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Quantifying the Benefits of New Bus Priority Logic in SCOOT

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European Conference of Transport Research Institutes

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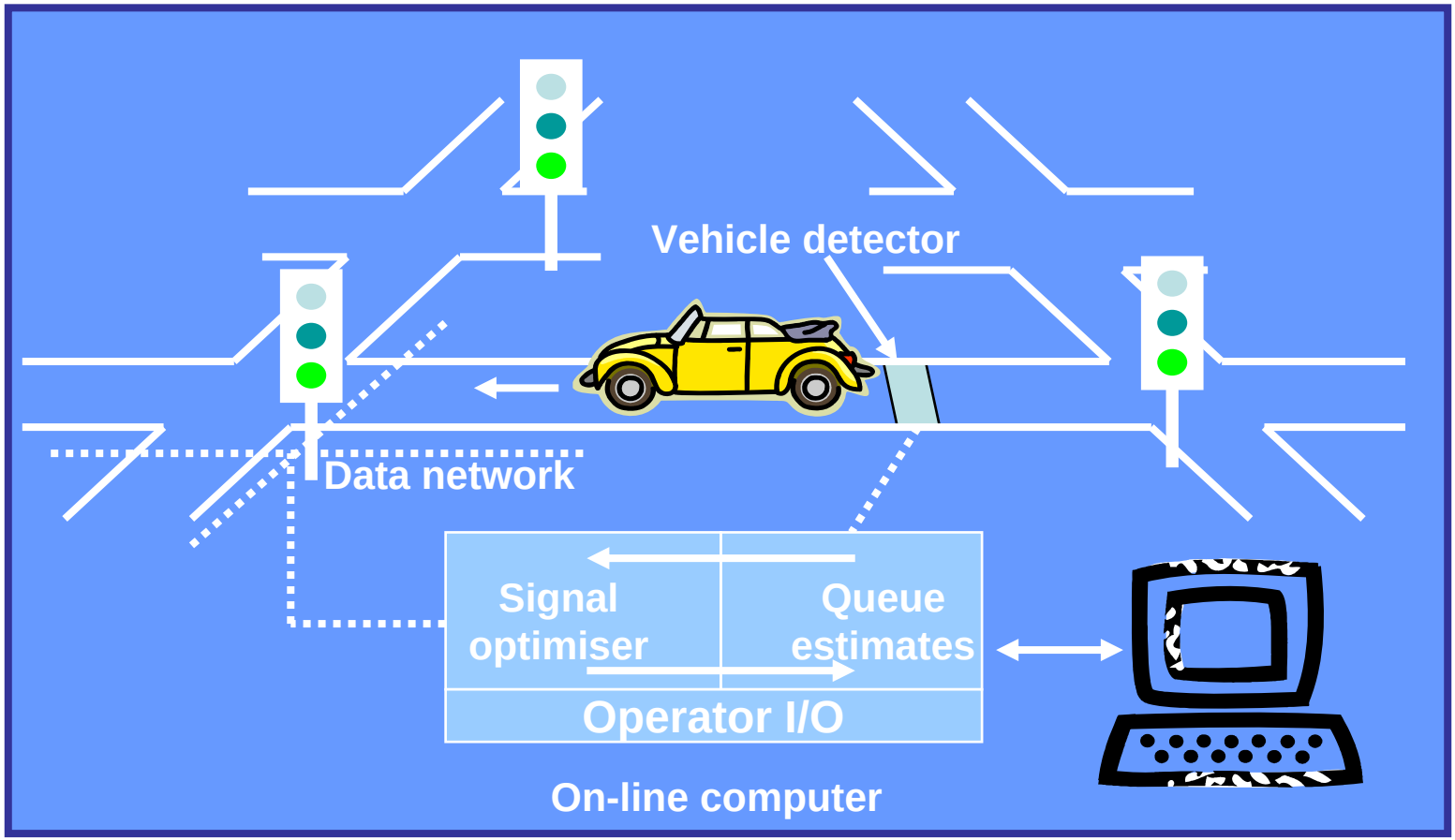
Overview

