Smart Signals Pilot

Greater Cambridge Partnership, Cambridgeshire County Council & Smart Cambridge
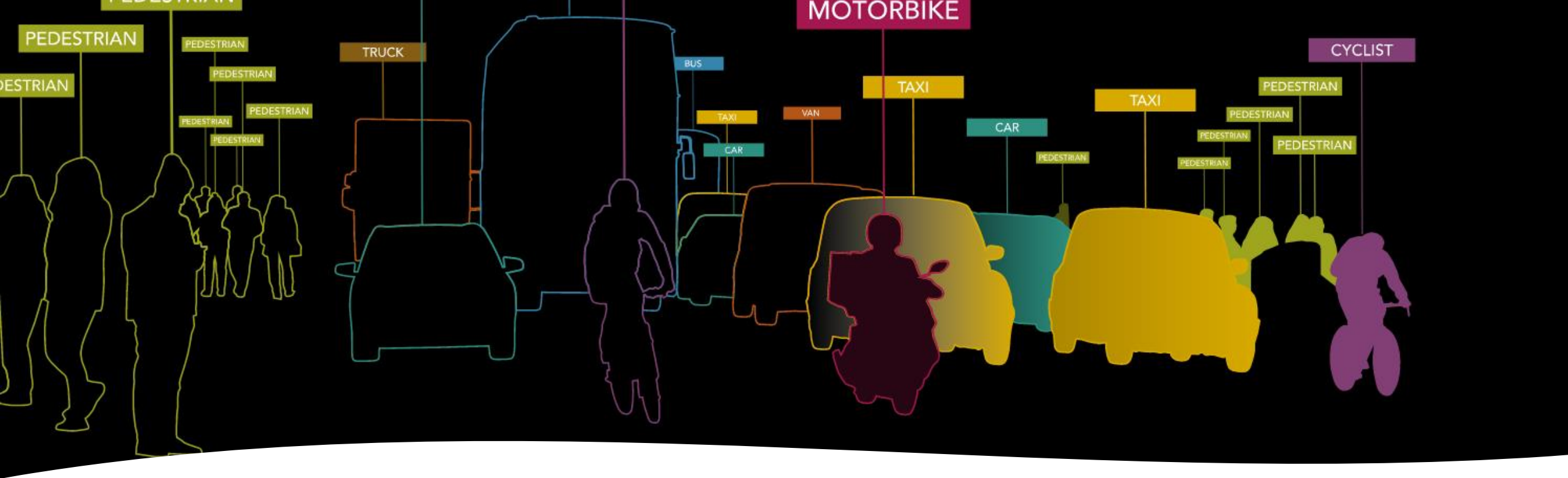
Project Background

- Technological advancement in traffic sensors
- Comprehensive traffic flow/journey time data becoming available
- New systems being created to integrate data in to traffic signals
- It's not a "silver bullet"
- Opportunity to trial new technology for our needs in Cambridgeshire
- Procured via an open tender process
- Product is being developed for our requirements as part of the trial

Purpose

"To investigate, trial and develop emerging technologies and data solutions that can be adopted to assist in the successful mitigation of sustainability challenges across the region, encouraging further economic growth"

Traffic Signals Background
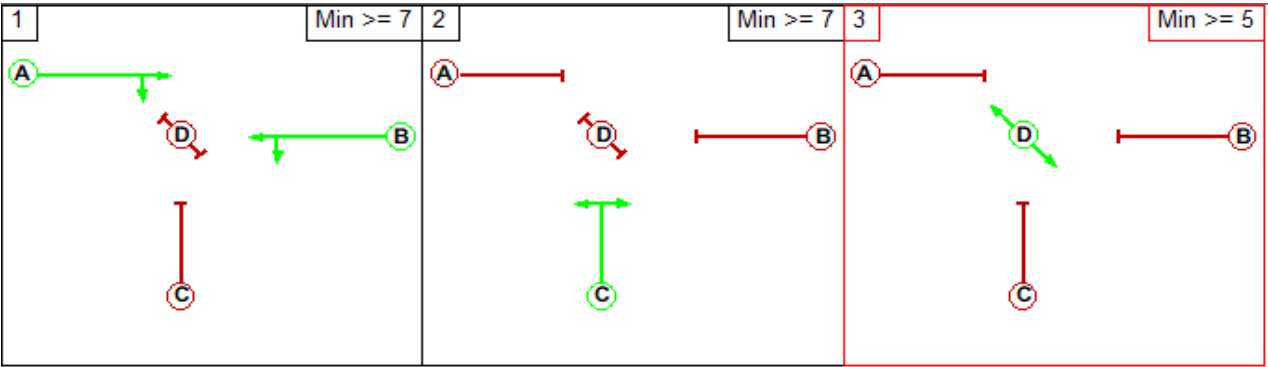
3 main reasons we install traffic signals:

