NETWORK CODING

Different Strokes

John Tarrant

AtkinsRéalis

In this session

- Look at some common questions that we come across while coding networks
  - Dummy, priority and flares
  - Merges and diverges
  - Centroid connectors
  - Supplementary files

Dummy, Priority and Flares

Example

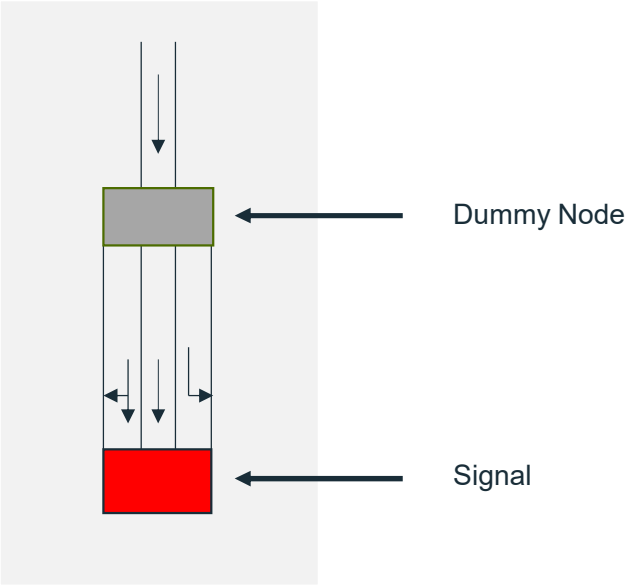
- Considering the coded layout of the 4 arm signalised junction (highlighted in red)
  - Highlighted (in green) link and junction not modelled

Example

- Single lane road with three lanes at junction
- Right turn shared with ahead movement
- How would you code this link and junction?

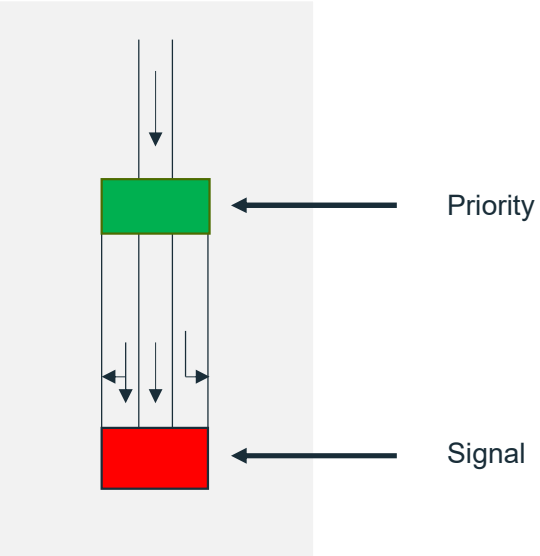
Option 1

- Use a Dummy node
  - Code where the link changes from single lane to 3 lanes
  - Signalised node with 3 lanes on approach



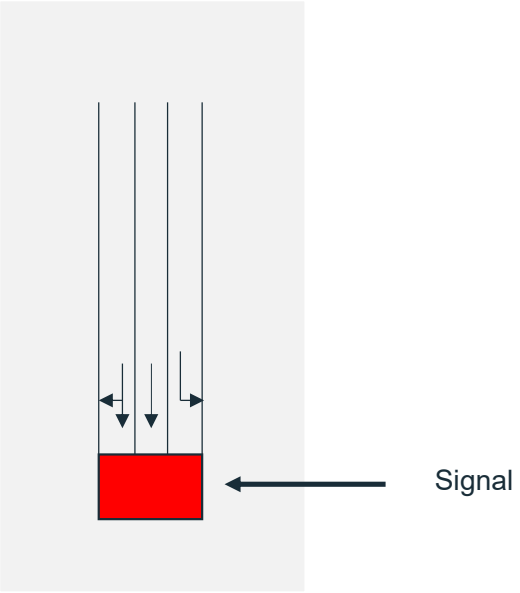
Option 2

- Use a Priority node
  - Code where the link changes from single lane to 3 lanes
  - Signalised node with 3 lanes on approach



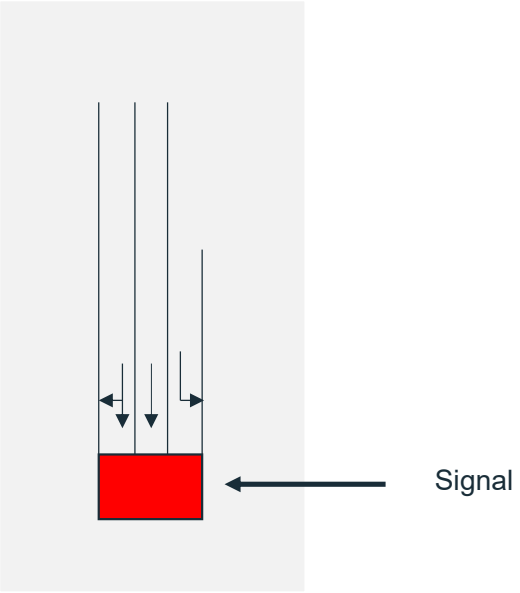
Option 3

- No new node inserted
- Signalised junction coded with 3 lanes at the stop line
  - Single lane mid link capacity constraint and a defined stacking capacity
  - Need to ensure that the mid link and stacking capacities don’t under / over-estimate delays



