Fitzroy Systems

SAND - Structural Analysis and Design, &
SCALE - Structural CALculations Ensemble,
Information sheet 42; Jan 2016.

Support

(1) **Technical support**, for technical support for all aspects of SAND and SCALE please email Dr Ian Brown, ian@fitzroy.com tel 01284 754240.

(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, tel 01284 754 240.

Eurocodes

We have made significant progress in 2015 with an additional 114 SCALE, LUCID and SPADE proformas now having new or substantially revised 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 buildings, timber, masonry, LUCID and SPADE proformas. In 2016 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 4.991)

Work on the next version of SCALE (version 5) has continued vigorously throughout 2015, however we decided it would be better to push on to finish the final envisaged product, rather than release an intermediate stage which required significant further restructuring. The vision for SCALE 5, which is nearly complete, has involved side-by-side development of matching Windows and iPad versions, with both versions including SCALE, LUCID, SPADE, NL-STRESS, NL-PLOT and SCP (for creating pdf output) in one executable. This alleviates problems jumping between executables on Windows, and facilitates launching analyses on iPads, viewing and editing the results, and generating and viewing pdf plots, within the app. The SCALE app also displays the new hyperlinked pdf User's Manual. A few items still need to be addressed before SCALE version 5 is ready for release. These changes should be finalised early in 2016.

SCALE version 5 dramatically improves the flow through a proforma, both forwards and backwards, and as such has brought to light aspects of the proformas that needed to be improved. The following aesthetic improvements have been made to the proformas during 2015.

- The use of proforma defined graphics characters has been further addressed such that all SCALE, LUCID, SPADE and NL-STRESS proformas and data files use the same character set. This allows the program to produce better quality output to the screen and to printers and pdfs - all graphical output is now done using fonts, with redefined characters removed from all proformas and data files.
- No proforma defined characters are included in any input or output, therefore previous calculations will re-print correctly without missing any characters.
- Changes made to 547 proformas to remove blank lines at the start of pages, and to adjust behaviour of the default answer prompt for SCALE version 5 such that the prompt does not disappear when stepping back to it.

Changes to User's Manuals.

The SAND, SCALE, LUCID, SPADE, NL-STRESS, PRAXIS, GUI, TAPE, and Multipad User's Manuals and Reference Manuals have been converted to a single standard pdf file, scale.pdf, which runs to over 600 pages. This allows for a Table of Contents (bookmarks), and Search facilities to be unified across all the User's Manuals.

Selecting the menu option Help->Contents anywhere in SAND/SCALE launches to the appropriate contents page, e.g. SCALE will launch to the SCALE contents page, NLSTRESS will launch to the NL-STRESS contents page. On the left hand side of the pdf window there are "Bookmarks" - an expandable treeview of the contents of all the User's Manuals (similar to the folders treeview in Windows Explorer), these contents may be hidden if required by clicking on the "X" at the top of the "Bookmarks" section, or by using the View menu option.

Like the previous htmlhelp file, the User's Manual contains many underlined hyperlinks which can be clicked on to jump to other sections of the manual for ease of navigation. The previous htmlhelp User's Manuals were not displaying correctly on recent Windows versions, and have now been removed.

For TAPE (plot editor) and GUI (NL-STRESS Graphical User Interface) the buttons for "Help" and "Examples" from the menu and the various dialog boxes will move the page displayed to the relevant page of the User's Manual, as happened for the previous htmlhelp manual.

The help text previously spread across proformas sc002, sc921, sc922, sc923, sc925 (sc924.hlp), lu100, lu200, lu300, lu400, lu500, lu600, lu700, lu800, lu901, lu908, lu966, lu967, lu996, sp901, sp908, sp966, sp967, sp996, has all been moved into the scale.pdf User's Manual.

A new LUCID help section 3.14 on "Reading reinforced concrete drawings" has been added.

