SATURN 101: Part 2 – Coding Signalised Roundabouts

2018 User Group Meeting

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Final 03/12/18 - UGM2018 SAT101 Part 2 Coding Signalised Roundabouts

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Part 2 – Coding Signalised Roundabouts

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Worked Example

A fictional proposal in Croydon Area

Case Study

- Croydon Area: A232 Old Town / Duppas Hill
- Signal existing grade-separated roundabout
- Enable upgraded pedestrian / cycling ‘super highway’ route

Project Stage:

- Proof of concept
  - Feed into Engineering Design
  - Initial design flows required

Model:

- Using 2041 LoHAM AM Peak
  - Cordoned out for demonstration

A232 Duppas Hill Roundabout

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Design Principles

From modeller's perspective

Signalised Gyratory

- Circulating traffic prioritised to minimise queueing within gyratory
  - Limited storage ('stacking') capacity within internal reservoirs
- Co-ordinated signals to maximise throughput
  - Major movements prioritised through platooning ('green waves')
- Entry arms used to queue excess demand

Signal Control

- UTC / SCOOT / MOVA controlled

Junction Design:

- Undertaken by specialist packages (eg LINSIG)
  - Inputs into SATURN for wider-area impacts
  - Iterative design process

A232 Duppas Hill Roundabout

Data Inputs & Assumptions

A232 Duppas Hill Roundabout

Scheme Layout

- Preliminary design
  - Assume retain existing layout incl. lanes etc

Saturation Flows

- Use TfL HAM junction coding template
  - Option available open to adjust for local conditions

Signal Timings

- Proof of concept stage so these need to be estimated
  - Assume cycle = 60s with 2 stages (25s Grn, 5s IG each)
  - Offsets need to be calculated

Traffic Flows

- Based on existing 2041 Ref Case outputs

Step through the process to code the signalised gyratory …

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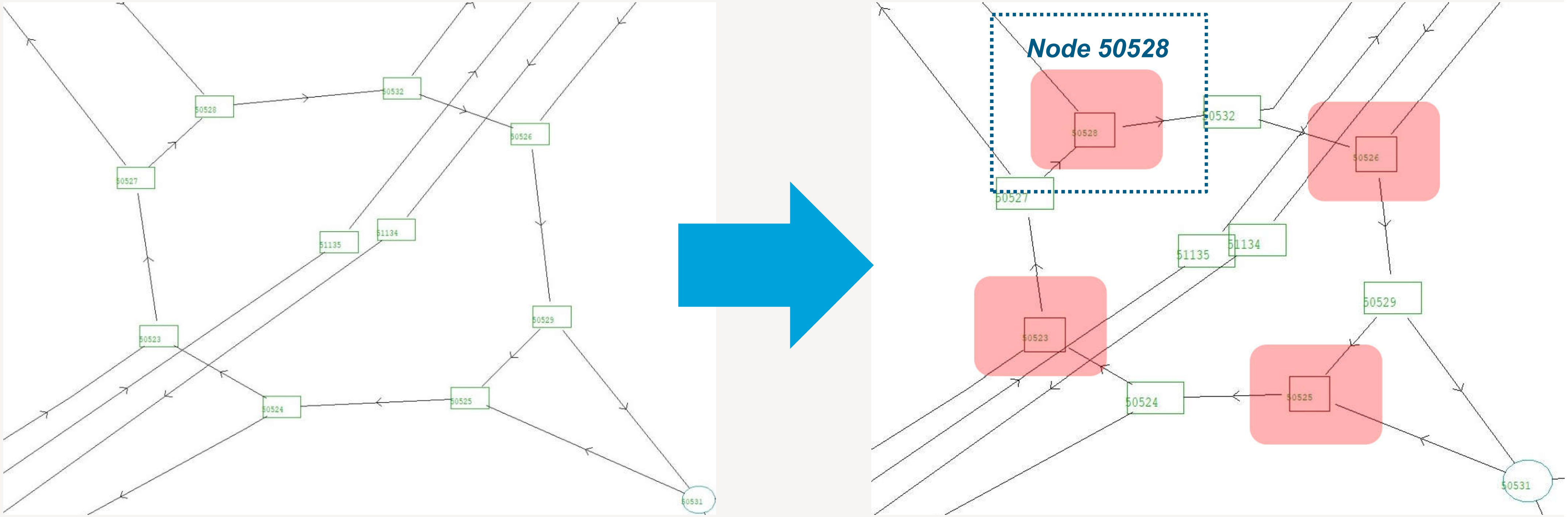
Step 1 – Update existing Junction Coding

