

## D.21 Changes in SATURN 11.3

### DATE OF LAST UPDATE: 20<sup>th</sup> SEPTEMBER 2016

**SATURN** 11.3 is the successor to all previous versions of **SATURN**. Following the full release of SATURN 11.2.05 in March 2013 a series of largely internal releases appeared numbered from 11.2.06 up to 11.2.12 in January 2014. Version 11.3.01 (effectively 11.2.13) was then released in Beta version, with a full release of 11.3.03G in April 2014. Further update releases of 11.3.07K took place in October 2014, 11.3.10E in January 2015, 11.3.12F in April 2015 and 11.3.12U in November 2015.

As always, in terms of backwards/forwards compatibility, the 11.3 network .dat files may contain new features (e.g., parameter names) which will **not** be recognised by pre 11.3 versions of **SATNET** but will not cause the program to crash; however pre 11.3 .dat files will be read perfectly happily by 11.3 **SATNET**. Similarly 11.3 network .ufs files contain new arrays which older version exe's will be able to read but not recognise whereas 11.3 exe's will be able to read pre 11.3 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 limited number of minor changes to the simulation but nevertheless one might expect 11.3.12 to give different – possibly significantly different – results to both earlier 11.3.xx versions **and** pre 11.3. Our advice therefore would be to re-run old networks “from scratch” and certainly: (i) not to do comparisons between 11.3 outputs and pre 11.3 outputs; and (ii) **check** the differences between 11.3.12 outputs and those from earlier 11.3.xx releases.

The following sections describe the changes made in **SATURN** 11.3 (and/or in the later versions of 11.2). Each note should give the precise release number in which the change was introduced (e.g., 11.3.2), the date and references to relevant sections in the Manual.

### D.21.1 SATNET and Network Definitions

- 1) The rules for NOXYC = T have been relaxed such that if zones are identified within 55555 co-ordinate data records by their numerical range only (i.e., a C is not used in column 1 to designate a zone) then if a number in the correct range ( $\leq$  MAXZN) cannot be identified as a zone it is tested as a node number. 11.2.6. 18/05/13.
- 2) An extra set of dummy links have been included at external simulation nodes with two or more connections to internal simulation nodes in order to allow all possible turns to/from internal simulation nodes. In particular this has important implications for the way in which .UFC route flows are converted into UFO flows and, in general, reduces the differences between the two sets of alternative link flows. See 18.9.3. Version 11.2.6. 11/06/2013.
- 3) The maximum number of count sets under 77777 increased to 405 from 120. Version 11.2.8. 15/09/13.

- 4) The maximum number of records contained in the network “history file” has been increased from 20 to 101. 11.02.09. 14/10/13.
- 5) Certain error messages related to links, not nodes (e.g., warning 42 for counted links which are bridged by centroid connectors) are now associated with the nodes at either end of the link. 11.2.09. 01/10/13.
- 6) Free-flow and capacity times as input on simulation link speed-flow records may now be input as pure delays which are to be added to the normal link cruise times as opposed to inputting total travel times as previously. See 6.4.12.2. 11.2.10. 24/11/13.
- 7) New advice has been provided on how to model mid-link pedestrian junctions as simulation nodes or, preferably, as part of link capacity-restraint curves. See 6.4.3.6 and 6.4.12.3. 11.2.10. 24/11/13.
- 8) A new logical Namelist parameter BYCAPI has been added to control the calculation of disaggregate summary statistics. Thus, in order for statistics by capacity index to be calculated by **SATALL/SATSIM**, BYCAPI must be T (and the alternative BYGRUP = F). In previous releases BYCAPI was, in effect, T. See 15.59.2. 11.2.12. 01/02/14.
- 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: (a) KONSTP = 5 (**both** flow **and** GAP criteria need to be satisfied), (b) PCNEAR = 1.0%; (c) ISTOP/RSTOP = 98%/97/5%; and (d) NISTOP continues as 4. Release 11.3.2. 14/03/14.
- 10) A minor change under AUTOX: if a link distance is not available for a new external link the distance is calculated from the crow-fly distance instead of a default of 100 m (assuming that SHANDY = T which it should be). See Section 15.12. Release.11.3.2. 17/03/14.
- 11) A new Serious Warning 187 identifies a problem with X-turns at signals where some green phases are terminated by a late (unopposed) cut-off but some are not. The problem is whether TAX is allocated or not. See Section 8.2.4.1. Release 11.3.4. 16/06/14.
- 12) If FREE77 = T in a network .dat file then the **whole** 77777 record **including** the node definitions is now read in free format, not fixed columns, so that it is now (normally) essential that a value of zero is explicitly included as the C-node when A-B denotes a link. See note 13), 6.10. There are, however, two exceptions to the rule of an explicit C-node; (1) if there are only 3 items in total on the line they are assumed to be “A B Count” and (2) if the 3<sup>rd</sup> item is real (i.e., has a decimal) then it is assumed to be a count, not a C-node. See note 14), 6.10. Release 11.3.4. 01/05/14.
- 13) The check for very small stacking capacities has been tightened up such that a stacking capacity of less than 1 PCU per lane now leads to a Serious Warning 188, given that such small stacking capacities can play havoc with the convergence of blocking back calculations. In addition the test is now based on **chain** stacking capacities. Release 11.3.5. 25/06/14.

