Active Traffic Management and Managed Lanes

"We can't solve problems by using the same kind of thinking we used when we created them."

Albert Einstein

What is Active Traffic Management?

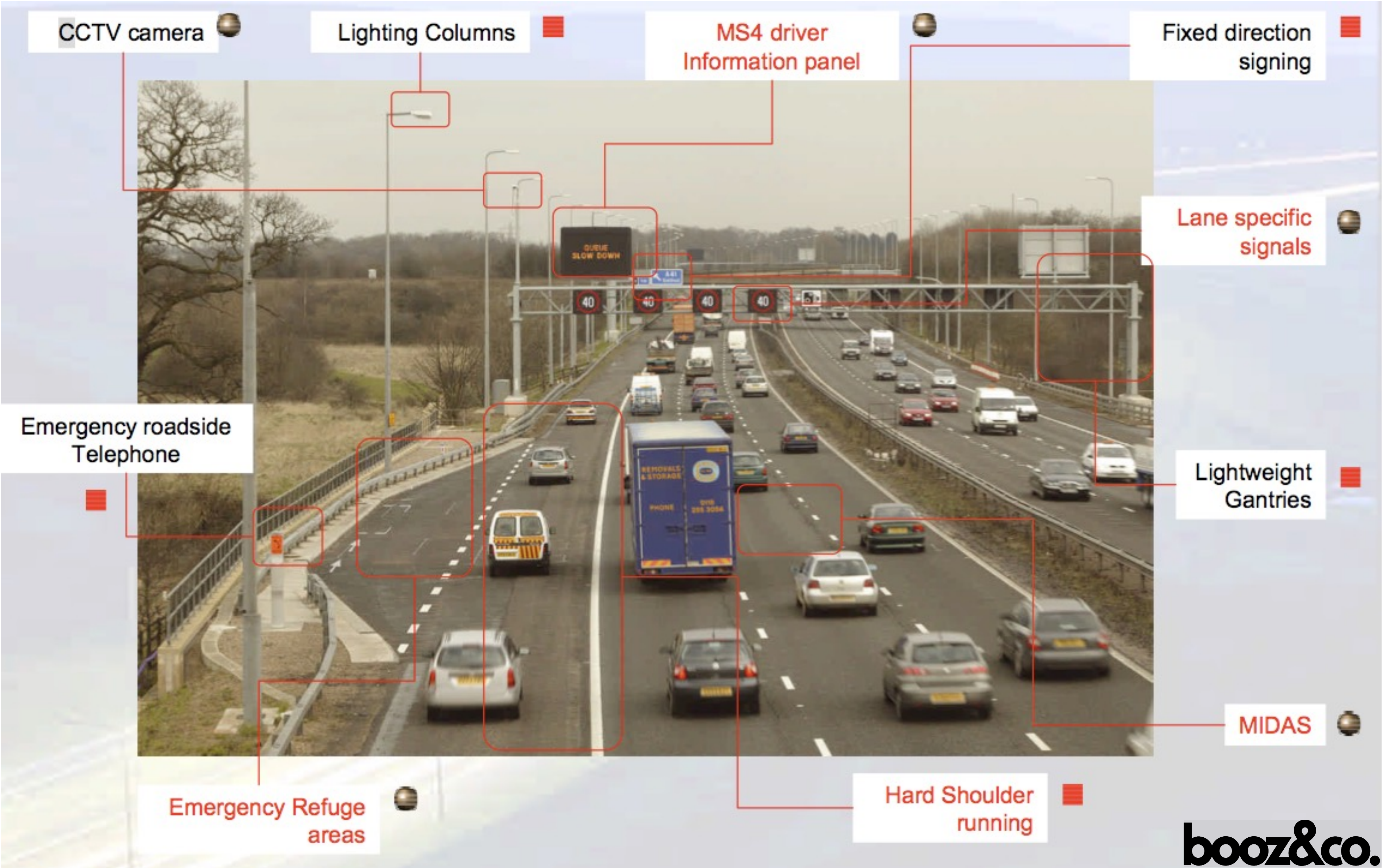
"ATM aims to use the latest technology to manage the existing road space in the safest and most efficient way possible"

Objectives:

- Improve safety
- Reduce congestion
- Provide more reliable journey times
- Reduce impact of incidents and congestion
- Improve driver comfort

Active Traffic Management (ATM)

- Gantries at 500m spacing
- Use of the Hard Shoulder
- Emergency Refuge Areas
- Closely spaced MIDAS loops
- Advanced Matrix Indicators
- MS4's Variable Message Signs
- CCTV video cameras


CCTV camera
Lighting Columns
MS4 driver Information panel
Fixed direction signing
Lane specific signals
Emergency roadside Telephone
Lightweight Gantries
MIDAS
Emergency Refuge areas
Hard Shoulder running
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4 Lane Operation with Variable Speed Limits

