Seismic Assessment of Large Number of Buildings Based on Visual Inspection

Course No: S04-022
Credit: 4 PDH

Ibrahim M. Metwally, Ph.D., P.E.

Continuing Education and Development, Inc.

P: (877) 322-5800
info@cedengineering.com

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1. Introduction & Understanding Rapid Visual Screening Procedure

The FEMA P-154: "Report, Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook, 3rd Edition", is the first of a two-volume publication on recommended methodology for rapid visual screening of buildings for potential seismic hazards. The technical basis for the methodology, including the scoring system and its development, is contained in the companion volume, FEMA P-155 report, Rapid Visual Screening of Buildings for Potential Seismic Hazards: Supporting Documentation (FEMA, 2015). Both this document and the companion document are third editions of similar documents first published by FEMA in 1988 and updated in 2002.

The rapid visual screening (RVS) procedure has been developed to identify, inventory, and screen buildings that are potentially seismically hazardous. Once identified as potentially hazardous, such buildings should be further evaluated by a design professional experienced in seismic design to determine if, in fact, they are seismically hazardous. The RVS procedure uses a methodology based on a sidewalk survey of a building and a Data Collection Form, which the person conducting the survey completes, based on visual observation of the building from the exterior, and if possible, the interior. Buildings may be reviewed from the sidewalk without the benefit of building entry, structural drawings, or structural calculations. Reliability and confidence in building attribute determination are increased, however, if the structural framing system can be verified during interior screening or using construction documents.

The two-page Data Collection Form (shown in Figure 1 and 2) includes space for documenting building identification information, including its use and size, a photograph of the building, sketches, and documentation of pertinent data related to seismic performance. Based on the data collected during the survey, a score is calculated that provides an indication of the expected seismic performance of the building.

Rapid Visual Screening of Buildings for Potential Seismic Hazards — **Level 1**
FEMA P-154 Data Collection Form — **HIGH Seismicity**

PHOTOGRAPH

Address: _____
Zip: _____
Other Identifiers: _____
Building Name: _____
Use: _____
Latitude: _____ Longitude: _____
S_S: _____ S_1: _____
Screener(s): _____ Date/Time: _____

No. Stories: Above Grade: _____ Below Grade: _____ Year Built: _____ ☐ EST
Total Floor Area (sq. ft.): _____ Code Year: _____
Additions: ☐ None ☐ Yes, Year(s) Built: _____

Occupancy: Assembly, Commercial, Emer. Services, ☐ Historic, ☐ Shelter, Industrial, Office, School, ☐ Government, Utility, Warehouse, Residential, # Units: _____

Soil Type: ☐A Hard Rock ☐B Avg Rock ☐C Dense Soil ☐D Stiff Soil ☐E Soft Soil ☐F Poor Soil ☐DNK *If DNK, assume Type D.*

Geologic Hazards: Liquefaction: Yes/No/DNK Landslide: Yes/No/DNK Surf. Rupt.: Yes/No/DNK

Adjacency: ☐ Pounding ☐ Falling Hazards from Taller Adjacent Building

Irregularities: ☐ Vertical (type/severity) _____ ☐ Plan (type) _____

Exterior Falling Hazards: ☐ Unbraced Chimneys ☐ Heavy Cladding or Heavy Veneer ☐ Parapets ☐ Appendages ☐ Other: _____

COMMENTS:

SKETCH

☐ Additional sketches or comments on separate page

BASIC SCORE, MODIFIERS, AND FINAL LEVEL 1 SCORE, S_{L1}

FEMA BUILDING TYPE (Do Not Know)	W1	W1A	W2	S1 (MRF)	S2 (BR)	S3 (LM)	S4 (RC SW)	S5 (URM INF)	C1 (MRF)	C2 (SW)	C3 (URM INF)	PC1 (TU)	PC2	RM1 (FD)	RM2 (RD)	URM	MH
Basic Score	3.6	3.2	2.9	2.1	2.0	2.6	2.0	1.7	1.5	2.0	1.2	1.6	1.4	1.7	1.7	1.0	1.5
Severe Vertical Irregularity, V_{L1}	-1.2	-1.2	-1.2	-1.0	-1.0	-1.1	-1.0	-0.8	-0.9	-1.0	-0.7	-1.0	-0.9	-0.9	-0.9	-0.7	NA
Moderate Vertical Irregularity, V_{L1}	-0.7	-0.7	-0.7	-0.6	-0.6	-0.7	-0.6	-0.5	-0.5	-0.6	-0.4	-0.6	-0.5	-0.5	-0.5	-0.4	NA
Plan Irregularity, P_{L1}	-1.1	-1.0	-1.0	-0.8	-0.7	-0.9	-0.7	-0.6	-0.6	-0.8	-0.5	-0.7	-0.6	-0.7	-0.7	-0.4	NA
Pre-Code	-1.1	-1.0	-0.9	-0.6	-0.6	-0.8	-0.6	-0.2	-0.4	-0.7	-0.1	-0.5	-0.3	-0.5	-0.5	0.0	-0.1
Post-Benchmark	1.6	1.9	2.2	1.4	1.4	1.1	1.9	NA	1.9	2.1	NA	2.0	2.4	2.1	2.1	NA	1.2
Soil Type A or B	0.1	0.3	0.5	0.4	0.6	0.1	0.6	0.5	0.4	0.5	0.3	0.6	0.4	0.5	0.5	0.3	0.3
Soil Type E (1-3 stories)	0.2	0.2	0.1	-0.2	-0.4	0.2	-0.1	-0.4	0.0	0.0	-0.2	-0.3	-0.1	-0.1	-0.1	-0.2	-0.4
Soil Type E (> 3 stories)	-0.3	-0.6	-0.9	-0.6	-0.6	NA	-0.6	-0.4	-0.5	-0.7	-0.3	NA	-0.4	-0.5	-0.6	-0.2	NA
Minimum Score, S_{MIN}	*1.1*	*0.9*	*0.7*	*0.5*	*0.5*	*0.6*	*0.5*	*0.5*	*0.3*	*0.3*	*0.3*	*0.2*	*0.2*	*0.3*	*0.3*	*0.2*	*1.0*

FINAL LEVEL 1 SCORE, $S_{L1} \geq S_{MIN}$:

EXTENT OF REVIEW
Exterior: ☐ Partial ☐ All Sides ☐ Aerial
Interior: ☐ None ☐ Visible ☐ Entered
Drawings Reviewed: ☐ Yes ☐ No
Soil Type Source: _____
Geologic Hazards Source: _____
Contact Person: _____

LEVEL 2 SCREENING PERFORMED?
☐ Yes, Final Level 2 Score, S_{L2} _____ ☐ No
Nonstructural hazards? ☐ Yes ☐ No

OTHER HAZARDS
Are There Hazards That Trigger A Detailed Structural Evaluation?
☐ Pounding potential (unless S_{L2} > cut-off, if known)
☐ Falling hazards from taller adjacent building
☐ Geologic hazards or Soil Type F
☐ Significant damage/deterioration to the structural system

ACTION REQUIRED
Detailed Structural Evaluation Required?
☐ Yes, unknown FEMA building type or other building
☐ Yes, score less than cut-off
☐ Yes, other hazards present
☐ No

Detailed Nonstructural Evaluation Recommended? *(check one)*
☐ Yes, nonstructural hazards identified that should be evaluated
☐ No, nonstructural hazards exist that may require mitigation, but a detailed evaluation is not necessary
☐ No, no nonstructural hazards identified ☐ DNK

Where information cannot be verified, screener shall note the following: EST = Estimated or unreliable data OR DNK = Do Not Know

Legend: MRF = Moment-resisting frame; BR = Braced frame; RC = Reinforced concrete; SW = Shear wall; URM INF = Unreinforced masonry infill; TU = Tilt up; MH = Manufactured Housing; LM = Light metal; FD = Flexible diaphragm; RD = Rigid diaphragm

Figure 1. RVS Level 1 Data Collection Form for High seismicity region

Rapid Visual Screening of Buildings for Potential Seismic Hazards — **Level 2 (Optional) HIGH Seismicity**

FEMA P-154 Data Collection Form

Optional Level 2 data collection to be performed by a civil or structural engineering professional, architect, or graduate student with background in seismic evaluation or design of buildings.

Bldg Name:	**Final Level 1 Score:**	S_{L1} =	*(do not consider S_{MIN})*
Screener:	**Level 1 Irregularity Modifiers:**	*Vertical Irregularity, V_{L1} =*	*Plan Irregularity, P_{L1} =*
Date/Time:	**ADJUSTED BASELINE SCORE:**	$S' = (S_{L1} - V_{L1} - P_{L1})$ =	

STRUCTURAL MODIFIERS TO ADD TO ADJUSTED BASELINE SCORE

Topic	Statement *(If statement is true, circle the "Yes" modifier; otherwise cross out the modifier.)*		Yes	Subtotals
Vertical Irregularity, V_{L2}	Sloping Site	W1 building: There is at least a full story grade change from one side of the building to the other.	-1.2	
		Non-W1 building: There is at least a full story grade change from one side of the building to the other.	-0.3	
	Weak and/or Soft Story *(circle one maximum)*	W1 building cripple wall: An unbraced cripple wall is visible in the crawl space.	-0.6	
		W1 house over garage: Underneath an occupied story, there is a garage opening without a steel moment frame, and there is less than 8' of wall on the same line (for multiple occupied floors above, use 16' of wall minimum).	-1.2	
		W1A building open front: There are openings at the ground story (such as for parking) over at least 50% of the length of the building.	-1.2	
		Non-W1 building: Length of lateral system at any story is less than 50% of that at story above or height of any story is more than 2.0 times the height of the story above.	-0.9	
		Non-W1 building: Length of lateral system at any story is between 50% and 75% of that at story above or height of any story is between 1.3 and 2.0 times the height of the story above.	-0.5	
	Setback	Vertical elements of the lateral system at an upper story are outboard of those at the story below causing the diaphragm to cantilever at the offset.	-1.0	
		Vertical elements of the lateral system at upper stories are inboard of those at lower stories.	-0.5	
		There is an in-plane offset of the lateral elements that is greater than the length of the elements.	-0.3	
	Short Column/ Pier	C1,C2,C3,PC1,PC2,RM1,RM2: At least 20% of columns (or piers) along a column line in the lateral system have height/depth ratios less than 50% of the nominal height/depth ratio at that level.	-0.5	
		C1,C2,C3,PC1,PC2,RM1,RM2: The column depth (or pier width) is less than one half of the depth of the spandrel, or there are infill walls or adjacent floors that shorten the column.	-0.5	
	Split Level	There is a split level at one of the floor levels or at the roof.	-0.5	
	Other Irregularity	There is another observable severe vertical irregularity that obviously affects the building's seismic performance.	-1.0	V_{L2} = _____
		There is another observable moderate vertical irregularity that may affect the building's seismic performance.	-0.5	*(Cap at -1.2)*
Plan Irregularity, P_{L2}	Torsional irregularity: Lateral system does not appear relatively well distributed in plan in either or both directions. *(Do not include the W1A open front irregularity listed above.)*		-0.7	
	Non-parallel system: There are one or more major vertical elements of the lateral system that are not orthogonal to each other.		-0.4	
	Reentrant corner: Both projections from an interior corner exceed 25% of the overall plan dimension in that direction.		-0.4	
	Diaphragm opening: There is an opening in the diaphragm with a width over 50% of the total diaphragm width at that level.		-0.2	
	C1, C2 building out-of-plane offset: The exterior beams do not align with the columns in plan.		-0.4	P_{L2} = _____
	Other irregularity: There is another observable plan irregularity that obviously affects the building's seismic performance.		-0.7	*(Cap at -1.1)*
Redundancy	The building has at least two bays of lateral elements on each side of the building in each direction.		+0.3	
Pounding	Building is separated from an adjacent structure by less than 1% of the height of the shorter of the building and adjacent structure and:	The floors do not align vertically within 2 feet.	-1.0	
		One building is 2 or more stories taller than the other.	-1.0	
		The building is at the end of the block.	-0.5	
		(Cap total pounding modifiers at -1.2)		
S2 Building	"K" bracing geometry is visible.		-1.0	
C1 Building	Flat plate serves as the beam in the moment frame.		-0.4	
PC1/RM1 Bldg	There are roof-to-wall ties that are visible or known from drawings that do not rely on cross-grain bending. *(Do not combine with post-benchmark or retrofit modifier.)*		+0.3	
PC1/RM1 Bldg	The building has closely spaced, full height interior walls (rather than an interior space with few walls such as in a warehouse).		+0.3	
URM	Gable walls are present.		-0.4	
MH	There is a supplemental seismic bracing system provided between the carriage and the ground.		+1.2	
Retrofit	Comprehensive seismic retrofit is visible or known from drawings.		+1.4	M = _____
FINAL LEVEL 2 SCORE, $S_{L2} = (S' + V_{L2} + P_{L2} + M) \geq S_{MIN}$:				*(Transfer to Level 1 form)*

There is observable damage or deterioration or another condition that negatively affects the building's seismic performance: ☐ Yes ☐ No

If yes, describe the condition in the comment box below and indicate on the Level 1 form that detailed evaluation is required independent of the building's score.

OBSERVABLE NONSTRUCTURAL HAZARDS

Location	Statement *(Check "Yes" or "No")*	Yes	No	Comment
Exterior	There is an unbraced unreinforced masonry parapet or unbraced unreinforced masonry chimney.			
	There is heavy cladding or heavy veneer.			
	There is a heavy canopy over exit doors or pedestrian walkways that appears inadequately supported.			
	There is an unreinforced masonry appendage over exit doors or pedestrian walkways.			
	There is a sign posted on the building that indicates hazardous materials are present.			
	There is a taller adjacent building with an unanchored URM wall or unbraced URM parapet or chimney.			
	Other observed exterior nonstructural falling hazard:			
Interior	There are hollow clay tile or brick partitions at any stair or exit corridor.			
	Other observed interior nonstructural falling hazard:			

Estimated Nonstructural Seismic Performance *(Check appropriate box and transfer to Level 1 form conclusions)*

☐ Potential nonstructural hazards with significant threat to occupant life safety →Detailed Nonstructural Evaluation recommended

☐ Nonstructural hazards identified with significant threat to occupant life safety →But no Detailed Nonstructural Evaluation required

☐ Low or no nonstructural hazard threat to occupant life safety →No Detailed Nonstructural Evaluation required

Comments:

Figure 2. RVS Level 2 Optional Data Collection Form for High seismicity region.

Once the decision to conduct rapid visual screening for a community or group of buildings has been made, the screening effort can be expedited by pre-field planning, including the training of screeners, and careful overall management of the process.

Completion of the Data Collection Form in the field begins with identifying the primary structural seismic force-resisting system and structural materials of the building. Basic Scores for various building types are provided on the form, and the screener circles the appropriate one. The screener modifies the Basic Score by identifying and circling Score Modifiers. The Score Modifiers are related to observed performance attributes and are then added (or subtracted) to the Basic Score to arrive at a Final Score. A more detailed screening of the building can be documented by using the optional form presented on the second page of the Data Collection Form. This optional form allows the user to adjust the Final Score with additional Score Modifiers. Basic Scores, Score Modifiers, and Final Scores relate to the probability of building collapse, should a rare earthquake occur (that is, a ground shaking level equivalent to the Maximum Considered Earthquake (MCE) currently used in national design and evaluation standards for the evaluation of existing buildings). Final Scores typically range from 0 to 7, with higher scores corresponding to better expected seismic performance and a lower potential for collapse.

The scores are based on average expected ground shaking levels for the seismicity region and are intended to reflect the seismic design and construction practices for that region. In general, there are little or no seismic design requirements in Low seismicity regions, limited seismic design requirements in Moderate seismicity regions, and extensive seismic design requirements in Moderately High, High, and Very High seismicity regions. Consequently, a building in a high seismicity region will have generally been constructed with more seismic resistance than a similar building in a Low seismicity region. Seismic design and construction practices, however, vary regionally and are not necessarily uniform across regions of similar seismic risk. Western states and particularly California have historically imposed stricter seismic design requirements sooner than other places, in large part because of greater awareness among design professionals. Moderately High, High, and Very High seismicity regions in other areas may have no seismic design provisions or may have only just recently adopted and begun to enforce seismic design provisions. The methodology provides Score Modifiers to adjust scores to reflect buildings built before seismic provisions were implemented (known as “pre-code”) and after modern seismic provisions were required (known as the “benchmark” year). By identifying pre-code and benchmark years that accurately reflect the local design and construction practices, the RVS procedure can be implemented in any area.

In this edition (FEMA P-154), seismicity regions have been updated to consider risk-targeted Maximum Considered Earthquake (MCER) ground motions. These ground motions are described in more detail in FEMA P-155. Figure 3 provides a map of seismicity regions in the United States.

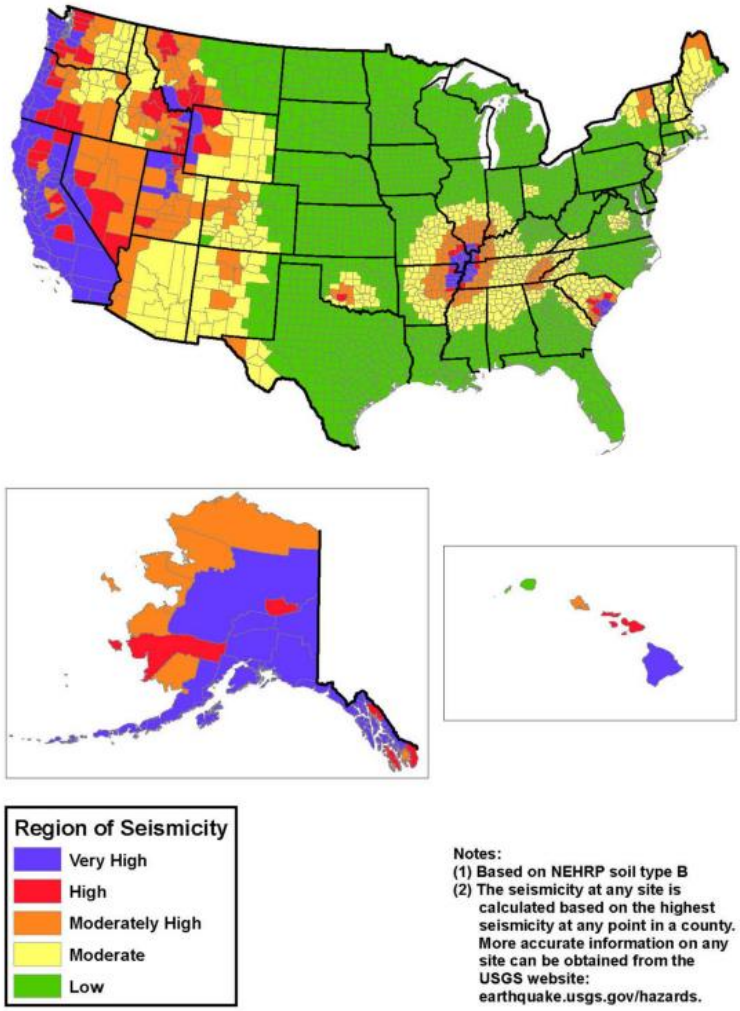


Figure 3.Map showing Very High, High, Moderately High, Moderate, and Low seismicity regions in the United States. A different RVS Data Collection Form has been developed for each of these regions.

The Data Collection Form used for rapid visual screening has now been extended with an optional second page, where the first page represents a Level 1 screening and the second page represents an optional Level 2 screening. The Level 2 screening is more detailed than the

Level 1 screening, and requires greater expertise to complete, but it is still rapid and visual. In both levels, the screener fills out the form and determines a score for the building. This score provides an indication of the expected seismic performance of the building. The Level 2 score can be higher than the Level 1 score (indicating less seismic risk), because Score Modifiers within the Level 1 screening score have more conservative values. In some instances, the Level 2 score can be lower than the Level 1 score, because the Level 2 screening evaluates some items in more detail and includes some items not covered by the Level 1 screening. For both levels, the screeners require training, and, for quality assurance purposes, the screening program must be overseen by a design professional knowledgeable in seismic design, evaluation, and risk assessment.

There are five versions of each form as shown in Appendix A, one each for regions of Low, Moderate, Moderately High, High, and Very High seismicity. The forms for Moderate, Moderately High, High, and Very High seismicity regions vary only in the values assigned to the Basic Scores and Score Modifiers and in the criteria used to assess pounding.

The entity that decides to conduct an RVS program may be a state legislature, city council, private company, school district, or other organization and is known as the "RVS Authority." Use of RVS on a community-wide basis enables the RVS Authority to divide screened buildings into two categories: those that are expected to have acceptable seismic performance, and those that may be seismically hazardous and should be studied further. A Final Score of 2 is suggested as a "cut-off," based on present seismic design criteria. Using this cut-off level, buildings with Final Score of 2 or less should be investigated by a design professional experienced in seismic design.

If a building receives a high score (i.e., above a specified cut-off score), the building is considered to have adequate seismic resistance to prevent collapse during a rare earthquake. The building score reflects probability of collapse or partial collapse only, and is not meant to be an indicator of the probability that the building will be usable following an earthquake. If a building receives a low score on the basis of this RVS procedure, it should be evaluated by a design professional experienced in seismic design. On the basis of a detailed inspection, engineering analyses, and other detailed procedures, a final determination of the seismic adequacy and the need for retrofit can be made.

Seismic Assessment of Existing Buildings Requires the following:

1) **Rapid Visual Screening** (Tier 1) (FEMA P-154) (Current Course)
2) **Detailed Evaluation Phase** (Tier 2) (ASCE41-13, FEMA P-807, FEMA P-58)

***Screening Phase (Tier 1) uses a Rapid Visual Screening (RVS) methodology, while the Tier 2 needs more detailed and sophisticated analysis*

Table 1 provides a simplified comparison of all the seismic evaluation methods with respect to the time required to perform the evaluation, the relative cost, and the qualifications needed to perform the evaluation.

Table 1. Comparison of Prominent Seismic Evaluation Methods in the United States

Seismic Evaluation Tools

Tiered Approach

For Evaluating Safety of Existing Buildings

For Forensic Engineering Purpose

Undamaged Buildings	FEMA P-154	ASCE 41-13 Tier 1	ASCE 41-13 Tier 2	ASCE 41-13 Tier 3 FEMA P-807 FEMA P-58
Earthquake-Damaged Buildings	ATC-20 Rapid	ATC-20 Detailed	FEMA 352 ATC-52-4	FEMA 306 ATC-52-4
Time Required	Minutes	Hours	Days	Weeks
Relative Cost	$	$$	$$$	$$$$
Qualifications	Trained building professionals	Structural engineers experienced in seismic evaluation and design		

The procedure presented in the FEMA P-154 Handbook is meant to be the preliminary screening phase of a multi-phase procedure for identifying potentially hazardous buildings. Buildings identified by this procedure as potentially hazardous should be analyzed in more detail by an experienced seismic design professional. The RVS method identifies building attributes that may contribute to poor seismic performance, and conservative assumptions have been made in developing the methodology. However, because rapid visual screening is designed to be performed from the sidewalk, with interior inspection not always possible, hazardous details will not always be visible, and seismically hazardous buildings may not be identified as such. Conversely, buildings initially identified as potentially hazardous by RVS may prove to be adequate.

The methodology presented here (FEMA P-154) can serve as an efficient step in assessing risk as part of a broader seismic risk-management program. Its cost is 15 to 75 minutes of inspection time for each building of interest, plus travel time between buildings, potentially several person-days of preparation time, and potentially several person-days to

compile results into decision-making information. Its benefits can be much greater, potentially eliminating the need for detailed seismic analysis of a large fraction of the buildings in question. Each such detailed evaluation that is avoided can save hours, days, or more of effort by an engineering professional.

2. Advantages and Limitations of the RVS Method

The RVS method described in FEMA P-154 has a number of advantages as well as limitations that need to be understood when developing and implementing a screening program, and when using the results.

2.1 Advantages of RVS

1) The primary advantages of the RVS method are speed and ability to use screeners who are not necessarily structural engineers.
2) As noted above, RVS has a unique niche in the spectrum of available seismic evaluation tools, as other tools require greater effort, expertise, and cost.
3) Because screening can be done quickly, large portfolios of buildings can be evaluated in a cost-effective manner
4) The method has also been used by many different people and jurisdictions throughout the United States for over 25 years. As a result, it has had a long track record of actual use and opportunities for scrutiny and improvement, including both the second and third edition updates of FEMA P-154.

2.2 Limitations of RVS

1) Limited review—often only from the exterior, typically without the benefit of drawing review, and without calculation—means the accuracy of the RVS method is anticipated to be less than that of more detailed, time-consuming, and expensive reviews.
2) Determining the seismic force-resisting system is integral to the method (and to any seismic evaluation). In some cases, the seismic force-resisting system cannot be identified by a rapid visual screening because the structure is covered by architectural finishes. A Detailed Structural Evaluation will be required to determine the building type.
3) An interior review is desirable, but not always possible given either the available time or access limitations. As such, interior hazards can be missed, and an understanding of the structural system and some of its deficiencies is necessarily limited.

4) The RVS method is applicable to conventional building types only. Bridges, large towers, and other non-building structure types, however, are not covered by this procedure.
5) In more detailed evaluation methods, drawings are reviewed and calculations are done, providing a more refined understanding of the individual building's structural characteristics. With drawing review, it may be possible to spot deficiencies known to be of concern that cannot be seen in a rapid visual screening. Seismic evaluation calculations determine the relationship between demands on members and their associated capacities and whether they are expected to have more desirable ductile behaviors or less desirable non-ductile behaviors. The RVS method does not include calculations, so assessments of seismic capacity are based on more general considerations related to building type, geometric irregularities, and site soil conditions.
6) Because large numbers of buildings are often screened and the level of expertise can vary widely, errors are inevitable. It is essential to have a thorough quality assurance program to minimize the extent of the errors. Given the large data collection effort and the potential flexibility in program goals, it is important to manage the program thoughtfully and with organizational skill to derive the most efficient use of personnel and to organize the collected information in the most useful way.

NOTE:The updated version of the FEMA P-154 Handbook (3rd Edition) provides advice to help minimize the limitations of the method so that the program can be as successful as possible.

3. Key Players in an RVS Program

Table 2 provides a description of the key players in an RVS program, including the roles and responsibilities of each, as well as the recommended qualification for each position.

Table 2. Key Players in an RVS Program

Entity	Description	Examples	Qualifications	Responsibilities
RVS Authority	Entity that has decided to conduct an RVS program and will use the results.	State legislature, city council, school district, private building owner.	Has authority to conduct an RVS program.	Sets the goals and objectives of the program and describes how the results will be used. Chooses the Program Manager and the Supervising Engineer. Approves the plan developed by the Program Manager.
Program Manager	Entity that will manage the RVS program on behalf of the RVS Authority.	Building department, qualified technical branch of government, outside consultant.	Knowledgeable about RVS. Capable of managing the project.	Defines the scope of the program and develops the budget. Oversees implementation of the screening program. Allocates screener resources to ensure efficient use of their time and minimize travel time. Program Manager likely has administrative staff to develop the record keeping system, conduct the pre-field data collection, and perform data entry.
Supervising Engineer	Individual who will provide the technical expertise necessary to run the RVS program.	Structural engineer (may be the Program Manager).	Structural engineer with a background in seismic evaluation and risk assessments. Understands RVS methodology and its technical basis as described in FEMA P-155.	Selects and modifies the Data Collection Form. Determines the key seismic code adoption dates and benchmark years. Determines cut-off score (with RVS Authority and Program Manager). May train the screeners. Available for screeners to consult with during field screening. Reviews completed forms. Assists in interpreting the results of the program.
Level 1 Screener	Individual who will conduct Level 1 screenings of buildings.	Civil or structural engineer, architect, design professional, building official, construction contractor, facility manager, firefighter, architectural or engineering student, or another individual with a general familiarity or background in building design or construction.	Receives appropriate FEMA P-154 training.	Performs Level 1 field screening.
Level 2 Screener	Individual who will conduct both Level 1 and Level 2 screenings of buildings.	Civil or structural engineering professional, architect, or graduate student with background in seismic evaluation or design of buildings.	Receives appropriate FEMA P-154 training.	Performs Level 1 and Level 2 field screenings.

