



101 ASH STREET

BUILDING CONDITION ASSESSMENT

FINAL REPORT

JULY 28, 2020

PREPARED BY KITCHELL

IN ASSOCIATION WITH

NINYO & MOORE ENVIRONMENTAL CONSULTANT

MIYAMOTO INTERNATIONAL

HKA ELEVATOR CONSULTING

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EXECUTIVE SUMMARY

INTRODUCTION

On June 3rd of 2020, The City of San Diego Public Works Department authorized Kitchell and its consultants to conduct a Facility Condition Assessment (FCA) for the Building located at 101 Ash Street, In Downtown San Diego, California. The assessment was conducted in accordance with ASTM Standard E 2018-08 (Property Condition Assessments) and a scope of services provided by the City. The FCA consisted of a review of known reports, assessments, drawings and other various documents that were provided to Kitchell by the City to become familiar with the history of the building, its systems and environmental condition. In addition, a seismic analysis was conducted to determine how the building will perform during an earthquake.

Kitchell and its consultants conducted an on-site walk-through of the building to identify and record the conditions of the major systems, visibly observe

the presence of asbestos containing materials (ACM) and verify data presented in the reports and assessments provided by the City.

Based on analysis, Kitchell has made recommendations for replacement, alteration, modification and abatement of the various systems analyzed in this assessment. The recommendations as outlined in this report, incorporate technical data including reports, drawings, and maintenance information regarding the existing systems combined with technical engineering design and construction knowledge utilizing industry standard useful life and system best practices. Where work to be completed is required by a code or standard, a reference is provided to the appropriate source document.

Conceptual cost estimates have been included based on the recommendations.

EXECUTIVE SUMMARY

PURPOSE

The purpose of this Report is to determine the existing physical and environmental conditions of the building and validate previous consultant's findings through evaluation of documentation provided by the City. Furthermore, the study identifies building systems and materials that are in need of repair, replacement and or removal to allow for safe occupation of the building by City staff.

SCOPE OF WORK

The City asked Kitchell to evaluate and analyze the following systems.

- Asbestos Containment and Remediation
- Mechanical, Electrical, Plumbing and Automation Systems
- Structural frame and Building Envelope
- Vertical transportation (Elevators)
- Life Safety Violations in need of correction

This study is based in part, on a site visit that included a walk-through of the building to inspect present conditions of materials and observe the MEP and Vertical transportation systems in operation.

EXECUTIVE SUMMARY

METHODOLOGY

Kitchell reviewed previous asbestos, environmental and building condition assessments, building systems asset lists, reports, surveys and as-built drawings, both digital and physical. A pre-assessment questionnaire was provided to the City to be completed by staff familiar with the building and its systems. An on-site building walk was conducted on Tuesday, June 16th of 2020 to make a visual non-intrusive, non-destructive inspection and evaluation of the various external and internal building elements that included HVAC, electrical panels and switchgear, plumbing systems and fixtures, asbestos related conditions and elevators. Air samples were taken in the building before and after HVAC startup to measure levels of airborne fibers.

City Staff and members of both Environmental Services Department (ESD) and Air Pollution Control District (APCD) also participated in the walk-through.

EXECUTIVE SUMMARY

GENERAL OVERVIEW

101 Ash St, is a 21-story concrete and steel hi-rise building situated on a one-acre parcel in central Downtown San Diego between 1st and 2nd Avenues four blocks south of interstate 5. A local iconic structure built in 1967, it served as the headquarters for San Diego Gas & Electric for fifty years. The building is currently not occupied. Along with its below ground parking structure, the building has a gross square footage of approximately 447,732 square feet. Pedestrian access from street level is by two raised concrete plazas along Ash Street. Two vehicular entrances are provided off of 1st and 2nd Avenues that provide parking for approximately 240 cars. The building's exterior is a combination of concrete and travertine cladding with single glazed, fixed anodized aluminum framed windows

The interior finishes primarily consist of painted gypsum board walls, carpeting, vinyl flooring and suspended acoustical ceiling tiles in metal track.

Zoning documents obtained by the City show the building to be a legally non-conforming development within the Center City Planned District-Core and designated as professional office use with accessory parking garage. A legal nonconforming use is a use of land or structure which was legally established according to the applicable zoning and building laws of the time, but which does not meet current zoning and building regulations.

Heating and cooling was originally provided by a central plant that consists of roof-mounted, chillers and cooling towers with air handlers. The original chillers and cooling towers have been shut down and the building is now served by a central plant off site. An electric water heater with a recirculating pump provides domestic hot water to the entire building. Fire sprinklers protect the entire building and fire extinguishers are located throughout.

The Building is supplied by underground 12.5 kV service feeders that terminate into the main switchgear. There are two emergency generators located on the 21st floor.

ASBESTOS

ASBESTOS-CONTAINING MATERIALS (ACM) ABATEMENT RECOMMENDATION

Remove ACM fireproofing from the visible and accessible areas of the floor decks, beams, and other structures covered with overspray (i.e., ducts, hangers, etc.) of the subject building, and that a non-asbestos-containing replacement be applied. Included in this recommendation is the design and installation of a new ceiling grid system that eliminates the gap found around the perimeter of the existing system. At this time, Ninyo & Moore does not recommend the removal of inaccessible fireproofing, like that found on enclosed beams, the exterior faces of beams, or other sealed and inaccessible locations. Our recommendation mirrors Option #1, as presented in the Shefa Report (Shefa, 2020), in relation to abatement scope. The estimated cost of the removal of ACM fireproofing and application of new fireproofing is \$20,368,000 and the estimated time of work is 84 weeks (approximately one year and eight months), based on applicable portions of the estimate for Option #1 as presented in the Shefa Report (Shefa, 2020).

SUMMARY

ACM have been identified in the subject building, including spray-applied fireproofing located on the floor decks, support beams, and other structures above the ceiling grid throughout the office space floors of the building. The apparent delamination and adhesive failure of the fireproofing system in the subject building requires corrective action (i.e., abatement). Abatement, broadly defined, is a method or a combination of methods to reduce a hazard. There is no regulatory-requirement for a certain level or

ASBESTOS

SUMMARY (CONT'D)

type of abatement, and other considerations (e.g., cost, time) involved are often drivers that affect abatement selection. The general types of abatement options are presented in the attached Glossary of Terms.

Ninyo & Moore's recommendation is in conjunction with the Kitchell team's recommendation and scope related to other building systems. A total project cost estimate and professional opinions regarding maintenance and modernization of other building systems (e.g., mechanical, electrical, fire and life safety) are found in other portions of the team report.

Ninyo & Moore, in conjunction with Kitchell, is recommending the below abatement option for the subject building. Our recommendation is based/built on the abatement options and cost estimates presented in the referenced Shefa Enterprises, Inc. Assessment (Shefa, 2020). The Shefa options, as well as other abatement options, are discussed in more detail in this section. The cost estimates referenced are preliminary and, as reported on page 8 of Shefa, 2020, "a formal Request for Quote (RFQ) from contractors is required" to better estimate project costs.

Our recommendation is based on the current building conditions, discussions with the City and SDAPCD, and the professional experience and training of Ninyo & Moore's staff. A leading driver of our recommendation and a benefit of this abatement option is the effective elimination of the potential hazard to building occupants that is posed by the ACM fireproofing, which has apparently been the primary cause of SDAPCD violations. Due to the material age and observed conditions and failure, it is likely that "there will be continued fallout" (Shefa, 2020) of the fireproofing material if left in place. Other benefits of removal include:

- Minimization of ongoing fireproofing maintenance: Based on the current material condition, removal eliminates the need to maintain ACM fireproofing using trained and certified asbestos workers, which would be required if current fireproofing was left in place. Ongoing maintenance of new, non-ACM fireproofing could be performed by non-asbestos workers.
- Ease of asbestos management: The level of effort and costs of managing remaining ACM (discussed later in section), as guided by an Asbestos Management Program (discussed later in report), would be reduced. The remaining identified ACM are not friable, in good condition, and are located in areas not accessible to non-maintenance workers or the public.
- Liability reduction: Removal of the friable ACM fireproofing reduces the continuing obligations and liabilities associated with its presence.

ASBESTOS

SUMMARY (CONT'D)

- Minimization of potential disturbance and exposure: As mentioned above, remaining identified ACM is not easily accessible, which minimizes the potential for inadvertent disturbance during typical building operations. This minimizes the potential for asbestos fiber release and occupant exposure.
- Elimination of ceiling cleaning costs and time: The demolition of the current ceiling system, and design and installation of a new system, eliminates the costs of cleaning.
- Ease of work: Given the unoccupied state of the subject building, the intrusive and intensive abatement work, as recommended, can more easily be accomplished than if done at a later date.

Limitations of our recommendation include the following:

- Remaining ACM: This abatement option would leave ACM in the subject building including, but not limited to, fireproofing on enclosed beams, fireproofing on the exterior of the building, dislodged fireproofing, thermal system insulation, flooring mastics, drywall joint compound (in certain areas, such as the mechanical shafts), and presently unidentified ACM.
- Required training: Since ACM will remain in the building, site-specific employee awareness training will be required.
- Required notification: Since ACM will remain in the building, annual notification will be required.
- Initial cost: The upfront cost of fireproofing removal is expensive.

ASBESTOS

SHEFA ENTERPRISES, INC. OPTIONS

SUMMARY

The abatement options and cost and time estimates, presented by Shefa Enterprises, Inc. in Appendix C, are discussed below as stand-alone options.

Option #1 – Removal of visible fireproofing from the deck, beams and overspray on other structures above ceiling.

This option is very similar to our recommended abatement option. Total estimated cost presented is \$34,740,755 and the estimated time of work is 89 weeks. Shefa Enterprises, Inc. reports that this option would be the more cost effective over a five year timeframe than their other options (Shefa, 2020). The other benefits and limitations presented with our recommendation are comparable. The additional scope and assumptions regarding building systems presented in this option have been updated by the Kitchell team in our recommendation, which creates the cost and time discrepancies between this option and our recommendation.

Option #2 – Application of spray encasement on visible asbestos-containing fireproofing material above ceiling.

This option would leave the ACM fireproofing in place and apply an encasement, or enclosure, system over the material. The ceiling grid system would be demolished, which would allow for the redesign of the system. Total estimated cost presented is \$26,425,303 and the estimated time of work is 89 weeks. Benefits of this option include:

- Decreased debris: The encasement system would decrease the amount of fireproofing debris that could fall through the perimeter gap in the ceiling and onto the ceiling system due to building vibration or sway, relative to present conditions.
- Decreased potential disturbance and exposure: Encasement would limit asbestos fiber release and, therefore, occupant exposure, relative to present conditions. The system would also minimize disturbance caused by work above ceilings, if the work was not going through the encasement and ACM to the deck and/or beams.
- Lower cost: Upfront labor and material costs would be lower than our recommendation for removal and replacement of fireproofing and mechanical systems work.

ASBESTOS

SUMMARY (CONT'D)

- Damage identification: Encasement systems typically consist of two layers, each a different color. If the first layer (closest to the ACM) is visible, the system may be damaged.

Limitations of this option include the following:

- Remaining ACM: This abatement option would leave ACM in the subject building including, but not limited to, fireproofing, dislodged fireproofing, thermal system insulation, flooring mastics, drywall joint compound (in certain areas, such as the mechanical shafts), and presently unidentified ACM.
- Required training: Since ACM will remain in the building, site-specific employee awareness training will be required.
- Required notification: Since ACM will remain in the building, annual notification will be required.
- Gravity Rules: The additional weight of the encasement system could pull the ACM fireproofing down, or expedite delamination if the fireproofing is damaged by water or building sway or vibration.
- Similar abatement time of work: The estimated schedule is the same as our recommendation for removal, but the option does not provide a permanent solution to the hazard posed by the fireproofing.
- Overspray precautions: Work methods during application will need to be implemented to minimize overspray of the encasement material, so that material costs remain low.
- Potential disturbance: The ACM fireproofing, as well as other ACM, will remain and work could disturb the material (e.g., attaching equipment to the deck or beams above the ceiling).
- Periodic inspection: The encasement system will have to be inspected to ensure that it remains intact and effective.
- Removal factor: The application of an encasement system complicates removal of ACM fireproofing (for tenant improvement or building demolition) and increases the amount of material that must be disposed.

ASBESTOS

SUMMARY (CONT'D)

Option #3 – Spray encasement on a three-foot area around the interior perimeter of each floor.

This option would leave the ACM fireproofing in place and partially apply an encasement, or enclosure, system over some of the material. Specifically, an encasement system three feet wide would be applied to the interior perimeter of each floor to minimize the potential for ACM fireproofing debris to fall through the gap between the ceiling and the perimeter wall (i.e., building shell). The ceiling grid system would be cleaned (wet wiped and HEPA vacuumed). Total estimated cost presented is \$20,597,955 and the estimated time of work is 26 weeks. Benefits of this option include:

- **Decreased debris:** The encasement system would decrease the amount of fireproofing debris that could fall through the perimeter gap in the ceiling due to building vibration or sway, relative to present conditions.
- **Lower cost:** Upfront labor and material costs would be lower than our recommendation for removal of fireproofing and mechanical systems work.
- **Quicker schedule:** Partial encasement is the quickest option presented, and quicker than our recommendation for removal.
- **Damage identification:** Encasement systems typically consist of two layers, each a different color. If the first layer (closest to the ACM) is visible, the system may be damaged.

Limitations of this option include the following:

- **Remaining ACM:** This abatement option would leave ACM in the subject building including, but not limited to, fireproofing, dislodged fireproofing, thermal system insulation, flooring mastics, drywall joint compound (in certain areas, such as the mechanical shafts), and presently unidentified ACM.
- **Required training:** Since ACM will remain in the building, site-specific employee awareness training will be required.
- **Required notification:** Since ACM will remain in the building, annual notification will be required.

ASBESTOS

SUMMARY (CONT'D)

- Gravity Rules: The additional weight of the encasement system could pull the ACM fireproofing down, or expedite delamination if the fireproofing is damaged by water or building sway or vibration.
- Overspray precautions: Work methods during application will need to be implemented to minimize overspray of the encasement material, so that material costs remain low.
- Potential debris: The ACM fireproofing, as well as other ACM, will remain, largely uncovered/unprotected, fireproofing debris could fall through the perimeter gap in the ceiling or onto the ceiling system.
- Potential disturbance: The ACM fireproofing will remain, largely uncovered/unprotected, and work could disturb the material.
- Necessary repair and replacement: Existing damage to the existing ACM fireproofing system would need to be repaired. In addition, the current ceiling system would need to be removed, cleaned, stored, and replaced/reinstalled following application of encasement system.
- Periodic inspection: The encasement system will have to be inspected to ensure that it remains intact and effective.
- Removal factor: The application of an encasement system complicates removal of ACM fireproofing (for tenant improvement or building demolition) and increases the amount of material that must be disposed.

ASBESTOS

SUMMARY (CONT'D)

Option #4 – Removal of visible asbestos containing materials throughout building (fireproofing above ceiling, inside columns, inside HVAC shaft, elevator shafts, flooring and black mastic, thermal system insulation, drywall in elevator shaft, roof [assumed ACM for this option]).

This option would remove all identified and accessible ACM (roofing is assumed to be ACM roofing) from the subject building (i.e., maximal abatement). The ceiling grid system would be demolished, which would allow for the redesign of the system. Total estimated cost presented is \$47,597,144 and the estimated time of work is 127 weeks. Benefits of this option include:

- Hazard minimization: Effectively eliminates the hazards to building occupants that are posed by ACM (with some limitations, discussed later in section).
- NOVs addressed: Removes the primary cause of SDAPCD violations.
- Minimization of ongoing fireproofing maintenance: Based on the current material condition, removal eliminates the need to maintain ACM fireproofing using trained and certified asbestos workers, which would be required if current fireproofing was left in place. Ongoing maintenance of new, non-ACM fireproofing could be performed by non-asbestos workers.
- Ease of asbestos management: Management of remaining ACM (discussed later in section), as guided by an Asbestos Management Program (discussed later in report), would be minimized in relation to our recommendation and the other options. The remaining identified ACM are not friable, in good condition, and are located in areas not accessible to non-maintenance workers or the public.
- Minimization of potential disturbance and exposure: As mentioned above, remaining identified ACM is not easily accessible, which minimizes the potential for inadvertent disturbance during typical operations. This minimizes the potential for asbestos fiber release and occupant exposure.
- Elimination of ceiling cleaning costs and time: The demolition of the current ceiling system, and design and installation of a new system, eliminates the costs of cleaning.
- Ease of work: Given the unoccupied state of the subject building, the intrusive and intensive abatement work of this option can more easily be accomplished than if done at a later date.

ASBESTOS

SUMMARY (CONT'D)

Limitations of this option include the following:

- Demolition: This option would be the most invasive and would require the demolition of some building systems, even if functional life remains.
- Highest cost: This would be the most expensive option, with the largest upfront cost.
- Remaining ACM: This abatement option would leave ACM in the subject building including, but not limited to, fireproofing on the exterior of the building and presently unidentified ACM.
- Required training: Since ACM will remain in the building, site-specific employee awareness training will be required.
- Required notification: Since ACM will remain in the building, annual notification will be required.

ASBESTOS

OTHER ABATEMENT OPTIONS

SUMMARY

Other options for abatement exist beyond the five discussed above, and would likely be less expensive in the immediate short-term. However, it is our professional opinion that they do not adequately address the real and perceived hazards posed by the ACM in the subject building. Additionally, the obligatory and continuing costs of maintaining these “non-removal” options would be high. As such, neither a cost nor time of work estimate was generated.

- **Bridging Encapsulation:** Bridging encapsulation is, in some ways, similar to encasement. The encapsulant is spray-applied and forms a barrier over the ACM but leaves the ACM in place, is susceptible to weight and other damage, and will require ongoing inspection and maintenance. In addition, the encapsulant does not form a rigid barrier, like an encasement, nor does it allow for the easy identification of damage, since there is only one layer and no color differentiation.
- **Penetrating Encapsulation:** Penetrating encapsulation functions by saturating and penetrating throughout the ACM and then hardening to “lock” asbestos fibers in the ACM matrix. The ACM remains in place, does not have a barrier between it and the outside forces/disturbance, is susceptible to weight and other damage, and will require ongoing inspection and maintenance.
- **Rigid Enclosure:** Construction of a rigid, airtight enclosure to seal-off the fireproofing poses a number of logistical problems. Similar to the existing drop ceiling system, the enclosure would have to be suspended or anchored, potentially disturbing the ACM. The enclosure would further limit space above the ceiling system. The enclosure would need to be airtight and fire-rated. Finally, the ACM fireproofing would still be present and deteriorating, which would create a hazard in the event of removal or an emergency.
- **Repair and Maintain:** Without a detailed, floor-by-floor assessment of the current condition of the fireproofing, this option is not viable. Even if an assessment of that kind had been or is performed, the public perception related to the hazards of ACM in the building would likely not support this option.

ASBESTOS

ADDITIONAL ABATEMENT DISCUSSION

SUMMARY

Abatement Cost Estimate Factors

Ninyo & Moore is not providing a cost estimate for abatement. Shefa Enterprises, Inc. has provided estimates for their options, which we have used to support our recommendation, but the supporting documentation and calculations were not available. However, a discussion of some general aspects that may affect potential abatement costs is presented below. Key to this discussion is the fact that the fireproofing is considered a friable ACM, which means that the material can be crushed with only hand pressure and is more likely to release asbestos fibers.

- **Material Removal:** The ACM fireproofing is spray-applied to the structural decks of the subject building, as well as other building systems components due to overspray. As with all ACM abatement, certified workers must perform the work. Work will be performed in a higher level of personal protective equipment than is currently required for building entry due to the nature of fiber release when removing ACM fireproofing. The work crew will consist of multiple “teams,” each handling a separate portion of removal (e.g., removal, material wetting, bagging and clean up). Even with a larger team, removal will be tedious around corners, edges, hangers, etc. Additionally, work will occur on scaffolding or in lifts, which involve additional safety concerns and training.
- **Material Transport and Disposal:** Friable ACM must be transported by a certified hazardous waste hauler/transporter and disposed of at a hazardous materials landfill that can and will accept friable asbestos waste.
- **Prevailing Wage:** The abatement project would be subject to prevailing wages, which the abatement contractor may pass on to the City.

ASBESTOS

SUMMARY (CONT'D)

Abatement Phasing

Abatement phasing is part of any large-scale abatement project. For practical reasons related to establishing negative air pressure and other engineering controls, worker efficiency, and work area clearance sampling requirements, abatement in the subject building will occur on a single-floor or multiple-floor basis (i.e., abatement work occurring on only one to three floors at any time, versus performing abatement on all floors at the same time). Following abatement and appropriate clearance based on federal and state clearance criteria, the abatement work area would be “open” to other trades/work and/or occupancy assuming the cleared floors can be appropriately isolated from other abatement work and shared building spaces (e.g., the building plenum, elevator shafts).

The City has relayed that a phased move-in of City employees is not desirable. While this will delay occupancy and return to productive use, during the “down” time, other trades can make needed or desired upgrades. The time between abatement and occupancy can be productive, if there is a plan to capitalize on the opportunity. It is our assumption, based on the removal of fireproofing and importance of maintaining building safety, that it would be desirable for new fireproofing to be applied soon after removal.