Hard shoulder running

– Use of the hard shoulder as a running lane under controlled conditions which has been successfully used in the Netherlands for over 7 years

– Dynamic use of hard shoulder only when needed to relieve congestion and to assist in the management of incidents

– Available for use when Mandatory speed limit is displayed above the hard shoulder

– Maximum permissible speed set at 50MPH when hard shoulder is being used (currently trialling 60mph)

– Hard shoulder running will only be used between junctions

Overhead Signage

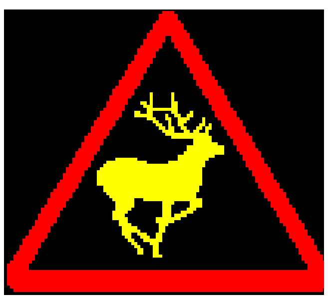
MS4 Overhead Signs

Queue

Accident

Ice

Skid Risk



Animals

Strong Wind

Emergency Refuge Areas

- A layby design with tapers reversed for ease of exit
- Should be used at ***all times*** if possible
- Essential safety measure when hard shoulder running in operation
- Vehicles will be detected on entry by operator
- Use SOS telephone
- Follow instructions, the operators can see
- Emergency Refuge Areas typically 100m in length and 4.6m wide - form of construction to match existing pavement construction

MIDAS –

(Motorway incident detection and automatic signalling)

– Currently used on much of the HA Network. ATM evolution is closer spacing of loops trialling down to 20m

– Measures vehicle speeds and duration over loop using tried and tested technology.

– Identifies when traffic flows have dropped below a predetermined level as with M25.

– Automatic system sets suitable speed limits to keep traffic flows at predetermined level. Gives greater accuracy than other technologies and cheaper.

– Switches off when traffic flows return to normal.

Combined Equipment Cabinets (CEC)

– CEC's contain all the equipment for operating the gantries, signs and signals and the CCTV cameras.

– Combine all roadside equipment in one place to reduce roadside clutter, maintenance issues and improve safety for operation.

– CEC cabinets located adjacent to ERA's to enable safe access for maintenance.

– CEC cabinets as used by rail industry

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Emergency Roadside Telephones

– New emergency roadside telephones, linked directly to the regional control centre

– Meet the new HA standard

– Available in every ERA at 500m intervals

– New phones additionally provide
    – Multi lingual controls
    –Text facility for disabled users

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Active Traffic Management

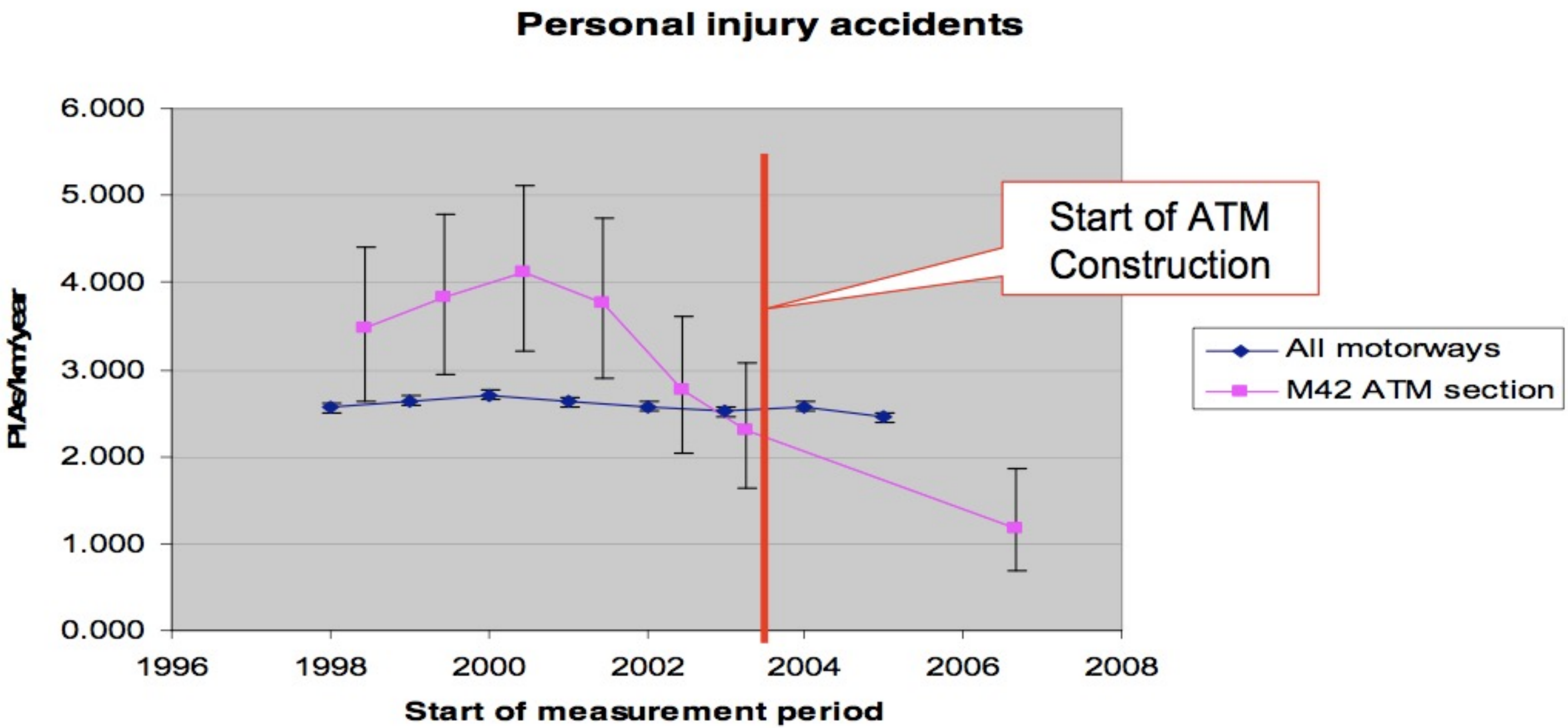
- Proven to alleviate congestion and improve the driving experience on the Network
- Combines tried and tested technology, infrastructure and procedures to make best use of the available road space
- Improves the detection of and response to incidents, reducing delays and improving safety
- Provides better value for money than widening