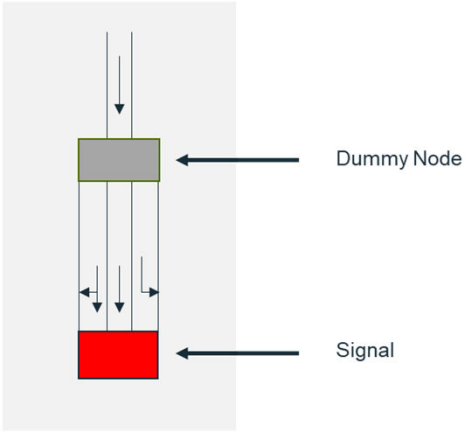
Option 4

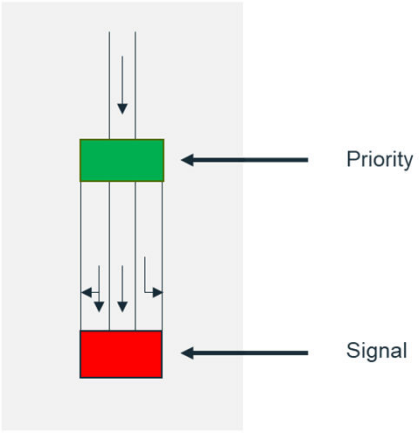
- No new node inserted
- Signalised junction coded with 2 lanes plus flare at the stop line
  - Same caveats as option 3
  - Flares can be unstable

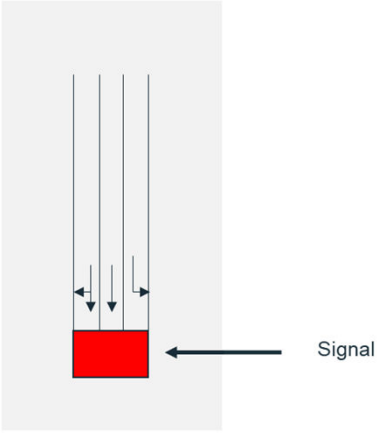


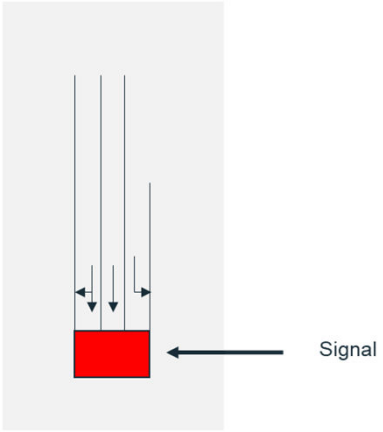
Which would you choose?

- Option 1
- Option 2
- Option 3
- Option 4
- Something else?



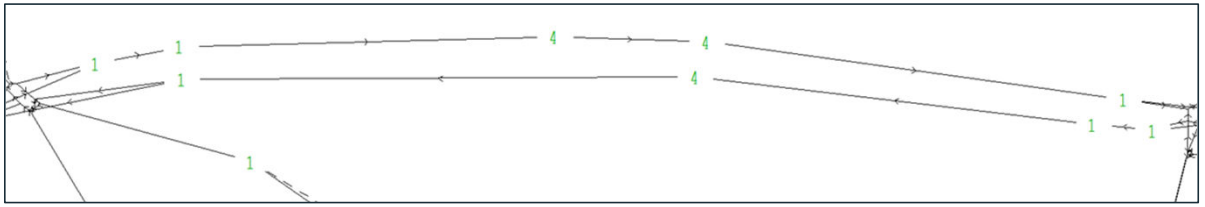


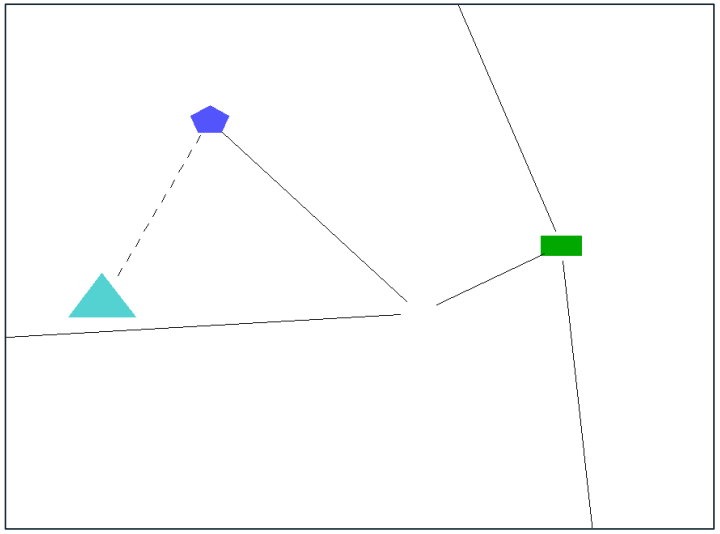




Use of Dummy Nodes

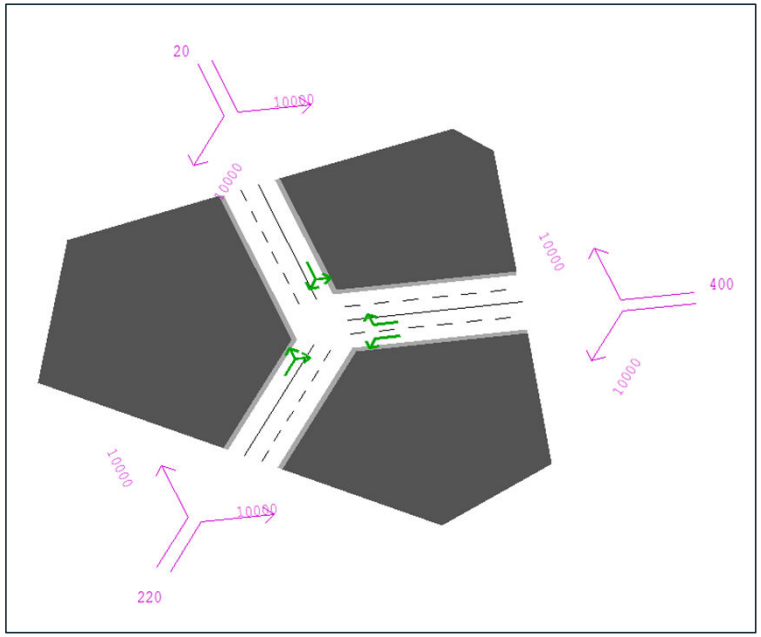
- We commonly see dummy nodes used to:
  - Shape a network
  - Provide a more precise location for a centroid connector
  - Where you need to distinguish between two sets of links (e.g. bus lane and normal road)
  - Represent a point where future modifications will be made