- Balance the demands of different approaches/users
- Road Safety requirement
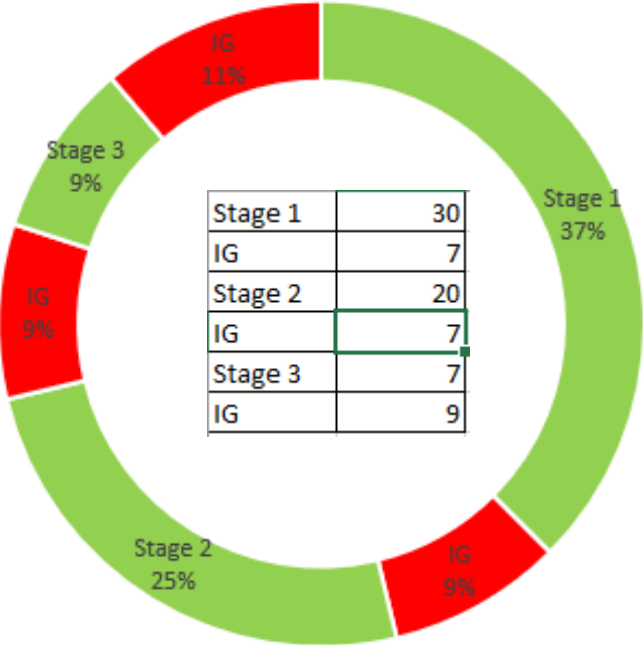- Public transportation priority

Traffic signal control constraints:

- Cycle Time
- Complexity of the junction
- Competing demands/priorities
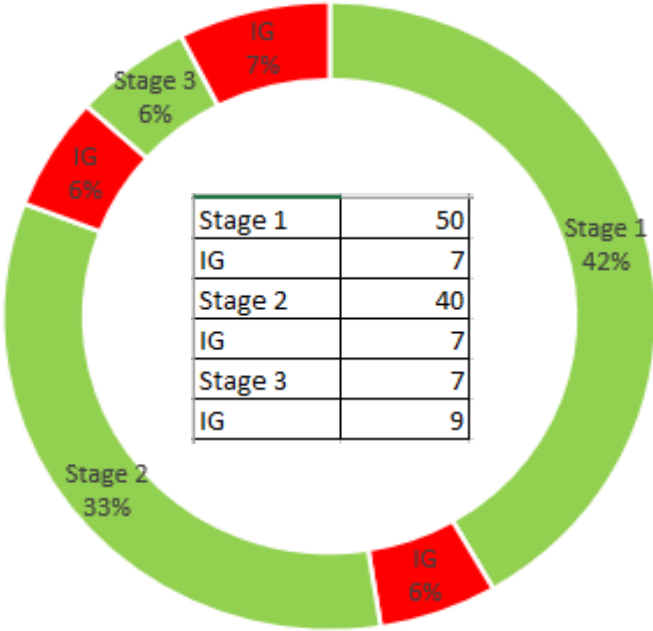- Safety periods & standards

