National Roads Traffic Management Study

Alan O’Brien, Chartered Engineer, Regional Director, AECOM
National Roads Traffic Management Study

**OBJECTIVES**
What should be achieved

**BASELINE**
The existing and future situation

**STRUCTURE**
How should measures be structured

**FEASIBILITY**
What can be considered

**MEASURES**
What is proposed

**OUTCOMES**
Review of the objectives
Vehicle Kilometres Travelled by National Fleet (Million Kilometres) by Type of Vehicle and Year (Million Kilometres)

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OBJECTIVES

What should be achieved

- 5% Reduction from Peak (2008) to trough (2011)
OBJECTIVES
What should be achieved

M50 WestLink Daily Traffic
### OBJECTIVES
What should be achieved

### Population projections

<table>
<thead>
<tr>
<th>Scenario</th>
<th>RPG</th>
<th>NRA Medium</th>
<th>NRA High</th>
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<td>2025 - State</td>
<td>5,564,300</td>
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<td>2006 - GDA</td>
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<td>2025 - GDA</td>
<td>1,515,700</td>
<td>1,334,665</td>
<td>1,640,590</td>
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OBJECTIVES
What should be achieved

Table 1-2 Forecasts of National Traffic Volumes

<table>
<thead>
<tr>
<th>Year</th>
<th>Cars (mvkm)</th>
<th>% Change</th>
<th>Goods (mvkm)</th>
<th>% Change</th>
<th>Total (mvkm)</th>
<th>% Change</th>
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<td>2009</td>
<td>30,247</td>
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<td>6,557</td>
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<td>36,803</td>
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<td>2025 (Without Smarter Travel)</td>
<td>39,455</td>
<td>30.4</td>
<td>10,961</td>
<td>67.2</td>
<td>50,415</td>
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<td>30,247</td>
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<td>10,961</td>
<td>67.2</td>
<td>41,208</td>
<td>12.0</td>
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Growth in Demand for Transport (2006 – 2025)
OBJECTIVES
What should be achieved

Composition of Traffic

All Traffic

Public Transport
Commuting
Retail
Freight
Business Travel
OBJECTIVES
What should be achieved

Composition of Traffic

Travel Mode

Low Value  High Value

Flexibility

Travel Time
OBJECTIVES
What should be achieved

- What should Traffic management achieve?
- Which measures should be considered?
- Where should they be implemented?
- What impacts are expected?
OBJECTIVES
What should be achieved

- Allocative efficiency;
- Delay from incidents;
- Maximise capacity;

- Public Transport;
- Manage Emissions;

- Access to jobs/services;

- Integrated Planning
- Network Integration

- Primary accidents
- Secondary accidents
National Roads Traffic Management Study

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OUTCOMES
Review of the objectives
Figure 3-10: Average kilometres driven by a car driver in 2004

- Slovakia: 20,788
- Ireland: 19,363
- United Kingdom: 19,039
- Croatia: 18,247
- Finland: 16,945
- Belgium: 16,764
- Denmark: 16,763
- Germany: 16,621
- France: 16,100
- Italy: 16,006
- Portugal: 15,886
- Slovenia: 15,548
- Austria: 15,238
- Hungary: 15,192
- Switzerland: 15,172
- Sweden: 15,080
- Greece: 15,071
- Netherlands: 15,045
- Cyprus: 14,926
- Estonia: 14,808
- Poland: 14,332
- Spain: 12,556
- Czech: 10,517
- Others: 8,000 - 12,000

The existing and future situation
BASELINE
The existing and future situation

Figure 3-10: Transport CO2 Emissions per Capita, 2007

The bar chart shows the transport CO2 emissions per capita for various countries in 2007. The USA has the highest emissions per capita, followed by Ireland, Austria, Belgium, and Denmark. The emissions are significantly lower in countries like Sweden, Italy, and the United Kingdom. The emissions for Cyprus are the lowest among the listed countries.
BASELINE
The existing and future situation
BASELINE
The existing and future situation
BASELINE
The existing and future situation
Productivity growth can help by ensuring the cost of transporting goods for industry via road freight remains competitive;

Productivity growth can improve the quality and speed of service being delivered;

Productivity growth has the potential to reduce the number of vehicles on our roads, which can in turn, lessen the welfare and monetary costs associated with traffic congestion.

Source: Forfas.
National Roads Traffic Management Study

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What can be considered

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STRUCTURE
How should measures be structured

OUTCOMES
Review of the objectives
How should measures be structured?

