Safety Registration Report Study

FINAL REPORT

Submitted to:

New York City Department of Buildings

Submitted by:

The Louis Berger Group, Inc.

In association with:

The Maia Strategy Group, LLC

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EXECUTIVE SUMMARY

One of the Department of Buildings' (DOB) key objectives is the safe conduct of construction work on buildings in New York City. To support the DOB's safety oversight responsibilities for major construction projects, the City Council enacted Local Law 8 of 2009 that requires most demolition, concrete, and general contractors to obtain a Safety Registration Number. The Safety Registration process facilitates the DOB's tracking of violations, accidents, and complaints associated with work undertaken by contractors.

The legislation requires the DOB to submit a report to the Mayor and City Council providing recommendations for establishing objective criteria for enforcement actions. The DOB completed the initial assessment (Phase I Report), and retained The Louis Berger Group (LBG) to prepare a Phase II Report outlining recommendations for enforcement thresholds and criteria. The Phase II Report was developed in accordance with the following objectives:

Conduct a statistical analysis of safety registrant data to support the enforcement action criteria;

Incorporate construction industry stakeholder input into enforcement recommendation criteria;

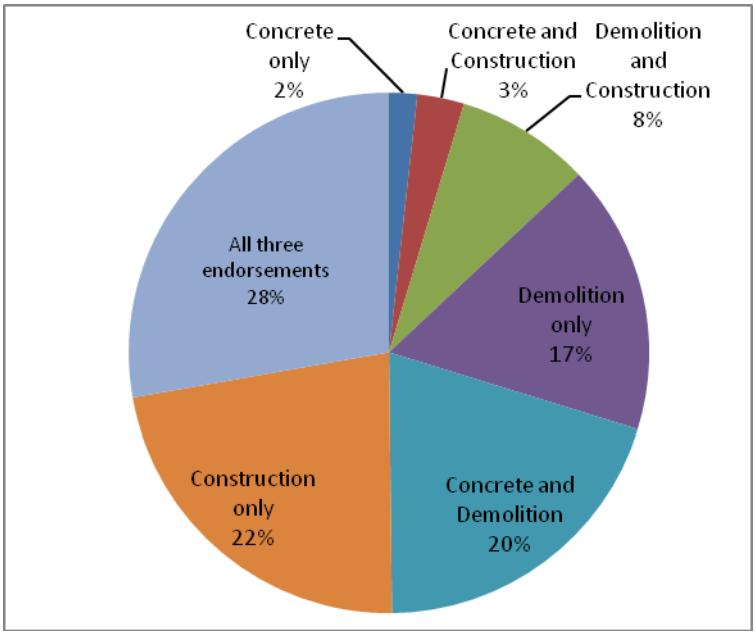
Summarize findings: include recommendations on enforcement action and produce a preliminary draft report for internal review and final report for submission to the Mayor and City Council

This section summarizes the findings of the Phase II study effort.

SAFETY REGISTRANTS

Taking into account data received through January 2011, a total of 2,875 businesses have acquired DOB Safety Registration Numbers as required by Local Law 8. A total of 1,454 of these registrants are General Contractors for 1, 2 and 3 family homes (GC123). A distribution of registrants by endorsement or safety registration subtypes is presented in Figure 1.

Figure ES-1: Distribution of Safety Registrants by Endorsement



DATABASE

At the start of Phase II, the study team created a relational database that linked the individual violation, accident, complaint, and job data from the DOB B-Smart database through common identification fields to safety registrants. To maximize the number of records, the team collected data on all violations, complaints and accident

reports that were issued in January 2008 or later. The resulting database was then filtered to include only those records that could be linked directly to safety registrants. Records with missing identifier information, or associated with other parties (e.g., owners and licensed trade contractors) were not included in the study dataset.

In development of the dataset, the study team has been able to assemble the information necessary to develop measures that characterize the normal range of registrant performance in violations, correction of violations, stop work orders, and accidents. These performance measures are suitable for use in a system that will flag and prioritize DOB's oversight activities. Through the course of the investigation, we have found opportunities for DOB to improve the thoroughness of its data collection or to enhance it with additional information. These opportunities are noted in report along with recommendations for future improvements to the performance measures that will enhance their reliability and representativeness.

KEY VARIABLES AND FINDINGS OF STATISTICAL ANALYSIS

Our evaluation identified several key variables considered in the development of performance measures as outlined below.

A. ECB Violations – Identified in the Phase I Report as the most easily generated measure of contractor safety, Environmental Control Board (ECB) violations were confirmed during Phase II as a key measure in evaluating safe contractor performance. Attributes that make violations an important performance measure include the following.

- Adjudication - Registrants are given full opportunity to contest the basis for a violation in a hearing.
- Validity – Most violations issued to registrants by inspectors are upheld in the adjudication process. During the two year study timeframe, only about 8 percent of the violations issued to safety registrants were dismissed by the ECB.
- Good record – Our study found that most registrants have a clean record with respect to ECB Violations. Approximately 61 percent of registrants had no violations on their record during our study time period. The proportion of registrants with between 1 and 3 violations was 19 percent. Only 10 percent of the registrant population had more than 9 violations during the study time period, and only 1 percent had more than 60 violations.
- Accounts for severity – The DOB notes the severity of the violation through a classification system that calls out those violations that pose an immediate hazard to safety (Class 1). Instances where previous violations have gone uncorrected or where contractors fail to cooperate with inspectors are noted as Aggravated. Review of the data shows that immediately hazardous Class 1 violations account for 39 percent of violations during the study period but that only 1 percent of the violations are aggravated.
- Leading indicator of accidents – Violations are a leading indicator of accidents. Registrants with high rates of violations are more likely to have accident records. For example, the two most serious accident types, which are "worker fell" and "material failure (fell)", typically have more preceding violations than other accident types. More specifically, one quarter of material failure accidents are preceded by more than 23 violations and one quarter of worker fell accidents are preceded by more than 15 violations. Violations that precede

accidents are more likely to be immediately hazardous (Class 1) than violations that do not precede accidents. Our examination of the distribution of accidents and violations found that registrants in the worst 6 percent of performers in terms of violations per job had a higher than normal probability of accidents.

B. Job Size and Complexity – Although violations are an important indicator of registrant safety performance, the analysis shows that the incidence of violations is directly related to the registrant's workload. Two sources of data collected by DOB can be used to assess the workload of registrants and take that workload into account when evaluating performance:

- Number of Permitted Jobs – The number of jobs that a registrant is engaged in was found to have a positive effect on the number of violations cited to that registrant. The relationship between number of jobs and violations was not linear, however. For new buildings jobs, for example, every ten-fold increase in the number of jobs was found to produce a two-fold increase in violations. This effect was less pronounced for other job types.
- Construction Floor Area (Job Square Footage) – Construction floor area has not been consistently recorded for entry in the DOB database. The study dataset includes this measure on less than 10 percent of job records. Regression analysis of this limited dataset indicates, however, that construction floor area by registrant explains approximately 40 percent of the variation in violations by registrant. Due to the limited number of records, the consultant team is recommending more systematic collection of floor area data before this measure is utilized in the performance measurement system.
- Job Cost – To further evaluate the complexity of work, we also recommend that job cost information be regularly collected by DOB and analyzed to determine if it is useful in separating registrants into categories reflective of how the volume and complexity of work affects the performance measures.
- Inspections – While we cannot test the effect of inspections on violation rates directly because of the lack of full data regarding the number and type of inspections by job, two findings suggest that the number of inspections also positively affects the number of violations.
  - Smaller businesses (GC123) have a lower violation rate than larger businesses. Because GC123 have smaller jobs that are typically subject to fewer inspections, the GC123's lower violation rate may be a reflection of the fewer inspections.
  - Assuming the same number of jobs, registrants with at least one proactive Buildings Enforcement Safety Team (BEST) job have more violations than other registrants. Because BEST jobs are subject to frequent proactive inspection, the positive effect of BEST status on the number of violations may be related to the BEST inspection regime.

C. Violations Correction Time – Unless dismissed by the ECB, violations need to be corrected or cured. Tracking of correction time is an important performance measure because it indicates prompt efforts to address safety concerns and comply with DOB regulations. In general, violations must be corrected within 40 days after they are issued. Class 1 violations need to be corrected immediately. Within our study time period, three quarters of violations were certified as corrected more than 41 days after they are issued. Prior to 2010, the DOB did not accept Certificates of Correction for a violation prior to the ECB hearing date. The long average time

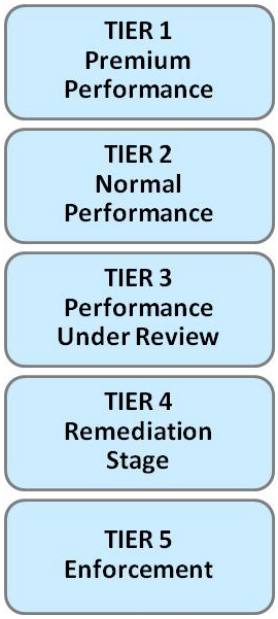
periods for correction observed in the study dataset are attributable primarily to this policy. At the present time, DOB accepts Certificates of Correction anytime following issuance of a violation. This policy is expected to reduce correction time overall. An analysis of Class 1 violations issued on or after October 2010 to general contractors shows an improvement in the correction time. Half of these Class 1 violations are corrected within 58 days and only one quarter were listed as corrected after more than 100 days.

D. **Stop-work Orders** – Stop-work orders are issued for important violations of department regulations and provide an indication of potential problems in project management that should be tracked by DOB. Most registrants, 74 percent, had no stop work orders issued during the study period. Approximately 9 percent had one stop work order on record, and 16 percent had two or more. In aggregate only 2.6 percent of safety registrant jobs were issued stop work orders.

REHABILITATION FRAMEWORK

The study team's understanding of the statistical distribution of the key variables in the safety registrant database allowed us to develop recommendations for a Rehabilitation Framework that identifies registrants with poor safety performance and encourages improved performance. The framework outlines the tracking of registrants with continued poor performance so that enforcement action may be prioritized.

The proposed framework is a five-tiered system which includes a base of performance measures. This system establishes flagging and prioritization which leads to increased monitoring and inspections. With continued records of non-compliance, registrants in the highest tier may be subject to registration suspension, revocation or denial of renewal. Compliance with safety regulations, the occurrence of accidents and cooperation with the enforcement process will determine a registrant's position in the tiered system.



Registrants with a typical record of safety performance and compliance are placed in the second tier. Providing an incentive for excellence, the first tier is reserved for registrants with an exceptional safety record. The system provides the registrant many opportunities to improve its safety record before being placed in the fifth and final tier, in which the registrant may be subject to license suspension, revocation or denial of renewal in accordance with standard DOB disciplinary procedures. DOB will closely monitor the disposition of existing violations, characteristics of accidents, and occurrence of new violations/accidents for all registrants placed in Tier 3 and work with registrants that are in Tier 4 to develop a remediation plan.

Registrants move from one tier to another in part based on whether they exceed a series of performance measure thresholds that are derived from both DOB data and external sources. Most of these thresholds are determined using a comparative approach, comparing registrants to other registrants with similar characteristics, as follows.

- Three comparison groups of registrants will be created for the initial performance rankings: GC123s; registrants with at least one job of 15 stories or 200 feet and taller, or lot coverage

of 100,000 square feet or more (a job falling under the BEST Squad's responsibilities); and all other safety registrants. These groupings are designed to provide an initial method to distinguish between registrants with low volume, low complexity assignments and those with higher volume, higher complexity assignments. By applying performance measures separately registrants by group, the framework takes into account the lower inspection rate for GC123 jobs and the regular inspections conducted for jobs under BEST-squad jurisdiction. To ensure that the evaluation groups reflect the best information available to DOB, we are recommending that DOB establish routine and comprehensive collection of construction floor area and job cost data and evaluate that data for use in separating registrants into categories reflective of volume and complexity of work affects the performance measures.

- Registrants with performance rankings that are clearly worse than normal performance would be identified. The evaluation threshold we recommend is the 94th percentile, which identifies the top 6 percent worst performers from the registrants in the comparison group. This level of violations per job performance was found to indicate higher than normal probability of accidents, and also indicates performance that is substantially worse than normal for other performance measures.
- To ensure that businesses with a low number of violations and active jobs will not be subjected to more stringent requirements than larger firms, registrants with less than three violations in the past two years will be excluded from assignment to Tier 3, so they will not be selected for increase scrutiny based solely based on their violation ranking as outline above.
- Confirming the importance of a zero-accident workplace, the accident threshold is determined by absolute measurement, with registrants with 1 or more fatal accidents in the past 6 months being selected for increased oversight.

THRESHOLDS

The thresholds for the following measures will be determined through the comparative approach, which is straightforward to implement and adaptable to changing circumstance:

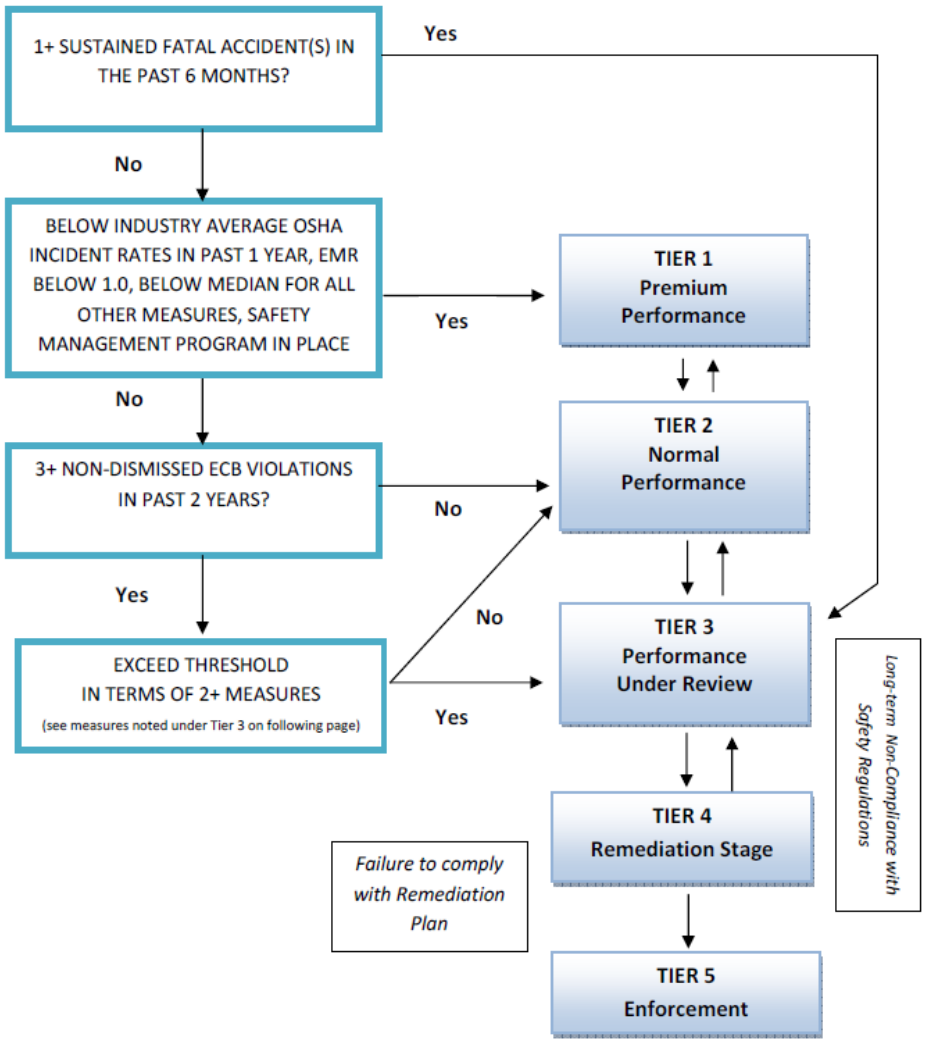
- Number of non-dismissed, sustained violations per job
- Number of non-dismissed, sustained immediately hazardous violations (Class 1) per job
- Average number of days to correct a Class 1 violation
- Number of stop work orders per job
- Experience Modification Rate (EMR)

The thresholds for the following measures will be determined using an absolute value:

- Number of Fatal Accidents Resulting in Violation
- Average days to correct violations above 30 days (at this level registrants are subject to increased inspection and can be cited for aggravated violations if the original infractions are not corrected).

As outlined above, the threshold performance measures are to be applied in a stepwise fashion to determine a registrant's placement in the tier system on a periodic basis. The proposed operation of the rehabilitation framework is summarized in the flow chart in Figure 2.