1. Current SCOOT logic
2. Develoments in London
3. New SCOOT logic
4. Simulation Studies
5. Conclusions

SCOOT UTC System



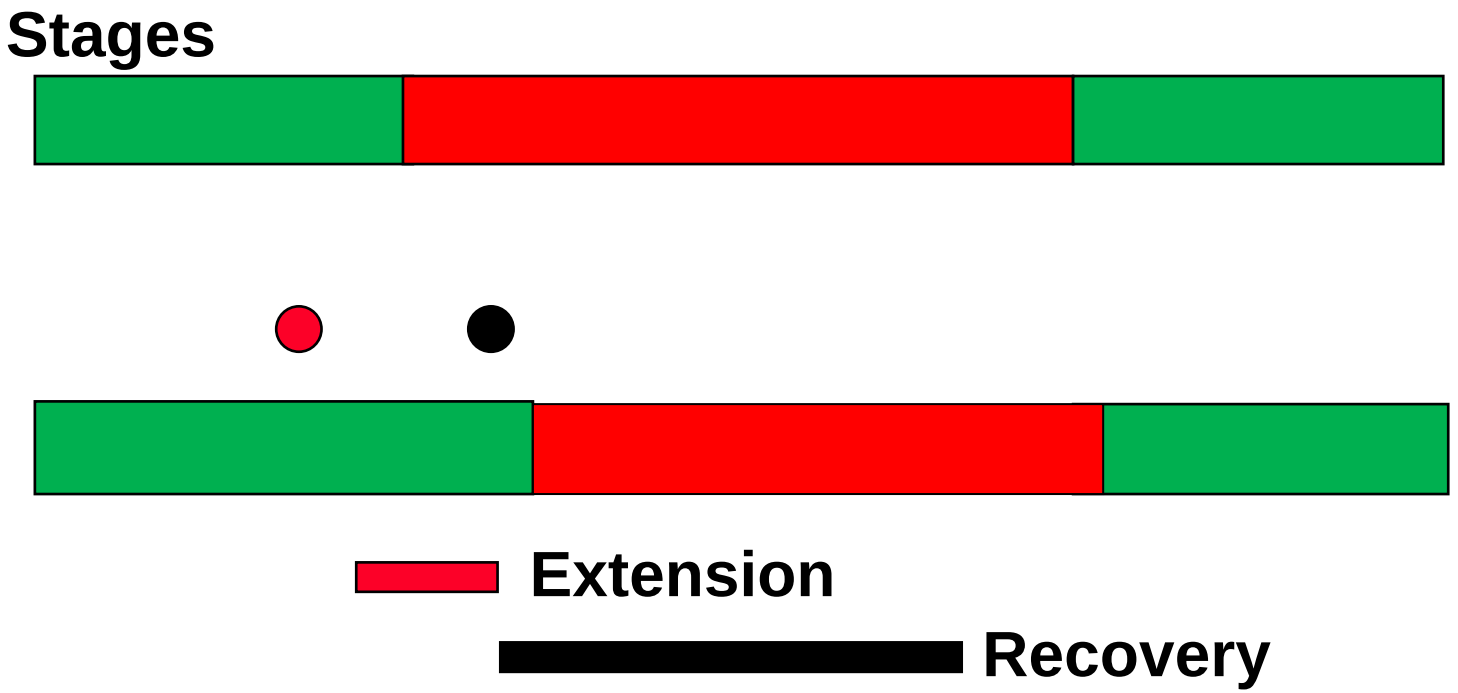
20% reduction in delay over typical TRANSYT fixed time system

