Going Beyond Zero by Using
Safety Leading Indicators & Predictive Analytics

CFMA - Boston

April 9, 2013

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Key Industry Financial Indicators

The top key industry financial indicators are displayed below to give an overview of the most current industry trends. Click on each arrow to be taken to the detailed report for each indicator.

Agenda

- What is CII?
- The RT 284 Research Team
- Definition of leading indicators
- Common leading indicators
- Making leading indicators work in your company
- Zurich Construction Leading Indicator Construction research team findings
- Utilization of a system to track

What is the Construction Industry Institute?

- CII is based at The University of Texas at Austin and was formed in 1989
- It is a consortium of more than 100 leading owners and contractors from both the public and private sectors and more than 30 leading U.S. Universities
- These organizations have joined together to enhance the business effectiveness and sustainability of the capital facility life cycle through CII research, related initiatives, and industry alliances
- The result of this has been the creation of best practices and implementation tools in 15 key areas such as: Constructability, Front End Planning, Project Risk and Zero Accident Techniques

RT 284 Research Team
Safety Leading Indicators

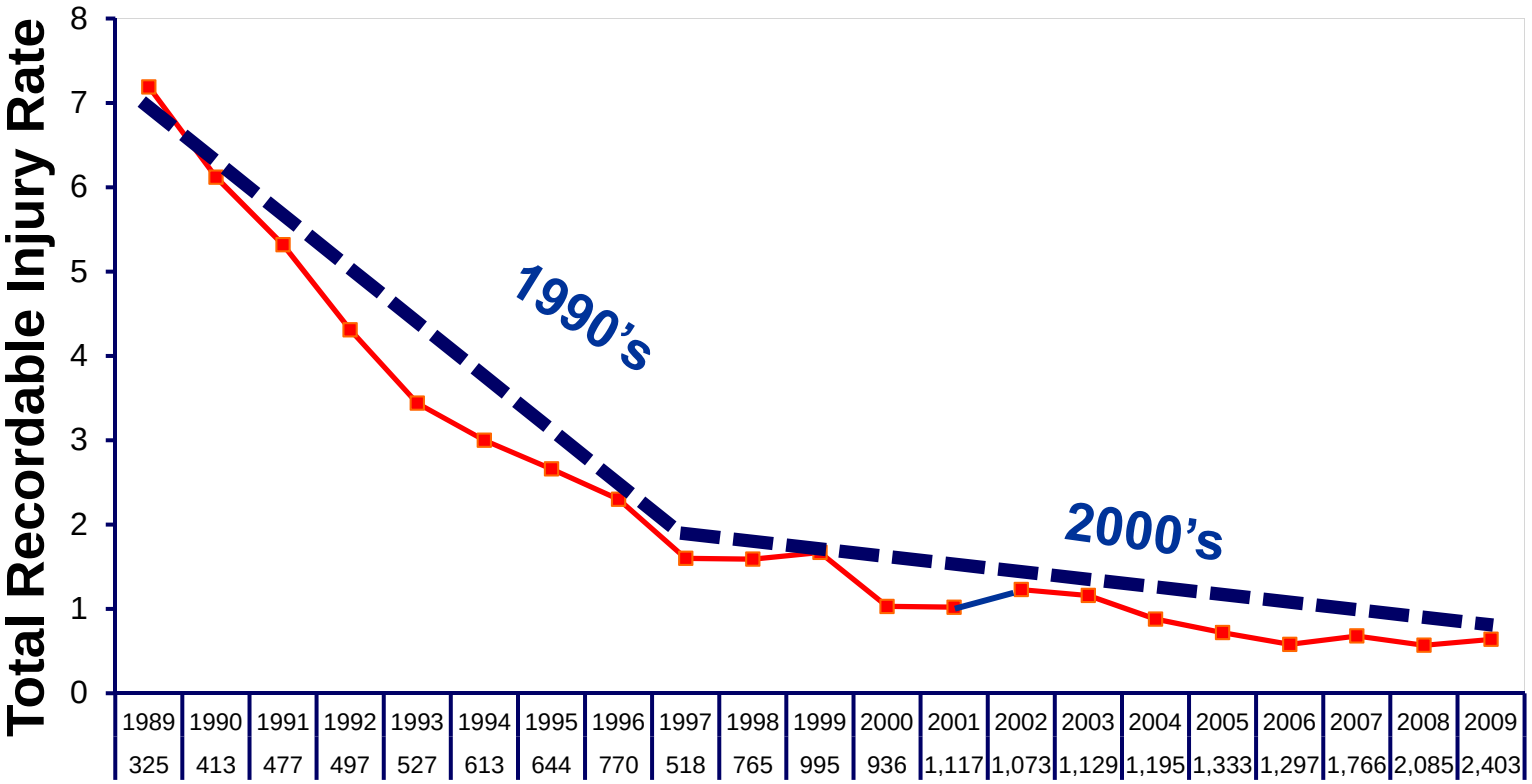
- Team of 20 individuals representing owners and contractors
- The two lead researchers were from the University of Florida and the University of Colorado at Boulder
- The team chair was Steve Trickel from Zachry and the vice chair was Dave Wulf from Conoco Phillips
- Two year research effort
- Finish Product
  - RT 284-1 Measuring Safety Performance with Active Safety Leading Indicators
  - RT 284-2 Implementing Active Safety Leading Indicators

History – 1993 – CII published Zero Injury Techniques & 2003 follow-up – Making Zero Accidents a Reality

1. Demonstrated Management Commitment
2. Staffing for Safety
3. Planning (pre-project and pre-task)
4. Safety Education: orientation and specialized training
5. Worker Involvement
6. Evaluation and recognition/reward
7. Subcontractor Management
8. Accident/incident investigations
9. Drug & Alcohol testing

- Plus – Fall Management program – with 100% 6' fall protection
- Safety in Design

CII TRIR Trends



What can we do to accelerate improvement?

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Scope of the Research

To identify the characteristics of passive and active leading indicators that most effectively predict safety performance on construction projects and to create a leading indicator measurement tool that facilitates the integration of leading indicators in a comprehensive safety program.

What are leading indicators?

Leading indicators are ***measures*** *of attitudes, behaviors, practices, procedures, techniques or conditions that influence construction safety performance*.

Another definition:

Leading Indicators are proactive measurable actions and/or results that may predict incidents, injuries and/or illness.

What are leading indicators?