Benefits of ATM

- Active Traffic Management: £5.6 M/km ($11M/km based on M42 cost data)
- **Benefit Cost Ratio: 6.8**

- Motorway Widening: £18 M/km to £25 M/km ($34 M/km to $ 47 M/km)
- **Benefit Cost Ratio: 2.3**

Benefits: Safety



- ☐ Personal Injury accidents (PIA) fall by 50%
- ☐ No Killed or Serious Injury Accidents (KSI) since start of Hard Shoulder Running

ATM Environmental Benefits

- Carbon monoxide (CO) reduced by 4%
- Particulate Matter (PM) reduced by 10%
- Carbon dioxide (CO_2) reduced by 4%
- Oxides of Nitrogen (NO_x) reduced by 5%

- Fuel consumption reduced by 4%
- Noise levels reduced by between 1.8 to 2.4 dB(A)

Motorist Survey Results

- 93% of participants who had used the hard shoulder felt that the instructions for using the hard shoulder were clear
- 84% felt confident using the hard shoulder as a running lane.
- Only 2% of those questioned had avoided using it altogether.
- 68% said that they felt more informed about traffic conditions
- 60% said it should be implemented elsewhere on the motorway network.

Managed Motorways

All Features of Active Traffic Management PLUS:

- ☐ Ramp Metering (access management)
- ☐ Bus-only lanes
- ☐ Differential Speed limits across lanes
- ☐ HOT Lanes