Over 200 towns and cities worldwide Continuous development

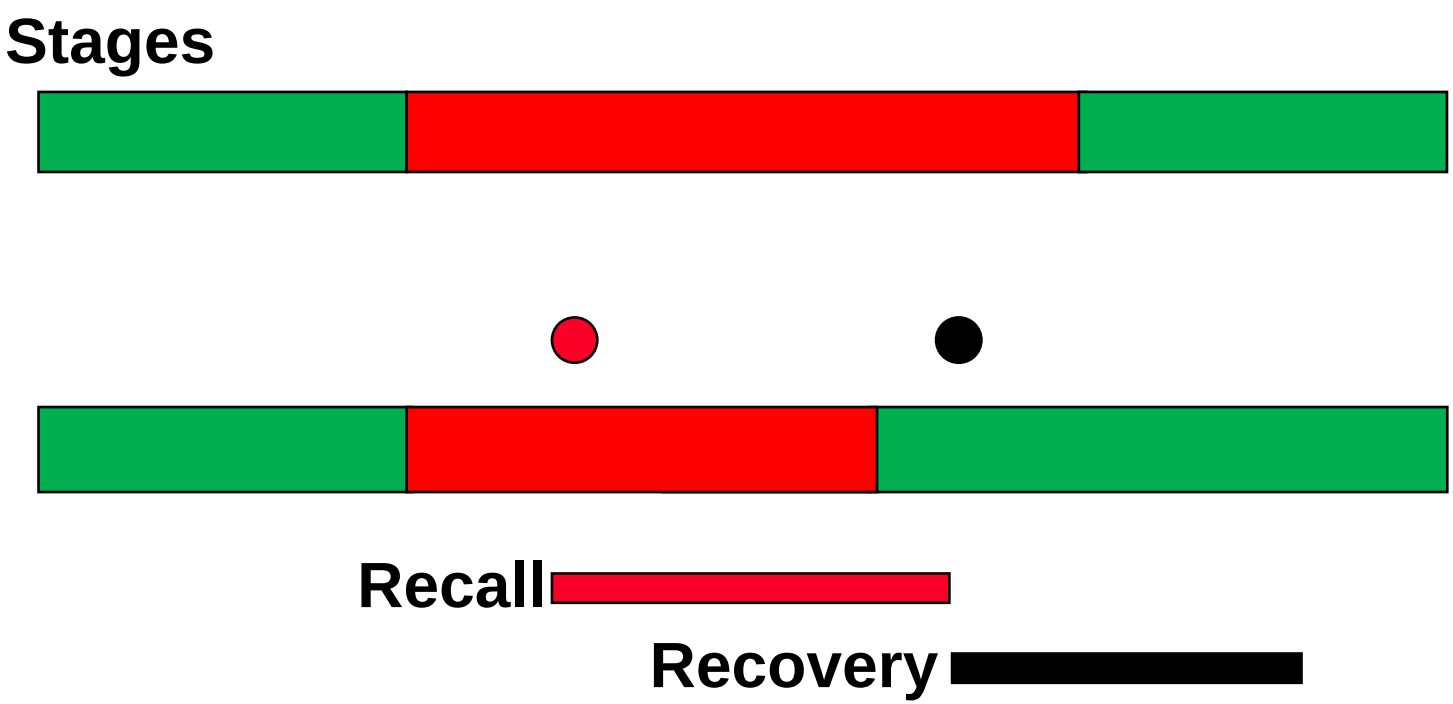
SCOOT Bus Priority

- **Provides bus priority in a SCOOT network**
  - Extensions, Recalls, Stage (phase) skipping
- **Flexible – different levels of priority**
  - Takes into account traffic conditions
  - Degree of saturation
  - Co-ordination
- **Differential priority - 'target buses needing priority'**
  - Potential for high priority to fewer buses
  - Improves regularity

Extensions


Stages
Extension
Recovery
Bus detected
Bus passes through junction

Recalls



- Bus detected
- Bus passes through junction

Detection

- **How to detect the bus?**
  - Transponders
  - Automatic Vehicle Location (AVL)

- **Where to detect the bus?**

  As far upstream as possible BUT an accurate journey time prediction is needed
  - 10 – 15 seconds from stop line
  - 70 – 100m upstream of the stop line
  - After bus stops

