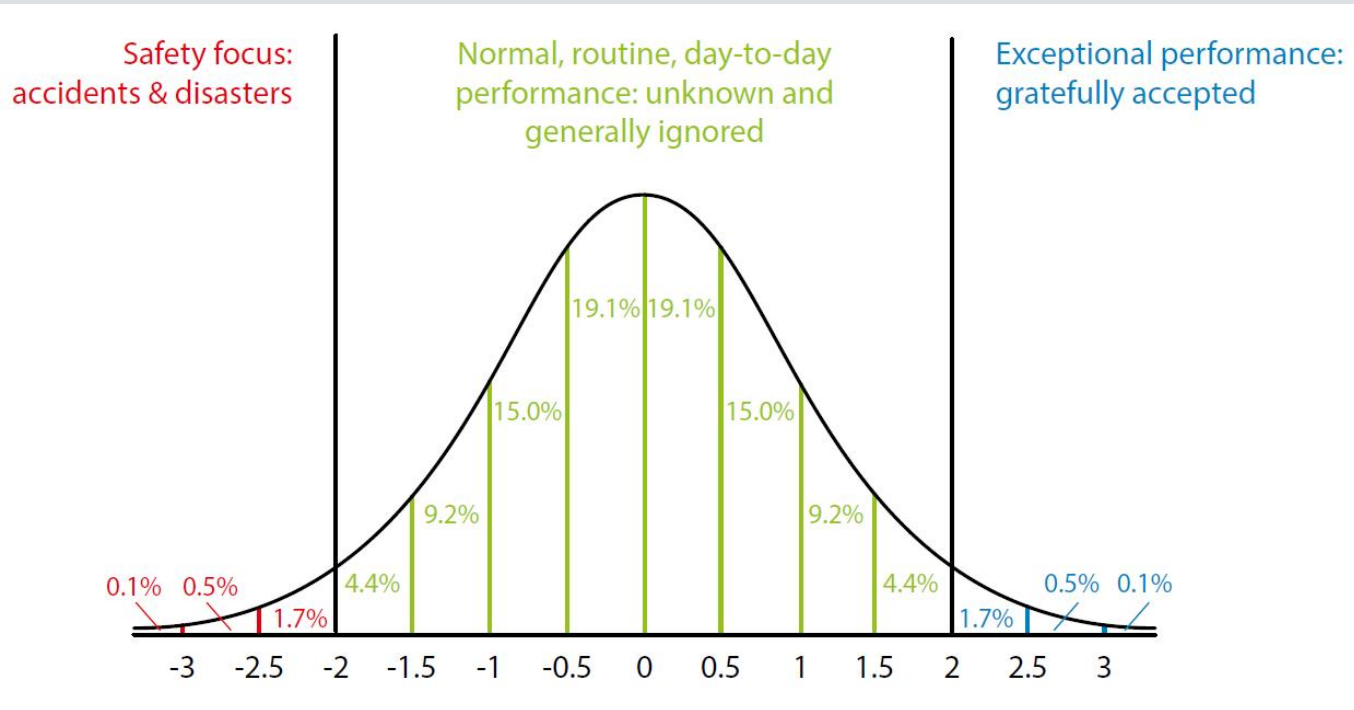
Construction workers killed



Source: OSHA data for NYC (5 boros) by Federal fiscal year (10/01 – 9/30)