4. Planning and Implementing an RVS Program

There are several steps involved in planning a successful RVS program. As a first step, the RVS Authority should define the goals and objectives of the RVS program and describe

how the RVS results will be used. The RVS Authority should then select a Program Manager to manage the program and a Supervising Engineer to provide the technical expertise necessary to conduct an RVS program. Next, the Program Manager, in consultation with the Supervising Engineer, should define the scope of the project. Defining the scope is done in conjunction with and concurrent to developing the project budget. Scope issues, such as deciding how many buildings will be screened, screener resources and experience, and whether Level 2 screenings will be performed, have a direct impact on the budget. Coordination is required to bring the project scope and the budget in line with one another.

Once the project scope and the project budget have been defined by the Program Manager and approved by the RVS Authority, implementation of the RVS program continues with additional Pre-Field Activities, such as the following:

- Pre-field planning, including selection and development of a recordkeeping system, and development of maps that document local seismic hazard information.
- Selection of the Data Collection Form based on the seismic hazard and review and modification of the Data Collection Form for the individual needs of the RVS program.
- Selection and training of screening personnel.
- Acquisition and review of pre-field data, including review of available building files and databases to collect existing information on the buildings to be screened (e.g., address, lot number, number of stories, design date) and identifying soil types for the survey area.
- Review of existing building plans, if available.

Following the completion of these pre-field activities, field screening of individual buildings is performed. The RVS program concludes after the screening data are checked for quality and the screening results are filed in the record-keeping system or database. The RVS Authority can then use the RVS results for decision making.

The general sequence of implementing the RVS procedure is depicted in Figure 4.

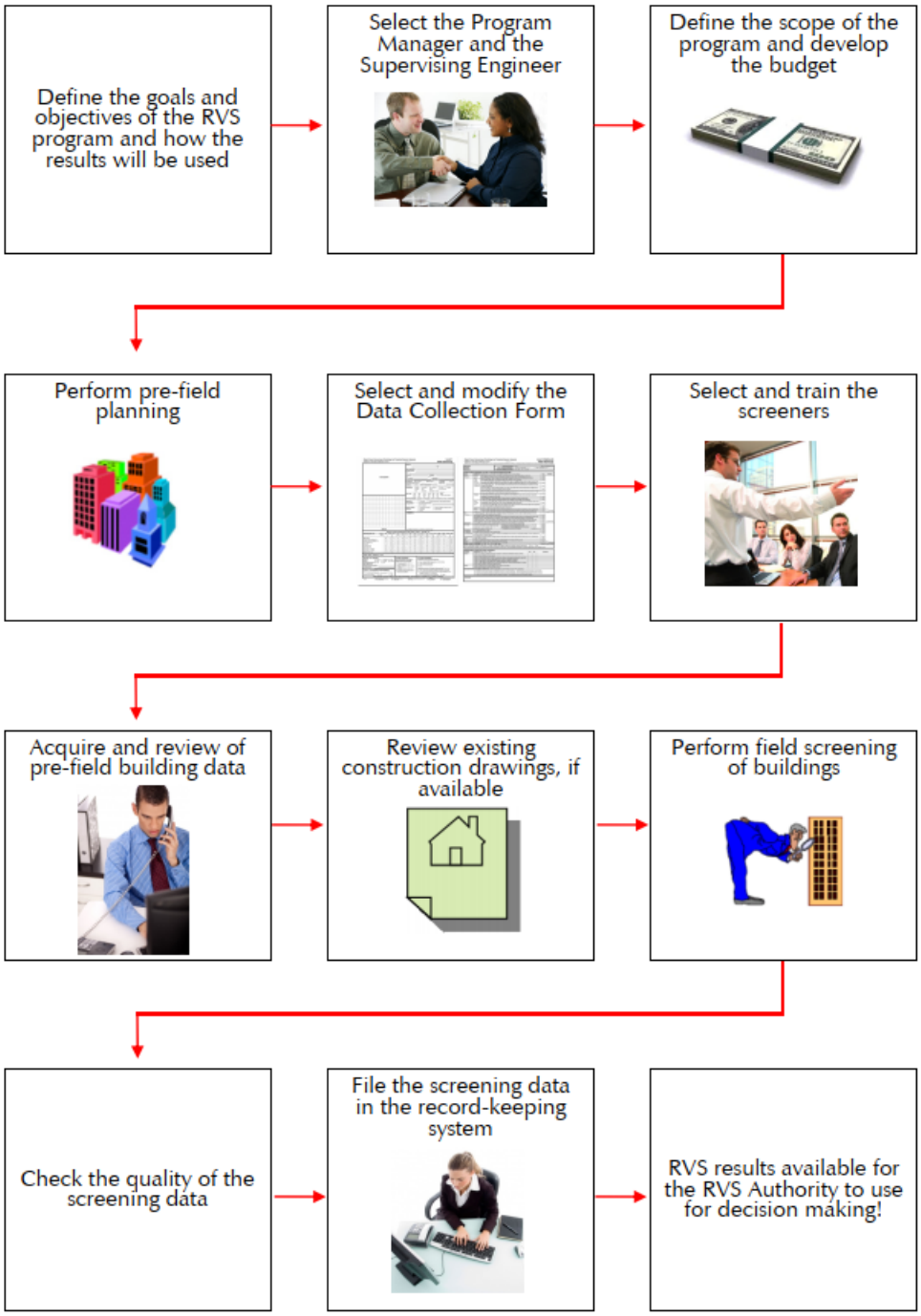


Figure 4. Rapid visual screening implementation sequence

5. Selecting the RVS Program Manager and the Supervising Engineer

The RVS Authority determines who will manage the RVS program. The Program Manager is responsible for defining the program scope, developing the program budget, and overseeing implementation of the screening program. The Program Manager must be knowledgeable about RVS and capable of managing the project. Whether the RVS Authority decides to manage the program itself or whether it decides to hire an outside consultant will depend on the capabilities of the RVS Authority, as well as the size and complexity of the program. If the RVS Authority is a building department, for example, it may be possible for individuals within the department to manage the program. If the RVS Authority is a state legislature, on the other hand, it will be desirable to hire a consultant to manage the program or assign the task to a qualified technical branch of government.

A Supervising Engineer is also required to run a successful RVS program. The Supervising Engineer should be a local practicing structural engineer with a background in seismic evaluation and risk assessments. The Supervising Engineer should ideally also have experience with the FEMA RVS methodology. If the Supervising Engineer is not knowledgeable about the technical basis of FEMA P-154, he or she should become so by reviewing both FEMA P-154 and FEMA P-155.

In addition to overall quality assurance, the Supervising Engineer has the following responsibilities:

- Selecting and modifying the Data Collection Form.
- Determining key seismic code adoption dates for the area being screened.
- Determining benchmark years for the area being screened.
- Determining the cut-off score to be used in concert with the RVS Authority and Program Manager.
- Training the screeners (alternatively, training courses may be available through FEMA).
- Being available for the screeners to consult with during the field screenings.
- Reviewing the completed forms.
- Providing assistance in interpreting the results of the RVS screening.

If the Program Manager is an experienced structural engineer, he or she can perform the role of Supervising Engineer.

5.1 Deciding Which Buildings to Screen

The RVS Program Manager may decide that because of budget, time, or other constraints, priorities should be set and certain areas within the region should be surveyed immediately, whereas other areas can be surveyed at a later time because they are assumed to be less hazardous. An area may be selected because it contains an older building stock and may have a higher density of potentially seismically hazardous buildings relative to other areas. For example, an area with older buildings within the RVS Authority region that consists mainly of unreinforced masonry buildings may be of higher priority than a newer area with mostly warehouse facilities, or a residential section of a city consisting of wood frame single-family dwellings.

The Program Manager may also decide that only buildings with certain attributes, such as a particular building type or occupancy, will be screened. For example, it may be decided to screen only school buildings.

5.2 Determining Screeners

Potential RVS screeners for Level 1 range from individuals with a general familiarity or background in building design or construction to experienced engineers and architects. Engineers and architects are likely to be more costly on an hourly basis than nonprofessionals, but this cost may be offset by the efficiency of the screener in the field, and the increased accuracy of the screenings, which in turn reduces the Supervising Engineer's effort. Of course, if the decision has been made to perform Level 1 and Level 2 screenings of all buildings at the same time, then all the screeners must be engineers or other qualified professionals.

Level 1 screeners should be generally familiar with the design and construction of buildings. This could include knowledge or hands-on experience with the structural elements of a building or historical interest in building materials or construction practices. All Level 1 and Level 2 screeners should receive the appropriate amount of FEMA P-154 training to help ensure competency.

6. Instructions of Filling Data Collection Form level I

1) Selection of the Data Collection Form

There are five Data Collection Forms, one for each of the following five regions of seismicity: Low, Moderate, Moderately High, High, and Very High. Each Data Collection Form has a Level 1 page and an optional Level 2 page. Full-sized versions of each form are provided in Appendix A.

Determination of Seismicity Region

To select the appropriate Data Collection Form, it is first necessary to determine the seismicity of the region that is to be screened as mentioned at the right top corner of Level 1 form as shown in the below image.

Rapid Visual Screening of Buildings for Potential Seismic Hazards **LEVEL 1**

(Adopted from FEMA P-154 Data Collection Form) **MODERATE Seismicity**

If the RVS program covers a large geographic area, different seismicity regions may apply for different building sites. The seismicity region can be determined by finding the county covering the surveyed region on the seismicity maps provided in Fig. 3, and identify the corresponding seismicity region. Each county shown in the Fig. 3 maps is assigned its seismicity designation on the basis of the highest seismicity in that county, even though it may only apply to a small portion of the county.

Table 3 can then be used to select the appropriate seismicity region, assuming that the highest seismicity level defined by the parameters in Table 3 shall govern.

Table 3. Seismicity Region Determination from MCER Spectral Acceleration Response (ASCE/SEI 41-13)

Seismicity Region		Spectral Acceleration Response, S_S (short-period, or 0.2 seconds)	Spectral Acceleration Response, S_1 (long-period, or 1.0 second)
	Low	less than 0.250g	less than 0.100g
	Moderate	greater than or equal to 0.250g but less than 0.500g	greater than or equal to 0.100g but less than 0.200g
	Moderately High	greater than or equal to 0.500g but less than 1.000g	greater than or equal to 0.200g but less than 0.400g
	High	greater than or equal to 1.000g but less than 1.500g	greater than or equal to 0.400g but less than 0.600g
	Very High	greater than or equal to 1.500g	greater than or equal to 0.600g

Notes: g = acceleration of gravity in horizontal direction

2) Building Identification

LEVEL 1

MODERATE Seismicity

Address:	.....	**City:**	.....
Other ID:	.....	**Use:**	.....
Building Name:	.....		
Latitude:	.....	**S_s:**	.....
Longitude:	.....	**S_1:**	.....
Screener:	.....	**Date/Time:**	.....

Notes:

Latitude and Longitude and Site Seismicity

S_s: Spectral Acceleration Response (Short Period) or 0.2 Sec.

S_1: Spectral Acceleration Response (long Period) or 1 Sec.

3) Building Information

#Stories - Above Ground:	Below Ground:	**Year Built:**	☐ Est	
Total Floor Area (sft):		**Code Year:**		
Additions:	☐ None	☐ Yes, Years Built:.....		
Occupancy:	☐ Assembly	☐ Commercial	☐ Emergency Services	☐ Historic
	☐ Industrial	☐ Office	☐ Schools	☐ Government
	☐ Utility	☐ Warehouse	☐ Residential,#Units:	☐ Shelter
Soil Type:	☐ A: Hard Rock	☐ C: Soft Rock		☐ E: Soft Soil
	☐ B: Normal Rock	☐ D: Hard Soil / DNK		☐ F: Poor Soil
Geohazards:	Liquefaction:	☐ Yes, ☐ No, ☐ DNK		
	Landslide:	☐ Yes, ☐ No, ☐ DNK		
	Surface Rupture:	☐ Yes, ☐ No, ☐ DNK		
Adjacency:	☐ Pounding	☐ Falling Hazards from Taller Adjacent Building		
Irregularities:	☐ Severe Vertical Irregularity	☐ Plan Irregularity		
	☐ Moderate Vertical Irregularity			
Exterior Falling Hazards:	☐ Unbraced Chimneys	☐ Heavy Cladding or Heavy Veneer		
	☐ Parapets	☐ Appendages		
	☐ Other:			

#Stories - Above Ground: Mention the number of floors above the natural ground level. The number of stories is a good measure for the height of the building.

 # Stories - Below Ground: Mention the number of floors below the natural ground level.

#Year Built: Mention the year in which the building was completed. If the "year built" cannot be available in some cases. At this case, the screeners can make estimation of building's year built by looking at the architectural and built styles from the street. If the screener fills that year built by approximation basic, check the EST box beside so that the data can be known as estimated.

 # Total Floor Area (sqft): Mention the total floor area of the building in square feet unit. If the building is multis*toried*, total floor area can be estimated by multiplying floor area of one story by the number of floors. The purpose of this data is to estimate the building cost or value and to estimate the occupancy load. If the building total floor area is on approximate basic, please put "EST" behind the data.

#Code Year: Describe the year of the building code that was used to design the building. "Code Year" can be checked on the drawings of the building. Some buildings may be constructed without following any Building Code or may be constructed before the Building Code was adopted. If the "Building Code" is not known, leave it blank.

#Additions: This information is related to the separate portions of the main building. Some extra or extended buildings are constructed attached to the main building. Extended building may be constructed as independent structures with separate joints or may be integrally attached to the main building. If additional buildings are present, the "YES" box should be checked and the built year for that additional building should be enumerated. If the year the addition was on the estimate basic, "EST" should be added beside the year data

4) Occupancy

Occupancy:	☐ Assembly	☐ Commercial	☐ Emergency Services	☐ Historic
	☐ Industrial	☐ Office	☐ Schools	☐ Government
	☐ Utility	☐ Warehouse	☐ Residential,#Units:	☐ Shelter

Check the relevant use or occupancy of the building. In RVS Form, there are 9 general occupancy classes and 3 occupancy designations, Table (4). These occupancy types can be correlated with the "Use" of the building. For example, the restaurant building is surveyed, screener may fill the "Use" as "Restaurant" and he or she can choose the "Occupancy" as "Commercial". If the building doesn't not fall on these mentioned occupancy classes, detailed explanations should be included in the "Comments" section. For occupancy designation, screener can check the relevant block; Historic, Government, or Shelter. Some school occupancies are used as an emergency, the screener will circle "School" and check the "Shelters" box.

Table 4. Occupancy Classes and Occupancy Designations

Occupancy Classes	
Assembly	Public assembly where 300 or more people gather. Examples include theaters, auditoriums, community centers, performance halls, and churches.
Commercial	Retail and wholesale businesses, financial institutions, restaurants, parking structure, and light warehouses.
Emergency Services	Critical facilities including police, fire stations, hospitals, and communication centers.
Industrial	Large facilities including factories, assembly plants, and heavy manufacturing facilities.
Office	Typical office buildings that house clerical and management functions.
Residential	Houses, townhouses, dormitories, motels, hotels, apartments and condominiums, and residences for the aged or disabled.
School	All public and private educational facilities from nursery school to university level.
Warehouse	Large warehouses used for product and commercial warehouses. (In FEMA - 154 Second Edition "Industrial" class included large warehouses).
Utility	Water, wastewater, power, gas, and electric facilities. (Captured as "Industrial" class facilities in FEMA - 154 Second Edition).
Occupancy Designations	
Government	Local, state, and federal non-emergency related buildings.
Historic	Many variations from community to community.
Shelter	Designated shelters or buildings specifically identified as shelters for post-event occupancy ("Emergency Services")

5) Soil Type

Soil Type:	☐ A: Hard Rock	☐ C: Soft Rock	☐ E: Soft Soil
	☐ B: Normal Rock	☐ D: Hard Soil / DNK	☐ F: Poor Soil

The soil type should be identified and documented on the Data Collection Form (see Figure above) during pre-field planning. If the soil type has not been determined as part of that process, it needs to be identified by the screener during the building site visit. If there is no basis for classifying the soil type, "DNK" should be selected and Soil Type D should be assumed.

Table 5. Soil Type Definitions (ASCE/SEI 7-10)

Soil Type/Site Class	Shear Wave Velocity[1], V_S^{30}	Standard Blow Count[1], N	Undrained Shear Strength of the upper 100ft[1], s_u
A. Hard Rock	$V_S^{30} > 5000$ ft/s		
B. Rock	2500 ft/s $< V_S^{30} <$ 5000 ft/s		
C. Very Dense Soil and Soft Rock	1200 ft/s $< V_S^{30} <$ 2500 ft/s	$N > 50$	$s_u > 2000$ psf
D. Stiff Soil	600 ft/s $< V_S^{30} <$ 1200 ft/s	$15 < N < 50$	1000psf $< s_u <$ 2000 psf
E. Soft Clay Soil	$V_S^{30} \leq$ 600 ft/s	$N < 15$	$s_u <$ 1000 psf
	More than 10 feet of soft soil with plasticity index $PI > 20$, water content $w > 40\%$, and $s_u < 500$ psf		
F. Poor Soil	Soils requiring site-specific evaluations. • Soils vulnerable to potential failure or collapse under seismic loading, such as liquefiable soils, quick and highly-sensitive clays, collapsible weakly-cemented soils. • Thicker than 10 feet of peat or highly organic clay. • Very high plasticity clays (25 feet with $PI > 75$). • More than 120 ft of soft or medium stiff clays.		

[1] Average values.

6) Geohazards

Geohazards:	Liquefaction:	☐ Yes, ☐ No, ☐ DNK
	Landslide:	☐ Yes, ☐ No, ☐ DNK
	Surface Rupture:	☐ Yes, ☐ No, ☐ DNK

NOTE: If the height of the slope is greater than the distance from the nearest side of the building to the slope, a ***potential landslide hazard*** block should be ***checked*** on the Data Collection Form. Refer to figure below for landslide hazard potential.

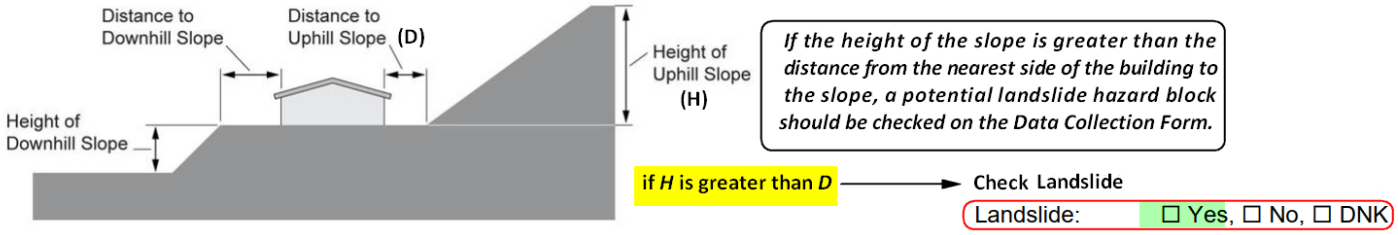


Figure 5. Building with Potential Landslide Hazard (FEMA 154)

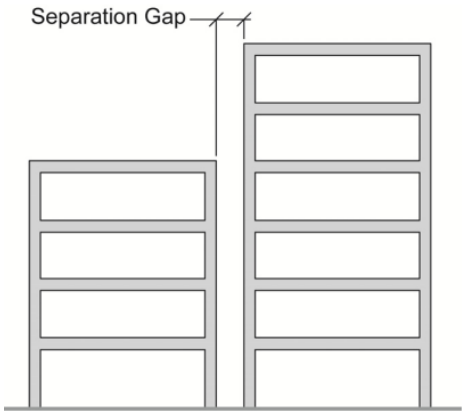
7) Adjacency

Adjacency:	☐ Pounding	☐ Falling Hazards from Taller Adjacent Building

Pounding is checked when TWO issues are happening together and they are:

1. **When the separation between adjacent buildings is less than:**
   - 2" times number of stories in shorter building (in Very High seismicity region)
   - 1 ½ "times number of stories in shorter building (in High seismicity region)
   - 1" times number of stories in shorter building (in Moderately High seismicity region)
   - ½ "times number of stories in shorter building (in Moderate and Low seismicity region)

Refer to the Figure 6 for Pounding Calculation and Consideration example



Examples:

a) Two 2-story buildings next to each other in High seismicity region: Minimum Separation = 1 1/2″ x 2 = 3″

b) 6-story building next to a 4-story building in Moderate seismicity region: Minimum Separation = 1/2″ x 4 = 2″

Figure 6.Separation Gap Calculation Examples (FEMA 154)

AND

2. One or more of the following conditions apply:

a) Floors are separated vertically by more than two feet, as shown in Figure 7. Damage and potential collapse are considered to be more likely when the floor mass of one building can directly impact the columns or walls of the adjacent building.

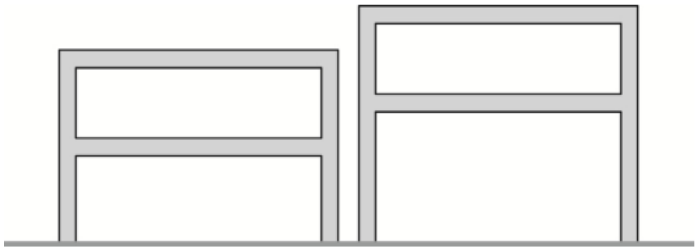


Figure 7. Schematic illustration of floors not aligning vertically.

b) One building is two or more stories taller than the adjacent building, as illustrated in Figure 8. Damage may concentrate in the taller building at the roof level of the shorter building.

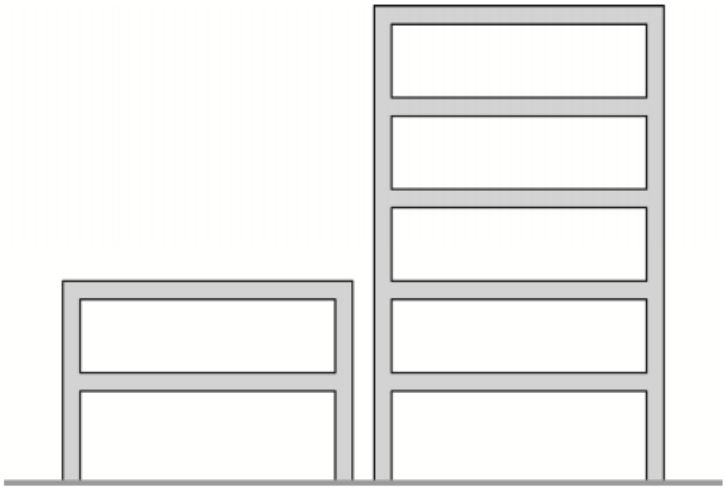


Figure 8. Schematic illustration of buildings of different height

c) The building is at the end of a row of three or more buildings, as illustrated in Figure 9. Higher demands are imposed on the end building when the adjacent building moves toward it and because it does not have a building on the other side to balance the loads. Higher levels of damage have been observed at end buildings in past earthquakes.

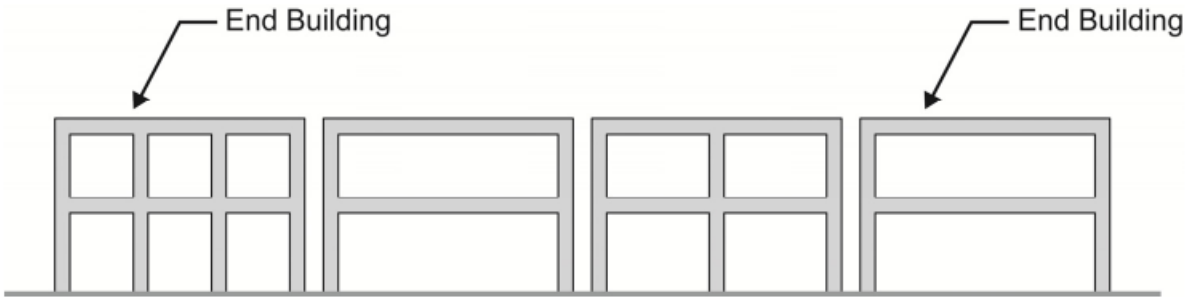
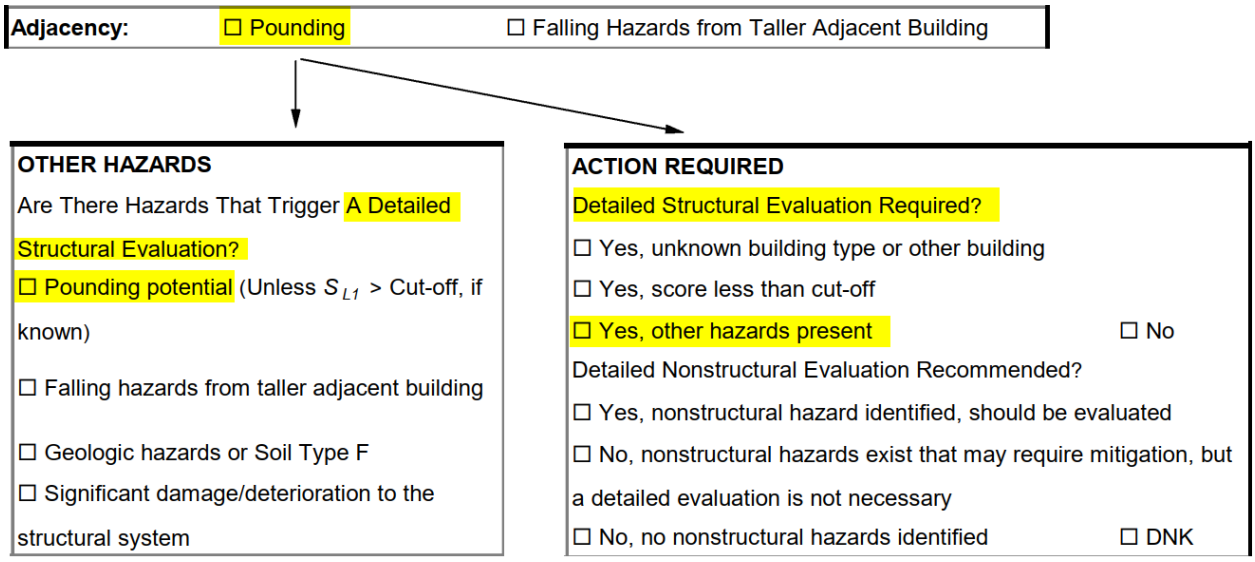
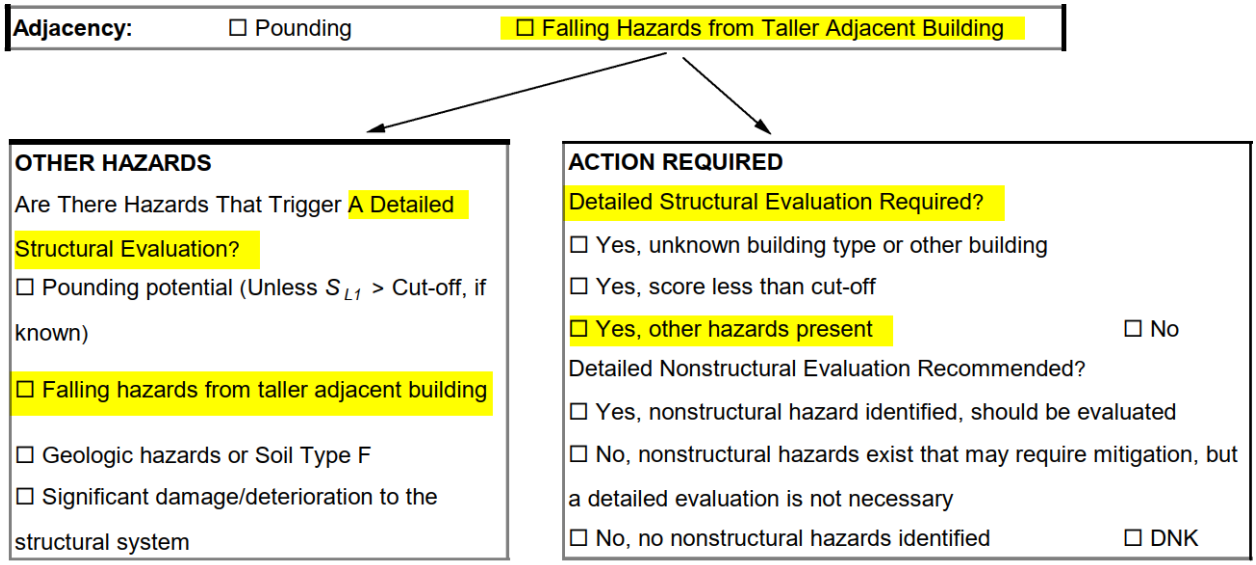


Figure 9. Schematic illustration of end buildings.

