Impacts of mega-event-driven development on urban transit systems and user experiences: A comparative study of four Olympic host cities

Figure 1: One of the posters in the Mayor of London's Get Ahead of the Games *campaign in the lead-up to the London 2012 Olympics*

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"All of you can be a champion"

Jacques Rogge (1942-2021), eighth President of the International Olympic Committee (2001-2013)

Displayed on a plaque at Zwembad de Krommerijn, Utrecht - the setting for tens of thousands of metres of stress-reducing swimming during the months of peak thesis-writing

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List of Acronyms

ALP	Alternative Licence Plate system - a policy that allows private vehicles to be driven on alternate days - even numbers on one day and odd numbers on the next. This was introduced during the Olympic Games in Beijing (and promised, but not in the end implemented, in Rio).
BRT	Bus Rapid Transit - a new bus system with demarcated lanes that was introduced in Rio in the lead-up to the 2016 Olympics
DLR	Docklands Light Railway
EU	European Union
EV	Electric Vehicle
FIFA	Federation Internationale de Football Association (In English: *International Football Association Federation*)
IOC	International Olympic Committee
IPC	International Paralympic Committee
HPPTR	High Performance Public Transport Ring - network of transport links that connected the four venue clusters for the Rio 2016 Games
NOC	National Olympic Committee - for each individual country
OG	Olympic Games
OGOC	Olympic Games Organising Committee – the organisation in the host city that is in charge of delivering the Olympic Games
ORN	Olympic Route Network - the network of road lanes painted with the Olympic rings for athletes and accredited guests
TfL	Transport for London - the body in charge of London's transit system
UAE	United Arab Emirates: Country in the Middle East
VLT	Veículo Leve sobre Trilhos. (English: *Light Rail Vehicle*). A new form of above-land rail transport built in Rio in the lead-up to the 2016 Olympics
WHO	World Health Organisation. Relevant for the purposes of this thesis because it sets the standards for acceptable levels of air pollution

Definitions & clarifications

-        "**Active mobility**": non-motorised transport, to include walking, running, cycling (bike or e-bike), rollerblading, scooting, wheeling, etc.

-        The "**Candidature File**" and "**Bidding Document**" are used interchangeably in this thesis to refer to the same thing: the document a candidate city submits to the IOC, outlining its plans for how it would manage Olympic hosting, were it to be selected.

-        **"Centennial Games":** The 1996 Olympics which were held in Atlanta, USA, 100 years after the first Modern Olympics in 1896. Athens' unsuccessful bid to host these Games - due largely to the IOC considering their *Transport Concept* to be "not well punctuated" and their main argument simply being that the Games should "come home" - was what spurred their successful bid for the 2004 Olympics.

- "**Centre d'Etudes Olympiques**": IOC Olympic research centre, located in Lausanne, Switzerland. Publisher of the *Candidature Files* and research funded by the IOC.

- "**Mega event**": Large-scale, international events hosted in one location (city, region, country or multiple countries) for a short period of time (usually one or multiple days or weeks). The most well-known of these are: the Summer Olympics, Winter Olympics, FIFA World Cup (international football championship), and World Expo (a fair that exhibits the culture, architecture and food from every country of the world), but they can also include music festivals and other sporting events.

- "**Metro**", "**subway**" and "**underground**" are all used interchangeably here to refer to the same thing: an urban underground railway system

- "**Modal distribution**" or "**modal share**": The share of total journeys taken by different forms of transport, to include, e.g. public transport, private vehicle, walking and cycling.

- "**Motorisation rate**": The number of cars per 1,000 people in the population

- The "**Olympic Family**": the prioritised group of individuals when it comes to Games-planning. The group essentially consists of most non-spectators: athletes, coaches, major sponsors, media, the IOC, and other accredited guests

- "**Non-Olympic cities**": those that have never hosted either the Winter or Summer Olympic Games

- "**Rio**" and "**Rio de Janeiro**" are used interchangeably in this proposal; while the latter is the formal, full name of the city, it is more commonly referred to by the former, shortened version

- "**Sustainable transport modes**": means of transport that does not require a private, motorised vehicle. This includes, but is not limited to: walking; cycling; electric cars, bikes or scooters; and public transport

- "**The Olympic Games**", "**The Olympics**" or the "**Games**" refers to the Summer Olympic and Paralympic Games.

- **Tokyo 2020/1**" refers to the Summer Olympic & Paralympic Games that took place in Tokyo in 2021. Originally scheduled for 2020, they were delayed due to the COVID-19 pandemic. The Games are commonly referred to as either "Tokyo 2020" or "Tokyo 2021" and so both years are included here for clarity

- A city's "**Transport Concept**" is the description in its Candidature File of how it is going to manage the mobility of athletes, spectators, sponsors and media during the Games

- "**Transit/transport system**": The infrastructure, policies and institutions that facilitate the movement of people. For the purposes of this thesis, this is focused on within-city networks, as well as lines that connect the city with the major airport(s) that serve it.

