NYC™ Buildings

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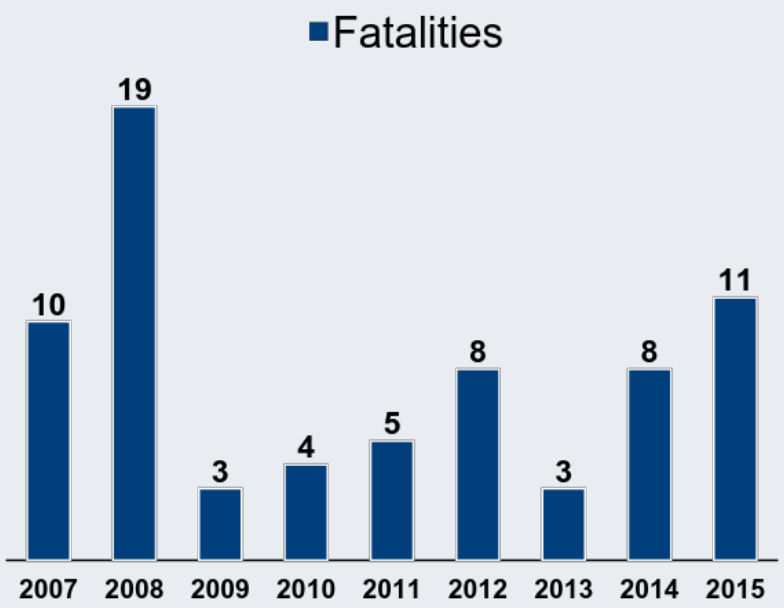
CONSTRUCTION INCIDENTS IN NYC



There is an upward trend in construction incidents

PROBLEM STATEMENT

How might we enable management at the Department of Buildings (DOB) to make better informed risk-mitigation decisions and articulate safety more clearly?


NYC

NYC DEPARTMENT OF BUILDINGS

Development

Enforcement

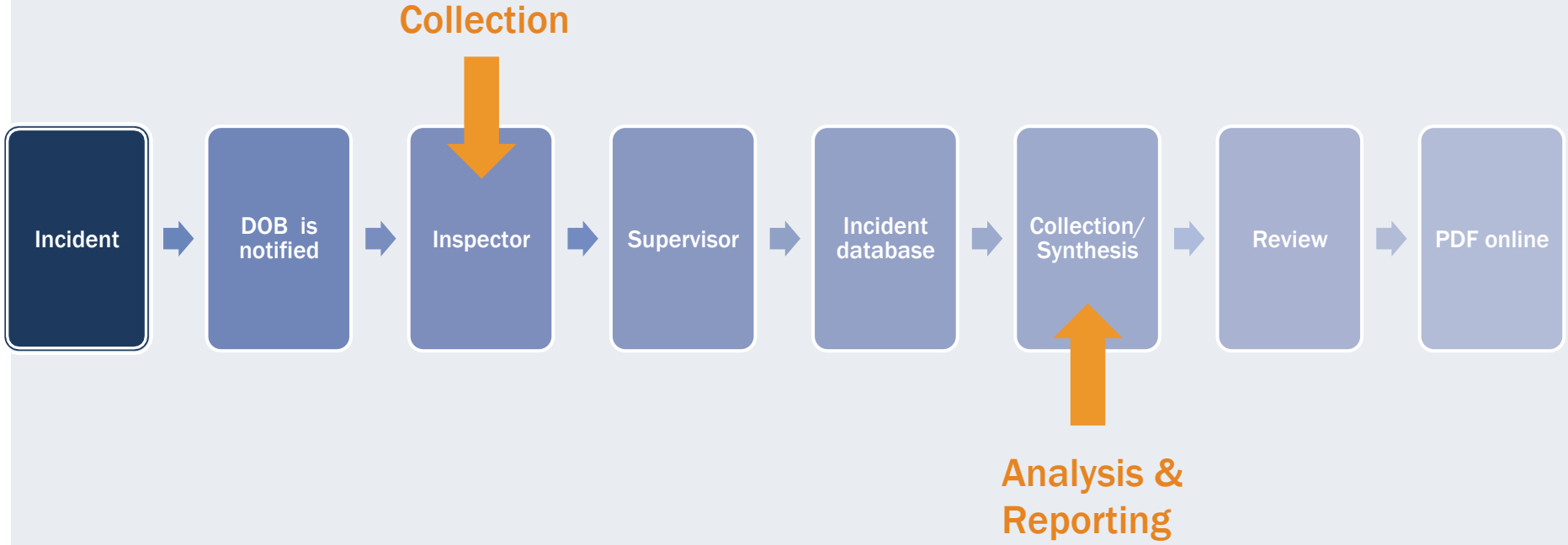
By 2017

- 1579 Full Time Employees
- Budget: $155 Million
- 50% Increase in 3 years

WHAT WE DID THIS SEMESTER: PROCESS

User Research Understanding the DOB	User Insights Identifying points of intervention	Prototyping Recommending possible solutions
• Visit DOB	• Synthesize user research	• Develop 2 prototypes
• Secondary research	• Reverse engineer the incident database	• Test prototypes with DOB management
• 14 phone interviews with DOB management		• Compile policy recommendations

DATA INSIGHTS – JOURNEY MAP
REPORTING ON AN INCIDENT

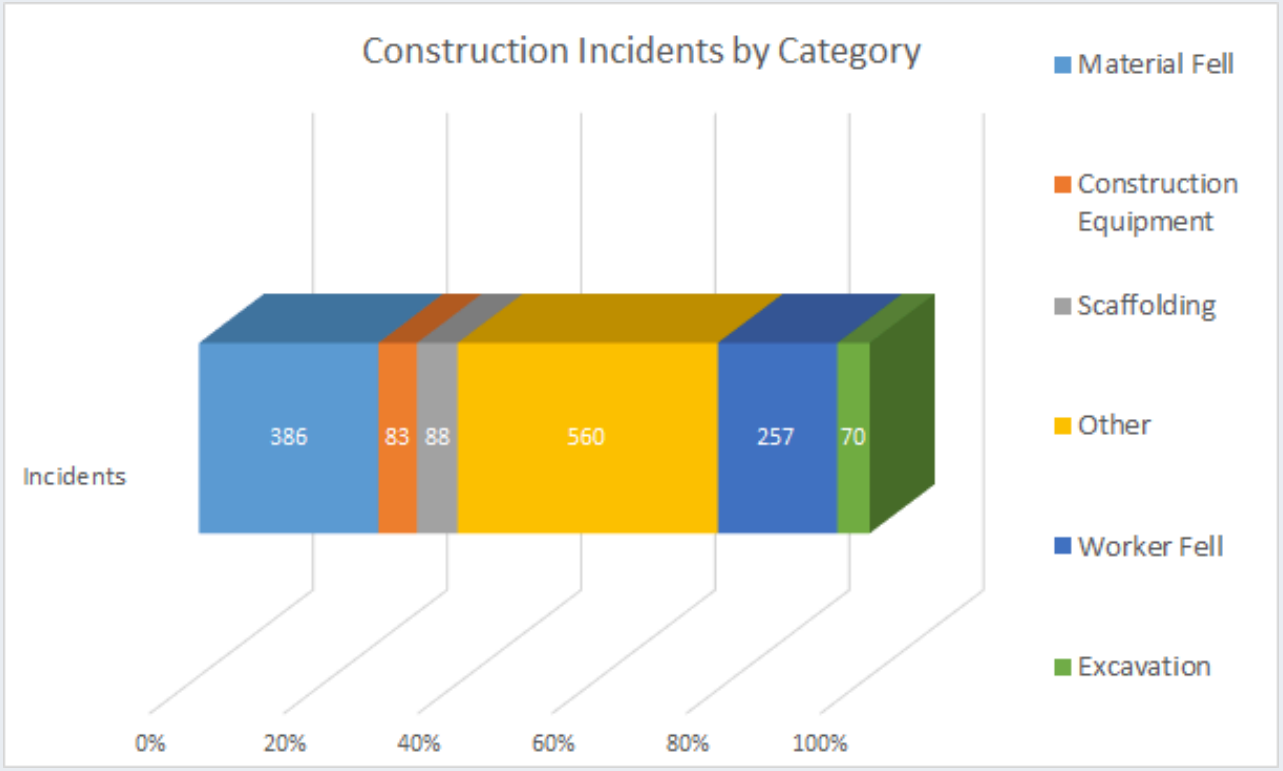


Where our prototypes fit in this process

INSIGHTS

DATA INSIGHTS
REPORTING & ANALYSIS

- Relevant incident data is isolated from other DOB data
- Majority of incidents are categorized as “Other”



DATA INSIGHTS
REPORTING & ANALYSIS

- Inspectors report incidents via email
- Entries are made with missing fields which extends the review process and delays online publication
- Only one person understands and uses the incident database on a day-to-day basis

DATA INSIGHTS
INCIDENT DATABASE

Incident data is incomplete

Out of 1444 entries for 2014-2015

- 99.0% have the location
- 93.7% have an associated complaint
- 90.3% have property owner information
- 55.7% have the relevant permit information
- 42.4% have contractor information
- 0.0% have the Site Safety Manager

Users reported the data as

"Confusing"

"Cryptic"

"Messy"

"Unclear"

MANAGEMENT INSIGHTS
EMPHASIZING SAFETY

- Management focus on service delivery aligns well with permitting but is misaligned with safety
- Executive messaging and incentives for safety unclear, particularly the role between DOB and OSHA
- Development inspectors are dis-incentivized to report safety issues
- Inspectors are sent on “sweeps” to specific kinds of work sites yet there is little evidence on how effective these are
- Public reporting on safety lags a few months
- Specific, measureable, actionable, realistic and timely (SMART) safety goals need to be set by DOB

PROTOTYPE A
DIGITAL INCIDENT FORM

NYC Buildings

Union Site ◯ Yes ◯ No

CONSTRUCTION RELATED INCIDENT

Incident Report ID: Report Date:

Incident Address

Borough | BIS Complaint # | Incident Date / / | Time a.m. / p.m.

