
Fitzroy Systems

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SAND - Structural Analysis and Design, & SCALE - Structural CALculations Ensemble, Information sheet 48; Jan 2022.

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.

All proformas now show full calculations to the Eurocodes or full calculations to the British Standards, or are analytical and applicable to both codes.

Windows 11.

All programs in the SAND and SCALE suites are fully supported, tested and operational on all 32-bit and 64-bit desktop/laptop versions of Windows 11, Windows 10, Windows 8.1, Windows 8, Windows 7, Windows Vista and Windows XP Service Pack 3.

Main changes to SCALE program in 2021 (Latest version is 6.14).

The main items outlined in the last newsletter as plans for 2021 have been completed, namely:

- Combined the GUI32 data editor so it appears in a resizable SCALE window.
- Updated SCP for printing directly from SCALE 6 rather than the previous saving and printing of pdf files. End calcs are also displayed on screen directly from the .cal file. Removed the pdfviewer program which was used for displaying and printing pdf files, to enhance stability.
- Added an NL-STRESS portal frame generator (proforma 820), with integrated wind and snow load generation.

The major version number has been incremented to SCALE 6. Development of SCALE version 5 started ten years ago, since when there have been 100 releases of SCALE 5. The move to version 6 signifies that the incorporation of all the previously separate programs into one SCALE executable is now complete. The SCALE 6 executable contains SCALE, LUCID, SPADE, NL-STRESS, NL-PLOT, NL-VIEW (formerly 3D GUI), TAPE, and now from 2021 the NL-STRESS GUI and the SC600P32 View Structure program.

SCALE now has rounded bottom buttons to match the Windows 11 style, and also to not get cropped by Windows 11's rounded window borders!

SCALE available on the Apple App Store.

SCALE is available on the Apple App Store. Monthly and annual in-app renewable subscription options are available. The SCALE app runs on all iPads with iOS 9.3 and above, i.e. on every iPad except the iPad 1 from 2010. The SCALE app includes the full versions of SCALE, LUCID, SPADE, NL-STRESS, NL-VIEW, NL-PLOT, and SCP (for creating pdfs). Click on the link on the fitzroy.com website, or search for "SCALE Structural Calculations" on the App Store.

Plans for 2022.

- Create training videos for all aspects of SCALE, LUCID, SPADE, NL-STRESS, NL-PLOT, NL-VIEW, TAPE, and the NL-STRESS GUI, and place them on the website.
- Add zoom facilities to the viewing calcs screen at the end of the proforma.
- There are still many intermediate files being saved to disk. Now that all of SCALE runs from one executable these files could be stored in memory to speed up the program, reduce conflict with antivirus checkers and cloud storage, and allow multiple copies of SCALE to run from one directory without clashes.
- Extend the integrated TAPE editor so it appears for any diagram on any results page.
- Combine the NL-STRESS GUI's steel section table selector so it's available from within the SCALE proformas.
- Add European IP steel sections to the proformas.
- Combine aspects of the NL-STRESS GUI with the NL-VIEW results viewer, so the user can easily make changes to the model and re-analyse on the fly.
- Introduce new NL-STRESS commands to generate plots using NL-PLOT and possibly NL-VIEW. Currently plots are achieved by the NL-STRESS proformas using parametric commands, but these commands are hard to follow and are removed before viewing the file in the NL-STRESS GUI, so an alternative would be useful.
- Introduce new NL-STRESS commands to replace the parametric sense= variable, as these are hard to follow and are removed before the viewing the file in the NL-STRESS GUI. (Notably: sense=2, include shear deformation; sense=3, ignore Professor Michael Horne's Q forces; sense=-3, ignore Q forces only if member is a cantilever; sense=7, use soft springs so NL-STRESS can compute the rotation of the member.)

Installation.

