The Impact of the Jubilee Line Extension of the London Underground Rail Network on Land Values

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Abstract

Using U.K. Government published property value data, an analysis of the impact of a major extension to London's subway network during the late 1990s was undertaken to establish whether value uplift attributable to new transport infrastructure could finance such projects.

Different approaches were used for commercial and residential land. Data deficiencies were a major problem and it was not possible to combine the results. Commercial land value uplift could not be quantified. For residential land the total figure (£9 billion) for the Jubilee Line Extension (JLE) was based on calculations for five stations. This could be several billion pounds higher or lower. The JLE actually cost £3.5 billion.

Although a method of spatially analyzing commercial ratable values was developed, data deficiencies prevented modeling a true 'landvaluescape'. It was concluded that this did not significantly affect the accuracy of results.

The matter of how individual land value increments could be fairly assessed and collected was not pursued but some recommendations were made as to how U.K. property data systems might be improved to support such fiscal instruments.

About the Authors

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He is currently a part-time doctoral researcher at Kingston University, lecturing and writing for various journals about his work studying the practical and political aspects of 'landvaluescape' mapping with special relevance to the U.K.

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HGF continued to provide administrative support to the project after Vickers left their employment, for which Gordon Brennan and Paul Brandon are to be thanked. DDS Ltd's generous financial support and advice on the property market in Southwark enabled the project to commence. Several estate agents and property owners gave considerable assistance free of charge while data sources were being investigated and Transport for London (TfL) were also supportive in many ways, especially Dave Wetzel, Chris Hyde and Neil Georgson.

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Introduction and Political Background

The issue of transport infrastructure funding has steadily risen up the political agenda in recent years, at least in the United Kingdom (U.K.). Public expenditure on urban infrastructure, including roads and railways but also hospitals, schools and other free goods that citizens expect their governments to provide at least partly from tax revenue, had shrunk by the late 1990s in real terms to one-twentieth of what it was in the mid-1970s when a Labour Government was last in power. This was largely because the Conservatives, who governed the U.K. from 1979 to 1997, privatized much of what had been publicly owned.

One of the last privatizations had been of the railways, in 1996 creating Railtrack plc to own and manage the fixed assets and several operating companies to run the trains. Railtrack's financial difficulties in raising private funds for the necessary investment led it into receivership in late 2001 and within a year it had metamorphosed into a non-profit corporation dependent again upon public finance, called Network Rail. The Railtrack episode focused public attention on the value of land transferred to private sector ownership, some would say at bargain basement prices, and its inability to securitize what seemed to many to be an extremely valuable asset: its land holding.

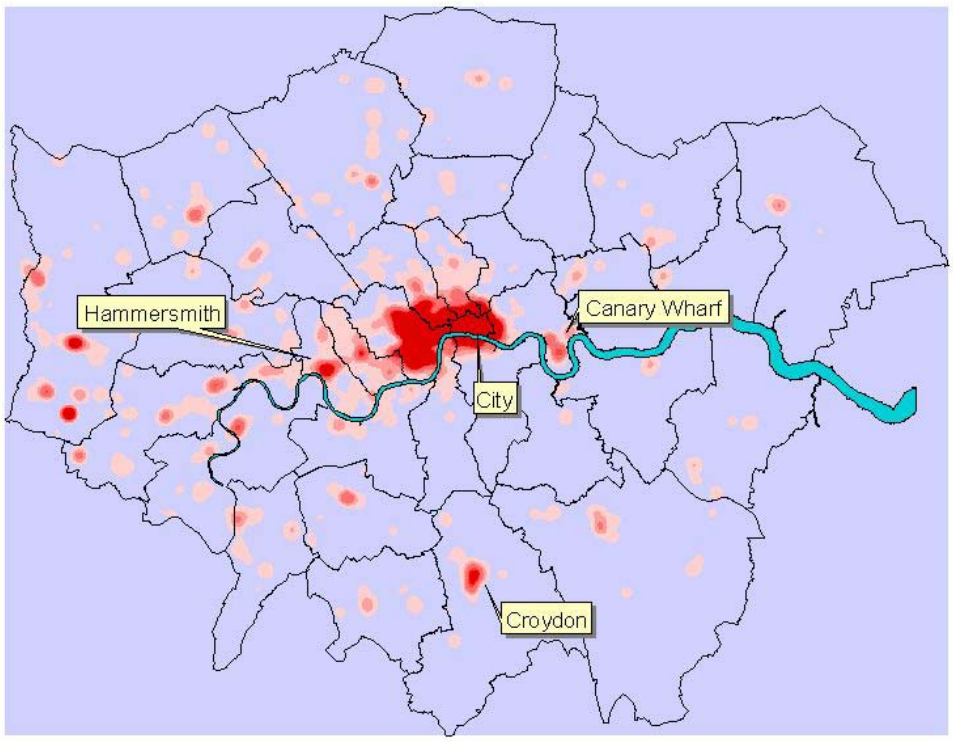
Earlier privatizations of public utilities often involved significant amounts of land, such as in water catchment areas. However the value of such land was usually a relatively small part of the financial assets transferred, involved a proportionately high cost of ownership and created little added value for adjoining owners. Railways, as with other transport networks, create economic opportunities for the entire community, which is reflected in the enhanced value of land adjacent to the highly visible and well-used points of access to their networks that became privately owned. Railtrack and now Network Rail have no way of tapping into the enhanced value of land that is influenced by their stations but not under their control.

Despite the apparent economic advantage of road transport over rail, if operating costs alone are considered, other political factors are conspiring to make Governments wary of building the massive numbers of main roads that congestion and demand would suggest are needed. Close to metropolitan areas, the loss of land to roads becomes very expensive in political as well as capital terms, making rail investment more attractive as concern about sustainable development and global warming increases. Since about 1996 there has been all-party consensus and popular support for greater investment in railways as part of an integrated urban transport system. However that investment has become more visible as a proportion of total government capital expenditure. Moreover the under-investment of the previous quarter century has left present Government and successor private agencies with a backlog, which means that merely maintaining and modernizing existing infrastructure consumes more of the total capital budget.

Hence the perceived need to look at other sources of funding for entirely new pieces of the rail network, such as the linking of London's West End to new commercial centres east of the City. Earlier links between the regenerating London Docklands, The City and

parts of East London looked to contributions from major property owners with moderate success but without any statutory framework and with no specific thought of a new funding mechanism such as land value taxation (LVT). The success of the Docklands Light Railway (DLR) in this respect so impressed the Danish authorities that they resolved in 1996 to fund the first metro in Copenhagen by assigning all the LVT in the area served to the company created to build and manage the railway and associated regeneration infrastructure. This in turn helped spur Transport for London (TfL), on its formation in 1998, to press U.K. Government into looking at the effect of the latest piece of London's rail network, the Jubilee Line Extension (JLE), on travel habits and property values in the city (see figure 1).

Figure 1: Locations of 1995 Office Rateable Values, London (from Geofutures, 2002)



Just as this JLE Impact Study (JLEIS) team, co-ordinated by Westminster University, was presenting a series of 'baseline' reports on how areas now served by the JLE had been before it was built, a book was published by someone personally aware of how property values in one such area had boomed. *Taken for a Ride* by Don Riley, caused a stir in mid-2001 for two reasons: firstly, it was written not by a rebel-rousing anti-establishment figure but by a property owner who had benefited from the boom; secondly because it pointed to the huge and unearned nature of the boom for those who happened to own property near the JLE stations and specifically recommended tapping into land values to fund similar projects (Riley, 2001). It seemed to almost every commentator that the answer to an apparently intractable and critically important problem had been found.

Until then, the received wisdom in Whitehall and the City, unaltered by change of Government from Conservative to supposedly leftist New Labour, was that if the private sector could not own and run public services then it should be involved closely in financing them. The Private Finance Initiative (PFI) and Public Private Partnership (PPP) are instruments for transferring risk – and reward – related to undertaking public sector projects, taking both the up-front capital expenditure and downstream rental income out of public accounting. In return for carrying risk, private financiers receive assets (land, buildings, signalling and control systems) on long leases, for the use of which they charge the public, through government agencies such as TfL. Those agencies continue to be held responsible for running the services and have to load the fares and other charges with the cost of servicing loans by their private partners that are invariably more expensive than loans that those public agencies could have negotiated directly.

What was now revealed, by Riley (2001) and - through his book - by economists such as Vickrey (1977), was that the security for loans to pay for creating and maintaining public infrastructure was the increment in land values and property rents that would be created by that infrastructure. Neglect or abandon a railway and any land value it has created disappears; create a new one and watch land values around stations grow, in proportion to the growth in footfall and accessibility to shops, smart homes and shiny offices that will assuredly appear as passenger numbers increase.

Riley himself, although basing his calculations on direct market evidence available to him through his business, realised that a more methodical approach to calculating the land value effect of the JLE was called for. A member of a U.K. national charity which promotes the study of land economics, the Henry George Foundation of Great Britain (HGF), he offered to contribute towards the cost of a study by HGF that would validate his claim that the land value uplift attributable to the JLE was far greater than the cost of the investment.

The Chief Executive of HGF, Tony Vickers, was already a David C. Lincoln Fellow in LVT, undertaking a study of how to introduce LVT to Britain (Vickers 2000, 2002 and 2003a). A member of his Fellowship study team, Mark Thurstain-Goodwin, was a postgraduate researcher at the Centre for Advanced Spatial Analysis (CASA) at University College London (UCL) and had worked with property value data of Lucas County Ohio to show how it could be used to create what Vickers called a ‘landvaluescape’ model of changes over space and time in the economic landscape of cities. The computer graphics derived from the landvaluescape of Toledo, main city of Lucas County, had illustrated to Vickers and participants in a survey of property tax stakeholders in Liverpool (Beardsley & de Wolf 2001) that such data was extremely revealing. Part of the aim of the study which Vickers and Thurstain-Goodwin conceived in relation to the JLE, as they wrote in a paper for the World Congress of Surveyors in Washington DC April 2002 (Thurstain-Goodwin & Vickers, 2002), was to see whether U.K. data could be manipulated within a landvaluescape model and reveal the land value uplift effect graphically.