New SCALE proformas added.

```
sc381  New Eurocode 3 proforma, Bearing stiffener at end support.
sc499  New Eurocode 3 proforma, Stability checks for notched "I" beam.
```

SCALE proformas removed.

```
sc002, sc921, sc922, sc923, sc925 (sc924.hlp), lu100, lu200, lu300, lu400,
       lu500, lu600, lu700, lu800, lu901, lu908, lu966, lu967, lu996,
       sp901, sp908, sp966, sp967, sp996, removed as all now in scale.pdf
       User's Manual.
sc120, sc121, removed as superseded by sc122 and sc123.
sc137, sc147, Birchwood B75 bridge beam, and SBB bridge beam, removed as
       no longer manufactured.
sc150  Wood and Armer theory, removed as no longer used.
sc375, sc376, sc377, sc378, now incorporated into sc374.
sc668  Static analysis of symmetrical guyed masts, removed as black box
       executable not maintained for Version 5, for guyed mast design
       please look at sc678.pro, sc690.pro, sc690.pro, and sw03.bmk.
sc675  Wave forces – 5th order, removed, as black box executable not
       maintained for Version 5, please email if you use this regularly.
sc766  Ground beam on elastic piles, removed as black box executable not
       maintained for Version 5, for ground beam design please look at
       m208.ndf, m209.ndf, vm130.ndf, vm131.ndf, pf19.ndf, and pf29.ndf.
sc700  Wind loads to CP3 Chapter 5, removed as CP3 was replaced by BS6399
       twenty years ago, please email if you use this regularly.
```

Changes to SCALE proformas.

In addition to the 114 proformas with new or substantially revised Eurocode versions added in 2015, and the aesthetic changes detailed above we have made amendments to a further 52 proformas as listed below:

```
sc086  Increased range for gk and qk and set As2=0 in SPANoD routine.
sc108  Updated expression for TRdmax & added missing units, modified TEd
       default value.
sc114, 115, 116  Clarified units for sfi and sfb.
sc117  Defined As2 value.
sc121  Added pic1, pic2, popup.pro, pop11 and EC2 design option statement.
sc122  Added Eurocode 3 design option, added mesage, popup.pro, pop11,
       heading starting with H1, replaced $3000 with $100, STORE 1 is now
       STORE 6.
sc123  Added note on Eurocode assessment.
sc125  Added note on Eurocode assessment.
sc127  Added note on Eurocode assessment.
sc131  Added note on Eurocode assessment.
sc132  Added Eurocode 3 design option, added popup.pro and common routines
       proforma bricom.pro, replaced several kN.m units with kNm.
sc133  Added note on Eurocode assessment.
sc135  Added note on Eurocode assessment.
sc148  Renamed to "General precast prestressed bridge beam".
sc152  Added note on Eurocode assessment.
sc154  Added note on Eurocode assessment.
sc156  Added note on Eurocode assessment.
sc158  Added note on Eurocode assessment.
sc273  Redefined default values, updated dowel spacing to EC5 Part 1–1
       Table 8.5.
sc300, 305, 310, 315  Added NL-STRESS pull-thru commands.
```

sc355   Added vibration of bottom flange and more text relating to partial factors for actions, added section size to SUMMARY when type=3.

sc356   **Added Eurocode 3 design option.**

sc357   **Added Eurocode 3 design option**, added routines mesage, popup.pro and pop11.

sc358   **Added Eurocode 3 design option**, added routines mesage, popup.pro and pop11.

sc359   **Added Eurocode 3 design option**, made reference to BS EN 1993-2:2006 Clause 3.1 and Table 3.1 of BS EN 1993-1-1:2005.

sc360   **Added Eurocode 3 design option.**

sc361   **Added Eurocode 3 design option**, replaced "Portion of web" with "Portion of flange", an2 with ans2 and an4 with ans4.

sc362   **Added Eurocode 3 design option.**

sc363   **Added Eurocode 3 design option.**

sc364   **Added Eurocode 3 design option**, replaced sy=355 with sy=345 , added bricom.pro and EC3 design option, redefined hw, and fw, replaced b with a for EC option, added missing units to y1 and y2.