Managed Motorways – Common ITS Elements

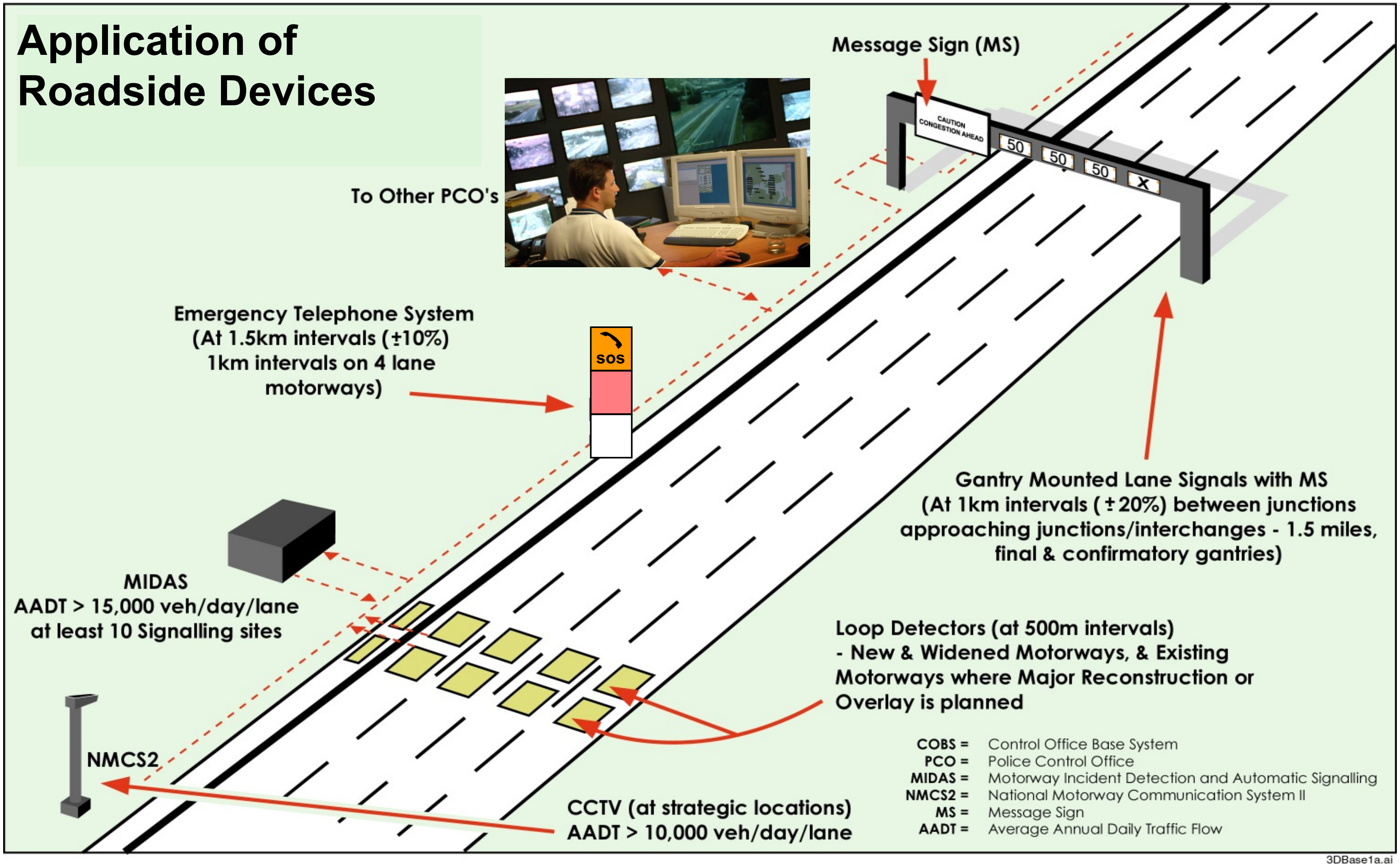
- Real Time Information-



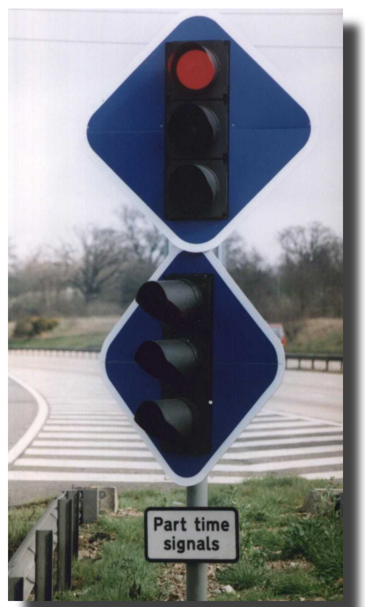
- Vehicle Detection Systems- *using GPRS, loop detectors*