Risk Assessment

All abatement options presented leave some ACM in place in the subject building. Based on the selected level/extent of abatement, a risk assessment should be developed for the remaining ACM in the subject building to assess the potential for asbestos fiber release and potential for occupant exposure to asbestos.

Ninyo & Moore is developing a risk assessment for the subject building, under the assumption that our recommended abatement option is performed.

Asbestos Management Plan

All abatement options presented leave some ACM in place in the subject building. Based on the selected level/extent of abatement and risks associated with the remaining ACM post-abatement, an asbestos management plan (AMP) should be developed to properly maintain the remaining ACM and to protect building occupant health. The AMP should address work controls and practices, training requirements for various employee types and work descriptions, notification requirements for building occupants, surveillance of remaining ACM, and appropriate documentation.

Ninyo & Moore is developing an AMP for the subject building, under the assumption that our recommended abatement option is performed.

ASBESTOS

OTHER DISCUSSION

SUMMARY

Condition Assessment of Fireproofing

As stated elsewhere in this report, a thorough condition assessment of the ACM fireproofing (i.e., level of damage and/or failure) has not been performed. This is due to the risk of disturbing ACM and the release of asbestos fibers during assessment above the ceiling system and the need for properly trained and medically cleared personnel.

Data Gaps

As the condition assessment project comes to a close, there remain some data gaps. The previous owner(s) and/or property managers of the building should have had an AMP or Operations and Maintenance (O&M) Plan that addressed the identified ACM present in the building and guided work on and around it. Analytical results from previous bulk sampling of suspect building materials would have been included or referenced in the AMP/O&M Plan. Documents addressing these data gaps have not been provided. At this time, these data gaps are considered minimal and non-critical.

SUMMARY OF WORK PERFORMED

SUMMARY

San Diego Air Pollution Control District Communication

Ninyo & Moore has, with the permission of the City, communicated directly with SDAPCD and participated on conference calls with SDAPCD, the City, and the Kitchell team. Direct communication with SDAPCD was with Mr. Matthew Allison, Asbestos Program Coordinator, and Mr. Miguel Jauregui, Air Quality Inspector.

It is Ninyo & Moore's understanding that SDAPCD's main concerns remain building occupant safety and potential asbestos-containing waste and debris, which are interrelated. To avoid future issuance of Notice(s) of Violation (NOVs), these concerns would need to be addressed in a satisfactory manner (i.e., adequate abatement, cleaning, and clearance). Abatement, to some extent, was understood to be needed in the subject building; however, in all discussions, SDAPCD representatives made it clear their jurisdiction is the enforcement of SDAPCD rules, including Rule 1206 "Asbestos Removal, Renovation, and Demolition" and Rule 51 "Nuisance." A specific type or form of abatement is not required nor does SDAPCD "approve" plans to address issues related to asbestos.

ASBESTOS

SUMMARY (CONT'D)

As such, SDAPCD indicated that they would not require clearance criteria above industry standards in the subject building and would defer to the selected industrial hygienist/consultant and abatement contractor regarding abatement means and methods.

Area Sampling and Site Reconnaissance

Ninyo & Moore has performed limited area sampling and site reconnaissance of the subject building. Sampling activities occurred both before and after the heating, ventilation, and air conditioning (HVAC) system was started for the condition analysis. Sample results were compared to the Environmental Protection Agency (EPA) clearance level for asbestos work of 0.01 fibers per cubic centimeter (f/cc). Sample results were also compared to the City of San Diego monitoring level for areas outside of asbestos work areas of 0.005 f/cc. All area sampling results were reported as less than 0.005 f/cc.

One personal air sample was also collected during the initial phase of sampling. Sample results were compared to the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL) of 0.1 f/cc over an eight-hour period (i.e., the PEL threshold is a time-weighted average [TWA]). The personal air sample result was reported as less than the PEL.

Site reconnaissance activities consisted of inspecting building finishes and included all floors of the subject building. The goal of the reconnaissance was to assess the extent of identified ACM, and to identify other suspect materials that may be present. ACM fireproofing was observed in electrical rooms and thermal system insulation was observed on mechanical floors. Due to reconnaissance limitations, Ninyo & Moore has assumed that fireproofing is located throughout the building and in poor or failing condition. Ninyo & Moore has also assumed that flooring mastic is present on floors 3 through 19. City personnel reported that floor tiles and mastic were abated on floors 1 and 2.

STRUCTURAL

BUILDING MODELING & SEISMIC ANALYSIS

RECOMMENDATION

The building currently conforms to the earthquake performance for an expected 225-year return period event. If it is desired to enhance the performance of the building to meet the requirements for the rare 975-year return period event, then seismic viscous dampers (earthquake shock absorbers) is the recommended method of strengthening. By strategically placing the dampers along the building height, one can reduce story drifts, accelerations, demand on structural and nonstructural components, and reduce pounding. Such strengthening will increase earthquake resiliency, reduce risk of collapse, mitigate pounding effect to the adjacent building, and decrease the likelihood of cladding damage. If this retrofit is conducted, it is recommended to perform more comprehensive nonlinear analysis, and to incorporate foundation rocking and soil structure interactions to characterize response more accurately and in detail.

SUMMARY

For a 1966 vintage steel structure, the tower's lateral force system was well conceived. Obviously, certain elements of the structure do not meet the modern earthquake structural design criteria but expected performance may be better than similar structures built in the same era. The key findings from this analysis are summarized in the following table.

STRUCTURAL

SUMMARY (CONT'D)

Summary of Results

Case	Existing		Retrofitted Rare (975-year event)
	Expected (225-year event)	Rare (975-year event)	
Meets performance requirements	Yes	No	Yes
Connections meet performance	Yes	Yes	Yes
Columns meet performance	Yes	No	Yes
Cladding damage reduced	Yes	No	Yes
Probability of collapse at very large earthquake	13%		1%
Structural damage (% building value)	11%	20%	4%

As seen in the table above, the 24-story tower building in its existing configuration conform to the earthquake performance requirements for an expected (225-year return period) earthquake per ASCE 41-17. For the rare 975-year return period event, several columns in the building do not conform to the performance requirements and damages are expected. The earthquake caused displacements for the 975-year return earthquake could damage the existing precast cladding panels, and pounding between the tower and adjacent three-story podium is anticipated.

If an earthquake performance for a rare 975-year return period event is desired to be increased as a voluntary upgrade, the addition of fluid viscous dampers at several levels (our initial estimates are bottom three levels and between 13th and 18th levels) of the structure to reduce the story drift and seismic demand on the member and connections. This strengthening will increase earthquake resiliency, reduce risk of collapse, reduce the pounding effect to the adjacent building, and mitigate damage to precast cladding. Since there is no change of occupancy to the structure and no modifications or renovations to the existing structural system, a structural retrofit of the building is not required.

A Scenario Expected Loss Assessment (SEL) is a prescriptive report based on guidelines from the American Society for Testing and Materials (ASTM) 'Standard Guide for Seismic Risk Assessments of Buildings'. This type of report is insurance-backed and does not involve analysis of a structure's actual behavior during a seismic event.

STRUCTURAL

SUMMARY (CONT'D)

Miyamoto International has completed the preliminary seismic risk evaluation for the subject building located at 101 Ash Street, San Diego, CA. The 23-story (with two levels of subgrade) steel moment frame building was constructed in 1966. The building, rectangular in plan, has a plan dimension of 180 x 70 ft. Typical floors measure 13.5 ft in height, whereas the first floor is 17 ft tall. The overall height of the building from the basement to the roof is approximately 315 ft.

The lateral load is resisted by a system of space (all bays) steel moment frames. In the longitudinal direction, there are six 30-ft long bays along each grid (18 bays total), and in the transverse direction, there are two 35-ft long bays along each grid (14 bays total). All columns are oriented such that their strong axis aligns in the transverse direction. All columns resist seismic loading in both strong and weak directions.

The structure under consideration has several features that enhance its earthquake resiliency, including the following: i) structural regular configuration; ii) redundancy in lateral force resistive system; iii) reinforced moment connections; and iv) complete joint penetration column splices. The building also has several design features that increase risk in earthquakes, including the

following: i) building aspect ratio with narrow transverse direction (315 ft tall and 70 ft wide); ii) welded moment connections iii) weak-axis connection for columns; and iv) slenderness of some built-up column sections at upper levels.

State-of-the-art performance based engineering was used to evaluate earthquake performance for primary structural elements. The provisions of American Society of Civil Engineers (ASCE) 41-17 were used to simulate a mathematical representation of the building and analyze its performance. ASCE 41-17 considers a number of structural performance objectives (POs). The basic safety objective for existing office buildings requires meeting a dual performance at different levels of seismic hazard. For an expected level (225-year return period earthquake), there is a 20% chance that an earthquake of that magnitude could be exceeded over a 50-year period. At this level, a certain level of damage is accepted; however, a margin of safety against collapse is to be maintained. For a rare (975-year return period earthquake), there is a 5% chance that an earthquake of that magnitude could be exceeded over a 50-year period. At this level, significant damage is tolerated but the structure is expected to continue to carry its gravity loading but have little remaining margin.

STRUCTURAL

SUMMARY (CONT'D)

In the current evaluation, the computer simulation model of the building using ETABS was constructed based on the available as-built drawings. Since no material information or test data were available, the ASCE 41-17 expected material grade for the period of building construction was used. The seismic hazard and site class (soil type) for the site were determined based on the Structural Engineers Association of California (SEAOC) and the United States Geological Survey (USGS) on-line tools. The structure was subjected to the two hazard levels described above and the demand on the structure was computed based on dynamic response spectrum analysis. The key results are summarized below.

The fundamental vibration periods for the building are approximately 3.6 to 4.3 seconds. This implies that this is a flexible building that could experience large motion. However, the building flexibility also limits the seismic forces imparted on the building.

- The tower building in its existing configuration conform to the earthquake performance requirements for an expected (225-year return period) earthquake.
- A number of columns in the building do not conform to the performance requirements for the rare 975-year return period earthquake and structural damages in these columns are expected
- The expected displacements and SDR for the 975-return period earthquake could damage the existing precast cladding panels
- At the 975-year return event pounding between the tower and adjacent three-story podium is anticipated.

MECHANICAL

OVERALL HEATING, VENTILATION, & AIR CONDITIONING (HVAC) SYSTEM

RECOMMENDATION

Conduct a thorough Heating, Ventilation, and Air Conditioning (HVAC) diagnostics of all HVAC system components in order to establish a baseline of operable HVAC systems and components that could be salvaged before the abatement and coordinated with the new air distribution system, HVAC controls, and system replacement. The goal of diagnostic testing is to determine the operating condition, efficiency, and effective useful life of the mechanical systems that could remain post abatement. For the purposes of this report, it is recommended to replace the HVAC system in its entirety. Tests should include, but are not limited to amp testing on motors, water quality testing, leak tests, temperature of return and supply chilled water, and valve operation. Any diagnostics testing should include the auxiliary components of the chilled water system downstream of the basement chilled water supply pumps such as isolation valves to ensure the system is operating efficiently and within realms of return water into the utility in regards to the Clearway Energy system agreement. This diagnostics will also aid in the identification and coordination with the replacement of the new HVAC control system.

SUMMARY

The documentation and information provided establishes a general timeline of the conditions of the mechanical, plumbing, and fire sprinkler systems. Before the acquisition by the City of San Diego, record drawings support multiple various tenant improvements that have affected the air distribution zones system downstream configuration including the layout of the ductwork and constant air volume (CAV) and variable air volume (VAV) units.

MECHANICAL

SUMMARY (CONT'D)

There are a combination of HVAC systems that appear to have the original unit housing to the 1967 construction. These systems include the main air handler [AC-1] and main supply and return fans. Although original, there is evidence that the system components have been properly maintained or serviced throughout the building's life. The remaining systems including the air handling equipment on the second floor have been replaced, renovated, or retrofitted within the last 15-20 years. Due to inconclusive information to confirm the effective remaining life of the HVAC components (ductwork, cooling coils, fan motors, dampers, compressors, etc.), it is assumed that based on industry standard useful life and technical reports that a majority of these systems are running ineffectively and inefficiently and should be replaced.

This report utilizes Building Owners and Managers Association International (BOMA) and American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) as the baseline reference for an equipment's industry standard useful life. The table below identifies the type of system found within the facility and its typical useful life.

HVAC Equipment Life

System	Industry Standard Useful Life (BOMA & ASHRAE) [Years]	Assumed System Age [Years]	Remaining Useful Life [Years]
Hydronic Air Handlers with downstream VAV boxes (20th floor)	25	53	-28
Hydronic Constant Volume Air Handlers (2nd Floor)	20	25	-5
Computer Room AC Units	20	15	5
Fan-Coil Units	20	53	-33
Constant Air Volume and Variable Air Volume (CAV & VAV) Boxes	25	53	-28
Air Washers and Humidifiers	12	25	-13
Supply, Exhaust, and Return Fans (20th Floor)	30	53	-23
Supply, Exhaust, and Return Fans (2nd Floor)	30	15	15
Metal Ductwork	30	53	-23
Dampers	20	53	-33
Diffusers, Grilles, Registers	30	1	29
Fire Dampers	30	53	-23

MECHANICAL

SUMMARY (CONT'D)

AirTek and Jackson and Blanc (J&B) Air Cleaning Closeout Report in 11/2019 shows a service of commercial duct cleaning following National Air Duct Cleaners Association Assessment, Cleaning, and Restoration of HVAC Systems (NA-DCA ACR) 2013 Cleaning procedures and have replaced the filters. The original filters were flat and bag filters that did not meet current MERV8 (minimum efficiency reporting value) requirements. It is unclear if there has been an air balance, duct leakage, or appropriate testing to verify the system is operating as designed since the completion of the cleaning and changing of the filters. Plexus Building Automation System (BAS) Evaluation Report conducted in March 2019 goes into further detail describing that even if the system was operational, components downstream do not actuate as designed without taking into consideration the design operational needs.

Specialized Pipe Technologies (SPT) Chilled Water Piping Epoxy Closeout conducted in December 2019 goes into detail about the epoxy coating applied within the supply and return chilled water piping for rehabilitation when connecting into Clearway Energy system. Although the pipes have been examined and repaired, it is unclear about the corrosion and wear undergone in the auxiliary components downstream of the piping.

Assuming that the abatement process will require all HVAC systems to be brought offline and sealed and all HVAC ductwork, dampers, diffusers, and grilles to be removed, it is recommended to replace all ductwork and HVAC systems throughout the building to fit with current codes and new design standards. This replacement will require the system to fit current building codes, energy codes including Title 24, and high rise standards.

There is an opportunity to provide cost savings for the entire HVAC retrofit by preserving HVAC systems (air handlers, fans, ductwork sections, etc.) that will fit the new design requirements of the building. A diagnostics test of all existing systems and components will be able to determine the efficiency, effectiveness and remaining useful life of current systems that could be preserved for the new design. This diagnostics is important to establish a baseline of the system capabilities of what equipment could still be effectively used post abatement.

MECHANICAL

AIR DISTRIBUTION

RECOMMENDATION

Due to the needs of abatement, it is recommended to replace all HVAC ductwork, dampers, diffusers, and grilles to fit with current codes and new design standards. Upon completion of the abatement, replacement of all ductwork, enhancement to the controls, and replacement of antiquated systems, it is recommended to conduct a thorough test and balance of the HVAC system as a recommended best practice to ensure the new design layout and controls are operating as designed. Tests should include, but are not limited to include air leak tests, air balance, ductwork pressurization, fan air flow, outside air analysis, and thermal load analysis.

SUMMARY

The current air distribution is concealed above-the-ceiling ducted systems with several supply, return, and exhaust air fans operating the upper floors in conjunction with AC-1 for floors 3 through 19. Fans appear to have been upgraded to operate off of variable frequency drives (VFD). In 2019, the main supply and return shafts have been pressure tested for leaks and a majority of the HVAC equipment and ducts were cleaned. The ductwork appears original to the 1967 construction and will require replacement based on industry standard useful life.

J&B inspection report 2019 recommends a third party to perform confirmation of all air flow at all end devices and air handlers to ensure they meet the design then will add just CAV/VAV fan coil, and air handler as needed to create a zone map and identify key deficiencies and discrepancies.

Assuming that the abatement process will require all HVAC systems to be brought offline and sealed and all HVAC ductwork, dampers, diffusers, and grilles to be removed, it is recommended to replace all ductwork and HVAC systems throughout the building to fit with current codes and new design standards. This replacement will require the system to fit current building codes, energy codes including Title 24, and high rise standards.

MECHANICAL

SMOKE CONTROL SYSTEM

RECOMMENDATION

Install appropriate fire-smoke dampers, smoke evacuation, stairway pressurization system, and ductwork system. Due to the abatement requirements and assumed age of the primary ductwork, it is a best practice recommendation to replace the air distribution system in its entirety. The new ducted system including smoke evacuation, shall integrate with the fire alarm and BAS system along with new motorized fire smoke dampers to comply with National Fire Protection Association (NFPA) standards and appropriate City standard high-rise building code.

SUMMARY

Original fire protection design does not consist of current code compliant fire-smoke dampers, smoke evacuation, and stairway smoke pressurization due to previous fire protection standards. The original system does not appear to have been disturbed during the various tenant improvements made to the building.

The fire dampers appear to be original fusible link style located on the supply and return lines at each floor are still in place per the original drawings. If a fire was to occur within the building, the current fusible link fire dampers located in the ductwork would only prevent supply air from feeding the fire. Furthermore, the current fire dampers would need an upgrade to a smoke rated damper integrated with the fire protection system in order to prevent smoke from entering in the HVAC return air system and distributing the smoke throughout the building.

J&B's fire damper findings as of 12/12/2019 further elaborate the following:

- 1967 fusible link fire dampers located on the supply lines at each floor are still in place per the original drawings and appear to not be disturbed. These fire dampers are not smoke rated.
- Fire dampers were not disturbed during the various tenant improvements and therefore were not considered for replacement and enhancement to current code requirements as it is considered an existing building condition.

MECHANICAL

CHILLED WATER SYSTEM & CHILLED WATER PIPING

RECOMMENDATION

Install new chilled water pipe insulation. Chilled water lines are currently condensing water on its exterior surface while operating, creating a corrosive environment on the exterior piping for the existing chilled water pipes. In order to prevent further corrosion, it is a best practice solution to install new chilled water pipe insulation to prevent condensation on the exterior surface of the pipe.

SUMMARY

The building consists of a decommissioned chilled water system which includes three chillers and two cooling towers within the building on the 20th floor. The main source of chilled water serving the building has been rerouted from this system to the Clearway Energy District Chilled Water System. The chilled water pumps have been pulled off of the new chilled water loop. Two new supply chilled water pumps installed in 2019 at the basement level feed into the existing system. Condensation occurs throughout the exposed chilled water lines while operational. A majority of the insulation appears original to the construction of the building.

The chilled water piping system as experienced reduction of interior pipe diameter due to heavy scale buildup and exterior degradation of the pipe due to age and use. In 2019, rehabilitation of the piping via epoxy coating has been applied throughout the system to prevent any further degradation of specific sections of the pipe. This epoxy insulation, although extends the life of the pipe, has been noted to impact performance by slightly reduce the pipe interior diameter. The rehabilitation did not affect the entire length of pipe as areas with heavy scale buildup have been avoided. Approximately every 18 feet of piping, condensation occurs at the collar joint supports due to lack of insulation.

MECHANICAL

AIR HANDLERS, AIR CONDITIONING UNITS, & TELECOMM/DATA ROOMS

RECOMMENDATION

Provide dedicated fan coil units for each telecomm/data room that requires 24-hour operation based on best practice. This replacement ensures proper climate control for the telecomm/data equipment independent of running the entire air handler serving the office spaces. The addition of the dedicated fan coil will have energy savings if the intended function is to keep the telecomm/data equipment running 24 hours a day.

Replace ductwork and mechanical equipment due to needs of abatement.

Thermally rezone the system and controls with regards to the thermal needs after abatement and system replacement. Accommodate the 24-hour fan-coil units as needed.

SUMMARY

The air handling unit's on the 20th and 2nd floor supply cooling via chilled water and heating via electric heat throughout the building. The 20th floor air handler appears to be original while the 2nd floor air handlers appear to be both 2005 and 1995 installation. Several units consist of a spray section with a water treatment center to manage humidity.

Other AC units have been added to the building and are not listed within the schedules. These include split system units located in the garage have been identified throughout the facility. Not enough documentation has been collected to confirm an accurate count, timeline of installation, timeframe of equipment repair, component replacement, location and service regions of the other AC units found throughout the facility.

Small telecomm/data rooms throughout each floor are either cooled inefficiently by a main air handling unit or have no cooling. Only the 2nd floor main computer data room operates off of its own dedicated computer room air conditioning system.

MECHANICAL

FAN COIL UNITS

RECOMMENDATION

Replace all fan coil units. Units are failing and have reached the end of their useful service life. Replace fan coil units to tie with new building control system. Replacement system will need to provide alternative heating type to electric heating as electrical heating is no longer compliant with current codes. A heating plant or utility will need to be provided into the building to satisfy this requirement.

Replace ductwork and mechanical equipment due to needs of abatement. Thermally rezone the system and controls with regards to the thermal needs after abatement and system replacement.

SUMMARY

Throughout 4th through 19th floor, there consists of perimeter hydronic fan coil system with electric heating. The upper floors consist of 845 original perimeter wall fan coils that are pneumatically controlled with chilled water cooling and electric heating.