sc365   **Added Eurocode 3 design statement**, added bricom.pro.

sc366   **Added Eurocode 3 design option**, added bricom.pro, redefined hw and fw, replaced dw with ds.

sc367   **Added Eurocode 3 design option**, added bricom.pro, redefined hw and fw.

sc368   **Added Eurocode 3 design option**, replaced tee stiffener with closed stiffeners, enhanced diagrams, clarified definitions for ds1 and ds2, added pic1, pic2.

sc369   **Added Eurocode 3 design option.**

sc370   **Added Eurocode 3 design option**, added wt to STRES3.

sc371   **Added Eurocode 3 design option**, added routines mesage and pop11, added missing default values to example.

sc372   **Added Eurocode 3 design option.** added routines mesage and pop11, beta=0 is now shown when web is vertical, enhanced diagrams, replaced "Slope of web to vertical" with "Slope of flange to vertical" when ans2=7.

sc373   **Added Eurocode 3 design option**, added routines mesage and pop11, added britab.pro and popup.pro, replaced deltae1 and deltae2 with delta and delta2, replaced delta1=>delta2 with delta1>=delta2, enhanced diagrams and long expressions, replaced => with >=, replaced lea mm ht & leb mm ht with lea mm & leb mm, replaced lea and leb with le on last line of calculation.

sc374   **Added Eurocode 3 design option**, proformas 375, 376, 377 and 378 have been incorporated into this proforma, made enhancements, proforma title updated, added Tee and Angle sections, welded sections enhanced, added LALine routine.

sc375   **Added Eurocode 3 design option, proforma combined into sc374.**

sc376   **Added Eurocode 3 design option, proforma combined into sc374.**

sc377, **Added Eurocode 3 design option, proforma combined into sc374.**

sc378, **Added Eurocode 3 design option, proforma combined into sc374.**

sc382   **Added Eurocode 3 design option**, corrected force units, added DESIGN STATEMENT, added steel grade.

sc386   Updated "Lateral torsional buckling" section.

sc408   Changed stype < 4 to stype < 7, added Mcr method for evaluating lamLT for channel sections, updated LTB for channels to cater for the case when not loaded between shear centre and the web. Added missing plus signs to DEL and DELlim. Routine ndsl removed, added LALine, replaced chcom with LALine (BS design option).

