Urban Transport Benchmarking Initiative

Annex A5

Demand Management

Working Group Report

July 2004

Annex A5

Demand Management

Working Group Report

Prepared for

European Commission
Directorate General for Energy and Transport

by

Author(s)	Luca Persia and Ian Bewick
Quality Control	Sarah Clifford
Project Manager	Jo Baker
Project Number	L/03/111
Version	1.1
Date	July 2004
File location	\\Ttr01\company\TTR PROJECTS\CURRENT PROJECTS\EC Benchmarking\Technical\ Project Reports - End Yr1\UTB-DM-REPORT
Last edited	02-08-2004

CONTENTS

0. EXECUTIVE SUMMARY

The demand management working group has developed a good working relationship over the first year of the project, with all participants benefiting from interesting site visits and stimulating discussion on demand management solutions to urban transport problems. The first year of data collection has provided some useful comparisons between the cities and has provided a good basis on which to build during year two. This report provides the first year's findings of the demand management working group.

The data collection process revealed variations in methods of collection, presentation and definitions of existing data obtained by the participants in the working group. This was particularly significant in the collection of data for different concentric zones in a city, a key issue in assessing demand for transport in a city. As such, these conclusions are somewhat biased towards more qualitative findings, particularly from the experience of the site visits, but include some interesting quantitative results.

For cities to benchmark their demand management measures against others requires some definition of what makes a city successful in managing demand. In most cities, this may be seen as a reduction in the number of cars accessing the city and an increase in the number of people using sustainable modes of public transport and walking. However, there are variations in the characteristics of cities which make it difficult to provide concrete standards against which to benchmark. For example, the small city of Oulu is surrounded by a vast rural area and few people use public transport to access the city centre. However, the demand for accessing facilities on the edge of the town by private car has led the local authority to improve and increase car parking facilities in the town centre. This would seemingly contradict most policies of demand management in European urban centres but may be a vital step in revitalising and re-centralising shops and services in the town and may indeed lead to demand for travel by other modes into the city centre.

In larger cities too, demand management is more complex than seeking to transfer journeys from private car to public transport modes. In London, the underground and rail networks operate close to capacity at peak times so Transport for London has invested in new buses and bus infrastructure to transfer demand towards bus travel. A high tech bus control centre uses digital camera technology to ensure that any incidents are dealt with quickly to ensure that buses keep moving through the city. There have also been increases in the level of cycling in London following the introduction of the congestion charge, showing that a reduction in the number of cars in the city centre and policies which deter car use can lead to positive modal shift without any negative impact on the vitality of the central area.

In Barcelona, the group saw a new tram system which had been implemented without any integration with private modes (park and ride) but as an urban public transport system designed to be easy to access by walking. One key advantage of the tramway is that it is at street level and is easier to access for "short hop" journeys than the metro system where escalators and underground walkways must be used. Barcelona also provided an interesting example of how restriction of road space can revitalise shopping and tourist areas and can be a popular measure once initial opposition is overcome. Similarly, the London congestion charge also gave the group a good example of how political determination in the face of widespread scepticism and opposition can help to change attitudes towards transport and influence behavioural change.

The example of Oulu also challenged traditional logic regarding reasons to travel by bicycle in a city. High levels of cycling are usually associated with a high density city and a temperate climate, but in Oulu the city is fairly low density and the climate is especially harsh during the winter. Yet the city boasts the highest modal share for cycling amongst the working group participants thanks to an investment in cycle routes and storage facilities and the development of a cycle-friendly culture. The sharing of space between cyclists and pedestrians in the centre of Oulu and the respect shown to each other by these road users is in contrast to many cities where conflict between different types of road users occurs. Moreover, Oulu demonstrated the potential for people to cycle for short distance urban trips if cycling is taken seriously by planners as a feasible mode of transport.

The demand management group is composed of cities of varying size, population and geographical characteristics, including large cities (London and Paris), medium sized cities (Warsaw, Dublin, Barcelona) and smaller cities (The Hague and Oulu). The group found that physical geography and climate can have a significant impact on the demand for transport and land use in a city, particularly in Oulu where the city is designed with wider streets to accommodate snow removal from roads, but also in Barcelona where the mountains constrain the city's expansion and London where the river forms a barrier between north and south.

The most interesting results obtained from year 1 of the benchmarking initiative are as follows;

- Density of jobs in the metropolitan area is greatest in The Hague at 3,106 jobs per km^2 and least dense in Warsaw where there are 278 jobs per km^2.
- Five of the seven working group cities have parking policies linked to development, most of which seek to limit the number of parking spaces at new developments.
- Five of the seven working group cities have parking policies linked to public transport policies, all of which demand that new development is well served by public transport.
- The cities with the lowest population density, Oulu and Warsaw, have the longest trip lengths for car journeys but Oulu also boasts the longest trip length for bicycle journeys.
- In Dublin and Ile de France, car trips are shorter (5.2km and 2.9km respectively), demonstrating a potential to substitute these trips with cycling and walking.
- Average lengths of train journeys in London (28.3km) and Barcelona (21.9km) are noticeably higher than in other cities. The high density of The Hague is reflected by the relative shortness of average bus (2.1km) and train (3.5km) journeys.
- In Barcelona, 5.6% of the road network is covered by bus lanes and 2.3% in Dublin. In Dublin, only 19.4% of the road network is covered by bus routes, compared to 53.1% in Barcelona. Barcelona also has the greatest density of bus stops per km of route (10.3) whereas the other cities have between 0.8-2.9 stops per km of bus routes. The Ile de France has the densest metro network at 1.7 stops per km of track followed by Barcelona at 1.2 stops per km of track. London and Dublin have the densest rail networks at 0.6 stops per km of track.
- Taking the total number of public transport stops including all modes, The Hague has the greatest density of stops per km^2 at 6.9 followed by London at 5.9. The other cities have between 0.9 – 2.6 stops per km^2.
- Data on parking spaces proved difficult to collect. From the data available, Barcelona has the greatest number of parking spaces per 1000 inhabitants at 240, followed by The Hague at 191 spaces per 1000 inhabitants. Ile de France has a high number of park and ride spaces (106,935) whereas other cities have relatively few.
- Authorities in London proved to be the most stringent at issuing parking fines with 3.14 fines issued per car registered. Barcelona and Oulu issue 1.14 fines and 0.96 fines per car

respectively. When measured against population, Barcelona issues 1004 fines per 1000 population, compared to 675 in London.

- Warsaw issues more fines per parking space (13.6) than any other city but this may reflect differences in the quality of the data collected as cities had difficulties recording exact numbers of parking spaces.
- The average normal urban speed limit of the 7 cities is 49.4 km per hour with Oulu notably lower at 40km / hr and Warsaw notably higher at 60km/hour. 35% of roads in Warsaw have limits under 60km / hour, 9% of roads in Oulu have limits over 40km / hour, In The Hague, there are more zones where the speed limit is lower than the norm of 50km/hour (57%).
- London has the greatest number of speed cameras at 400, followed by Barcelona with 99.
- In London, Dublin and Barcelona 80% of parking spaces are subject to parking charges.
- Maximum hourly on street parking charges are highest in Ile de France at €3, Warsaw has the lowest maximum at €0.57. The lowest minimum is in Dublin where hourly charges range from €0.19 to €1.90, Barcelona has the highest "minimum" as all charges are €2.50 per hour.
- In London, hourly parking charges vary most - from €0.63 to €3.36 and there is a similarly large difference between minimum and maximum charges in Dublin (€0.25 - €2.40) but in Barcelona, the charges are constant at €1.70.
- London has the highest annual parking revenues per inhabitant (€51 per year) and per car registered (€237 per year) and a revenue of €940 per parking space.
- Only three of the cities, Dublin, Barcelona and London have some sort of road pricing scheme for which data could be provided. In Dublin, tolls for road bridges vary from €0.70 for a car to €4.90 for trucks and similarly in Barcelona, for an outer ring road, charges vary from €1 – €2.50 depending on vehicle size. In London, there is a flat charge of €7.50 (£5) to enter the congestion charging zone in the city centre. These charges bring annual revenues of €83 per car in Dublin, €37 per car in Barcelona and €107 per car in London. When measured against population, road pricing gives revenues of €31 per inhabitant in Dublin, €11 per inhabitant in Barcelona and €23 per inhabitant in London.

1. INTRODUCTION

1.1 Project Background

The Urban Transport Benchmarking Initiative has sought to apply the concept of benchmarking to the urban transport systems present in cities across the EU, including the New Member States. This is in keeping with the European Union's policy approach which places considerable importance upon the role attractive, efficient local and regional transport systems can play in the economic development and social cohesion of the EU. In the field of urban transport the exchange and promotion of best practices is one of the main policy tools that the European Commission possesses. The Urban Transport Benchmarking initiative has therefore compared the differences between the participating cities' transport systems in order to identify and promote interesting practices in urban transport.

The benchmarking concept has great potential when applied to urban transport systems. A range of previous initiatives have provided this project with the opportunity to deepen the focus of the benchmarking process and, by learning from previous experiences, provide more comparable results. The development of more practical data indicators has aided the learning process for the organisations involved in the project and this has greatly helped to improve the robustness of the data collected for the project.

The Urban Transport Benchmarking Initiative has adhered to the European Commission's subsidiarity principle by including as many urban transport stakeholders as possible. The process of the Urban Transport Benchmarking Initiative has been a fluid one, responding to the issues which were raised by participants in the project, rather than following a rigid, predetermined process. In this way the subsidiarity principle has been fulfilled, because the recommendations of interesting practices are coming from a network of urban transport operators, user groups, local authorities and municipalities, rather than a single centralised institution. It is therefore hoped that the project's findings will provide a useful resource for other urban transport stakeholders and help them to implement innovative solutions to commonly experienced urban transport problems.

The Urban Transport Benchmarking Initiative has been based around 5 themes, for which data has being collected by the participating cities. These themes have been organised as working groups and these are listed below:

- Behavioural and Social Issues in Public Transport
- City Logistics
- Cycling
- Demand Management
- Public Transport Organisation and Policy

This report presents the findings of the Demand Management working group, outlining the methodology used by the working group, the data collected and analysed and the recommendations emanating from the analysis. The Urban Transport Benchmarking Initiative will be re-launched for a second year in September 2004 and it is hoped that the cities represented in the working group will continue their involvement in the Demand Management working and gain real benefit from the

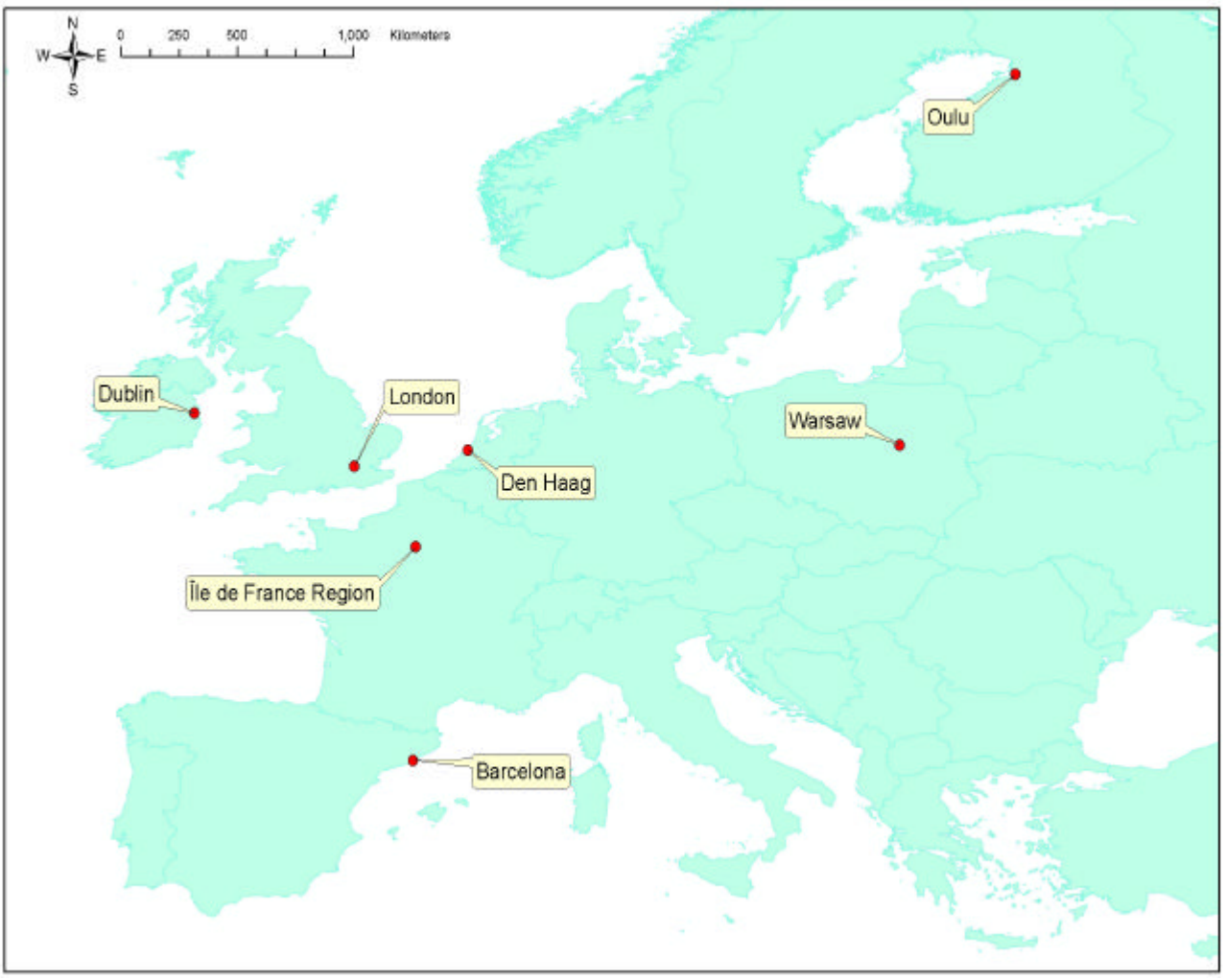
benchmarking process. The recommendations at the end of this report illustrate the ideas currently being developed for year two of the Urban Transport Benchmarking Initiative.

1.2 Methodology of the working group

The Demand Management working group was formed at the launch conference of the Urban Transport Benchmarking Initiative in Brussels in November 2003. The cities that have participated in the working group include are illustrated in Figure 1.1 and include:

- Barcelona
- London
- Southwark
- The Ile de France region
- The Hague
- Warsaw
- Oulu
- Dublin

Figure 1.1: Cities and regions represented in the working group



The working group has broadly followed the timetable that has been adhered to by the other Urban Transport Benchmarking Initiative working groups (see Table 1.1 below) and has used the meeting time at each of the three site visits to discuss each stage of the benchmarking process. The aim of

the working group has been to try to identify interesting practices through the use of both quantitative data and qualitative analysis in order that the participants in the group may learn from each other's approaches to urban transport.

Table 1.1: Working group time-plan

Event	Date	Progress
Launch Conference	November 6th 2003	Discuss themes and indicators
Site Visit 1	January 15th-16th	Ratify indicators and define research questions. Agree a plan for data collection and agree units that are comparable within the group.
Site Visit 2	February 26th-27th	Collation of data and identification of any problems at this stage. Discussion of problematic indicators.
Site Visit 3	April19th - 20th	Interpretation and presentation of data, working towards group's findings in preparation for the final conference
Final conference	June 15th 2004	Presentation of Year 1 results

1.3 Definition of the working group theme

It is important to define the term "Demand Management" as it can cover many areas of transport planning policy. A useful broad definition is that demand management is the formulation of policies which seek to reduce total traffic volume and / or promote shift to sustainable transport modes. Demand Management can also be defined as strategies which result in a more efficient use of transportation resources. Demand Management encompasses land use planning regulations, pricing issues and access restriction.

In the long term, the goal of authorities and planners involved in demand management can be seen as an integration of urban planning and transport planning. Policies such as setting limits on the number of parking places allowed at new housing / leisure / business developments and compelling developers to contribute towards the improvement of local transport facilities are a step forward in using regulations to reduce the demand for car travel.

The development of pricing policies such as congestion charges is the biggest challenge facing European cities at the present time. Other measures which are covered by the term demand management are; access control, reallocation of road space to sustainable modes and traffic calming.

The demand management working group concentrates on the "push" measures to reduce the impact of cars on cities (such as pricing and parking control) rather than "pull" measures such as improved public transport and cycling facilities.

Group expert Luca Persia suggested the themes for the group which were defined in more detail during the first site visit in Barcelona. At this meeting, a list of thematic indicators was also presented to the group for discussion. The group chose to examine the following research questions;

- How do cities currently perform?
- Which is the potential of demand management?
- How can cities enforce demand management regulations?
- How can cities make demand management measures acceptable?

1.4 Site Visits

As described above, the working group attended a total of three site visits over the course of the first year of the Urban Transport Benchmarking Initiative. The venues for the visits were:

1) Barcelona
2) London
3) Oulu

These visits provided a very useful insight into demand management practices applied in cities from outside the group. Full details of these site visits have been presented as case studies of the interesting practices the group experienced and are available in Annex 5.2, which accompanies this report. A summary of these visits is also available on the project website www.transportbenchmarks.org.

1.5 Contents and Purpose of this report

This report sets out the results obtained from the first year of data collection and the experience gained from the site visits. Section 2 gives an introduction to the working group participants and some background data from the common indicators. Section 3 outlines the process of defining the thematic indicators. Initial analysis of the data collected in year 1 is shown in Section 4 with some initial findings and conclusions summarised in Section 5.

The main report is supported by two Annexes; Annex A5.1 contains the full list of indicators collected by the working group, complete with definitions and Annex A5.2 contains details of some interesting case studies of demand management measures in Europe, maps of the demand management working group cities and summaries of the site visits held during year one.

2. WORKING GROUP PARTICIPANTS

2.1 Working group members

Table 2.1 outlines the participants in the group, the organisations they work for and the cities and regions they are representing in the project.

Table 2.1: Summary of working group participants

Area	Organisation	Country	Participant
Dublin	Dublin Transportation Office	IRE	Ciaran McKeon
Ile de France	Syndicat de Transport Ile de France	FR	Clothilde Fretin Brunet
Barcelona	Autoritat del Transport Metropolita	ESP	Xavier Rosello
Oulu	Oulu Municipality	FIN	Jaakko Ylinampa
The Hague	City of the Hague Department for Urban Development	NL	Toine Molenschot
London / Southwark	Southwark Metropolitan Borough Council	UK	Roy Turner
Warsaw	Warsaw City Roads Administration	POL	Janusz Fota
London	Transport for London	UK	Roger Torode

The cities and regions represented in the working group cover a wide geographical area and offer a range of varying practices and experiences which were shared over the course of the project. The key interest shared by all members of the working group is a desire to manage transport demand in the city.

In order to make any comparisons between the interesting practices applied in cities or regions represented in the working group it is essential to display an awareness of the background of each of the participating cities and regions. The remainder of this section summarises the geographical and urban transport situations in each of the participating cities / regions and utilises some background statistics from the Urban Transport Benchmarking Initiative Common Indicators to provide some context for further comparisons.

2.2 Description of cities represented

Warsaw

Warsaw City Roads Administration wishes to address issues of increasing traffic levels in a city where the road infrastructure has not been sufficiently upgraded to cope with traffic volumes. 88% of the road network is in need of repair. A reconstruction of the road network in the city is

proposed and there has been considerable political pressure to upgrade the road network but the budget is limited. The authority therefore wishes to use the EC benchmarking process as a way of learning from Western European cities how to manage demand during the period of disruption from the road works and beyond.

Barcelona

The Metropolitan Transport Authority was created in 1997 to cover many areas of administration across a region covering 4.3 million people. The authority has, until recently, only been responsible for management of the public transport system in the city region but a recent law has changed the roles and responsibilities of the authority so that in future it will manage all modes of transport, including roads. The authority, however, has little experience of traffic management and sees the EC benchmarking initiative as a valuable way of learning from the experience of other cities. In particular, the Barcelona authority is interested in learning about urban road pricing. The city has successful park and ride schemes which have helped to reduce demand for travel into the city centre by car but these schemes have become overcrowded. The authority also wishes to upgrade interchanges between personal and public transport modes.

Southwark

The London Borough of Southwark is situated to the South East of the centre of London, south of the River Thames. The location of the borough, close enough to the centre to incorporate a small part of the London Congestion Charge scheme, is the 2nd largest municipal land owner in the UK. The area has experienced economic decline and there are areas of deprivation which suffer from high volumes of through traffic which often use inappropriate routes through residential streets. Southwark Borough Council wishes to learn about different methods of addressing these issues.

Transport for London

Transport for London (TfL) was set up by London Mayor Ken Livingstone to provide an authority to oversee all modes of transport in Greater London. TfL combines some of the roles which were previously undertaken by the metropolitan borough councils and some which were previously the responsibility of the National Government. There has been much interest in the London Congestion Charging scheme which TfL is keen to share with other partners.

Paris (Ile de France)

The Ile de France Transport Authority is an example of best practice for inter-modal personal / public transport interchanges with successful park and ride (P+R) schemes on the regional rail network. However, to ensure that P+R schemes are used efficiently across the city region, the authorities need to introduce common parking policies across the different boroughs. This is seen as being crucial to achieving equal economic development across the Ile de France. However, the STIF authority has no powers over parking policy.

The Hague

A The Hague region covers 1 million people. The city offers good practice in cycling and public transport priority schemes. Access control in the city centre has also been developed as have ITS schemes. As a member of PLUME, the city is starting to integrate land use and transport planning.

Dublin

The Dublin Transportation Office was set up in 1995 and is responsible for Strategic Transport Planning for the Greater Dublin Area, which covers the 4 Dublin Local Authorities and 3 Local Authorities in the Mid East Region. There are currently in excess of 1.5 million people living in the Greater Dublin Area. The public transport network consists of Suburban Rail (3 lines) and bus. Two new light rail lines were under construction in 2002 and opened in summer / autumn of 2004. Demand Management is seen as an integral part of the current DTO strategy. The DTO are undertaking a demand management study, and this study, which will propose measures including a preferred package of measures for future implementation and will be completed in 2004.