- 14) Serious Warning 165 – an X-turn at signals has two or more lanes allocated and the inside lane is shared with, say, straight ahead traffic – is no longer applied if the straight ahead traffic has other (further inside) lanes that it may use if the shared lane is blocked by the X-turners. Release 11.3.5. 26/06/14.
- 15) New checks have been introduced such that data which is normally read in fixed columns (e.g., powers and capacity indices within 11111 and/or 33333 link speed-flow records and counts under 77777) is also read using free format which should give the same result. Any differences – which may be due to data in incorrect columns – are flagged as either Serious Warning 189 (link speed-flow) or 190 (counts). Release 11.3.6. 20/07/14.
- 16) A .RGS file may now be input directly into **SATNET** in order to define updated signal stage timings (parameter FILRGS) – as opposed to using the network edit facilities in P1X to update the settings after the network has been built by **SATNET**. See 6.3.4, 6.4.3.5 and 11.9.14. Release 11.3.11. 07/02/15.
- 17) FILBMP, input under &PARAM, may now be used to define a **folder** where the bitmap files are located as opposed to a specific file. See 11.3.6. Release 11.3.11. 01/03/15.
- 18) The available data to store the equivalent network links per each spider link has been increased such that it is unlikely to cause the Spider aggregation of nodes to terminate prematurely. In practical terms this means that CPU run times under SPIDER have been improved. 11.3.12. 02/04/15.
- 19) The default value of MAXSPA, the maximum number of arms under which a node may be aggregated under SPIDER, has been reduced from 30 (a silly value which has always been the default!) to 15. Which, as with 18), should also improve run times with SPIDER. See 15.56.3. 11.3.12. 02/04/15.
- 20) 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.
- 21) 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.
- 22) 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.
- 23) 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.

- 24) 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 14.9. 11.3.17. 22/04/16.
- 25) 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). 11.4.1. 18/06/16.
- 26) 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). 11.4.1 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.

## D.21.2 SATALL

- 1) The algorithms used to calculate .UFO files from Frank-Wolfe .UFC files have been substantially improved in release 11.2.05 both in terms of their accuracy but also in terms of the required CPU time. In particular a multi-core element has been introduced and enabled when MULTIC=T (and which effectively renders SATUFO\_MC redundant). See 15.53. In addition further significant improvements have been introduced in version 11.2.7 – 18/06/13 (and subsequently incorporated into version 11.2.05U as well).
- 2) Continuation runs of SATALL (e.g. SATALL net MASL 1) will **not** now automatically create .UFC files by running an extra SAVEIT assignment **unless** the parameter SAVEIT is explicitly entered on the command line (e.g., SATALL net MASL 1 SAVEIT). The reason is to avoid wasting extra CPU time when it may not actually be required. See 9.12.1.1. Release 11.3.3. 01/03/14.
- 3) 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**. Release 11.3.14. 06/07/15.
- 4) 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. Release 11.3.14. 01/08/15.
- 5) 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. Release 11.4.4. 17/09/16. [Currently not implemented in Multi-core version]