If the building meets any of the three criteria above plus item 1, the screener checks the "Pounding" box and a Detailed Structural Evaluation is triggered in the "Other Hazards" and "Action Required" fields at the bottom of the Level 1 form.



Similarly, if falling hazards from an adjacent building are identified, the screener checks the "Falling Hazards" box and a Detailed Structural Evaluation is triggered in the "Other Hazards" and "Action Required" fields at the bottom of the Level 1 form.



8) Irregularities

Irregularities:	☐ Severe Vertical Irregularity	☐ Plan Irregularity
	☐ Moderate Vertical Irregularity	

Irregularities: Check the relevant block of "Severe Vertical Irregularities", "Moderate Vertical Irregularities" and "Plan Irregularities". See the tables below for detailed explanations of each irregularity case, Table 6 and Table 7.

Table 6. Vertical Irregularity Reference Guide (FEMA 154)

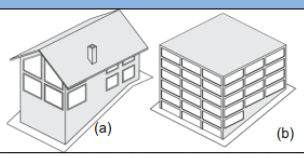
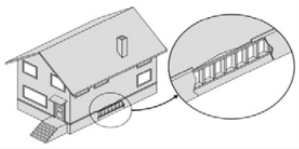
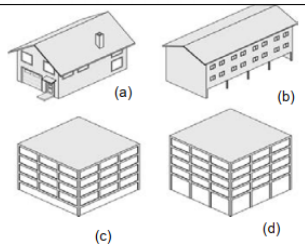
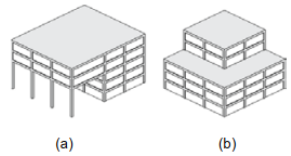
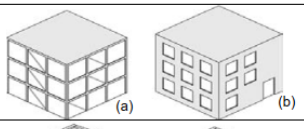
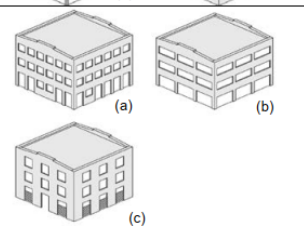
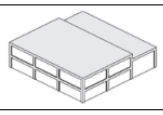
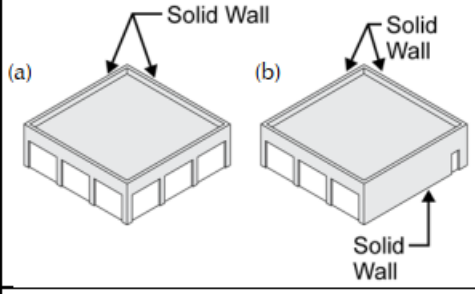
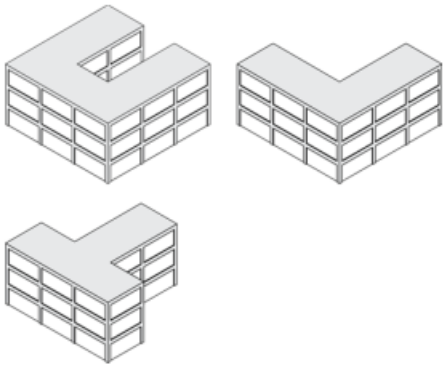
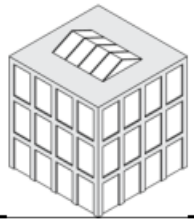
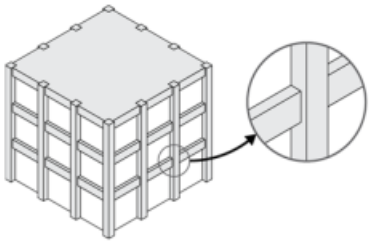
Vertical Irregularity		Severity	Level 1 Instructions
Sloping Site		Varies	Apply if there is more than a one-story slope from one side of the building to the other. Evaluate as Severe for W1 buildings as shown in Figure (a); evaluate as Moderate for all other building types as shown in Figure (b).
Unbraced Cripple Wall		Moderate	Apply if unbraced cripple walls are observed in the crawlspace of the building. This applies to W1 buildings. If the basement is occupied, consider this condition as a soft story.
Weak and/ or Soft Story		Severe	Apply: Figure (a): For a W1 house with occupied space over a garage with limited or short wall lengths on both sides of the garage opening. Figure (b): For a W1A building with an open front at the ground story (such as for parking). Figure (c): When one of the stories has less wall or fewer columns than the others (usually the bottom story). Figure (d): When one of the stories is taller than the others (usually the bottom story).
Out-of plane Setback		Severe	Apply if the walls of the building do not stack vertically in plan. This irregularity is most severe when the vertical elements of the lateral system at the upper levels are outboard of those at the lower levels as shown in Figure (a). The condition in Figure (b) also triggers this irregularity. If non stacking walls are known to be nonstructural, this irregularity does not apply. Apply the setback if greater than or equal to 2 feet.
In-plane Setback		Moderate	Apply if there is an in-plane offset of the lateral system. Usually, this is observable in braced frame (Figure (a)) and shear wall buildings (Figure (b)).
Short Column/ Pier		Severe	Apply if: Figure (a): Some columns/ piers are much shorter than the typical columns/ piers in the same line. Figure (b): The columns/ piers are narrow compared to the depth of the beams. Figure (c): There are infill walls that shorten the clear height of the column. Note this deficiency is typically seen in older concrete and steel building types.
Split Levels		Moderate	Apply if the floors of the building do not align or if there is a step in the roof level.

Table 7. Plan Irregularity Reference Guide (FEMA 154)

Plan Irregularity		Level 1 Instructions
Torsion		Apply if there is good lateral resistance in one direction, but not the other, or if there is eccentric stiffness in plan (as shown in Figures (a) and (b); solid walls on two or three sides with walls with lots of openings on the remaining sides).
Non-Parallel Systems		Apply if the sides of the building do not form 90-degree angles.
Reentrant Corner		Apply if there is a reentrant corner, i.e., the building is L, U, T, or + shaped, with projections of more than 20 feet. Where possible, check to see if there are seismic separations where the wings meet. If so, evaluate for pounding.
Diaphragm Openings		Apply if there is a opening that has a width of over 50% of the width of the diaphragm at any level.
Beams do not align with columns		Apply if the exterior beams do not align with the columns in plan. Typically, this applies to concrete buildings, where the perimeter columns are outboard of the perimeter beams.

9) Exterior Falling Hazards

Exterior Falling Hazards:	☐ Unbraced Chimneys	☐ Heavy Cladding or Heavy Veneer
	☐ Parapets	☐ Appendages
	☐ Other:	

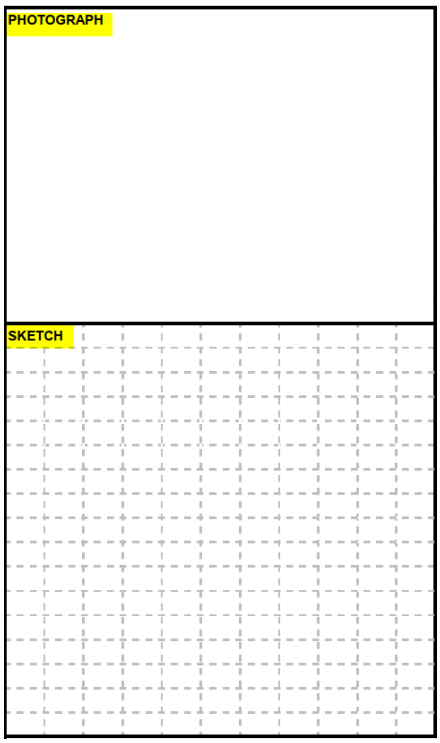
Exterior Falling Hazards: Check the relevant exterior falling hazards in the form. "Un-braced chimneys" are common falling hazards for masonry and wood frame building as they are unreinforced and not adequately tied the main building**."** Parapets", "Heavy cladding or heavy veneer", and "appendages" or "canopies" or "architectural elements" are in the same problem with chimneys. If these are not properly anchored or properly unreinforced, the appropriate box should be checked. Detailed explanations can be put in the "Comments" section checking "Other" box in this part.

10) Comments

COMMENTS
☐ Additional sketches or comments on separate page

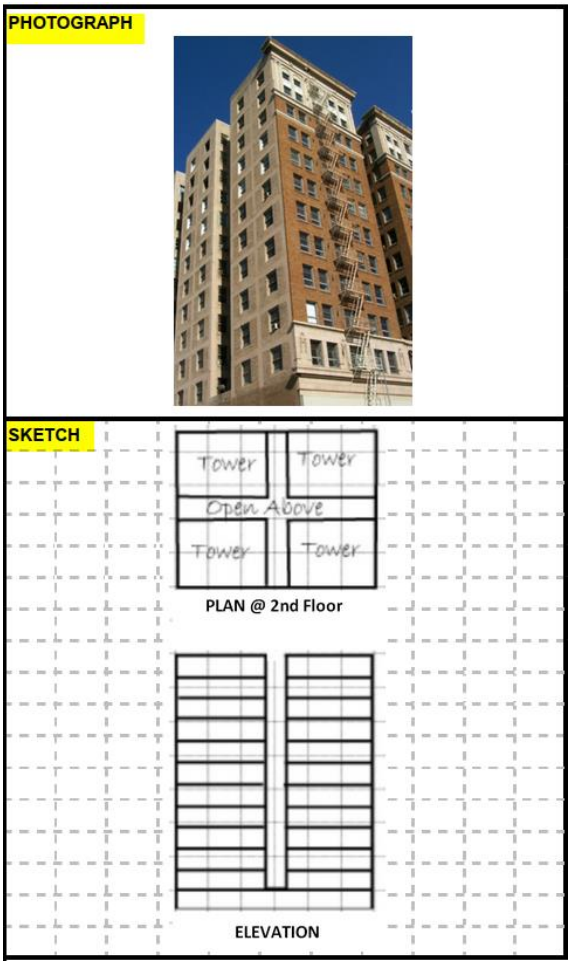
In "Comments" space, write down the detailed explanations of the building describing important structural features.

11) Photographs and Sketch Part



Photographs: There is the space on Level 1 Data Collection Form for attaching photos. Put the recorded photos of the building in that space. If possible, the screener should take the photos of the building targeting each side of the building and any important features such as observing adjacency, pounding, exterior falling hazards for the identification purposes. Screener can take one or more photos of the building, but have to sure that the other photos are also attached with the Form (either electronic format or hard copy format).

Sketch: Draw a sketch of the surveyed building in that area. The screener can draw a plan sketch or elevation sketch indicating the significant features of the building as per preferences. At least the screener should draw the plan of the building. More detailed information or important features can be recorded on the sketch. See to the following example.



12) Basic Score, Modifiers and Final Score

Table 8. Matrix of Basic scores and Score Modifiers

BASIC SCORE, MODIFIERS, AND FINAL LEVEL 1 SCORE, S_{L1}																				
BUILDING TYPE	DNK	W1	W1A	W2	S1	S2	S3	S4	S5	C1	C2	C3	PC1	PC2	RM1	RM2	URM	MH	BN1	BN2
Basic Score		**5.1**	**4.5**	**3.8**	**2.7**	**2.6**	**3.5**	**2.5**	**2.7**	**2.1**	**2.5**	**2.0**	**2.1**	**1.9**	**2.1**	**2.1**	**1.7**	**2.9**	**1.7**	**3.2**
Severe Vertical Irregularity, V_{L1}		-1.4	-1.4	-1.4	-1.2	-1.2	-1.4	-1.1	-1.2	-1.1	-1.2	-1.0	-1.1	-1.0	-1.1	-1.1	-1.0	NA	-1.0	-0.9
Moderate Vertical Irregularity, V_{L1}		-0.9	-0.9	-0.9	-0.8	-0.7	-0.9	-0.7	-0.7	-0.7	-0.7	-0.6	-0.7	-0.6	-0.7	-0.7	-0.6	NA	-0.6	-0.6
Plan Irregularity, P_{L1}		-1.4	-1.3	-1.2	-1.0	-0.9	-1.2	-0.9	-0.9	-0.8	-1.0	-0.8	-0.9	-0.8	-0.8	-0.8	-0.7	NA	-0.7	-0.8
Pre-Code		-0.3	-0.5	-0.6	-0.3	-0.2	-0.2	-0.3	-0.3	-0.3	-0.4	-0.3	-0.2	-0.2	-0.2	-0.2	-0.1	-0.5	NA	NA
Post-Benchmark		1.4	2.0	2.5	1.5	1.5	0.8	2.1	NA	2.0	2.3	NA	2.1	2.5	2.3	2.3	NA	1.2	NA	NA
Soil Type A or B		0.7	1.2	1.8	1.1	1.4	0.6	1.5	1.6	1.1	1.5	1.3	1.6	1.3	1.4	1.4	1.3	1.6	1.3	0.8
Soil Type E (1-3 stories)		-1.2	-1.3	-1.4	-0.9	-0.9	-1.0	-0.9	-0.9	-0.7	-1.0	-0.7	-0.8	-0.7	-0.8	-0.8	-0.6	-0.9	-0.6	-1.1
Soil Type E (>3 stories)		-1.8	-1.6	-1.3	-0.9	-0.9	NA	-0.9	-1.0	-0.8	-1.0	-0.8	NA	-0.7	-0.7	-0.8	-0.6	NA	NA	NA
Minimum Score, S_{MIN}		1.6	1.2	0.9	0.6	0.6	0.8	0.6	0.6	0.3	0.3	0.3	0.3	0.2	0.3	0.3	0.2	1.5	0.2	0.8
FINAL LEVEL 1 SCORE, $S_{L1} \geq S_{MIN}$																				

The structural scoring system consists of a matrix of Basic Scores (one for each FEMA Building Type and its associated seismic force-resisting system) and Score Modifiers to account for observed attributes that modify seismic performance. The five forms vary from each other only in the values of these Basic Scores and Score Modifiers and the Level 2 pounding criteria. The Basic Scores and Score Modifiers are based on (1) time-dependent seismic design and construction practices in the region; (2) attributes known to decrease or increase seismic resistance capacity; and (3) maximum considered ground motions for the seismicity region under consideration. The Basic Score, Score Modifiers, and Final Score all relate to the probability of building collapse, should the maximum ground motions considered by the RVS procedure occur at the site. Final Scores typically range from 0 to 7. For choosing Basic Score, Modifiers and Final Score, building type must be known. Refer to table (7) below for Building Type. Circle the relevant score according to building type and sum them. After that, balance with S_{MIN}. Final Level Score, S_{L1} must be greater than S_{MIN} in all building type. A higher score means that the building has smaller probability of collapse.

Two key characteristics of seismic performance are construction material (e.g., wood, concrete) and type of seismic force-resisting-system (moment frame, braced frame, or shear wall). A building classification system allows buildings with similar materials and seismic force-resisting systems to be grouped together, facilitating the fast identification of a building's likely strengths and vulnerabilities, and thus the building's expected performance during an earthquake. The FEMA P-154 RVS procedure groups the most common combinations of construction materials and seismic force-resisting systems in the United States into 17 types, referred to here as "FEMA Building Types." Each FEMA Building Type has its own Basic Score for each seismicity region, providing a measure of the expected performance of each FEMA Building Type in each seismicity region.

Following are the 17 FEMA Building Types considered in the FEMA P-154 RVS procedure, as shown in Table 9.

Table 9. FEMA P-154 Building Types

Building Type	
DNK	If the building type cannot significantly identified, or engineer is not sure the building type
W1	Light wood frame single- or multiple-family dwellings of one or more stories in height
W1A	Light wood frame multi-unit, multi-story residential buildings with plan areas on each floor of greater than 3,000 ft^2
W2	Wood frame commercial and industrial buildings with a floor area larger than 5,000 square feet. For commercial and industrial buildings with less than 5,000 square feet, the W2 type can be used as well.
S1	Steel moment-resisting frame buildings
S2	Braced steel frame buildings
S3	Light metal buildings
S4	Steel frame buildings with cast-in-place concrete shear walls
S5	Steel frame buildings with unreinforced masonry infill walls
C1	Concrete moment-resisting frame buildings
C2	Concrete shear wall buildings
C3	Concrete frame buildings with unreinforced masonry infill walls
PC1	Tilt-up buildings
PC2	Precast concrete frame buildings
RM1	Reinforced masonry buildings with flexible floor and roof diaphragms
RM2	Reinforced masonry buildings with rigid floor and roof diaphragms
URM	Unreinforced masonry bearing wall buildings
MH	Manufactured Housing
BN1	Good Brick Nogging Building
BN2	Poor constructed Brick Nogging Building

Pre-Code: One of the key issues that must be addressed in the planning process is the determination of the year in which seismic codes were initially adopted and enforced by the local jurisdiction; and the year in which significantly improved seismic codes were adopted and enforced (this latter year is known as the benchmark year). On the Very High, High, Moderately High, and Moderate seismicity forms, Basic Scores are provided for buildings built after the initial adoption of seismic codes, but before substantially improved codes were adopted (benchmark year). This generally corresponds to buildings designed based on the Uniform Building Code (UBC) in the period between 1941 and 1975. Score Modifiers designated as “Pre-Code” and “Post-Benchmark” are provided, respectively, for buildings built before the adoption of codes and for buildings built after the adoption of substantially improved codes. In Low seismicity regions, the Basic Scores have been calculated assuming the buildings were built without consideration of seismic codes. For buildings in these regions, the Score

Modifier designated as "Pre-Code" is not applicable (N/A), and the Score Modifier designated as "Post-Benchmark" is applicable for buildings built after the adoption of seismic codes.

13) Extent of Review, Other Hazards, and Action Required

EXTENT OF REVIEW	**OTHER HAZARDS**	**ACTION REQUIRED**
Exterior: ☐ Partial ☐ All Sides ☐ Aerial	Are There Hazards That Trigger A Detailed	Detailed Structural Evaluation Required?
Interior: ☐ None ☐ Visible ☐ Entered	Structural Evaluation?	☐ Yes, unknown building type or other building
Drawing Reviewd: ☐ Yes ☐ No	☐ Pounding potential (Unless S_{L1} > Cut-off, if	☐ Yes, score less than cut-off
Soil Type Source:……	known)	☐ Yes, other hazards present ☐ No
Geohazards Source:……	☐ Falling hazards from taller adjacent building	Detailed Nonstructural Evaluation Recommended?
Contact Person:……		☐ Yes, nonstructural hazard identified, should be evaluated
LEVEL 2 SCREENING PERFORMED?	☐ Geologic hazards or Soil Type F	☐ No, nonstructural hazards exist that may require mitigation, but
☐ Yes, Final Level 2 Score, S_{L2}: ☐ No	☐ Significant damage/deterioration to the	a detailed evaluation is not necessary
Nonstructural Hazards? ☐ Yes ☐ No	structural system	☐ No, no nonstructural hazards identified ☐ DNK
Where information cannot be verified, screener shall note the following: EST = Estimated or unreliable data (OR) DNK = Do Not Know		

Extent of Review: This section cover the whole screening process identifying whether the screener had access the Exterior and Interior sides of the building, Drawing, Soil Type and Geohazards Source, and Contact Person. If the level 1 score is less than cut-off point or if the screener thinks that the building requires further investigation, it is checked "Yes" in "Level 2 Screening Performed?" A score of 2.0 is suggested as a cut-off point for standard occupancy buildings, based on present seismic design criteria.

Other Hazards: Check the relevant box concerning "Pounding potential", Falling Hazards", "Geologic Hazards of Soil Type" and "Significant Damage/ Deterioration to the structural system". These hazards are not considered in the score system of the Level 1 form, but they can cause damage to the building. If one of these hazards conditions exists in the building, a "Detailed Structural Evaluation" is required even though the Level 1 score is less than the cut-off point.

Action Required: As per consequences of above hazards conditions and overall screening process, tick the appropriate box in the form for further process. It is the final part of Level 1 Data Collection Form. There are two parts in the "Action Required" section; structural and non-structural evaluation parts. Check the relevant box in each part. See the following sections for choosing criteria of each option. "DNK" (Do not know) option is also presented in the form.

For Detailed Structural Evaluation,

Tick **"*Yes, unknown FEMA Building Type or other building*"** if the screener has little or no confidence about any choice for the structural system, or if the building does not conform to any of the (17) FEMA Building Types considered on the form, the screening cannot be used to conclude that the building is not potentially hazardous. Therefore, a Detailed Structural Evaluation of the building should be conducted by an experienced design professional. In some cases, the Supervising Engineer or another more experienced screener may be able to determine the FEMA Building Type and complete the screening.

Tick **"*Yes, score less than cut-off*"** if the building receives a score that is less than the cut-off, it may be seismically hazardous and should receive a Detailed Structural Evaluation by an experienced design professional.

Tick **"Yes, other hazards present"** if other hazards are present, as indicated in the "Other Hazards" section of the form, the building may be seismically hazardous and should receive a Detailed Structural Evaluation by an experienced design professional.

Tick **"No"** if the building receives a score greater than the cut-off, and no other hazards are present, then a Detailed Structural Evaluation is not required.

For Detailed Nonstructural Evaluation*,*

Tick **"*Yes, nonstructural hazards identified that should be evaluated*"** if a nonstructural hazard has been observed and further nonstructural evaluation is recommended to determine whether the identified potential falling hazard is actually a threat. For example, a detailed evaluation would be necessary to determine whether a building's heavy cladding is properly anchored. If the detailed evaluation reveals that it is properly anchored, the heavy cladding is no longer considered a falling hazard.

"*No, nonstructural hazards exist that may require mitigation, but a detailed evaluation is not necessary*" This box is checked if a nonstructural hazard that is a known threat has been observed; eg; an unreinforced brick chimney. In these cases, additional evaluation is not necessary, although mitigation will be necessary if the threat is to be reduced. The jurisdiction may decide to make mitigation of these falling hazards mandatory.

"*No, no nonstructural hazards identified*" If no exterior falling hazards have been observed during the screening, further nonstructural evaluation is not necessary.

7. Instructions of Filling Data Collection Form Level II (Optional)

Level 2 Data Collection Form is optional type and it should be filled by a civil or structural engineering professional, architect, or graduate student who has experiences and background knowledge on seismic evaluation of design of buildings. It should be noted that the screener applies same type of seismicity region to both Level 1 and Level 2 Form. If possible, Level 1 and Level 2 should be screened by same person. In Level 2 Data Collection Form, it includes four main sections;

(1) Building Information and Adjusted Base Line Score
(2) Structural Modifiers to Add to Adjusted Baseline Score
(3) Observable Nonstructural Hazards
(4) Comments

1) Building Information and Adjusted Base Line Score

Rapid Visual Screening of Buildings for Potential Seismic Hazards — **LEVEL 2 (Optional)**

(Adopted from FEMA P-154 Data Collection Form) — **MODERATE Seismicity**

Optional Level 2 Data Collection to be performed by a civil or structural engineering professional, architect, or graduate student with background in seismic evaluation or design of buildings.

Building Name :	***Final Level 1 Score:*** S_{L1} =		(Do not consider S_{MIN}.)
Screener :	***Level 1 Irregularity Modifiers:***	Vertical Irregularity , V_{L1} =	Plan Irregularity, P_{L1} =
Date/ Time :	***ADJUSTED BASELINE***	$S' = (S_{L1} - V_{L1} - P_{L1})$ =	

Building Name: Mention the name of the building so that it can be easily known and identify.

Screener: Fill in the name of the screener. It is important as the screener can have more information on the building that he or she did survey. This information can be useful at a later stage.

Date/ Time: Describe the date and time at which the building is screened/ surveyed.

Final Level 1 Score: Take the SL1 value from Level 1 Data Collection Form.

Level 1 Irregularities Modifiers; Vertical Irregularity: Fill in the Level 1 Vertical Irregularity Score.

Level 1 Irregularities Modifiers; Plan Irregularity: Fill in the Level 1 Plan Irregularity Score.

Adjusted Baseline Score: Fill in the S' value by calculating with the following equation. VL1 and PL1 values are taken from the above Vertical Irregularity Modifier and Plan Irregularity Modifier.

$$S' = S_{L1} - V_{L1} - P_{L1}$$

2) Structural Modifiers to Add to Adjusted Baseline Score

In this part, there are three main modifiers that can give different score modifiers.

- Verticals Irregularity, V_{L2}
- Plan Irregularity, P_{L2}
- Miscellaneous, M (Comprising of Redundancy, Pounding, S2, C1, PC1, RM1, URM, MH Building, and Retrofit features)

Circle the relevant score modifiers for each section, and then sum all and get the V_{L2}, P_{L2}, and M Score Modifiers respectively. Final Level 2 Score, SL2 is the summing of Adjusted Baseline Score, (S' value from *Building Information and Adjusted Base Line Score for Level 2* section), Vertical Irregularity (V_{L2} Score Modifier), Plan Irregularity (P_{L2} Score Modifier), and M Score Modifiers. See the equation below for Final Level 2 Score. SL2 score can be transfer to Level 1 Form so that it can be judged with S_{MIN}.

$$\textit{Final Level 2 Score, } S_{L2} = S' + V_{L2} + P_{L2} + M \geq S_{MIN}$$
$$S' + V_{L2} + P_{L2} + M \geq S_{MIN}$$

In the last part of Final Level 2 score, there is a "Yes" / "No" question stating that the building has observable damage or deterioration or another condition that negatively affects the building's seismic performance. If the screener checks the "Yes" box, more detailed explanations can be filled out in the "Comments" section al the last part of Level 2 Data Collection Form.

Table 10. "Structural Modifiers to Add to Adjusted Baseline Score" Portion of Level 2 Data Collection Form Level 2 Form

STRUCTURAL MODIFIERS TO ADD TO ADJUSTED BASELINE SCORE					
Topic	**Statement (If statement is true, circle "Yes" modifier; otherwise cross out the modifier)**			**Yes**	**Subtotals**
Vertical Irregularity, V_{L2}	*Sloping Site*	W1 Building : There is at least a full story grade change from one side of the building to the other.		-1.4	
		Non-W1 Building : Ther is at least a full story grade change from one side of the building to the other.		-0.4	
	Weak and/or Soft Story (Circle one maximum)	W1 Building Cripple Wall : An unbraced cripple wall is visible in the crawl space.		-0.7	
		W1 House over Garage : Underneath an occupied story, there is a garage opening without a steel moment frame, and there is less than 8 ft of wall on the same line (for multiple occupied floors above, use 16 ft of wall minimum)		-1.4	
		W1A Building Open Front : There are openings at the ground story (such as for parking) over at least 50 % of the length of the building.		-1.4	
		Non-W1 Building : Length of lateral system at any story is less than 50 % of that at story above or height of any story is more than 2.0 times the height of the story above.		-1.1	
		Non-W1 Building : Length of lateral system at any story is between 50 % and 75 % of that at story above or height of any story is between 1.3 and 2.0 times the height of the story above.		-0.6	
	Setback	Vertical elements of the lateral system at an upper story are outboard of those at the story below causing the diaphragm to cantilever at the offset.		-1.2	
		Vertical elements of the lateral system at upper stories are inboard of those at lower stories.		-0.6	
		There is an in-plane offset of the lateral elements that is greater than the length of the elements.		-0.4	
	Short Column/ Pier	C1,C2,C3,PC1,PC2,RM1,RM2 : At least 20 % of columns (or piers) along a column line in the lateral system have height/depth ratios less than 50 % of the nominal height/depth ratio at that level.		-0.5	
		C1,C2,C3,PC1,PC2,RM1,RM2 : The column depth (or pier width) is less than one half of the depth of the spandrel, or there are infill walls or adjacent floors that shorten the column.		-0.5	
	Split Level	There is a split level at one of the floor levels or at the roof.		-0.6	
	Other Irregularity	There is another observable severe vertical irregularity that obviously affects the building's seismic performance.		-1.2	V_{L2} =
		There is another observable moderate vertical irregularity that may affect the building's seismic performance.		-0.6	*(Cap at -1.4)*
Plan Irregularity, P_{L2}	Torsional Irregularity: Lateral system does not appear relatively well distributed in plan in either or both directions. (Do not include the W1A open front irregularity listed above)			-1	
	Non-parallel System: There are one or more major vertical elements of the lateral system that are not orthogonal to each other.			-0.5	
	Reentrant Corner: Both projections from an interior corner exceed 25 % of the overall plan dimensions in that direction.			-0.5	
	Diaphragm Opening: There is an opening in the diaphragm with a width over 50 % of the total diaphragm width at that level.			-0.3	
	C1, C2 Buildings Out-of-plane Offset: The exterior beams do not align with the columns in plan.			-0.4	P_{L2} =
	Other Irregularity: There is another observable plan irregularity that obviously affects the building's seismic performance.			-1	*(Cap at -1.4)*
Redundancy	The building has at least two bays of lateral elements on each side of the building in each direction.			0.4	
Pounding	Building is separated from an adjacent structure by less than 1.5 % of the height of the shorter of the building and adjacent structure and:	The floors do not align vertically within 2 feet.	(Cap total pounding modifiers at -0.9)	-1.2	
		One building is 2 or more stories taller than the other.		-1.2	
		The building is at the end of the block.		-0.6	
S2 Building	"K" bracing geometry is visible.			-1.2	
C1 Building	Flat plate serves as the beam in the moment frame.			-0.5	
PC1/ RM1 Building	There are roof-to-wall ties that are visible or known from drawings that do not rely on cross-grain bending. (Do not combine with post-benchmark or retrofit modifier)			0.4	
	The building has closely spaced, full height interior walls (rather than an interior space with few walls such as in a warehouse)			0.4	
URM	Gable walls are present.			-0.5	
MH	There is a supplemental seismic bracing system provided between the carriage and the ground.			1.2	
Retrofit	Comprehensive seismic retrofit is visible or known from drawings.			1.4	M =
FINAL LEVEL 2 SCORE, S_{L2} = (S' + V_{L2} + P_{L2} + M) ≥ S_{MIN} :					***(Transfer to Level 1 Form)***
There is observable damage or deterioration or another condition that negatively affects the building's seismic performance: ☐ Yes ☐ No If yes, describe the condition in the comment box below and indicate on the Level 1 form that detailed evaluation is required independent of the building's score.					

