APPENDIX A: MATERIAL TESTING AND CONDITION ASSESSMENT REQUIREMENTS

1.0 INTRODUCTION

Material testing programs can both confirm the Material Properties listed on the existing drawings and/or determine Material Properties for buildings where existing drawings are not available. A Condition Assessment program on the other hand is meant to confirm the design details that are used in the building analysis.

In order to conduct a Material Testing and Condition Assessment Program (MTCAP), the owner shall hire a Civil or Structural Engineer licensed in California to guide them through the process, select sample locations, observe final patch back, and interpret results. The MTCAP shall be in accordance with ASCE 41-17.

2.0 PURPOSE

This document serves as a summary and clarification of the major material testing and Condition Assessment requirements of seismic Ordinance No. 17-1011 and is intended to be used in combination with ASCE 41-17. Where this document is found to conflict with ASCE 41-17, ASCE 41-17 requirements shall prevail unless specifically stated in this document. Items in this document that are in *italics* are additional or clarifications to requirements in ASCE 41-17.

Although the ordinance is intended to cover Non-Ductile Concrete (NDC) Buildings and Pre-Northridge Steel Moment Frame (PN-SMF) Buildings, this document recognizes that there will be cases where CMU walls are used in combination with these two Lateral Force Resisting Systems (LFRS). For this reason, this document clarifies MTCAP requirements for these 3 materials. If other materials are found in a building that affect the LFRS, then the design professional is encouraged to discuss the testing program and Condition Assessments program with the Building Official in advance.

3.0 DEFINITIONS

Condition Assessment – the examination of the building to determine the following:

1. Determine the presence of degradation of primary and secondary components, if any.
2. Verify the presence and configuration of the structural elements and components and their connections, and the continuity of load path.
3. Identify and document other conditions including neighboring buildings, nonstructural components that may influence building seismic performance or prior remodeling that has not been documented.
4. Collect information to select a Knowledge Factor.
5. Confirm component orientation, plumbness and physical dimensions.

Visual – a direct visual inspection of representative primary seismic components and connections.

Comprehensive – a more in depth level of assessment of the Lateral Force Resisting System, which may include removal of finishes or, for concrete structures, local minimized removal of concrete cover to observe steel reinforcing.

Testing – laboratory testing of material samples taken from a structure to determine in – place mechanical properties of materials and components of the Lateral Force Resisting System.

Usual Data Collection – a minimum level of testing to confirm material strengths and properties that is used when there is little to no knowledge of Material Properties and the building is being analyzed for a Life Safety or lower performance level.

Comprehensive Data Collection - a minimum level of testing to confirm material strengths and properties that is used when there is little to no knowledge of Material Properties and the building is being analyzed for greater than Life Safety performance level.

Coefficient of Variation – the ratio of the standard deviation to the mean value of a specific material property based on a number of tests.

Material Properties – the strength and stiffness properties of the building material.

Default Properties – minimum Material Properties based on observed historical knowledge that can be used as a default for analysis.

Nominal Properties – Material Properties specified in the construction documents, if available, which shall be taken as lower-bound Material Properties.

Lower Bound Properties – Defined as either the listed Default Property, nominal material value from construction documents or specifications, or the mean minus one standard deviation when material testing is performed. Lower bound Material Properties are used to check force-controlled actions.

Expected Properties – Defined as either the default material property multiplied by a factor per ASCE 41 tables, the ultimate material property from construction documents or specifications or the mean tested value if testing is performed. Expected Material Properties are used to check deformation controlled actions.

Knowledge Factor – a factor used to reduce component capacities to account for uncertainty in the collection of as-built data ranging from 0.75 to 1.0.

4.0 SCOPE

The scope of the MTCAP required is dependent upon the performance objective, selected analysis procedure (Tier 2 or Tier 3) and amount of as-built information available. The MTCAP shall be performed on the existing elements that are being evaluated in the lateral analysis.

Where additional lateral force resisting elements have been constructed as part of an approved alteration or retrofit and existing drawings are available that indicate the Material Properties for that element, no testing is required to be performed. In such cases the Knowledge Factor, K, is permitted to be taken as 1.0 when used to determine the capacity of that element. However, Visual Condition Assessment is required to ensure elements have not been modified from those shown on approved drawings. An approved alteration or retrofit is one in which the associated project was permitted through the city of West Hollywood and received final closeout.

The scope of the testing and Condition Assessment shall be determined per the following Flow Chart A and B located at the end of this appendix.

5.0 RESULTS REPORT REQUIREMENTS

The MTCAP results report for the entire building are required to be submitted as part of the seismic retrofit plans (See Structural Retrofit Guidelines). It is recommended that the engineer review the number, type, and test/assessment locations with the city prior to executing the program. The Program may be submitted earlier if desired and is recommended.

As a minimum, the MTCAP report shall include the following for review by the City:

1. Building description.
2. Building floor plans with Condition Assessment and testing locations, indicating the type of test to be performed.
3. Photographs of Condition Assessment , testing area, test samples, and repair
4. Testing results and statistical analysis
5. Raw data and statistics.
6. Proposed design values (i.e. expected, lower bound, Knowledge Factor) along with any deviations from the original construction documents (if available).

Grouping of all test sample results shall have a rational basis. For instance, grouping test results of construction in different years, or reinforcing steel with different grades is not permitted. If a building is comprised of an original building and additions, the number of samples for the original building and each addition shall meet the ASCE 41-17 requirements separately. Combining of the data of the original building and additions is not allowed. Based on the statistical analysis, expected strength of each material property shall be determined for each data group.

The MTCAP results report shall bear the engineer's signature and stamp. Indicate in the MTCAP results report if as-built drawings are available or not. If as-built drawings are available, state if specified Material Properties are available or not.

6.0 MATERIAL TESTING REQUIREMENTS

Tables 1 through 4 included at the end of this appendix and subsequent sections below outline the ASCE 41-17 Material Testing requirements for steel, reinforced concrete, and reinforced masonry materials. ***Italicized text represents additions or clarifications to the requirements contained in the ASCE 41-17 code.***

The design professional shall work together with the contractor to select destructive testing locations that do not create an unsafe condition during the testing. All test locations shall be repaired to a state that is equivalent to their original condition.

6.1 Steel Material Testing

The following sections are intended to clarify steel coupon testing information not already covered in the Table 3 at the end of this appendix.

