Detectors in a real time system

USER MANUAL: RTA-TC-251
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FILENAME: DETECTORS.PPT
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Detectors

Detectors in SCATS have two functions -

- **Tactical control of an intersection**
- **Strategic control of a system.**

Tactical Control

SCATS tactical control refers to the lower level of control which is undertaken by the intersection.

Tactical control provides local flexibility to meet cycle by cycle variation in demands.

Tactical Control

Tactical control allows :

- Demanding a stage
- Extending a stage

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Demand Functions

The three basic types of demand are :

- **Locked**
- **Non Locked**
- **Presence timed**

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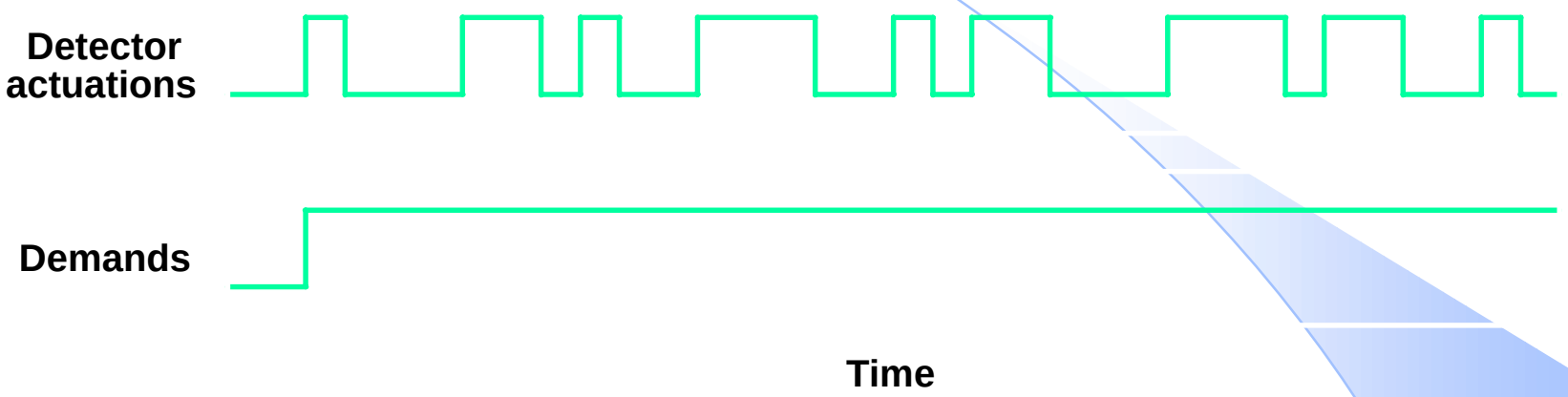
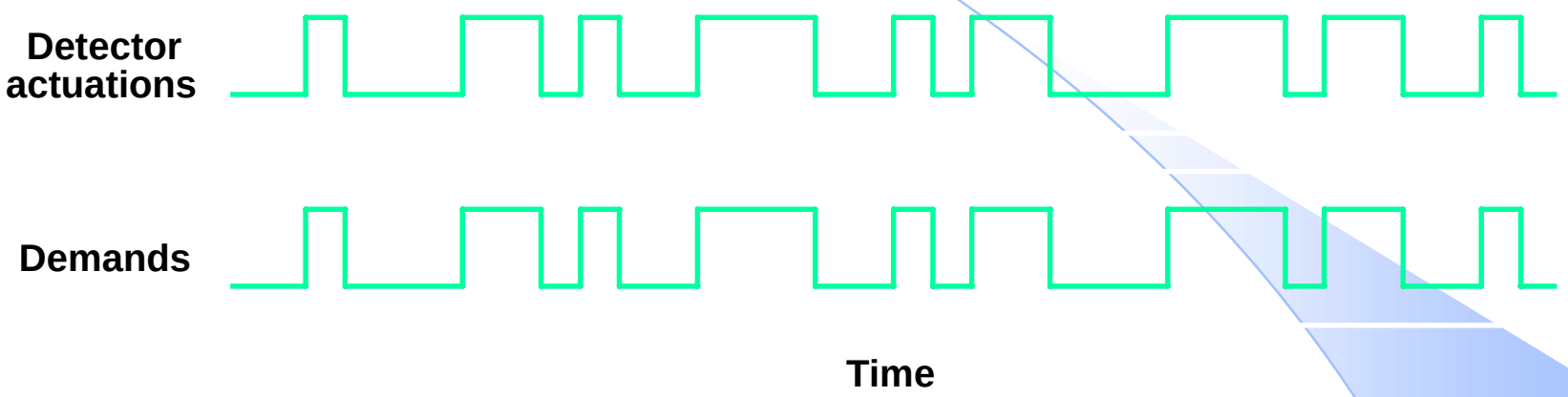
Demand Functions