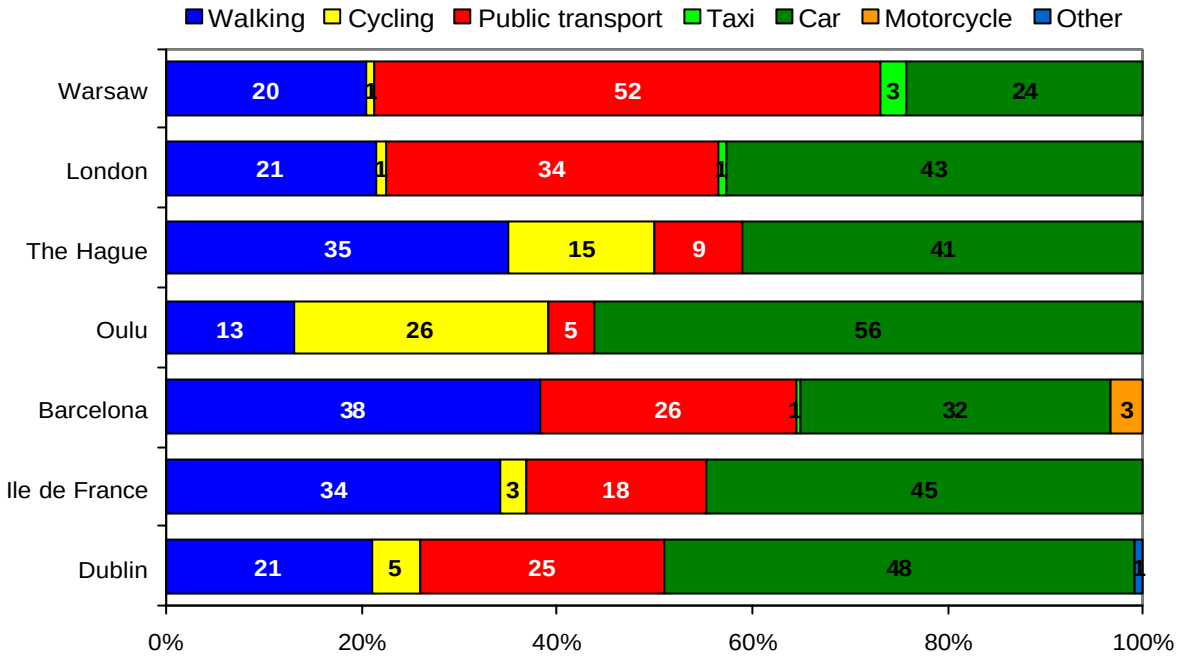
2.3 Background data from the common indicators

This section of the report uses data from the common indicators and background data from the thematic indicators in order to provide some basic information and comparisons for each of the cities / regions represented in the working group. Table 2.2 and Figure 2.1 outline some of the key statistics for each of the cities / regions in the working group. The modal split data shows some noticeable variation in travel habits, the highest modal share for public transport is seen in Warsaw (52%) of trips, the highest modal share for car journeys is in Oulu (56%) which also has the greatest proportion of cyclists (26% of trips).

Table 2.2: Background statistics for cities/regions in the working group

Statistics (2002)	Dublin	Ile de France	Barcelona	Oulu	The Hague	London	Warsaw
GDP per capita in €	44,857	37,472	22,181	22,761	26,000	33,222	13,315

Figure 2.1 Modal Split of the Cities



Notes;

- Data for Dublin reflects the daily trips to places of work, school and university only (irrespective of start time). Mode split for full day will be different. In particular, the car mode share is likely to be much higher.
- The data for Barcelona in Figure 2.1 is the combined modal share of walking and cycling.

3. DEFINITION OF THEMATIC INDICATORS

3.1 Research question / working group focus

At the first site visit in Barcelona in January 2004, the group confirmed that the following research questions would be used in order to focus the aims of the benchmarking exercise:

- How do cities currently perform?
- Which is the potential of demand management?
- How can cities enforce demand management regulations?
- How can cities make demand management measures acceptable?

The research questions can be broken down in more depth, with reference to each of the above identified research areas, the following questions were addressed:

- Integration of transport and urban planning:
  - How the current land use configuration affects the mobility system.
  - To what extent are transport and land use planning integrated?
  - Which are the most effective measures (e.g. public transport oriented developments, parking standards, and developer contributions)?

- Parking location and regulation:
  - Which parking regulation and control measures are currently adopted (e.g. duration, time of day, permits/bans)?
  - How are these measures enforced?
  - How to avoid negative effects (e.g. "search traffic")?

- Parking and congestion charging:
  - Which parking / congestion charging schemes are currently adopted (e.g. short / long stay, fixed / variable fare / cordon charging schemes, road sections tolls)?
  - How are these measures enforced?
  - How to increase acceptability of these measures?

- Space restriction/reallocation:
  - What is the current portion of road space allocated to each transport mode (car, public transport, cyclists and pedestrians)?
  - How is this allocation enforced?
  - How to increase acceptability of these measures?

The list of thematic indicators was agreed upon in Barcelona. These are shown below, along with the definitions for each one and the units in which the data will be collected.

Thematic indicators

The above identified research areas and questions led to a definition of a thematic indicator list. This list takes into account what has been included in the common indicator list, trying to supplement the common indicators in view of the subgroup objectives.

The suggested indicators have been grouped according to the identified research areas, even if many of them are useful for more than one research area.

An important issue for the demand management group was the definition of the urban areas for data collection. To achieve the aim of the subgroup of understanding the relationships between the land use configuration and the transport system characteristics, a more detailed distinction of the urban areas was thought to be useful. Moreover, a clearer view of the city structure and patterns is very important to draw some conclusions on the transferability of best practice. Originally, a subdivision of the city / region into four "concentric" areas was chosen:

1. **Central Area** (Central Business District) – It includes the main administrative, financial and cultural areas (e.g. Central London, Limited Traffic Zone in Rome).
2. **Inner Area** – It includes the older and denser part of the city, usually the area developed prior to the Second World War (e.g. Inner London).
3. **Built-up Area** – It is the urban area usually encircled by a ring road[1] (e.g. M25 in London, Francilienne in Paris, G.R.A. in Rome).
4. **Regional Area** – It includes the surrounding districts where most of the trips entering the city start from (e.g. Ile de France).

However, collection of meaningful data for such well defined concentric zones proved difficult for the participant cities to achieve, although it should be noted that recording of such data would be extremely useful for participant cities in understanding transport demand in different zones of the city. Following further discussion of indicator collection, the group decided to collect data for areas which were more comparable and for which cities had better data:

1. The metropolitan area
2. The regional area.

Beyond the real thematic indicators for which cities submitted data that were used to assess how cities currently perform with reference to the identified demand management policies, another group of "performance indicators" was suggested. Performance indicators are useful when assessing the results achievable with the implementation of effective measures / policies (best practice). Later in this report, existing data on at least one "reference case" for each of the identified research areas are presented as case studies. For example, for the third research area 'Parking and congestion charging'; the London congestion charging scheme is adopted as a reference case.

[1] At the Barcelona meeting it was agreed that EMTA cities can use the EMTA definition of "metropolitan area", unless clear differences between the two definitions emerge at local level.

3.2 Methodology for indicator definition

Much of the discussion time was allocated to the topic of indicator definition and all of the participants in the group were able to give their input to the process. Group expert Luca Persia presented a list of potential indicators at the Barcelona meeting. The participants each rated the data indicators that had been formulated in order to decide whether the data was relevant, available and collectable. The indicators that satisfied these criteria were then refined by the working group and finalised in order that the participants could collect data for their city / region.

3.3 Data collection and analysis

Data Collection

Data were collected during early 2004. In order to make the collection of data easier and to ensure that data were submitted in a standardised format a data entry form was created. This was supported by a handbook which defined the indicators chosen by the working group.

In order to try and make the collection of data as straightforward as possible for the participants some general principles were established. The two key issues in terms of the collection of data were:

1. Definitions and collection methods used to obtain data inevitably vary between cities. It was therefore very important that where pre-existing definitions for data indicators were used (as opposed to those stated in the data handbook) the cities defined what the figures relate to, because otherwise the data collected would have been incomparable.

2. The recommended study year for the project was 2002, because it was assumed that very little data would be available for 2003. It was recognised that cities have varying levels of data. Where cities did not have data for 2002 they were asked to supply data for the nearest year that data was available for. This was not a particular problem; because the participants were encouraged to explain specifically what year data referred to if it was not for the study year of 2002.

The working group meeting in Oulu (April 2004) was used to discuss the data submitted and the approach to analysing the data. Following this meeting several indicators were refined and data was re-collected in order to try and improve comparability between the cities and regions represented in the group.

Data Analysis

The process of analysis commenced after the third site visit in Oulu at which the data was ratified by the participants in the group and some small amendments were made. The group decided upon an approach to analysing the data which involved the group expert and rapporteur undertaking an initial analysis of the submitted data and circulating the suggested findings and analysis for the group to comment upon.

The main aim of the data analysis was to look for best practices and try to establish reasons for variations between indicators for which data are collected. In order to achieve this in a meaningful way the participants have been involved in this process in order that the outcome is a set of findings that are supported by reasoned analysis rather than a collection of statistics. Throughout the analysis process the limitations of the data have been respected in order that misleading conclusions are not developed into recommendations.

3.4 Data limitations and barriers to data collection

The main limitations of the data stem from the fact that a large proportion of the figures are not immediately comparable. This is primarily because of the varying methods of collection, presentation and definitions of existing data obtained by the participants in the working group. However, the project can also be viewed as a positive way in which participants can identify gaps in data and can compare data collection in other cities.

4. ANALYSIS OF THEMATIC INDICATORS

The analysis of the working group indicators has been presented as a review of the data collected by the participating cities. Where relevant, comparisons have been drawn with other indicators collected by the working group and with common indicators collected. The analysis has been broken down into three sections according to the research questions. Section 4.1 looks at indicators which seek to answer the question "How do cities currently perform?", section 4.2 "How to enforce demand management measures?" and section 4.3 "What is the potential of demand management?"

This section contains the following indicators which were collected in order to present the current situation in each city / region

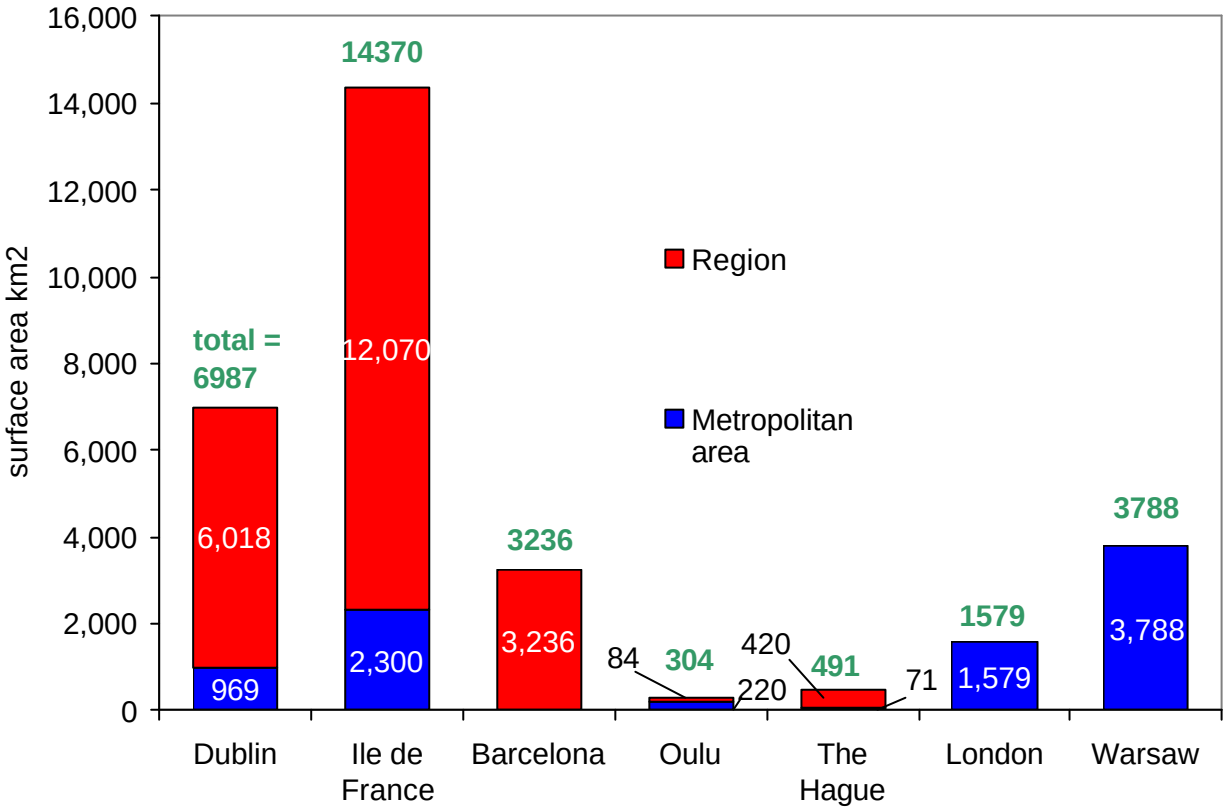
Table 4.1 'How Cities Perform' Indicators

Indicator	Measurement
Surface Area	Area in Km^2 of adopted city/region subdivision
Population	Number of residents in adopted city/region subdivision
Employment	Number of residents of adopted city/region subdivision currently employed
Concentration of services in the vicinity of main PT nodes	Average number of residents and jobs within a 500m distance from a PT node
Extent to which parking policies are linked to development	Are parking policies linked to development? If yes please describe
Extent to which parking policies are linked to PT policies	Are parking policies linked to public transport policy? If yes please describe
Average Trip Length	Average length of trips (in Km) be each transport mode
Access to public transport	Number of stops in adopted city/ region subdivision by mode.
Level of Integration of the Public Transport System	Number of interchanges between public transport modes in the adopted city/region subdivision.
Accessibility by Car	Number of parking spaces available. Please state which are on-street/off-street parking spaces
Level of integration between private and public transport systems	Number of parking spaces that are available in Park and Ride facilities

4.1 Research Question 1: How do cities currently perform?

Indicator 2.1; "surface area", shows that Ile de France has the largest "region" and "metropolitan area" covering a total of 14,370km^2. The largest single metropolitan area is Warsaw at 3,788km^2. Dublin has a large region of 6,018 km^2 surrounding a smaller metropolitan area of 969km^2. Oulu is the smallest city and is surrounded by a small administrative "region" although the sphere of influence of the city covers a vast, sparsely populated rural area. Figure 4.1 shows km^2 for the metropolitan area and the region. The area represented by the red bars shows the surface area of the region, not including the metropolitan area, the figures in green show the total for the region including the metropolitan area.

Figure 4.1 Surface area of metropolitan area and region



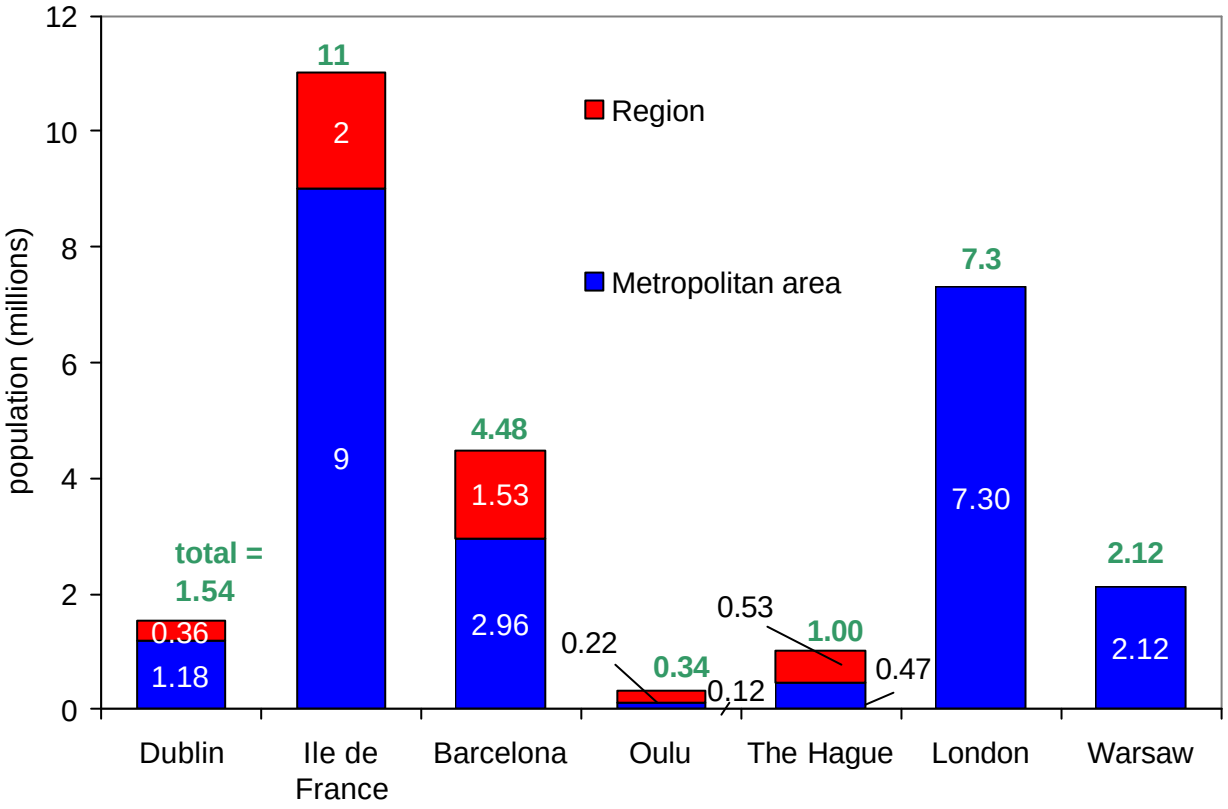
Notes;

- Barcelona has a dense inner area of 97.6km^2 of which 78.9km^2 is considered "built up". See Annex A5.2 which shows maps of the cities.
- A significant part of the metropolitan area of Dublin is still undeveloped. 1.08 of the 1.18 million population of the metropolitan area live in an area of 433km^2
- London data is for Greater London which is shown by map 2.8 in Annex A5.2. Throughout this report, Greater London will be referred to as the Metropolitan area although it could be argued that the size of this area is such that it could be considered as a region. Only one set of data was submitted for London.
- The term "metropolitan area" is not very clear in Warsaw. As "metropolitan area" is not an exact administrative term - it describes Warsaw and small villages surrounding the city) but it is not

defined officially. The region is a "voivodship" which is very wide (more than 35 000 km) thus all figures in this report refer only to the metropolitan area.

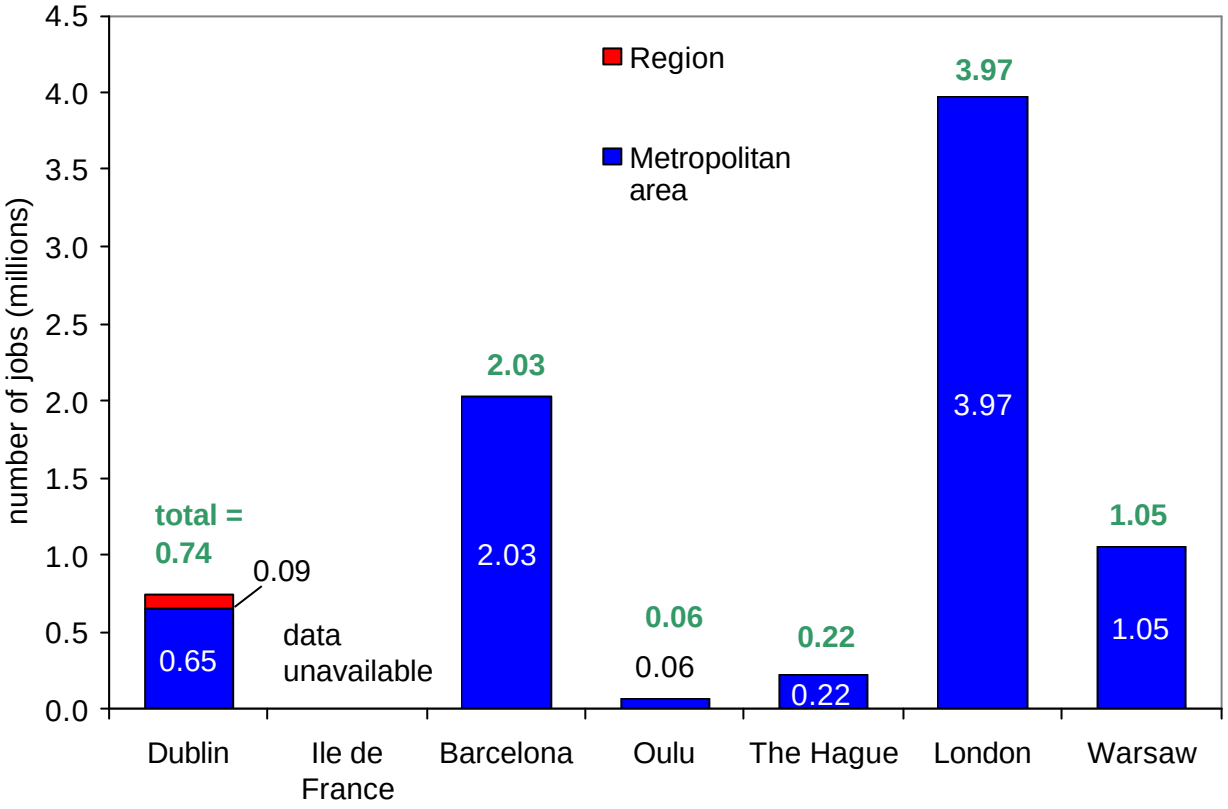
Indicator 2.2, population, is shown in Figure 4.2. Ile de France has the highest overall population, most of which is contained within the metropolitan area. The population figures shown by the red bars represent the regional population, not including the metropolitan area; the figure in green above the bars shows the total population of the region including the metropolitan area.

Figure 4.2 Population



The number of jobs (indicator 2.3) in a city demonstrates the influence that a city has on its region and indicates the demand for commuter trips to the city from outlying areas. Figure 4.3 shows that the number of jobs is highest in London. Figures for the Ile de France were unavailable.