Use of Dummy Nodes

- Key things to note:
  - Flows through a dummy node are unrestricted (unless banned)
  - Capacity is defined by the mid link capacity (defined in the speed flow curve), doesn't use the turn saturation flows. Set to 9999 if not defined.
  - Blocking back



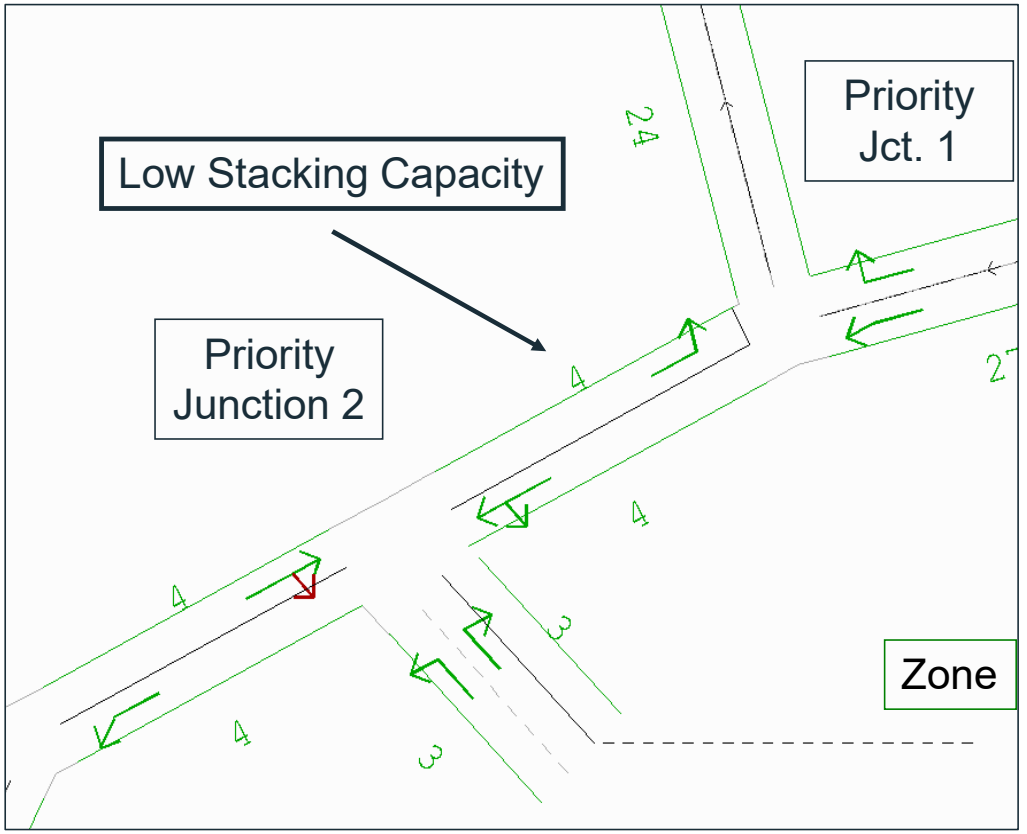
Use of Dummy Nodes

- Best practice:
  - Avoid the use of them, consider using priorities instead
    - Though note, potential 3rd arm considered – need to be careful!
  - Use GIS files to shape network
  - Set mid link capacities and not lane capacities

Stacking Capacity

- Definition - The number of PCUs which would cause a queue to extend into the previous junction
- Calculation – Number of lanes X Link length / ALEX (average length of a vehicle, default 5.75)

- Short links cause stacking problems, leading to blocking back, instability in link flow and costs and therefore potential convergence issues
- This it is important to ensure the link stacking capacity is represented accurately

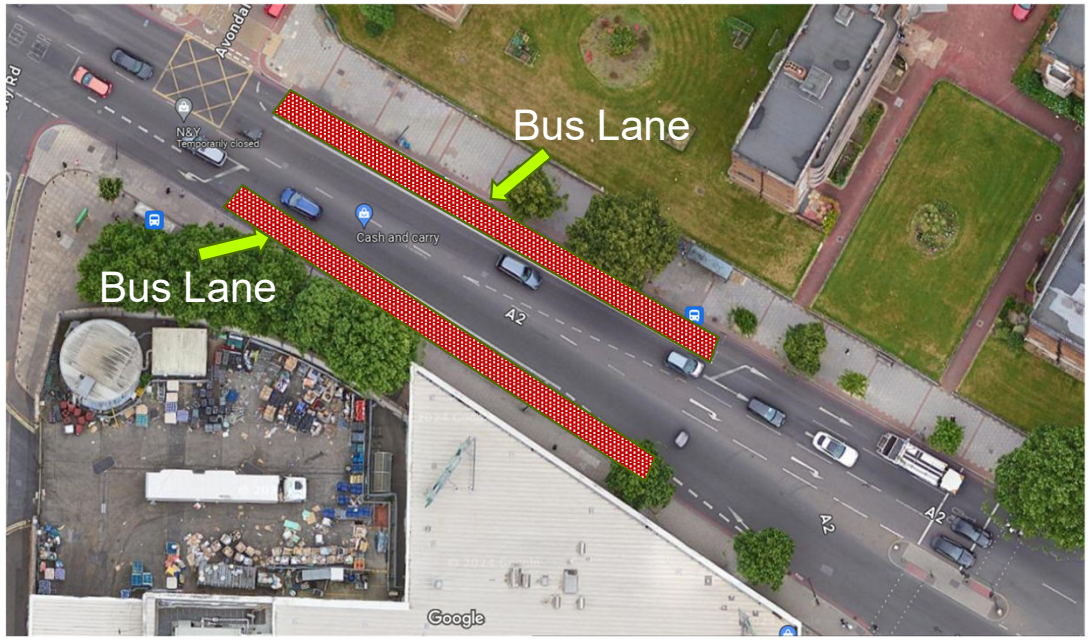


Flares

- Shared movements not allowed
- Length of the flare >10PCUs, then code as a full lane
- Can currently only be used for Priority and Signalised junctions
  - Note: from v11.7 onwards, flares do also appear on Roundabouts

