



**SATURNnext Programme**  
– Area Charging  
2018 User Group Meeting

November 2018

*Final 03/12/18 - UGM2018 SATURNnext Programme – Area Charging*

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# SATURNnext Programme FY18/19

## Early Access for Users

As a SATURNnext member:

- › early hands on experience of potential new features
- › chance to influence development
- › working more closely with SATURN development team
- › potential resolution of in-house IT “problems” before Release

## Underway for FY18/19

Similar format to previous years with focus on

- › SATURN 11.5 Beta Release
  - › Classic – rerunning existing forecasts / comparing / new analysis
  - › Area Charging – learning new feature and testing on different networks
- › SATGPU Beta
- › Next SatView v1.30 (2019 Q1)



# SATURNnext Programme Requirements

## Users must be in a position to...

- › rapidly install new versions
  - › it is expected that releases will be monthly
  - › some developments may require intermediate uploads/testing
- › run basic tests and report back timely
- › be able to participate in regular forum webinars
  - › in terms of personal time
  - › and necessary communication facilities

## Software Restrictions

- › Development License
  - › will be time expiry / 'soft' licence (downloaded from internet) depending on requirements
  - › limited in number
- › so if not actively responding, we will require any licences to be surrendered

# Questions that may be asked

## Can I use it for external fee paying work?

In general, Yes BUT remember that it is at your risk – for example...

- › we may not take the development under investigation in to release
- › the development may be withdrawn as alternative methods are investigated
- › the dongle / testing license may have to be withdrawn

## Do I get my costs reimbursed?

No

## How do I register an interest?

Please register an interest by sending an email to [saturnsoftware@atkinsglobal.com](mailto:saturnsoftware@atkinsglobal.com)

We will require a few technical details which you may not have to hand so we will send you an electronic form to complete

## Do I have to sign an agreement?

Yes (when selected) to accept the terms and conditions but this has been kept to a minimum

# SATURNnext – Area Charging

Webinar Thursday 13th December 2018

Application of User Charging in SATURN

Tolls – recap of existing feature

Area Charging – the new feature

- › Coding Area based charges
- › Multiple Charged Zones
- › Multiple Charge Systems
- › Multiple Charge Regimes
- › Supplementary Charges
- › Compliance
- › Discretionary Trips

Inputting Area Tolls

Outputs and Analysis options



## Updated Section 20

SATURN MANUAL (v11.5) SATURN  
Modelling Road User Charges in SATURN

### 20. Modelling Road User Charges in SATURN

#### INTRODUCTION

Increasingly these days motorists are being asked to pay directly to drive along specific routes or to specific locations and the location and scale of these charges are planning issues. This section describes how such charges - or "tolls" as we prefer to call them - may be modelled within SATURN, with particular reference to new facilities introduced in SATURN 10.3.

Tolls arise in a number of different contexts, for example, fixed tolls to cross a bridge or to use a section of motorway, tolls levied to enter a particular area of a city (whether collected directly at a toll point or indirectly via electronic methods) or entry-to-exit motorway tolls. Other less obvious examples include parking charges.

One common feature of most tolling systems is that their impact is differential across the population of all drivers. For example tolls may differ between cars and trucks, parking charges will differ between short-stay and long-stay, etc. etc. In addition the "perceived" cost of a toll may depend critically on who is paying it. Thus most studies of charges in SATURN are carried out in the context of "multiple user classes" (see 7.3).

#### 20.1 The Role of Tolls in SATURN Modelling

Tolls are defined as a (monetary) charge per "link" (where link in this context includes simulation turns, centroid connectors, etc. as well as buffer/simulation roads) per user class so that, in the context of a route over a succession of links, they are additive. Thus we preclude the possibility of directly modelling non-additive tolls, i.e., the situation which commonly arises with entry-to-exit tolls on motorways whereby the toll from A to C is different from the sum of the toll from A to B plus B to C. Note as well that tolls cannot be defined by node either so that parking charges (which might most naturally be associated with a node/car park) must be associated with links entering that node.

Once defined the way in which tolls affect choices within SATURN is relatively straightforward: they are simply one extra component in the definition of generalised cost; see 7.11.1 and 7.11.2. As such they influence route choice within the assignment as well as the minimum o-d costs used within elastic or variable demand assignment.