sc409 Updated destabilizing load expressions and C1 values for exact
       approach, utilised expression given in NA.2.18, added DESload.
sc410 Removed chcom as was not used, added LALine.
sc411 Removed Lm'=Lm' and Lh=Lh, updated text, updated DESIGN SUMMARY,
       replaced McRdy & MybRd with McRd & MbRd. Replaced Unity1 & Unity2
       with Un1 & Un2, added Lmh (haunch), added text and diagram to
       SUMMARY, added screen help diagram relating to MA and MB, defined
       EC zones A, B and C, added Ex4 and made general improvements, added
       LTBus, LTBhr, ZONES1 and ZONES2, added footnote to BS DESIGN
       SUMMARY, added EC Ex5, updated expressions for Do' & ho', added
       pitch of haunch, added further BS routines ACHECK, LTBmom & mtVAL.
sc428 Changed stype < 4 to stype < 7, added Mcr method for evaluating
       lamLT for channel sections, added LALine routine to both design
       options.
sc436 Moments at point loads are now displayed on screen, added "NOTE:
       More than one segment may need to be considered", added C1=1.0
       (Table 3.1).
sc437 Made C1 user defined when no restraint is provided at point loads,
       added green screen display notes, set C1=1.127 when no restraint at
       point loads is provided.
sc429 Added SECcls when NEd>0.
sc432, 434, 436 Added LALine routine.
sc437 Updated "Lateral torsional buckling" section.
sc438 Added option to use NDSL procedure for lamLT calculation, added
       LALine routine.
sc440 Modified green display notes relating to Cmy and CmLT, added MyEd',
       replaced Unity1 & Unity2 with Un1 & Un2.
sc445 Replaced MybRd with MbRd, program now stops when MyEdB > MbRd,
       replaced Unity1, Unity2, McRdy with Un1, Un2, McRd, expression Un1
       now uses MyEd and not MyEdB, lateral torsional buckling routine
       renamed to ltb, added LTB routine, when MyEd=0 is specified program
       assumes MyEd=0.1 kNm, added option to have 2 or 3 column segments,
       made general enhancements.
sc450 **Eurocode 3 design option extended** to accommodate channel sections,
       added IF stype<4 to BS classification check.
sc454 Updated ecNL.
sc463 Radius of gyration iz is now displayed in output, added more green
       display text.
sc462 **Added Eurocode 3 design option**, replaced swc<=swf with swc<swf and
       Appendix with Annex, rafter pitch set to a maximum of 30° as per
       SCI publication, replaced dp with hp in picbase diagram, added
       missing constant K to OTM equation, replaced L'E<2.5, L'E<2.3,
       L'E<2.1, L'E<1.8 with L'E≥2.5, L'E≥2.3, L'E≥2.1, L'E≥1.8, added
       Longitudinal stability heading, added re-evaluation of
       pyp=TABLE(920,tp,pgrade) based on actual plate thickness.
sc463 Modified expression for factor kzw, added mesage subroutine and
       added pic1.
sc464 updated "Lateral torsional buckling" section, set K=1 for non-
       destabilizing loads.
sc465, 467 Updated "Lateral torsional buckling" section.
sc468 Added STOP to intequ for Class 4 members and when Unity > 1, added
       IF rest=0 to design summary .
sc470 **Eurocode 3 option updated.** Made enhancements to green display
       diagram, added note at start of EC option stating that the
       "Simplified method" in BS 5950 will be adopted until such time the
       EC method is made available, expression for Izze modified, added
       LIMOUT, fys1,fys2.

sc480 Replaced a3 with e3 and removed a2, et is now user defined,
       enhanced green display diagram, updated "Web cleat bearing strength
       – supporting member".
sc474 Removed wbres as both web buckling and bearing checks are
       considered by webres, added more green display notes on welding,
       removed references to electrode classification.
sc484 Modified section relating to rest=1, added ltbuck subroutine,
       replaced IF Dp<Dn with IF hp<hn, added IF nn=1 OR nn=2 and EC Ex7 &
       8, added properties Wply= +vu(9) It= +vu(11), modified lnmax
       expression, added classification option.
sc488, 489 Added references to Eurocode 3 Part 1–1, 1–5 & 1–8.
sc490 **Eurocode option updated to SCI P398**, added ecc, Aw, NwEd,Iw, Mweb,
       enhanced slip resistance check and listed friction coefficients for
       EC design option.
sc492 **Eurocode option updated to SCI P398**, added inner', Ex4 and several
       mu<1 scenarios, modified assumptions section (EC option), updated
       expression for Av in euvshr.
sc525 Added flag=1 and more text to eusumm.
sc537 Added more text to summary and eusumm relating to earth face leaf.
sc543 **Added Eurocode 3 design statement.**
sc546 **Added Eurocode 3 design statement.**
sc547 **Added Eurocode 3 design statement.**
sc548 **Added Eurocode 3 design statement.**
sc550 **Added Eurocode 6 design option.**
sc552 **Added Eurocode 6 design option**, removed >> to allow nput values for
       segment 2 etc.
sc611 **Added Eurocode 2 design option.**
sc612 **Added Eurocode 2 design option.**
sc620 **Added Eurocode 2 design option.**
sc639 **Added Eurocode 2 design option.**
sc662 **Eurocode compliant.**
sc663 **Eurocode compliant.**
sc664 **Eurocode compliant.**
sc670 **Added Eurocode 1 design option**, added heading line "NL–STRESS –
       VEHICLE LOAD SHARING".
sc678 **Eurocode compliant.**
sc679 **Eurocode compliant.**
sc686 **Eurocode compliant.**
sc715 Replaced l1 with ll when optn=10.
sc750 Defined unbattered mass–concrete wall.
sc769 **Eurocode compliant.**
sc772 **Eurocode compliant.**
sc773 **Eurocode compliant.**
sc780 **Eurocode compliant.**
sc781 **Eurocode compliant.**
sc782 **Eurocode compliant.**
sc786 **Eurocode compliant.**
sc787 **Eurocode compliant.**
sc789 **Eurocode compliant.**
sc790 **Eurocode compliant.**
sc791 **Eurocode compliant.**
sc794 **Eurocode compliant.**
sc780 **Eurocode compliant.**
sc800 **Eurocode compliant.**
sc915 Updated to show graphics characters used by SCALE, LUCID, SPADE,
       NL–STRESS.

