

D. Latest Changes in SATURN Version 11.4

D.22 Changes in SATURN 11.4

Date of last Update: 23rd November 2017

SATURN 11.4 is the successor to all previous versions of **SATURN**. The first release of SATURN v11.4.05 was undertaken in March 2017.

As always, in terms of backwards/forwards compatibility, the 11.4 network .dat files may contain new features (e.g., parameter names) which will **not** be recognised by pre 11.4 versions of **SATNET** but will not cause the program to crash; however pre 11.4 .dat files will be read perfectly happily by 11.4 **SATNET**. Similarly 11.4 network .ufs files contain new arrays which older version programs will be able to read but not recognise whereas 11.4 programs will be able to read pre 11.4 ufs files. Matrix .ufm files have not fundamentally changed and should be both forward and backward compatible.

In terms of results there have been a significant number of changes to the simulation and one might expect 11.4.05 to give different – possibly significantly different – results to pre 11.4. Our advice therefore would be to re-run old networks “from scratch” and certainly not to do comparisons between 11.4 outputs and pre 11.4 outputs.

The following sections describe the changes made in **SATURN 11.4** (and/or in the **later** versions of 11.4). Each note should give the precise version number in which the change was introduced (e.g., 11.4.05), the date and references to relevant sections in the Manual.

D.22.1 SATNET and Network Definitions

- 1) The maximum number of link tolls that can be stored in .UF* files has been increased in order to deal with (rare?) situations where virtually every link in a network is tolled over multiple user classes. Previously tolled links times user classes had to be less than the maximum number of links; this restriction is now removed. 11.3.14. 15/06/15.
- 2) The “rules” governing Warning 68 – a priority junction turn with a priority marker G might be better modelled as an M for merge – have been modified such that the number of warnings is likely to increase. For example, the warning is now applied to junctions with greater than 3 arms. 11.3.14. 10/08/15.
- 3) The “rules” by which speed-flow etc. data contained within 33333 “buffer” link data are applied to simulation links have been tightened up. More specifically, for outbound simulation links to an external simulation node if capacity-restraint data is contained on **both** 11111 and 33333 records then the former always takes precedence. 11.3.15. 08/02/16.
- 4) The parameter DOUBLE which modifies the “rules” for TOPUP = T has been effectively removed by making its use within TOPUP mandatory. In brief, this means that if a simulation node is coded twice (or more often)

within the main 11111 data set or within subsidiary \$INCLUDE files then the **first** occurrence is always used; previously the first occurrence always had to be within the main 11111 data set. See Section 6.15.2. 11.3.15. 13/02/16.

- 5) The QUIET option has been extended so that **all** error message windows (in addition to the main summary window) are suppressed if QUIET = T. See Section 14.9. 11.3.17. 22/04/16.
- 6) Extra error checks have been introduced within 444444 data inputs to warn when continuation records required for NOMADS > 10 are missing. See Section 6.7, note (9). 11.4.01. 18/06/16.
- 7) The formatting rules by which generalised cost weights per KNOB fields are read have been modified such that integer inputs are read as integers rather than having assumed decimal places. Thus a weight input as ' 1' is interpreted as 1.0 rather than 0.01. See Section 6.11, note 14). 11.4.01 01/06/16.

N.B. This may mean that the current **SATURN** release gives **different** results from previous versions if integer input fields have been used.

- 8) The default values for parameters controlling the gap acceptance at simulated junctions have been revised to bring them into line with current practice. The values for GAP, GAPM and GAPR have been reduced from 5.0, 3.0 and 4.0 seconds to 2.0, 1.0 and 1.5 seconds respectively. 11.4.05. 22/10/17.
- 9) In order to conform with DfT recommendations the default values for parameters controlling the convergence of the simulation-assignment loops have been changed so that STPGAP is reduced from 1.0% to 0.1%. In addition, the values for AK_MIN, MASL and NITA_S have been changed from 0.0, 15 and 99 to 0.05, 50 and 256 for improved (default) assignment convergence and secondary analysis. 11.4.05. 22/10/17.
- 10) The default is now set to use spider web networks as a matter of course (i.e. SPIDER=T) with the default to use spider web for analysis if possible also set true (USESPI=T). Note that the default DAT files provided for SATLOOK and P1X (SATLOOK0.DAT and P1X0.DAT) have also been changed – previously they had USESPI=F so care may need to be taken when copying changes from earlier versions and/or using earlier versions as the behaviour may change. 11.4.06. 03/02/18.