3) Observable Nonstructural Hazards

Table 11. "Observable Nonstructural Hazards" Portion of Level 2 Data Collection Form

OBSERVABLE NONSTRUCTURAL HAZARDS				
Location	**Statement (Check "Yes" or "No")**	***Yes***	***No***	**Comments**
Exterior	There is an unbraced unreinforced masonry parapet or unbraced unreinforced masonry chimney.			
	There is heavy cladding or heavy veneer.			
	There is a heavy canopy over exit doors or pedestrian walkways that appears inadequately supported.			
	There is an unreinforced masonry appendage over exit doors or pedestrian walkways.			
	There is a sign posted on the building that indicates hazardous materials are present.			
	There is a taller adjacent buidling with an unanchored URM wall or unbraced URM parapet or chimney.			
	Other observed exterior nonstructural falling hazard.			
Interior	There are hollow clay tile or brick partitions at any stair or exit corridor.			
	Other observed interior nonstructural falling hazard.			
Estimated Nonstructural Seismic Performance *(Check appropriate box and transfer to Level 1 form conslusions)*				
☐ Potential nonstructural hazards with significant threat to occupant life safety. --> Detailed Nonstructural Evaluation recommended.				
☐ Nonstructural hazards identified with significant threat to occupant life safety. --> But no Detailed Nonstructural Evaluation required.				
☐ Low or no nonstructural hazard threat to occupant life safety. --> No Detailed Nonstructural Evaluation required.				

Check the relevant statement stating "Yes" or "No". The main non-structural hazards are exterior and interior location of the building. In both exterior and interior non-structural hazard parts, it is required that the screener read each and every statement and checks the relevant box. If the screener chooses "Yes" box, there is comments section at the right side of the statement. Describe the important features or characteristics on this comments section. There are seven statements concerning with Exterior Observable Non-Structural Hazards and two statements stating Interior Observable Non-Structural Hazards.

After reviewing each of the statements, the screener uses judgment to estimate the nonstructural seismic performance of the building. There are three boxes in this part;

- *Potential Nonstructural Hazards with significant threat to occupant life safety.*
- *Nonstructural hazards identified with significant threat to occupant life safety.*
- *Low or no nonstructural hazard threat to occupant life safety.*

If the screener chooses first option, then the relevant measures will be "Detailed Non-structural Evaluation Recommended." For second option, the relevant option will be *"Detailed Nonstructural Evaluation is recommended But not required".* For the third option, the measure is *"No Detailed Nonstructural Evaluation is required".*

4) Comments

Comments :

Describe the special conditions or important features in the “Comments” space. The screener should fill in the detailed information of what he or she found out. If required, the screener can use extra sheet of paper to note down the information ensuring that this sheet is attached to the Data Collection Form.

8. Examples of Rapid Visual Screening Programs

Example 1: It is required to perform rapid visual screening RVS for 3703 Roxbury Street.

Field Screening of the Building

- Upon arriving at the site, the screener observed the building as a whole (Figure 10) and began the process of verifying the information in the building identification portion of the form (upper right corner), starting with the street address. The screener added her name and the date and time of the field screening to the building identification portion of the form.

Figure 10. Exterior view of 3703 Roxbury Street.

- The FEMA Building Type (S2, steel braced frame) was verified by looking at the building with binoculars (Figure 11)

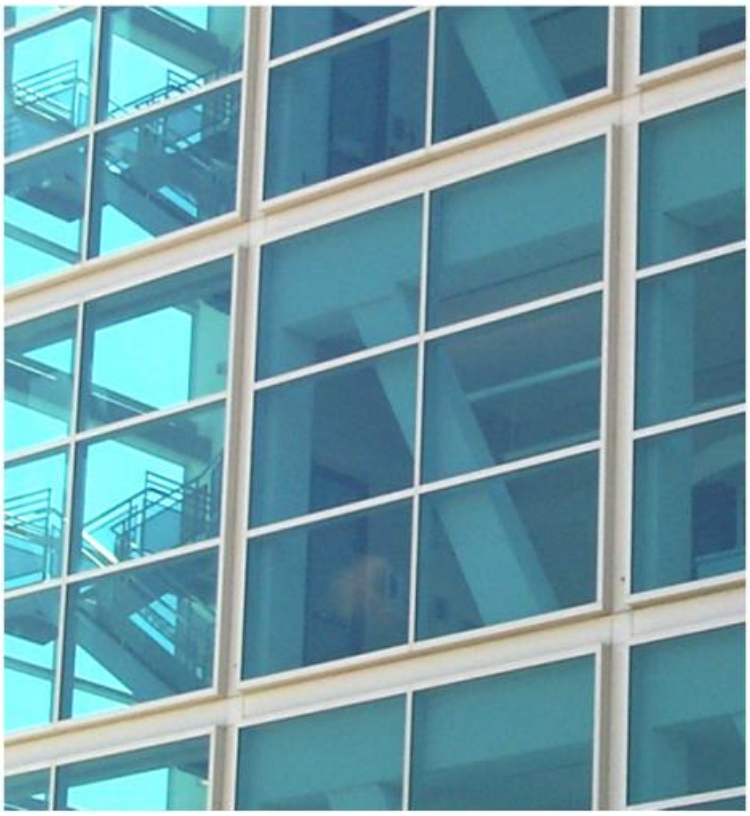


Figure 11. Close-up view of 3703 Roxbury Street exterior showing perimeter braced steel framing.

- The number of stories (10) was confirmed by inspection, and the year built noted on the form (1986) appeared appropriate.
- The base dimensions of the building were estimated by pacing off the distance along each face, assuming 3 feet per stride, resulting in the determination that it was 75 feet by 100 feet in plan. On this basis, the listed square footage of 76,000 square feet was verified as correct.
- No additions to the building were observed.
- Sketches of the plan and elevation views of the building were drawn in the "Sketch" portion of the form. Several digital photographs were taken of the building, to be added to the form later.

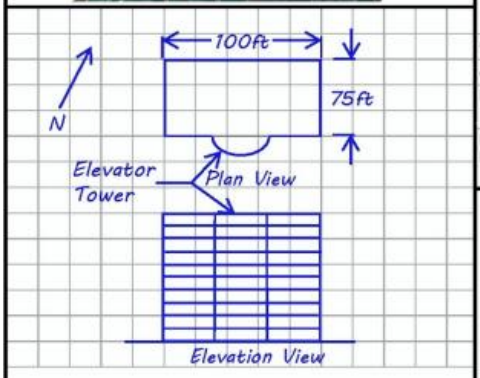
- The building use (office) was circled in the "Occupancy" portion of the form.
- No adjacent buildings were observed
- The next step for the screener was to identify any vertical or plan irregularities. The screener consulted the Vertical and Plan Irregularity Reference Guides (FEMA P-154, Appendix B.5 & B.6) and found that none of the listed irregularities applied to the building being screened.
- No falling hazards were observed, as glass cladding is not considered as heavy cladding.

Identification of the Modifiers in Level 1 Form & Final Decision

- The next step in the process was to circle the appropriate Basic Score and the appropriate Score Modifiers. Having verified the FEMA Building Type as S2, the screener circled "S2" on the form along with the Basic Score beneath it.
- No irregularities were observed, so none of the irregularity modifiers was circled.
- The screener checked the Quick Reference Guide and found that the building did not qualify for the Post-Benchmark modifier.
- Since the building is on Soil Type D, no soil modifiers were applied.
- The Final Level 1 Score, S_{L1}, was determined to be 2.0
- The screener completed the Extent of Review portion of the form, indicating that she viewed the exterior of the building from all sides, but was not able to enter the building to inspect the interior. The soil type source and geologic hazards source were entered during the pre-field phase. The screener noted that no Level 2 screening was performed.
- She then reviewed the Other Hazards portion of the form and did not identify any other hazards that might trigger a detailed evaluation.
- Because this score was equal to the cut-off score of 2.0, the screener checked the "Yes" box in the Detailed Structural Evaluation Required field and "No" in the Detailed Nonstructural Evaluation Required field as no nonstructural hazards were identified.

Figure 12 shows the completed Level 1 form for 3703 Roxbury.

Rapid Visual Screening of Buildings for Potential Seismic Hazards — **Level 1**
FEMA P-154 Data Collection Form — **HIGH Seismicity**



SKETCH

Address: 3703 Roxbury Street
Anyplace Zip: 91234
Parcel Number: 7469027035; S2
Building Name: Smith & Co.
Use:
Latitude: Longitude:
S_s: S_1:
Screener(s): D. Taylor Date/Time: 2/28/14 10am

No. Stories: Above Grade: 10 Below Grade: 0 Year Built: 1986 ☐ EST
Total Floor Area (sq. ft.): 76,000 Code Year:
Additions: ☒ None ☐ Yes, Year(s) Built:

Occupancy: Assembly, Commercial, Emer. Services, ☐ Historic, ☐ Shelter, Industrial, (Office), School, ☐ Government, Utility, Warehouse, Residential, # Units:

Soil Type: ☐A Hard Rock ☐B Avg Rock ☐C Dense Soil ☒D Stiff Soil ☐E Soft Soil ☐F Poor Soil DNK *If DNK, assume Type D.*

Geologic Hazards: None

Adjacency: ☐ Pounding ☐ Falling Hazards from Taller Adjacent Building

Irregularities: ☐ Vertical (type/severity) ☐ Plan (type)

Exterior Falling Hazards: ☐ Unbraced Chimneys ☐ Heavy Cladding or Heavy Veneer ☐ Parapets ☐ Appendages ☐ Other:

COMMENTS:
No irregularities, adjacent buildings, or falling hazards observed.

☐ Additional sketches or comments on separate page

BASIC SCORE, MODIFIERS, AND FINAL LEVEL 1 SCORE, S_{L1}

FEMA BUILDING TYPE (Do Not Know)	W1	W1A	W2	S1 (MRF)	S2 (BR)	S3 (LM)	S4 (RC SW)	S5 (URM INF)	C1 (MRF)	C2 (SW)	C3 (URM INF)	PC1 (TU)	PC2	RM1 (FD)	RM2 (RD)	URM	MH
Basic Score	3.6	3.2	2.9	2.1	2.0	2.6	2.0	1.7	1.5	2.0	1.2	1.6	1.4	1.7	1.7	1.0	1.5
Severe Vertical Irregularity, V_{L1}	-1.2	-1.2	-1.2	-1.0	-1.0	-1.1	-1.0	-0.8	-0.9	-1.0	-0.7	-1.0	-0.9	-0.9	-0.9	-0.7	NA
Moderate Vertical Irregularity, V_{L1}	-0.7	-0.7	-0.7	-0.6	-0.6	-0.7	-0.6	-0.5	-0.5	-0.6	-0.4	-0.6	-0.5	-0.5	-0.5	-0.4	NA
Plan Irregularity, P_{L1}	-1.1	-1.0	-1.0	-0.8	-0.7	-0.9	-0.7	-0.6	-0.6	-0.8	-0.5	-0.7	-0.6	-0.7	-0.7	-0.4	NA
Pre-Code	-1.1	-1.0	-0.9	-0.6	-0.6	-0.8	-0.6	-0.2	-0.4	-0.7	-0.1	-0.5	-0.3	-0.5	-0.5	0.0	-0.1
Post-Benchmark	1.6	1.9	2.2	1.4	1.4	1.1	1.9	NA	1.9	2.1	NA	2.0	2.4	2.1	2.1	NA	1.2
Soil Type A or B	0.1	0.3	0.5	0.4	0.6	0.1	0.6	0.5	0.4	0.5	0.3	0.6	0.4	0.5	0.5	0.3	0.3
Soil Type E (1-3 stories)	0.2	0.2	0.1	-0.2	-0.4	0.2	-0.1	-0.4	0.0	0.0	-0.2	-0.3	-0.1	-0.1	-0.1	-0.2	-0.4
Soil Type E (> 3 stories)	-0.3	-0.6	-0.9	-0.6	-0.6	NA	-0.6	-0.4	-0.5	-0.7	-0.3	NA	-0.4	-0.5	-0.6	-0.2	NA
Minimum Score, S_{MIN}	*1.1*	*0.9*	*0.7*	*0.5*	*0.5*	*0.6*	*0.5*	*0.5*	*0.3*	*0.3*	*0.3*	*0.2*	*0.2*	*0.3*	*0.3*	*0.2*	*1.0*

FINAL LEVEL 1 SCORE, $S_{L1} \geq S_{MIN}$: 2.0

EXTENT OF REVIEW
Exterior: ☐ Partial ☒ All Sides ☐ Aerial
Interior: ☐ None ☒ Visible ☐ Entered
Drawings Reviewed: ☒ Yes ☐ No
Soil Type Source: State Geologist
Geologic Hazards Source: State Geologist
Contact Person:

LEVEL 2 SCREENING PERFORMED?
☐ Yes, Final Level 2 Score, S_{L2}: _____ ☒ No
Nonstructural hazards? ☐ Yes ☐ No

OTHER HAZARDS
Are There Hazards That Trigger A Detailed Structural Evaluation?
☐ Pounding potential (unless S_{L2} > cut-off, if known)
☐ Falling hazards from taller adjacent building
☐ Geologic hazards or Soil Type F
☐ Significant damage/deterioration to the structural system

ACTION REQUIRED
Detailed Structural Evaluation Required?
☐ Yes, unknown FEMA building type or other building
☒ Yes, score less than cut-off
☐ Yes, other hazards present
☐ No
Detailed Nonstructural Evaluation Recommended? *(check one)*
☐ Yes, nonstructural hazards identified that should be evaluated
☐ No, nonstructural hazards exist that may require mitigation, but a detailed evaluation is not necessary
☒ No, no nonstructural hazards identified ☐ DNK

Where information cannot be verified, screener shall note the following: EST = Estimated or unreliable data OR DNK = Do Not Know

Legend: MRF = Moment-resisting frame, BR = Braced frame, RC = Reinforced concrete, SW = Shear wall, URM INF = Unreinforced masonry infill, TU = Tilt up, MH = Mobile Home, LM = Light metal, FD = Flexible diaphragm, RD = Rigid diaphragm

Figure 12. Completed Data Collection Form for Example 1, 3703 Roxbury Street.

Example 2: It is required to perform rapid visual screening RVS for 3711 Roxbury Street.

Unlike Example 1, there was little information in the building identification portion of the form (only street address, zip code, parcel number and soil type were provided).

Figure 13. Exterior view of 3711 Roxbury Street

Field Screening of the Building

- The screener determined the number of stories to be 12 and the building use to be commercial and office.
- He paced off the building plan dimensions and estimated the plan size as 58 feet by 50 feet. Based on this information, the total square footage was estimated to be 34,800 square feet (12 stories by 50 feet by 58 feet), and the number of stories, use, and square footage were written on the form.
- Based on a review of information in Appendix D of FEMA P-154, the construction era was estimated to be in the 1940s. The screener wrote in the year of construction as 1945 and checked the "EST" box to note that the date was estimated.
- The screener circled both "Office" and "Commercial" to indicate the observed occupancies
- The screener noted that an adjacent 11-story building was separated from the building being screened by only 12 inches. The screener determined the minimum separation gap for pounding per the Level 1 Pounding Guide (1 ½ inches per story for 11 stories equals 16.5 inches) and found that the actual separation was less than the minimum. In addition, the building being screened was at the end of the block. Based on these two conditions, the screener checked the "Pounding" box in the Adjacency section of the form.
- The screener consulted the Vertical and Plan Irregularity Reference Guides (FEMA P-154, Appendix B.5 & B.6) and determined that the four individual towers extending above the base represented an out-of-plane offset. The screener noted this severe vertical irregularity.
- Sketches of the plan and elevation views of the building were drawn in the "Sketch" portion of the form. The cornices at roof level were observed, and entered on the form.

Identification of the Modifiers in Level 1 Form & Final Decision

- Noting that it was a 12-story building, a review of the material in Table D-6 (FEMA P-154, Appendix D), indicated that the likely options for FEMA Building Type were S1, S2, S5, C1, C2, or C3. On more careful examination of the building exterior with the use of binoculars (see Figure 14), it was determined the building was Type C3, concrete frame with unreinforced masonry infill, and this alpha-numeric code, and accompanying Basic Score, were circled on the Data Collection Form.

Figure 14. Close-up view of 3711 Roxbury Street building showing exterior infill frame construction

- Because the four individual towers extending above the base represented a vertical irregularity, this modifier was circled. The screener checked the Quick Reference Guide and compared the estimated date of construction to the pre-code year for FEMA Building Type C3. Since 1945 was after the pre-code year of 1941, the screener did not circle the pre-code modifier.
- Noting that the soil is Type E, as determined during the pre-field data acquisition phase, and that the number of stories was 12, the modifier for Soil Type E (> 3 stories) was circled. The total of the Basic Score plus applicable Score Modifiers was 1.2 - 0.7 - 0.3 = 0.2. Noting that this is less than the minimum score, S_{MIN} = 0.3, the screener indicated that the Final Level 1 Score, S_{L1}, was 0.3.
- Under Extent of Review, the screener noted that he was not able to view all sides of the building by checking the "Partial" box under Exterior. He indicated that he was not able to view the interior of the building by checking "None" under Interior.

- Under Other Hazards, he noted that pounding potential of the building with its neighbor triggers a Detailed Structural Evaluation.
- Because the building's Final Score was less than the cut-off score of 2.0, and because of the other hazards present (pounding), the building required a Detailed Structural Evaluation by an experienced seismic design professional.
- Because of the cornices, the building required a Detailed Nonstructural Evaluation.

A completed version of the Level 1 form, including photographs attached at a later date, is provided in Figure 15. Completed form for 3711 Roxbury Street.Figure 15.

Rapid Visual Screening of Buildings for Potential Seismic Hazards — **Level 1**
FEMA P-154 Data Collection Form (08/26/14) — **HIGH Seismicity**

Address: 3711 Roxbury Street
Anyplace Zip: 91234
Parcel Number: 7469027034
Building Name:
Use: Commercial with offices above
Latitude: Longitude:
S_S: S_1:
Screener(s): A. Jones Date/Time: 2/28/14 11am

No. Stories: Above Grade: 12 Below Grade: 0 Year Built: 1945 ☒ EST
Total Floor Area (sq. ft.): 34,800 EST Code Year:
Additions: ☒ None ☐ Yes, Year(s) Built:

Occupancy: ☐ Assembly ◯ Commercial ☐ Emer. Services ☐ Historic ☐ Shelter
☐ Industrial ◯ Office ☐ School ☐ Government
☐ Utility ☐ Warehouse ☐ Residential, # Units:

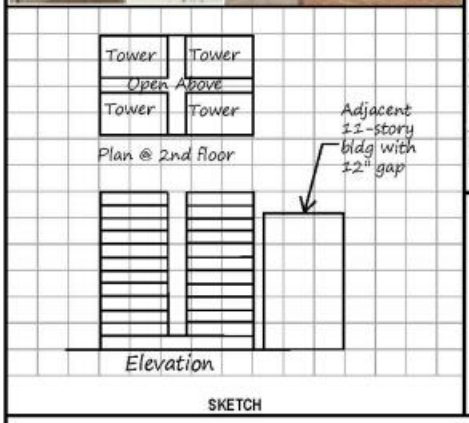
Soil Type: ☐ A Hard Rock ☐ B Avg Rock ☐ C Dense Soil ☐ D Stiff Soil ☒ E Soft Soil ☐ F Poor Soil ☐ DNK If DNK, assume Type D.

Geologic Hazards: None

Adjacency: ☒ Pounding ☐ Falling Hazards from Taller Adjacent Building

Irregularities: ☒ Vertical (type/severity) Out-of-plane setback (severe)
☐ Plan (type)

Exterior Falling Hazards: ☐ Unbraced Chimneys ☐ Heavy Cladding or Heavy Veneer ☐ Parapets ☐ Appendages ☒ Other: Cornices at roof



SKETCH

COMMENTS:
Per Level 1 Pounding Reference Guide, required gap is 11 x 1.5 = 16.5" > 12" existing gap. And, building being screened is at end of block. Pounding potential exists.

☐ Additional sketches or comments on separate page

BASIC SCORE, MODIFIERS, AND FINAL LEVEL 1 SCORE, S_{L1}

FEMA BUILDING TYPE (Do Not Know)	W1	W1A	W2	S1 (MRF)	S2 (BR)	S3 (LM)	S4 (RC SW)	S5 (URM INF)	C1 (MRF)	C2 (SW)	C3 (URM INF)	PC1 (TU)	PC2	RM1 (FD)	RM2 (RD)	URM	MH
Basic Score	3.6	3.2	2.9	2.1	2.0	2.6	2.0	1.7	1.5	2.0	1.2	1.6	1.4	1.7	1.7	1.0	1.5
Severe Vertical Irregularity, V_{L1}	-1.2	-1.2	-1.2	-1.0	-1.0	-1.1	-1.0	-0.8	-0.9	-1.0	-0.7	-1.0	-0.9	-0.9	-0.9	-0.7	NA
Moderate Vertical Irregularity, V_{L1}	-0.7	-0.7	-0.7	-0.6	-0.6	-0.7	-0.6	-0.5	-0.5	-0.6	-0.4	-0.6	-0.5	-0.5	-0.5	-0.4	NA
Plan Irregularity, P_{L1}	-1.1	-1.0	-1.0	-0.8	-0.7	-0.9	-0.7	-0.6	-0.6	-0.8	-0.5	-0.7	-0.6	-0.7	-0.7	-0.4	NA
Pre-Code	-1.1	-1.0	-0.9	-0.6	-0.6	-0.8	-0.6	-0.2	-0.4	-0.7	-0.1	-0.5	-0.3	-0.5	-0.5	0.0	-0.1
Post-Benchmark	1.6	1.9	2.2	1.4	1.4	1.1	1.9	NA	1.9	2.1	NA	2.0	2.4	2.1	2.1	NA	1.2
Soil Type A or B	0.1	0.3	0.5	0.4	0.6	0.1	0.6	0.5	0.4	0.5	0.3	0.6	0.4	0.5	0.5	0.3	0.3
Soil Type E (1-3 stories)	0.2	0.2	0.1	-0.2	-0.4	0.2	-0.1	-0.4	0.0	0.0	-0.2	-0.3	-0.1	-0.1	-0.1	-0.2	-0.4
Soil Type E (> 3 stories)	-0.3	-0.6	-0.9	-0.6	-0.6	NA	-0.6	-0.4	-0.5	-0.7	-0.3	NA	-0.4	-0.5	-0.6	-0.2	NA
Minimum Score, S_{MIN}	1.1	0.9	0.7	0.5	0.5	0.6	0.5	0.5	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.2	1.0

FINAL LEVEL 1 SCORE, $S_{L1} \geq S_{MIN}$: 1.2-0.7-0.3=0.2 < 0.3; use S_{MIN}=0.3

EXTENT OF REVIEW
Exterior: ☒ Partial ☐ All Sides ☐ Aerial
Interior: ☒ None ☐ Visible ☐ Entered
Drawings Reviewed: ☐ Yes ☒ No
Soil Type Source: State Geologist
Geologic Hazards Source: State Geologist
Contact Person:

LEVEL 2 SCREENING PERFORMED?
☐ Yes, Final Level 2 Score, S_{L2} _____ ☒ No
Nonstructural hazards? ☐ Yes ☐ No

OTHER HAZARDS
Are There Hazards That Trigger A Detailed Structural Evaluation?
☒ Pounding potential (unless S_{L2} > cut-off, if known)
☐ Falling hazards from taller adjacent building
☐ Geologic hazards or Soil Type F
☐ Significant damage/deterioration to the structural system

ACTION REQUIRED
Detailed Structural Evaluation Required?
☐ Yes, unknown FEMA building type or other building
☒ Yes, score less than cut-off
☒ Yes, other hazards present (pounding)
☐ No
Detailed Nonstructural Evaluation Recommended? (check one)
☒ Yes, nonstructural hazards identified that should be evaluated
☐ No, nonstructural hazards exist that may require mitigation, but a detailed evaluation is not necessary
☐ No, no nonstructural hazards identified ☐ DNK

Where information cannot be verified, screener shall note the following: EST = Estimated or unreliable data OR DNK = Do Not Know

Legend: MRF = Moment-resisting frame; BR = Braced frame; RC = Reinforced concrete; SW = Shear wall; URM INF = Unreinforced masonry infill; TU = Tilt up; MH = Manufactured Housing; LM = Light metal; FD = Flexible diaphragm; RD = Rigid diaphragm

Figure 15. Completed form for 3711 Roxbury Street.

Example 3: It is required to perform rapid visual screening RVS for 5020 Ebony Drive building

The building was a high-rise residential building (Figure 19) in a new part of the city in which new development had begun within the last few years. The building was not included in the electronic Building RVS Database; consequently, there was not a partially prepared Data Collection Form for this building (No Pre-field Planning Stage). The screeners wrote the address of the building on a blank form along with their names and date and time of the screening.

Figure 16. Exterior view of 5020 Ebony Drive

Field Screening of the Building

Based on visual inspection, the screeners determined that:

- The building had 22 stories above grade, including a tall occupied penthouse story, and 2 additional stories of parking below grade.
- No additions
- It was designed after 2000 by estimation
- Its use was both commercial (in the first story) and residential in the upper stories. The building uses (Commercial and Residential) were circled in the "Occupancy" portion.
- The screeners paced off the building plan dimensions to estimate the plan size to be approximately 270 feet by 180 feet. Based on this information and considering the symmetric but non-rectangular floor plan, the total square footage was estimated to be 712,800 square feet.
- The screeners photographed the building and drew a sketch of a portion of the plan view of the building in the space on the form allocated for a "Sketch."
- The screeners did not know the soil type, but assumed Soil Type D, based on the instructions in FEMA P-154 when soil type is unknown, as well as their knowledge that an adjacent site only a quarter mile away was on Soil Type D.
- The screeners observed the building's plan irregularity (reentrant corners) and noted it on the form.
- Given the design date of 2000, the anchorage for the heavy cladding on the exterior of the building was assumed to have been designed to meet the anchorage requirements initially adopted in 1967 (per the information provided in the Quick Reference Guide). No other falling hazards were observed.
- The window spacing in the upper stories and the column spacing at the first floor level indicated the building was either a steel moment frame building, or a concrete moment frame building. The screeners attempted to view the interior but were not provided with permission to do so. They elected to indicate that the building was either an S1 (steel moment-resisting frame) or C1 (concrete moment-resisting frame) type on the Data Collection Form and circled both types, along with their Basic Scores.