Until now very little research has been published using spatial analysis or any other methodology on the subject of transport projects and their land value effects. What

studies there are follow a wide variety of methods and produce a wide range of conclusions, as a recent comprehensive research of the literature commissioned by TfL and the U.K. Government Office of the Deputy Prime Minister (ODPM), responsible for regional and urban policy in England and Wales shows (RICS, 2002). Few such studies have been done in the U.K. Most are from North America where there is comprehensive property data coverage in cities. British property researchers have almost no experience in this type of work, other than on a narrowly defined development project basis.

To undertake the data gathering, quality assessment and most of the analysis, a third member of this project team was recruited. Stephen Mitchell, an economist and educator, was able to assign two days a week for the two years that it was estimated this study would take. Mitchell already had a firm grounding in the ideas of Henry George regarding the role of the economic rent of land and natural resources in human society: classical, as opposed to neo-liberal, political economics. His links with the London branch of the School of Economic Science (SES) meant that the findings of this research would be used to educate a growing and influential body of SES' freethinking adults concerned with the issue of sustainable urban development.

Vickers and Mitchell have, since this study commenced, both enrolled as part-time postgraduate researchers at Kingston University (London): Vickers left the employ of HGF in 2002 and is developing his landvaluescape concept in a doctoral thesis due to be published in 2006; Mitchell is exploring the deficiencies of neo-liberal economic models in relation to property markets, at masters level. Thurstain-Goodwin has set up his own company, Geofutures Ltd, to work on a wide range of spatial analysis projects.

During the course of this work, the debate on funding transport in the U.K. has continued ever louder and focused on London and its travel-to-work hinterland of southeastern England. There are several inter-linking strands to this debate:

- The Mayor of London has conceived, planned and implemented within 18 months a radical new scheme of Congestion Charging, which is in effect a form of LVT covering central London. The 'Big C' came into effect in February 2003 and covers the area between most London rail terminals and was an immediate success, measured by the drop in privately operated road traffic levels within the **C** (over 20% during the hours it operates) and the increased use and speed of buses and cycles. The area is very likely to expand quite soon to take in remaining rail terminals to the west.
- London has been chosen by the U.K. Government in its bid to host the 2012 Olympics. Sites east of the city are being studied and it is acknowledged that an assurance must be given (and accepted as credible by the Olympic Committee) that transport links to and between these sites will be improved if London is to win the Games vote, in under two years.
- The Eurostar rail link to mainland Europe is near completion, giving rise to questions about how it will impact upon parts of London where new stations will provide direct access to vast new areas.

- ODPM has committed to the area either side of the Thames Estuary east of London, known as Thames Gateway, being one of the three largest growth areas in England in terms of new housing and jobs. It is acknowledged that the greatest threat to achieving this growth is the cost of new urban infrastructure, including new crossings of the lower Thames. Both the other major new growth areas are also to be within one hour's travel (by car or train) of Central London, thus heavily increasing the potential demand for rail and road movement.
- ODPM and TfL are fully committed to CrossRail, a company that they jointly own and which has been created to build and operate new rail links (over- and under-ground) between major growth nodes mainly east and west of London. However there is a huge gap between the funds so far allocated for CrossRail and what will be required.
- Legislation to enable Business Improvement Districts (BIDs) will by end 2003 complete its passage through U.K. Parliament. BIDs will be able to sponsor new transport projects and raise funds from within their business communities by a levy on some or all of the existing payers of the National Non-Domestic Rate (NNDR). However the debate about BIDs legislation has exposed the fact that NNDR exempts property owners and property that is without occupiers, which is quite different to BIDs in North America.
- A report for the U.K. Treasury on economic measures needed to smooth entry into the Euro zone has suggested that a tax on land values might be the best way of dampening house prices as the lower European mortgage interest rates influence U.K. markets (Muellbauer, 2003). In London, land comprises about half the value of most homes.

ODPM commissioned research in 2002 specifically to look at ways of funding new rail projects in Greater London. The report by RICS Policy Unit acknowledges that most potential sources of funds involve tapping into property values in some form or other. Several forms of property tax were considered by the author (Whelan 2003), including BIDs and LVT itself. The total bill for 64 identified new major transport projects in London, most of them involving rail, is estimated at between £53 billion and £76 billion, with a funding gap of approximately £35 billion. Seventeen 'innovative' funding mechanisms were also identified that could be used to help generate funding for these projects, nine of which involve property or land values.[1] Whelan's report did not include studies of the specific land-value effects associated with the various projects but merely 'expert estimates' by property professionals.

Four out of five leading candidates to be the first Mayor of London in 2000, under the newly devolved regional system of government in the U.K. capital, have since expressed qualified support for the use of land values to finance the Greater London Authority (GLA). As the second set of elections approaches in May 2004, it seems certain that this will be one of the most pressing subjects for debate. Transport is one of the most crucial services that GLA has to deliver. The GLA does not yet have tax-raising powers other than road pricing (such as **C**), workplace parking charges and a levy on the hybrid property/poll tax Council Tax. If it can be shown that land values are intimately

associated with transport investment then whoever wins the 2004 elections will want to be able to develop mechanisms for using land value to fund transport.

This is the political context in which the present study has been undertaken. It is not the only such study. That which ODPM and TfL commissioned, through Westminster University, using commercial property company Chestertons, proved to have followed an unsatisfactory methodology which gave no clear answers to the 'land value effect' question on the JLE and has never been published. TfL has itself commissioned a separate study, in which it changed the terms of reference to ensure that land values were separated from building values and a wider variety of data sources and analytical methods were considered. This research by Jones Lang Lasalle (JLL) is due to report by December 2003, in time to feed into work on devising funding mechanisms for CrossRail and other major TfL projects. It has involved a far larger budget and more specialist property expertise and data than was available to the present authors. Quite deliberately, in order to produce independent findings, the two research teams have not been collaborating.

A broader ranging study for RICS Policy Unit and ODPM, being undertaken by ATIS REAL Weatheralls, UCL and Symonds, aims to develop a methodology for appraising the expected and actual impacts of transport projects on property values (RICS, 2002). The first stage literature review and is being followed by a pilot case study of the Croydon Tramlink in South London. A final report is not expected until the latter part of the current decade.

This paper has also had a far narrower brief than those by Chestertons, RICS and JLL. The aim of the study is merely to prove that a sufficient source of revenue, attributable to a specific transport investment project, has been created. Other studies mentioned are required to develop a methodology that can be repeated and improved upon in order to serve as the basis for developing specific funding mechanisms that tap into land values for any transport project in London and possibly elsewhere in Britain.

Conduct of Study

Investigation of Data Sources

At a one-day conference in Liverpool in February 2002, to launch Vickers' second David C. Lincoln Fellowship Working Paper (Vickers 2002), speakers from Pennsylvania were able to detail the relative ease with which property data can be acquired in North America. The uses to which such data can be put and the means by which they are produced and modelled in geographic information systems (GIS) in some advanced local jurisdictions are set out by staff of Lucas County Ohio in Ward *et al* (2002) and were described by the County's Chief Assessor at a seminar in London on 1 July 2003 (German, 2003).

The process of splitting the land component of property values from the building component, which underpins LVT in those countries that use it (such as most of the U.S., even where LVT is not used) is almost unknown in the U.K. Because of this absence of

publicly available official land value assessments, the research team encountered many obstacles or 'blind alleys' in the search for data sources to enable their aim to be achieved.

This section describes the various sources of property data that were explored and the problems associated with each. It assumes no knowledge of the U.K. legal, technical and property/land market situation and draws comparisons with the U.S., where this report is published.

The project proposal (Section E.2) set out a number of methods and data sources that it was originally intended to use. In summary, these were:

- Valuation Office Agency (VOA) Uniform Business Rate (UBR) valuations on non-domestic property;
- VOA Council Tax (CT) 'bandings' for domestic property;
- Privately held property data obtained from major landowners such as TfL, GLA, London Boroughs, developers and non-profit housing landlords;
- Her Majesty's Land Registry (HMLR) registered sale price lists;
- Estate agents and newspapers, for advertised sale prices and commercial rents.

These and other potential sources of data that arose were considered during the study and are now described.

VOA / UBR Rating Lists

The VOA is an executive agency of the Inland Revenue and comes under Treasury control. The main task of VOA is to maintain valuation lists for UBR (also known as the National Non-Domestic Rate or NNDR) and CT. The NNDR is a much more complex system than CT and relies on a continuous stream of information about market rents in all commercial property sectors, most of this being acquired under conditions of confidentiality. Few researchers are given access to the raw data used by VOA to compile its NNDR lists, even if public sector clients sponsor them.

Having established at the outset that VOA would not allow access to their raw data, several weeks were spent negotiating to obtain the lists themselves, direct from VOA, for parts of London needed by the research team. It was agreed that data from the official lists could be supplied direct 'at cost' but when the quoted cost for selected data was compared with costs from existing value-added resellers (VARs) of rating lists, it was found that obtaining official lists from these non-official sources was cheaper than obtaining them from VOA. In addition, VARs such as FOCUS, the marketing arm of Property Intelligence plc, are used to supporting relatively inexpert clients, whereas VOA cannot support customers at all.

FOCUS sold the team two CD-ROMs of NNDR/UBR lists, each containing data for the whole of England and Wales. These Lists are completely revised every five years: 1990,

1995, 2000 etc. However the valuation 'antecedent dates' for a List are April 1st 1988, 1993, 1998 etc – some time ahead of the 'currency' of the List, which is compiled over a considerable period prior to each antecedent date and then adjusted to it. Lists are then maintained in between five-yearly Revaluations, to take account of new developments on the ground and the results of appeals and consequent local reassessments, all of which are referred back to the previous antecedent date.

For the purpose of this study, the two 'before and after snapshots' taken were the 1995 List updated to August 2000 (before) and 2000 List also updated to August 2000. FOCUS do not archive VOA data. VOA was making its updated Lists available to firms like FOCUS three times a year, hence August: it plans to reduce the gap between published updates to two weeks by 2006.

In lay terms, what the research team had for NNDR was a 'before' List containing assessed rating valuations of all commercial property subject to property tax at April 1995 values (including additions and alterations found up to August 2000) and an 'after' list of all such property values (for tax purposes only) as at August 2000 but at notional April 2000 values. It was therefore possible to compare the rateable values of properties that appeared in both lists. This was done and Geofutures (2002) reported the results in the team's interim report.