### D.21.3 Simulation

- 1) Further revisions to the modelling of flares have been made, in particular to deal with the situation where the “straight ahead” traffic that shares with the flared turn can use two or more lanes such that traffic from the “non-flared” lane can move over into the “flared” lane to take advantage of the space available in the “flared” lane which is not being fully utilised. See section 8.2.6.3. 11.2.8. 01/10/13.
- 2) New rules have been introduced to deal with situations where a link with an explicit capacity limit (i.e., from a speed flow curve) has an arrival flow exceeding its capacity such that all the exit turns are aggregated into a single “river” (see 8.8.2). Thus, for example, random delays per turn are calculated for the river/link as a whole rather than individually. However if the lanes are already shared then the new rules do not apply. In practice, this will only apply to considerably fewer than one link per thousand. 11.2.9. 03/11/13.
- 3) Output simulation summary statistics (as output by either **P1X** or **SATLOOK**) may now be disaggregated either by traffic borough (using TfL conventions) or by explicitly defined node “groups” defined by a .N2G file (FILN2G in .dat files). See 5.1.7, 11.11.4 and 15.59. 11.2.9. 03/11/13.
- 4) Flow-weighted average link times which include the effect of CLICKS on certain user classes are calculated and stored as either DA code 4008 (weighted by vehicles) or 4018 (or weighted by PCU) in output .ufs files from **SATALL**. See 15.47.4. 11.2.10. 11/11/13.
- 5) A number of relatively minor “improvements” have been made to the node simulation, primarily to deal with a number of “funnies” in the lane allocation algorithm and/or flows in excess of mid-link capacities. Overall differences are expected to be small. Release 11.3.2. 17/03/14.
- 6) Similarly a number of minor “improvements” have been made to the way in which assignment speed-flow curves are calculated based on simulation data, hopefully resulting in marginal improvements to the overall convergence. Release 11.3.3. 22/03/14.
- 7) A further addition to the modelling of flares extends the principle outlined in 1) above where turning movements which “share” a lane with the flared movements are allocated extra capacity in an adjacent lane. Now “other” turning movements which share that adjacent lane may also have their capacities increased (the “knock-on effect”). This is applied to both signals (11.3.6) and, subsequently, priority junctions (11.3.7). See Section 8.2.6.3. 11.3.7. 05/08/14.
- 8) An error has been corrected in the calculation of total network bus-hours and bus-kms. Previously, if a link had a bus lane but certain bus routes on

that link were deemed **not** to use the bus lane (e.g., the route took an exit from the offside lane but the bus lane was on the nearside) then those buses were excluded from the calculations. The new bus-hrs etc. are therefore very marginally larger than the old. The same correction also applies to total pcu-hrs etc. Release 11.3.7. 23/08/14.

- 9) A small adjustment in the lane choice model improves the allocation of flows to 2 or more lanes which are only used by a single turning movement. Examples where this applies (a) are rare and (b) have very little overall impact on delays etc. but the 11.3.8 simulation will produce marginal differences from previous versions. Release 11.3.8. 12/11/14.
- 10) In addition to correcting a “clear” error with flared plus filter turns (see 21) in App.E.9) further minor refinements have been made to the lane choice model in 11.3.10, the end result being that 11.3.10 gives different simulation results from previous releases. 11.3.10. 16/01/15.
- 11) 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.
- 12) 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.
- 13) Minor changes have been made to the modelling of blocking back. 11.3.15. 18/11/15.
- 14) 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. Version 11.3.15. 09/15.
- 15) 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.
- 16) 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.

- 17) 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 11.4.3. 20/09/16.