Figure ES-2: Flow Chart Summary of Rehabilitation Framework



To ensure that registrant performance is monitored on a regular and continuous basis, we recommend that the performance measure rankings be produced by DOB every six months. To provide adequate notice of the operation and function of the program, the first two ranking cycles should be considered a trial. This will provide DOB with a period of one year to monitor and evaluate performance of the system and to implement the recommendations for enhancement of the measures. Notice of tier ranking will be provided to registrants but the tier placement will have no bearing on DOB inspection or enforcement action during this period. The third cycle will start six months after the trial period and will not take into account the registrant placement in the first two cycles. A summary of the operation of the Rehabilitation Framework is presented in Table ES-1.

Table ES-1 – Summary of Rehabilitation Framework

Tier	Description	Threshold Status	DOB Action	Detailed review of Registrant	Action by Registrant
Tier 1	**Premium Performance** – Excellent performance record	*Eligible if all of the following:* Below average in terms of OSHA RIR and DART EMR below 1 Below median for all other measures Safety management program in place	Notice Letter. DOB may reduce frequency of inspections.	None required.	If interested, apply for Tier 1 Status by certifying that company has active safety management system and qualifies by other performance measures.
Tier 2	**Normal Performance** – Normal record of violations per job and no incidents with injuries or fatalities.	This tier includes all registrants with performance measure results not falling into the other tiers.	Notice Letter. Standard inspection requirements.	None required.	None required; continue to correct/ cure violations as they arise.
Tier 3	**Performance under Review** – Substantially higher rate of violations or accidents than normal.	1 or more sustained accidents with fatality in last 6 months. *OR:* At least TWO of the following: Top 6% worst performance in terms of: - Violations per job (unless less than 3 violations in measurement period.) - Class 1 violations per job - Stop work orders per job - EMR Average time to correct a Class 1 violation exceeding 30 days.	Warning letter by mail requiring response. May increase level of inspection activity as warranted.	Closely monitor disposition of existing violations, characteristics of accidents, and occurrence of new violations/accidents. Move registrant to Tier 2 if violation/job/inspection below median for Tier 3 registrants and no accidents Move registrant to Tier 4 if registrant ranks at Tier 3 level for more than two consecutive periods UNLESS no new violations/ all existing violations are corrected.	Registrant must improve performance to Tier 2 or Tier 1 level or avoid new violations and correct existing violations within two following periods to avoid elevation to Tier 4.
Tier 4	**Remediation Stage** – Continuing high rate of violations, poor record of correction	Ranking at Tier 3 level for more than two consecutive periods and new violations/uncorrected violations	Warning letter by mail requiring response and conveying remediation plan requirements.	Increased level of inspections and monitoring of violations disposition to ensure compliance with remediation plan.	Registrant must submit remediation plan to DOB and successfully complete within agreed time period to avoid enforcement action.
Tier 5	**Enforcement** – Failure to remediate poor record	Failure to comply with remediation plan.	Notice letter by mail requiring response. Begin proceedings for suspension or revocation of registration or non-renewal of expiring registration.	Flag registrant ownership; closely monitor new registrations by same owners for compliance with standards.	Registrant must comply with DOB conditions and standards for registration reinstatement as appropriate.

The time frame of the data on which performance measure rankings are based will vary in accordance with the features of each measure. For the thresholds related to violations and stop work orders, the rankings will be based on data of the preceding year. EMR rankings will be based on the most recent EMR provided to the registrant by the New York Compensation Insurance Rating Board. The EMR is calculated to include the last three years of a contractor's performance. Because accidents are of a more serious and immediate nature than the other measures, accident counts (as defined above) will be based data for the previous 6 months.

Depending on the outcome of the updated ranking and accident counts, registrants move down the tier system to a tier with less oversight, move up to a tier with more oversight, or remain in the same tier. Registrants who are ranked in Tier 3 for more than two consecutive periods based on their violation, stop work order, or EMR rankings are automatically moved to Tier 4. Registrants in Tier 3 that do not incur new violations or accidents are not advanced to Tier 4. Registrants in Tier 3 with favorable performance in terms of violations per inspection (below median performance) will be placed in Tier 2.

The tiered structure allows for reductions in the level of oversight by DOB for registrants in Tiers 1 and 2, as compared to current practice. Increased levels of oversight will be prioritized to Tiers 3 and 4, which are expected, based on the preliminary estimation of performance measures outlined in this report, to contain less than 10 percent of registrants overall.

The report outlines several recommendations for implementation of the framework, listing the procedural requirements, notice and response requirements, and the structure of the remediation plan.

The report also outlines key challenges that DOB is likely to face in the implementation of the framework, and potential responses that may mitigate problems in the performance tracking and prioritization system.

The recommendations of the study team include a set of performance measure thresholds and framework for implementation that is suited to the data currently collected by DOB. Stakeholder outreach sessions combined with research conducted by the study team have identified recommendations for improvement of data collection and maintenance and enhancements to the performance measures.

Comments received during stakeholder outreach have confirmed that safety is the top priority of all participants in the New York City construction industry. This report outlines a system for prioritization of DOB's oversight and disciplinary responsibilities that is designed to promote compliance with regulations, safe practices on construction sites, and proactive steps to identify and improve poor performance by registrants.

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1. INTRODUCTION

To ensure that the Department of Buildings (DOB) has the information it needs to properly regulate the safety of major construction work, the City Council enacted Local Law 8 of 2009. The law requires all general contractors, demolition contractors and concrete contractors to obtain a Safety Registration Number before conducting the following types of work:

- A New Building permit, other than 1-, 2- and 3-family homes
- An alteration permit or an enlargement more than 25 percent of an existing building's floor area
- An alteration permit to add three or more stories to an existing building
- An alteration permit for demolition or alteration of more than 50 percent of an existing building's floor area
- An alteration permit to remove one or more floors of an existing structure
- A demolition permit
- The placement of 2,000 cubic yards or more of concrete in connection with excavations, foundation or superstructure work.

The Safety Registration process will allow the DOB to track violations, accidents, and complaints attributable to work undertaken by contractors and enable enforcement action such as suspension, revocation, or refusal to renew Safety Registrations.

A key component of the legislation is the requirement that the DOB submit a report to the Mayor and City Council providing recommendations for establishing objective criteria for enforcement actions. The report has been developed in two phases of work.

Phase I: As part of Phase I, completed in May 2010, the DOB conducted an initial assessment of:

- Currently available enforcement data that may be relevant to denying, suspending or revoking a safety registration number;
- Criteria used by other municipal agencies and jurisdictions to deny, suspend or revoke a license; and
- Factors to be considered in establishing the criteria.

As part of Phase I, the DOB conducted a series of roundtable meetings with construction industry stakeholders to obtain stakeholder feedback and recommendations.

Phase II: The DOB retained The Louis Berger Group, Inc. (LBG) to help prepare the second phase of the report. The goal of Phase II was the development of criteria to revoke, suspend or deny renewal of safety registration based on existing and new data. The key objectives of Phase II were:

- Perform data analysis and statistical analysis based on existing data and new data;
- Obtain stakeholder input to apply to safety registration program;

- Summarize findings: include recommendations on enforcement action and enhancements in data collection and organization; produce a preliminary draft report for internal review and final report for submission to the Mayor and City Council.

This Final Report of the Phase II findings includes the following sections:

- Overview of data sources
- Key findings of statistical analysis
- Summary of benchmarking
- Summary of literature review
- Summary of Stakeholder input
- Recommendations on Thresholds and Standards for Enforcement Action

2. OVERVIEW OF DATA SOURCES

The statistical analysis conducted in this study was based on data maintained by DOB in its BIS Database. Key variables (i.e., jobs, violations, accidents, and stop work orders) were linked to safety registrants in a relational structure. This allowed the consultant team to develop statistical profiles of each variable, and identify relationships between variables. The analysis of the data supported the development of performance measures and thresholds used in the Rehabilitation Framework.

2.1. B-SMART DATABASE

In preparation of this report, LBG conducted a thorough review of the B-Smart database with particular focus on the following data sets:

Safety Registrants – Safety Registrants are individuals, corporations and partnerships registered under the Safety Registrant Program. Using the taxpayer ID to identify businesses owned by the same entity, we found a total of 2,875 unique safety registrants, 1,454 of which are General Contractors for 1,2,3 family homes (GC123) (i.e., registration with DOB required to obtain a new building permit for 1,2,3 family homes).

License – DOB license table keeps track of 40 categories of licenses and registrations, ranging from safety registrations and general contractor registrations to licenses to perform very specific activities such as an electrician license and a welder license.

Job – Strictly defined, a job is an application to the DOB for a permit and can have a status ranging from pre-filed, application processed, permit issued to completed or suspended. The number of permitted jobs is an indicator of the volume of work for a particular contractor or group of contractors, and for the level of construction activity in the City in general.

Environmental Control Board (ECB) Violations - Environmental Control Board (ECB) Notices of Violation, referred to as ECB violations, are the most common type of violation issued by the DOB. The ECB is an administrative tribunal that hears cases in which New York City has charged a person or business with violating City laws that protect health, safety, and a clean environment.

Accidents – Accidents are any incident on a construction site resulting in injuries or fatalities to workers or the public.

Complaints – A complaint is an expression of dissatisfaction about a construction site or building that is entered in the DOB database. Complaints can be reported by citizen or government agencies. The DOB uses the complaint system also to route and track inspections.

Stop work orders – Stop work orders require that the contractor stop (1) all work on a construction site with the exception of any necessary remedial work to make the site safe (full stop work order) or (2) certain types of work (partial stop work order). The DOB issues a stop work order when inspectors find hazardous or unsafe work and/or conditions to protect the public as well as buildings and properties from unsafe conditions. To lift a stop work order, the violating conditions must be corrected and re-inspected and civil penalties must be paid.

2.2. STUDY RELATIONAL DATABASE

To prepare for the statistical analysis, LBG created a relational database that linked the individual data tables in the B-Smart system through common identification fields. For example, safety registrants were linked to jobs and to ECB violations through the license number. During this process, a large proportion of the original records extracted from the B-Smart system were omitted because: (1) the records were not associated with safety registrants or with registered general contractors; (2) it could not be established with whom the records were associated because of missing or incomplete identifiers. The relational database includes only violations, jobs and accidents that LBG was able to link to safety registrants, either directly through the license number or name or indirectly through an ECB violation number. Examples of data issues include missing license numbers, missing business names, and misspelling of business names. Section 7.2.7 of this report includes recommendations for improved data collection. Table 1 shows a comparison between the DOB count of violations, stop work orders, and construction-related accidents and the number of records in the study dataset that can be directly attributed to safety registrants.

Table 1 – Comparison of Safety Registrant Study Relational Database with Total Counts, 2009

	DOB B-Smart System Totals	Safety Registrant Study	Safety Registrants as % of DOB Total
ECB Violations	78,358	5,991	7.65%
Stop Work Orders	9,770	388	3.97%
Construction-related Accidents	218	84	38.53%

Source: New York City Department of Buildings (2010); The Louis Berger Group (2011).

Violation, accident, complaint and job data included in the relational database, or study data set, was collected from January 2008 to September 2010, which is the study time period. The quality of the data was instrumental in the determination of the study time period. It was LBG's objective to maximize the number of records in the study dataset. Our review of the data determined that relatively more ECB violations issued in 2008 or after were assigned a valid license number in the ECB violation table than

ECB violations issued prior to 2008. Therefore, LBG selected 2008 as the start of the study period. Because many safety registrants had an insurance tracking number with the DOB years before obtaining their safety registration (in or after April 2009) and because it is not the objective of this study to assess the effect of registration on an individual business's safety record, the approach is reasonable.

3. STATISTICAL ANALYSIS

To provide a base of information regarding the performance of safety registrants, the consultant team conducted a quantitative evaluation of the study dataset. This section, which describes the evaluation and findings, starts with an overview of key variables in the study dataset and continues with a discussion of relationships between variables that are instructive in the development of safety performance measures. The section also outlines thresholds in the performance measures that can be used to identify registrants with safety records that are not typical of safety registrants as a whole.

3.1. OVERVIEW OF KEY VARIABLES

The analysis began with the identification of key variables in the dataset and a statistical profile of the key variables.

3.1.1. SAFETY REGISTRANTS

Based on counts conducted in January 2011, a total of 2,875 businesses have acquired DOB Safety Registration Numbers as required by Local Law 8. There are three endorsement or safety registration subtypes that allow the business to perform a certain type of work: demolition, concrete or construction. Each business can obtain one or more endorsements.

A subset of 1,454 Safety Registrants are GC123s. Based on their general contractor registration, they automatically obtained a safety registration construction endorsement. A little more than half of these GC123 obtained demolition and/or concrete endorsements in addition to their construction endorsement.

The distribution of endorsements is presented in Table 2.

Table 2 - Endorsements

Endorsement	GC123 with endorsement	Other Safety Registrants with endorsement	All Safety Registrants with endorsement
Construction Only	46.0%	33.4%	39.8%
Concrete Only	-	1.3%	0.6%
Demolition Only	-	4.7%	2.3%
Construction and Concrete	1.4%	4.6%	3.0%
Construction and Demolition	22.1%	12.0%	17.1%
Concrete and Demolition	-	1.1%	0.5%
All three endorsements	30.4%	43.0%	36.6%
Total Number of Registrants	**1,454**	**1,421**	**2,875**

Source: New York City Department of Buildings (2010); The Louis Berger Group (2011).

Safety Registrants businesses include mostly corporations, some sole proprietors and very few partnerships (Table 3).

Table 3 - Business Types

Business Type	Safety Registrants
Corporation	89.1%
Sole Proprietor	10.8%
Partnership	0.1%

Source: New York City Department of Buildings (2010); The Louis Berger Group (2011).

3.1.2. JOBS

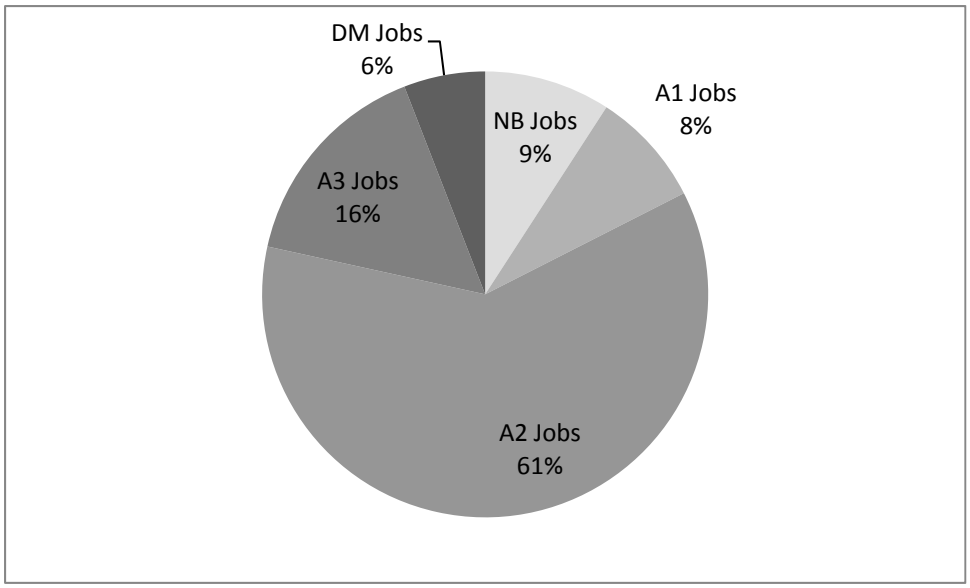
DOB groups permits for construction into jobs comprising the full range of activities in an alteration or new construction project at a building location. Job count is an indicator of the volume of work for a particular contractor or group of contractors, and for the level of construction activity in the City in general. The study dataset includes about 41,700 jobs that are associated with safety registrants.[1] The number of jobs undertaken during the study period varies among safety registrants. A quarter of the safety registrants had three jobs or fewer in the study time period. The median number of jobs per safety registrant was 7, meaning that half of the safety registrants had 7 jobs or fewer in the study time period. Only 11 safety registrants had more than 300 jobs.

The B-Smart system characterizes jobs by job type. The mix of job types varies among safety registrants. Job types are New Building (NB), Alteration 1 (A1) (i.e., major alterations for which a new Certificate of Occupancy (C of O) is required), Alteration 2 (A2) (i.e., smaller alterations for which a new C of O is not

[1] This includes only jobs that are permitted, signed off or completed.

required and that involve multiple types of work), Alteration 3 (A3) (i.e., smaller alterations for which a new C of O is not required and that involve only one type of work), and Demolition (DM) jobs. A2 jobs are the most common job type, accounting for 61 percent of all safety registrant jobs (Figure 1).