1. Convert to Expanded gyratory if necessary
   - *Preference for separate entry / exit nodes*

2. Convert Priority (Type 1) to Signal (Type 3)
3. Update saturation flows for new junction type

Relatively Straightforward



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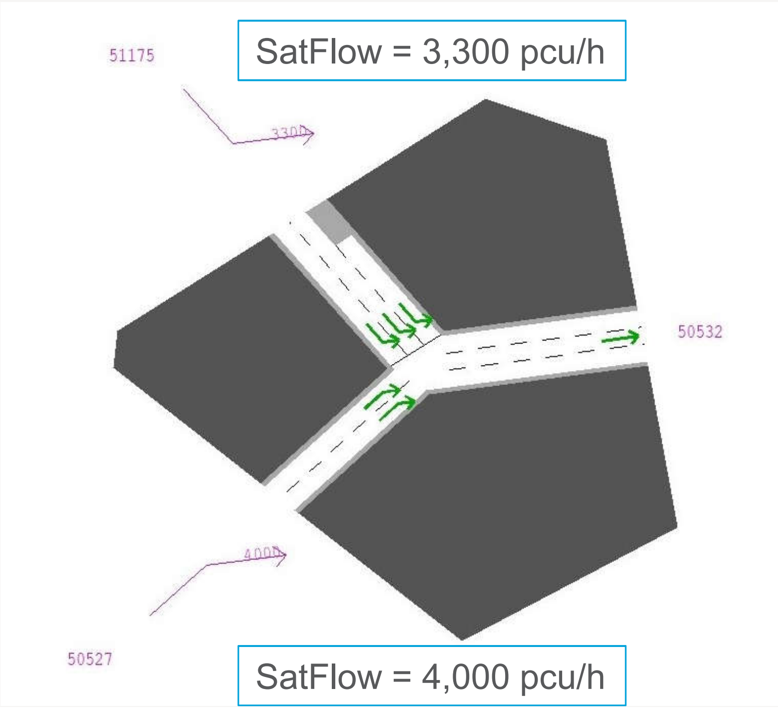
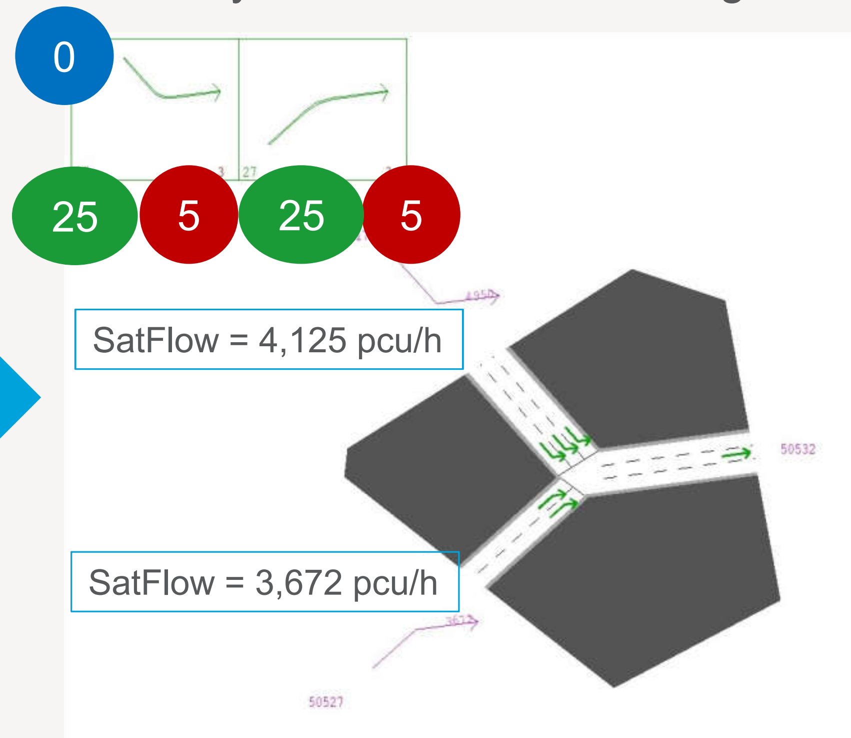
Step 2a – Junction specifics edits