Identification of the Modifiers in Level 1 Form & Final Decision

- In addition, the screeners circled the Post-Benchmark Score Modifiers, given that the estimated design date (year 2000) occurred after the benchmark years for both FEMA Building Type S1 and FEMA Building Type C1 (per the information on the Quick

Reference Guide, FEMA P-154), and the Score Modifiers for plan irregularity (in both the S1 and C1 columns).

- By adding the circled numbers in both the S1 and C1 columns, scores of 2.7 and 2.8 were determined for the two FEMA Building Types. Using the lesser score of the two, the screener noted the Final Level 1 Score, S_{L1}, as 2.7. Because this is greater than the cut-off score of 2.0, a Detailed Structural Evaluation of the building by an experienced seismic design professional was not required. Before leaving the site, the screeners completed the Extent of Review, Other Hazards, and Action Required portions of the form. A completed version of the Data Collection Form is provided in Figure 17.

Rapid Visual Screening of Buildings for Potential Seismic Hazards — **Level 1**
FEMA P-154 Data Collection Form — **HIGH Seismicity**

Address: 5020 Ebony Drive
Anyplace Zip: 91011
Parcel Number:
Building Name:
Use: Residential and commercial
Latitude: Longitude:
S_S: S_1:
Screener(s): D. Taylor/A. Jones Date/Time: 2/28/14 1pm

No. Stories: Above Grade: 22 Below Grade: 2 Year Built: 2000 EST
Total Floor Area (sq. ft.): 712,800 Code Year:
Additions: [X] None [ ] Yes, Year(s) Built:

Occupancy: Assembly, Commercial, Emer. Services, Historic, Shelter; Industrial, Office, School, Government; Utility, Warehouse, Residential, # Units: DNK

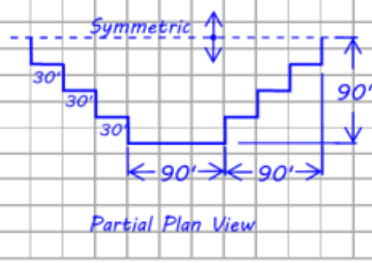
Soil Type: [ ] A Hard Rock [ ] B Avg Rock [ ] C Dense Soil [X] D Stiff Soil [ ] E Soft Soil [ ] F Poor Soil — DNK (If DNK, assume Type D)

Geologic Hazards: None

Adjacency: [ ] Pounding [ ] Falling Hazards from Taller Adjacent Building

Irregularities: [ ] Vertical (type/severity) [X] Plan (type) reentrant corners

Exterior Falling Hazards: [ ] Unbraced Chimneys [ ] Heavy Cladding or Heavy Veneer [ ] Parapets [ ] Appendages [ ] Other:



SKETCH

COMMENTS:
Year built is after benchmark year for cladding anchorage. Therefore, heavy cladding not a falling hazard.

Not apparent whether steel or concrete. Assume S1 or C1. Both are scored with similar results.

[ ] Additional sketches or comments on separate page

BASIC SCORE, MODIFIERS, AND FINAL LEVEL 1 SCORE, S_{L1}

FEMA BUILDING TYPE (Do Not Know)	W1	W1A	W2	S1 (MRF)	S2 (BR)	S3 (LM)	S4 (RC SW)	S5 (URM INF)	C1 (MRF)	C2 (SW)	C3 (URM INF)	PC1 (TU)	PC2	RM1 (FD)	RM2 (RD)	URM	MH
Basic Score	3.6	3.2	2.9	2.1	2.0	2.6	2.0	1.7	1.5	2.0	1.2	1.6	1.4	1.7	1.7	1.0	1.5
Severe Vertical Irregularity, V_{L1}	-1.2	-1.2	-1.2	-1.0	-1.0	-1.1	-1.0	-0.8	-0.9	-1.0	-0.7	-1.0	-0.9	-0.9	-0.9	-0.7	NA
Moderate Vertical Irregularity, V_{L1}	-0.7	-0.7	-0.7	-0.6	-0.6	-0.7	-0.6	-0.5	-0.5	-0.6	-0.4	-0.6	-0.5	-0.5	-0.5	-0.4	NA
Plan Irregularity, P_{L1}	-1.1	-1.0	-1.0	-0.8	-0.7	-0.9	-0.7	-0.6	-0.6	-0.8	-0.5	-0.7	-0.6	-0.7	-0.7	-0.4	NA
Pre-Code	-1.1	-1.0	-0.9	-0.6	-0.6	-0.8	-0.6	-0.2	-0.4	-0.7	-0.1	-0.5	-0.3	-0.5	-0.5	0.0	-0.1
Post-Benchmark	1.6	1.9	2.2	1.4	1.4	1.1	1.9	NA	1.9	2.1	NA	2.0	2.4	2.1	2.1	NA	1.2
Soil Type A or B	0.1	0.3	0.5	0.4	0.6	0.1	0.6	0.5	0.4	0.5	0.3	0.6	0.4	0.5	0.5	0.3	0.3
Soil Type E (1-3 stories)	0.2	0.2	0.1	-0.2	-0.4	0.2	-0.1	-0.4	0.0	0.0	-0.2	-0.3	-0.1	-0.1	-0.1	-0.2	-0.4
Soil Type E (> 3 stories)	-0.3	-0.6	-0.9	-0.6	-0.6	NA	-0.6	-0.4	-0.5	-0.7	-0.3	NA	-0.4	-0.5	-0.6	-0.2	NA
Minimum Score, S_{MIN}	1.1	0.9	0.7	0.5	0.5	0.6	0.5	0.5	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.2	1.0

FINAL LEVEL 1 SCORE, $S_{L1} \geq S_{MIN}$: S_{L1} = 2.7 2.8

EXTENT OF REVIEW
Exterior: [ ] Partial [X] All Sides [ ] Aerial
Interior: [X] None [ ] Visible [ ] Entered
Drawings Reviewed: [ ] Yes [X] No
Soil Type Source:
Geologic Hazards Source:
Contact Person:

LEVEL 2 SCREENING PERFORMED?
[ ] Yes, Final Level 2 Score, S_{L2} [X] No
Nonstructural hazards? [ ] Yes [ ] No

OTHER HAZARDS
Are There Hazards That Trigger A Detailed Structural Evaluation?
[ ] Pounding potential (unless S_{L2} > cut-off, if known)
[ ] Falling hazards from taller adjacent building
[ ] Geologic hazards or Soil Type F
[ ] Significant damage/deterioration to the structural system

ACTION REQUIRED
Detailed Structural Evaluation Required?
[ ] Yes, unknown FEMA building type or other building
[ ] Yes, score less than cut-off
[ ] Yes, other hazards present
[X] No
Detailed Nonstructural Evaluation Recommended? (check one)
[ ] Yes, nonstructural hazards identified that should be evaluated
[ ] No, nonstructural hazards exist that may require mitigation, but a detailed evaluation is not necessary
[X] No, no nonstructural hazards identified [ ] DNK

Where information cannot be verified, screener shall note the following: EST = Estimated or unreliable data OR DNK = Do Not Know

Legend: MRF = Moment-resisting frame; BR = Braced frame; RC = Reinforced concrete; SW = Shear wall; URM INF = Unreinforced masonry infill; TU = Tilt up; MH = Manufactured Housing; LM = Light metal; FD = Flexible diaphragm; RD = Rigid diaphragm

Figure 17. Completed Data Collection form for 5020 Ebony Drive

Example 4: It is required to perform rapid visual screening RVS for the main classroom building at Roosevelt Elementary School.

Figure 18. Exterior view of modern reinforced brick masonry building at Roosevelt Elementary School

Pre-field Planning Stage

In this stage, the screener determined the following information:

- Address
- Number of stories
- Year built
- Soils information

Field Screening of the Building

After walking around the building and through the interior of the building, the screener identified the followings:

- The screener verified the pre-field information. She checked Soil Type D and indicated liquefaction potential, based on the pre-filled information in the "Extent of Review" portion of the form (Level 1).
- The building as a FEMA Building Type ***RM2*** (reinforced masonry building with rigid floor and roof diaphragms) and sketched the plan of the building.
- All of the interior walls were finished, but she was able to identify which walls were structural versus nonstructural by tapping on them. Those walls that sounded solid were deemed structural, and those that sounded hollow were deemed nonstructural. She added this information to the sketch.

Identification of the Modifiers in Level 1 Form

Using the Vertical Irregularity Reference Guide (FEMA P-154, Appendix B.5), she identified the building as having ***a short column irregularity*** due to the presence of infill walls at the first floor that effectively shortened the length of the columns. Because the east-west walls were all concentrated at the center of the building, the screener identified the building as ***torsionally irregular***. Considering the ***plan and vertical irregularities***, the screener calculated a score of 0.1(Basic Score = 1.7, Sever Vl. Irreg. V_{L1} = -0.9, Plan Irreg. P_{L1}= -0.7, the sum. = 1.7-0.9-0.7=0.1), but used $\boldsymbol{S_{MIN}}$ to set the Level 1 Final Score at 0.3. See to filled Level 1 Form (Figure 19).

Identification of the Modifiers in Level 2 Form

The screener completed the Level 2 portion of the form, reviewing each of the Level 2 statements, and the nonstructural portion of the Level 2 form. The Level 2 Final Score, which included a more modest penalty for short columns and a positive modifier for redundancy, was calculated as +0.8.

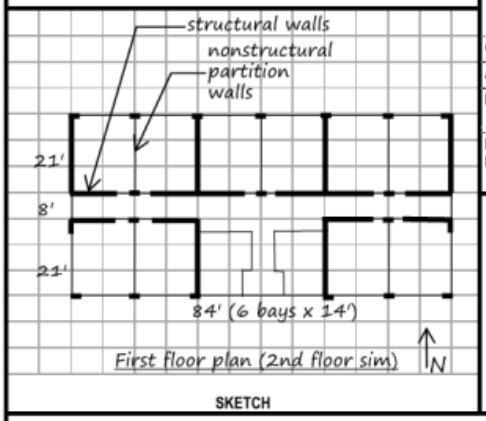
Final Decision

This score was transferred back onto the Level 1 form. Under "Other Hazards," the screener checked the "Geologic Hazards or Soil Type F" box to acknowledge that liquefaction potential at the site is a trigger for a Detailed Structural Evaluation. Under "***Action Required***,"

the screener checked both **"Yes, score less than cut-off"** and "**Yes, other hazards present"** (because of the liquefaction potential). No exterior falling hazards were observed in either the Level 1 or the Level 2 screening.

The completed Level 1 Data Collection Form for the main classroom building is shown in Figure 22. The completed Level 2 Data Collection Form is shown in Figure 23.

Rapid Visual Screening of Buildings for Potential Seismic Hazards — **Level 1**
FEMA P-154 Data Collection Form — **HIGH Seismicity**



SKETCH

Address: 169 Parkway Blvd
Green City, Any State Zip: 90922
Other Identifiers: Roosevelt Elementary School
Building Name: Main Building
Use:
Latitude: 40.282306 Longitude: -74.310469
S_S: 1.48 S_1: 0.39
Screener(s): P. Catz Date/Time: 8/14/13 1pm

No. Stories: Above Grade: 2 Below Grade: 0 Year Built: 1993 ☐ EST
Total Floor Area (sq. ft.): 8423 sqft Code Year:
Additions: ☒ None ☐ Yes, Year(s) Built:

Occupancy: Assembly, Commercial, Emer. Services, Historic, Shelter, Industrial, Office, School, Government, Utility, Warehouse, Residential, # Units:

Soil Type: ☐A Hard Rock ☐B Avg Rock ☐C Dense Soil ☒D Stiff Soil ☐E Soft Soil ☐F Poor Soil ☐DNK If DNK, assume Type D.

Geologic Hazards: Liquefaction: Yes No/DNK Landslide: Yes No/DNK Surf. Rupt.: Yes No/DNK

Adjacency: ☐ Pounding ☐ Falling Hazards from Taller Adjacent Building

Irregularities: ☒ Vertical (type/severity) Short Columns/Severe
☒ Plan (type) Torsion - see comments

Exterior Falling Hazards: ☐ Unbraced Chimneys ☐ Heavy Cladding or Heavy Veneer ☐ Parapets ☐ Appendages ☐ Other:

COMMENTS:
Exterior walls are all in north-south direction. Interior screening reveals additional interior walls in both directions. But the all the east-west walls are concentrated very close to the core. Therefore, consider as torsionally irregular.

Infill at first floor causes short columns.

☐ Additional sketches or comments on separate page

BASIC SCORE, MODIFIERS, AND FINAL LEVEL 1 SCORE, S_{L1}

FEMA BUILDING TYPE (Do Not Know)	W1	W1A	W2	S1 (MRF)	S2 (BR)	S3 (LM)	S4 (RC SW)	S5 (URM INF)	C1 (MRF)	C2 (SW)	C3 (URM INF)	PC1 (TU)	PC2	RM1 (FD)	RM2 (RD)	URM	MH
Basic Score	3.6	3.2	2.9	2.1	2.0	2.6	2.0	1.7	1.5	2.0	1.2	1.6	1.4	1.7	1.7	1.0	1.5
Severe Vertical Irregularity, V_{L1}	-1.2	-1.2	-1.2	-1.0	-1.0	-1.1	-1.0	-0.8	-0.9	-1.0	-0.7	-1.0	-0.9	-0.9	-0.9	-0.7	NA
Moderate Vertical Irregularity, V_{L1}	-0.7	-0.7	-0.7	-0.6	-0.6	-0.7	-0.6	-0.5	-0.5	-0.6	-0.4	-0.6	-0.5	-0.5	-0.5	-0.4	NA
Plan Irregularity, P_{L1}	-1.1	-1.0	-1.0	-0.8	-0.7	-0.9	-0.7	-0.6	-0.6	-0.8	-0.5	-0.7	-0.6	-0.7	-0.7	-0.4	NA
Pre-Code	-1.1	-1.0	-0.9	-0.6	-0.6	-0.8	-0.6	-0.2	-0.4	-0.7	-0.1	-0.5	-0.3	-0.5	-0.5	0.0	-0.1
Post-Benchmark	1.6	1.9	2.2	1.4	1.4	1.1	1.9	NA	1.9	2.1	NA	2.0	2.4	2.1	2.1	NA	1.2
Soil Type A or B	0.1	0.3	0.5	0.4	0.6	0.1	0.6	0.5	0.4	0.5	0.3	0.6	0.4	0.5	0.5	0.3	0.3
Soil Type E (1-3 stories)	0.2	0.2	0.1	-0.2	-0.4	0.2	-0.1	-0.4	0.0	0.0	-0.2	-0.3	-0.1	-0.1	-0.1	-0.2	-0.4
Soil Type E (> 3 stories)	-0.3	-0.6	-0.9	-0.6	-0.6	NA	-0.6	-0.4	-0.5	-0.7	-0.3	NA	-0.4	-0.5	-0.6	-0.2	NA
Minimum Score, S_{MIN}	1.1	0.9	0.7	0.5	0.5	0.6	0.5	0.5	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.2	1.0

FINAL LEVEL 1 SCORE, $S_{L1} \geq S_{MIN}$: 1.7-0.9-0.7 = 0.1; use S_{MIN} = 0.3

EXTENT OF REVIEW
Exterior: ☐ Partial ☒ All Sides ☒ Aerial
Interior: ☐ None ☐ Visible ☒ Entered
Drawings Reviewed: ☐ Yes ☒ No
Soil Type Source: Vs30 Maps - Type D
Geologic Hazards Source: State Geologist - Liq. Pot.
Contact Person:

LEVEL 2 SCREENING PERFORMED?
☒ Yes, Final Level 2 Score, S_{L2} 0.8 ☐ No
Nonstructural hazards? ☐ Yes ☒ No

OTHER HAZARDS
Are There Hazards That Trigger A Detailed Structural Evaluation?
☐ Pounding potential (unless S_{L2} > cut-off, if known)
☐ Falling hazards from taller adjacent building
☒ Geologic hazards or Soil Type F
☐ Significant damage/deterioration to the structural system (liquefaction)

ACTION REQUIRED
Detailed Structural Evaluation Required?
☐ Yes, unknown FEMA building type or other building
☒ Yes, score less than cut-off
☒ Yes, other hazards present
☐ No

Detailed Nonstructural Evaluation Recommended? (check one)
☐ Yes, nonstructural hazards identified that should be evaluated
☐ No, nonstructural hazards exist that may require mitigation, but a detailed evaluation is not necessary
☒ No, no nonstructural hazards identified ☐ DNK

Where information cannot be verified, screener shall note the following: EST = Estimated or unreliable data OR DNK = Do Not Know

Legend: MRF = Moment-resisting frame; BR = Braced frame; RC = Reinforced concrete; SW = Shear wall; URM INF = Unreinforced masonry infill; TU = Tilt up; MH = Manufactured Housing; LM = Light metal; FD = Flexible diaphragm; RD = Rigid diaphragm

Figure 19. Completed Level 1 Data Collection Form for the main building at Roosevelt Elementary School

Rapid Visual Screening of Buildings for Potential Seismic Hazards — **Level 2 (Optional)**

FEMA P-154 Data Collection Form (08/26/14) — **HIGH Seismicity**

Optional Level 2 data collection to be performed by a civil or structural engineering professional, architect, or graduate student with background in seismic evaluation or design of buildings.

Bldg Name: Roosevelt Elementary – Main Bldg	**Final Level 1 Score:**	S_{L1} = 0.1	*(do not consider S_{MIN})*
Screener: P. Catz	**Level 1 Irregularity Modifiers:**	*Vertical Irregularity,* V_{L1} = −0.9	*Plan Irregularity,* P_{L1} = −0.7
Date/Time: 8/14/13 1pm	**ADJUSTED BASELINE SCORE:**	$S' = (S_{L1} - V_{L1} - P_{L1})$ = 1.7	

STRUCTURAL MODIFIERS TO ADD TO ADJUSTED BASELINE SCORE

Topic	Statement *(If statement is true, circle the "Yes" modifier; otherwise cross out the modifier.)*		Yes	Subtotals
Vertical Irregularity, V_{L2}	Sloping Site	W1 building: There is at least a full story grade change from one side of the building to the other.	-1.2	
		Non-W1 building: There is at least a full story grade change from one side of the building to the other.	-0.3	
	Weak and/or Soft Story *(circle one maximum)*	W1 building cripple wall: An unbraced cripple wall is visible in the crawl space.	-0.6	
		W1 house over garage: Underneath an occupied story, there is a garage opening without a steel moment frame, and there is less than 8' of wall on the same line (for multiple occupied floors above, use 16' of wall minimum).	-1.2	
		W1A building open front: There are openings at the ground story (such as for parking) over at least 50% of the length of the building.	-1.2	
		Non-W1 building: Length of lateral system at any story is less than 50% of that at story above or height of any story is more than 2.0 times the height of the story above.	-0.9	
		Non-W1 building: Length of lateral system at any story is between 50% and 75% of that at story above or height of any story is between 1.3 and 2.0 times the height of the story above.	-0.6	
	Setback	Vertical elements of the lateral system at an upper story are outboard of those at the story below causing the diaphragm to cantilever at the offset.	-1.0	
		Vertical elements of the lateral system at upper stories are inboard of those at lower stories.	-0.5	
		There is an in-plane offset of the lateral elements that is greater than the length of the elements.	-0.3	
	Short Column/ Pier	C1,C2,C3,PC1,PC2,RM1,RM2: At least 20% of columns (or piers) along a column line in the lateral system have height/depth ratios less than 50% of the nominal height/depth ratio at that level.	-0.5	
		C1,C2,C3,PC1,PC2,RM1,RM2: The column depth (or pier width) is less than one half of the depth of the spandrel, or there are infill walls or adjacent floors that shorten the column.	(-0.5)	
	Split Level	There is a split level at one of the floor levels or at the roof.	-0.5	
	Other Irregularity	There is another observable severe vertical irregularity that obviously affects the building's seismic performance.	-1.0	V_{L2} = −0.5
		There is another observable moderate vertical irregularity that may affect the building's seismic performance.	-0.5	*(Cap at -1.2)*
Plan Irregularity, P_{L2}	Torsional irregularity: Lateral system does not appear relatively well distributed in plan in either or both directions. *(Do not include the W1A open front irregularity listed above.)*		(-0.7)	
	Non-parallel system: There are one or more major vertical elements of the lateral system that are not orthogonal to each other.		-0.4	
	Reentrant corner: Both projections from an interior corner exceed 25% of the overall plan dimension in that direction.		-0.3	
	Diaphragm opening: There is an opening in the diaphragm with a width over 50% of the total diaphragm width at that level.		-0.2	
	C1, C2 building out-of-plane offset: The exterior beams do not align with the columns in plan.		-0.4	P_{L2} = −0.7
	Other irregularity: There is another observable plan irregularity that obviously affects the building's seismic performance.		-0.7	*(Cap at -1.1)*
Redundancy	The building has at least two bays of lateral elements on each side of the building in each direction.		(+0.3)	
Pounding	Building is separated from an adjacent structure by less than 1% of the height of the shorter of the building and adjacent structure and:	The floors do not align vertically within 2 feet.	-1.0	*(Cap total pounding modifiers at -1.2)*
		One building is 2 or more stories taller than the other.	-1.0	
		The building is at the end of the block.	-0.3	
S2 Building	"K" bracing geometry is visible.		-1.0	
C1 Building	Flat plate serves as the beam in the moment frame.		-0.4	
PC1/RM1 Bldg	There are roof-to-wall ties that are visible or known from drawings that do not rely on cross-grain bending. *(Do not combine with post-benchmark or retrofit modifier.)*		+0.3	
PC1/RM1 Bldg	The building has closely spaced, full height interior walls (rather than an interior space with few walls such as in a warehouse).		+0.3	
URM	Gable walls are present.		-0.4	
MH	There is a supplemental seismic bracing system provided between the carriage and the ground.		+1.2	
Retrofit	Comprehensive seismic retrofit is visible or known from drawings.		+1.4	M = +0.3

FINAL LEVEL 2 SCORE, $S_{L2} = (S' + V_{L2} + P_{L2} + M) \geq S_{MIN}$: 1.7 − 0.5 − 0.7 + 0.3 = 0.8 *(Transfer to Level 1 form)*

There is observable damage or deterioration or another condition that negatively affects the building's seismic performance: ☐ Yes ☒ No

If yes, describe the condition in the comment box below and indicate on the Level 1 form that detailed evaluation is required independent of the building's score.

OBSERVABLE NONSTRUCTURAL HAZARDS

Location	Statement *(Check "Yes" or "No")*	Yes	No	Comment
Exterior	There is an unbraced unreinforced masonry parapet or unbraced unreinforced masonry chimney.		X	
	There is heavy cladding or heavy veneer.		X	
	There is a heavy canopy over exit doors or pedestrian walkways that appears inadequately supported.		X	
	There is an unreinforced masonry appendage over exit doors or pedestrian walkways.		X	
	There is a sign posted on the building that indicates hazardous materials are present.		X	
	There is a taller adjacent building with an unanchored URM wall or unbraced URM parapet or chimney.		X	
	Other observed exterior nonstructural falling hazard:		X	
Interior	There are hollow clay tile or brick partitions at any stair or exit corridor.		X	
	Other observed interior nonstructural falling hazard:		X	

Estimated Nonstructural Seismic Performance *(Check appropriate box and transfer to Level 1 form conclusions)*

☐ Potential nonstructural hazards with significant threat to occupant life safety –> Detailed Nonstructural Evaluation recommended

☐ Nonstructural hazards identified with significant threat to occupant life safety –> But no Detailed Nonstructural Evaluation required

☒ Low or no nonstructural hazard threat to occupant life safety –> No Detailed Nonstructural Evaluation required

Comments:

Figure 20. Completed Level 2 Data Collection Form for the main building at Roosevelt Elementary School

Example 5: It is required to perform rapid visual screening RVS for the Main Building plus Addition at Washington Middle School. The screener performed Level 1 and Level 2 screenings of the main classroom building at Washington Middle School.

Figure 21. Photo of exterior of Washington Middle School

Pre-field Planning Stage

In this stage, the screener determined the following information:

- Address,
- Number of stories,
- Year built, and
- Soils information
- Seismicity zone (High)
- Year built of addition was 1994

Field Screening of the Building

- The screener verified the pre-field information. He checked Soil Type C and indicated that no geologic hazards were present, based on the pre-filled information in the "Extent of Review" portion of the form.
- After walking around the building and through the interior of the building, he identified the original building as a C2 (concrete shear wall). He confirmed that the walls were concrete and not stucco over metal or wood framing by knocking on the walls and verifying that they were solid.
- He observed steel braces at the addition and concluded that it was an S2 (steel braced frame).
- He sketched a plan of the building, including the addition, and an elevation
- He calculated the area of the building and found that the area provided on the form did not appear to include the area of the addition. He crossed out the provided area and wrote in a revised value.

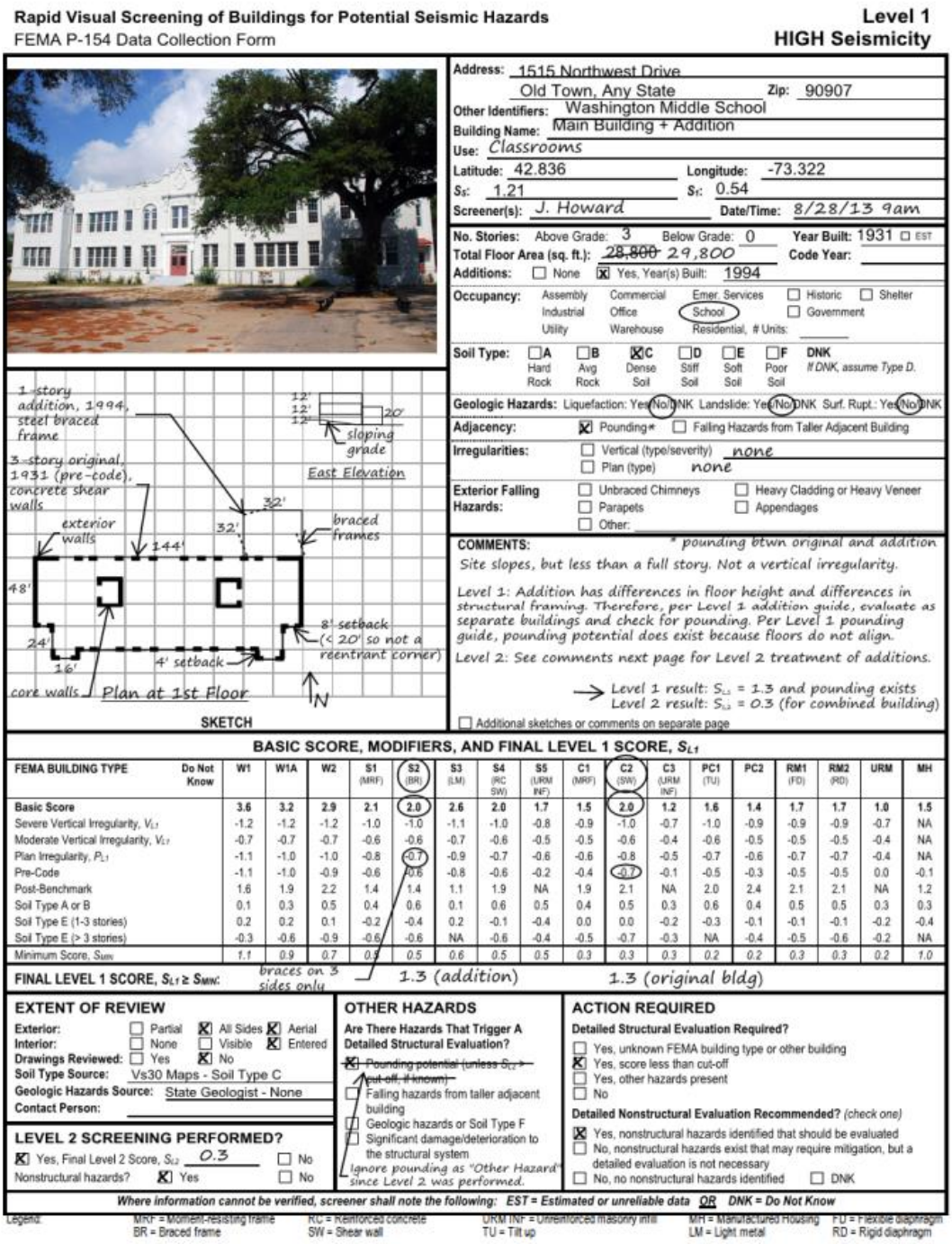
Identification of the Modifiers in Level 1 Form

- The screener consulted the Level 1 Building Additions Reference Guide, which indicated that because the addition and the original building had different structural framing, they should be evaluated separately and pounding should be considered. He checked pounding using the Level 1 Pounding Reference Guide and found that pounding potential does exist because the roof of the addition does not align with the floor of the original building.
- While he could have used a separate form for the addition, he opted to use a single Level 1 form for both portions of the building. He calculated a Level 1 score for the original building, and a second Level 1 score for the addition.
- The screener did not observe any of the irregularities listed in the Vertical Irregularity Reference Guide in the main building. Because the addition has braced frames on only three sides, the screener identified the addition as torsionally irregular using the Plan Irregularity Reference Guide.
- Considering the original building is pre-code, the screener calculated the Level 1 Score for the original building as 1.3. Considering the plan irregularity and the soil type, the screener calculated the Level 1 Score for the addition as 1.3.