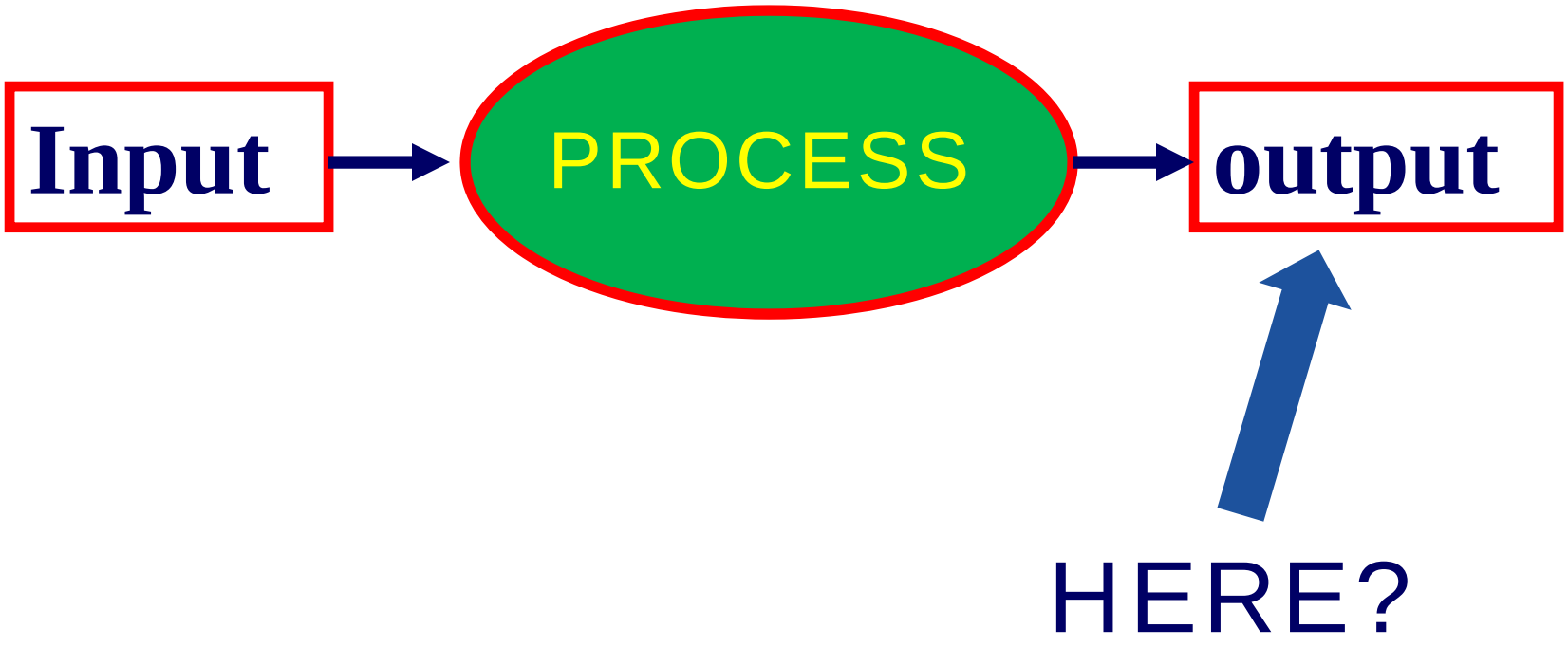
Passive Indicators – An indicator that does not have an actionable metric. Example - requiring pre-task planning takes place.

Active Leading Indicators – A metric that prompts a proactive response relative to the process it measures. Example – measuring whether pre-task plans are completed, by who, addressing appropriate hazards, reviewed with crews and reviewed for quality.

We will concentrate on Active Leading Indicators

Measurement is important to evaluate the efficiency of any process

Where should the measurements take place?



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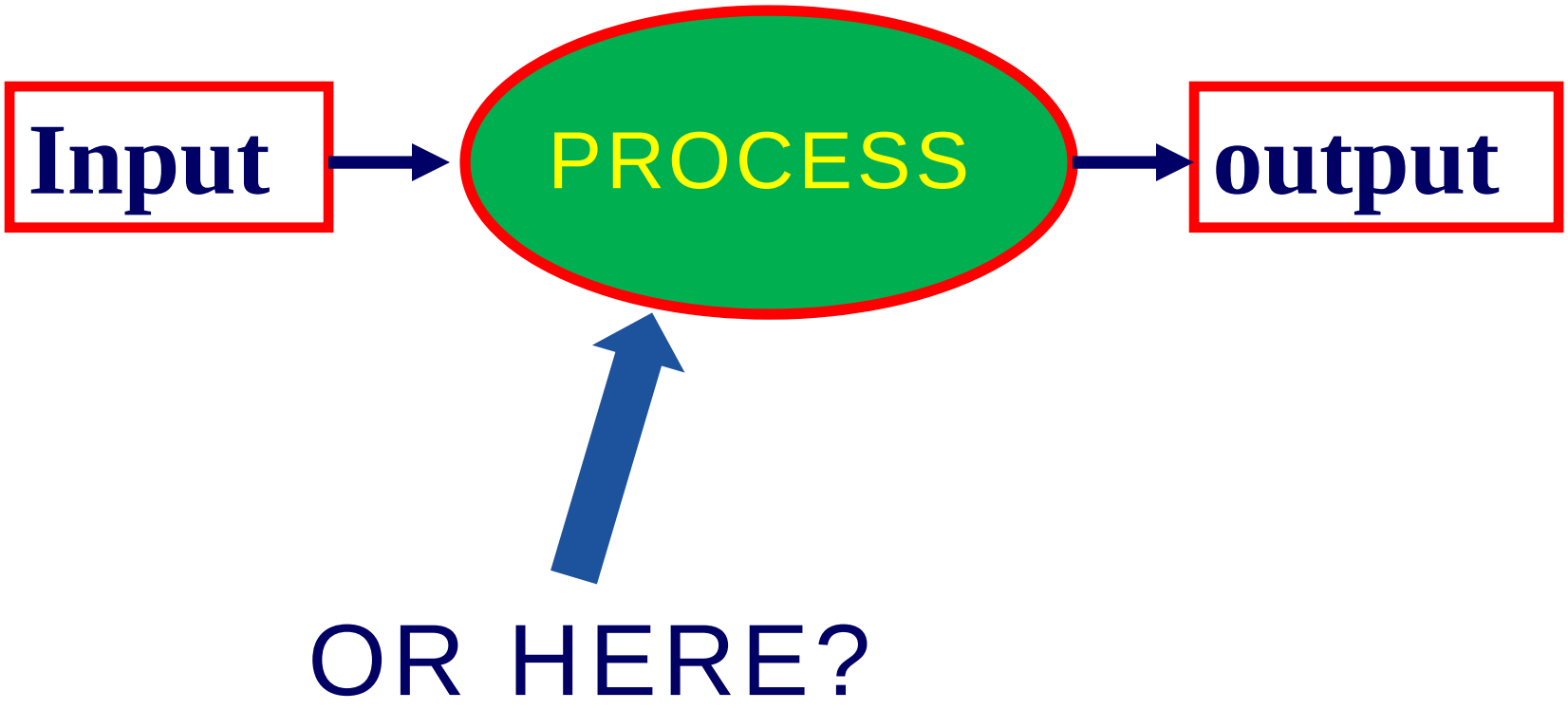