The main problem with the NNDR Lists is that only property that is occupied appears in them. Commercial property that is vacant and vacant sites that are without current commercial uses do not generally feature in the lists. A further problem is that whenever a property undergoes change of use (e.g. industrial to retail), internal sub-division or amalgamation, change of address or in any way changes in its description in the List, it becomes almost impossible to compare with previous Lists. Since the most significant changes in valuation are likely to accompany changes in use, etc., any analysis of the aggregate effect of one or more events (such as the construction of the JLE) is likely to result in an under-estimate.

Strictly speaking, NNDR Lists are not collections of property values in the sense that North American property tax lists are. They feature 'hereditaments' as records and these are 'rateable entities' that may have a tenuous relationship to a particular piece of land, examples being advertising hoardings or cable ducts. A hereditament has a location element but not all locations have hereditaments.

Further difficulties arise when trying to use NNDR data to demonstrate uplift in value of commercial property between arbitrary dates:

i. The VOA assessment is on the basis of rental value to occupier in the *current* use to which the hereditament (property) is being put. It cannot properly reflect market pressure to assign a higher value use to the property, which is likely to follow from nearby infrastructure development such as the JLE. Under the U.K. planning system, permission to change to a higher value use almost always lags considerably behind the market. Consequently VOA list values will be lower –

perhaps much lower – than actual market values which, under LVT, would be the basis of assessments.

ii. By the time the full JLE effect has taken place – or the next quinquennial revaluation, whichever comes sooner – other factors will be affecting property rental values. Some will be so-called 'secondary' factors, which may well be themselves consequent upon the JLE, such as privately funded development of adjacent sites. Unless valuations are undertaken at frequent intervals, the effects of the many different factors acting upon a local property market cannot be separated. This is particularly the case with commercial property, which is not a single market but several inter-linked markets (retail, leisure, offices, warehouses, etc).

iii. All VOA valuations have to be corrected back to the previous antecedent date, however recent the market data underlying them may be. Since VOA do not issue details of that market data, for reasons of confidentiality, errors are introduced between the dates of its collection and publication in Lists, which make it less useful than it might be if raw market data was available.

iv. As with all property tax assessment lists, the data consists of many subjective assessments linked to a limited extent by the nature of the mass assessment methodology used. VOA admits to using a computerised complex mass assessment system[2] but does not, as yet, publish its methodology for production of Lists, nor use automated *spatial* analysis at all. Some 75% of assessments are initially appealed and the Agency hopes GIS will assist its 'right first time' aspiration for the 2005 List by making the process more transparent (VOA, 2002) and less liable to be appealed.

CT

The first and so far only set of data produced for CT has an antecedent date of 1992. The next full revaluation for England is not due until 2007. This is too large a span of time to be useful for this study. In any case, CT is a very approximate valuation: properties are divided into one of only eight 'bands' according to assessed capital market value.
CT does cover all types of residential property and could be useful for this type of study if, in future, the period between revaluations and/or the spread of values within each band was less than it now is. However the study team was unanimous in deciding early on to use other sources of residential property value data which are closer to market value and more up-to-date.

Property Owners' Data

Mitchell spent most of his time on this study between July 2001 and June 2002 investigating a variety of local London sources of property value data, mainly the owners of large estates and property interests. These included TfL itself, which in the guise of its predecessor London Underground Ltd, the GLA and other London-wide public bodies

had been expected to hold considerable data on property transactions to which they had been party; local London Boroughs with considerable holdings of all kinds of property; housing charities such as the Peabody Trust, which has several large estates near JLE stations; and smaller operators in the property business such as DDS Ltd.

Although TfL and DDS were sponsors of this study, for several reasons they were unable to give access to data for use in this research. This will be explained later. In addition there are generic reasons why such data are difficult to use.

- Difficulty in combining individual private data records and data sets with each other or with official U.K. property data sets. In the absence of a proven, public domain system or methodology for merging disparate property value data types that could be made available to the research team, the cost of collection, compilation and analysis would have been far greater than the resources provided. Whilst some established property research companies undoubtedly have the capability to do this – and were indeed known to be doing it in parallel with this study for the JLE – this study team lacked the skills, resources and experience of such companies.

- Individual property transaction figures are of limited worth unless the circumstances surrounding each transaction are known. The ideal situation in which buyer and seller (or lessee and lessor) are in an 'arms length' situation, equally free agents and in possession of sufficient market information for the transaction to truly represent 'free market' conditions are uncommon. Largely because of the confidentiality surrounding deals and the absence of a pool of 'neutral' information on current market prices and rents, the U.K. property market operates less 'freely' and efficiently than that of many developed countries and market data need to be subjected to scrutiny by experts before being used in analysis. Whilst some property owners were willing to discuss their data and most were very interested in the aims of this research, there was a reluctance to share data with outsiders.

- The volume of data available from a few owners within each JLE station catchment area was insufficient to achieve the aim of the study. Riley was only able to assemble a modest amount of data and produce a rough estimate of total JLE uplift from it after over a decade of personal activity in the market near one or two JLE stations. None of the other JLE stations revealed market operators of similar or more substantial stature to Riley who were equally willing to share their data.

HMLR Price Sales

Since 1990 HMLR has collected price paid information on all registered property transactions and this information has been publicly available, to those with good reason to have it such as potential buyers (but not to the public generally until 1995). Transactions of freehold and of leases longer than 25 years have had to be registered, so

that there is a growing database of property price data. Although *commercial* leases are generally either too complex (especially if for a long period) for use in analyses of assemblies of raw HMLR data, or of shorter duration than 25 years and therefore not (until 2003) retained by HMLR for public use, the vast majority of transactions of *domestic* property are of freehold or long leases.

Since 1995 HMLR has actively marketed its house price data and since 1998 it has been available over the Internet, but at a charge[3]. National and regional house price indices are free but as the level of aggregation reduces the market value of the data to HMLR increases and it is required by Treasury to sell it at a rate that maximises its income.[4] HMLR has been at the forefront of work to maximise the benefits to 'U.K. plc' of using publicly acquired geographic information, such as the National Land Information Service (NLIS). It has also moved towards a fully electronic property conveyancing system using NLIS and is, unlike VOA, engaging with the general public (or their agents) concerning individual property data transactions on a daily basis. Because HMLR supports research that has potential to increase the marketability of its data, this study was allowed free access to an appropriate scale and coverage of house price data. Details of the data acquired are included under the Method section.

The level of detail was limited by the legal requirement for HMLR to protect individual transaction data from those who do not *need* to know. U.K. Data Protection Acts regard property price transaction data as 'personal', in the sense that parties to each transaction supply transaction details under statute only on the understanding that those details will not be disclosed in full to third parties. Only a potential buyer needs to know who is the owner of a property and what was paid for it – or its value for mortgage purposes - at the time the owner purchased. Potential buyers pay a nominal charge to have this information, sufficient to cover costs of handling the enquiry. Other customers for HMLR data are limited to aggregate, hence anonymised, collections of price paid information.

HMLR house price data is available on a quarterly basis and could therefore be suitably divided into a 'before JLE' and 'after JLE' pair of snapshots for the geographic areas required. The data is also categorised under four types of property: detached house; semi-detached (duplex); terraced (town house); and flats/maisonettes (apartments). If there is only one transaction of a particular type of property in a particular area, then the data for that type/area will not normally be made available in order to maintain confidentiality of the transaction.

Two kinds of geography are used by HMLR for its house price data: local government geography (local authority and component electoral wards); and the Royal Mail postal system of postcode area (e.g. 'SE'), district ('SE1'), sector ('SE1 2') and full unit postcode ('SE1 2LJ'). A postcode is typically between twenty and forty domestic properties, or may be an entire block of apartments or small street.

The size of a local authority varies greatly in both population and area. The JLE falls within six London Boroughs: City of Westminster, Lambeth, Southwark, Tower Hamlets, Greenwich and Newham. Unfortunately local government wards are liable to change fairly frequently, making time series studies difficult. Also a ward is generally larger than

a postcode sector, which seldom changes its boundaries (see figure 2). Therefore postcode sector was the type and level of geography by which the HMLR data was acquired. It was not possible to acquire full postcode data for several reasons:

a. HMLR normally charges far more for this data than the project could afford or justify as being essential for its purposes;
b. Most postcodes have very few domestic property transactions, of any type of property, per quarter;
c. Postcodes change more frequently than electoral wards, as land is redeveloped, making time series comparisons difficult at this level.

HMLR postcode sector house price data was therefore chosen for the main part of this study, as being the most cost effective source of information able to provide full coverage of the JLE area and of control areas. The whole of Greater London Authority area was acquired for the year 1995 (before) and the four quarters 4/01 to 3/02 (after), to give the greatest time span possible.

Other Data

Some research was carried out using secondary sources of property information: estate agents, private and professional data agencies, and newspapers. It was felt that there was insufficient coverage and/or geographic detail available from such sources for this study. Sources considered included the Royal Institution of Chartered Surveyors (RICS), the Estates Gazette and Nationwide Building Society. They all also involved substantial charges, making their acquisition unjustified for this purpose. However for different types of studies of the domestic property market, such as looking at longer-term trends within the whole of a defined area, these sources might have been preferable.

Relations with Co-sponsors

The study team had expected considerable help or at least collaboration from TfL and DDS. In practice it was not possible to secure a formal agreement with TfL for support to this research, because it is constrained by Government procurement rules and had already procured consultancy contracts of a much greater value to achieve very similar, more comprehensive results in the same time-frame as this project. Throughout the project the study team remained on good terms with key individuals at TfL, who were however unable to divulge much detail on these other contracts but were able to offer useful advice. Several meetings took place, including one with the TfL Commissioner for Transport Bob Kiley and Don Riley of DDS, facilitated by Vice Chair of TfL and LVT supporter (member of HGF) Dave Wetzel.

