

PENNSYLVANIA PIER ANALYSIS

SUMMARY OF FEBRUARY 2002 REVISIONS — VERSION 1.1

Below is the list of corrections made to the PAPIER computer program and incorporated into Version 1.1:

- 1) The SI units for the soil thickness parameter in the EVL command has been changed from 'mm' to 'm'. Earlier version input files do NOT have to be modified. The program will interpret an input value greater than 20 as being assumed to be millimeters and will automatically convert the value to meters. [IR #126]
- 2) An error in which the moments and shears computed at the critical transverse faces of pile-supported footings were being based on the 1/4-pt location instead of the 3/4-pt location has been corrected. [IR #122]
- 3) The lower range limits of various input parameters related to reinforcement bar spacings have been changed from 0.0 to 1.0" (25 mm) in order to prevent internal error messages and/or erroneous results. [IR #120]
- 4) A problem with the program including buoyancy effects when computing two-way punching shear for spread footings on rock whenever the user did not specify any soil cover on top of the footing via the EVL command has been corrected. [IR #119]
- 5) When end distance of column vertical reinforcement exceeds the column height and the RCC command was used for a circular column, the warning message was corrected to state that the problem was in the RCC command and not the RSF command. [IR #118]
- 6) A problem with buoyancy force being considered for spread footings on rock whenever no soil cover was specified on top of the footing via the EVL command has been corrected. [IR #115]
- 7) The effective width and depth dimensions used to compute column shear capacity have been corrected. The width is always taken as the full, out-to-out dimension and the effective depth is always taken as 0.72 times the out-to-out width. This change is applied to both LFD and LRFD. [IR #114]
- 8) The methodology for computing the fatigue stress range was modified so as to more accurately reflect the actual stress range state. The steel reinforcement stress is computed first for the MINIMUM loading (DL + LL min.), then separately for the MAXIMUM loading (DL + LL max.) The stress range is then computed by taking the difference of the two values. Previously, the program computed the stress range stresses in one pass by using the moment and axial load ranges directly. This approach could result in incorrect stress range values especially for T-type cross-sections in the cap. [IR #113]
- 9) The correct "cracked" vs. "uncracked" cross-section state is now used to compute the dead load steel reinforcement stresses reported in the "Fatigue Applicability" table in the dump file. Also, the steel reinforcement stress range resulting from the steel applicability loading (2.0 x FAT-LL limit state) is no longer set to a negative value if the total DL + LL stress remains negative (in compression.) The stress range is always reported as a positive value. [IR #112]

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- 10) Load multiplier revised from 1.5 to 2.0 when determining whether cracked vs. uncracked section properties are to be used in subsequent pier cap fatigue computations. [IR #111]
- 11) The MINIMUM of the ice crushing strength and the ice flexural strength is now correctly used instead of the MAXIMUM of these two values. [IR #110]
- 12) The required area of torsion reinforcement is now reported correctly in the "Torsion Reinforcement" table in the dump file. [IR #109]
- 13) The sign of transverse ice loading applied to columns was corrected to be consistent with stream flow. Stream flow 'L>R' should produce a positive transverse column moment. Previous version resulted in a negative transverse moment. [IR #107]
- 14) An error in the equation for computing vertical ice adhesion force for pier having semi-circular ends (US units only) has been corrected. [IR #106]
- 15) A tolerance problem has been corrected when specifying reinforcement in columns. Previously, the program would abruptly abort with the error message "Negative Location - CLFGENLC" whenever the terminating vertical reinforcement location was close but not exactly equal to the column height. [IR #105]
- 16) Problem with program aborting with QuickWin 'Out of Memory' error on computers running Windows98 Second Edition at higher screen resolutions and color palettes has been corrected. The user can now set the display settings to higher resolutions and true (32-bit) color, and the program will run properly. [IR #104]
- 17) Problem with program aborting with "Invalid Limit/Group Number in LDFGLDAP" error message in the input summary phase of preparing the output file has been corrected. [IR #103]
- 18) Applicability of "wind on superstructure" and "wind on live load" was corrected by checking if the user specified a non-zero value for EITHER the transverse or longitudinal wind reaction factor. Previously, the program was checking whether BOTH factors were non-zero. Also, the reporting of the Wind on Substructure Pressure Load table in the dump file was corrected. [IR #99]
- 19) A more explicit error message is now displayed when inappropriate intermediate cross-section data is specified in the CPR and SWD commands. In addition, clarifying language was added to the input parameter descriptions in the user's manual. [IR #98]
- 20) STRENGTH-VI limit state is now considered applicable only if ice loading is present. In previous version, STRENGTH-VI limit state was always considered applicable. [IR #97]
- 21) Program is now compiled in the release mode resulting in a smaller executable file size. Also, compiler option was changed to ensure that "Output Conversion Error" runtime error messages are not displayed during program execution whenever there is a value overflow of a formatted output field. [IR #95]