According to the 2017 BSE Engineering Evaluation and J&B inspections, there were reports of valve leaks throughout the system due to the age and use of the system over time. System issues include no power, broken or missing components, restricted chilled water flow, heater not functional, unbalanced motors, and deteriorated valves causing leaks. About half of the fan coils contain a deficiency that will prevent them from operating properly. These deficient units are scattered throughout each floor.

These systems will fail as they continue to operate. Due to the age of this system parts are no longer supported by manufacturer requiring a third party to procure replacement components and is recommended for replacement.

MECHANICAL

HEATING HOT WATER PLANT

RECOMMENDATION

Electrical heating is no longer allowed as a solution for space heating per CEC Section 140.4(g). In order to comply with current codes, a heating hot water plant alternative will be needed to replace the heat produced by electric heating. The building's original heating system design primary heat source was through fluorescent light fixtures with secondary strip heating via fan coil units, CAV/VAV boxes, and air handlers. Due to the LED upgrade, the primary source of heat, fluorescent lighting, no longer supplies heat. Two alternate recommended replacement options:

1. Utilizing Clearway Energy District as a heating hot water utility to supply heating hot water to the building.
2. Add a gas-fired boiler plant in the basement of the facility to provide heating hot water throughout the building. This option will require a gas utility line into the building.

Both options require the addition of heating hot water coils to the air handlers, fan coils, and CAV/VAV boxes, heating hot water piping distributed throughout each floor of the building, appropriate heating hot water pumps and accessories, and need for integration with the new HVAC control system. Conservatively, we have estimated Option 2 which will require the most new equipment installed into the facility.

SUMMARY

The overall HVAC design of the building consists of primarily electrical heating elements via the air handlers, fan coil units, and CAV/VAV boxes. It has been reported that the original design intended to use the fluorescent lighting system to contribute to the overall heating load. However, due to LED enhancements, the lighting no longer contributes a heating load. Based on several technical reports, it has been identified that the current electric heating system does handle current design conditions. The electric heating system cannot be replaced in kind and is considered a key concern in regards to building energy efficiency.

MECHANICAL

BUILDING HVAC CONTROLS - BAS (BUILDING AUTOMATION SYSTEM)

RECOMMENDATION

Replace the entire HVAC control system (BAS system) including front-end server, system software, new electronic controllers, electronic HVAC actuators, sensors, transducers, and all new graphics to indicate all current control points within the building and define an accurate sequence of operations. Current BAS system is inaccurate to the current design and thermal sequence of operations and in failure due to outdated software and failing controllers, actuators, sensors, and transducers. The system utilizes pneumatic and electronic controls to control the space, but a majority of pneumatic components are at the end of its expected useful life. Due to the scope of the abatement, it is a best practice recommendation to demolish the existing pneumatic control system and enhance the system to a complete electronic system. The new BAS system shall interface with all new HVAC equipment (including fans, air handlers, fan coils, and CAV/VAV's), new thermal zoning, fire alarm system and fire protection system including fire dampers to provide adequate smoke control.

SUMMARY

The Building Automation System (BAS) system is a building HVAC control system that reads and directs all components of the HVAC system and is a key factor for HVAC operation, controllability, thermal comfort, and energy efficiency. The existing system operates primarily on pneumatics sourced from air compressors installed on the 20th floor.

In 2019, a BAS system evaluation report identified that the BAS system is in failure, is no longer supported by the manufacturer and is past its industry expected useful service life. The main system centralized computer and software was noted to be considered obsolete well over 15 years ago with major discrepancies in regards to the accuracy of the equipment information. System operates off of Windows XP with no connection to the internet. System operates off of a dot matrix printer. VAV controls have evidence of electrical damage on the controls and actuators and

MECHANICAL

SUMMARY (CONT'D)

are wired without their own discrete controller. If any controller was to fail, it will take out the controllability of the entire floor. Many temperature and duct static pressure transducers have been removed, relocated, or damaged beyond repair. Actuators throughout the building are full open or full closed and do not operate as designed.

Based on this evaluation, it is recommended to replace the entire BAS system including front-end server, software, controllers, actuators, sensors, transducers, establish a standard sequence of operation so the systems function as designed and a new graphical interface that is easy to use and integrated with a supported control standard open protocol network known as BACnet (Building Automation and Control network) as opposed to restoring this antiquated system. BACnet is a communication protocol for building automation and control that has become an industry standard in HVAC.

J&B and Climatec daily inspection log in 2019 verifies the status of failing actuators and controllers on the VAV's and FCU's as well as sites lack of temperature sensors within the building. They have consolidated and removed working actuators and controllers from working units on the upper floors and have relocated them to the lower floors to begin occupying the floors. It is unclear if the upper floor unit components have been replaced. They recommend an open protocol BACnet system to prevent the need to replacing the control system in its entirety.

COMPUTER ROOM AIR CONDITIONING (CRAC) UNITS

The 2nd floor consists of a dedicated raised floor server room with several computer room air conditioning units. These units appear to be installed in 2005. With no major issues noted. This system will need to be integrated with the new building control system as described later in this report.

CONSTANT AIR VOLUME (CAV) & VARIABLE AIR VOLUME (VAV) BOXES

Downstream of the air handling units are CAV and VAV boxes with and without electric reheat. As reported by the BSE Engineering Report and J&B inspections, there are 138 CAV's and VAV's throughout floor 3 through 19 that have on-going issues. Issues include no power, broken or missing components, restricted chilled water flow, heater not functional, unbalanced motors, and valve deterioration. Several design changes through tenant improvements have been completed throughout the building causing several VAV's and CAV's to be modified or replaced. The modification of the existing system has changed the downstream airflow from its original design and has affected thermal comfort levels.

It is recommended to replace these systems due to the abatement process and replacement of all the ductwork.

MECHANICAL

FIRE SPRINKLER SYSTEM

RECOMMENDATION

Replace existing access doors to the HVAC main duct shaft to an appropriate fire rated maintenance access. Fire sprinkler system is currently not integrated with the fire alarm system and is lacking areas of coverage in certain rooms of the facility. These three items are a concern for life safety. It is recommended to integrate the fire sprinkler system with the fire alarm system and provide additional fire sprinkler coverage in areas lacking required fire sprinkler coverage.

SUMMARY

Fire sprinkler system covers the entire building. The fire sprinkler system consists of a single riser and is fed from a diesel fire pump located in basement level with a secondary circulation electric fire pump. The fire sprinkler pen- nants appear to be in good condition.

There are reports of several fire life safety issues that are critical to the safe occupation of the building. These items include no fire rated doors by the main HVAC shaft to prevent fire spreading during an event, inadequate sprinkler coverage, and lack of integration of the wet pipe system with the fire alarm system.

MECHANICAL

VERTICAL PIPING: SEWER, VENT, & STORM WATER PIPING

RECOMMENDATION

Rehabilitate south stack storm roof vertical line, lateral connections and branch lines per recommendations of the SPT inspection conducted in 2019 as a best practice solution due to the reported failure and leaks along the storm water piping line. Further information regarding the condition of the pipes failure are within the following documents:

- CASS Pipe Inspection Report – 2017
- SPT South Stack Roof Drain and Collection Pipe Inspection - 2019

SUMMARY

Primary concerns regarding the plumbing are based on the sewer and storm drain system. During the 2019 sewer evaluation, the inspection identified rust, scale build-up and failure along various sanitary sewer lines throughout the building terminating to the sewer pit and ejector pump located in garage. The sewer piping issues on the north stack have been closed out and addressed as of 2020. The south stack issues are still on-going as the latest evaluation was as of April 2020.

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ELECTRICAL

NORMAL (NON-EMERGENCY) POWER SYSTEM

RECOMMENDATIONS

Provide an electrical modernization project to replace all the original 1967 equipment and 12.5Kv feeders based on best practices. The panels installed in 1993 and switchboards installed in 2005 are in good condition and do not require upgrades at this time.

Upgrade all lighting installed prior to 2018 to LED-based fixtures. Provide lighting controls to meet current energy codes.

SUMMARY

The building is supplied power underground from SDG&E via (2) 12.5 Kv service feeders. These feeders terminate in the building main switchgear. This switchgear consists of Westinghouse model DHP, metal-clad, porcelain insulated, draw-out air circuit breakers. This circuit breaker type was manufactured between 1963 and the early 1980's. The main switchgear is housed in (2) separate cabinets that are connected with a tie breaker to automatically power the building if one of the (2) feeders should fail.

ELECTRICAL

SUMMARY (CONT'D)

The outgoing sections of this switchgear distribute 12.5Kv feeders throughout the building to various electrical rooms and vaults. These remote locations contain dry-type step down transformers. The primary side of these transformers connects to the 12.5Kv feeders through Westinghouse type LBF, medium voltage load interrupter fused switches. The secondary of these transformers supply distribution switchboards of various voltages that in turn feed power, lighting, and HVAC equipment. The distribution switchboards contain metal enclosed, freestanding draw-out circuit breakers that are typically General Electric type AKD-5. AKD-5 breakers were manufactured between 1960 and 1977.

A major tenant improvement project occurred in 1993. This installed several new 120/208V panelboards in the electrical rooms of remodeled floors. These reconnected to the existing original switchboards. The panelboards of this era are within but nearing the end of their rated life.

A new data center was installed on the 2nd floor in 2005. This provided a new transformer, switchboards, and UPS systems for this area. This isolated portion of the electrical system appeared to be in good condition and had no signs of deterioration.

The 2018 renovation replaced the majority of lighting on the 1st, 17th, 18th, and 19th floors with

LED-based fixtures. The remaining floors reused the previous fluorescent light fixtures. Replacing the older fixtures with LED based lighting is recommended. This would trigger upgrades to the lighting controls to comply with energy codes including daylight harvesting and multi-level switching.

The 2018 tenant improvement projects re-used the existing panels in the electrical rooms on each floor for the new or altered branch circuits. T.I. Based on documentation and field observation, the majority of the panels are General Electric type from the original 1967 installation. These are well beyond their expected life and replacement of these panelboards are recommended.

The building electrical infrastructure consisting of the 12.5 Kv switchgear, medium voltage distribution, transformers, switchboards, and motor control centers remain as installed in 1967. This equipment is beyond its rated life and is no longer manufactured. Surplus replacement parts will be increasingly difficult to procure. However, the metal enclosed draw-out style of circuit breakers used in the main switchgear and distribution switchboards is considered a highly reliable style of electrical distribution and there are options for retrofitting the individual draw-out breakers without requiring a complete replacement of the line-ups. We did notice one of the spare circuit

ELECTRICAL

SUMMARY (CONT'D)

breakers in the GE switchboards was racked out and nameplate indicated its parts were used to maintain a separate breaker. We did observe stickers on the switchboards, transformers, and medium voltage switches indicating that ABM, a testing company, inspected the equipment in 2018. This report identified (10) specific issues such as trip functions not working or failures of racking systems. This indicates the protection system is functional overall. However, several repairs were recommended that will require locating and installing surplus parts.

A 2017 assessment stated that there were no Arc Flash labels on the electrical equipment. However, we observed these labels are installed with a date of 2/19. The labels did not identify who provided the arc flash study.

The draw-out switchgear, medium voltage switches, and medium voltage dry-type transformers are over 50 years old and obsolete. Best practices would be to recommend replacement. This would be a major electrical project. A less costly option would be an aggressive maintenance program to extend the lifespan of the equipment. This would involve periodically

de-energizing parts of the building, to thoroughly test, clean, and inspect the electrical gear. The results of the inspection would guide the Owner's decision making for select upgrades in future projects on a case-by-case basis.

The 12.5Kv feeders rise throughout the building in the electrical rooms and are spliced at pull-boxes to supply the dry-type transformers. We could not safely open the energized pullboxes to observe the splice or condition of the cables, as this would require arc flash protective clothing to be worn over the asbestos hazmat clothing. The 1967 installation drawings do not indicate the insulation type of these cables. Typically, the failure point of older cables is at a splice connection. A modernization project should replace these old 12.5Kv backbone cables. The expected lifetime of modern cables is 30-40 years. To extend the use of these cables, a maintenance program should include periodic thermal scanning of the electrical connections, testing of the insulation resistance, and verifying tightness of connections. This would provide confidence in the cables or indicate replacement is needed. We found no documentation that indicates these cables were tested or that they have ever experienced a failure.

ELECTRICAL

SUMMARY (CONT'D)

The electrical nature of the building is to distribute (2) 12.5 kV feeders to each remote substation. This provides the assurance that power can be maintained if one feeder is lost. However, this decision was made by the original designers to increase reliability and is not code required. An upgrade may consider providing only one 12.5 kV feeder to each remote power center.

The original 1967 panelboards with molded case circuit breakers should be replaced due to age. In addition to age, we saw no documentation that indicates they have been maintained. Breakers that are not exercised and cleaned can have dust build-up that can impact the tripping reliability. While it would be possible to remove,

test, and re-install individual circuit breakers this would be labor intensive and leave the building with the existing older generation circuit breakers. These are relatively simple to replace and branch circuit wiring can typically be reconnected.

Equipment expected lifetimes provided in the table below are based on the Whitestone Facility Maintenance and Repair Cost Reference. This guide provides reasonable and objective estimates for this equipment. The end of lifetime would indicate the expectation for a replacement or major overhaul of the equipment. These are estimates to be used in long-term maintenance and repair planning.

Electrical Equipment Life

System	Industry Standard Rated Life [Years]	Equipment Age [Years]	Remaining Useful Life [Years]
Draw-out 12 kV Switchgear	20-50	50	0
Draw-out 600V Switchboards	20-50	50 15 (2005)	0 20
Panelboards	30	50 (1967) 27 (1993) 15 (2005)	-20 3 15
Medium Voltage Switch	30	50	-20
Motor Control Center	30	50	-20
Dry-Type Transformers	30	50	-20
12 kV Cables	35	50	-15
Lighting	20	27 (1993) 2 (2018)	-7 18
Devices (Receptacles, Light Switches)	20	50 (1967) 27 (1993) 2 (2018)	-30 -7 18

ELECTRICAL

EMERGENCY POWER SYSTEM

RECOMMENDATIONS

Upgrade the system with a new generator or generators and provide separate and independent wiring for emergency and standby equipment per modern code. Connect all equipment that is code mandated to be connected to generator power in the high-rise to the new system. Ensure emergency and exit lighting will resume within 10 seconds. Provide a code-required remote annunciator panel at constantly attended location to supervise the new generator(s).

Determine if existing 60kW generator needs to remain. This is near the end of its rated life but does not supply life safety loads. Therefore, replacement is not urgent.

SUMMARY

The building contains (2) 250KVA solar gas turbine emergency generators on the 21st floor. The generators are original to the 1967 construction and are well beyond their expected 25-year rated life. However, testing documentation from 2019 indicates the generators are operational and can provide 100% of their ratings for 2 hours.

These are designed to parallel on loss of normal power. Documentation indicates they require 25 seconds to synchronize and then provide power to the building.

There are (2) 600A automatic transfer switches which each supply (2) 600A emergency switchboards. The emergency switchboards distribute emergency power to panelboards located in electrical rooms on the various floors.

ELECTRICAL

SUMMARY (CONT'D)

The generators provide power to all the elevators in a sequential manner such that only one elevator is energized at a time, emergency lighting, security systems, AC-1 which is a 125HP supply fan that serves the floors from 3 to 19, and compressors for pneumatic controls.

AC-1 is intended to be manually started after the elevators complete their recall sequence. We're unsure of the intention to power this large fan by the generators. There is no code requirement for this to be on the generator. The original designers may have intended the building to be occupied during a power outage and wanted to supply air.

The drawings indicate that emergency lighting is connected to the emergency circuits that are derived from the generators. Emergency lighting is code-required to activate within 10 seconds of a power outage (CEC 700.12). The current generators cannot meet this as it takes 25 seconds to provide emergency power. The Gensler drawings do not indicate battery backups within the fixtures. The use of batteries and/or inverters could correct this timing issue.

The code requires the generator provide power to smoke control ventilation systems in a high rise (CBC 403.4.8). These are not connected to the generator, as these mechanical systems typically would include smoke exhaust fans,

pressurization fans, and electrically operated fire dampers. These are not present in the building (see Mechanical). The code requires that electrical fire pumps be connected to the emergency power system in a high rise (CBC 403.4.8). The electric fire pump is not connected to the generators.

It has been noted that several IDF rooms lack adequate HVAC conditioning. The HVAC system for the 2nd floor Data center is not on generator power although the servers are connected to UPS units that will remain operating during a power outage. Generator power to provide 24/7 conditioning to these areas are sometimes provided depending on their criticality. This would need to be discussed with Owner when a generator replacement project is planned.

A generator assessment by BSE Engineering recommended a larger, 750kW sized single generator as a replacement option. An engineering study of existing and future loads would need to be performed to confirm this planning number. Further study would be needed to determine if a larger replacement generator could be installed on the 21st floor or need to be located in the parking garage.

The emergency wiring is original to the building and at that time it was not required to separate wiring between emergency and non-emergency,

ELECTRICAL

SUMMARY (CONT'D)

legally-required standby loads. Emergency systems are identified to be essential for safety to human life such as emergency lighting. Legally-required standby systems are items that are required to assist in fire fighting or rescue operations but are not essential for life safety. These would include smoke evacuation systems and elevator power. Modern code requires separate wiring distribution and electrical equipment for emergency and standby loads. This protects the emergency system from damage due to electrical failures caused by the standby loads. This would require modifications to the existing wiring and additional electrical equipment to fully separate these branches.

There is another 60kW Kohler generator installed on the Parking level B. This was installed in the mid 1990s. This generator supplies standby power to various panelboards that appear to have been installed at the same time as the generator. These are located on the 1st, 2nd, 4th,

5th, 8th and 9th floors. This suggests that, at this time, it was desired to provide generator-backed power to equipment but the installer knew that it was not allowed to add these to the existing emergency system and this system had inadequate capacity. Therefore, this generator was provided in place of upgrading the existing system. We could not find the documentation for this installation. This generator is also at the end of its rated life. There are notes that these was provided for data rooms that are no longer needed.

Equipment expected lifetimes provided in the table below are based on the Whitestone Facility Maintenance and Repair Cost Reference. This guide provides reasonable and objective estimates for this equipment. The end of lifetime would indicate the expectation for a replacement or major overhaul of the equipment. These are estimates to be used in long-term maintenance and repair planning.

Electrical Equipment Life

System	Industry Standard Rated Life [Years]	Equipment Age [Years]	Remaining Useful Life [Years]
Generators	25	50 (1967)	-25
		25 (1995)	0
Transfer Switches	18	50 (1967)	-32
		25 (1995)	-7

ELECTRICAL

FIRE ALARM SYSTEM

RECOMMENDATIONS

The fire alarm panel is nearing its end of life and the majority of the devices are older than the panel itself. This mixture of different generations of devices and original wiring is likely contributing to the difficulties in maintaining the system and clearing of the false alarms. An abatement project that removes ceilings and fireproofing may further damage the devices and wiring.

We recommend a fire alarm upgrade project be installed after the abatement is completed. This would provide a new fire alarm panel, devices, and wiring in conduit through the building. The system would comply with current fire code and be fully commissioned and tested. The new system would monitor the sprinkler system, interface with elevator recall functions, include a fire department communications system, and an emergency voice/alarm notification system.

Best practices would provide a smoke control system and associated dampers and fans that would interface to this new system. See mechanical for discussion of upgrades to air distribution system.

SUMMARY

The lobby contains an addressable main fire alarm panel which is a Notifier #NFS2-3030 with fire fighters telephone service. The NFS2-3030 is still manufactured and is UL and CSFM listed.

Based on the review of the records for the building, the NFS2-3030 was installed in 2007 to replace a Notifier fire alarm panel that had failed. We did not find references to the fire alarm system prior to 2007 and later Tenant Improvement projects did not indicate fire alarm

ELECTRICAL

SUMMARY (CONT'D)

work. We believe that the system has not been altered in any significant manner since 2007. The 2007 project did not replace the entire fire alarm system and re-used the majority of the existing fire alarm devices and the previous fire alarm wiring.

The main fire alarm panel is located in the 1st floor lobby. On each floor there are remote fire alarm power supplies to drive that floors fire alarm speakers and strobes.

The floors contain smoke detectors, monitoring of the sprinkler flow switches, door holders on the elevator lobbies fire doors, firefighter's telephone jacks, and pull stations.

We have received documentation that shows portions of the fire alarm system were tested by the Inspector between 2019 and 2020. These tests included recall of the elevators. The comments generally indicated that the portions of the building tested were safe for use. There was mention that some elevators were not operating (see elevator report).

During the Kitchell survey there were several trouble alarms on the panel. We have reviewed documentation that mentioned certain systems could not be tested until fire alarm panel was

clear of these conditions. These items included elevator recall and fire door holders. This appears to be a frequent and ongoing issue.

The 2007 fire alarm drawings do not indicate a connection to fire dampers. We have no reason to believe the fire alarm system interfaces to control the fire dampers in the building. A 2019 letter from Jackson and Blanc confirmed that the dampers are original to the building that are fusible link only. The same letter stated that it was agreed if this system was not disturbed the AHJ would allow it to remain.

Modern codes (CFC 909.16) require a smoke control panel in a high-rise building for first responders to monitor and control the smoke control system. This could not be achieved by upgrading the fire alarm system alone but would need modifications to the air distribution system as well.