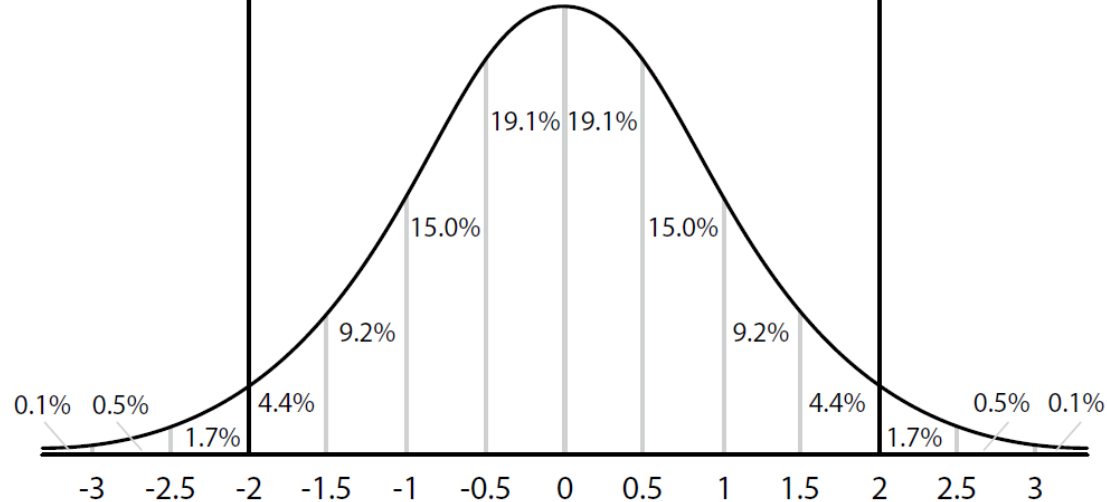




Easy to see
Complicated aetiology
Difficult to change
Difficult to manage

'Difficult' to see
Uncomplicated aetiology
Easy to change
Easy to manage

Easy to see
Complicated aetiology
Difficult to change
Difficult to manage



Design
(tools, roles, environment)



Work-As-Imagined

Work & production planning
("lean" - optimisation)



Work-As-Imagined

**Safety management,
investigations & auditing**



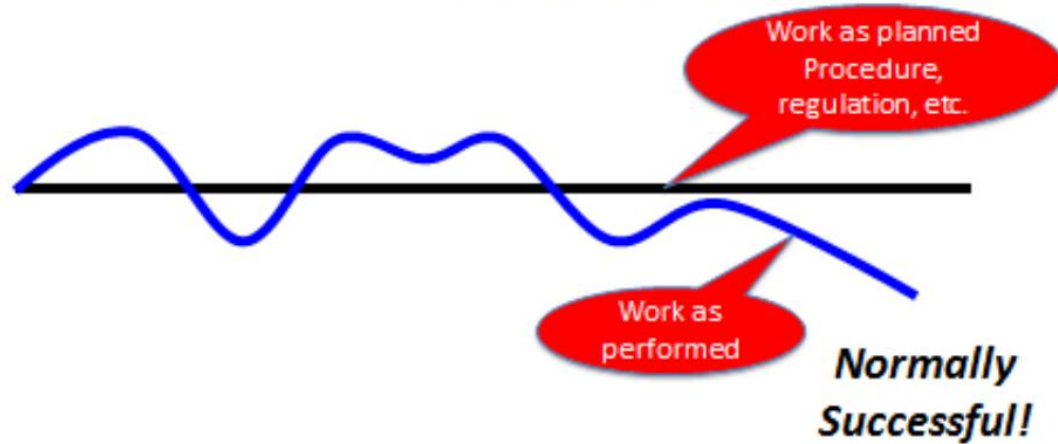
Work-As-Imagined



Work-As-Done



Work as Planned vs. Work as Performed



(Conklin / Edwards)

Our Response

- More code, procedures and rules
- Fix workforce through training
- Enforcement and Discipline
- Citations, Fines and Violation Notices
- Criminal Penalties
- Engineer, Educate & Enforce