#### D.21.4 P1X and/or SATDB

- 1) A new option has been added when adding Capacity Indices as global variables to a .dat file to ensure that all data in columns 11 to 40 is blanked out so that the newly defined index will uniquely define the link speed-flow curve. 11.2.6. 24/04/13.
- 2) An added option under ME2 Analysis allows links which were included in a particular combined (666) constraint set to be selected, thereby making their identification much easier. Sections 11.8.5 and 13.8. 11.2.6. 26/04/13.
- 3) Furthermore, a selected set of combined constraints may be subject to Select Link Analysis directly, the prime function of which would be to detect multiple crossings. (Alternatively, a set of 666 combined constraints may be selected as a screen line under SLA although it is more convenient to do it under ME2 Analysis.) 11.2.6. 28/04/13.
- 4) The use of solid bars to indicate selected links which are currently centred on the link independent of which direction is selected may now be made “directional”, i.e., along the direction of travel. 11.2.6. 27/04/13.
- 5) Zones may now be nominated numerically using their **sequential** numbers as opposed to their “name”, e.g., in selecting origins and destinations for tree building. 11.2.6. 06/05/13.
- 6) Joy rides and analyses of timed routes (Validation) may now alternatively use average stop delays as calculated on a link AB rather than the turn-specific delay at B. See 11.7.2.1 and 11.8.2. 11.2.6. 11/06/13.
- 7) SLA calculations based on .UFC files now use double precision variables in order to avoid “losing” trips due to rounding errors. 11.2.7. 18/06/13.
- 8) There is a subtle change in the output statistics for SLA link flows in that the original Demand and Actual flows now **exclude** any fixed flows so that they are more directly comparable to the reported SLA flows which also do not include any fixed flows. 11.2.7. 18/06/13.
- 9) A new batch file, P1XDUMP, similar to DBDUMP will also dump selected data from a .UFS file to text files but using the **P1X** internal codes (see Appendix I.1) rather than DA codes. See 15.46.2. 11.27. 30/08/13.
- 10) Two new options under Information list (a) the “History Records” (6.2) on their own and (b) all the “must have” files, i.e. all the files such as the trip matrix file which are essential to run this network plus a list of all the \$INCLUDE records from the original .dat file which also are “essential” files. See 11.8.4.10 and 11.8.4.11 respectively. 11.2.9. 11/10/13.
- 11) TfL Traffic Boroughs and/or Groups per node/zone may be selected as node data for display either in **P1X** plots or in **SATDB** node data bases. 11.2.9. 03/11/13.

- 12) KEY file control may be initiated from within **P1X** rather than via the command line. Access is via the Files Menu. See Section 11.4.5. 11.2.10. 16/11/13.
- 13) 2 new options in **SATDB** Miscellaneous Data add (a) link saturation flows and (b) number of lanes per turn with **negative** values to indicate bus only (following the conventions used for data inputs in **SATNET**). See Section 11.6.10.8. 11.2.10. 23/11/13.
- 14) An option "SLA in a Basket" has been provided in order to undertake SLA calculations in a semi-batch mode. Basically the user selects a set of SLA's which are added to a "basket" and, at the end of the SLA selection, the full set of calculations take place, at the end of which the program terminates. Ideal to set up a long weekend run on Friday afternoon! See Section 11.8.1.14. 11.3.3. 22/03/14.
- 15) The maximum number of selected nodes within SLA has been effectively doubled from 9 to 19. 11.3.3. 22/03/14.
- 16) A policy of minimising the number of "to screen" operations which take place while **P1X** is running in KEY-VDU mode has been initiated on the basis that there is no real reason to, e.g., mark selected nodes with a star on the screen if nobody is looking at it. Hopefully this will reduce the number of times **P1X** outputs "interrupt" concurrently running windows. 11.3.5. 19/06/14.
- 17) A new option (#30) in the standard tables for simulation nodes lists all the link times and speeds including, per user class, the extra delays due to CLICKS. The vehicle- and PCU-weighted times/speeds are also printed. Section 11.11.1. Version 11.3.5. 27/06/14.
- 18) Under node graphics editing, a node may now be simulated even if it has warnings etc. that have been upgraded to Fatal Errors under **WRIGHT = T** but with a **NAFFS ALERT** message attached. So if the program crashes you have been warned! 11.3.5. 08/07/14.
- 19) Information on (bus) routes may now be restricted to certain **classifications** of routes, e.g., only routes with timing points, only routes with positive bus frequencies, etc. See 11.8.4.2. 11.3.07. 18/08/14.
- 20) When tracing routes link by link, e.g., a bus route or an O-D tree as joy-ride, the display of every individual link data in the banner (which may take a large number of clicks to work through) may now be fast-forwarded to the end of the route by clicking on Up1 in the menu bar. 11.3.07. 20/08/14.
- 21) Routes may now be optionally nominated by typing in their text name rather than pointing to a line in the banner. 11.3.07. 25/08/14.
- 22) A new option under Files/Output creates a Bus Route text file with one record for every link within every coded route. The format is ad hoc and has been created at the request of one particular user; extensions/modifications could be easily accommodated. See 11.4.2.4. 11.3.07. 05/09/14.
- 23) The modelled times used in the Validation of routes may now be based on times which include contributions from added CLICKS delays, either for an