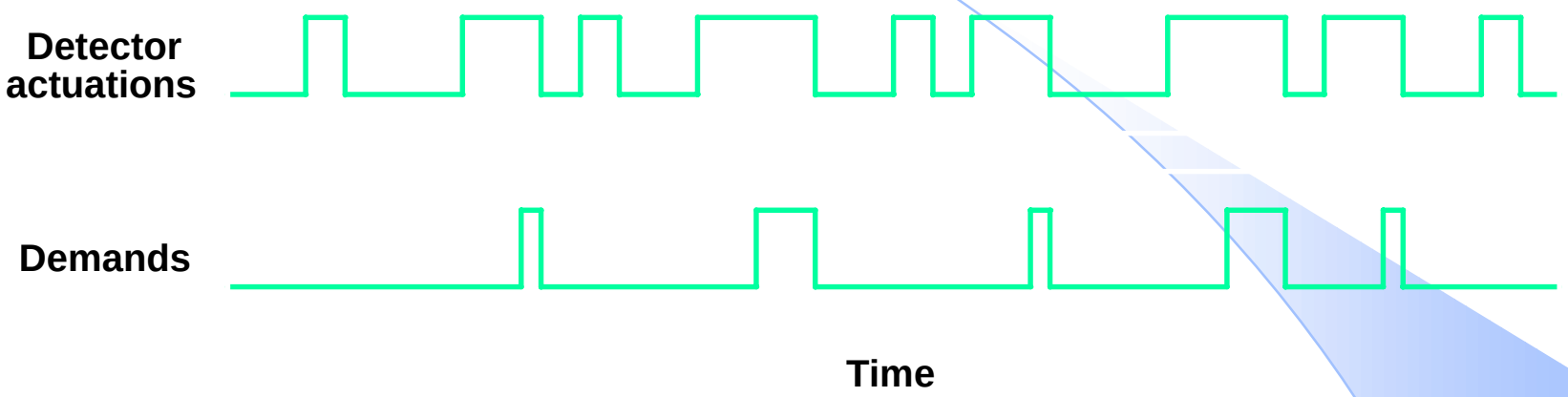
- Locked demand

Demand Functions



- Non-locked demand

Demand Functions



- Presence-timed demand

Extension functions

Once a stage is running:

- if no demands for other stages, stay in rest interval
- if demands for other stages, extend the stage if necessary

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Extension functions

Generally speaking, extend stage if:

- vehicles are faced by green signal
- detector actuations indicate vehicles are present
- red is next

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Extension functions

Extension time is governed by:

- gap timer
- headway timer
- waste timer

These are called approach timers.

Extension functions

- Traffic signals work at their optimum when vehicles travel in platoons.
- The gap timer detects the end of the platoon.
- The headway and waste timers detect the efficiency within the platoon.

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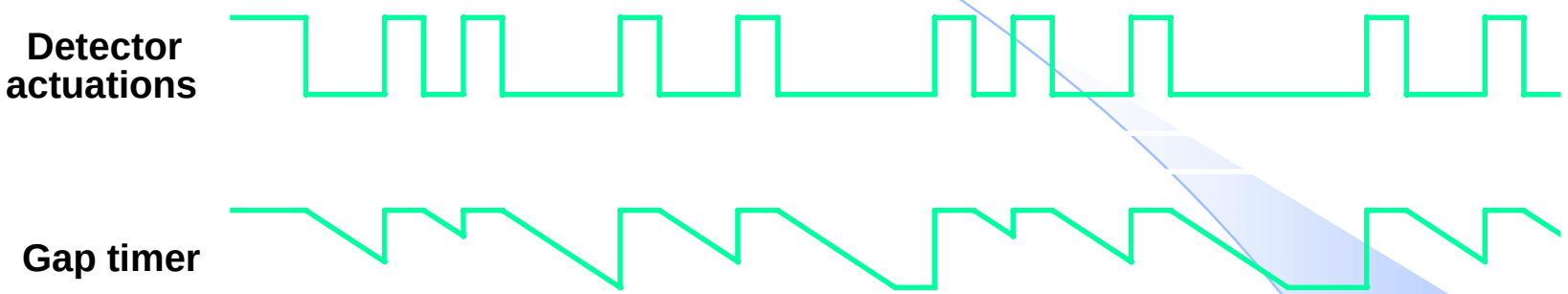
Operation of gap timer



- Gap timer starts timing at start of stage

Gap timers

Typical Gap time settings for stopline detectors are:

* 2.5 seconds for an exclusive left or right turn lane
* 3 to 4 seconds for a through or shared lane
* *HK 4 seconds*

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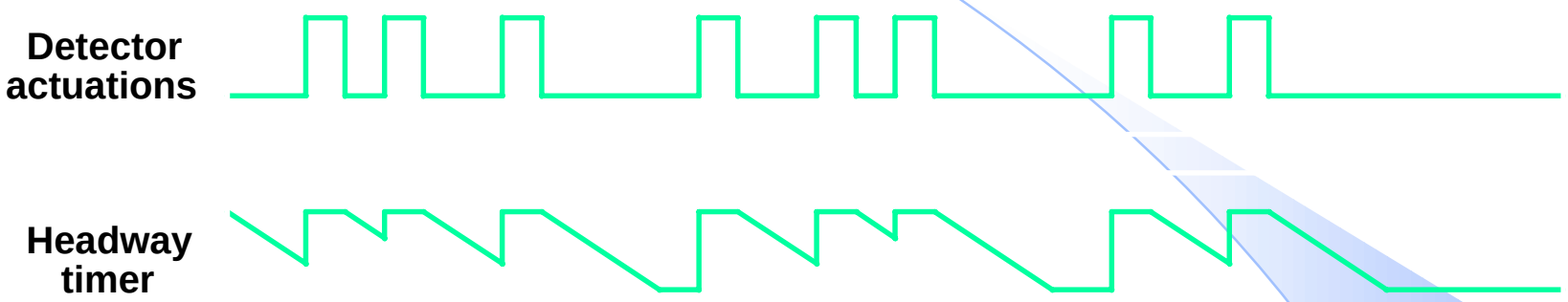
Operation of headway timer



- Headway and waste timer start timing at start of extension green interval

Headway timer

Typical Headway time settings for stopline detectors are:

* 1.25 * space time at saturation flow / number of lanes
* *HK*
  - 3 or more lanes 0.8 seconds
  - 2 lanes 1.0 seconds
  - 1 lanes 1.2 seconds