Thus, within SATURN demand models proper, there are no direct facilities for "multiple criteria" modelling. For example it is not possible to define a demand function in SATURN/SATEASY which is a function of time, distance and monetary tolls separately, they are all subsumed within generalised cost. It would, of course, be feasible for users to define such complex demand functions themselves using the facilities within MX since it is quite possible to skim distinct matrices of time, distance and tolls from an assignment (although there may be certain conceptual problems of their uniqueness).

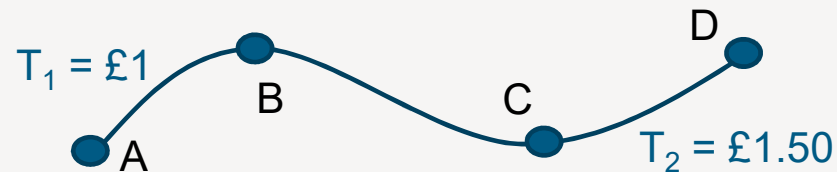
5/10/2018 / Apr 18 20-1  
Section 20.docx

## Tolls – what's currently there

Tolls are defined as (monetary) charge per 'link' per user class

- › link in this context includes Buffer / Simulation links, Simulation Turns, Centroid connectors
- › cannot be defined by Node or Zones, so need to be defined on link entering

In the context of a route over a succession of links, they are additive



$$\begin{aligned} \text{A-D Toll} &= T_1 + T_2 \\ &= £2.50 \end{aligned}$$

- › An extra component in Generalised Cost
- › influences the route choice and minimum o-d costs within elastic or variable demand assignment

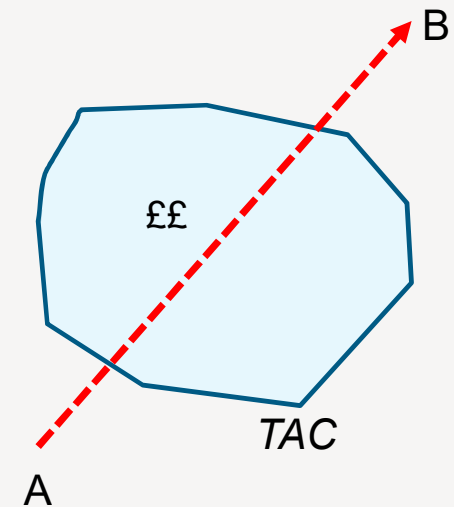
Can be used to give Penalty times or Toll Charges

## Introduction to Area Charging (i)

The system of charging whereby every vehicle using roads within an area pays a charge.

Vehicles are not actually charged at the cordon, but charged for travelling within the area.

A charged area consists of all links inside a water-tight cordon so that the area may be defined simply by specifying all the links in the cordon.

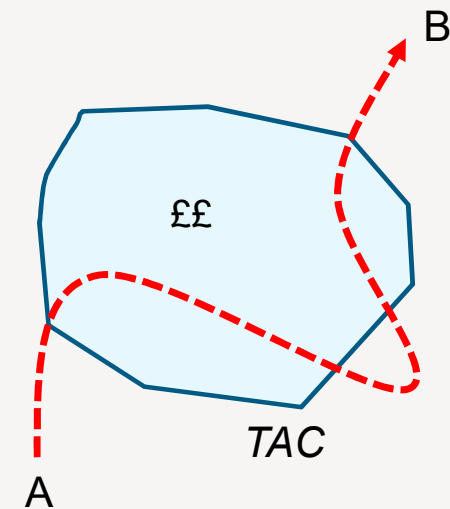


## Introduction to Area Charging (ii)

Once the charge has been paid, an O-D trip may leave and re-enter the charge area as many times as it likes without paying again.

Area-based charging differs from defining a set of tolls on all entry and exit links to the same area where a toll may be paid more than once on exit/re-entry.

Traffic that uses roads within the area but neither leaves or enters the area may be charged.