The 2022 update installs a new desktop shortcut named "SCALE 6" (to launch program scale.exe), for both SAND and SCALE licences. For new installations of SCALE 6, the installer now looks for previous versions of SCALE 5 and SCALE 4 shortcuts to get the previous installation and working directories. You can delete any existing shortcuts to SCALE 5, as the target is the same.

As SCALE now includes all the NL-STRESS features that were previously only included in the SAND suite, there is no longer a separate front screen for SAND.

SCALE version 6 retains the familiar scale ruler icon with a red stripe. The icon for SCALE version 4 is the same scale ruler but with a blue stripe to differentiate between the old and new versions.

SAND and SCALE version 4 are still included in the installation for users who are familiar with their interfaces. Any existing shortcuts you have to them remain unchanged, shortcuts to the previous versions can be created on new computers to the programs scale32.exe and sand32.exe respectively. Each front screen now includes a new button which will launch SCALE version 6 if required.

Changes to SCALE in 2021.

- Added an initial line to the SCALE 6 menu: "Select this line to enter the proforma number directly" so you can jump straight in if you know the proforma number you want.
- SCALE 6 printing now uses SCP to print directly to the printer, without creating a pdf first. Select the printer, page size and paper tray using the top menu option "File->Print Setup..." You can adjust the margins to find the best fit. You can change the aspect ratio: set negative margins to stretch the text outwards. Use print setup to adjust the graphics margins: to move the NL-PLOT, LUCID, SPADE output around the page if required. NL-PLOT plots and LUCID and SPADE drawings are always drawn to scale. Printing tested with Windows 11 to Windows XP, using laser, inkjet, networked, usb, pdf and parallel port printers. Right click on calcs and "Save as PDF File...", and "File->Convert a File to PDF..." work as before.
- Revised the Files button operation so the treeview cannot be collapsed, as this could cause confusion.
- The proforma 'flowchart' '/p' option has now been extended with a new '/a' option. This embeds all sub-files into the file listing and also adds the line numbers to the file, this is useful when debugging proformas.
- Number of allowable strings in a proforma doubled from 1000 to 2000 to fix problems with option 42 calling option 546.
- Increased maximum proforma length from 32000 to 60000 lines to accommodate sc820.pro.
- Fixed a file handle leak which caused SCALE to stop after saving 700 zero length pdf files within SCALE (when parametric checking finds bugs).
- NL-VIEW has a new button to switch between STAGE 2 and STAGE 3 when three elastic NL-STRESS stages are present in the proforma, i.e. for sc820 and sc855. NL-VIEW STAGE 2 and STAGE 3 screenshots saved to the calcs are built up as before, but now report STAGE 2 or STAGE 3 as appropriate at the top of the results page. For NL-VIEW STAGE 2 and STAGE 3, the initial sizing is based on the maximum values in both stages, use "settings" to change the scaling, all view settings are retained when switching between stages.
- NL-VIEW now only shows toolbar buttons for FY FZ MY MZ as appropriate for the different analysis types.
- NL-VIEW DS ANIM now resumes the animation when returning from settings and when switching between stages.
- NL-VIEW DS ANIM toolbar button now hidden for plastic and sway analyses as it represents elastic loading only and would be misleading for non-linear behaviour.
- NL-VIEW plane frame, initial view now starts in XY view.
- Added long term concrete modulus calculations to NL-STRESS proformas.
- Modified cchart.ndf and subr.ndf to fix a problem with creating concrete beam and column charts after an NL-STRESS analysis.
- Fixed a bug with File->Copy File.
- Fixed crash if saving a pdf with a missing NL-VIEW screenshot.
- Removed an extraneous message for some NL-STRESS runs.
- NL-STRESS error messages now start with a '###' as per SCALE error messages.
- When 'Restarting' a named proforma file the screen is no longer blank.
- Fixed reporting of several SCALE error messages if there is a problem with the proforma logic.
- Reworded "Output" button to "Full Calcs"/"Condensed"/"Summary" for improved clarity, changed its shortcut to Ctrl+s.
- Changed "Redo Stage" button shortcut to Ctrl+d.