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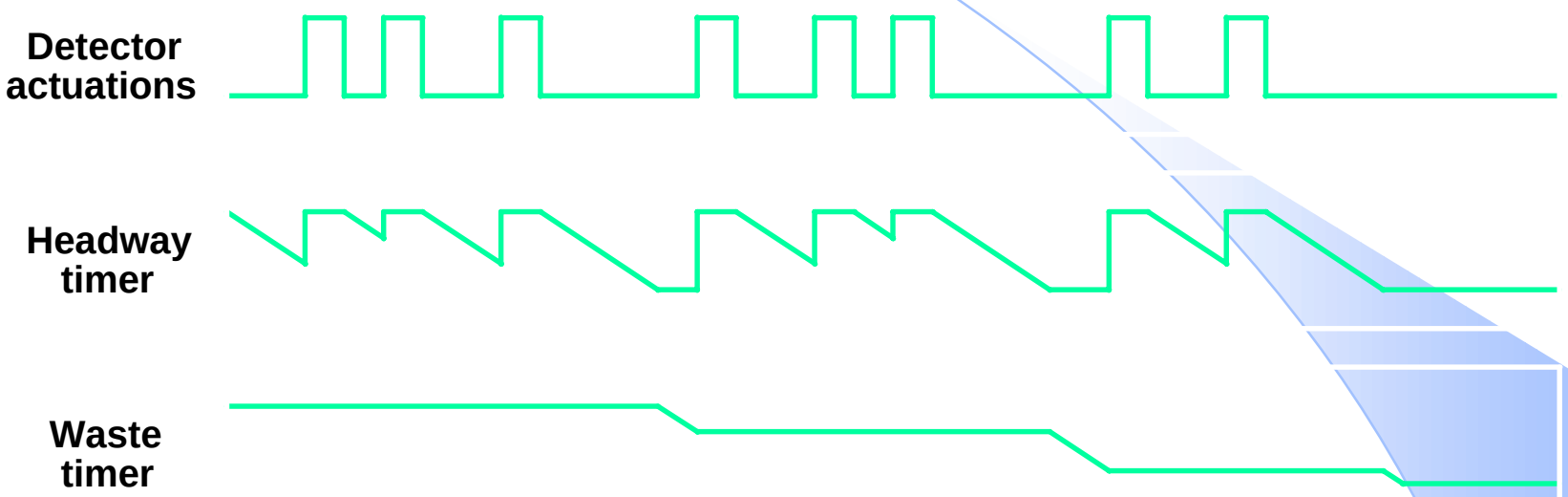
Operation of waste timer



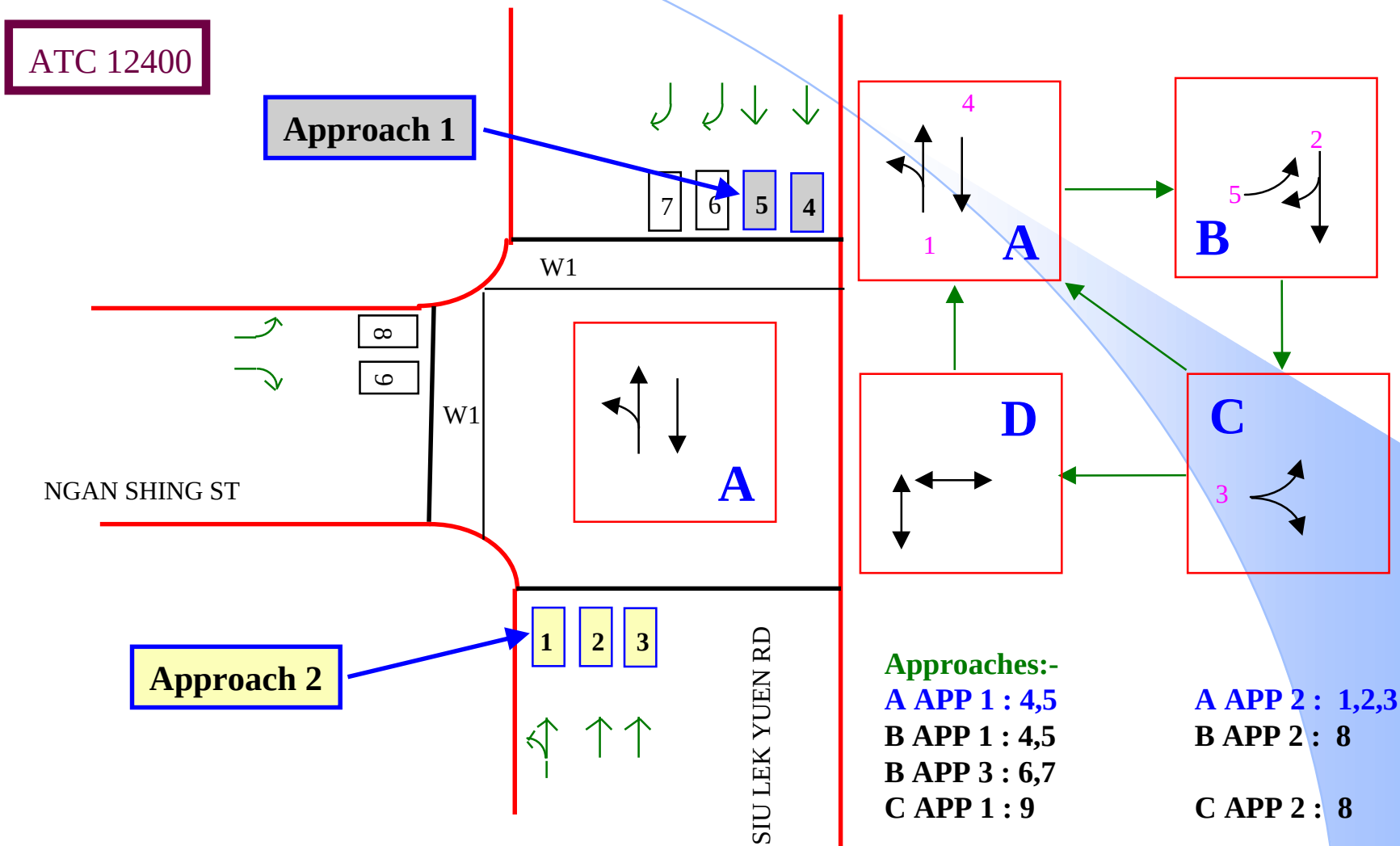
Waste timers

Typical Waste time settings for stopline detectors are:

