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SAND - Structural Analysis and Design, & SCALE - Structural CALculations Ensemble, Information sheet 43; Jan 2017.

Support

(1) **Technical support**, for technical support for all aspects of SAND and SCALE please email a marked up copy of the calculations in question to Dr Ian Brown ian@fitzroy.com.

(2) **Accounts**, if you have changed address or if there is a new contact person, please email: Jeanette Brown, jeanette@fitzroy.com or post to Lark Lodge, Fornham St Martin, Bury St Edmunds, Suffolk IP31 1SR.

Eurocodes

We have made significant progress in 2016 with an additional 29 SCALE proformas now having new Eurocode versions. There are now over 500 proformas which show full calculations to the Eurocodes or full calculations to the British Standards, or are analytical and applicable to both codes.

We have completed the majority of all steel, reinforced concrete, piling, composite, timber, masonry, LUCID and SPADE proformas. In 2017 we will continue development of the Eurocode versions of proformas.

Windows 10

All programs in the SAND and SCALE suites are fully supported and operational on all 32-bit and 64-bit desktop/laptop versions of Windows 10, Windows 8.1, Windows 8, Windows 7, Windows Vista and Windows XP.

List of SCALE proformas

To view the full list of SCALE proformas, click on the menu option File─>Display a File (or File─>Print a File to print); then in the File name box type scale.mnu and click Open. Proformas which have full Eurocode versions or are applicable to both are marked with an “(E)”.

Changes to SCALE program (Latest version is 4.995)

SCALE version 5 is now substantially complete. There are still a few features to add, so a shortcut is not installed automatically yet. To run SCALE version 5. create a shortcut to the program **scale.exe** in the SAND installation directory. As part of the verification process, 25,000 pages of output from multiple examples for every proforma and multiple examples for every NL-STRESS data file have been compared for each version - there are only occasional rounding differences present which are due to inherent nature of using different maths libraries in SCALE 4 (Compaq Visual Fortran) and SCALE 5 (Microsoft Visual Studio 2015 and Xcode 8 (for 32-bit and 64-bit iPad versions)).

The vision for SCALE version 5 has involved side-by-side development of matching Windows and iPad versions (iPad version coming very soon), with both versions including SCALE, LUCID, SPADE, NL-STRESS, NL-PLOT and SCP (for creating pdf output) in one executable. This alleviates the problems jumping between executables on Windows, and facilitates launching analyses on iPads. Both versions allow for viewing and editing the results; and generating, viewing and printing pdfs of results, drawings and plots; all within the one SCALE application.

SCALE version 5 dramatically improves the flow through a proforma, both forwards and backwards, and as such brought to light further aspects of the proformas that needed to be improved. The following aesthetic improvements have been made to the proformas and data files during 2016:

- Changes made to 420 proformas to provide alternate wording in proformas for example changing "Press < and Enter to revise" to "Please select '◄◄ Redo Stage' to revise", changing "Continue Display Escape" to "Please select 'Continue ►'", and added option to redo stages rather than automatically stopping in hundreds of proformas.
- NL-STRESS can now have a list of desired NL-PLOTS listed at the end of the data file, and these will be automatically included at the end of the results file, using a continuation of the page headings and numbering. Plot options extended to include a plot of loads on the structure. Changes made to 716 .ndf and .bmk file to add sample plots.

Changes for both Version 4 and Version 5:

- NL-PLOT: fixed an occasional problem with black-and-white dot-dash plotting.
- NL-PLOT: when only 1 load case plotted, the title is now displayed on the plot.
- For non-linear analyses, NL-PLOT now plots the number of increments and the location of plastic hinges on the plot as diamonds. When run in batch mode, NL-STRESS now updates the screen display to keep the user informed of progress, and prints out any failure messages to match non-batch mode.
- Fixed potential floating point overflow in NL-STRESS when dealing with plastic springs.
- SCALE multiline edit boxes, now have all units displayed, any powers now display with the appropriate squared, cubed etc. as required.

In 2017, work will continue to improve SCALE version 5:

- There a lot of intermediate files being saved to disk, these could be stored in memory to speed up the program.
- The option to switch between Normal, Condensed and Summary calculations on the fly will be added back in, this feature is substantially working but requires further testing.
- When NL-STRESS launches a long running SCALE proforma, for example to generate concrete charts at the end of m101.ndf, the main window is not as responsive as it should be, fix this.
- Send out invites for beta testing the iPad app, if you'd like to beta test the iPad app please email ian@fizroy.com.

Please send any feedback, or feature requests, to ian@fitzroy.com

New SCALE proformas added.

sc431 **New Eurocode 3 and BS proforma**, Beam (UB, UC or Channel) with biaxial bending.
sc455 **New Eurocode 3 proforma**, Steel stair with flat plate stringers.
sc483 **New Eurocode 3 and BS proforma**, shelf angle supporting slab.

