

D. Changes in SATURN Version 11.6

D.24 Changes in SATURN 11.6

Date of last update: 18th April 2023

SATURN 11.6 is under development as the successor to all previous versions of **SATURN**.

The first SATURNnext release of 11.6.01, following internal testing within Atkins, took place in April 2022. Work is continuing on 11.6.02, with multi-core, for full release expected in Spring 2023.

As always, in terms of backwards/forwards compatibility, the 11.6 network .dat files may contain new features (e.g., parameter names) which will **not** be recognised by pre 11.6 versions of **SATNET** but will not cause the program to crash; however, pre 11.6 .dat files will be read perfectly happily by 11.6 **SATNET**. Similarly, 11.6 network .ufs files contain new arrays which older version programs will be able to read but not recognise whereas 11.6 programs will be able to read pre 11.6 ufs files. Matrix .ufm files have not fundamentally changed and should be both forward and backward compatible.

The simulation routines in early versions of 11.6 up to 11,6,02F were virtually identical with those in the release versions of 11.5.05H (July 2020) and 11.5.05N (July 2021) with a very rare exception listed in D.24.3. However, from 11.6.02G an improvement with more widespread (also in D.24.3), 11.6 may no longer give identical results.

The following sections describe the changes made in **SATURN 11.6**. Each note should give the precise version number in which the change was introduced (e.g., 11.6.01A), the date and references to relevant sections in the Manual.

D.24.1 SATNET and Network Definitions

- 1) The checks for disconnected O-D pairs in the trip matrix have been extended to identify zones which are disconnected due to being attached to links for which **all** user classes have been banned. Version 11.6.01A, 28/05/20.
- 2) The checks for simulation arms being correctly input in clockwise order which is based on the input X,Y co-ordinates now allows for FIFO rules to be applied to the initial X,Y inputs used to check angles and crow-fly distances as well as their final input. 11.6.01A. 11/08/20.
- 3) A new logical variable DIJKST(ra) replaces the current parameter NIJKST(ra) such that the use or otherwise of the Dijkstra tree building algorithm is set directly rather than depending on the size of the network. 11.6.01E. 22/01/21.
- 4) The default value of SAVEIT is now .FALSE. in order to encourage users to use the new program **SATUFE** (aka SATUFC++) to generate a UFC++ file rather than the old style .UFC files. 11.6.01W. 04/01/22.

- 5) An unidentified TAZ cordon link is now a semi-fatal rather than a non-fatal error. 11.06.01W. 13/01/22.
- 6) SATNET will now process 3-TAC networks (although SATALL will not yet assign them). 11.6.01X. 31/01/22.
- 7) The maximum number of KNOBS values has now been increased from 8 to 20. And, similarly, the maximum number of cost weights per KNOB defined under 88888 has also been increased to 20 which means that a second record per user class (indicated by a + sign at the end of record 1) may be required. See 6.11. Version 11.6.01Z. 08/04/22.
- 8) User-class specific values of SUET may no longer be set under the 88888 data segment, only as UCSUET() within &PARAM inputs. 11.6.01Z. 08/04/22.
- 9) The test for whether data records under 77777 contain more fields than required has now been extended to 44444 and 88888 records. Serious Warning 197 (but really only worth a Warning). 11.6.02C. 24/05/22.
- 10) A new test has been added under 88888 to detect if a KNOBS field is not used anywhere in the definition of generalised costs. Serious Warning 198 (but really only worth a Warning). 11.6.02C. 24/05/22.
- 11) Certain default Namelist parameter values have been changed from DVV 11.5.05N version (including: MULTIC = T to match Release 11.5.05N). 11.6.02E. 18/06/22.
- 12) Extra checks have been added on data in Link Records 2B that TAX and/or APRESV have been set when they are not applicable for those links. Included under Warning 99. Version 11.6.02L. 14/08/22

D.24.2 SATALL/Assignment

- 1) PARTAN assignment is now available within SATUFC to create new .UFC files for MUC as well as SUC networks. Set SPARTA = T. 11.6.01A. 14/07/20.
- 2) The tables of TAC trips and charges have been extended to include tables of compliant and non-compliant trips where relevant. In addition, the tables of total mandatory costs do not include any contributions from **compliant** trips. 11.6.01Q. 12/08/21.
- 3) Where possible the new tree building algorithm LUCIEN is used in place of either Dijkstra or Celeste in the TAC-based routines, both single- and multi-core. 11.6.02D. 16/06/22.
- 4) The use of the “twins” option to assign two user classes with identical cost definitions in a single pass may be switched off (essentially for test purposes only) by setting a network Namelist parameter TWINS = F. See 20.6.6.4. Version 11.6.02E. 18/06/22.