**FISCAL**
Tolling/User Charging

**CONTROL**
Regulations and Policies

**TRAFFIC CONTROL**
Measures to Control Traffic

**STRUCTURE**
How should measures be structured?

**DEMAND MANAGEMENT**
Measures to influence Demand
How should measures be structured

- Traffic Management
  - Control Measures
    - Traffic Control
    - Demand Management
  - Fiscal Measures
    - Point Tolls
    - Parking Charges
    - Distance Based Charging
    - Cordon Charging
    - Congestion Pricing
  - Traffic Control
    - Intelligent Transport Technologies
    - Capacity Enhancements
    - Priority
    - Network Control Centres
  - Demand Management
    - Travel Information
    - Development Restrictions
    - Parking Standards
    - Travel Planning
National Roads Traffic Management Study

OBJECTIVES
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Regulations and Policies

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DEMAND MANAGEMENT
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FEASIBILITY
What can be considered

FISCAL
Tolling/User Charging

Charge per km

Degree of Saturation %

‘Externality’

Charge
Cost
### Table 14-1: Summary of International Rationale for Introduction of Road Pricing

<table>
<thead>
<tr>
<th>Area</th>
<th>Reduce Congestion</th>
<th>Improve Air Quality</th>
<th>Sustain Economy</th>
<th>Improve Urban Environment</th>
<th>Raise Funds for Transport</th>
<th>Modify/Replace Taxation Regime</th>
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<tr>
<td><strong>Case Studies</strong></td>
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</table>
FEASIBILITY
What can be considered

FISCAL
Tolling/User Charging

On-Board Unit calculates position and/or distance travelled and matches to digital map of charged roads.

Charges accrued by On-Board Unit are periodically transmitted to control/enforcement stations and sent to the processing office.

Licence plate details of unequipped vehicles or those not paying the correct charges are recorded.

Driver registers his or her intent to use roads within the charging cordon prior to setting out on journey. Provides licence plate details.

Images of licence plates are recorded. Majority are read automatically by ANPR and compared to a list of registered users and exempt vehicles. Remaining are read manually.

Licence plate details of non-registered vehicles are recorded. Details of registered vehicles are discarded.
FEASIBILITY
What can be considered

FISCAL
Tolling/User Charging
FISCAL
Tolling/User Charging

FEASIBILITY
What can be considered

**Figure:**
Crossing point where GNSS or DSRC is the most favorable technology, based on number of road segments and number of vehicles applicable for tolls.
What can be considered

**FISCAL**
Tolling/User Charging
FISCAL
Tolling/User Charging

FEASIBILITY
What can be considered

- Closed System
- Open System
- 10c – 15c per km
### FISCAL Tolling/User Charging

#### FEASIBILITY
What can be considered

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**Table 19-6: Tolling Scenarios for Testing**

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<tr>
<th>Scenarios</th>
<th>Approach</th>
<th>M1-BMN</th>
<th>BMN-N2</th>
<th>N2-N3</th>
<th>N3-N4</th>
<th>N4-N7</th>
<th>BMT-N81</th>
<th>FIN-BAT</th>
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• Dublin Area Road Pricing
• Goods Vehicle Road Pricing
FEASIBILITY

What can be considered

FISCAL
Tolling/User Charging

CONTROL
Regulations and Policies

DEMAND MANAGEMENT
Measures to influence Demand

TRAFFIC CONTROL
Measures to Control Traffic
<table>
<thead>
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<th>Measure</th>
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<td></td>
<td>Regional Control Centre</td>
<td>Berlin, Germany</td>
</tr>
</tbody>
</table>
Explore a number of applications
- Variable Speed Limits
- Ramp Metering
- Hard Shoulder Running
- PTF and PTFT Lanes
- HOV and HOT Lanes

Have they been successful?
Why are they successful?
Under which environments will they be most successful?
Ramp Metering
- Allocate entering traffic to mainline
- Reduce turbulence – improve operation
- Well researched, good guidance
- Protects capacity reductions arising out of bottlenecks
- Common throughout Europe, North America, Japan
TRAFFIC CONTROL
Measures to Control Traffic

FEASIBILITY
What can be considered

Junction No.
3 M1
4 Ballymun
5 N2
6 N3
7 N4
9 N7
10 Cookstown
11 N81
12 Scholarstown/ Firhouse
13 Ballinteeer/ Dundrum
14 Sandyford
15 Carrickmines
16 Cherrywood
17 M11