Using Node 50528 as an example: (i) updated saturation flows + assumed signal timings
(ii) 2 stages with entry arm movement for stage 1





Step 2b – Junction specifics edits

Stacking capacities within the gyratory are very important

Design principle: circulating traffic prioritised to minimise queueing within gyratory

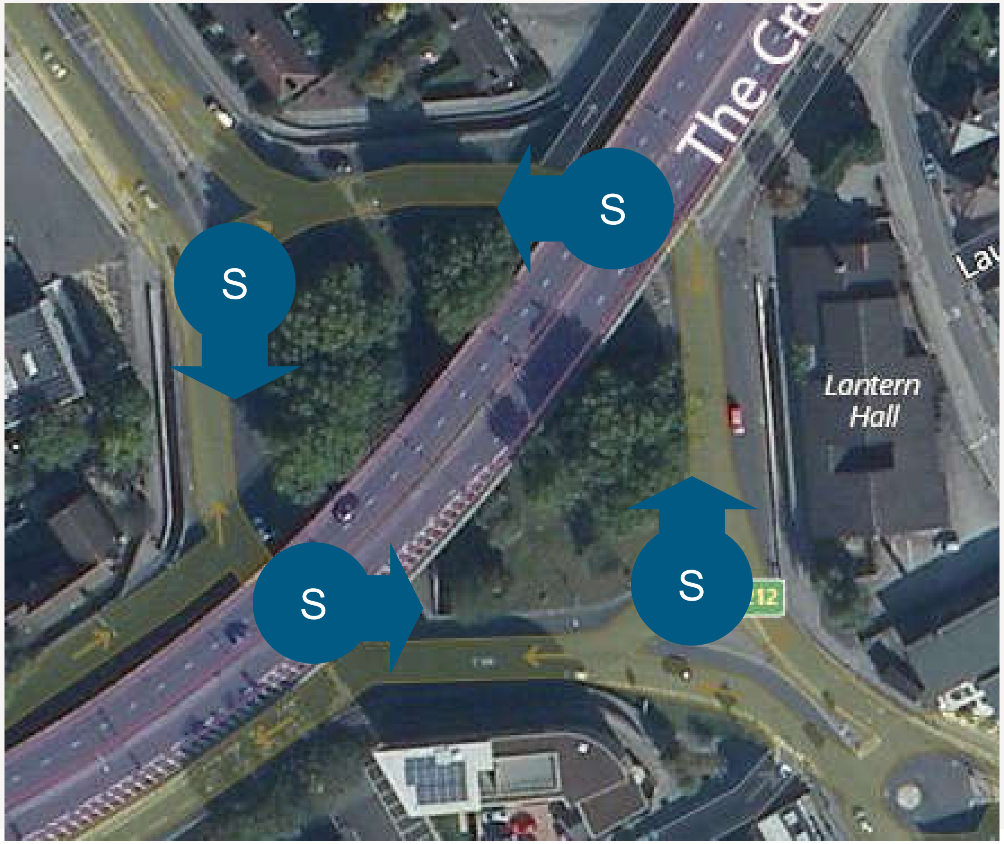
- Limited storage (‘stacking’) capacity within internal reservoirs
- Use negative stack to override blocking back?

Explicitly code rather than take default

- Default = # of lanes x link length
  - Likely to overestimate due to flaring

Also consider if saturation flows need to be adjusted due to partial lanes rather than full

Storage Reservoirs S



Step 3a – Coordinating Signals ….

Platooning traffic streams

- Minimise travel time within gyratory for key traffic stream(s)
  - Likely to be conflicting streams