* 4 to 10 seconds, these being 10% of the maximum green time.
* *HK*

  Greater value 20% of maximum green time or 6 seconds

A APPROACH TIMERS



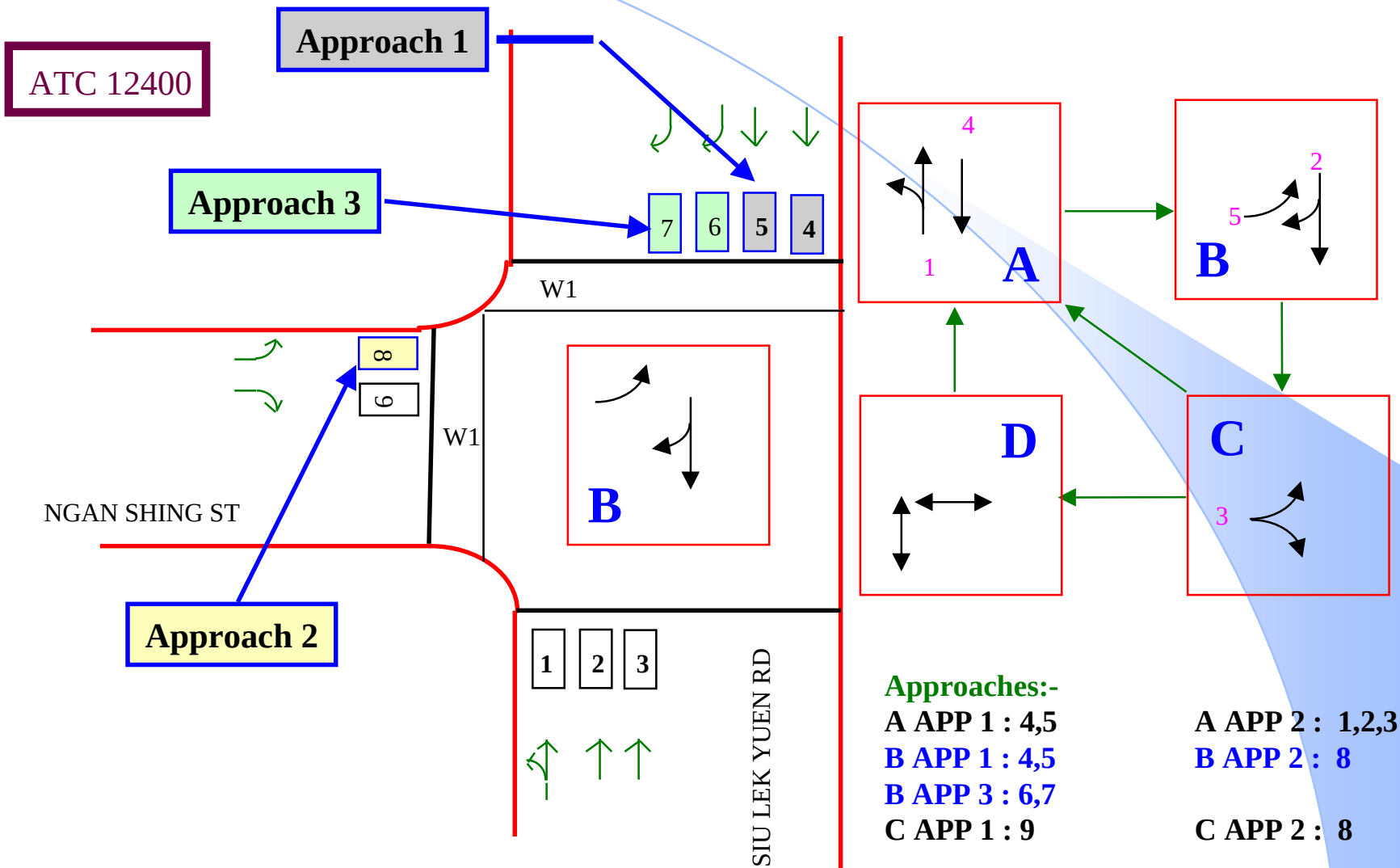
Approaches:-

A APP 1 : 4,5
B APP 1 : 4,5
B APP 3 : 6,7
C APP 1 : 9

A APP 2 : 1,2,3
B APP 2 : 8

C APP 2 : 8

B APPROACH TIMERS



Approaches:-

A APP 1 : 4,5
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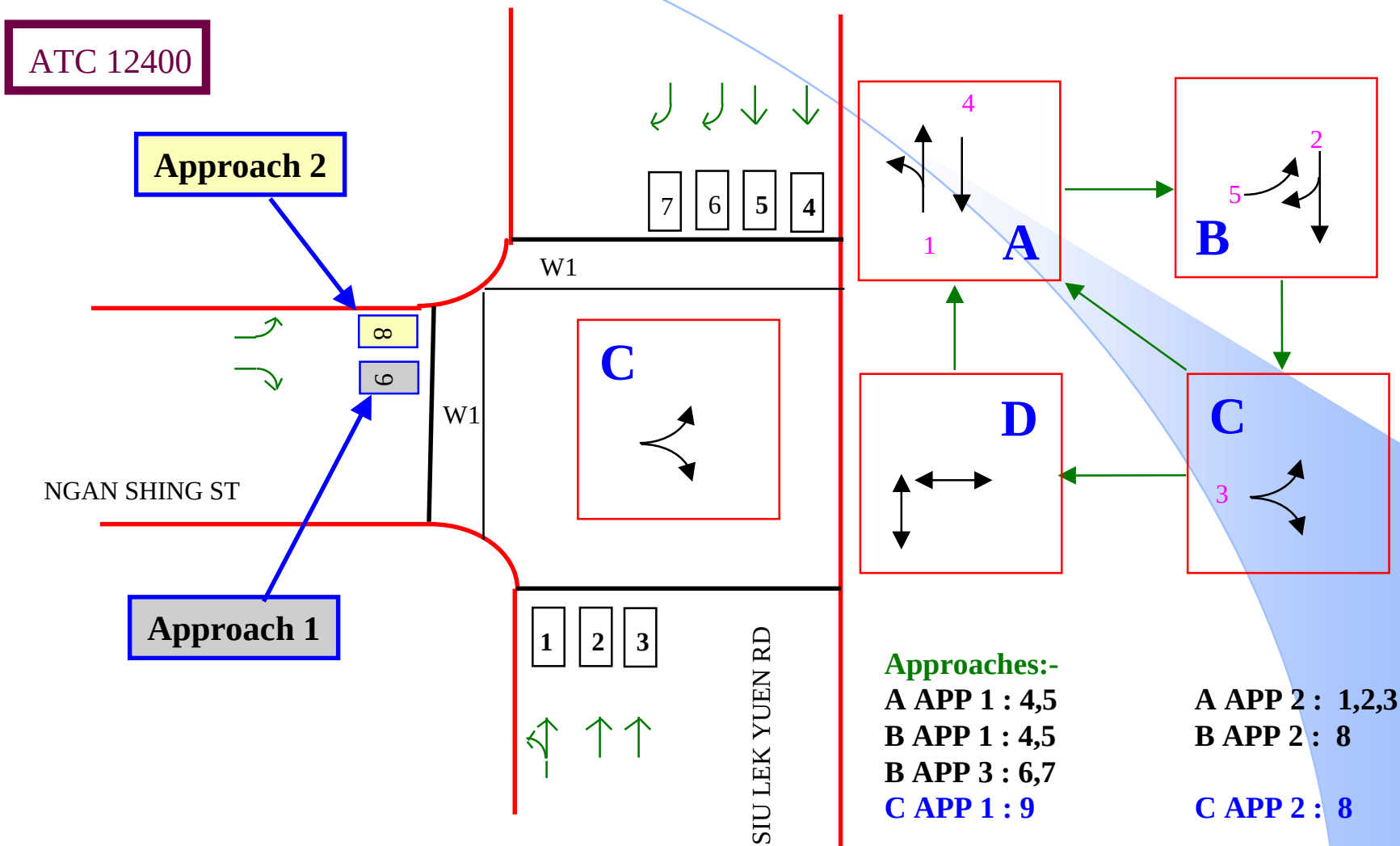
C APP 1 : 9