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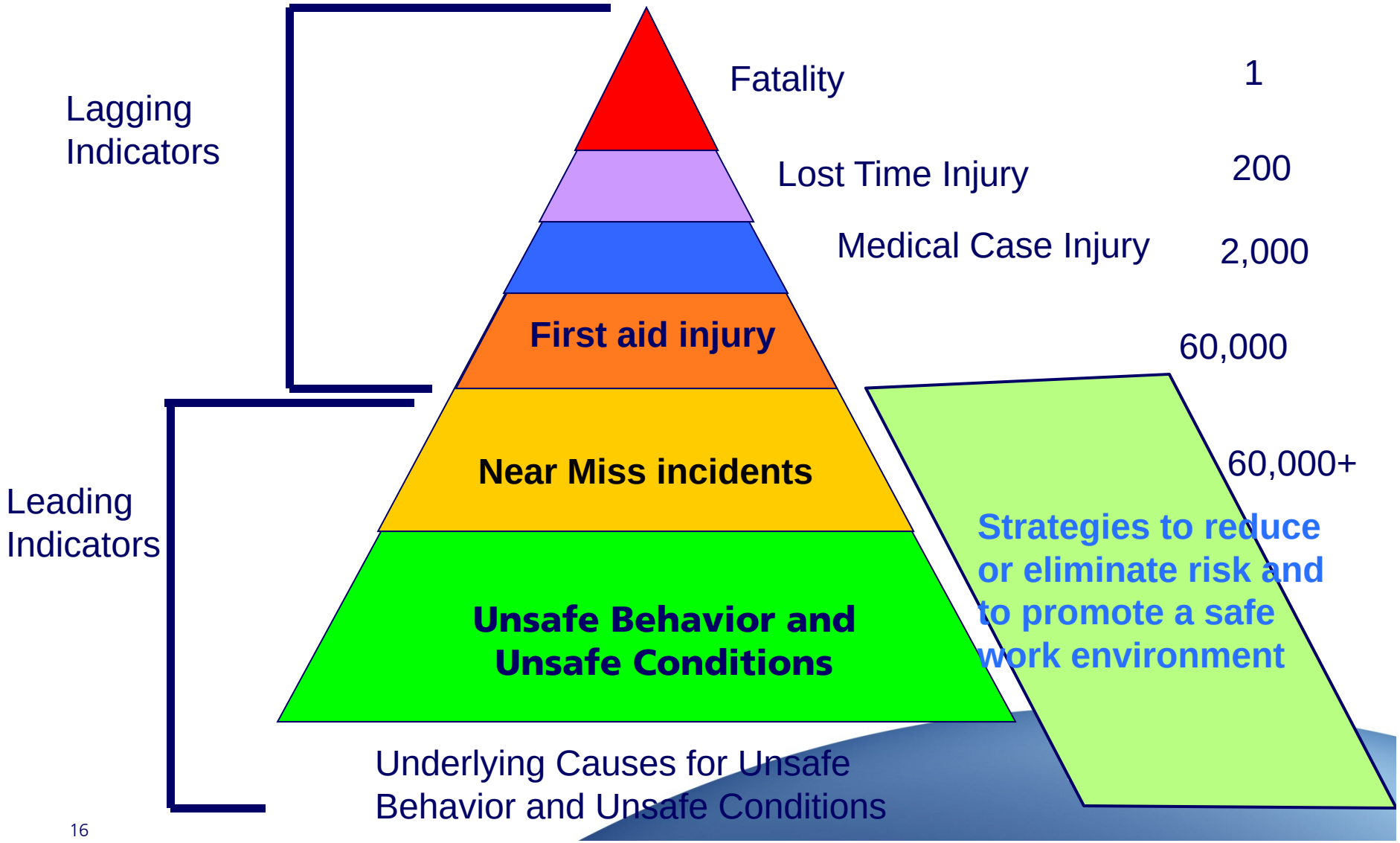
- Traditional view of safety is from the pessimistic perspective.
(the focus is on our failures)

- If unacceptable numbers of injuries occur, it is too late to prevent them.

- The question: can we or should we change the way we look at safety?

Consider the Contrast of Lagging Indicators and Leading Indicators of Safety Performance

Lagging vs Leading Indicators of Safety Performance



Lagging, Downstream or Trailing Measures Focus on the End Results, not the Process

The traditional measures of safety force us to focus on our failures (when it is too late)

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RIR
DART
Litigation
Regulatory Citations
Loss ratio
EMR

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What are Leading Indicators of Safety?

Proactive measures of processes that precede or influence safety performance

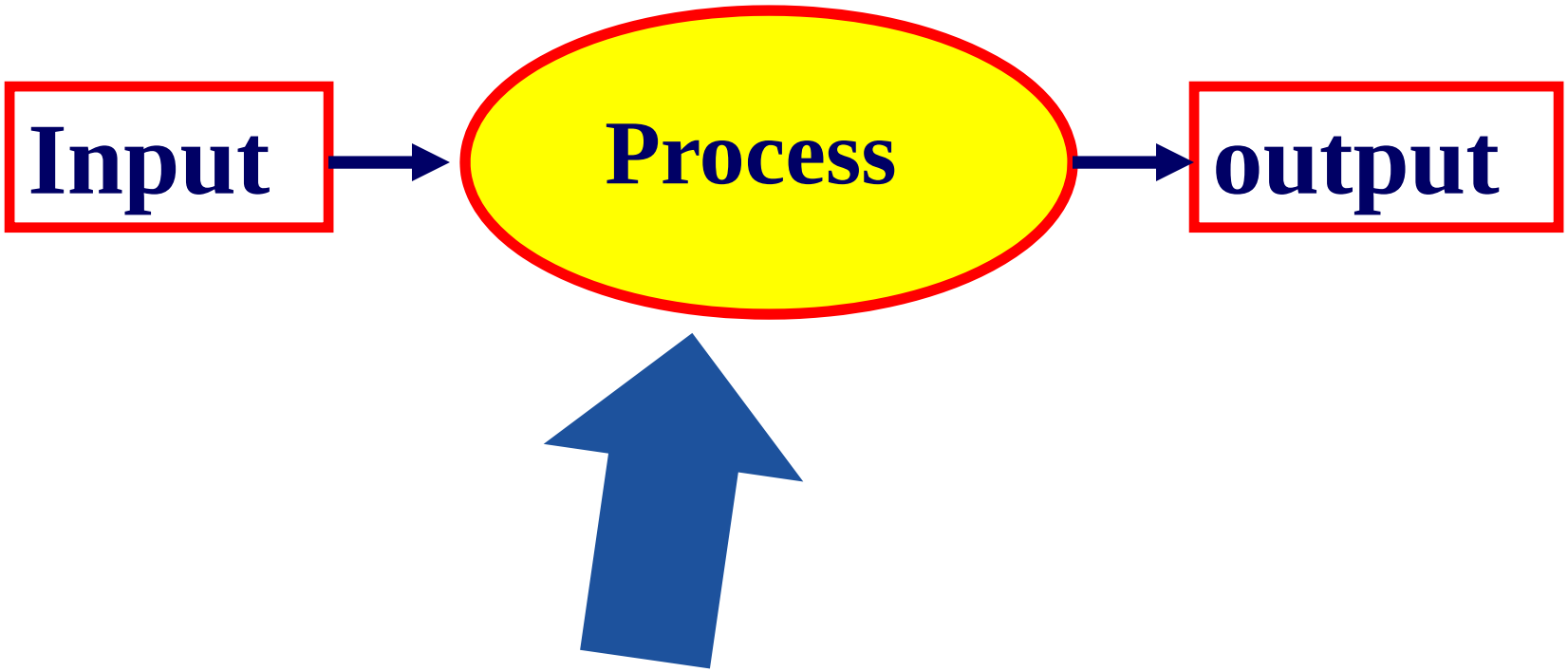
Signal the need for interventions before incidents occur

While lagging indicators indicate that there is a problem, leading indicators help identify the source of the problem

While lagging indicators give information about end results only, leading indicators focus on the safety process

- The focus is on the actions or behaviors that lead to success

Focus of leading indicators



Focus on the Safety Process

Provides management with assurances when the process is working as intended

Provides management with the opportunity to respond when weaknesses in the process are identified

Studying safety leading indicators

Studying safety leading indicators

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14 award-winning project descriptions

Studying safety leading indicators

Resulted in identifying many safety leading indicators

- **If you go onto a project and don't know the injury rate, how do you know whether it is safe or not?**

Most Common Leading Indicators

- **Near Miss Reporting**
- **Project Management Team Safety Process Involvement**
- **Worker Observation Process**
- **Stop Work Authority**
- **Auditing Program**
- **Pre-Task Planning**
- **Housekeeping Program**

Most Common Leading Indicators

- Owner's Project Manager participates in Worker Orientation
- Foreman Feedback Meetings with Owner's Project Manager
- Owner Performs Safety Walk Through
- Pre-task Planning for Vendor Activities
- Vendor Safety Audits
- Vendor Exit Debrief
- Vendor Design for Safety

What is the best safety leading indicator?