D.24.3 Simulation

- 1) A correction has been made to arms at signalised intersections which have (a) one lane, (b), flares to both left and right and (c) more than 4 total arms at the node. 11.06.01Z. 04/04/22.
- 2) Minor changes have been made to the calculation of random delays at give-ways at priority junction with a view to removing potential discontinuities as V/C ratios pass through 1. Version 11.6.02G. 11/07/22.

D.24.4 P1X and/or SATDB

- 1) A SATDB data base column may be edited graphically by selecting links from a P1X network plot and automatically resetting their stored values. Option 20 in the P1X-SATDB menu. 11.6.01A. 28/05/20.
- 2) Select Link Analysis may now be undertaken for all user classes **except** one nominated class (as opposed to one class only). See 11.8.1.7. Version 11.6.01A. 28/05/20.
- 3) The option to carry out Select Link Analysis in SATDB has been removed; the options in P1X must be used instead. Version 11.6.01A. 02/06/20.
- 4) SLA may now be based on selected **vehicle** classes rather than user classes, where (as above) the vehicle class may be “only one” or “all but one”. See 11.8.1.7. Version 11.6.01A. 03/06/20.
- 5) If a link in network 1 has been split into two links in network 2 (or vice versa) then the two sets of links are matched so that link data from network 2 appears on the correct link or links in network 1 annotation. Previously any data from such mismatched links were assumed to be missing. 11.6.01A. 19/06/20.
- 6) An additional form of SLA has been introduced – referred to as X-SLA – whereby the OD flows which use a given link A-B are assigned to the “second best” routes they would have used if A-B were closed. Output statistics include the **differences** between the mean O-D times and distances for routes using the selected link and for routes which divert. X-SLA cannot be applied in all cases; e.g., it cannot be applied to a selected origin since if you ban trips from that origin there are no other routes available. See 11.8.1.20. Version 11.6.01A. 20/06/20.
- 7) The SATLOOK-based option to identify all simulation nodes with different coding between networks 1 and 2 has been extended to (a) store the data in a node data base column and (b) automatically return to P1X with the differing nodes highlighted. 11.6.01A. 24/06/20.
- 8) Time vrs. distance plots for bus routes and/or validation routes now have the names of links along the route annotated horizontally along the X-axis and the name of crossroads annotated vertically (where the names are taken from the GIS file). 11.6.01C. 25/10/20.
- 9) The SLA matrix may now be based on Pija factors rather than the absolute number of trips. See 11.1.8.16. Version 11.6.01C. 02/11/20.

- 10) The option to rebuild a network .UFN file from within network editing directly has been removed; instead, a .dat file must be created to be input to **SATNET**. 11.6.01C. 07/11/20.
- 11) The joy-ride node-by-node tables output in the .LPP files may now be optionally CSV-formatted, i.e., with commas inserted after each entry. 11.6.01D. 28/11/20.
- 12) Data relating to either SAVEIT link flows or times per SAVEIT iteration may now be read directly from a network UFC++ file. 11.6.01D. 28/11/20.
- 13) DBDUMP and P1XDUMP now include a command line format parameter \$EF to output real data in an **E-Format**, or \$RF for standard **Real** format, plus a parameter. For example, \$RF15.3 will output in fixed column format F15.3. See 15.46.1. Version 11.6.01H. 22/03/21.
- 14) Major changes have been made to the procedures by which Select Link Analysis (SLA) calculations are carried out. See 11.8.1. Version 11.6.01H. 22/03/21.