Figure 4.3 Number of jobs

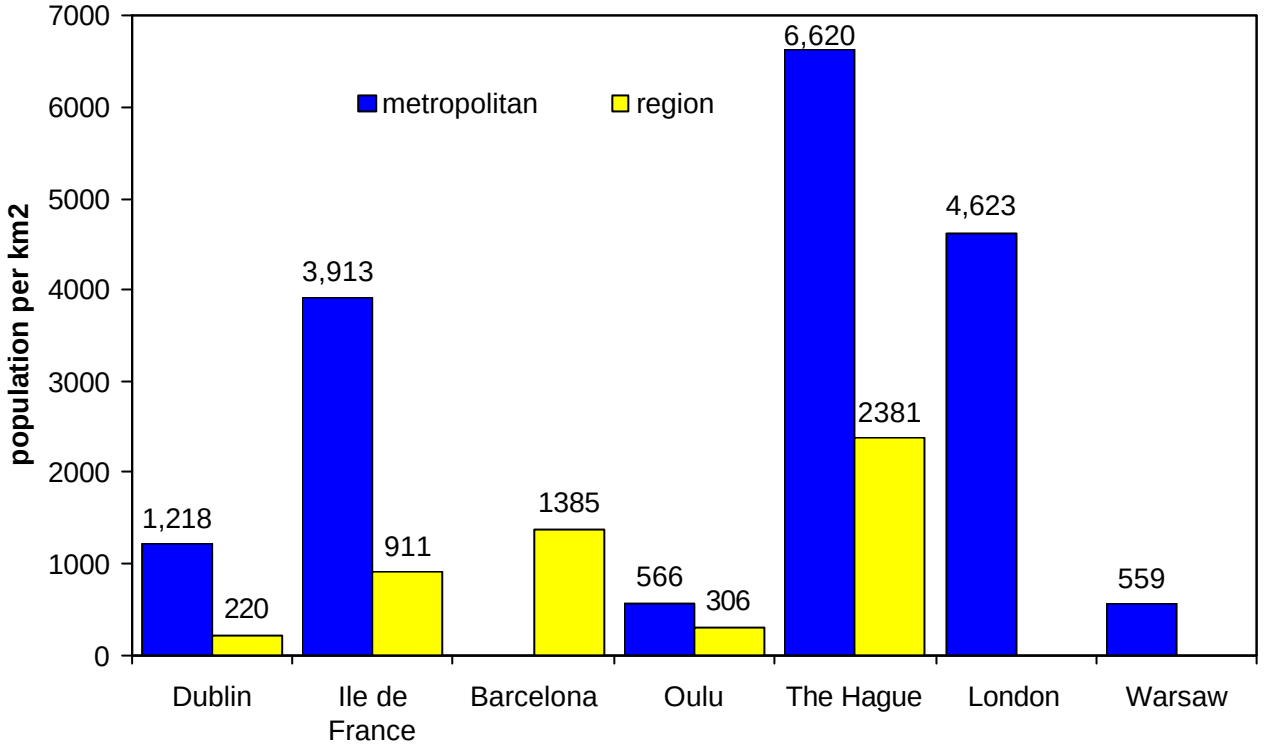


As the above figures show, the demand management group is composed of cities of varying size, population and geographical characteristics, including large cities (London and Paris), medium sized cities (Warsaw, Dublin, Barcelona) and smaller cities (The Hague and Oulu). The group found that physical geography and climate can have a significant impact on the demand for transport and land use in a city, particularly in Oulu where the city is designed with wider streets to accommodate snow removal from roads, but also in Barcelona where the mountains constrain the expansion of the city and London where the river forms a barrier between north and south.

Such differences in the characteristics of the participant cities necessitate the use of relative indicators to provide informative comparisons between the cities. Figures 4.4 – 4.6 show the population density, job density, and "attractiveness" of the cities.

Figure 4.4 shows that the metropolitan area of The Hague is the most densely populated area, followed by Ile de France and London. The "built up" areas of Barcelona are very densely populated (7,622 inhabitants per km^2) but do not correspond to an administrative are for which data is collected (neither metropolitan nor regional). The population density of the region includes the metropolitan area.

Figure 4.4 Population density metropolitan and region area

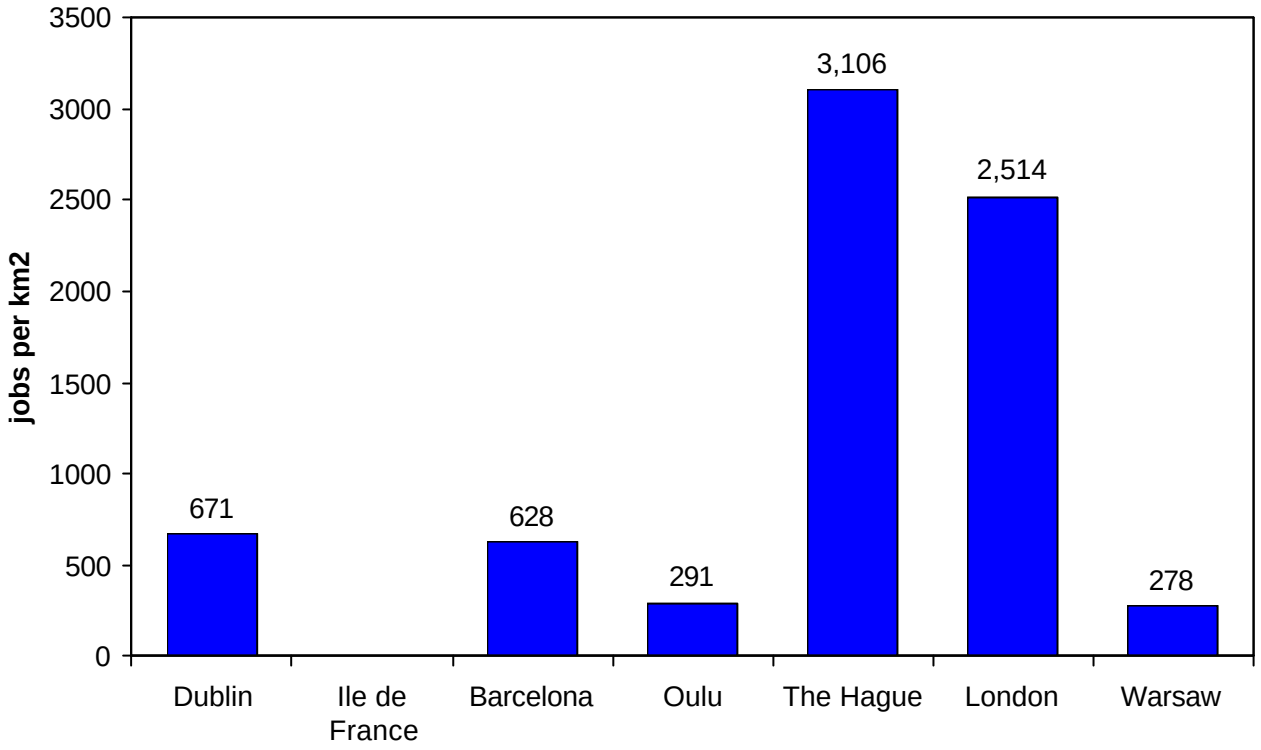


Notes;

- Dublin since provided a revised population density of 2,505 inhabitants per km^2 for the "built up" metropolitan area which contains 1.08 of the 1.18 million metropolitan area population in an area of 433km^2. All calculations in this document refer to the full metropolitan area with a density of 1,218km^2, as shown above.
- The "built up" area of Barcelona is also very dense at 7,622 inhabitants per km^2.

Indicator 2.3 provided the number of jobs in each metropolitan area (see Figure 4.3). Job density can be measured by combining indicators 2.2 (surface area) and 2.3 (number of jobs) to show how many jobs are in the city per km^2. Figure 4.5 shows this calculation, revealing that The Hague has the highest number of jobs per km^2, followed by London and Warsaw.

Figure 4.5 Job density

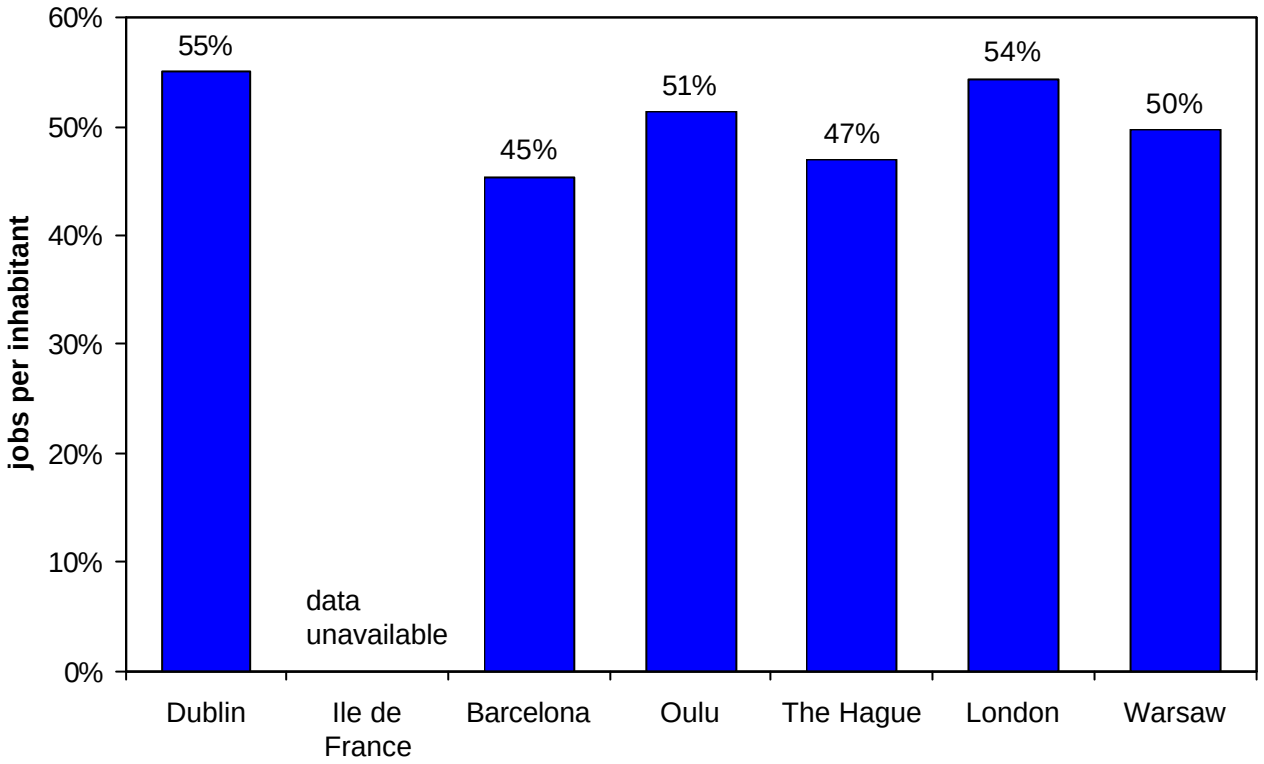


Notes:

- If the "built up" area of Barcelona is considered, the job density is 3,456 jobs per km^2
- Data used is for the metropolitan area
- Dublin = 649,722 jobs / 969km^2
- Barcelona = 2,032,745 jobs / 3,236km^2
- Oulu = 63,951 jobs / 220km^2
- The Hague = 220,500 jobs/ 71km^2
- London = 3,970,000 jobs / 1,579km^2
- Warsaw = 1,052,201 jobs / 517km^2

Figure 4.6 shows the "attractiveness" of a city which has been calculated by comparing the number of jobs in each city with its population to give a percentage figure. This produced very similar results of between 45-55% in each city.

Figure 4.6 Attractiveness of cities



Notes:

- Data used is for the metropolitan area
- Dublin = 649.722 jobs / 1,180,083 people
- Barcelona = 2,032,745 jobs / 4,482,623
- Oulu = 63,951 jobs / 124,588
- The Hague = 220,500 jobs / 470,000
- London = 3,970,000 jobs / 7,300,000
- Warsaw = 1,052,201 jobs / 1,688,200

Tables 4.2 – 4.4 show in the information provided for the following indicators;

- Concentration of services in the vicinity of main public transport nodes (average number of residents and jobs within a 500 metre distance from a public transport node)
- Extent to which parking policies are linked to development
- Extent to which parking policies are linked to public transport policies

Table 4.2 Concentration of services in the vicinity of main public transport modes

Dublin	Average Population within 500m of Rail Station in Dublin = 2,474
Ile de France	Data unavailable
Barcelona	65%
Oulu	4600 residents, 1000 jobs
The Hague	Central Station: Residents 7,100, Employed: 25,000 Holland Spoor: Residents: 11,600, Employed: 6,000
London	Data unavailable
Warsaw	See map in Annex A5.2

Notes on the data:

- Data for Dublin refers to the average population within 500 metres of 44 of the 45 rail stations in the Metropolitan Area. Figures were derived using DTO model zone data for population and assigning a proportion based on pinpoint (household) data within the station catchment. Population estimates are accurate to c. 10%. Figures for employment numbers within the station catchments are unavailable for both the Metropolitan and Hinterland Areas. No information is available on population within station catchments in the Hinterland Area

- Data for London is currently under investigation by the Transport Information & Modelling Team, Transport for London - TfL Buses Fact Sheet states that 6.3m people live within 400 metres of a bus stop, which is 85% of the resident population

Table 4.3 Extent to which parking policies are linked to development

City	Parking policy linked to Development?	Description
Dublin	✓	Parking Standards for all developments are specified in the Development Plans for each of the 7 Local Authorities.
Ile de France	×	No for Park and Ride parking. Yes for proximity parking.
Barcelona	×	No parking policies are included in urban development plans
Oulu	✓	Yes, 1 space for 50-100 m2 (50 business space, 85 offices, 100 meeting and dwelling, 85 hotels etc.)
The Hague	✓	City: 3 areas: CBD 1 space per 10 employees, 19th century ring 1 space per 5 employees, other 1 space per 2 employees
London	✓	Parking in London is linked to development as set out in The London Plan "Parking Strategy & Standards" (see notes below for further details.)
Warsaw	✓	Strict regulations exist for parking in Warsaw. These relate to 4 development zones identified in July 2001. Further details are given in the notes below.

- The London Plan "Parking Strategy & Standards" - Policies 3C.22 & 3C.23, paragraphs 3.205 - 3.213 (pg 125 - 127).

  Policy 3C.22 Parking strategy

  The Mayor, in conjunction with boroughs, will seek to ensure that on-site car parking at new developments is the minimum necessary and that there is no over-provision that could undermine the use of more sustainable non-car modes. The only exception to this approach will be to ensure that developments are accessible for disabled people. UDP policies and transport Local Implementation Plans should adopt on- and off-street parking policies that encourage access by sustainable means of transport, assist in limiting the use of the car and contribute to minimising road traffic.

  Policy 3C.23 Parking in town centres

  UDP policies and transport Local Implementation Plans should set out appropriate parking standards for town centres. These should help to enhance the attractiveness of town centres

and to reduce congestion. These standards should take into account public transport provision and the need to reduce travel by car and pedestrian and cycle access. The Mayor's Transport Strategy "Effective Management of Parking" - Policies 4G.4, 4G.5 & 4G.6, paragraphs 4G.83 - 4G.101 (pg 220 - 226) are also relevant.

- In July 2001 Warsaw City Council made a statement pointing out four zones (see map B2, in Annex A5.2) and determining rules of further development.

Table 4.4 Extent to which parking policies are linked to public transport policies

City	Parking policies linked to PT policies?	Description
Dublin	×	No, but there is a provision to provide for lower parking provisions subject to Local Authority planning permission. (Policies being reviewed at the moment)
Ile de France	✓	Yes for Park and Ride
Barcelona	✓	One big car park was built to improve access to Barcelona which today is partially used. Many railway stations have park & ride areas.
Oulu	×	No not directly
The Hague	✓	Yes, e.g. 1 space per 10 employees is within 750 meters of major PT nodes (like Central Station)
London	✓	Transport Assessments and Public Transport Accessibility Levels (PTALs) have been introduced to detail proposed measures aiming to improve access by public transport, walking and cycling.
Warsaw	✓	In July 1999 City roads administration established the charged zone of unguarded parking in the centre of Warsaw.

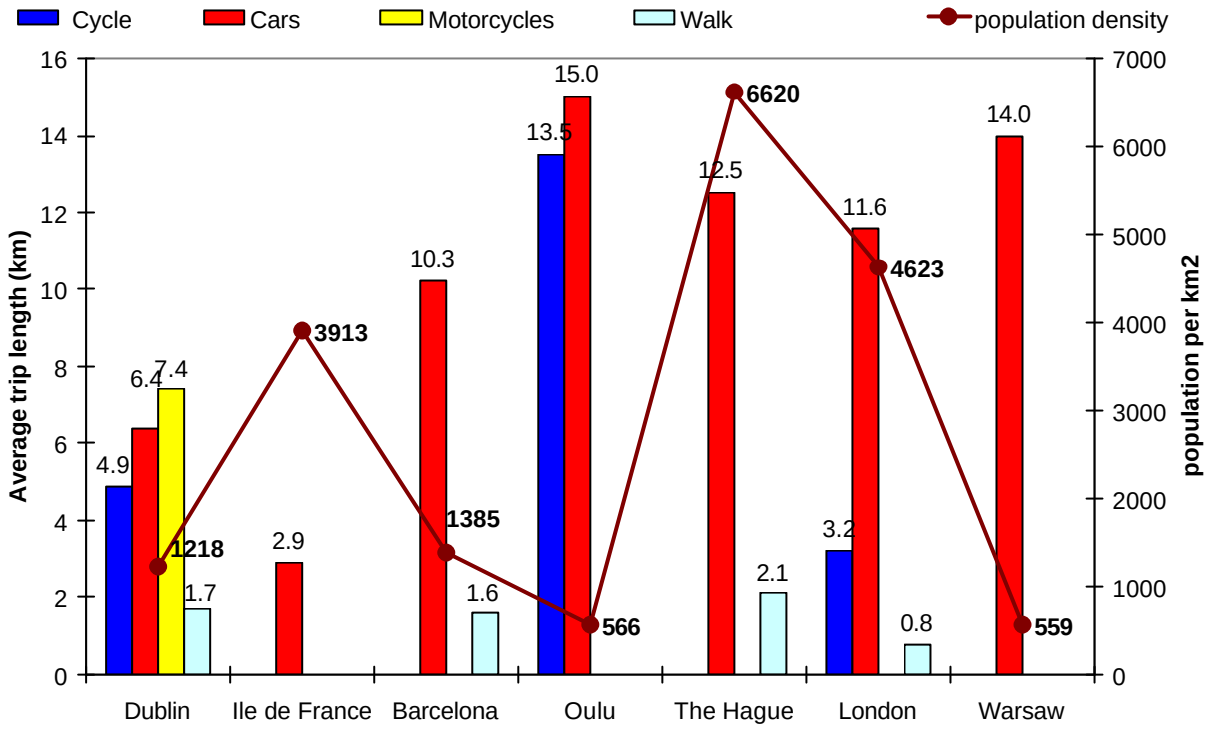
Indicator 2.7 Indicator average trip length

The average length of trips made in a city can be a useful way indicating of how many trips are long-distance, demonstrating the sphere of influence of the city. Figures 4.7 and 4.8 show the average trip length for personal and private modes and the population density of the city.

For personal modes in Figure 4.7, it can be seen that the cities with the lowest population density, Oulu and Warsaw, have the highest trip lengths for car (15km and 14km respectively) but also in Oulu for bicycle (13.5km). However, The Hague, with the highest population density, also has relatively high average trip lengths for car (12.5km). In Dublin and Ile de France, car trips are

shorter (5.2km and 2.9km respectively), demonstrating a potential to substitute these trips by cycling and walking.

Figure 4.7 Average trip lengths (personal modes)

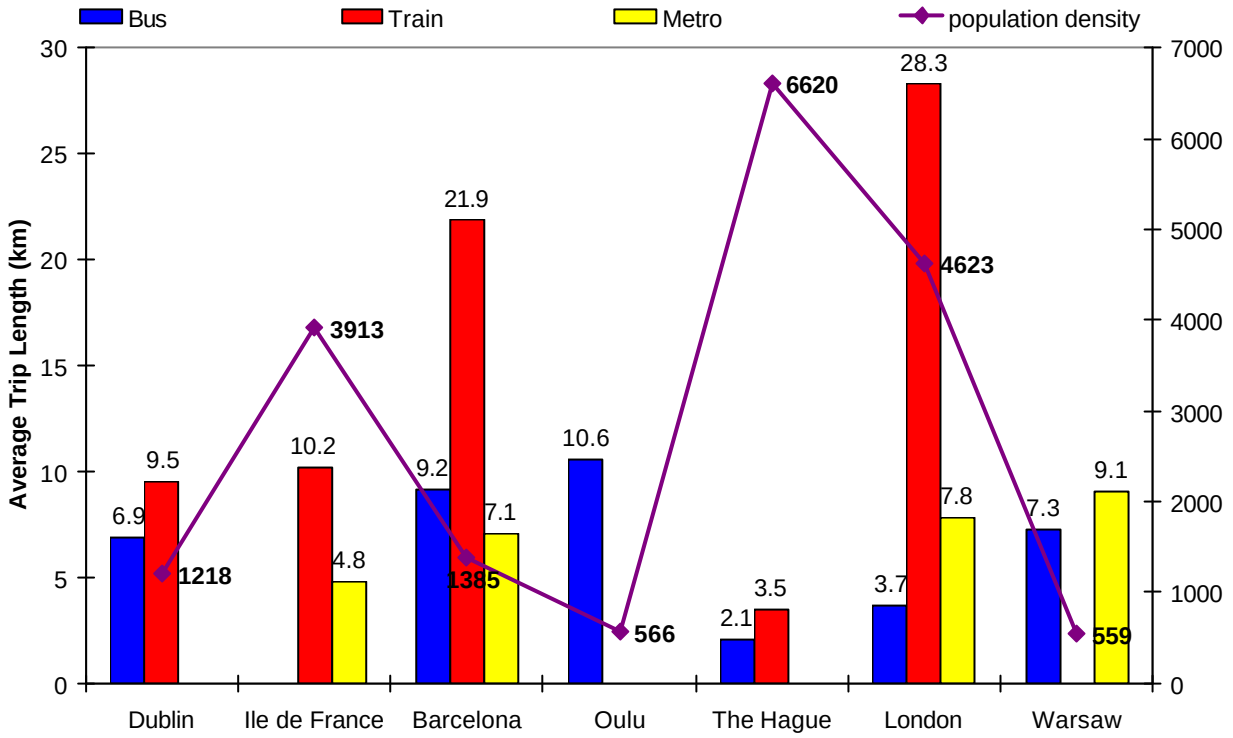


Notes

- Data for Dublin reflects the daily trips to places of work, school and university only.