A APP 2 : 1,2,3
B APP 2 : 8

C APP 2 : 8

C APPROACH TIMERS



Approaches:-

A APP 1 : 4,5
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C APP 1 : 9

A APP 2 : 1,2,3
B APP 2 : 8

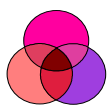
C APP 2 : 8

Strategic Detectors

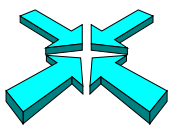
SCATS strategic control refers to the top level of control which is impressed on the subsystem.

Using flow and occupancy data collected from vehicle detectors, the strategic algorithms determine :

Optimum cycle time



Stage splits



Offsets

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Strategic control

Strategic detectors are the eyes of SCATS.

Strategic detectors are located at each critical intersection in each subsystem.

Sometimes light volume lanes are ignored.

Shared detectors

The local controller bases tactical decisions on information from the vehicle detectors at the intersection, some of which can also be strategic detectors.

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Location

Both Strategic and Tactical detectors are located at or near the stop line and are 4 to 4.5 metres in length.

The front of the loop is normally 1.5 m back from the stop line but can be located anywhere up to 5 m back, to avoid pits or bad road surface.

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Degree of Saturation

With the strategic data, the system has to calculate how busy the lane is, remembering that lanes have different -

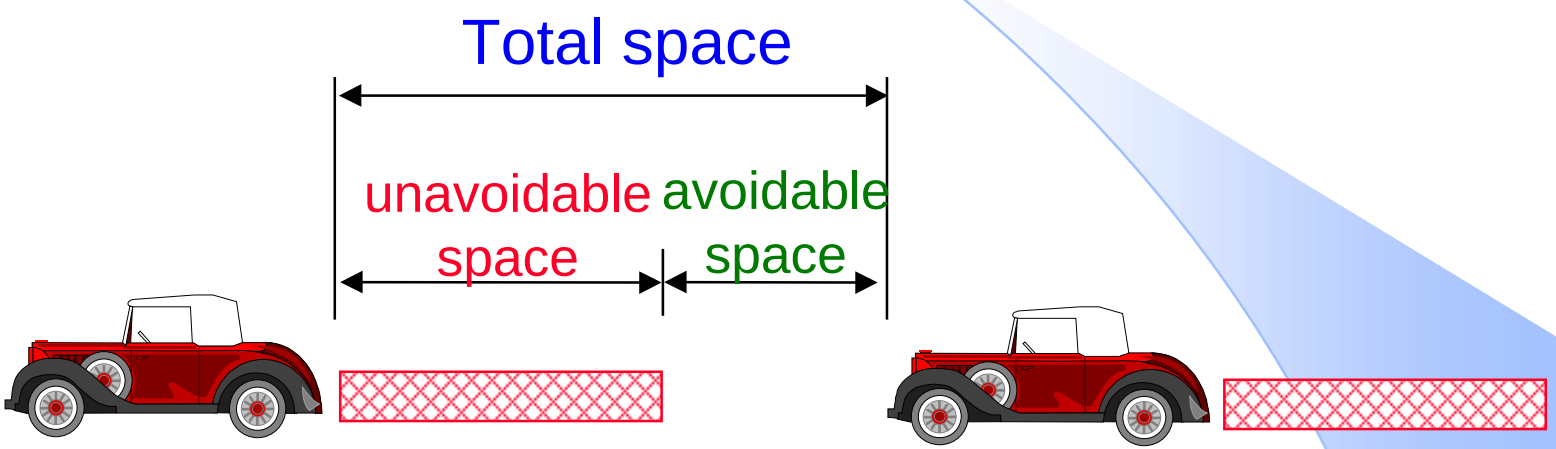
- Traffic movements
  - Left turn
  - Right turn
  - Through movements
  - Shared movements

Degree of Saturation

- Gradient
- Types of vehicles
- Down stream parking
- etc.

The parameter used to calculate how busy a lane was, is the space between vehicles.