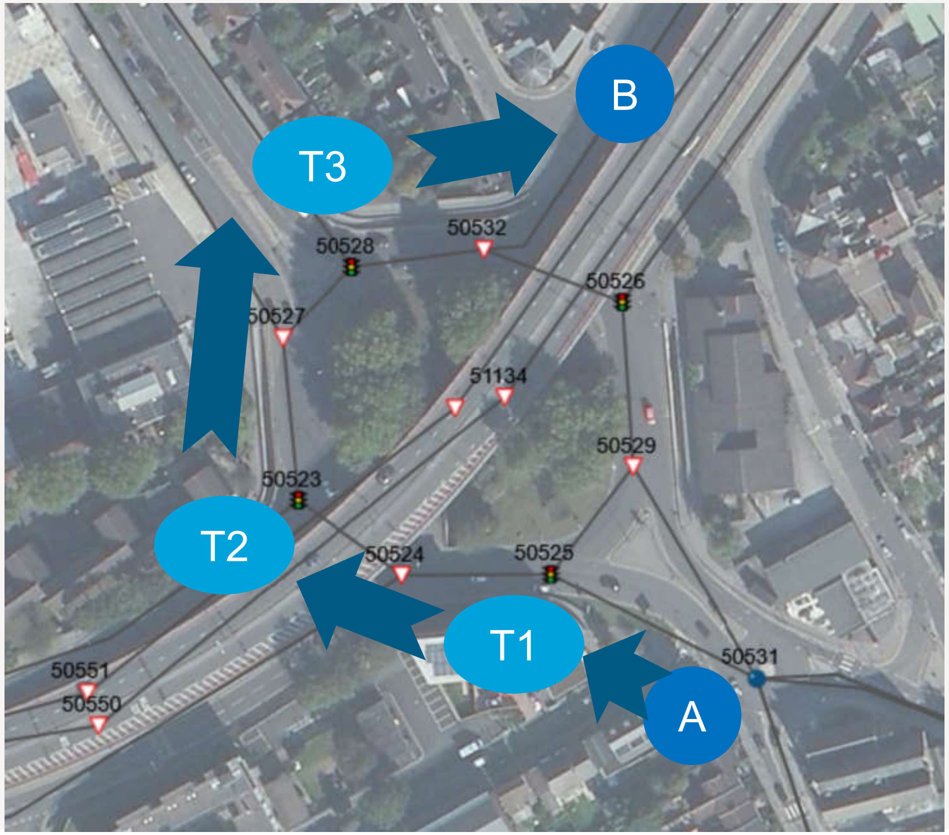
Co-ordinating offsets

- For main traffic stream from A -> B
- Remember: Stage 1 = Entry Arm,
  Stage 2 = Circulating Arm

Timing Points

- At T1, vehicles stream AB enters gyratory at node 50525
- At T2, stream reaches node 50523
- At T3, stream reaches node 50528
- At T4, stream exits gyratory

For intermediate timing points T2 and T3, stage 2 should be active. Hence, we now calculate Time T2 and T3