Figure 1 – Jobs by Type for Safety Registrants, 2008-2010



Source: New York City Department of Buildings (2010); The Louis Berger Group (2011).

A registrant's volume of work can be approximated by the number of jobs it worked on within the study time period. However, some jobs may involve more effort and complexity than others. Additional information useful in characterizing a registrant's volume of work includes square footage of new construction or alteration (construction floor area), number of stories in the building being constructed or altered, or number of on-site person-hours. At the current time, data on square footage and stories is only available for a very small subset of records (less than 1 percent) in the study dataset and data on person-hours is not collected. An alternative source that may provide an indication of the volume of work is the job type information. While the available data does not allow for the quantitative determination that some job types involve more man-hours than other job types, by definition, A1 jobs (major alterations) involve more work than A2 and A3 jobs (smaller alterations). While small firms (GC123) tend to have smaller scale jobs than large firms, they do not have fewer jobs than large firms (Table 4). In general, the distribution of jobs per registrant is also similar across endorsement types. While the maximum number of jobs per registrant varies significantly across endorsement type combinations, a closer look at the contractors with the most jobs shows that registrants with 200 jobs or more are outliers, accounting for only 0.8 percent of the total number of registrants. An exception is that registrants with only a concrete endorsement typically have fewer jobs than other endorsement types, with three quarters of the registrants having 5 jobs or fewer. Registrants with only a demolition endorsement tend to have more jobs, with one quarter of these registrants having more than 27 jobs.

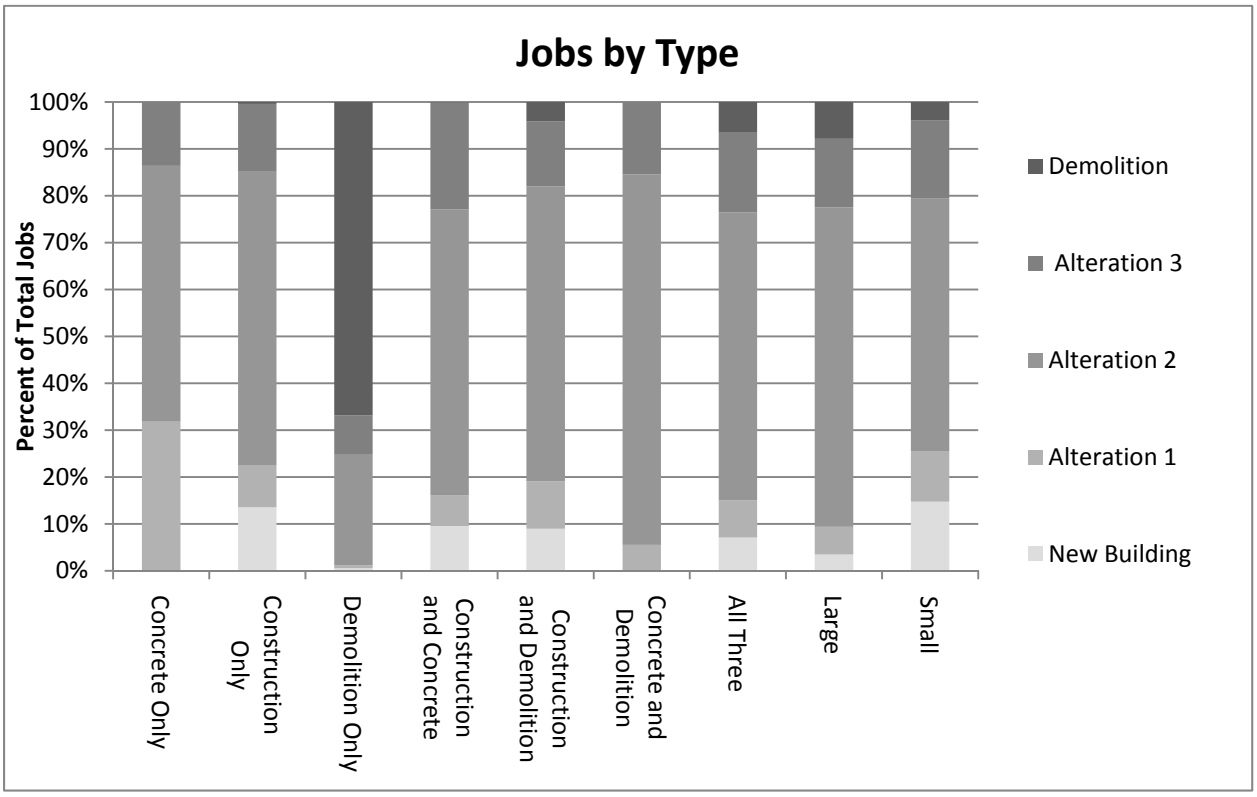
Table 4 – Jobs for Safety Registrants and General Contractors without Endorsement, 2008-2010

	Concrete Only	Construction Only	Demo Only	Construction and Concrete	Construction and Demolition	Concrete and Demolition	All Three Endorsements	Large Firms	Small Firms (GC123)	All Safety Registrants
Total Number of Jobs	22	5,640	1,208	1,200	6,933	181	9,186	20,730	20,968	41,698
	Number of Jobs per Contractor									
For a quarter of the contractors, the number of jobs is equal to or less than:	1	3	4	3	4	4	5	3	3	3
For half of the contractors, the number of jobs is equal to or less than (i.e., median):	3	6	9	6	8	12	11	7	8	7
For three quarters of the contractors, the number of jobs is equal to or less than:	5	14	27	12	17	19	20	16	16	16
Maximum	10	322	102	257	411	55	405	888	405	888
	Number of Contractors									
Total Number of Contractors with job data	6	420	63	77	461	12	423	1279	1335	2614
Number of Contractors with 50 jobs or more	0	19	8	11	24	1	29	75	63	138
Number of Contractors with 100 jobs or more	0	7	1	3	5	0	19	28	30	58
Number of Contractors with 200 jobs or more	0	2	0	1	1	0	8	9	11	20
Number of Contractors with 400 jobs or more	0	0	0	0	1	0	1	3	1	4
	Percent of Contractors									
Number of Contractors with 50 jobs or more	0.0%	4.5%	12.7%	14.3%	5.2%	8.3%	6.9%	5.9%	4.7%	5.3%
Percent of Contractors with 100 jobs or more	0.0%	1.7%	1.6%	3.9%	1.1%	0.0%	4.5%	2.2%	2.2%	2.2%
Percent of Contractors with 200 jobs or more	0.0%	0.5%	0.0%	1.3%	0.2%	0.0%	1.9%	0.7%	0.8%	0.8%
Percent of Contractors with 400 jobs or more	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	0.2%	0.2%	0.1%	0.2%

Source: New York City Department of Buildings (2010); The Louis Berger Group (2011).

The mix of job types varies by size and endorsement. Figure 2 shows that small contractors (GC123) have relatively more NB jobs than large contractors. While registrants with only demolition endorsements have, as one would expect, more demolition jobs than other registrants, they are also engaged in other types of jobs.

Figure 2 – Jobs by Type for Safety Registrants and General Contractors without Endorsement, 2008-2010



Source: New York City Department of Buildings (2010); The Louis Berger Group (2011).

3.1.3. ECB VIOLATIONS

The Phase I Report identified Environmental Control Board (ECB) violations as an important measure of contractor safety. ECB violations represent enforcement of City laws and regulations governing contractor work on construction sites. Violations issued for hazardous or unsafe conditions, or for violations of safe work practices, are a direct measure of contractor performance with respect to safety standards. Violations are also a valid measure for DOB oversight because the ECB adjudication process allows contractors the opportunity to contest violations at a hearing.

ECB violations are the most common type of violation issued by the DOB. The ECB is an administrative tribunal that hears cases in which New York City has charged a person or business with violating City laws that protect health, safety, and a clean environment. The ECB Notice of Violation requires that the respondent corrects the violating condition and provides proof of the correction by filing a Certificate of Correction obtained from the DOB. In addition to correcting the violation, the respondent may also be required to pay a penalty. The respondent has the option to contest the violation at a hearing. When respondents contest the violation at a hearing, the violation can be upheld or dismissed by the ECB. If

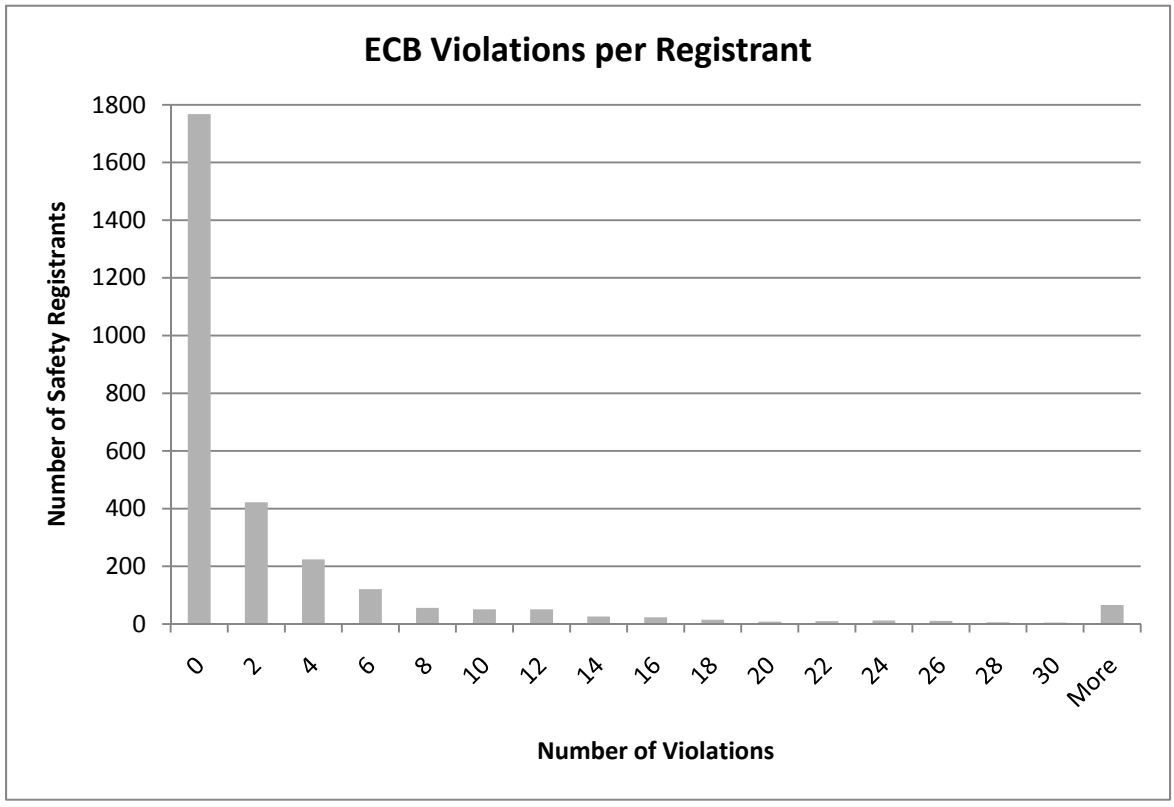
the violation is dismissed, no penalty is required and no Certificate of Correction needs to be filed. The respondent also has the option to correct the violation and file a Certificate of Correction before the first hearing date. If the certificate for a violation designated as Class 2 (major violation) or Class 3 (lesser violation) is accepted, the violation is cured and no hearing will take place.

CHARACTERISTICS OF VIOLATIONS

The study dataset includes about 11,740 ECB violations issued to safety registrants during the study time period. A total of 11,497 of these violations (approximately 98 percent) were classified as sustained; the remainder are pending. Sustained violations are cured, stipulated, upheld or dismissed by the ECB and include those for which default judgments were entered. A relatively small portion of the sustained violations to safety registrants were dismissed. Dismissed violations accounted for 8.8 percent of the violations issued in 2008, 8.3 percent of violations issued in 2009, and 6.7 percent issued in 2010. The total number of non-dismissed, sustained violations in the study dataset is 10,641.

Most registrants, approximately 61 percent, had no violations on their record during our study time period. The proportion of registrants with between 1 and 3 violations was 19 percent. Only 10 percent of the registrant population had more than 9 violations during the study time period, and only 1 percent had more than 60 violations. The distribution of non-dismissed, sustained violations in the study time period is shown in Figure 3.

Figure 3 – Non-Dismissed ECB Violations by Safety Registrant, 2008-2010



Note: Includes only sustained, non-dismissed violations.
Source: New York City Department of Buildings (2010); The Louis Berger Group (2011).

ECB violations can be characterized in several ways as shown in Table 5 and summarized below.

Severity – Based on the 2008 Building Code, ECB violations are classified into three classes based on severity, with Class 1 (immediately hazardous), Class 2 (major violation) and Class 3 (lesser violation). Most violations issued to safety registrants are in Class 1 or Class 2, accounting for 39 percent and 60 percent, respectively. Violations issued to small contractors (GC123) are less likely to be immediately hazardous, with only 30 percent of violations in Class 1 compared to 46 percent of violations issued to large registrants.

Aggravated Level - Almost none of the violations issued to safety registrants are aggravated. Large firms have relatively more violations that are assigned a level 1 or 2 aggravation than smaller firms (GC123). Violations receive an Aggravated Offense Level 1 if the same condition or charge was observed against the respondent at the property within 3 years of the date of issuance of the current violation. Aggravated Offense Level 2 violations include the following: 1) Violating conditions that resulted in an accident causing serious injury or death, or posed a significant risk of injury or death, or that affected a significant number of persons; or 2) respondent failed to provide the DOB with requested information in support of an investigation; or 3) respondent has a history of non-compliance with laws, rules or regulations enforced by the DOB at any location throughout the City.

Violation Type – Violations included in this study issued in 2009 or later are of one of two types: construction or cranes and derricks. Almost all violations for which a violation type is recorded are construction violations.

Infraction type - In addition to violation types, ECB violations are also assigned more detailed infraction types. However, the most common infraction types are generic categories with "miscellaneous violation" accounting for 43 percent and "failure to safeguard public and property affected by construction operations" for 17 percent.

Correction Time – Unless dismissed by the ECB, all violations need to be corrected or cured. In general, violations must be corrected within 40 days after they are issued. Class 1 violations need to be corrected immediately. Within our study time period, three quarters of violations were certified as corrected more than 41 days after they are issued. About half of the violations were listed as corrected within 104 days or less. Immediately hazardous (Class 1) violations were not corrected faster than other violations. While the median number of days to correct a violation is similar for large and small firms (GC123), the median number of days to correct a Class 1 violation is higher for GC123s. Prior to 2010, the DOB did not accept Certificates of Correction for a violation prior to the ECB hearing date. The long average time periods for correction observed in the study dataset are attributable primarily to this policy. At the present time, DOB accepts Certificates of Correction anytime following issuance of a violation. This policy is expected to reduce correction time overall. An analysis of Class 1 violations issued on or after October 2010 to general contractors shows an improvement in the correction time. Half of these Class 1 violations are corrected within 58 days and only one quarter were listed as corrected after more than 100 days.

Penalty balance – About 35 percent of violations have a positive penalty balance. GC123s are more likely to have a positive balance than large firms. For a portion of these violations, the positive penalty balance reflected in the study dataset may be because the hearing date is very recent and the penalty is not yet due.

Table 5 – Characteristics of Violations issued to Safety Registrants, 2008-2010

Characteristic	Large	Small (GC123)	Total Safety Registrants
Violation Severity			
CLASS - 1	45.6%	30.1%	39.2%
CLASS - 2	53.3%	68.5%	59.6%
CLASS - 3	1.1%	1.4%	1.2%
Number of records	5,542	3,862	9,404
Aggravated Level			
Aggravated Offense Level 1	0.2%	0.2%	0.2%
Aggravated Offense Level 2	1.0%	0.6%	0.8%
Not Classified as Aggravated	98.80%	99.30%	99.0%
Number of records	5,523	3,842	9,365
Violation Type			
Construction	1.9%	1.7%	1.8%
Cranes and Derricks	98.1%	98.3%	98.2%
Number of records	3,225	2,153	5,378
Time to Correct			
Median number of days to correct violation	122	127	104
Median number of days to correct Class 1 violation	140	203	156
Number of records	6,322	4,319	9,404
Penalty Balance			
Positive (More than $0)	36.2%	43.1%	34.6%
Number of records	6,322	4,319	10,641

Note: Includes only sustained, non-dismissed violations.
Source: New York City Department of Buildings (2010); The Louis Berger Group (2011).