- **"Transfer of Knowledge" programme** - also referred to as the "Olympics Knowledge Management Programme" or "OKMP", as it was renamed in 2005. Set up by the International Olympic Committee (IOC) in order to promote the sustainable and positive legacy of Olympics-driven transport changes, this facilitates communication and transfer of knowledge between previous and (prospective) future host cities, the participation of organisers of future Olympics in events of the current Games cycle, and grants access to topical experts (such as Philippe Bovy for transport)

- The **"World Cup"** refers to the the finals of the FIFA football world cup, hosted by a different country every four years

- The **"World Expo"** is an exhibition featuring all the countries of the world that exhibits the culture, architecture, ideas and food of the participating nations and is organised around a central modern-day challenge. Lasting up to six months, it is held in a different country every five years

N.B:

1. Dates of the publication of media reports are referred to in the DD/MM/YY format.
2. The image quality from cities' *Candidature Files* not optimal, but some figures have still been included to give an impression of the layout of event venues and transport connections

Abstract

This thesis investigates the transport component of mega-event driven development through the case studies of four former Olympic host cities: Athens (2004), Beijing (2008), London (2012) and Rio de Janeiro (2016). By comparing each city's baseline scenario with the transport changes that were promised in its bid to the IOC and those then implemented in the lead-up to the Games, the catalytic effect of Olympics-hosting on improving a city's transport - particularly public transport - infrastructure will be outlined. The impact of these Olympics-driven changes will then be investigated, through an analysis of the effect this had on the longer-term trajectory of each city's transit system and the behaviours and perceptions of those that interact with it. This is uncovered through an analysis of transport-related media reports published before, during and after the Games (to gain an understanding of reported public opinion); academic and grey literature on the Olympics' transport legacy (including policies that were introduced during the Games and maintained or tightened afterwards, or transport lines that were built for the event and extended after it was over); and available public opinion surveys on their perception of these transport changes. Through comparison across the four case studies, this thesis concludes that Olympics-hosting does spur the rapid development of a city's transit system, especially the coverage and capacity of its public transport network. However, this comes at a cost - in terms of public finance (especially for small or lower/middle income countries); opportunity (with money spent on, e.g., new airport-to-city centre connections or venue-to-venue lines that might better serve the local community if used on other projects); and equity (with new lines not affordable for, or useful to, all residents). This impact is correlated with each city's baseline scenario, with those that have more limited infrastructure at the time of bidding experiencing the most rapid developments in their transport system, but also more likely to experience the aforementioned costs.

Introduction

Societal Problem

The concept of "mega-event driven development" has attracted increasing attention in recent years, as it has become clear that cities have targeted the hosting of mega-events not just out of interest for the event itself, but also as a means of catalysing urban development (Varrel & Kennedy, 2011; Taha & Allan, 2020). A successful bid to host such an event brings with it a hard deadline before which a city must implement the necessary changes to its transport system in order to facilitate the safe and efficient movement of large numbers of people. A mega-event also brings the attention of the world's media, funding from private sources (such as sponsors) and the focus of academics and professionals in the field of urban development – all promoting changes to the city's transport system. However, such a rapid process of urban development – in contrast to the more incremental norm – may have consequences (Martins Rodrigues, 2014). These include the vast amount of public spending that is required to implement these transport changes (and the opportunity cost of this spending); the rushed implementation of new transport infrastructure which is then completed to a lesser standard than planned; disruption to local livelihoods during this implementation; and a focus on transporting athletes and spectators between event venues during the weeks of the Games rather than serving the city's residents once the event is over.

This thesis thus investigates the impact of mega-event driven transport development on a city's transit system and the experiences of its residents. The Summer Olympics have been chosen as the mega-event to focus as the world's biggest, most famous, and most focused on one individual city (unlike the next biggest mega-event - the FIFA World Cup - that is hosted by multiple cities within a country). The Olympics rotate every four year cycle, with a different city hosting the event each time, resulting in the imbalance between short-term requirements for the Games delivery and the long-term interests of those living in the city. The transport component of Olympics preparation and hosting has been selected as its impact is the most tangible and affects all residents - unlike, for instance, sports infrastructure, whose impact is less universal. The four host cities of Athens, Beijing, London and Rio de Janeiro were chosen as they each came to the point of Olympics bidding and hosting from a very different starting point of urban development, the transport infrastructure that was already in place, and the opportunities that were presented to its citizens as likely to arise from hosting the event.

This thesis therefore aims to uncover the impact of mega-event-driven development in cities starting from a different baseline, through the lens of the biggest such event hosted in one individual city - the Olympic Games.

Scientific background and previous studies

Various scholars have investigated the concept of mega-event driven development, and the changes that are implemented to a city's transport system as it prepares to host the Olympics. Martins Rodrigues (2014) explains that the nature of a mega-event - which brings with it a huge influx of people and places the city on a world stage - provides the impetus for "revolutionary" urban development, at a rate much faster than the typical "evolutionary" norm, with incremental change over many years. This brings with it a promise of associated benefits for citizens which is used by cities as a rationale for them to support the mega-event bid, as Ribeiro & Almeida (2020, p. 36) explain: 'Olympic bids promise improved transportation systems as a legacy for host cities, allowing the population to expect an opportunity to improve accessibility and urban mobility'. Some emphasise the perks of such accelerated development of cities' transport systems, arguing

that it 'provides an opportunity to make rapid urban transformations because of the availability of both public-sector and private-sector funds' (Yamawake & Tomaz, 2019, p.1). Kassens-Noor (2015, p. 2) adds that it is 'widely believed the Olympics can achieve completion of twenty-year initiatives in only a six-year span prior [to the] Games'. Coaffee (2007), similarly argues that the period between the bidding for, and hosting of, the Games, allows for 30 years of urban development initiatives to be compressed into this period between a city being chosen as host by the IOC and its hosting of the Games. As Fitzgerald & Maharaj (2022, p. 181) explain, this mega-event driven development has been particularly targeted by the BRICS emerging economy countries (Brazil, Russia, India, China and South Africa). Two cities in these countries – Rio de Janeiro and Beijing – are included in this research.

