2. DEFINITIONS, ABBREVIATIONS & NOTATIONS

This Chapter provides the definition of terms used throughout these Interim Guidelines. In addition, abbreviations and symbols, used in other sections of the Interim Guidelines are listed here, together with their typical usage.

2.1 Definitions

As used in this document, the terms defined below shall be interpreted to have the meaning indicated, unless specifically indicated elsewhere in this document to have other meaning in a specific context.

2.1.1 Administrative

The definitions of this section apply to the titles of persons involved in the design, construction, regulation, or use of buildings and to the standards, codes and ordinances by which such use is regulated.

Building Code — The locally enforced set of regulations governing the design, construction, alteration, occupancy and repair of building structures.

Commentary: Although some municipalities and government agencies develop and maintain independent building codes, most building construction in the United States is regulated under locally adopted editions of one of three model building codes: the Uniform Building Code (UBC), the National Building Code (NBC) and the Standard Building Code (SBC). The UBC has been used as a model in this advisory because most buildings damaged by the Northridge Earthquake were designed under earlier editions of that code, and because the seismic design regulations contained in the other two codes, were until 1993, based on those contained in the UBC. In 1993, both the NBC and SBC adopted seismic design regulations based on the NEHRP Recommended Provisions for the Development of Seismic Regulations for New Buildings (Building Seismic Safety Council - 1991). Where references to the UBC provisions are contained in these Interim Guidelines, they are generally to the 1994 edition of that document, unless another edition is specifically identified. Where these Interim Guidelines make reference to specific provisions in the UBC, parallel provisions in the NEHRP Recommended Provisions are generally identified in {parentheses}, where parallel provisions exist. Note that the formulae and requirements contained in these parallel provisions are not always identical, and caution should be exercised when referencing the NEHRP Recommended Provisions from these Interim Guidelines.

Building Official — That officer or authorized representative who has been appointed with legal authority to regulate the construction, alteration, occupancy and use of building structures within a recognized state, county, or municipality.

Building Owner	That person, corporation or agency holding legal title to the property being constructed, inspected, or repaired, or persons designated with authority to act on their behalf with regard to the building.
Contract Documents	The drawings, specifications and contractual terms under which the responsibilities of the various parties in a project to construct or modify a building are defined.
Contractor	That corporation, partnership, or person retained by the Building Owner to manage and/or perform construction work on a building.
Engineer of Record	The structural engineer in responsible charge of the preparation of drawings and specifications for the inspection, repair, modification or construction of a structure.
Erector	A contractor performing the erection, repair and/or modification of structural steel frames.
Evaluation	The process, including preliminary screening, on-site inspection, and structural analysis, of determining if a building has been structurally damaged, the effect of damage on the building's integrity, and development of strategies for the occupancy, structural repair and/or modification of the building.
Fabricator	A contractor performing fabrication of structural steel elements to be incorporated in a structural steel frame.
Inspection	On-site investigation of the condition of a structure (or components of a structure) through direct visual observation, aided as necessary by special non-destructive testing techniques.
Owner's Inspector	A welding inspector retained by the Building Owner to perform quality assurance inspections of weldments. The AWS D1.1 Code defines this individual as the "Verification Inspector."
Peer Review	An independent technical review of project construction documents as well as supporting data, calculations and assumptions, conducted by structural engineers and intended to provide the Owner and Engineer of Record with an opinion as to the extent that the design complies with applicable standards of care and is likely to achieve its intended objectives.
Special Inspector	An Inspector employed by the Building Owner under the requirements of Section 1701 of the Building Code. When such person performs special inspections related to weldments, he/she shall possess the qualifications noted for a Welding Inspector.
Structural Engineer	A person holding professional engineering registration with the state having jurisdiction, for the practice of structural engineering. The person should have particular training, knowledge and expertise in the structural design of buildings and structures. In some states such a person may hold registration as a Civil Engineer or Professional Engineer.

Welding Code	American Welding Society publication ANSI/AWS D1.1-94, *Structural Welding Code - Steel, 1994 Edition.*
Welding Engineer	A person with particular training, knowledge and expertise in metallurgy, the joining of metal elements to each other by the process of welding, and non-destructive testing techniques.
Welding Inspector	A person meeting the requirements of AWS D1.1, Section 6.1.3.1 (and certified by ICBO where applicable) to perform inspections of structural steel weldments. In AWS D1.1, this person is known as "Inspector."
Welder	A person qualified to perform welding in accordance with the provisions of AWS D1.1.