- Bottom Line: HUMAN ERROR



The Heinrich 300-29-1 Model

Heinrich's Safety Triangle 1930AC

Catastrophe

1

Fatality

10

Serious Injury

100

Minor Injury

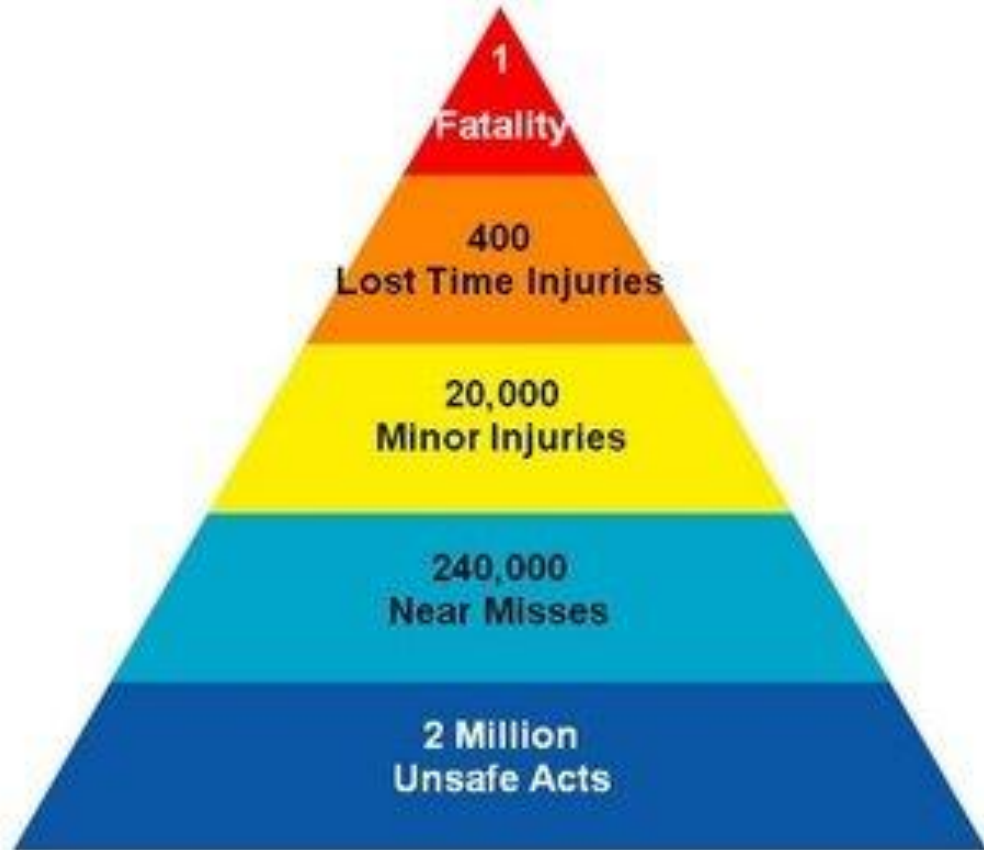
1000

Near Miss

10000



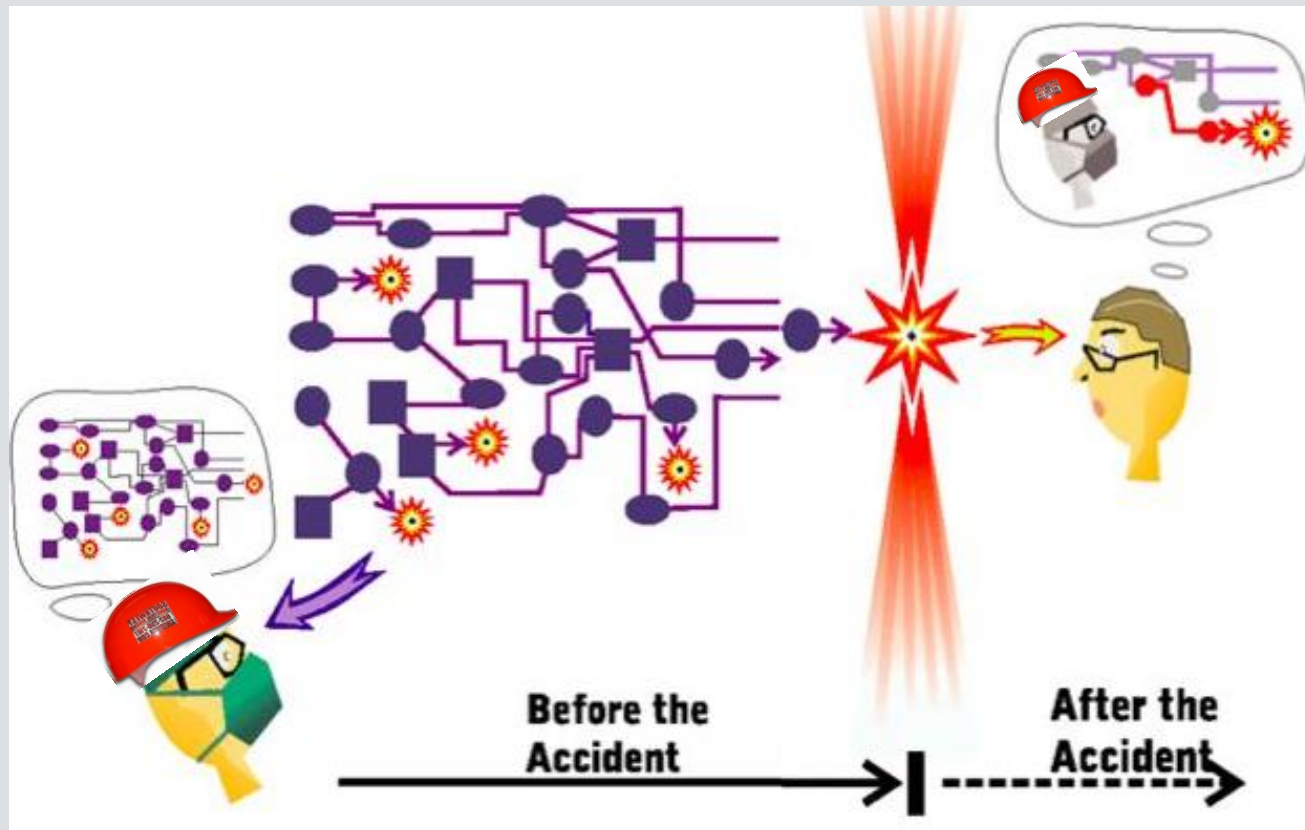
Heinrich's Triangle Theory



As Investigators:

Cognitive Bias

- **Cognitive Dissonance**: the mental discomfort (psychological stress) experienced by a person who simultaneously holds two or more contradictory beliefs, ideas, or values.
- **Fundamental Attribution Error**: You judge others on their character, but yourself (the organization) on the situation
- **Hindsight Bias**: With knowledge of the outcome of the event, you exaggerate the knowledge of the probability of that outcome. (Complex things look simple, linear).
- **Outcome Bias**: Refers to the influence of the outcome knowledge on decisions that led up to that outcome.



Source: Richard Cook

Local Rationale Principle

- What people do makes sense to them at the time
- What they are doing right before an accident makes total sense to them; that's why they are doing it
- WHY?

“If you don’t understand why it made sense for people to do what they did – then your perspective is off, not theirs.” - Jens Rasmussen

Systems Thinking

The process of understanding how things influence one another as a whole

Sociotechnical systems (i.e., a company) not as a structure consisting of constituent departments but as a complex web of dynamic, evolving relationships and transactions.



Systems Thinking

Mistake, mishap, and disaster are socially organized and systematically produced by social structures. (Vaughan, 1996)

Successful systems produce failure as a normal, systematic by-product of its creation of success (Dekker, 2008)



Complexity Systems

- Networked
- Interdependencies
- Relationships
- Nonlinear - a change in the size of the input does not produce a proportional change in the size of the output
- Emergence - traits of a system which are not apparent from its components in isolation but which result from the interactions
- Adaptive - capacity to change and learn from experience



Systems Thinking

“If we have a system of improvement that’s directed at improving the parts taken separately, you can be absolutely sure that the performance of the whole will not be improved. The performance of a system depends on how the parts fit, not how they act taken separately.” Russ Ackoff