User's manuals.

The User's Manuals for SCALE, LUCID, SPADE, NL-STRESS, NL-VIEW, NL-PLOT are contained in the file scale.pdf. The help manual can be easily launched from the menu option Help->Help.

Parametric checking of SCALE proformas.

Proforma 42 parametric checking has been further enhanced, as part of Fitzroy's effort to reduce the likelihood of you encountering an error when running through a proforma. We are aiming to test all proformas with all possible input values. The parametric checking has been extended further in 2021 with 72 new .prm files and 144 modified .prm files being developed.

Proforma 42 now tells you what parameter tables are present to choose between. When run with option npat=15 zni=166 for 2490 sample stack files, the proforma now generates coverage plots for each variable against every other variable. For npat=15 zni=166, for variable type zty=1 the proforma now uses an algorithm to generate better coverage across the variable space. Where previously the scatter plots were straight lines, the points now cover the whole chart area. The proforma collates any ### error messages encountered into a text file, e.g. sc250.1.txt. The proforma collates all calcs, plots, error messages, the proforma and the parametric file into one pdf document, e.g. sc250.1.pdf, with a bookmark index, and with all the stack files as pdf attachments. (Collating the files requires the combinepdf.exe and pdftk.exe files (available from the download page) to be present in the installation directory, these files are not otherwise required for anything in SCALE.)

Proforma 41 is a new proforma to automate running through proforma 42 multiple times. First save the parameter tables required in a .lst file - the included sc042.lst contains all parameter tables. Enter the filename when option 41 is run, or click on the Files button to select the file from a list. Intermediate files are saved into a subdirectory, e.g. 250.1 for proforma 250 table 1, such that multiple instances of SCALE option 41 can be run at once from the same directory.

New proformas.

- sc820 new proforma: 3D Portal frame structure (2-10 bays) with optional haunches. Mono pitch, rectangular and gable roof frames can be considered with several vertical bracing options. End frames can either be moment frames or frame posts and simply supported rafters. The geometry, material properties and loading for the frame are input interactively. The proforma offers options for: wind loading assessment & unit loads assessment. Overhead travelling crane and/or mezzanine floor are also available user options. The proforma creates and runs an NL-STRESS data file, and then presents the results and plots of applied loading, bending moments, shear forces and deflected shape.
- sc854 Sway stability of braced frames. The proforma considers several braced frames for analysis taking into account second order effects using the "amplified moments method". The amplification factor is evaluated in STAGE 1 and then used in STAGE 2 to amplify the wind and equivalent horizontal forces. The space frame column bases and all other frame joints are assumed to be pinned throughout.
- sp461 End plate connection - beam to beam. This option details a beam with an end plate connected to a supporting column.
- sp462 Beam over column connection. This option details a beam over a column with an end plate at the head of the column.
- sp463 Crank beam over column connection. This option details a crank beam over a column with plates at the head of the column.
- sp464 Diagrammatic elevation of box frame. This option details a box frame in elevation. Use this proforma in conjunction with SPADE proformas 462 and 463 to produce details A & B.

Changes to SCALE proformas.

In addition to the changes detailed above, we have made amendments to 215 proformas, the main changes are listed below:

lu120,130,220,410,424,430,440,510,610,810,820 modified text relating to scale.

lu460 initialise bar type for main bars to btm=72 before START, added bdi=16 default values to example.

sc042 added ptype.

sc073 added scenario IF nbars=1.

sc089,094,095,097,134 replaced "concrete grade fck" with "cylinder strength fck".

sc090 replaced "concrete grade fck" with "cylinder strength fck", moved default values from EC to before START, added scenario IF nbars<nbar.