2.1.2 Technical

The definitions of this section indicate the terms by which specific structural components and elements are indicated in this document.

Assembly	The substructure of a steel frame that occurs at a floor level and consists of a single column and one or more floor girders and/or beams that attach directly to it.
Backing	A material or device placed against the back side of the joint, or at both sides of a weld in electroslag welding, to support and retain molten weld metal. The material may be partially fused or remain unfused during welding, and may be either metal or nonmetal.
Backup Bar	A non-preferred term, in common use, for a steel bar used as backing in a complete joint penetration weld. More appropriate terminology is "steel backing."
Chord	A direct tension or compression element placed at diaphragm edges to resist flexural demands on the diaphragm.
Collector	A structural element used to accumulate shear forces from a diaphragm and distribute them to vertical elements such as frames or walls located along a common line. Also see Strut and Tie.
Connection	The attachment of one structural element, for example a beam, to another, for example a column. As typically used in this document, connection means the attachment of a beam to a column for moment resistance. Important components of this connection include the beam itself, the beam shear tab, the column and its associated panel zone, continuity and doubler plates, and any additional plates used to join these elements together. Other types of connections include bracing connections, gravity connections, base plate connections and column splice connections.
Damage	Degradation in the strength or stiffness of a structural element or alteration of the configuration of the structure or its elements resulting from structural loading, such as induced by an earthquake.

Damage Index	A numerical index used to quantify the amount of degradation a moment resisting connection (or a group of moment resisting connections) has experienced. A value of 0 indicates no damage and a value of 10, total damage.
Design Basis Earthquake	Earthquake ground motion with a probability of exceedance at a site of 10% in 50 years. Such ground motions has an average return period of 475 years.
Diaphragm	A horizontal (or nearly horizontal) element of the lateral force resisting system used to distribute lateral loads to the vertical elements of the lateral force resisting system.
Drift	The total lateral deformation of a structure over its height.
Drift Index	Dimensionless quantity indicating the ratio of a structure's lateral deformation to its height.
Dual System	A structural system in which lateral load resistance is provided by a moment resisting frame in parallel with one or more braced frames and/or shear walls, and meeting the criteria of UBC-94 Section 1627.6.5.
Ductility	The ability of a material, component, element or structure to deform inelastically beyond its yield strength without significant loss in load carrying ability.
Electrode	A component of the electrical circuit that terminates at the arc, molten conductive slag, or base metal.
End Dam	A small plate located at the edge of a beam flange to column flange joint, oriented perpendicular to the joint and intended to serve as a boundary for weld deposition. C*ommentary: End dams are a mis-application of the requirement for weld tabs that was adopted by some erectors in Southern California. End dams as such are not mentioned in the AWS D1.1 code and they do not constitute weld tabs as required and defined in the code.*
Expected Yield Stress	The average stress at which material conforming to an ASTM specification will exhibit yield behavior, as determined by statistical evaluation of production samples.
Flux	A material used to hinder or prevent the formation of oxides and other undesirable substances in molten metal and on solid metal surfaces, and to dissolve or otherwise facilitate the removal of such substances.
Flux-Cored Arc Welding	An arc welding process that produces coalescence of metals by heating them with an arc between a continuous filler metal electrode and the work. Shielding is provided by a flux contained within the tubular electrode. Additional shielding may or may not be obtained from an externally supplied gas or gas mixture.
Fully Restrained Connection	A beam to column connection with sufficient rigidity to hold the original angles between the intersecting members virtually unchanged at loads approaching the strength of the weakest member.