Equipment expected lifetimes provided in the table below are based on the Whitestone Facility Maintenance and Repair Cost Reference. This guide provides reasonable and objective estimates for this equipment. The end of lifetime would indicate the expectation for a replacement or major overhaul of the equipment. These are estimates to be used in long-term maintenance and repair planning.

Electrical Equipment Life

System	Industry Standard Rated Life [Years]	Equipment Age [Years]	Remaining Useful Life [Years]
Fire Alarm Control Panel	15	13 (2007)	3
Fire Alarm Devices (Smoke, Pulls, Strobes)	15-20	Unknown (Pre-2007)	Unknown

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FIRE AND LIFE SAFETY

FIRE INSPECTION VIOLATIONS

RECOMMENDATION

Rectify all violations.

SUMMARY

The San Diego Fire Marshal conducted two separate building fire inspections that occurred in February and August of 2017. These inspections cited numerous violations that pose life safety risks to building occupants. These violations include missing fire caulking at wall penetrations, elevator lobby doors that lacked magnetic hold opens and receivers, fire rated barriers that have been damaged, altered or otherwise compromised, and missing fire sprinklers and fire doors. City Staff indicated that corrections to these violations are currently in progress but no timeline for completion has been established. Several of these items have been completed as part of the Tenant Improvements occurring in the building.

Fire Rescue cited a lack of through wall penetration fire caulking in several of the electrical and utility rooms. During the site walk, material was observed applied to

FIRE AND LIFE SAFETY

SUMMARY (CONT'D)

these areas. The material used could not be verified as a UL listed fire caulking. Furthermore, City staff indicated that during the fire inspection Fire Rescue could not confirm the material and questioned its compliance. Further investigation confirms the product used is an aerosol applied foam fire and draft stop tested using ASTM 84 guidelines. ASTM 84 is a standard that is used to test the burning characteristics of building materials. Although the fire block foam is rated to slow the spread of smoke and flames, it is only rated for use in residential Type V (wood) and commercial non-rated construction. Therefore, it is not an approved product for

Type I (Steel and concrete) high-rise construction as a fire stopping measure.

Kitchell has reviewed several lists provided by the building management company indicating partial completion of items. Based on conversation with City staff and Fire Rescue, it is unclear what has been completed or if current corrections have been made by licensed or certified personnel. Due to a lack of clarity, corrections to the violations cited by the Fire Marshal have not been verified, therefore, this report will assume nothing has been completed and all corrections remain outstanding and will be estimated accordingly.

ACOUSTICAL CEILING

RECOMMENDATION

Replace existing suspended ceiling track and panels.

SUMMARY

Part of the asbestos abatement process will include the removal of spray applied fire proofing to the super structure of the building. To gain access to these interstitial areas, the ceiling systems will need to be removed before abatement can begin. Once asbestos has been removed and new fireproofing applied, the ceiling system can then be replaced. A large portion of tiles and track are original to the building and do not

meet the seismic bracing requirements the current building code requires and will most likely be damaged during demolition. Furthermore, due to the ceiling's age, replacement parts will be difficult to procure. Any ceiling replacement of the original system will require an upgrade with one that complies with California Building Code (CBC) Section 808 – Acoustical Ceiling Systems.

ELEVATOR

EXISTING ELEVATORS

RECOMMENDATIONS

A systematic plan should be put into place for modernization or upgrades. The life expectancies provided in the summary below indicate there are items that are due to replacement within 12-13 years.

SUMMARY

When modernization is considered the elevator equipment should be considered as separate devices rather than inclusive. Total system modernization is planned when the components are not able to meet the requirements of the current end user.

The devices reviewed in a major modernization comprise of the hoist machine, controllers, fixtures, door operators, and hoistway equipment.

The existing Elevators are driven by Direct Current (DC) gearless traction machines are in-efficient when compared to the current gearless traction machines. Since this machines have not been in production for some time spare parts may be difficult to obtain in the future. Replacement of these hoist machines will be done during the modernization.

The existing controllers have a life expectancy of 20 -25 years the controllers are now 13 years old. The controllers will need to be replaced in 12 years.

ELEVATOR

SUMMARY (CONT'D)

The door operators have a shorter time period for replacement than the major components such as hoist motor, motor drives, and controller. The door operators are an upgrade that can be done before an elevator would go through a modernization. However, the selected door operator should be compatible to work with any future controllers.

Signal fixtures are an item that can be upgraded at any time but if the controller is being modernized, the signal fixture would need to be changed to meet the latest codes. It is advisable to do both controller and signal fixtures be done at the same time. Having that said although the estimated useful life for the fixtures is shorter than the controller, fixture parts availability should not be an issue. They are many independent fixture suppliers that provide components to extend the remaining useful life.

The hoistway equipment will be replaced during the modernization although the useful life is a little longer than the other major components it would be best be done during the modernization to avoid further down time in the future.

PROJECT DELIVERY

METHODS

RECOMMENDATIONS

101 Ash St. has performed admirably during its long life. However, it is an old building possessing various systems and conditions in various states, running the gamut of outdated to broken and nonfunctional, some of which are unforeseen at this time. Due to this complexity and uncertainty, a delivery method that champions integrated collaboration, fosters multi-disciplinary communication, providing flexibility to the builders and engineers, while limiting the risk to the City should be seriously considered. Although there are many pros and cons to different delivery methods, there are a couple that should be explored before a final decision is made.

DESIGN-BUILD

Design-Build is a project delivery method to deliver a project in which the design and construction services are contracted by a single entity known as the design-builder. The Owner manages only one contract with a single point of responsibility. The designer and contractor work together from the beginning as a team, providing unified project recommendations to fit the owner's schedule and budget. Design-Build is characterized by high levels of collaboration between the design and construction disciplines, with input from multiple trades into the design. Typically larger, more complex projects utilize this approach as it lends itself to larger contractors with design-build experience. Generally, projects utilizing Design-Build are delivered in less time and cost than traditional delivery methods.

PROJECT DELIVERY

CMAR

The Construction Manager at Risk (CMAR) is a delivery method that entails a commitment by the Construction Manager (or Contractor in many cases) to deliver the project within a Guaranteed Maximum Price (GMP) based on owner provided construction documents and specifications. The CMAR provides professional services at the beginning of the project and acts as a consultant to the owner in the design development and construction phases. In addition to working in the owner's interest, the CMAR must manage and control construction costs not to exceed the GMP because contractually, any costs exceeding the GMP that are not change orders are the financial liability of the CMAR. With CMAR, the owner carries more of the risk because they are responsible for the design and engineering of the project, whereas in design build the design build entity assumes this risk.

The above two examples are general descriptions of project delivery that within each has many variations and nuances that should be fully explored before the City makes a final commitment.

APPENDIX A

ESTIMATING

Conceptual costs were estimated using a rough order of magnitude. Hard costs are based on historical cost data from similar building types and applied to the given area of the building or space. Contingencies, mark-ups for general conditions, over-head and profit, and insurance and bonds are added along with escalation (which is based on the time between preparation of the cost estimate to the anticipated midpoint of construction) to arrive at a total construction cost. Non-construction costs, or soft costs, that include items such as design services, project management, permits and fees, inspections, taxes, PR, etc., are then added to arrive at a total estimated cost for the project.

The conceptual estimate below is a line item cost take off based on the recommendations made by Kitchell and includes complete new HVAC, normal and emergency electrical power, fire alarm, additional fire sprinklers, demolition for these systems and repairs for the Fire Marshal's list of violations. Costs include the following:

Escalation – the increase of costs and products over time, calculated to the midpoint of construction.

Estimating Contingency – A percentage of the hard costs that accounts for uncertainty in estimating due to incomplete information.

Construction Contingency - A percentage of the construction costs set aside to cover any unexpected costs that can arise throughout a construction project including change orders.

Non-Construction or Soft Costs - Items such as design and engineering services, project management, permits, fees and inspections.

The cost estimate assumes normal working hours. In addition, it does not include low voltage, data, AV, security, phones, or site upgrades of any kind, including site electrical. The asbestos abatement costs are provided by another source but included for reference. Elevator costs are also included separately. Kitchell seeks direction from the city as to how it would like these estimates presented in the final report.

APPENDIX A

ITEM	DESCRIPTION	QTY	UNIT	UNIT PRICE	TOTAL COST
C10	Interior Construction				
C1010	Partitions, Repairs as directed by State Fire Marshall	1	LS	\$130,000.00	\$130,000
	Subtotal Partitions				\$130,000
C1020	Interior Doors, Repairs as directed by State Fire Marshall	1	LS	\$285,000.00	\$285,000
	Subtotal Doors				\$285,000
	Total C10 Interior Construction				\$415,000
D30	HVAC				
D3010	Energy Supply				
	Gas Piping (to boilers in Basement)	150	LF	\$48.34	\$7,251
	Subtotal Energy Supply				\$7,251
D3020	Heat Generation				
	Gas Fired Boilers (3,400 mbh each)	4	EA	\$151,054	\$604,214
	Expansion Tank	1	EA	\$6,042	\$6,042
	Hot Water Circulating Pumps	3	EA	\$6,646	\$19,939
	VFD's for Pumps	3	EA	\$3,625	\$10,876
	Subtotal Heat Generation				\$641,071
D3030	Refrigeration				
	Refrigerant Piping (Garage split systems)	300	LF	\$48.34	\$14,501
	Subtotal Refrigeration				\$14,501
D3040	HVAC Distribution				
	Heating Hot Water Piping, w/insulation	44,865	LF	\$48.34	\$2,168,646
	Chilled Water Piping, w/insulation	39,555	LF	\$60.42	\$2,389,969
	Supply Ductwork, w/insulation	178,032	LBS	\$14.50	\$2,581,667
	Return Ductwork, w/insulation	89,016	LBS	\$14.50	\$1,290,834
	Exhaust Ductwork	35,606	LBS	\$12.08	\$430,278
	Garage Exhaust Ductwork	17,766	LBS	\$12.08	\$214,694
	Fire/Smoke Dampers	40	EA	\$1,450	\$58,005
	Exhaust Fans	13	EA	\$1,812.64	\$23,564
	Return Air Fan RA-1 (21st floor) (80,600 cfm)	1	EA	\$36,253	\$36,253
	Return Air Fan RA-3 (2nd floor) (13,750 cfm)	1	EA	\$18,126	\$18,126
	Supply Air Fan SA-1 (Level A) (45,000 cfm)	1	EA	\$30,211	\$30,211
	Supply Air Fan SA-2 (Level A) (15,000 cfm)	1	EA	\$20,543	\$20,543
	Garage Exhaust Fans (45,000 cfm each)	2	EA	\$30,211	\$60,421
	Garage Supply Fans (45,000 & 15,000 cfm)	2	EA	\$24,169	\$48,337
	VAV Box with Hot Water Coil (Floors 3-19)	138	EA	\$1,450	\$200,116

APPENDIX A

ITEM	DESCRIPTION	QTY	UNIT	UNIT PRICE	TOTAL COST
	Diffusers, Registers and Grilles (less garage)	356,064	SF	\$0.60	\$215,139
	Chilled Water Pumps (Installed in 2019)	NA	EA	\$0.00	\$0
	Stairwell Pressurization Fans	1	LS	\$36,253	\$36,253
	Smoke Relief/Exhaust Fans	1	LS	\$90,632	\$90,632
	Subtotal HVAC Distribution				\$9,913,689
D3050	Terminal Packaged Units				
	Air Handling Unit (20th Floor-Serves floors 3-19)	97,880	CFM	\$16.92	\$1,655,934
	Multiple Air Handling Units (13 total) (serving lower and upper floors)	101,200	CFM	\$12.08	\$1,222,930
	Fan Coil Units (chilled and heating water) (Floors 3-19 perimeter)	845	EA	\$1,813	\$1,531,683
	Wall Mounted Fan Coil Units (IDF Rooms)	20	EA	\$1,450	\$29,002
	Split Systems (Garage) (Unconfirmed quantity)	6	EA	\$12,084	\$72,506
	Subtotal Terminal Packaged Units				\$4,512,055
D3060	HVAC Instrumentation & Controls				
	DDC Controls (less garage)	356,064	SF	\$12.08	\$4,302,779
	DDC Controls (garage)	88,832	SF	\$6.04	\$536,736
	Subtotal HVAC Instrumentation & Controls				\$4,839,514
D3070	Testing, Adjusting and Balance				
	Pre-Measure Air Flows	444,896	SF	\$0.60	\$268,813
	Test and Balance (less garage)	356,064	SF	\$1.51	\$537,847
	Test and Balance (garage)	88,832	SF	\$0.60	\$53,674
	Subtotal Testing, Adjusting and Balance				\$860,333
D3090	Other Special HVAC Systems				
	Commissioning	444,896	SF	\$1.51	\$672,031
	Seismic Restraints	444,896	SF	\$1.03	\$456,981
	Firestopping and Penetrations	444,896	SF	\$0.36	\$161,288
	Other Special HVAC Systems				\$1,290,300
D40	Fire Protection				
	Total D30 HVAC				\$22,078,714
D4010	Sprinklers				
	Additional Sprinkler Coverage	10,000	SF	\$12.08	\$120,843
	Subtotal Sprinklers				\$120,843
D50	Electrical				
	Total D40 Fire Protection				\$120,843
D5010	Electrical Service and Distribution				

APPENDIX A

ITEM	DESCRIPTION	QTY	UNIT	UNIT PRICE	TOTAL COST
	Normal Power				
	1500kVa, 12Kv-4160V - Dry Type XFMR	1	EA	\$116,613	\$116,613
	1000kVa, 12Kv-480V - Dry Type XFMR	1	EA	\$100,300	\$100,300
	750kVa, 12Kv-480V - Dry Type XFMR	1	EA	\$87,007	\$87,007
	500kVa, 12Kv-480V - Dry Type XFMR	2	EA	\$57,400	\$114,801
	300kVa, 12Kv-480V - Dry Type XFMR	1	EA	\$44,470	\$44,470
	225kVa, 12Kv-480V - Dry Type XFMR	1	EA	\$35,044	\$35,044
	112.5kVa, 12Kv-480V - Dry Type XFMR	1	EA	\$26,706	\$26,706
	12kV Fused Switch, 400A	48	EA	\$4,229	\$203,016
	600A, 480/277V SWBD - (6)225AF Breakers	1	EA	\$18,126	\$18,126
	400A, 480/277V SWBD - (6)225AF Breakers	2	EA	\$12,084	\$24,169
	600A, 480/277V SWBD - (8)225AF Breakers	2	EA	\$20,543	\$41,087
	MCC 1A, 600A, 480/277V, 12 Starters	1	EA	\$7,855	\$7,855
	MCC 4, 600A, 480/277V, 12 Starters	1	EA	\$7,855	\$7,855
	MCC 5, 1600A, 480/277V, 12 Starters	1	EA	\$15,710	\$15,710
	MCC 2, 3, 18, 600A, 480/277V, 12 Starters	3	EA	\$7,855	\$23,564
	225A Branch Panelboards	150	EA	\$5,075	\$761,310
	(2) 12KV Wiring between basement and 21st floor ALLOWANCE	1	LS	\$120,843	\$120,843
	Emergency Power				
	45kVA XFMR 3PH, 4W	4	EA	\$4,834	\$19,335
	1200A, 480/277V - ATS	1	EA	\$33,836	\$33,836
	200A, 480/277V - ATS	1	EA	\$6,042	\$6,042
	200kW Generator	2	EA	\$253,770	\$507,540
	60kW Generator	1	EA	\$85,073	\$85,073
	600A, 480/277V SWBD - (8)225AF Breakers	2	EA	\$22,960	\$45,920
	125A Panelboard - EM	17	EA	\$4,592	\$78,064
	125A Panelboard - STANDBY	13	EA	\$4,592	\$59,696
	Subtotal Electrical Service and Distribution				\$2,583,983
D5020	Lighting and Branch Wiring				
	Equipment Connections				
	Mechanical Equipment Connections and Branch	444,886	SF	\$1.92	\$854,805
	Plumbing & Fire Protection Equipment (Pumps & VFDs)	1	LS	\$108,759	\$108,759
	Subtotal Equipment Connections				\$963,563
D5020	Power Devices (General)				
	Devices	444,886	SF	\$0.97	\$430,090
	Branch	444,887	SF	\$1.21	\$537,614
	Temporary Power for Construction	444,887	SF	\$0.27	\$118,275
	Subtotal General Power Devices				\$1,085,980

APPENDIX A

ITEM	DESCRIPTION	QTY	UNIT	UNIT PRICE	TOTAL COST
D5020	Lighting and Branch Wiring				
	Fixtures Allowance	444,886	SF	\$14.50	\$6,451,355
	Lighting Controls Allowance	444,887	SF	\$3.63	\$1,612,842
	Subtotal Lighting and Branch Wiring				\$8,064,197
D5030	Fire Alarm				
	Full System Allowance	444,887	SF	\$6.04	\$2,688,071
	Subtotal Fire Alarm				\$2,688,071
	Total D50 Electrical				\$15,385,793
F20	Selective Demolition				
F2010	Building Elements Demolition				
	Mechanical Demolition	444,886	SF	\$2.24	\$994,584
	Area Make Safe for Others	444,886	SF	\$0.24	\$107,523
	Electrical Demolition	444,886	SF	\$1.81	\$806,419
	Subtotal Building Elements Demolition				\$1,908,526
	Total F20 Selective Demolition				\$1,908,525.87
	SUBTOTAL HARD COSTS				\$39,908,876
	CONTINGENCY				
	ESTIMATING CONTINGENCY ¹	15.00%			\$5,986,331
	SUBTOTAL CONSTRUCTION COSTS				\$45,895,208
	MARK-UPS				
	GENERAL CONDITIONS	8.00%			\$3,671,617
	OVERHEAD & PROFIT	6.00%			\$2,974,009
	INSURANCE & BONDS	3.00%			\$1,576,225
	SUBTOTAL MARK-UPS				\$8,221,851
	SUBTOTAL CONSTRUCTION COSTS & MARK-UPS				\$54,117,059
	ESCALATION				
	ESCALATION ²	15.00%			\$8,117,559
	SUBTOTAL CONSTRUCTION COSTS				\$62,234,618

APPENDIX A

ITEM	DESCRIPTION	QTY	UNIT	UNIT PRICE	TOTAL COST
	CONSTRUCTION CONTINGENCY ³	10.00%			\$6,223,462
	TOTAL CONSTRUCTION COSTS			\$153.87	\$68,458,080
	NON-CONSTRUCTION COSTS ⁴	30.00%			\$20,537,424
	SUBTOTAL PROJECT COSTS			\$200.04	\$88,995,504
	Asbestos Abatement, Fireproofing, and Ceiling Replacement ⁵				\$26,248,750
	TOTAL PROJECT COSTS			\$259.04	\$115,244,254

¹ Estimating contingency: A percentage of the hard costs that accounts for uncertainty in estimating due to incomplete information.

² Escalation: the increase of costs and products over time, calculated to the midpoint of construction. Escalation is calculated at 5% per year.

³ Construction contingency: A percentage of the construction costs set aside to cover any unexpected costs that can arise throughout a construction project including change orders.

⁴ Non-construction costs: Items such as design and engineering services, project management, permits, fees and inspections.

⁵ This item was not estimated by Kitchell and is provided for reference only. A 5% contingency and 10% escalation was added.

APPENDIX B

GLOSSARY OF TERMS

Abatement: the ending, reduction, or lessening of a potential asbestos hazard. Abatement generally is one, or a combination, of five control options, namely 1) removal, 2) encapsulation, 3) enclosure, 4) repair, and 5) operations and maintenance (O&M)

- 1) Removal: the permanent elimination of a potential asbestos hazard through proper demolition and disposal of ACM
- 2) Encapsulation: a temporary solution to a potential asbestos hazard through application of a spray-applied sealant that either forms a protective membrane over ACM (bridging encapsulant) or saturates the ACM and bonds them to the substrate (penetrating encapsulant)
- 3) Enclosure: a temporary solution to a potential asbestos hazard through installation of an air-tight barrier around ACM. At times referred to as “encasement”, especially when spray-applied
- 4) Repair: a temporary solution to a potential asbestos hazard through correction of minor damage and/or failure of ACM
- 5) Operations and Maintenance (O&M): an ongoing solution to a potential asbestos hazard through establishment and execution of procedures related to the cleaning, maintenance, notification, etc. of and around ACM

Asbestos: asbestiform (fibers possessing great strength, flexibility, durability, etc.) varieties of chrysotile, amosite, crocidolite, tremolite, anthophyllite, actinolite, and any of these materials that has been chemically treated and/or altered

Asbestos-containing Material (ACM): any material containing more than one percent asbestos (>1.0%)

APPENDIX B

GLOSSARY OF TERMS (CONT'D)

Asbestos-Containing Waste Material (ACWM): waste that contains or has been contaminated by ACM

Asbestos Management Plan: a building-specific O&M program or plan

Breach: in relation to an abatement containment, a break or puncture through a critical barrier, such as the poly sheeting over a door, wall, vent, etc.