- Communications Network Design- *CCTV, VMS, HAR*


Typical ITS Configuration on Highways/Motorways

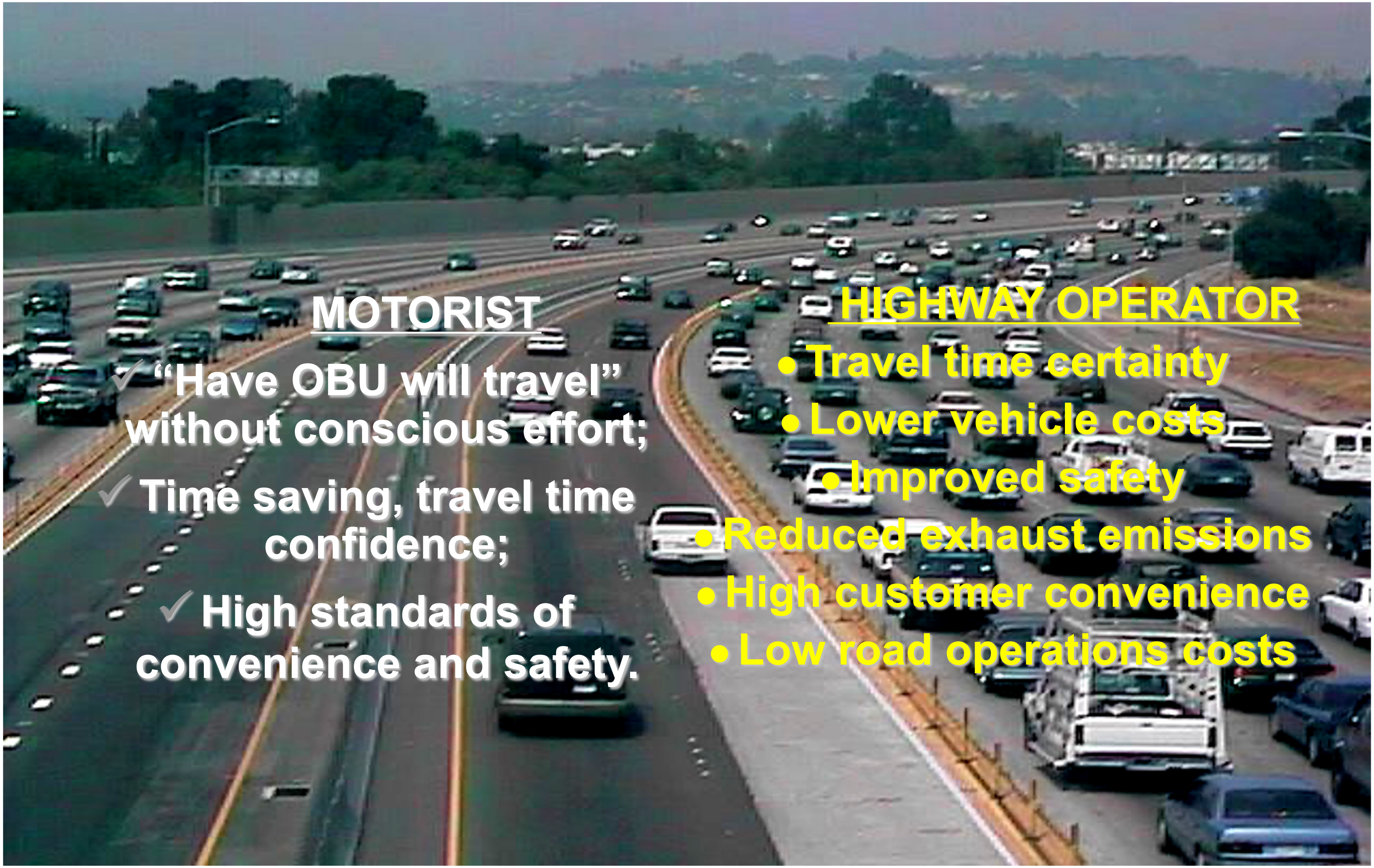


Managed Motorways – Ramp Metering



- Ramp Metering
- Less Congestion
- "Metered" Access

Managed Motorways – Managed Lanes / Tolling



The US ETC market is technologically at a crossroads – currently closed tolling market to emerging "open" standards

	Present Systems		Emerging Solutions		
	915 MHz ETC	Video Tolling	GPS+GSM/CDMA based tolling	5.9 GHz DSRC	5.9 GHz DSRC Hybrid (GPS/GSM/CDMA/ WIMAX)
Current Situation	▪ Proprietary solutions ▪ Very limited Interoperability ▪ Exclusive focus on tolling and initial HOT lanes	▪ No individual hardware or registration ▪ ~85% accurate plate reads in US required ▪ Very high back office cost ▪ Small presence in US: DSRC+Video tolling (Tampa/FL pilot, DSRC+ Video on some TX highways (video toll at 30% premium price)	▪ Requires much less infra-structure than DSRC tolling systems ▪ Harder to prevent fraud with "pure" GPS tolling ▪ Currently limited interest in U.S.	▪ Motivated by safety/ security ▪ Main objective: Interoperability ▪ Open standard ▪ Many potential applications ▪ Aftermarket devices encouraged by US DOT during VII roll-out	▪ Makes sense if there is movement to GPS+GSM/ CDMA solutions ▪ Power issues ▪ Limited capacity of cell networks within cities
Assess-ment	▪ Legacy systems ▪ Lack in performance for broader add-on applications ▪ Limited inter-operability create huge drawback ▪ Proprietary Systems hamper procurement ▪ Limits ITS integration	▪ Market for use as <u>supplement</u> to DSRC (with premium price) ▪ Unlikely to replace DSRC ▪ Given further advances in the video tolling technology, possible competition as „non invasive" technology	▪ Possibly for freight ▪ Little toll authority interest ▪ May change if cell networks decide to enter market w/GPS cell phone as cheap OBU for V2I ▪ "Oregon" and WSDOT pilots promising ▪ "Open Standards"	▪ New open standards ▪ Long lead time for full program roll out ▪ Implications for entire OEM community ▪ "open" standards to enable ITS integration ▪ Procurement options ▪ New m-payment options	▪ Could be appealing with VII embedded in vehicles at manufacturing ▪ Leverage potential with GPS use in Logistics, freight & CVs ▪ Not interesting unless movement to sophisticated road pricing