SPACE TIME

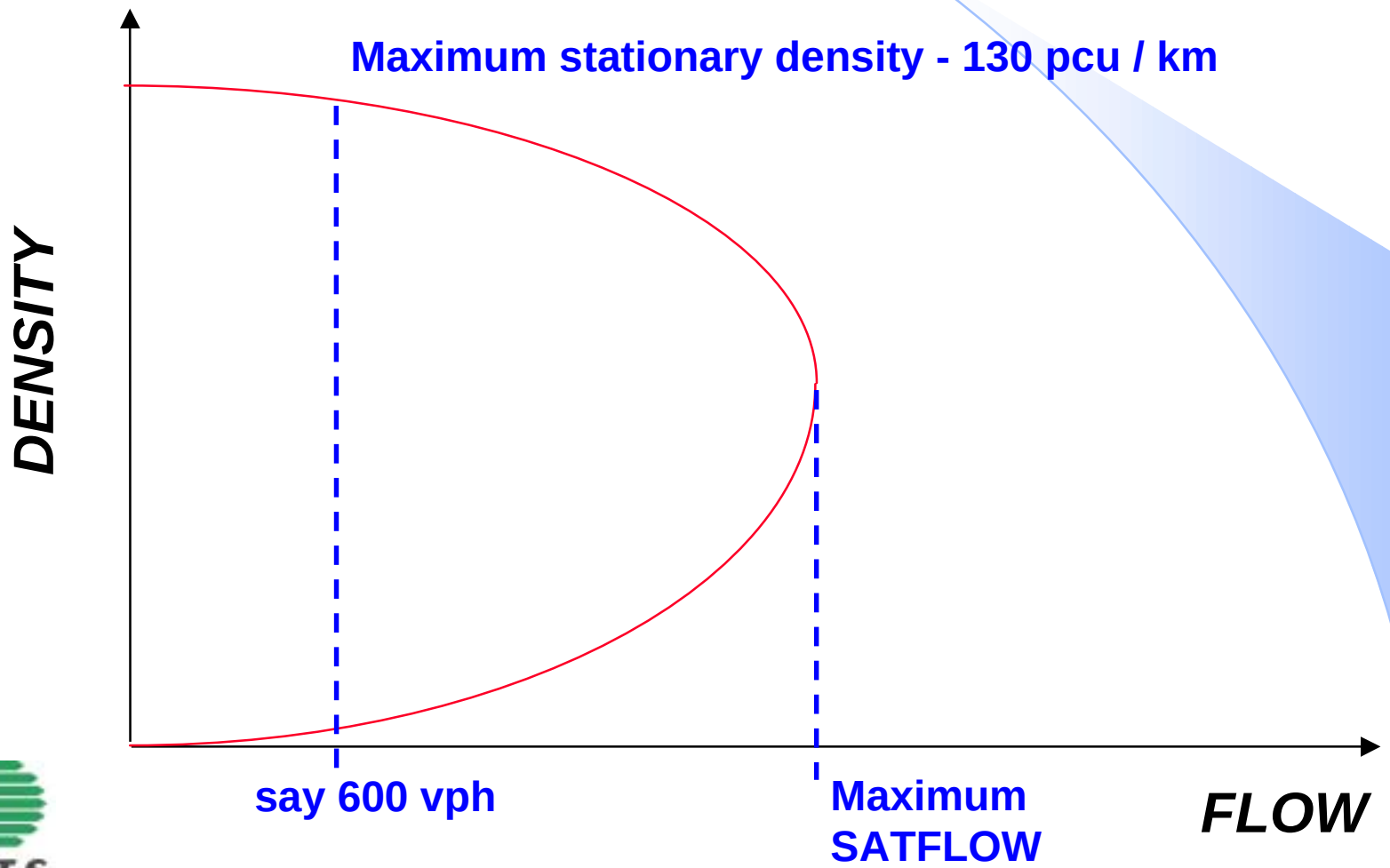


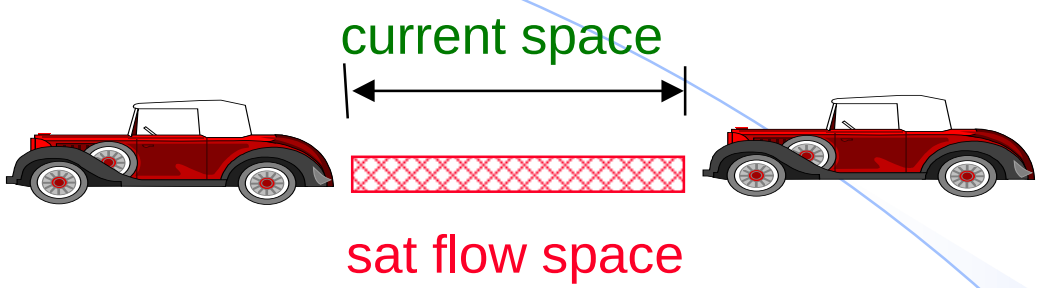
Degree of Saturation

Another term for how busy a lane is, the Degree of Saturation.

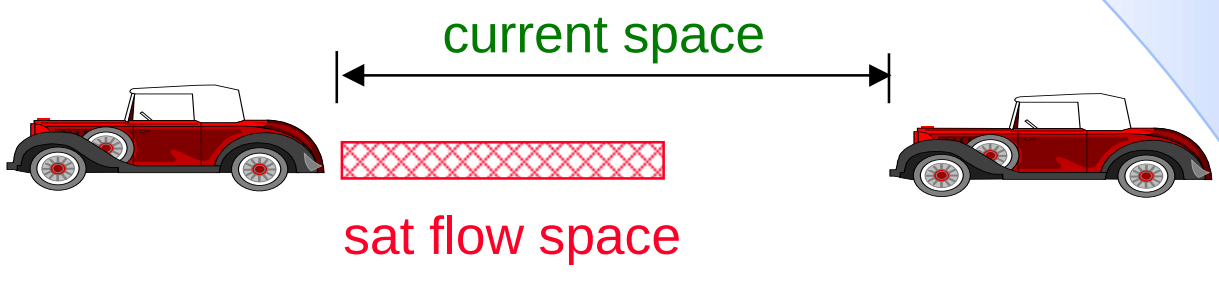
$$DS = \frac{\text{How much green did you need}}{\text{How much green you got}}$$