sc091,092 replaced "concrete grade fck" with "cylinder strength fck", added IF bichk=1 AND single=2 to replace IF bichk=1, added IF bichk=1 AND single=1 and scenario IF nbars<nbar, moved EC default values to before START.

sc096 replaced "concrete grade fck" with "cylinder strength fck", renamed STEELF relating to EC with euSTEELF and retained STEELF relating to BS.

sc098 replaced "concrete grade fck" with "cylinder strength fck", when iterations do not converge after 20 cycles a WARNING is now given.

sc099 replaced "concrete grade fck" with "cylinder strength fck", set minimum cover=25.

sc104 replaced "concrete grade fck" with "cylinder strength fck", added IF single=2 to SUMMARY.

sc108 replaced Concrete grade with Char strength of concrete.

sc117 added missing EDIT's, replaced Asv with area where appropriate, made str hidden where appropriate, enhanced DESIGN SUMMARY.

sc134 added missing STOP command, repositioned text above EDIT, added date on line 1.

sc151 defined gamc and gams before START command, updated chkrng for ans4.

sc111 added several scenarios to proforma.

sc118 removed EDIT /W 2 before \$101, replaced ds with d.

sc122 added IF ans7=1 to SUMMARY and +Ecs(i)=Ecs(1) when ans9=1.

sc134,151,153,155,157 replaced 'concrete grade fck' with 'cylinder strength fck'

sc160 removed cover'=0 and cover=0 before IF ZZZZ1=0, added scenario IF ratio<1.

sc162 added scenario IF As2=0.

sc164 added scenario IF b>3*a OR b<0.5*a.

sc253 added missing plus sign to "factor".

sc255 updated chkrng for ley' and lez'.

sc256 pk1 now needs to be specified when scr=0, euK3 and eumo is are now being used for both vari=1 & 2.

sc269,275 added 1E-6 to several chkrng.

sc275 added 1E-6 to chkrng for variable dc.

sc286,288 enhanced diagrams.

sc310 corrected selection of stype=1 and stype=2.

sc350 added option to use hot finished circular hollow sections (CHS) only for both Rail and Post, updated CLASSp and CLASSr, added option to use SHS and RHS, added more text, added ec3sec.pro and ec3com.pro, made general enhancements.

sc351 added scenario IF D<=2*edg.

sc384,387,388 updated limiting slenderness to BS EN 1993-1-4:2006+A2:2020.

sc385 added scenario IF selfc=1 before IF EXIST and set selfc=0, updated limiting slenderness to BS EN 1993-1-4:2006+A2:2020.

sc386 replaced expression $MybRd = Wply * fy / (gamM1 * 10^3)$ with $MybRd = Wply * fy / (gamM1 * 10^3)$, added scenario IF $mo \geq 1$, removed variable name Lamo.

sc390 replaced MyED with MyEd.

sc391 replaced WARNING text VzEd kN > VplRd kN with VzEd kN > VplRd/2 kN. May 21 added flag=3 and flag=4, when flag=3 defined k1 & MEDy', when +flag=4 defined k1 & MEDz'.

sc392 replaced 'Minimum concrete grade' with 'Minimum grade of steel'.

sc407 added missing expression $L' = L * 1000$ needed for when simple=3.

sc408 updated STORE 2.6 16 1 to STORE 2.6 17 1.

sc410,411,414 extended to import NL-STRESS data and results from SPACE FRAME analyses, so they can be called by sc820.

sc411 added scenarios IF NRESP=12 and IF prod=0.

sc419 updated to show compressive strength classes as C20/25, C32/40, C25/30 and C40/50.

sc422 made eufststf an internal routine, added FcRdf' and more screen display text, replaced FcRdbf with FcRdf, added references to SCI P398, added more text.

sc423 removed scenario IF $trow = 2$ THEN $p2 = p1$ ENDIF as variable p2 is no longer used, added variable FcRdf', replaced FcRdbf with FcRdf, added references to SCI P398, set flmx=0 for EC, added more text.