Clearance: in relation to abatement, the comparison of sampling results within a containment to criteria established by the U.S. Environmental Protection Agency (EPA), namely 0.01 fibers per cubic centimeter or 70 structures per square millimeter, or other agency. If the results meet the criteria, the abatement work methods are assumed to have been sufficient to minimize fiber release and the containment is clear for occupation by non-asbestos workers

Delamination: the separation into layers. As it applies to ACM, delamination is the partial or complete separation of ACM or an ACM system from the substrate. Delamination is a type of failure

Engineering Control: in relation to abatement, a method or procedure intended to limit asbestos fiber release

Failure: the omission of expected or necessary performance

Friable ACM: material that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure

Hazard: in relation to ACM, the potential for fiber release from a material. The level of hazard is based on ACM location, condition, and potential for disturbance

Industry Standard: in relation to asbestos, the requirements and level of care established by EPA, as directed by the Asbestos Hazard Emergency Response Act (AHERA) and Asbestos in Schools Hazard Assessment Reauthorization Act (ASHARA), and by state and local governments and/or agencies

Isolate: in relation to abatement, an engineering control that keeps an area under containment apart from other spaces

Negative Air Pressure Containment: in relation to abatement, an engineering control that establishes a negative pressure differential relative to adjacent spaces, which pulls clean air into the abatement area and allows for the filtration of exhausted air

APPENDIX B

GLOSSARY OF TERMS (CONT'D)

Phasing: in relation to abatement, a control that segments the scope of abatement work into more manageable portions. Phasing also allows for the piecemeal opening of large abatement projects, as cleared portions can be occupied by non-asbestos workers

Plenum: a space provided or used for air circulation

Risk Assessment: an evaluation of the exposure risk associated with ACM. A risk assessment factors in the hazard(s) of ACM present, as well as accessibility, potential for damage, and role within building function considerations. A risk assessment will also consider preventative measures to avoid ACM disturbance

Substrate: the underlying layer or material

Surveillance: periodic inspection of ACM, including assessment of deterioration and disturbance

Survey: typically part of a more broad hazardous building material survey, which includes lead-containing surfaces and universal waste; the initial inspection for potential ACM

Disclaimer: This Glossary of Terms is intended only for informational purposes. While based on definitions found in applicable regulations (e.g., AHERA and California Code of Regulations, Title 8, Section 1529 Asbestos) and on industry best practices, these definitions should not be considered codified in law or legally defensible.

APPENDIX C

ASBESTOS ASSESSMENT AND PRELIMINARY BUDGET FINAL REPORT

The following appendix includes an excerpt from the Asbestos Assessment and Preliminary Budget Final Report dated July 22, 2020 by Shefa Enterprises Inc.

APPENDIX C

❖ Shefa Enterprises, Inc.

Option 1 Cost Estimate: Removal of Asbestos Containing Fireproofing from Ceiling Deck and Beams

Required Tasks	Time	Cost Estimate
• Removal of FP on ceiling deck and beams, demolition of ceiling tiles and ceiling grid	76 weeks (1 contractor) 7 days a week Two 8-hour shifts/day	\$ 17,911,000
• Cleaning of remaining cassettes	1 week	\$ 211,200
• Re spray of fireproofing	8 weeks	\$ 2,457,000
• HVAC upgrade	40 weeks	\$ 2,522,453
• Re insulate contaminated HVAC ducts and pipes	19 weeks	\$ 1,500,000
• Install new ceiling tile and grid	57 weeks	\$ 2,457,000
• Painting of area		\$ 157,500
• Construction Clean up		\$ 207,000
• Third party on site air monitoring	76 Weeks	\$ 851,200
• Added Scope	13 weeks	
Update Lighting Control		\$ 60,000
Southstack Sewer Repairs		\$ 200,000
Entry Door Hardware		\$ 30,000
Bathroom toilets and tiles		\$ 45,000
3 rd floor patio access - ADA ramp & door		\$ 40,000
IDF Closet Doors		\$ 30,000
Permanent AC Units 5 IDF rooms		\$ 40,000
Fire Suppression Work		\$ 25,000
Blinds		\$ 100,000
21 st floor Roof Hatch		\$ 60,000
Basement Level B Sewer Main		\$ 35,000
Backflow Valve Outside Bldg		\$ 100,000
TSW Monitoring Center		\$ 30,000
Access Control 3 rd Floor		\$ 15,000
Striping of garage		\$ 20,000
Fire Alarm System Fixes		\$ 60,000
Sub Total		\$ 29,189,353
• Construction Management		\$ 3,020,935
• 5% Contingency		\$ 1,510,467
• Public Works oversight		\$ 850,000
• Moving Costs		\$ 1,500,000
Total	Time 89 Weeks	\$ 34,740,755

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❖ *Shefa Enterprises, Inc.*

Option 2: Spray Encasement of Fireproofing on Ceiling Deck and Beams (Floors 1-19)

Required Tasks	Time	Cost Estimate
• Spray encasement on ceiling deck and beams, demolition of ceiling tile and grid	76 weeks	\$ 15,407,000
• Cleaning remaining cassettes	1 week	\$ 211,200
• HVAC upgrade for ability to isolate floors	40 weeks	\$ 2,522,453
• Re insulate contaminated HVAC ducts and pipes	19 weeks	\$ 1,500,000
• Install new ceiling tile and grid	57 weeks	\$ 2,457,000
• Painting		\$ 157,500
• Construction Clean up		\$ 207,000
• Third party on site air monitoring		\$ 851,200
• Added Scope	13 weeks	
Update Lighting Control		\$ 60,000
Southstack Sewer Repairs		\$ 200,000
Entry Door Hardware		\$ 30,000
Bathroom toilets and tiles		\$ 45,000
3 rd floor patio access - ADA ramp & door		\$ 40,000
IDF Closet Doors		\$ 30,000
Permanent AC Units 5 IDF rooms		\$ 40,000
Fire Suppression Work		\$ 25,000
Blinds		\$ 100,000
21 st floor Roof Hatch		\$ 60,000
Basement Level B Sewer Main		\$ 35,000
Backflow Valve Outside Bldg		\$ 100,000
TSW Monitoring Center		\$ 30,000
Access Control 3 rd Floor		\$ 15,000
Striping of garage		\$ 20,000
Fire Alarm System Fixes		\$ 60,000
Sub Total		\$ 24,228,353
• 10% Construction Management		\$ 2,402,300
• 5% Contingency		\$ 1,100,000
• Public Works oversight		\$ 850,000
• Moving Costs		\$ 1,500,000
Total	Time 89 weeks	\$ 26,425,303

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❖ *Shefa Enterprises, Inc.*

Option 3: Spray Encasement on a Three Foot Area Around the Interior Perimeter of Each Floor

Required Tasks	Time	Cost Estimate
• Spray encasement of a 3 ft area around perimeter of building	13 weeks	\$ 3,296,000
• Cleaning remaining cassettes	1 Week	\$ 211,200
• Third party on site air monitoring	13 Weeks	\$ 145,600
• HEPA vacuum ceiling tile and grid	13 weeks	\$ 4,968,000
• HVAC upgrade	40 weeks	\$ 2,522,453
• Re insulate contaminated HVAC ducts and pipes	19 weeks	\$ 1,500,000
• Painting	19 weeks	\$ 157,500
• Construction Clean up		\$ 207,000
• Added Scope	13 weeks	
Update Lighting Control		\$ 60,000
Southstack Sewer Repairs		\$ 200,000
Entry Door Hardware		\$ 30,000
Bathroom toilets and tiles		\$ 45,000
3 rd floor patio access - ADA ramp & door		\$ 40,000
IDF Closet Doors		\$ 30,000
Permanent AC Units 5 IDF rooms		\$ 40,000
Fire Suppression Work		\$ 25,000
Blinds		\$ 100,000
21 st floor Roof Hatch		\$ 60,000
Basement Level B Sewer Main		\$ 35,000
Backflow Valve Outside Bldg		\$ 100,000
TSW Monitoring Center		\$ 30,000
Access Control 3 rd Floor		\$ 15,000
Striping of garage		\$ 20,000
Fire Alarm System Fixes		\$ 60,000
Sub Total		\$ 18,361,165.95
• 10% Construction Management		\$ 3,020,935
• 5% Contingency		\$ 1,000,000
• Public Works oversight		\$ 850,000
• Moving Costs		\$ 1,500,000
Total	Time 26 weeks	\$ 20,597,955

APPENDIX C

❖ Shefa Enterprises, Inc.

Option # 4: Removal of asbestos containing materials throughout Building (fireproofing, flooring and black mastic, thermal system insulation, drywall in elevator shaft) Exclusions: possible fireproofing on exterior of building beneath outer skin; TSI from unidentified areas and mechanical rooms 20th and 21st floors; drywall mud that has not been identified throughout building.

Required Tasks	Time	Cost Estimate
• Removal of FP from decks & beams demo of ceiling tiles/grid	76 weeks	\$ 18,500,000
• Cleaning of remaining cassettes	1 week	\$ 211,200
• Re spray of FP on on decks and beams	14 weeks	\$ 2,457,000
• Remove & replace flooring/carpet and mastic	15 weeks	\$ 3,202,902
• Demo / replace columns (fireproofing & drywall)	15 weeks	\$ 2,210,380
• TSI remove / replace	19 weeks	\$ 4,440,530
• Remove / replace freight elevator fireproofing & drywall	5 weeks	\$ 530,428
• Remove / replace roof	5 weeks	\$ 257,950
• HVAC upgrade	40 weeks	\$ 2,600,000
• Install new ceiling tile and grid	57 weeks	\$ 2,500,000
• Painting prior to re occupancy	2 weeks	\$ 160,000
• Construction Clean up (includes carpet, interior windows)	2 weeks	\$ 207,000
• Third party on site air monitoring	114 weeks	\$ 1,276,000
• Added Scope	13 weeks	
Update Lighting Control		\$ 60,000
Southstack Sewer Repairs		\$ 200,000
Entry Door Hardware		\$ 30,000
Bathroom toilets and tiles		\$ 45,000
3 rd floor patio access - ADA ramp & door		\$ 40,000
IDF Closet Doors		\$ 30,000
Permanent AC Units 5 IDF rooms		\$ 40,000
Fire Suppression Work		\$ 25,000
Blinds		\$ 100,000
21 st floor Roof Hatch		\$ 60,000
Basement Level B Sewer Main		\$ 35,000
Backflow Valve Outside Bldg		\$ 100,000
TSW Monitoring Center		\$ 30,000
Access Control 3 rd Floor		\$ 15,000
Striping of garage		\$ 20,000
Fire Alarm System Fixes		\$ 60,000
Sub Total		\$ 39,345,343
• 10% Construction Management		\$ 4,137,916
• 5% Contingency		\$ 2,260,854
• Public Works oversight		\$ 850,000
• Moving Costs		\$ 1,500,000
Total		\$ 47,597,144

APPENDIX D

SEISMIC RISK EVALUATION

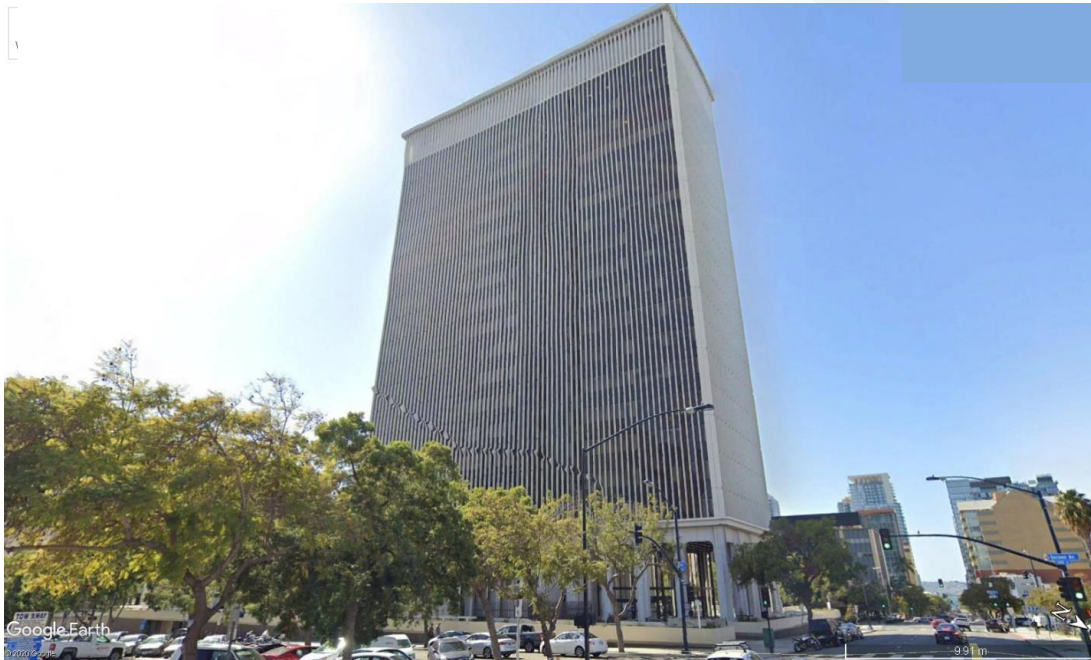
The following appendix includes the Seismic Risk Evaluation Report dated July 27, 2020 by Miyamoto International.

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101 Ash Street – Seismic Risk Evaluation

2020 July 27

Seismic Hazard Evaluation of the
101 Ash Street
San Diego, CA
2020 July 27



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Miyamoto International, Inc.

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APPENDIX D

101 Ash Street – Seismic Risk Evaluation

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1. EXECUTIVE SUMMARY

1.1 Synopsis

For a 1966 vintage steel structure, the tower’s lateral force system was well conceived. Obviously, certain elements of the structure do not meet the modern earthquake structural design criteria but expected performance may be better than similar structures built in the same era. The key findings from this analysis are summarized in Table 1.

Case	Existing		Retrofitted
	Expected (225-year event)	Rare (975-year event)	Rare (975-year event)
Meets performance requirements	Yes	No	Yes
Connections meet performance	Yes	Yes	Yes
Columns meet performance	Yes	No	Yes
Cladding damage reduced	Yes	No	Yes
Probability of collapse at very large earthquake	13%		1%
Structural damage (% building value)	11%	20%	4%

Table 1. Summary of results, existing and retrofitted buildings

As seen in Table 1, the 24-story tower building in its existing configuration conform to the earthquake performance requirements for an expected (225-year return period) earthquake per ASCE 41-17. For the rare 975-return period event, several columns in the building do not conform to the performance requirements and damages are expected. The earthquake caused displacements for the 975-year return earthquake could damage the existing precast cladding panels, and pounding between the tower and adjacent three-story podium is anticipated.

If an earthquake performance for a rare 975-year return period event is desired to be increased as a voluntary upgrade, the addition of fluid viscous dampers at several levels (our initial estimates are bottom three levels and between 13th and 18th levels) of the structure to reduce the story drift and seismic demand on the member and connections. This strengthening will increase earthquake resiliency, reduce risk of collapse, reduce the pounding effect to the adjacent building, and mitigate damage to precast cladding. Since there is no change of occupancy to the structure and no modifications or renovations to the existing structural system, a structural retrofit of the building is not required.

A Scenario Expected Loss Assessment (SEL) is a prescriptive report based on guidelines from the American Society for Testing and Materials (ASTM) Standard Guide for Seismic Risk Assessments of Buildings’. This type of report is insurance-backed and does not involve analysis of a structure’s actual behavior during a seismic event.

1.2 Summary and discussions

Miyamoto International has completed the preliminary seismic risk evaluation for the subject building located at 101 Ash Street, San Diego, CA. The 23- story (with two levels of subgrade) steel moment frame building was constructed in 1966. The building, rectangular in plan, has a plan dimension of 180 x 70 ft. Typical floors measure 13.5 ft in height, whereas the first floor is 17 ft tall. The overall height of the building from the basement to the roof is approximately 315 ft.

The lateral load is resisted by a system of space (all bays) steel moment frames. In the longitudinal direction, there are six 30-ft long bays along each grid (18 bays total), and in the transverse direction, there are two 35-ft long bays along each grid (14 bays total). All columns are oriented such that their strong axis aligns in the transverse direction. All columns resist seismic loading in both strong- and weak-directions.

The structure under consideration has several features that enhance its earthquake resiliency, including the following: i) structural regular configuration; ii) redundancy in lateral force resistive system; iii) reinforced moment connections; and iv) complete joint penetration column splices. The building also has several design features that increase risk in earthquakes, including the following: i) building aspect ratio with narrow transverse direction (315 ft tall and 70 ft wide); ii) welded moment connections iii) weak-axis connection for columns; and iv) slenderness of some built-up column sections at upper levels.

State-of-the-art performance based engineering was used to evaluate earthquake performance for primary structural elements. The provisions of American Society of Civil Engineers (ASCE) 41-17 were used to simulate a mathematical representation of the building and analyze its performance. ASCE 41-17 considers a number of structural performance objectives (POs). The basic safety objective for existing office buildings requires meeting a dual performance at different levels of seismic hazard. For an expected level (225-year return period earthquake), there is a 20% chance that an earthquake of that magnitude could be exceeded over a 50-year period. At this level, a certain level of damage is accepted; however, a margin of safety against collapse is to be maintained. For a rare (975-year return period earthquake), there is a 5% chance that an earthquake of that magnitude could be exceeded over a 50-year period. At this level, significant damage is tolerated but the structure is expected to continue to carry its gravity loading but have little remaining margin.

In the current evaluation, the computer simulation model of the building using ETABS was constructed based on the available as-built drawings. Since no material information or test data were available, the ASCE 41-17 expected material grade for the period of building construction was used. The seismic hazard and site class (soil type) for the site were determined based on the Structural Engineers Association of California (SEAOC) and the United States Geological Survey (USGS) on-line tools. The structure was subjected to the two hazard levels described above and the demand on the structure was computed based on dynamic response spectrum analysis. The key results are summarized below.

The fundamental vibration periods for the building are approximately 3.6 to 4.3 seconds. This implies that this is a flexible building that could experience large motion. However, the building flexibility also limits the seismic forces imparted on the building.

Story drift ratio (SDR, story movement) is a key component for assessment of building performance during an earthquake event. For the 225-year event, maximum SDR is approximately 0.8%. At this level, it is expected that the building will perform adequately. For the 975-year event, the average SDR is 1.5% and values closer to 2% are computed at the first level (due to flexibility of base connection) and at upper levels (due to the higher mode effects). For new steel moment frame buildings constructed to meet modern seismic codes, the SDR is limited to 2%. Given the building vintage, it is recommended to limit SDR for this structure to closer to 1.2%.

Demand to capacity ratio (DCR) is used to assess the performance of components such as connections, beams, and columns. Beam-to-column connections are a key component of the steel moment frame buildings. Many of the connections for the building's construction period do not have large ductility (ability

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to absorb the earthquake energy) and thus it is critical to keep DCR values low. The computed DCR for the moment frame connections is less than 1.0 and less than 1.6 for the 225-year and 975-year earthquakes, respectively. In other words, for the expected event, the connections will be undamaged and for rare earthquake they will experience damage, but at an acceptable level

Several of built-up column sections are considered seismically non-compact; modern steel structures require elements in the lateral force resisting system to be seismically compact. Seismic compactness is a geometric property that prevents localized failures such as flange buckling. In addition, for lower-level columns on the building perimeter, the axial force is large (due to large aspect ratio of the building in the transverse direction). For such cases, the acceptable value of DCR is smaller than cases where columns have lower axial loads. For the 225-year earthquake, the DCRs meet the ASCE 41-17 requirements. For the rare (975-year) earthquake, approximately 30 columns are not compliant. A handful of non-compliant columns are the mid-height, whereas the most are at the lower levels. All non-compliant columns are at the perimeter (Grid lines D and F) where the overturning due to seismic forces is largest.

Based on the results from the preliminary structural analysis, the following can be inferred.

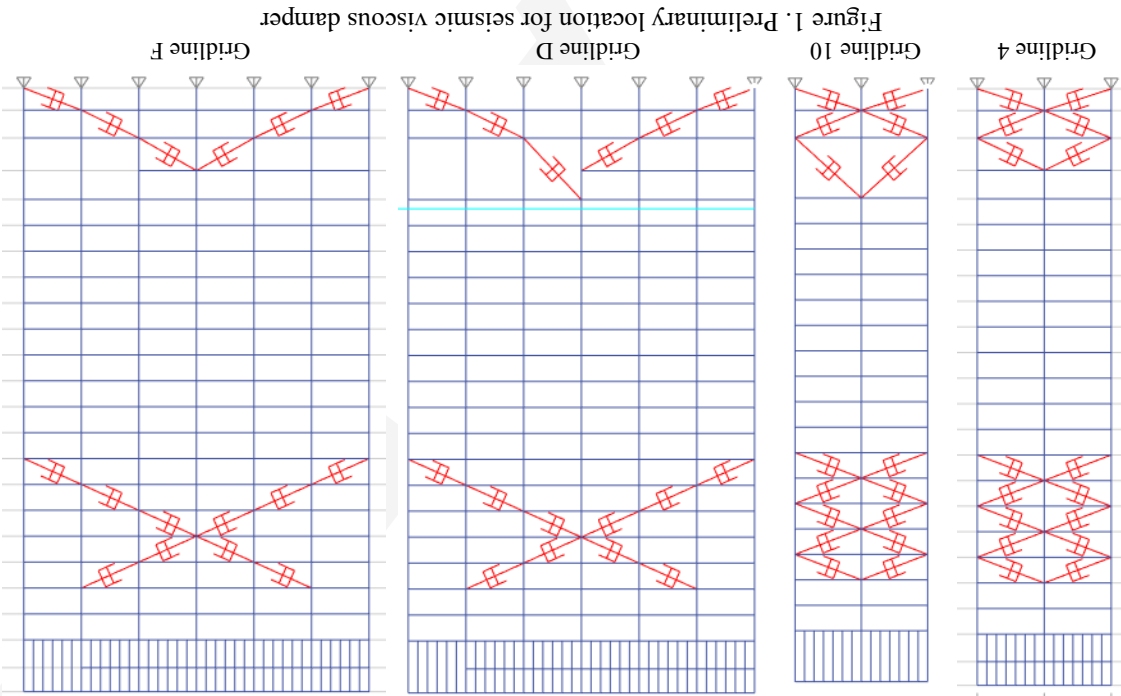
- The tower building in its existing configuration conform to the earthquake performance requirements for an expected (225-year return period) earthquake.
- A number of columns in the building do not conform to the performance requirements for the rare 975-year return period earthquake and structural damages in these columns are expected
- The expected displacements and SDR for the 975-return period earthquake could damage the existing precast cladding panels
- At the 975-year return event pounding between the tower and adjacent three-story podium is anticipated.