Step 3b – Calculating offsets

To calculate the offsets

Require the travel times between each time point

- Extract from the traffic model based on coded fixed speeds and distance

Need a datum where t=0

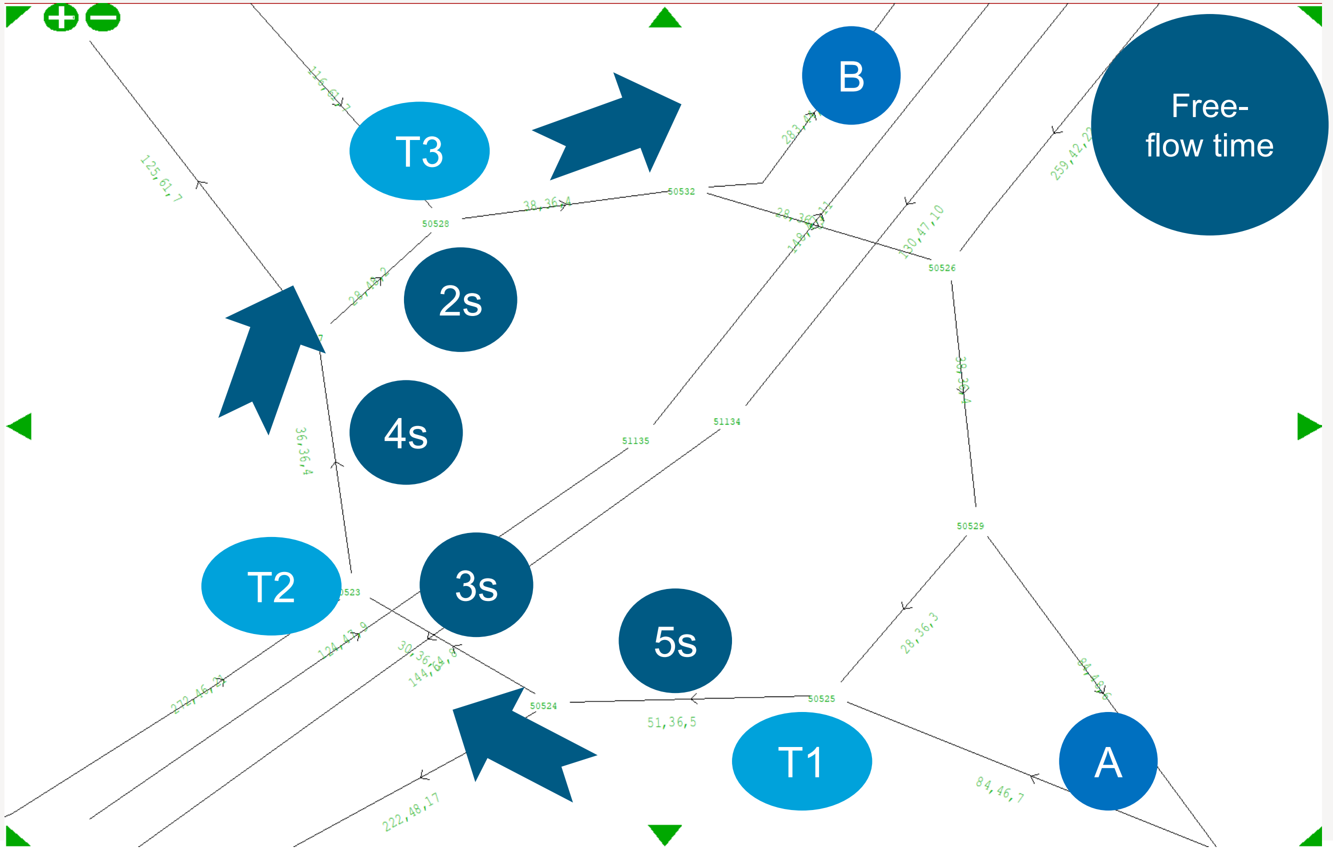
- If unconnected junctions, assume T1 = 0
- If not, need to align with datum set for the other signals in the UTC area

For T1 = 0 then

- Time T2 = 5s + 3s = 8s
- Time T3 = T2 + 4s + 2s = 14s

Available from P1X UFN file

Option to use SIGOPT



Step 3c – Converting to Stage Times

To calculate the offsets

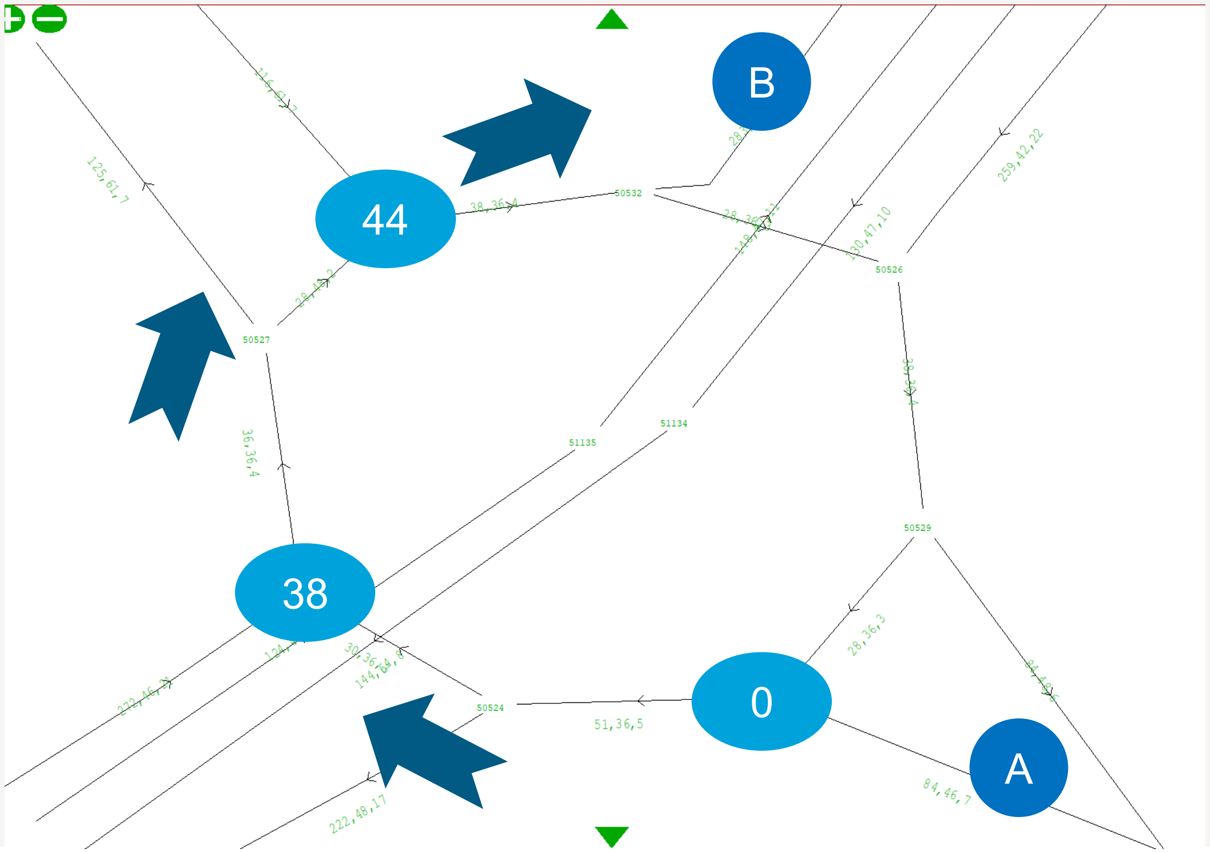
Remember!

