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Technical Letter
No. 1110-2-534

30 September 1994

Engineering and Design
**STRUCTURAL EVALUATION OF WELDED ALUMINUM GUARDRAILS
ON CIVIL WORKS PROJECTS**

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1. Purpose

This engineer technical letter (ETL) provides guidance for structural evaluation of guardrails on civil works projects.

2. Applicability

This ETL applies to all HQUSACE elements, major subordinate commands, districts, laboratories, and field operating activities having responsibilities for the design of civil works projects.

3. References

- a.* ER 1130-2-303, Maintenance Guide.
- b.* EM 385-1-1, Safety and Health Requirements Manual.
- c.* American Iron and Steel Institute. 1985. Criteria for Structural Applications of Steel Tubing and Pipe, 150 East 42nd Street, New York, NY 10017.
- d.* American Society for Testing and Materials. 1992. "Test Methods for Performance of Permanent Metal Railing Systems and Rails for Building," (E 935-92) Annual Book of ASTM Standards, Vol 04.07, 1916 Race Street, Philadelphia, PA 19103.
- e.* National Association of Architectural Metal Manufacturers. 1985. "Pipe Railing Manual," 2nd ed., 600 South Federal Street, Chicago, IL 60605.

f. National Ornamental and Miscellaneous Metals Association. 1986. Metal Rail Manual, 2nd ed., Suite 109, 2996 Grandview Ave., NE, Atlanta, GA 30305.

4. Background

a. Welded aluminum railing. Aluminum railing has been used on many civil works projects, and railing systems have usually been specified as standard building products and were purchased and installed without design computations. Several districts have recently identified welded aluminum railings at civil works projects which do not meet U.S. Army Corps of Engineers (USACE) safety standards (see paragraph 4*b*). The welding of the aluminum rail post to the base or connection plate is potentially an inadequate detail.

b. Corps safety requirements. All railing systems should be designed and constructed to meet the minimum safety standards prescribed in Section 21.B of EM 385-1-1. Existing railing systems should be inspected in accordance with ER 1130-2-303. Inspection and evaluation requirements for metal railings should be generally consistent with ASTM (1992).

5. Action

a. Existing railing systems. Evaluation of all existing railing should be performed as part of the Priority A or B inspection (Section 24 of ER 1130-2-303) in accordance with the guidance provided in Appendix A.

(1) If the results of a structural evaluation indicate that the railing is grossly inadequate to resist the design load (i.e., less than 65 percent of the design load), then a load test should be performed on the railing system to ensure that the railing is capable of withstanding the maximum design load. Specific guidance on field testing of railings, if needed, does not exist, so any required field testing should generally be performed to obtain results consistent with ASTM (1992), which is for laboratory tests. After testing, all critical details such as the weld connecting the aluminum rail post to the base or connection plate should be carefully inspected.

(2) Engineers should evaluate the results of the performance load tests on the railings and upgrade or replace unsafe railings as necessary.

b. New railing systems. All railings for new construction should be structurally adequate to meet the requirements of EM 385-1-1. Design engineers should ensure that all welded details are adequate before releasing the plans for fabrication and installation.

FOR THE DIRECTOR OF CIVIL WORKS:

Appendix A: Structural Safety Assessment
of Existing Metal Guardrails



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