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- 22) The partial effect of a pile located near a shear critical section has been corrected. Previously, a pile was either considered entirely or not at all based on the location of the centerline of pile relative to the critical section location. [IR #94]
- 23) Under certain conditions of applied moment — particularly with regards to the sign of the moments (positive or negative) — a value of zero was erroneously being computed and reported for the tensile stress in the steel reinforcement of a column for the crack control serviceability check. In some cases, the correct controlling load case was not being found and reported. This error has been corrected. [IR #93]
- 24) The default number of POIs in the pier cap is now a function of the pier type. A default number of 4 is used for H1 and H2 types, while a default number of 10 is used for B1, B2 and SS types. The number of POIs for multi-column "bent"-type piers was increased to help prevent missing maximum positive moment locations in the pier cap, which commonly do NOT occur at the mid-point of a bay. [IR #92]
- 25) Upper range limits were increased for pile compression and tensile nominal resistance input parameters in FTG command. [IR #91]
- 26) The user's manual was revised to correctly reflect the fact that only one load factor is required for TU/SH forces in the LFR command. [IR #89]
- 27) An error in the IDP.EXE input processor program that prevented the user from entering data for Parameters 9 thru 17 for the second soil layer in the SOI command has been corrected. [IR #83]
- 28) In the user's manual, Note 1 of the RCF command was revised to correctly describe how the default pier cap flexural reinforcement profile is interpreted when no RCP command(s) is specified by the user. [IR #81]
- 29) The extension of the parameter definition file has been changed from .PDF to .PD to avoid confusion with Adobe Acrobat files. [IR #79]
- 30) The maximum number of LLR commands permitted in the input file was increased from 3 to 4 to allow specifying HS, IML, P-82 and Fatigue vehicles all within the same run. [IR #77]
- 31) Numerous corrections and refinements were made to the computation of service-level stresses for the steel reinforcement in the pier cap. Most notable was that the fact that sign convention of the axial force in the pier cap was being misinterpreted. Instead of a positive value being interpreted as compression and a negative value as tension, the program was doing the reverse. This error could result in significantly underestimated tensile stresses in the steel reinforcement, particularly for multi-column bents having short column heights. Other corrections made include: computation of steel reinforcement stresses for T-section pier caps; computation of allowable fatigue stress range; logic in determining whether fatigue is applicable; the logic as to whether cracked or uncracked section properties are applicable; and fatigue output table was made consistent with other output tables in that results or an explanatory message is provide for each POI location. [IR #74]

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- 32) The load factor for 'WA' load type (Water) has been corrected for the Extreme-II limit state. Previously, a value of 0.0 was used. The correct value is 1.0. [IR #70]
- 33) The revised minimum column vertical reinforcement policy, as stipulated in Strike-off Letter 431-01-05, has been implemented. [IR #64]
- 34) On screen graphics are now available when the program is run in the "command line" mode. Previously, when run in this mode, all user interaction was eliminated, which prevented the viewing of graphics using the new Engineering Dataset Manager program. [IR #63]
- 35) The revised application of the PHL-93 dual tandem loading, as stipulated in Strike-off Letter 431-01-05, has been implemented. [IR #62]
- 36) An error in determining whether or not the superstructure may be submerged for wall-type piers has been corrected. [IR #61]
- 37) The program now properly detects and prints an error message if reactions for a permit-type vehicle only are specified via the LLR command. DM-4 stipulates that the permit vehicle occupies one lane while the remaining lanes are to be loaded with the design vehicle. Consequently, reactions for a design vehicle must be specified in addition to reactions for a permit vehicle if the permit vehicle group combination/limit state is to be investigated. [IR #59]
- 38) For multi-column pier bents on combined footings, the program has been corrected to limit the user to enter the height of only the left-most column and properly establishes the height of all remaining columns based on the bottom of pier cap profile. [IR #56]
- 39) Reinforcement bar locations generated by the program using the "perimeter" option in the RSF command for 'RS' and 'RP' section types are now correct. In previous version, the generated bar locations were not necessarily placed at the proper distance away from the face of column. [IR #36]
- 40) The number of permitted column offsets specified via the OFF command has been increased from 1 to 20. [IR #32]
- 41) The algorithm for determining maximum force effects in combined footings has been completely revised. Instead of using maximized force effects determined independently at the bottom of each column, forces are maximized separately for a given column and then concurrent forces are used for remaining columns. With this revision, combined footings may now be specified. [IR #24]
- 42) The minimum load factor for DW (future) dead loads has been set to 0.0 so that these loads are automatically excluded from the minimum axial load condition. This change was intended to eliminate the need for separate PAPIER runs — with and without future dead loads. [IR #16]