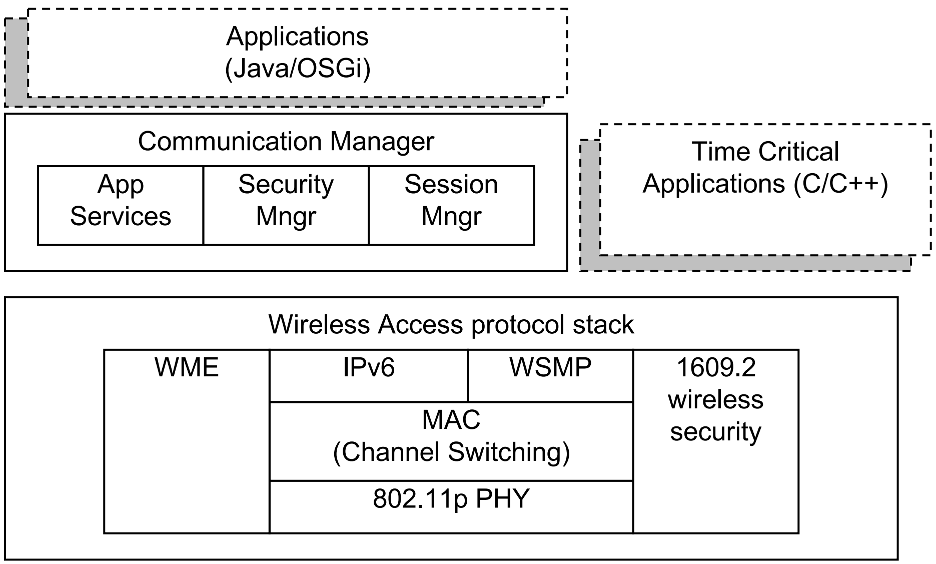
Current 915 MHz Compared to 5.9 GHz WAVE

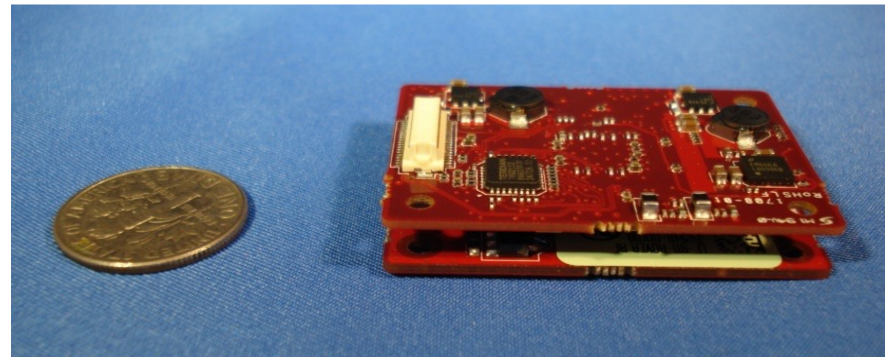
	5.9 GHz	915 MHz
Protocols	IEEE, open standard (802.11p)	Multiple versions, many proprietary
Largest Data Rate	3 MBit/s to 27 Mbit/s & 54 MBit/s (w/ 2 channels)	In the range of 500 Kbits/s
Range	Up to 1,000 meters	Up to 10 meters
Max. Transmit Power (EIRP)	+ 33 dBm (2 W)	+ 33 dBm (2 W), + 36 dBm (4 W)
Competitive multi-vendor market	Expected – Standard open to all vendors	None
Reliability of bi-directional data	High. Designed to meet these requirements	Weak
Capabilities to shape communication zones	Very good	Limited
Size of antennae	Smaller	Larger
“Built-in” localization capabilities	Very good	Very limited
Capabilities	• Data transfer in high speed environments with multiple devices simultaneously; Compatible with other communications (3G, WiFi, WiFiMAX). Integrates with GPS for VII services and new payment methods. • Open, multi-vendor Procurement • Several Suppliers • Interoperable • Can be combined with GPS system for communications to roadside	• Designed for tolling; Limited interoperability; closed and proprietary systems are obstacle for integrated ITS services. • Non-Competitive Procurements • Single Source supply chain • Non-Interoperable • Due to proprietary standard, difficult if not impossible to combine with 3rd Party GPS products.

