

Bridges and Structures

January 24, 2001

All Employees

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Gary Novey

Subject: Substructure Design-MM No. 5 (Maximum T-Pier Heights Based on KL/r).

Questions have been brought up about the maximum column heights that can be used for T-pier design. Based on AASHTO Specification 8.16.5.2.6 the maximum KL/r that can be used for column design without having to do a second order analysis is 100. Under the 100 limit AASHTO allows the designer to use moment magnifiers to take into account slenderness. We would like to limit the height of T-pier columns so that the KL/r ratio is kept below the limit of 100. The mainframe program automatically calculates and uses the moment magnifiers, but is limited to designs below the 100 limit.

If you exceed the 100 limit in the program, a message will come up stating:

“KL/R>100,THE FOLLOWING P & M ON COL DO NOT INCLUDE  
SLENDERNESS EFFECTS, DESIGNER SHALL ANALYZE THE STRUCTURE  
ACCORDING TO AASHTO SECTION 8.16.5.1.”

Attached are some hand calculations that were done to give the designers an idea of maximum heights that can be used. Working backwards from the KL/r limit of 100 for a 2.5 ft thick rectangular column, the maximum design height is approximately 36 feet. These calculations are based on using a K of 2.0.

Options that can be considered for increasing the heights of columns are:

1. Increasing the column width to reduce the KL/r to below 100.
2. Substituting round columns for the design.
3. Using a combination of a thicker pier wall with the larger columns placed on top of the wall.

If this situation comes up, check with your section leader for approval on which option to use.

GAN/DGB/lis