Gas Shielded FCAW	A flux-cored arc welding process variation in which additional shielding is obtained from an externally supplied gas or gas mixture.
Group	A set consisting of those moment resisting connections in a building primarily intended to resist lateral forces in a given direction of building response, and selected as having similar seismic response characteristics, and therefore, similar probability of being damaged in an earthquake
Gravity Connection	A connection designed to transmit gravity loads from one structural element to another, but not intended to participate in the lateral force resisting system for the structure.
Heat Affected Zone	The portion of the base metal whose mechanical properties or microstructure have been altered by the heat of welding, brazing, soldering, or thermal cutting.
Heat Treatment	A controlled heating and cooling of a metal, usually involving re-crystallization.
Incipient Root Crack	A small planar discontinuity or cracking at the root of a weld.
Interpass Temperature	In a multipass weld, the temperature of the weld area between weld passes.
Interstory Drift	The lateral deformation of a structure within a given story.
Interstory Drift Index	The drift index for a particular story of a structure.
Joint	The juncture of one piece of base metal (for example a beam flange) to another (for example a column flange).
Lamellar Discontinuities	Defects in rolled structural shapes or plate, typically consisting of non-metallic sulfide and oxide inclusions which have been flattened by the rolling process and aligned parallel to the direction of rolling.
Lamellar Tear	A subsurface terrace and step-like crack in the base metal with a basic orientation parallel to the wrought surface caused by tensile stresses in the through-thickness direction of the base metal weakened by the presence of small dispersed, planar shaped, nonmetallic inclusions parallel to the metal surface.
Lateral Force Resisting System	Those elements of a structure which are intended to provide lateral strength and stiffness for the resistance of lateral forces due to wind or earthquake.
Liquid Dye Penetrant Testing	A method of NDT in which a highly fluid, red dye penetrant is sprayed on the surface of a joint to detect open surface defects. (PT)
Magnetic Particle Testing	A method of NDT which uses a flux field and iron powder to detect surface and sub-surface discontinuities. (MT)
Magnitude	A scale indicating the energy released by an earthquake.
Maximum Capable	The most severe ground motion likely to be experienced at a site, given the

Earthquake	known seismologic and geotectonic environment. This may be determined by deterministic methods in regions with well defined seismic sources, or by probabilistic methods. If probabilistic methods are used, it may be taken as that level of ground motion with a 10% probability of exceedance in 100 years. Such ground motion has an average return period of approximately 1,000 years.
Metallurgical Stress Riser	A significant deviation in the mechanical properties (usually hardness and micro-structure) between two adjacent regions in a weldment. These may result from arc strikes, improperly made tack welds, and improperly prepared thermally cut surfaces.
Minimum Specified Yield Strength	The lower bound of acceptable yield strength permitted by ASTM specifications, as measured by simple tensile test in accordance to ASTM requirements.
Modification	A structural alteration intended to improve the strength, stiffness, or energy dissipation capacity of a structure and/or its elements.
Moment Frame	A continuous plane of framing in which the beams are joined to the columns with moment resisting connections.
Moment Magnitude	A scale indicating the energy released by an earthquake. Moment magnitude can be calculated based on the surface area of fault rupture amount of slip across the surface, and the stress drop during the event. For moderate magnitude events (<7) moment magnitude and Richter or local magnitude are approximately the same. Above that level, moment magnitude is a more accurate representation.
Notch Toughness	The ability of a material to absorb energy (usually when loaded dynamically) in the presence of a flaw.
Ordinary Moment Resisting Frame	A moment-resisting frame not meeting the requirements of UBC-94 Section 2211.7
Panel Zone	In a moment-resisting beam-column connection, that portion of the column web (or webs) effective in developing the flexural stresses from the girder(s) through shear behavior.
Partially Restrained Connection	A connection between beams and columns that does not possess sufficient rigidity to hold virtually unchanged the original angles between the members at load levels approaching the strength of the weaker member.
Peening	The mechanical working of metals using impact blows.
Plastic Hinge	In a flexural element, that region along a beam's span at which flexural yielding occurs.
Plastic Moment	The moment that causes a plastic hinge to form in a flexural member.