Vickers was invited to comment on the terms of reference of a study commissioned by TfL into the links between transport projects and land values, also to comment on the proposed study methodology that emerged from that contract's first stage in May 2003. He was also given sight of the draft property value report by Chestertons for TfL/ODPM (Chesterton, 2002), part of the series of JLE Impact Studies commissioned through the

University of Westminster before this Lincoln study was conceived. Both these documents gave a good insight into the ways in which U.K. commercial property consultants approach such work and confirmed that many of the problems set out in this report seem incapable of satisfactory resolution until and unless a GIS approach to such studies can be adopted (RICS, 2002). Although Vickers had specifically recommended that TfL's research include GIS methods at its heart, it appears that no suitable methodology has been developed yet for use in the U.K.

The main reason why help from and collaboration with TfL was minimal was that both parties accepted that the results of all parallel studies on such similar terms of reference would carry more weight if they were seen to be genuinely independent of each other. The differences between the aims of each study were greater than the similarities. There was no need for frequent or detailed communication between study teams and since there was no contractual relationship between TfL or its contractors and this study team, only occasional *ad hoc* enquiries were made. Nevertheless it is possible to claim that there was a significant level of collaboration, because on several occasions TfL have made informal reference to this project in communications with other parties. The reverse is also true. As regards DDL, for the same reason – to ensure independence of methodology and results – no access to private files was given once the initial contract with Lincoln had been awarded. No influence was placed upon the study team by DDL, although Riley gave certain contacts with other local property market players to Mitchell.

Rationale Behind Methodology

The aim of the study was to produce a single figure for land value uplift attributable to the JLE, within a limited budget and using only data that is available in the public domain. If possible a way of graphically illustrating the land value effect was to be devised.

RICS (2002) should have included a section on methodology and another on data sources. However the RICS literature review produced *" little in the way of direction for further methodological progress"* with *"the area of attribution ... particularly weak"*. This study, with far less resources, was therefore not alone in finding little or no guidance from the literature.

It was therefore decided to follow a broadly similar method (but different data sources) to that used by Riley (2001), since the aim was to validate his findings. The main differences between this study and Riley's are:

1. The use of control areas, to try and account for general national and regional trends in property values.

2. Having *"reliable data from official sources"* which others could access if needed to validate these findings.

3. Concentration on residential data. Geofutures (2002) had been unable to use NNDR data to put any figure on the uplift to commercial property values and there were no alternative sources of official data or proven methodology available to use.

FIGURE 2: Southeast London, showing JLE with administrative and postal boundaries. [next page]

Method

Defining the Area of Influence

Any method of drawing lines to try and define the boundary of the area influenced by a new rail system will be open to criticism. Riley (2001) drew two concentric circles at 400 and 1000 yards around JLE stations. There is some indication that commuters are prepared to walk further from home to rail station (and vice versa on going home) than between office and train, so the larger circles were more significant for this residential property study than they were for Riley.

Matching the Data Source to the Area

The HMLR house price data was sorted by postcode sector and all sectors wholly or partly within the 1000-yard circles around JLE stations were considered to be potentially influenced by the JLE. Invariably sectors fell partly outside the outer circles, in which case an appropriate fraction of postcode sector was estimated.

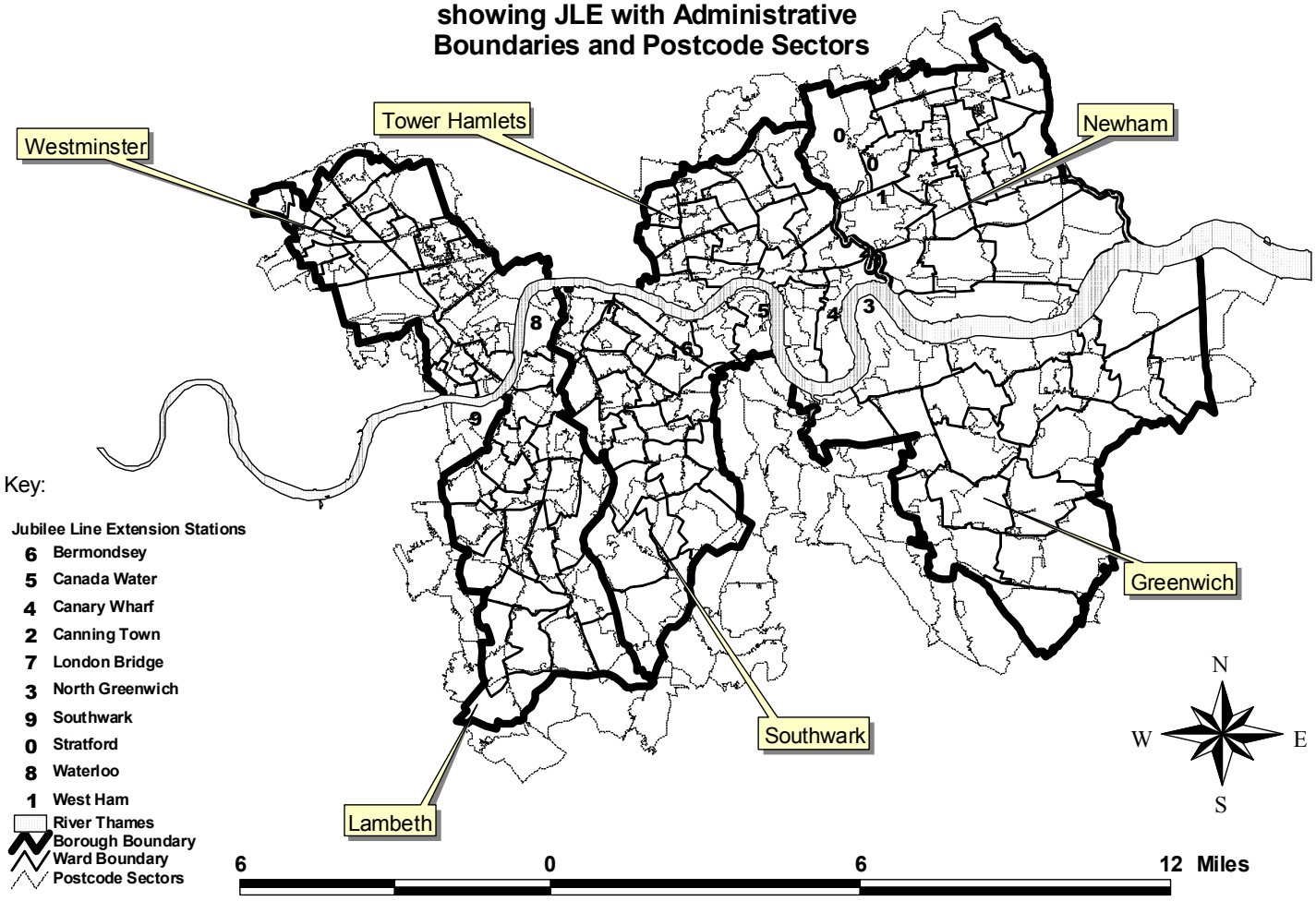
Calculation of Incremental Value Change

Data was supplied by HMLR in quarterly time periods (three months of house price transactions in each sector) but to give a larger sample four quarters were combined for both the 'before' and 'after' calculations. The calendar year 1995 was the 'before' era and 10/2001 to 9/2002 was the 'after' era, taking the largest possible span of time. Any anticipatory price rise effect before the JLE was announced is therefore lost. The period extends forward almost two years after the JLE opened in 11/1999.

πr^2 gives the area of the circles of 400 and 1000-yard diameter (r =diameter/2). Areas overlapping the River Thames and onto the opposite bank were excluded, which has the effect of depressing the potential gross uplift effect. However, set against this is the known desirability of living and working near water, so that making waterside homes more accessible through proximity to the JLE could have had an especially marked effect on land values.

To convert house prices to 'land value' an average floor area for a dwelling was taken to be 662 square feet (ft^2) for a typical flat/maisonette (F/M). This figure is deemed to be generous by London standards.

Figure 2: South East London, showing JLE with Administrative Boundaries and Postcode Sectors



It was assumed for the purpose of this study that all land in the JLE station area circles was residential. This was done for simplicity but also because the aim was to establish *potential* for funding infrastructure from land values. The land value effect of the JLE upon other types of land use *will* be different (more *or* less) than that for residential uses but it is all land and potentially there to be used for homes or ancillary uses. In practice most homes in this part of London are in blocks of flats between three and six floors high which, if 'spread out' at ground level, would more nearly approach the assumed area of land per home.

It was also assumed that the proportion of *sales* of each of the four types of home in the HMLR lists reflected the *actual* proportions of such types. Of course this assumption ignores any local and/or temporal preferences *between* types that may have been operating to increase or decrease the proportion of homes *within* any type that were being sold. In the vast majority of cases it was found that F/M outnumbered the total of all other types. Floor areas allocated to other categories were of much less significance but were adjusted nonetheless (see spreadsheets at Appendix 1).

The difference between the aggregate value of sales in 1995 and in 2001/02 gives an absolute uplift figure for each house type. Multiplied by the total number of units, the total value uplift for a residential category is arrived at and presented for that JLE station.

The equations are developed and worked out in Appendix 1.

Control Areas

Several options were considered as the basis for measuring the 'JLE effect' against the 'No JLE' situation. The aim was to define areas that were similar to the JLE stations' environs in every respect except that they did not acquire new underground rail stations in the period 1995-2001. Then the same exercise described above would be carried upon these areas collectively.

The first option was take the whole country (U.K. or England) and simply extract the underlying national trend in house prices multiplied by the same number of total houses in the JLE stations. Whilst this is of some interest, of itself it is inadequate. To include all extremes of economic fortune is too coarse a comparator figure.

The area could have been narrowed down to Greater London as a whole. Again, a host of supply side or secondary factors which cannot be properly accounted for would come in, varying between parts of London, making any 'average' uplift for London meaningless.