Figure 4.8 shows that average lengths of train journeys in London (28.3km) and Barcelona (21.9km) are noticeably higher than in other cities. Bus journeys in London are much shorter (3.7), showing the dominance of long distance travel for train journeys into London. The high density of The Hague is reflected by the relative shortness of average bus (2.1km) and train (3.5km) journeys.

Figure 4.8 Average trip length public modes

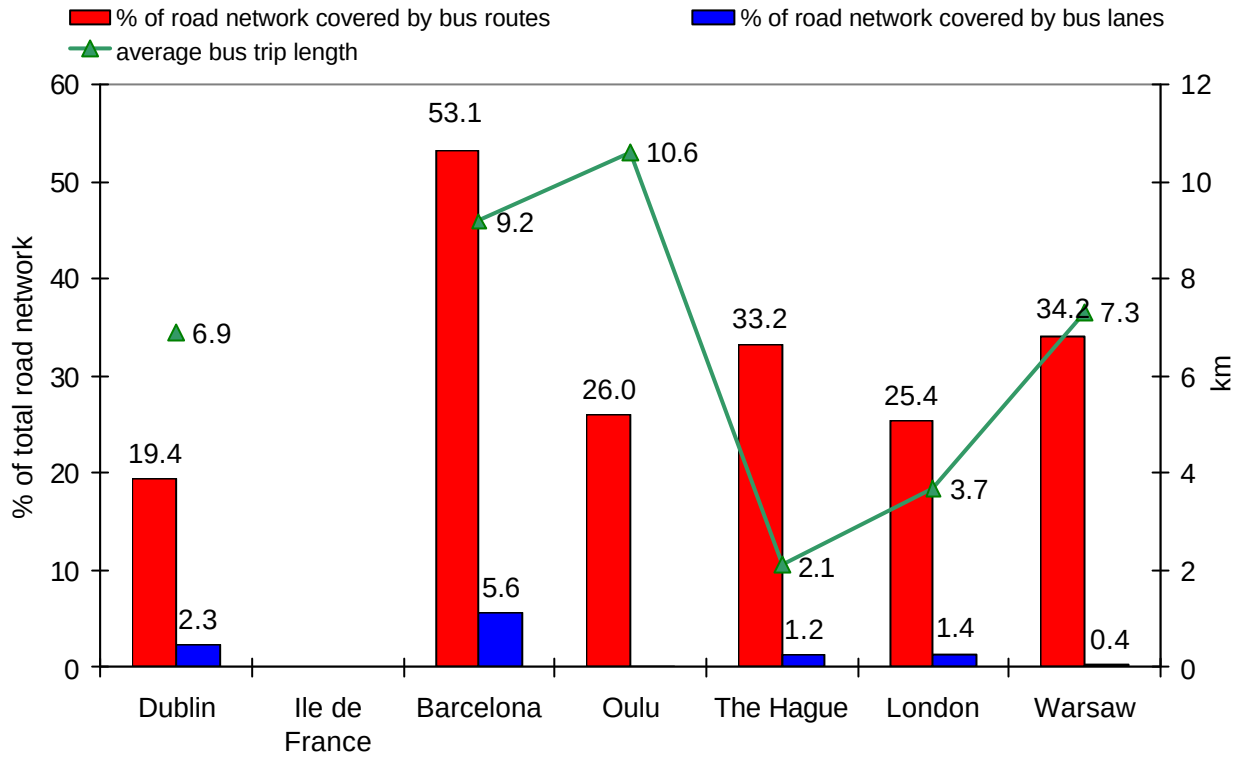


Notes

- Data for Dublin reflects the daily trips to places of work, school and university only.
- In Barcelona, average bus trip length includes longer distance metropolitan lines, not only city lines. This explains why its average length is higher than that of the metro.

It is possible to compare the average trip length data for private and personal modes with some of the infrastructure data collected by the cities for the common indicators. Figure 4.9 shows the average length of bus journeys compared to the bus route network as a percentage of the total road network. The graph does not really show any trends although it is interesting to note the high level of coverage in Barcelona where the number of kilometres of bus network is equivalent to 53% of the total road network and bus trips are longer at 9.2km. In London, the number of kilometres of bus network is equivalent to 25% of the total road network and bus trips are shorter at 3.7km. In Barcelona, 5.6% of the road network is covered by bus lanes, 2.3% in Dublin

Figure 4.9 Average length of bus trips and % of road network covered by bus routes



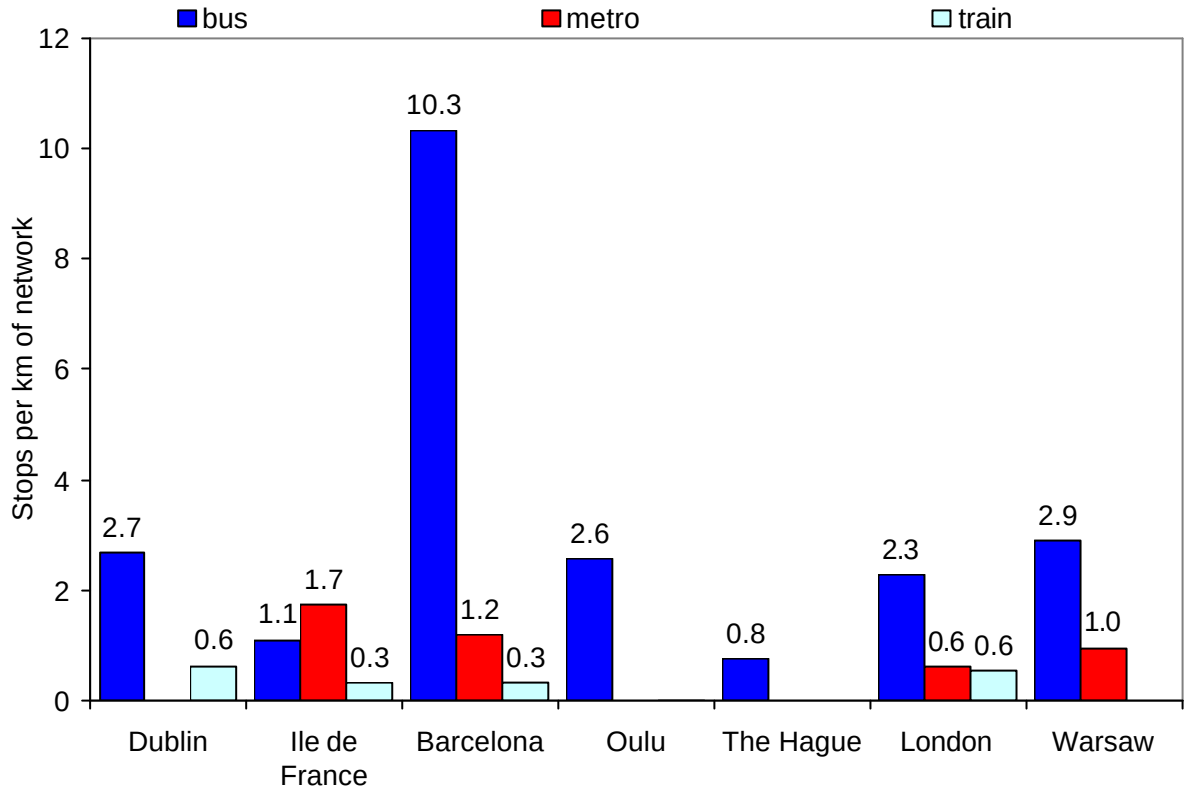
Notes

- Bus network as % of road network covered by bus routes was calculated using indicators 2.2 and 2.3 of the common indicator dataset.

For indicator 2.8, cities collected data on the number of public transport stops in the region and metropolitan area. This can be compared with the overall network length data provided by the common indicator dataset. Figure 4.10 shows the number of public transport stops per kilometre of network for each of the public transport modes. For this calculation, the number of stops in the regional area has been taken in order to be consistent with the data provided in the common indicator dataset which usually gives total network data, rather than network lengths within certain boundaries.

As Figure 4.10 shows, Barcelona has the densest network of bus stops along the bus network with 10.3 stops per km of bus route. The metro networks in the Ile de France and Barcelona have more stops per kilometre of route (1.7 and 1.2 respectively) than those of London (0.6) and Warsaw (1.0).

Figure 4.10 Density of stops on public transport network



Notes;

The number of stops takes figures for the region. The length of the network is taken from common indicator 2.2.

Figures 4.11 - 4.14 show the number of bus stops, train stations, metro stops and tram stops in each metropolitan area and region. Key observations from these figures are;

- Dublin (2,500), Warsaw (2,770) and Barcelona (2,734) all have a similar number of bus stops in the metropolitan area.
- The Hague has a low number of bus stops (275) but the highest number of tram stops (205), showing that trams operate like buses (in terms of density of stops) rather than like trains in this city.
- Ile de France (439) and Greater London (435) have a similar number of train stations but Ile de France has more metro stations (380 compared to London's 253)

Figure 4.11 Number of bus stops

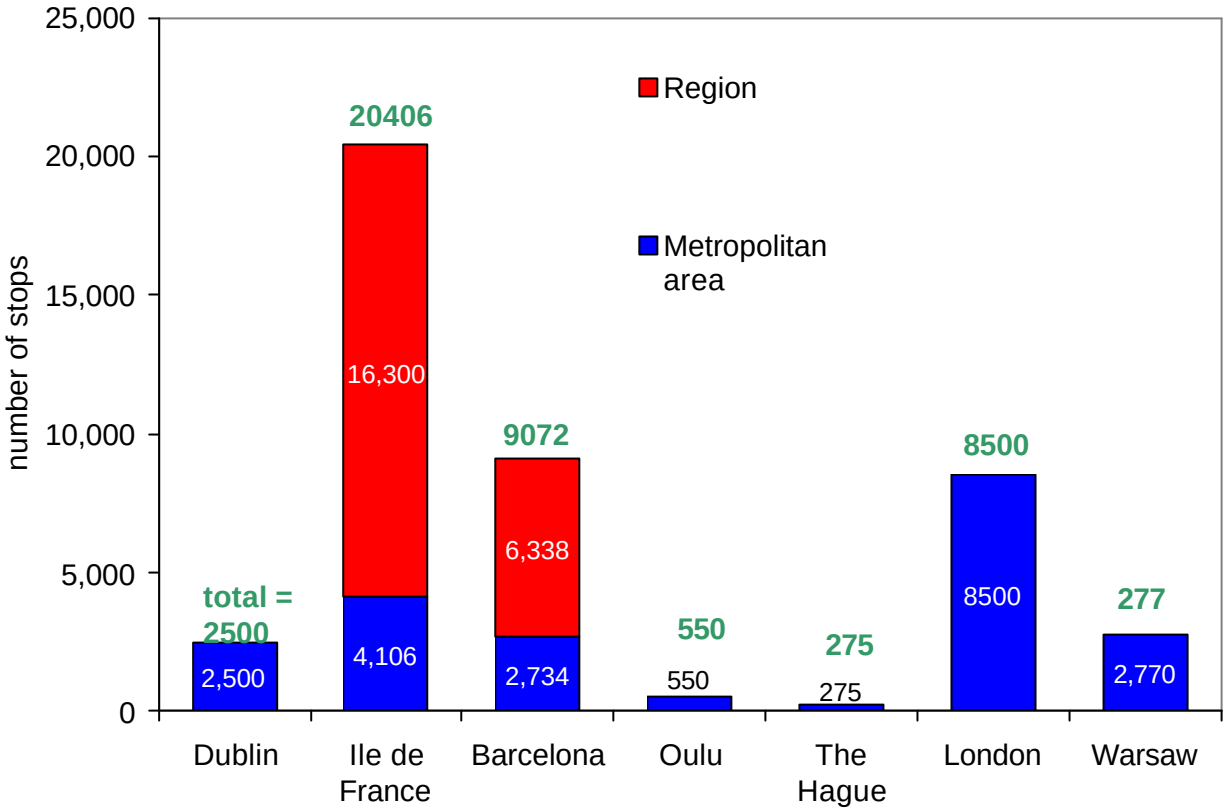


Figure 4.12 Number of train stations

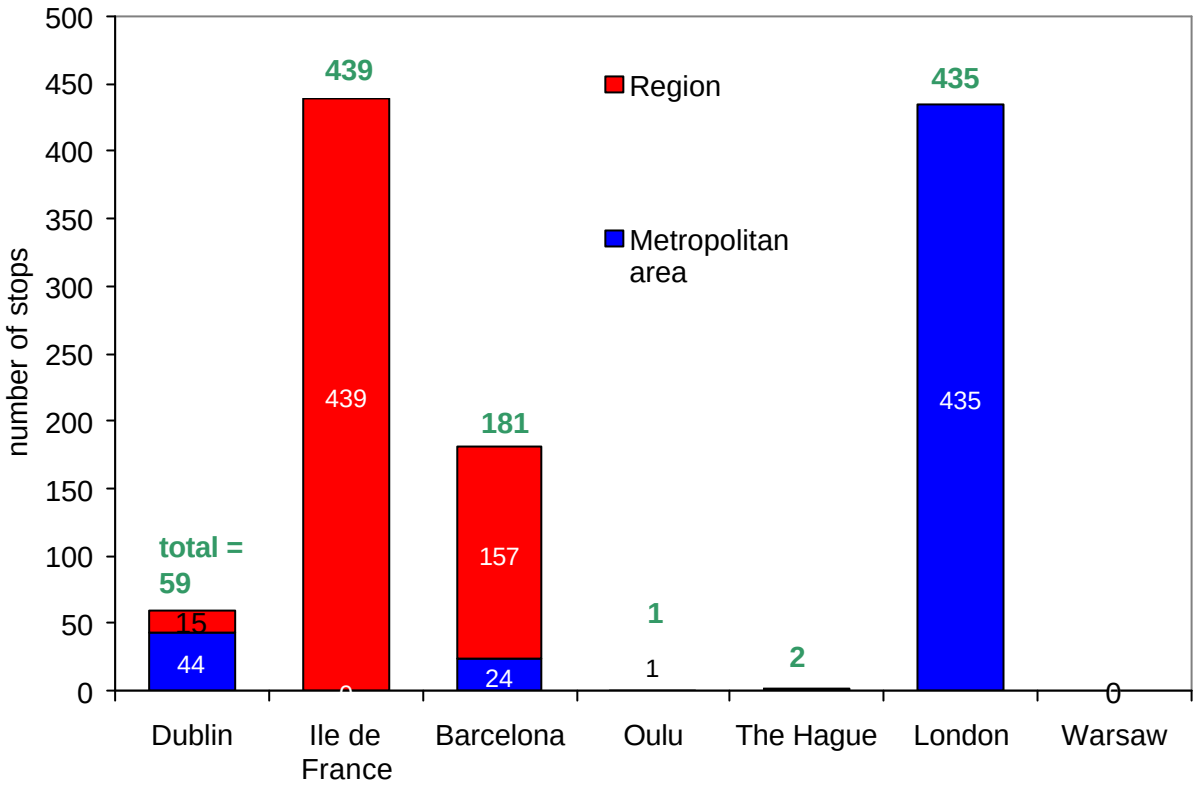
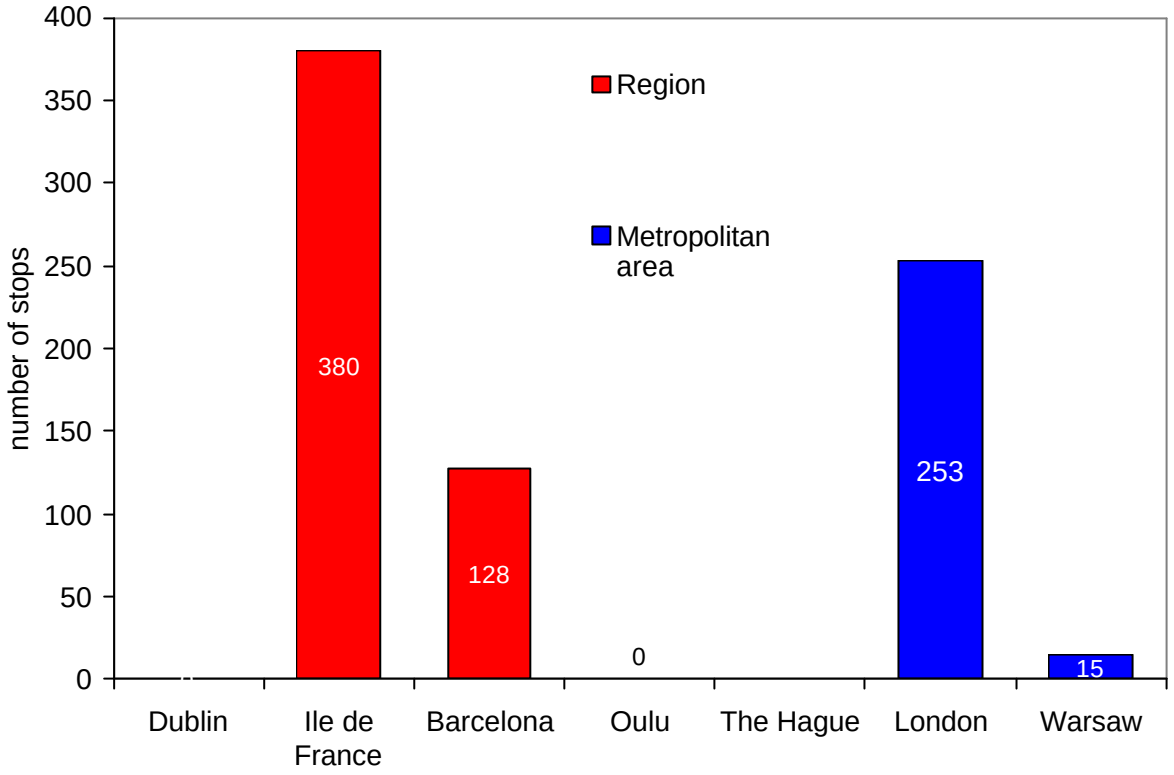


Figure 4.13 Number of Metro stops



- In Dublin, 36 stops on 2 new light rail lines in the Metropolitan area were under construction in 2002

Figure 4.14 shows that Warsaw and The Hague have the most developed tram networks of 514 and 205 stops respectively. The Ile de France region, Barcelona and London all have more modest tram schemes of one or two lines.

Figure 4.14 Number of tram stops

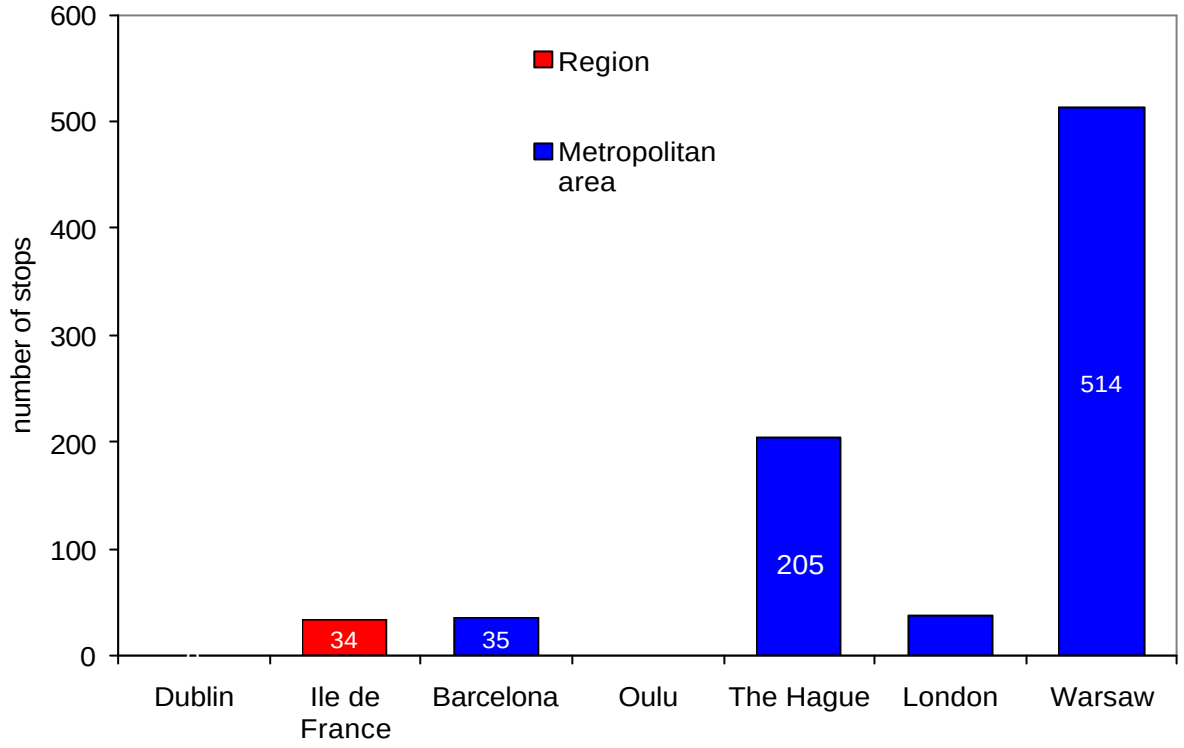
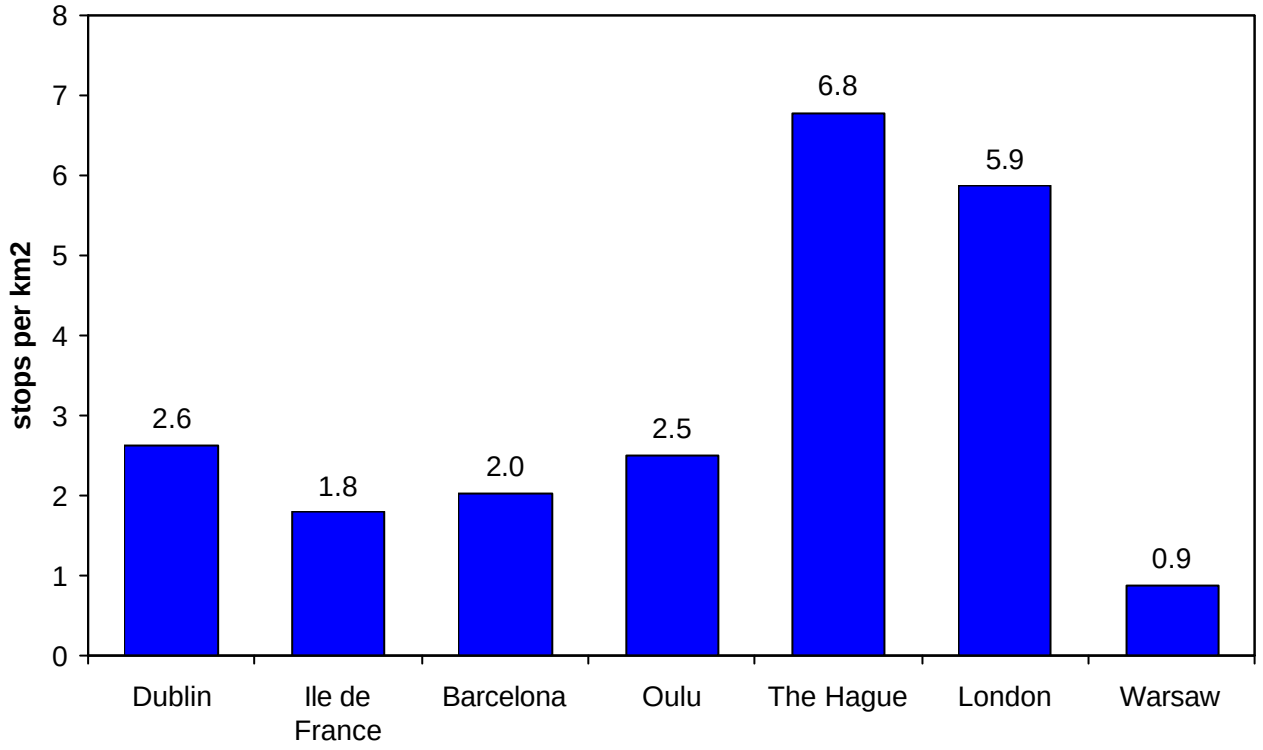


Figure 4.15 shows the number of public transport stops (all modes) per km^2 which gives a better comparison between the cities. The Hague and London appear to have a greater density of public transport stops than the other cities.