individual user/vehicle class or a weighted average by vehicle or PCU flows. Such times may correspond more closely to the sources of the observed travel times. See Section 11.7.2.1. Version 11.3.07. 09/09/14.

- 24) Similarly CLICKS times may be added to the cumulative times for joy rides. See 11.8.2.3. 11.3.07. 10/09/14.
- 25) Two new data items have been added to the standard lists of node data: (1) the maximum reduction in V/C per node following signal optimisation and (2) the maximum stage length shift following optimisation. 11.3.08. 7/10/14.
- 26) Requests to list the full data base contents (link and/or node) to the screen may now be requested directly from the graphics menus where link and/node data is added. 11.3.08. 7/10/14.
- 27) Under Convergence/10 Worst listings the lists may be restricted to a single entry per node or per link – as opposed to the current practice where entries are printed per individual turn so that, say, it is possible for all 10 worst entries to refer to the same simulation node. 11.3.08. 7/10/14.
- 28) Under Convergence/10 Worst listings the data may also be stored directly as a data base column (either link or node) and an ordered list may be optionally displayed directly from the Convergence menu. This enables the top 20, 30, etc. entries to be displayed rather than simply the top ten. See 11.15.2. 11.3.08. 7/10/14.
- 29) An option has been added to exclude any pre-loaded flows from the Demand or Actual annotated link flows. The option may be toggled on or off under the Options sub-menu within Choice of Link Anno menu; the default is **not** to exclude pre-loaded flows but this may be changed via the namelist parameter INC\_PL within the latest versions of p1x0.dat. 11.3.09. 14/12/14.
- 30) Bandwidth annotation with multiple data entries now correctly follows curved GIS links. 11.3.12. 02/04/15.
- 31) The latest Silverfrost (formerly Salford) graphics library used necessitated a small change in the graphics handling. The user may notice a change in the colour palette, for example "orange" now looks more orange than the previous browner colour. 11.3.12. 15/04/15.
- 32) Stacking capacities may now be defined by negative values as part of the network editing process. 11.3.14. 08/07/15.
- 33) 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.
- 34) 6 new link display variables have been added; 2 based on %differences between successive loop flows (as used to calculate %FLOWS/ISTOP stopping criterion) and 4 based on SAVEIT and UFO link flows. See Appendix I.1.2. 11.3.16. 06/03/16.
- 35) 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. 11.3.16. 07/03/16.

- 36) 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. 11.3.17. 12/04/16.
- 37) 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. 11.3.17. 12/04/16
- 38) 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. 11.3.17. 20/04/16.
- 39) “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.
- 40) 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. 11.4.1. 26/06/16.
- 41) 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 11.4.1. 29/06/16.
- 42) 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. Version 11.4.1. 09/07/16.
- 43) 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. Version 11.4.1. 20/07/16.
- 44) 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. Version 11.4.4. 19/09/16.