All LUCID proformas now Eurocode compliant.

lu110   Added more expressions so that the EC bars are drawn to scale, added more scenarios.

lu210   Added more expressions so that the EC bars are drawn to scale, added more scenarios, lowered drawing tittle, replaced LBC-C with LBC-C (NTS), corrected mark reference for mark 15 in b115.

lu220   Added (NTS) to sections and more expressions so that the EC bars are drawn to scale, set bds=16, removed piapa=piap when scr1=1, added f01 & f11 to b7020 (BS version), added f11sl, lowered drawing tittle, LBB-B (bars NTS) shifted to LHS.

lu310   Added more lines relating to bar mark 08, added necessary expressions so that the EC bars are drawn to scale, added further scenarios.

lu420   Updated d20117 and d221 routines to display bar mark 17 and 05 correctly on plan (BS version), added more expressions so that the EC bars are drawn to scale.

lu430   Added (NTS) to d30700 and more expressions so that the EC bars are drawn to scale, removed f01, f02, f05, f10, f11 and f17.

lu440   Added (NTS) to d40872, removed f03, f04, f09, f10, f19 and f22, repositioned LBB1 and LBB2.

lu510   Replaced LBSCHEMATIC ELEVATION OF BARS with LBSCHEMATIC ELEVATION OF BARS (NTS).

lu610   Added more expressions so that the EC bars are drawn to scale, added more scenarios, lowered drawing tittle, set +lap=0 when over=0 added missing concla=5,9 and kicker height kh to relevant expressions.

lu710   Stairs re-numbered, added NOTE.

lu810   Added more expressions so that the EC bars are drawn to scale, added more scenarios, repositioned drawing tittle, shifted note relating to drawing scale, replace "stirrups" with "links" and expression A(8)=ro*INT((l'*24/116.7)/ro) with A(8)=ro*INT((l'*42/116.7)/ro).

lu820   Added more expressions so that the EC bars are drawn to scale, added more scenarios.

All SPADE proformas now Eurocode compliant.

sp004   Added code=1 & 2, added UKB & UKC relating to code=2, added EC Tables UBS & UCS.

sp021   Added code=1 & 2, added UKB & UKC relating to code=2.

sp250   Added popup.pro and missing chkrng.

sp252   Replaced UB & UC with UKB & UKC.

sp410, 412, 416 Replaced UB & UC with UKB & UKC.

sp612   Replaced x'=x'+20 with x'=wallx-20 to correct vertical leg of membrane between slab and screed, replaced yp'=sc*sval with yp'=1.5*scd*sval which relates to screed depth.

sp614   Replaced plabel 17 18 with plabel 43 44, replaced $17 & $18 with $43 & $48.

sp801   added optional second chart series, added option for labels for points, made display of points and lines optional, fixed grid limit selection algorithm and stretched graph to fit page.

Downloading updates during 2016

Further updates in 2016 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 2016.EXE.

Ian Brown 01/01/16