Figure 4.15 number of public transport stops per km^2 (metropolitan) surface area



Notes;

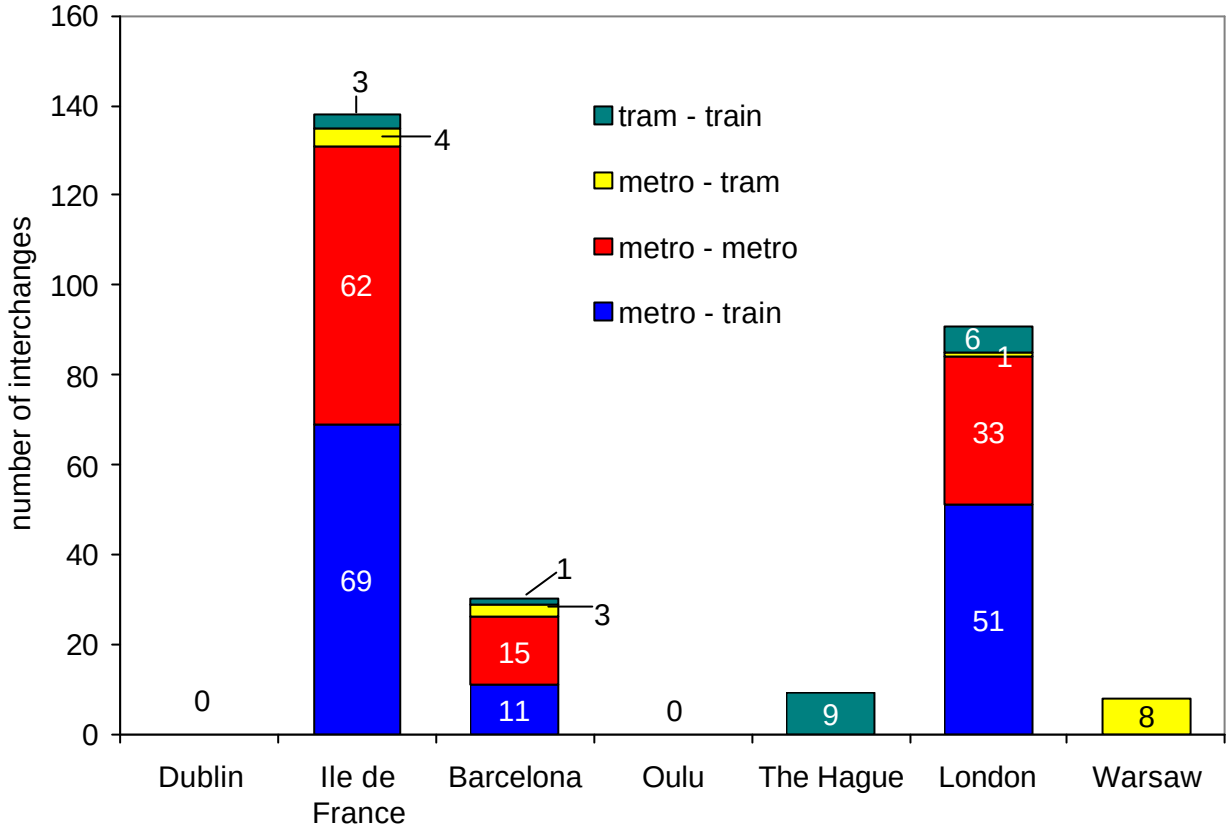
- In Barcelona, there is a dense inner area with a high concentration of public transport stops – 11.3 per km^2.

Table 4.5: Geographical area data used for Figure 4.15

	Dublin	Ile de France	Barcelona	Oulu	The Hague	London	Warsaw
Public transport stops	2544	4106	2921	551	482	9260	3306
metropolitan area (km$^{2)}$	969	2300	3236	220	71	1579	517

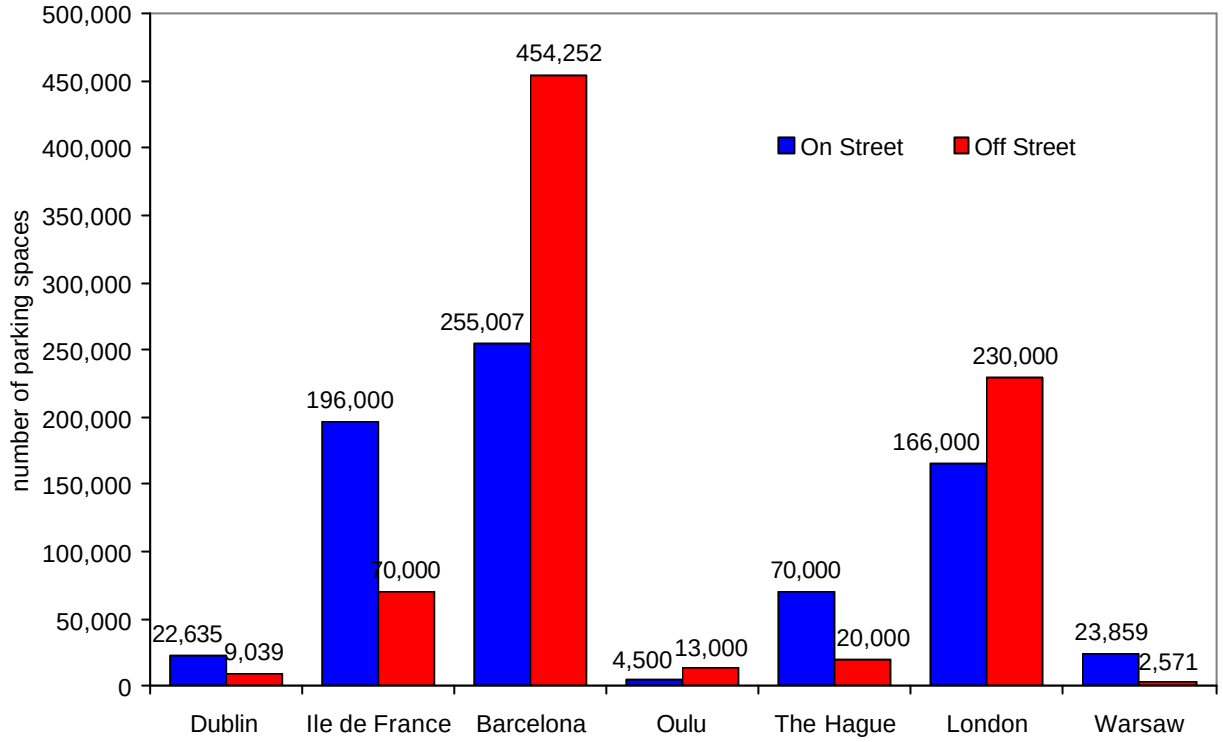
Figure 4.16 shows the number of multi-modal transport interchanges. This excludes interchanges with bus services, as there are too many examples of such interchanges in larger cities, although it should be noted that bus interchanges play a key role in Dublin where rail coverage is quite low.

Figure 4.16 Number of multi-modal interchanges (excluding bus)



Indicator 2.9 collected the number of on street and off street parking spaces which is shown in Figure 4.17. Barcelona appears to have a large number of parking spaces for a city of its size, although this could be explained by better collection of such data in Barcelona.

Figure 4.17 Number of parking spaces



Notes;

- Dublin figures relate to the City Centre which covers an area of 13km^2
- Warsaw figures refer to the charged parking zone in the centre of Warsaw.

It is more instructive to compare the number of parking spaces by the following ratios, which are displayed in Figures 4.18 - 4.20

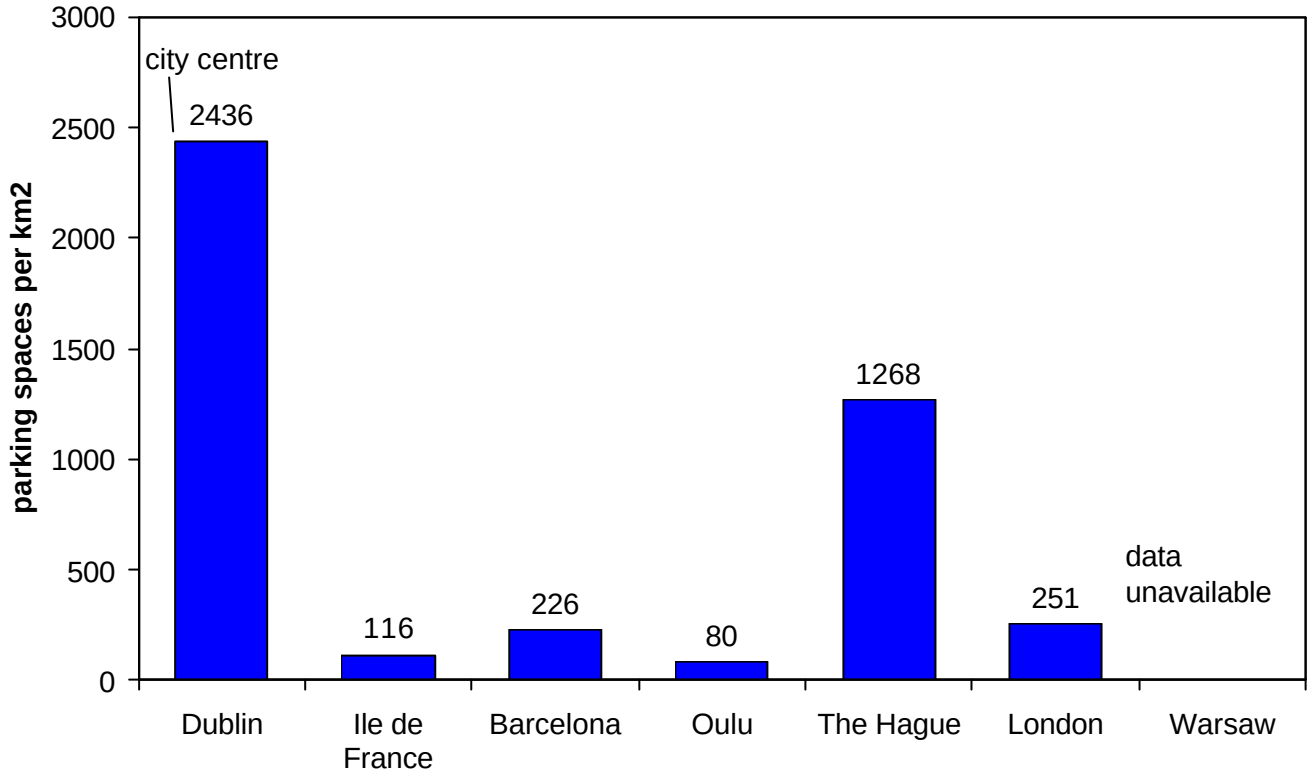
- Number of parking spaces per km^2
- Number of parking spaces per registered car
- Number of parking spaces per 1000 population

The key results shown in Figures 4.18 - 4.20 are;

- The Hague has the greatest density of parking spaces with 1,268 spaces per km^2, Dublin's centre has a density of 2,436 spaces per km^2.
- Ile de France metropolitan area has the greatest demand for parking spaces with 11.3 cars sharing each parking space. In other cities for which metropolitan area data exists, there are between 1.9 and 4 cars per parking space.
- Barcelona has the best provision of parking spaces per 1000 population at 240, followed by The Hague with 191.

Please note that these figures are calculated using the parking data provided by the cities, which may be incomplete. Parking data proved to be problematic for some cities to collect.

Figure 4.18 Number of parking spaces per km^2

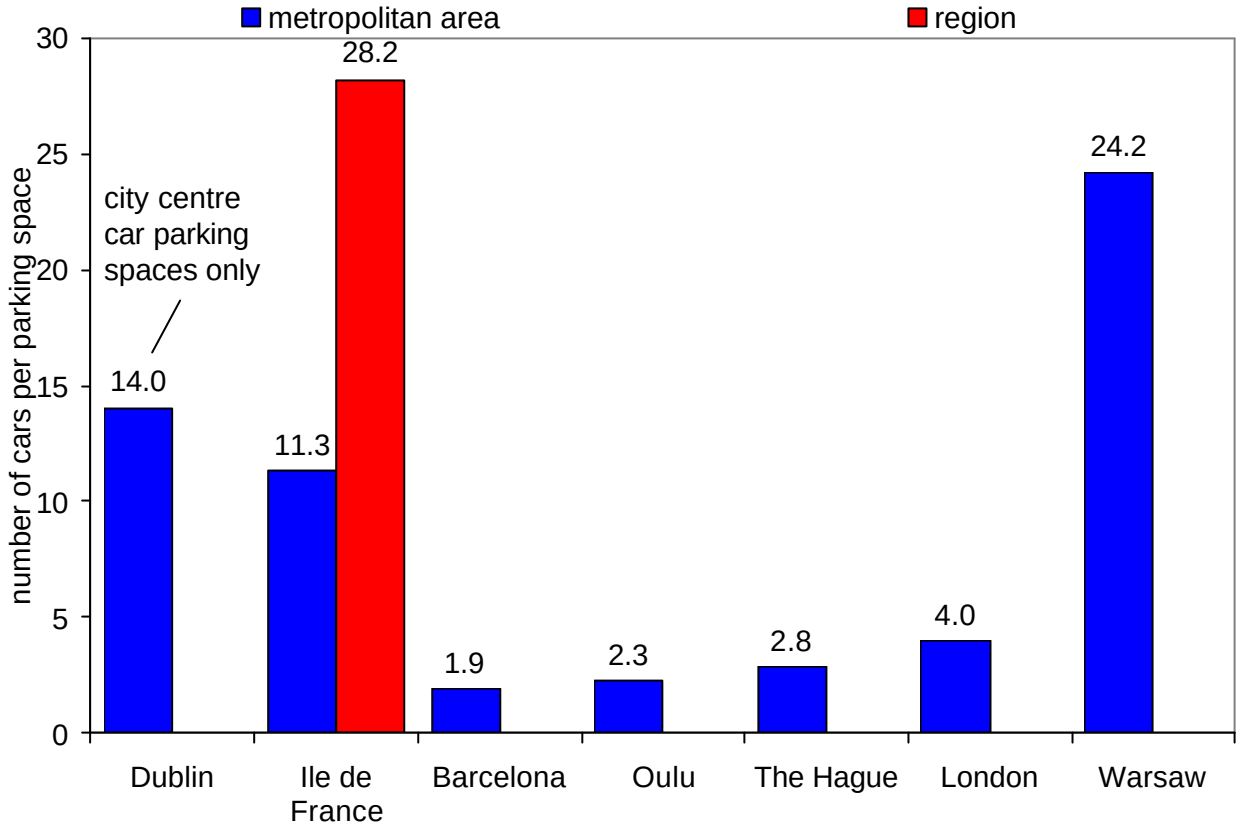


Notes;

- Dublin figure refers to City Centre only where there are 2,436 spaces per km^2. (31,674 spaces/13km^2)
- In Warsaw, there are 23,859 parking places in the charged parking zone is in the centre of Warsaw (see map 2.3, Annex A5.2) There are many more spaces, but authorities are not able to provide a total, because apart from the charged parking places drivers can park everywhere under the condition they do not break the traffic law

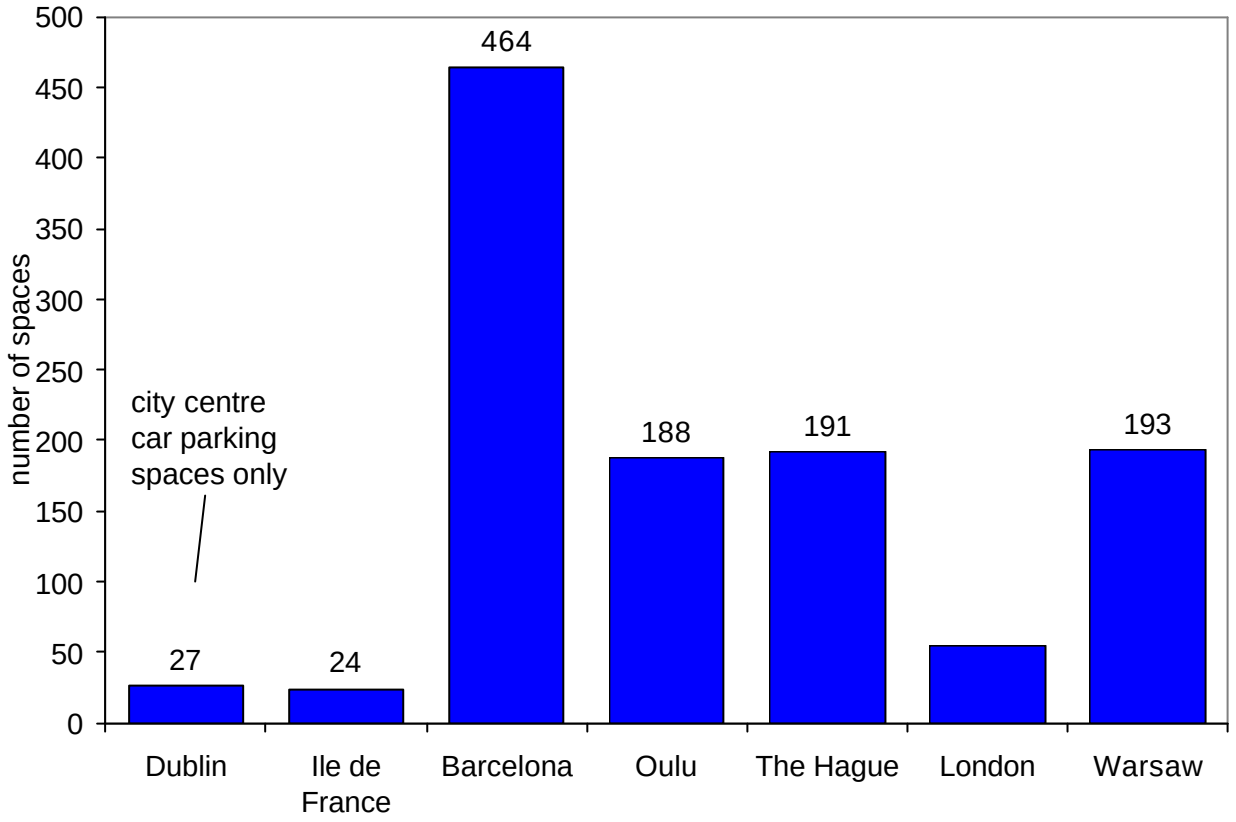
Using the figures from the common dataset, indicator 3.1 number of cars registered in the city, Figure 4.19 shows the number of cars per parking space.

Figure 4.19 Number of cars per parking space



In Figure 4.20, the figure for Dublin represents the number of city centre parking spaces per 1000 population of the whole metropolitan area. The figure for Warsaw represents the number of parking spaces per 1000 population of the city centre area only. In Warsaw, there are 16 spaces per 1000 population of the metropolitan area.

Figure 4.20 Number of spaces per 1000 inhabitants

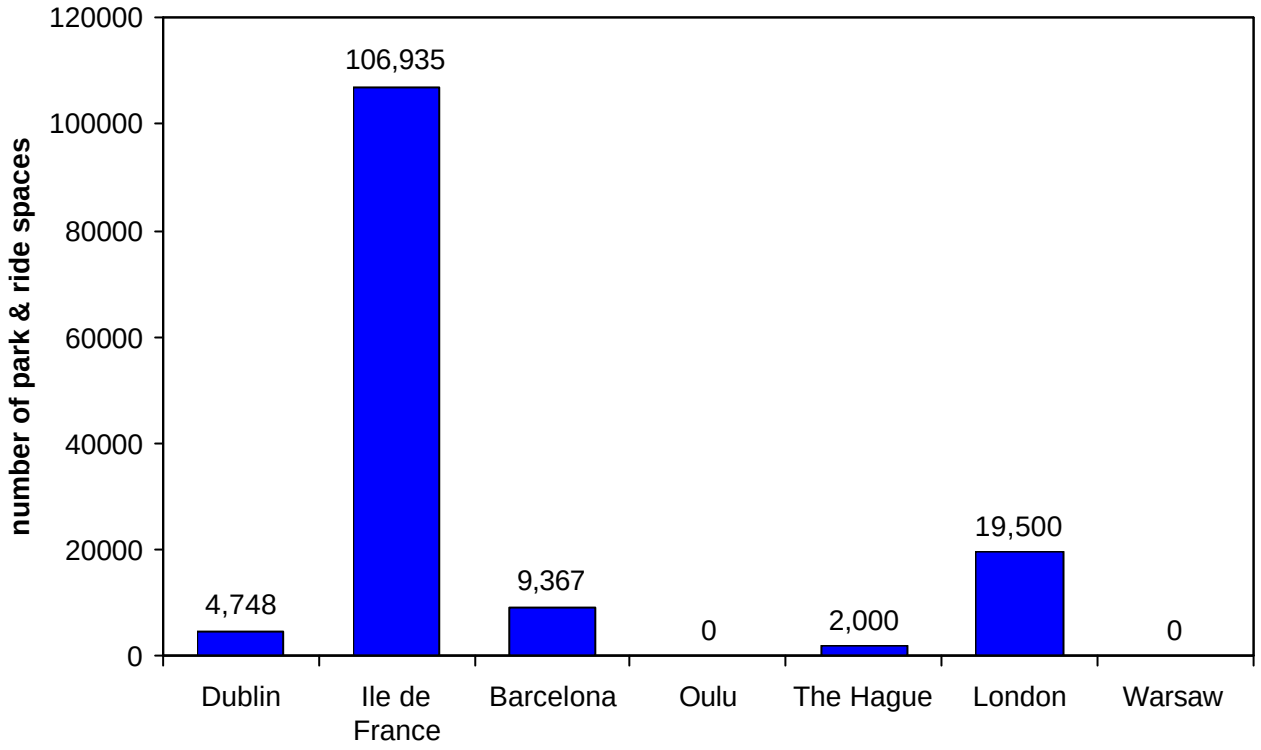


Notes;

- The figure for Warsaw is derived from parking spaces in Srodmiescie, the central area, only.
- The figure for Dublin is derived from the city centre parking spaces and the population of the metropolitan area.