Plastic Rotation	The angular deformation which occurs in a plastic hinge, once yielding has initiated. Expressed in radians.
Potentially Hazardous	A building declared by the building official to be considered hazardous but not yet evaluated by a structural engineer in accordance with these Interim Guidelines.
Postheating	The application of heat to an assembly after welding, brazing, soldering, thermal spraying, or thermal cutting.
Preheat	The heat applied to the base metal or substrate to attain and maintain preheat temperature.
Preheat Temperature	A specified temperature that the base metal must attain in the welding, brazing, soldering, thermal-strain, or cutting area immediately before these operations are performed.
Quality Assurance	The auditing of the Contractor/Fabricator/Erector's quality control system and procedures, usually performed by the Owner's Inspector or Special Inspector.
Quality Control	The Contractor/Fabricator/Erector's quality program.
Radiographic Testing	An NDT process in which X-rays or gamma rays are passed through a weldment to expose a film, which when developed can indicate the presence of discontinuities and defects. (RT)
Repair	Construction work intended to restore a damaged structure or structural element to approximately the same configuration, stiffness, and strength that existed prior to the onset of damage.
Rigid Connection	See "Fully Restrained Connection"
Runoff Tab	A non-preferred usage for "weld tab".
Self Shielded FCAW	A flux-cored arc welding process variation in where shielding is exclusively provided by a flux contained within the tubular electrode.
Semi-Rigid Connection	Same as "Partially Restrained Connection"
Shielded Metal Arc Welding	An arc welding process that produces coalescence of metals by heating them with an arc supplied between a covered metal electrode and the work. Shielding is obtained from decomposition of the electrode coating.
Special Moment-Resisting Frame	A welded moment-resisting frame meeting the requirements of UBC-94 Section 2211.7
Steel Backing	Backing comprised of steel.

Strength	The capacity of a section to resist applied axial loads, shears and/or moments, as indicated in UBC-94 section 2211.4.2
Stress Relief	Uniform heating of a structure or a portion thereof to a sufficient temperature to relieve the major portion of the residual stresses, followed by uniform cooling.
Stop Drill	Drilling a hole at the end of a crack to stop it from running.
Strut	A compressive element, provided to control differential displacements between two elements of a structural system.
Through Thickness	For elements of hot rolled steel shapes and plates, a term referring to stresses or strains imposed on the element perpendicular to a plane aligned with the direction of rolling.
Tie	A tensile element, typically placed in a diaphragm, to provide continuity, but also provided at foundation level to control differential lateral displacements of individual foundations.
Toughness	The ability of a smooth member (unnotched) to absorb energy, usually when loaded slowly.
Ultimate Tensile Strength	The maximum load divided by the original cross-sectional area of the specimen.
Ultrasonic Testing	An NDT process in which high frequency sound waves are reflected through a material and recorded by an instrument to indicate the presence of discontinuities (UT).
Welding Specification	A specification which sets the general requirements for welding work performed on a project, including the responsibilities of individuals and the processes which may be used. This specification is part of the contract documents.
Welding Procedure Specification	A rigorous written specification of all important welding parameters for a given welded connection including welding process, material thickness and fit-up of parts, welding position, electrode type and stick out, voltage, amperage, polarity, preheat and interpass temperatures, etc.
Welded Steel Moment-Resisting Frame, Welded Steel Moment Frame	A plane (or nearly so) frame structure deriving lateral load stability from rigid interconnection of the beams and columns (WSMF). Rigid connections may consist either of fully welded connections or connections which are partially welded and partially bolted. This includes both ordinary moment-resisting frames (OMRFs) and special moment-resisting frames (SMRFs) as defined in the Uniform Building Code.
Weld Tab	Additional material, upon which a weld may be initiated or terminated.
Yield Stress	The average tensile stress during yielding in the plastic range, and/or the stress determined in a tension test when the strain reaches 0.005 in. per in.

Yield Strength	The uniaxial tensile stress at which a material exhibits a specified limiting deviation from the proportionality of stress to strain. Deviation expressed in terms of strain.

2.2 Abbreviations

When used in this document, abbreviations shall refer to the following terms:

AASHTO	American Association of State Highway and Transportation Officials
AASHTO FCP	A document published by AASHTO for the fabrication of fracture-critical, non-redundant steel bridges, often called the Fracture Control Plan.
AISC	American Institute of Steel Construction
ANSI/AWS D1.1	Structural Welding Code - Steel, published by the American Welding Society
ASNT	American Society for Nondestructive Testing
ASTM	American Society for Testing and Materials
ATC	Applied Technology Council
ATLSS	NSF Center on Advanced Technology for Large Structural Systems at Lehigh University
AWS	American Welding Society
CJP	Complete Joint Penetration
CUREe	California Universities for Research in Earthquake Engineering
EBF	Eccentric Braced Frame
EGW	Electro Gas Welding
ESW	Electro Slag Welding
FEMA	Federal Emergency Management Agency
FCAW	Flux Cored Arc Welding
FCAW-g	Flux Cored Arc Welding - Gas Shielded
FCAW-ss	Flux Cored Arc Welding - Self Shielded
GMAW	Gas Metal Arc Welding