For example: (a) SLA only works with SPIDER networks; (b) It also only works with .UFC files (with .UFF added on an experimental basis); (c) If a single node has been selected an extra option allows for a separate SLA for each turn at that node – see 11.8.1.21. 28/05/21.
- 15) Link by link tables of individual bus routes may now be displayed in a window with the option of CSV formats. Similarly joyride tables may also be displayed in a window and/or be printed as CSV. 11.6.01E. 27/11/20.
- 16) The full tables for arboreta which previously were sent to the LP only may now be sent to a window. Both now have the option of CSV formats. 11.6.01K. 06/05/21.
- 17) The stars at selected nodes in P1X joyrides are retained if the window is resized. 11.6.01K. 08/05/21.
- 18) Sequential spider node numbers may be annotated at their corresponding “normal” node locations. 11.6.01M. 21/05/21.
- 19) The SLA banner menu has been modified so that (a) it is divided into two parts and (b) a separate option now exists to select a single node with or without the new added option of analysing all turns at that node. 11.6.01M. 02/06/21.
- 20) X-SLA flows may be annotated either (a) on their own, (b) jointly with SLA flows or (c) as the difference between SLA and X-SLA. 11.6.01N. 09/07/21.
- 21) In addition, differences in the average O-D times and distances between SLA and X-SLA routes are calculated and displayed in the banner. See 11.8.1.20. Version 11.6.01N. 13/07/21
- 22) X-SLA may also be applied to an automatic loop over all turns at a simulation node. By turning on a “text-only” option individual plots are suppressed but a table giving O-D differences for each turn is displayed at the conclusion of the calculations. 11.6.01N. 13/07/21.

- 23) Information / Bus SLA now creates a table of all routes using a particular link (either 1-way or 2-way) with cumulative times, distances and speeds per route plus totals/averages over all routes. The table may optionally be output in CSV format to a .CSV file. In addition, a full listing of link-by-link times etc. for each route may be included in the .LPP file. See 11.8.4.3. Version 11.6.01O. 24/07/21.
- 24) Trees may now be built to and from nodes (currently simulation only) as opposed to zones only. See 11.8.3. Version 11.6.01P. 06/08/21.
- 25) A \$INCLUDE file which includes only selected simulation nodes may be created and used as “building blocks” to represent various scenarios. See 11.9.2.8. Version 11.6.01Q. 22/08/21.
- 26) Annotated bus routes (under Information) etc. now allow circular bandwidths at each simulation node proportional to the delay at that junction. See 11.8.4.2. Version 11.6.01Q. 27/08/21.
- 27) Changes to One Song and SATRAP to enable UFF files to be used to set routes. 11.6.01T. 04/10/21.
- 28) When running **P1X** in KEY (only) mode the banner now displays the selected line in **red** and all other lines in **grey** to make the choice more obvious. 11.6.01T. 17/10/21.
- 29) The options under P1XDUMP to dump, e.g., all user class flows have been corrected. 11.6.01U. 03/11/21.
- 30) Signal diagrams within node graphics may now be displayed by phases rather than stages. See 11.2.2. Version 11.6.01V. 13/12/21.
- 31) SLA screen line analyses now treat the minimum number of crossings = 0 or 1 differently from previous versions. See 11.8.1.11. Version 11.6.1V. 30/12/21.
- 32) The command P1X net -36 requests an initial window centred on **zone** 36 where the negative value denotes a zone rather than a node. See 11.5.6. Version 11.6.01X. 28/01/22.
- 33) Options to annotate KNOBS data, both individually and collectively, have been added. See Appendix I.1.1, #171-173. Version 11.6.01Z. 08/04/22.
- 34) Most (or possibly all) SLA flow-based options using .UFF input files now work with TAC networks; matrix-based TAC options will be added later. 11.6.01Z. 22/04/22.
- 35) DCF flows (see 20.6.17) for TAC networks may now be calculated using either SATRAP or One Song using UFF files in addition to UFC files. 11.6.02C. 20/05/22.
- 36) If a GIS polygon contains more than 512 boundary points it is “truncated” by, say, including only every 2nd point if that brings it below 512. Version 11.6.02D. 09/06/22.