Indicator 2.10 measured the number of Park and Ride spaces available in the city. The Ile de France region has an important Park and Ride policy which is illustrated by the high number of spaces. The concept has yet to be established in Warsaw and Oulu. The data in Figure 4.21 refer to the regional area in the case of Dublin and Ile de France.

Figure 4.21 Number of park and ride spaces



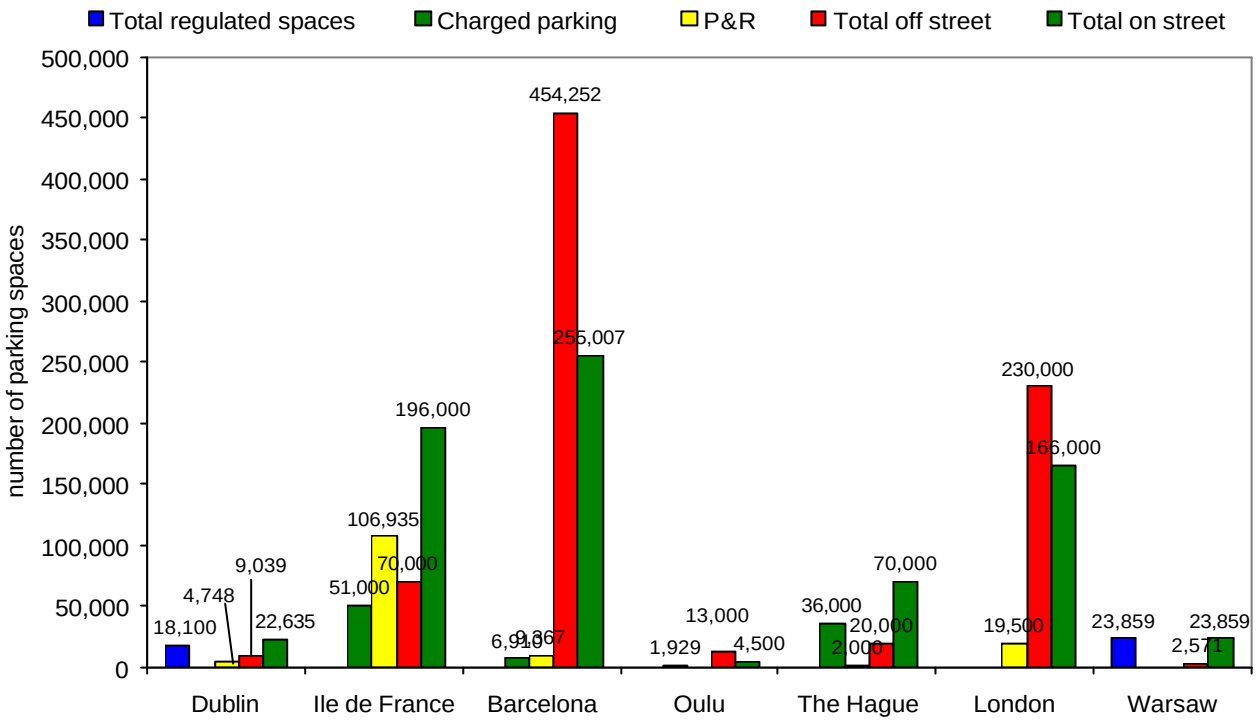
4.2 Research Question 2: Enforcing Demand Management

Indicator 3.1 'Parking Spaces' aimed to collect different types of parking spaces in each city. However, the data submitted were incomplete and many participants only had parking data for certain areas of the city. The completion of this indicator which aimed to provide the different types of parking spaces present in each city should be a priority for year two of benchmarking. A review of different types of parking spaces present in London is shown in Annex A5.2. This can provide a basis for future work on categorisation of parking. Data from indicator 2.10, on street and off street parking, are included in Figure 4.22.

Table 4.6 'Enforcing Demand Management' indicators

3.1	Level of parking regulation	The number of regulated parking places for each different method of regulation that applies
3.2	Level of parking regulation enforcement	The number of fines issued per annum for a) free and b) charged parking places
3.3	Percentage of the road network with speed limits	Length (in Km) of the road network in the adopted city subdivision & % of these roads with speed limits
3.4	Percentage of the road network with automatic speed control	% of the road network in the adopted city subdivision with automatic speed control.
3.5	Percentage of charged parking places	Percentage of parking spaces that are subject to parking charges
3.6	Minimum and maximum parking fare	Minimum and maximum parking charges (in €) for both on street and off street parking
3.7	Extent of pedestrianisation	The percentage of the road network that is pedestrianised (not accessible to cars and motorcycles at any time).
3.8	Streets with access control	The percentage of the road network that has access restrictions in place for cars.
3.9	Traffic calmed streets	The percentage of the road network that has traffic calming measures in place

Figure 4.22 Number of parking spaces

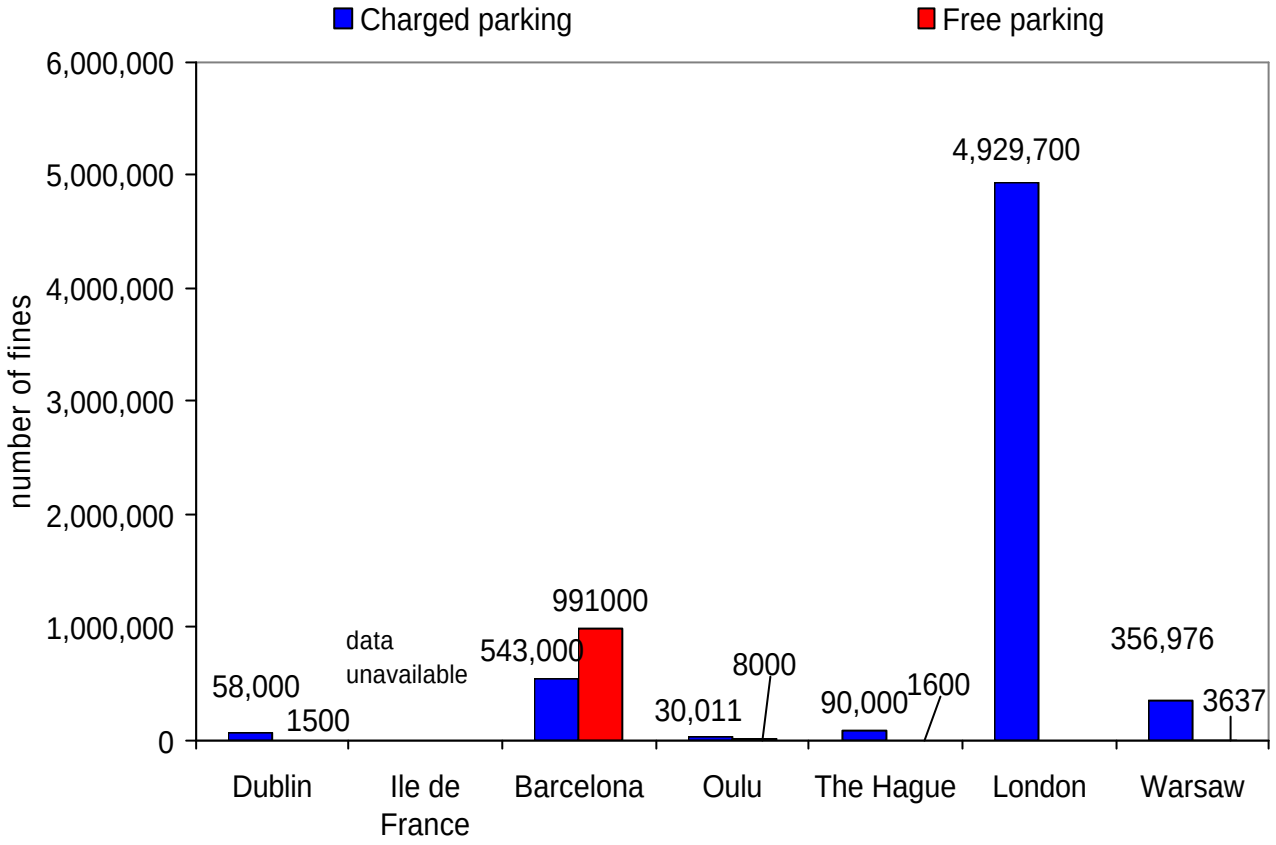


Notes;

- In Barcelona, there are also 12,317 motorcycle parking spaces and there are 148,097 free car parking spaces.
- Dublin and Warsaw data refers to the city centre only.

Indicator 3.2 measured the number of fines issued in the city which is displayed in Figure 4.23.

Figure 4.23 Number of fines



A more instructive comparison is to show the number of fines per cars registered, using the common indicator dataset. This is displayed in Figure 4.24 which shows that London authorities are the most stringent in enforcing parking restrictions, issuing 1.63 fines per car, followed by Barcelona (0.98) and Oulu (0.96). However, when the number of fines issued is measured against the number of inhabitants (as shown in Figure 4.25), Barcelona issues more fines per 1000 inhabitants (1004) followed by London (675).

Figure 4.24 Number of fines per cars registered

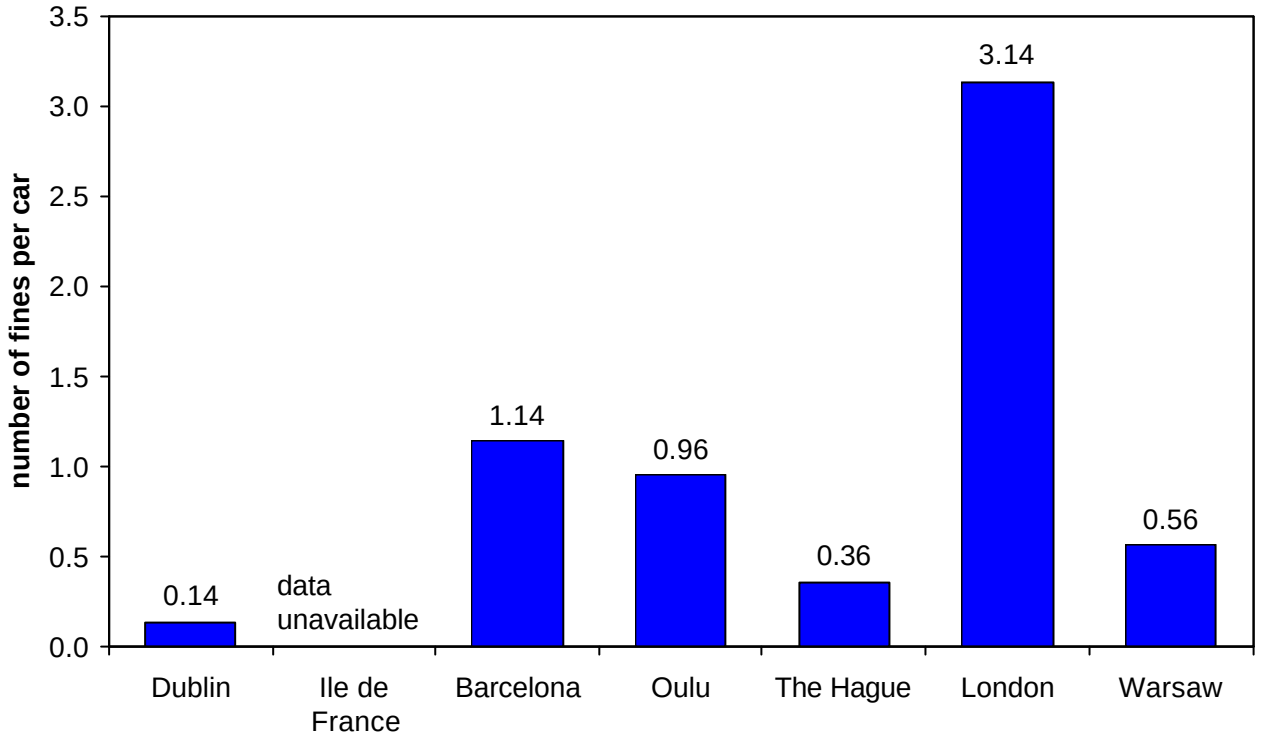
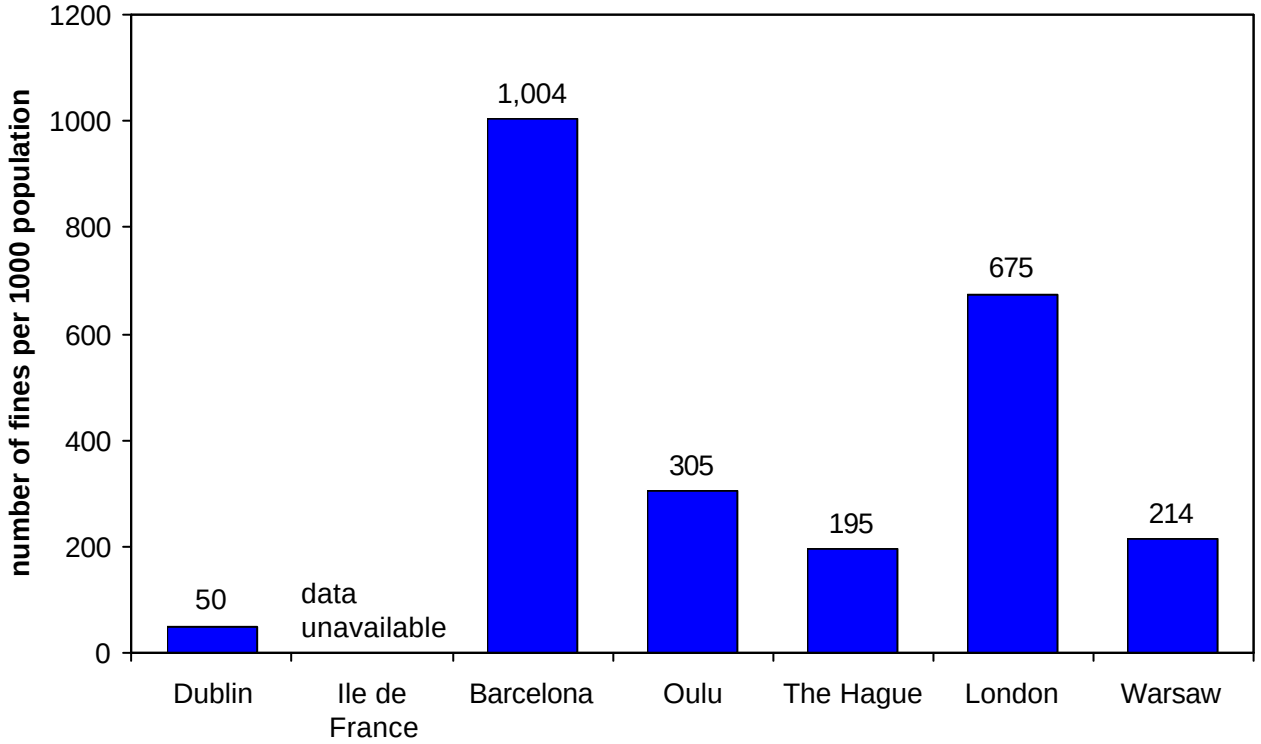
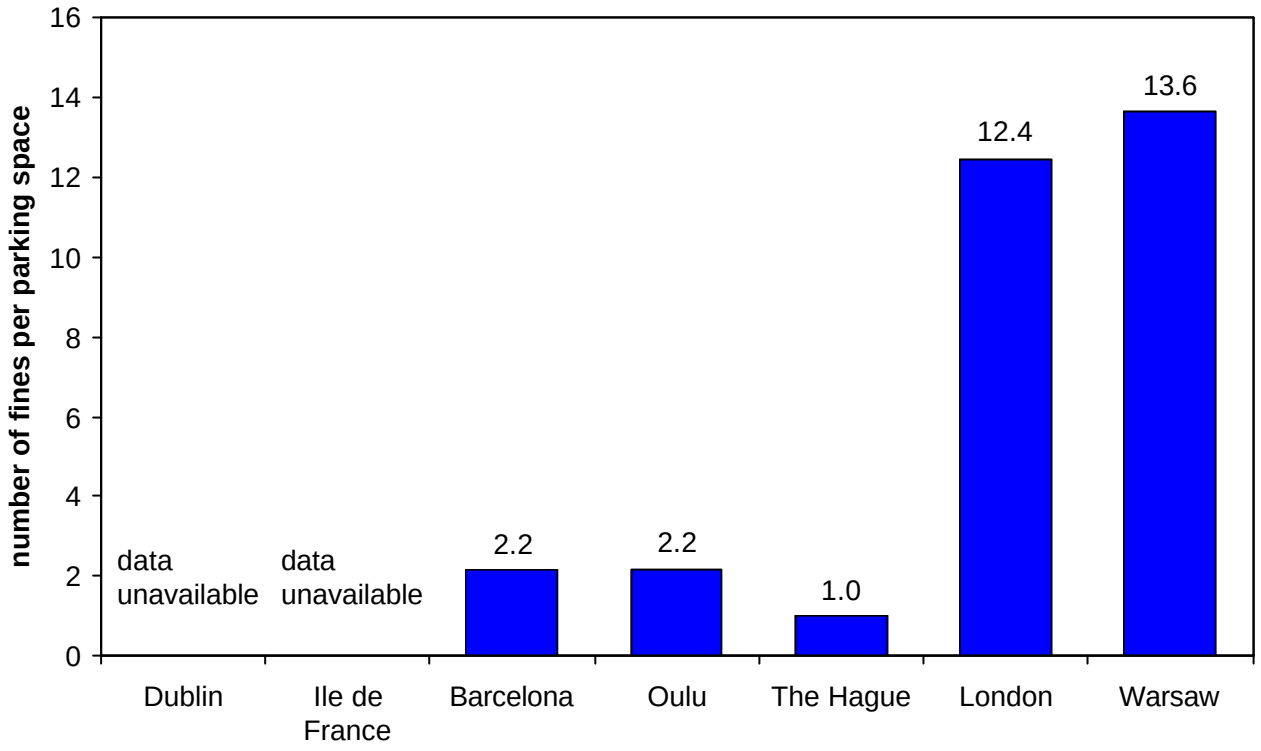


Figure 4.25 Number of fines per 1000 population



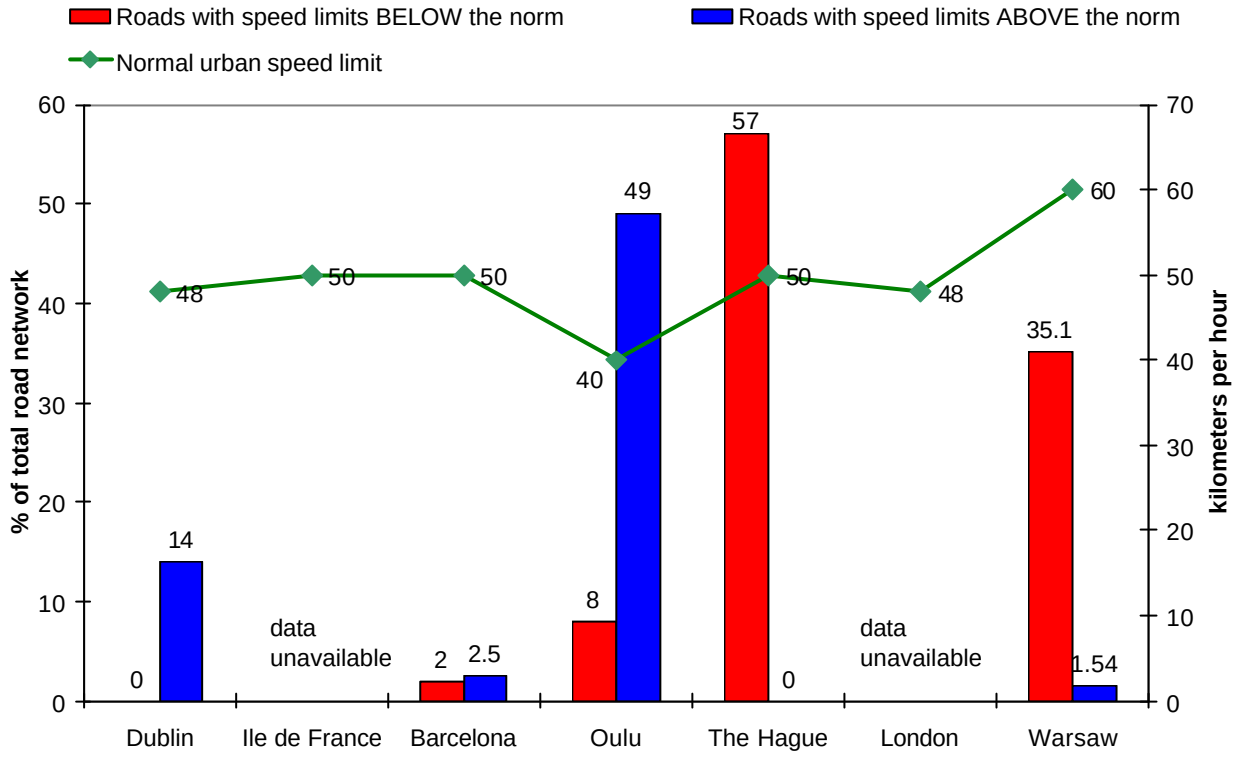
The number of fines per parking space is shown in Figure 4.26. The greatest number of fines issued per parking space is in Warsaw (13.6) followed by London (12.4).