Unit | Occupancy: ◯ 1-2 Family ◯ Multiple Dwelling ◯ Commercial ◯ Manufacturing

1. DOB Inspection and Determination

Inspector/DOB Responder(s) | Date Inspected / / | Time a.m. / p.m.

Inspector Action: ☐ No Action Necessary ☐ No Access ☐ ECB Violation ☐ DOB Violation ☐ Referred to another Unit/ City Agency

☐ Request Report from PE/RA of record ☐ Unsafe Building Violation ☐ Call PE/RA/Supervisor ☐ Refer to OSHA ☐ SWO

Vacate # | # Units | Address if different / Additional Address(es):

Provide Additional Info and Action Justification - *if applicable: include violation number (s)*

☐ DOB Previously Inspected? | Last Inspected Date / /

Injury/Fatality Affected: ☐ Construction Worker ☐ Building Occupant ☐ Pedestrian ☐ Other | Number of Fatalities:

Number of Injuries: | Details:

Emergency PE/RA/Supervisor (Name, Title)

Type: ☐ No Action Necessary ☐ No Access ☐ Request Shoring by Owner ☐ Request Area Protection ☐ Request Demolition

☐ Unsafe Building Recommended Procedure ☐ Request PE/RA Record Report ☐ Request Monitoring Report

Instruction Method ☐ Order to Owner ☐ Immediate Emergency DEC ☐ Emergency DEC ☐ HPD Executed

Provide Details / Justification Action:

Completed on / / | Streets Closing Detail Safeguarded Area:

2. Construction Related Incident Categories

Contractor Name | Contractor Phone Number

Contractor License # | License Type | License Class | Contact Person

Work According to Permit ◯ Yes ◯ No–Outside Scope ◯ Without Permit | Permit Type | Permit #

☐ BEST Site Safety Site

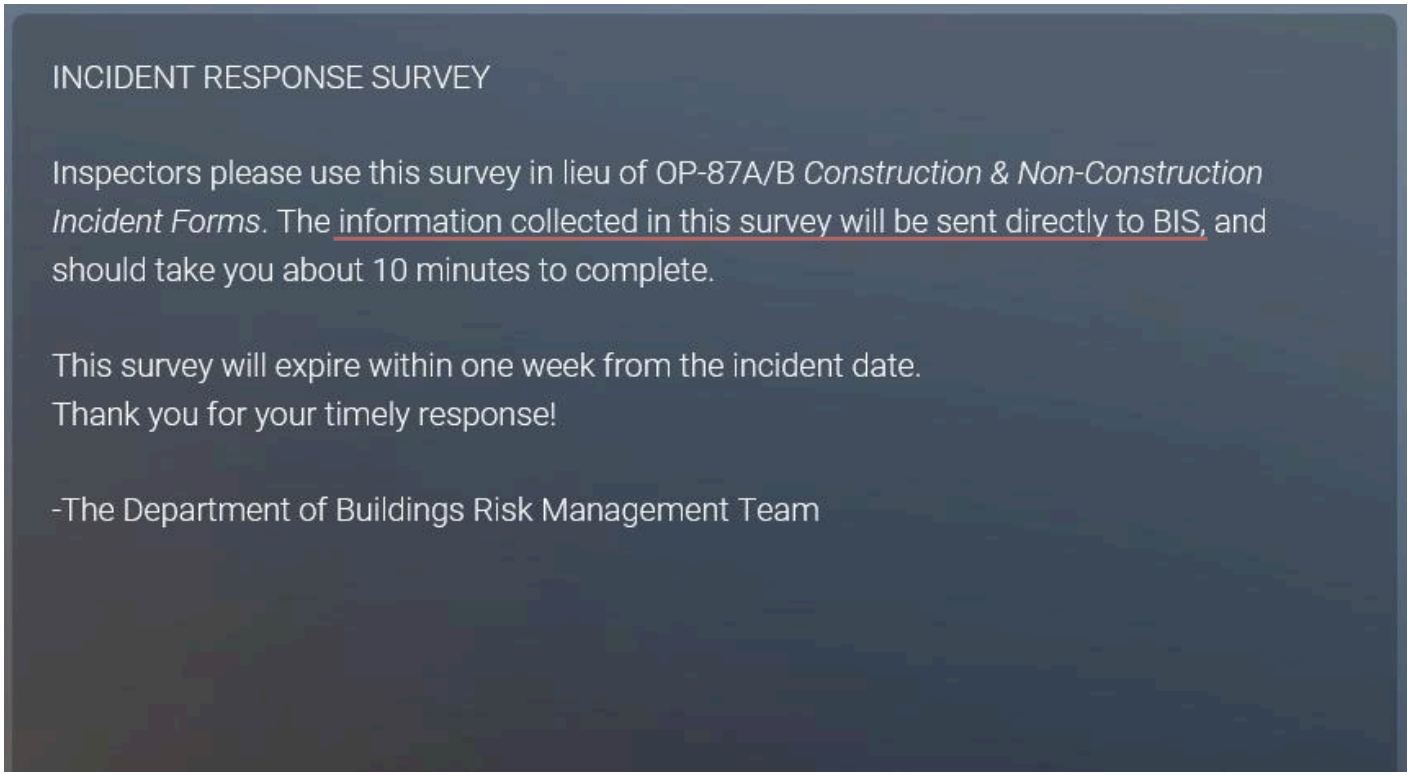
OSHA Injury/Fatality Type: ☐ No Accident ☐ Fall ☐ Crushed/Collapse ☐ Struck By ☐ Shock (Electrical)

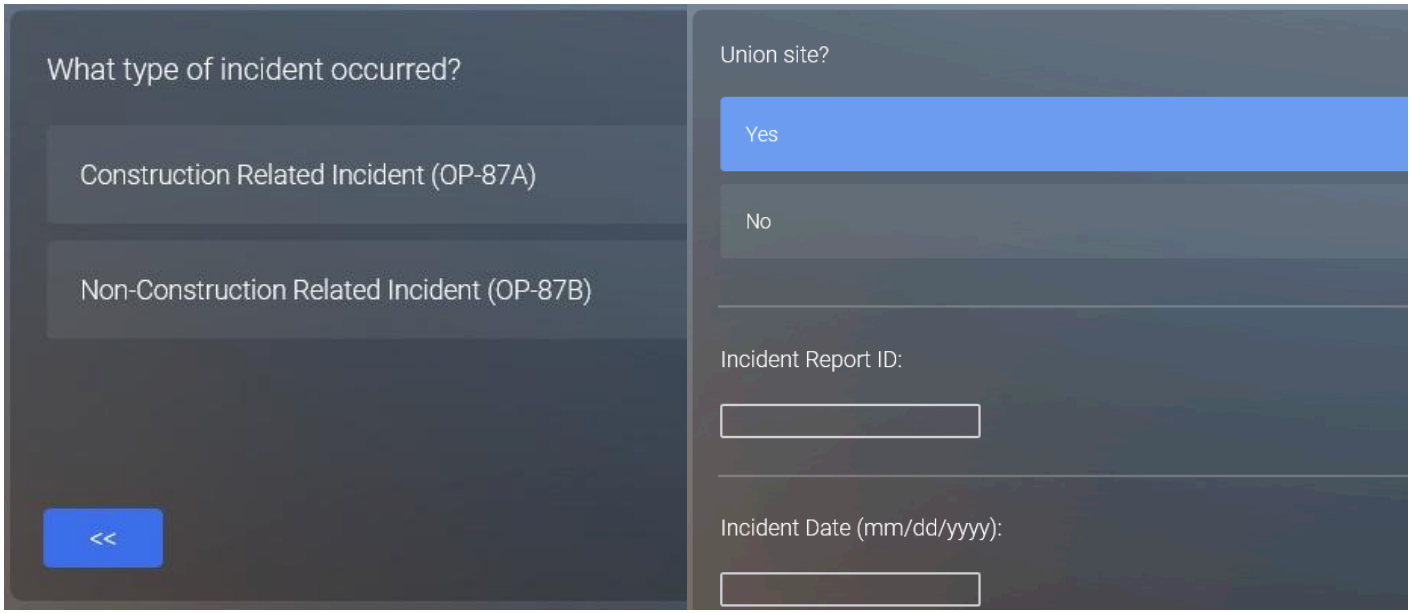
Did the worker wear required protection ◯ No ◯ Yes ◯ Don't Know