D.22.2 SATALL

- 1) The rules by which a .UFC file is converted into a .UFO have been revised at the margins with the objective of improving the fit between the two sets of resulting O-D flows. Equally applicable to **SATUFO**. 11.3.14. 06/07/15.
- 2) The treatment of V>C delays which exceed MAXQCT/2 has been “rationalised” so that the assignment and the simulation give the same results with significant improvements to the convergence. N.B. Normally delays should **not** be affected by MAXQCT, i.e., they should be much less than MAXQCT. Therefore this “correction” only really affects networks which

have been badly set up for one reason or another in the first place, e.g., your trip matrix is unreasonably large or MAXQCT is too small (Default: 60 minutes). See 8.4.7.2. 11.3.14. 01/08/15.

- 3) An option to use the Dijkstra shortest-path algorithm rather than d'Esopo – which should be more CPU-efficient for “large” networks – has been added along with a critical parameter NIJKST which defines the number of spider nodes above which Dijkstra will be used. For very large networks (e.g., LoHAM) using Dijkstra can reduce assignment CPU times by more than one third. See 7.11.14. 11.4.04. 17/09/16.
- 4) A parameter PLUFO has been added which is added to all OD cells prior to the calculation of a .UFO file from .UFC in order that zero-trip cells will be better represented for operations such as skimming. PLUFO should be a very small value, e.g., Default 0.0001. Version 11.4.05. 20/12/16.
- 5) The default is now set to use spider web networks as a matter of course (i.e. SPIDER=T in the creation of networks in SATNET). As always, care should be taken when copying networks from earlier versions and/or using earlier versions as the behaviour may change. 11.4.06. 03/02/18.

D.22.3 Simulation

- 1) The calculation of random delays has been changed under RAGS = T so as to be more self-consistent for turns which: (a) share lanes, (b) are give-ways and (c) have different saturation flows. Almost all of these occur at single lane entries to priority junctions but it may also apply to, say, filter turns at signals. In certain circumstances the differences can be quite significant, e.g., up to 60 seconds, although the vast majority will be under 1 second. 11.3.13. 19/05/15.
- 2) A number of changes – mostly small, some not so small – have been made to the modelling of flares, the general objective being to make capacities etc. less sensitive to the point at which the queue length either in the flare or in the main lane equals the flare capacity. 11.3.15. 18/11/15.
- 3) Minor changes have been made to the modelling of blocking back. 11.3.15. 18/11/15.
- 4) A new concept of “virtual flows” has been introduced at signals where, e.g., straight ahead flows share a lane with X-turns which are totally blocked and both flows are very near zero, in which case both capacities are calculated as being very zero in the simulation and there is very little incentive for the assignment to increase the straight ahead flows which become “stuck in a hole”. Virtual flows within the simulation provide an empirical means of escape from the hole. See 8.2.5.3. 11.3.15. 09/15.
- 5) The “rules” by which cost-flow curves are defined for a simulation link where the total link arrival flow exceeds the mid-link capacity have been changed in order – hopefully – to improve convergence. 11.3.15. 15/12/15.
- 6) A “bug” has been corrected in the simulation whereby simulation turns at: (a) signals, (b) single lane arms with (c) an X-turn present and (d) zero flow were assigned semi-arbitrary capacities and delays. The bug was fairly

benign as long as the flows **should** be zero since total vehicle hours etc. would not be incorrectly calculated; however if the bug was preventing flows to be assigned to that turn the problem would be more serious. Corrected in 11.3.18. 28/04/16.

- 7) The algorithm which determines lane choice at signals where an X-turn shares the outer lane with one or more other movements has been “improved” to deal with various possible instabilities. Final versions are in 11.4.03. 20/09/16.
- 8) Further minor changes have been made to the simulation routines, in particular dealing with flares and with X-turns at signals. 11.4.05 and 11.5.01. 31/01/17.
- 9) In particular more major changes have been introduced on simulation links with a single lane but flares to both left and right. In previous releases it was possible for such a configuration to be simulated as over-capacity whereas in reality there should be sufficient capacities for all possible turns. 11.4.05 and 11.5.02. 01/02/2017.
- 10) An error associated with FCF (Fixed Cost Flows) applied to external simulation nodes has been corrected with minor (but non-zero) consequences. 11.4.05 and 11.5.01. 14/03/17.
- 11) A very minor update has been made to priority junctions with flares where the V/C ratio of the lane as a whole may be < 1.0 but an individual turn may have $V/C > 1.0$, in which case lane capacity is reduced to make both V/C equal and > 1.0 . This occurs extremely rarely but, if it does, the overall simulation outputs will be affected. 11.4.05 and 11.5.02L. 07/06/17.
- 12) The procedure to check that V/C ratios are the same for all turns in shared lanes, in particular when $V/C > 1$, have been tightened up. 11.4.05 and 11.5.02Q. 22/07/17.
- 13) The use of SATALL as a continuation run (i.e., SATALL net MASL n) has been improved by making the choice of NITA on the first assignment more consistent with what would have been set on a run with extra loops. (Although in most cases the value set for NITA is correct, albeit for slightly wrong reasons.) 11.4.05 and 11.5.02T. 17/08/17.
- 14) A minor change to the blocking back of links which are fed both by direct flows from centroids downstream as well as “normal” entry flows upstream means that slightly more traffic is blocked from the upstream entries. In most cases the impact is minimal but if the flow from the zones is significantly greater than the normal entry flow (which it should **not** be) then the impact may be significant. However, in such cases, convergence should be improved. 11.4.05K and 11.5.02U. 24/08/17.
- 15) The rules have been changed in order to better deal with a potential problem of discontinuous delays on simulation links with: (a) a mid-link speed-flow curve, (b) turns which do not share lanes and (c) total arrival flow very near the link capacity. The new rules remove a potential discontinuity in turn delays and capacities where the flow is just above / just below capacity and therefore lead to improved convergence. 11.4.05 and 11.5.02. 19/09/17.