- 37) If a zone number has been included in the definition of a GIS polygon (see App.Z.1) it is annotated in white in the centre of the polygon (but only if in-filled). 11.6.02D. 09/06/22.
- 38) Field 2 in a .ERL field may now be used to highlight nodes with user-selected errors and using Field 2 as the pen number. See 11.6.5.5. Version 11.6.02D. 09/06/22.
- 39) Highlighted nodes which are selected on the basis of different messages may now also be selected by a “range” of errors, e.g., anything worse than a Warning rather than Warnings on their own. In addition, the full range of, say, Warnings may be selected but each individual node is assigned a specific pen colour dependent on its error status. See 11.6.5.5. Version 11.6.02D. 09/06/22.
- 40) The A-Z banner now includes data related to any highlighted nodes displayed; e.g., the pen colour used to designate Warnings in general or, more specifically, the pen colour for a particular message if appropriate. In the case of certain highlighting options (e.g., errors or ERL fields) the A-Z banner is displayed immediately after the highlighted plot. See 11.6.5.5. Version 11.6.02D. 09/06/22.
- 41) A new option has been added under Validation>>UFS Routes to display **all** the timed routes, either with red or green colours to indicate whether they fail or pass DfT criteria or with full “Hallmark” bandwidths. See 11.7.2.7. Version 11.6.02E. 24/06/22.
- 42) DCF calculations in SATRAP have been extended to allow OD routes to be selected based on either paying a particular charge and/or diverting around that charge area with both AND or OR logic. See 11.10.7.4. Version 11.6.02H. 21/07/22.
- 43) A new .ERL file may be added via File Menu / Inputs. 11.6.02K. 13/08/22.
- 44) Global link data updates now allow values of TAX, APRESV, FLAREF and FLAREX to be read from an input text file and added a network .dat file under Network Editing. See 11.9.17.5. Version 11.6.02L. 27/08/22.
- 45) Global node data input under network editing may now be contained in a text file which has been created from either link or turn data so that rather than having a single initial field to define a node there may be 2 or 3 fields, in which case the user must identify the relevant node field. See 11.9.17.3. Version 11.6.02M. 03/09/22.
- 46) If a network has its .dat file re-created (Files/Outputs) any duplicated 33333 buffer links are output only once. See 11.4.2.1. Version 11.6.02M. 11/09/22.
- 47) Extra DA codes added to an output .UFS file from SATDB may now use the full range of possible codes from 5023 up to the absolute maximum of 9994. See 11.10.12. Version 11.6.02Q. 12/10/22.
- 48) Node graphics for signals now includes a phase-based / Linsig-style display mode for signal timings. See menu choices GeneralDisplay/Linsig. See 11.12.2. Version 11.6.02S. 22/11/22.

- 49) A cordon created within **P1X** may be output as a “TAZ” text file suitable for inclusion within the **SATNET** 44444 data to define an Area Charging Zone; see 12.1.4 and 20.6.?. Version 11.6.02U. 30/12/22.
- 50) If a “change a parameter” option has been selected but no change is made to that parameter (e.g., just hit return) then the plot is not refreshed. 11.6.02U. 15/01/23
- 51) If a data item is currently annotated and the choice of networks for annotation is altered (for 2 or more networks) then the plot may be automatically refreshed by toggling a parameter AUTO_MND on. 11.6.02U. 15/01/23.
- 52) If a sequence of windows has been created it is now possible to jump to the “next” window as opposed to the “last” window. See 11.5.3. Version 11.6.02U. 15/01/23.