ORIGINAL INCIDENT FORM

OP-87A Construction Related Incident

Should be filled out manually by inspector on site



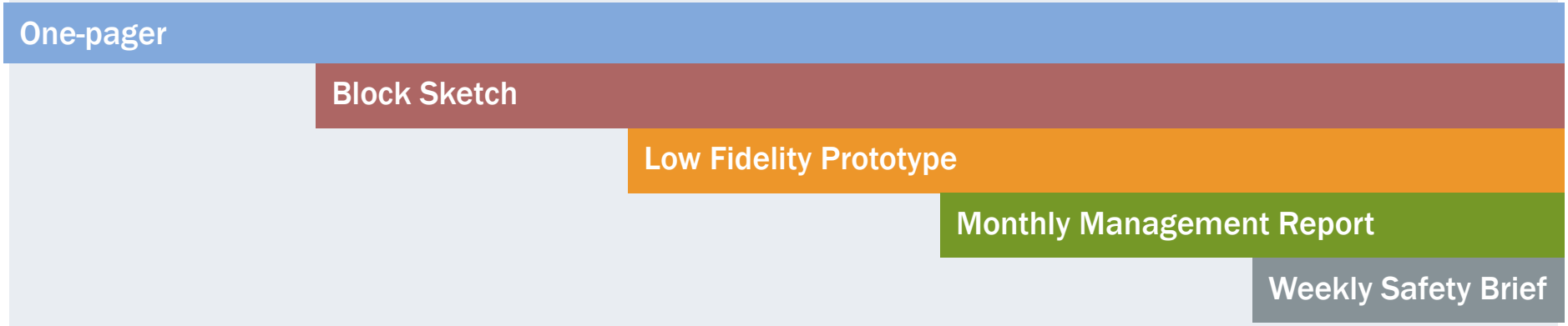


PROTOTYPE A

Digital Form OP-87A/B

PROTOTYPE B
WEEKLY SAFETY BRIEF

PROTOTYPING AS AN ITERATIVE PROCESS



Title

Period of X-Y

Incident metrics

Incidents/Borough
Accidents/sq ft construction
Injuries/ Contractor
Injuries/ Self-inspected sites
Incident categorization (severity of injury)
Incident categorization (interior v. exterior)
SWOs / # violations

The incident metrics give a snapshot of the current status of construction safety. These are descriptive indicators illustrating construction safety and serve as a baseline.

DoB Actions

# violations cited for safety
# sweeps conducted
# proactive site inspections
$ collected in fines (safety violations)

The DOB Actions indicators are used to provide insight on the impact of the different tools the DOB has to improve construction safety. Each of these indicators can be broken down by incident category or department response and the category with the highest number of violations, for example, can be highlighted to provide incentives for management to take action.

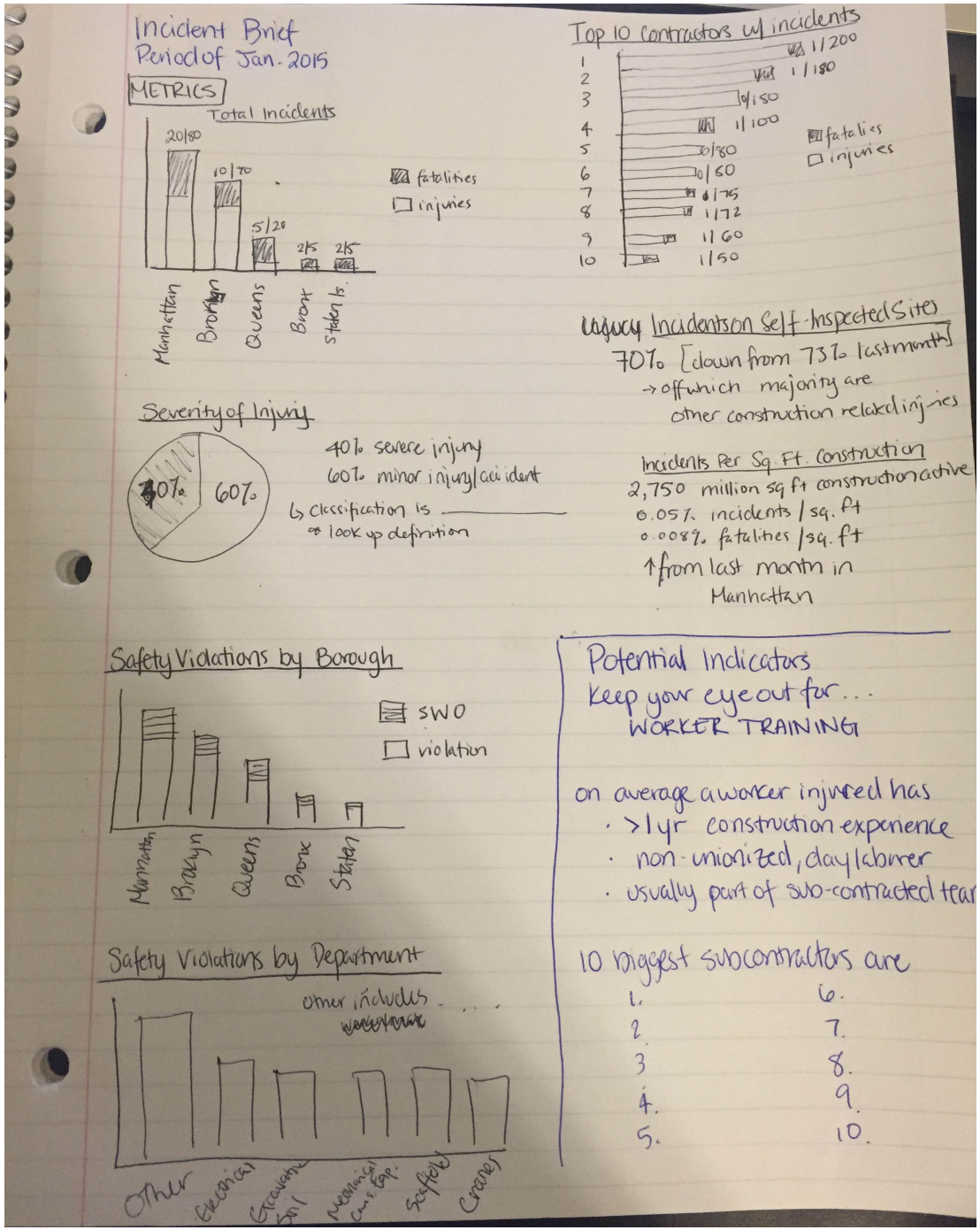
Potential Indicators

Worker training
Major/Minor renovations
New buildings
Union vs. non-union workers
Permit and job types

These potential indicators are aspects that we think have an impact on construction safety. This section can focus on a new "potential" each brief or could be a brainstormed list that could help managers allocate resources to prevent incidents from occurring.

GRAPHICAL EDITION

Feedback from DOB received by email on April 4, 2016

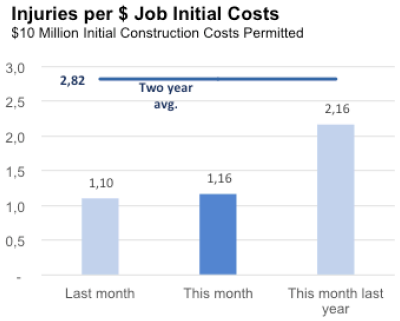


LOW FIDELITY

Feedback from DOB received by email on April 4, 2016

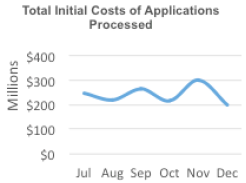
FIRST ITERATION

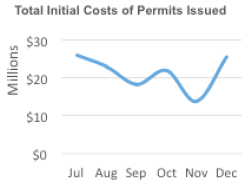
Department of Buildings
Monthly Management Report

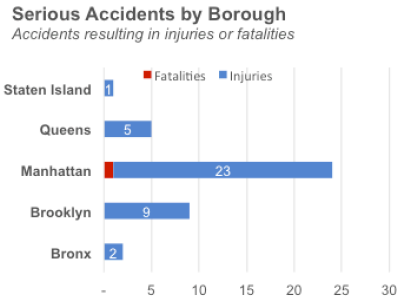


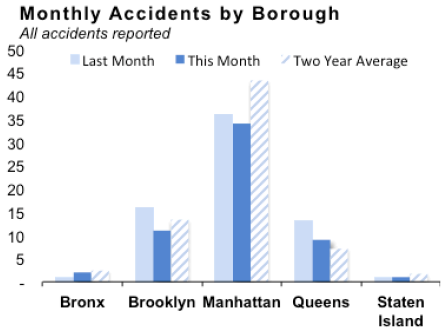
Injuries as a factor of Initial Job costs is a good method of normalizing data as initial costs have the strongest correlation to accidents with injuries and fatalities.