6.1.1 Steel Element Testing Requirement

The following properties are required for each member component type of the LFRS (e.g., beams, columns, braces and each steel grade used in the structure):

a. Ultimate tensile and yield capacities. (ASTM A370)

b. Modulus of elasticity.

c. Deformation characteristics including mode of failure. (ASTM A370)

d. Carbon equivalent, as applicable per section 6.1.4.

e. Elongation data.

Note: Other testing beyond the above requirements (such as hardness or fatigue) are not required unless specifically needed in the lateral analysis.

Reference: ASCE 41-17 Section 9.2.2.1.1.

6.1.2 Testing Requirements for Welds and Plates in Connections

When required to determine limit states of deformation-controlled connection materials that are part of the LFRS or when required to determine weldability of such connection materials (reference section 6.1.4), the following test shall be conducted:

a. Chemical composition per ASTM A751.

b. Hardness per ASTM E-110.and A370.

Note: chemical composition of steel shall be a complete list of components.

Reference: ASCE 41-17 Section C9.2.2.3.1.

6.1.3 Location of Steel Test Samples

Sampling shall take place in regions where the decreased section strength caused by the sampling remains higher than the capacity required at the reduced section to resist the design loads. Alternately, where the reduced section strength caused by sampling becomes lower than the required capacity, the lost section shall be temporarily supported and restored by repairs to the section.

Reference: ASCE 41-17 Section 9.2.2.3.1.

6.1.4 Testing for Weldability of Steel

Where welding to existing steel components is required as part of a retrofit, the carbon equivalent of the existing components shall be determined to establish weldability of the material, unless it is confirmed that the existing material conforms to a weldable material specification. The welding procedures shall be determined based on the chemistry of the base material and filler material, as specified in AWS D1.1 Section 8. Materials conforming to ASTM A36, ASTM A242, ASTM A307, ASTM A572, ASTM A913, ASTM A972, and ASTM A992 shall be deemed to be weldable.

Reference: ASCE 41-17 Section 9.2.2.3.1.

6.2 Concrete Material Testing

The following sections are intended to clarify concrete core testing information not already covered in the Table 1 at the end of this appendix.

6.2.1 Concrete Element Testing Requirements

The following Material Properties are required for each LFRS member component type (e.g., beams, columns, walls in the structure):

a. Concrete compressive strength (reference Section 6.2.5)

b. Concrete unit weight (reference Section 6.2.4)

c. *Concrete modulus of elasticity* (see Section 6.2.2 for alternate)

Reference ASCE 41-17 Section 10.2.2.1.1

6.2.2 Concrete Modulus of Elasticity Test Alternative

The modulus of elasticity and tensile strength shall be permitted to be estimated from the compressive strength testing data.

Reference: ASCE 41-17 Section 10.2.2.4.2.2.

6.2.3 Location of Concrete Test Samples

When determining Material Properties with the removal and testing of samples for laboratory analysis, sampling shall take place in primary gravity and lateral force resisting system elements in regions with the least stress.

Reference: ASCE 41-17 Section 10.2.2.3.1.

Samples shall be taken from elements, distributed throughout the building, that are critical to the structural behavior of the building. *Multiple concrete core samples taken from the same element or same area may result in the sampling of the same truck of concrete reducing the required random nature of sampling.*

Reference: ASCE 41-17 Section 10.2.2.4.2.2.

Core drilling shall be preceded by nondestructive location of the reinforcing steel, and core holes should be located to avoid damage to or drilling through the reinforcing steel. Core holes shall be filled with non-shrink concrete or grout of comparable strength.

Reference: ASCE 41-17 Section 10.2.2.3.2.

6.2.4 Normal or Light Weight Concrete Testing

Identify concrete type, either normal weight or lightweight for concrete core samples and confirm it based on unit weight test.

6.2.5 Testing Method Concrete Element

Removal of core samples shall use the procedures included in ASTM C42. Testing shall follow the procedures contained in ASTM C42, ASTM C39, and ASTM C496. Core strength shall be converted to in-place concrete compressive strength by an approved procedure, *such as that included in ACI 214.4R.*

Reference: ASCE 41-17 Section 10.2.2.3.2.

6.2.6 Application of Nondestructive Test for Concrete

Quantification of concrete strength via ultrasonic or other nondestructive test methods shall not be substituted for core sampling and laboratory testing.

Reference: ASCE 41-17 Section 10.2.2.4.2.2.

6.2.7 Damaged Concrete Test

Tests shall be performed on samples from components that are identified as damaged or degraded to quantify their condition. Test results from areas of degradation shall be compared with strength values specified in the construction documents. If test values less than the specified strength in the construction documents are found, further strength

testing shall be performed to determine the cause or identify the degree of damage or degradation.

Reference: ASCE 41-17 Section 10.2.2.4.2.2.

6.2.8 Concrete Core Test Diameter

Except as provided in ASTM C42 Section 7.1.2, the diameter of core specimens for the determination of compressive strength shall be at least 94 mm [3.70 in.] or at least two times the nominal maximum size of the coarse aggregate, whichever is larger.

Reference: ASTM C42

If limited member thickness makes it impossible to obtain cores with length-diameter ratio (L/D) of at least 1.0 or if clear distance between reinforcement is limited, core diameters less than 94 mm [3.70 in.] are not prohibited. If a core diameter less than 94 mm [3.70 in.] is used, report the reason.

It should be noted that smaller diameter cores generally produce a large scatter in the results. Therefore, it is recommended to extract the largest diameter cores possible with constraints discussed above.

Reference: ASTM C42

6.2.9 Concrete Core Test Length

Except as provided in ASTM C42 section 7.1.2, the preferred length of the capped or ground specimen is between 1.9 and 2.1 times the diameter. If the ratio of the length to the diameter (L/D) of the core exceeds 2.1, reduce the length of the core so that the ratio of the capped or ground specimen is between 1.9 and 2.1. Core specimens with length-diameter ratios equal to or less than 1.75 require corrections to the measured compressive strength. A strength correction factor is not required for L/D greater than 1.75. A core having a maximum length of less than 95 % of its diameter before capping or a length less than its diameter after capping, trimming, or end grinding shall not be tested.