While some scholars, therefore, highlight the potential benefits of mega-event-driven development, others have raised concerns about the consequences of these accelerated transport changes: their high cost and the impacts they may have on individual livelihoods. Some point out that this results in a high public debt that may be difficult to repay - particularly in host countries/cities that are emerging economies and have limited transport infrastructure at the time of winning its bid, and that must therefore invest a significant proportion of public finances in increasing this infrastructure in the lead-up to the Games. Others point out the opportunity cost of such spending: 'A major public concern is that the money that is spent on infrastructure development could alternatively be used to address the social challenges in the host city and country' (Fitzgerald & Maharaj, 2022, p. 181). This is widely reported to have been the situation in Athens, for example, where both media and academics (e.g. Crotty, 2009; Georgiakis & Nauright, 2012; Karamichas, 2012; Panagiotopoulou, 2013) have made the link between the money spent on the Games and the financial crisis that began in 2009. Others focus on the negative impact of the Games on citizens' livelihoods, saying, 'Scholars show that the changes brought to Olympic cities may not improve urban mobility, lead to disruption of post-event urban services and consequently influence the quality of life of locals' (Ribeiro & Almeida, 2020, p. 36). In this sense, these authors contrast between the expectation of residents at the time when their city bid for the event and the reality of Olympics-driven changes. Such concerns can be exacerbated when money is invested in transport projects that do not have a defined purpose in after the Games, as these authors also explain (*Ibid*, p. 45): 'Making decisions without considering the city's future benefits for their locals may lead to extravagant spending on transport projects that are, ultimately, unnecessary'. Part of the challenge of Olympic transport planning is the mismatch between short- and long-term goals: the requirements for the weeks of the event versus the interests of the city's residents once the event is over. This 'long-term legacy is more important for the city... but the short-term design requirements are much better specified, understood and funded' (Iereomonachou et al, 2010, p. 332).

Most of the studies that have been done on this topic so far on the impact of Olympic hosting on a city's system focus on a case study of one individual city. It appears that there has only been one (published) study so far that aims to compare findings across different Olympic host cities, a paper by Kassens-Noor entitled 'Transport legacy of the Olympic Games, 1992-2012' (including Barcelona, Atlanta, Sydney, Athens and London, published in 2013). As the name suggests, this paper focuses on the long-term impact of the hosting of the Games on a city's transport system. She particularly highlights the influence of the IOC's *Transfer of Knowledge* (now *Olympic Games Knowledge Management* (OGKM)) programme (whereby future (potential) host cities can engage in dialogue with topical experts and previous hosts in order to learn from their experiences) and the specific nature of the Games on the transport system that results in the city. She finds that these five host cities experienced five major changes to their transport systems: new or improved airport-city centre transport connections; airport improvements; new high-capacity transport modes; additional road capacity; and so-called "advanced intelligent transport systems" (to include new traffic management centers, observation cameras along travel routes, and variable message signs). She stresses the danger of underutilisation of Olympic-driven transport projects and recommends that 'resources, staff, and knowledge management prior to the Games have to be arranged so as to sustain after-Games use' (*Ibid*, p. 404). She explains that even though the four host cities she has studied are clearly very different, the

transport legacies are similar 'because of the almost identical demands the Olympics places on the hosts' transportation systems, which have accumulated in the IOC's Transfer of Knowledge programme' (*Ibid,* p. 405).

Research Gap

While Kassens-Noor's paper outlines the Olympics-driven transport changes implemented in five host cities, she does not aim to investigate the **impact** of these changes on the experiences and perceptions of individuals who interact with these transport systems. This impact can include the disruption to livelihoods and local businesses from transport changes that are made; whether, and to what extent, these changes alter residents' perceptions of their transport system; and any knock-on effects of efforts to reduce congestion, improve air quality and increase the modal share of sustainable transport methods for the Games. These individual impacts may be overlooked in a programme such as the OGKM one, which is the focus of Kassens-Noor's paper, given that it facilitates the "top-to-top" transfer of knowledge between organisers and authorities rather than through any bottom-up consultation with councils or local communities.

Furthermore, while Kassens-Noor finds that Olympics-driven transport changes are similar across different host cities, no matter what their baseline, because of the similar requirements that the Olympics places on these cities and the impact of the OGKM programme, she does not aim to understand how the differing baseline scenario of these host cities may affect the impact of these changes. For instance, while host cities prepare their public transit system to make it ready to transport large numbers of spectators between event venues, these preparations are likely to have a very different impact in Rio - which bid for the Games from a baseline of limited infrastructure - as compared to London, which already had one of the most established and developed public transit systems in the world. Congested and polluted cities like Athens and Rio were required to implement restrictions on private vehicle use in the lead-up to the Games; London, on the other hand, with an established congestion scheme already in place, did not need to implement any new measures. While Kassens-Noor's paper only includes cities of the Global North, this research includes two of these emerging economies - or BRICS countries: China (host of Beijing 2008) and Brazil (host of Rio 2016) - in order to help fill this research gap.

Research aim and research question

Given the research gap outlined above, the main research question has been formulated as follows:

(RQ): What is the impact of Olympics-driven transport changes on a city's overall transit system and its users, and how does this vary depending on the city's baseline scenario?

With sub-research questions as follows:

(RQ1): What Olympics-driven transport changes were implemented to the transport systems of Athens, Beijing, London and Rio?
(RQ2): How did these changes affect the behaviour, perceptions and livelihoods of residents interacting with these systems?

(RQ3): How do these changes and their effects differ by each city's baseline scenario - *the state of their transport system at the time it successfully bids for the Games?*

The overall aim of this thesis is to investigate mega-event driven development in practice: that is, the impact that a city's urban development catalysed by one specific mega-event has on citizens - and how this is affected by the city's starting point when it comes to the point of mega-event-hosting.

