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The purpose of this research project is to re-examine the Charpy V-Notch (CVN) base metal requirements and inspection requirements for government owned steel bridges that contain at least one Fracture Critical Member (FCM). FCMs are defined as members that will cause global failure of the bridge if the FCM fails. Currently FCMs are required by federal law to be inspected with a hands on inspection every two years, although a waiver may be obtained in a limited amount of cases. Hands on inspections are conducted using only the human eye, where the distance between the human eye and the member is no greater than one arms length. The flaw detection capabilities of the hands on inspection program are not known at this time. Future means of quantifying the probability of detecting a crack are discussed. This report will review the history of the Charpy V-Notch (CVN) test and the use of the CVN test in steel bridge material requirements. Damage tolerant design is proposed as an alternative to current U.S. bridge material selection and inspection practice. A deterministic procedure is proposed instead of the reliability based procedures that have been proposed previously in the literature. This is because the distributions of the relevant variables are not known for steel bridges and inspectors. The Master Curve method, standard crack assessment procedures, and the finite element software ABAQUS were used to investigate the critical crack size at a transverse stiffener weld toe. The lack of consistent fracture resistance among the various steel grades is shown. The transverse stiffener detail was chosen because it will most likely be the most fatigue prone detail in most new bridges. A new CVN requirement is proposed to eliminate the discrepancy among the grades. It is recommended that other welded details be investigated in the future. There are many FCMs that have geometries that have not been previously investigated using modern procedures. A procedure for incorporating three dimensional finite element modeling and the standard crack assessment guides is proposed. The procedure is illustrated using a coverplate detail. Future analytical and experimental research needs are outlined.