CHARACTERISTICS OF VIOLATIONS BY ENDORSEMENT TYPE

In general, the distribution of violations per registrant is similar across endorsement types. (Table 6) While the maximum number of violations per registrant varies significantly across endorsement type combinations, registrants with 50 sustained, non-dismissed violations or more are outliers, accounting for only 1.3 percent of the total number of registrants.

The key characteristics of violations by registrant endorsement type (Table 7) are as follows:

Severity - Violations issued to registrants with both a construction and a demolition endorsement are less often immediately hazardous than those issued to other firms.

Aggravated Level - Almost none of the violations are aggravated.

Violation Type – The majority of violations are construction violations for every endorsement type.

Compliance status – Violations issued to contractors with only a demolition endorsement take longer to correct than violations issued to other contractors.

Penalty balance – Contractors with only a demolition endorsement also have proportionally more violations with a positive penalty balance than other endorsement types.

Table 6 – Violations issued to Safety Registrants by Endorsement Type, 2008-2010

	Concrete only	Construction only	Demolition only	Construction and Concrete	Construction and Demolition	Concrete and Demolition	All Three Endorsements	All Safety Registrants
Total Number of Violations	1	4,080	234	385	1,061	11	4,869	10,641
	Number of Violations per Registrants							
For a quarter of registrants, the number of violations is equal to or less than:	0	0	0	0	0	0	0	0
For half of registrants, the number of violations is equal to or less than (i.e., median):	0	0	0	1	0	0	0	0
For three quarters of registrants, the number of violations is equal to or less than:	0	2	4	5	2	1	3	2
Maximum	1	327	32	48	89	6	276	327
	Number of Registrants							
Total Number of Registrants	18	1,144	67	86	492	15	1,053	2,875
Number of Registrants with 25 violations or more	0	30	0	4	3	0	49	88
Number of Registrants with 50 violations or more	0	16	0	0	1	0	21	38
Number of Registrants with 100 violations or more	0	7	0	0	0	0	3	10
Number of Registrants with 200 violations or more	0	3	0	0	0	0	1	4
	Percent of Registrants							
Percent of Registrants with 25 violations or more	0.0%	2.6%	0.0%	4.7%	0.6%	0.0%	4.7%	3.1%
Percent of Registrants with 50 violations or more	0.0%	1.4%	0.0%	0.0%	0.2%	0.0%	2.0%	1.3%
Percent of Registrants with 100 violations or more	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.3%	0.3%
Percent of Registrants with 200 violations or more	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%

Source: New York City Department of Buildings (2010); The Louis Berger Group (2011).

Table 7 – Characteristics of Violations issued to Safety Registrants by Endorsement Type, 2008-2010

	Construction Only	Demolition Only	Construction and Concrete	Construction and Demolition	All three endorsements	All Registrants
Severity						
Class 1	41.7%	40.4%	43.2%	28.5%	39.0%	39.2%
Class 2	57.3%	56.6%	56.2%	70.1%	59.6%	59.6%
Class 3	1.0%	3.0%	0.6%	1.3%	1.3%	1.2%
Number of records	3,690	166	333	911	4,295	9,404
Aggravated Level						
Aggravated Offense Level 1	0.3%	0.0%	0.0%	0.1%	0.1%	0.2%
Aggravated Offense Level 2	1.2%	0.0%	1.2%	0.1%	0.6%	0.8%
Not Aggravated	98.4%	100.0%	98.8%	99.8%	99.3%	99.0%
Number of records	3,682	166	332	908	4,268	9,365
Violation Type						
Cranes and Derricks	2.0%	0.0%	4.3%	0.9%	1.8%	1.8%
Construction	98.0%	100.0%	95.7%	99.1%	98.2%	98.2%
Number of records	2,038	131	209	549	2,445	5,378
Time to Correct						
Median Number of Days to Correct	96.5	292.5	187	133	140	104
Median Number of Days to Correct for Class 1 Violations only	127	506	196	171	176	156
Number of Records	4,080	234	385	1061	4,869	10,641
Penalty Balance						
Positive balance	34.6%	56.0%	42.2%	36.7%	32.5%	34.6%
Number of records	4,080	234	385	1,061	4,869	10,641

Note: Due to the small number of violations associated with registrants possessing only a concrete endorsement or a concrete and demolition endorsement (1 violation and 11 violations, respectively), these endorsement combinations are excluded from this table.
Source: New York City Department of Buildings (2010); The Louis Berger Group (2011).

FACTORS AFFECTING REGISTRANT VIOLATION RATES, VIOLATION SEVERITY, AND DELAYED CORRECTION

We used statistical methods, including logarithmic transformations, correlation coefficients, linear regression models, and non-parametric tests to better understand the factors that are associated with ECB violations, violation severity, and delayed correction and to explain the variation in the number of ECB violations across safety registrants. Presented below is a discussion of our findings related to all the variables analyzed, in keeping with the scope of work of our study. It should be noted that only a portion of the variables outlined below were found to be suitable for use in the rehabilitation framework based on stakeholder and DOB input. Variables utilized in the framework and the rationale for selecting the thresholds for the framework are discussed in Section 7.

VIOLATION RATES

The number of violations per safety registrant is affected by:

Number of Jobs – As expected, safety registrants with more jobs tend to have more violations. The number of jobs positively affects the number of violations.

Firm Size – The relationship between violations and jobs is stronger for small firms (GC123) than for large firms. In other words, the positive effect of the number of jobs on the number of violations is larger for GC123s than for other registrants.

Job Types – NB jobs are likely to have more violations than other job types. A2 jobs are likely to have fewer violations than other job types. As shown in the Table 8, the average number of violations for a NB job is 0.43, which is five to ten time higher than for the other job types. The finding is confirmed by a linear regression that is graphically represented in Figure 4. As shown in Table 9, the model estimates that registrants with 20 NB jobs would have 3.6 violations while registrants with 20 A2 jobs would have 0.6 violations. This could be a reflection of one or more of a diverse set of factors including duration, complexity, scale, and number of workers (man-hours) involved in these jobs.

Table 8 - Violation per Job by Job type

Job Type	Number of Jobs	Number of ECB Violations	Violation per Job
A1	3,484	252	0.07
A2	25,412	922	0.04
A3	6,526	502	0.08
DM	2,460	227	0.09
NB	3,816	1,657	0.43

Source: New York City Department of Buildings (2010); The Louis Berger Group (2011).

Figure 4 - Violations by Job Type

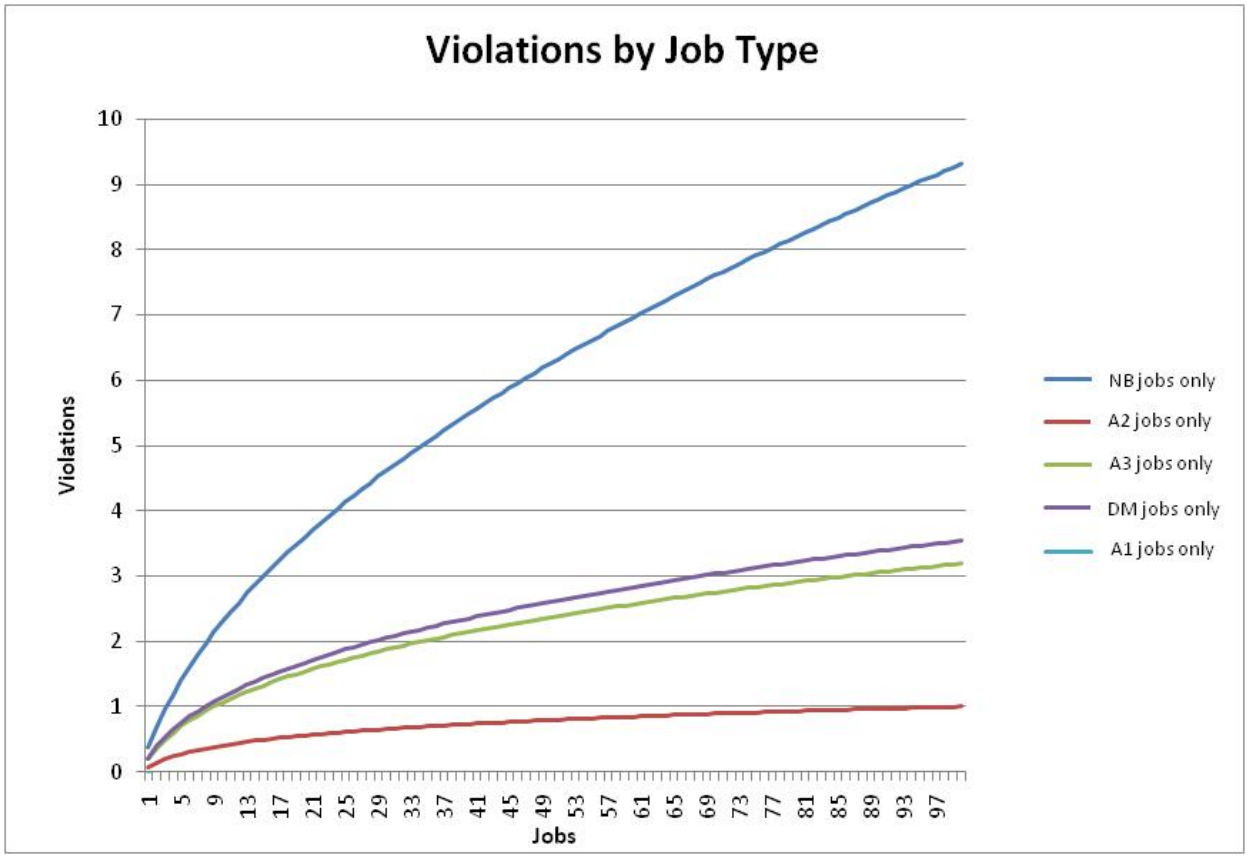


Table 9 – Model Estimates Violations per Job by Job Type

New Building		Alteration 2	
Jobs	**Violations**	**Jobs**	**Violations**
1	0.4	1	0.1
10	2.3	10	0.4
20	3.6	20	0.6

Endorsement Type - Registrants with construction and demolition endorsements are likely to have fewer violations than registrants with other endorsement combinations. These findings are based on a comparison of the distribution of violations per job across registrants within each endorsement group and a linear regression that partially explains the number of violations per registrants based.

Construction Floor Area (Job Square Footage) – As noted above, construction floor area has not been consistently recorded for entry in the DOB database. The study dataset includes this measure on less than 10 percent of job records. Our evaluation of the records that do include this measure (4,104 records) indicates a positive correlation between the number of violations and construction floor area

recorded by registrant. Regression analysis of this limited dataset indicates that construction floor area by registrant explains approximately 40 percent of the variation in violations by registrant. Due to the limited number of records, the consultant team is recommending more systematic collection of floor area data before this measure is utilized in the performance measurement system.

Inspections[2] – While we cannot test the effect of inspections on violation rates directly because of the lack of full data regarding the number and type of inspections by job, two findings suggest that the number of inspections positively affects the number of violations.

- Smaller businesses (GC123) have a lower violation rate than larger businesses. Because GC123 have smaller jobs that are typically subject to fewer inspections, the GC123's lower violation rate may be a reflection of the fewer inspections.
- Assuming the same number of jobs, registrants with at least one BEST job have more violations than other registrants. Because BEST jobs are subject to frequent inspection, the positive effect of BEST status on the number of violations may be related to the BEST inspection regime.

VIOLATION SEVERITY

The analysis shows that violation severity is affected by:

Endorsement – Violations issued to safety registrants with both a construction and a demolition endorsement are less likely to be immediately hazardous (Class 1) than violations issued to other registrants.

Size – Violations issued to small contractors (GC123) are less likely to be immediately hazardous than violations issued to large contractors.

Job type – Violations issued on A1 jobs are least likely to be immediately hazardous.

TIME TO CORRECT

The analysis shows that correction time varies by:

Endorsement – Immediately hazardous (Class 1) violations issued to registrants with only a demolition endorsement take longer to correct than Class 1 violations issued to other registrants. On the other hand, Class 1 violations issued to registrants with only a construction endorsement are typically corrected sooner.

Size – Class 1 violations issued to large contractors tend to be corrected sooner than those issued to GC123s.

[2] The DOB inspection system consists of proactive and non-proactive inspections. Proactive inspections are based on an inspection unit protocol and/or standard operating procedures (i.e. BEST inspections, Scaffold Safety & Shed Enforcement, existing or active construction conditions). Non-proactive inspections are driven by citizen complaints.

The analysis shows that the correction time does not vary by severity:

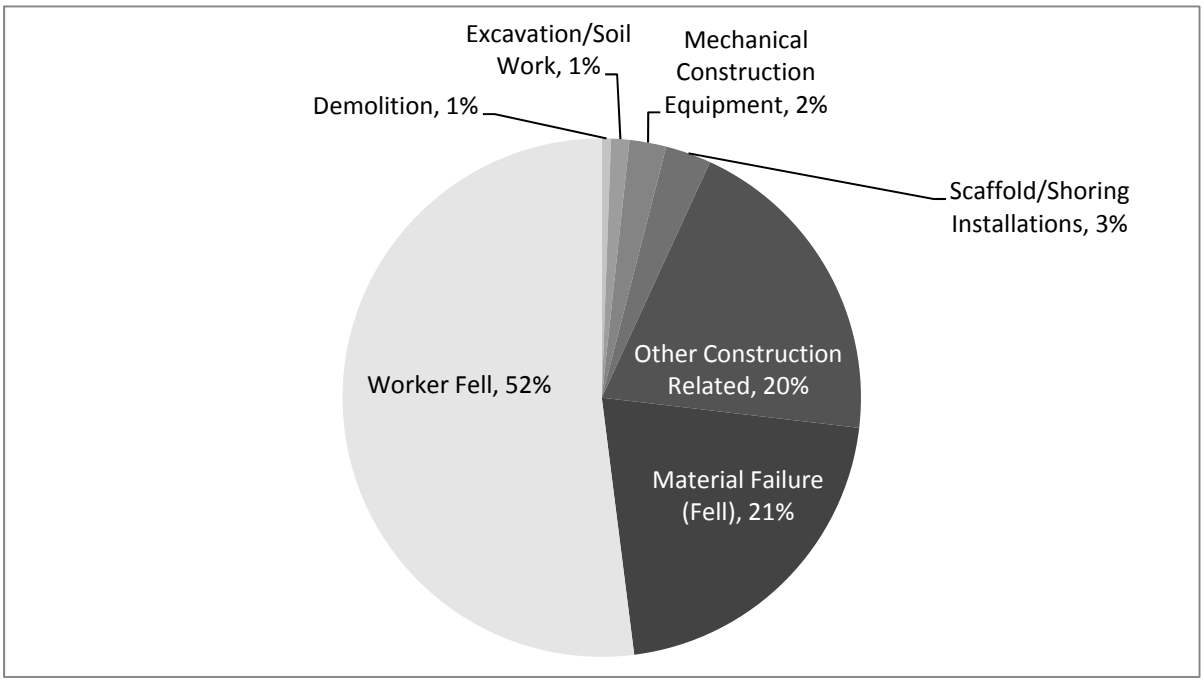
Violation severity – While registrants are required to correct Class 1 violations immediately, Class 1 violations typically remain uncorrected longer than Class 2 or Class 3 violations.

3.1.4. ACCIDENTS

A total of 175 construction-related accidents reported in the 2008-2010 study period were linked to safety registrants and included in the study dataset. These accidents included 190 injuries and fatalities. Half of the injuries were attributed to falls (Figure 5). Injuries caused by falling material or other construction-related accidents are the next largest categories of injuries. To obtain a better understanding of the injuries classified as "other construction-related injuries," we reviewed the OSHA injury classification, which shows that most of these injuries occurred because someone was struck by a falling object.

For at least 57 percent of these accidents, an ECB violation was issued. An additional 5 percent of accidents led to a stop work order.

Figure 5 – Type of Accidents for Safety Registrants, 2008-2010



Source: New York City Department of Buildings (2010); The Louis Berger Group (2011).

To identify the relationship between violations and accidents, we examined ECB violations that preceded the accidents, meaning that they were issued (1) at the same building (BIN) and (2) to the same registrant as the accident (3) at an earlier point in time. The remaining ECB violations in the study dataset are considered violations that do not precede accidents.