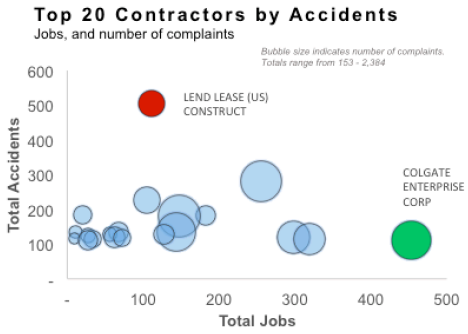
Some analysis here…
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis non est sollicitudin, vestibulum nisl quis, laoreet elit. Donec posuere tempus mauris ut molestie.



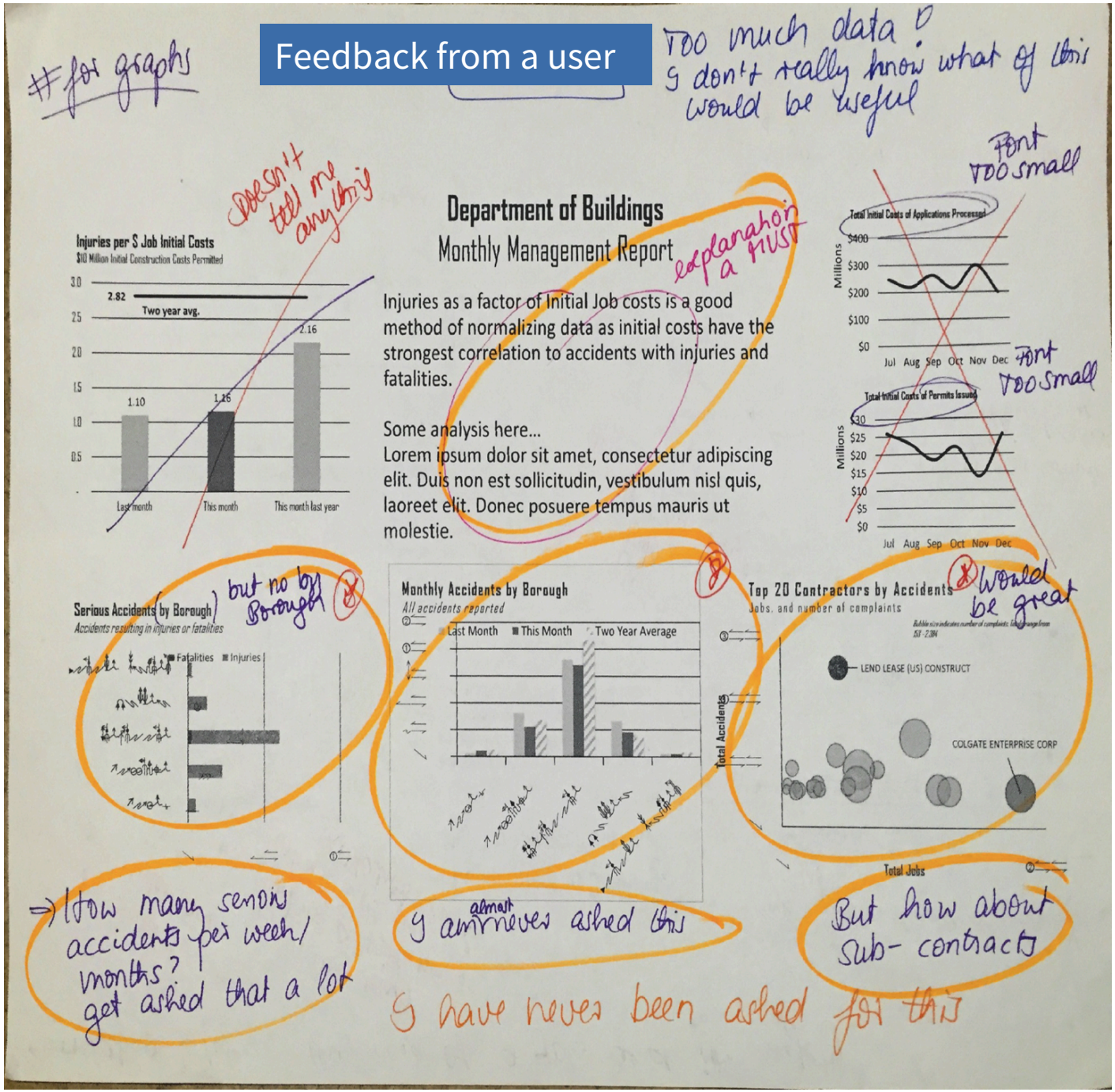








Feedback received via phone from DOB on April 11, 2016.



USER TESTING:

MANAGEMENT SAFETY BRIEF

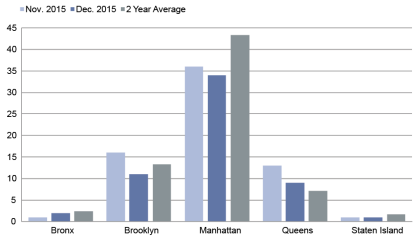
This is an example of feedback we received on our prototype

Weekly Safety Brief

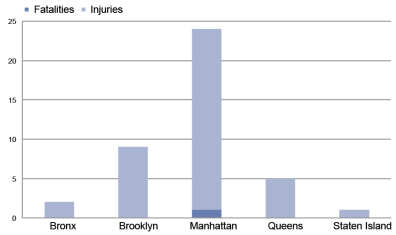
For the first week of December 2015

- Total incidents have decreased in December 2015
- Most incidents occurred in new buildings and minor alterations A2
- Top contractors with incidents were Lend Lease Construction and Colgate Enterprise Corporation

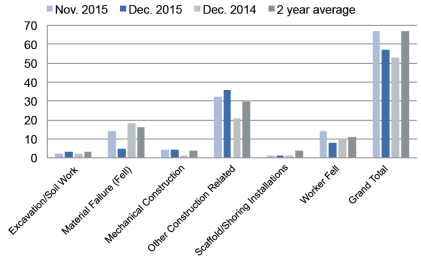
Total incidents by borough



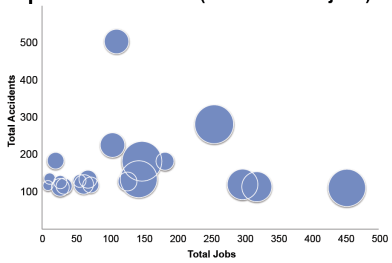
Serious Incidents by borough



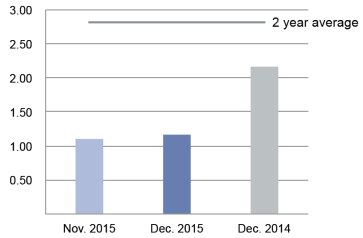
Incidents by category



Top 20 contractors (accidents and jobs)



Incidents per initial job cost ($10 millions)



Total incidents by reporting party

Incidents by type of construction

Type of Construction	Building Sites	Accidents	Injuries	Fatalities
0-Demolition	2%	7%	8%	6%
1-New Building	11%	48%	50%	25%
2-Major Alteration	13%	8%	7%	0%
3-Minor Alteration A2	62%	25%	24%	69%
4-Minor Alteration A3	11%	11%	11%	0%
5-Scaffold or Sign SG	1%	0%	0%	0%

PROTOTYPE VERSION 5

RECOMMENDATIONS

RECOMMENDATIONS

I. BECOME DATA DRIVEN

Continue to improve **data collection** and **analytic capacity**

II. CREATE EVIDENCE BASE

Identify **evidence-based practices** and **evaluate DOB actions** and safety programs

III. IMPLEMENT SAFETY FIRST

Implement a safety **performance management process**

I. BECOME DATA DRIVEN

*Continue to improve **data collection** and **analytic capacity***

SHORT TERM

1) Simplify current paper accident form.

2) Standardize incident reporting procedures.

3) Streamline data entry and approval process.

4) Apply design thinking / user-centered process.

5) Require all inspectors to report safety violations.

I. BECOME DATA DRIVEN

*Continue to improve **data collection** and **analytic capacity***

LONG TERM

1) Migrate incident database to Accela.
2) Expand analytics team by hiring:
   - Safety data manager
   - Data scientist
   - GIS analyst
3) Publish regular safety analytic reports, including the underlying machine-readable data.
4) Acquire analytics software *(Tableau, Domo,Oracle BI).*

II. CREATE EVIDENCE BASE

*Identify **evidence based practices** and **evaluate DOB actions**.*

SHORT TERM

1) Review current DOB and industry practices.