**D.21.5 MX**

- 1) An internal matrix within MX may be designated as a TfL matrix via a toggle option 16 under Main Menu Option 1, following which certain new options become available. See point 4) below. 11.2.1. 27/11/12.
- 2) Added option to set all row/zone “names” to their sequential values; useful, e.g., after editing and/or renaming the current set of zones. Option 15 from main menu 1. 11.2.6. 11/06/13.
- 3) An option to automatically compress a matrix based on TfL zoning conventions to a 45 x 45 traffic borough matrix has been created. See Section 10.4.4 for the aggregation of the internal matrix and 10.16.4 for the output of an aggregated .ufm matrix. 11.2.9. 08/10/13.
- 4) Similarly, more general options compress a zone-to-zone matrix into a “group-to-group” matrix based on a .Z2G control file (where a “group” could be a “sector”, a traffic borough, etc. etc.). See 10.4.4 and 10.16.4. 11.2.11. 16/12/13.
- 5) By contrast another option “expands” or “decompresses” a matrix defined in terms of, say, group to group movements into one defined by zone to zone movements whereby all zone-to-zone values take the **same** corresponding group-to-group cell value. This could be applied to a matrix of, say, OD costs or factors but **not**, logically, to a trip matrix where the group-to-group trips would need to be factored down when disaggregated to a zonal level. See 10.4.5 and 10.16.5. 11.2.6. 11/06/13.
- 6) Batch files to automatically carry out new options 3), 4) and 5) above have also been created: MXZ2G, MXZTB and MXG2Z. See 10.20.22/23/24. 11.2.11. 16/12/13.
- 7) The “structure” of .UFM files has been enhanced such that a matrix which has been compressed from zone-to-zone to group-to-group “remembers” the original zone definitions and the correspondence between zones and groups such that the original zonal matrix can be automatically opened and/or re-created without direct user intervention. 11.2.12. 05/01/14.
- 8) The “order” of the options under main menu item 14 – create an output .UFM file – has been “rationalised” such that the option to use an M5 control file is now number 3, not 5. This may therefore affect any user-set key files which use the M5 option such that an entry 5 must be changed to 3. In case of queries please contact DVV and/or Atkins. 11.2.12. 05/01/14.
- 9) A “reboot” option allows the original command line to be re-processed if the zonal structure has been transformed in some way. The idea is that if you input a zonal matrix and then compress it to a group matrix (see points 8 and 9 above) in order to “view” the matrix in terms of group-to-group you may return to the original zone-to-zone version. This therefore gets around a “feature” of **MX** whereby you cannot store a zonal matrix and a group matrix in internal memory at the same time but this way you can swap between them. See 10.4.6. 11.2.12. 18/01/14.

- 10) A new batch file MXDIVIDE divides one matrix by another cell by cell. It is useful, for example, to calculate growth factors between two trip matrices. See 10.20.25. 11.1.12. 01/01/14.
- 11) 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. 11.4.1. 21/06/16.

### D.21.6 SATPIJA

- 1) A Namelist option USEUFO allows **SATPIJA** to use a .UFO file – assuming that one has been created for the network in question either by using OBA in the first place or by SAVUFO/SATUFO with Frank Wolfe – in preference to a .UFC file, potentially resulting in very much reduced CPU times. See 13.3.14. 11.2.7. 20/06/13.
- 2) The calculations based on .UFO inputs (i.e., following either OBA or SATUFO with USEUFO=T) have been made faster and now include the test to exclude IJ cells from the output .UFP file if there are zero trips in that cell in the trip matrix. 11.2.7. 03/07/13.
- 3) A new Namelist parameter USESPI = T allows calculations to be based on spider networks. But, N.B., **not** yet available for all options; e.g., it does not work with GROUPS = T. Proceed with care! 11.3.7. 10/08/14.
- 4) 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. 11.3.15. 19/02/16.

### D.21.7 SATME2

- 1) The output .ME2 file has been extended so that it contains, e.g., target flows, errors, etc., per combined constraints but associated with each of the individual links. Thus in **P1X** all the links within the same combined set will have the same attributes displayed which makes it easier to identify combined sets. See Section 13.8. 11.2.6. 22/04/13.