Construction Projects

- A complex, dynamic, resourced-constrained environment
- Teams must reconcile multiple opposing goals (cost, schedule, quality, safety)
- Constantly hunting for efficiencies
- Productivity gains by borrowing against safety margins in ways that are not measured or outcomes predicted
- All normal things to do
- Success and failure come from the same source



Complex Systems

- A complex, dynamic, resourced-constrained environment
- Teams must reconcile multiple opposing goals (cost, schedule, quality, safety)
- Constantly hunting for efficiencies
- Productivity gains by borrowing against safety margins in ways that are not measured or outcomes predicted
- All normal things to do
- Success and failure come from the same source



Design
(tools, roles, environment)



Work-As-Imagined

Work & production planning
("lean" - optimisation)



Work-As-Imagined

**Safety management,
investigations & auditing**



Work-As-Imagined



Work-As-Done

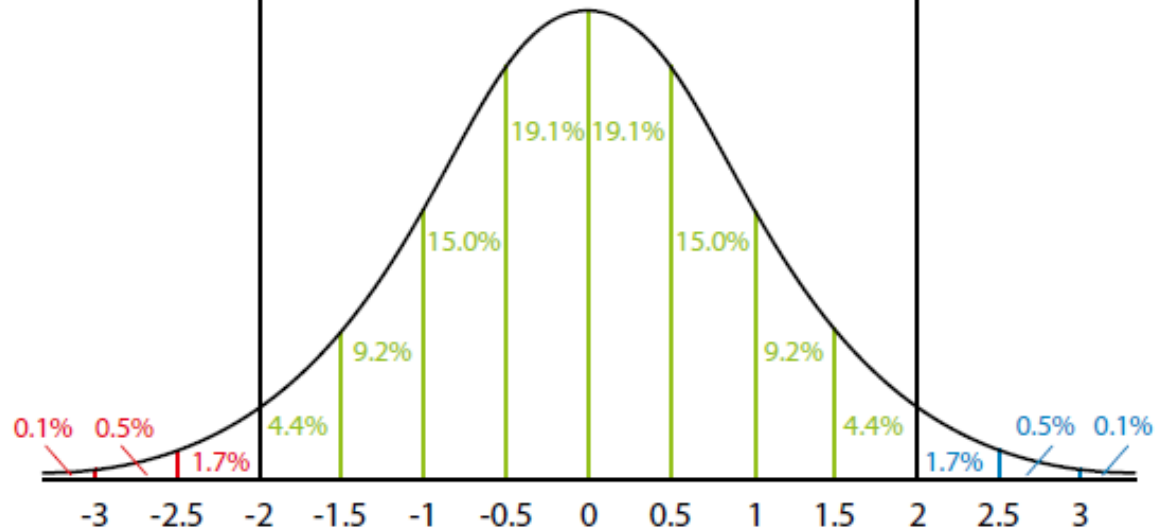


Source: Erik Hollnagel

Safety focus:
accidents & disasters

Normal, routine, day-to-day
performance: unknown and
generally ignored

Exceptional performance:
gratefully accepted



Source: EuroControl

Subjective

- Beliefs
- Values
- Intentions
- Points of View
- Perception
- Relationship
- Culture

- Transformative
- Adaptive Challenge
- Complex, Non-Linear
- Systems thinking
- Capability Oriented
- Possibility
- Context
- **Adaptive/Resilient**

Objective

- Procedures
- Rules
- Process
- Standards
- Inspections/Audits
- Laws

- Transactional
- Systems & Processes
- Technical Challenge
- Focus on Doing
- Simple, Linear
- Work Execution Oriented
- Probability
- Content
- **Control**

Socio -

- Beliefs
- Values
- Intentions
- Points of View
- Perception
- Relationship
- Culture

- Transformative
- Adaptive Challenge
- Complex, Non-Linear
- Systems thinking
- Capability Oriented
- Possibility
- Context
- **Adaptive/Resilient**

Technical

- Procedures
- Rules
- Process
- Standards
- Inspections/Audits
- Laws

- Transactional
- Systems & Processes
- Technical Challenge
- Focus on Doing
- Simple, Linear
- Work Execution Oriented
- Probability
- Content
- **Control**



Old View

VS.