Signal Heads
Ramp meter Controller
Advance warning signs
Slip Road Traffic Sensors
Sufficient Queuing Capacity Required
Sufficient Acceleration Space Required
No interaction with adjacent local traffic network

Unsuitable Northbound Slip
Suitable Southbound Slip
Section with potential suitability for coordinated operation

Sufficient Queuing Capacity Required
No interaction with adjacent local traffic network
Signal Heads
Sufficient Acceleration Space Required
Slip Road Traffic Sensors
Advance warning signs
Ramp meter Controller

Sufficient Queuing Capacity Required
No interaction with adjacent local traffic network
Signal Heads
Sufficient Acceleration Space Required
Slip Road Traffic Sensors
Advance warning signs
Ramp meter Controller

Sufficient Queuing Capacity Required
No interaction with adjacent local traffic network
Signal Heads
Sufficient Acceleration Space Required
Slip Road Traffic Sensors
Advance warning signs
Ramp meter Controller
Case Study – M11

- Entry flow generated shockwaves
- Turbulence leads to congestion
- No downstream bottleneck!
- Utilise variations in traffic density
- Achieved capacity increase of 10%+
Variable Speed Limits

- Match speed to flow conditions
- Reduce variation in speeds
- Different forms of application
- But different expectations
  - Congestion reduction
  - Safety Improvements
TRAFFIC CONTROL
Measures to Control Traffic

FEASIBILITY
What can be considered

M1 Southbound - Outside Lane - AM Period

Mean Flow (Q)

Range of Maximum Flow (Q_max)

Congested Flow

Vehs per Min
Flow Breakdown can be described in terms of ‘probability’
Hard Shoulder Running
• Basic concept - additional lane to increase capacity
• Alternative to traditional widening
• Requires high level of ITS support
• Tends to require VSL
• Significant variation in standards for
  o Speed Control
  o Lane Widths
  o Lay-by designs
• Concept of Toll Lanes (PTFT)
TRAFFIC CONTROL
Measures to Control Traffic

FEASIBILITY
What can be considered...
TRAFFIC CONTROL
Measures to Control Traffic

FEASIBILITY
What can be considered

Without Lane Gain
- VSL + Access Control
- Ramp Metering
- Varb Speed Limit

With Lane Gain
- VSL + Ramp Metering
- Varb Speed Limit

Upstream Mainline Flow - Additional Slip Road Flow
HOV Lanes
- Allocate lanes to 2+ or 3+ car occupants
- Common in US
- But difficult to establish business case
- Many being converted to HOT Lanes
- Basis for toll-free for high occupancy vehicles is questionable
TRAFFIC CONTROL
Measures to Control Traffic

FEASIBILITY
What can be considered

Long List of Interventions

Categorize

Control

Fiscal

Traffic Control
Demand Management

Intelligent Transport
Capacity Enhancement
Priority
Information
Network Control

Sifting

Test Against Objectives

Consider Affordability and Risks

Rejected Options

Shortlist of Interventions
### OBJECTIVES

**Economy**
- Improve allocative efficiency
- Reduce the economic impact of delay through effective incident management
- Address excessive reliance on national roads as a means of supporting commuting traffic
- Maximize the capacity of congested areas through effective management solutions

**Environmental**
- Encourage public transport on national roads
- Contribute to reductions in CO2 emissions, air pollution and noise

**Accessibility**
- Maintain and improve opportunities for access

**Integration**
- Promote an understanding of integrated land use and transport planning policies
- Encourage the use of public transport on national roads through supporting network integration

**Safety**
- Reduce knock-on safety risks that result from incidents
- Reduce the frequency and severity of accidents on National Roads

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Intelligent Transport</th>
<th>Capacity</th>
<th>Priority</th>
<th>Information</th>
<th>Network Control</th>
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<td>✓</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

| Adopt/Reject | ✓ | ✓ | × | ✓ | ✓ | ✓ | ✓ | ✓ |

- **✓**: Measure adopted as technically feasible and strongly supporting strategy
- **✓**: Measure adopted but subject to further study of specific sites
- **×**: Measure rejected due to technical challenges or conflict with study objectives
What can be considered

FEASIBILITY

FISCAL
Tolling/User Charging

CONTROL
Regulations and Policies

DEMAND MANAGEMENT
Measures to influence Demand

TRAFFIC CONTROL
Measures to Control Traffic
DEMAND MANAGEMENT
Measures to influence Demand