sc424 added FcRd, added more screen display text and modified expression for FcRd', added references to SCI P398.

sc425 added FcRd', added more screen display text and modified expression for FcRd', added more text relating to tables and alpha chart, added references to SCI P398, set Leff=Leff1 etc.

sc427 added references to SCI P398, added more text.

sc429 added scenario IF $mo \geq 1$.

sc437 updated STORE 2.6 16 1 to STORE 2.6 17 1, added IF stype=3 THEN $h = od13$ ENDIF & IF stype=6 THEN $h = od16$ ENDIF.

sc440 extended to import NL-STRESS data and results from SPACE FRAME analyses, so can be called by sc820. Added scenario IF F=0 (BS option).

sc441 updated SUMMARY, replaced Concrete grade with Compressive strength of concrete, added TABLE 1.3, replaced MED=MyED with MED=MyEd.

sc445 extended to import NL-STRESS data and results from SPACE FRAME analyses, so can be called by sc820.

sc453 added scenarios IF stype=3 THEN $h = od13$ ENDIF IF stype=6 THEN $h = od16$ ENDIF, set $Wplz = Wply$ and $Welz = Wely$ when stype=3 or 6, added scenario IF MyEd>0 and set $psi = 0$ when MyEd=0 is selected by user.

sc457 added scenario IF $psiM > M$.

sc458 modified Unity1 expression is now being used when NEd=0, added scenario IF NEd=0.

sc460 the "sway-check method" only is used by this proforma, the "Amplified Moments Method" is no longer offered as an alternative method (BS option only), removed EHF's from STAGE 2 loading cases as PLASTIC method is used for the analysis, added load case 5 in STAGE 3, added further text, added variable name ansdpi, added further loading cases to STAGE 2 when ansdpi=2, added missing example default values.

sc462 if no haunches present in steel frame portals, proforma now assumes lmm length of haunch instead ($H = 0$ is only applicable for steel frames with a lattice rafter), replaced default value single=2 with single=1.

sc465 added missing scenarios IF code=1.

sc467 added scenario IF resPL=1, updated text.

sc472 set ChiLT=1 when rest=1, removed (+=M) immediately after NL=1.

sc480 added scenario IF $beta1 > 1$.

sc485 added references to P358.

sc486 added variable FcRdf', replaced FcRdbf with FcRdf, added references to SCI P398, added more references to SCI P398, replaced IF Leff1>Leff THEN Leff=Leff1 ENDIF with IF Leff1>Leff THEN Leff=Leff1 ENDIF, limiting value Leff1 is now only reported if it governs for both code=1 and 2, added more text.

sc487 added variable FcRdf', replaced FcRdbf with FcRdf, replaced example default values FcRd with FcRdf, added references to SCI P398, added more text.

sc488,489 updated SUMMARY, replaced Concrete grade with Compressive strength of concrete.

sc491 updated example default values (EC only), added references to SCI P398, added missing Patterns, added more text.

sc492 made general changes to headings, added more scenarios relating to web bearing resistance, added buckling resistance check to compression cover plate, updated routines euvshr and euhshr.

sc493 added further cond=1 relating to joint=3, added DIGITS 3, added *** Fail ***, added scenario IF thetal=theta2 AND thetal=90.

sc494 added references to SCI P398, replaced [/10 with /10 at start of lines, added more text.

sc495 renamed span of Tee section, added scenario IF ans3=1 AND L>6*d.

sc512 added scenario IF Nid>0.

sc515 added scenarios IF Mmd>0, IF Mid>0, IF Myy>0 and IF Mzz>0.

sc521 updated chkrng for Md', Vd, Mu and Vu.

sc525 replaced com1 with fecc.

sc532 added 1E-6 to chkrng for t1, t2, den1 and den2.

sc536 replaced chkrng with chkrng.

sc537 replaced 0.95d with 0.95*d, modified chkrng for variable name po(a).