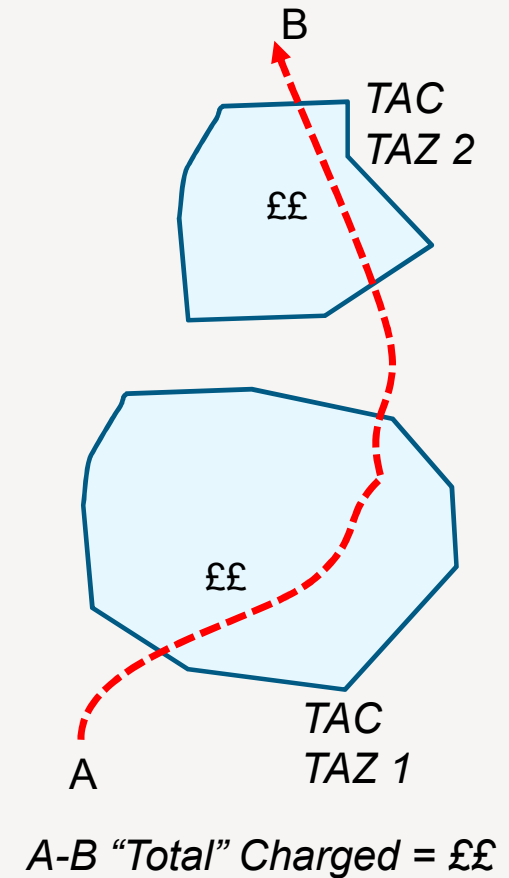


## Multiple Zones

Possible to define multiple areas with common property.

i.e. once a trip enters one area and pays the charge it can enter/re-enter any other areas with the same charge system without paying an additional charge.

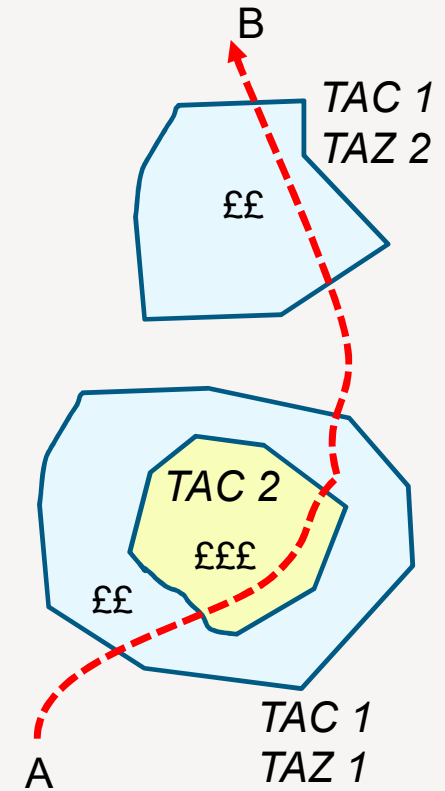
We call the individual cordoned areas “Area Zones” and one “Area Charge” can apply to multiple Zones.



# Multiple Charge Systems

Possible to have more than one charge system

i.e. multiple charge systems with different sets of charges and different sets of areas/zones

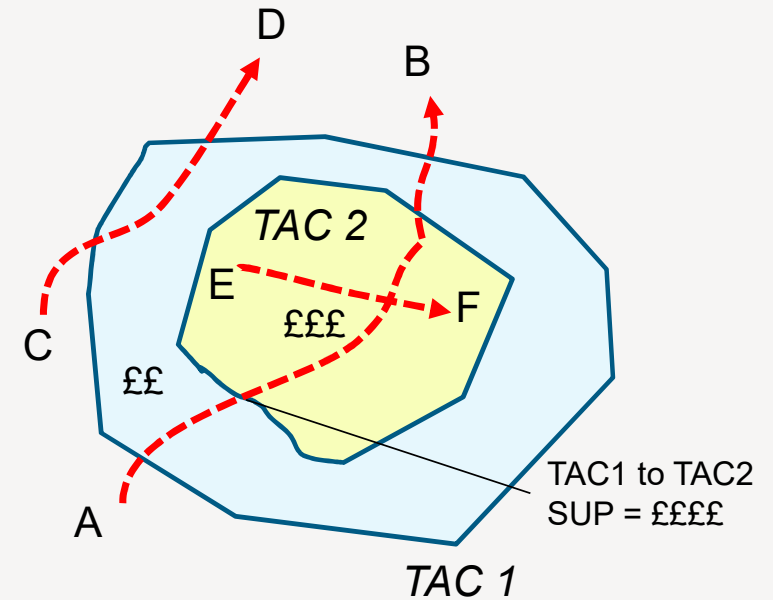


$$A-B \text{ Total Charged} = \text{££} + \text{£££}$$

## Supplementary Charge

Possible to add a “supplementary” charge for one Charge System within specific (overlapping) Charge Zones belonging to a different Charge System

i.e. an additional charge when a trip entering one charge system enters another charge system