1.2.1 Recommendations

The following is recommended based on our findings.

- If it is desired to enhance the performance of the building to meet the requirements for the rare 975-year return period event, then seismic viscous dampers (earthquake shock absorbers) is the recommended method of strengthening. By strategically placing the dampers along the building height, one can reduce story drifts, accelerations, demand on structural and nonstructural components, and reduce pounding. Such strengthening will increase earthquake resiliency, reduce risk of collapse, mitigate pounding effect to the adjacent building, and decrease the likelihood of cladding damage .If this retrofit is conducted, it is recommended to perform more comprehensive nonlinear analysis, and to incorporate foundation rocking and soil structure interactions to characterize response more accurately and in details. Preliminary locations for the 64 seismic dampers are presented in Figure 1.

Dr. Kit Miyamoto, S.E.
Dr. Amir Gilani, S.E.
Dr. Tsutomu Nifuku, S.E.
Casey Lubawy, S.E.
Miyamoto International, Inc



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DEFINITIONS

BSE 1E	Moderate earthquake with return period of 225 years or probability of occurrence of 20% in 50 years
BSE 2E	Rare earthquake with return period of 975 years or probability of occurrence of 5% in 50 years
DCR	Demand to capacity ratio. Computed seismic demand on a member divided by its capacity
<i>m</i> -factor	Modification factor corresponding to the permissible value of DCR for a component corresponding to the ability of a member or connection to resist the earthquake energy
PFA	Peak floor acceleration
SDR	Story drift ratio. Displacement of a level minus displacement of level below divided by the story height

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2. INTRODUCTION

2.1 Overview

Preliminary analysis of the 23-story office tower at 101 Ash Street, San Diego was conducted. The structure, constructed in 1966, comprises two levels of basement, a three-story structure, and a tower building. The three-story building is separated from the tower by a seismic gap (2-in wide level below ground and 4-in wide above ground). In this report, only the seismic performance of the tower building is considered.

The gravity and lateral forces in the tower building are supported by a system of steel columns, girders, and beams. Constructed in late 1960's per applicable building codes at the time of construction, it is not expected that the building would comply with all the requirements of the modern seismic codes. Steel-framed buildings have performed very well in the past earthquakes. However, many structures of this era used the Welded Unreinforced Flange (WUF) connection that has shown vulnerable to damage in the Northridge and Kobe earthquakes. Additionally building of this vintage used the weak (minor)-axis column connection that are no longer common. The tower building does possess certain characteristics such as geometric regularity and redundancy that would elevate its seismic performance.

To assess the performance of the building in its existing condition, a dual approach consisting of performance based structural engineering analysis and state-of-the-art seismic risk assessment was conducted.

To assess performance of the building after implementation of seismic retrofitting, the model of the building was updated by the addition of seismic protection dampers, which showed significant benefits and the reduction in potential losses in future earthquakes.

2.2 Evaluation criteria

Provisions of ASCE 41-17 (ASCE 2018) were used for the seismic evaluation of the building. For existing buildings, ASCE 41-17 defines two levels of seismicity: basic safety earthquake (BSE) of BSE-1E and BSE-2E corresponding to events with 225-year and 975-year recurrence intervals, respectively. The 225-year event is a typical event, whereas, the 975-earthquake is a rare event.

The selected performance objectives (POs) for the tower are based on the recommendations of ASCE 41-17. The document defines basic performance objective for existing buildings (BPOE) as requiring meeting the following for commercial buildings:

- Life safety (LS) at BSE-1E
- Collapse prevention (CP) at BSE-2E

The selected performance objectives are summarized in Table 2

PO	Seismic hazard	PO	Expected performance after earthquake
BOPE	BSE-1E	LS	Structure has damaged components but retains a margin of safety against the onset of partial or total collapse
	BSE-2E	CP	Structure has damaged components and continues to support gravity loads but retains no margin against collapse

Table 2. Performance objectives (adapted from ASCE 2018)

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3. DESCRIPTION OF THE BUILDINGS

3.1 General

The steel-framed tower investigated is located at 101 Ash Street, San Diego, CA; see Figure 2. Measured from basement, the tower is a 23-story steel moment frame building constructed in 1966. The building has a plan dimension of 180 x 70 ft, with individual bays measuring 30x35 ft. The building is rectangular in plan. Typical floors measure 13.5 ft in height, whereas, the first floor is 17 ft tall. The overall height of the building from the basement to the roof is approximately 315 ft.



Figure 2. Tower building

3.2 Gravity systems

Gravity loading is resisted by a system consisting of 5.5-in. thick one-way flat slab and steel beams transferring the gravity loading to the steel girders, then to the steel columns supported on shallow foundations (spread footings).

3.3 Lateral load system

The lateral load is resisted by a system of steel space moment frames. Figure 3 presents the plan view of a typical floor and the location of the lateral load resisting system. In the longitudinal direction, there are six 30-ft long bays along each grid (18 bays total), and in the transverse direction, there are two 35-ft long bays along each grid (14 bays total). All columns are oriented such that their strong axis aligns in the transverse direction.

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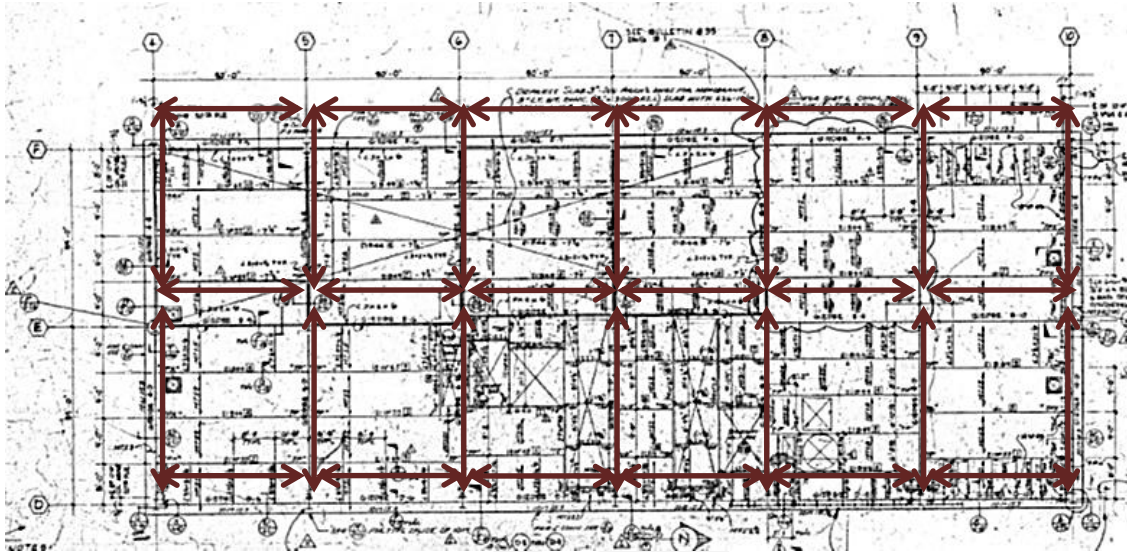


Figure 3. Lateral load resisting system

4. SEISMIC HAZARD

The building site is classified as Class D. For the building site and soil conditions, the BSE-1E and BSE-2E seismic hazard can be developed based on the response spectrum plots; see Figure 4. The seismicity at the site is moderately high and falls in the seismic design category (SDC) D.

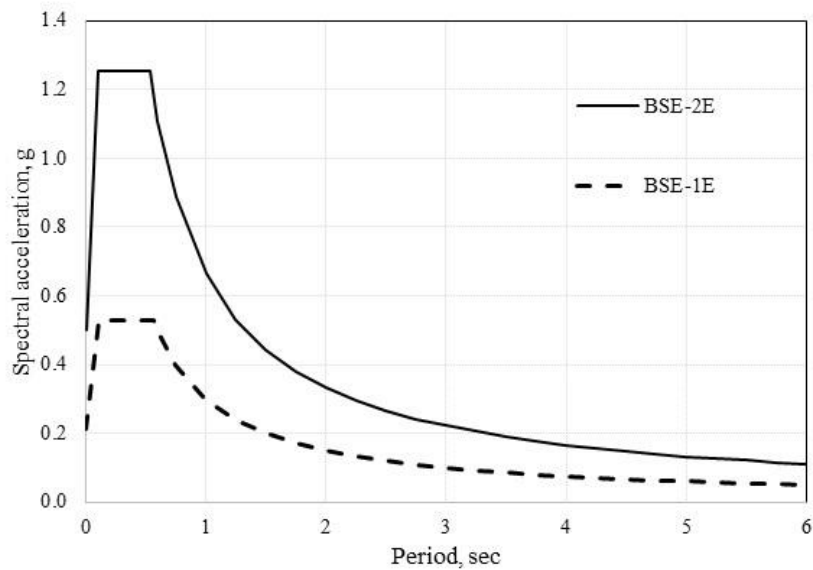


Figure 4. Seismic hazard for the site

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5. BUILDING CHARACTERISTICS

5.1 Overview

Steel moment frame buildings with ductile beam-to-column connections have performed very well in past earthquakes. Even steel buildings with non-ductile WUF are considered lower risk than other more vulnerable construction types such as unreinforced masonry (URM) or non-ductile reinforced concrete buildings.

5.2 Factors enhancing seismic performance

The structure under consideration has several key design features that enhance its earthquake resistance, including the following:

- *Structural configuration.* The building is regular in plan, with no re-entrant corners or vertical off-sets. Regular buildings have performed well in past earthquakes.
- *Redundancy.* Steel moment frames are used at each gridline connection
- *Reinforced Moment connections.* As seen in Figure 5, in the transverse direction, cover plates are used for top and bottom flange. In the longitudinal direction, bottom haunches are used for the girders. This type of detailing is more ductile than WUF connection and serves to move the plastic hinging and yielding away from the critical beam-to-column joints. In the longitudinal direction, the girders are attached to box plates welded to column flanges. This is a superior connection than welding girders to the column webs.

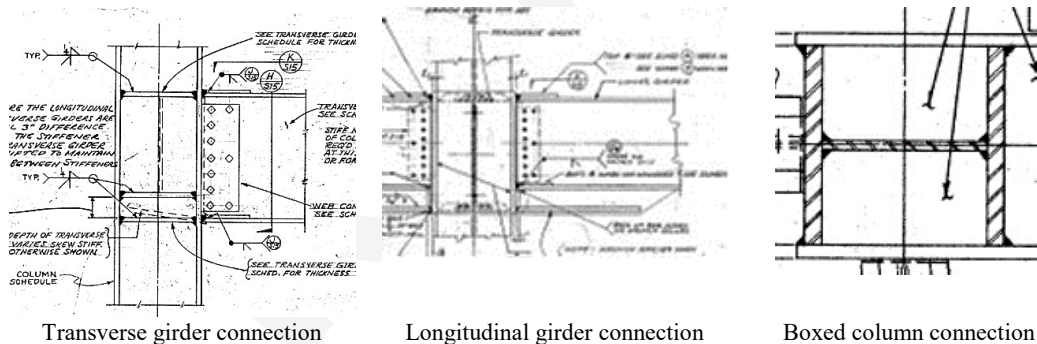


Figure 5. Connection details

- *Column splices.* Complete joint penetration (CJP) welding was used for all column splices. This precludes failure at the splice that is a major concern for building of this vintage where partial joint penetration welding was typically used.

5.3 Factors decreasing seismic performance

The structure under consideration has several key design features that reduces its earthquake resistance, including the following:

- *Column support.* Since the columns are supported on spread footings without grade beams, the base of columns cannot develop significant flexural resistance and this leads to increase demand on the other column connections
- *Weak-axis connection.* All the columns orient in such a way that their weak axis coincides with the building's longitudinal axis. This would result in the building be more flexible in this direction

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- *Seismic gap.* The seismic gap is 4 in. wide above the ground. The flexible steel structure could deform more than 4 in at this level and pond to the adjacent three-story building. This concern is somewhat mitigated because the floor at the two structures occur at the same level
- *Welding.* For many buildings constructed in this era, welding did not have high values of Charpy toughness. There is significant welding at the connections including welding of column web to column flanges for the built-up columns.
- *Slenderness.* A number of built-up columns and rolled beams do not meet the AISC 341 ([AISC 2016](#)) geometrical requirements for seismically compact sections. Such sections have limited capacity to undergo plastic rotations in earthquakes
- *At some gridlines, two-story columns are used.* This could lead to weak or soft story configuration.

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6. ACCEPTANCE CRITERIA

The seismic evaluation of the building used a number of acceptance criteria, summarized in this section. These thresholds were used to assess the performance of the structure in its current and retrofit configurations.

6.1 Steel beam-to-column connections

ASCE 41-17 provides limitation for the demand to capacity ratios (DCR), referred to as modification factors (*m*-factors) that accounts for the capacity of a component to dissipate the seismic energy. The permissible *m*-factors¹ for the building are presented in Table 4. In this report, *m*-factor for the WUF connection is used for evaluation.

Component	Direction	Detail	LS	CP
Connections ²	Transverse	Cover-plate	2.8	3.4
	Longitudinal	Bottom haunch	2.7	3.4
Beams	--	WUF	1.3	2.4
	--	Rolled	Governed by connections	

Table 4. Permissible *m*-factors (adapted from ASCE 2018)

6.2 Steel columns

For the (rolled and built-up) steel columns, the *m*-factor depends on two factors: the axial load in the column, and the width to depth ratio for column web and flanges. Example cases are presented in Table 5. For the tower building, a number of column sections are considered non-compact and the lower-level columns have significant axial force. As seen from the table, for such columns a smaller *m*-factor is permitted because these columns have less ductility: ability to absorb the seismic energy in a predictable manner.

Component	Section flange	Axial force ratio	LS	CP
Columns	Compact	0.15	6	8
	Half-way compact and slender	0.15	3.6	5
		0.55	1.6	1.9
	Half-way compact and slender	0.55	1.3	1.5

Table 5. Example of permissible column *m*-factors (adapted from ASCE 2018)

6.3 Precast claddings

The building has precast concrete cladding. Gaps are provided between adjacent panels to accommodate the building story drift ratio (SDR). In-plane distortion can result in contract at corners. FEMA P58 (FEMA 2018) provides suggestion for SDR that can be accommodated by cladding depending on the construction period and occupancy; see Table 6

Vintage	Commercial/residential occupancy
Pre 1994	1.2%
Post 1997	2.0%

Table 6. Suggested SDR limitations for claddings (adapted from FEMA 2018)

Out-of-plane cladding anchorage damage can also occur if the building experiences high accelerations. The anchorage design for the cladding panel is not known. However, prior to 1994, the component anchorages were designed for the following acceleration for the project site:

¹ Modification factors denote the acceptable threshold for the acceptable demand to capacity ratio (DCR) and is indicative of a component's capacity to dissipate the seismic input energy.

² Conservatively based on W36 section, the larger depth of beam in the building.

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Eq. 1. $Design\ force = importance * component\ coefficient * seismic\ factor * weight$

Eq. 2. $Design\ force = 1.0 * 0.3 * 4 = 1.2\ weight$

Often in design, allowable stress design was used and the allowable stresses were increased by a factor of 1.3 due to short duration of seismic loading. Accordingly, it is assumed that the cladding anchorages were designed to withstand an acceleration of approximately 0.9 g.

6.4 Pounding

For building situated close to one another, pounding could occur because of narrow seismic gap. FEMA 154 (FEMA 2015) defines several criteria to evaluate for pounding. The cases and consequences are summarized in Table 7. The structure considered in this report falls in the third category

Description	1. Not considered	2. Most severe	3. Assess
Building separation is less than 1% of height of shorter building	N	Y	Y
Floors align	--	N	Y
Taller building has two or more stories than shorter building	--	--	N

Table 7. Severity of pounding (adapted from FEMA 2015)

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7. SEISMIC PERFORMANCE OF EXISTING BUILDING

7.1 Overview

ASCE 41-17 (ASCE 2018) provides comprehensive requirements for seismic evaluation and upgrade of existing buildings and was used for this structure. Computer program ETABS (CSI 2020) was used to prepare a three-dimensional mathematical model of the building; see Figure 6. This model was used to assess the performance of the existing building moment frames. Nominal spans and member sizes specified in the original construction documents were used in analysis. Dimensions were based on centerline dimensions provided in the drawings. Gravity loading on the building is composed of member self-weights, design live load and additional dead load to account for non-structural elements such as flooring, ceiling, and duct work, which is distributed uniformly on floor slabs. The weight of heavy mechanical components was also included in the model. Expected (per ASCE 2018) material properties were used. Since construction drawings were available, a knowledge factor of 1.0 was assumed in analysis.

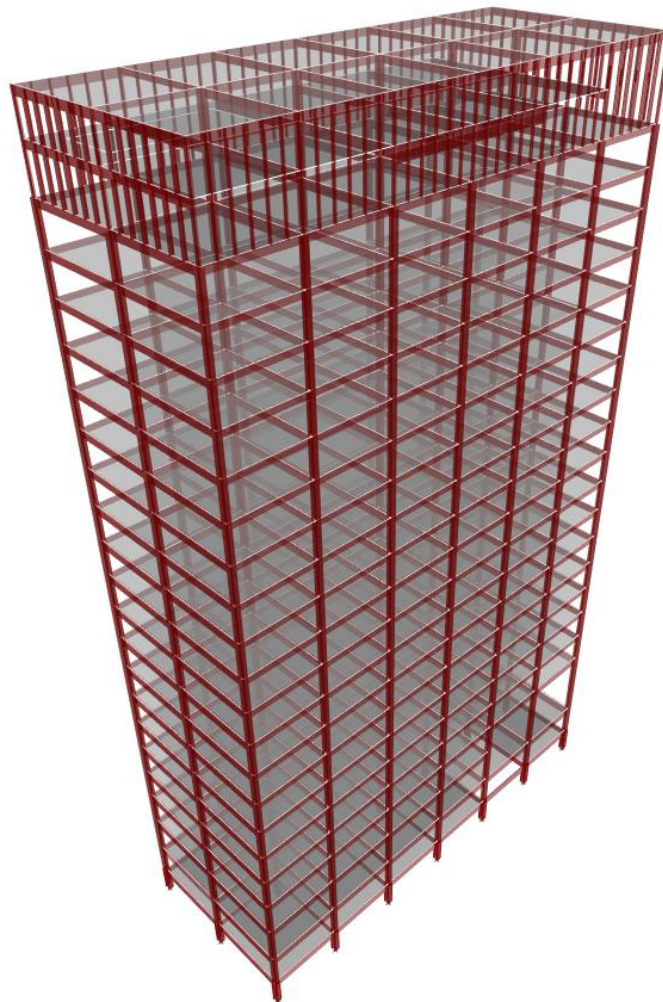


Figure 6. Mathematical model of the building used for structural analysis

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7.2 *Dynamic properties*

The seismic weight of the building is calculated at 28,000 kips. Table 8 presents the modal properties of the building for the fundamental modes in each direction. Note the following:

- There is no coupling of responses in various direction. This is expected because the structure is regular in plan
- This is a long-period and flexible structure with the longitudinal direction (coinciding with the column weak axis) corresponding to the first mode.
- The long period(s) of the building would result in large displacement but will place the structure on the descending slope of seismic demand of Figure 4 and thus limit the seismic forces acting on the buildings

Mode	Period, sec	Mass participation, %		
		Longitudinal	Transverse	Torsion
1	4.3	76%	0%	0%
2	3.7	0%	69%	5%
3	3.5	0%	5%	71%
4	1.6	12%	0%	0%
5	1.4	0%	13%	1%
6	1.3	0%	1%	12%

Table 8. Modal properties

To assess the performance of the structure, the response spectrum analysis was used and sufficient number of modes was included to capture nearly the entire seismic mass of the building. Since (all) steel moment frame columns have beams spanning to them in both direction, orthogonal seismic loading was considered for this building.

7.3 *Performance at BSE-1E (225-year event)*

7.3.1 *Beam-to-column-connections*

Figure 7 presents the performance of connections at BSE-1E. Note the following:

- Connections meet ASCE 41-17 requirements
- DCR values are less than 1. In other words, connections remain elastic (damage free).