Cycle Time

90s Cycle Time

Stage 1	30
IG	7
Stage 2	20
IG	7
Stage 3	7
IG	9

Stage 1 37%
IG 11%
Stage 3 9%
IG 9%
Stage 2 25%
IG 9%

Green time = 71%

Red time = 29%

120s Cycle Time

Stage 1	50
IG	7
Stage 2	40
IG	7
Stage 3	7
IG	9

Stage 1 42%
IG 7%
Stage 3 6%
IG 6%
Stage 2 33%
IG 6%

Green time = 81%

Red time = 19%

Junction Complexity

Stage 1	7
IG	5
Stage 2	30
IG	7
Stage 3	7
IG	7
Stage 4	18
IG	5
Stage 5	11
IG	7
Stage 6	7
IG	9
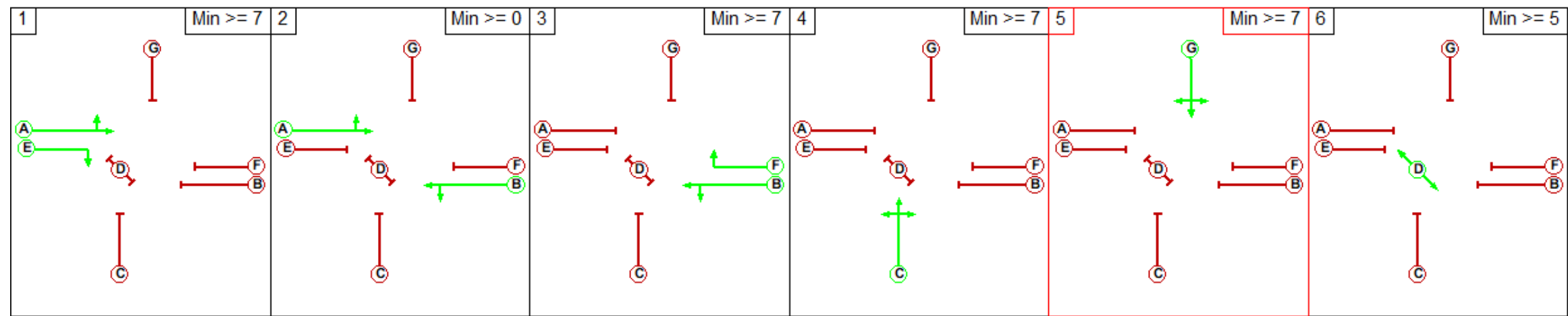
Complex Junction - 120s cycle time
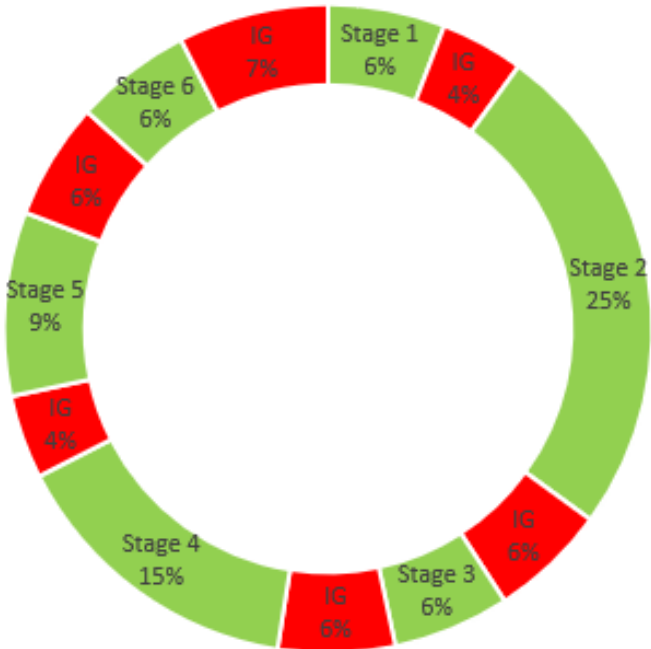
Green time = 67%