Set Back Bus Lanes

- Often see bus lanes which stop several PCUs before the stop line, allowing general traffic to move into the left lane
- Is an additional node more vital in these cases?
  - In SATURN terms, the presence of a bus lane just means that buses are excluded from the link capacity calculation. And it does not result in conflicting movements at the junction being simulated.
  - I.e. in most cases where bus flows are relatively low compared to general traffic, whether an additional node is added or not has little impact
- Visually the additional node looks more accurate admittedly!



Merges & Diverges

Merges & Diverges

- There are many tools available to model merge and diverge characteristics:
  - Merge, weave and queue markers
  - APRESV parameter
  - Negative stacking capacity
- A lack of evidence about how each coding method matches with reality
- Common issue - Inability to reflect journey times

Merges & Diverges

Standard M marker

- No impact on major arm
- Merge focuses on inside lane only

APRESV

- Affects lane choice on major arm
- If APRESV=0 then same flow on all major lanes in GAPM calculation
- If APRESV=1 then merging volume moved from lane 1 and shared between other lanes. Higher probability of gaps and more capacity for slip flow.

Queue marker

- Adds queueing delay after the merge point (link B-C)
- Delay = 226 X (V/C - 0.75)
- Only works on nodes with 1 inbound and 1 outbound arm
- Distance – 100 to 300m

Merges & Diverges

Negative Stacking Capacity

- Chain is broken so link B-C and C-E considered separately

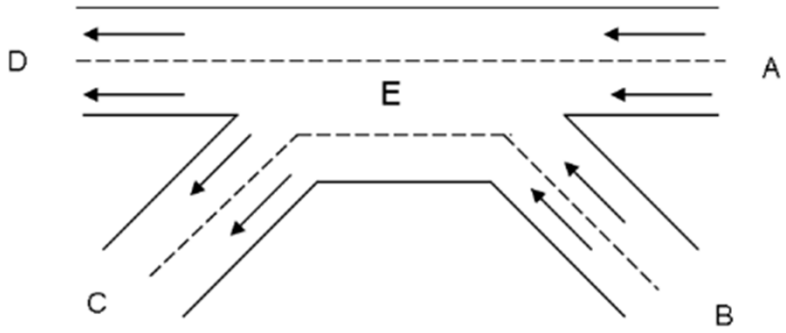
Double M

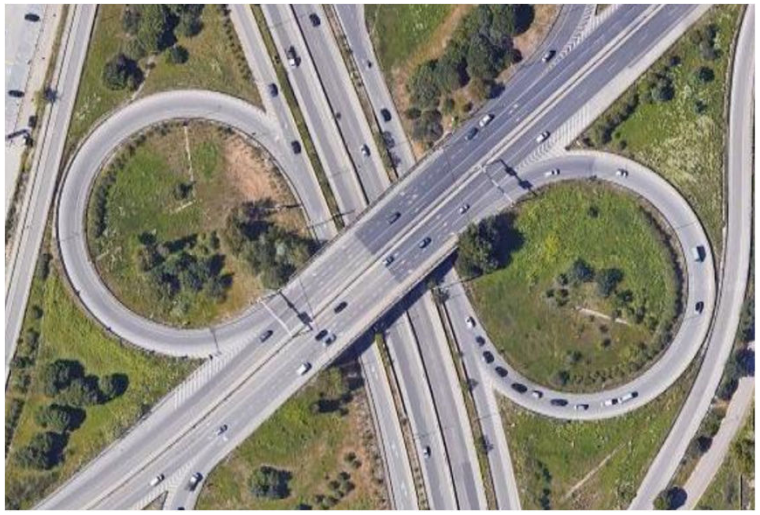
- Applied to both major and minor arms
- Both turns have equal weighting and change to use the available capacity, 'fighting' for the remainder

Merges & Diverges

Weaving

- Only works on nodes with 2 inbound and 2 outbound arms
- Put a weave marker on the movements that directly ‘conflict’ (turns B-E-D and A-E-C below)
- Creates turn rather than link delay, i.e. is effectively at point and applies to a short distances





What options / combinations are you using?

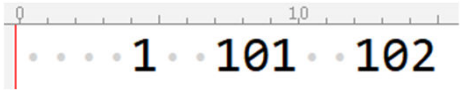
Centroid Connectors

Centroid Connectors

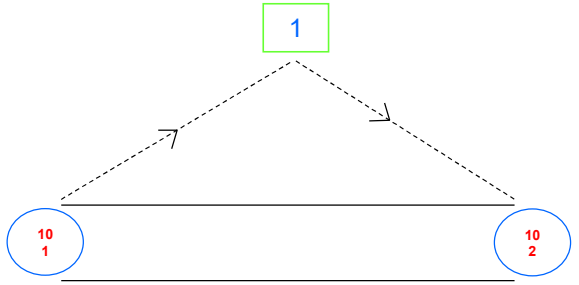
- Imaginary links through which the demand loads on to the network
- In SATURN, centroid connectors can be
  - Simulation Centroid Connectors – coded under 22222 card
  - Buffer Centroid Connectors – coded under 33333 card
- At least one connector must be specified for each centroid and no more than six

Simulation Centroid Connectors (22222)

- Centroid Connector spans along a model link – ‘Spanning’
- The coded data under 22222 in this case would read