Figure 4.26 Fines per parking space



Indicator 3.3 aimed to characterise the road network by identifying the % of the road network where speed limits are higher than the norm. The average normal urban speed limit of the 7 cities is 49.4 km per hour with Oulu notably lower at 40km / hr and Warsaw notably higher at 60km / hour. However, as Figure 4.27 shows, in both Oulu and Warsaw, a large percentage of the road network has a speed limit different to this norm (49% of roads in Oulu have limits over 40km / hour, 35% of roads in Warsaw have limits under 60km / hour). For most cities, there is little variation from the normal urban speed limit. In The Hague, there are more zones where the speed limit is lower than the norm of 50km / hour (57%).

Figure 4.27 Normal urban speed limit and percentage of road network with limits above and below the normal limit



Indicator 3.4 aimed to identify the level of technology used for road traffic enforcement. There were many different ways in which cities used technology, the most comparable being the number of speed cameras present on the city road network. London has the greatest number of speed cameras at 400, followed by Barcelona with 99. This is shown in Figure 4.28.

Figure 4.28 Number of speed cameras

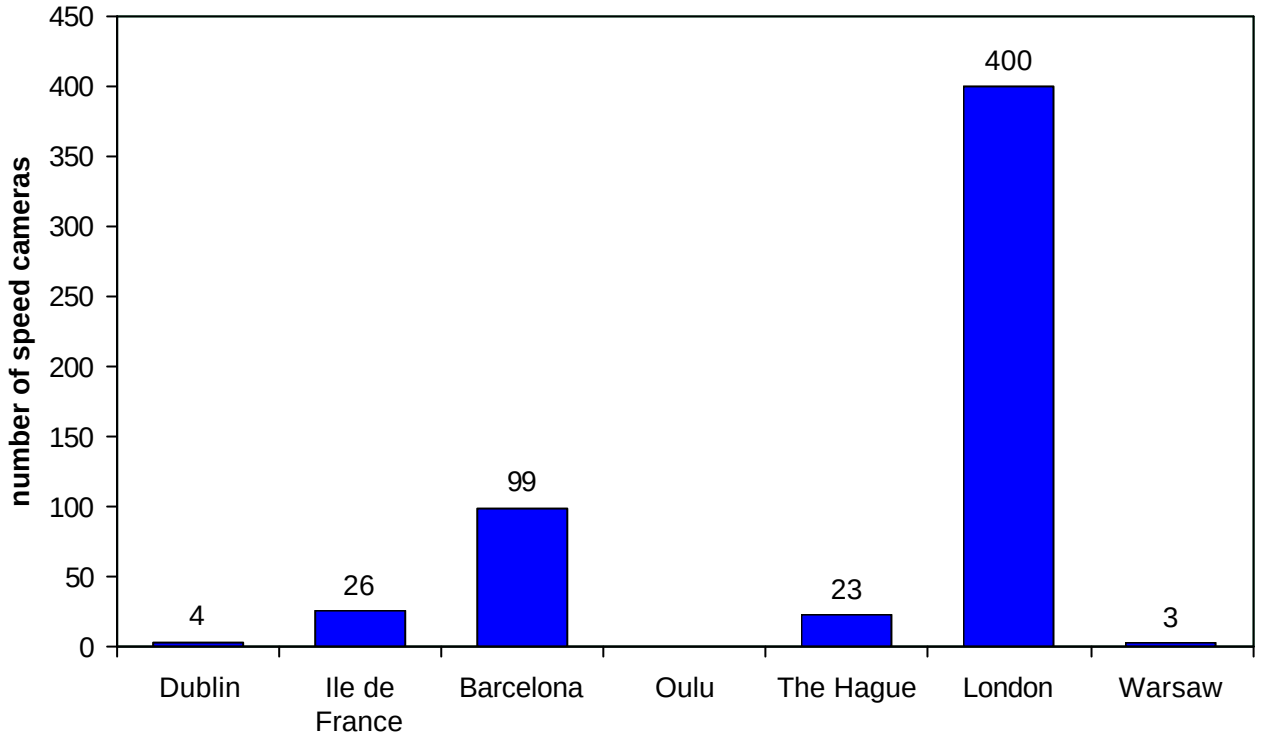
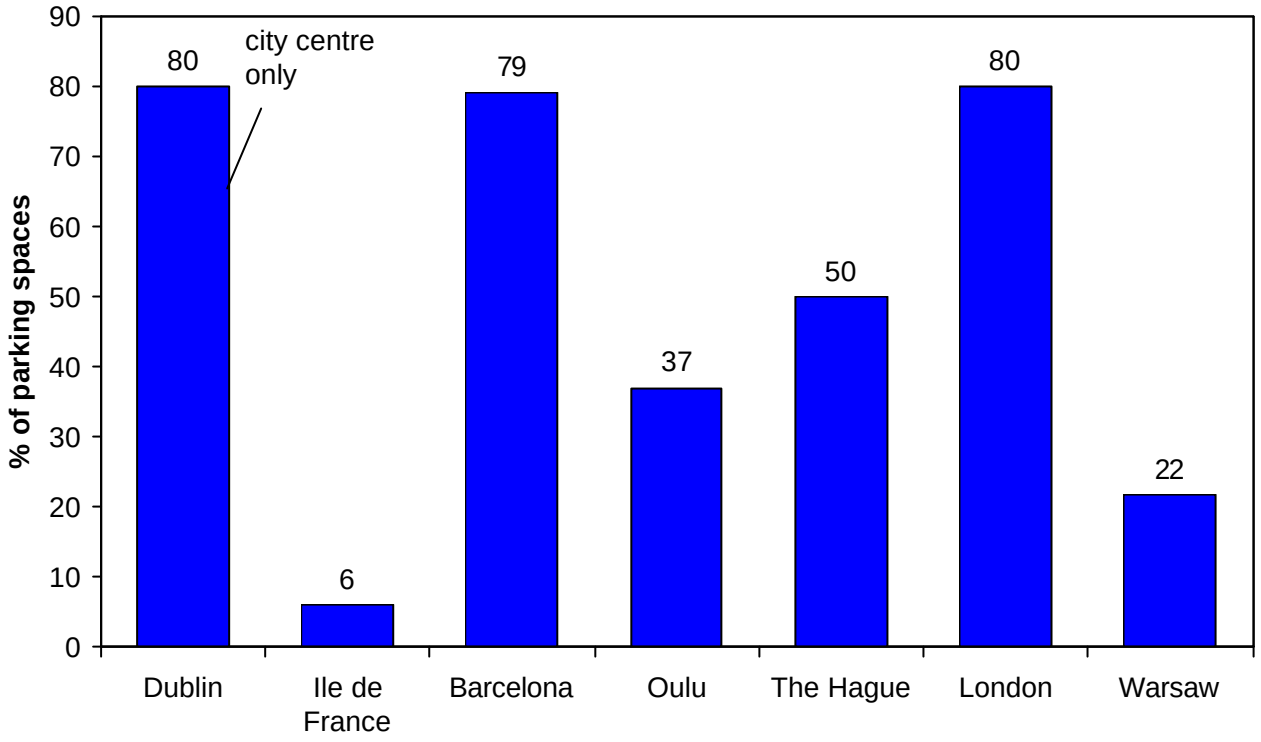


Figure 4.29 shows the percentage of parking spaces that are subject to parking charges. The figure shows that in London, Dublin and Barcelona 80% of spaces are charged (for which there are data).

Figure 4.29 Percentage of public parking spaces that are subject to parking charges



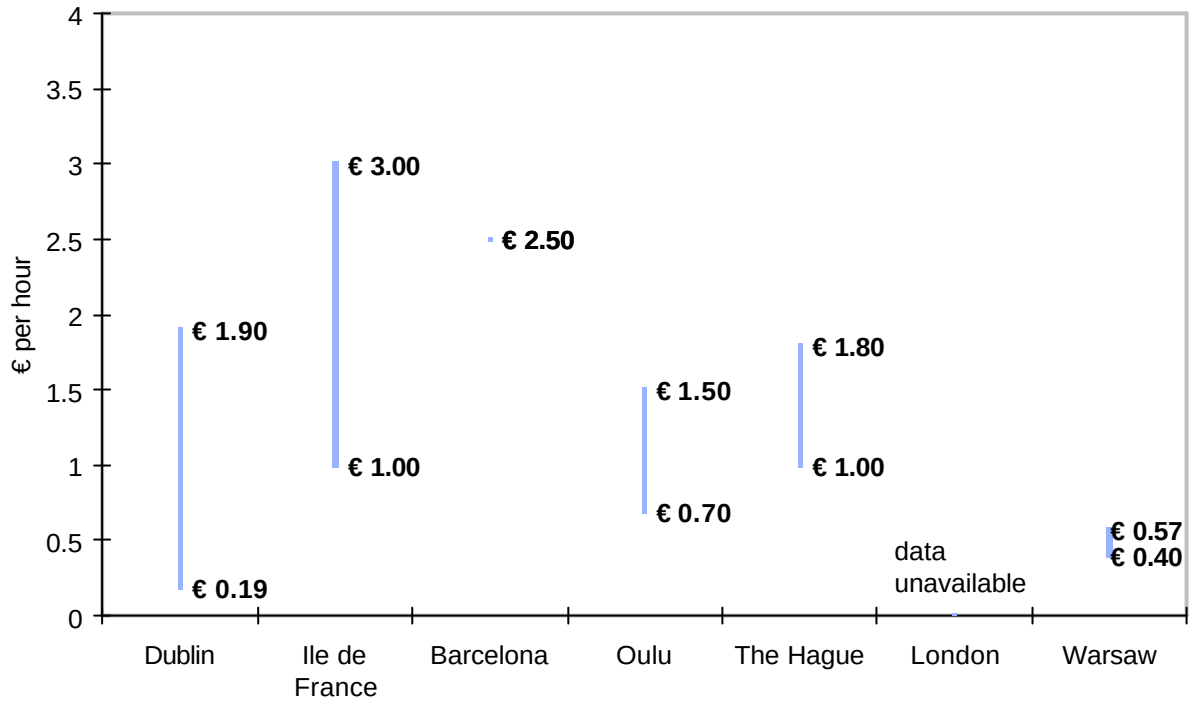
Notes:

- Figure for Dublin is approximate

Indicator 3.5 recorded the maximum and minimum on street parking charges per hour in each city. These are shown in Figure 4.30 where the upper tip of the vertical line is the maximum hourly parking charge and the lower tip is the minimum hourly charge. Figure 4.31 shows the charges for off street parking.

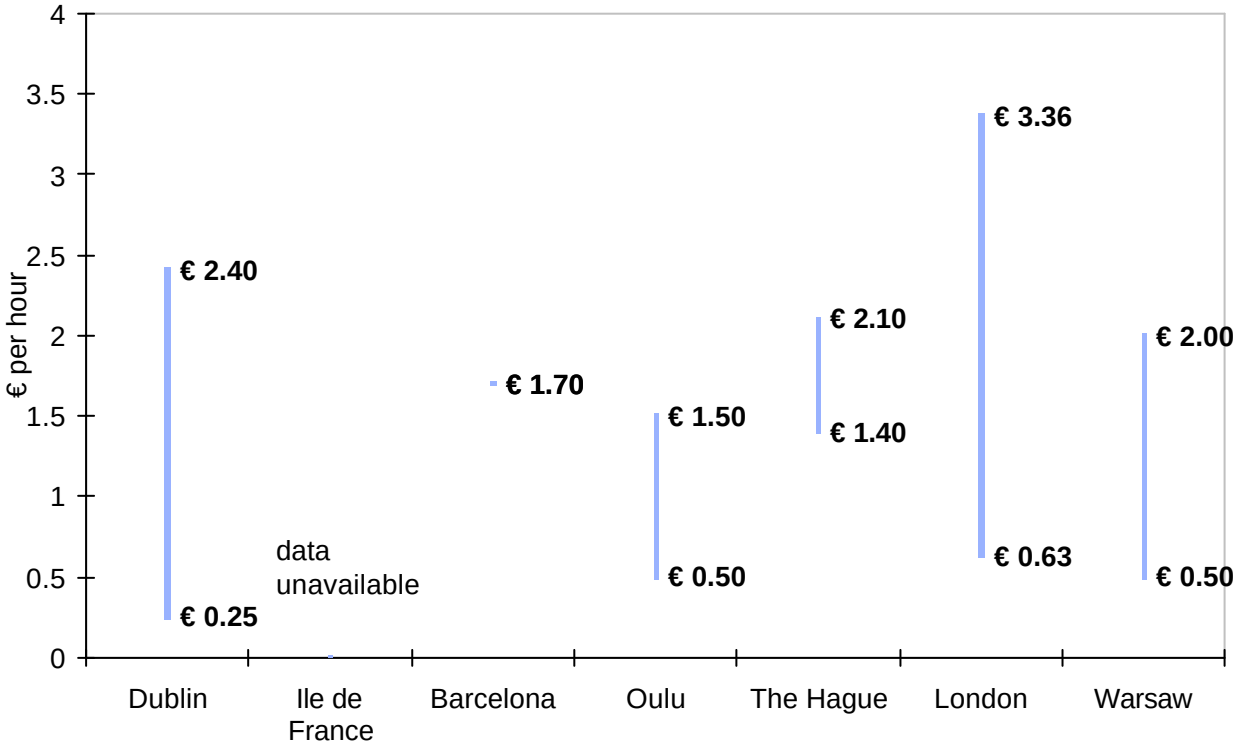
Maximum hourly on street parking charges are highest in Ile de France at €3, Warsaw has the lowest maximum at €0.57. The lowest minimum is in Dublin where hourly charges range from €0.19 to €1.90, Barcelona has the highest "minimum" as all charges are €2.50 per hour.

Figure 4.30 Maximum and minimum on street parking charges per hour



For off street parking in Figure 4.31, London has provided data and this shows a wide variation in hourly parking charges from €0.63 to €3.36, there is a similarly large difference between minimum and maximum charges in Dublin (€0.25 - €2.40) but in Barcelona, the charges are again the same.

Figure 4.31 Maximum and minimum off street parking charges per hour

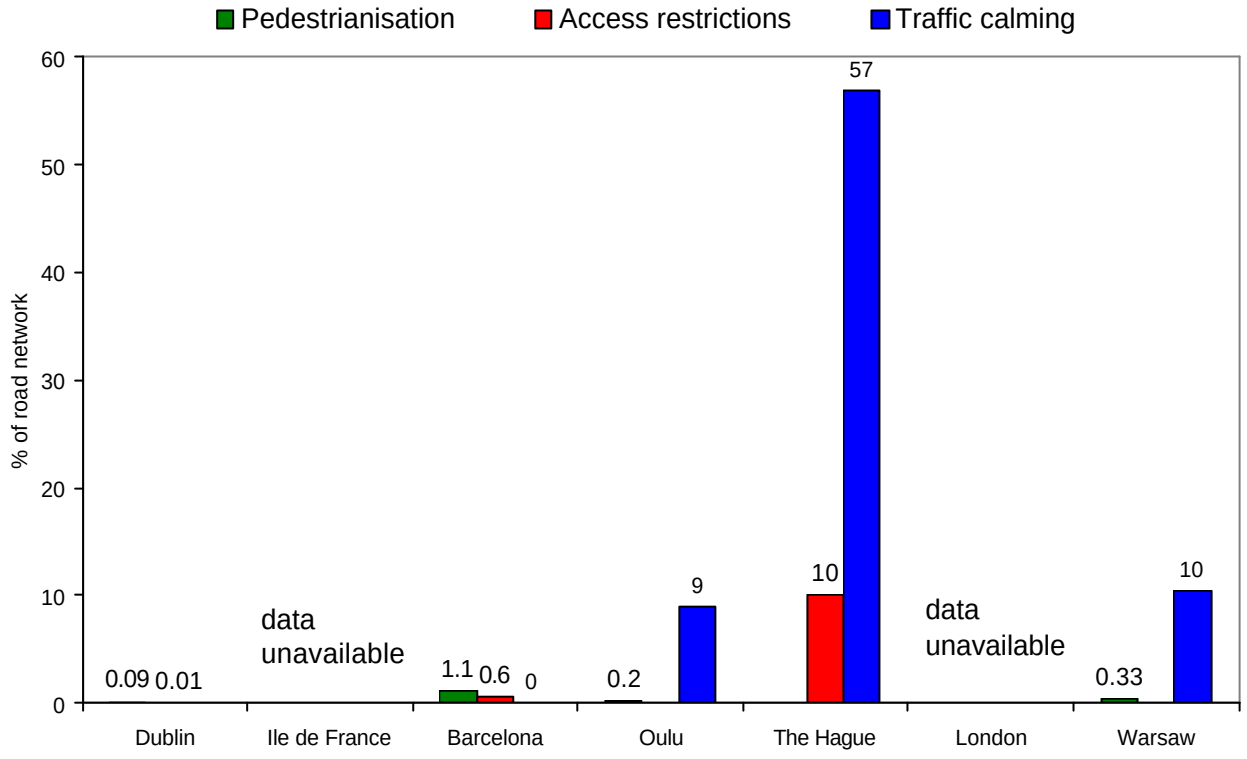


Notes;

- Figures for Warsaw are for private parking in the city centre

Figure 4.32 shows indicators 3.7 - 3.9 which refer to % of restricted road space. The Hague has the greatest level of restricted road space of the cities with 57% of roads having access restrictions and 10% of roads having traffic calming.

Figure 4.32 Percentage of restricted road space



4.3 Research Question 3 – Potential of demand management

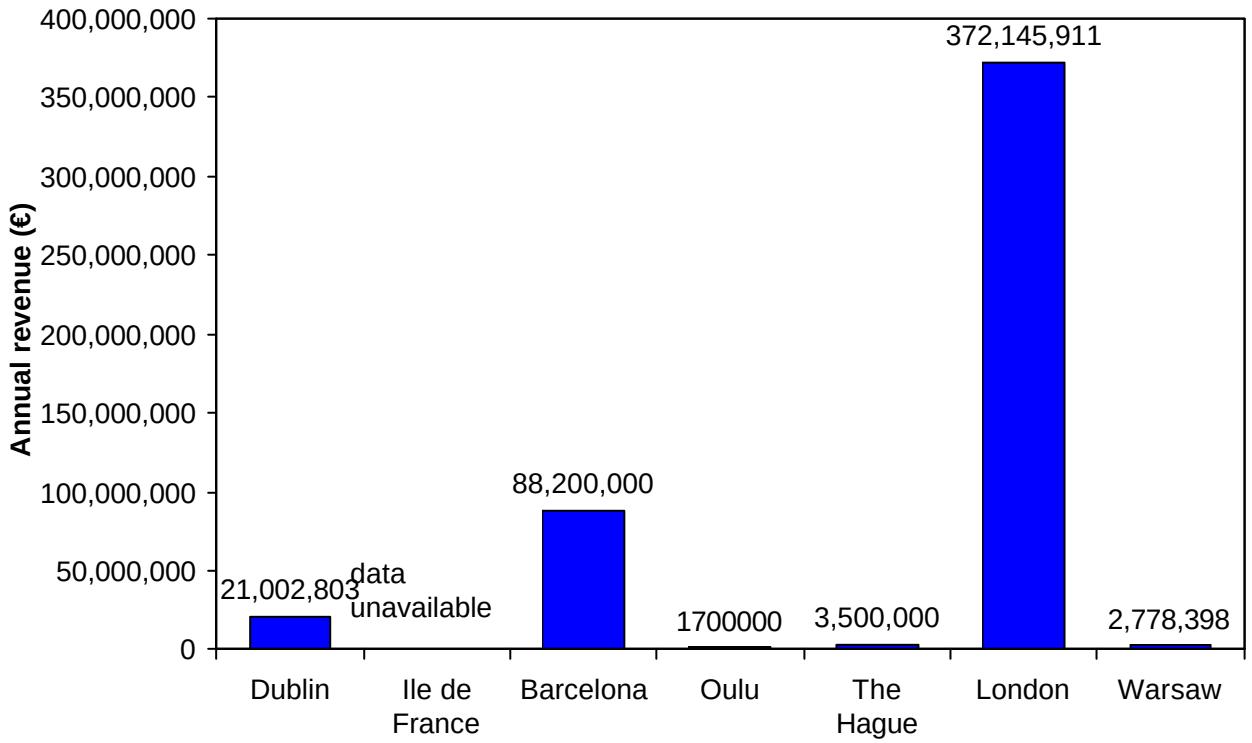
Table 4.7 shows the indicators collected for the potential of demand management research question.

Table 4.7 'Potential of demand management indicators'

5.1	Total yearly revenues from parking	The total amount (in €) of revenue income which is earned from parking charges (net revenue including VAT)
5.2	Implemented road pricing schemes	The percentage of the city's road network that is covered by road pricing schemes. Please also describe any existing/planned road charging schemes in the city
5.3	Level of charges for road pricing schemes	The charges (in € for each vehicle type) which exist for road pricing schemes in the city
5.4	Total yearly revenues from road pricing	The total yearly revenue (in €) generated by road pricing/access charging schemes in the city.

Indicator 5.1 related to parking revenues and the data are shown in Figure 4.33. London has the greatest revenue from parking charges at €372m, followed by Barcelona at €88m. Figures for the Ile de France were unavailable.