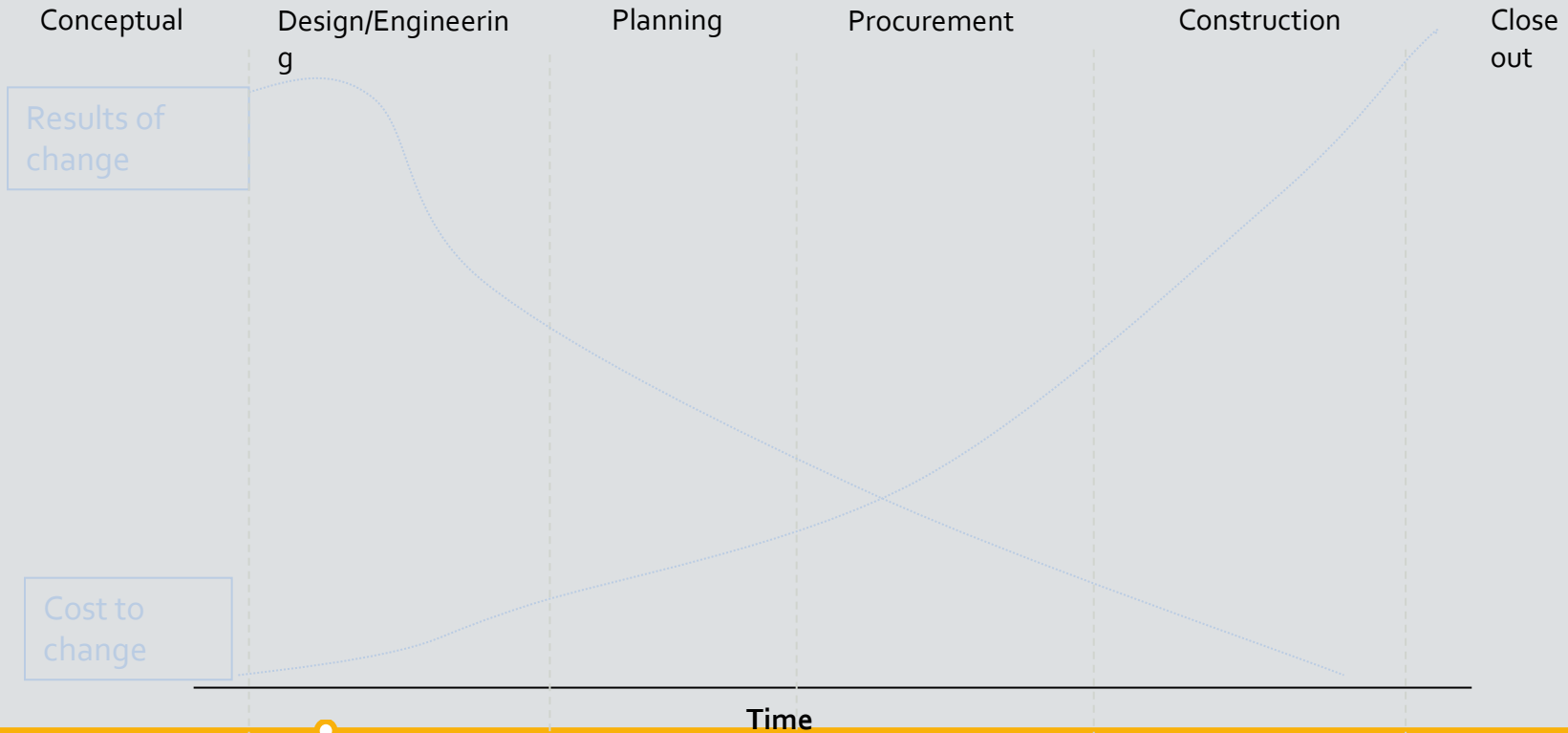
New View

- People are a problem to control
- The world works because people follow rules
- Safety is the absence of negatives
- Human error is the “*cause*” of trouble