Changes to SCALE proformas.

In addition to the 29 proformas with new Eurocode versions added in 2016, and the aesthetic changes detailed above we have made amendments to a further 58 proformas as listed below:

sc077 **Added Eurocode design option**. Replaced gammaS with gamS, added popup and several check range commands, modified diagrams to show intersecting vertical U-bars only as per table173 (Reynolds RCD Handbook 10th edition), added M to diagrams, made enhancements and changes to BS, added more text to diagrams etc.
sc078 Removed strength reduction factor expression as this is not used, added theta', IF th>1, added if θ'<22° and "Angle of inclination of strut", added "Check crushing strength", VRdm displayed on screen.
sc082 Replaced variable name bt with b, made variable name b user defined, added procedure conflx .
sc083 Updated EC design option, program now stops when VEd ≥ VRdc.
sc084 Updated expression for vRdm, removed strength reduction factor (v) expression as this is no longer used, when no links are required links are no longer calculated, added limiting value k=2, added "Limiting percentage area", added θ=45˚ and θ=22˚, added note relating to nominal links, set Limiting angle theta to θ'=22˚, removed euc1<>1 as this is not used, replaced reinforcement with links for fyk and fyd, added "Angle of inclination of strut" and "Check crushing strength", VRdm is now displayed on screen.
sc089 **Added Eurocode design option**. Replaced gammaS with gams, added WARNING where applicable, per1 and per2 are now defined, replaced qq with ans1, added chkrng and popup.pro, removed volume of main bars and links from “Reinforcement Summary”.
sc091 Added variable name NEd'.
sc094 Added variable names NRd, MRd, NEd and MEd.
sc099 Added gross concrete area Ac, changed scenario Mo2<NEd*e0 to Mo2<NEd*1000*e0, replaced Mrat>0.3 with Mrat>0.24.
sc100arh Updated loading design tables.
sc104 Replaced variable name N with NEd and introduced NEd', added gross concrete area Ac, removed offending check range for variable N.
sc108 Updated expression for TRdmax and Ex1 default value for TEd, added and modified text, made theta user defined, replaced ltbars with tlbars, added "Limiting thickness", updated Table 4.4, replaced variable name t with tef, added heading "Crushing limit for combined shear and torsion", set θ=22˚ when VRd22>=VEd.
sc109 **Added Eurocode design option**. Corrected units for Young’s modulus, added diagram to BS SUMMARY.
sc114 **Added Eurocode design option**. Added TAB32 "Composite section" heading is now printed only when difs>10, enhanced diagrams, moved procedure DIFSHR to bricom.pro, added BSDIFSHR, prstmo, Lcomb1, Lcomb2 and creepc.
sc115 **Added Eurocode design option**. Added DIFSHR routine to bricom.pro, enhanced diagrams, removed fpitc1 and fpitc2 as no longer used.
sc116 **Added Eurocode design option**. Added DIFSHR routin to bricom.pro, enhanced diagrams, removed fpitc1 and fpitc2 as no longer used.
sc117 Added more green text relating to spacing of tension bars and modified upper limit for pchTA.

sc118 Increased range on FEd and load.
sc122 Repositioned EDIT /W 2 associated with to bd1 and bspac, replaced fy with fym in BS Design Summary, fym is now reported in Summary only when the characteristic strength of reinforcement is constant.
sc124 **Added Eurocode design option.** Extended Summary.
sc126 **Added Eurocode design option.** Added further chkrng commands and routine pic1.
sc128 **Added Eurocode design option.** Updated to BD 37/01.
sc130 **Added Eurocode design option.** Added (per notional lane) to KEL and W where appropriate including tables.
sc132 Added flag=0 and removed offending units on a command line, added further EDIT commands.
sc134 **Added Eurocode design option.** Updated default values, added further chkrng commands, replaced V<Vmax with V<=Vmax, ans7=0 replaced with ans7=2, replaced ans1=0 with ans1=2 and Ast with Area where appropriate.
sc138 **Added Eurocode design option.** Moved DIFSHR routine to bricom.com, enhanced diagrams.
sc139 **Added Eurocode design option.** Moved DIFSHR routine to bricom.com, enhanced diagrams.
sc140 **Added Eurocode design option.** Added eTAB32, DIFSHR routine moved to bricom.com, enhanced diagrams.
sc141 **Added Eurocode design option.** Replaced "Total number of strands" with "Total area of strands". Table 5 is no longer used, references to BS5896:1980 replaced with BS5896:2012, added lfst', Table 1 modified, added more text and creepc, enhanced diagrams.
sc142 **Added Eurocode design option.** Enhanced diagrams added prstmo, Lcomb1 & Lcomb2 and creepc.
sc143 **Added Eurocode design option.** Enhanced diagrams added prstmo, Lcomb1 & Lcomb2 and creepc.
sc144 **Added Eurocode design option.** Removed fpitc1 and fpitc2, enhanced diagrams, added prstmo, Lcomb1, Lcomb2 and creepc.
sc145 **Added Eurocode design option.** Updated Table 3, added bDIFSHR, added TAB32, bsDIFSHR, pbPRO, STRMOD and creepc.
sc146 **Added Eurocode design option.** Updated Table 3, added bDIFSHR, added TAB32, bsDIFSHR, pbPRO, STRMOD and creepc.
sc148 **Added Eurocode design option.** Added TAB32, Lcomb1, Lcomb2 and creepc.
sc151 **Added Eurocode design option.** Removed MAXMIN, added chkrng, added mesage, EDIT, pop11, popup.pro, replaced Kn units with with kN, added gamc and gams.
sc153 **Added Eurocode design option.** Replaced Kn units with kN added gamc and gams.
sc155 **Added Eurocode design option.** Added gamc and gams.
sc157 **Added Eurocode design option.** Added popup.pro and common routines proforma bricom.pro, replaced Kn units with kN, added gamc and gams.
sc160 Added text on screen relating to k1 and made k1 user defined, added scenario IF h>=800. Replaced end restrained with end restraint, updated text for creep factor K1, redefined a3 to a2 where appropriate, made ho visible for edge restraint, cover c' for slabs is now defined in output, added several DIGIT commands.
sc165 **Added Eurocode design option.** Added eTAB32 and creepc, enhanced diagrams.
sc210 Added degsc, set direct=1 when solid=1.
sc212 Added degsc, set direct=1 when solid=1.
sc214, 216, 218, 220 - Added degsc, enhanced diagrams.
sc224 Added option to use SCI P405 rules for shear connection, enhanced diagrams.