2) Track DOB actions and evaluate impact on safety outcomes.

LONG TERM

1) Hire a program evaluation manager.

III. IMPLEMENT SAFETY FIRST

*Implement a safety **performance management process***

SHORT TERM

1) Develop single key measure of safety.
   - *e.g. serious injuries per total construction costs*

2) Create executive messaging to emphasize safety.

3) Disseminate weekly safety briefing to all employees.

4) Implement bi-weekly Safety First meetings.

III. IMPLEMENT SAFETY FIRST

*Implement a safety **performance management process***

LONG TERM

1) Expand safety metrics to managers and inspectors.

2) Develop proactive responses using analytics.

3) Consider quarterly or annual Safety-First meeting with contractors and other safety stakeholders.

APPENDIX

I. USER INSIGHTS ON DATA COLLECTION

- No one is physically filling out the paper forms
- Information on incidents is passed from inspectors to supervisors via set email list serves
- Form is too long for inspector to fill out on site
- There is a need for a standard, multi-user, electronic data collection system
- Must be coupled with strong executive message around accountability
- DOB should design process with feedback from inspectors using tools such as user testing
- A digital form to file incidents must be included in the proposed tablet system for inspectors

II. GOALS FOR DOB

In order to prevent construction related injuries and fatalities, DOB must improve is analytical and organizational capacity to:

1. Identify and prevent accident risk,
2. Develop effective risk mitigation responses,
3. Evaluate performance of DOB staff with regards to safety, and
4. Report safety data in a timely and machine readable manner.

FOR INTERNAL USE ONLY

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KIRSTEN RULF
DAN WAGNER

Summary of DOB Statistics 2015

Some quick calculations

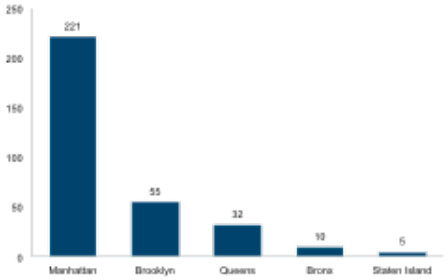
As you may already know, we are a group of Harvard students representing the Kennedy School of Government and the Graduate School of Design. As part of the course titled "Technology and Governance" our task is to assist the Department of Buildings of NYC to find ways in which to utilize technology in a way that would assist you at DOB to understand and prevent further incidents to take place in construction sites.

Our first step was to look at the data that is published by DOB online. We want to figure out what data is being collected and how the data management process can be tailored in a way that is most informative. This sheet surves both to summarize the strength of the data that is already being collected by the DOB, as well as to start a conversation about what kind of information would be most useful for you in your work.

323 incidents

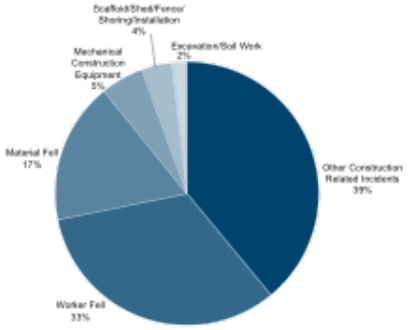
356 injured **9** fatalities

22 incidents with more than 1 injury



Number of Incidents by Borough

The number of incidents correlates to the number of construction sites in each Borough

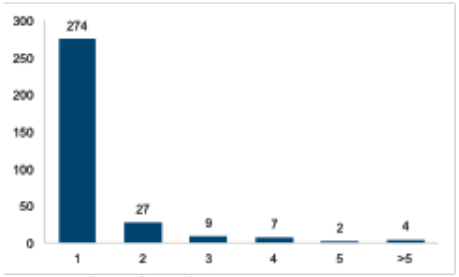


Type of Incident

The type of incident also does not indicate the severity of injuries or if there were any fatalities.

213 sites with incidences

49 sites with more than 1 incidence



Number of Incidences per Construction Site

There were 3 sites that had 10 or more incidences. The highest frequency was 17.

Possible data sets to build on:

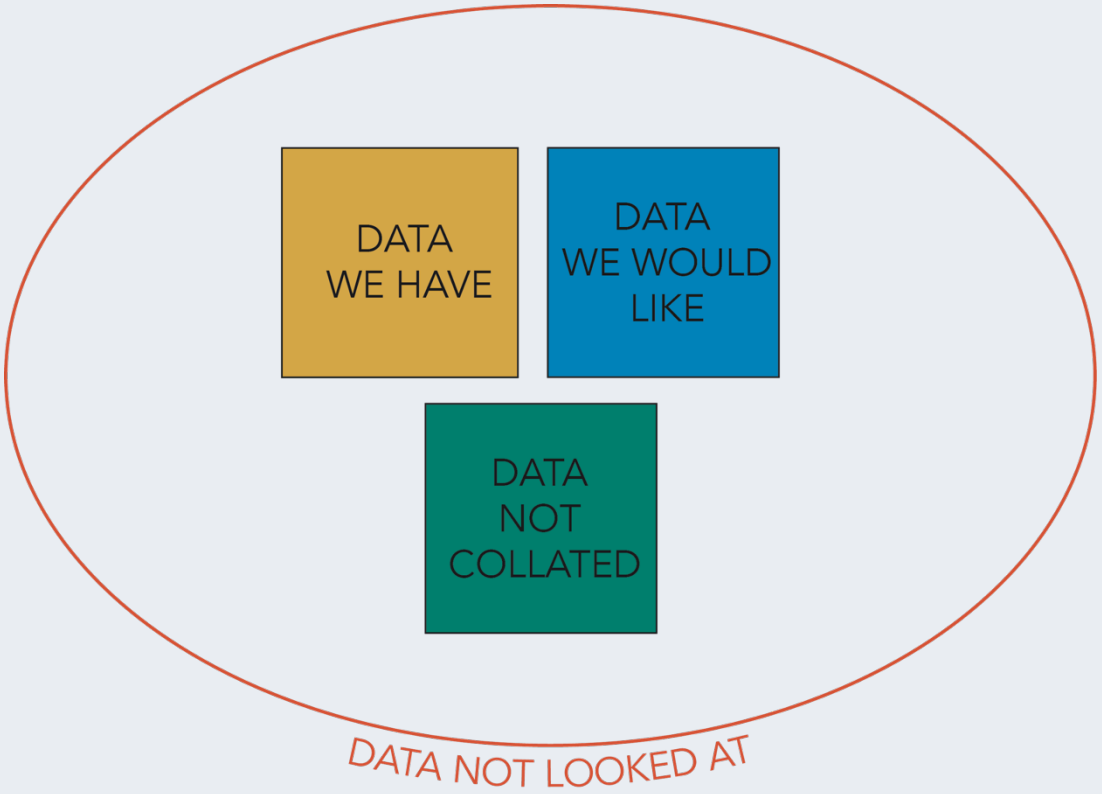
- Historical trends
- Geographic Information Systems (GIS)
- Demographic
- EMS
- Meteorelogical

III. One- Pager

Representation presented at client visit on Feb 2015.

IV. USER INSIGHTS DATA

A diagram of the data DOB collects or has access to.



The bigger challenge is getting DOB to use the data on a regular basis and not only after an incident occurs.

V. USER PERSONAS

DATA BROKER

The sole user of the incident database. This only person is at DoB that understands the incident database, can navigate through it and can identify it's shortcomings.

DATA MINERS

This persona is data-savvy and has the capacity to carry-out data analysis. These users have some interaction with the incident database however generally need to peice together information from other sources in order to conduct analysis. A tedious and cumbersome process, this user refers to the data broker for help.

DISENGAGED

This user has never used the incident database, nor do they have incentive to in their daily work. Users in this group also identified that construction safety is not the core responsibility or mandate of the DoB.

DECISION MAKERS

This persona is interested only in results of data analysis as a foundation for their decision to allocate scarce DoB resources. These users are concerned about site safety, but it is not a top priority in their daily work. Raw data is none of their concern. They want a well-presented, succinct report.

Our categorization of DOB employees and how they interact with the incident database.

