

CECW-ED

Technical Letter
No. 1110-2-551

31 August 1998

**Engineering and Design
IDENTIFICATION, INSPECTION, AND EVALUATION
OF FRACTURE CRITICAL MEMBERS OF IN-SERVICE BRIDGES**

1. Purpose

This Engineer Technical Letter (ETL) provides guidance in the identification, inspection, and evaluation of fracture critical members of in-service bridges owned and operated by the U.S. Army Corps of Engineers (USACE) on Civil Works projects. This ETL is not intended to provide guidance on analysis and design of bridges.

2. Applicability

This ETL applies to all USACE Commands having responsibilities for planning, inspecting, evaluating, and documenting the safety of in-service bridges.

3. References

References are listed in Appendix A.

4. Distribution Statement

Approved for public release; distribution is unlimited.

5. Background

a. The national average for bridge failures per year is 150 collapses resulting in the death of 12 people. Nationally, bridge collapses are not now as frequent as they were in the nineteenth century; however, they still occur. It is extremely important that fracture critical members on

bridges be identified, properly inspected, and evaluated.

b. As noted in Appendix A, a significant amount of information is currently published on inspecting and evaluating fracture critical members. A methodology for identifying fracture critical members is explained in this ETL. Information pertaining to state-of-the-art techniques for real-time damage assessment of bridge structures is provided in Appendix B.

6. Summary

This ETL summarizes procedures for the identification, inspection, and evaluation of fracture critical members of USACE in-service bridges on public roads. The ETL is not intended to provide guidance on how to develop a numerical model, apply loads and boundary conditions, or develop load combinations. However, once a structural model has been developed, this ETL will provide guidance on identifying, inspecting, and evaluating fracture critical members of in-service bridges. Two bridges, Summit Inland Waterway Bridge crossing the Delaware River and Chesapeake Bay and St. George's Highway Bridge located in Delaware and Maryland crossing the Chesapeake Bay and Delaware Canal, are analyzed using the finite element method to demonstrate a procedure of locating fracture critical members. The structural degradation process resulting from fracture and fatigue is presented to provide background for critical assessment and inspection planning. A state-of-the-art review of new techniques in

structural damage monitoring and structural integrity assessment methodology is presented in Appendix B. This review summarizes information pertaining to new methodology and technology available for more effective inspection and evaluation of bridges. The reader should be aware that the information in Appendix B is new technology and may not apply to all conditions. CECW-ED should be contacted if there is a concern about applicability.

7. Objectives

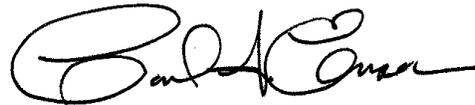
The objective of this ETL is to provide information on the identification, inspection, and

FOR THE COMMANDER:

evaluation of fracture critical members on in-service bridges. In addition, this ETL provides information pertaining to state-of-the-art review of new techniques for real-time damage assessment of bridge structures.

8. Action

The guidance in this ETL should be used to identify, inspect, and evaluate fracture critical members on bridges owned and operated by USACE on Civil Works projects.

A handwritten signature in black ink, appearing to read "Carl F. Enson". The signature is fluid and cursive, with a long horizontal stroke extending to the right.

CARL F. ENSON, P.E.
Chief, Engineering Division
Directorate of Civil Works