sc546 added scenarios IF l11=0 THEN l11=0.0001 ENDIF, IF l12=0 THEN l12=0.0001 ENDIF, IF l13=0 THEN l13=0.0001 ENDIF and IF l14=0 THEN l14=0.0001 ENDIF.

sc548 added CS 454 Table 7.5.1a and more text.

sc561 added minimum depth of box below gutter, updated chkrng for W.

sc601 added scenario IF Iinc=0 THEN Iinc=0.01 ENDIF.

sc602 added 31.5E6 kN/m² (Strength class C25/30 short term), added youngs routine to sc8000.pro, added sc8000.pro.

sc602,606,664 added youngs routine to sc8000.pro, added sc8000.pro.

sc640 updated proper routine with regards to E & G values, added reference to 'Strength class C25/30 short term'.

sc663 added units for angle THETA and scenario IF THETA>60.

sc666 updated STORE 5 1 13 to STORE 5 1 14.

sc688 added default e=10.5E6 kN/m² to example and added reference to Strength class C25/30 long term.

sc701 removed eudr1 routine and updated EC drift=1 section.

sc701a,702a,717a,820a,820c new routine proformas called by the new '3D Space Frame' proforma sc820.

sc716 updated chkrng for nLpt, added missing plus sign to nLpt (EC option).

sc742 added scenario IF cx=A.

sc756 added scenario IF area<dist/10, added further text.

sc757 revised chkrng for FVleft and FVrt.

sc764 made reference to Strength class C25/30 short and long term, added further elastic modulus options, set mat=2.

sc770 added chkrng 2+1E-6 1 Fs, removed surplus "." immediately after variable Fc.

sc771 removed navigation symbols >> and >< relating to fast forward.

sc775 program now uses soil angle of friction phi=0.01 when phi=0 is specified by user.

sc777 rounded E value, added scenarios IF fclass=4 and IF $E \geq 31.5$ AND $E \leq 32$.

sc786 added WARNING and missing STOP command.

sc794 when $K_{Pas} = K_{Act}$ $L_3 = 0$ and $A_3 = 0$, safety factor is set to 1.001 when $SF_1 = 1$ is specified by the user.

sc800 added fcd and further text, added references to C25/30 concrete strength class, redefined fck, added ltermE routine, EGvals is no longer used, added default values to example, replaced strength with compressive strength.

sc801 replaced Grade 40 with strength class C25/30, added fck which is now used in subr.ndf, added ltermE and EGvals routines, added default values to example, added 'compressive strength' and scenario IF $mt = 1$.

sc802 removed lines after FINISH as this is a steel proforma only.

sc803 added further elastic modulus options, added expression for modulus of rigidity, replaced strength with compressive strength, expression for constants replaced with CONSTANTS E e ALL G g ALL.

sc808 added reference to Strength class C25/30 short term and Strength class C25/30 long term, modulus of rigidity is now evaluated by the program, EGVALr, EGVALb & EGVALc updated accordingly.

sc809 modulus of rigidity is now evaluated by the program.

sc810 added further elastic modulus options, replaced strength with compressive strength.

sc820 new '3D Space Frame' proforma.

sc855 added gnotes routine, updated JOINT LOADS and loads on rafters, added more text and routine rhpro, added haunch length to diagram, amplification factor amp is now applied to horizontal loads only, added amp to STAGE 3 wind cases, added variable name ansdpi, added further loading cases to STAGE 2 when $ansdpi = 2$.

sc855b, 855e, 855d, 855h, 855l, 855m added gnotes routine, amplification factor amp is now applied to horizontal loads only, added amp to STAGE 3 wind cases, added variable name ansdpi, added further loading cases to STAGE 2 when $ansdpi = 2$, added missing default values to example.