Red time = 33%

Traffic Signal Control Methods

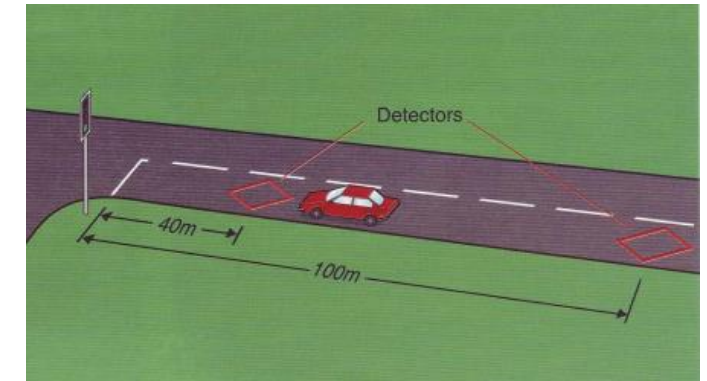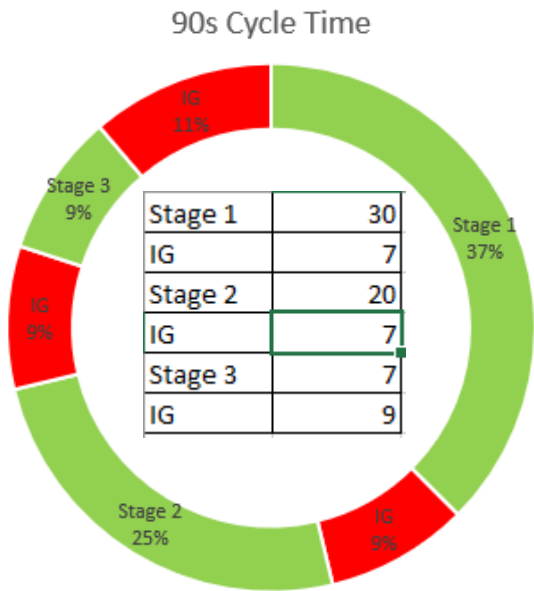| **Detection on each approach**	**Stages only run when required**	**Stages only run for as long as required**
Vehicle Actuated (VA)	Split, Cycle & Offset Optimisation Technique (SCOOT)	Microprocessor Optimised Vehicle Actuation (MOVA)
• Standard approach since WW2 • Designed for individual junctions • Stages run up to a pre-set max time • Pre-set times can be adjusted by time	• Introduced in 1980's • Designed to coordinate multiple junctions using an algorithm • Can operate using different parameters at different times	• Introduced in 1990's • Designed to improve individual junction performance using an algorithm • Flexibility to adjust timings throughout day
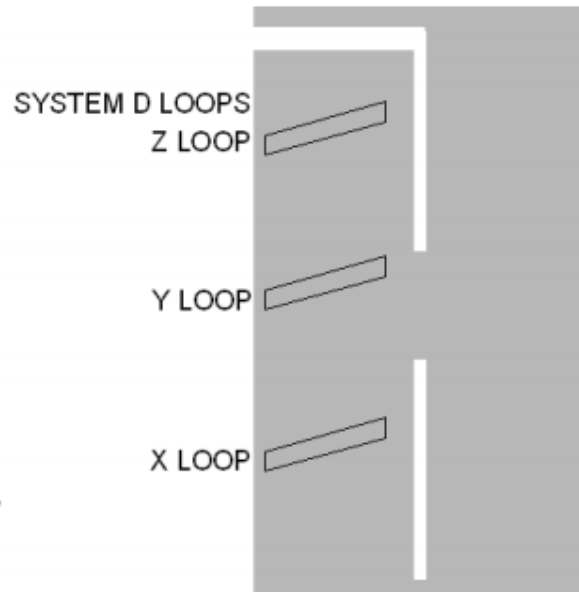
Traffic Signals Control Methods Cont…