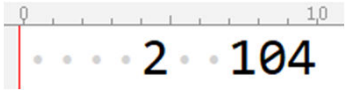
- Implies that zone 1 is connected to link 101-102



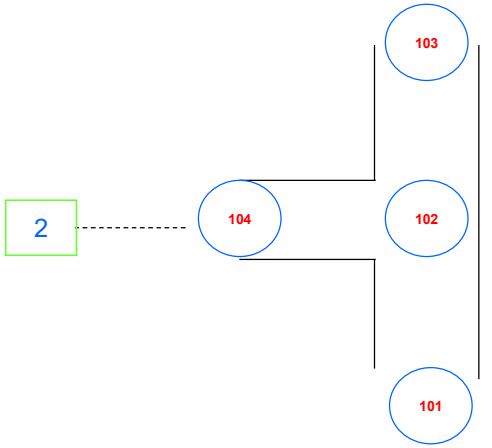
- Traffic TO zone 1 leaves from a point just beyond node 101 and that traffic FROM zone 1 enters the link at a point just before node 102, as though traffic were parking on the link somewhere between nodes 101 and 102

Simulation Centroid Connectors (22222)

- External Simulation Link – ‘Spigots’
- The coded data under 22222 in this case would read



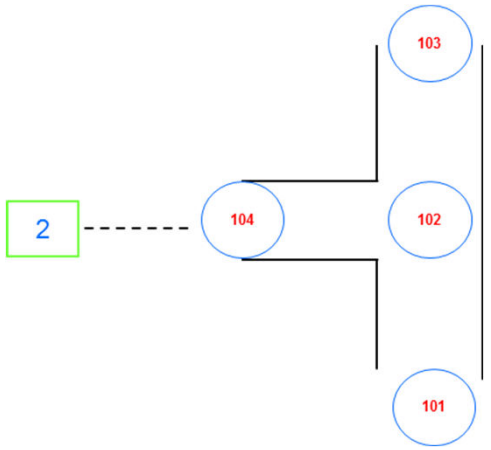
- Assumed that traffic FROM zone 2 enters the network at node 104 and proceeds along link (104 -102), while traffic TO zone 2 exits from node 104 after taking link (102-104)



Buffer Network Data (33333)

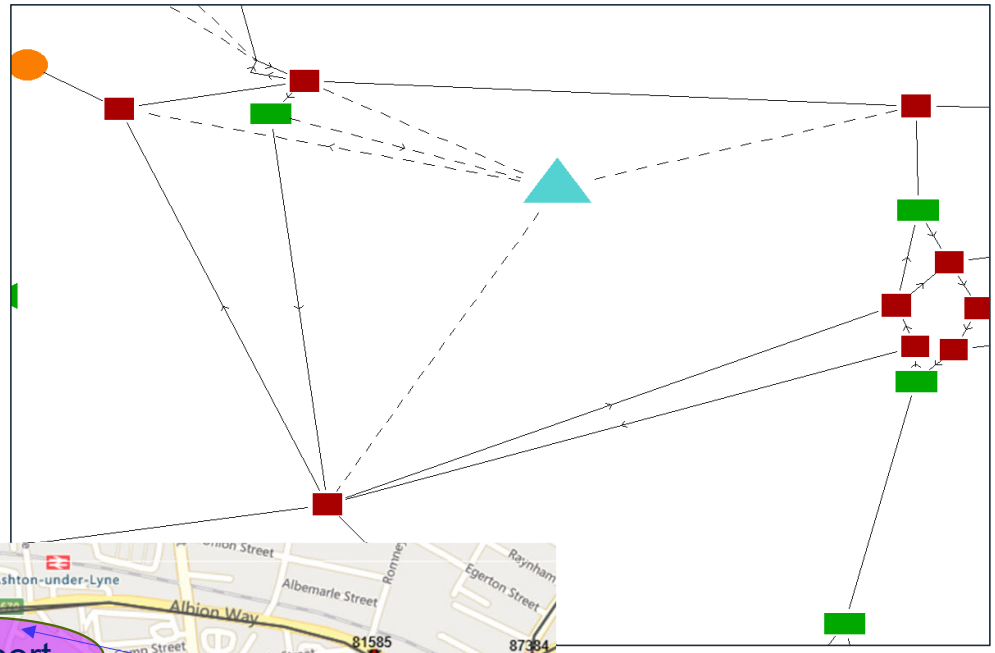
- A spigot connector, linking to a buffer node instead of a simulation node
- On the buffer network we code the likes of speed and distance

```
C       2       104   30   30       2S   100 10.0  999
```

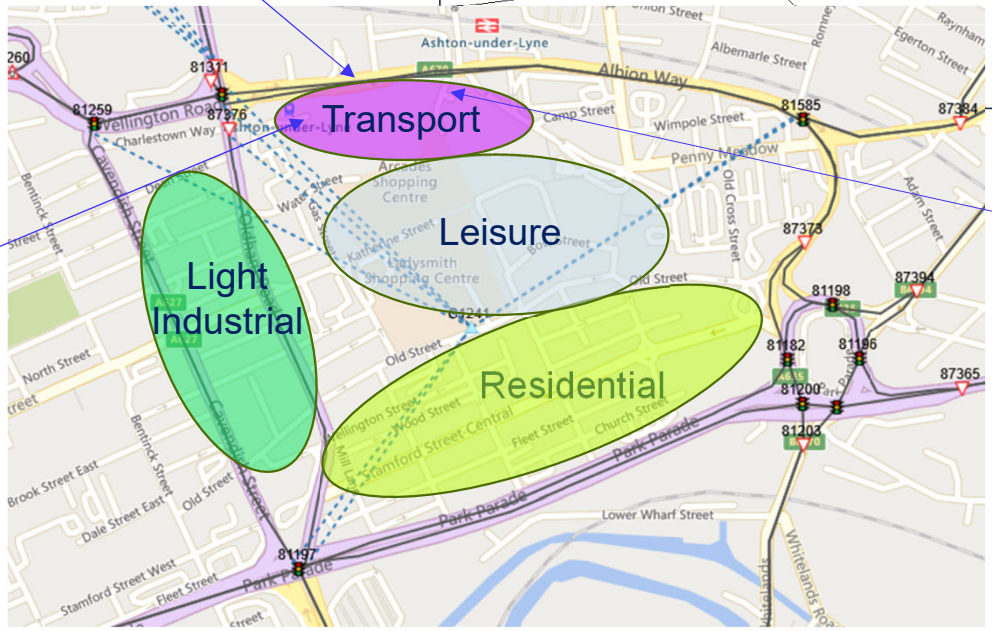


Example

- Loading a large commercial / mixed development zone onto Signalised / Roundabout junctions with multiple centroid connectors