Our analysis indicates that violations are a leading indicator of accidents. Specifically, the analysis resulted in the following two findings:

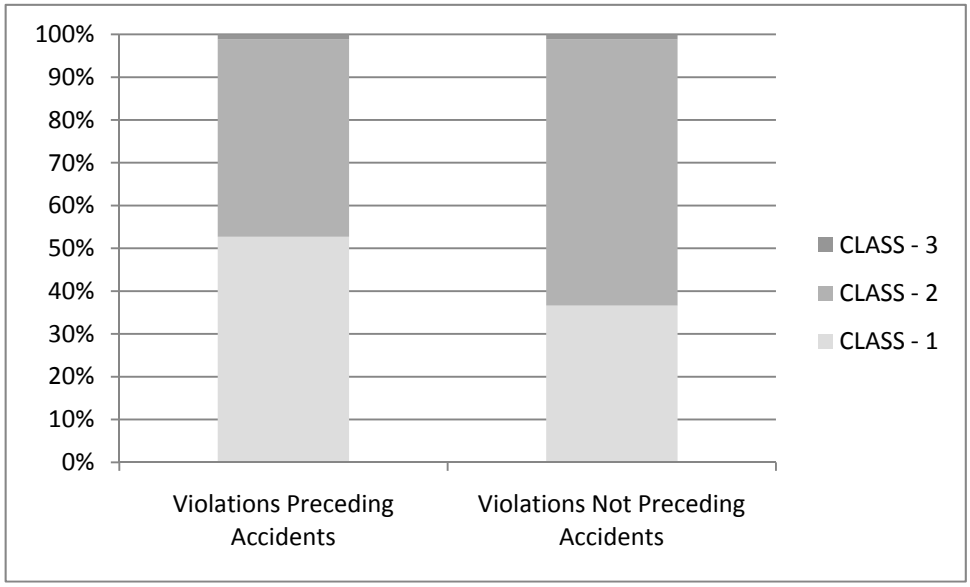
- The two most common accident types, which are "worker fell" and "material failure (fell)", typically have more preceding violations than other accident types. More specifically, one quarter of material failure accidents are preceded by more than 23 violations and one quarter of worker fell accidents are preceded by more than 15 violations (Table 10). By comparison, one quarter of "other construction incidents", the third largest accident type, are preceded by more than 9 violations.
- Violations that precede accidents are more likely to be severe (Figure 6). More than half (53 percent) of the violations preceding accidents are immediately hazardous compared to 37 percent of the violations that do not precede accidents.
- Registrants with accident records have a higher level of violations than registrants without. For the portion of the registrant pool with violations, the mean number of violations per job is 0.3. For registrants with both violations and accidents the mean is 1.0. Testing shows that this difference is statistically significant. Normalizing these distributions and comparing the ranges suggested that the mean for the accident distribution was a suitable breakpoint for identifying the worst performers in the violations per job distribution as a whole. Incidence of violations above this level also suggests a higher probability for accidents. The critical level is the 94th percentile or top 6 percent worst performers on the violations per job measure.

Table 10 – Number of Violations preceding accidents by Accident Type

	Worker Fell	Material Failure (Fell)	Other	All Accident Types
50% of accidents are preceded by more than:	3	1	2	2
25% of accidents are preceded by more than:	15	23	9	13

Source: New York City Department of Buildings (2010); The Louis Berger Group (2011).

Figure 6 - Comparison of Violation Severity for Violations preceding accidents and other violations



Source: New York City Department of Buildings (2010); The Louis Berger Group (2011).

3.1.5. COMPLAINTS AND STOP WORK ORDERS

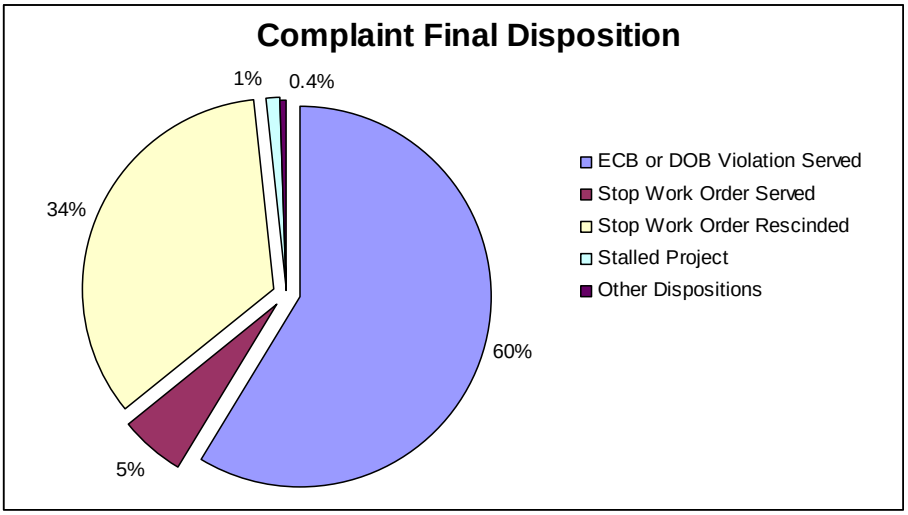
Complaints can be registered by anyone who feels the need to report a problem associated with a construction site, building, or building related issue. The study database includes 2,389 complaints that were linked to safety registrants through resulting ECB violations. Nearly 20 percent of ECB violations issued to safety registrants between 2008 and 2010 resulted from complaints. Stop work orders are a subset of complaints and can be issued for a range of violating conditions, such as working without a permit, failing to provide approved plans on site, and working contrary to approved plans, etc. A total of 988 stop work order related final dispositions[3] between 2008 and 2010 were linked to safety registrants in LBG's database through resulting ECB violations.

Complaints are used as a tracking system by DOB to enable monitoring of the disposition of violations and stop work orders arising from inspections. Most of the complaints issued to safety registrants during our study period originated with the DOB (83 percent). The remaining complaints originated with calls by citizens (13 percent) or other sources (4 percent).

The final disposition of the complaints (Figure 7) shows that nearly all complaints linked to registrants through the ECB violations data resulted in either issuance of a violation or a stop work order.

[3] Stop Work Order related dispositions are partially and full Stop Work Orders, Violations for not obeying Stop Work Orders, and Rescinded Stop Work Orders. The Rescinded Stop Work Orders are the final conclusion to Stop Work Orders which allow contractors to return to work after the Department verifies the work can be started again.

Figure 7 - Final Disposition of Complaints



Source: New York City Department of Buildings (2011); The Louis Berger Group (2011).

Our broader analysis of stop work orders issued to registrants shows that over 74 percent of safety registrants had no stop work orders issued during the study period. Approximately 9 percent had one stop work order on record, and 16 percent had two or more. In aggregate only 2.6 percent of safety registrant jobs were issued stop work orders.

4. BENCHMARKING SUMMARY

To ensure that our proposed rehabilitation framework includes considerations of effective practices used elsewhere, we conducted a review of other jurisdictions. Eight local governments were selected based on their high levels of construction activity: Houston, TX; Dallas, TX; Washington, DC; St. Petersburg, FL; Phoenix, AZ; Los Angeles, CA; San Francisco, CA; and Chicago, IL. None of the selected governments revoke, suspend or renew a general contractor license based on unintentional safety violations. In one example, occupational licenses are suspended or revoked based on safety violations using a tiered enforcement system where the severity of the violations and the frequency determine the penalty. Examples identified during our benchmarking research with key features of the most relevance to Safety Registration Program are outlined below.

Washington D.C. - As part of the District of Columbia general contractor licensing program, contractors obtain a license in one of five classes based on project value (i.e., Contractors with a Class A license have no limits in terms of project value while contractors with a Class E license are not entitled to engage in any single project of a value of more than $0.5 million). According to the District of Columbia Municipal Regulations, these licenses can only be denied, suspended or revoked under the following limited number of circumstances:

- Material misstatement in the license application;
- Failure to comply with regulations regarding to construction management;
- Fraudulent conduct related to construction contracts;
- Misrepresentation;
- Deceptive and misleading advertisement;
- Willful or fraudulent circumvention of regulations regarding the conduct of the business; and
- Working beyond the scope of the class of the license.

Dallas and Houston, TX - While not specifically for general contractor licenses, the State of Texas has an enforcement plan for occupational licenses, including building-related occupations such as electricians, which is in effect in Dallas and Houston. Under this enforcement plan, licenses can be suspended for working without a permit or violation of safety regulations. The enforcement plan categorizes violations into four violation types (A to D) based on severity, with each type three levels of penalties (first violation, second violation, and third violation). The most severe violation type (Class D) leads to revocation. For the other violation types, a second or a third violation leads to probated or full suspension of up to one year. Class A violations (least severe) are mostly failures to display information. Class B violations include failure to maintain the liability insurance and working without a license. Class C violations include performing duties in a negligent manner, misrepresentation, fraud and extortion but also performing electrical work that does not comply with the codes including providing safe and proper installation and service, and assuring the electro-mechanical integrity of all work and installations are to applicable code. Class D violations include violating a previous order of the Commission or Executive Director, and falsification of information on the license application.

If the department proposes to deny a license or take disciplinary action against a license holder, the license holder is entitled to a hearing. A license holder whose license has been revoked may apply for a new license after the first anniversary of the date of the revocation.

Phoenix, AZ - The Development Services Department in Phoenix is responsible for construction safety enforcement through the issuance of permits and site inspection of construction activities. The Building Maintenance Registration Program under section 18 of the Phoenix Building Construction Code states that a registration may be suspended or revoked for any of the following reasons:

- Performing construction work outside the scope of the registration without obtaining a separate permit;
- Performing construction work without a licensed supervisor, or without the supervisor's knowledge, consent or oversight;
- Concealing work without inspection approval or authorization;
- Refusal to uncover concealed work;
- Constructing or installing work contrary to inspection orders;
- Failure to report all construction work done under authority of the building maintenance registration; and
- Refusal to eliminate unsafe conditions.

When a building official determines that a violation has occurred and that suspension or revocation of the registration is warranted, the registrant is notified in writing by certified mail and given an opportunity for an administrative hearing with the building official. The suspension or revocation takes effect 10 days after the date of notification unless, within such time, the registrant requests an administrative hearing. When an administrative hearing is requested, the building official considers all evidence submitted at the hearing and notifies the registrant in writing of the final decision within 10 days. All final decisions of the building official to suspend or revoke a building maintenance registration may be appealed in accordance with administrative provisions.

Example of Performance Tiers – Tiered rankings for performance are used outside the building construction sector. One notable example is the auto insurance industry. To avoid penalizing good drivers with the high rates required to offset losses incurred by poor drivers, auto insurance providers in many states have implemented a tiered system of rates. The system most often consists of three tiers: 1) Preferred, with the lowest rates for drivers with excellent performance, 2) Standard, with rates that reflect normal performance of the pool of insured drivers, and 3) Sub-standard, with rates that reflect the higher rate of claims filed by poor drivers. As necessary, insurers add sub-tiers within each level to reflect gradations in performance. Placement of drivers into tiers is based on accident record and other risk factors found to be directly related to the frequency and value of claims. The industry has found that claims are related to previous accident record, age of drivers, moving violation record, place of residence, and make of vehicle. Drivers covered by an insurer are placed into categories based on these factors and premium levels are calculated so that each group pays claims in proportion to the losses expected. Drivers can improve their placement in the tiered system by taking safety training courses (to diminish, for example, the effect of moving violation "points") or by showing a sustained period of good performance. Tiered systems have been standard practice in the industry for many years and have been found effective in optimizing the rate structure for all drivers and in encouraging safety performance (Insurance Council of New Jersey, 2010).

5. LITERATURE REVIEW SUMMARY

In addition to the benchmarking research, the study team conducted a broader literature review to identify effective practices in safety performance measurement.

The literature notes that due to the nature of the work being performed, the construction industry has one of the worst safety performance records of all industries. In 2009, construction accounted for 6 percent of the private sector workforce and for 8 percent of the non-fatal occupational injuries and illnesses and 19 percent all occupational fatalities.[4] Jimmie Hinze, a construction safety expert from the University of Florida, explains how the underlying reason for the industry's high injury rate is its uniqueness; the nature of the site and the parties involved tend to be different every time.[5] In line with the Zero Accident Concept[6], he points out that these unusual challenges do not justify the greater frequency of accidents but instead only signify that safety must be dealt differently in construction than in other industries.

In our literature search, the study team did not identify research work that specifically outlines approaches to set thresholds based on which governments can revoke, suspend or not renew licenses. We found a limited number of studies that use statistical analyses to assess contractor safety. Of these, most of studies we identified were geared toward consideration of safety in contractor selection by owners. These studies outline the following recommendations which are relevant to our evaluation.

- *Recommended Performance Measures* – The studies reviewed by the team recommend using data related workers' compensation insurance (e.g., Experience Modification Rates (EMR)) and injury data from the Occupational Safety and Health Administration (OSHA)[7] to evaluate a contractor's safety record.
- *Broad Base of Performance Measures* – Studies point at the importance of combining different measures instead of relying on one measure.[8] In a 1998 study based on more than 1,700 surveys of construction workers, contractors, insurance professionals and owners, De la Garza et al. recommended combining the EMR and the Workers Compensation Claim Frequency with OSHA incident rates to evaluate contractor safety.[9] Hinze recommends that further research

[4] Bureau of Labor Statistics (2010) "Workplace Injuries and Illnesses" BLS News Release, October 21, 2010; Bureau of Labor Statistics "Census of Fatal Occupational Injuries" Accessed at http://www.bls.gov/iif/oshcfoi1.htm on January 31, 2011.

[5] Hinze J. Safety Solutions Manual, Instructor's Manual for Construction Safety. Accessed from web.dcp.ufl.edu/hinze/Safety-Solutions-Manual.doc on November 22, 2010.

[6] The Zero Accident Concept implies that every accident is avoidable.

[7] Part of the U.S. Department of Labor, OSHA was created by Congress with the Occupational Safety and Health Act of 1970 to ensure safe and healthful working conditions by setting and enforcing standards and by providing training, outreach, education and assistance. The OSHA Data Initiative (ODI), which started in 1995, collects work-related injury and illness data from employers within specific industry and employment size specifications, which is then used to calculate establishment specific injury and illness incidence rates.

[8] De la Garza, J., Hancher, D., and Decker, L. "Analysis of Safety Indicators in Construction." Journal of Construction Engineering and Management, Vol. 124. No. 4, July/August 1998. Hinze J. Safety Solutions Manual, Instructor's Manual for Construction Safety. Accessed from web.dcp.ufl.edu/hinze/Safety-Solutions-Manual.doc on November 22, 2010.

[9] De la Garza, J., Hancher, D., and Decker, L. "Analysis of Safety Indicators in Construction." Journal of Construction Engineering and Management, Vol. 124. No. 4, July/August 1998.

be conducted to integrate several safety measures in one single reliable indicator of safety performance. When limited to the readily available measures, Hinze finds that the injury frequency rate in combination with the EMR or in combination with the loss ratio are helpful in providing a reasonable measure of safety performance.[10] Hinze also points out that using published injury rates from a particular industry as a benchmark may not be desirable because some industries have injury frequency rates that are too high to be used as a goal. He recommends that benchmarking should be based on data from safe peer institutions.[11]

6. STAKEHOLDER INPUT

Information meetings with stakeholders, particularly the registrants and their representative trade association leadership, have been an important aspect of both phases of the Safety Registration Study. This section summarizes the comments received during the stakeholder outreach sessions.

6.1. SUMMARY OF INDUSTRY STAKEHOLDER PERSPECTIVES - PHASE I STUDY

In April of 2010, the NYC DOB conducted a series of roundtable meetings with construction industry stakeholders as part of its Phase I analysis effort. Four subcommittees broadly segmenting the construction industry by endorsement type were created and a summary of the discussions with each subcommittee group is provided below.

There was a general consensus across all four subcommittees that adjudicated ECB violations should form the basis for the development and enforcement of safety criteria. Nonetheless, stakeholders suggested that the analysis and enforcement of safety criteria be limited to ECBs that are related to construction safety and are a result of a contractor's willful negligence. With the exception of stop work orders, both the DOB and industry stakeholders agreed that other types of complaints had a higher likelihood of being unrelated to the goal of improving or maintaining construction site safety.

Stakeholders suggested evaluating ECB violations across a number of dimensions if this data was to be used in setting enforcement criteria.