(RQ1) will be answered by analysing each city's *Transport Concept,* and comparing this to the changes that were made to the city's transport system in the years between their successful bid and their hosting of the Games. This include, for example: airport expansions (Athens, Beijing), new airport-to-city centre connections (Athens, Rio), new and expanded metro and light rail systems (Athens, Beijing, Rio); temporary Games lanes for the Olympic Family (the prioritised group, including athletes, coaches, media, top sponsors, and other accredited officials) (Athens, Beijing, Rio, London); and new policies or public campaigns to reduce congestion and air pollution (Athens, Beijing, Rio). Also included will be continued changes to the city's transport system after the Games, if they can be shown to be a direct legacy of The Olympics (such as the continued expansion of a rail line or metro system that was originally built for the Games (Beijing, Rio); or the maintenance of reduced public transport prices or restrictions on private vehicle use after the Games are over (Beijing)).

(RQ2) has been formulated in direct response to the research gap outlined above, so as to gain a greater understanding of not just these changes themselves but the impact they had on a host city's residents. This includes, for example, if new transport lines constructed for the Games were utilised and useful to residents after they were over (Athens, Beijing, London, Rio); the disruption to local livelihoods and businesses during the building of these new lines or during the Games themselves (Athens, London, Rio); the impact on citizens of restrictions on private vehicle use that aimed to reduce congestion (Athens, Beijing); whether or not Olympics-driven transport changes actually led to a shift in the modal distribution of different transport methods (Athens, Beijing, London); the opportunity cost of these changes; and, ultimately, how citizens perceived their overall transport system in the aftermath of the Games, based on public opinion surveys (Athens, London, Rio). This question will be answered by means of a media review of transport-related news reports from different sources from each city in the lead-up to, during and after the Games and a review of public information surveys, to the extent that they exist (available for London, Rio and Athens but not Beijing).

(RQ3) aims to address the second part of the research gap: whether or not, and to what extent, these transport changes and their effects differ depending on a city's baseline situation. That is, how mega-event-driven development varies between a city like London (with an extensive and widely used existing public transport system), Athens (with considerable problems of congestion and illegal parking), Beijing (where a culture of cycling had been replaced by rapid motorisation and whose public transport system had not kept up with rising demand) and Rio (a city of the Global South where sustainable transport modes dominated, but whose congestion was among the worst in the world). As Kassens-Noor has explained, Olympics-hosting places similar demands on cities, regardless of their starting point. However, the impact of this starting point on the effects of these demands remains unstudied. With emerging economies increasingly targeting mega-events in order to catalyse their development, it is crucial to understand the impacts of this accelerated and Olympics-tailored development on the residents of host cities. This will be answered by comparing the impacts described in response to (RQ2) with each city's baseline scenario.
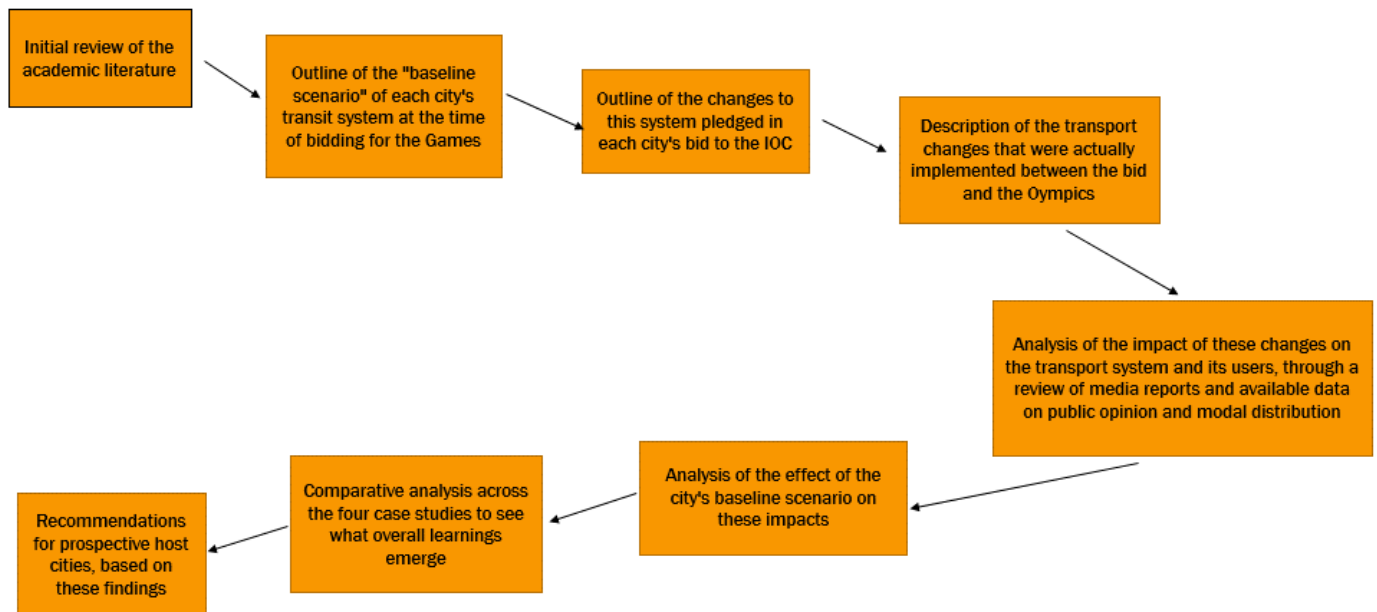
Research framework

Figure 2: Research framework

Source: Author's own

Theory

Key concepts: mega-event driven development; mega-event syndrome; white elephants; focusing event

This thesis investigates the impact of Olympic hosting on cities' transport systems and the citizens that live in these cities and interact with these systems. There are a number of theories that can be applied to this research. These include: mega-event driven development; mega-event syndrome; white elephants; and the concept of a focusing event.