- **There is no best leading indicator.**
- **Different processes require different indicators.**
- **Strong safety commitment from management is necessary for success.**

The concept

- Safety leading indicators can be measured and can alert management about the need for a positive response **before** an injury occurs.
- Some are strategies most companies are already doing!
  - Site safety audits
  - Toolbox meetings
- A **shift** toward:
  - Measurement of the strategies
  - Setting thresholds
  - Implementing an action plan if the values are not desirable

Example: Near Miss Reporting

- Most firms have near miss programs BUT few measure, track, and respond in an organized fashion
- This may be a great place to start

  - Evaluate your near miss reporting process (who, what, how often)
  - What might you measure?
  - What is your target?
  - What if your measurements show unacceptable results?

Research Summary

Implementation Resource

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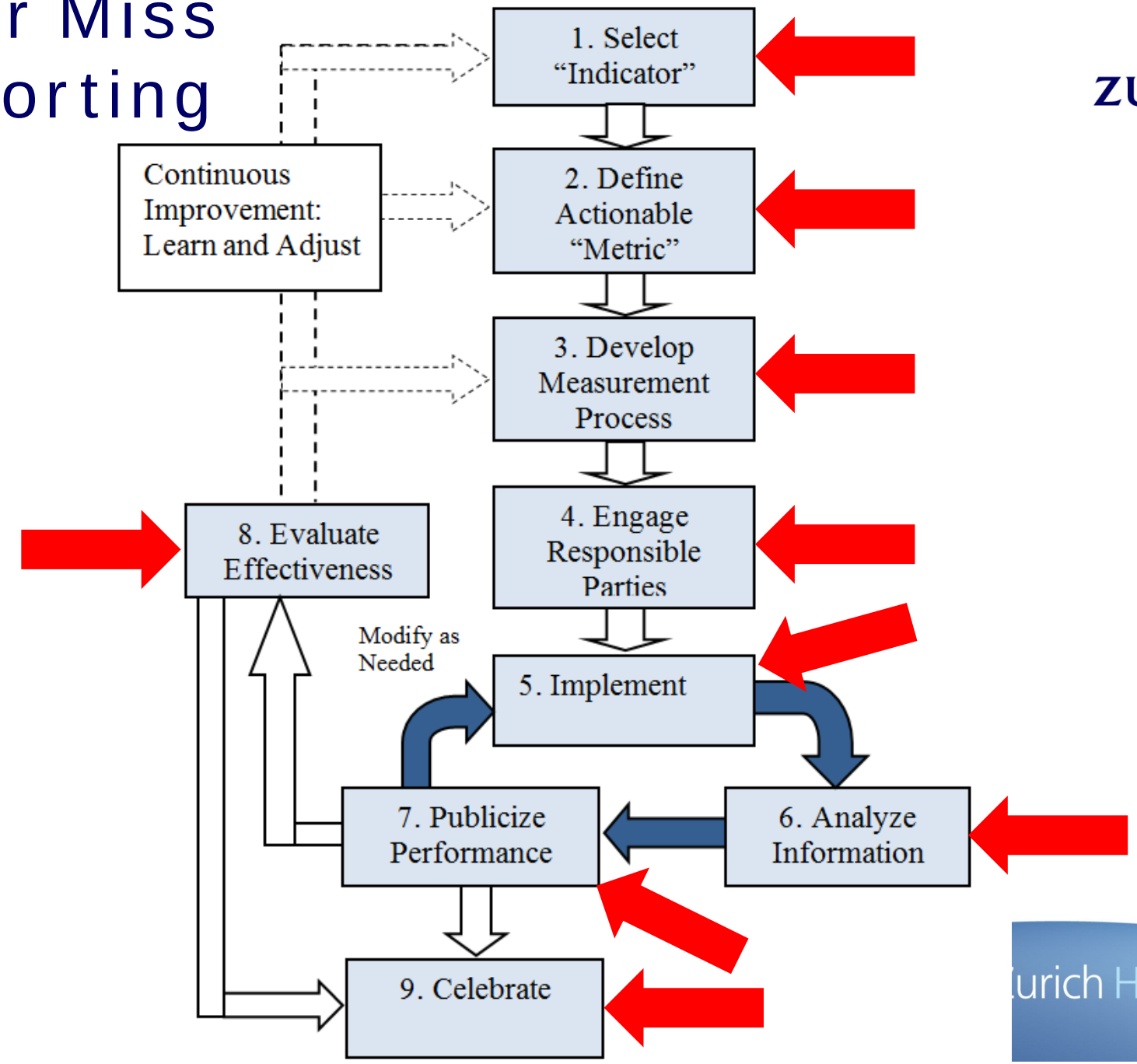
Near Miss Reporting



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Other Findings from the research of Leading Indicators

- Very few leading indicators are fully implemented (case average TRIR approx. 2.0).
- Projects where leading indicators were measured and fully implemented had an average TRIR of 0.19!
- **Every** firm can benefit from safety leading indicators.
- A strong foundation of safety is a **prerequisite**.
- A **champion** must be committed to success.
- The next step is to **carefully** select a few safety leading indicators and implement them on your project.

Zurich Construction Roundtable Recommendations and Solutions:

- Perform a cultural assessment to establish a baseline
- Educating management (both client and company) on understanding lagging indicators vs. leading indicators
- Reporting results on a continuous basis at all levels of the company (example: company dashboard)
- Determine what, why and how to measure (develop a plan)
- Behavioral Based Observation Process Is In Place and Working
- Focus Observation Process Is In Place and Working
- Near Miss/Near Hit Reporting Process Is In Place and Working
- Employee Perception Surveys Are Conducted To Determine State of EH&S Health.
- Pre-Hire Screening of Employees Is Conducted.

Zurich Construction Roundtable Recommendations and Solutions:

- Contractor Selection (EH&S) Process Is In Place Prior to Start of Project.
- Active Management Safety Participation –Tours / Walkabout / Written Communications
- Supervisor Safety Activity Evaluated.
- Hazard ID/Analysis Process Is In Place Prior To Start of Project.
- JHA/JSA Are Conducted Prior To Start of New Work/At The Beginning of Shift
- Recognition for achievement based on leading indicators vs. lagging indicators:
- Educating owners to shift focus to leading indicators

- **Measure the process – do they align**
  - What do you state
  - What is written (the plan)
  - What is implemented