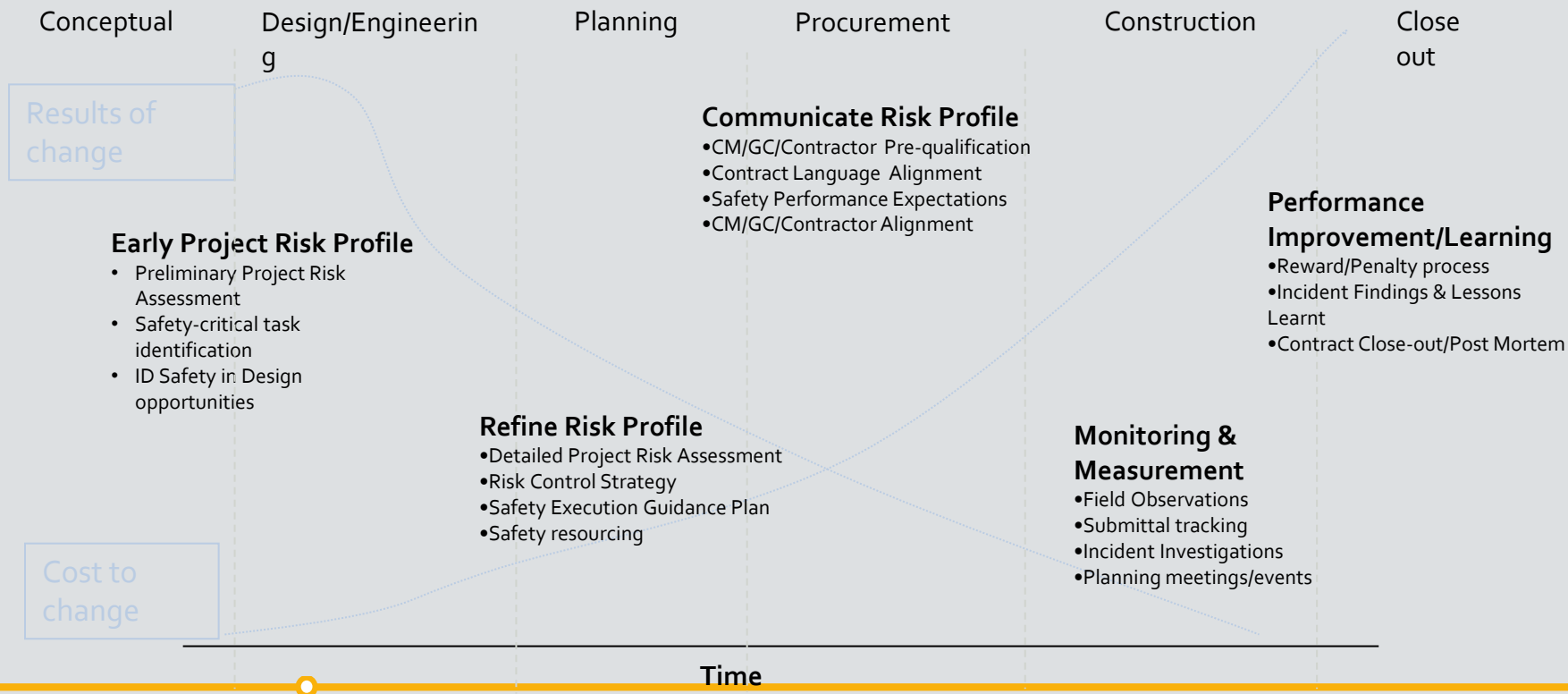
- People are a solution to harness
- The world works because people adapt (resilience)
- Safety is the presence of positives (how people create success; people create safety)
- Human error is a “*symptom*” of deeper trouble; starting point, not a conclusion



Project Life Cycle Model



Project Life Cycle Model – Safety Management Integration



thank you