5.9 GHz systems deliver high performance, enforcement, scalability, and VII compliance, offering significant advantages over legacy 915 MHz systems

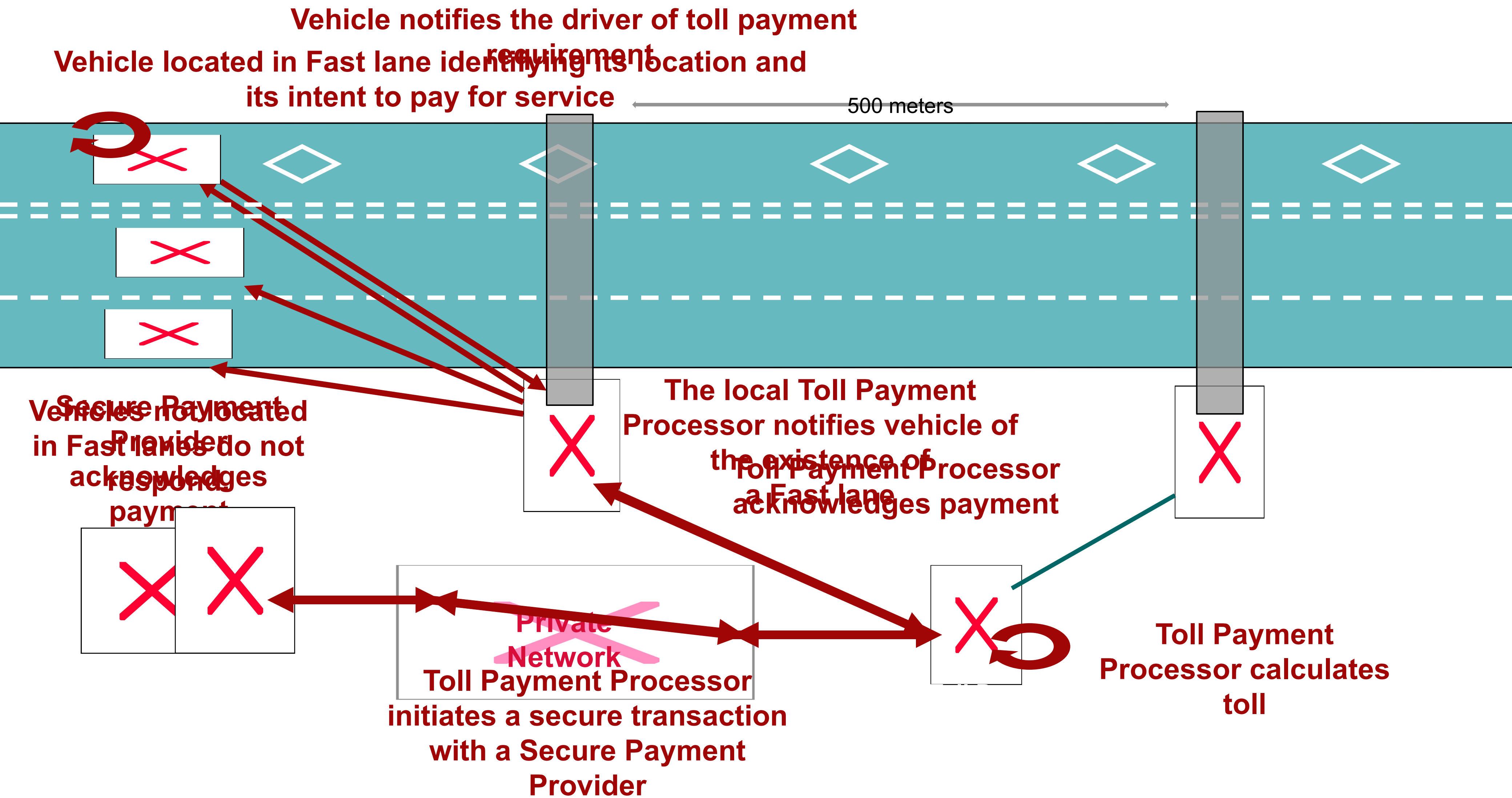
Current 5.9 GHz WAVE Protocol Stack

- **Radio development platform and licensed software/firmware suite that supports 802.11, 1609, Communications Manager and Application Software**
- **Based on Atheros chipset tested in POC**
- **1609 “open wireless interface”**
- **Flexible licensing models**