Reference: ASTM C42

6.3 Concrete Anchor Material Testing

Cast-in-place or post-installed anchors shall be classified in groups of similar type, size, geometry, and structural use. Testing shall be performed in groups of anchors used for out-of-plane wall anchorage and in groups of anchors whose failures in tension or shear would cause the structure not to meet the selected Performance Objective. For usual testing, 5% of the anchors with a minimum of three anchors of each anchor group shall

be tested in place, in tension, to establish an available strength, construction quality, or both. For comprehensive testing, 10% of the anchors with a minimum of six anchors of each anchor group shall be tested in place, in tension, to establish an available strength, construction quality, or both. The test load shall be specified by the registered design professional and shall be based on the anticipated demand or strength in accordance with available construction information. If the test load is used as the basis for anchor strength calculation, the available anchor strength shall not be taken as greater than 2/3 of the test load. Testing of the anchors to failure is not required, and a test load lower than the expected failure load shall be permitted. If the test load is not achieved in one or more anchors tested in a group, anchors in that group shall be tested under a tensile load smaller than that specified for the preceding tests. Otherwise, the strength of the tested anchor group shall be ignored. Testing in accordance with Section 10.2.2.4.2.5 shall be permitted to determine the available strength based on a statistical distribution of the test results.

Reference: ASCE 41-17 Section 10.2.2.4.1 (#5) & Section 10.2.2.4.2.5

6.4 Steel Reinforcing Material Testing

The following sections are intended to clarify steel reinforcing coupon testing information not already covered in the Table 2 at the end of this appendix.

6.4.1 Steel Reinforcing Testing Requirement

The following Material Properties are required for each lateral force resisting member type (e.g., beams, columns, walls in the structure):

a. Reinforcing steel tensile and ultimate yield point. (Reference 6.2.4)

b. Reinforcing steel modulus of elasticity.

c. Reinforcing steel chemical composition and carbon equivalent.

d. Reinforcing steel surface deformation.

Note: State the rebar size, gage length for the elongation test per ASTM A370.

Reference: ASCE 41-17 Section 10.2.2.1 & Section 10.2.2.3.2

*Alternatively, use the following Material Properties for column reinforcing **IF** the lab has the expertise (i.e. metallurgical engineer) that can correlate the test values to both tensile and ultimate yield strengths:*

a. *Chemical composition and carbon equivalent.*
b. *Hardness per ASTM A370.*
c. *Surface deformation.*

Note: Chemical composition of steel shall be a complete list of components.

6.4.2 Steel Reinforcing Test Methods

Tension testing of reinforcing bars shall be in accordance with ASTM A370. *All test specimens shall be the full section of the bar as rolled (8-in. gage length) and shall not be reduced.*

Reference: ASCE 41-17 Section 10.2.2.3.2. & C10.2.2.3.2

6.4.3 Repair of Removed Reinforcing Test Sample

Where sampling include removal of local bar segments, the removed reinforcing shall be replaced and spliced to maintain continuity of the reinforcing bar for transfer of bar force unless an analysis confirms that replacement of the original components is not required.

6.4.4 Pre-stressing Steel Test Sampling

Sampling pre-stressing steel tendons for laboratory testing shall only be performed on pre-stressed components that are part of the seismic-force-resisting system. Pre-stressed components in diaphragms shall be permitted to be excluded. Tendon or pre-stress removal shall be avoided if possible. Determination of Material Properties may be possible, without tendon or pre-stress removal, by careful sampling of either the tendon grip or the extension beyond the anchorage, if sufficient length is available. All sampled pre-stressed steel shall be replaced with new, fully connected, and stressed material and anchorage hardware, unless an analysis confirms that replacement of original components is not required.

Reference: ASCE 41-17 Section 10.2.2.4.2.4.

6.4.5 Testing Method of Connector Steel Element

Properties of connector steels shall be permitted to be determined by wet and dry chemical composition tests and direct tensile and compressive strength tests as specified by ASTM A370. Where strengths of embedded connectors are required, in-place testing shall satisfy the provisions of ASTM E488.

Reference: ASCE 41-17 Section 10.2.2.3.2.

6.4.6 Precast Concrete Steel and Reinforcing Test

Conventional reinforcing and connector steels tests shall be conducted to determine both yield and ultimate strengths of reinforcing and connector steel. Connector steel is defined as additional structural steel or miscellaneous metal used to secure precast and other concrete shapes to the building structure.

Reference: ASCE 41-17 Section 10.2.2.4.2.3.

6.5 Reinforced Masonry Material Testing

The following sections are intended to clarify masonry prism testing information not already covered in the Table 4 at the end of this appendix.

6.5.1 Reinforced Masonry Element Testing Requirement

The following Material Properties shall be obtained:

1. Masonry compressive strength.
2. *Masonry unit weight.*
3. Elastic modulus of masonry (See section 6.5.3).
4. Masonry Bed Joint flexural tensile strength

Reference: ASCE41-17 Section 11.2.3.1.

6.5.2 Reinforced Masonry Compressive Strength Test Method

Expected masonry compressive strength, f_{me}, shall be determined using one of the following two methods:

1. Test prisms shall be extracted from existing walls and tested in accordance with ASTM C1314 per TMS 602 Section 1.4.B.3.
2. Prisms shall be fabricated from actual extracted masonry units, and a surrogate mortar shall be designed on the basis of a chemical analysis of actual mortar samples. The test prims shall be tested per TMS 602 Section 1.4.B.3,

The expected compressive strength shall be based on the net mortared area.

Reference: ASCE 41-17 Section 11.2.3.3.

6.5.3 Masonry Modulus of Elasticity Testing Alternative

Expected values of elastic modulus for masonry in compression, E_{me} shall be determined in accordance with TMS 402 *using tested compression strength*.

Reference: ASCE 41-17 Section 11.2.3.4.

6.5.4 Masonry Shear Modulus Testing Alternative

The expected shear modulus of masonry, G_{me} shall be permitted to be taken from Section 1.8.2.2.1 of TMS 402*using tested compression strength*.

Reference: ASCE 41-17 Section 11.2.3.7.

6.5.5 Location of Masonry Test Samples

Samples for tests shall be taken at locations representative of the material conditions throughout the entire building, taking into account variations in workmanship at different story levels, variations in weathering of the exterior surfaces, and variations in the condition of the interior surfaces due to deterioration caused by leaks and condensation of water and/or the deleterious effects of other substances contained within the building.

Reference: ASCE 41-17 Section 11.2.3.9.

6.5.6 Partially Grouted Masonry Test

In a masonry prism test, if CMU walls are partially grouted, same number of prism samples shall be taken to perform material test for grouted and un-grouted prism samples.

Reference: ASTM C1314.

6.5.7 Variation in Masonry Strength Test

Additional tests shall be done to estimate material strengths in regions where properties differ, or nondestructive Condition Assessment tests in accordance with Section 11.2.2.2 shall be used to quantify variations in material strengths. An increased sample size shall be permitted to improve the confidence level. The relation between sample size and confidence shall be as defined in ASTM E139.