Continuous Improvement

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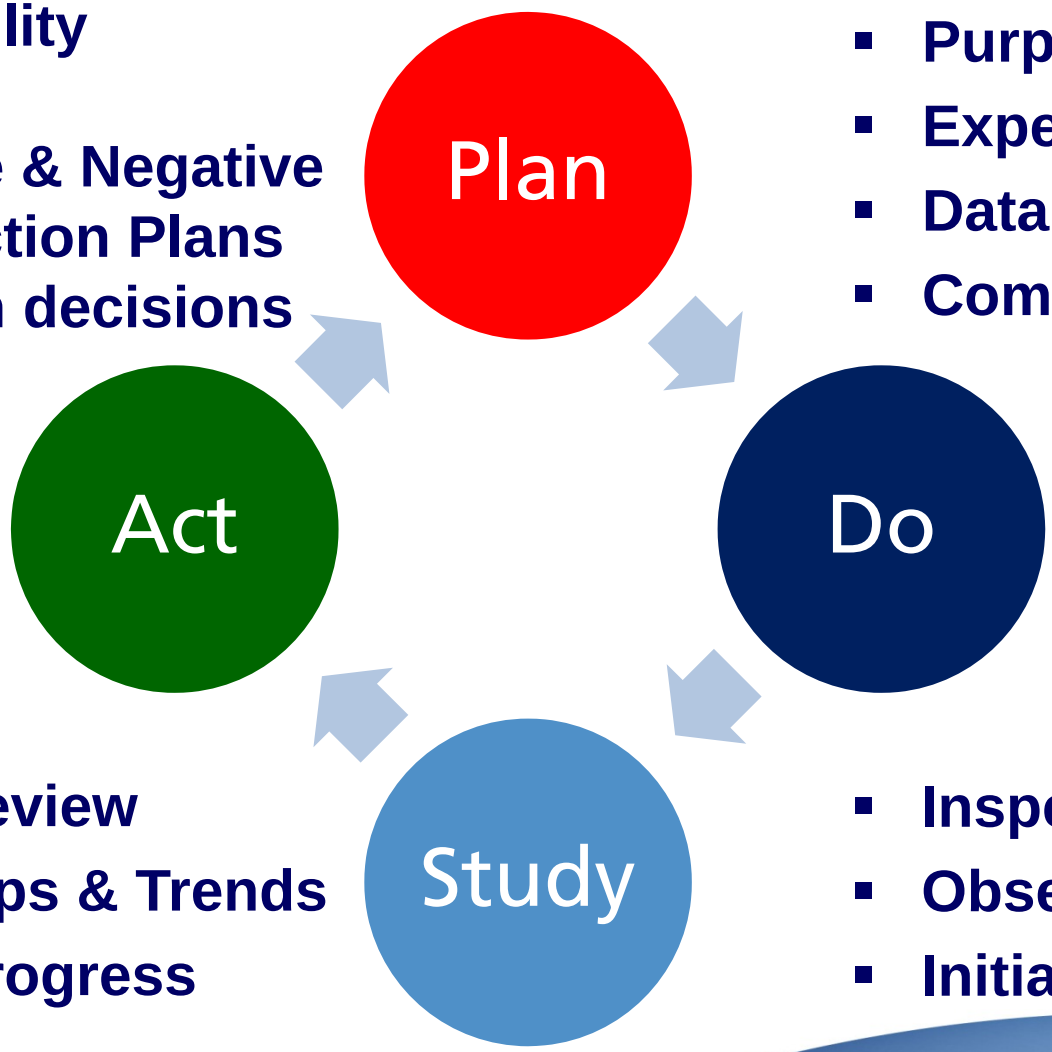
- Accountability
- Feedback
  - ✓ Positive & Negative
- Develop Action Plans
- Data-driven decisions



- Purpose
- Expectations
- Data Use Plan
- Communication

- Periodic Review
- Identify Gaps & Trends
- Measure Progress

- Inspection Strategy
- Observe
- Initial Correction

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How companies predict and prevent

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Collect

Analyze

Predict & Prevent

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How organizations predict

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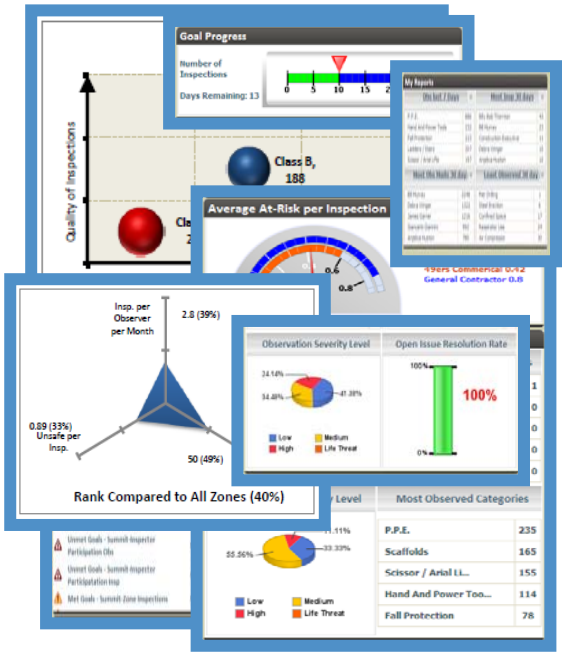
From basic…

…to advanced…



…to predictive models

- 110 Livingston Street
- 191 Peachtree Tower
- 2 Fevrier Sofitel Hotel
- Alexander Hamilton U.S. Custom House
- Alexander Stadium
- Aliiolani Hale
- Atomium
- Auditorium Building
- Azadi Tower
- Bajrakli Mosque
- Bank of China Tower
- Bankers Hall Towers
- Basler Messeturm
- Beetham Tower
- Belcourt Castle
- Berlaymont Building
- Birmingham Town Hall
- Blenheim Palace
- Brihadeeswara Temple
- BT Tower (Birmingham)
- Bucharest Mall
- Buckingham Palace
- Casa Milà
- Cathedral of Christ the Saviour
- Cathedral of Christ the Saviour
- Central Plaza
- Chateau de Boisclaireau
- Château Frontenac
- Chiang Kai Shek Memorial Hall

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Predictive Solutions safety data set

- Over 130 million observations – over 1.7 million added each month
- Over 3 million inspections
- Nearly 40,000 unique observers
- Over 15,000 worksites

Safety truths overview

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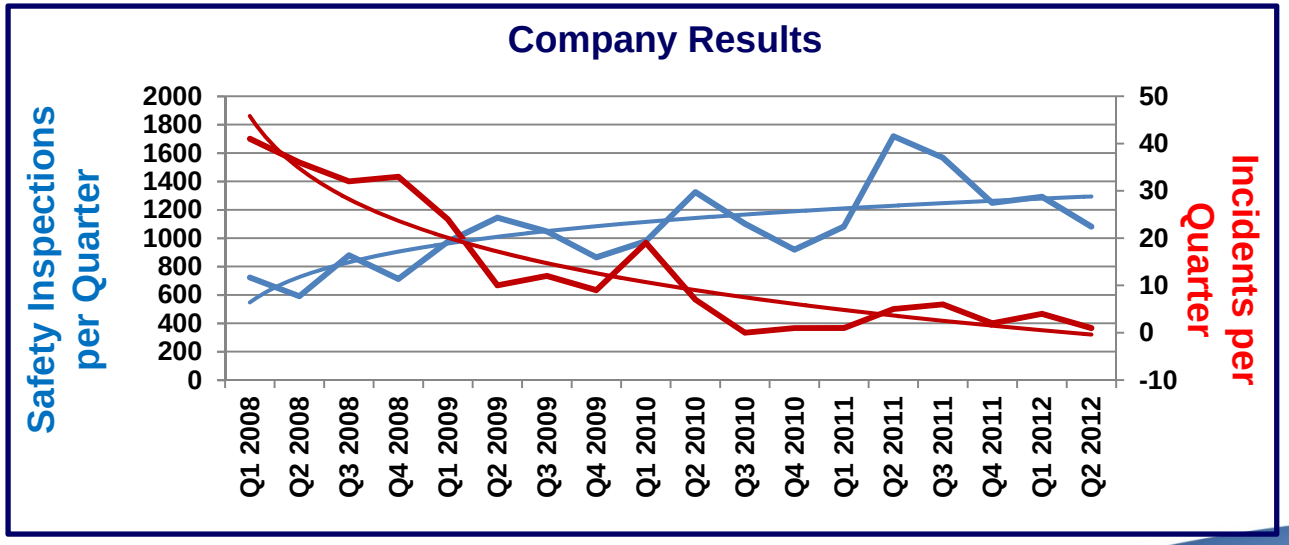
- Do a large quantity of inspections
- Involve a wide & diverse population
- Empower to report unsafes
- Fix unsafe issues

Case Study : Electrical Contractor

Overall Program Results

- 230% increase in inspections
- Advanced/predictive analytics to create leading indicators
- Targeted improvement opportunities
- Consistent results
  - 90% decrease in Incidents
  - 60% decrease in workers comp last two years



There are many examples

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Incident/Injury Reduction

In Summary

- **Safety leading indicators tell you the safety potential of your project and provide signals when specific corrective actions should be taken.**
- **Predictive Analytics can target your focus, to lead to Zero Incidents**
- **Who measures your leading indicators? Internal/external**

Questions

What does a safety inspection look like?