- Planning Guidelines
- Area Wide Travel Planning
- Integration with Park & Ride
- Monitoring and Evaluation

FEASIBILITY
What can be considered
DEMAND MANAGEMENT
Measures to influence Demand

FEASIBILITY
What can be considered

Dublin City Parkway
(for Cork, Kerry, Waterford, Limerick, Galway)
National Roads Traffic Management Study

OBJECTIVES
What should be achieved

BASELINE
The existing and future situation

STRUCTURE
How should measures be structured

FEASIBILITY
What can be considered

MEASURES
What is proposed

OUTCOMES
Review of the objectives
Solutions which rely solely on control techniques

Solutions which use fiscal measures, supported by control measures
M50 Traffic Management Strategy: Option 1 – Fiscal

**What is proposed**

- **PTF and Toll Lanes**: Existing facility on DPT
- **Multi-Point Tolling**: Existing €2 to €2.50 removed and replaced with individual €1.30 tolls
- **Variable Speed Limits**: Between Junction 3 and Junction 11 to improve safety, and reduce delays due to incidents
- **Incident Detection**: Extend existing Dublin Port System through to Junction 16 using MIDAS and CCTV
What is proposed:

- **Incident Detection**: Extend existing Dublin Port System through to Junction 16 using MIDAS and CCTV.
- **Single-Point Tolling**: Existing €2 retained.
- **Variable Speed Limits**: Between Junction 3 and Junction 11 to improve safety, and reduce delays due to incidents.
- **PTF and Toll Lanes**: In conjunction with VSL, consider PTF Toll Lane between Junction 1 and 9 (DPT currently operates as PTF Toll).
- **Selected Access Control**: To be considered on Junctions 12 through 16 to manage access to the M50 during Peak Periods.
GDA Traffic Management Strategy: Option 1 – Fiscal

What is proposed:
- Single-Point Tolling: Introduction of €1.30 charge on radial routes for traffic entering built-up area. M3 toll remains at €1.30.
- Incident Detection: Extend M50 system onto radials within built-up area.
- Selected Access Control:
  - Located on major junctions within untolled sections of built-up area.
- Variable Speed Limits:
  - On approaches to the M50 through built-up area, where full grade separation is provided.
- PTF Lanes:
  - To be examined on radials with sufficient demand.

Note: With the exception of the M3 toll at Pase, all proposed tolls are in addition to those currently in place on the M1, M3, M4 and M50 within Greater Dublin Area.
GDA Traffic Management Strategy: Option 2 - Control

- **Incident Detection**: Extend M50 system onto Radials within Built-up Area
- **Reversible Lanes**: Examine on long corridors with limited weaving
- **Selected Access Control**: Located on major junctions within built-up area
- **Variable Speed Limits**: On approaches to the M50 through built-up area, where full grade separation is provided
- **PTF and Toll Lanes**: To be examined on radials with sufficient demand, potentially also as reversible lanes

*Note: Existing tolls retained on M1, M3, M4 and M50 within Greater Dublin Area with this approach*
Cork Area Traffic Management Strategy: Option 1 – Fiscal

- Reversible Lane
  - Support Public Transport Priority on South City Link, potentially through use of Reversible Lane
- Variable Speed Limits
  - Provide on-grade separated sections of South Ring Road to reduce incidents and improve flow
- Interchange Upgrade
  - Upgrade at Dunkettle, Bandon and Sarfield to remove strategic bottleneck
- Single-Point Tolling
  - Introduction of charge on Jack Lynch Tunnel to manage traffic flows onto South Ring Road
- Selected Access Control
  - Located on major junctions along the South Ring Road for traffic not using tunnel
- Incident Detection
  - Incident Detection to be provided along upgraded Route
Cork Area Traffic Management Strategy: Option 2 – Control

- Reversible Lane
- Support Public Transport Priority on South City Link, potentially through use of Reversible Lane
- Interchange Upgrade
- Upgrade at Dunkettle to remove strategic bottleneck
- Variable Speed Limits
- Provide on grade separated sections of South Ring Road to reduce incidents and improve flow
- Incident Detection
- Incident Detection to be provided along upgraded Route
- Selected Access Control
- Located on major junctions along the South Ring Road
- PTF Lanes
- To be examined as part of widening on South Ring Road