Reference: ASCE 41-17 Section 11.2.3.9.3.

7.0 CONDITION ASSESSMENT REQUIREMENTS

Tables 6 through 8 included at the end of this appendix and subsequent sections below outline the ASCE 41-17 Condition Assessment requirements for steel, reinforced concrete, and reinforced masonry elements. ***Italicized text represents additions or clarifications to the requirements contained in the ASCE 41-17 code.***

Where required, the design professional shall work together with the contractor to select destructive Condition Assessment locations that do not create an unsafe condition during the testing. All test locations shall be repaired to a state that is equivalent to their original condition.

7.1 Steel Elements Condition Assessment

In addition to items noted in Tables 6 and 7 of this document, collect and report the following items/data:

1. Examination of the physical condition of primary and secondary components and the documentation of the presence of any degradation.
2. Verification of the presence and configuration of structural elements and components and their connections, and the continuity of load paths among components, elements, and systems.
3. Identification and documentation of other conditions, including neighboring party walls and buildings, the presence of nonstructural components that influence building performance, and prior remodeling.

Reference: ASCE 41-17 Section 9.2.3.1 and additional requirements in Moment Frame Connection Condition Assessment Section.

7.2. Reinforced Concrete Elements Condition Assessment

In addition to items noted in Table 5 of this document, collect and report the following items/data:

1. Examination of the physical condition of primary and secondary components, and the presence of any degradation shall be noted.
2. Verification of the presence and configuration of components and their connections, and the continuity of load paths between components, elements, and systems.
3. A review and documentation of other conditions, including neighboring party walls and buildings, presence of nonstructural components and mass, and prior remodeling.
4. Collection of information needed to select a Knowledge Factor.
5. Confirmation of component orientation, plumbness, and physical dimensions.

Reference: ASCE 41-17 Section 10.2.3.1.

7.3 Reinforced Masonry Elements Condition Assessment

In addition to items noted in Table 8 of this document, collect and report the following items/data:

1. The physical condition of primary and secondary components and the presence of any degradation. The condition of existing masonry shall be evaluated for unit surface or mortar joint deterioration due to weathering caused by freeze-thaw cycles or frequent moisture saturation.
2. The presence and configuration of components and their connections and the continuity of load paths among components, elements, and systems.
3. Other conditions, including the presence and attachment of veneer, neighboring party walls and buildings, presence of nonstructural components, prior remodeling, and limitations for retrofit that may influence building performance.

The condition of existing masonry shall be classified as good, fair or poor defined as follows based on Visual examination and other approved procedures that consider the nature and extent of damage or deterioration present:

1. Good Condition: Masonry found during Condition Assessment to have mortar and units intact with no visible cracking, deterioration or damage.
2. Fair Condition: Masonry found during Condition Assessment to have mortar and units intact with minor cracking.
3. Poor Condition: Masonry found during Condition Assessment to have degraded mortar, degraded masonry units, or significant cracking.

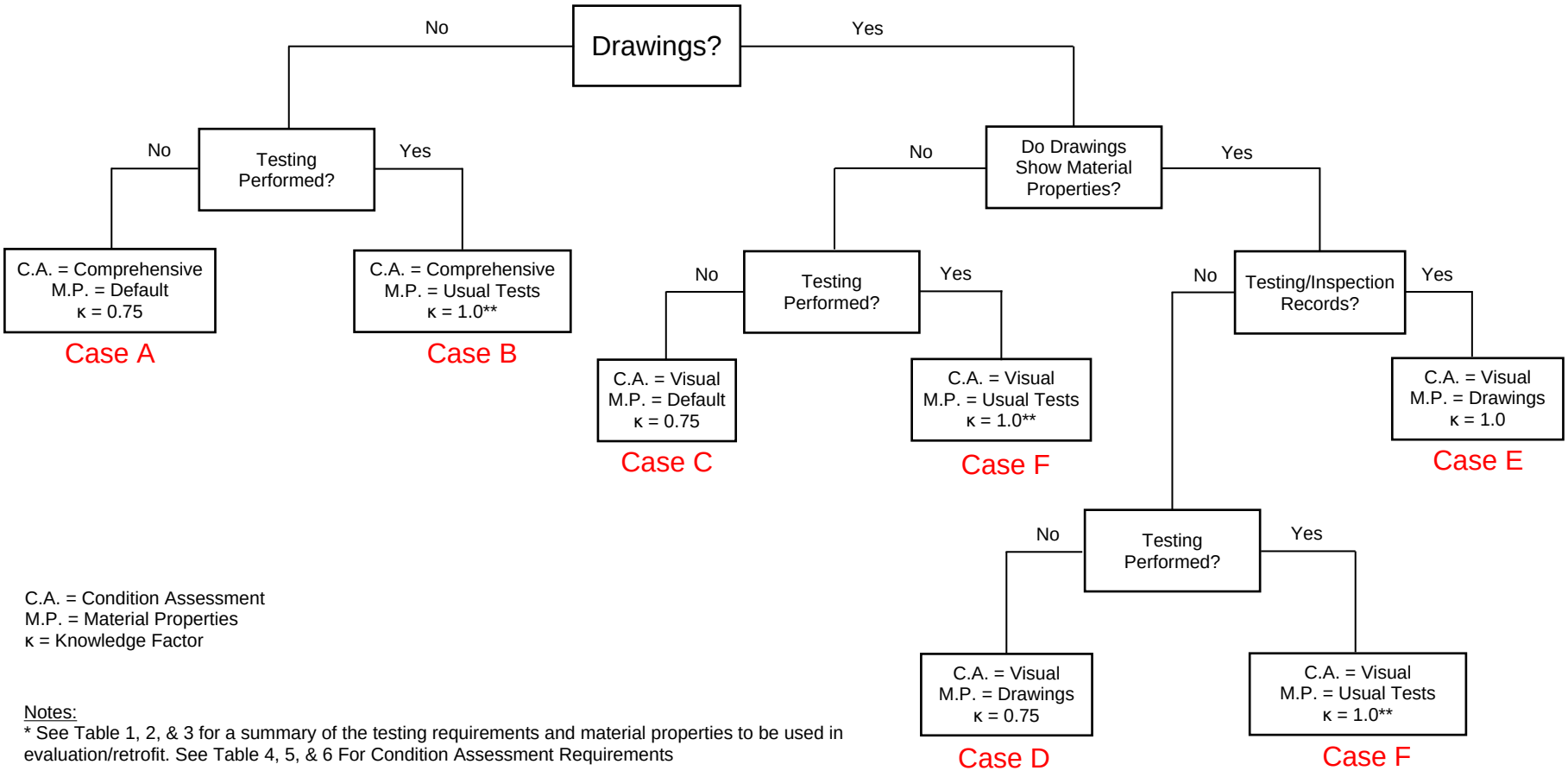
Reference: ASCE 41-17 Section 11.2.2.