Bus Fleet Management & Operations in London

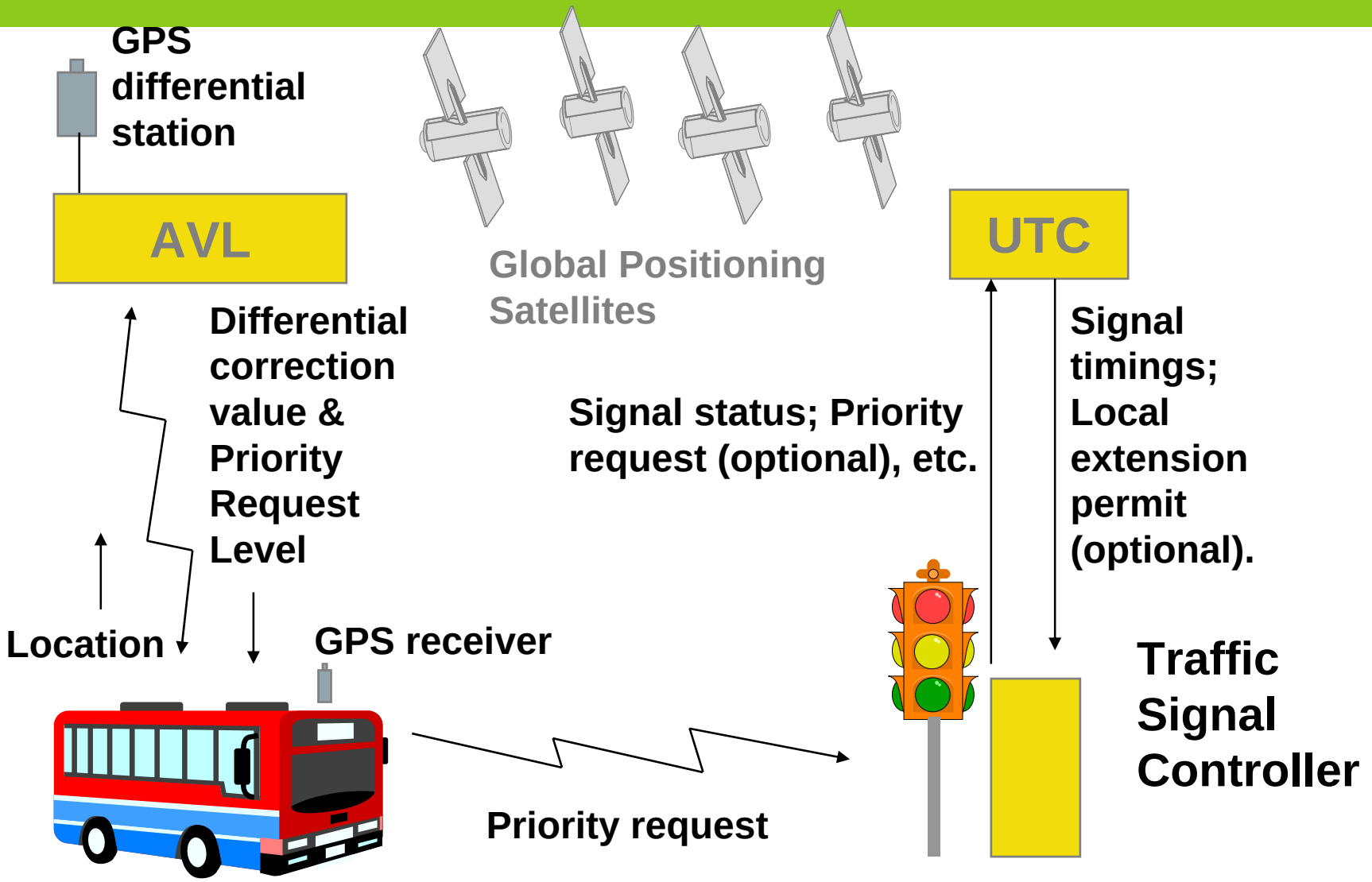
- **BUS – GPS based AVL**
  - bus priority
  - real time passenger information
  - operational management
  - performance assessment