HAZ	Heat Affected Zone
ICBO	International Conference of Building Officials
LAST	Lowest Anticipated Service Temperature
MT	Magnetic Particle Testing
NEHRP	National Earthquake Hazards Reduction Program
NDE	Nondestructive Examination.
NDT	Nondestructive Testing
NIST	National Institute of Standards and Technology
NSF	National Science Foundation
OMRF	Ordinary Moment-Resisting Frame
PGA	Peak Ground Acceleration, horizontal unless otherwise specified.
PT	Liquid Dye Penetrant Testing
RT	Radiographic Testing
SAC	A joint venture of SEAOC, ATC and CUREe
SAW	Submerged Arc Welding
SEAOC	Structural Engineers Association of California
SMAW	Shielded Metal Arc Welding
SMRF	Special Moment-Resisting Frame
SSPC	Structural Shape Producers Council
UBC	Uniform Building Code
UT	Ultrasonic testing
VI	Visual Inspection
WPS	Welding Procedure Specification
WSMF	Welded Steel Moment Frame

W	Designation for a wide flange structural shape
WT	Designation for a structural "T" section cut from a wide flange cross section

2.3 Notations

α	In the design of modifications to existing WSMF structures, a coefficient that accounts for strain hardening and modeling uncertainty.
β	In the design of new WSMF structures, a coefficient to adjust specified yield stress to an expected mean value for the material grade, and to account for strain hardening and modeling uncertainty.
σ	The standard deviation for the defect indices in a group of inspected connections.
b	A factor which represents the number of multiples of the standard deviation for a normal distribution above the mean that would be required to exceed a damage index D of 33%.
b_f	Width of a beam flange - inches
d	Damage repair cost for a building, expressed as a % of building replacement cost.
d_j	A damage index, assigned to connection "j", and used to determine the overall damage index "D "within a structure as well as to determine if repair and or modification is warranted.
d_{avg}	The mean value of the damage index for a group, considering all connections inspected in the group
f_a	The axial stress in a column
k	The total number of connections in a group of connections, at a typical floor in the group
k_i	The total number of connections in a group at floor "i"
m_i	The number of inspected connections in a group at floor "i" including additional connections inspected due to their proximity to damaged connections
p	The number of floors in a building
n	The number of connections in a group, inspected as part of an initial sample

s	Standard deviation for material strength parameters, based on industry study
t_f	Thickness of the flange of a beam section - inches.
A_a	Effective peak ground acceleration coefficient, contained in building codes based on the NEHRP Provisions.
D	The average damage index for a group of connections at a typical floor.
D_i	A damage index representing the proportional damage to the connections in the lateral force resisting system in one group of connections (or in one horizontal direction) at a floor, based on combining the damage to inspected connections at that floor and the average observed damage at other floors, to all uninspected connections in the group at the floor.
D_{max}	The maximum damage index for a group of connections at any floor.
F_y	Specified minimum uniaxial tensile yield stress.
F_{ya}	Actual yield stress of component in an existing building
F_{ye}	Expected yield stress of component in a new building
F_{ym}	Mean yield strength for specified material, based on industry published data
L	Width of a frame bay - ft (meters)
L’	Distance between plastic hinges along a beam - ft (meters)
M	The magnitude of an earthquake.
M_c	The moment demand at the center of the column when a beam mechanism is formed
M_e	The design moment for a connection.
M_p	That bending moment which causes a plastic hinge to form in a flexural element of a frame, at minimum specified yield stress.
M_{pr}	The bending moment expected to cause a plastic hinge to form in a flexural element of a frame, considering the expected yield stress.
M_w	The moment magnitude of an earthquake.
P	The probability that damage to connections on at least one floor has resulted in a damage index D_i of 1/3 or more.

P_f	The probability that the damage to connections at any floor have resulted in a damage index D_i of 1/3 or more.
S	The standard deviation for the damage indices of a the set of inspected connections belonging to a group, at one floor level.
T	Fundamental period of vibration - seconds
T_I	Fundamental period of vibration of a base isolated structural system - seconds
Z	Seismic zone coefficient defined in the UBC, and representative of the effective peak ground acceleration produced by a design earthquake.
Z_b	Plastic section modulus of the beam
Z_c	Plastic section modulus of the column

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