Fixed Time

90s Cycle Time

Stage 1	30
IG	7
Stage 2	20
IG	7
Stage 3	7
IG	9

VA

54s Cycle Time

Stage 1	30
IG	7
Stage 2	10
IG	7

MOVA

80s Cycle Time

Stage 1	56
IG	7
Stage 2	10
IG	7
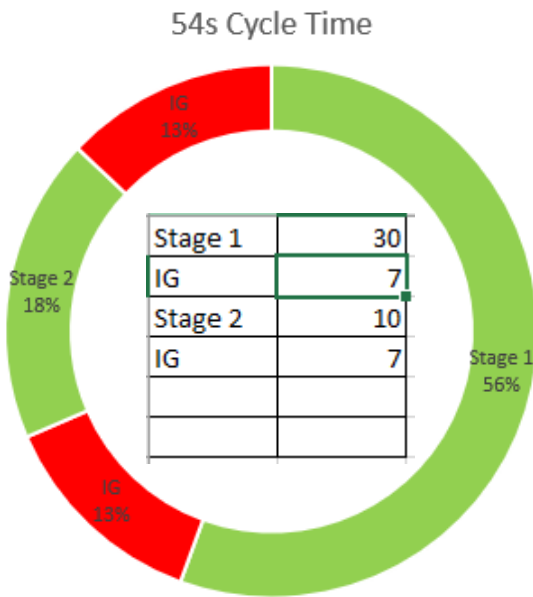
SCOOT

What is a Smart Junction

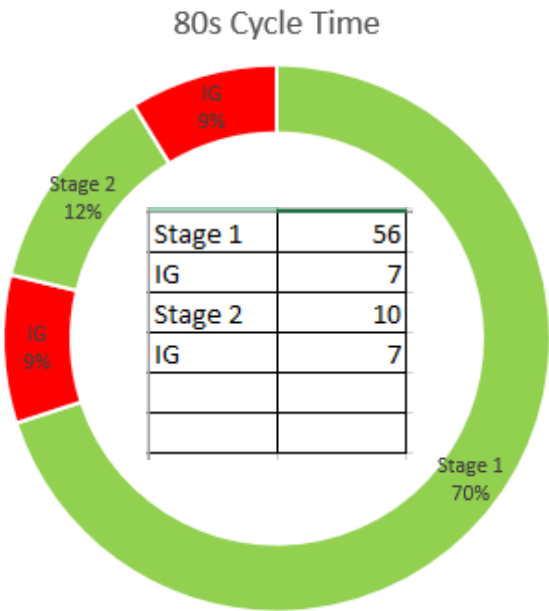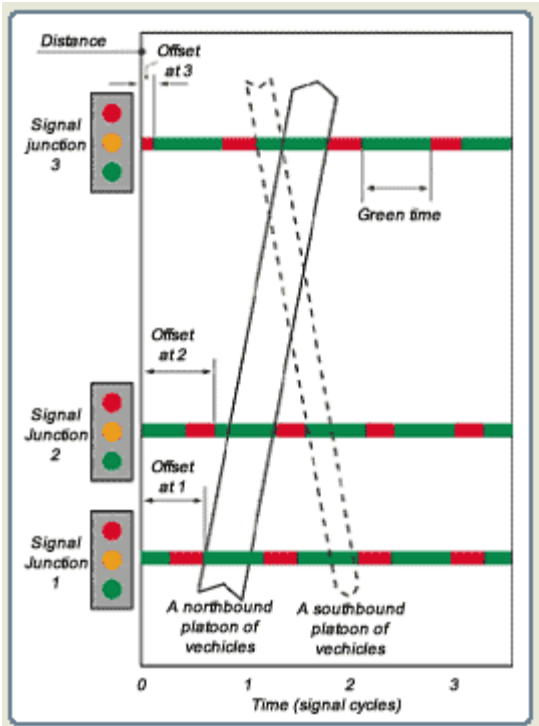- Control Unit or Control System with Machine Learning capabilities to take data inputs and adjust traffic signals timings as required.
- Utilises sensors and/or data sources capable of utilising detailed traffic data classified.
- Ability to identify and prioritise different road users
- Ability to monitor journey times of vehicles passing through the junction(s).

The Key Questions

- Reducing congestion caused by individual traffic signals

- Coordinating the network more effectively to respond to changing traffic patterns

- Prioritising more sustainable transport modes to reduce stops and delay to encourage modal shift

- Providing more comprehensive and accurate data on the use of the network for strategic decision making

How will performance be measured?

Understanding of scene
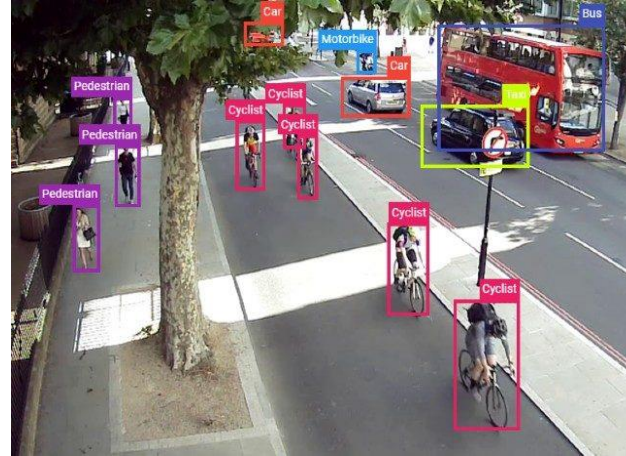
Average pedestrian wait time & numbers

Average Cyclist Wait and Green time

Bus journey times

Traffic journey time and flows

Overall junction performance

Cambridge Smart Junctions

Robin Hood junction
- Operates under MOVA control
- Utilised by all transport modes
- New control method designed in
- Independent of other junctions

Hills Road area
- Operates under SCOOT control
- Utilised by all transport modes
- High traffic levels
- Opportunity to expand in future

Project timelines

	Project start	3 Months	6 Months	9 Months
SENSORS	Design / Prep-works / Ethernet to polecaps	Install Sensors / Gather data		
VIU	Install ADSL / Update controller config / Build VIU	Test new config / Verify new config	Install VIU / Control using Max Occupancy algorithm	
AI ALGORITHM		Build initial, uncalibrated simulation / Calibrate simulation	Train AI agent	Control using AI

