



Federal Emergency Management Agency

Washington, D.C. 20472

1. **Date Published:** June 8, 2001
2. **Response and Recovery Directorate Policy Number:** 9524.7
3. **Title:** Interim Welded Steel Moment Frame Policy for the Nisqually Earthquake Disaster
4. **Purpose:** This policy provides guidance in determining the eligibility of costs for inspection, evaluation and repair of welded steel moment frames of structures damaged by the Nisqually Earthquake.
5. **Scope and Audience:** This policy is specific to the provision of FEMA Public Assistance recovery grants for the Nisqually Earthquake (FEMA-DR-1361-WA) that occurred on February 28, 2001 in the State of Washington. It prescribes eligible and ineligible costs associated with the inspection, evaluation and repair of welded steel moment frames of structures constructed with steel framing joined by welded connections subject to brittle fracture, such as those constructed prior to 1995 using the prescribed detail of *Section 2710 (g) B* of the 1991 **Uniform Building Code** or its equivalent. This policy is intended to guide FEMA personnel responsible for the administration of the FEMA Public Assistance Program. The provisions of this policy are effective immediately.
6. **Background:** The Robert T. Stafford Disaster Recovery and Emergency Assistance Act, as amended, ("Stafford Act") and implementing regulations in 44 CFR Part 206 provide an administrative allowance (sometimes called "the sliding scale") to reimburse subgrantees for costs incurred while requesting, obtaining and administering Federal disaster assistance grants. This allowance, which is based on a fixed percentage of the cost of eligible repairs, is intended to include the costs incurred for an applicant's evaluation of the extent of damage to eligible damaged facilities. FEMA's policy is that there generally is no reimbursement separate from the allowance for costs incurred in the search for damage conducted by an applicant.

However, FEMA has made an exception to that policy in recognizing the unique situation presented by the inspection of welded steel moment frame connections that potentially can have brittle fractures. These connections typically are covered with architectural finishes and occasionally are protected with asbestos or other fire retardants. These coverings add complexity to an inspection of such connections. Because of the numerous incidents of structural damage to welded steel moment frames (WSMF) caused by the Northridge Earthquake, it was necessary to establish a policy by which FEMA would determine the eligibility of funding for inspection, evaluation and repair of this damage.

A multi-year study of the welded steel moment frame fracture issue has resulted in recommended criteria to the technical community for (a) evaluation of steel moment frame buildings affected by strong earthquake ground shaking to determine if they have been damaged, and to what extent; (b) identification of those buildings that have been so severely damaged that they constitute a significant safety hazard; and (c) repair of damaged structures such that they may safely be restored to long term occupancy. These results are published in **Recommended Post-earthquake Evaluation and Repair Criteria for Welded Steel Moment-Frame Buildings**, Federal Emergency Management Agency, FEMA 352, July 2000. FEMA 352 provides the technical base for this policy.

The revision of RR #9524.1, Welded Steel Moment Frame Policy, August 17, 1999, will be made following FEMA's normal coordination procedure. That policy was based on FEMA 267, *Interim Guidelines: Evaluation, Repair, Modification and Design of Welded Moment Frame Structures*, August 1995, which is now out-of-date. The revision of RR #9524.1 will replace the recommendations of FEMA 267 with those of FEMA 352.

This Interim Policy is being issued at this time because the revision of RR Policy #9524.1 will take too long to be responsive to the Nisqually Earthquake recovery and because FEMA 352 provides the best current technical information.

FEMA has identified two potential cost impacts caused by the publication of FEMA 352. These impacts are a consequence of the changes between FEMA 267 and FEMA 352 and do not reflect changes in policy. The potential cost impacts are assessed below:

First. Physical indications that require the search for damaged welded moment frame connections are similar in FEMA 267 and FEMA 352 but not identical.

- The number of buildings to be inspected may decrease slightly because FEMA 267 used local ground accelerations equal to or greater than 0.20 g whereas FEMA 352 uses local ground accelerations equal to or greater than 0.25 g.
- However, the number of buildings to be inspected may also increase slightly because FEMA 352 dropped the condition of permanent interstory drift and change in building period, and added local Modified Mercalli Intensity condition.

Second. In the selection of the number of connections to be inspected in the search for damaged connections, the minimum number of connections has been increased slightly. However, whenever significantly damaged connections are found, FEMA 352 recommends that, for an exterior moment frame, 9 additional connections rather than 4 additional connections be inspected, and, for an interior moment frame, 13 additional connections rather than 12 additional connections be inspected. For a severely damaged building the change in cost will be small, but for a minimally damaged building the cost increase may be significant.

The currently published national policy on welded steel moment frame buildings (RR #9524.1) included a discussion of the use of mitigation measures under Section 406 of the Stafford Act. That topic is not being addressed in either the planned revision to

RR #9425.1 or in this interim policy for the Nisqually Earthquake recovery. Instead, proposed mitigation measures for welded steel moment frame buildings, as all other public assistance grant program mitigation measures, will be evaluated under the provisions of RR #9526.1, Hazard Mitigation Funding Under Section 406 (Stafford Act).

