Commentary: The behavior of this type of connection can be controlled by a number of different modes including flexural yielding of the beam section, flexural yielding of the end plates, yielding of the column panel zone, tension failure of the end plate bolts, shear failure of the end plate bolts, and failure of the various welded joints. Some of these modes are brittle, and therefore are undesirable, while others have significant ductility. Flexural yielding of the beam and shear yielding of the column panel zone are behavioral modes capable of exhibiting acceptable levels of inelastic behavior. Other modes are not. In order to design a connection of this type, it is necessary to select which modes of behavior are to be permitted to control the connection's inelastic deformation. Once desired modes of behavior for the connection are selected, the various elements of the connection are designed with sufficient strength so that other modes are unlikely to occur. FEMA-355D, State of the Art Report on Connection Performance, provides further discussion of the performance of these connections, and summaries of test data and references.

3.2.1.1 Design Procedure

The connection shall be designed so that yielding occurs either as a combination of beam flexure and panel zone yielding or as beam flexure alone. The end plate, bolts and welds must be designed so that yielding does not occur in these elements.The design should be performed using the steps below. The various parameters used in the equations are defined in Figure 3-14 and in *AISC-LRFD*.

Step 1: Calculate M_f and M_c according to the methods of Section 3.2.6.

Step 2: Select end plate bolt size by solving Equation 3-20 for T_{ub} and selecting bolt type and A_{bolt} as required:

$$M_f < 2T_{ub}\left(d_o + d_i\right) \tag{3-18}$$

where:

T_{ub} = $90A_{bolt}$ for A325 bolts
= $113A_{bolt}$ for A490 bolts
and d_o and d_i are as defined in Figure 3-14

Step 3: Check the adequacy of the selected bolt size to preclude shear failure by ensuring that the area A_b of the bolts satisfies the formula:

$$A_b \geq \frac{\dfrac{2M_f}{L - d_c} + V_g}{3F_v} \tag{3-19}$$

Step 4: Determine the minimum end plate thickness t_p required to preclude end plate flexural yielding from the equation: