# Fitzroy Systems

## SAND - Structural Analysis and Design, &
## SCALE - Structural CALculations Ensemble,
## Information sheet 41; Jan 2015.

## 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 2014 with an additional 27 proformas now having new or substantially revised Eurocode versions. There are now over 400 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 and masonry proformas. In 2015 we will continue development of the Eurocode versions of proformas, and finalise the Eurocode versions of the LUCID and SPADE 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 8.1, Windows 8, Windows 7, Windows Vista and Windows XP. All programs have also been tested and are fully operational on the 64-bit Technical Preview of the next version of Windows: named Windows 10.

Windows 10 brings back the Start button – everything will be a lot more familiar for users from a Windows 7/Vista/XP background than the Windows 8 'Metro' interface.

## List of SCALE proformas

To view the full list of SCALE proformas, click on the menu option File─>Display File (or File─>Print 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 4.97)

Work on the next version of SCALE (version 5) is substantially complete, however a few items still need to be addressed before it is ready for release. These changes should be finalised early in 2015.

SCALE version 5 dramatically improves the flow through a proforma, both forwards and backwards, and as such has brought to light many aspects of the proformas that could also be improved. The following aesthetic improvements have been made to the proformas during 2014.

- Over 12,000 prompts and assignments have been re-aligned to column 35 (due to the improvements in the flow, any misalignment is more visible in version 5).

- Over 1,200 multiline prompts (EDIT) have been added or revised. Extra multiline prompts have been added to improve the flow compared with a succession of single prompts. The multiline prompts have been standardised on three (of the previous five) formats: the EDIT /W 10, EDIT A(10) and EDIT A(10),B(10) formats. To simplify matters, the EDIT 10 and EDIT A B C D formats have been removed, as there were only a dozen occurrences in all of the proformas, they have now been converted into the EDIT /W format.

- All multiline prompts have been aligned so the prompts are at column 35 such that no text is obscured on the screen for either version.

- The text in ~300 pop-ups has been re-structured such that it is displayed without pop-ups to improve the flow of the proformas.

- About 160 instances of proformas starting off by presenting a blank page for "Location" to the user have been revised to provide more explanatory text.

- About 500 occurrences where proformas had prompts on newly cleared screens have been revised to stop the screen being cleared.

- About 150 occurrences where proformas paused to view progress on newly cleared screens have been revised to stop the screen being cleared.

- About 140 instances where proformas could have a pause straight after a prompt have been revised to remove this possibility.

- The use of proforma defined graphics characters has been addressed to produce better quality output to printers and pdfs - all graphical output is now done using fonts, with redefined characters removed from most proformas.

- No proforma defined characters are included in any output, therefore previous calculations from now on will re-print correctly without missing any characters.

- More detail has been added to many proformas to enable summary outputs, as summary outputs will be much more discoverable in SCALE version 5. Version 5 allows switching between normal, condensed and summary modes on the fly during the calculation. During the calculation the window can also be scrolled down to view the calculations that have just been created.

- The units in all the proformas have been addressed so that they will appear correctly on the single line and multiline prompts for SCALE version 5.

A check of every proforma structure has been added into the checking that is done when updating the website, this now generates the "flowchart" for every proforma, this is very useful for example for finding any missing ENDIFs and ENDDEFINEs. Fixed ten proformas as required.

Following feedback, when a pdf is created, either by printing to the "Fitzroy PDF Printer" or using the menu option "Convert a file to pdf" the default pdf viewer will be launched to view the pdf file.

# Changes to SCALE proformas

In addition to the 27 proformas with new or substantially revised Eurocode versions added in 2014, and the aesthetic changes detailed above we have made amendments to a further 170 proformas as listed below:

sc073  **Added fire resistance check to Eurocode design option**, added
      accurate option for F3 evaluation.
sc074  **Added fire resistance check to Eurocode design option**, added
      effflw, b1', b2', pic3, pic4.
sc075  **Added fire resistance check to Eurocode design option**, added
      accurate option for F3 evaluation, effflw, b1', b2', pic3, pic4.
sc077  Added mesage routine and WARNING when changes need to be made,
      replaced kN-m/m with kNm/m, added missing area units.
sc080, 81, 82  **Added fire resistance check to Eurocode design option**,
      added bar spacing requirements for concentrated loads and chkrng to
      effective depth d, added accurate option for F3 evaluation.
sc086  Added accurate option for F3 evaluation and bw values to green
      display, made bw user defined.
sc088  Revised default values for Ex's 1 & 2 to limit vEd < 2(vRdc) as per
      NA Clause 6.4.5(3).
sc090  **Added fire resistance check to Eurocode design option**, repositioned
      +lwconc=1, ctype values are now 1 or 2.
sc091  **Added fire resistance check to Eurocode design option**.
sc092  **Added fire resistance check to Eurocode design option**, removed (1-
      3) from printing,.
sc098  Added IF N>Nc and more explanatory text, replaced default value
      fcu=30 with fcu=35 for Eurocode design option.
sc099  Biaxial bending check is now a requirement.
sc101  Modified EDIT arrays to fit on individual screens removed redundant
      ENDDEFINE.
sc106  **Added fire resistance check to Eurocode design option**, added mesage
      routine, b1', b2', pic3 and pic4, added IF flange=0, b=ba.
sc107  **Added fire resistance check to Eurocode design option**, and added
      b1', b2', pic3 and pic4, added IF flange=0, b=ba.
sc108  Removed table 32000.
sc109  Added mesage routine, removed munits routine.
sc111  **Added Eurocode design option**, added message routine, removed
      munits, added (factored) where applicable, added missing 1.4 factor
      to self weight expression, enhanced diagrams,
sc117  Added mesage routine and defined flag2 value as appropriate.
sc119  Added oc=6 to Eurocode design option, repositioned oc=5 for BS
      design option.
sc142  Added missing units to variable name pcr.
sc160  Defined dd=d', added option to specify kt for both short and long
      term loading, added green screen display notes relating to fire
      resistance, updated several lines after EDIT /W 2.
sc162  Defined dd=d', added option to specify kt for both short and long
      term loading, added option to avoid Edge & End restraint checks,
      added cwcasf.
sc164  Removed table 32000.
sc221  **New Eurocode 3 proforma:** Lateral restraint from a trapezoidal steel
      decking.

sc225  Removed space before command REPEAT, added green display headings
       for Concrete section and Steel section, modified text relating to
       ans2, ans3, ans22 and ans33.
sc226  Removed space before command REPEAT.
sc250  Incorporated NA Amendment No.2, removed table 32000, replaced fmk
       with fvk in fvd expression.
sc251  Incorporated NA Amendment No.2 and removed table 32000.
sc252  Incorporated NA Amendment No.2, removed table 32000, added psi2.
sc253  Incorporated NA Amendment No.2, removed table 32000, added psi2.
sc254  Set cbs=20 in example, incorporated NA Amendment No.2, added option
       to proceed when deflection fails with WARNING displayed in SUMMARY
       (BS option only), enhanced Eurocode deflection section, removed
       table 32000, added variable psi2.
sc255  Incorporated NA Amendment No.2, removed table 32000, added psi2.
sc256  Incorporated NA Amendment No.2, added option to use stainless steel
       plate and bolts, removed table 32000, added variable psi2.
sc257  Set cbs=20 in example, incorporated NA Amendment No.2, removed
       table 32000.
sc258  Incorporated NA Amendment No.2, added IF Vd'/2 ≤ FvwEd and 'Design
       shear force per web', removed note about conversions factors for
       grade values, removed strength property factors 2.7 & 1.8, replaced
       Shear Modulus with Panel shear modulus of rigidity and sigt=M/Zm
       with sigt=Md/Zm (Eurocode design option), removed table 32000.
sc259  Incorporated NA Amendment No.2, replaced bs1<pfc0d with bs1 ≤
       pfc0d, removed note about conversions factors for grade values,
       removed strength property factors 2.7 & 1.8, replaced Shear Modulus
       with Panel shear modulus of rigidity, replaced // to span with //
       to ply span where appropriate, added option to use OSB sheathing
       (Eurocode design option), removed table 32000.
sc267  Replaced gamM with gamG, revised eudtf to exclude strength class
       C14, chkrng for d revised, removed table 32000.
sc268  Removed table 32000.
sc269  Incorporated NA Amendment No.2, removed note about conversions
       factors for grade values.
sc271, 272, 273, 274, 275, 280  Removed table 32000.
sc284, 286, 288, 290, 292, 512  Added mesage routine.
sc300  **Added note on Eurocode design option.**
sc305  **Added note on Eurocode design option.**
sc310  **Added note on Eurocode design option.**
sc315  **Added note on Eurocode design option** and missing STOP command.
sc320  **Added note on Eurocode design option.**
sc325  **Added note on Eurocode design option**, replaced lpb > bv with lpb ≤
       bv & fb > pb with fb ≤ pb, replaced fe < pe and fc < pc with fe ≤
       pe and fc ≤ pc.
sc330  **Added note on Eurocode design option.**
sc335  **Added note on Eurocode design option.**
sc340  **Added Eurocode design option**, added mesage routine.
sc345  **Added note on Eurocode design option.**
sc350  **Added Eurocode design option**, replaced 'not less than 3m' with
       'less than 3m'.
sc351  Replaced Z with elastic modulus, added mesage routine.
sc355  **Added Eurocode design option**, renamed Tables 11, 12, 13 and 14 to
       Tables 110, 120, 130 and 140, corrected scenario in resbf routine.
sc363, 370  Added missing ENDIF command.
sc392  Added mesage routine, removed text on fire protection thickness.
sc408  Added green screen display values for length between restraints
       (LT), added mesage routine, removed all references to effective
       length parameter K, made enhancements, set psi=1 when C1=1, added
       +compr=0, replaced C1=1.132 with C1=1.127, replaced IF stype<5 with
       IF stype<4 in BS classification check.

sc409  Added mesage routine, removed all references to effective length
       parameter K, made enhancements, set psi=1 when C1=1, replaced
       C1=1.132 with C1=1.127.
sc410  Replaced d't < 70*e with d't ≤ 70*e.
sc421  Added kk, replaced strength with stress, enhanced green display
       notes, removed IF fb>15 from BS design option.
sc436  Removed // in places to display moments at point loads 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 displays and more green display notes, set
       C1=1.127 when no restraint at point loads is provided.
sc438  Removed table 32000.
sc440  Replaced VzEd < 0.5*VzRd & VyEd < 0.5*VyRd with VzEd ≤ 0.5*VzRd &
       VyEd ≤ 0.5*VyRd added option for Channel section column (Eurocode
       design option only), replaced ref to ec440.pro with ec3cha.pro
       added BS option for Channel section column design, added Fvz=0 and
       VyEd=0 before START.
sc442  Replaced VzEd < 0.5*VzRd & VyEd < 0.5*VyRd with VzEd ≤ 0.5*VzRd &
       VyEd ≤ 0.5*VyRd.
sc450  Added channel sections to Eurocode design option, added IF stype<4
       to BS classification check.
sc452  Added defaults dr1, dr2, df1, df2, ir1, ir2, if1, if2 etc. before
       start, removed several scenarios associated with dr1, dr2, df1, df2
       etc., added °C units.
sc453  Added defaults dr1, dr2, df1, df2, ir1, ir2, if1, if2 etc. before
       start, removed several scenarios associated with dr1, dr2, df1, df2
       etc., added °C units.
sc462  **Added Eurocode design option**, added mesage routine, replaced swc ≤
       swf with swc < swf and Appendix with Annex, rafter pitch set to a
       maximum of 30 degrees 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 pic1 and mesage routine.
sc464  Updated expression for factor kzw.
sc467  Non-integer spans are now accepted.
sc468  Added missing gamM0 and gamM1 from unity expression.
sc470  Replaced Appendix with Annex, when end anchorage is not required
       buckling and bearing checks are carried out and end posts provided
       as appropriate, added bucber & resweb, replaced ss with ss', added
       steel grade to output page 1.
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.
sc476  Added ≤ 1 to SUMMARY and EDIT's for bay=2,3 & 4.
sc481  Defined factor k1 to be used and set dnb=dnt, when nn=2 added
       'overall stability check of the beam is beyond the scope of this
       proforma', added option to use UKPFC supported beam (Eurocode
       design option only).
sc488  Added WARNING when mx < bd and enhanced expression for mx, removed
       offending edmin above IF hp < hc+200, defined "mx" & "m" and
       simplified their expressions, modified fbd expression, added eta1,
       eta2 and bcond, bgrade is now entered once.
sc489  Added WARNING when mx<bd and enhanced expression for mx, defined
       "mx", added achr=1 when uplift=1 to get TENSION results in SUMMARY,
       modified fbd expression, added eta1, eta2 & bcond.