7. **Policy:** Only eligible facilities constructed with steel framing connections subject to brittle fracture, such as those constructed prior to 1995 using the prescribed detail of Section 2710 (g) B of the 1991 **Uniform Building Code** or its equivalent, are eligible under this Policy.

A. Inspection Reimbursement Under Section 406 of the Stafford Act

- 1) Preliminary post-earthquake assessment. The preliminary post-earthquake assessment described in FEMA 352, Chapter 3, leads to a building posting as Green, Yellow or Red. Section 3.2 provides conditions that are used to determine if the building needs to undergo a preliminary evaluation. If the conditions of Section 3.2 allow it to be classed as unlikely to have experienced significant damage, building inspections and evaluations are the responsibility of the owner and eligibility for reimbursement is provided in accord with item 3, below. However, if the building may have experienced significant damage, the visual inspections and preliminary evaluation described in Section 3.3 will be eligible for disaster recovery reimbursement through a Project Worksheet (PW). Section 3.3 provides a checklist of indications of potential damage that leads to evaluations requiring posting of the building as Green, Yellow or Red. Section 3.3.3.4 delineates the numbers and locations of welded moment connections requiring visual inspection for the preliminary evaluation.
- 2) Strong likelihood of significant welded steel moment frame damage. This is to be determined as indicated by Yellow or Red postings based on the evaluation of damage to welded moment connections described in FEMA 352, Section 3.3.4. As provided through a PW, FEMA will reimburse the costs of visual bottom flange connection inspections performed at locations selected in accordance with FEMA 352, Chapter 4, Method 2. Section 4.4.2 (Method 2) provides guidance for the inspection of a sample of the total welded moment frame connections in the building. If certain types of damage are discovered, additional visual inspection of bottom flange connections and/or top flange connections at locations recommended by FEMA 352, Chapter 4 (after the initial discovery of damaged connections) will also be eligible for reimbursement, but only after FEMA has been informed of the frame damage already discovered, and after the PW has been modified to include the follow-on inspection. The modified PW also may authorize nondestructive testing if the visual inspections indicate a significant potential of concealed damage. The eligible cost of inspecting connections includes only:
 - Removal of necessary architectural finishes such as plaster/drywall
 - Removal of fire retardants in the inspection area of the connection.
 - Visual inspections.

- Nondestructive testing only as appropriate, necessary and approved. Testing may include liquid dye-penetrant testing or magnetic particle testing, but not ultrasonic testing.

3) Little likelihood of significant welded steel moment frame damage.

If either of the following conditions exist:

- a building was not required to undergo a preliminary evaluation (based on FEMA 352, Section 3.2), or
- a Green posting was assigned to a building (based on damage to welded moment connections as described in FEMA 352, Section 3.3.4.3, Table 3-2: Postearthquake Condition Designations), then FEMA will reimburse the costs of visual inspections only for those connections where significant damage associated with the declared earthquake disaster is found. Significant connection damage shall be as defined in FEMA 352, Chapter 4 (Table 4-1a: Connection Damage Indices), for $d_j \geq 1$.

Visual inspection of additional connections (at locations recommended by FEMA 352, following the discovery of damaged connections) will also be eligible for reimbursement, but only after FEMA has been informed of the frame damage already discovered, and a PW for the follow-on inspection has been approved. The PW may also authorize non-destructive testing if the visual inspections indicate a significant potential for concealed damage.

- 4) Except as provided above, any inspections performed that do not yield discovery of significant connection damage attributable to the earthquake will not be eligible for FEMA reimbursement.

B. Evaluation Reimbursement. Eligible reimbursable costs will include reasonable evaluation of the effects of the identified significant connection damage on the future performance of the building structure. To be eligible, this evaluation should be limited to that which is in accordance with FEMA 352, Chapter 4 recommendations. Generally, FEMA will not fund detailed analytical or experimental studies or Level 2 evaluations as described in FEMA 352, Chapter 5. Funding of such evaluations is eligible only if a PW based on a specific scope-of-work and cost estimate is approved in advance.

C. Repair Reimbursement

- 1) The cost to repair the damaged connections to their pre-earthquake condition in accordance with the suggested repair strategies of FEMA 352, Chapter 6 may be eligible for reimbursement. Repair of the architectural finishes and fire retardants removed in the area of the connection damage repair is eligible. Funding of repairs is eligible only if a PW based on a specific scope-of-work and cost estimate is approved in advance.
- 2) FEMA 352 provides recommendations, not requirements.

8. References:

- *Recommended Post-earthquake Evaluation and Repair Criteria for Welded Steel Moment Frame Buildings*, Federal Emergency Management Agency, FEMA 352, July 2000.
- RR Policy #9526.1, Hazard Mitigation Funding Under Section 406 (Stafford Act), dated August 13, 1998.

9. Supersession: None

10. Authorities: Section 406 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, P.L. 93-288 as amended and 44 CFR 206

11. Originating Office: Infrastructure Division, Response and Recovery Directorate

12. Signature:

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