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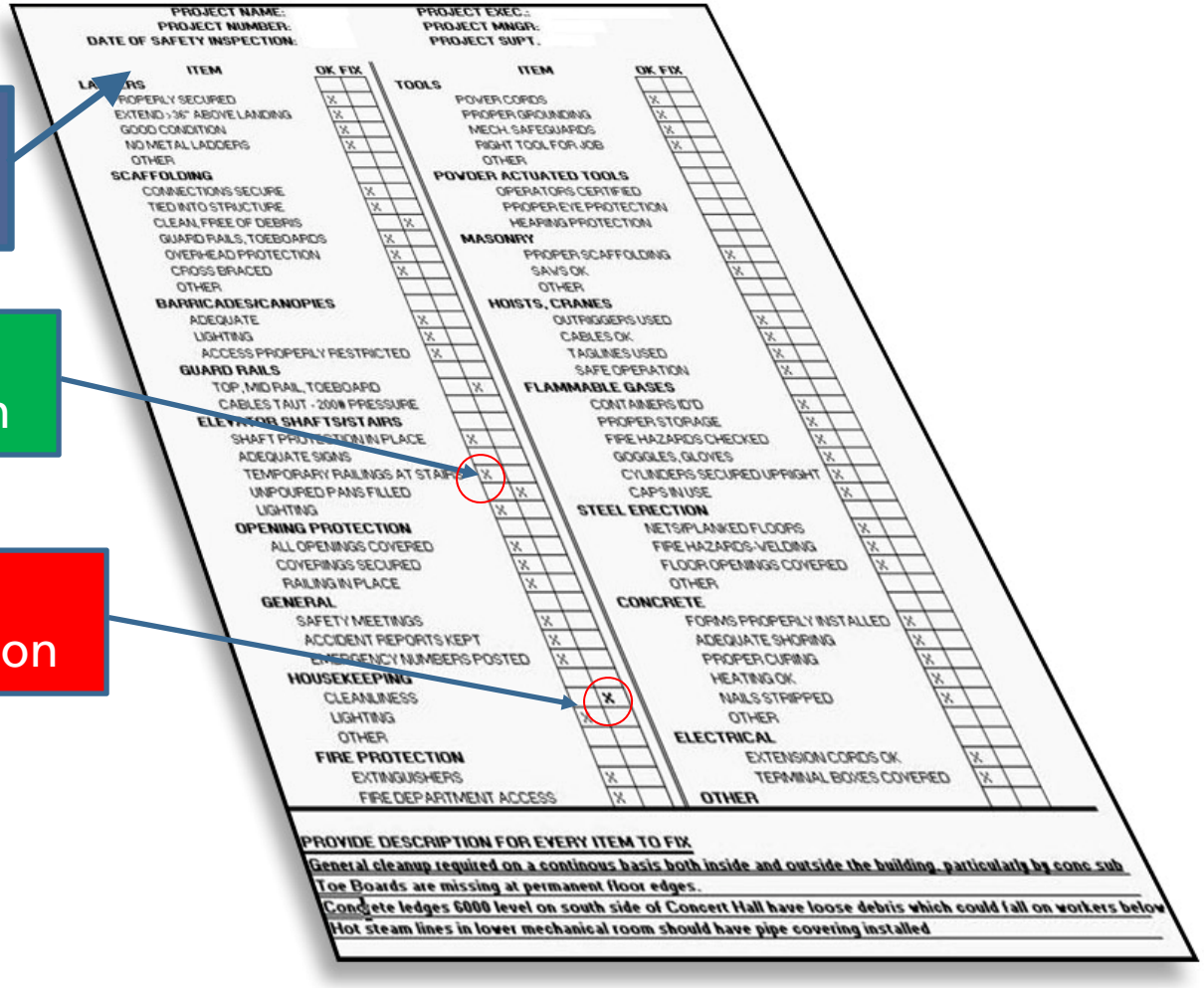
Inspection

Safe Observation

Unsafe Observation



PROJECT NAME:
PROJECT NUMBER:
DATE OF SAFETY INSPECTION:

PROJECT EXEC.:
PROJECT MNGR:
PROJECT SUPT.

ITEM	OK	FIX
LADDERS		
PROPERLY SECURED	X	
EXTEND >36" ABOVE LANDING	X	
GOOD CONDITION	X	
NO METAL LADDERS	X	
OTHER		
SCAFFOLDING		
CONNECTIONS SECURE	X	
TIED INTO STRUCTURE	X	
CLEAN, FREE OF DEBRIS		X
GUARD RAILS, TOEBOARDS	X	
OVERHEAD PROTECTION	X	
CROSS BRACED	X	
OTHER		
BARRICADES/CANOPIES		
ADEQUATE	X	
LIGHTING	X	
ACCESS PROPERLY RESTRICTED	X	
GUARD RAILS		
TOP, MID RAIL, TOEBOARD		X
CABLES TAUT - 200# PRESSURE		
ELEVATOR SHAFTS/STAIRS		
SHAFT PROTECTION IN PLACE	X	
ADEQUATE SIGNS		
TEMPORARY RAILINGS AT STAIRS	X	
UNPOURED PANS FILLED		X
LIGHTING	X	
OPENING PROTECTION		
ALL OPENINGS COVERED	X	
COVERINGS SECURED	X	
RAILING IN PLACE	X	
GENERAL		
SAFETY MEETINGS	X	
ACCIDENT REPORTS KEPT	X	
EMERGENCY NUMBERS POSTED	X	
HOUSEKEEPING		
CLEANLINESS		X
LIGHTING	X	
OTHER		
FIRE PROTECTION		
EXTINGUISHERS	X	
FIRE DEPARTMENT ACCESS	X	

ITEM	OK	FIX
TOOLS		
POWER CORDS	X	
PROPER GROUNDING	X	
MECH. SAFEGUARDS	X	
RIGHT TOOL FOR JOB	X	
OTHER		
POWDER ACTUATED TOOLS		
OPERATORS CERTIFIED		
PROPER EYE PROTECTION		
HEARING PROTECTION		
MASONRY		
PROPER SCAFFOLDING	X	
SAWS OK	X	
OTHER		
HOISTS, CRANES		
OUTRIGGERS USED	X	
CABLES OK	X	
TAGLINES USED	X	
SAFE OPERATION	X	
FLAMMABLE GASES		
CONTAINERS ID'D	X	
PROPER STORAGE	X	
FIRE HAZARDS CHECKED	X	
GOGGLES, GLOVES	X	
CYLINDERS SECURED UPRIGHT	X	
CAPS IN USE	X	
STEEL ERECTION		
NETS/PLANKED FLOORS	X	
FIRE HAZARDS-WELDING	X	
FLOOR OPENINGS COVERED	X	
OTHER		
CONCRETE		
FORMS PROPERLY INSTALLED	X	
ADEQUATE SHORING	X	
PROPER CURING	X	
HEATING OK	X	
NAILS STRIPPED	X	
OTHER		
ELECTRICAL		
EXTENSION CORDS OK	X	
TERMINAL BOXES COVERED	X	
OTHER		

PROVIDE DESCRIPTION FOR EVERY ITEM TO FIX

General cleanup required on a continous basis both inside and outside the building, particularly by conc sub

Toe Boards are missing at permanent floor edges.