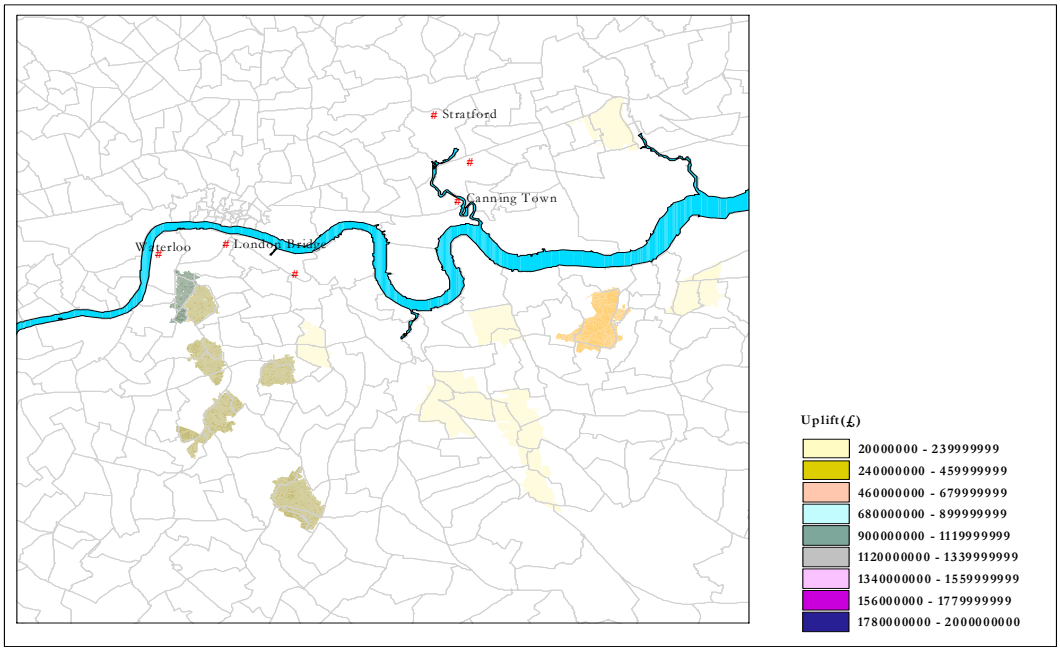
A better approach, which was considered closely, would be to choose specific control areas in London of the same size as the 'JLE circles' and as close to them as possible, on the basis that similar economic factors (other than the JLE) would be at play. However it was felt that a 'ripple effect' due to the JLE would still be present, on the other hand that the fluctuations in other economic factors might exceed effect of the JLE in some stations, thereby totally masking the JLE effect being looked for. From inspection on the ground, it was found that areas quite close to one another and to JLE stations were totally different in character.

For this reason an alternative approach was employed, which could be seen as subjective but which was thought to have a logical grounding. Areas were chosen which had, at the 'before' era of 1995, a similar residential profile: similar proportions and numbers of each dwelling type and a similar average house price. House price, which is what is being objectively measured, was taken as being the best measure of an area's character for this purpose.

HMLR supplied data in price bands of £10,000 for each dwelling type, enabling a standard deviation of price to be calculated for each postcode sector in and its assigned control area. This was used in the significance testing calculation only.

The locations of the control areas in relation to the JLE stations are shown in Figure 3. All are in South or East London.

Figure 3: Study Control Areas



Results and Analysis

Owing to lack of resources and time, it was not possible to calculate the uplift for each of the ten stations of the JLE. Six stations were calculated and some of them were taken as estimates for the remaining four. The calculations are in Appendix 1 and the results are in Table 1 below (next page).

'City East'

Canada Water was taken as an approximation for Canary Wharf and North Greenwich. The latter is more of a traditional residential district, with some salubrious accommodation for over two centuries, whereas the other two are mainly commercial areas in what could be called 'the new City of London', with a small amount of increasingly desirable housing. All have attractive waterfront potential, however Canada Water in particular has a very immature housing market, which is probably the reason for its negligible apparent land value uplift on this measure. It could be said that these three stations should not be bracketed together and produce dubious 'results'. On the other hand, the uplift is so small that it hardly affects the final answer.

East End

West Ham was taken as surrogate for Canning Town and Stratford. It is half way between them in a north-south line, with Stratford at the northeast end of the JLE and becoming a

major rail intersection as the Euro Tunnel link nears completion. This area, north of the River Thames, has never been fashionable to live in and has a preponderance of Victorian terraced housing serving the docks and associated industry. The arrival of the JLE has begun to change the demography, so far without much physical redevelopment compared to stations further west.

South Bank

The remaining four stations were calculated separately, because it was expected that their uplift would constitute the bulk of the total and all were distinct. Waterloo and Southwark 1000-yard circles overlap and a deduction was made from the total to account for this.

Analysis

The JLE cost £3.5 billion to build and table 1 indicates that it generated a land value of about £9 billion. This takes no account of the possibility that commercial land may have risen in value to a greater extent than residential. It assumes that all land was in private residential use, which is clearly a gross simplification of a highly complex set of changes in the property market during the time in which the JLE was built. Therefore the figure above comes with a very strong 'health warning' and is no recommendation for the method chosen, which was by default the least unsatisfactory available to this particular study team given their resources and skills.

Table 1: JLE Domestic House Price Uplift Results

Station name	**Total uplift attributable to JLE (£ bn)**
Waterloo	2.18
Southwark	2.70
London Bridge	1.41
Bermondsey	1.06
Canada Water	0.04
Canary Wharf*	0.04
North Greenwich*	0.04
Canning Town*	0.76
West Ham	0.76
Stratford*	0.76
TOTAL	**9.75 (say, £9 bn)**

Significance Testing

Statistical analysis of the individual results was carried out for each of the six stations and their control areas, calculations are shown in Appendix 1, except Canada Water where there was clearly an insignificant uplift. This is a standard procedure for calculations of this type.

Each of the four South Bank JLE stations shows a highly significant uplift, with a less than 5% chance that this assertion is wrong for West Ham. Therefore the conclusion is that in five out of six calculated stations at least – and probably in seven out of ten in total – the JLE has made a significant difference to land values. Despite the limited nature of attempts to control for other factors or to calculate a range of uplift figures, the overall interpretation of these results is that attributable land value uplift was sufficient to have paid for the JLE, if a method of tapping into that uplift could have been found.

General Discussion

Secondary Effects

Some researchers (Chesterton, 2002) express concern about the need to distinguish between uplift caused directly by creation of new public infrastructure such as the JLE and uplift caused by so-called 'secondary factors', such as development of other public infrastructure (or commercial property development) more or less independently of that being studied but in the same geographic area. The property market is highly complex, slow to react to influences such as JLE and unpredictable in its reaction to this and countless other factors, some of them very local and some global.

It has to be said that a project as large as the JLE is highly likely to induce other investments (public and private) in its area of influence, because the improved accessibility it creates favours many other kinds of economic activity besides those which exist before it is built. Therefore 'secondary' development and its effects are arguably directly - or at least indirectly - attributable to the JLE, because they would probably not have occurred unless the JLE was there (or known to be coming). Nevertheless in the context of using value uplift to fund specific projects such as the JLE, this is a very valid concern. It would be inequitable to use **all** of a special levy on property owners in an area deemed to have benefited from such a project to pay for that project, if the cause of the extra uplift was clearly not **just** that project but was due to one or more significant secondary factors.

However if there is also clearly an overwhelming unearned benefit going to large numbers of property owners from any large publicly funded project, then it is just as inequitable not to require them to pay substantially towards it. The injustice of subsidising landowners balances the injustice of not compensating those whose property values suffer from public investment and those who also invest but are penalised through taxes for doing so.

The logic of accepting that owners who benefit from the JLE should pay towards it in some way can extend to saying that all owners who benefit from any investment in property or public infrastructure should pay towards it. In other words, if it is both possible and just to fund one project from land values, why not fund all such projects in this way? If this logic were to be followed, then the need to distinguish between primary and secondary factors would disappear. A general tax shift, off those who contribute to rising property values by investing onto those who benefit without any such investment, would greatly reduce the need to draw boundaries of 'value influence' around rail stations or any other 'influence centres'. The revenue from a general tax on property owners, based on regular assessments of value that would reveal increases (and decreases) peculiar to location and time could go into a rolling general infrastructure investment fund and also be used to relieve other taxes that bear on production. This is in fact what happens in cities that have a land value tax (LVT), such as Brisbane, which has similar responsibilities to the Greater London Authority (GLA)/TfL.

Therefore those who raise the issue of secondary effects but also acknowledge that there is significant uplift from projects like the JLE ought to join forces with those who seek a general shift in the pattern of taxation. It was not the purpose of this study to look at how the value uplift from the JLE could be captured but to determine if it was there to be captured. Value uplift from an infinite number of investment projects (public and private) spills over into an equal number of variously sized indeterminate areas of value change, all capable of being captured by a well designed revenue raising scheme. The effort in separating these areas, influences and amounts of uplift from one another is probably not worth expending: it would be much simpler to devise a system of general taxation based on land values.

Control Areas

The worst that a poor choice of control areas can do is to degrade the accuracy of the result. Since the order of magnitude and degree of significance of the result in this case seems much larger than the possible error that might be caused by poor choice of control areas, the subject hardly seems to deserve detailed discussion.

The control areas were chosen based on them having similar types and prices of housing stock before the JLE, not on any consideration of their condition after the JLE was opened, other than the fact they were all beyond the influence of the JLE and any other major new transport link. Secondary local factors affecting house prices will have been at play in all control areas, as well as national and regional factors. But the significance testing of results seems to show that these factors generally had much smaller total effect than the effect of the JLE on house prices around most of its stations.

To test the above assertions it would be possible to select different control areas using the same criteria or to use one or more of the other methods considered. We do not consider this to be necessary.

Use of GIS

The project proposal stated that the results would be presented with "*a 'landvaluescape' representing the incremental change in land values due to the capital investment in the line"* and that the computation and confidence levels *"will be illustrated by use of geographic information systems"*. This was attempted and to some extent was achieved in the interim report by Thurstain-Goodwin, with commercial data. However for a number of reasons, mainly relating to data availability problems described above, it was not possible to achieve any useful form of map graphic for presentation of final results. This section explains what was attempted in the final stages of the project, taking Table 1 figures and Appendix 1 as input.

Thurstain-Goodwin, in a similar study of the property effect of the South London Croydon Tramway for RICS/ODPM currently nearing completion, describes a process he has followed there which is very like what was proposed for this JLE study, in a paper delivered to the 2003 AGI Conference (Thurstain-Goodwin, 2003). With a much larger budget for his study and the Government as client, he was able to use almost raw HMLR transaction data – defined by unit post-code rather than postcode sector. He was therefore mapping spatial variations in unique transaction point data, not large polygons of crudely averaged mass transaction data. This was the method envisaged at the outset by him, with Mitchell & Vickers, for this JLE study.