- **Virtual detectors – locations configured in the on-bus computer**

- **No on-street hardware to detect buses**

- **Flat fare ticketing, off bus ticketing reduce bus stop dwell times**

Use of AVL for Bus Priority at Traffic Signals



Bus Priority – New Development

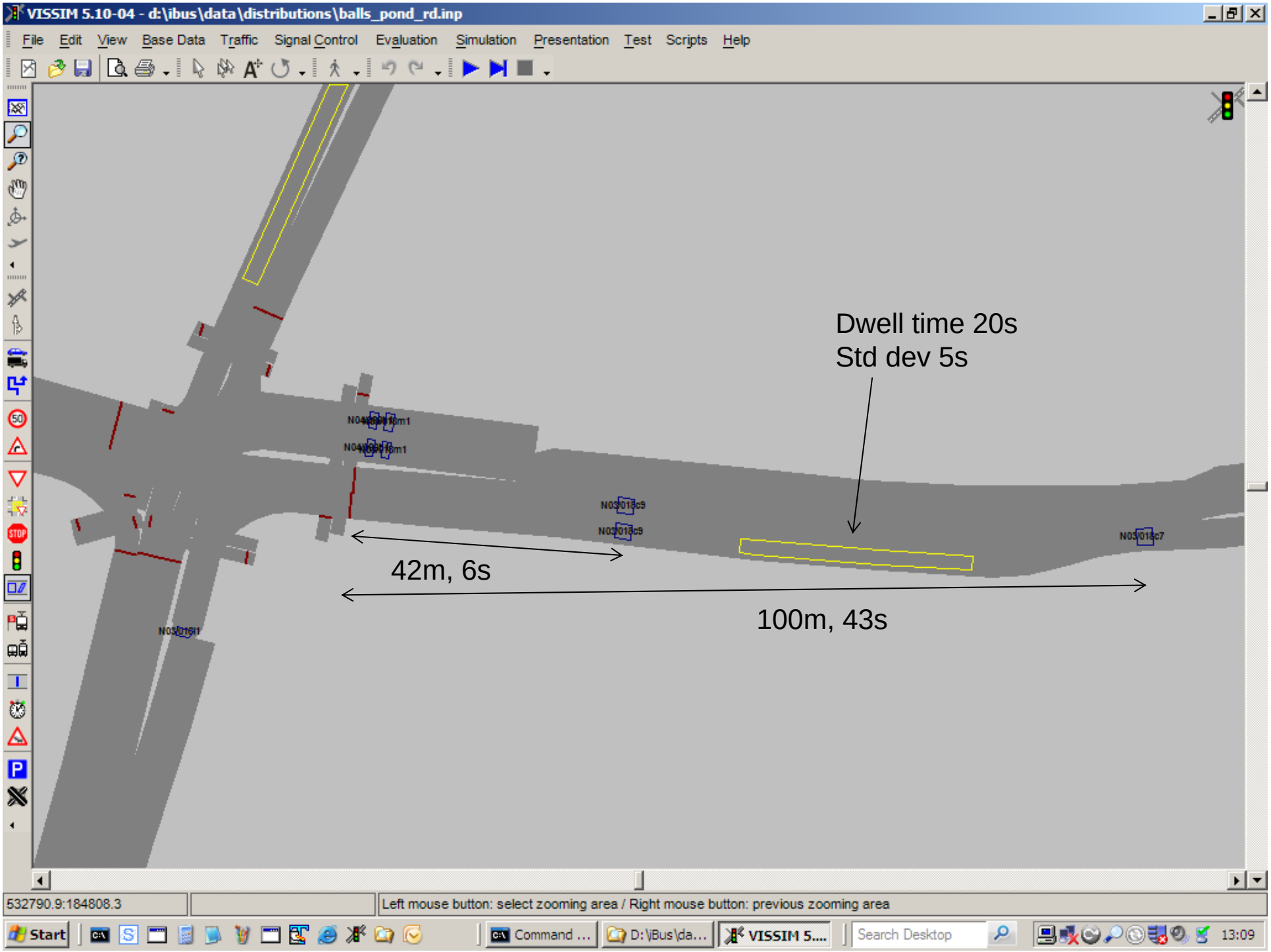
- **Multiple detection points**
  - Can have more than one bus detector on a link
- **Cancel detector**
  - Can curtail green extension when bus exits link
- **Long bus journey times**
  - Can detect buses earlier
  - Delays decision until correct point in cycle
- **Predictive priority**
  - Detect bus before it reaches bus stop
  - Bus stop dwell time included in bus journey time
  - Need to allow extra time for green extension due to more variable journey time (Bus Variability parameter, BVARY)
  - Use cancel detector to curtail extension – reduces wasted green time