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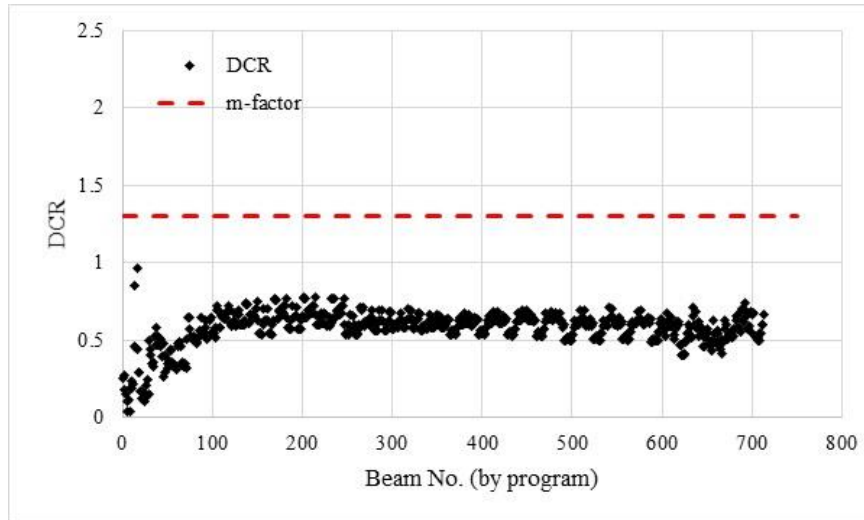


Figure 7. Performance of beams (connections), existing BSE 1E

7.3.2 Columns

Figure 8 presents the performance of columns at BSE-1E. Note the following:

- Connections meet ASCE 41-17 requirements
- DCR values are less than or close to unity. In other words, columns remain elastic (damage free).

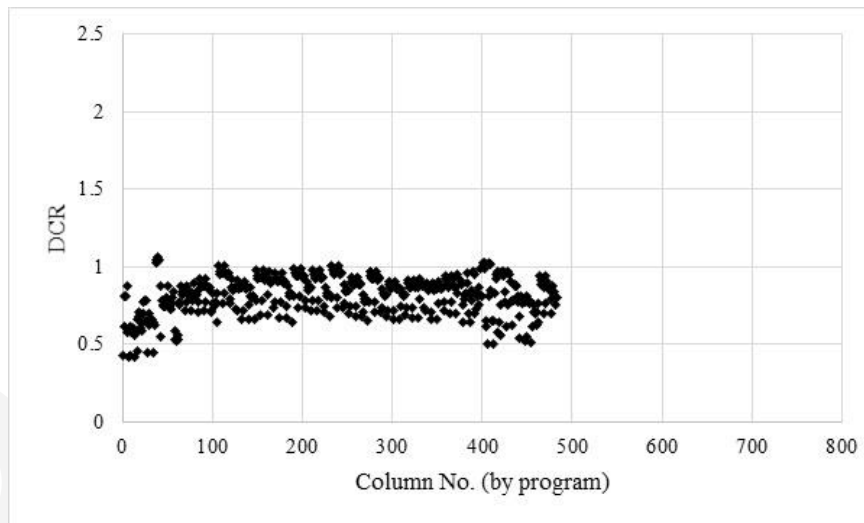


Figure 8. Performance of columns, existing BSE 1E

7.3.3 Cladding

Figure 9 presents SDR. Note that the maximum drift ratio is less than 0.8% and thus cladding damage is not anticipated.

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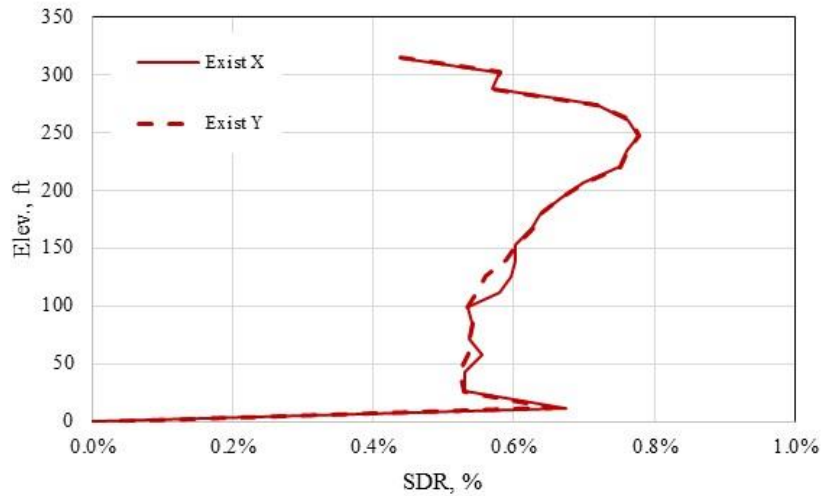


Figure 9. SDR, existing BSE 1E

7.3.4 Pounding

Figure 10 presents the computed floor displacements. Note that the seismic gap provided is adequate and thus no pounding is anticipated.

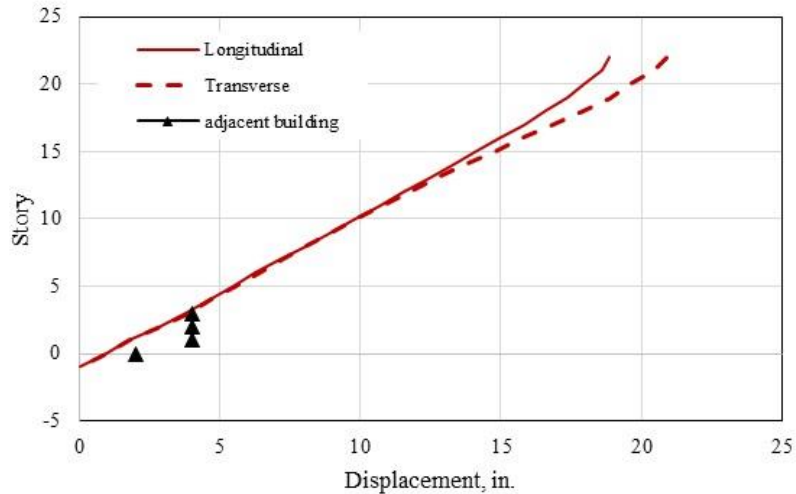


Figure 10. Floor displacements, existing BSE 1E

7.4 Performance at BSE-2E 975-year event)

7.4.1 Beam-to-column-connections

Figure 11 presents the performance of connections at BSE-2E. Note the following:

- Connections meet ASCE 41-17 requirements
- The connections will undergo certain amount of yielding (damage) but this is at an acceptable level as they will not fracture or cause collapse at this level of damage.

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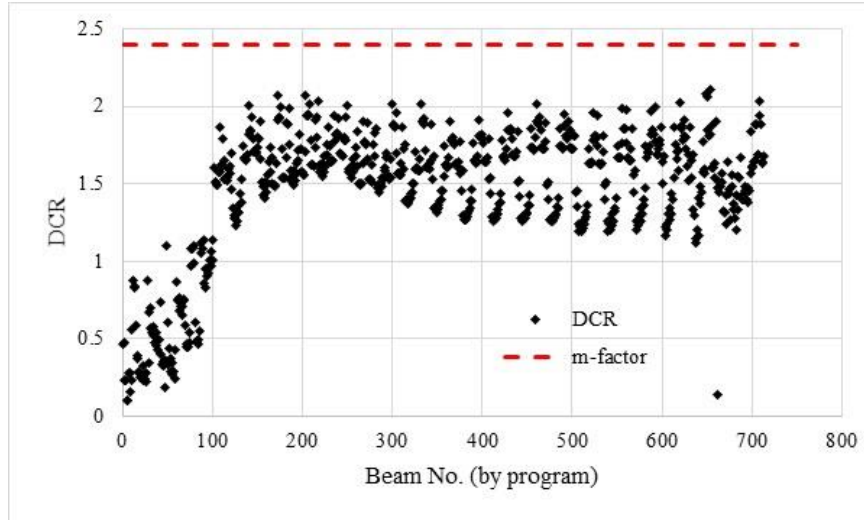


Figure 11. Performance of beams (connections), existing BSE 2E

7.4.2 Columns

Figure 12 presents the performance of columns at BSE-2E. Note the following:

- Columns do not meet ASCE 41-17 requirements

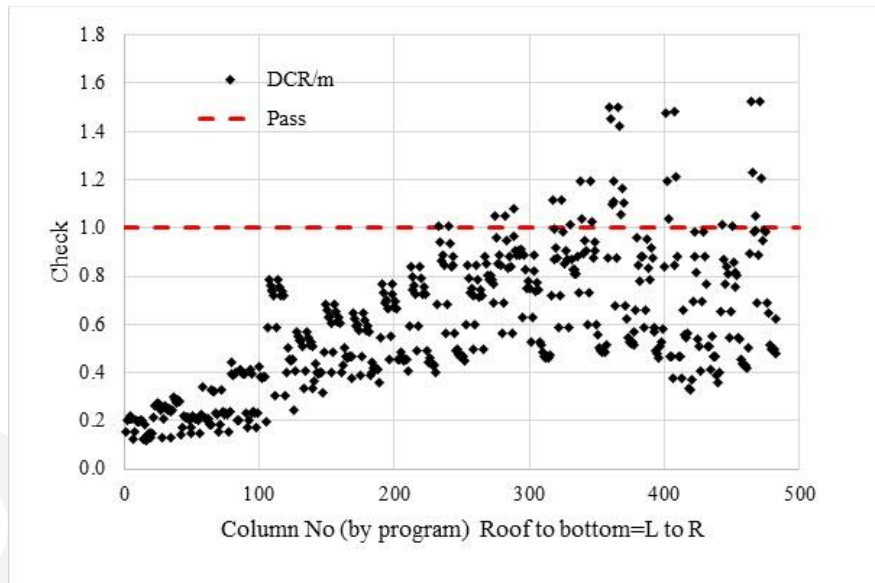


Figure 12. Performance of columns, existing BSE 2E

7.4.3 Cladding

Figure 13 presents SDR. Note that the drift ratio exceeds 1.2% along the building height for a number of levels and as such cladding damage is expected. Figure 14 presents the peak floor acceleration (PFA) along the building height. Note that the high PFA at the upper levels could result in damage to the cladding

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anchorage and other acceleration-sensitive nonstructural components such as the items located at the mechanical level.

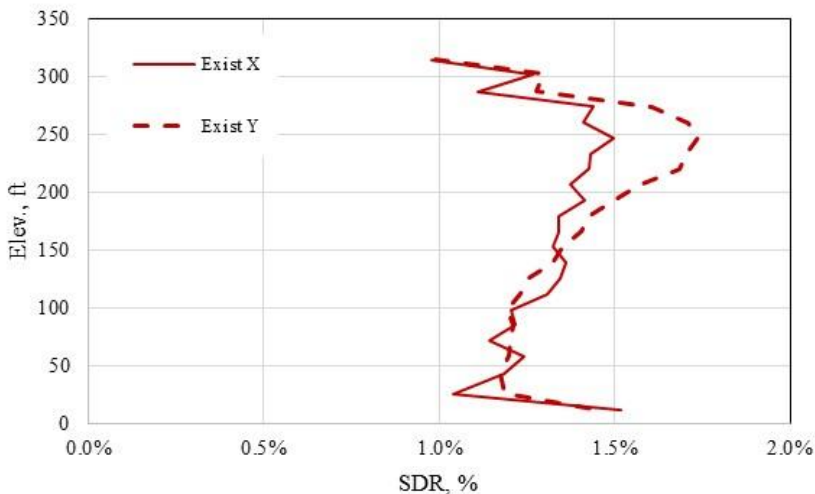


Figure 13. SDR, existing BSE 2E

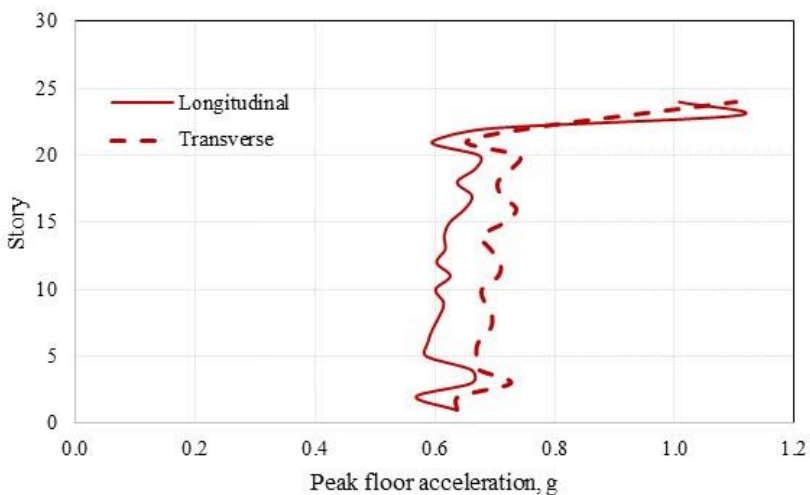


Figure 14. Peak floor accelerations, existing BSE 2E

7.4.4 Pounding

Figure 15 presents the computed floor displacements. Note that the seismic gap provided is not adequate and thus pounding is expected.

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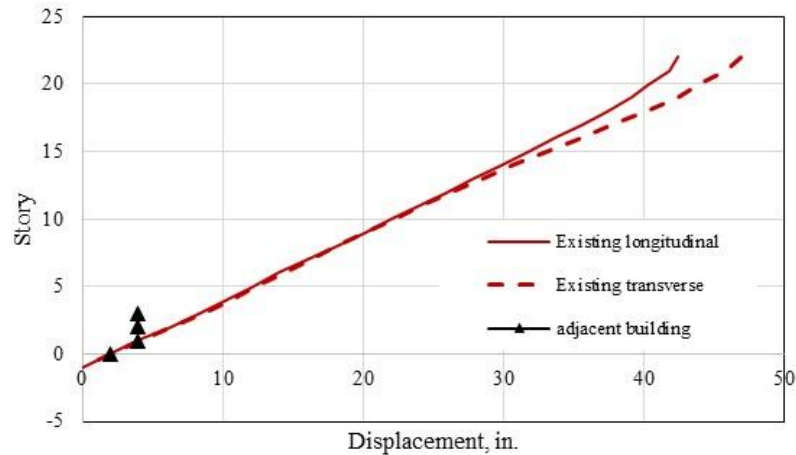


Figure 15. Floor displacements, existing BSE 2E

7.5 Summary

The structure in its existing configuration is expected to have satisfactory response at the 225-year event. However, structural and nonstructural damage, and pounding is expected to occur at the 975-year event and the building does not comply with the ASCE 41-17 requirements. Accordingly, seismic retrofit of the building is recommended. A cost-effective retrofit focused on addressing the key deficiencies is presented in the next section.

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8. STRUCTURAL UPGRADE USING SEISMIC FLUID VISCOUS DAMPERS

8.1 Overview

Fluid viscous dampers, see Figure 16, are proposed to seismically retrofit for the building. This solution addresses the key deficiencies identified for the building and will result in significant additional protection for structural and nonstructural systems. One key advantage of the proposed seismic retrofit is that it eliminates the need for (intrusive and expensive) structural strengthening.

Dampers possess the following characteristics:

- Maintenance free
- Have been widely used in seismic retrofit of buildings
- Minimize the need for strengthening of existing members and foundations.
- Can be aesthetically integrated into the building architectural features.
- Cost-effective.
- Minimize disruption to building occupancy.



Figure 16. Viscous damper installed in a California building

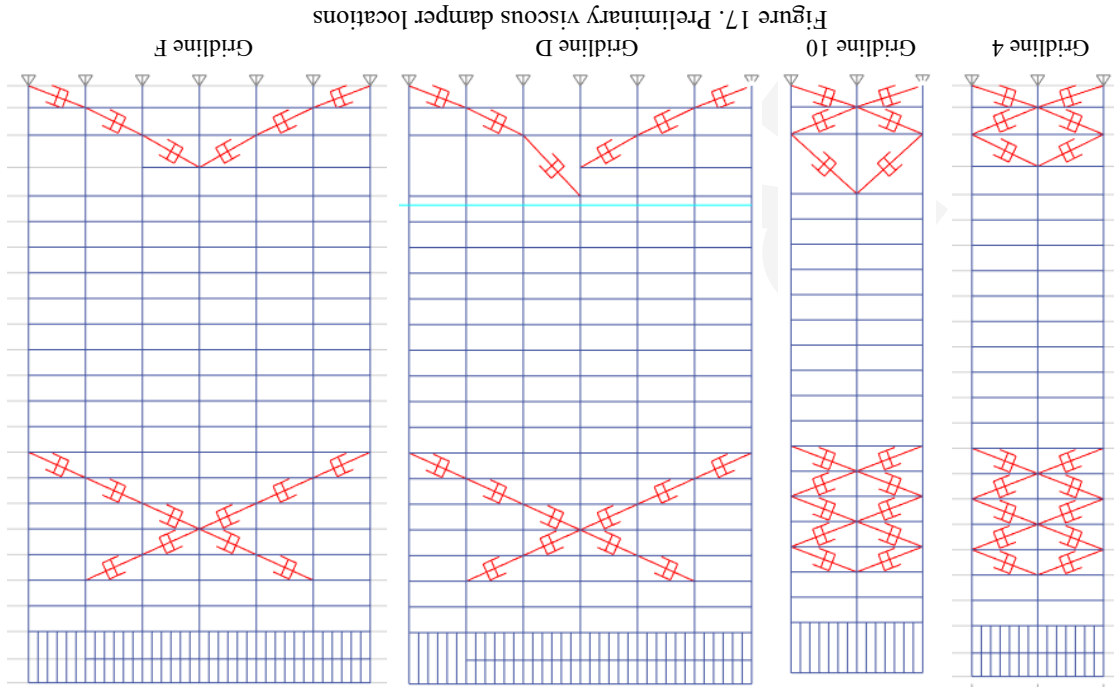


Figure 17. Preliminary viscous damper locations

Table 9. Seismic viscous damper properties

Damper specifications	
C (nominal)	120
α	0.5
Number	64
Force kips	300
Stroke, in.	+/-4

It is proposed to add seismic dampers on the exterior of the building, along the height, they are distributed to mitigate the observed seismic deficiencies. Preliminary locations are presented in Figure 17. Table 9 presents the specifications for the seismic dampers

8.2 Proposed seismic damper configuration

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9. SEISMIC PERFORMANCE OF THE RETROFITTED BUILDING

9.1 Overview

The mathematical model of the building was updated and seismic dampers were added; see Figure 18. Nonlinear response history analysis (NLRHA) was performed. For such analysis, Recorded acceleration records from past earthquakes were synthesized such that their spectrum closely matched the target spectrum of Figure 4 for BSE 2E. ASCE 41-17 requires that a minimum of 7 pairs of records be used in analysis. Figure 19 presents the target spectrum and the spectra of the closely matched records.

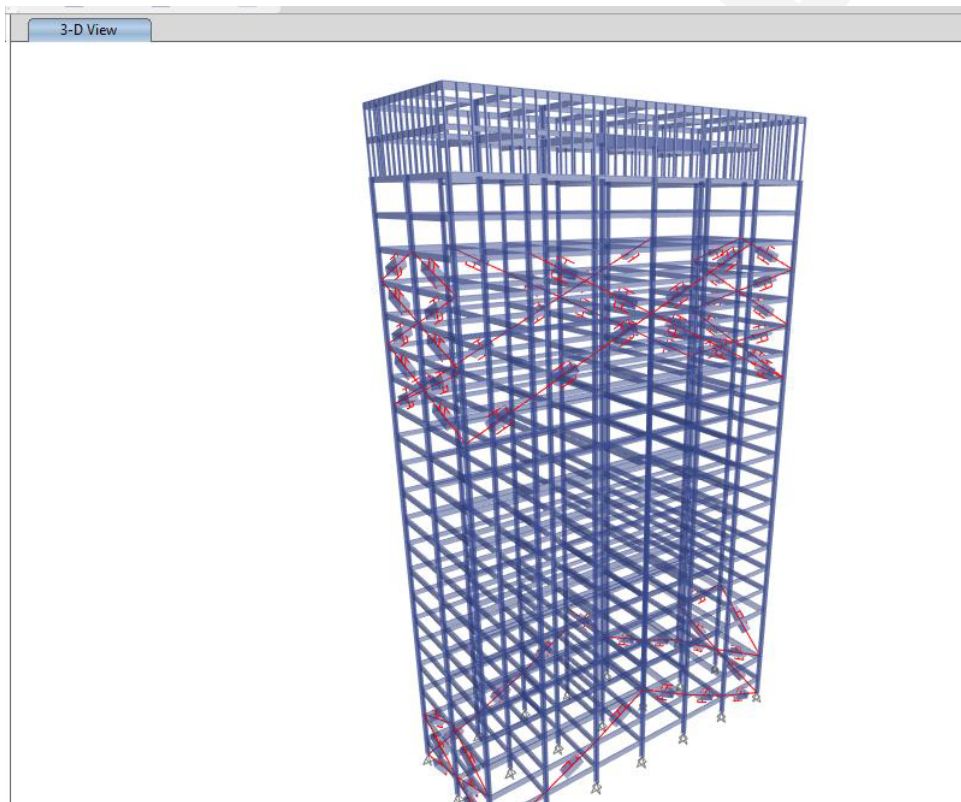


Figure 18. Mathematical model of the retrofitted structure

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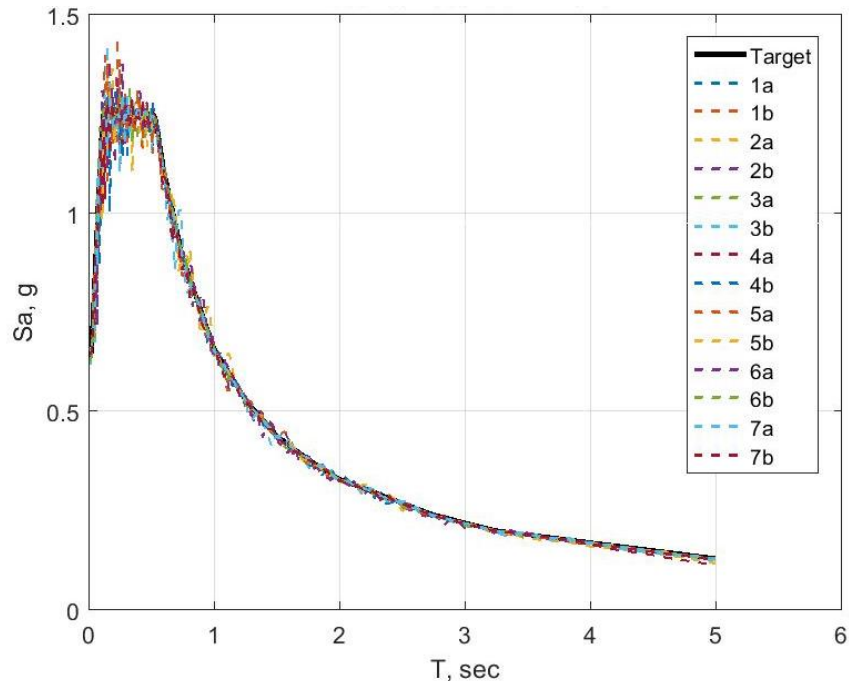


Figure 19. Matched acceleration records

Since the existing structure had satisfactory response at BSE 1E, the response of the retrofitted model to the BSE 2E was investigated.