D.22.4 P1X and/or SATDB

- 1) Stacking capacities may now be defined by negative values as part of the network editing process. 11.3.14. 08/07/15.
- 2) Error statistics as selected from the Display Menu may now use the link flow as defined for a **single user** class and/or a **single vehicle** class rather than the total flow. 11.3.15. 17/11/15.
- 3) Six new link display variables have been added: two based on %differences between successive loop flows (as used to calculate %FLOWS/ISTOP stopping criterion) and a further four based on SAVEIT and UFO link flows. See Appendix I.1.2. 11.3.16. 06/03/16.
- 4) PMAKE and/or Network Editing: A new option is provided to create a file of 11111 coding data of just those nodes which have been edited so that the file may be used as a \$INCLUDE file to introduce the same changes in other networks. See Section 11.9.2.8. Version 11.3.16. 07/03/16.
- 5) The procedure to select a route, either a bus route or a timed route under Validation, has been improved in order to make “searching” through a large number of routes easier. For example, a “page” may be nominated such that if there are 20 routes per banner then page 21 would advance the banner list to routes 401 to 420. See 11.8.4.2. Version 11.3.17. 12/04/16.
- 6) The Hallmark option to display timed route validation statistics has been converted to a “toggle” option such that, once selected, it may subsequently be turned off. See 11.7.2.6. Version 11.3.17. 12/04/16
- 7) A new output option under Network Editing / PMAKE allows a “clean” .dat file to be constructed from an original .dat file which includes, e.g., \$INCLUDE files, deleted nodes, etc. such that the 11111 data is in correct numerical order and all non-relevant data has been removed. See 11.9.2.9. Version 11.3.17. 20/04/16.
- 8) “Compass points” in the corners of screen plots may now be suppressed via a toggle within the “Options” banner menu within the Window menu or from the pull-down menu under Window in the control bar. 11.3.17. 26/04/16.
- 9) An additional column has been added to the cumulative Joyride table in the .LPP file to include the “extra” delay (actual delay less the minimum delay at zero flow); previously this was only listed within the banner. 11.4.01. 26/06/16.
- 10) A new option has been included within the batch procedure SIGOPT which allows any \$INCLUDE files which include new signal timings to be updated “in situ” rather than embedding them within the new .dat file (as was previously done by default). The new option – being much more useful - is now chosen by default even though it differs from previous practice. See 15.31.6.1. Version 11.4.01. 29/06/16.
- 11) Link and/or turn time travel times as experienced by buses, in particular in the presence of bus lanes where they may differ from “normal” travel times, may now be selected for annotation. See items 127 and 128 in App I.1.4. 11.4.01. 09/07/16.

- 12) Average junction delays per simulation link may be selected with the weights set by UC flows rather than total flows; e.g., to differentiate between junction delays for LGV and HGV. See item 129 in App I.1.3. 11.4.01. 20/07/16.
- 13) A new simulation node convergence parameter has been added – the total number of internal iterations required to set the lane choice and/or reduction in capacity due to lane sharing. See item 43 in App.I.3 and Section 8.8.5. 11.4.04. 19/09/16.
- 14) An option has been included under node graphics to “extend” the nominal length of each input arm. This may correct a potential problem of junctions with many arms and/or lanes being “too big” for the space provided. See 11.12.3.1. Version 11.4.05. 19/12/16.
- 15) A further option under Node Graphics allows the entry angles for each arm to be determined **either** by the co-ordinates of the A-node or by a curved line as set on a .GIS file (if it exists). The previous default was to use the GIS line. See 11.12.3.1. 11.4.5. 20/12/16.
- 16) The Namelist Parameters included on a re-created network .dat file may now be restricted to those with **non-default** values only. In addition they may be output with either 1 or 4 parameters per record. See 11.4.2.1. 11.4.05. 23/12/16.
- 17) The default is now set to use spider web for analysis if possible (USESPI=T), with the default in the default DAT files provided for P1X (P1X0.DAT) also being changed. Previously the DAT file had USESPI=F so care may need to be taken when copying changes from earlier versions and/or using earlier versions as the behaviour may change. 11.4.06. 03/02/18.