Identification of the Modifiers in Level 2 Form & Final Decision

- Prior to performing the Level 2 portion of the form, the screener consulted the Level 2 Building Additions Reference Guide. Based on the Level 2 guide, the screener treated the original plus addition as a single building. He applied (1) the reentrant corner modifier to account for the difference in the plan dimension between the original and the addition; (2) the setback modifier to account for the difference in height; and (3) the torsional irregularity modifier to account for the difference in structural systems. He also applied modifiers for split level (because the roof of the addition does not align with any of the original floor levels) and redundancy (because there are multiple bays of lateral elements in both directions on both sides of the building.
- He made sure to apply the appropriate caps to V_{L2} and P_{L2} as instructed on the Level 2 form. The Level 2 score was calculated as -0.3, so *SMIN* (for the original building) was used as the Final Level 2 Score, S_{L2} = 0.3. This score was transferred back onto the Level 1 form.
- No exterior falling hazards were observed in the Level 1 screening. During the Level 2 screening, however, the screener observed what appeared to be hollow clay tile partitions. He noted this on the Level 2 form.
- Detailed structural evaluation is required because the score less than cut-off besides the detailed nonstructural evaluation is recommended.

The completed Level 1 Data Collection Form for the building is shown in Figure 22. The completed Level 2 Data Collection Form is shown in Figure 23.



Rapid Visual Screening of Buildings for Potential Seismic Hazards — **Level 1**
FEMA P-154 Data Collection Form — **HIGH Seismicity**

Address: 1515 Northwest Drive
Old Town, Any State Zip: 90907
Other Identifiers: Washington Middle School
Building Name: Main Building + Addition
Use: Classrooms
Latitude: 42.836 Longitude: -73.322
S_S: 1.21 S_1: 0.54
Screener(s): J. Howard Date/Time: 8/28/13 9am

No. Stories: Above Grade: 3 Below Grade: 0 Year Built: 1931 ☐ EST
Total Floor Area (sq. ft.): ~~28,800~~ 29,800 Code Year:
Additions: ☐ None ☒ Yes, Year(s) Built: 1994

Occupancy: Assembly, Industrial, Utility, Commercial, Office, Warehouse, Emer. Services, School, Residential # Units:, Historic, Government, Shelter

Soil Type: ☐A Hard Rock ☐B Avg Rock ☒C Dense Soil ☐D Stiff Soil ☐E Soft Soil ☐F Poor Soil ☐DNK If DNK, assume Type D.

Geologic Hazards: Liquefaction: Yes/No/DNK Landslide: Yes/No/DNK Surf. Rupt.: Yes/No/DNK

Adjacency: ☒ Pounding* ☐ Falling Hazards from Taller Adjacent Building

Irregularities: ☐ Vertical (type/severity) none ☐ Plan (type) none

Exterior Falling Hazards: ☐ Unbraced Chimneys ☐ Heavy Cladding or Heavy Veneer ☐ Parapets ☐ Appendages ☐ Other:

1-story addition, 1994, steel braced frame
3-story original, 1931 (pre-code), concrete shear walls
12' 12' 12' 20' sloping grade
East Elevation
32' 32' exterior walls braced frames
144'
48'
24' 16' 4' setback 8' setback (< 20' so not a reentrant corner)
core walls
Plan at 1st Floor
N
SKETCH

COMMENTS: * pounding btwn original and addition
Site slopes, but less than a full story. Not a vertical irregularity.
Level 1: Addition has differences in floor height and differences in structural framing. Therefore, per Level 1 addition guide, evaluate as separate buildings and check for pounding. Per Level 1 pounding guide, pounding potential does exist because floors do not align.
Level 2: See comments next page for Level 2 treatment of additions.
→ Level 1 result: S_{L1} = 1.3 and pounding exists
Level 2 result: S_{L1} = 0.3 (for combined building)
☐ Additional sketches or comments on separate page

BASIC SCORE, MODIFIERS, AND FINAL LEVEL 1 SCORE, S_{L1}

FEMA BUILDING TYPE (Do Not Know)	W1	W1A	W2	S1 (MRF)	S2 (BR)	S3 (LM)	S4 (RC SW)	S5 (URM INF)	C1 (MRF)	C2 (SW)	C3 (URM INF)	PC1 (TU)	PC2	RM1 (FD)	RM2 (RD)	URM	MH
Basic Score	3.6	3.2	2.9	2.1	2.0	2.6	2.0	1.7	1.5	2.0	1.2	1.6	1.4	1.7	1.7	1.0	1.5
Severe Vertical Irregularity, V_{L1}	-1.2	-1.2	-1.2	-1.0	-1.0	-1.1	-1.0	-0.8	-0.9	-1.0	-0.7	-1.0	-0.9	-0.9	-0.9	-0.7	NA
Moderate Vertical Irregularity, V_{L1}	-0.7	-0.7	-0.7	-0.6	-0.6	-0.7	-0.6	-0.5	-0.5	-0.6	-0.4	-0.6	-0.5	-0.5	-0.5	-0.4	NA
Plan Irregularity, P_{L1}	-1.1	-1.0	-1.0	-0.8	-0.7	-0.9	-0.7	-0.6	-0.6	-0.8	-0.5	-0.7	-0.6	-0.7	-0.7	-0.4	NA
Pre-Code	-1.1	-1.0	-0.9	-0.6	-0.6	-0.8	-0.6	-0.2	-0.4	-0.7	-0.1	-0.5	-0.3	-0.5	-0.5	0.0	-0.1
Post-Benchmark	1.6	1.9	2.2	1.4	1.4	1.1	1.9	NA	1.9	2.1	NA	2.0	2.4	2.1	2.1	NA	1.2
Soil Type A or B	0.1	0.3	0.5	0.4	0.6	0.1	0.6	0.5	0.4	0.5	0.3	0.6	0.4	0.5	0.5	0.3	0.3
Soil Type E (1-3 stories)	0.2	0.2	0.1	-0.2	-0.4	0.2	-0.1	-0.4	0.0	0.0	-0.2	-0.3	-0.1	-0.1	-0.1	-0.2	-0.4
Soil Type E (> 3 stories)	-0.3	-0.6	-0.9	-0.6	-0.6	NA	-0.6	-0.4	-0.5	-0.7	-0.3	NA	-0.4	-0.5	-0.6	-0.2	NA
Minimum Score, S_{MIN}	1.1	0.9	0.7	0.5	0.5	0.6	0.5	0.5	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.2	1.0

FINAL LEVEL 1 SCORE, $S_{L1} \geq S_{MIN}$: braces on 3 sides only — 1.3 (addition) — 1.3 (original bldg)

EXTENT OF REVIEW
Exterior: ☐ Partial ☒ All Sides ☒ Aerial
Interior: ☐ None ☐ Visible ☒ Entered
Drawings Reviewed: ☐ Yes ☒ No
Soil Type Source: Vs30 Maps - Soil Type C
Geologic Hazards Source: State Geologist - None
Contact Person:

LEVEL 2 SCREENING PERFORMED?
☒ Yes, Final Level 2 Score, S_{L2} 0.3 ☐ No
Nonstructural hazards? ☒ Yes ☐ No

OTHER HAZARDS
Are There Hazards That Trigger A Detailed Structural Evaluation?
☒ ~~Pounding potential (unless S_{L2} > cut-off, if known)~~
☐ Falling hazards from taller adjacent building
☐ Geologic hazards or Soil Type F
☐ Significant damage/deterioration to the structural system
Ignore pounding as "Other Hazard" since Level 2 was performed.

ACTION REQUIRED
Detailed Structural Evaluation Required?
☐ Yes, unknown FEMA building type or other building
☒ Yes, score less than cut-off
☐ Yes, other hazards present
☐ No
Detailed Nonstructural Evaluation Recommended? (check one)
☒ Yes, nonstructural hazards identified that should be evaluated
☐ No, nonstructural hazards exist that may require mitigation, but a detailed evaluation is not necessary
☐ No, no nonstructural hazards identified ☐ DNK

Where information cannot be verified, screener shall note the following: EST = Estimated or unreliable data OR DNK = Do Not Know

Legend: MRF = Moment-resisting frame; BR = Braced frame; RC = Reinforced concrete; SW = Shear wall; URM INF = Unreinforced masonry infill; TU = Tilt up; MH = Manufactured Housing; LM = Light metal; FD = Flexible diaphragm; RD = Rigid diaphragm

Figure 22. Completed Level 1 Data Collection Form for the main building (original plus addition) at Washington Middle School.

Rapid Visual Screening of Buildings for Potential Seismic Hazards — **Level 2 (Optional)**

FEMA P-154 Data Collection Form — **HIGH Seismicity**

Optional Level 2 data collection to be performed by a civil or structural engineering professional, architect, or graduate student with background in seismic evaluation or design of buildings.

Bldg Name: WMS - Main Building	**Final Level 1 Score:**	S_{L1} = 1.3	*(do not consider S_{MIN})*
Screener: J. Howard	**Level 1 Irregularity Modifiers:**	*Vertical Irregularity,* V_{L1} = 0	*Plan Irregularity,* P_{L1} = 0
Date/Time: 8/28/13 9am	**ADJUSTED BASELINE SCORE:**	$S' = (S_{L1} - V_{L1} - P_{L1})$ = 1.3	

STRUCTURAL MODIFIERS TO ADD TO ADJUSTED BASELINE SCORE

Topic	Statement *(If statement is true, circle the "Yes" modifier; otherwise cross out the modifier.)*		Yes	Subtotals
Vertical Irregularity, V_{L2}	Sloping Site	W1 building: There is at least a full story grade change from one side of the building to the other.	-1.2	
		Non-W1 building: There is at least a full story grade change from one side of the building to the other.	-0.3	
	Weak and/or Soft Story *(circle one maximum)*	W1 building cripple wall: An unbraced cripple wall is visible in the crawl space.	-0.6	
		W1 house over garage: Underneath an occupied story, there is a garage opening without a steel moment frame, and there is less than 8' of wall on the same line (for multiple occupied floors above, use 16' of wall minimum).	-1.2	
		W1A building open front: There are openings at the ground story (such as for parking) over at least 50% of the length of the building.	-1.2	
		Non-W1 building: Length of lateral system at any story is less than 50% of that at story above or height of any story is more than 2.0 times the height of the story above.	-0.9	
		Non-W1 building: Length of lateral system at any story is between 50% and 75% of that at story above or height of any story is between 1.3 and 2.0 times the height of the story above.	-0.5	
	Setback	Vertical elements of the lateral system at an upper story are outboard of those at the story below causing the diaphragm to cantilever at the offset.	-1.0	
		Vertical elements of the lateral system at upper stories are inboard of those at lower stories.	(-0.5) *	
		There is an in-plane offset of the lateral elements that is greater than the length of the elements.	-0.3	
	Short Column/ Pier	C1,C2,C3,PC1,PC2,RM1,RM2: At least 20% of columns (or piers) along a column line in the lateral system have height/depth ratios less than 50% of the nominal height/depth ratio at that level.	-0.5	
		C1,C2,C3,PC1,PC2,RM1,RM2: The column depth (or pier width) is less than one half of the depth of the spandrel, or there are infill walls or adjacent floors that shorten the column.	-0.5	
	Split Level	There is a split level at one of the floor levels or at the roof.	(-0.5)	
	Other Irregularity	There is another observable severe vertical irregularity that obviously affects the building's seismic performance.	-1.0	V_{L2} = -1.0 (Cap at -1.2)
		There is another observable moderate vertical irregularity that may affect the building's seismic performance.	-0.5	
Plan Irregularity, P_{L2}	Torsional irregularity: Lateral system does not appear relatively well distributed in plan in either or both directions. *(Do not include the W1A open front irregularity listed above.)*		(-0.7) *	
	Non-parallel system: There are one or more major vertical elements of the lateral system that are not orthogonal to each other.		-0.4	
	Reentrant corner: Both projections from an interior corner exceed 25% of the overall plan dimension in that direction.		(-0.4) *	
	Diaphragm opening: There is an opening in the diaphragm with a width over 50% of the total diaphragm width at that level.		-0.2	
	C1, C2 building out-of-plane offset: The exterior beams do not align with the columns in plan.		-0.4	P_{L2} = -1.1 (Cap at -1.1)
	Other irregularity: There is another observable plan irregularity that obviously affects the building's seismic performance.		-0.7	
Redundancy	The building has at least two bays of lateral elements on each side of the building in each direction.		(-0.3)	
Pounding	Building is separated from an adjacent structure by less than 1% of the height of the shorter of the building and adjacent structure and:	The floors do not align vertically within 2 feet.	-1.0	
		One building is 2 or more stories taller than the other.	-1.0	
		The building is at the end of the block.	-0.5	
		(Cap total pounding modifiers at -1.2)		
S2 Building	"K" bracing geometry is visible.		-1.0	
C1 Building	Flat plate serves as the beam in the moment frame.		-0.4	
PC1/RM1 Bldg	There are roof-to-wall ties that are visible or known from drawings that do not rely on cross-grain bending. *(Do not combine with post-benchmark or retrofit modifier.)*		+0.3	
PC1/RM1 Bldg	The building has closely spaced, full height interior walls (rather than an interior space with few walls such as in a warehouse).		+0.3	
URM	Gable walls are present.		-0.4	
MH	There is a supplemental seismic bracing system provided between the carriage and the ground.		+1.2	
Retrofit	Comprehensive seismic retrofit is visible or known from drawings.		+1.4	M = +0.3

FINAL LEVEL 2 SCORE, $S_{L2} = (S' + V_{L2} + P_{L2} + M) \geq S_{MIN}$: 1.3 − 1.0 − 1.1 + 0.3 = −0.5; use S_{MIN} = 0.3 *(Transfer to Level 1 form)*

There is observable damage or deterioration or another condition that negatively affects the building's seismic performance: ☐ Yes ☒ No

If yes, describe the condition in the comment box below and indicate on the Level 1 form that detailed evaluation is required independent of the building's score.

OBSERVABLE NONSTRUCTURAL HAZARDS

Location	Statement *(Check "Yes" or "No")*	Yes	No	Comment
Exterior	There is an unbraced unreinforced masonry parapet or unbraced unreinforced masonry chimney.		X	
	There is heavy cladding or heavy veneer.		X	
	There is a heavy canopy over exit doors or pedestrian walkways that appears inadequately supported.		X	
	There is an unreinforced masonry appendage over exit doors or pedestrian walkways.		X	
	There is a sign posted on the building that indicates hazardous materials are present.		X	
	There is a taller adjacent building with an unanchored URM wall or unbraced URM parapet or chimney.		X	
	Other observed exterior nonstructural falling hazard:		X	
Interior	There are hollow clay tile or brick partitions at any stair or exit corridor.	X		corridor appears to be hollow clay tile
	Other observed interior nonstructural falling hazard:		X	

Estimated Nonstructural Seismic Performance *(Check appropriate box and transfer to Level 1 form conclusions)*

- ☒ Potential nonstructural hazards with significant threat to occupant life safety –> Detailed Nonstructural Evaluation recommended
- ☐ Nonstructural hazards identified with significant threat to occupant life safety –> But no Detailed Nonstructural Evaluation required
- ☐ Low or no nonstructural hazard threat to occupant life safety –> No Detailed Nonstructural Evaluation required

Comments: * Addition has differences in horizontal dimension, floor height, and structural framing. Therefore, per Level 2 addition guide, evaluate as single building and consider reentrant corner, setback and torsional irregularities.

Figure 23. Completed Level 2 Data Collection Form for the main building (original plus addition) at Washington Middle School

9. APPENDIX A: DATA COLLECTION FORMS

Rapid Visual Screening of Buildings for Potential Seismic Hazards — **LEVEL 1**

(Adopted from FEMA P-154 Data Collection Form) — **VERY HIGH Seismicity**

PHOTOGRAPH

SKETCH

Address: ..... City: .....
Other ID: ..... Use: .....
Building Name: .....
Latitude: ..... S_s: .....
Longitude: ..... S_1: .....
Screener: ..... Date/Time: .....

#Stories - Above Ground: ..... Below Ground: ..... Year Built: ..... ☐ Est
Total Floor Area (sft): ..... Code Year: .....

Additions: ☐ None ☐ Yes, Years Built: .....

Occupancy: ☐ Assembly ☐ Commercial ☐ Emergency Services ☐ Historic ☐ Industrial ☐ Office ☐ Schools ☐ Government ☐ Utility ☐ Warehouse ☐ Residential,#Units: ☐ Shelter

Soil Type: ☐ A: Hard Rock ☐ C: Soft Rock ☐ E: Soft Soil ☐ B: Normal Rock ☐ D: Hard Soil / DNK ☐ F: Poor Soil

Geohazards: Liquefaction: ☐ Yes, ☐ No, ☐ DNK; Landslide: ☐ Yes, ☐ No, ☐ DNK; Surface Rupture: ☐ Yes, ☐ No, ☐ DNK

Adjacency: ☐ Pounding ☐ Falling Hazards from Taller Adjacent Building

Irregularities: ☐ Severe Vertical Irregularity ☐ Plan Irregularity ☐ Moderate Vertical Irregularity

Exterior Falling Hazards: ☐ Unbraced Chimneys ☐ Heavy Cladding or Heavy Veneer ☐ Parapets ☐ Appendages ☐ Other:

COMMENTS

☐ Additional sketches or comments on separate page

BASIC SCORE, MODIFIERS, AND FINAL LEVEL 1 SCORE, S_{L1}

BUILDING TYPE	DNK	W1	W1A	W2	S1	S2	S3	S4	S5	C1	C2	C3	PC1	PC2	RM1	RM2	URM	MH	BN1	BN2
Basic Score		**2.1**	**1.9**	**1.8**	**1.5**	**1.4**	**1.6**	**1.4**	**1.2**	**1.0**	**1.2**	**0.9**	**1.1**	**1.0**	**1.1**	**1.1**	**0.9**	**1.1**	**0.9**	**0.8**
Severe Vertical Irregularity, V_{L1}		-0.9	-0.9	-0.9	-0.8	-0.7	-0.8	-0.7	-0.7	-0.7	-0.8	-0.6	-0.7	-0.7	-0.7	-0.7	-0.6	NA	-0.6	-0.6
Moderate Vertical Irregularity, V_{L1}		-0.6	-0.5	-0.5	-0.4	-0.4	-0.5	-0.4	-0.3	-0.4	-0.4	-0.3	-0.4	-0.4	-0.4	-0.4	-0.3	NA	-0.3	-0.3
Plan Irregularity, P_{L1}		-0.7	-0.7	-0.6	-0.5	-0.5	-0.6	-0.4	-0.4	-0.4	-0.5	-0.3	-0.5	-0.4	-0.4	-0.4	-0.3	NA	-0.3	0.0
Pre-Code		-0.3	-0.3	-0.3	-0.3	-0.2	-0.3	-0.2	-0.1	-0.1	-0.2	0.0	-0.2	-0.1	-0.2	-0.2	0.0	0.0	NA	NA
Post-Benchmark		1.9	1.9	2.0	1.0	1.1	1.1	1.5	NA	1.4	1.7	NA	1.5	1.7	1.6	1.6	NA	0.5	NA	NA
Soil Type A or B		0.5	0.5	0.4	0.3	0.3	0.4	0.3	0.2	0.2	0.3	0.1	0.3	0.2	0.3	0.3	0.1	0.1	0.1	0.2
Soil Type E (1-3 stories)		0.0	-0.2	-0.4	-0.3	-0.2	-0.2	-0.2	-0.1	-0.1	-0.2	0.0	-0.2	-0.1	-0.2	-0.2	0.0	-0.1	0.0	0.0
Soil Type E (>3 stories)		-0.4	-0.4	-0.4	-0.3	-0.3	NA	-0.3	-0.1	-0.1	-0.3	-0.1	NA	-0.1	-0.2	-0.2	0.0	NA	NA	NA
Minimum Score, S_{MIN}		0.7	0.7	0.7	0.5	0.5	0.5	0.5	0.5	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.2	1.0	0.2	0.2

FINAL LEVEL 1 SCORE, $S_{L1} \geq S_{MIN}$

EXTENT OF REVIEW
Exterior: ☐ Partial ☐ All Sides ☐ Aerial
Interior: ☐ None ☐ Visible ☐ Entered
Drawing Reviewd: ☐ Yes ☐ No
Soil Type Source: .....
Geohazards Source: .....
Contact Person: .....
LEVEL 2 SCREENING PERFORMED?
☐ Yes, Final Level 2 Score, S_{L2}: ☐ No
Nonstructural Hazards? ☐ Yes ☐ No

OTHER HAZARDS
Are There Hazards That Trigger A Detailed Structural Evaluation?
☐ Pounding potential (Unless S_{L1} > Cut-off, if known)
☐ Falling hazards from taller adjacent building
☐ Geologic hazards or Soil Type F
☐ Significant damage/deterioration to the structural system

ACTION REQUIRED
Detailed Structural Evaluation Required?
☐ Yes, unknown building type or other building
☐ Yes, score less than cut-off
☐ Yes, other hazards present ☐ No
Detailed Nonstructural Evaluation Recommended?
☐ Yes, nonstructural hazard identified, should be evaluated
☐ No, nonstructural hazards exist that may require mitigation, but a detailed evaluation is not necessary
☐ No, no nonstructural hazards identified ☐ DNK

Where information cannot be verified, screener shall note the following: EST = Estimated or unreliable data (OR) DNK = Do Not Know

Rapid Visual Screening of Buildings for Potential Seismic Hazards

LEVEL 2 (Optional)
VERY HIGH Seismicity

(Adopted from FEMA P-154 Data Collection Form)

Optional Level 2 Data Collection to be performed by a civil or structural engineering professional, architect, or graduate student with background in seismic evaluation or design of buildings.

Building Name :	***Final Level 1 Score:*** S_{L1} =	(Do not consider S_{MIN})
Screener :	***Level 1 Irregularity Modifiers:*** Vertical Irregularity , V_{I1} =	Plan Irregularity, P_{I1} =
Date/ Time :	***ADJUSTED BASELINE*** $S' = (S_{L1} - V_{I1} - P_{I1})$ =	

STRUCTURAL MODIFIERS TO ADD TO ADJUSTED BASELINE SCORE

Topic		Statement (If statement is true, circle "Yes" modifier; otherwise cross out the modifier)	Yes	Subtotals
Vertical Irregularity, V_{L2}	*Sloping Site*	W1 Building : There is at least a full story grade change from one side of the building to the other.	-0.9	
		Non-W1 Building : Ther is at least a full story grade change from one side of the building to the other.	-0.2	
	Weak and/or Soft Story (Circle one maximum)	W1 Building Cripple Wall : An unbraced cripple wall is visible in the crawl space.	-0.5	
		W1 House over Garage : Underneath an occupied story, there is a garage opening without a steel moment frame, and there is less than 8 ft of wall on the same line (for multiple occupied floors above, use 16 ft of wall minimum)	-0.9	
		W1A Building Open Front : There are openings at the ground story (such as for parking) over at least 50 % of the length of the building.	-0.9	
		Non-W1 Building : Length of lateral system at any story is less than 50 % of that at story above or height of any story is more than 2.0 times the height of the story above.	-0.7	
		Non-W1 Building : Length of lateral system at any story is between 50 % and 75 % of that at story above or height of any story is between 1.3 and 2.0 times the height of the story above.	-0.4	
	Setback	Vertical elements of the lateral system at an upper story are outboard of those at the story below causing the diaphragm to cantilever at the offset.	-0.7	
		Vertical elements of the lateral system at upper stories are inboard of those at lower stories.	-0.4	
		There is an in-plane offset of the lateral elements that is greater than the length of the elements.	-0.2	
	Short Column/ Pier	C1,C2,C3,PC1,PC2,RM1,RM2 : At least 20 % of columns (or piers) along a column line in the lateral system have height/depth ratios less than 50 % of the nominal height/depth ratio at that level.	-0.4	
		C1,C2,C3,PC1,PC2,RM1,RM2 : The column depth (or pier width) is less than one half of the depth of the spandrel, or there are infill walls or adjacent floors that shorten the column.	-0.4	
	Split Level	There is a split level at one of the floor levels or at the roof.	-0.4	
	Other Irregularity	There is another observable severe vertical irregularity that obviously affects the building's seismic performance.	-0.7	V_{L2} =
		There is another observable moderate vertical irregularity that may affect the building's seismic performance.	-0.4	*(Cap at -0.9)*
Plan Irregularity, P_{L2}	Torsional Irregularity: Lateral system does not appear relatively well distributed in plan in either or both directions. (Do not include the W1A open front irregularity listed above)		-0.5	
	Non-parallel System: There are one or more major vertical elements of the lateral system that are not orthogonal to each other.		-0.2	
	Reentrant Corner: Both projections from an interior corner exceed 25 % of the overall plan dimensions in that direction.		-0.2	
	Diaphragm Opening: There is an opening in the diaphragm with a width over 50 % of the total diaphragm width at that level.		-0.2	
	C1, C2 Buildings Out-of-plane Offset: The exterior beams do not align with the columns in plan.		-0.2	P_{L2} =
	Other Irregularity: There is another observable plan irregularity that obviously affects the building's seismic performance.		-0.5	*(Cap at -0.7)*
Redundancy	The building has at least two bays of lateral elements on each side of the building in each direction.		0.2	
Pounding	Building is separated from an adjacent structure by less than 1.5 % of the height of the shorter of the building and adjacent structure and:	The floors do not align vertically within 2 feet.	-0.7	
		One building is 2 or more stories taller than the other.	-0.7	
		The building is at the end of the block.	-0.4	
S2 Building	"K" bracing geometry is visible.		-0.7	
C1 Building	Flat plate serves as the beam in the moment frame.		-0.3	
PC1/ RM1 Building	There are roof-to-wall ties that are visible or known from drawings that do not rely on cross-grain bending. (Do not combine with post-benchmark or retrofit modifier)		0.2	
	The building has closely spaced, full height interior walls (rather than an interior space with few walls such as in a warehouse)		0.2	
URM	Gable walls are present.		-0.3	
MH	There is a supplemental seismic bracing system provided between the carriage and the ground.		0.5	
Retrofit	Comprehensive seismic retrofit is visible or known from drawings.		1.2	M =

FINAL LEVEL 2 SCORE, $S_{L2} = (S' + V_{L2} + P_{L2} + M) \geq S_{MIN}$: ***(Transfer to Level 1 Form)***

There is observable damage or deterioration or another condition that negatively affects the building's seismic performance: ☐ Yes ☐ No
If yes, describe the condition in the comment box below and indicate on the Level 1 form that detailed evaluation is required independent of the building's score.

OBSERVABLE NONSTRUCTURAL HAZARDS

Location	Statement (Check "Yes" or "No")	Yes	No	Comments
Exterior	There is an unbraced unreinforced masonry parapet or unbraced unreinforced masonry chimney.			
	There is heavy cladding or heavy veneer.			
	There is a heavy canopy over exit doors or pedestrian walkways that appears inadequately supported.			
	There is an unreinforced masonry appendage over exit doors or pedestrian walkways.			
	There is a sign posted on the building that indicates hazardous materials are present.			
	There is a taller adjacent building with an unanchored URM wall or unbraced URM parapet or chimney.			
	Other observed exterior nonstructural falling hazard.			
Interior	There are hollow clay tile or brick partitions at any stair or exit corridor.			
	Other observed interior nonstructural falling hazard.			