Evaluation of New Bus Priority Features

- **SCOOT–VISSIM micro-simulation study**
- **On-street trials in London**

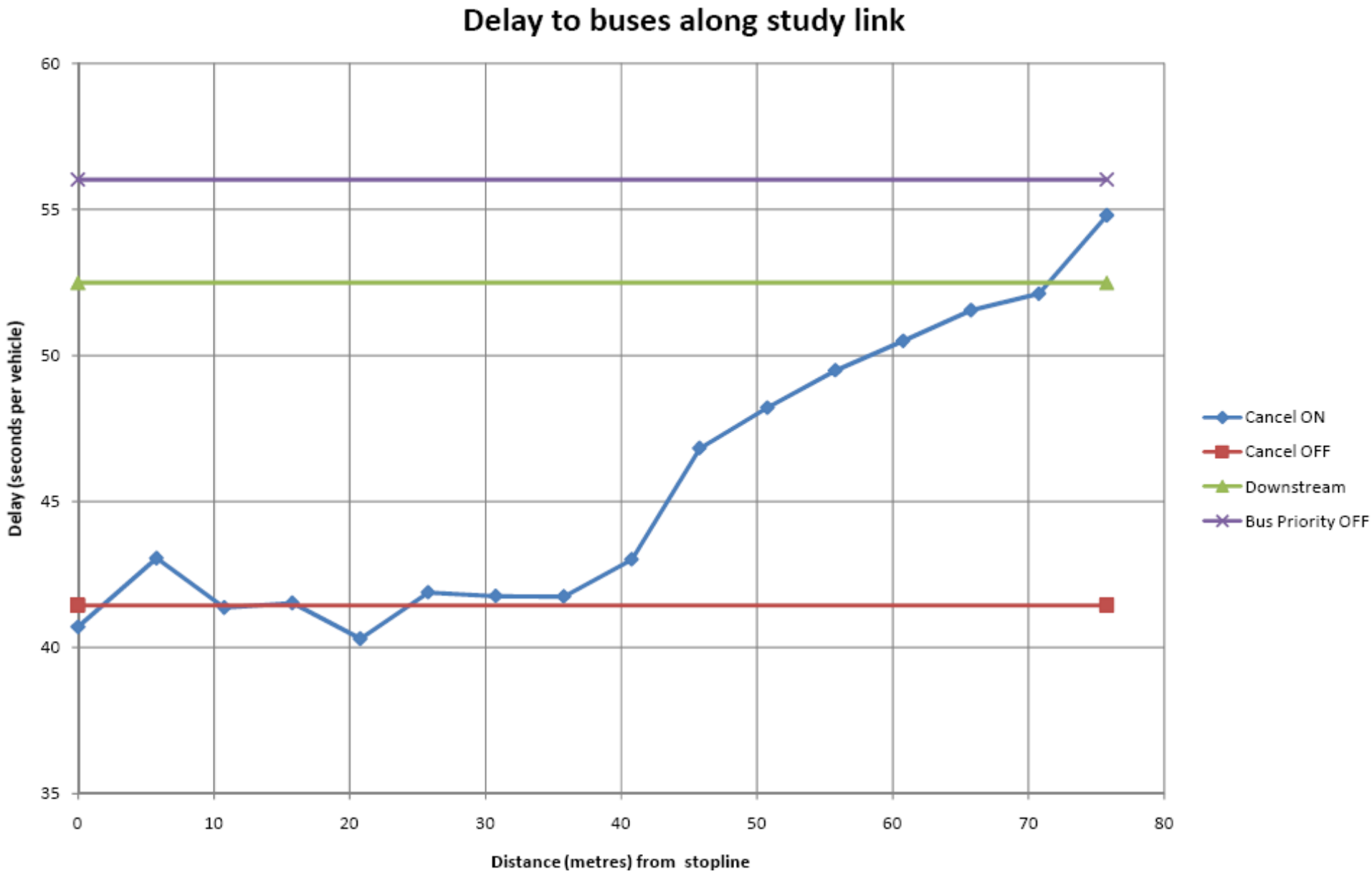
Where to put the Cancel Detector

- **Local extensions**
  - Detectors can be placed at the stop line
- **Central extensions have a transmission lag**
  - A simulation study was required
- **VISSIM model of Balls Pond Road**
  - Bus stop close to stop line
- **Multiple runs to get an average delay per vehicle**


VISSIM 5.10-04 - d:\ibus\data\distributions\balls_pond_rd.inp
File Edit View Base Data Traffic Signal Control Evaluation Simulation Presentation Test Scripts Help
Dwell time 20s
Std dev 5s
42m, 6s
100m, 43s
532790.9:184808.3
Left mouse button: select zooming area / Right mouse button: previous zooming area
Start
Command ...
D:\Bus\da...
VISSIM 5....
Search Desktop
13:09

SCOOT Parameters

- To make best position of cancel detector easy to spot, settings that exaggerate the effect were chosen.
- Large opposing flows
- Extension saturation target set to 130%
- Maximum extension set to 30 seconds.
- BVARY for upstream detection: 10 seconds
- BVARY for downstream detection: 2 seconds