- Severity of violation
- A company's record over time (i.e., overall safety performance, historical safety performance; performance as legislation enactment; number of open violations (as opposed to all violations; weighting of violations according to how recently they were acquired)
- Volume of work conducted by each firm
- Complexity of work performed (e.g., number of stories)
- Number of inspections made
- Phase of a project

[10] Ibid. 7
[11] Ibid. 7

The issue of ECB severity was of particular importance given that some firms pay violation fines to expedite proceedings rather than as an admission of guilt. (This option was not available during the study time period.)

A major theme raised by all groups was the correct assignment of responsibility to the offending subcontractors. Stakeholders even suggested the identification of individual trades as part of the safety registration and renewal process to enhance this level of accountability.

The Experience Modification Rate (EMR) was proposed as an additional safety performance metric that could be used to govern the issuance of safety registrations. One concern raised however, was that the low ratings of some general contractors would negatively reflect on subcontractors. Nonetheless, the concept of a composite enforcement index using both EMR and ECB violation data complemented other recommendations for the creation of a graduated regulatory framework that identifies a number of intermediate stages that present opportunities for mitigation. The subcommittees suggested the consideration of jobs completed without accident as part of the evaluation process and could be incorporated into a graduated approach.

6.2. SUMMARY OF INDUSTRY STAKEHOLDER PERSPECTIVES PHASE 2

In March 2011, the DOB conducted three additional stakeholder meetings. The meetings were organized by endorsement type but also included representatives of government agencies. The purpose of these meetings was to receive input from the stakeholders on the proposed rehabilitation framework developed by DOB and LBG.

At the meetings, LBG presented the key findings of the study and the proposed framework. Attendees were provided the opportunity to ask questions, provide comments and voice concerns. The following comments related to additional factors that would need to be taken into account in the threshold system:

- Job Characteristics - When comparing registrants in terms of violations per job, job characteristics such as job size, square footage, length of job, job complexity, type of work, and borough should be taken into account. Number of man-hours was suggested as a useful addition to the dataset. Demolition contractors pointed out how the nature of their work is different from that of general contractors.
- Number of Inspections – The number of inspections should be taken into account when comparing registrants in terms of violations per job. The disparity in the number of inspections for large sites vs. small sites should be factored in the thresholds. The DOB should review their inspection protocol, decrease the number of BEST inspections and include all other jobs in its proactive inspection program, except 123 family homes.
- Firm size – Some attendees suspect that there is no link between accidents and violations on smaller buildings without proactive inspections. They also expressed concern that large companies will be penalized with the accident thresholds because larger sites with site safety managers are required to report all accidents while smaller jobs do not have that requirement.
- Experience – The number of years a business operates under the same name with a good safety record should be taken into account. One attendee explained that experience should also be

taken into account because the more experienced contractors have more complex and dangerous jobs.

- Type of accident – Several attendees noted the importance of the type of accident, with falls being more dangerous than other accidents.

Attendees expressed concern that the framework is relying too heavily on ECB violations. Comments related to ECB violations and the ECB system:

- ECB process – They point out that the ECB process is not consistent, similar cases have different outcomes, the process is too long, and inspectors need to be properly trained. One contractor suggested that inspectors issue warnings prior to issuing violations to give contractors the opportunity to correct the situation. The question was raised how the DOB will take into account stipulations. They expressed concern that contractors may time the adjudication to manipulate the threshold framework. They also pointed out how most ECB violations are classified as severe and how in some cases violations are issued for incidents over which the registrant had no control.

Some attendees do not consider the EMR to be a suitable measure:

- Calculation of the EMR – Attendees pointed out how the entire payroll is considered when calculating the EMR, including office personnel and yard maintenance workers, providing larger companies with an advantage. They also pointed out that some general contractors have limited personnel on site and that the EMR does not take into account the claims submitted by the subcontractors.
- Owner controlled insurance program (OCIP) - Many developers/owners are taking out a policy for the entire project. The contractor's safety record for these projects is not immediately reflected in the EMR.

Other comments:

- Subcontractors – Attendees point out that general contractors often get violations for the subcontractor's actions. Under that system, there is no incentive for subcontractors to perform at the safest level. Subcontractors should be subject to the same registration and enforcement process as general contractors
- Confidentiality – Stakeholders expressed concern about the use of the framework outside of the DOB and the effect on their future business opportunities.
- Tiered system – Attendees pointed at the importance of a predetermined time frame within which the contractor must correct the situation that should be clearly communicated. One attendee suggested creating a three-tiered system instead of a five-tiered system.
- Ongoing jobs – An attendee asked whether they would be allowed to continue ongoing jobs in the event of suspension or revocation.
- Benchmarking – One attendee requested that the benchmarking study include other east coast cities and other large cities, such as Chicago and Los Angeles.
- Preliminary report – Several stakeholders asked if they would have an opportunity to comment on the preliminary report before it is presented to City Council.

7. PROPOSED REHABILITATION FRAMEWORK

The Safety Registration Study was designed to produce two key work products intended to guide and facilitate the DOB's responsibility for safety oversight and enforcement. These work products are as follows.

- *Performance measures and recommendations for continuous monitoring* – Through an evaluation of existing DOB data and review of the literature, the study team developed recommendations for performance measures which DOB can use to identify poor performance and prioritize its oversight activities.
- *Recommendations on enforcement action* – The study team also developed recommendations for how the measures could be used in a framework to promote rehabilitation of poor performing registrants. This framework provides an organizing structure for DOB oversight and enforcement action.

In the presentation of these recommendations, this section starts with an overview of the guiding principles for the development and implementation of the framework, and continues with a detailed description of the proposed framework and its implementation. Finally, the section provides recommendations on the data collection needs associated with implementation of the framework.

7.1. GUIDING PRINCIPLES

Our review of the data, benchmarking research, available safety regulation literature, and construction industry input suggests a number of principles that should inform the development and implementation of a rehabilitation framework. Principles include fairness and due process, objectivity and transparency, effectiveness and ease of application. These principles are outlined below.

Fairness and Due Process – Accounting for key factors influencing safety performance, incorporating multiple safety performance measures, a tiered enforcement response, and providing a clear path for remediation are key characteristics of fair rehabilitation framework.

- *Account for Key Factors Influencing Performance.* The rehabilitation framework should focus on issues and metrics that are truly salient to construction safety. Although the DOB records general complaints filed by the public that could and do include some legitimate construction safety concerns, both the DOB and the construction industry agree that the complaints database includes too many non-construction related concerns. ECB violations have been identified by both sides as providing the most reasonable basis for the establishment of a rehabilitation framework. The fact that negative EMR and Loss Ratio scores can be minimized by paying claims out-of-pocket further highlights the degree to which caution must be exercised when articulating a fair and meaningful framework.
- *Incorporate Multiple Safety Performance Measures.* The varied size of individual contractors within the market introduces significant challenges in the design of a regulatory framework that applies to all. The EMR, Loss Ratio, WCCF and RIR have all been shown to address a narrow aspect of construction safety while ignoring others. An assessment that evaluates multiple

safety performance criteria is less likely to overlook key safety concerns that should be identified and tracked.

- *Apply Tiered Levels of Enforcement Response and Provide a Clear Path for Remediation.* The benchmarking research found graduated enforcement approaches that afforded reasonable opportunities to either mitigate or challenge the grounds for non-compliance to be common features of the safety enforcement policies in other jurisdictions. This finding also echoes the desired approach highlighted in the industry stakeholder discussions and is therefore likely to engender the least resistance during implementation. A graduated framework also has the added advantage of incentivizing improved site safety and promoting a pro-active response from the construction industry.

Objective Measurement and Transparency – The performance measures used in enforcement need to reflect impartiality given the competitive nature of the construction industry. Both EMR scores and ECB violations have been identified by industry stakeholders as providing reasonable measures of construction safety performance. ECB violations are adjudicated through an administrative law system affording full due process.

Focus on Effectiveness – The performance measures applied in the enforcement program and the enforcement actions themselves should be targeted towards encouraging pro-active compliant performance. The EMR, for instance, ties safety objectives to business outcomes and thus incentivizes better compliance from contractors.

Ease of Application – The success of the proposed rehabilitation framework will largely depend on how easy it is to implement and maintain. The chances of success are likely to improve if the framework is grafted onto – or enhances – existing safety management practices to minimize impacts to both the regulated business community and the enforcing agency. Both the DOB and the construction industry have reached some consensus on the rationale for using ECB violations and EMR as the basis for a rehabilitation framework.

7.2. REHABILITATION FRAMEWORK RECOMMENDATIONS

To effectuate the principles outlined above, the study team recommends a five-tiered system that places registrants into categories based on their performance across multiple safety measures. A key aspect of this rehabilitation framework proposal is that it affords registrants several opportunities to improve performance before DOB considers enforcement action. Under this system, the enforcement options available to DOB—suspension, revocation, or denial of registration renewal—are last resorts to be considered by DOB only after continued poor performance by the registrant, and failure of coordinated efforts to improve performance.

The system targets registrants with a record of long-term non-compliance with DOB regulations. Under the proposed framework, all safety registrants will be categorized into one of five tiers during periodic performance measurement by DOB. The framework is designed as a flagging system that will help DOB to better direct its inspections, focusing on those with the worst safety records and decreasing inspections for those with the best records.

Compliance with safety regulations, the occurrence of accidents, and cooperation with the enforcement and rehabilitation process will determine a registrant's position in the tiered system. Registrants with an exceptional record will be placed in the first tier, registrants with a poor record will be placed in the

third tier, and the remainder will be placed in the second tier. Under this proposed framework, DOB would produce rankings every six months at which time registrants can move up or down the tiers depending on compliance with the performance standards.

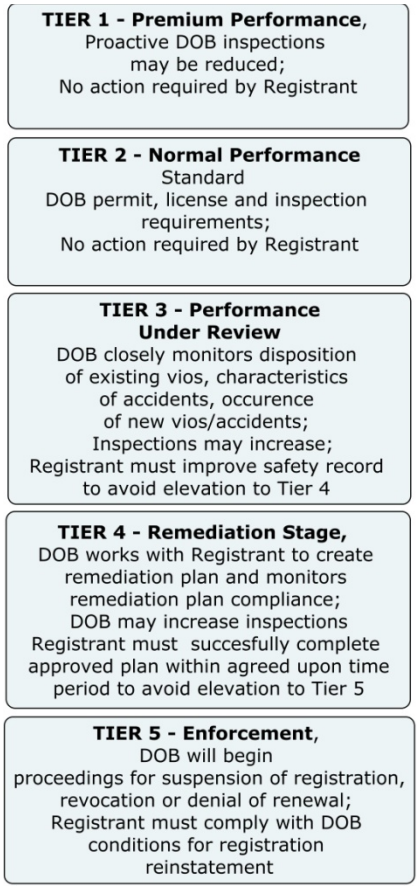
Registrants with continued poor or worsening performance will be assigned to a fourth tier where they will be required to enter into a remediation plan with DOB. The plan will outline steps which the registrant must take to improve performance within an agreed-upon time frame. Registrants who fail to perform to the standards of the remediation plan will be placed in a fifth tier in which they may be subject to registration suspension, revocation or denial of renewal.

The framework is designed as a guide. The recommendations are not intended to limit the DOB's existing authority to order a stop to an individual permit activity, job, or series of jobs in progress by a registrant, if a pattern of activity presents immediate concerns to public safety. Key characteristics of the proposed framework are presented below.

7.2.1. TIERED SYSTEM

We propose a graduated framework that encourages a standardized, systematic approach to identifying performance requiring further review and prioritizing inspections. The framework has the added advantage of incentivizing compliance with site safety standards and promoting a proactive response from the registrants. The framework consists of five tiers, which are presented in Figure 8. Registrants with a typical record of safety performance and compliance are placed in the second tier. Providing an incentive for excellence, the first tier is reserved for registrants with an exceptional safety record. The system provides the registrant many opportunities to improve its safety record before being placed in the fifth and final tier in which the registrant may be subject to license suspension, revocation or denial of renewal in accordance with standard DOB disciplinary procedures. DOB will closely monitor the disposition of existing violations, characteristics of accidents, and occurrence of new violations/accidents for all registrants placed in Tier 3 and work with registrants that are in Tier 4 to develop a remediation plan.

Figure 8 - Rehabilitation Tiers



7.2.2. THRESHOLD SETTING

Registrants move from one tier to another based in part on whether they exceed a series of performance measure thresholds that are derived from both DOB data and external sources. Most of these thresholds are determined using a comparative approach, comparing registrants to other registrants with similar characteristics, as follows.

- Three comparison groups of registrants will be created for the initial performance rankings: GC123s; registrants with at least one job of 15 stories or 200 feet and taller, or lot coverage of 100,000 square feet or more (a job falling under the BEST Squad's responsibilities); and all other safety registrants. These groupings are designed to provide an initial method to

distinguish between registrants with low volume, low complexity assignments and those with higher volume, higher complexity assignments.

Recommendation for future enhancement: In consultation with the DOB, we believe the best method to distinguish registrants by the volume and complexity of work is to evaluate registrants separately in three groups based on the registrant's active total square feet in construction, alteration or demolition. To accomplish this we recommend the following:

- Because construction floor area has not been consistently recorded for entry in the DOB database, we recommend that DOB collect data on square footage (constructed or altered) for every job associated with safety registrants.
- Our review of the limited data suggest that the three categories for registrant groupings most useful for evaluating performance should be: GC123; registrants with less than 100,000 square feet construction floor area (active jobs); and registrants with more than 100,000 square feet in construction floor area.
- Because the data on construction floor area is currently limited, we recommend that once the area data has been collected, DOB evaluate the groupings of registrants outlined above. The purpose of the evaluation is to determine the most appropriate breakpoints. Breakpoints would be set at a level which provides statistically different distributions for each group on each performance measure.
- To further evaluate the complexity of work, we also recommend that job cost information be regularly collected by DOB and analyzed to determine if it is useful in separating registrants into categories reflective of volume and complexity of work affects the performance measures.

- Registrants with an excellent safety record – an OSHA recordable injury rate (RIR) and OSHA Days Away from Work Rate (DART) below the industry average for New York State,[12] an EMR below 1.0,[13] and ranking below the median in terms of all other safety measures - are eligible to apply for Tier 1. Placement in Tier 1 is dependent upon self-reporting the existence of a safety management system.
- Registrants with performance rankings which are clearly worse than normal performance would be identified. The evaluation threshold we recommend is the 94th percentile, which identifies the top 6 percent worst performers from the registrants in the comparison group. This level is associated with a higher probability of accidents when applied to the violations per job and Class 1 violations per job measures. For all performance measures, this level clearly distinguishes poor from average performance and limits the number of safety registrants that will be subjected to more detailed review to a level which is manageable for continuous DOB review and tracking.

[12] The U.S. Bureau of Labor Statistics note that the averages per 100 full time workers for NYS in 2009 were 4.7 (RIR) and 2.5 (DART).

[13] An EMR below 1.0 indicates a good experience history (claims history for an individual firm is below the expected rate) warranting a reduction in base premium. U.S. Army Corps of Engineers, Albuquerque District, *Zero Accident Program* (2002).

- To ensure that businesses with a low number of violations and active jobs will not be subjected to more stringent requirements than larger firms, registrants with less than three violations in the past two years will be excluded from assignment to Tier 3, so they will not initially be selected for increased scrutiny based solely on their violation ranking as outline above.
- Confirming the importance of a zero-accident workplace, the accident threshold is determined by absolute measurement, with registrants with 1 or more fatal accidents in the past 6 months being selected for increased oversight.

The thresholds for the following measures will be determined through the comparative approach outlined above.

- Number of non-dismissed, sustained violations per job – The data confirms our expectation that registrants with more active jobs are likely to have more violations (see Section 3.1.3), so the violations measure is calculated on a per job basis.

  Recommendation for future enhancement: As outlined above in the discussion on registrant groupings, job count does not fully measure workload because not all jobs are the same in scale and duration. To better measure workload, we recommend that DOB replace the measure of number of violations per job with the number of violations by total floor area constructed or altered (in 1,000 or 10,000 square foot increments). Alternatively, DOB could consider routine collection of job cost data and evaluation of this data for use in measuring workload.