Estimated Nonstructural Seismic Performance *(Check appropriate box and transfer to Level 1 form conslusions)*

☐ Potential nonstructural hazards with significant threat to occupant life safety. --> Detailed Nonstructural Evaluation recommended.
☐ Nonstructural hazards identified with significant threat to occupant life safety. --> But no Detailed Nonstructural Evaluation required.
☐ Low or no nonstructural hazard threat to occupant life safety. --> No Detailed Nonstructural Evaluation required.

Comments :

Rapid Visual Screening of Buildings for Potential Seismic Hazards

LEVEL 1

(Adopted from FEMA P-154 Data Collection Form)

HIGH Seismicity

PHOTOGRAPH

SKETCH

Address: ..... **City:** .....

Other ID: ..... **Use:** .....

Building Name: .....

Latitude: ..... S_s: .....

Longitude: ..... S_1: .....

Screener: ..... **Date/Time:** .....

#Stories - Above Ground: ..... Below Ground: ..... **Year Built:** ..... ☐ Est

Total Floor Area (sft): ..... **Code Year:** .....

Additions: ☐ None ☐ Yes, Years Built:.....

Occupancy: ☐ Assembly ☐ Commercial ☐ Emergency Services ☐ Historic
☐ Industrial ☐ Office ☐ Schools ☐ Government
☐ Utility ☐ Warehouse ☐ Residential,#Units: ☐ Shelter

Soil Type: ☐ A: Hard Rock ☐ C: Soft Rock ☐ E: Soft Soil
☐ B: Normal Rock ☐ D: Hard Soil / DNK ☐ F: Poor Soil

Geohazards: Liquefaction: ☐ Yes, ☐ No, ☐ DNK
Landslide: ☐ Yes, ☐ No, ☐ DNK
Surface Rupture: ☐ Yes, ☐ No, ☐ DNK

Adjacency: ☐ Pounding ☐ Falling Hazards from Taller Adjacent Building

Irregularities: ☐ Severe Vertical Irregularity ☐ Plan Irregularity
☐ Moderate Vertical Irregularity

Exterior Falling Hazards: ☐ Unbraced Chimneys ☐ Heavy Cladding or Heavy Veneer
☐ Parapets ☐ Appendages
☐ Other:

COMMENTS

☐ Additional sketches or comments on separate page

BASIC SCORE, MODIFIERS, AND FINAL LEVEL 1 SCORE, S_{L1}

BUILDING TYPE	DNK	W1	W1A	W2	S1	S2	S3	S4	S5	C1	C2	C3	PC1	PC2	RM1	RM2	URM	MH	BN1	BN2
Basic Score		**3.6**	**3.2**	**2.9**	**2.1**	**2.0**	**2.6**	**2.0**	**1.7**	**1.5**	**2.0**	**1.2**	**1.6**	**1.4**	**1.7**	**1.7**	**1.0**	**1.5**	**1.0**	**1.4**
Severe Vertical Irregularity, V_{L1}		-1.2	-1.2	-1.2	-1.0	-1.0	-1.1	-1.0	-0.8	-0.9	-1.0	-0.7	-1.0	-0.9	-0.9	-0.9	-0.7	NA	-0.7	-0.8
Moderate Vertical Irregularity, V_{L1}		-0.7	-0.7	-0.7	-0.6	-0.6	-0.7	-0.6	-0.5	-0.5	-0.6	-0.4	-0.6	-0.5	-0.5	-0.5	-0.4	NA	-0.4	-0.5
Plan Irregularity, P_{L1}		-1.1	-1.0	-1.0	-0.8	-0.7	-0.9	-0.7	-0.6	-0.6	-0.8	-0.5	-0.7	-0.6	-0.7	-0.7	-0.4	NA	-0.4	-0.5
Pre-Code		-1.1	-1.0	-0.9	-0.6	-0.6	-0.8	-0.6	-0.2	-0.4	-0.7	-0.1	-0.5	-0.3	-0.5	-0.5	0.0	-0.1	NA	NA
Post-Benchmark		1.6	1.9	2.2	1.4	1.4	1.1	1.9	NA	1.9	2.1	NA	2.0	2.4	2.1	2.1	NA	1.2	NA	NA
Soil Type A or B		0.1	0.3	0.5	0.4	0.6	0.1	0.6	0.5	0.4	0.5	0.3	0.6	0.4	0.5	0.5	0.3	0.3	0.3	0.9
Soil Type E (1-3 stories)		0.2	0.2	0.1	-0.2	-0.4	0.2	-0.1	-0.4	0.0	0.0	-0.2	-0.3	-0.1	-0.1	-0.1	-0.2	-0.4	-0.2	-0.6
Soil Type E (>3 stories)		-0.3	-0.6	-0.9	-0.6	-0.6	NA	-0.6	-0.4	-0.5	-0.7	-0.3	NA	-0.4	-0.5	-0.6	-0.2	NA	NA	NA
Minimum Score, S_{MIN}		1.1	0.9	0.7	0.5	0.5	0.6	0.5	0.5	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.2	1.0	0.2	0.2

FINAL LEVEL 1 SCORE, $S_{L1} \geq S_{MIN}$

EXTENT OF REVIEW

Exterior: ☐ Partial ☐ All Sides ☐ Aerial

Interior: ☐ None ☐ Visible ☐ Entered

Drawing Reviewd: ☐ Yes ☐ No

Soil Type Source:.....

Geohazards Source:.....

Contact Person:.....

LEVEL 2 SCREENING PERFORMED?

☐ Yes, Final Level 2 Score, S_{L2}: ☐ No

Nonstructural Hazards? ☐ Yes ☐ No

OTHER HAZARDS

Are There Hazards That Trigger A Detailed Structural Evaluation?

☐ Pounding potential (Unless S_{L1} > Cut-off, If known)

☐ Falling hazards from taller adjacent building

☐ Geologic hazards or Soil Type F

☐ Significant damage/deterioration to the structural system

ACTION REQUIRED

Detailed Structural Evaluation Required?

☐ Yes, unknown building type or other building

☐ Yes, score less than cut-off

☐ Yes, other hazards present ☐ No

Detailed Nonstructural Evaluation Recommended?

☐ Yes, nonstructural hazard identified, should be evaluated

☐ No, nonstructural hazards exist that may require mitigation, but a detailed evaluation is not necessary

☐ No, no nonstructural hazards identified ☐ DNK

Where information cannot be verified, screener shall note the following: EST = Estimated or unreliable data (OR) DNK = Do Not Know

Rapid Visual Screening of Buildings for Potential Seismic Hazards

LEVEL 1

(Adopted from FEMA P-154 Data Collection Form)

HIGH Seismicity

PHOTOGRAPH

SKETCH

Address: ..... **City:** .....

Other ID: ..... **Use:** .....

Building Name: .....

Latitude: ..... S_s: .....

Longitude: ..... S_1: .....

Screener: ..... **Date/Time:** .....

#Stories - Above Ground: ..... Below Ground: ..... **Year Built:** ..... ☐ Est

Total Floor Area (sft): ..... **Code Year:** .....

Additions: ☐ None ☐ Yes, Years Built: .....

Occupancy: ☐ Assembly ☐ Commercial ☐ Emergency Services ☐ Historic
☐ Industrial ☐ Office ☐ Schools ☐ Government
☐ Utility ☐ Warehouse ☐ Residential,#Units: ☐ Shelter

Soil Type: ☐ A: Hard Rock ☐ C: Soft Rock ☐ E: Soft Soil
☐ B: Normal Rock ☐ D: Hard Soil / DNK ☐ F: Poor Soil

Geohazards: Liquefaction: ☐ Yes, ☐ No, ☐ DNK
Landslide: ☐ Yes, ☐ No, ☐ DNK
Surface Rupture: ☐ Yes, ☐ No, ☐ DNK

Adjacency: ☐ Pounding ☐ Falling Hazards from Taller Adjacent Building

Irregularities: ☐ Severe Vertical Irregularity ☐ Plan Irregularity
☐ Moderate Vertical Irregularity

Exterior Falling Hazards: ☐ Unbraced Chimneys ☐ Heavy Cladding or Heavy Veneer
☐ Parapets ☐ Appendages
☐ Other:

COMMENTS

☐ Additional sketches or comments on separate page

BASIC SCORE, MODIFIERS, AND FINAL LEVEL 1 SCORE, S_{L1}

BUILDING TYPE	DNK	W1	W1A	W2	S1	S2	S3	S4	S5	C1	C2	C3	PC1	PC2	RM1	RM2	URM	MH	BN1	BN2
Basic Score		**3.6**	**3.2**	**2.9**	**2.1**	**2.0**	**2.6**	**2.0**	**1.7**	**1.5**	**2.0**	**1.2**	**1.6**	**1.4**	**1.7**	**1.7**	**1.0**	**1.5**	**1.0**	**1.4**
Severe Vertical Irregularity, V_{L1}		-1.2	-1.2	-1.2	-1.0	-1.0	-1.1	-1.0	-0.8	-0.9	-1.0	-0.7	-1.0	-0.9	-0.9	-0.9	-0.7	NA	-0.7	-0.8
Moderate Vertical Irregularity, V_{L1}		-0.7	-0.7	-0.7	-0.6	-0.6	-0.7	-0.6	-0.5	-0.5	-0.6	-0.4	-0.6	-0.5	-0.5	-0.5	-0.4	NA	-0.4	-0.5
Plan Irregularity, P_{L1}		-1.1	-1.0	-1.0	-0.8	-0.7	-0.9	-0.7	-0.6	-0.6	-0.8	-0.5	-0.7	-0.6	-0.7	-0.7	-0.4	NA	-0.4	-0.5
Pre-Code		-1.1	-1.0	-0.9	-0.6	-0.6	-0.8	-0.6	-0.2	-0.4	-0.7	-0.1	-0.5	-0.3	-0.5	-0.5	0.0	-0.1	NA	NA
Post-Benchmark		1.6	1.9	2.2	1.4	1.4	1.1	1.9	NA	1.9	2.1	NA	2.0	2.4	2.1	2.1	NA	1.2	NA	NA
Soil Type A or B		0.1	0.3	0.5	0.4	0.6	0.1	0.6	0.5	0.4	0.5	0.3	0.6	0.4	0.5	0.5	0.3	0.3	0.3	0.9
Soil Type E (1-3 stories)		0.2	0.2	0.1	-0.2	-0.4	0.2	-0.1	-0.4	0.0	0.0	-0.2	-0.3	-0.1	-0.1	-0.1	-0.2	-0.4	-0.2	-0.6
Soil Type E (>3 stories)		-0.3	-0.6	-0.9	-0.6	-0.6	NA	-0.6	-0.4	-0.5	-0.7	-0.3	NA	-0.4	-0.5	-0.6	-0.2	NA	NA	NA
Minimum Score, S_{MIN}		1.1	0.9	0.7	0.5	0.5	0.6	0.5	0.5	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.2	1.0	0.2	0.2

FINAL LEVEL 1 SCORE, $S_{L1} \geq S_{MIN}$

EXTENT OF REVIEW

Exterior: ☐ Partial ☐ All Sides ☐ Aerial
Interior: ☐ None ☐ Visible ☐ Entered
Drawing Reviewd: ☐ Yes ☐ No
Soil Type Source: .....
Geohazards Source: .....
Contact Person: .....
LEVEL 2 SCREENING PERFORMED?
☐ Yes, Final Level 2 Score, S_{L2}: ☐ No
Nonstructural Hazards? ☐ Yes ☐ No

OTHER HAZARDS

Are There Hazards That Trigger A Detailed Structural Evaluation?
☐ Pounding potential (Unless S_{L1} > Cut-off, if known)
☐ Falling hazards from taller adjacent building
☐ Geologic hazards or Soil Type F
☐ Significant damage/deterioration to the structural system

ACTION REQUIRED

Detailed Structural Evaluation Required?
☐ Yes, unknown building type or other building
☐ Yes, score less than cut-off
☐ Yes, other hazards present ☐ No
Detailed Nonstructural Evaluation Recommended?
☐ Yes, nonstructural hazard identified, should be evaluated
☐ No, nonstructural hazards exist that may require mitigation, but a detailed evaluation is not necessary
☐ No, no nonstructural hazards identified ☐ DNK

Where information cannot be verified, screener shall note the following: EST = Estimated or unreliable data (OR) DNK = Do Not Know

Rapid Visual Screening of Buildings for Potential Seismic Hazards

LEVEL 2 (Optional)
HIGH Seismicity

(Adopted from FEMA P-154 Data Collection Form)

Optional Level 2 Data Collection to be performed by a civil or structural engineering professional, architect, or graduate student with background in seismic evaluation or design of buildings.

Building Name :	***Final Level 1 Score:*** S_{L1} =	(Do not consider S_{MIN})
Screener :	***Level 1 Irregularity Modifiers:*** Vertical Irregularity, V_{L1} =	Plan Irregularity, P_{L1} =
Date/ Time :	***ADJUSTED BASELINE*** $S' = (S_{L1} - V_{L1} - P_{L1})$ =	

STRUCTURAL MODIFIERS TO ADD TO ADJUSTED BASELINE SCORE

Topic		Statement (If statement is true, circle "Yes" modifier; otherwise cross out the modifier)	Yes	Subtotals
Vertical Irregularity, V_{L2}	*Sloping Site*	W1 Building : There is at least a full story grade change from one side of the building to the other.	-1.2	
		Non-W1 Building : Ther is at least a full story grade change from one side of the building to the other.	-0.3	
	Weak and/or Soft Story (Circle one maximum)	W1 Building Cripple Wall : An unbraced cripple wall is visible in the crawl space.	-0.6	
		W1 House over Garage : Underneath an occupied story, there is a garage opening without a steel moment frame, and there is less than 8 ft of wall on the same line (for multiple occupied floors above, use 16 ft of wall minimum)	-1.2	
		W1A Building Open Front : There are openings at the ground story (such as for parking) over at least 50 % of the length of the building.	-1.2	
		Non-W1 Building : Length of lateral system at any story is less than 50 % of that at story above or height of any story is more than 2.0 times the height of the story above.	-0.9	
		Non-W1 Building : Length of lateral system at any story is between 50 % and 75 % of that at story above or height of any story is between 1.3 and 2.0 times the height of the story above.	-0.5	
	Setback	Vertical elements of the lateral system at an upper story are outboard of those at the story below causing the diaphragm to cantilever at the offset.	-1.0	
		Vertical elements of the lateral system at upper stories are inboard of those at lower stories.	-0.5	
		There is an in-plane offset of the lateral elements that is greater than the length of the elements.	-0.3	
	Short Column/ Pier	C1,C2,C3,PC1,PC2,RM1,RM2 : At least 20 % of columns (or piers) along a column line in the lateral system have height/depth ratios less than 50 % of the nominal height/depth ratio at that level.	-0.5	
		C1,C2,C3,PC1,PC2,RM1,RM2 : The column depth (or pier width) is less than one half of the depth of the spandrel, or there are infill walls or adjacent floors that shorten the column.	-0.5	
	Split Level	There is a split level at one of the floor levels or at the roof.	-0.5	
	Other Irregularity	There is another observable severe vertical irregularity that obviously affects the building's seismic performance.	-1.0	V_{L2} =
		There is another observable moderate vertical irregularity that may affect the building's seismic performance.	-0.5	*(Cap at -1.2)*
Plan Irregularity, P_{L2}		Torsional Irregularity: Lateral system does not appear relatively well distributed in plan in either or both directions. (Do not include the W1A open front irregularity listed above)	-0.7	
		Non-parallel System: There are one or more major vertical elements of the lateral system that are not orthogonal to each other.	-0.4	
		Reentrant Corner: Both projections from an interior corner exceed 25 % of the overall plan dimensions in that direction.	-0.4	
		Diaphragm Opening: There is an opening in the diaphragm with a width over 50 % of the total diaphragm width at that level.	-0.2	
		C1, C2 Buildings Out-of-plane Offset: The exterior beams do not align with the columns in plan.	-0.4	P_{L2} =
		Other Irregularity: There is another observable plan irregularity that obviously affects the building's seismic performance.	-0.7	*(Cap at -1.1)*
Redundancy		The building has at least two bays of lateral elements on each side of the building in each direction.	0.3	
Pounding	Building is separated from an adjacent structure by less than 1.5 % of the height of the shorter of the building and adjacent structure and:	The floors do not align vertically within 2 feet. (Cap total pounding modifiers at -0.9)	-1	
		One building is 2 or more stories taller than the other.	-1	
		The building is at the end of the block.	-0.5	
S2 Building		"K" bracing geometry is visible.	-1	
C1 Building		Flat plate serves as the beam in the moment frame.	-0.4	
PC1/ RM1 Building		There are roof-to-wall ties that are visible or known from drawings that do not rely on cross-grain bending. (Do not combine with post-benchmark or retrofit modifier)	0.3	
		The building has closely spaced, full height interior walls (rather than an interior space with few walls such as in a warehouse)	0.3	
URM		Gable walls are present.	-0.4	
MH		There is a supplemental seismic bracing system provided between the carriage and the ground.	1.2	
Retrofit		Comprehensive seismic retrofit is visible or known from drawings.	1.4	M =

FINAL LEVEL 2 SCORE, $S_{L2} = (S' + V_{L2} + P_{L2} + M) \geq S_{MIN}$: ***(Transfer to Level 1 Form)***

There is observable damage or deterioration or another condition that negatively affects the building's seismic performance: ☐ Yes ☐ No
If yes, describe the condition in the comment box below and indicate on the Level 1 form that detailed evaluation is required independent of the building's score.

OBSERVABLE NONSTRUCTURAL HAZARDS

Location	Statement (Check "Yes" or "No")	Yes	No	Comments
Exterior	There is an unbraced unreinforced masonry parapet or unbraced unreinforced masonry chimney.			
	There is heavy cladding or heavy veneer.			
	There is a heavy canopy over exit doors or pedestrian walkways that appears inadequately supported.			
	There is an unreinforced masonry appendage over exit doors or pedestrian walkways.			
	There is a sign posted on the building that indicates hazardous materials are present.			
	There is a taller adjacent building with an unanchored URM wall or unbraced URM parapet or chimney.			
	Other observed exterior nonstructural falling hazard.			
Interior	There are hollow clay tile or brick partitions at any stair or exit corridor.			
	Other observed interior nonstructural falling hazard.			

Estimated Nonstructural Seismic Performance *(Check appropriate box and transfer to Level 1 form conslusions)*

☐ Potential nonstructural hazards with significant threat to occupant life safety. --> Detailed Nonstructural Evaluation recommended.
☐ Nonstructural hazards identified with significant threat to occupant life safety. --> But no Detailed Nonstructural Evaluation required.
☐ Low or no nonstructural hazard threat to occupant life safety. --> No Detailed Nonstructural Evaluation required.

Comments :

Rapid Visual Screening of Buildings for Potential Seismic Hazards

LEVEL 1

(Adopted from FEMA P-154 Data Collection Form)

MODERATELY HIGH Seismicity

PHOTOGRAPH

SKETCH

Address: ..... **City:** .....
Other ID: ..... **Use:** .....
Building Name: .....
Latitude: ..... **S_s:** .....
Longitude: ..... **S_1:** .....
Screener: ..... **Date/Time:** .....
#Stories - Above Ground: ..... Below Ground: ..... **Year Built:** ..... ☐ Est
Total Floor Area (sft): ..... **Code Year:** .....
Additions: ☐ None ☐ Yes, Years Built:.....
Occupancy: ☐ Assembly ☐ Commercial ☐ Emergency Services ☐ Historic ☐ Industrial ☐ Office ☐ Schools ☐ Government ☐ Utility ☐ Warehouse ☐ Residential,#Units: ☐ Shelter
Soil Type: ☐ A: Hard Rock ☐ C: Soft Rock ☐ E: Soft Soil ☐ B: Normal Rock ☐ D: Hard Soil / DNK ☐ F: Poor Soil
Geohazards: Liquefaction: ☐ Yes, ☐ No, ☐ DNK; Landslide: ☐ Yes, ☐ No, ☐ DNK; Surface Rupture: ☐ Yes, ☐ No, ☐ DNK
Adjacency: ☐ Pounding ☐ Falling Hazards from Taller Adjacent Building
Irregularities: ☐ Severe Vertical Irregularity ☐ Plan Irregularity ☐ Moderate Vertical Irregularity
Exterior Falling Hazards: ☐ Unbraced Chimneys ☐ Heavy Cladding or Heavy Veneer ☐ Parapets ☐ Appendages ☐ Other:

COMMENTS

☐ Additional sketches or comments on separate page

BASIC SCORE, MODIFIERS, AND FINAL LEVEL 1 SCORE, S_{L1}

BUILDING TYPE	DNK	W1	W1A	W2	S1	S2	S3	S4	S5	C1	C2	C3	PC1	PC2	RM1	RM2	URM	MH	BN1	BN2
Basic Score		**4.1**	**3.7**	**3.2**	**2.3**	**2.2**	**2.9**	**2.2**	**2.0**	**1.7**	**2.1**	**1.4**	**1.8**	**1.5**	**1.8**	**1.8**	**1.2**	**2.2**	**1.2**	**2.2**
Severe Vertical Irregularity, V_{L1}		-1.3	-1.3	-1.3	-1.1	-1.0	-1.2	-1.0	-0.9	-1.0	-1.1	-0.8	-1.0	-0.9	-1.0	-1.0	-0.8	NA	-0.8	-0.9
Moderate Vertical Irregularity, V_{L1}		-0.8	-0.8	-0.8	-0.7	-0.6	-0.8	-0.6	-0.6	-0.6	-0.6	-0.5	-0.6	-0.6	-0.6	-0.6	-0.5	NA	-0.5	-0.6
Plan Irregularity, P_{L1}		-1.3	-1.2	-1.1	-0.9	-0.8	-1.0	-0.8	-0.7	-0.7	-0.9	-0.6	-0.8	-0.7	-0.7	-0.7	-0.5	NA	-0.5	-0.8
Pre-Code		-0.8	-0.9	-0.9	-0.5	-0.5	-0.7	-0.6	-0.2	-0.4	-0.7	-0.1	-0.4	-0.3	-0.5	-0.5	-0.1	-0.3	NA	NA
Post-Benchmark		1.5	1.9	2.3	1.4	1.4	1.0	1.9	NA	1.9	2.1	NA	2.1	2.4	2.1	2.1	NA	1.2	NA	NA
Soil Type A or B		0.3	0.6	0.9	0.6	0.9	0.3	0.9	0.9	0.6	0.8	0.7	0.9	0.7	0.8	0.8	0.6	0.9	0.6	1.0
Soil Type E (1-3 stories)		0.0	-0.1	-0.3	-0.4	-0.5	0.0	-0.4	-0.5	-0.2	-0.2	-0.4	-0.5	-0.3	-0.4	-0.4	-0.3	-0.5	-0.3	-1.2
Soil Type E (>3 stories)		-0.5	-0.8	-1.2	-0.7	-0.7	NA	-0.7	-0.6	-0.6	-0.8	-0.4	NA	-0.5	-0.6	-0.7	-0.3	NA	NA	NA
Minimum Score, S_{MIN}		1.6	1.2	0.8	0.5	0.5	0.9	0.5	0.5	0.3	0.3	0.3	0.3	0.2	0.3	0.3	0.2	1.4	0.2	0.5

FINAL LEVEL 1 SCORE, $S_{L1} \geq S_{MIN}$

EXTENT OF REVIEW

Exterior: ☐ Partial ☐ All Sides ☐ Aerial
Interior: ☐ None ☐ Visible ☐ Entered
Drawing Reviewd: ☐ Yes ☐ No
Soil Type Source:.....
Geohazards Source:.....
Contact Person:.....
LEVEL 2 SCREENING PERFORMED?
☐ Yes, Final Level 2 Score, S_{L2}: ☐ No
Nonstructural Hazards? ☐ Yes ☐ No

OTHER HAZARDS

Are There Hazards That Trigger A Detailed Structural Evaluation?
☐ Pounding potential (Unless S_{L1} > Cut-off, If known)
☐ Falling hazards from taller adjacent building
☐ Geologic hazards or Soil Type F
☐ Significant damage/deterioration to the structural system

ACTION REQUIRED

Detailed Structural Evaluation Required?
☐ Yes, unknown building type or other building
☐ Yes, score less than cut-off
☐ Yes, other hazards present ☐ No
Detailed Nonstructural Evaluation Recommended?
☐ Yes, nonstructural hazard identified, should be evaluated
☐ No, nonstructural hazards exist that may require mitigation, but a detailed evaluation is not necessary
☐ No, no nonstructural hazards identified ☐ DNK

Where information cannot be verified, screener shall note the following: EST = Estimated or unreliable data (OR) DNK = Do Not Know

Rapid Visual Screening of Buildings for Potential Seismic Hazards

LEVEL 2 (Optional)
MODERATELY HIGH Seismicity

(Adopted from FEMA P-154 Data Collection Form)

Optional Level 2 Data Collection to be performed by a civil or structural engineering professional, architect, or graduate student with background in seismic evaluation or design of buildings.

Building Name	:	***Final Level 1 Score:*** S_{L1} =	(Do not consider S_{MIN})
Screener	:	***Level 1 Irregularity Modifiers:*** Vertical Irregularity , V_{L1} =	Plan Irregularity, P_{L1} =
Date/ Time	:	***ADJUSTED BASELINE*** $S' = (S_{L1} - V_{L1} - P_{L1})$ =	

STRUCTURAL MODIFIERS TO ADD TO ADJUSTED BASELINE SCORE

Topic		Statement (If statement is true, circle "Yes" modifier; otherwise cross out the modifier)	Yes	Subtotals
Vertical Irregularity, V_{L2}	*Sloping Site*	W1 Building : There is at least a full story grade change from one side of the building to the other.	-1.3	
		Non-W1 Building : Ther is at least a full story grade change from one side of the building to the other.	-0.3	
	Weak and/or Soft Story (Circle one maximum)	W1 Building Cripple Wall : An unbraced cripple wall is visible in the crawl space.	-0.6	
		W1 House over Garage : Underneath an occupied story, there is a garage opening without a steel moment frame, and there is less than 8 ft of wall on the same line (for multiple occupied floors above, use 16 ft of wall minimum)	-1.3	
		W1A Building Open Front : There are openings at the ground story (such as for parking) over at least 50 % of the length of the building.	-1.3	
		Non-W1 Building : Length of lateral system at any story is less than 50 % of that at story above or height of any story is more than 2.0 times the height of the story above.	-1	
		Non-W1 Building : Length of lateral system at any story is between 50 % and 75 % of that at story above or height of any story is between 1.3 and 2.0 times the height of the story above.	-0.5	
	Setback	Vertical elements of the lateral system at an upper story are outboard of those at the story below causing the diaphragm to cantilever at the offset.	-1	
		Vertical elements of the lateral system at upper stories are inboard of those at lower stories.	-0.5	
		There is an in-plane offset of the lateral elements that is greater than the length of the elements.	-0.3	
	Short Column/ Pier	C1,C2,C3,PC1,PC2,RM1,RM2 : At least 20 % of columns (or piers) along a column line in the lateral system have height/depth ratios less than 50 % of the nominal height/depth ratio at that level.	-0.5	
		C1,C2,C3,PC1,PC2,RM1,RM2 : The column depth (or pier width) is less than one half of the depth of the spandrel, or there are infill walls or adjacent floors that shorten the column.	-0.5	
	Split Level	There is a split level at one of the floor levels or at the roof.	-0.5	
	Other Irregularity	There is another observable severe vertical irregularity that obviously affects the building's seismic performance.	-1	V_{L2} =
		There is another observable moderate vertical irregularity that may affect the building's seismic performance.	-0.5	*(Cap at -1.3)*
Plan Irregularity, P_{L2}		Torsional Irregularity: Lateral system does not appear relatively well distributed in plan in either or both directions. (Do not include the W1A open front irregularity listed above)	-0.8	
		Non-parallel System: There are one or more major vertical elements of the lateral system that are not orthogonal to each other.	-0.4	
		Reentrant Corner: Both projections from an interior corner exceed 25 % of the overall plan dimensions in that direction.	-0.4	
		Diaphragm Opening: There is an opening in the diaphragm with a width over 50 % of the total diaphragm width at that level.	-0.3	
		C1, C2 Buildings Out-of-plane Offset: The exterior beams do not align with the columns in plan.	-0.4	P_{L2} =
		Other Irregularity: There is another observable plan irregularity that obviously affects the building's seismic performance.	-0.8	*(Cap at -1.3)*
Redundancy		The building has at least two bays of lateral elements on each side of the building in each direction.	0.3	
Pounding	Building is separated from an adjacent structure by less than 1.5 % of the height of the shorter of the building and adjacent structure and:	The floors do not align vertically within 2 feet. (Cap total pounding modifiers at -0.9)	-1	
		One building is 2 or more stories taller than the other.	-1	
		The building is at the end of the block.	-0.5	
S2 Building		"K" bracing geometry is visible.	-1	
C1 Building		Flat plate serves as the beam in the moment frame.	-0.5	
PC1/ RM1 Building		There are roof-to-wall ties that are visible or known from drawings that do not rely on cross-grain bending. (Do not combine with post-benchmark or retrofit modifier)	0.3	
		The building has closely spaced, full height interior walls (rather than an interior space with few walls such as in a warehouse)	0.3	
URM		Gable walls are present.	-0.4	
MH		There is a supplemental seismic bracing system provided between the carriage and the ground.	1.2	
Retrofit		Comprehensive seismic retrofit is visible or known from drawings.	1.4	M =

FINAL LEVEL 2 SCORE, $S_{L2} = (S' + V_{L2} + P_{L2} + M) \geq S_{MIN}$: ***(Transfer to Level 1 Form)***

There is observable damage or deterioration or another condition that negatively affects the building's seismic performance: ☐ Yes ☐ No
If yes, describe the condition in the comment box below and indicate on the Level 1 form that detailed evaluation is required independent of the building's score.