As noted above, part of the reason a city may seek to host the Olympic Games is because it provides the impetus, funding and strict deadline for significant investments in transport infrastructure and institutions, resulting in an accelerated pace of transport-system change. This is a case of "**mega-event driven development**" - as described by Duignan (2021). As the term suggests, this refers to development that is specifically driven by the hosting of a mega-event. 'The hosting of mega-events has been actively pursued by some of the world's major centres as a way to "fast-track" their urban regeneration agenda and stand out among the global competition for international capital' (Silvestre, 2021, p. 1). As noted above, Kassens-Noor argues that this can result in urban transport development that may be suboptimal for the city, with new infrastructure arranged in specific clusters around event venues rather than necessarily being best-placed for citizens - ultimately resulting in large amounts of public money spent on new transport lines that are under-utilised, rather than on more pressing social concerns.

The fact that the hosting of the mega-event provides a fixed, immovable deadline for implementing certain transport changes - and international attention - means that it acts as a "**focusing event**" for significant changes to the city's transport system. This concept of a "focusing event" is one usually applied to public

policy theory - tangentially related to the field of urban transport investment and development. Such an event is 'a critical moment that brings a particular policy issue to the fore' (Atlas of Public Management, n. d.). These are seen as windows of opportunity for progress to be made within a specific policy area, usually triggered by a sudden crisis - like, for example, increased investment in renewable energy as an alternative to nuclear power in the aftermath of an accident at a power plant. However, it is also possible to apply this theory to 'institutionalized events such as periodic elections or budget deadlines' (Béland & Howlett, p. 223). In this sense, the hosting of the Olympics Games is a deadline before which a city has to implement certain transport infrastructure and policy, to fulfil the IOC's expectations for the event.

However, as previously noted, this focusing event can create a mismatch between short-term goals (the hosting of the Games) and a positive long-term legacy. This may result in short-term thinking and legally-questionable urban planning along the lines of "**mega-event syndrome**", as coined by Müller (2015). He describes this "syndrome" as, 'a group of symptoms that occur together and afflict mega-event planning, including overpromising benefits, underestimating costs, rewriting urban planning priorities to fit the event, using public resources for private interest, and suspending the rule of law'. (*Ibid* p. 6). Müller thus cautions ambitious promises being made to citizens at the time of bidding for the mega-event: 'an event host … [should] … not tie mega-events to large-scale urban development, avoiding higher risks that could create cost overruns, substandard construction quality, and oversized infrastructure not suitable for post-event demands' (*Ibid*). This conflict - between the potential benefits for citizens resulting from their city hosting the Olympic Games but the high risk of benefits not being realised - merits a study like this which aims specifically to focus on these impacts, on both overall transit systems and individual citizens.

One of the potential consequences of this so-called "mega-event syndrome" is the construction of infrastructure that ends up falling under the categorisation of "**white elephants**". As defined by Turro & Penyalver (2019, p. 3) there are 'major projects, showing certain political or even economic short-term appeal but that are essentially inefficient' or, alternatively, 'investment projects with negative social surplus' (Robinson & Torvik, 2005, p. 197) - that is, the cost of these investments is greater than the societal benefit that is derived from them. 'They are a particular type of inefficient redistribution, which are politically attractive when politicians find it difficult to make credible promises to supporters'; politically, they tend to "look good" but generally do not result in optimal societal benefits (*Ibid*). This might mean, for example, the construction of a new train or metro line to an Olympic venue that provides no social value once the Games are over. Phillipe Bovy, Olympic transport consultant, claims that these do not exist in the field of transportation; in a 2010 interview, he stated, "In 30 years of Olympic experience, I have seen quite a few sports venues turned White Elephants, but I have never seen real Transport White Elephants" (quoted in *its magazine,* February 2010, p. 16). An investigation of the **impacts** of new infrastructure built for the Olympics will help to uncover the veracity of this claim.

Methods

In order to answer the research questions and fill the research gap outlined, this thesis will proceed as follows:

1. An outline will be provided of the "baseline scenario" of each of the four host cities - Athens, Beijing, London and Rio - at the time of their successful bid for the Olympic Games - in 1997, 2001, 2005 and 2007 respectively. This will include an overview of its population size, transport system and rationale for bidding for the Games.

2. The pledges made by each city in its *Transport Concept* - its bid to the IOC - will be laid out. Where possible, the IOC's evaluation of these plans will also be included, along with public opinion surveys that illuminate how a city's residents perceived the bid.

3. These pledges will be compared to the actual changes that were implemented to the city's transport system in its preparation for the Games, as described in academic literature. Also included will be any changes that were implemented after the Olympics but that are clearly linked to a Games legacy - for example the continued expansion of a rail system that was built for the event or the maintenance or further tightening of policies to limit congestion or encourage public transport use that were first implemented for the Olympics. The combination of 2 & 3 will answer *(RQ1): What Olympics-driven transport changes were implemented to the transport systems of Athens, Beijing, London and Rio?*

4. In order to understand the impact of these transport changes on the city's residents (to answer *(RQ2): How did these changes affect the behaviour, perceptions and livelihoods of residents interacting with these systems?*), the results of a review of transport-related media reports from each host city will be outlined. This media review has been conducted by searching for the key terms "name of city + transport + Olympics + year of hosting" in the online archives of regional, national and international news outlets for each host city. BBC World News reports were included for all case studies for consistency and to give an international perspective. Additionally, the following news outlets have been included for each city, giving a total number of reports of (n=x):
   a. **Athens:** El Kathimerini (national perspective, included because it has an English version and an extensive online archive from this time, unlike most Greek news outlets). n = 47
   b. **Beijing:** China Daily (Beijing-based newspaper, included because it has an English version). While this is a state-run newspaper (the media in China is censored), many of its articles are critical and it appears to have a balanced perspective. n = 101
   c. **London:** The Daily Mail (a right wing, tabloid publication) and The Guardian (a left wing, broadsheet publication) (considered the "most" right and left wing of the UK's news outlets in a 2017 YouGov poll). Both of these were included to give as balanced a perspective as possible, there not being a language barrier in this case. n = 44
   d. **Rio:** The Rio Times (English language, national scope) and Diario do Rio (Portuguese language (not a barrier in this case), regional focus). Again, both included to try and give a balanced perspective. n = 49

In addition to these media reports, information from academic papers, grey literature and public opinion surveys is included where available to give as full a picture as possible of the impact of Olympics-driven transport changes on the behaviours and perceptions of city residents.