8.0 ATTACHMENTS

The following attachments shall be considered part of Appendix A

- Flow Chart A: MTCAP Requirements - Tier 2 Analysis and Retrofit
- Flow Chart B: MTCAP Requirements - Tier 3 Analysis and Retrofit
- Table 1: Concrete Material Testing Requirements
- Table 2: Reinforcing Steel Material Testing Requirements
- Table 3: Structural Steel Material Testing Requirements
- Table 4: Reinforced Masonry Material Testing Requirements
- Table 5: Non-Ductile Concrete Condition Assessment Requirements
- Table 6: Pre-Northridge Steel Moment Frame Condition Assessment Requirements
- Table 7: Pre-Northridge Steel Moment Frame Connection Condition Assessment Requirements
- Table 8: Reinforced Masonry Condition Assessment Requirements

Flow Chart A: Material Testing and Condition Assessment Requirements
Tier 2 Analysis and Retrofit (*)

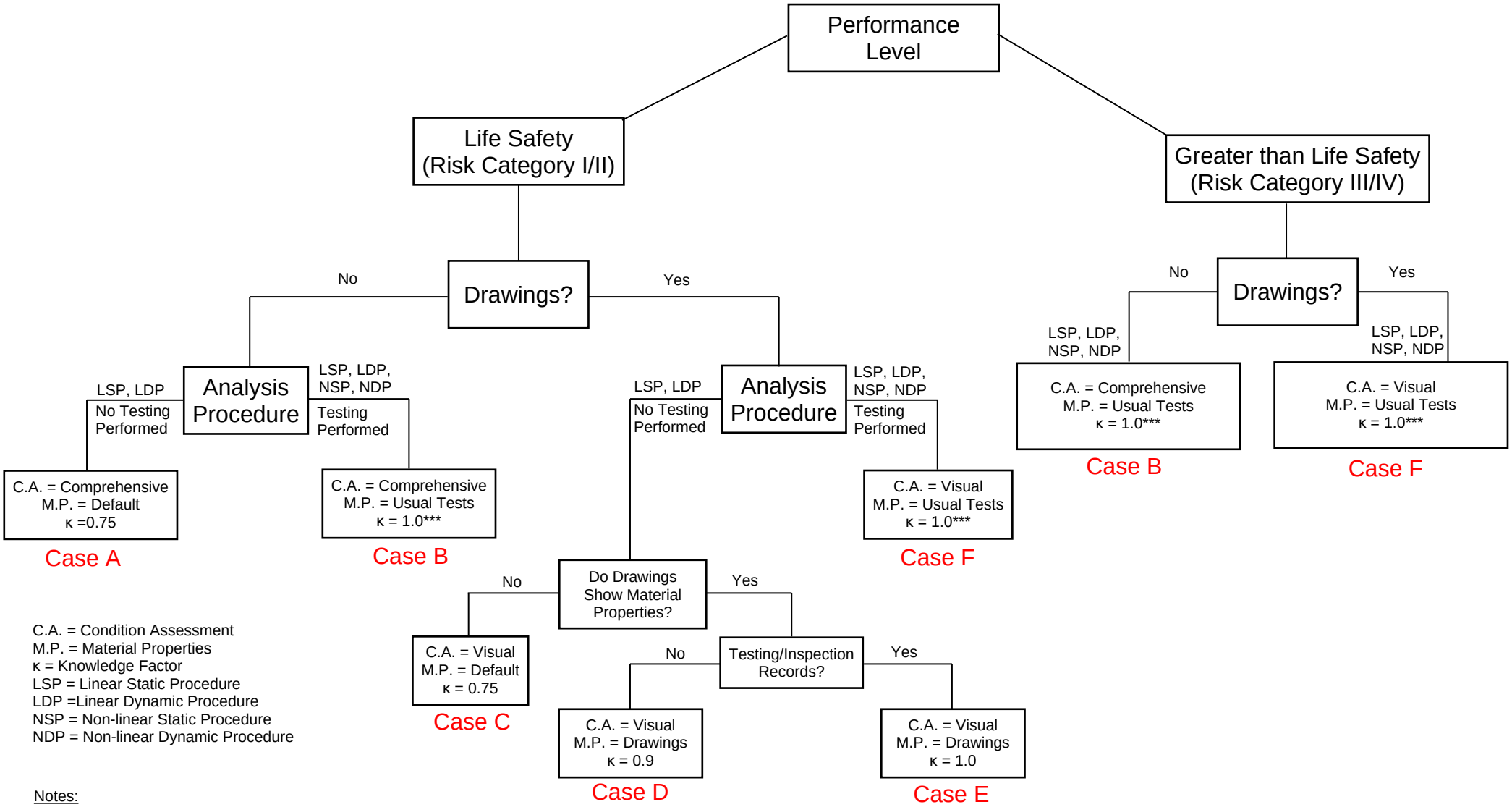


C.A. = Condition Assessment
M.P. = Material Properties
κ = Knowledge Factor

Notes:
* See Table 1, 2, & 3 for a summary of the testing requirements and material properties to be used in evaluation/retrofit. See Table 4, 5, & 6 For Condition Assessment Requirements

** κ=0.75 where COV > 20% after additional testing.

Flow Chart B: Material Testing and Condition Assessment Requirements
Tier 3 Analysis and Retrofit (*)



C.A. = Condition Assessment
M.P. = Material Properties
κ = Knowledge Factor
LSP = Linear Static Procedure
LDP =Linear Dynamic Procedure
NSP = Non-linear Static Procedure
NDP = Non-linear Dynamic Procedure

Notes:
* See Table 1, 2, & 3 for a summary of the testing requirements and material properties to be used in evaluation/retrofit. See Table 4, 5, & 6 For Condition Assessment Requirements

** Where Inspection/Testing Records are available with COV< 20%, No testing is required.

*** κ=0.75 where COV > 20% after additional testing.

Table 1: Concrete Material Testing Requirements[1]