Figure 4.33 Parking revenues



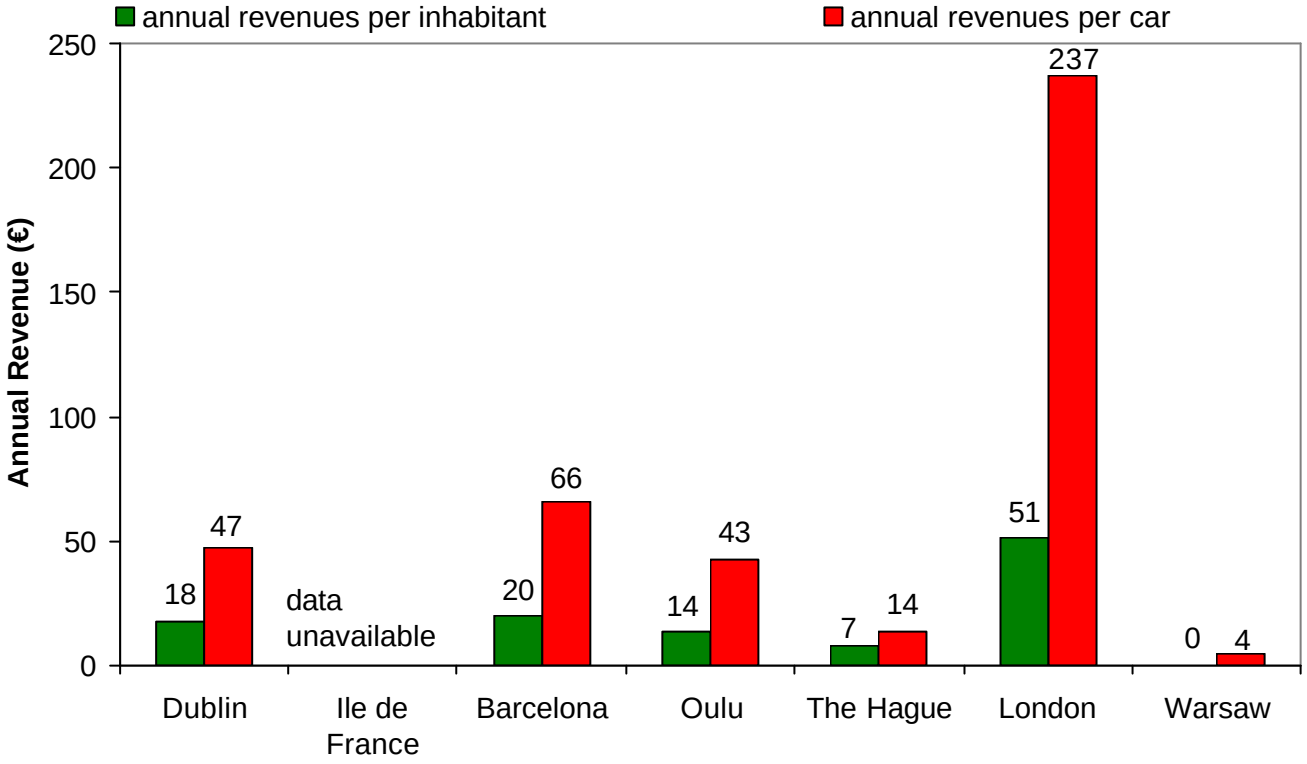
Notes;

- Dublin figure excludes revenues from city centre multi-storey car parks.

For better comparison between cities, parking revenues have been measured against population, number of cars and number of car parking spaces. These are shown in Figure 4.34 and 4.35. Again,

London has the greatest revenues per inhabitant (€51 per year) and per car registered (€237 per year).

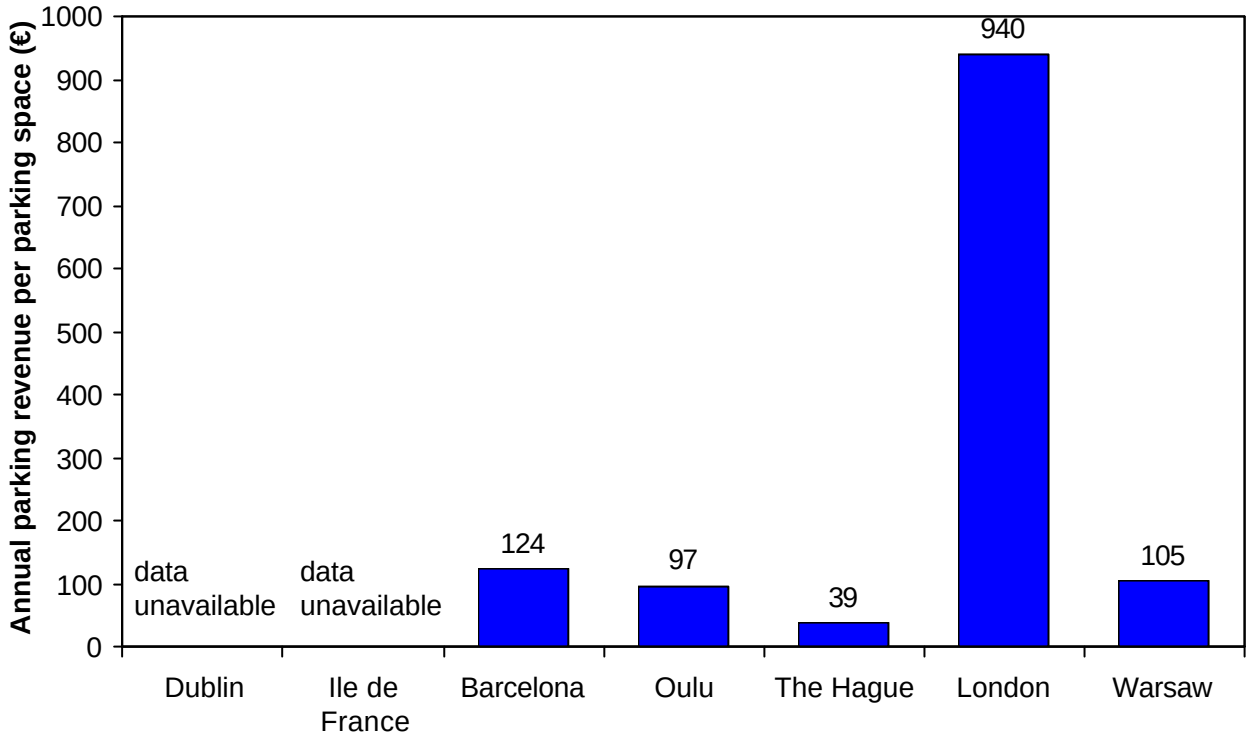
Figure 4.34 Parking revenues per inhabitant and per car



- Dublin figure excludes revenues from city centre multi-storey car parks.

Figure 4.35 shows that parking revenue per space per year is greatest in London where €940 is earned per parking space per year.

Figure 4.35 - Parking revenue per car parking space



Notes; Dublin data was not included in chart at request of working group member.

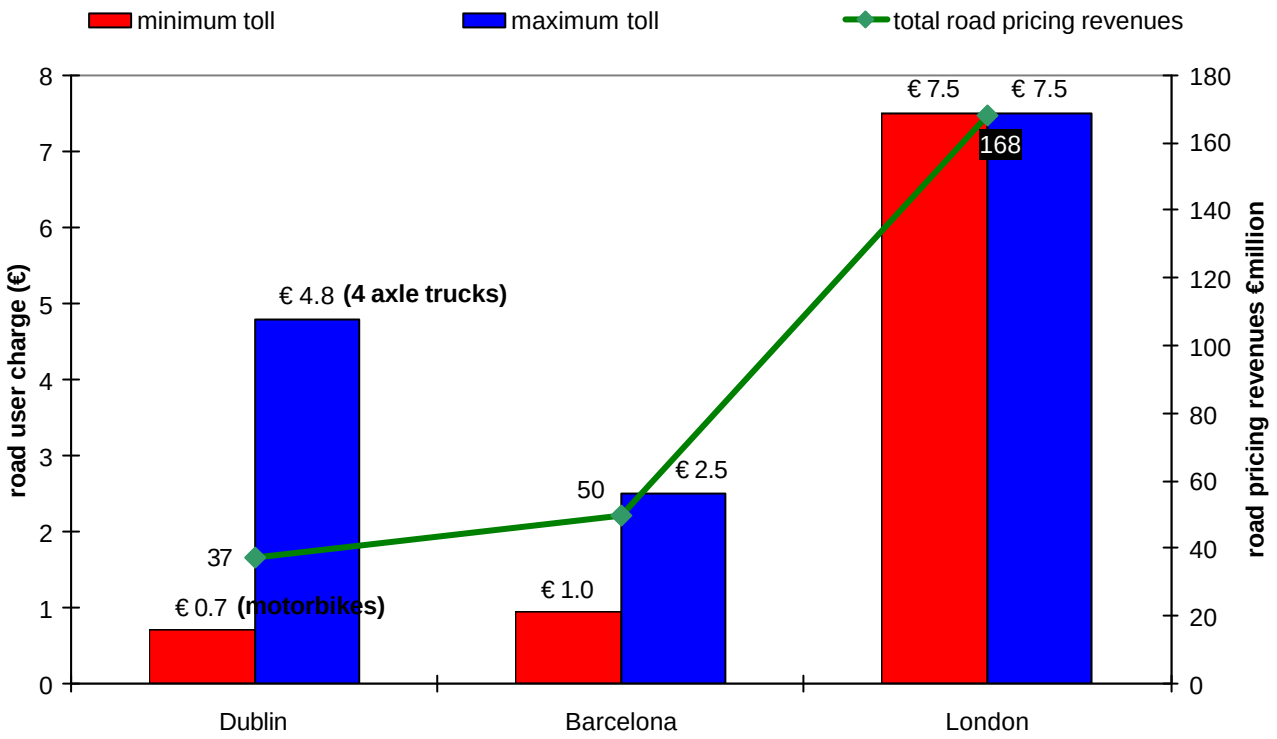
Table: 4.8: Parking revenue and number of spaces in each city

	Dublin (centre)	Ile de France	Barcelona	Oulu	The Hague	London	Warsaw (centre)
Annual revenue	21,002,803		88,200,000	1,700,000	3,500,000	372,145,911	2,778,398
Number parking spaces	31,674	266,000	709,259	17,500	90,000	396,000	26,430

Indicators 5.3 & 5.4 related to revenues and charges from road user charging. Only three of the cities; Dublin, Barcelona and London have some sort of road pricing scheme for which data could be provided. In Dublin, charges are made on 2 toll schemes on bridges over the river Liffey - one on M50 an orbital motorway to the west of the city, the second to the east of the city centre, also allowing for orbital trips. In Barcelona, charges are also made on high speed roads on the edge of the city. In London, there is a congestion charge scheme as described in the case study in Annex A5.2.

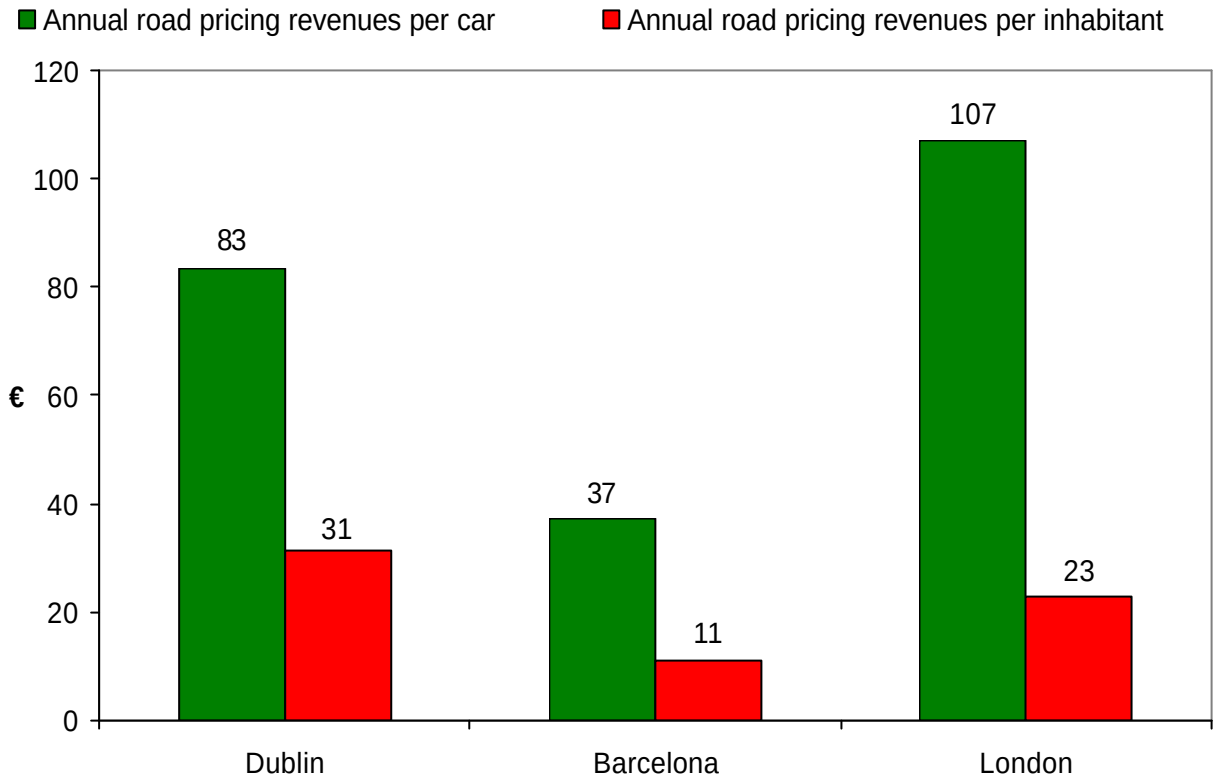
These charges bring annual revenues of €83 per car in Dublin, €37 per car in Barcelona and €107 per car in London. When measured against population, road pricing gives revenues of €31 per inhabitant in Dublin, €11 per inhabitant in Barcelona and €23 per inhabitant in London. See Figure 4.36 and 4.37.

Figure 4.36 Road user charging – revenues and charges



Road pricing revenues were also measured against number of inhabitants and number of cars, as shown in Figure 4.37.

Figure 4.37 Road pricing revenues per inhabitant and per car



5. CONCLUSIONS

5.1 Overview of findings

The demand management working group has developed a good working relationship over the first year of the project, with all participants benefiting from interesting site visits and stimulating discussion on demand management solutions to urban transport problems. The first year of data collection has provided some useful comparisons between the cities although there is still much work to do to refine data and undertake further analysis.

From the first year of benchmarking, some initial findings can be presented but it should be emphasised that these are preliminary findings in the benchmarking process. The data collected in year one will provide extremely useful base data on which to build in future. The data collection revealed variation in methods of collection, presentation and definitions of existing data obtained by the participants in the working group. This was particularly significant in the collection of data for different concentric zones in a city, a key issue in assessing demand for transport in a city.

As such, these conclusions are somewhat biased towards more qualitative findings, particularly from the experience of the site visits.

For cities to benchmark their demand management measures against others requires some definition of what makes a city successful in managing demand. In most cities, this may be seen as a reduction in the number of cars accessing the city and an increase in the number of people using sustainable modes of public transport and walking. However, there are variations in the characteristics of cities which make it difficult to provide concrete standards against which to benchmark. For example, the small city of Oulu is surrounded by a vast rural area and few people use public transport to access the city centre. However, the demand for accessing facilities on the edge of the town by private car has led the local authority to improve and increase car parking facilities in the town centre. This would seemingly contradict most policies of demand management in European urban centre but may be a vital step in revitalising and re-centralising shops and services in the town and may indeed lead to demand for travel by other modes to the city centre.

In larger cities too, demand management is more complex than seeking to transfer journeys from private car to public transport modes. In London, the underground and rail networks operate close to capacity at peak times so Transport for London has invested in new buses and bus infrastructure to transfer demand towards bus travel. A high tech bus control centre uses digital camera technology to ensure that any incidents are dealt with quickly to ensure that buses keep moving through the city. There have also been increases in the level of cycling in London following the introduction of the congestion charge, showing that a reduction in the number of cars in the city centre and policies which deter car use can lead to positive modal shift without any negative impact on the vitality of the central area.

In Barcelona, the group saw a new tram system which had been implemented without any integration with private modes (park and ride) but as an urban public transport system designed to be easy to access by walking. One key advantage of the tramway is that it is at street level and easier to access for "short hop" journeys than the metro system where escalators and underground walkways must be used. Barcelona also provided an interesting example of how restriction of road

space can revitalise shopping and tourist areas and can be a popular measure once initial opposition is overcome. Similarly, the London congestion charge also gave the group a good example of how political determination in the face of widespread scepticism and opposition can help to change attitudes towards transport and influence behavioural change.

The example of Oulu also challenged traditional logic regarding reasons to travel by bicycle in a city. High levels of cycling are usually associated with a high density city and a temperate climate, but in Oulu the city is fairly low density and the climate is especially harsh during the winter. Yet the city boasts the highest modal share for cycling amongst the working group participants thanks to an investment in cycle routes and storage facilities and the development of a cycle-friendly culture. The sharing of space between cyclists and pedestrians in the centre of Oulu and the respect shown to each other by these road users is in contrast to many cities where conflict between different types of road users occurs. Moreover, Oulu demonstrated the potential for people to cycle for short distance urban trips if cycling is taken seriously by planners as a feasible mode of transport.

The demand management group is composed of cities of varying size, population and geographical characteristics, including large cities (London and Paris), medium sized cities (Warsaw, Dublin, Barcelona) and smaller cities (The Hague and Oulu). The group found that physical geography and climate can have a significant impact on the demand for transport and land use in a city, particularly in Oulu where the city is designed with wider streets to accommodate snow removed from road, but also in Barcelona where the mountains constrain the expansion of the city and London where the river forms a barrier between north and south.

The most interesting results obtained from year one of the benchmarking initiative are as follows;

- Density of jobs in the metropolitan area is greatest in The Hague at 3,106 jobs per km^2 and least dense in Warsaw where there are 278 jobs per km^2.
- Five of the seven working group cities have parking policies linked to development, most of which seek to limit the number of parking at new developments.
- Five of the seven working group cities have parking policies linked to public transport policies, all of which demand that new development is well served by public transport.
- The cities with the lowest population density, Oulu and Warsaw, have the longest trip lengths for car journeys but Oulu also boasts the longest trip length for bicycle journeys.
- In Dublin and Ile de France, car trips are shorter (5.2km and 2.9km respectively), demonstrating a potential to substitute these trips by cycling and walking.
- Average lengths of train journeys in London (28.3km) and Barcelona (21.9km) are noticeably higher than in other cities. The high density of The Hague is reflected by the relative short length of average bus (2.1km) and train (3.5km) journeys.
- In Barcelona, 5.6% of the road network is covered by bus lanes, 2.3% in Dublin. In Dublin, only 19.4% of the road network is covered by bus routes, compared to 53.1% in Barcelona. Barcelona also has the greatest density of bus stops per km of route (10.3) whereas the other cities have between 0.8-2.9 stops per km of bus routes. The Ile de France has the densest metro network at 1.7 stops per km of track followed by Barcelona at 1.2 stops per km of track. London and Dublin have the densest rail networks at 0.6 stops per km of track.
- Taking the total number of public transport stops including all modes, The Hague has the greatest density of stops per km^2 at 6.9 followed by London at 5.9. The other cities have between 0.9 – 2.6 stops per km^2.

- Data on parking spaces proved difficult to collect. From the data available, Barcelona has the greatest number of parking spaces per 1000 inhabitants at 240, followed by The Hague at 191 spaces per 1000 inhabitants. Ile de France has a high number of park and ride spaces (106,935) whereas other cities have relatively few.
- Authorities in London proved to be the most stringent at issuing parking fines with 3.14 fines issued per car registered. Barcelona and Oulu issue 1.14 fines and 0.96 fines per car respectively. When measured against population, Barcelona issues 1004 fines per 1000 population, compared to 675 in London.
- Warsaw issues more fines per parking space (13.6) than any other city but this may reflect differences in the quality of the data collected as cities had difficulties recording exact numbers of parking spaces.
- The average normal urban speed limit of the 7 cities is 49.4 km per hour with Oulu notably lower at 40km / hr and Warsaw notably higher at 60km / hour. 35% of roads in Warsaw have limits under 60km / hour, 9% of roads in Oulu have limits over 40km / hour, in The Hague there are more zones where the speed limit is lower than the norm of 50km / hour (57%).
- London has the greatest number of speed cameras at 400, followed by Barcelona with 99.
- In London, Dublin and Barcelona 80% of parking spaces are subject to parking charges.
- Maximum hourly on street parking charges are highest in Ile de France at €3, Warsaw has the lowest maximum at €0.57. The lowest minimum is in Dublin where hourly charges range from €0.19 to €1.90, Barcelona has the highest "minimum" as all charges are €2.50 per hour.
- In London, hourly parking charges vary most - from €0.63 to €3.36 and there is a similarly large difference between minimum and maximum charges in Dublin (€0.25 - €2.40) but in Barcelona, the charges are constant at €1.70.
- London has the highest annual parking revenues per inhabitant (€51 per year) and per car registered (€237 per year) with revenue of €940 per parking space.
- Only three of the cities; Dublin, Barcelona and London have some sort of road pricing scheme for which data could be provided. In Dublin, tolls for road bridges vary from €0.7 for a car to €4.90 for trucks and similarly in Barcelona, for an outer ring road, charges vary from €1 – €2.5 depending on vehicle size. In London, there is a flat charge of €7.50 (£5) to enter the congestion charging zone in the city centre. These charges bring annual revenues of €83 per car in Dublin, €37 per car in Barcelona and €107 per car in London. When measured against population, road pricing gives revenues of €31 per inhabitant in Dublin, €11 per inhabitant in Barcelona and €23 per inhabitant in London.

5.2 Recommendations for developing the working group themes

The working group has made good progress in obtaining data relating to demand management and this report presents some interesting initial results and comparisons between the cities. In the second year, the group will refine some of the data provided and more emphasis will be placed on certain indicators which the group sees as being valuable. In discussions at the site visits during the project, it became apparent that parking data was often difficult to obtain but also seen as being vital when planning transport in a city. The parking data presented in this report provides a useful introduction to the topic but there is a lack of comparable data in many cases, particularly with regard to the many different types of parking infrastructure and pricing regimes present in the cities. This theme may be developed in year two of the project.

The completion of indicator 3.1, which aimed to provide the different types of parking spaces present in each city, should be a priority for the second year of benchmarking.

Restricting road space and re-allocation of road space from private cars to more sustainable modes also proved to be interesting topics to the group, following on from the innovative practices observed in Barcelona and London. Data on the level of restricted road space and the potential to transfer road space to other modes may be a theme to follow in year two.

It should be noted that the group members will decide the future direction of the working group and will be consulted on their preferences for data collection and site visits at the launch conference for year two of the Urban Transport Benchmarking Initiative.

5.3 Next steps and future intentions for the working group

The working group members expressed an interest in retaining the composition of the group in year two and a representative of Brussels local authority has already expressed an interest in joining the group. The re-launch conference / workshop will provide a platform for group members to express their ideas for the orientation of the group. There was considerable interest in visiting the cities of the working group members who have not yet staged a site visit (The Hague, Dublin, Warsaw and Ile de France). Also, the group may be keen to visit another city in Europe which is not in the group.