5. The results of 3 & 4 will be compared to 1 - the baseline scenario - in order to understand how these changes and their effects differ based on each city's starting point, and these results compared among the different cities in order to see what overall learnings emerge. While, as Kassens-Noor describes, Olympic host cities tend to focus on the same elements of a transport system in order to prepare for Games hosting, the baseline situation will be shown to impact the speed and extent of these changes, as well as their impact on residents. This comparison will seek to answer *(RQ3): How do these changes and their effects differ by each city's* baseline scenario - *the state of their transport system at the time it successfully bids for the Games?*

6. Finally, the results of this research will be used to provide recommendations for future (potential) host cities of the Olympics and other mega-events, as well as for the IOC (or organising body of other such mega-events).

Results: The four case studies

Transport at the Olympics & rationale for selection of case studies

Unless stated otherwise, the following information has been gathered/deduced from reading individual cites' candidature files, available open-access from the IOC's Centre d'Etudes Olympiques (*Olympic Research Centre*).

The Summer Olympic Games are the biggest international sporting event in the world, featuring athletes from every country. Held in a different city every four years, they are considered to be the pinnacle of sporting performance. Olympic transport consultant Philippe Bovy (2017) summarises the monumental size of the Summer Olympic Games: there are 205 participating countries, 11,000 athletes, 6-7,000 supporting staff, 5-6,000 officials, 25,000+ accredited media, 100-200,000 volunteers, 6-9 million ticket sales, along with a paid workforce, logistical staff, security personnel and worldwide audience of half the world's population. These millions of people have to be transported between dozens of different event venues over a period of several weeks with perfect reliability; the hosting of such an event therefore requires a transport system that is efficient, extensive and user-friendly.

In order to be granted the right to host the Olympics, a city must engage in a competitive, multi-step process. First, if there are multiple potential bids from the same country, they must be selected by their National Olympic Committee. The next stage is the "Candidature Phase" during which they submit their "Candidature File" to the IOC. This file must cover the 17 criteria required by the IOC as to why the city is suitable for Olympics-hosting, and why they should be selected, including, for example: Environment and Meteorology; Customs and immigration formalities; Medical and health services; and, of relevance for this thesis, the "Transport Concept": how the city will manage the movement of people during the Games. These criteria are assessed by the IOC based on a weighted average system with a shortlisted selection of cities then visited by the IOC. One city is then selected to host which must then sign a contract with the IOC, stipulating that the plans should not be altered before the event except with the consent of the committee. Each host city's *Transport Concept* must include a guarantee from the relevant (transport or governmental) authorities that the permission and resources to ensure the implementation of the promised changes exist; this ensures that the majority of these changes are implemented.

As Kassens-Noor (2013) explains, the specific nature of Olympics-hosting and the influence of the OGKM programme means that host cities follow a similar pattern with these preparations. The "Olympic Family" - is transported by private shuttles on Olympic lanes (which are part of the regular road system but are demarcated and closed off to the general public during the weeks of the Games; see Figure 3, below). Spectators, on the other hand, are expected to travel by public transport and active mobility (walking and cycling). This model has been in place since the Sydney 2000 Games, following the learnings from the previous Olympics in Atlanta, the "prime counterexample" for how Olympics transport should be done, when spectators missed events - and athletes arrived only moments before theirs - because of congestion in the city (Bovy, 2019).

Figure 3: Images of the ORN in London (left) and Rio (right)

Source: The Times (London) & Mail Online (Rio)

It is worth noting here that there has been a change in the bidding procedure in recent years, with the IOC now engaging in an iterative process of "targeted dialogue" with potential future host cities rather than through the candidature process outlined above. Brisbane (2032 Summer Games host) was the first to be selected through this process. This appears to be in response to a decreased appetite recently among cities to host the Games, as evidenced most clearly by the fact that many have withdrawn their bid following rejection by public referenda (Bason & Grix, 2018). For the Olympics, this includes Vienna (2028 Summer Games); Innsbruck and two separate proposed bids from the cantons of Valais and Graubunden in Switzerland (2026 Winter Games); Hamburg (2024 Summer Games); and Krakow and Munich (2022 Winter Games) (Livingstone, 2018). At the most recent IOC selection process for the Summer Games (in 2017), the two upcoming host cities, Paris (2024) and Los Angeles (2028), were selected without competition - in stark contrast with the 11 cities that competed for the right to host the 2004 Games. Further discussion of how this new selection process affects the relevance of the findings of this thesis is described in the *Limitations* and *Conclusions & Broader Relevance* sections.

CASE 1: Athens 2004

Outline of city & bid

Athens was famously the host of the original, Ancient Olympic Games as well as the location of the first Modern Olympics in 1896. The population of Athens was 3,145,000 in 1997 when making its bid for the Games; by 2004 it had risen slightly to 3,182,000, making it by far the smallest of the four case studies. With a population of 10 million (UN, 2023), Greece was also the smallest country to host the Games since Finland in 1952. This also meant that a high proportion of the country's GDP was required to host the event: USD 10bn reportedly spent on Olympic hosting (CNBC; Boomberg; Politico) from an annual GDP of USD 238.8bn in 2004 (World Bank, 2023). The city bid unsuccessfully to host the Games again 100 years later - the so-called "Centennial Games" - but lost out to Atlanta, as the IOC deemed the city had relied too heavily on the argument that the 1996 Olympics should "come home" without providing enough detail on how it would actually host the Games. Its 2004 bid therefore aimed to correct for this, with an extensive description of how existing and new infrastructure - which had already expanded thanks to EU funding - would be used to