Case [1][7]	Information Available	Level of Testing Performed	Minimum Number of Tests Required[4]	Test Results	Expected Strength	Lower-Bound Strength	Knowledge Factor (κ)
A	No Drawings Available	No Testing	N/A	N/A	Default (Table 10-2) x 1.5 (Table 10-1)	Default (Table 10-2)	κ=0.75 (Table 6-1)
B	No Drawings Available or Greater Values/Knowledge Factor Desired	Usual Testing (Section 10.2.2.4.1)	(1) Core for each type of seismic resisting component[5] and *(3) cores from each concrete strength*, with at least (6) cores total taken for the entire building	*COV < 20%*	Mean Test Value	Mean Test Value - Std Dev	κ=1.0 (Section 10.2.4)
				COV > 20% [3]	*Mean Test Value - Std Dev (Section 10.2.2.3.1)*	*Mean Test Value - Std Dev (Section 10.2.2.3.1)*	*κ=0.75 (Section 10.2.4)*
C	Drawings Available & No Properties Specified	No Testing	N/A	N/A	Default (Table 10-2) x 1.5 (Table 10-1)	Default (Table 10-2)	κ=0.75 (Table 6-1)
D	Drawings Available & Properties Specified (No Inspection/Testing Records)	No Testing	N/A	N/A	Specified (f'c) x 1.5 (Table 10-1)	Specified (f'c)	κ=0.9 (Table 6-1)
E	Drawings Available & Properties Specified (w/ Inspection/Testing Records)	No Testing	N/A	*COV < 20%* [6]	Mean Record Value	Mean Record Value - 1 Std Dev	κ=1.0 (Table 6-1)
F	Drawings Available & Properties Specified (No Testing/Inspection Records)	Minimum Usual Testing (Section 10.2.2.4.1)	(1) Core from each specified concrete strength, with at least (3) cores total taken for the entire building.	*Those Result Less than Specified Expected Strength* [2]	*Low Tested Value for Corresponding Specified Strength*	*Low Tested Value for Corresponding Specified Strength*	κ=1.0 (Table 6-1)
				Those Results Greater than Specified Expected Strength [2]	Corresponding Specified (f'c) x 1.5 (Table 10-1)	Corresponding Specified (f'c)	κ=1.0 (Table 6-1)
		Usual Testing (Section 10.2.2.4.1)	(1) Core for each type of seismic resisting component[5] and *(3) cores from each concrete strength*, with at least (6) cores total taken for the entire building	*COV < 20%*	Mean Test Value	Mean Test Value - Std Dev	κ=1.0 (Section 10.2.4)
				COV > 20% [3]	*Mean Test Value - Std Dev (Section 10.2.2.3.1)*	*Mean Test Value - Std Dev (Section 10.2.2.3.1)*	*κ=0.75 (Section 10.2.4)*

Notes:

1. See Flow Chart A & B
2. Specified Expected Strength = Specified (f'c) x 1.5 (Table 10-1)
3. Additional testing is required to attempt to reduce the COV to less than 20%. If additional testing does not reduce the COV to less than 20%, this path is available. (Section 10.2.2.4.2.1)
4. In determining coefficient of variation, cores shall be grouped by grades of concrete and element type. (Section 10.2.2.4.2.1)
5. Seismic Resisting component types include walls, beams, columns, and slabs.
6. *Where COV > 20% Case F is applicable.*
7. *Different Cases May be used for different element or strengths*
8. *Note that no sample result can be excluded from the data set to reduce the COV unless a written documentation from the testing agency confirming that the sample was damaged prior to testing is submitted for review and approval by the City. The testing lab shall provide reasons of any errors involved in the lab testing procedure including sampling, sample transportation, sample storing, calibration and operation of testing equipment etc.*

Table 2: Reinforcing Steel Material Testing Requirements[1]

Case [1][4]	Information Available	Level of Testing Required	Minimum Number of Tests Required	Test Results	Expected Strength	Lower-Bound Strength	Knowledge Factor (κ)
A	No Drawings Available	No Testing Required	N/A	N/A	Default (Table 10-3 and 10-4) x 1.25 (Table 10-1)	Default (Table 10-3 and 10-4)	κ=0.75 (Table 6-1)
B	No Drawings Available or Greater Values/Knowledge Factor Desired	Usual Testing (Section 10.2.2.4.1)	(2) strength test coupons of reinforcing steel shall be removed from the building for testing.	*COV < 10%*	Mean Test Value	Mean Test Value - Std Dev	κ=1.0 (WEHO 7.4.10)
				COV > 10% [2]	*Mean Test Value*	Mean Test Value - Std Dev	κ=0.75 (Section 10.2.4)
C	Drawings Available & No Properties Specified	No Testing Required	N/A	N/A	Default (Table 10-3 and 10-4) x 1.25 (Table 10-1)	Default (Table 10-3 and 10-4)	κ=0.75 (Table 6-1)
D	Drawings Available & Properties Specified (No Inspection/Testing Records)	No Testing Required	N/A	N/A	Specified (Fy) x 1.25 Factor (Table 10-1)	Specified (Fy)	κ=0.9 (Table 6-1)
E	Drawings Available & Properties Specified (w/ Inspection/Testing Records)	No Testing Required	N/A	*COV < 10%* [3]	Mean Record Value	Mean Record Value - 1 Std Dev	κ=1.0 (Table 6-1)
F	Drawings Available, but Greater Values Desired	Usual Testing (Section 10.2.2.4.1)	(2) strength test coupons of reinforcing steel shall be removed from the building for testing.	*COV < 10%*	Mean Test Value	Mean Test Value - Std Dev	κ=1.0 (WEHO 7.4.10)
				COV > 10% [2]	*Mean Test Value*	Mean Test Value - Std Dev	κ=0.75 (Section 10.2.4)

Notes:

1. See Flow Chart A & B
2. *Additional testing is required to attempt to reduce the COV to less than 10%. If additional testing does not reduce the COV to less than 10%, this path is available. (Section 10.2.2.4.2.1)*
3. *Where COV > 10% Case F is applicable.*
4. *Different Cases May be used for different element or strengths*
5. *Note that no sample result can be excluded from the data set to reduce the COV unless a written documentation from the testing agency confirming that the sample was damaged prior to testing is submitted for review and approval by the City. The testing lab shall provide reasons of any errors involved in the lab testing procedure including sampling, sample transportation, sample storing, calibration and operation of testing equipment etc.*

Table 3: Structural Steel Material Testing Requirements[1]