5.9 Technology Enables Tolling - Managed / HOT Lanes



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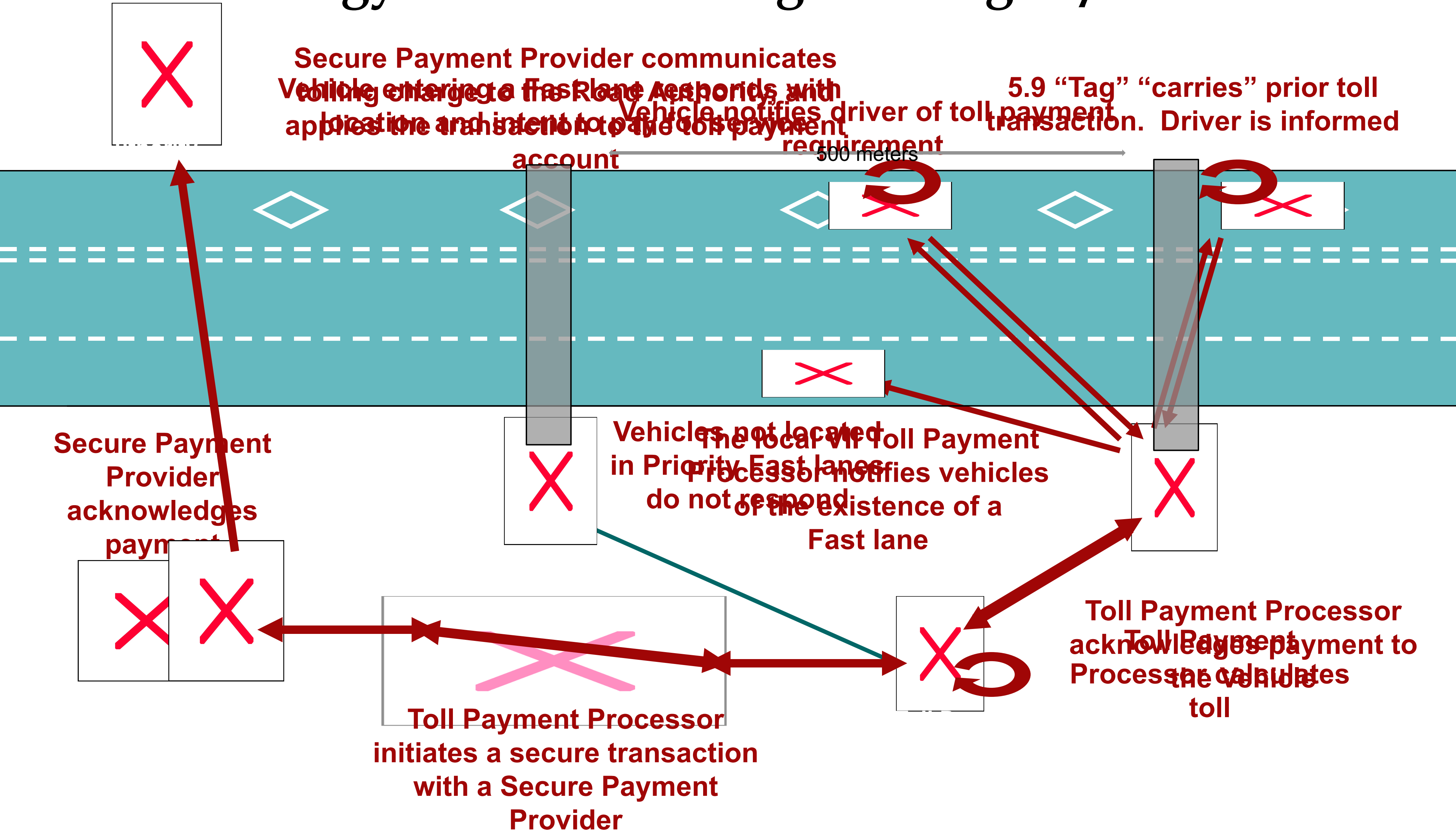

Shared Services of ATM, Managed / HOT Lanes

- Control Centre/Traffic Management Centre
- Civils and Utilities
- Communications Network
- Roadside Cabinets
- Gantry and structures
- CCTV Video
- Sensors:
  - detection/presence
  - vehicle count,
  - traffic flow/speed,
  - traffic mix,
  - probe vehicles,
  - vehicle width/height detection
  - DSRC for tolling/communications

Benefits of ATM Combined with Managed/HOT Lanes

Demand

- Active Traffic Management: £5.6 M/km ($10.5M/km based on M42 cost data
- Benefit Cost Ratio: 6.8
- Managed / HOT Lanes: £1.8 M/km ($3.4 M/km)
- Benefit Cost Ratio: 8.3
- Combined ATM + Managed HOT lanes: £6.4 M/km ($12M/km)
- Benefit Cost Ratio: 18.4

Supply

- Motorway Widening: £18 M/km to £25 M/km ($34 M/km to $ 47 M/km)
- Benefit Cost Ratio: 2.3

Summary: ATM and Managed / HOT Lanes deliver

- Improved safety
- Reduced congestion
- Provide more reliable journey times
- Reduce impact of incidents and congestion
- Improve driver comfort
- Improve the environment
- Singularly or combined, provides benefits

THANK YOU!

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