Each unique unit post-code is associated by Royal Mail with only between ten and about fifty homes, depending on density and type of housing: a single large multi-storey block of fifty housing units (addresses) might be one post-code, ten large detached houses spread across the edge of a village another. Geocodes of the centroids of unit post-codes are randomly distributed at intervals of about 50 metres and allow standard techniques for generating value data surfaces to be used, such as Inverse Distance Weighting (IDW). For the Croydon study, HMLR data for second quarter 1996 was compared with that for the same area and quarter of 2002, to produce two value data surfaces. The spread of transactions and the interpolated value surface for 2002 are shown in two map graphics in Thurstain-Goodwin (2003), his AGI paper. Unfortunately he was not able to allow these graphics to be used here.

The difference (volume) between the surfaces formed by the two eras of house price data represent an estimate of the value uplift attributable to the Tramlink. In the same way, had it been possible to acquire unit post-code transaction data around JLE stations, two value surfaces could have been created. By integration, the area between the two surfaces would give an estimate of value uplift attributable to the JLE.

Thurstain-Goodwin lists several generic and U.K.-specific problems with his own method which, while not fatal to his results (yet to be published), he warned AGI readers of his paper require to be addressed before the method can be recommended for wider use. They all affect the ability of spatial analysts working with current U.K. national property data sets to confidently use surface interpolation algorithms that are commonly used elsewhere, both in other countries for property value mapping and more generally for

mapping phenomena such as climate and other physical and objectively measured variables. These include:

a. **Lack of attribute data associated with properties**. In countries where computer aided mass assessment (CAMA) and/or spatial analysis of property data are used, the data is normalised by solving for a number of variable elements in property value relating to physical attributes such as age, number of bedrooms and garages, construction material, double glazing, etc. These countries collect such attributes routinely in the same database that holds property transaction prices, whereas HMLR merely holds the single attribute 'type' (F/M etc.) for houses.

b. **Coarseness of geo-referencing.** In the U.S. and other countries that have a cadastre, each property has its own geo-code. Although Britain does now have a National Land and Property Gazetteer (NLPG), which allows each addressable property to be uniquely geo-coded, most data sets do not yet carry that geo-code – among those so far not fully geo-coded is the HMLR's. So long as spatial analysts have to rely on the Royal Mail post-code, they will be using a spatial reference that obscures significant variations in value within postcodes: it is well known among valuers that house prices can vary a great deal from one end of street to another, or on either side of a road.

These problems did not affect the results in this study, however they do point to the great difference in scope between U.K. and U.S., at this time, for using GIS in such studies. The problems in this study were more to do with the lack of access to postcode level of detail for HMLR data, leading to a very great deal of generalisation: the entity being mapped – postcode sector – is so large that it does not allow any kind of surface modelling approach to be taken. On the other hand, with the larger samples of transactions in each [postcode sector / 12-month / house type] data entity used in this analysis, the problem of variations in property attributes ('a' above) becomes much less serious: the chances of the average of a sample of 100 transactions being skewed by the attributes of particular properties sold is much less than if the sample used is of only ten properties, let alone one. In Thurstain-Goodwin's Croydon Tramlink study, individual transactions were used directly in the modelling and the chances of distortions in the resulting data surface being due to characteristics of individual properties were much greater, especially where sales data was sparse.

Therefore although the inability to use GIS to analyse and display the results is disappointing, it does not affect the headline results and the study has revealed what needs to - and can be - done to enable GIS to be used in future, once data problems have been fixed. This is dealt with in the final section.

Recommendations for Further Work

On the JLE

With the JLL study for TfL ongoing at the time of writing, it does not seem necessary to have further studies of the JLE value uplift effect commissioned at this time. Given the continuing high priority accorded by regional and national politicians and the property and transport industries to the subject of funding London's transport infrastructure sustainably, we would only ask that the relevant authorities and professions carefully and urgently consider the conclusions and recommendations of this and the JLL study.
In particular we hope that the clear conclusion reached here, that the potential revenue from such projects is far greater than the financial investment needed to fund them, is used to bury the argument about secondary effects and to extend the case for studying the wider influences on land value and ways of capturing unearned value uplift equitably, efficiently and sustainably. We have shown that there is absolutely no need for continuing under-investment in public infrastructure in the London area, if not far beyond.

On Developing a Method for Similar Studies in the U.K.

Before a widely acceptable method of tapping into land value uplift for public revenue can be implemented, certain deficiencies in land information must be corrected. This need neither take long nor be unduly expensive but will require political leadership and resolve. It can no longer be said to be a minor issue, nor can it be avoided if problems over under-funding of transport and other public services are to be resolved.

Vickers, in another study for Lincoln (Vickers, 2003a) and in his doctoral research at Kingston University (Vickers, 2003b), has made several recommendations. Thurstain-Goodwin (2003) has concurred with some. In a sentence, property market data need to become more affordable, better maintained and enriched with further attribution and connectivity. Better spatial analysis of how the property market operates in the U.K. is in the public interest and in the interest of the property industry in particular. It is absurd, in the twenty-first century, not to be able to conduct studies such as this with greater ease.

The reason why one can be hopeful that a method of conducting such studies more easily is fairly close at hand is that a number of projects already commissioned by the U.K. Government are contributing, sometimes unintentionally, to the desired outcome. Table 2 below lists the main ones, giving their objectives, scope and current time frames, with a column giving recommendations applying to each where the project needs to change course and why (in order to make land value studies easier).

If all the projects in Table 2 were better integrated and the recommendations for enhancements were adopted, it is likely that studies such as this would, by 2010, be able to use the GIS method we set out to use. This would make the operation of the property market in relation to transport investments much more transparent and provide a valuable tool for appraisal of new transport schemes. Such a tool should be in the public domain

and available to all parties involved in their finance, planning and implementation, without having to pay for the use of the geodata which the tool relies on.

If in one or two trial areas, approximately the size of a local property tax billing authority, studies were to be commissioned immediately with all recommended actions in the above table adopted in just those areas, the method we propose could be developed for wider subsequent use well before 2010. In the GLA area, which has such an enormous and urgent need for new sources of revenue to fund transport infrastructure, it would be justified under purely transport grounds for such a study to commence now. It should draw on the latest practice in geo-statistical analytical methods in other countries, as described by Thurstain-Goodwin (2003).

As pointed out recently by Whelan (2003) for RICS, there are several mechanisms for tapping into land values to fund transport projects already. However by far the largest potential source of land value revenue for transport in London is an annual levy on all land owners (LVT), for which a full land valuation exercise would be needed. GLA / TfL ought to therefore offer to help pay for the necessary enhancements in land information systems to enable LVT, while beginning to use other forms of land value capture in the short term.

Table 2: Relevant U.K. Geo-information Initiatives

Project Name	**Project Description**	**Time Frame & Coverage**	**Recommendations, with reasons**
1. **National Land & Property Gazetteer (NLPG)**	Map-based electronic gazetteer of all land and property, with unique Geocodes and reference numbers, continuously maintained by local authorities and accessible to all.	Great Britain, street addresses and map link but no property attributes, by 2005. Sep 2003: about 75% complete.	a. Extend to non-addressable properties (inc. undeveloped land) for full geographic cover; b. Link to NLUD (see below) giving current use of all land; c. Add selected building attributes, to enable normalisation of land values.
2. **Land Title Registers**.	HMLR has computerised all title plans and index maps to them, future transactions (freehold & leases >3 yrs) and charges must be added and price paid is included for all transactions since 1990.	England & Wales only, all conveyancing electronic from 2003, completion (except land not transacted) by 2006.	a. Retrospective compulsory registration, to enable full land valuation by legal entity and apportionment of land tax between beneficiaries. b. Link to NLPG, to facilitate registration and valuation without site inspection.

Project Name	Project Description	Time Frame & Coverage	Recommendations, with reasons
3. **MasterMap**	Structured, seamless, continuously maintained database of all physical and administrative map features. Includes air photography, transport network and land management 'themes'.	Product launched with topographic theme complete end 2002; transport and air photo themes 2003. (See PGA below)	a. Speed up completion of land management theme, using definitive HMLR index. b. Reduce prices for private sector users, to maximise use of (and benefits from) publicly funded data.
4. **National Land Information Service (NLIS)**	Electronic property conveyancing system, linking solicitors to local authorities and other agencies with data requires for transactions. Helps HMLR and other agencies to comply with *e-government* targets. Funded by PFI and likely to be profitable.	Available nation-wide (Great Britain) from 2002, dependent on NLPG for efficiency. May be nation-wide by 2005. Many other NLIS applications envisaged.	a. Increase charges to users to raise revenue to fund faster NLPG completion and enhancement. b. Look at other NLIS applications that were in original spec.
5. **Project Acacia**	Initiative to produce and maintain definitive national databanks of addresses, streets, non-addressable properties and in due course property ownership and occupancy parcels and possibly other elements as well, together with the related definitive mapping, all linked together and held as a land and property layer within the framework of OS MasterMap.	Launched with MOU but no funds in Sep 02 by agencies including VOA, OS, HMLR, local authorities, Royal Mail. Includes Scotland. Implied link to EU's INSPIRE project. Two pilots under way.	a. Explicitly state that property values need to be part of project. b. Prepare case for core U.K. Government funding of research and development. c. Consider linking to NLUD (see below).
6. **Pan-Government Agreement #(PGA)**	Agreement that central government (not the user) will pay OS for all map data used by its departments and agencies. Dramatically increases GIS use in public sector.	Piloted 2002-03 and confirmed for further five years. Unlikely to end.	a. Extend principle to all other geo-data produced / used by public bodies. b. Consider making all publicly produced geo-data free-to-view through NLIS channels and internet.
7. **National Land Use Database (NLUD)**	Aspires to be a consistent record of land use at national level, kept up-to-date. Currently only extends to vacant and derelict developable urban land.	Disseminated nation-wide from 2001 but regarded as inconsistent. No funds for further development.	Revive under Project Acacia, with wider remit including attribution of buildings and potential 'highest and best' use as well as actual/ current.
8. **ValueBill**	Use of GIS to improve efficiency of collection of property taxes.	Pilot commenced in 18 local authorities 2003, aim is to be nation-wide (E&W) by 2005.	a. Use to map property values at parcel level and also to create 'value surfaces'. b. Integrate with Acacia.