VI. USER TESTING
FEEDBACK

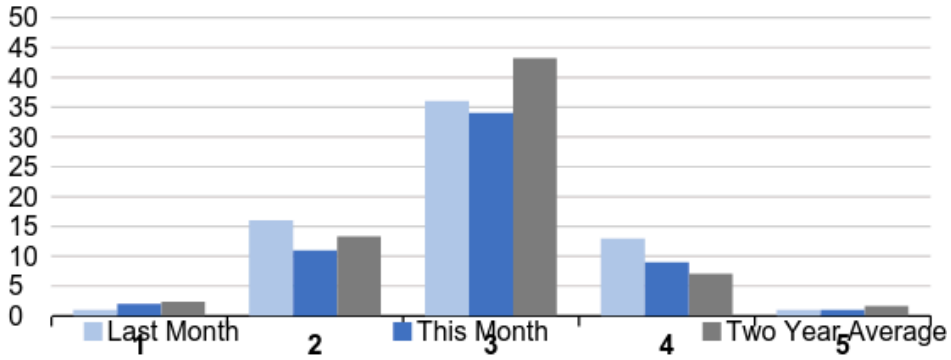
- Duplication of inspector names and inspector ID number.
- Drop down menus for dates when possible.
- Number of fatalities/ injuries should be moved to one of first questions.
- Percent completed number on top should change while going through the survey.

VII. Monthly Management Report

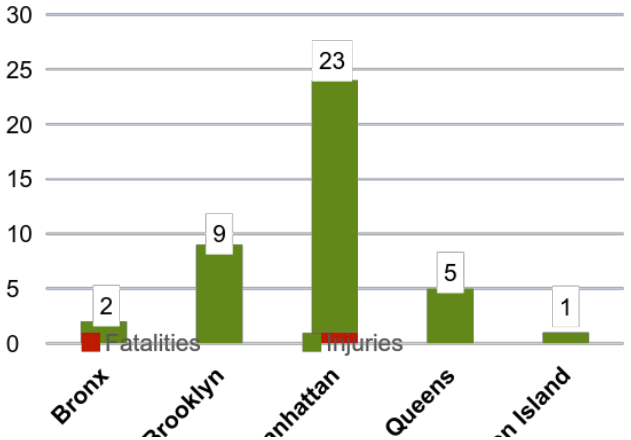
Description of Data Analysis and Indicators

Department of Buildings
Weekly Safety Brief

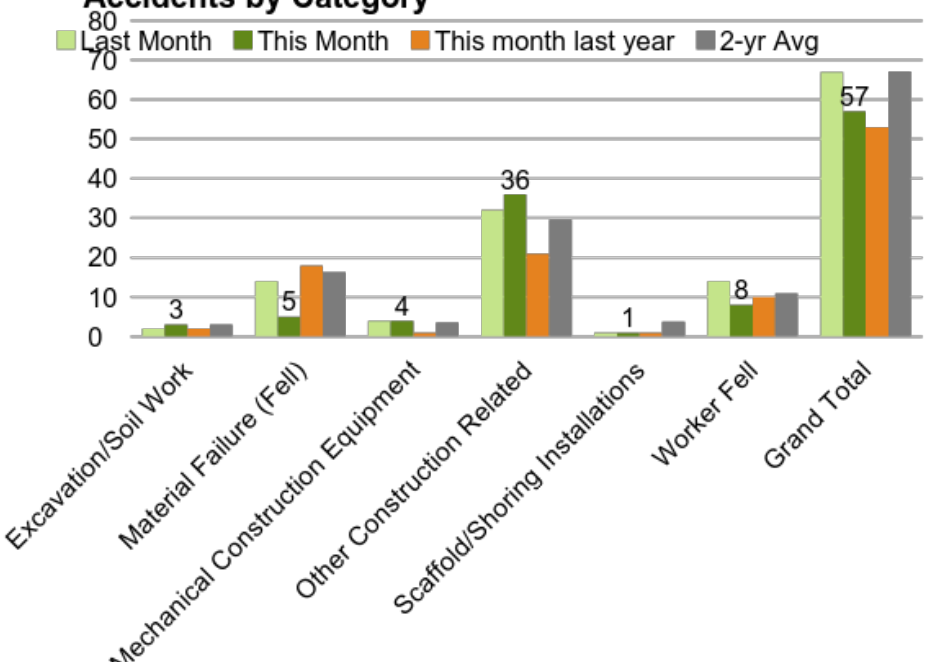
Monthly Accidents by Borough
All accidents reported



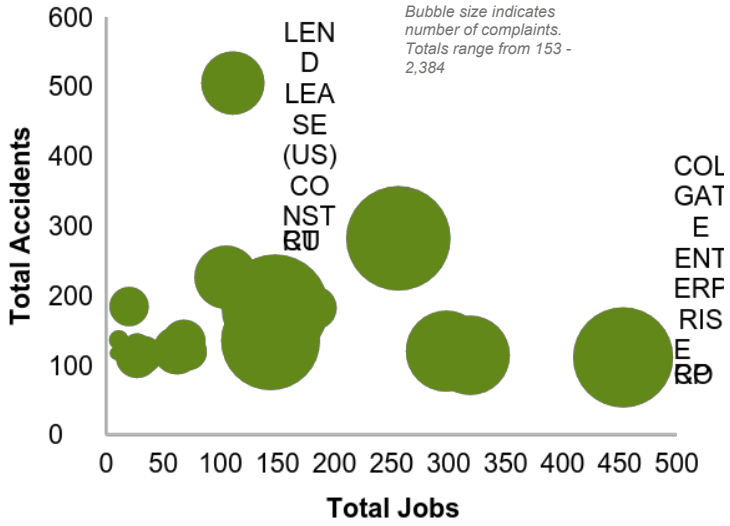
Serious Accidents by Borough
Accidents resulting in injuries or fatalities



Accidents by Category

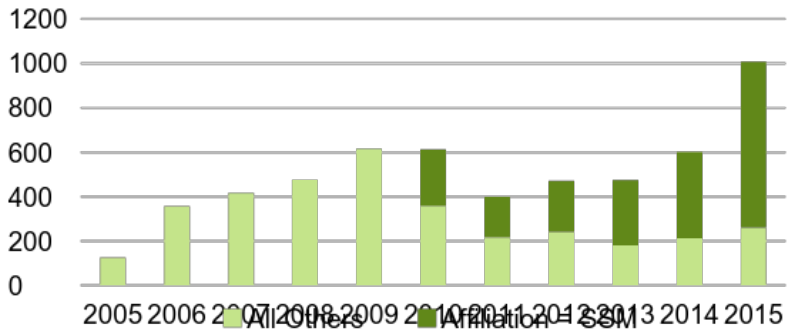


Top 20 Contractors

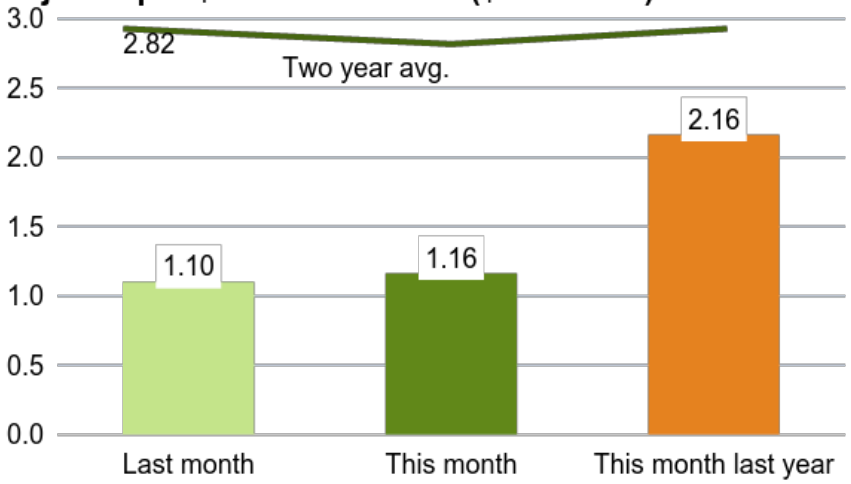


Department of Buildings
Weekly Safety Brief

Total Construction Accidents by Reporting Party



Injuries per $ Job Initial Costs($10 Million)