DENSITY / FLOW RELATIONSHIP

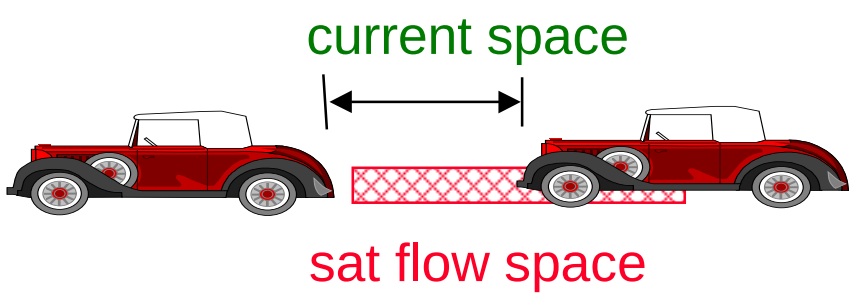




DS = 100%



DS <100%



DS >100%

Measured parameters

Every cycle the controller sends to the regional computer information for the nominated approaches -

- The total time that the loop was occupied
- The number of vehicles that when over the loop
  - The leading edges are summed and 1 added to the total (N+1)

SCATS also knows how long the approach was green.

  - The sum of the green, yellow and red periods

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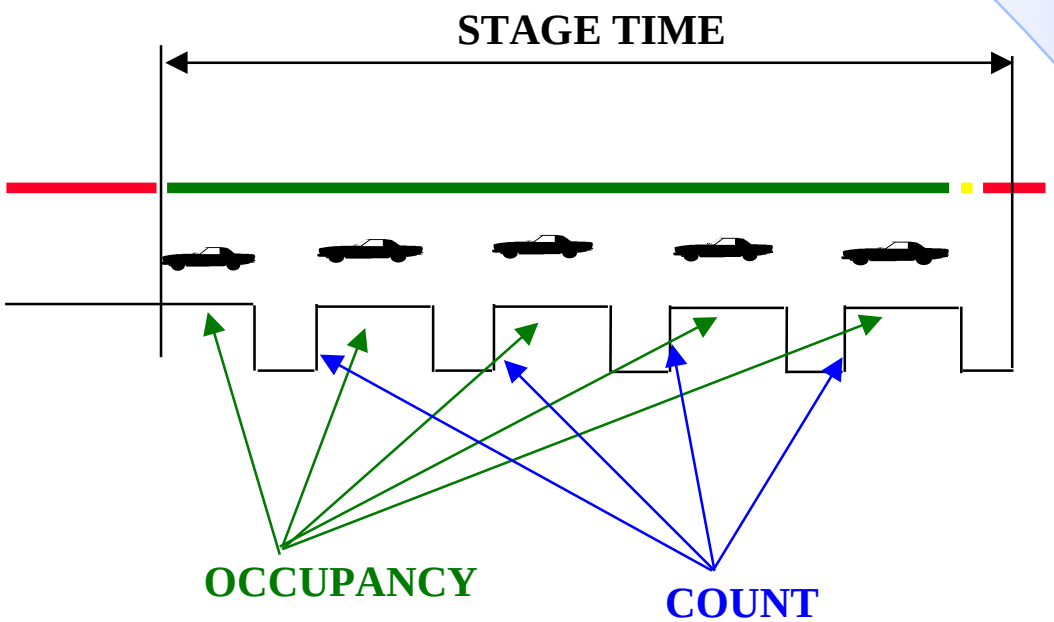
Measured parameters



Calculated parameters

From the measured data two other values are calculated -

* Space Time
  - Which is the Stage Time minus the total Occupancy time
* Average Space Time
  - Which is the Space Time divided by the number of vehicles

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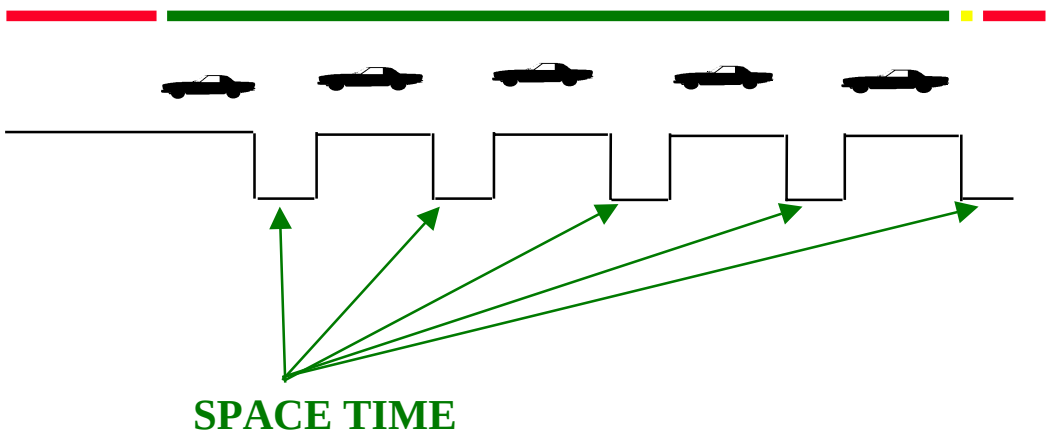
Calculated parameters

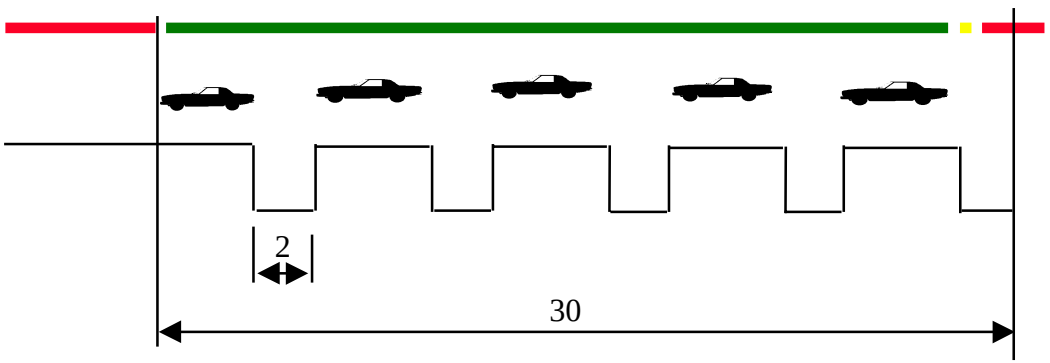


DS at traffic Signals

Lets look at 3 cycles of the same approach at an intersection.