sc855c, 855f, 855j, 855k, 855n added gnotes routine, haunch properties are now evaluated automatically by program, replaced spro with SPRO, amplification factor amp is now applied to horizontal loads only, added amp to STAGE 3 wind cases, added variable name ansdpi, added further loading cases to STAGE 2 when $ansdpi = 2$, added missing default values to example.

sc856 added cchart.ndf, added ltermE and default values to Ex1 Option=4, added "compressive strength".

sc862 redefined p7, p8, p9, p10 & p11 when $tie = 1, 2$ & 3.

sc872 added DIGITS 4 for Option=3 & 4.

sc876 added further elastic modulus options, removed expression $g = E/2.6$, replaced strength with compressive strength.

sc877, 879, 892, 924, 983 added further elastic modulus options.

sc878 added further elastic modulus options and expression for modulus of rigidity, made references to $mat = 2$ only (concrete), removed references to nu.

sc889 added fcd and references to C25/30 concrete strength class, redefined fck, added ltermE and default values to example, added "compressive strength".

sc895 added text after command FINISH relating to the long-term elastic modulus of concrete and the use of expression $E_{cLT} = E / (1 + \Phi)$.

sc921 updated default values to example, replaced prorata with prorated.

sc923 added further elastic modulus options, added matsel and expressions for modulus of rigidity.

sc2000 updated to show compressive strength classes as C20/25, C32/40, C25/30 and C40/50.

sp202 replaced "drawing not to scale" with "drawing is not to scale", replaced bend with bcol, added bw to diagram, added further scenarios relating to ct=1, replaced IF ct=1 THEN +csw=cw with IF ct=1 THEN csw=cd, ccrs is now offered on screen when ct=1, updated offs expression with offs=(sbw-scsw), modified labels for column depth and width.

sp416 added missing (1=Yes, 0=No) to tenstf.

sp422 added missing (1 or 2) for bmnum selection.

sp440 added missing (1 or 2) to parameter bmnum, removed word untorqued. updated proforma to draw correctly for the case when bmnim=2 and simla=1.

sp442 added \$10 & \$11 before START.

sp458 added \$10 before START, added x1.

sp460 added \$10, \$50, \$60 before START, replaced \$11 with Grade.

sp492 added \$10 before START, replaced \$11 with Grade.

sp510 added \$10 before START, defined \$11, \$12, \$13 before START.

sp512 added \$10 before START, defined \$11, \$12 before START.

sp540,580 added \$10 before START.

sp550 added \$10 before START, defined \$20 before START.

sp582 added \$10 before START, added text before START for \$20, \$21, \$30, \$31, \$32.

sp590 added text before START for \$15, \$16, \$20, \$21, \$22, added \$10 before START.

sp592 added \$99, \$51, \$53, \$54, \$55, \$595 etc. above START, added IF strys<4 and IF strys=4 and more text, added missing commands required for two storey structure.

sp605,608,610,612,613,614 added insulation between screed and slab, added text before START, updated diagrams.

sp615 added wall types, added text before START.

sp616,618 added \$10 above START, added text above START, added insulation between screed and slab, added option to have id=0.

sp619 added solid insulation between joists, added more text.

sp620 added \$10 above START, added text above START, replaced cip with ci where appropriate, added insulation between screed and slab, added option to have id=0.

sp622,624 added \$10 above START, added text above START, added insulation between screed and slab, added option to have id=0.

sp630 added \$10 above START, added text above START, added insulation between screed and slab, added more IF mem=0 scenarios, added more scenarios relating to dimensions, updated slabin.

sp632 added \$10 above START, added text above START, added insulation between screed and slab, added more IF mem=0 scenarios, added IF mem=1 scenario relating to dimensions, updated slabin.

sp634 added insulation between screed and slab, added more IF mem=0 scenarios, added IF mem=1 scenario relating to dimensions, updated slabin.

Downloading updates during 2022.

Further updates in 2022 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 2022.EXE.

Ian Brown 01/01/22