Accidents: % by Severity and Construction Type

	Building Sites	Accidents	Injuries	Fatalities
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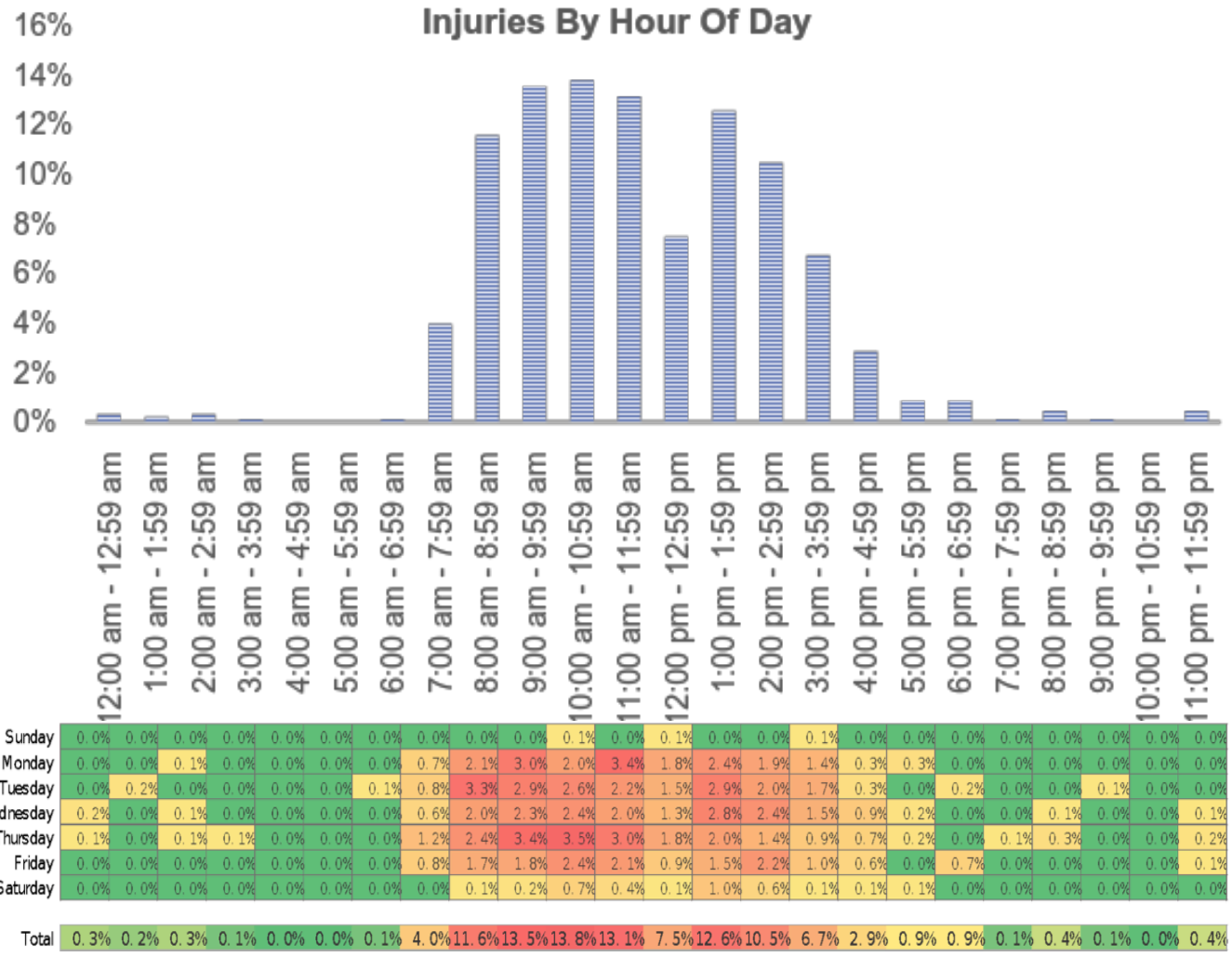
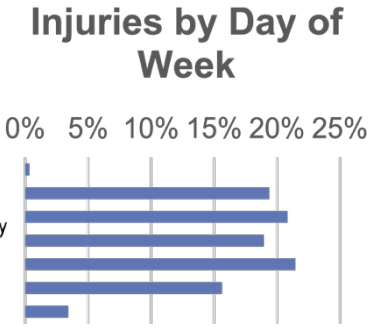
5-Scaffold or Sign SG	1%	0%	0%	0%
	100%	100%	100%	100%

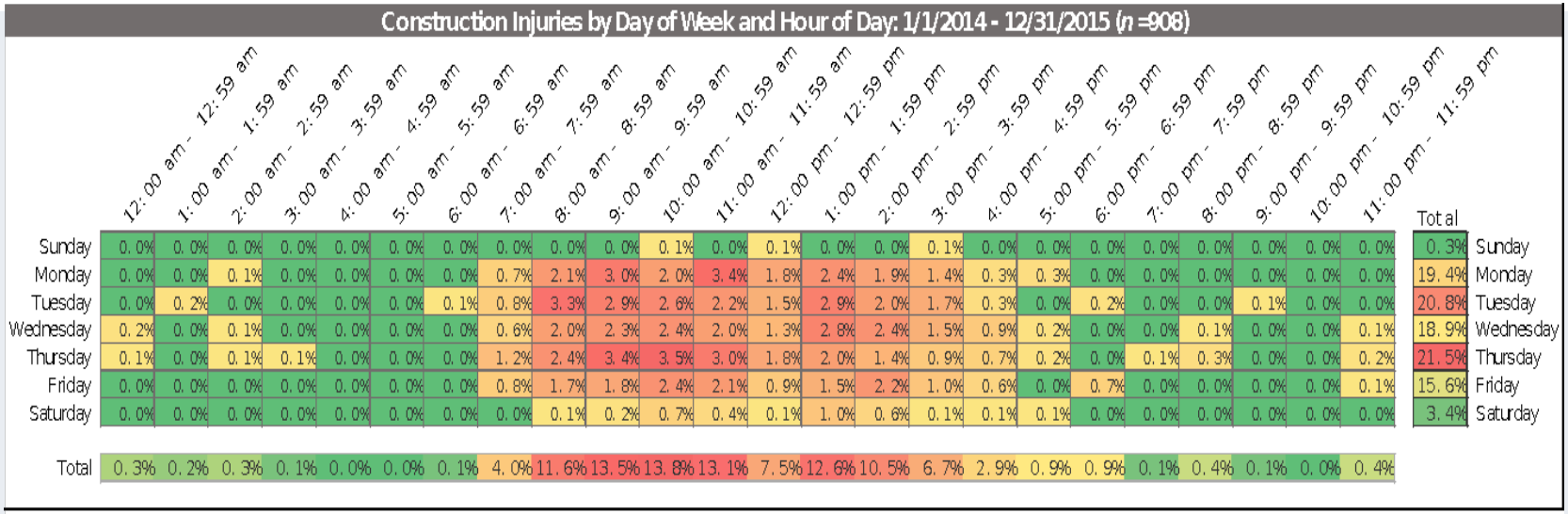
Department of Buildings
Weekly Safety Brief

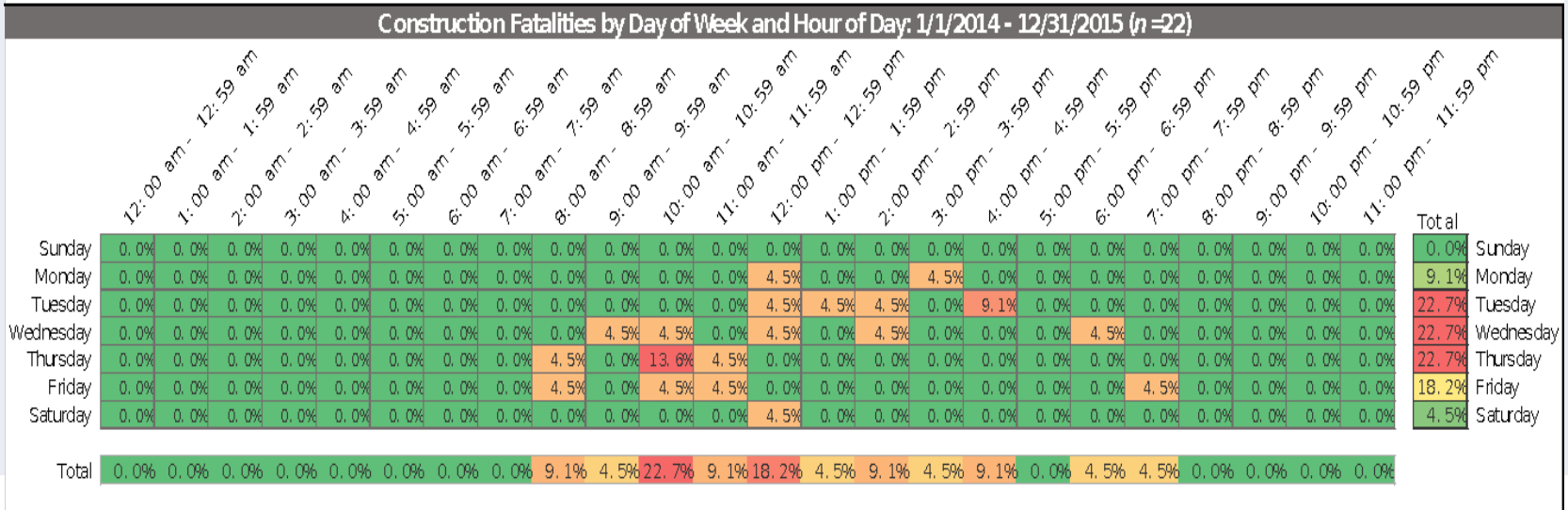


Construction Accidents with injuries are most likely to occur on Thursday mornings.