Bus Interchange Exit

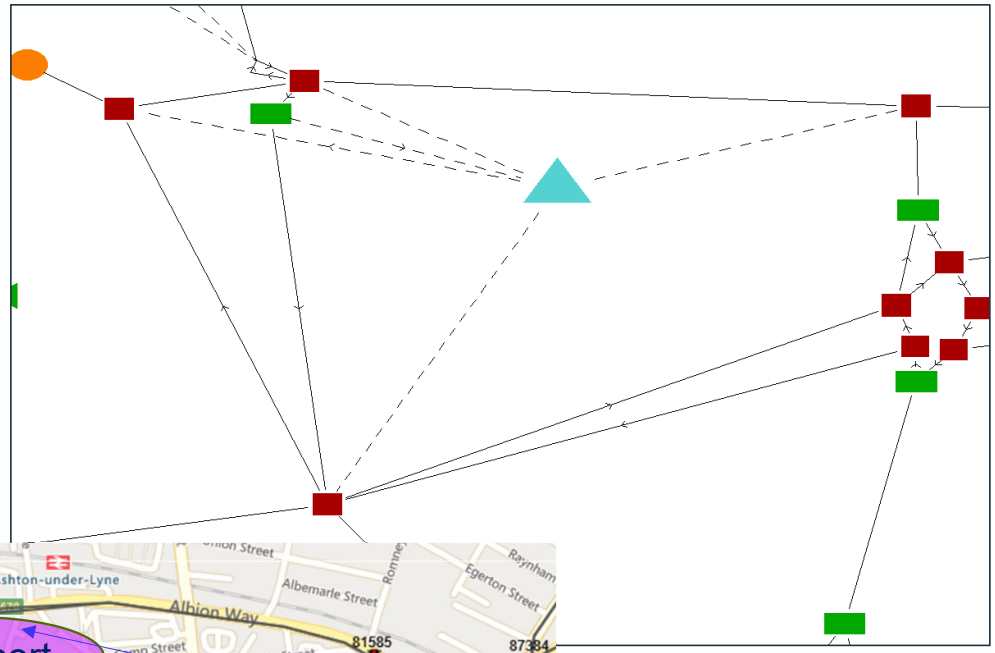


Bus Interchange Entrance

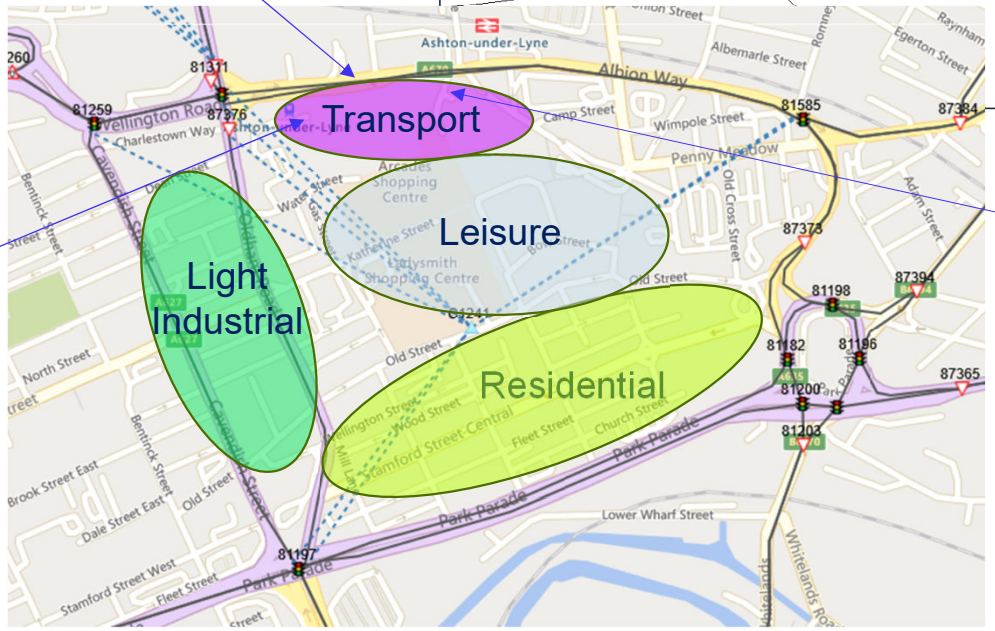
Shopping Centre Car Park Entrance / Exit

Example

- Is this good practice?
- Any consequences?
- What do we need to consider?