- T2 and T3 are when the Stage 2 Circulatory Arm starts not Stage 1
- As T2 = 8s & T3 = 14s and
- Length of Stage 1 & 2 = 30 secs each

Stream AB:

- Enters gyratory and passes Timing Point 1 between t = 0 -> 25
- Passes Timing Point 2 between t = 8 -> 33
  - Hence Offset = 38s
- Passes Timing Point 3 between t = 14 -> 39
  - Hence Offset = 44s

Coded Offsets



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Step 4 – Intermediate Nodes and Cyclic Flow Profiles

In SATURN, platooning impacts are integral part of the simulation process

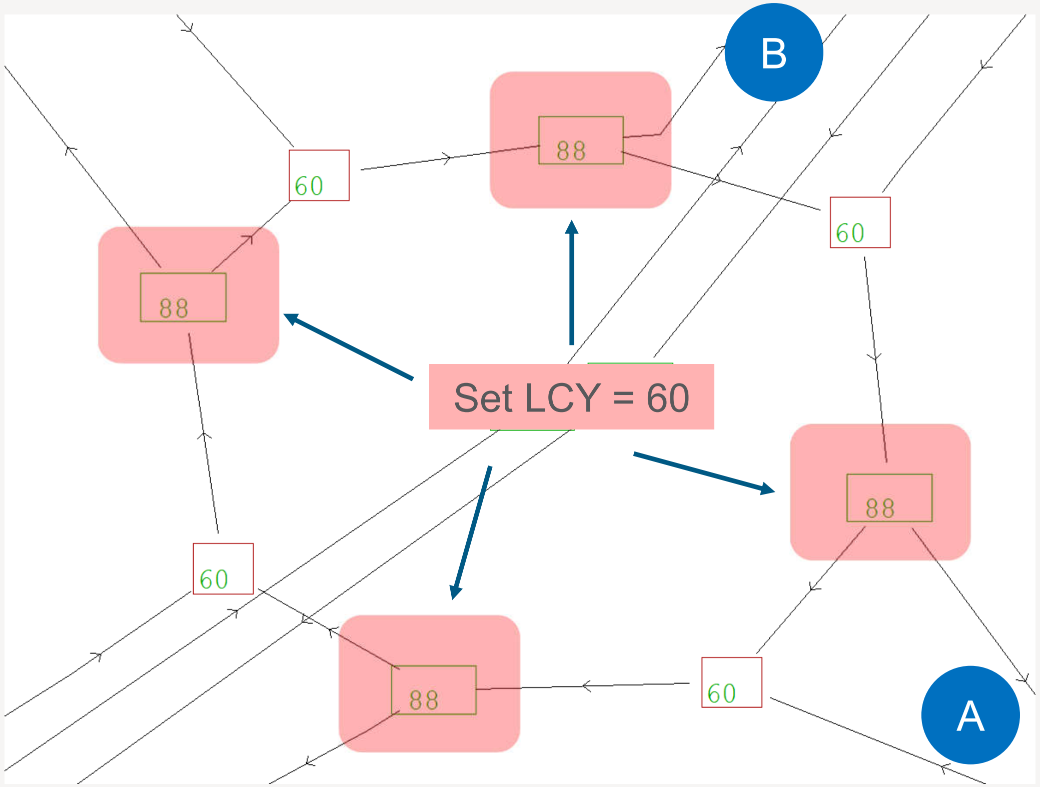
Undertaken by examining **cyclic flow profiles**