sc490 Replaced FbRduc < FbRdlc with FbRduc ≤ FbRdlc, nominal tension
       FtEd'=1 kN is now assumed when no splice tension develops, added
       example to Eurocode design option.
sc492 Updated Eurocode to include h13, b13, tw13, tf13, Izz and Wplz.
sc493 Added D13, B13, t13, T13, r13, h13, b13, tw13, and tf13.
sc494 Added D13, B13, t13, T13, r13, h13, b13, tw13, and tf13.
sc498 Removed IF p1 > 140 OR p1 > 200, added scenarios IF p1 > 14*tp OR
       p1>200 and more text, set variable tp, added pic3, pic5
       repositioned ecpic3 and ecpic5.
sc503 Incorporated Amendment No.1 in Eurocode 6 Part 1-1 and the NA to
       Eurocode 6 Part 1-1, removed table 32000.
sc510 Removed table 32000.
sc515 Example defaults revised, removed unused maxmin.
sc519 Incorporated Amendment No.1 in Eurocode 6 Part 1-1 and the NA to
       Eurocode 6 Part 1-1, modified several scenarios and example default
       values, replaced Upper limit for design moment Md1' with Md2'.
sc505 Incorporated Amendment No.1, Eurocode 6 Part 1-1 & the NA to
       Eurocode 6 Part 1-1.
sc520 Incorporated Amendment No.1, Eurocode 6 Part 1-1 & the NA to
       Eurocode 6 Part 1-1.
sc521 Revised example defaults, added example to cater for ans9=0 and
       green screen display offering a value for the normalized mean comp
       strength fbn', added +cjoint=0 to example and scenario IF mortyp=1
       when ans9=0.
sc525 Replaced +t=t mm with t= +t mm, defined sd for BS design option,
       introduced mesage routine when ans5=0, added po1 & po', added
       diagram and more text when ans5=0.
sc528 Revised example defaults, made gamG and gamQ user defined, table
       32000 removed.
sc537 Revised example defaults, only brickwork pocket-type retaining
       walls are now used, added mesage routine and shear enhancement
       routine enhfvd.
sc540 Enhanced diagram, added more explanatory text and mesage routine.
sc541 **Added Eurocode design option**, enhanced diagrams, added ans1, ans2,
       ans3, ans4 ans5 & ans6, replaced a with ath and a' with ath', added
       more green display diagrams, set values for E, v, f and s before
       START, replaced la=e+c+s with la=e+c, added fmax.
sc554 Updated statement relating to Eurocode 6, table 32000 removed,
       added (u/s of base) for the evaluation of angle of friction phib,
       replaced (+/-) with (+ve or -ve) added gamx, gams, game and gamf.
sc560 Introduced diagram pic1.
sc562 Removed table 32000.
sc564 Added mising ENDIF command.
sc566 Removed table 32000.
sc605 Added popup.pro and mesage routine.
sc620 Added mesage routine, replaced popstf with note1.
sc623 Repositioned pop11 routine.
sc649 **Added Eurocode design option**, removed several STOP commands, added
       mesage routine, revised option 12 diagram variable names, added
       missing kNm units in option 12, replaced ty, tz, dy, dz with TY,
       TZ, DY, DZ in option 11, replaced t' with +t'.
sc650 **Added Eurocode design option**, removed several STOP commands added
       mesage routine, added compute to option 5, updated rotate routine,
       ans1=1 is now set before START command, replaced XX axis with ZZ.
sc652 **Added Eurocode design option**, enhanced diagrams.
sc653 **Added Eurocode design option**, enhanced diagrams.
sc701 Removed table 32000.
sc702 Incorporated NA Amendment No.1, crosswind dimension redefined as
       b=L & b=W where necessary, added mesage routine, more explanatory
       text and scenario 'IF ans3<>0 AND ans2=0', removed text from long