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host a successful Olympics (Centre d'Etudes Olympiques, 1997). At the time of bidding, transport in the city was dominated by the automobile, heavily congested and notorious for illegal parking, which was rampant in the city (Kassens-Noor, 2015). The IOC, in its review of the candidates for the 2004 Games, acknowledges that, 'Athens presently has significant problems with airport access and transportation within the city' (IOC, 1997, p. 19). However, Athens' bid enjoyed great public support, with the vast majority of citizens saying they were in favour of Athens hosting the Games - it appears that this message of the Olympics returning to where they belonged was shared by most of its residents. As Georgiakis, S. & Nauright (2012, p. 6) describe, 'When Athens won the right to host in 2004, the Greek nation broke out in a wave of nationalist fervour'. It has not been possible to source the public opinion poll conducted by the IOC (for all candidate cities) that would be able to confirm this sentiment with data.

Transport description in bidding document

As described in its *Candidature File,* Athens' transport plans for the 2004 Games included: a new airport at Spata that would have a capacity of 16 million when opening and 50 million in its final phase; improvements to the (road and rail) airport-to-city centre connections; a new ring road around the city; an expansion of the metro (two new lines for a total network capacity of 49km that could carry 350,000 passengers per day) and suburban rail systems; a new light rail system that would serve the event venues along the coast; new dedicated lanes to speed up bus travel; a new integrated traffic management plan; a temporary ORN in the "Olympic Ring" which would connect the main event venues; and efforts to reduce the background traffic of Athenians (such as encouraging them to take holidays during the Games). The *Transport Concept,* along with the IOC's report on the 2004 candidate cities, explains that many of these infrastructural changes (including the airport, road and metro improvements) were already underway at the time of bidding, and would be completed whether or not the city was awarded the Games. As had been piloted during the Sydney 2000 Games (and as a response to the Atlanta disaster), the provisions for the Athens 2004 Olympics focused on the movement of spectators with public transport, with 'all possible measures… taken to discourage access by private car' (Centre d'Etudes Olympiques, 1997). However, there was still some provision for parking at venues in Athens, the last Olympic host to do so up until now.

As can be seen in *Figure 4,* below, the sport venues for the Athens 2004 Games were spread around the city rather than in one or multiple clusters, as was the case for the other host cities included in this research. This meant that new transport connections (*Figure 5*) built for the Games had the potential to serve residents and businesses from all over the city. As Kassens-Noor (2015, p. 4) explains, the transport investments made for the 2004 Games had 'great potential to set forth a new way of travel for Athenian commuters'. The exception to this was the new planned rail line along the coast to the Sailing Centre and Coastal Complex (also seen in *Figure 4*), whose projected legacy was based on the expectation of future developments in the area, but which failed to materialise because of the financial crisis that hit Greece from 2009 onwards (as explained in further in *Impacts*).

Figure 4: Map of Athens' Olympic venues. As can be seen, these were spread around the city, with the Olympic village in the North.
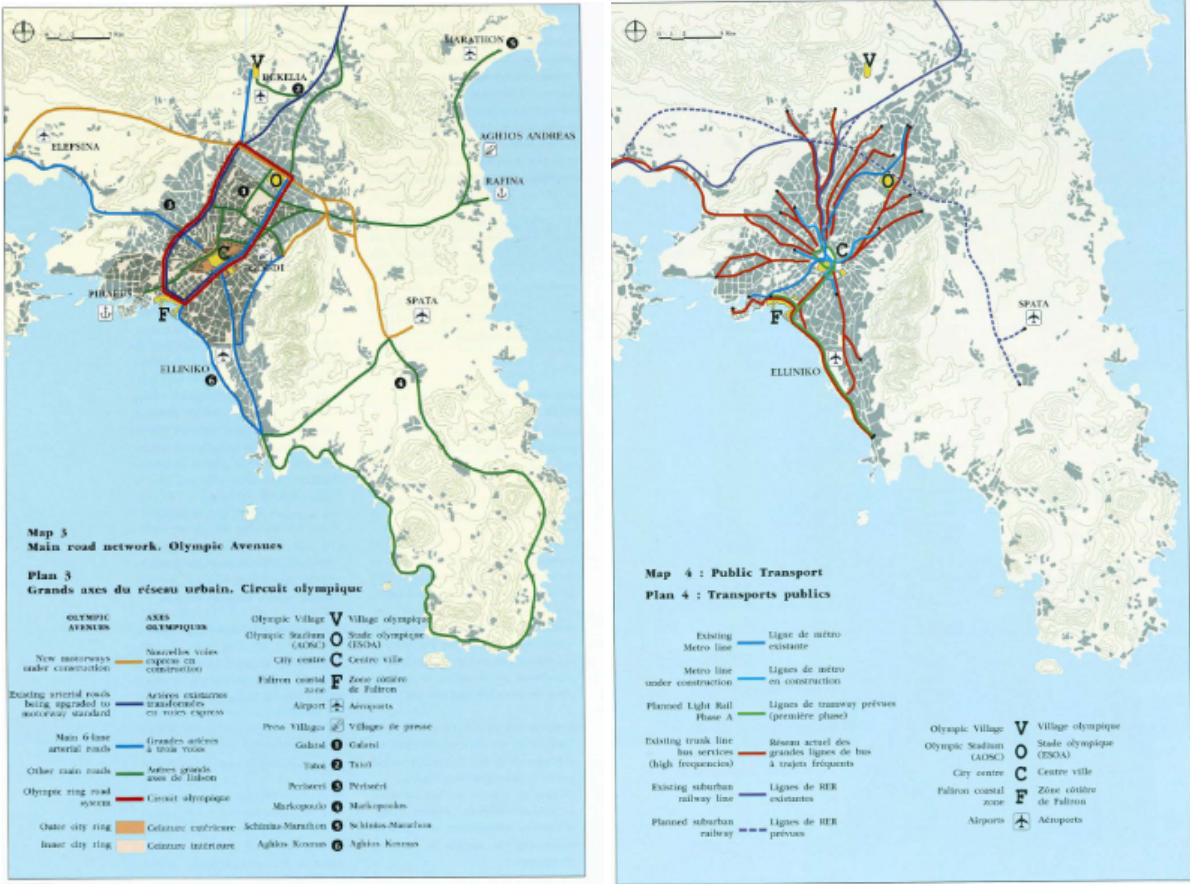
Source: Maps of World