*A-B Total Charged = ££ + £££ + ££££*

*C-D Total Charged = ££*

*E-F Total Charged = £££*

# Compliance

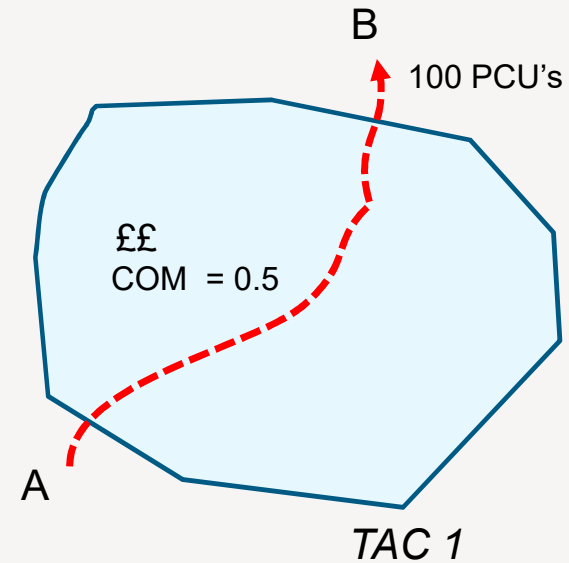
Certain classes of vehicles within particular user class might be exempt from paying within a particular charge area

› Example – Petrol cars within cars user class

This can be implemented by defining % split of user class who wont pay within a particular system

Avoids adding extra user class for compliant vehicles.

Charge system specific and can sensibly range between 0.0 to 1.0



$$A-B \text{ Total Received} = (100 \times 0.5) \times \text{££}$$

*(indicative example shown assumes charge insufficient to divert traffic around charged area)*

## Discretionary Trips

O-D trips where neither O nor D lie within a charge area but their minimum cost route involves payment of the charge (ie goes through the area) are called 'Discretionary Trips'.

If either one of the O or D lies inside a charge area itself then it has no option other than paying the charge and then are 'Mandatory Trips'.

For modelling purposes, there can be greater interest in the trips opting for discretionary charges rather than just all trips charged; with similarly interest in congestion effects from those re-routeing to avoid the charges.

# Outputs and Analysis options (i)

## Summary Statistics

- › Summary and descriptive statistics including Total paid, Total flows paying tolls, etc for each charge system

## Matrices of Trips paying charge

- › by charge regime, by mandatory or discretionary

## Minimum Cost Matrices

- › include tolls of course, but can be for compliant / non-compliant

## Average Skim Matrices

- › Time, Distance, Penalty, Toll, (“All”), DA code
- › produces two sets of matrices –
  - › disaggregated by discretionary choice of tolls paid in a blocked format
  - › as a weighted O-D average over the various choices.

## Outputs and Analysis options (ii)

### Displaying Charge Links in P1X / SatView

- › by charge regime
- › by boundary links / all links of area

### Disaggregate TAC Flows in P1X / SatView

- › by charge regime,
- › by user class

### Individual O-D routes and Forest in P1X

- › by charge regime,
- › by user class

Select Link Analysis – currently under development

# Next Steps

## Sign-up to SATURNnext

- › Please register an interest by sending an email to [saturnsoftware@atkinsglobal.com](mailto:saturnsoftware@atkinsglobal.com)
  - › Alternatively, give us your contact details today
- › We will require a few technical details which you may not have to hand so we will send you an electronic form to complete and an Agreement to sign

## Next Technical Webinar

- › Thursday 13th December 2018 for SATURN 11.5 including Area Tolling
  - › Using Skype
  - › Software will be available in advance

## What about SATGPU?

- › Separate workstream
  - › Lower uptake as requires access to specialist hardware
  - › Register above and also state interest in SATGPU
    - › *Release Software and Instructions will be forwarded*



Any questions?

Technical Skype Webinar:  
*Thursday 13<sup>th</sup> December 2018*