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          Peak velocity pressure expressions, removed table 32000, replaced
          BS EN 1191 with BS EN 1991.
sc704, 705, 707  Added mesage routine, enhanced diagrams.
sc706  Added mesage routine, enhanced diagrams, Location: placed at start
          of page, enhanced diagrams.
sc710  Added Eurocode design option, added mesage routine.
sc711  Added Eurocode design option, added mesage routine.
sc715  Added Eurocode design option, revised optn10 and optn11 to relate
          to Qk and not Gk, added mesage routine, added pop11 routine and
          scenario VER<5, replaced ld with ll, added more explanatory text
          and popup.pro.
sc716  Added Eurocode design option, added mesage routine.
sc717  Added Eurocode design option, added mesage routine, dead load
          allowances after first scr3.
sc718  Added Eurocode design option.
sc732  Added an additional check on VRdmax.
sc734, 735  Added an additional check on VRdmax, added routine maxshr,
          added ssflag=1, enhanced diagram.
sc742  Added an additional check on VRdmax, enhanced to accept an applied
          moment at the bottom of column.
sc743  Added an additional check on VRdmax, enhanced to accept an applied
          moment at bottom of column, added ssflag=2, ssflag=3 and +AY=2*AY'.
sc744, 745  Added an additional check on VRdmax, enhanced to accept
          applied moments at bottom of column, added ssflag=1.
sc746  Added an additional check on VRdmax, enhanced to accept applied
          moments at bottom of column, replaced (ly-cy/2) with (ly/2-cy/2) in
          diagram, added ssflag=3.
sc747, 748  Added an additional check on VRdmax, enhanced to accept an
          applied moment at bottom of column, added ssflag=2 and ssflag=3.
sc749  Added an additional check on VRdmax, enhanced to accept applied
          moments at bottom of column, set AY=2*AY, AX=0 and introduced AX',
          added ssflag=2 and ssflag=3.
sc751  Added diagrams to SUMMARY to suit theta=0.
sc752  Removed table 32000.
sc760, 756  Enhanced diagram.
sc765  Introduced ko and dimensions h and b, revised text before prompt
          "ans", the moment of inertia is now evaluated automatically, added
          pop11 routine and popup.pro, replaced Constant with compute for
          beta only, added m-1 units to beta and note routine, removed Case
          1, Case 2 and Case 3 from output.
sc782, 772  Added pop11, mesage routines and popup.pro.
sc794  Added missing mesage routine in RowerR routine, removed several
          EDITs affecting diagrams, enhanced diagrams.
sc805  Added l/s/m2 units.
sc870, 861, 790, 789, 766, 694, 679, 622, 596, 595, 563, 561 Modified EDIT
          arrays to fit on individual screens.
sc871  Removed table 32000.
sc872, 902  Added mesage routine and popup.pro routine.
sc964, 962  Replaced POPUP with a green screen display note.
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LUCID library files have been converted into regular proforma files to make the addition of Eurocode versions more straightforward.

## Downloading updates during 2015

Further updates in 2015 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 2015.EXE.

Ian Brown 01/01/15