DS at traffic Signals

Total Stage time	**=**	**30s**
Total occupied time	**=**	**20s**
Number of vehicles	**=**	**5 cars**
Space Time	**=**	**10s**
Average Space Time	**=**	**2s**



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DS at traffic Signals

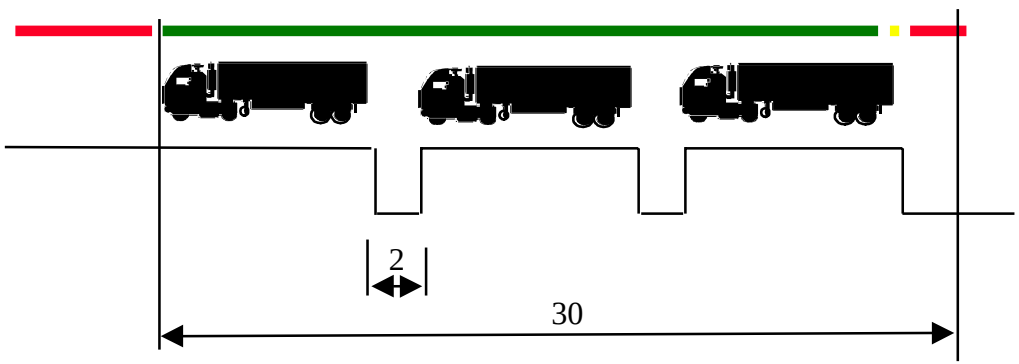
Total Stage time = 30s

Total occupied time = 24s

Number of vehicles = 3 trucks

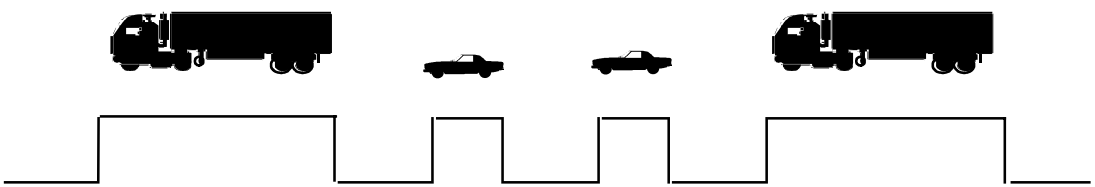
Space Time = 6s

Average Space Time = 2s



DS at traffic Signals

Lets look at 2 cars and 2 trucks.



DS at traffic Signals

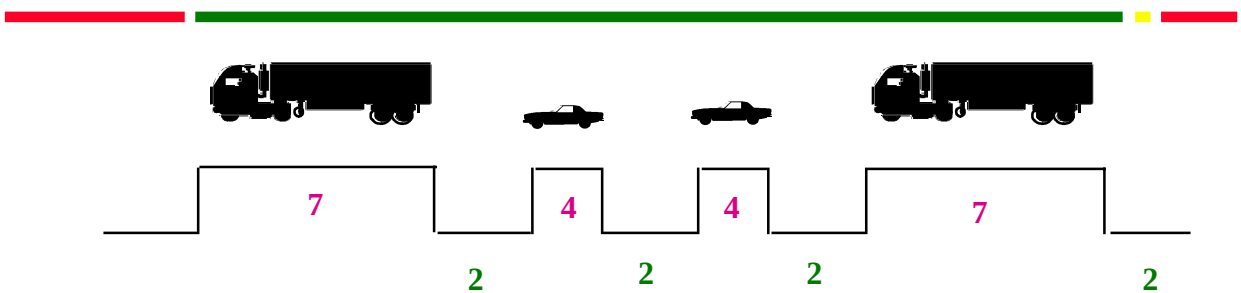
Total Stage time = 30s

Total occupied time = 22s

Number of vehicles = 4

Space Time = 8s

Average Space Time = 2s



Calculated DS

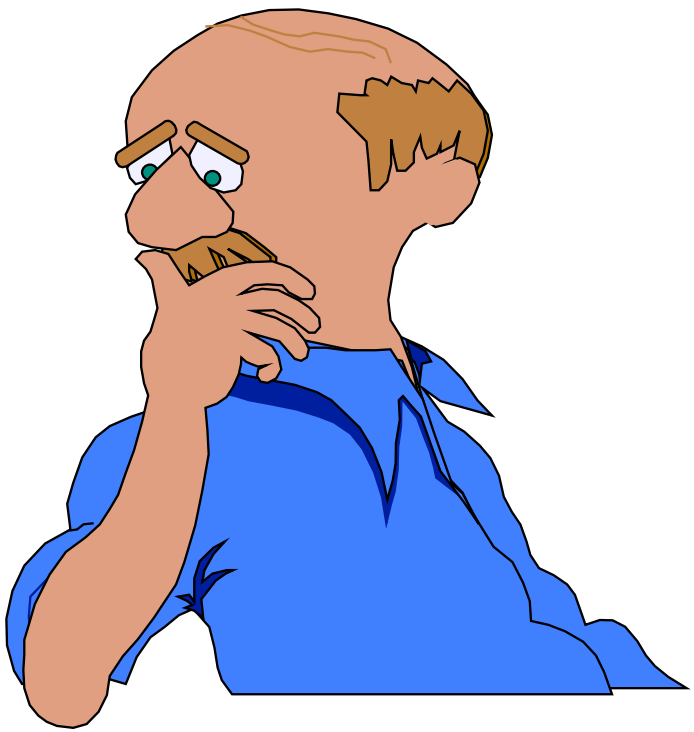
In all three examples the Average Space Time was 2 seconds, so they would all produce a DS of the same value.

The fact that traffic was made up of difference vehicle classes had no affect on the DS.

Degree of Saturation

Each Strategic detector has a mechanism for self calibration, it is constantly checking the best measured flow. This data is then stored in the Strategic Input.

Questions



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