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Appendix 1 – Calculations of House Price Uplift and Significance

Calculations are made for each of the six JLE stations Waterloo, Southwark, London Bridge, Bermondsey, Canada Water and West Ham. Following the set of six calculations is a note concerning the method used for significance testing (for statisticians only) and a set of tests for each of the same six stations.

NOTES TO THE SPREADSHEETS WHICH FOLLOW.

All figures are in £.
Subscripted figures in brackets denote the number of property transactions.

The calculation:

- pi (π) is multiplied by the fraction (* see example below) of the postcode sector which has been allocated to the concentric circle i.e. 400 or 1000 yards.
- This result is divided by the floor space for the property type e.g. for a flat/ maisonette (F/M) 662 ft squared. The assumption is that this gives the number of residential units, of this type, in the postcode sector under consideration.
- Multiply the result by the amount of 'uplift,' and the total uplift for the sector is arrived at.

*** an example:**
for Waterloo the fractions used were as follows:
I) within a 400 yard radius: SE1 7 - 5/10; SE1 8 - 3/10; SE1 9 - 1/10.
II) within a 1000 yard radius: SE1 7 - 1/12.

- Note the same fractions are repeated for the corresponding control areas i.e. if SE 12 8 is used as a control for SE 1 7 then the fraction allocated to SE 12 8 is 5/10.
- Also, in some cases, the fractions do not total 1, for any one radius. This is because:
  I) the circle overlaps with the river or to the north side or
  II) the circle overlaps with another station catchment area.
- In the latter case the station to the right 'gives way,' in preference to that on the left.
- An anomaly to this rule is Waterloo, which has arisen merely as a result of the way the results were initially processed. In this case, Waterloo gives way to Southwark.

A numerical example (see Waterloo spreadsheet):

e.g. Waterloo SE1 7; (3.142* 1200ft*1200ft* 5/10)/662ft2
equals 3417.23 ft2. Of course, 1200ft here represents 400 yards.
Now, 3417.28* £331,602 is £1,133,176,900.
This is the total uplift in value for the postcode sector SE1 7, within a radius of 400 yards of Waterloo station.

It is only the 1000 yard uplift figures that are carried forward to the final uplift calculation and Table 1.

Waterloo Station

Postcode Sector, Residential Type and Year

SE1 7	1995	2001/02	UPLIFT	UPLIFT WITHIN 400 yards	UPLIFT WITHIN 1000 yards	WATERLOO TOTAL UPLIFT
Flats/ Maisonettes (F/M)	56332(11)	387934(70)	331602	1133176900	991529770	
SE1 8 F/M	na	369960(38)	313628*	614764200		
SE1 9 F/M	103833(3)	456298(45)	352465	240895730		
			Totals	**1988836830**	**991529770**	**2980366600**

*The figure assumed for SE1 8 in 1995 was £56332. This is an exceptional case, used in the absence of otherwise finding a suitable control. SE1 8 was taken to be a similar area to SE1 7 and hence the value of £56332.

Waterloo Control Areas	1995	2001/02	UPLIFT	400 yards	1000 yards	Control Total Uplift
SE12 8 (for SE1 7 and SE1 8)	50716(33)	128775(75)	78059	426670490	233405780	
SE11 4 (for SE1 9)	92299(133)	299506(190)	207207	141522380		
			Totals	**568192870**	**233405780**	**801598650**

JLE Uplift for Waterloo is: 2178767950 or £2.18 billion (bn).

Note: Where JLE uplift is Waterloo uplift minus control uplift. A similar procedure is adopted in the spreadsheets which follow.

Southwark (values are flats/ maisonettes unless otherwise stated)

	1995	1998/99	2001/02	UPLIFT	Uplift 400 yards	Uplift 1000 yards	Total Southwark Uplift
SE1 0	na	109165(15)	211700(29)	102535	262797280	459869480	
SE1 1	na	161314(38)	276544(52)	115230	na	516806550	
SE1 6	45170(11)	na	169755(103)	124585	na	279393150	
SE1 7	(see Waterloo spreadsheet)				na	1083118500	
SE1 8	ditto				1071666900	na	
SE1 9	ditto				241411280	1901826700	
				Totals	**1575875460**	**4241014380**	**5816889840**

Note:
400yd fractions: SE1 0 3/8; SE1 8 4/8; SE1 9 1/8.
1000yd fractions: SE1 0 1/8; SE1 1 1/8; SE1 6 1/16; SE1 7 1/8; SE1 9 3/16.

Southwark Control Areas:

	1995	1998/99	2001/02	Uplift	Uplift 400 yards	Uplift 1000 yards	Total Control Uplift
SE13 5 (for SE1 0)	na	87581(185)	139441(164)	51860	132917180	232601500	
SE3 7 (for SE1 1)	na	123206(114)	197856(162)	76648	na	343780170	
SE17 3 (for SE1 6)	47401(29)	na	145306(61)	97905	na	219560840	
SE12 8 (for SE1 7 and SE1 8)				78059*	266749530	350108760	
				78059*	na	na	
SW11 4 (for SE1 9)				207207*	177021130	1394041400	
				Totals	**576687840**	**2540092670**	**3116780510**

*see Waterloo spreadsheet for derivation of these results.

JLE Uplift for Southwark is:
2700109330 or £2.70 bn.

London Bridge

		1995	1998/99	2001/02	Uplift	Total Sector Uplift 400 yards	Total Sector Uplift 1000 yards	Total Uplift For London Bridge
SE1 1		na	161314(38)	276544(52)	115230	157519410	na	
SE1 2		121804(105)	na	333645(280)	211841	289586650	633430010	
SE1 3		52666(3)	na	227823(165)	175157	239439620	523742200	
SE1 4	F/M	79568(65)	na	243330(148)	163762	na	440683540	
	Terraced(T)	69383(6)	na	171944(19)	102561	na	30665739	
SE1 9		103833(3)	na	456298(45)	352465	963639310	na	
					Totals	1650184990	1628521489	3.279E=+09 or 3279000000

Controls for Postcode Sectors

	1995	1998/99	2001/02	Uplift	Sector Uplift 400 yards	Sector Uplift 1000 yards	Total Control Uplift
SE3 7 (for SE1 1)	na	123206(114)	197856(162)	76648	104771100		
SE10 8 (" SE1 2)	77927(40)	na	192236(104)	114309	156250390	341783910	
SW11 4 (" SE1 9)	91870(106)	na	271479(138)	179609	491019530		
SE17 3 (" SE1 3) F/M	see result for Southwark		145306(61)	97905	133827560	292747780	
SW11 2 (" SE1 4 F/M)	65502(89)	na	189277(179)	123775		333091990	
SE12 9 (" SE12 9 T.)	65866(47)	na	138478(92)	72612		18661284	
				Totals	885868580	986284964	1.87E+09 or 1870000000

JLE Uplift for London Bridge
IS 1.41E+09 or £1.41 bn

Bermondsey Station

						Total Sector Uplift		Total Uplift for Bermondsey
		1995	1998/99	2001/02	Uplift	400 YDS	1000 YDS	
SE16 2	F/M	29500(10)	n/a	133033(41)	103533	66337753	557214610	
	Terraced(T)	62000(3)	n/a	143992(14)	81992	15055648	126431660	
SE16 3	F/M	42200(15)	n/a	121105(104)	78909		580454600	
	T	52765(4)	n/a	149036(22)	96271		133624150	
SE16 4	F/M	56000(4)	n/a	241300(93)	185300	886511030	332428200	
	T	163340(4)	n/a	233825(20)	70485	72458580	27207210	
SE1 2		121804(105)	na	333645(280)	211841		633404590	
SE1 3		52666(3)	n/a	227823(165)	175157		349087900	
SE1 5	F/M	37358(18)	n/a	118221(58)	80863		67682331	
	T	71063(30)	n/a	252364(80)	181301		211215670	
					Totals:	1040363011	3018750921	4059113932

Controls for Postcode Sectors:

SE18 1 (for SE16 2) F/M	24831	n/a	85073	60242	38615122	324222444	
SE18 4 (for SE16 2) T	60998	n/a	186322	125324	23059616	193249608	
SE15 4 (for SE16 3) F/M	40083	n/a	141326	101243		744743508	
SE 18 7 (for SE16 3) T	52282	n/a	114310	62028		86094864	
SE 24 9 (for SE16 4) F/M	58936	n/a	162199	103263	494010192	185253822	
SE 24 9 (for SE16 4) T	130400	n/a	349739	219339	225480492	84664854	
SE15 2 (for SE1 2) F/M	105034	n/a	176673	71639		214200610	
SE5 9 (for SE1 3) F/M	52245	n/a	157007	104762		208790666	
SE13 6 (for SE1 5) F/M	39059	n/a	113372	74313		83774313	
SE 23 2 (for SE1 5) T	71861	n/a	148369	76508		89131820	
				Totals:	781165422	2214126509	2995291931

JLE Uplift for Bermondsey is: £1.06BN

Canada Water

	1995	1998/99	2001/02	Uplift	Total Uplift 400	Total Uplift 1000	Total Uplift for Canada Water
SE16 1	90261(106)	na	203574(188)	113313	418200150	975851560	
T.	90890(61)	na	245525(42)	154635	170367610	397566590	
Semi- Detached (S/D)	93625(4)	na	201000(5)	107375	10930861	25447875	
SE16 2	29500(10)	na	133033(41)	103533	66337753	348251370	
T.	62000(3)	na	143992(14)	81992	15055648	79040288	
SE16 4	56000(4)	na	241300(93)	185300	126644430	na	
T.	163340(4)	na	233825(20)	70485	10354155	na	
				Totals:	817890607	1826157683	2644048290

Controls	1995	1998/99	2001/02	Uplift			Control
SE3 7 (for SE16 1 F/M)	75991(67)	na	197856(162)	121864	449759010	1049437700	
SE22 8 (for SE16 1 T	98338(44)	na	253591(89)	155253	171048480	399113120	
SE26 6 (SE16 1 S/D	84178(7)	na	195404(11)	111226	11322896	26420090	
SE18 1 (SE16 2 F/M)	23875(16)	na	85073(42)	61198	39212018	205863090	
SE18 4 (SE16 2 T)	57416(6)	na	186322(108)	128906	23670155	124268310	
SE24 9 (SE16 4 F/M)	63144(38)	na	162199(115)	99055	67699753	na	
SE24 9 (SE16 4 T)	121359(52)	na	349739(67)	228380	33548725	na	
				Totals:	796261037	1805102310	2601363347

JLE Uplift for Canada Water is:
42684943 or £0.043 bn.