D.24.5 MX

- 1) The batch file MXSUB2 now allows for the output matrix to be the **absolute** difference between the two input matrices. See 10.20.13. Version 11.6.01A. 27/06/20.
- 2) The batch options such as MXSUB2 can now work with matrices of virtually any size independent of the level with which \$MX has been compiled. For example, matrices with multiple blocks which normally exceed the maximum number of columns can be processed. 11.6.01A. 14/07/20.
- 3) UFM2TBA2 now has option on the command line to allow zero-value cells to be included in the output TUBA2 file. 11.6.01A. 25/08/20.
- 4) The trip length distribution now includes the standard deviation as well as the mean. 11.6.01C. 13/11/20.
- 5) UFM files which were created via a network-based procedure, e.g., skimming, now include the name of the “generating” network file on their header records and this is printed as appropriate. 11.6.01S. 09/09/21.
- 6) A new “zipped” format has been created for blocked .UFM files whereby any blocks which are necessarily all zeros (e.g., a block that refers to trips that pay TAC 2 for a user class which is exempt from TAC 2) are explicitly excluded from .UFM files. Potentially this can lead to a reduction of the size of .UFM files by over 50%. See 10.2.11. Version 11.6.01U. 06/11/21.
- 7) In the case of matrices with either levels or blocks the definition of whether a cell is intra-zonal or not is always based on its position within its **sub-matrix**, not on its absolute row and column positions. See 10.6.1 and 10.8.9. Version 11.6.01V. 25/11/21.
- 8) The internal zone-to-zone matrix may now be aggregated to a TAC-to-TAC matrix for (mostly trip) matrices derived from an Area Charging TAC network. 11.6.02U. 12/12/22.

D.24.6 SATCH: Cordoning

- 1) The cordoned trip matrix totals disaggregated by internal/external (cordon) zones is now printed. 11.6.01M. 07/06/21.
- 2) UFF-functionality has been added for both TAC and non-TAC networks. Version 11.6.02Q. 20/10/22.
- 3) The full set of matrix cordoning options available with **SATCH** is now also available interactively within **P1X**. 11.6.02S. 21/11/22,

D.24.7 NEW PROGRAMS: SATUFE/SATUFC++ AND SATUFF

- 1) A new program SATUFE (aka SATUFC++) has been introduced to create .UFC files via a post-SATALL SAVEIT assignment. The new program is faster than existing SAVEIT procedures and creates a much more compact .UFC file which in turn speeds up any subsequent analyses using .UFC files. See 7.11.16 and 12.9. Version 11.6.01. 01/02/21.
- 2) SATUFF uses the new UFC++ files from SATUFE in order to create a ".UFF" file which stores trees in an "incremental" fashion. UFF files may be used instead of .UFC or .UFO files to reconstruct trees for analyses such as skimming or SLA and require very much less CPU to do so. See 12.10. Version 11.6.01. 01/02/21.
- 3) At the time of writing UFF files may be used in SATDB / SATRAP, SATPATH, SATPIJA, SATCH, SATLOOK Skimming or in P1X / SLA but not X-SLA. Both TAC and non-TAC networks are catered for. From 11.6.01P. 24/07/21.
- 4) Note that SATUFE creates .LPE files, SATUFF produces .LPF files and SATOFF now outputs a .LPO file (formerly .LPF) to avoid confusion with SATUFF. 11.6.01R. 04/09/21.
- 5) SATUFF now creates an updated network .UFS file, output as network_UFF.UFS but possibly renamed network.UFS by the batch file, which contains the file/pathnames for the output .UFF file. (Similar to SATUFE which creates a network_UFC.UFS file). 11.6.02J. 02/08/22.

D.24.8 SATLOOK / Skimming batch files

- 1) The simulation/buffer summary statistics calculated "on the fly" (option 4 in the main menu, then 2) may now be disaggregated by an integer DB column with extra options to create cumulative totals. For example, if the network links have been divided into 3 rings, inner, middle and outer, then statistics may be calculated for, e.g., inner on its own, inner plus middle (cumulative), etc. etc. See 11.11.4.3. Version 11.6.01A. 27/05/20.
- 2) The "main" menu in SATLOOK is no longer split into two sub-segments. 11.6.01A. 02/06/20.
- 3) A new option under Simulation Summary Statistics allows the outputs to be disaggregated by TAC and/or TAZ regions under area charging. 11.6.01A. 22/06/20.