Cases [1][9]	Information Available	Level of Testing Required	Minimum Number of Tests Required[2][5]	Test Results	Expected Strength	Lower-Bound Strength	Knowledge Factor (κ)[6]
A	No Drawings Available	No Testing Required	N/A	N/A	Default (Table 9-1 and 9-2) x Factor (Table 9-3)	Default (Table 9-1 and 9-2)	κ=0.75 (Table 6-1)
B	No Drawings Available or Greater Values/Knowledge Factor Desired	Usual Testing (Section 9.2.2.4.1)	(1) Strength coupon and (1) weld metal sample from each *seismic force resisting* component type[7], *with at least (3) steel coupons or welds form each strength determined.* [4]	*COV < 10%*	Mean Test Value	Mean Test Value - Std Dev	*κ=1.0*
				COV > 10% [3]	Mean Test Value	Mean Test Value - Std Dev	κ=0.75 (Table 6-1)
C	Drawings Available & No Properties Specified	No Testing Required	N/A	N/A	Default (Table 9-1 and 9-2) x Factor (Table 9-3)	Default (Table 9-1 and 9-2)	κ=0.75 (Table 6-1)
D	Drawings Available & Properties Specified (No Inspection/Testing Records)	No Testing Required	N/A	N/A	Specified (Fy) x Factor (Table 9-3)	Specified (Fy)	κ=0.9 (Table 6-1)
E	Drawings Available & Properties Specified (w/ Inspection/Testing Records)	No Testing Required	N/A	*COV < 10%* [8]	Mean Record Value	Mean Record Value - 1 Std Dev	κ=1.0 (Table 6-1)
F	Drawings Available, but Greater Values Desired	Usual Testing (Section 9.2.2.4.1)	(1) Strength coupon and (1) weld metal sample from each *seismic force resisting* component type[7], *with at least (3) steel coupons or welds form each strength determined.* [4]	*COV < 10%*	Mean Test Value	Mean Test Value - Std Dev	*κ=1.0*
				COV > 10% [3]	Mean Test Value	Mean Test Value - Std Dev	κ=0.75 (Table 6-1)

Notes:

1. See Flow Chart A & B
2. When testing is performed, Test Values shall be compared to the default values in Table 9-1 and 9-2 for the particular era of building construction. The amount of testing shall be doubled if the expected and lower-bound yield and tensile strengths are lower than the default values. (Section 9.2.2.4.2)
3. *Additional testing is required to attempt to reduce the COV to less than 10%. If additional testing does not reduce the COV to less than 10%, this path is available.*
4. If it is determined from testing that more than one material grade exists, additional sampling and testing shall be performed until the extent of each grade in component fabrication has been established. (Section 9.2.2.4.2 Item 2)
5. See Section 9.2.2.4.2 for requirements where archaic materials are identified
6. A knowledge Factor of 0.75 shall be used if the components and their connections are composed of cast or wrought iron (Section 9.2.4)
7. *Component Types include beams, columns, braces and metal deck*
8. *Where COV > 10% Case F is applicable.*
9. *Different Cases May be used for different element or strengths*
10. *Note that no sample result can be excluded from the data set to reduce the COV unless a written documentation from the testing agency confirming that the sample was damaged prior to testing is submitted for review and approval by the City. The testing lab shall provide reasons of any errors involved in the lab testing procedure including sampling, sample transportation, sample storing, calibration and operation of testing equipment etc.*

Table 4: Reinforced Masonry Material Testing Requirements[1]

Case [1][7]	Information Available	Level of Testing Performed	Minimum Number of Tests Required[4][8]	Test Results	Expected Strength	Lower-Bound Strength	Knowledge Factor (κ)
A	No Drawings Available	No Testing	N/A	N/A	Default (Table 11-2b) x 1.3 (Table 11-1)	Default (Table 11-2(b))	κ=0.75 (Table 6-1)
B	No Drawings Available or Greater Values/Knowledge Factor Desired	Usual Testing (Section 11.2.3.9.1 item 2)	(1) test for each type of seismic resisting component[5], with at least (6) tests total taken for the entire building.	*COV < 25%*	Mean Test Value	Mean Test Value - Std Dev	κ=1.0 (Section 11.2.4)
				COV > 25% [3]	*Mean Test Value - Std Dev*	*Mean Test Value - Std Dev (Section 10.2.2.3.1)*	*κ=0.75 (Section 11.2.4)*
C	Drawings Available & No Properties Specified	No Testing	N/A	N/A	Default (Table 11-2b) x 1.3 (Table 11-1)	Default (Table 11-2(b))	κ=0.75 (Table 6-1)
D	Drawings Available & Properties Specified (No Inspection/Testing Records)	No Testing	N/A	N/A	Specified x 1.3 (Table 11-1)	Specified	κ=0.9 (Table 6-1)
E	Drawings Available & Properties Specified (w/ Inspection/Testing Records)	No Testing	N/A	*COV < 25%* [6]	Mean Record Value	Mean Record Value - 1 Std Dev	κ=1.0 (Table 6-1)
F	Drawings Available & Properties Specified (No Testing/Inspection Records)	Minimum Usual Testing (Section 11.2.3.9.1)	(2) tests shall be performed for each different masonry strength used in the building , *with at least (3) tests total taken for the entire building*	*Those Result Less than Specified Expected Strength* [2]	*Low Tested Value for Corresponding Specified Strength*	*Low Tested Value for Corresponding Specified Strength*	κ=1.0 (Table 6-1)
				Those Results Greater than Specified Expected Strength [2]	Corresponding Specified x 1.3 (Table 11-1)	Corresponding Specified	κ=1.0 (Table 6-1)
		Usual Testing (Section 11.2.3.9.1)	(1) test for each type of seismic resisting component[5] and *(3) test from each masonry class*, with at least (6) tests total taken for the entire building	*COV < 25%*	Mean Test Value	Mean Test Value - Std Dev	κ=1.0 (Section 11.2.4)
				COV > 25% [3]	*Mean Test Value - Std Dev*	*Mean Test Value - Std Dev*	*κ=0.75 (Section 11.2.4)*

Notes:

1. See Flow Chart A & B
2. Specified Expected Strength = Specified (f'c) x 1.5 (Table 10-1)

3. Additional testing (double the minmum amount) is required to attempt to reduce the COV to less than 25%. If additional testing does not reduce the COV to less than 25%, this path is available. (Section 11.2.3.9.3)

4. In determining coefficient of variation, samples shall be grouped by grades of concrete and element type. Note that no sample result can be excluded from the data set to reduce the COV unless a written documentation from the testing agency confirming that the sample was damaged prior to testing is submitted for review and approval by the City. The testing lab shall provide reasons of any errors involved in the lab testing procedure including sampling, sample transportation, sample storing, calibration and operation of testing equipment etc. (Section 10.2.2.4.2.1)
5. Seismic Resisting component types include walls, beams, column, and slabs.
6. Where COV > 25% Case F is applicable.
7. Different Cases May be used for different element or strengths
8. If the mean values from in situ material tests are less than the default values prescribed in Section 11.2.3.10, the number of tests performed shall be doubled. (Section 11.2.3.9.3)
9. Note that no sample result can be excluded from the data set to reduce the COV unless a written documentation from the testing agency confirming that the sample was damaged prior to testing is submitted for review and approval by the City. The testing lab shall provide reasons of any errors involved in the lab testing procedure including sampling, sample transportation, sample storing, calibration and operation of testing equipment etc.