West Ham

	1995	1998/ 99	2001/02	Uplift	Total Sector Uplift 400 YDS	1000 YDS	Total Uplift for West Ham
E3 3	37826(14)	na	112744(59)	74918	64003964	336020810	
E13 0	31368(22)	na	105684(92)	74316		103653370	
T	47942(92)	na	131543(130)	83601		281568170	
E15 2	28400(5)	na	140322(187)	111922		489942690	
T.	46834(26)	na	191059(98)	144225		347034300	
E15 3	32588(8)	na	101620(56)	69032	107275730	128802350	
T.	51475(75)	na	165624(110)	114149	434300000	521160000	
				Totals:	**605579694**	**2208181690**	**2813761384**

Control Area		1995	1998/99	2001/02	Uplift			Total for Control
E6 2 for all	F/M	30581(24)	na	87377(54)	56796			
	Terr.	50858(165)	na	136060(252)	85202			
					for E3 3	48503784	254730060	
					E13 0		112058510	
					T		280314580	
					E15 2		248596090	
					T		204996010	
					E15 3	88309990	105924540	
					T	324108410	388947130	
					Totals	**460922184**	**1595566920**	**2056489104**

JLE Uplift for West Ham is:
757272280 or £0.757 bn.

Note to the Significance Tests Which Follow (by Stephen Mitchell):

It should be recognized that below is in accordance with statistical theory and is not intended for the layperson.

The significance test:

A null hypothesis (H0) is set:

H0: μ (the station under consideration) e.g. Waterloo = μ (of the control area).

This is set against an alternative hypothesis, which we call H1,

H1: μ ditto above > μ ditto above

i.e. the station mean is greater than that of the control counterpart.

The following **test statistic (z)** will be used:

Z= X1-X2-0/ sigma hat * square root of 1/n1+ 1/n2

When the formula is:

- X1 and X2 are, in fact, the sample means, taken from the station and control means, respectively.
- Since we set H0: μ 1= μ 2 then μ 1- μ 2=0.
- Sigma hat i.e. the best estimate for the standard deviation is the pooled estimate, where sigma= square root of n1* S1 squared + n2* S2 squared divided by n1+ n2-2, and the sample standard deviations, S are derived from the banding data supplied by HMLR (class intervals of £10,000).

The test:

If the resulting z- score is greater than the value for the 95% level of confidence: given by statistical tables, as 1.645, then H0 would be rejected. It could then be said that the station mean and thereby value of property is greater than the control property value.

Otherwise H0 is accepted and the two means and property values are viewed as statistically equivalent

A Test of Significance for Waterloo

Calculating the pooled estimate for the standard daviation i.e. sigma hat:

H0: U(mew)Waterloo(1)=U Control(2)
against the Alternative Hypothesis(H1)

H1: U(mew)Waterloo(1)>U Control(2)

The test statistic (z):

z=X1-X2-0/sigma hat*square root of 1/n1+1/n2

An example of the calculation:
X1=(387934*70)+(369960*38)+456298*45)/ 70+38+45
X1=£403,577- all subsequent sample means are calculated similiarly.

Compiling a frequency table for Waterloo from HMLR banding data:

class interval midpoint x	f
55000	1
110000	1
135000	7
175000	23
250000	104
350000	65
450000	53
550000	30
700000	23
900000	3
1125000	3
1375000	2
1875000	1
2125000	2
sigma f	318

therefore S1=248154
(by calculation)

A frequency table for the control areas:

midpoint x	f
45000	3
65000	3
75000	7
85000	5
95000	14
110000	22
135000	31
175000	28
250000	44
350000	4
550000	1
900000	1
sigma f	163

therefore S2=90427

The pooled estimate is arrived at as follows:
sigma hat=square root of 318*248154squared+163*90427squared/318+163-2
equals 208961

Significance Test For Southwark

Ho:U1=U2
H1:U1>U2

Using Southwark spreadsheet figures:
X1=295,999
X2=199,922

Sample standard deviations, S1 and S2, and sample sizes, n1 and n2, as per tables opposite.

The pooled estimate is thus:
sigma hat=square root of n1*s1squared+..
..+n2*s2 squared/
n1+n2-2

sigma hat= 173009(by calc.)

The significance test

z= 295999-199922/
173009*square root of
1/337+1/652
is 8.28

As 8.28>1.645, Ho can be rejected in favor of H1.

There is evidence to suggest that these samples do not share the same parent population.

Southwark Frequency Table Midpoint		Control Frequency Table Midpoint	
x	f	x	f
25000	1	5000	1
55000	2	25000	1
65000	1	45000	4
75000	3	55000	5
85000	3	65000	8
110000	11	75000	12
135000	58	85000	14
175000	71	95000	23
250000	148	110000	75
350000	79	135000	146
450000	60	175000	152
550000	31	250000	113
700000	23	350000	59
900000	3	450000	23
1125000	3	550000	12
1375000	2	700000	7
1875000	1	900000	1
2125000	2		
S1=117900 (by calc.)		S2=114064	
n1=502		n2=656	

Conclusion:

It can be said that the residential prices in Southwark are significantly greater than the corresponding control areas after the JLE.

Significance Testing for London Bridge

Ho:U1=U2
H1:U1>U2
where U1 is the population mean for London Bridge residential prices and U2 is the population mean for the control areas.

The test statistic:
z=X1-X2-0/
sigma hat*
square root of
1/n1+1/n2

When:
X1= 289,429
X2= 197,002
and the pooled estimate for the standard deviation, sigma hat is153,399, using values for S & n from the tables opposite.

The significance test

z=289429-197002/
153399*
square root of 1/709+1/736.
z=11.45

As 11.45>1.645, Ho is rejected at the 5% level of significance, in favour of H1.

London Bridge Frequency Table Midpoint

x	f
25000	1
35000	1
45000	1
55000	3
75000	2
85000	4
95000	3
110000	11
135000	52
175000	104
250000	340
350000	151
450000	66
550000	17
700000	18
900000	4
1125000	4
1375000	2
1625000	1
1875000	3

S1=183,608.
n1=788

Frequency Table for Control Areas

x	f
25000	2
35000	3
45000	1
55000	6
65000	5
75000	17
85000	14
95000	22
110000	80
135000	130
175000	194
250000	170
350000	75
450000	27
550000	13
700000	7
900000	1

S2=114064
n2=767

Bermondsey Significance Test

Ho:U1=U2

H1:U1>U2

Where U1 is the Bermondsey population mean for residential prices and U2 is the Control population mean.

Test statistic values:

X1= 243,312

X2= 160,669

(by calculation from Bermondsey spreadsheet).

Pooled estimate for the standard deviation is 132712.

(values for S1,S2,n1 & n2 can be seen opposite).

Sample values for the test statistic itself are, n1=857 and n2=1007 (see Bermondsey spreadsheet).

The test statistic:

z=X1-X2-0/

pooled estimate*

square root of 1/n1+1/n2.

z=13.40 As 13.40>1.645, Ho is rejected at the 5% level of significance, in favour of H1.

Conclusion:

Bermondsey Frequency Table Midpoint:		Control Frequency Table:	
x	f	x	f
35000	2	25000	2
45000	3	35000	2
55000	10	45000	5
65000	7	55000	22
75000	5	65000	16
85000	19	75000	31
95000	24	85000	47
110000	78	95000	55
135000	156	110000	136
175000	149	135000	229
250000	204	175000	258
350000	114	250000	162
450000	50	350000	18
550000	13	450000	16
700000	15	550000	6
900000	3	700000	1
1125000	4		
1375000	1		
1625000	1		
1875000	2		
	S1= 239762		S2= 79070
	n1= 860		n2= 1006

The evidence suggests X1 and X2 do not share the same parent population mean.
Furthermore, it can be said that Bermondsey res. prices are sig. higher than corresponding Control prices.

West Ham Significance Test

Ho: U1=U2

H1: U1>U2

Where U1 is the population mean for West Ham and U2 is the population mean for the Control.

Using the test statistic, where:

X1=139,821

X2=127,469

Derived from West Ham spreadsheet.

Pooled estimate: see tables opposite for relevant estimates.

sigma hat= 92407.

n1=732

n2=306

The test statistic is 1.96.

As 1.96>1.645, Ho is rejected at the 5% level of significance.

West Ham Frequency Table Midpoint

x	f
25000	1
35000	2
45000	10
55000	13
65000	14
75000	31
85000	48
95000	72
110000	87
135000	216
250000	187
350000	56

S1=107222

n1=737

Control Frequency Table

x	f
35000	1
45000	2
55000	9
65000	7
75000	10
85000	18
95000	19
110000	44
135000	129
175000	63
250000	4

S2=36237

n2=304

Conclusion:

There is some evidence to suggest that West Ham and the control areas come from different parent populations.

In other words, West Ham has greater residential prices than the corresponding Control.

Endnotes

[1] Whelan only lists five 'property-related taxes': business rate levy (on NNDR); tax incremental financing; BIDs; LVT; greenfield development tax (GDT). However several other 'mechanisms' in his list are in fact using land values in some form: road pricing; workplace parking charges (and general parking fees); freehold levy; planning gain; buy-in charges. The last three and GDT are one-off taxes, others are levied annually or continuously.

[2] VOA does not yet use full computer aided mass assessment (CAMA) for NNDR in the sense that most North American tax jurisdictions and assessors would understand it. However 80% of valuations are produced automatically 'first pass', allowing valuers to target the remainder with their skills (Leggo 2002).

[3] Individual records can be viewed free of charge.

[4] Academic researchers can sometimes negotiate free supply but this is a very different situation to the U.S., where such data has to be supplied at no more than the cost of handling.