- Number of non-dismissed, sustained immediately hazardous violations (Class 1) per job – This measure focuses on the immediately hazardous or Class 1 violations while taking into account workload. For each registrant, the measure is calculated by dividing the number of non-dismissed Class 1 violations by the total number of jobs. Analysis showed that Class 1 violations are more likely to lead to accidents than less severe violations (see Section 3.1.4 above). We recommend that the threshold for this measure also be set at 6 percent.
- Number of stop work orders per job– Stop work orders can be issued for a range of violating conditions, such as working without a permit, failing to provide approved plans on site, and working contrary to approved plans. While all stop work orders result in an ECB violation, the number of stop work orders per job is an additional indicator of serious poor performance. To link the measure specifically to safety conditions we recommend limiting this measure to stop work orders related to Class 1 violations.
- Experience Modification Rate (EMR) – The EMR is an adjustment to the workers' compensation insurance premium based on prior years' payroll and loss data. Private and public owners frequently use the EMR when selecting a contractor. The EMR thus offers a dual incentive for employers to operate safely as a lower EMR keeps operating cost down as well as increases the number of contract opportunities. In New York State, the EMR is calculated by the New York Compensation Insurance Rating Board - a non-profit, unincorporated association of insurance carriers that includes the State Insurance Fund - based on insurance carrier records or, for self-insured, on information directly provided by the employer.
- Violations per inspection – Inspections at a site are expected to positively affect the number of violations issued at that site. Both DOB and stakeholders expressed concern that it may be very difficult for registrants placed in a tier with more oversight to obtain a violation per job ranking that places them in a better tier when inspections are not incorporated in the measure.

Recommendation for future enhancement: To address the impact of inspections on rate of violations, we recommend that DOB collect inspection data (initially only for jobs associated with registrants placed in Tier 3) and that registrants in Tier 3 be compared to each other in terms of violations per job per inspection. Using this measure, registrants can be afforded the opportunity to move from Tier 3 to Tier 2 even with a continued elevated violation per job rate. Registrants showing better than normal violations per job per inspection (less than the median) without additional accidents on their record will return to Tier 2.

The advantages of the comparative approach are that it is straightforward to understand and implement and that it is adaptable to changing circumstances. As construction becomes safer over time and fewer violations are issued, thresholds created using this approach will become lower. Similarly, as the current limited dataset becomes more complete, the threshold values will change. By creating different rankings for GC123s or small firms and other contractors, the framework takes into account that GC123s or small firms are subject to fewer inspections and therefore have a lower violation rate.

The threshold for the following measure will be determined using an absolute value:

- Number of Fatalities Resulting in Violation – Fatal accidents are any incident on a construction site resulting in fatalities to workers or the public. Since any fatal accident resulting in violations can be an indicator of broader safety compliance concerns, the study team recommends that registrants with one fatality resulting in a violation in the previous 6-month period are placed in Tier 3.
- Average number of days to correct a Class 1 violation – Registrants are required to correct Class 1 violations, which are immediately hazardous violations, immediately after being cited. The study team recommends that the threshold value would be set at 30 days; registrants who on average take longer than 30 days to correct their violations would exceed the threshold. For each registrant, the measure is calculated by the combined number of days to correct all Class 1 violations by the registrant's total number of Class 1 violations. Current regulations require that DOB re-inspect a jobsite with uncorrected violations starting between 30 and 60 days of the issuance date. The inspector issues a new violation if the condition still exists. This system promotes compliance but creates a significant workload for DOB inspectors. By providing an incentive to correct within 30 days, the inclusion of this threshold in the framework will contribute to the framework's objective of reducing the overall number of inspections and reallocating inspections to those with the worst safety record.

A combination of measures is necessary to address the inevitable shortcomings associated with each individual measure. During the stakeholder meetings, for example, several attendees expressed their negative opinion of the ECB system as a whole, questioning the fairness of the system and the consistency of decisions. To avoid reliance exclusively on ECB related measures, other performance measures such as EMR and the OSHA injury rates were incorporated into the framework.

7.2.3. OPERATION OF THE REHABILITATION FRAMEWORK

As outlined above, the threshold performance measures are to be applied in a stepwise fashion to determine a registrant's placement in the tier system on a periodic basis. The proposed operation of the rehabilitation framework is summarized in the flow chart below (Figure 9) and the table that follows (Table 11).

Figure 9 - Proposed Rehabilitation Framework Flow Chart

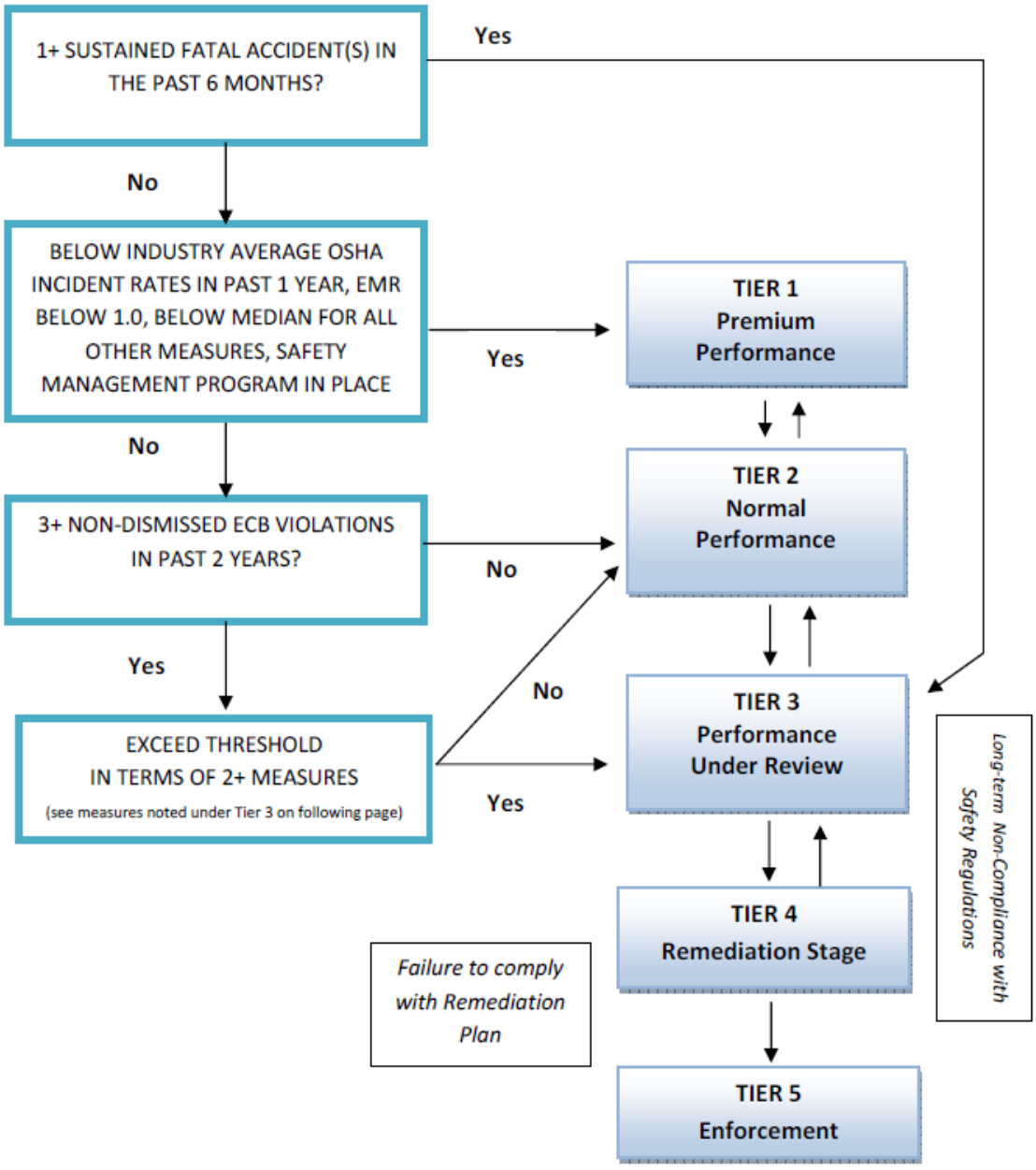


Table 11 - Summary of Rehabilitation Framework

Tier	Description	Threshold Status	DOB Action	Detailed review of Registrant	Action by Registrant
Tier 1	**Premium Performance** – Excellent performance record	*Eligible if all of the following:* Below average in terms of OSHA RIR and DART EMR below 1 Below median for all other measures Safety management program in place	Notice Letter. DOB may reduce frequency of inspections.	None required.	If interested, apply for Tier 1 Status by certifying that company has active safety management system and qualifies by other performance measures.
Tier 2	**Normal Performance** – Normal record of violations per job and no incidents with injuries or fatalities.	This tier includes all registrants with performance measure results not falling into the other tiers.	Notice Letter. Standard inspection requirements.	None required.	None required; continue to correct/ cure violations as they arise.
Tier 3	**Performance under Review** – Substantially higher rate of violations or accidents than normal.	1 or more sustained accidents with fatality in last 6 months. *OR:* At least TWO of the following: Top 6% worst performance in terms of: - Violations per job (unless less than 3 violations in measurement period.) - Class 1 violations per job - Stop work orders per job - EMR Average time to correct a Class 1 violation exceeding 30 days.	Warning letter by mail requiring response. May increase level of inspection activity as warranted.	Closely monitor disposition of existing violations, characteristics of accidents, and occurrence of new violations/accidents. Move registrant to Tier 2 if violation/job/inspection below median for Tier 3 registrants and no accidents Move registrant to Tier 4 if registrant ranks at Tier 3 level for more than two consecutive periods UNLESS no new violations/ all existing violations are corrected.	Registrant must improve performance to Tier 2 or Tier 1 level or avoid new violations and correct existing violations within two following periods to avoid elevation to Tier 4.
Tier 4	**Remediation Stage** – Continuing high rate of violations, poor record of correction	Ranking at Tier 3 level for more than two consecutive periods and new violations/uncorrected violations	Warning letter by mail requiring response and conveying remediation plan requirements.	Increased level of inspections and monitoring of violations disposition to ensure compliance with remediation plan.	Registrant must submit remediation plan to DOB and successfully complete within agreed time period to avoid enforcement action.
Tier 5	**Enforcement** – Failure to remediate poor record	Failure to comply with remediation plan.	Notice letter by mail requiring response. Begin proceedings for suspension or revocation of registration or non-renewal of expiring registration.	Flag registrant ownership; closely monitor new registrations by same owners for compliance with standards.	Registrant must comply with DOB conditions and standards for registration reinstatement as appropriate.

7.2.4. PERFORMANCE MEASUREMENT CYCLE

To ensure that registrant performance is monitored on a regular and continuous basis, we recommend that the performance measure rankings be produced by DOB every six months as follows.

- To provide adequate notice of the operation and function of the program, the first two ranking cycles should be considered a trial. This will provide DOB with a period of one year to monitor and evaluate performance of the system and to implement the recommendations for enhancement outlined in 7.2.2. Notice of tier ranking will be provided to registrants but the tier placement will have no bearing on DOB inspection or enforcement action during this trial period.
- The third cycle will start six months after the conclusion of the trial period and will not take into account the registrant placement in the first two measurement periods.

The time frame of the data on which performance measure rankings are based will vary in accordance with the features of each measure as follows.

- For the thresholds related to violations and stop work orders, the rankings will be based on data of the preceding year. As violations work their way through the adjudication process they will appear in the database, available for use in the performance measure calculation.
- EMR rankings will be based on the most recent EMR provided to the registrant by the New York Compensation Insurance Rating Board. The EMR is calculated to include the last three years of a contractor's performance.
- Because accidents are of a more serious and immediate nature than the other measures, fatal accident counts (as defined above) will be based on data from the previous 6 months.

Depending on the new ranking and accident counts, registrants move down the tier system to a tier with less oversight, move up to a tier with more oversight, or remain in the same tier. The system targets registrants with long-term, recurrent non-compliant behavior or poor safety records. Registrants who are ranked in Tier 3 for more than two consecutive periods based on their violation, stop work order, or EMR rankings are automatically moved to Tier 4, unless they had no new violations during these two periods and all their existing violations are corrected or the DOB considers mitigation factors (see below).

The tiered structure allows for reductions in the level of oversight by DOB for registrants in Tiers 1 and 2, as compared to current practice. Increased levels of oversight will be prioritized to Tiers 3 and 4, which are expected, based on the preliminary estimation of performance measures outlined in this report, to contain less than 10 percent of registrants overall.

7.2.5. IMPLEMENTATION PROCEDURES

To ensure that the rehabilitation framework meets the DOB's goal of promoting improved performance with respect to safety measures, the study team has developed several recommendations for procedures to be followed in the application of the rehabilitation framework. These recommendations are outlined in the sections below.

MANUAL REVIEW

Prior to announcing the rankings to registrants, the DOB will conduct a manual review of all information related to the violation, stop work order, EMR rankings and accident counts of all registrants placed in Tier 4. The DOB will also review a small subset of registrants placed in Tier 1, 2, and 3, selected randomly.

The purpose of this review will be to ensure that the calculations of the thresholds are performed accurately and are based on correct counts of violations, jobs, stop work orders and accidents. At a minimum, the DOB review will include checking the accuracy of data and correcting potential data entry errors. Based on the findings of the review, the DOB may find reason to revise or correct the ranking and assign the registrant the appropriate tier based on the revision. During this manual review for Tier 4 registrants, the DOB, at its discretion, may also take into account mitigating factors not incorporated in the performance measures (see below).

NOTICE REQUIREMENTS

Registrants will receive notice of their placement in the tiered system within 10 business days after the manual review of the DOB is completed. The letters will list the tier, explain its meaning, include the data used to calculate the registrant's measures (e.g., number of non-dismissed, sustained ECB violations, number of non-dismissed, sustained Class 1 ECB violations, number of jobs, average number of days to the correct a Class 1 violation, number of serious, sustained accidents, number of stop work orders), and provide the next steps required of the registrant and the DOB. Registrants will receive the notice by regular mail.

The notice letter for Tier 3 will explain the ways to move up to a better tier and the consequences of remaining in Tier 3 for more than two cycles. The letter will include a form that the registrant has to sign and return to DOB by fax, mail or email to acknowledge that receipt of the notice.

When a registrant is placed in Tier 4, the registrant is required to work with DOB to develop a remediation plan that is acceptable to both parties. The registrant will receive a letter from DOB, explaining the consequences of being in Tier 4 and requesting him to contact the unit at DOB tasked to administer the Safety Registration Program, so that a meeting regarding the remediation plan may be scheduled.

PREMIUM PERFORMANCE APPLICATION

Registrants that are found eligible to apply for Tier 1 based on their performance record would have the option to submit an application to the DOB for premium performance status. Premium performance status would be awarded to registrants with an active safety management system and would be based on self-reported information. The application would consist of a checklist in which the registrant indicates the safety management actions that the company is currently taking. To be approved the safety management program has to include at least 2 of the elements for each of these two categories:

Management Commitment

- Commitment statement
- Safety and health management evaluation

- Documented self-inspections at least weekly

Employee involvement

- Toolbox talks for employees and subcontractors, at least weekly
- Employee Incentive program
- Safety and health training (beyond minimum required)
- Involvement of employees in self-inspections

These requirements are inspired by the OSHA Voluntary Protection Programs (VPP). VPP status is awarded to contractors with an extensive safety management system and OHSA incidence rates below the industry average. The status is site-specific and is currently awarded to very few construction sites in New York State.

REMEDIATION PLAN

The registrant is required to make the request for a remediation plan meeting within 10 business days of receipt of the Tier 4 notice. Failure to respond to the notice will place the registrant at risk for a suspension of the registration until a remediation plan meeting is held. The meeting itself should be scheduled within 30 business days of receiving the notice, unless the registrant requests and obtains an extension from the DOB or a later date is more convenient for the DOB. Registrants who feel that they are incorrectly placed in Tier 4 should bring all supporting documentation to the meeting. A representative designated by the Commissioner will have responsibility for conducting the meeting, approving and documenting the remediation plan, and tracking compliance.

The remediation plan should have several key components as follows.

- Steps that the registrant will take to improve site safety conditions and performance. This section should include specific commitments to resolve outstanding violations and steps that will prevent similar or related violations from occurring. The steps can include physical precautions, procedural changes, training, and similar initiatives to address deficiencies that have lead to violations or accidents.
- The methods that the registrant will use to inform DOB of its progress in meeting the requirements (e.g., proof of correction/cure, proof of implementation of physical improvements or training initiatives, comprehensive safety management system). The section should also include the steps that DOB will take to monitor performance during the remediation plan period including the number and nature of inspections.
- Handling of new accidents and violations. Accidents and violations that occur while a registrant is operating under a remediation plan can constitute evidence that the registrant has not taken adequate steps to improve safety conditions and performance. Accidents can occur despite good faith efforts at prevention, however, and violations issued for procedural reasons may not be an indication of continued safety problems. The remediation plan should detail the specific types and number of violations and accidents that will constitute violation of the plan and terms for time to correct.
- The timeframe for implementation of both the plan and individual commitments and reporting requirements. To ensure timely resolution of outstanding safety issues, the typical plan should

be completed within 6 months with any uncorrected violations prioritized for earlier resolution. The plan should include clear indication of final and intermediate dates for plan compliance.