Concrete ledges 6000 level on south side of Concert Hall have loose debris which could fall on workers below

Hot steam lines in lower mechanical room should have pipe covering installed

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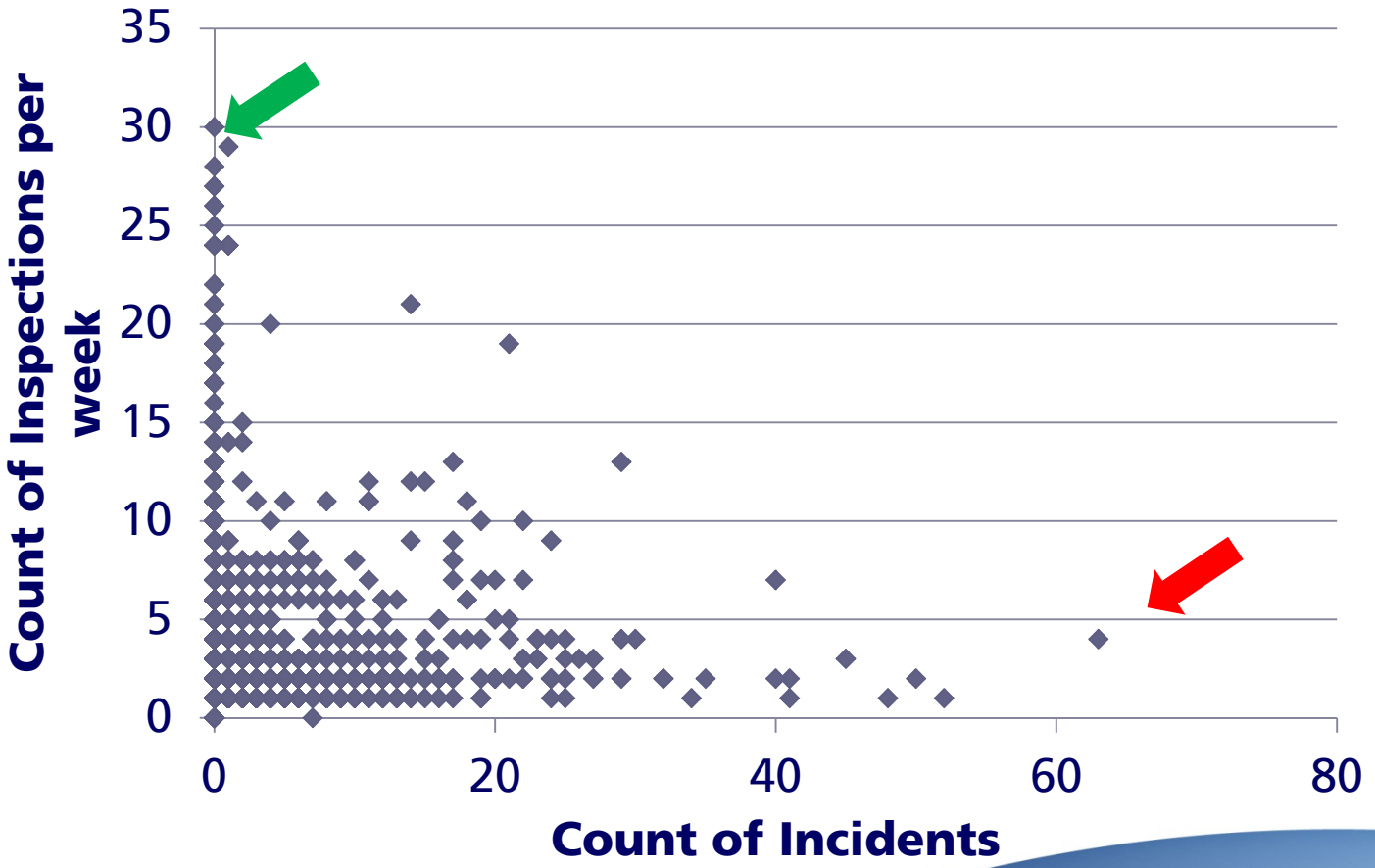
Safety truth #1: More Inspections result in safer outcomes



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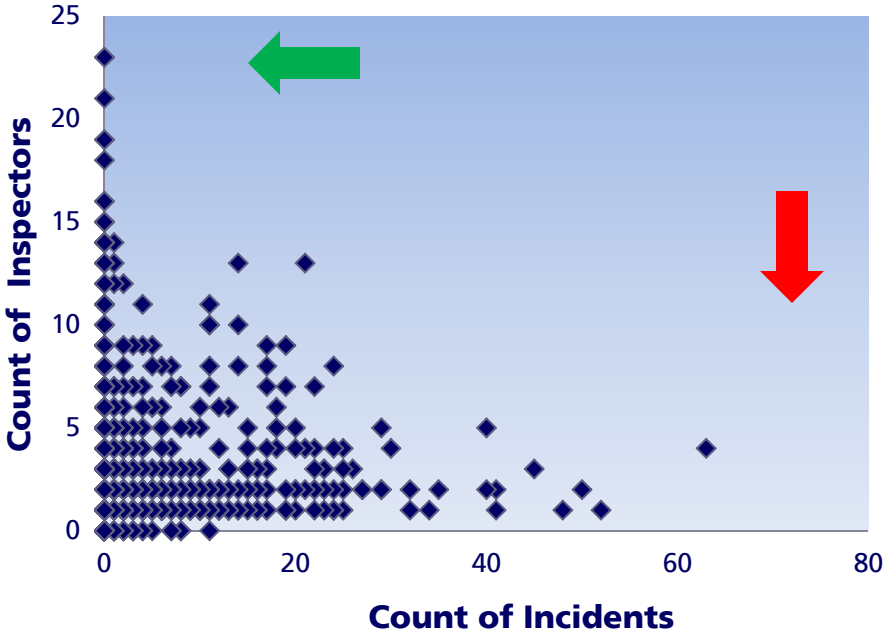
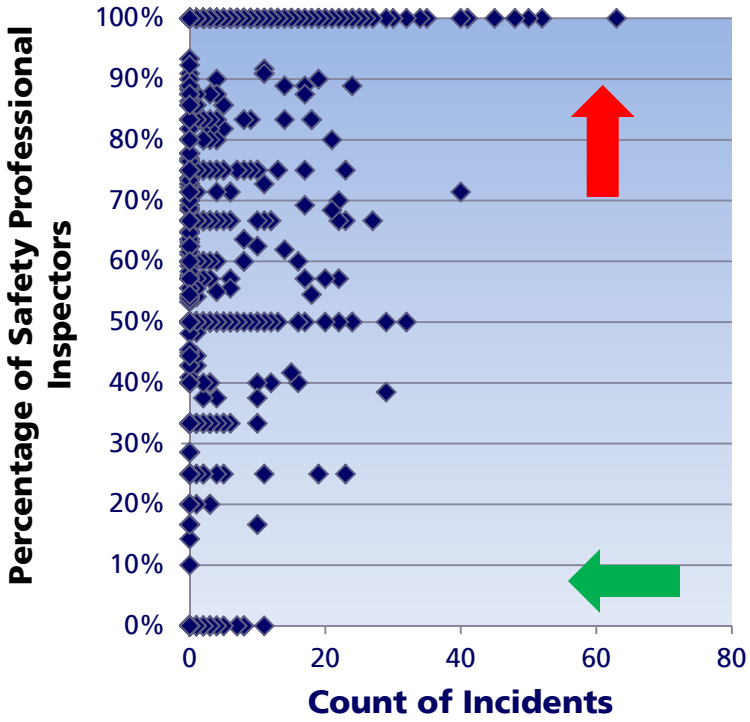
Safety truth #2: More quantity and diversity in safety inspectors result in safer outcomes