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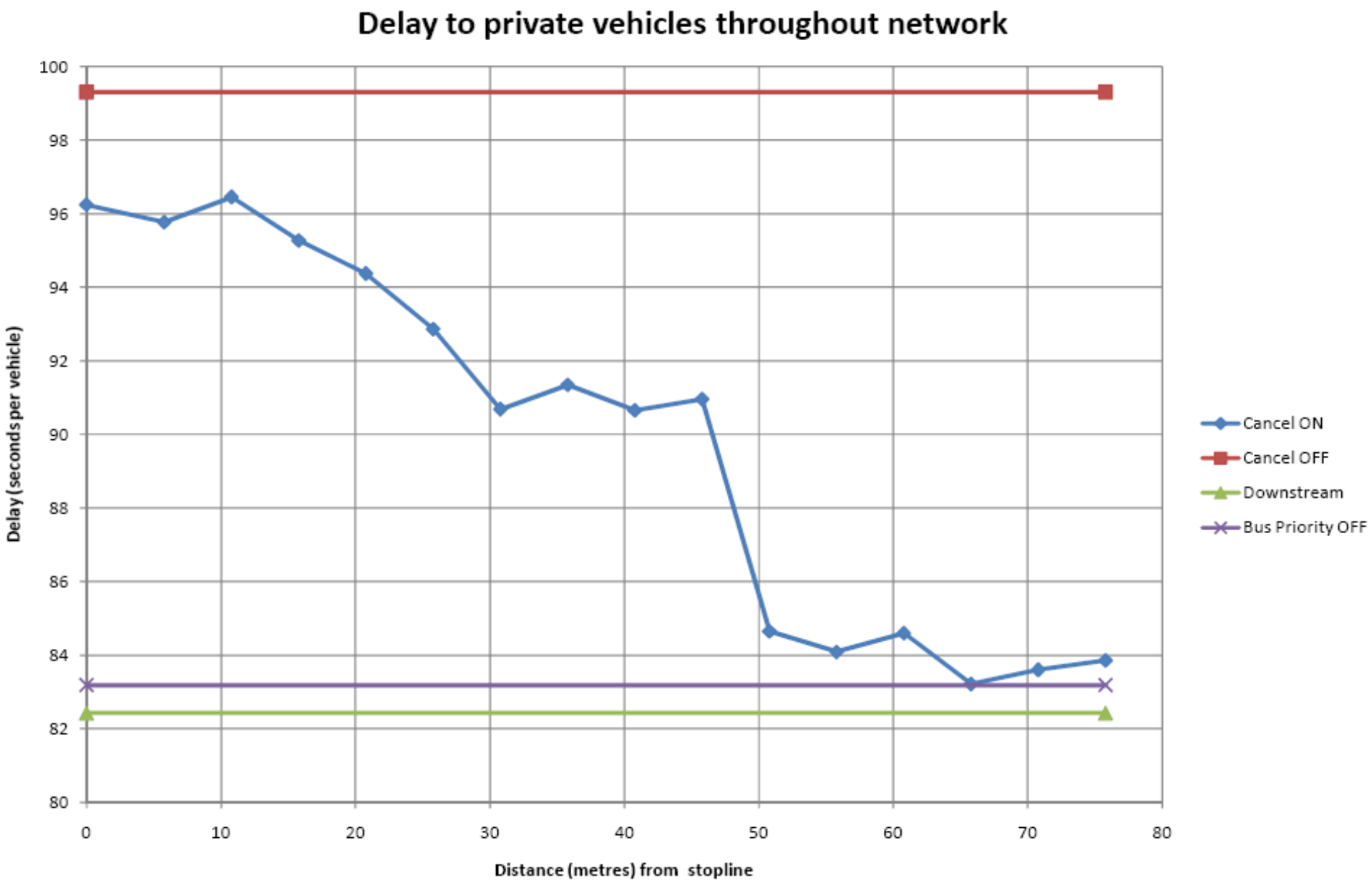
Delay to private vehicles throughout network
Delay (seconds per vehicle)
100
98
96
94
92
90
88
86
84
82
80
0
10
20
30
40
50
60
70
80
Distance (metres) from stopline
Cancel ON
Cancel OFF
Downstream
Bus Priority OFF

Results

- **Ideal location of cancel detector**
  - From graphs: 30 to 40 metres from stop line.
  - 10 metres uncertainty in location from iBUS.
  - Place cancel detector at 30 metres.

- **Use of upstream detector saves buses 10 seconds compared with downstream detector.**

- **Use of cancel detector saves private vehicles 8 seconds compared with upstream detector alone, but is 8 seconds worse than downstream detector.**

- **Private vehicles suffered due to high opposing flows and long extensions.**

Reduced Flows

- **Reduce opposing flows by 25%**
- **Reduce maximum extension to 20 seconds**

Bus Priority	Bus Detectors	BVARY	Delay per bus on priority link	Delay per private vehicle over network
OFF	None	N/A	52.9	74.3
ON	Downstream	2	46.6	75.6
ON	Upstream	2	44.2	76.5
ON	Upstream	6	44.5	77.1
ON	Upstream	10	43.5	76.9
ON	Up and cancel	2	43.4	76.6
ON	Up and cancel	6	42.3	76.3
ON	Up and cancel	10	43.8	76.9

Findings to Date

- **Early bus detection is beneficial even in the absence of a bus stop**

- **Important to reduce priority settings**
  - if more than one arm is granted priority
  - if opposing flows are heavy
  - if there are high bus flows on side streets

- **In these cases:**
  - Use extension target saturation of 100%
  - Use maximum extension of 15 seconds

- **It is possible for buses to receive priority with little disbenefit to other vehicles, particularly if the buses are on the main link**

Conclusions

- New facilities enable buses to be detected further from stop line
- Useful for where bus stops are near stop line
- Enables more extensions to be granted
- Cancel detector means unnecessary “wasted” green reduced
- Need to be cautious if multiple arms are set up for bus priority, or if bus flows are high and junctions are busy.