What is proposed
National Roads Traffic Management Study

OBJECTIVES
What should be achieved

BASELINE
The existing and future situation

STRUCTURE
How should measures be structured

FEASIBILITY
What can be considered

MEASURES
What is proposed

OUTCOMES
Review of the objectives
Impacts of Traffic Management include

TRAVEL DEMAND
- Traffic flow on roads
- Passenger flows on rail links
- Network passenger/traffic demand
- Mode share impacts
- Travel time impacts
- Journey length impacts
- Changes in demand
- Speed on links
- Network Performance Impacts (speed, km, hours, trips)
Impacts include

FINANCIAL

- Traffic flow through toll points
- Toll revenue
- Public transport fare revenue
- Impact on exchequer
Impacts include

ENVIRONMENTAL
- Vehicle km travelled (by all modes)
- Emissions (at inter-zonal level)
- Accessibility Impacts (WEB’s)
- Air Quality
## Analysis Tools

<table>
<thead>
<tr>
<th>Measure</th>
<th>Location</th>
<th>Model</th>
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<tbody>
<tr>
<td>Traffic Control</td>
<td>M1, M11, N25, N4</td>
<td>Microsimulation Models</td>
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<tr>
<td>Fiscal</td>
<td>M50, GDA, Cork</td>
<td>National Transport Model, NTA Model, CASP/Dunkettle Model</td>
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<tr>
<td>Demand Management</td>
<td>National</td>
<td>Econometric, Accessibility and Land Use Models</td>
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**National Traffic Management Strategy**

**Strategic Appraisal**

<table>
<thead>
<tr>
<th>Project Details</th>
<th>M50, Dublin</th>
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<tr>
<td>Project Title</td>
<td>Fiscal Strategy</td>
</tr>
<tr>
<td>Project Description</td>
<td>Introduction of multi-point tolling on M50 to replace existing toll point between N3 and N4. Provision of other supporting traffic management measures</td>
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<th>Project Costs</th>
<th>Score</th>
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<td>Likely Cost ($m)</td>
<td>medium</td>
<td>low capital cost, but higher operational costs</td>
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<tr>
<td>Risk Level</td>
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<td>proven individual technologies</td>
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<tr>
<td>Likely Revenue (Annual $m)</td>
<td>~ €50m</td>
<td>Net increase includes deduction for operating costs</td>
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<tr>
<td>Likely Return on Investment</td>
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<td>congestion relief, accident benefit and incident response</td>
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<td>Comments</td>
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<td>proven individual technologies</td>
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<tr>
<td>no major works required. Systems already in place</td>
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<tr>
<td>will represent increase in toll for some users</td>
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<table>
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<tr>
<th>Quality of Evidence</th>
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<td>Quality of Supporting Evidence</td>
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<td>Key Risks</td>
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<td>- Not all links on M50 will be tolled - may lead to localised congestion on untolled sections</td>
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<tr>
<td>- Reduction in tag coverage would increase costs</td>
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<th>Strategic Fit</th>
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National Roads Traffic Management Study

Conclusions
CONCLUSIONS
Main findings of the study

• Important need for network management and control
• Good national and international experience of measures
• Application is very site-specific. No global solutions
• Fiscal policy has significant impact on solution
• Control measures provide limited capacity benefit – improve safety/reliability
• Good integration required with land use policies/public transport planning
• Negative effects of Traffic Management are very limited, and are manageable
“If the only tool that you have is a hammer, you see every problem as a nail”
• What should Traffic management achieve?
  Series of objectives under economy, environmental, safety, accessibility/social inclusion, safety
• Which measures should be considered?
  Long list of measures identified
• Where should they be implemented?
  Location dependant – principles have been established
• What impacts are expected?
  Reassignment, mode share, and demand responses. Leading to reductions in emissions and road accidents
CONCLUSIONS

Main findings of the study

• **Reporting**
  - *Traffic Management Study, Final Report*
    www.nra.ie/NetworkManagement/NationalRoadsTrafficManagementStudy
  - **Research Papers**
    www.nra.ie/Publications/TransportResearchandInformationNotes
  - **Demographic Studies (Unit 20.1)**
    http://www.nra.ie/NetworkManagement/ProjectAppraisalGuidelines
  - **National Transport Model Validation report**
    www.nra.ie/NetworkManagement/ProjectAppraisalGuidelines
National Roads Traffic Management Study

Alan O’Brien, Chartered Engineer, Regional Director, AECOM

Thank You