- 4) SKIMTAC ALL, SKIM_ALL and SATTUBA now automatically output a .ufm trip matrix with one level per user class – useful if the network uses the same original level to define multiple user classes or if there are other factors; otherwise it is identical to the original trip matrix. See 15.41.6 and 20.6.19.4. Version 11.6.01N. 30/06/21.
- 5) The output time, distance etc. matrices produced by SKIMTAC ALL may now optionally be factored to use standard TUBA units, e.g., kms and hours, rather than SATURN units of metres and seconds. [But not recommended and not tested]. See 20.6.19.3. Version 11.6.01N. 30/06/21.
- 6) Skimming from a forest or from a single tree (Options 9 and 14) now allow links to be banned and/or penalised. 11.6.01S. 04/10/21.
- 7) Skimming UFF-functionality has been added for both TAC and non-TAC networks. 11.6.02Q. 20/10/22.
- 8) SKIMTIJ added to UFF-functionality. 11.6.02R. 13/11/22.
- 9) A new option (24 in the main menu) prints a summary of all the errors identified in **SATNET** split by error type (Warnings, etc.) and, in the case of multiple input networks, by network. See 11.11.24. Version 11.6.02S. 21/11/22.
- 10) The average TAC area charge matrices output by SKIMTAC ALL now assign a default value set by DEFODC in the preferences file to all unconnected OD cells. See 20.6.19.3. Version 11.6.02U. 14/01/23.

SATPIG and SATPATH

- 1) SATPIG will only work with .UFC files, not .UFO. Therefore, if set, USEUFO = T is ignored and a .UFC file is used in preference. See 12.6.1. Version 11.6.01A. 11/08/20.
- 2) A virtually entirely new program SATPATH covers most of the same functions as SATPIG but works much faster being based exclusively on .UFF files, spider networks etc. It effectively replaces SATPIG and has been designed with applications to TfL TAC networks as a priority. See 12.8. Version 11.6.01U. 02/11/21.
- 3) SATPATH creates a .LPK output file while SATPIG creates .LPG. 11.6.01U. 02/11/21.

D.24.9 SATPIJA and SATME2

- 1) The (optional) output KP file (PIJAKP = T) now gives **both** the origin and destination zone number rather than a packed value. See 13.7.4. Version 11.6.02I. 26/07/22.

D.24.10 General Changes

- 1) A test has been included if an unformatted file being input is empty so that the program still terminates in that case but with a SATURN “soft landing” rather than a hard crash. 11.6.01C. 23/11/20.

- 2) “True” Direct Access files have been introduced in limited circumstances to pass unformatted data from one program for another, the first such application being to pass spider link costs from SATUFC++ to SATUFF. See 12.9 and 12.10. Version 11.6.01E. 07/02/21.
- 3) Two new tree building algorithms have been introduced, CELESTE and LUCIEN, which are potentially much faster than Dijkstra and/or d’Esopo. See 7.11.15 and 15.66. Version 11.6.01A. 01/02/21.
- 4) If a GIS file contains text names for links (App. Z Block 6) then these text names are added to various tables etc. in addition to purely numerical identifiers, e.g., Maple St rather than 16-82. Similarly, simulation turns are identified by the names of the entry and exit links. 11.6.01O. 19/07/21.
- 5) If a pathname set in a .KEY file cannot be opened a second attempt is made to open the file using just the filename but in the home directory. 11.6.01T. 06/10/21.
- 6) Output LP filenames, rather than having fixed program-specific extensions such as .LPP added to a network filename, may now be user-set on the command line. For example, “P1X network my_choice.lp4” creates a line printer file my_choice.lp4 rather than network.LPP. This avoids the problem that if P1X is being run repeatedly on the same network (e.g., using a sequence of standard KEY files) then the same output LPP file is continually over-written. Equally “P1X network my_choice.TXT” creates an explicit text file directly. See 3.3.2.3. Version 11.6.01U. 09/11/21.

D.24.11 SatWin

SatWin has been updated to incorporate 11.6 enhancements. 11.6.02V. 18/04/23.

D.24.12 SatView

SatView changes are only documented here for items related to changes in the SATURN programs. Please see SatView documentation for enhancements within that program.

- 1) SatView now handles Zone-to-Zone (Z2Z) connectors. SatView v1.33. 18/10/22

DVV / DAS – 03/03/23

D.25 Version Control (11.6)

JOB NUMBER: 5213865		DOCUMENT REF: App D-Future.doc				
Revision	Purpose / Description					
		Originated	Checked	Reviewed	Authorised	Date
11.6.03	SATURN v11.6.03 Release	DVV	DAS	RJ	RJ	01/06/23