9.2 Seismic performance at BSE 2E

The seismic performance of the retrofitted model to the 975-year event is presented in this section and comparisons are made to the existing structure.

9.2.1 Beam-to-column-connections

Figure 20 presents the performance of connections at BSE-2E. Note the following:

- Connections meet ASCE 41-17 requirements

Figure 21 presents the expected level of damage (yielding) in beam-to-column connections at BSE 2E. Note that the addition of seismic dampers reduced the expected yielding (damage) level in connections by a large amount and resulting in an essentially elastic behavior.

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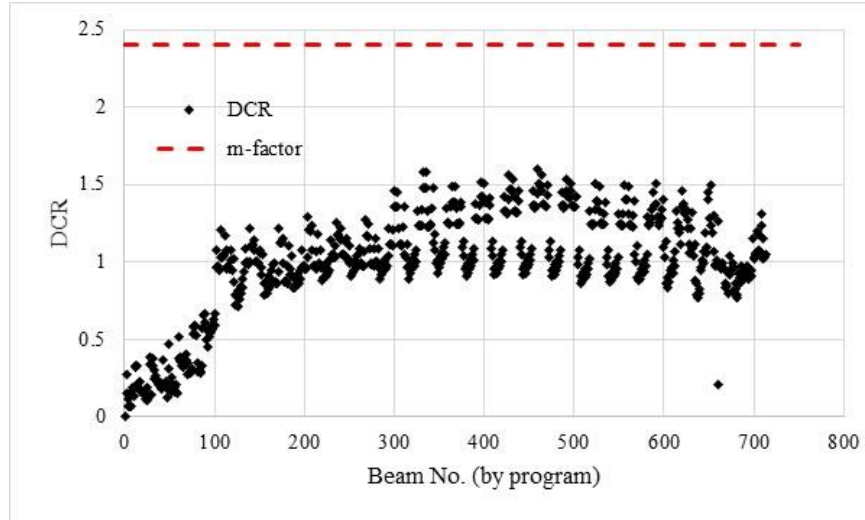


Figure 20. Performance of beams (connections), retrofitted BSE 2E

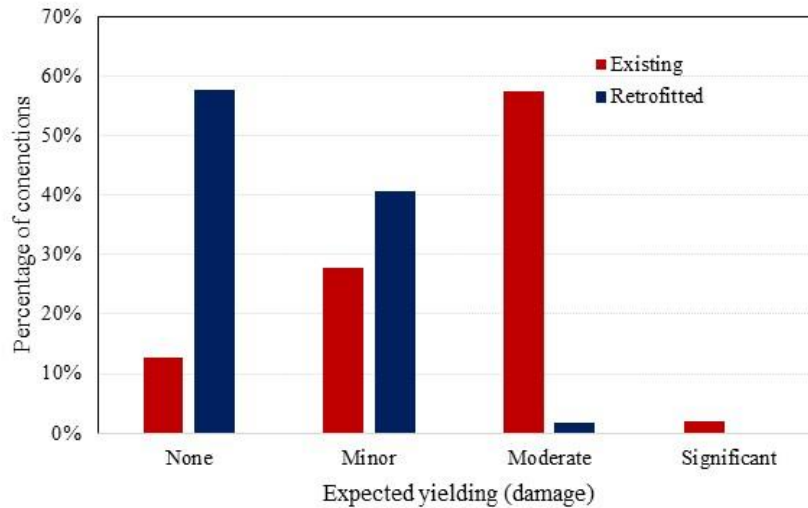


Figure 21. Expected level of connection damage, BSE 2E

9.2.2 Column

Figure 22 presents the performance of columns at BSE-2E. Note the following:

- Connections meet ASCE 41-17 requirements

Figure 23 presents the expected level of damage (yielding) in columns at BSE 2E. Note that the addition of seismic dampers reduced the expected yielding (damage) level in columns by a large amount. For example, the number of columns expected to moderate to significant yielding (damage) has decreased by a factor of 3.

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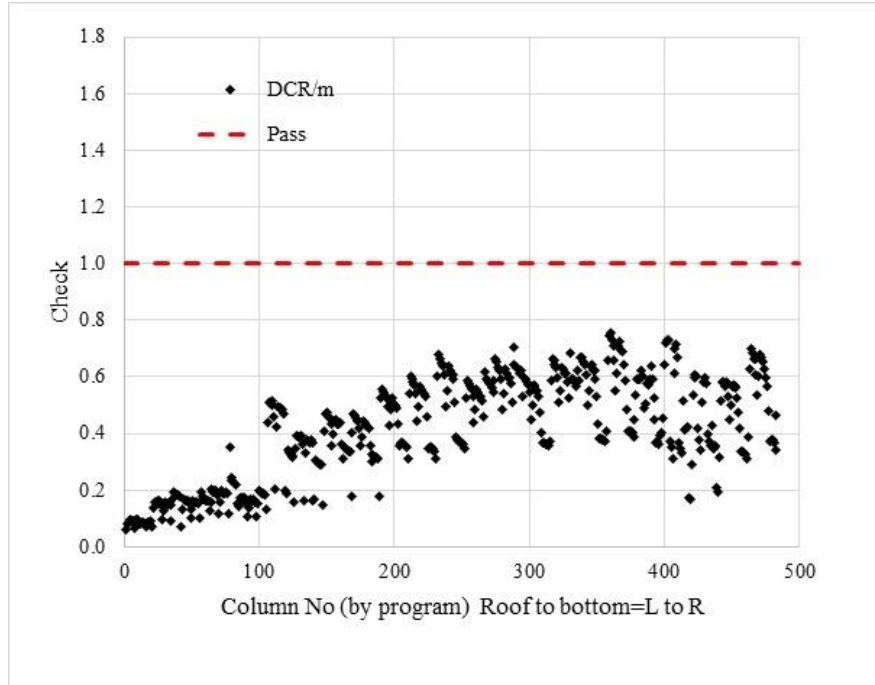


Figure 22. Performance of columns, retrofitted BSE 2E

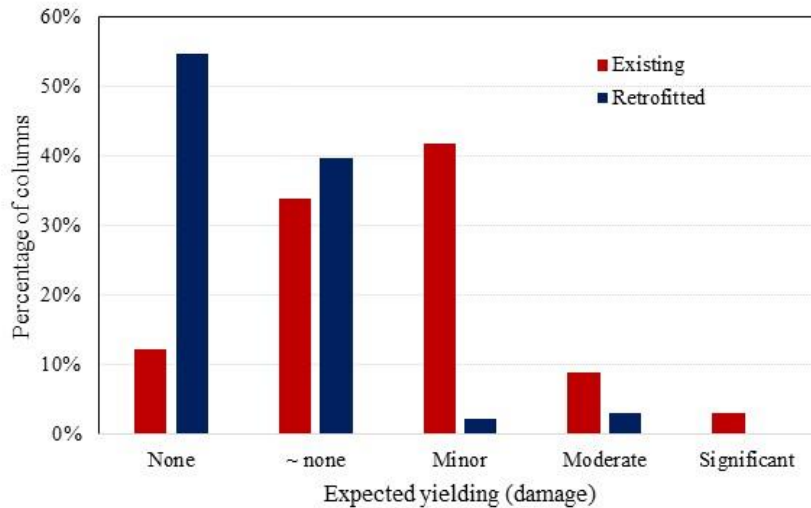


Figure 23. Expected level of column damage, BSE 2E

9.2.3 Cladding

Figure 24 presents SDR for existing and retrofitted buildings. Note that the drift ratios are reduced by an average of approximately 30% and for the retrofitted building, the maximum SDR is 1.2%. In other words, cladding damage has been mitigated. Figure 25 presents PFA along the building height for existing and retrofitting structures. Note that the PFA is reduced by close to 50%. The reduced PFA will mitigate damage to cladding anchorage and other nonstructural components.

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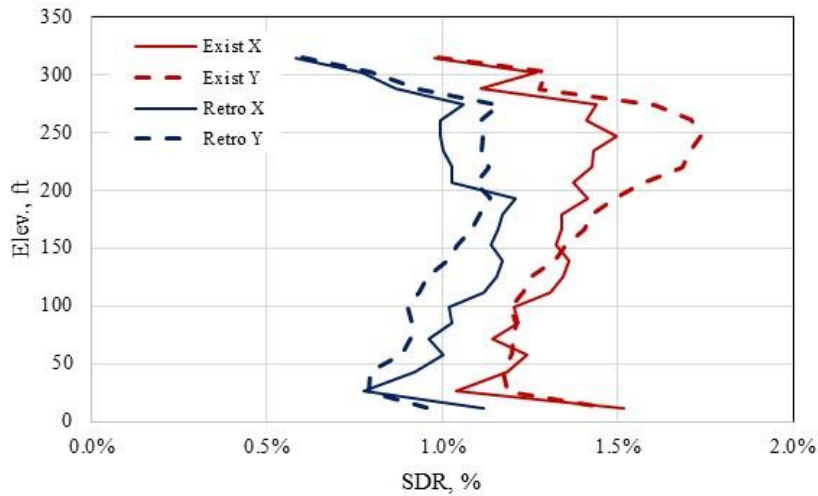


Figure 24. SDR, retrofitted BSE 2E

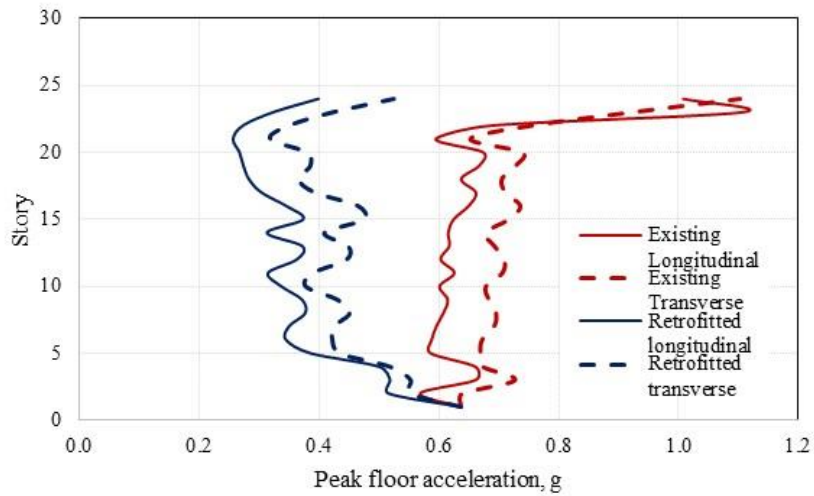


Figure 25. Peak floor accelerations, retrofitted BSE 2E

9.2.4 Pounding

Figure 26 presents the computed floor displacements for the existing and retrofitted structures. Note that for the retrofitted structure, the pounding is unlikely to court at ground level and below. Pounding could still occur at the above floors but its impact is reduced by the damper retrofit and could be mitigated by enlarging the seismic gap.

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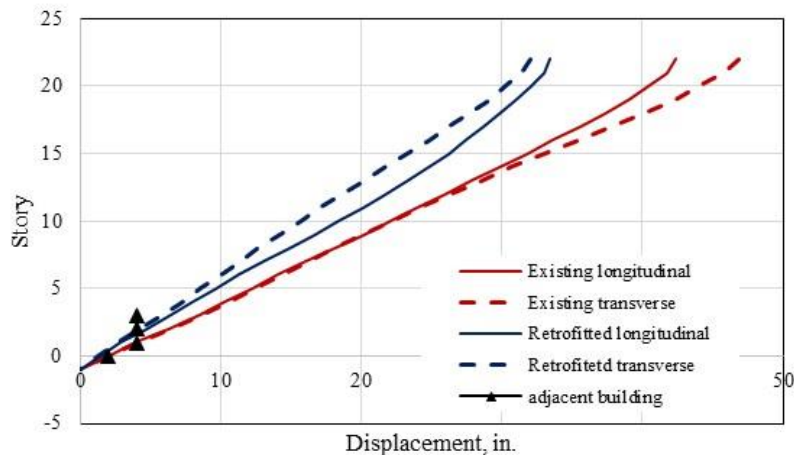


Figure 26. Floor displacements, retrofitted BSE 2E

9.3 Discussions

When retrofitted by seismic viscous dampers, the structure is expected to have satisfactory response at the 975-year event. Structural, nonstructural damage are significantly reduced, cladding is protected, and pounding is reduced.

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10. RISK ANALYSIS

10.1 Overview

Seismic risk prediction program (SP3 2020) was used to assess the seismic risk for the existing and retrofitted models of the building. The program is a powerful software that allows computing loss, repair time, and other key parameters for both structural and nonstructural components. In this section, the emphasis is on the structural performance. The program engine uses Monte Carlo simulation to determine the mean values of structural responses and consequences from a given earthquake intensity. In this section, 10,000 simulations were used and the earthquake hazard was selected with a return periods of 225 and 975 years—consistent with other sections of this report

10.2 Analysis results

The input for analysis consisted of the structural responses discussed in the earlier sections of this report. Figure 27 presents the probability of collapse at a rare 975-year return earthquake. The existing structure has collapse probability of 13%, but retrofit with dampers reduce this to less than 1%.

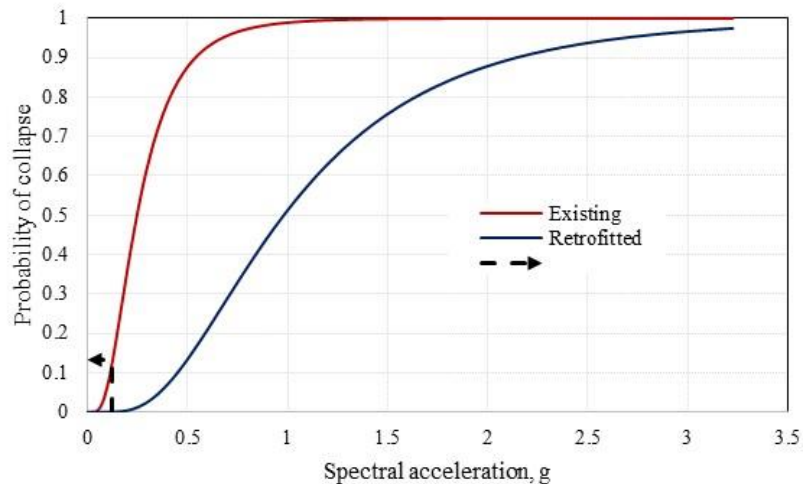


Figure 27. Probability of collapse

The estimated mean losses for the existing and retrofitted building are presented in Table 10 as percentage of building value. Note that there is significant reduction in losses once retrofitting is undertaken.

	Mean loss, %
Existing, 225 years	11%
Existing, 975 years	20%
Retrofitted, 975 years	4%

Table 10. Scenario-based risk analysis

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11. CONCLUSIONS

The seismic performance of the tower to earthquake loading was investigated using a combination of advanced structural analysis and risk assessment. Analysis and evaluation showed that the existing building did not meet its performance objectives. However, once retrofitted with seismic vicious dampers, there was significant improvement in structural response and resulting reduction in seismic risk for the building. Key findings are summarized in Table 11

Case	Existing		Retrofitted	
	Expected (225-year event)	Rare (975-year event)	Rare (975-year event)	Rare (975-year event)
Meets performance requirements	Yes	No		Yes
Connections meet performance	Yes	Yes		Yes
Columns meet performance	Yes	No		Yes
Cladding damage reduced	Yes	No		Yes
Pounding to adjacent building not likely	No	No		Reduced
Probability of collapse		13%		1%
Structural damage (% building value)	11%	20%		4%

Table 11. Summary of results

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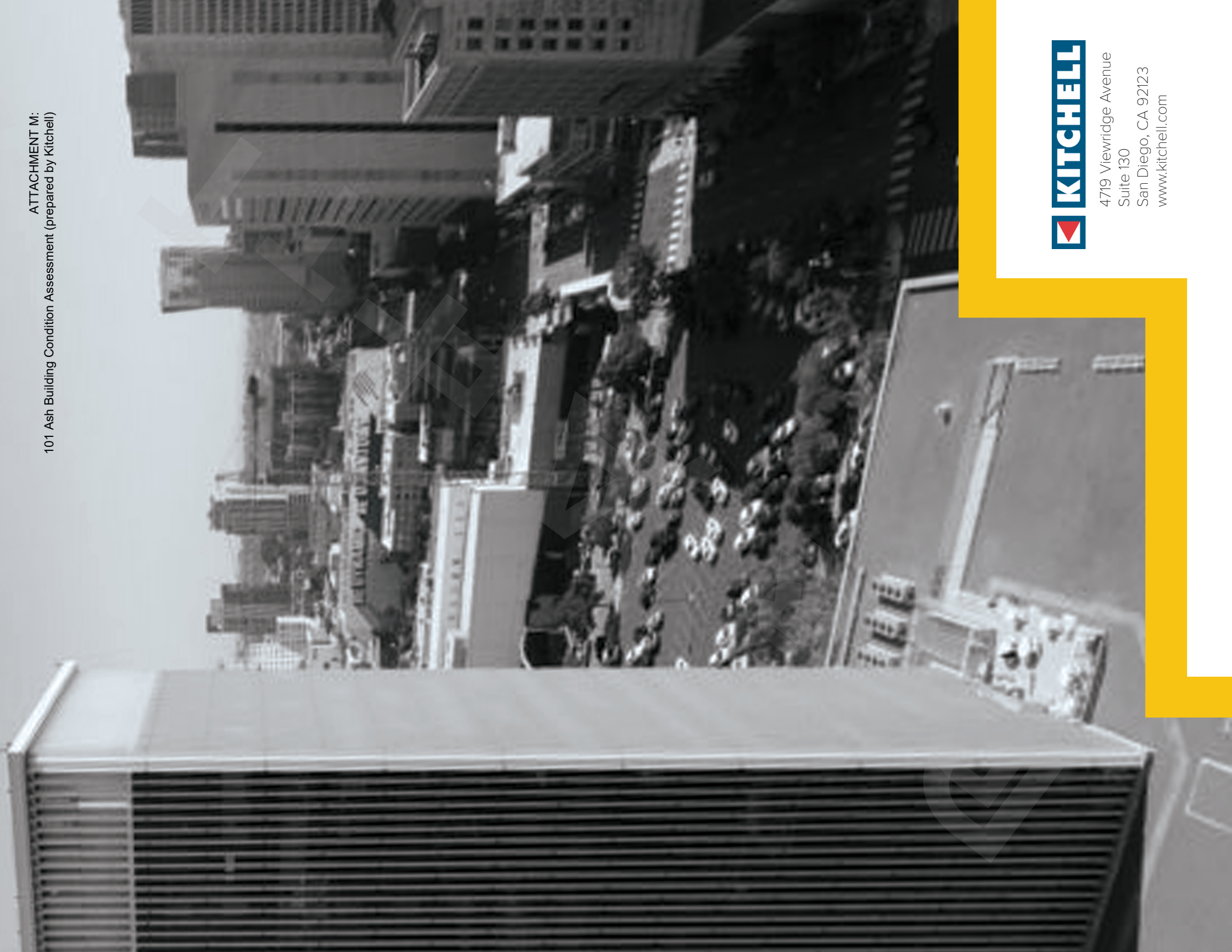
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APPENDIX E

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KITCHELL

4719 Viewridge Avenue
Suite 130
San Diego, CA 92123
www.kitchell.com