- The outcome with successful completion of the remediation plan and consequences for violation of the plan. Successful completion of the plan should merit reduction to Tier 2 for the next 6 month cycle. Violation of the remediation plan merits escalation to Tier 5 where enforcement action is considered (see below).

The plan will be signed by the registrant and DOB official designated by the Commissioner to administer the program.

The content of the plan will be customized for each registrant based on negotiations between the DOB and the registrant. In some cases, returning to acceptable performance (Tier 2 and below) based on the performance measures alone in a short timeframe may be difficult because of slow responding measures such as the EMR, which is based on three years of data prior to the current year and violations measures, which are based on the two years of performance. In these cases, other considerations such as the registrant's commitments to institute training programs, new safety procedures, hire experienced safety management staff, and concrete steps to reduce the time to correct violations may be components of the remediation plan.

ENFORCEMENT ACTION

Registrants who do not comply with the remediation plan will be placed immediately in Tier 5. At that time, they will receive a notice letter that explains their placement and the appropriate next steps by the registrant and DOB. When a registrant is placed in Tier 5, the registrant will be subject to suspension, revocation or denial of renewal.

The enforcement process will follow existing procedures specified by DOB for disciplinary action, including the following.

- Hearing at the Office of Administrative Trials and Hearings (OATH) followed by a determination by the Commissioner. Action taken by the Commissioner can include requiring monetary payment and/or imposition of a fine; probation (with agreement for monitoring for a period of time); suspension, revocation, or denial of registration renewal.
- Settlement in lieu of formal disciplinary action. As with disciplinary actions for other licenses and registrations with the DOB jurisdiction, the parties may agree to an alternative course of action as a substitute for formal disciplinary action.
- Voluntary surrender of registration. In lieu of the disciplinary actions outlined above, the registrant may choose to voluntarily surrender the registration and will not be eligible for reinstatement or renewal.

Registrants who were subject to suspension can apply for a reinstatement after conclusion of the suspension period specified in the Commissioner's Order.

At the discretion of the Commissioner, registrants facing suspension or revocation may be afforded the opportunity to complete existing construction activity or continue the activity until other arrangements are practical.

OTHER CONSIDERATIONS IN MOVEMENT BETWEEN TIERS

To ensure full consideration of the registrant's performance record, the DOB, at its discretion, may also take into account mitigating factors not incorporated in the performance measures when evaluating whether a registrant that was selected for Tier 4 based on the measures should move to, or remain in, Tier 3. In keeping with comments received during industry outreach sessions, the study team recommends that these additional factors include the following:

- Job Complexity – Some complex construction jobs may not be comparable to other building construction work in the city and this level of complexity may not be adequately captured in the job square footage metric tracked in the DOB database. On a case-by-case basis, DOB may consider job complexity when evaluating violation rates that warrant continued placement in Tier 3.
- Violation Severity – Class 1 violations include a wide range of infractions that are considered immediately hazardous. On a case-by-case basis, DOB may consider the particular type of violations cited to make a further determination on severity when evaluating violation rates that warrant continued placement in Tier 3.
- Timely Correction of Violations – DOB may consider a good record in addressing outstanding violations as a mitigating factor when considering whether to move a registrant from Tier 3 to Tier 4. Timely correction may warrant a delay in this movement and continued monitoring by DOB.
- Safety Training – Registrants implementing training programs (e.g., OSHA-10, OSHA-30) may warrant a delay in movement from Tier 3 to Tier 4. Training initiatives indicate a proactive response from the registrant in addressing safety issues and can be expected to result in future improvement in the registrant's safety performance.
- Comprehensive safety management system – Registrants with an active safety management program that fits the criteria of the premium performance management program required for Tier 1 may also warrant consideration in movement from Tier 3 to Tier 4.
- Years in Business – DOB may wish to consider a long record of business operation as a mitigating factor in the evaluation of movement from Tier 3 to Tier 4. As noted in our stakeholder outreach sessions with Demolition endorsement-holders, experienced firms are more likely to engage in complex jobs—incurring violation or risk of accidents as a result of the uncertainty inherent in these assignments. This factor could be implemented in one of two ways: measurement of continuous business operation from the date of registration, or through direct request for this information from the registrant.

OTHER PROCEDURAL RECOMMENDATIONS

The study team recommends two additional procedural requirements that would promote effective implementation of the Rehabilitation Framework, as follows.

- To ensure consistency with other licenses and registrations regulated by DOB and the City of New York, the DOB should have the authority to take enforcement action against registrants that make false statements on their registration applications or other official filings with the DOB related to the Safety Registration Program. This enforcement action would be handled

outside the Rehabilitation Framework but would promote its effective operation by discouraging false filings and fraudulent responses.

- To promote use of the framework as a tool to track and prioritize DOB's oversight responsibilities, the study team recommends that the tier ranking of a safety registrant be kept confidential. This confidentiality would promote focus on rehabilitation and improvement in performance and compliance. This recommendation does not apply to enforcement action taken against registrants after their assignment to Tier 5, which would be a matter of public record (as with other DOB disciplinary actions).

7.2.6. CHALLENGES IN IMPLEMENTATION

The research undertaken by the study team combined with the outreach and coordination with stakeholders has revealed several challenges facing the implementation of the proposed Rehabilitation Framework. These challenges are noted below along with potential responses designed to minimize and avoid problems during implementation and ongoing operation of the program.

- Performance Incentives –The relative performance measures recommended for the tier system thresholds (e.g., top 6 percent worst performers) are appropriate for the data distribution and provide flexibility in the performance measures as compliance changes (hopefully through improvement) over time. A relative measurement system can promote mediocre performance, however, as registrants have the incentive only to keep pace with their peers, not to outperform with respect to the comparison group. The following factors of the framework should work to minimize this effect:
  - Tier 1 provides an incentive for good performance with reduced levels of oversight for the best performing contractors.
  - Periodic performance measurement and the confidentiality of registrant rankings provides a level of uncertainty as to a registrant's rank with respect to the peer group in the subsequent measurement period. Registrants have the incentive therefore to improve on their previous performance to avoid crossing the thresholds or to maintain a favorable rank.
  - The performance measures used (violations, uncorrected violations, stop work orders, EMR) are accompanied by other penalties and disincentives (fines, delays, increased costs, and decreased procurement opportunities) that act as deterrents to continued poor performance.
- Increase in Contested Violations – By including sustained violations as a key performance measure, the proposed system may incentivize registrants to contest all violations through ECB hearing and/or to delay corrections to avoid appearance of a sustained violation in the database. As many violations are currently stipulated or resolved without proceeding to a hearing, this may place a burden on the ECB system. Considerations that may work to minimize this effect include the following.
  - The framework is designed to use the performance measures as a prioritization system. Disciplinary action is dependent upon compliance with a remediation plan, which will include consideration of other actions a registrant can take to improve site safety and demonstrate a commitment to improved safety performance.

  - The framework includes other measures such as EMR, accidents, and stop work orders—it is not based exclusively on violations performance.
  - We recommend that DOB consider several mitigating factors, as appropriate, in moving registrants between tiers.
  - Few violations (less than 10 percent) are ultimately dismissed in the ECB process. This rate has stayed steady during our study period and is unlikely to change substantially over time.

- Cycle of Increased Scrutiny and Violations – Feedback received during stakeholder outreach indicates a concern among registrants that Tier 3 and Tier 4 classification coupled with increased inspection activity would create a vicious cycle of increased oversight and violations that would prevent improvements in safety performance. Violations are serious infractions that DOB cannot ignore in a safety enforcement program, but the DOB must be aware of this challenge in implementation.
  - As noted above, disciplinary action is predicated upon failure in compliance with the remediation plan—the performance measures are only used to indicate when DOB should engage in this type of oversight. In development of the remediation plans, DOB should consider actions other than improvement in violations performance (such as implementation of a safety management program or improvement in the number of violations noted during subsequent inspections) to lessen the impact of this effect.
  - To incentivize better performance on inspections, we recommend that the DOB evaluate violations per job per inspection to establish a measure of normal performance (median). As outlined above, those registrants showing better than median performance on this measure can be moved to Tier 2, provided they have no additional serious accidents on their record.
- Defaults – ECB default judgments based on the non-responsiveness of violators may complicate the application of the performance framework.
  - The procedures for applying the framework require positive response from the registrants. Failure to respond to a Tier 4 assignment places the registrant at risk for a temporary suspension until the remediation plan is agreed upon.
  - DOB may consider mitigating (and aggravating) factors such as specific reasons for non-responsiveness to violations or notices in the application of the framework and in decisions on disciplinary action.
- Broad Definition of Class 1 Violations – Evaluation of the data shows that 40 percent of violations cited during the study period received the Class 1 Immediately Hazardous status. Although these are serious infractions that cannot be ignored by DOB, the concern among registrants is that not all violations in this category merit the "immediately hazardous" classification.
  - We have included a recommendation for a closer examination of violation severity as a factor in the application of the framework. DOB may wish to consider expansion of the classification system to accommodate an additional category describing the most serious infractions.
- Proactive Response – The framework is intended to prioritize DOB's oversight activities. Application of the framework should not hamper or diminish the DOB's authority to take

immediate action to prevent or correct safety issues. The recommendations are not intended to limit the DOB's existing authority to order a stop to an individual permit activity, job, or series of jobs in progress by a registrant, if a pattern of activity presents immediate concerns for public safety.

- EMR – In developing the framework, the study team did not want to place full reliance on any one performance measure. This included EMR, which has some drawbacks that make it unsuitable as the sole measure of safety performance.[14] In a 1995 paper in the Journal of Construction Engineering and Management, Hinze and colleagues find that the EMR decreases when hourly wages and/or total wages increase.[15] Firms paying higher wages have lower EMR values even though their safety performance may be identical to firms paying lower wages. Firm size is also important because smaller firms have minimum attainable values of EMR that are much higher than those of larger firms. He concludes that caution should be applied when comparing contractors based on their EMR. Especially for large projects where a large portion of the project will be subcontracted, he warns that the EMR should not be used as the sole criteria for contractor selection. A review of articles on industry websites showed employers can keep their EMR low by reducing the number of claims and the size of the claims. Having an insurance policy with a deductible that requires the employer to pay for small claims out-of-pocket keeps the number of claims down. Return to work programs that require injured workers to return to work quickly reduce the amount claimed. Returning employees are typically given restricted duty but are being paid full wages, thereby avoiding a claim for disability payments.[16] EMR has been included in the framework to broaden the base of the performance measures utilized. When used with a relative threshold for flagging and prioritizing oversight, we believe EMR is a useful indicator of performance.

7.2.7. DATA COLLECTION RECOMMENDATIONS

The implementation of the proposed Rehabilitation Framework, which relies in large part on DOB data for performance measures, is dependent upon the good condition and continued upkeep of the data. Currently the DOB has a sizable dataset capturing a variety of attributes describing the performance of regulated construction contractors in New York City. Although the DOB has made strides in collecting and analyzing the data in the past two years, the database systems remain geared toward collecting data for single-purpose applications (e.g., tracking disposition of violations) or stand-alone collection of data. The system is currently set up as cordoned tables of data that ideally should relate to each other, but currently do not.

[14] Samelson, N. and Levett, R. "Owner's guidelines for selecting safe contractors." J. Constr. Div., ASCE, 108(4), 617-623; Hinze, J., Bren, D., and Piepho, N. "Experience Modification Rating as Measure of Safety." Journal of Construction Engineering and Management, Vol. 121. No. 4, December 1995; De la Garza, J., Hancher, D., and Decker, L. "Analysis of Safety Indicators in Construction." Journal of Construction Engineering and Management, Vol. 124. No. 4, July/August 1998.

[15] Hinze, J., Bren, D., and Piepho, N. "Experience Modification Rating as Measure of Safety." Journal of Construction Engineering and Management, Vol. 121. No. 4, December 1995.

[16] http://www.gradingandexcavation.com/buyers-guide-2010/safety-management-emr.aspx; http://www.safetymanagementgroup.com/articles/Do-You-Understand-Your-EMR.aspx Accessed on February 3, 2011.

This fractionalized system presents a challenge for development and implementation of performance measures since seemingly related attributes such as safety registrants and their ECB violations are not readily connected. Currently, the DOB has two data systems, BIS and B-Smart, and an additional database that the DOB shares with the Environmental Control Board, AIMS. Each system has its own set of personnel that administers them and their own set of data entry rules. This diminishes data integrity and ultimately leads to a less than synergetic data management approach.

In order to use the threshold system as an effective tracking and prioritization tool, the DOB would need to create a relational database system with a high amount of data integrity to ensure continued confidence in the data's output. For the DOB to increase its ability to harness accurate statistical and descriptive data about the City's construction projects, contractors, and their challenges, we recommend the following actions with respect to data collection and maintenance:

- Create a unified data dictionary that all database systems must adhere to. The data dictionary will provide definitions, format structure, and the overall context to the data within the databases.
- Set rules and guidelines for the sharing of data between systems that enhance current and future data integrity. This includes a documented database map of all of the data stored in the database's systems and external sources and how they can be related. Based on the map the DOB can see how the relationships between inter-departmental groups relate more clearly. This removes data ownership issues and assists in data relationship building.
- Create data validation rules and automatic verification checks within the system for entering data. By running automatic routines that present blank cells and data that is not identical to what it is supposed to be (license numbers in one table versus license numbers in another).
- Minimize manual data entry where possible. By using existing data that is already populated in the database the DOB can auto fill data fields with key attributes such as license number, ECB violation number, or any other unique key that is related to a host of already inputted data. By using existing data, the system will drastically reduce typing, formatting, spelling, and invalid entry errors. This will also maximize data integrity and productivity.

In addition to general recommendations regarding the database, this report has highlighted specific recommendations that would enhance the operation of the Rehabilitation Framework. These recommendations are as follows. Detailed recommendations are included in Section 1.2 of the Appendix.

- To account for the size of construction work in the performance measure system, DOB should improve the consistency of its collection of construction floor area or building square footage data for new building construction, alterations, and demolition permits. Uniform and complete collection of this variable would allow for the violations per registrant performance to be calculated on a job area basis (e.g., violations per 1,000 or 10,000 sq. ft.) In the current study dataset there are currently a substantial number of records lacking a building area datapoint. We recommend that the performance measure be modified to include this data as soon as practical—optimally within the one-year trial period recommended in section 7.2.4.
- An enhancement of the construction floor area measure could be an estimate of person-hours of work required for construction, alteration, or demolition. This would account for complexity of work not fully captured in building area. Another alternative measure would be the cost of

the construction work. We recommend that DOB investigate the feasibility of collection of these measures through registrant self-reporting during the permit application process.

- To provide additional detail and uniform classification of violations severity, we recommend that the Department consider implementation of an additional or supplementary classification to identify the most serious of the Class 1 violations. This would allow for focus on the most serious safety infractions in the performance measurement system. A supplementary classification could be tailored specifically for framework performance measure by regrouping violations causes. This may require more specific guidance to inspectors in the classification or documentation of violations when citations are written in the field.
- As with violations, the performance measure for accidents could be enhanced to focus more precisely on the more serious cases, for example accidents leading to injury that require more than first aid as a response. This would require additional guidance to registrants on the standards for reporting and classification of accidents.
- We also recommend that inspections be tracked on a more comprehensive basis to allow for incorporation of inspections in the performance measurement system. For example, a "violations per job per inspection" measure would allow for tracking of improvement in the number of violations issued for each inspection. This improvement would allow for movement from Tier 3 to Tier 2, providing incentive for registrants to improve performance, and breaking the cycle of violations that may arise with increased scrutiny.

8. CONCLUSION

Comments received from stakeholders during outreach activities conducted during this study have confirmed that safety is the top priority of all participants in the New York City construction industry. This report outlines a system for prioritization of DOB's oversight and disciplinary responsibilities that is designed to promote compliance with regulations, safe practices on construction sites, and proactive steps to identify and improve poor performance by registrants. Under this system, performance measures are used as a guide to flag registrants with poor or worsening performance. Enforcement action is a last resort that will be taken only after the failure of coordinated efforts by the registrant and DOB to improve performance (as established in an agreed-upon remediation plan). By recognizing excellence in compliance and safety standards and flagging performance that warrants closer scrutiny, the system is intended to allow DOB to prioritize oversight activities and focus on working with registrants to promote safety.