

# Appendix H

## Overview of Design Calculations

The test girders were designed based on the procedure shown in Figure H.1. The methodology shown in this figure was also followed to establish the magnitude of load to be applied to each end of the test girder. Assumed material properties had been used for design; however, the as-built details and measured material properties were used to analyze the experimental data. As a result, the design flow chart had to slightly be interpreted differently. The predicted capacities were obtained based on the inferred magnitudes of prestressing force loss, shown in Table H.1.

**Table H.1.** Inferred prestress loss

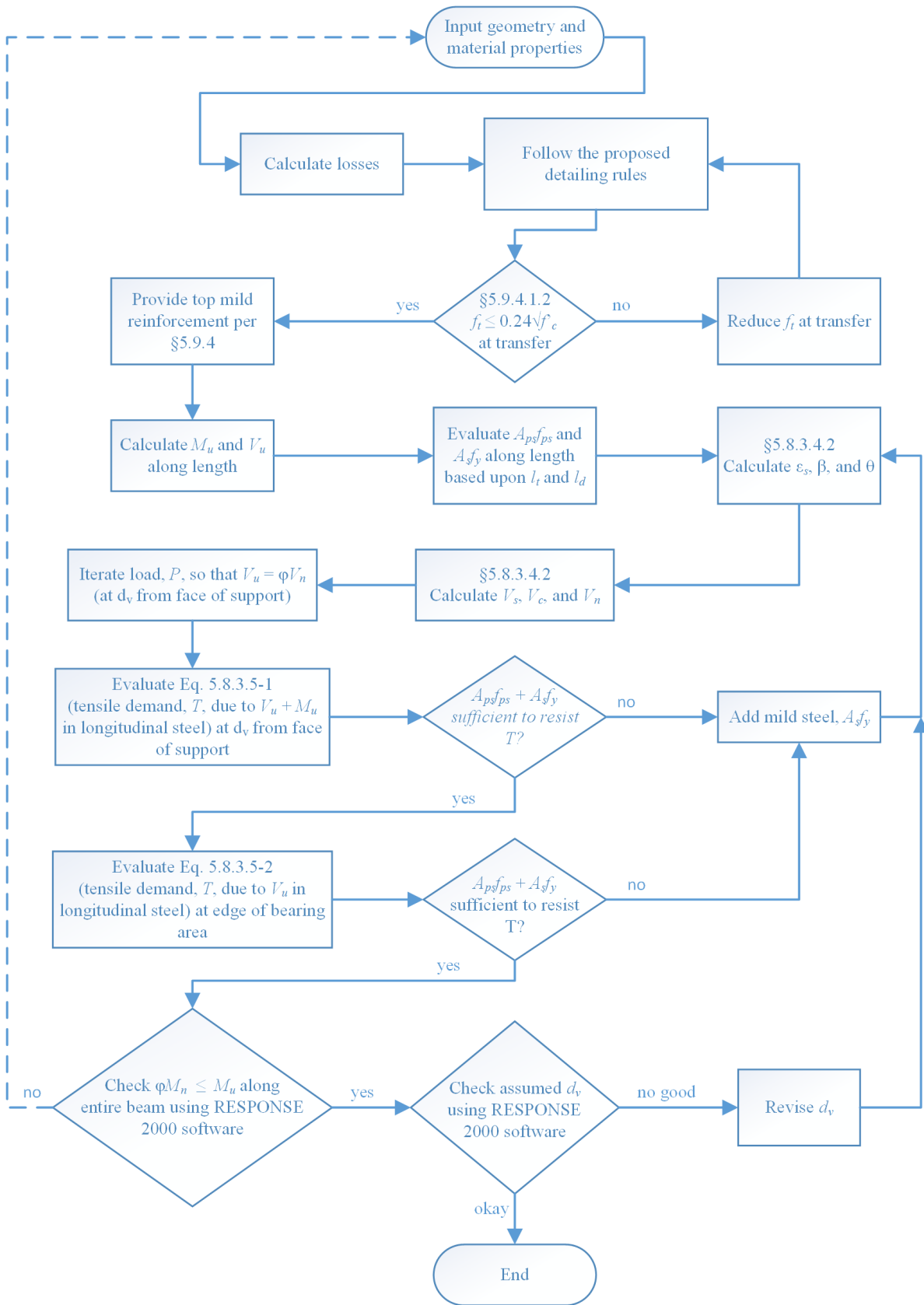
Girder	Loss
AASHTO BI-36	9%
AASHTO BT-54	8%
AASHTO Type III-a	8%
AASHTO Type III-b	8%
Nebraska NU-1100	11%
Texas U-40	3%

The following example is used to illustrate the design method.

**BI-36, End B**

The design was based on nominal properties:  $f_y=60$  ksi for nonprestressing reinforcement and  $f'_c=6$  ksi. The value of load ( $P$ ) was determined to be 165 kips with no additional longitudinal reinforcement, and No. 4 transverse steel spaced at 12 in. on center beyond  $h/4$ , where  $h$  = girder depth. The applicable values of  $\phi$  from *AASHTO LRFD Specifications* were used.

For analysis, the design steps shown in Figure H.1 were repeated (with  $\phi = 1$ ) with the following measured properties:  $f_y = 67.5$  ksi for transverse steel and  $f'_c = 12.2$  ksi. The value of  $P$  was found to be 242 kips but 4 No. 5 longitudinal reinforcing bars would have to be extended to 6.5 ft. However, the girder was fabricated (based upon design material properties) with no longitudinal bars. The iterative procedure was repeated but with the goal of ensuring that the tensile demand can be resisted by the strands, i.e.,  $T = A_{ps}f_{ps}$ . The value of  $P$  was determined to be 207 kips. At this load,  $V_u$  (demand) at the interior face of the support is not equal to the corresponding capacity ( $\phi V_n$ ) because the actual material properties were different from the assumed design properties.



**Figure H.1.** Design flow chart