- Refer back to Part 1 Simulated Capacities

Platooning effects will only occur between junctions with the same coded Cycle Time (LCY)

- Signal = explicitly coded
- Others types use global default unless node specific value specified

Hence, intermediate priority junctions within gyratory should also have their LCY values set to 60 seconds as per the adjacent signals



Step 5 – Test the Scheme

Run the assignment with the coded timings

- Assumed 50:50 split between entry and circulatory arms
- Provides first estimate

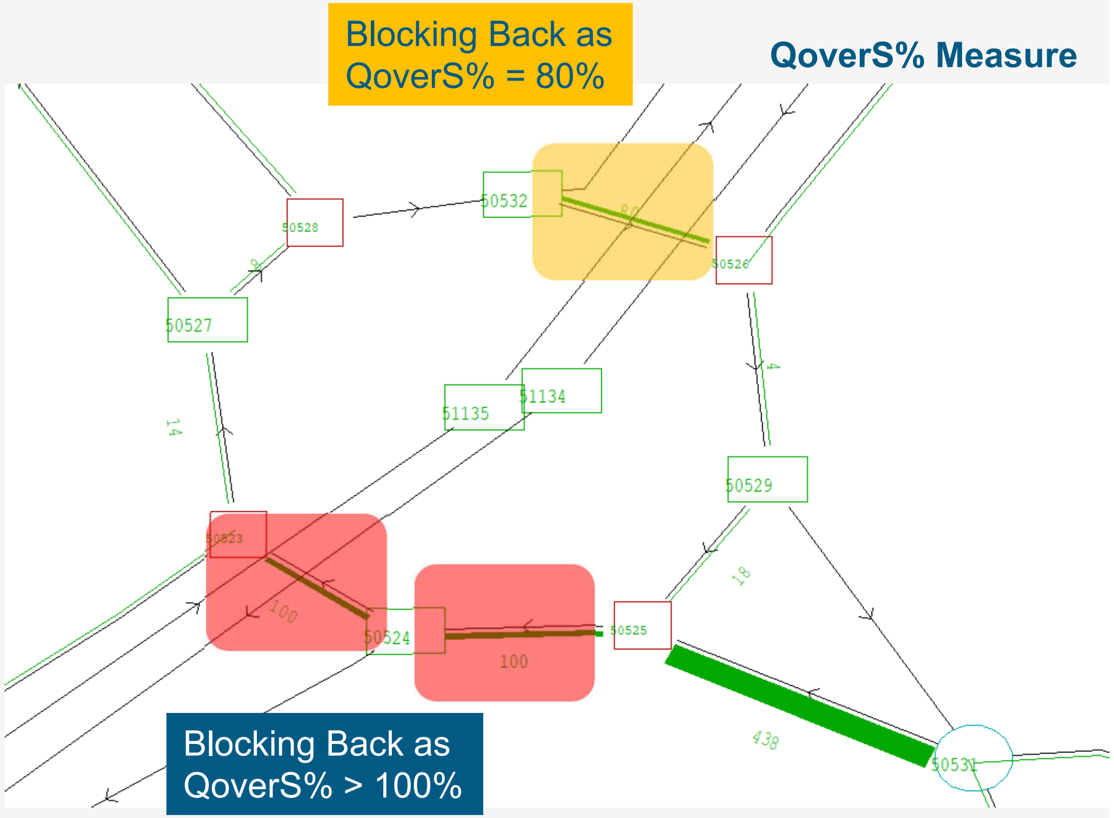
Review performance

- First - circulatory movements
  - Is there any queueing within the gyratory?
    - *Any queues should be on the entry arms only*
  - If so, increase green time for circulatory (less for entry)
- Second - entry arms
  - Can any spare capacity (ie time) on the gyratory arm be reallocated to entry arms?

Use P1X Signal Optimisation routines

- Recalculate offsets

Repeat until workable solution for design



See Worked Practical Example