Matrix estimation may now be undertaken based on aggregates of zones (e.g., sectors, traffic boroughs, etc.) rather than individual zones, involving changes to both **SATPIJA** and **SATME2**. See Section 13.5. 11.2.12. 03/02/14.

- 2) The .LPM file now gives a complete list at the bottom of all the Warnings etc. encountered during the run and the number of times each has occurred. In addition all errors have been assigned numbers. 11.3.5. 09/07/14.
- 3) Two extra output tables, 12c and 12d, have been added to do a basic statistical comparisons of the trip matrix trip ends, input and output, as

required (in part) for standard DfT TAG Unit M3.1 (previously Unit 3.19) Table 5 statistics. 11.3.6. 28/07/14.

- 4) In addition a full summary table of those statistics required by DfT TAG Unit M3.1 (“Table 5”) has been included. 11.3.6. 28/07/14.
- 5) The maximum number of counts permitted in Levels M1 to N1 has increased by up to 6% whilst the maximum number of count and zonal constraints permitted in Levels S – M3 and N2 has increased by between 16% and 83%. 11.3.12U. 25/09/15.
- 6) 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.21.8 SATLOOK / Skimming batch files

- 1) A new batch file SKIMDA has been created in order to do a forest skim on **any** DA code as opposed to, say, SKIMDIST which operates using a specific DA code. See 15.27.7. 11.2.08. 29/09/13.
- 2) Network summary statistics, which previously could be output disaggregated by link capacity indices, may now also be disaggregated either by “traffic boroughs” defined by TfL zonal name definitions or, more generally, into “groups” as defined by an input file FILN2G as set in the original network .dat file or interactively defined within **SATLOOK**. See 11.11.4 and 15.59. Version 11.2.09. 12/10/13.
- 3) An option has been added under main menu option 4 to allow statistics for **all** different types of flows to be printed in a single pass (and also therefore output to a CSV file in a single pass). 11.2.12. 12/02/14.
- 4) Bus summary statistics (main option 6) now automatically create a CSV file with one row per route containing all relevant statistics, such as travel times, distances etc. 11.3.07. 08/09/14.

#### D.21.9 New SPIDER Network Applications/SATCH

- 1) New Namelist variables USESPI and USEUFO have been added in **SATCH** in order to more easily turn on or off the use of SPIDER networks and/or UFO (in preference to UFC). See 12.1.1.3. Version 11.2.11. 18/12/13.
- 2) **SATCH** now calculates and prints the average times and distances for all O-D trips entering/leaving at each cordon point based on the link times and distances used by those trips outside the cordon. These calculations are carried out as part of the trip matrix calculations (so DOMAT = T) and – at the present time – only if a .UFC file is used without SPIDER (USEUFO = F and USESPI = F). See 12.1.14. Version 11.3.14. 29/06/15.
- 3) Multiple “islands” of simulation nodes within a “sea” of FCF nodes may now be created using multiple runs of **SATCH**. See 12.1.11. Version 11.3.15. 10/11/15.



### D.21.10 General Changes

- 1) The “rules” for using 99999 to terminate data inputs have been tightened up for certain input files, for example, the input to MXM5 as described in Appendix W, so that “truncated” 99999 records such as a single 9 followed by two or more blanks no longer are interpreted as an end of data set record. This means that defining zones or nodes with numbers such as 9, 99, etc. will no longer be misinterpreted as end of data sets. N.B. These changes do **not** apply at all to **SATNET** inputs. 11.2.08. 15/09/13.
- 2) For all interactive programs such as **P1X**, **MX**, etc. a listing of the .LOG file is given at the bottom of the .LP file – useful for recreating the run without necessarily still having a copy of the actual .LOG file. See 14.5.1. Version 11.2.11. 13/12/13.
- 3) The “rules” by which extensions are recognised in filenames have been tightened up so that, for example, a filename given as “network.mine”, i.e., without a standard SATURN extension such as .dat or .ufs, would not have .mine identified as a potential SATURN extension. 11.3.17. 30/03/16