Bus Interchange Exit



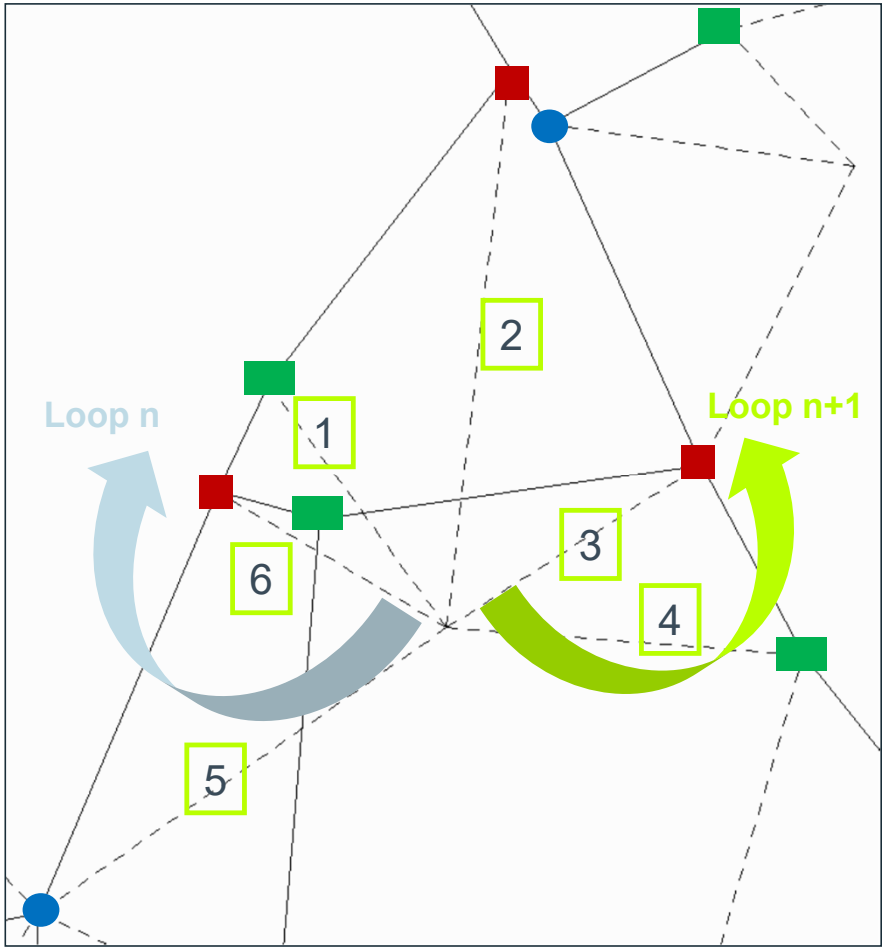
Bus Interchange Entrance

Shopping Centre Car Park Entrance / Exit

Some Thoughts

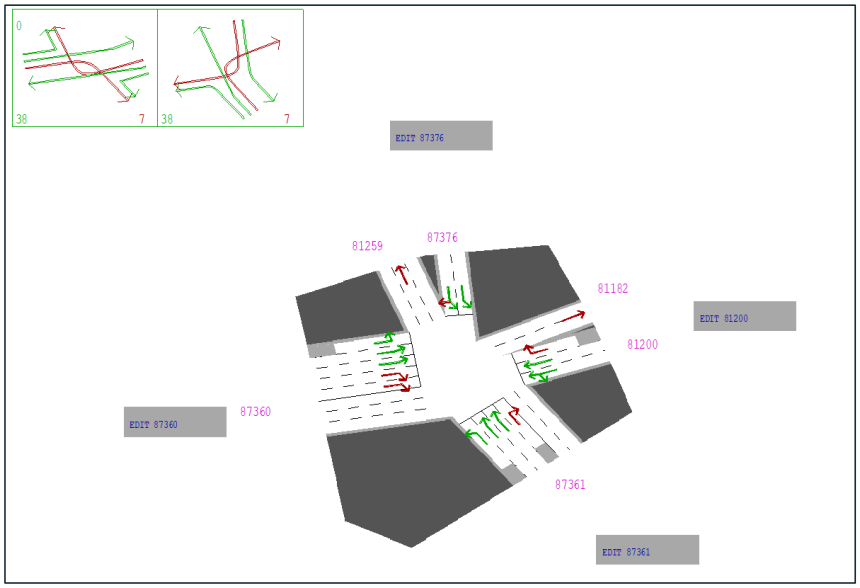
- Web of Centroid Connectors, multiple centroid loading points
- Coupled with detailed simulated junction coding, so an imbalance between zones & network coverage
- If network is congested, likely to cause instability in link flows due to oscillation in CC flows

- An example
  - Loop N favours CCs 1 & 6
  - Loop N+1 switches to CCs 3 & 4
  - Oscillates



Some Thoughts

- Adding centroid connectors to the Signalised junctions:
  - May force traffic to use specific routes
  - Modelled flows will not reflect the observed counts if any
  - Modelled turn flows cannot be used for any junction assessments
- Make sure the representation of any junction in a simplistic manner does not make the traffic condition artificially worse