Widespread involvement performs best

The risk curve

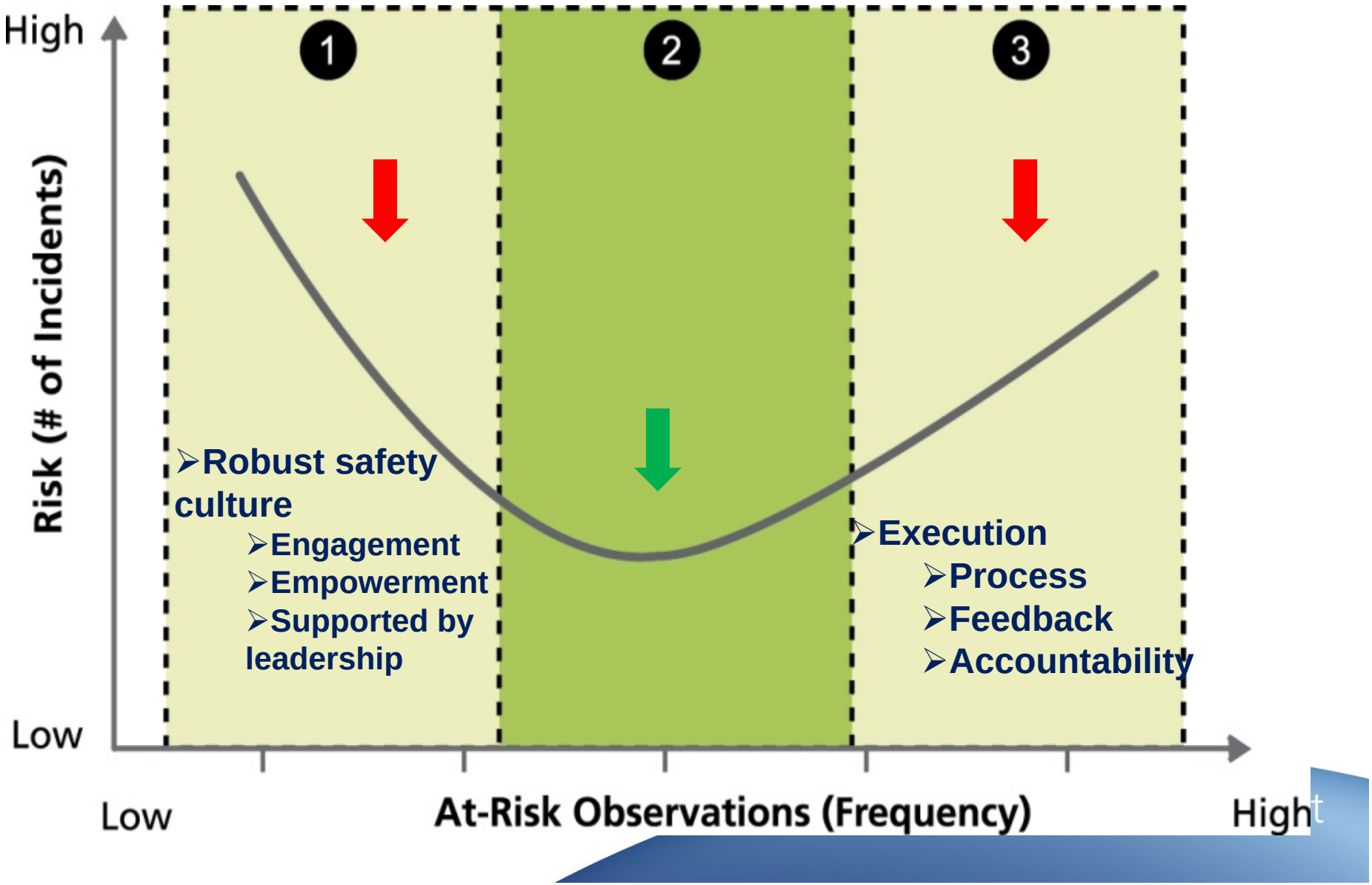


Exhibit 1: Zero Injury Safety **Culture Building Blocks**	
	Representative Examples
Attitudes	Zero injury is attainable on every shift and every project Zero injury culture needs to permeate all company activities and not be viewed as a separate process
Beliefs	All levels of the organization believe that zero injury is achievable – from company executives to all craft/trade employees All employees accept personal responsibility and accountability for zero injury
Values	The company values the health and safety of all employees The company is committed to employees going home safe at the end of every work day
Assumptions	Employees are not taking unnecessary risk New employees accept safe work practices as the expectation
Norms	Employee behavior on projects rejects shortcuts and recognizes that unnecessary risk-taking is not acceptable Zero injury is ingrained in the way the company builds every construction project – regardless of size, location, company division, manager/supervisor, and/or schedule


Sustaining
Maintaining focus and keeping commitment fresh
"What can we do together to keep getting better at safety"
All employees
Celebrating success and continuous improvement
Reinforcing and reinvigorating
Conceiving
Overcoming apathy and indifference
"Challenging the status quo"
Senior leadership
Creating concern, awareness, and desire for change
Thinking and analyzing
Exhibit 2:
Zero Injury
Safety Culture
Development
Cycle
Adopting
Convincing stakeholders of benefits
"Throwing the gauntlet down" and "Drawing a line in the sand"
Senior leadership
Instilling attitude, beliefs, and values; leadership by example
Committing and communicating
Implementing
Overcoming resistance to change
"We care about you" and "We're committed to you safely completing your work today"
Managers and supervisors
Acceptance by employees and adherence to new work practices
Training and changing
Multiplying
Raising up leaders and "torch bearers"
"This is how and why things are done safely in our company"
All employees
Winning the hearts and minds of all employees to achieve consistency
Coaching and educating

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Exhibit 4: Management Safety **Culture Assessment**

	Assessment Category	Assessment Factors
1.	Organizational Leaders Operationalize Commitment	Demonstrable senior leadership participation and involvement Resource allocation Core processes and results measured Accountability system for safety at all levels of the organization
2.	Identify Safety and Reliability as Goals	Safety as a goal is consistently and clearly articulated Multiple and independent channels of communication Decentralized decision-making authority
3.	High Levels of Redundancy in Personnel and Technical Safety Measures	Continuous operations and training Job hazard analyses are owned, continuously reviewed, and updated
4.	Organization Strives for a "High Reliability Culture"	Presents optimism toward a desired future state Consistent communications Adaptability to change
5.	Sophisticated Forms of Trial and Error Organizational Learning	Capacity to learn and act Accident investigations are blame-free and pursue systemic improvements Hazard analysis occurs before accidents