



Federal Emergency Management Agency

Washington, D.C. 20472

1. **Date:** August 17, 1999
2. **Response and Recovery Directorate Policy Number:** 9524.1
3. **Title:** Welded Steel Moment Frame Policy
4. **Purpose:** To revise the policy by which FEMA determines the eligibility of funding for inspection, evaluation and repair of welded steel moment frames of structures damaged by earthquakes.
5. **Scope and Audience:** This policy 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 applies to all disasters declared after publication of this document. It is intended to guide FEMA personnel responsible for the administration of the FEMA Public Assistance Program.
6. **Background:** The Stafford Act and implementing regulations in 44 CFR Part 206 provide an allowance 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 inspection of welded steel moment frame connections that potentially can have brittle fractures. These connections are typically 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 the Federal Emergency Management Agency (FEMA) would determine the eligibility of funding for inspection, evaluation and repair of this damage.
7. **Policy:** The policy combines programmatic considerations and the unique inspection problems posed by welded steel moment frame brittle fracture damage. 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. Strong likelihood of significant welded steel moment frame damage.

FEMA will reimburse the costs of visual bottom flange connection inspections performed at locations selected in accordance with the *Interim Guidelines: Evaluation, Repair, Modification and Design of Welded Steel Moment Frames*, Federal Emergency Management Agency, FEMA 267, August, 1995 (Guidelines) selection procedure:

- When the external building damage associated with the declared earthquake is of such an extent to indicate the strong likelihood of steel moment frame connection damage, and
- If significant connection damage, attributable to the earthquake, is found on at least one connection.

Structurally significant connection damage shall be defined as given in the Guidelines, excluding weld damage Types W1 and W5 (see below).

Visual inspection of additional bottom flange connections and/or top flange connections at locations recommended by the Guidelines after 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 after a Project Worksheet (PW) for the follow-on inspection has been approved. The Damage Index criteria of the Guidelines will be used after replacing the "1/3" coefficient in equation (4-5) by "1/2". The follow-on 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, and
- Removal of fire retardants in the inspection area of the connection.
- Visual inspections.
- Nondestructive testing only as appropriate, necessary and approved. Testing may include dye penetrant testing and magnetic particle testing, but not ultrasonic testing.

2. Little likelihood of significant welded steel moment frame damage.

If the building does not satisfy the conditions of item 1 above, FEMA will reimburse the costs of connection visual inspections only for those connections where significant damage associated with the declared earthquake disaster is found. Again, significant connection damage shall be defined as given in the Guidelines, excluding weld damage types W1 and W5. Visual inspection of additional connections at locations

recommended by the Guidelines 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 Damage Index criteria of the Guidelines will be used after replacing the “1/3” coefficient in equation (4-5) by “1/2”. The follow-on PW may also authorize non-destructive testing if the visual inspections indicate a significant potential of concealed damage.

3. Except as provided in item 1 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 the Guideline recommendations. Generally, FEMA will not fund detailed analytical or experimental studies. 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 (after changing equation (4-5) coefficient from “1/3” to “1/2” and excluding W1 and W5 connection repairs) may be eligible for reimbursement. Repair of the architectural finishes in the connection damage repair area also is eligible. Funding of such repairs is eligible only if a PW based on a specific scope-of-work and cost estimate is approved in advance.

2. The cost to strengthen (upgrade) damaged and undamaged connections may be considered for Section 406 mitigation measures if the measures meet standards of cost effectiveness.

8. Reference: FEMA’s policy for the inspection, evaluation and repair of WSMF connections is consistent with the professional guidance generated with Federal funds through FEMA Mitigation Directorate. The source document which provided the information for the initial policy is entitled *Interim Guidelines: Evaluation, Repair, Modification and Design of Welded Steel Moment Frames*, Federal Emergency Management Agency, FEMA 267, August, 1995 (**Guidelines**)¹. Final Guidelines are being prepared and will supercede the Interim Guidelines as the source document for this policy. The Final Guidelines will be based on the results of many studies and field

¹ These “interim guidelines” provide recommended actions, but are not legal requirements.

experiences since 1995. This policy will be reviewed following publication of the Final Guidelines.

A. Weld damage classifications W1 and W5 as defined in the Guidelines are considered now to be construction flaws representative of the as-built condition, not earthquake-caused damage. Therefore, connections with only these indications are not considered to have earthquake damage and are not eligible for federal disaster funds. Specifically, they are defined as follows:

- W1 – Weld root indications – These include both W1a and W1b indications
- W5 – Ultrasonic Testing (UT) detectable indication - non-rejectable.

B. The Guidelines provide a post earthquake evaluation process which includes a process of identifying which buildings should be inspected and a detailed connection evaluation procedure. Visual inspection of the bottom flange welded connections and a limited number of UT inspections of the column flange near these girder connections have been recommended since the Guidelines were published. When significant visual welded bottom flange damage is observed, top flange connections should be visually inspected. Until more definitive recommendations are made, visual inspections should follow a procedure given by the three alternative methods to select which connections are to be inspected; method A - random selection, method B - deterministic selection, and method C - analytical selection. The initial number of connections that require inspection depends upon the method selected. However, additional visual inspections should be considered as earthquake related connection damage is identified. The Damage Index approach for recommending additional connection inspection and repair criteria has been found to be conservative. The current recommendations are to decrease some of the connection damage severity indices and to change the cumulative damage index at any floor from $1/3$ to $1/2$. For this revision of the policy only the change in equation (4-5) coefficient from $1/3$ to $1/2$ has been implemented. This change in the coefficient will be reviewed and new damage index values will be established after the Final Guidelines are published.

9. Supersession: Response and Recovery Policy Number 4511.300 PO, EX

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. Review Date: Two years from date of publication or upon publication of the Final Guidelines, whichever occurs first.

13. Signature:



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14. Distribution: Regional Directors, Regional and Headquarters RR Division Directors