sc225 **Added Eurocode design option.** Updated to BD 37/01, Table 24 renamed as Table 23.
sc226 **Added Eurocode design option.**
sc254 Replaced (1=Yes, 0=No) with (1 or 2) for deflim prompt.
sc258 Replaced IF d > 6 with IF dn > 6, added IF type=1 OR type=3.
sc351 Added load factor gamQ.
sc382 Replaced ans1 with ans.
sc384 Added class 1 and class2, when D > 240 program refers user to EN 1993-1-6, added scenarios NEd > 0 AND Mtt <> 0 to member classification.
sc385, 386, 388 - Updated Classification section to Table 5.2 of BS EN 1993-1-4:2006+A1:2015.
sc387 Updated Classification section to Table 5.2 of BS EN 1993-1-4:2006+A1:2015, moved EDIT down a line.
sc416 replaced "EDIT /W 2s" with "EDIT /W 2".
sc440 Added OR NEd=0, removed McRd from interaction equation.
sc460 **Added Eurocode design option.**
sc470 Added ans7, ans8 and option to deviate from the NA to BS EN 1993-1-5 with a DESIGN STATEMENT at the end of the proforma.
sc477 Modified expression for beov2.
sc482 Replaced kN units with kN/mm units for FwRd and FwEd, made fillet weld leg length s user defined, replaced Factored vertical load with Design vertical load.
sc483 Replaced offending self with shelf, added deflection check (routines DEF and euDEF), extended DESIGN SUMMARY.
sc490 Replaced text "three values" with "two values" where applicable and added an additional scenario to SPLICE SUMMARY when hl<>hu.
sc498 Added green screen display diagram to p3.
sc525 Added steel spreaders to EC version only, replaced "old" with "x1" and modified check range for x1 for both BS and EC design options.
sc535 Added ans10, defined fbn and delta when ans10=1.
sc541 Replaced Deflen with Defln for consistency and Deg with °.
sc566 Added enote3 and enote4.
sc570, 571, 572 - Added IZc, column s.w. now input as a udl.
sc576 Added IZc1 and IZc2, column s.w. now input as a udl, replaced EDIT /W 2 with EDIT /W 3.
sc573, 574, 575, 577, 578, 579, 580, 581 - Added IZc1 and IZc2, column s.w. now input as a udl.
sc598 Added text "Span units below are in m" to clarify span units when spans are unequal.
sc701 Added revised snow load shape coefficients for mono-pitch roofs to NA Clause NA.2.17, incorporated SCI AD397 (ref NSC May 16).
sc702 Replaced "compose" with "compute", added meffHt routine, updated FigNA3, FigNA4, FigNA5, FigNA6, FigNA7 and FigNA8, repositioned scenario IF He(0) < 2 OR He(90) < 2.
sc726 Updated load combinations to BCSA publication No.53/16 (2nd edition July 16), added several chkrng commands and option for single span steel portal frame.
sc794 Added NOTE and enhanced diagrams.

Downloading updates during 2017

Further updates in 2017 will be posted to the download website at the beginning of April, July and October, please visit the download website for the latest version of 2017.EXE.

Ian Brown 01/01/17