D.22.5 MX

- 1) The rules governing the format of the control file used for MXM5 (editing zones) have been extended to allow a continuation record for a zone which is being sub-divided into >5 new zones to be indicated by a **blank** in columns 1-5 as an alternative to repeating the old zone name. The main (only?) advantage of the new option is that it “looks right” and is similar to continuation records elsewhere but it is risky in that it may get confused with other situations where leaving the first 5 columns blank is used to indicate that a totally new zone follows in columns 1-6 only. So available but not recommended. 11.4.01. 21/06/16.

D.22.6 SATPIJA

- 1) The default value of USEUFO is now taken from the input network .UFS file, i.e., the value set under &PARAM in the .dat file. Previously the default was always .FALSE. See Section 13.2.1 and 13.3.14. Version 11.3.15. 19/02/16.

D.22.7 SATME2

- 1) Extra checks have been added to detect “incorrect” input .UFP files, e.g., with multiple entries from the same O-D pair – which hopefully will no longer occur since certain bugs have been corrected in **SATPIJA**. 11.3.16. 20/02/16.

D.22.8 SATLOOK / Skimming batch files

- 1) Various batch files to skim, e.g., times or distances, now allow skimming to be carried out on a network with multiple user classes for a **single** user class using the command line token “UC n”. This applies to SKIM_ALL, SKIMTIME, SKIMDIST, SKIMTOLL, SKIMPEN, SKIMDA and SATC_AV. See 15.27.7.3. Version 11.4.05. 20/12/16.
- 2) The default is now set to use spider web for analysis if possible (USESPI=T), with the default in the default DAT files provided for SATLOOK (SATLOOK0.DAT) also being changed. Previously the DAT file had USESPI=F so care may need to be taken when copying changes from earlier versions and/or using earlier versions as the behaviour may change. 11.4.06. 03/02/18.

D.22.9 SatWin

- 1) Updates to SatWin graphical user interface (GUI) to provide compatibility with the new SatView and SatCoder products along with a general refresh. The new version is called SatWin v11.4 and will be released as part of SATURN v11.4.

D.22.10 SatView

- 1) A number of enhancements have been made to SatView as part of the v1.18 release published in July 2017. These are described in the corresponding v1.18 Release Note.
- 2) The UFS2UFV batch process, as described in Appendix X, has been updated to provide additional Data Fields in SatView v1.20 onwards. 11.4.05. 23/11/17
- 3) SatView v1.20 published in November 2017 (in parallel with the UFS2UFV updates identified above) as part of the wider SATURN v11.4 release.


D.22.11 SatStat

- 4) Additional reporting with the last four loops for LPT Tables 2 (Total Assignment hours) now exported to the CSV file for the Highways England RTM. Corresponding updates to the SatStat Excel spreadsheet. NB that the changes are not backward compatible. Changes undertaken for SatStat (v3.50) and SatStat Summary Report.xlsx (v4.30). 11.4.05S. 23/11/17

D.22.12 General Changes

None

D.23 Version Control

JOB NUMBER: 5157408		DOCUMENT REF: App D.doc				
Revision	Purpose / Description					
		Originated	Checked	Reviewed	Authorised	Date
10.9.10	SATURN v10.9 Release (absorb App D17)	DVV	DG	IW	IW	04/09/09
10.9.12	SATURN v10.9 Release (Full)	DVV	DG	IW	IW	22/10/09
10.9.22	Web release – Dec 10	DVV	AG	IW	IW	06/12/10
10.9.24	SATURN v10.9 Release (Full)	DVV	AG	IW	IW	06/05/11
11.01.09	SATURN v11.1 Release (Full)	DVV	AG	IW	IW	31/03/12
11.2.01	SATURN v11.2 Beta Release (absorb App D19)	DVV	JS	IW	IW	07/12/12
11.2.05	SATURN v11.2 Release (Full)	DVV	JS	IW	IW	17/03/13
11.3.03	SATURN v11.3 Release	DVV	EN	IW	IW	28/03/14
11.3.07	SATURN v11.3.07 Release	DVV	DAS	IW	IW	26/09/14
11.3.10	SATURN v11.3.10 Release	DVV	DAS	IW	IW	22/01/15
11.3.12	SATURN v11.3.12 Release	DVV	DAS	IW	IW	22/04/15
11.3.12+	SATURN 2016 UGM (absorb App D21)	DVV	DAS	IW	IW	31/10/16
11.4.06	SATURN v11.4.06 Release	DVV	DAS	IW	IW	18/01/18