- Pilot to run for 12 months from installation of sensors
- Option to extend pilot by a further 12 months in contract
- Initial findings report October 2021
- Interim progress report January 2022
- Final performance report June 2022 (subject to any extension)

Progress to date


Hills Road & Cherry Hinton Road junctions:

- Sensors deployed

- Simulated modelling and "training" of agent in progress

- Control unit and new traffic signal controller configuration installed

- Initial control of junction using Vivacity's "Max Occupancy" algorithm (not AI) - 7th July

- Initial AI control expected to take place in August/September

Robin Hood junction:

- Site survey carried out on 29/06/21 following completion of the new site.

- Sensors have been specified and currently being built.

- Sensors scheduled to be installed week commencing 30th August.

- 3 months data collection and simulation to take place after sensor install.

- Initial AI control anticipated in November

How has COVID impacted on traffic flows

- Data taken from multiple Vivacity sensors in Cambridge City
- Peak periods smaller than first lock down in 2020
- Day traffic has returned as shops/activities have opened up
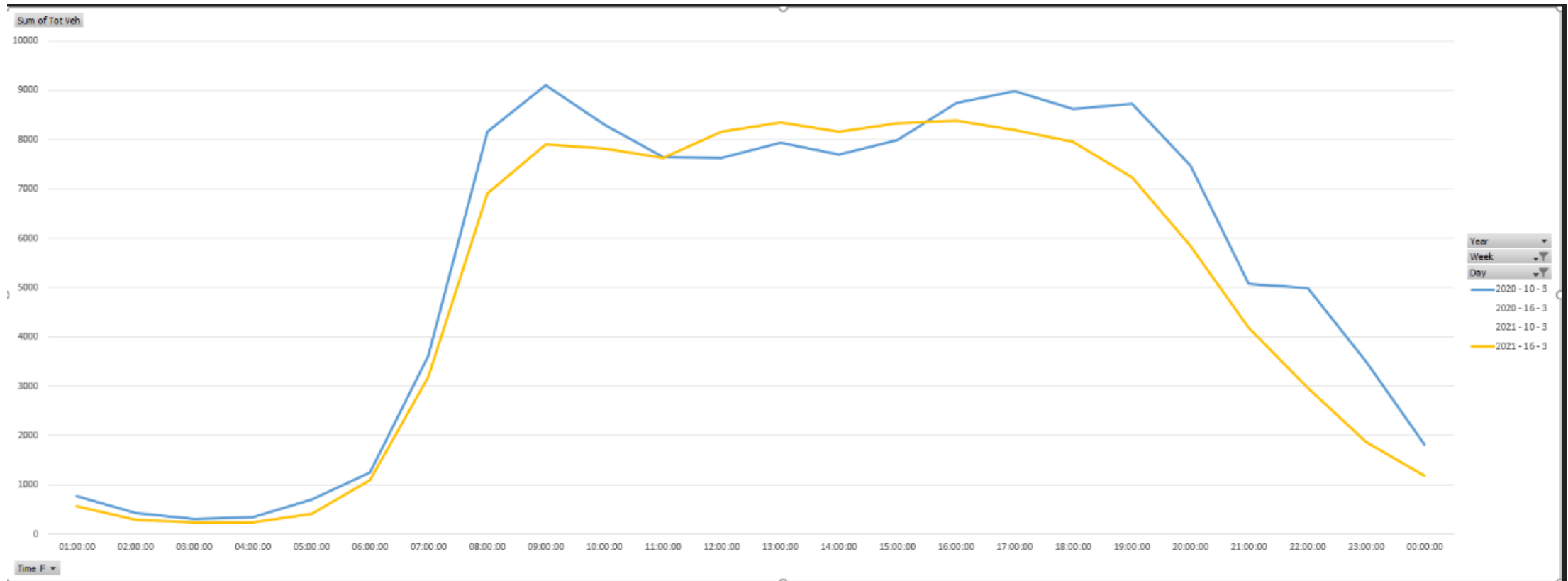
Summary

- Project is a trial

- Comparison of AI vs existing control methods to support network management

- Assess prioritising different road users

- Identify capabilities and limitations of the technology

- Assessment of traffic data

- Support development of network management strategies

Thank you

Any questions?