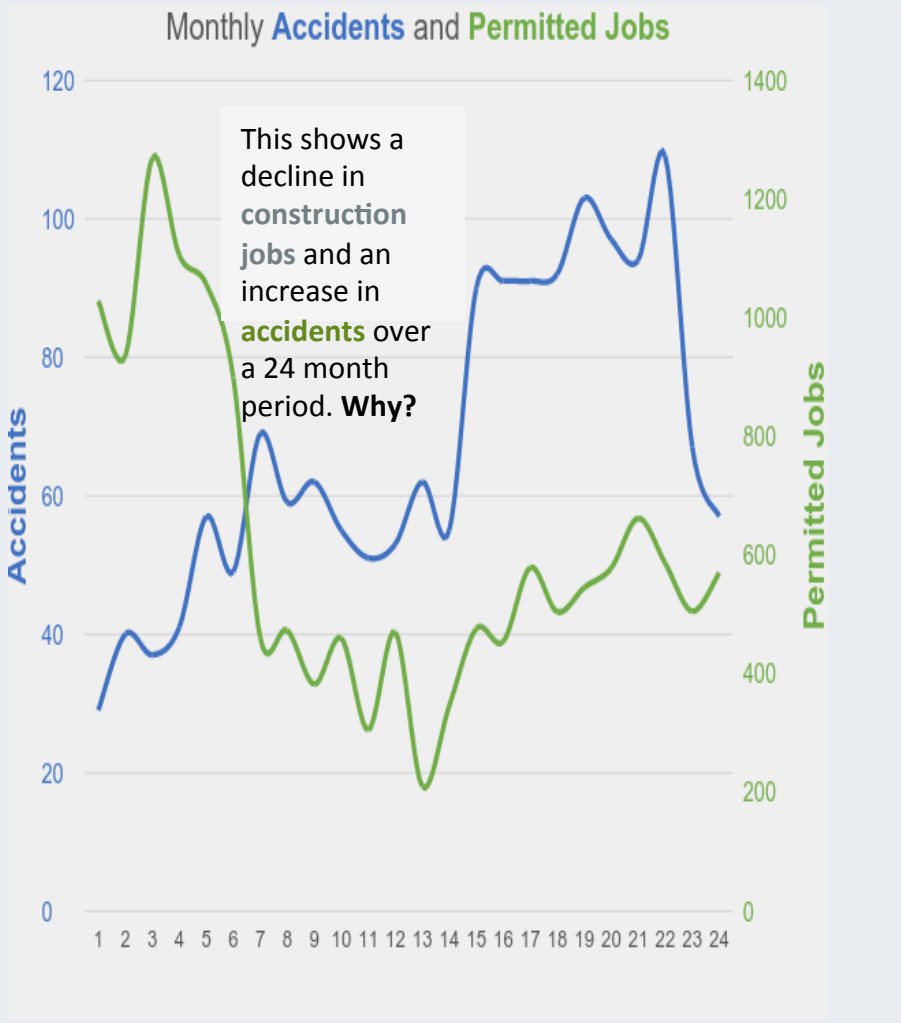


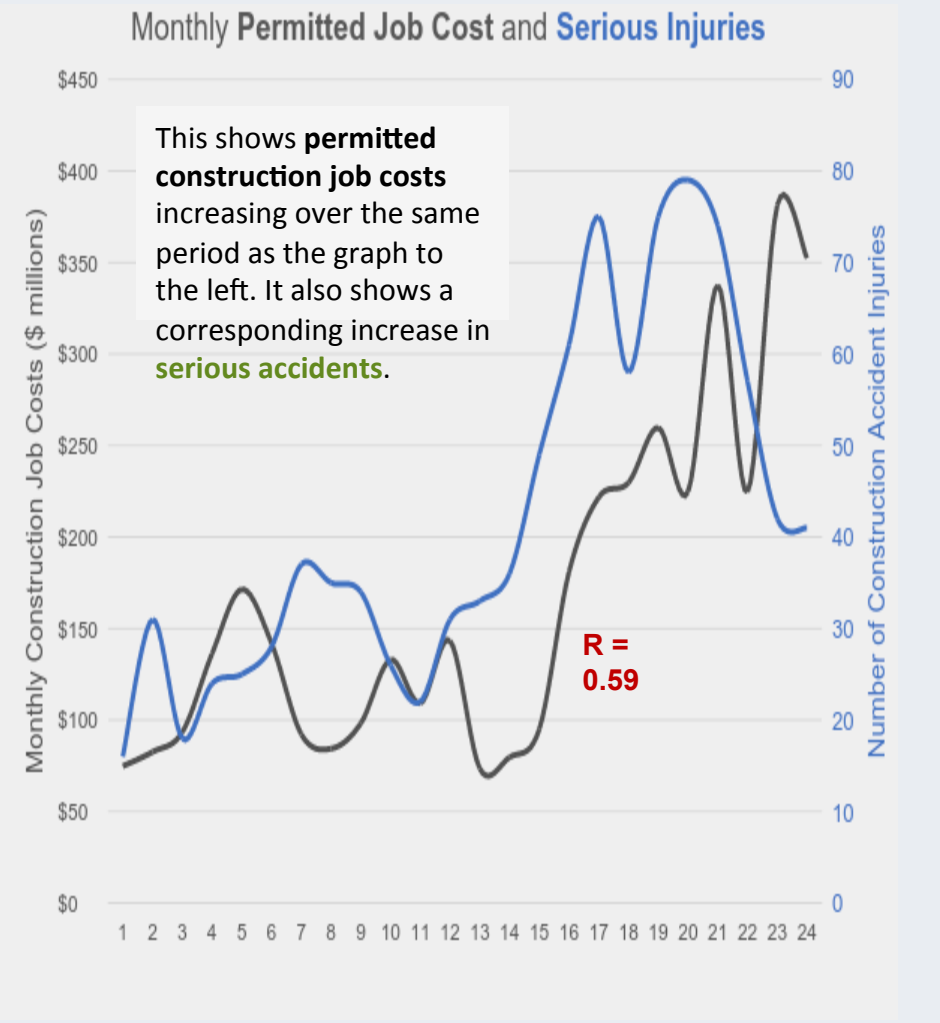
CONSTRUCTION INJURIES BY DAY OF WEEK AND HOUR OF DAY





Finding a good measure of accident rates over time





Serious Injuries per Total Active Construction Costs

patients transported to hospital by EMS per $10 million in current permitted job costs

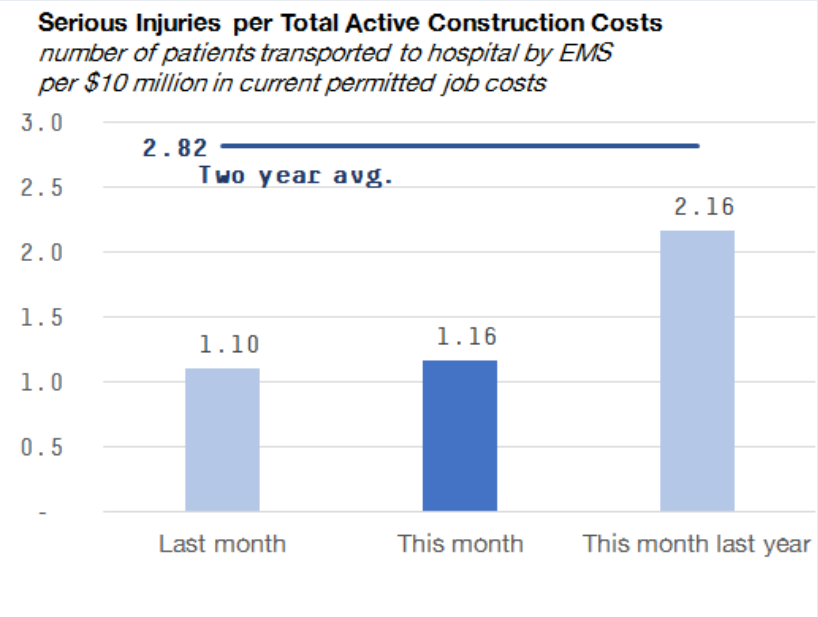
While it may appear that construction accidents have increased recently, it may very well be that *fewer overall are occurring when factoring construction volume*.

The challenge here is to **identify two useful measures that when evaluated together provide a meaningful and consistent rate**. A classic example is frequency of an event divided by the population (e.g., number of homicides per 100,000 population).

Ideally we'd use a more reliable indicator than simply *total* accidents. (We know that regulatory changes involving Site Safety Manager requirements increased total accidents reported.)

We recommend using *serious injuries*, as identified by the least subject measure (like those injuries resulting in an ambulance transport to the hospital).

And then divide serious injuries by a meaningful measure of current construction volume - like total costs of current permitted jobs:



(serious injuries) / (total costs of current permitted jobs) = key safety performance measure

Finding the Strongest Correlation

Note: this measure needs to be further refined. There is likely a lag between the time the permit is issued and work starts. Perhaps a better indicator is the total value of all ongoing construction during a give month, but the data we have lack work completion dates.

Measure	R value
Proposed Zoning Sqft	0.40
Proposed No of Stories	0.44
Initial Cost	0.59
Total Jobs	-0.33