OBSERVABLE NONSTRUCTURAL HAZARDS

Location	Statement (Check "Yes" or "No")	Yes	No	Comments
Exterior	There is an unbraced unreinforced masonry parapet or unbraced unreinforced masonry chimney.			
	There is heavy cladding or heavy veneer.			
	There is a heavy canopy over exit doors or pedestrian walkways that appears inadequately supported.			
	There is an unreinforced masonry appendage over exit doors or pedestrian walkways.			
	There is a sign posted on the building that indicates hazardous materials are present.			
	There is a taller adjacent building with an unanchored URM wall or unbraced URM parapet or chimney.			
	Other observed exterior nonstructural falling hazard.			
Interior	There are hollow clay tile or brick partitions at any stair or exit corridor.			
	Other observed interior nonstructural falling hazard.			

Estimated Nonstructural Seismic Performance *(Check appropriate box and transfer to Level 1 form conslusions)*

☐ Potential nonstructural hazards with significant threat to occupant life safety. --> Detailed Nonstructural Evaluation recommended.
☐ Nonstructural hazards identified with significant threat to occupant life safety. --> But no Detailed Nonstructural Evaluation required.
☐ Low or no nonstructural hazard threat to occupant life safety. --> No Detailed Nonstructural Evaluation required.

Comments :

Rapid Visual Screening of Buildings for Potential Seismic Hazards

LEVEL 1

(Adopted from FEMA P-154 Data Collection Form)

MODERATE Seismicity

PHOTOGRAPH

SKETCH

Address: ..... **City:** .....
Other ID: ..... **Use:** .....
Building Name: .....
Latitude: ..... **S_s:** .....
Longitude: ..... **S_1:** .....
Screener: ..... **Date/Time:** .....
#Stories - Above Ground: ..... Below Ground: ..... **Year Built:** ..... ☐ Est
Total Floor Area (sf): ..... **Code Year:** .....
Additions: ☐ None ☐ Yes, Years Built:.....
Occupancy: ☐ Assembly ☐ Commercial ☐ Emergency Services ☐ Historic ☐ Industrial ☐ Office ☐ Schools ☐ Government ☐ Utility ☐ Warehouse ☐ Residential,#Units: ☐ Shelter
Soil Type: ☐ A: Hard Rock ☐ C: Soft Rock ☐ E: Soft Soil ☐ B: Normal Rock ☐ D: Hard Soil / DNK ☐ F: Poor Soil
Geohazards: Liquefaction: ☐ Yes, ☐ No, ☐ DNK; Landslide: ☐ Yes, ☐ No, ☐ DNK; Surface Rupture: ☐ Yes, ☐ No, ☐ DNK
Adjacency: ☐ Pounding ☐ Falling Hazards from Taller Adjacent Building
Irregularities: ☐ Severe Vertical Irregularity ☐ Plan Irregularity ☐ Moderate Vertical Irregularity
Exterior Falling Hazards: ☐ Unbraced Chimneys ☐ Heavy Cladding or Heavy Veneer ☐ Parapets ☐ Appendages ☐ Other:

COMMENTS

☐ Additional sketches or comments on separate page

BASIC SCORE, MODIFIERS, AND FINAL LEVEL 1 SCORE, S_{L1}

BUILDING TYPE	DNK	W1	W1A	W2	S1	S2	S3	S4	S5	C1	C2	C3	PC1	PC2	RM1	RM2	URM	MH	BN1	BN2
Basic Score		**5.1**	**4.5**	**3.8**	**2.7**	**2.6**	**3.5**	**2.5**	**2.7**	**2.1**	**2.5**	**2.0**	**2.1**	**1.9**	**2.1**	**2.1**	**1.7**	**2.9**	**1.7**	**3.2**
Severe Vertical Irregularity, V_{L1}		-1.4	-1.4	-1.4	-1.2	-1.2	-1.4	-1.1	-1.2	-1.1	-1.2	-1.0	-1.1	-1.0	-1.1	-1.1	-1.0	NA	-1.0	-0.9
Moderate Vertical Irregularity, V_{L1}		-0.9	-0.9	-0.9	-0.8	-0.7	-0.9	-0.7	-0.7	-0.7	-0.7	-0.6	-0.7	-0.6	-0.7	-0.7	-0.6	NA	-0.6	-0.6
Plan Irregularity, P_{L1}		-1.4	-1.3	-1.2	-1.0	-0.9	-1.2	-0.9	-0.9	-0.8	-1.0	-0.8	-0.9	-0.8	-0.8	-0.8	-0.7	NA	-0.7	-0.8
Pre-Code		-0.3	-0.5	-0.6	-0.3	-0.2	-0.2	-0.3	-0.3	-0.3	-0.4	-0.3	-0.2	-0.2	-0.2	-0.2	-0.1	-0.5	NA	NA
Post-Benchmark		1.4	2.0	2.5	1.5	1.5	0.8	2.1	NA	2.0	2.3	NA	2.1	2.5	2.3	2.3	NA	1.2	NA	NA
Soil Type A or B		0.7	1.2	1.8	1.1	1.4	0.6	1.5	1.6	1.1	1.5	1.3	1.6	1.3	1.4	1.4	1.3	1.6	1.3	0.8
Soil Type E (1-3 stories)		-1.2	-1.3	-1.4	-0.9	-0.9	-1.0	-0.9	-0.9	-0.7	-1.0	-0.7	-0.8	-0.7	-0.8	-0.8	-0.6	-0.9	-0.6	-1.1
Soil Type E (>3 stories)		-1.8	-1.6	-1.3	-0.9	-0.9	NA	-0.9	-1.0	-0.8	-1.0	-0.8	NA	-0.7	-0.7	-0.8	-0.6	NA	NA	NA
Minimum Score, S_{MIN}		1.6	1.2	0.9	0.6	0.6	0.8	0.6	0.6	0.3	0.3	0.3	0.3	0.2	0.3	0.3	0.2	1.5	0.2	0.8

FINAL LEVEL 1 SCORE, $S_{L1} \geq S_{MIN}$

EXTENT OF REVIEW
Exterior: ☐ Partial ☐ All Sides ☐ Aerial
Interior: ☐ None ☐ Visible ☐ Entered
Drawing Reviewd: ☐ Yes ☐ No
Soil Type Source:.....
Geohazards Source:.....
Contact Person:.....
LEVEL 2 SCREENING PERFORMED?
☐ Yes, Final Level 2 Score, S_{L2}: ☐ No
Nonstructural Hazards? ☐ Yes ☐ No

OTHER HAZARDS
Are There Hazards That Trigger A Detailed Structural Evaluation?
☐ Pounding potential (Unless S_{L1} > Cut-off, If known)
☐ Falling hazards from taller adjacent building
☐ Geologic hazards or Soil Type F
☐ Significant damage/deterioration to the structural system

ACTION REQUIRED
Detailed Structural Evaluation Required?
☐ Yes, unknown building type or other building
☐ Yes, score less than cut-off
☐ Yes, other hazards present ☐ No
Detailed Nonstructural Evaluation Recommended?
☐ Yes, nonstructural hazard identified, should be evaluated
☐ No, nonstructural hazards exist that may require mitigation, but a detailed evaluation is not necessary
☐ No, no nonstructural hazards identified ☐ DNK

Where information cannot be verified, screener shall note the following: EST = Estimated or unreliable data (OR) DNK = Do Not Know

Rapid Visual Screening of Buildings for Potential Seismic Hazards

LEVEL 2 (Optional)
MODERATE Seismicity

(Adopted from FEMA P-154 Data Collection Form)

Optional Level 2 Data Collection to be performed by a civil or structural engineering professional, architect, or graduate student with background in seismic evaluation or design of buildings.

Building Name :	***Final Level 1 Score:*** S_{L1} =	(Do not consider S_{MIN})
Screener :	***Level 1 Irregularity Modifiers:*** Vertical Irregularity , V_{L1} =	Plan Irregularity, P_{L1} =
Date/ Time :	***ADJUSTED BASELINE*** $S' = (S_{L1} - V_{L1} - P_{L1})$ =	

STRUCTURAL MODIFIERS TO ADD TO ADJUSTED BASELINE SCORE

Topic		Statement (If statement is true, circle "Yes" modifier; otherwise cross out the modifier)	Yes	Subtotals
Vertical Irregularity, V_{L2}	*Sloping Site*	W1 Building : There is at least a full story grade change from one side of the building to the other.	-1.4	
		Non-W1 Building : Ther is at least a full story grade change from one side of the building to the other.	-0.4	
	Weak and/or Soft Story (Circle one maximum)	W1 Building Cripple Wall : An unbraced cripple wall is visible in the crawl space.	-0.7	
		W1 House over Garage : Underneath an occupied story, there is a garage opening without a steel moment frame, and there is less than 8 ft of wall on the same line (for multiple occupied floors above, use 16 ft of wall minimum)	-1.4	
		W1A Building Open Front : There are openings at the ground story (such as for parking) over at least 50 % of the length of the building.	-1.4	
		Non-W1 Building : Length of lateral system at any story is less than 50 % of that at story above or height of any story is more than 2.0 times the height of the story above.	-1.1	
		Non-W1 Building : Length of lateral system at any story is between 50 % and 75 % of that at story above or height of any story is between 1.3 and 2.0 times the height of the story above.	-0.6	
	Setback	Vertical elements of the lateral system at an upper story are outboard of those at the story below causing the diaphragm to cantilever at the offset.	-1.2	
		Vertical elements of the lateral system at upper stories are inboard of those at lower stories.	-0.6	
		There is an in-plane offset of the lateral elements that is greater than the length of the elements.	-0.4	
	Short Column/ Pier	C1,C2,C3,PC1,PC2,RM1,RM2 : At least 20 % of columns (or piers) along a column line in the lateral system have height/depth ratios less than 50 % of the nominal height/depth ratio at that level.	-0.5	
		C1,C2,C3,PC1,PC2,RM1,RM2 : The column depth (or pier width) is less than one half of the depth of the spandrel, or there are infill walls or adjacent floors that shorten the column.	-0.5	
	Split Level	There is a split level at one of the floor levels or at the roof.	-0.6	
	Other Irregularity	There is another observable severe vertical irregularity that obviously affects the building's seismic performance.	-1.2	V_{L2} =
		There is another observable moderate vertical irregularity that may affect the building's seismic performance.	-0.6	*(Cap at -1.4)*
Plan Irregularity, P_{L2}		Torsional Irregularity: Lateral system does not appear relatively well distributed in plan in either or both directions. (Do not include the W1A open front irregularity listed above)	-1	
		Non-parallel System: There are one or more major vertical elements of the lateral system that are not orthogonal to each other.	-0.5	
		Reentrant Corner: Both projections from an interior corner exceed 25 % of the overall plan dimensions in that direction.	-0.5	
		Diaphragm Opening: There is an opening in the diaphragm with a width over 50 % of the total diaphragm width at that level.	-0.3	
		C1, C2 Buildings Out-of-plane Offset: The exterior beams do not align with the columns in plan.	-0.4	P_{L2} =
		Other Irregularity: There is another observable plan irregularity that obviously affects the building's seismic performance.	-1	*(Cap at -1.4)*
Redundancy		The building has at least two bays of lateral elements on each side of the building in each direction.	0.4	
Pounding	Building is separated from an adjacent structure by less than 1.5 % of the height of the shorter of the building and adjacent structure and:	The floors do not align vertically within 2 feet. (Cap total pounding modifiers at -0.9)	-1.2	
		One building is 2 or more stories taller than the other.	-1.2	
		The building is at the end of the block.	-0.6	
S2 Building	"K" bracing geometry is visible.		-1.2	
C1 Building	Flat plate serves as the beam in the moment frame.		-0.5	
PC1/ RM1 Building	There are roof-to-wall ties that are visible or known from drawings that do not rely on cross-grain bending. (Do not combine with post-benchmark or retrofit modifier)		0.4	
	The building has closely spaced, full height interior walls (rather than an interior space with few walls such as in a warehouse)		0.4	
URM	Gable walls are present.		-0.5	
MH	There is a supplemental seismic bracing system provided between the carriage and the ground.		1.2	
Retrofit	Comprehensive seismic retrofit is visible or known from drawings.		1.4	M =

FINAL LEVEL 2 SCORE, $S_{L2} = (S' + V_{L2} + P_{L2} + M) \geq S_{MIN}$: ***(Transfer to Level 1 Form)***

There is observable damage or deterioration or another condition that negatively affects the building's seismic performance: ☐ Yes ☐ No
If yes, describe the condition in the comment box below and indicate on the Level 1 form that detailed evaluation is required independent of the building's score.

OBSERVABLE NONSTRUCTURAL HAZARDS

Location	Statement (Check "Yes" or "No")	Yes	No	Comments
Exterior	There is an unbraced unreinforced masonry parapet or unbraced unreinforced masonry chimney.			
	There is heavy cladding or heavy veneer.			
	There is a heavy canopy over exit doors or pedestrian walkways that appears inadequately supported.			
	There is an unreinforced masonry appendage over exit doors or pedestrian walkways.			
	There is a sign posted on the building that indicates hazardous materials are present.			
	There is a taller adjacent building with an unanchored URM wall or unbraced URM parapet or chimney.			
	Other observed exterior nonstructural falling hazard.			
Interior	There are hollow clay tile or brick partitions at any stair or exit corridor.			
	Other observed interior nonstructural falling hazard.			

Estimated Nonstructural Seismic Performance *(Check appropriate box and transfer to Level 1 form conslusions)*

☐ Potential nonstructural hazards with significant threat to occupant life safety. --> Detailed Nonstructural Evaluation recommended.
☐ Nonstructural hazards identified with significant threat to occupant life safety. --> But no Detailed Nonstructural Evaluation required.
☐ Low or no nonstructural hazard threat to occupant life safety. --> No Detailed Nonstructural Evaluation required.

Comments :

Rapid Visual Screening of Buildings for Potential Seismic Hazards

LEVEL 1

(Adopted from FEMA P-154 Data Collection Form)

LOW Seismicity

PHOTOGRAPH

SKETCH

Address: ..... **City:** .....

Other ID: ..... **Use:** .....

Building Name: .....

Latitude: ..... S_s: .....

Longitude: ..... S_1: .....

Screener: ..... **Date/Time:** .....

#Stories - Above Ground: ..... **Below Ground:** ..... **Year Built:** ..... ☐ Est

Total Floor Area (sft): ..... **Code Year:** .....

Additions: ☐ None ☐ Yes, Years Built:.....

Occupancy: ☐ Assembly ☐ Commercial ☐ Emergency Services ☐ Historic ☐ Industrial ☐ Office ☐ Schools ☐ Government ☐ Utility ☐ Warehouse ☐ Residential,#Units: ☐ Shelter

Soil Type: ☐ A: Hard Rock ☐ C: Soft Rock ☐ E: Soft Soil ☐ B: Normal Rock ☐ D: Hard Soil / DNK ☐ F: Poor Soil

Geohazards: Liquefaction: ☐ Yes, ☐ No, ☐ DNK; Landslide: ☐ Yes, ☐ No, ☐ DNK; Surface Rupture: ☐ Yes, ☐ No, ☐ DNK

Adjacency: ☐ Pounding ☐ Falling Hazards from Taller Adjacent Building

Irregularities: ☐ Severe Vertical Irregularity ☐ Plan Irregularity ☐ Moderate Vertical Irregularity

Exterior Falling Hazards: ☐ Unbraced Chimneys ☐ Heavy Cladding or Heavy Veneer ☐ Parapets ☐ Appendages ☐ Other:

COMMENTS

☐ Additional sketches or comments on separate page

BASIC SCORE, MODIFIERS, AND FINAL LEVEL 1 SCORE, S_{L1}

BUILDING TYPE	DNK	W1	W1A	W2	S1	S2	S3	S4	S5	C1	C2	C3	PC1	PC2	RM1	RM2	URM	MH	BN1	BN2
Basic Score		**6.2**	**5.9**	**5.7**	**3.8**	**3.9**	**4.4**	**4.1**	**4.5**	**3.3**	**4.2**	**3.5**	**3.8**	**3.3**	**3.7**	**3.7**	**3.2**	**4.6**	**3.2**	**3.9**
Severe Vertical Irregularity, V_{L1}		-1.5	-1.5	-1.5	-1.4	-1.3	-1.6	-1.2	-1.3	-1.3	-1.2	-1.1	-1.3	-1.1	-1.1	-1.1	-1.2	NA	-1.2	-1.0
Moderate Vertical Irregularity, V_{L1}		-1.0	-0.9	-0.9	-0.9	-0.8	-1.0	-0.7	-0.7	-0.7	-0.7	-0.6	-0.8	-0.6	-0.6	-0.6	-0.7	NA	-0.7	-0.7
Plan Irregularity, P_{L1}		-1.6	-1.4	-1.3	-1.2	-1.1	-1.4	-1.0	-1.1	-1.0	-1.0	-0.9	-1.2	-0.9	-0.9	-0.9	-1.0	NA	-1.0	-1.1
Pre-Code		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Post-Benchmark		2.2	2.4	2.5	2.0	1.6	1.4	2.1	NA	2.3	2.2	NA	1.9	2.6	2.3	2.3	NA	1.8	NA	NA
Soil Type A or B		0.9	1.1	1.3	1.0	1.2	0.8	1.3	1.4	0.9	1.2	1.2	1.3	1.3	1.4	1.4	1.3	0.9	1.3	0.5
Soil Type E (1-3 stories)		-1.2	-1.7	-2.3	-1.2	-1.4	-1.0	-1.7	-2.0	-1.4	-2.0	-1.6	-1.7	-1.6	-1.7	-1.7	-1.5	-2.1	-1.5	-0.6
Soil Type E (>3 stories)		-1.7	-2.0	-2.2	-1.2	-1.4	NA	-1.7	-1.9	-1.3	-1.9	-1.6	NA	-1.6	-1.6	-1.7	-1.4	NA	NA	NA
Minimum Score, S_{MIN}		2.7	2.1	1.5	0.9	0.8	1.2	0.8	0.9	0.5	0.6	0.5	0.6	0.4	0.6	0.5	0.4	2.5	0.2	0.9

FINAL LEVEL 1 SCORE, $S_{L1} \geq S_{MIN}$

EXTENT OF REVIEW

Exterior: ☐ Partial ☐ All Sides ☐ Aerial

Interior: ☐ None ☐ Visible ☐ Entered

Drawing Reviewd: ☐ Yes ☐ No

Soil Type Source:.....

Geohazards Source:.....

Contact Person:.....

LEVEL 2 SCREENING PERFORMED?

☐ Yes, Final Level 2 Score, S_{L2}: ☐ No

Nonstructural Hazards? ☐ Yes ☐ No

OTHER HAZARDS

Are There Hazards That Trigger A Detailed Structural Evaluation?

☐ Pounding potential (Unless S_{L1} > Cut-off, If known)

☐ Falling hazards from taller adjacent building

☐ Geologic hazards or Soil Type F

☐ Significant damage/deterioration to the structural system

ACTION REQUIRED

Detailed Structural Evaluation Required?

☐ Yes, unknown building type or other building

☐ Yes, score less than cut-off

☐ Yes, other hazards present ☐ No

Detailed Nonstructural Evaluation Recommended?

☐ Yes, nonstructural hazard identified, should be evaluated

☐ No, nonstructural hazards exist that may require mitigation, but a detailed evaluation is not necessary

☐ No, no nonstructural hazards identified ☐ DNK

Where information cannot be verified, screener shall note the following: EST = Estimated or unreliable data (OR) DNK = Do Not Know

Rapid Visual Screening of Buildings for Potential Seismic Hazards

LEVEL 2 (Optional)
LOW Seismicity

(Adopted from FEMA P-154 Data Collection Form)

Optional Level 2 Data Collection to be performed by a civil or structural engineering professional, architect, or graduate student with background in seismic evaluation or design of buildings.

Building Name :	***Final Level 1 Score:*** S_{L1} =		(Do not consider S_{MIN})
Screener :	***Level 1 Irregularity Modifiers:*** Vertical Irregularity , V_{L1} =	Plan Irregularity, P_{L1} =	
Date/ Time :	***ADJUSTED BASELINE*** $S' = (S_{L1} - V_{L1} - P_{L1})$ =		

STRUCTURAL MODIFIERS TO ADD TO ADJUSTED BASELINE SCORE

Topic		Statement (If statement is true, circle "Yes" modifier; otherwise cross out the modifier)	Yes	Subtotals
Vertical Irregularity, V_{L2}	*Sloping Site*	W1 Building : There is at least a full story grade change from one side of the building to the other.	-1.5	
		Non-W1 Building : Ther is at least a full story grade change from one side of the building to the other.	-0.4	
	Weak and/or Soft Story (Circle one maximum)	W1 Building Cripple Wall : An unbraced cripple wall is visible in the crawl space.	-0.7	
		W1 House over Garage : Underneath an occupied story, there is a garage opening without a steel moment frame, and there is less than 8 ft of wall on the same line (for multiple occupied floors above, use 16 ft of wall minimum)	-1.5	
		W1A Building Open Front : There are openings at the ground story (such as for parking) over at least 50 % of the length of the building.	-1.5	
		Non-W1 Building : Length of lateral system at any story is less than 50 % of that at story above or height of any story is more than 2.0 times the height of the story above.	-1.3	
		Non-W1 Building : Length of lateral system at any story is between 50 % and 75 % of that at story above or height of any story is between 1.3 and 2.0 times the height of the story above.	-0.6	
	Setback	Vertical elements of the lateral system at an upper story are outboard of those at the story below causing the diaphragm to cantilever at the offset.	-1.3	
		Vertical elements of the lateral system at upper stories are inboard of those at lower stories.	-0.6	
		There is an in-plane offset of the lateral elements that is greater than the length of the elements.	-0.4	
	Short Column/ Pier	C1,C2,C3,PC1,PC2,RM1,RM2 : At least 20 % of columns (or piers) along a column line in the lateral system have height/depth ratios less than 50 % of the nominal height/depth ratio at that level.	-0.6	
		C1,C2,C3,PC1,PC2,RM1,RM2 : The column depth (or pier width) is less than one half of the depth of the spandrel, or there are infill walls or adjacent floors that shorten the column.	-0.6	
	Split Level	There is a split level at one of the floor levels or at the roof.	-0.6	
	Other Irregularity	There is another observable severe vertical irregularity that obviously affects the building's seismic performance.	-1.3	V_{L2} =
		There is another observable moderate vertical irregularity that may affect the building's seismic performance.	-0.6	*(Cap at -1.5)*
Plan Irregularity, P_{L2}	Torsional Irregularity: Lateral system does not appear relatively well distributed in plan in either or both directions. (Do not include the W1A open front irregularity listed above)		-1.1	
	Non-parallel System: There are one or more major vertical elements of the lateral system that are not orthogonal to each other.		-0.6	
	Reentrant Corner: Both projections from an interior corner exceed 25 % of the overall plan dimensions in that direction.		-0.6	
	Diaphragm Opening: There is an opening in the diaphragm with a width over 50 % of the total diaphragm width at that level.		-0.4	
	C1, C2 Buildings Out-of-plane Offset: The exterior beams do not align with the columns in plan.		-0.5	P_{L2} =
	Other Irregularity: There is another observable plan irregularity that obviously affects the building's seismic performance.		-1.1	*(Cap at -1.6)*
Redundancy	The building has at least two bays of lateral elements on each side of the building in each direction.		0.4	
Pounding	Building is separated from an adjacent structure by less than 1.5 % of the height of the shorter of the building and adjacent structure and:	The floors do not align vertically within 2 feet.	-1.3	
		One building is 2 or more stories taller than the other.	-1.3	
		The building is at the end of the block.	-0.6	
		(Cap total pounding modifiers at -0.9)		
S2 Building	"K" bracing geometry is visible.		-1.3	
C1 Building	Flat plate serves as the beam in the moment frame.		-0.6	
PC1/ RM1 Building	There are roof-to-wall ties that are visible or known from drawings that do not rely on cross-grain bending. (Do not combine with post-benchmark or retrofit modifier)		0.4	
	The building has closely spaced, full height interior walls (rather than an interior space with few walls such as in a warehouse)		0.4	
URM	Gable walls are present.		-0.6	
MH	There is a supplemental seismic bracing system provided between the carriage and the ground.		1.8	
Retrofit	Comprehensive seismic retrofit is visible or known from drawings.		1.6	M =

FINAL LEVEL 2 SCORE, $S_{L2} = (S' + V_{L2} + P_{L2} + M) \geq S_{MIN}$: ***(Transfer to Level 1 Form)***

There is observable damage or deterioration or another condition that negatively affects the building's seismic performance: ☐ Yes ☐ No
If yes, describe the condition in the comment box below and indicate on the Level 1 form that detailed evaluation is required independent of the building's score.

OBSERVABLE NONSTRUCTURAL HAZARDS

Location	Statement (Check "Yes" or "No")	Yes	No	Comments
Exterior	There is an unbraced unreinforced masonry parapet or unbraced unreinforced masonry chimney.			
	There is heavy cladding or heavy veneer.			
	There is a heavy canopy over exit doors or pedestrian walkways that appears inadequately supported.			
	There is an unreinforced masonry appendage over exit doors or pedestrian walkways.			
	There is a sign posted on the building that indicates hazardous materials are present.			
	There is a taller adjacent building with an unanchored URM wall or unbraced URM parapet or chimney.			
	Other observed exterior nonstructural falling hazard.			
Interior	There are hollow clay tile or brick partitions at any stair or exit corridor.			
	Other observed interior nonstructural falling hazard.			

Estimated Nonstructural Seismic Performance *(Check appropriate box and transfer to Level 1 form conclusions)*

☐ Potential nonstructural hazards with significant threat to occupant life safety. --> Detailed Nonstructural Evaluation recommended.
☐ Nonstructural hazards identified with significant threat to occupant life safety. --> But no Detailed Nonstructural Evaluation required.
☐ Low or no nonstructural hazard threat to occupant life safety. --> No Detailed Nonstructural Evaluation required.

Comments :

References

1) FEMA P-154, Rapid visual screening of buildings for potential seismic hazards: a handbook. Washington DC: Federal Emergency Management Agency; 2015.

2) FEMA P-155 Report, Rapid Visual screening of Buildings for Potential Seismic Hazards: Supporting Documentation (FEMA, 2015), 3rd Edition", Washington DC: Federal Emergency Management Agency; 2015.

3) Sinha R, Goyal A. A National Policy for Seismic Vulnerability Assessment of Buildings and Procedure for Rapid Visual Screening of Buildings for Potential Seismic Vulnerability. 2004. https://www.civil.iitb.ac.in/~rsinha/Vulnerability_ Assessment.pdf [Accessed 5 November 2020].

4) Ilki A, Comert M, Demir C, Orakcal K, Ulugtekin D, Tapan M, Kumbasar N. Performance Based Rapid Seismic Assessment Method (PERA) for Reinforced Concrete Frame Buildings. Adv Struct Eng 2014;17(3):439–59. https://doi.org/ 10.1260/1369-4332.17.3.439.