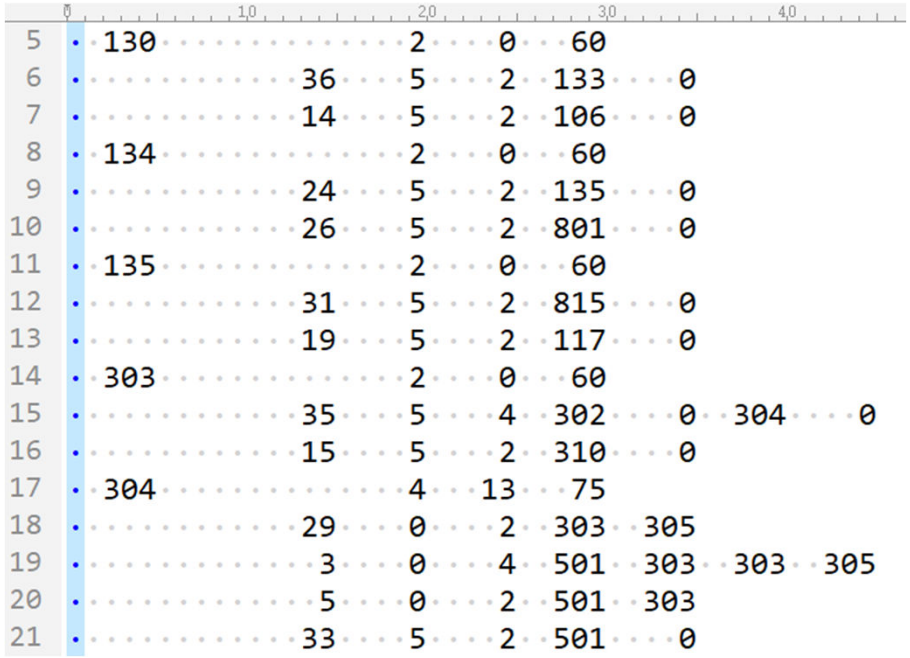
Good Practice

- No restriction on what type of junction the connector should be loaded into
- Note when centroid connectors are loaded to Signalised or Roundabouts…
  - Observed signal timings or circulation capacity of the roundabouts would not account for additional demand from zone loading/unloading
    - Overcapacity link and/or turns likely to result
    - Potential convergence issue
- Do not mix up the simulation and buffer centroid connectors in the simulation area
- Coding the simulation centroid connectors on priority junctions or external nodes as spigots is preferable

Supplementary Files

RGS Files

- RGS
  - Contains the signal settings for either all or a subset of a network's signalised nodes
  - May be used to:
    - Over-ride signal data within the main DAT file and any $INCLUDE files
      - Set the parameter FILRGS
      - If the timings for a specific node are not included in the input RGS file then the data from the DAT file(s) is used
    - Create an output file from SATNET
      - Set FREDDY = T
  - Note - RGS over-writing of the main DAT file as part of an assignment is dependent on SATURN version



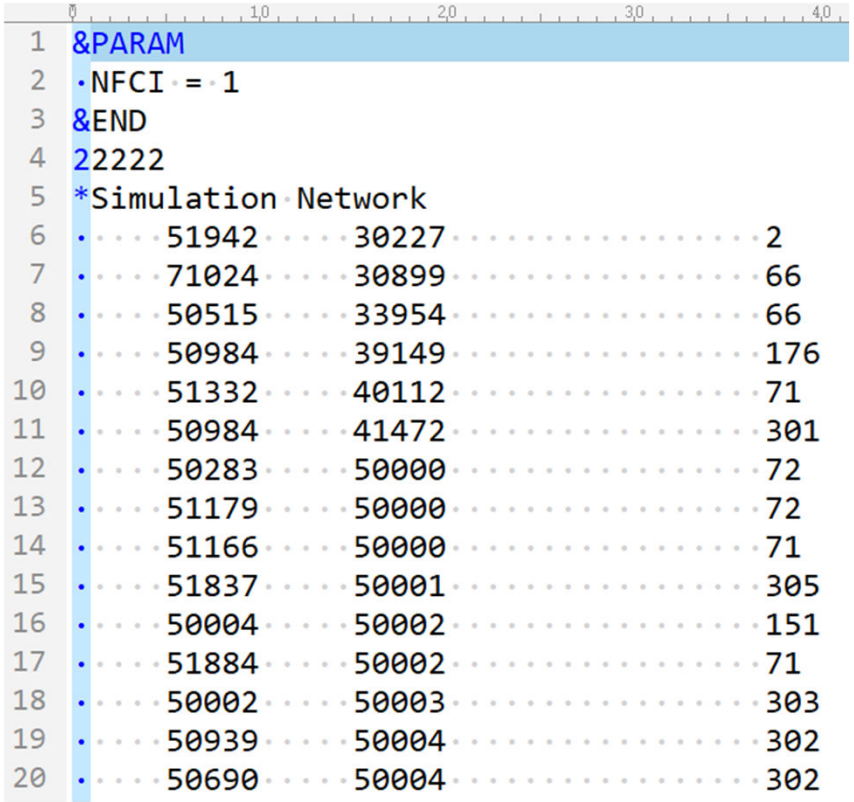
KNOBS

- KNOBS
  - Allows additional data items - referred to as “knobs” - to be input for each link or turn (buffer or simulation) using the ‘33333’ data records
  - Can be included within the assignment (e.g. tolls) or as stored information to display (e.g. traffic counts)
  - (negative knobs?)
  - Knobs and Generalised Cost
  - Knobs and Skims
  - For more information see manual section 15.14

```
1      12502      12496          0      0      0      0   -241
2      12499      12496          0      0      0      0   -272
3      12505      12508          0      0      0      0   -173
4      12917      12508          0      0      0      0   -193
5      34176      12869          0      0      0      0   -841
6      12496      13149          0      0      0      0    -22
7      18164      18137          0      0      0      0   -765
8      20415      18165          0      0      0      0  -1091
9      20159      20064          0      0      0      0   -242
10     20062      20073          0      0      0      0   -207
11     20077      20076          0      0      0      0   -120
12     20080      20077          0      0      0      0    -68
13     20158      20078          0      0      0      0   -228
14     20082      20080          0      0      0      0   -283
15     20094      20082          0      0      0      0   -150
16     20181      20094          0      0      0      0   -504
17     20418      20415          0      0      0      0   -493
18     20870      20416          0      0      0      0   -856
19     20416      20417          0      0      0      0   -468
20     20421      20418          0      0      0      0   -223
```

XFILES

- XFILE
  - Allows some 1s card information to be stored in a separate file
    - Creates a ‘cleaner’ main DAT file
  - Set the parameter XFILE
  - Manual not clear, but assume it overwrites the main DAT and any $INCLUDE files
  - Full set of fields:
    - Link – Flares, tax, APRESV, capacity indices and RBKS
    - Turns - GAP values



Supplementary Files

- Which of these are you using?
  - RGS
  - KNOBS
  - XFILE
- Any others?
- Any additional files you'd like to see?

thank you

UNIVERSITY OF LEEDS

FVVB Ltd

AtkinsRéalis