Table 5: Non-Ductile Concrete Condition Assessment Requirements			
Case [1]	**Information Available**	**Level of Condition Assessment Required**	**Minimum Condition Assessment Required**
A & B	No Drawings Available	Comprehensive	At least (3) connections of each primary connection type shall be exposed for inspection. *Of particular importance is the splice, standard and hooked development of each primary connection.* If common detailing among the three connections is observed, it shall be permitted to consider this condition as representative of installed conditions. If variations are observed among like connections, additional connections shall be inspected until an accurate understanding of building construction is gained. (Section 10.2.3.2.2)
C, D, E, & F	Drawings Avaliable	Visual	*The design professional shall walk the entire building and perform a visual building observation of the lateral seismic-force-resisting system (LFRS). The intent of the visual observation is to observe evidence that the existing LFRS (diaphragm, vertical systems, foundations, and connections) as-built conditions match the available drawings. Removal of existing finishes is not expected, however, the design professional shall attempt to verify the LFRS by removing ceiling tiles, tapping on walls, exploring non-finished areas, etc. Where the design professional finds deviations, or suspects that all, or portions of, the existing LFRS is not in general conformance with the available drawings, then a Comprehensive Condition Assesment shall be conducted on the suspect elements.* (Section 10.2.3.2.1)

Notes:
1. See Flow Chart A&B
2. Condition assessment exposure is defined as local minimized removal of cover concrete and other materials to inspect reinforcing system details. All damaged concrete cover shall be replaced after inspection. (Section 10.2.3.2.2)

Table 6: Pre-Northridge Steel Moment Frame Condition Assessment Requirements

Case [1]	Information Available	Level of Condition Assessment Required	Minimum Condition Assessment Required
A & B	No Drawings Available	Comprehensive	In the absence of construction drawings, at least three connections of each type (beam-column in moment frame and brace-beam column in braced frames) shall be exposed for the primary structural components. If no deviations within a connection group are observed, the sample shall be considered representative. If deviations within a connection group are observed, then additional connections shall be exposed until the extent of deviations is determined. (Section 9.2.3.2.2) See Table 7 for additional Requirements.
C, D, E, & F	Drawings Avaliable	Visual	*The design professional shall walk the entire building and perform a visual building observation of the lateral seismic-force-resisting system (LFRS). The intent of the visual observation is to observe evidence that the existing LFRS (diaphragm, vertical systems, foundations, and connections) as-built conditions match the available drawings. Removal of existing finishes is not expected, however, the design professional shall attempt to verify the LFRS by removing ceiling tiles, tapping on walls, exploring non-finished areas, etc. Where the design professional finds deviations, or suspects that all, or portions of, the existing LFRS is not in general conformance with the available drawings, then a Comprehensive Condition Assesment shall be conducted on the suspect elements.* (Section 9.2.3.2.1) See Table 7 for additional requirements.

Notes:
1. See Flow Chart A&B
2. Engineer shall verify metal deck profile and puddle weld pattern in terms of size, spacing and side seam fastening pattern of metal deck. (Section 9.2.3.1)

Table 7: Pre-Northridge Steel Moment Frame Connection Condition Assessment Requirements			
Case [1]	**Information Available**	**Level of Condition Assessment Required**	**Minimum Condition Assessment Required**
A, B, C, D, E, & F	No Drawings Available or Drawings Available	Visual & Comprehensive	Moment Frame connections part of the lateral force resisting system shall be assessed for previous earthquake damage per Section 4.4.2 of FEMA 352. Given the proximity of the City of West Hollywood to the 1994 Northridge Earthquake epicenter and measured peak ground accelerations from stations near the City, it is assumed that most, if not all, of the buildings experienced ground shaking above the limits requiring assessment per FEMA 352. A minimum number of moment frame beam-to-column connections shall be assessed for damage per the requirements contained in FEMA 352 Table 4-3. The design professional shall select locations where columns splices are expected to occur so that column splices can be inspected concurrently.

Notes:
1. See Flow Chart A&B

Table 8: Reinforced Masonry Condition Assessment Requirements			
Case [1]	**Information Available**	**Level of Condition Assessment Required**	**Minimum Condition Assessment Required**
A & B	No Drawings Available	Comprehensive	Destructive and *non-destructive* testing shall be used to determine all masonry wall types (reinforced, unreinforced, composite, noncompoiste, grouted, partially grouted, or ungrouted). Thickness, wall length, and locations of all masonry shear and bearing walls shall be noted on plan. The wall type, size, rebar size, and spacing shall be verified using *non-destructive* or destructive testing at aleast (3) locations per building or until a representative pattern is identified. Connections between masonry walls and floors or roofs shall be examined to identify details and condition on a minimum of (3) connections per connection type using *non-destructinve* or destructive testing. (Section 11.2.2.1 and 11.2.2.2) See Section 11.2.2 for additional requirements.
C, D, E, & F	Drawings Avaliable	Visual	*The design professional shall walk the entire building and perform a visual building observation of the lateral seismic-force-resisting system (LFRS). The intent of the visual observation is to observe evidence that the existing LFRS (diaphragm, vertical systems, foundations, and connections) as-built conditions match the available drawings. Removal of existing finishes is not expected, however, the design professional shall attempt to verify the LFRS by removing ceiling tiles, tapping on walls, exploring non-finished areas, etc. Where the design professional finds deviations, or suspects that all, or portions of, the existing LFRS is not in general conformance with the available drawings, then a Comprehensive Condition Assesment shall be conducted on the suspect elements.* (Section 11.2.2.1). See 11.2.2 for additional requirements.

Notes:
1. See Flow Chart A&B