### D.21.11 SATWIN

- 1) A new SATWIN graphical user interface (GUI) was developed for the 11.2 release (using Microsoft WPF) to replace the existing SATWIN version (after a decade of good service!). The new SATWIN updates the existing workflows and enables model specific set-up and operations and to be saved and re-loaded. See section 3. In August 2013, SATWIN11 Service Pack 1 (v11.6.01 Beta) was released providing:
  - An improved quick start screen providing access to your most recent Model Complex files in a single click as well as a prompt to save prior to exit;
  - Restructuring of the groups of SATURN modules and new icons;
  - Major updates to SATWIN command line calls to provide full integration with the existing SATURN batch files; and
  - Increased stability and resilience.
- 2) A restructuring of the ribbon groupings and program icons undertaken to improve the model workflow. SATWIN11 Version 1.6.02. Release 11.3.03. 28/03/14.
- 3) A new web-based help version of the User Manual created from the existing documentation to make it more accessible and easier to undertake searches and navigation. Available in Beta form. SATWIN11 Version 1.6.02. Release 11.3.03. 28/03/14.
- 4) A number of minor bug fixes undertaken following user feedback. SATWIN11 Version 1.6.03. Release 11.3.07. 19/09/14
- 5) Revisions to the (internal) handling of path/filenames to enable SATURN to correctly access data files located on Windows Servers that have disabled short names. A new function has been added to update existing batch files for earlier SATURN versions. Release SATWIN11 version 1.8. 19/12/14 (and included in the v11.3.10E release in January 2015).

- 6) A collection of updates including: (i) upgrade to Microsoft .NET4.5.1 framework; (ii) new option to specify an alternative folder location when running the test networks; (iii) several updates to the existing modules and their organisation; (iv) cosmetic changes to the user interface. Release SATWIN11 version 1.9 21/04/15 (and included in v11.3.12 release in April 2015).

#### D.21.12 DRACULA and PT-SATURN

- 1) Some overdue housekeeping – access to the PT-SATURN product has been removed from SATURN 11.3.03 onwards. Similarly, DRACULA is no longer distributed by Atkins although there is still limited access to DRACULA (e.g., under node graphics) for users who independently have access to DRACULA exes.

#### D.21.13 New Licence Levels (N4 and X7)

- 1) The existing Licence Levels beyond the standard N3 level were restructured with the v11.2 release to remove the proliferation of bespoke versions for individual applications. The source code has also been restructured to reduce memory requirements for these larger levels with a new standard 'N4' introduced.

The changes are summarised below:

Array / Level		Simulation Junctions	Assignment Links	Zones*
B to N3 Standard		Unchanged – see Section 15.28		
N3 'Standard'		21,000 (No change)	200,000 (No change)	2,000+ (No change)
Removed levels	N3 'Inter'	21,000	700,000	2,750+
	N3 'Large'	Bespoke		
N4		23,000	200,000	4,000
X7		30,000	250,000	5,750

Note: '+' if a larger version is required, please contact Atkins to discuss your specific requirements.

Note: With the internal restructuring, there may be some issues of backward compatibility for very large networks using SPIDER Network Aggregation. The networks may not be able to be opened in subsequent versions of **P1X**. In these situations, the user should revert back to the earlier version of P1X from the original SATURN version used to create them.

- 2) Revisions to the internal array dimensions for Level X7 following a request from TfL. 11.3.12. 22/04/15

IJW / DVV / DAS – 20/09/16



### D.21.14 Version Control

JOB NUMBER: 5120257		DOCUMENT REF: App D21.doc				
Revision	Purpose / Description					
		Originated	Checked	Reviewed	Authorised	Date
10.9.10	SATURN v10.9 Release	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
11.01.10	Web release- Sep 10	DVV	JS	IW	IW	14/09/12
11.2.01	SATURN v11.2 Beta Release	DVV	JS	IW	IW	07/12/12
11.2.05	SATURN v11.2 Release (Full)	DVV	JS	IW	IW	31/03/13
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
11.3.12U	SATURN v11.3.12U Release	DVV	DAS	IW	IW	16/11/15
11.4.03	Latest additions	DVV	DAS			20/09/16