FIgure 5: Maps of Athens plans for its road (left) and public transport (right) network for the 2004 Games

Source: Centre d'Etudes Olympiques (1997, p. 78 & 9)

Transport changes implemented

As promised in the bidding file, Athens made significant investment in, and improvements to, its transport infrastructure in the lead-up to the 2004 Games. The city 'completed construction for its new airport, modernized old and built new roads, made transportation accessible to the disadvantaged, extended the metro line and tram network, built a suburban rail line, increased the parking infrastructure, modernized train stations and inaugurated a state-of-the art traffic management centre' (Kassens-Noor, 2015, p. 4). New roads - including the highway promised in the bidding document - were built, while others were improved. The two additional metro lines were constructed, and improvements were made to the existing line. New stretches of the tram along the coast were built for spectators to be able to reach the Sailing Centre and Coastal Complex by public transport. In total, 40 km of new urban motorways, 80 km of a metropolitan arterial upgrades, a 30 km extension of the existing Metro Line 1, along with new Lines 2 and 3; a suburban rail network that was connected both to the new airport and national rail services; 23 km of light rail that connected the city centre of Athens to the coast (*Ibid*); and 180km of new bus lanes (Bovy, 2019) were built. Athens was the first city to implement the now commonplace ORN, with 160 km of roads specifically demarcated for the "Olympic Family" - athletes, coaches, media, main sponsors, and other accredited guests (Bovy, 2019). There was also a crackdown on illegal parking that had been commonplace in the city and a public information campaign to encourage residents to use public transport - or stay at home - during the Games (*Ibid*).

Based on the combined effect of these measures, according to Bovy (*Ibid*), the city's endemic road congestion was replaced by "fast, convenient Games travel journeys", and the city's transport system coped relatively well with Games transport - though, as he admits, this was partly due to lower-than-normal spectator numbers, as not all event tickets were sold. Furthermore, as outlined in further detail in the media review (below), these changes were not without challenges and, ultimately, were only completed at the eleventh hour. Kassens-Noor (2015, p. 4) explains: 'This development did not come easy. In the first three to four years, Athens barely made any progress in implementing the infrastructure as advertised in its Olympic bid. Preparations were stalled by agency feuds, because responsibilities for paying, building and operating the infrastructure had not been clearly assigned before the bid'. Furthermore, while the transport lines were completed in time, this was not true of all event venues, with the Olympic Village reduced in size, no roof on the pool and a smaller number of venues overall (*Ibid*).

Media review

While Athens' *Candidature File* claims that most of the proposed changes to the city's transport system would have been carried out anyway, even if it had not won its bid, a review of the media reports suggests differently: that without the fixed deadline of the Games, many of these changes would not have been completed. As described by one opinion piece ('Rendezvous with 2004 finally arrives', *Kathimerini,* 02.01.04), 'Athenians and Greeks will have the Olympics, and the 2004 deadline, to thank for countless improvements to their capital'. Another ('Games force urban makeover, *Kathimerini*, 27.12.02) reports the Transport Minister as saying, '"The Olympic Games bring with them discipline because they have an immovable deadline of the Opening Ceremony. That kind of deadline did not exist in my county many times."' Authorities hoped that through investment in a wide range of transport modes - tram, metro, bus, light rail and improved roads - they would encourage a long-term shift in Athenians' mobility choices, from 21% modal share of public transport in 2002 to 42% "in the next few years" ('French experts help Greece in traffic management for 2004', *Kathimerini,* 17.04.02). The hope was that this would be in contrast with 'the car is king' mentality described by the President of the International Paralympic Committee (IPC) (in 'Athens tries to bring order to parking chaos for Olympics', *Kathimerini,* 18.02.04). Illegal parking and congestion were

rampant across the city (as mentioned in 8% of reports), with a 100:1 ratio of cars to legal parking spaces, little enforcement of parking regulations and 70,000 new cars added to the city's streets each year. As described by one report (*Ibid*), 'Unlike in any other major European capital, meters simply do not exist in Athens. What does exist is parking anarchy.'

The predominant theme that emerges from a review of Olympics transport-related media reports in the lead-up to, during and after the Athens Games is how behind schedule the preparations were: this is mentioned in 44% of the reports included in this review. This even led to threats from the IOC (mentioned in 9% of reports) - issued publicly to the Athenian organising committee - that they would choose a different host city if Athens did not make progress more quickly. This tardiness in the Games preparations was reportedly a result of leadership problems (6%) and excessive bureaucracy (2%) and resulting in backtracking on initial plans (15%) because they were behind schedule (30%) and/or over budget (6%). However, as outlined by Kassens-Noor (2015), these concerns were more heavily directed towards venue, rather than transport, preparedness.

In the end, according to these reports, and as explained by Kassens-Noor (2015), the Athens Olympic Games Organising Committee (OGOC) sped up its rate of preparations from 2000 onwards. 'The head of the Athens organising committee says they've created a mirable in less than four years'. ('Athens dashes for finish in Olympic race', *BBC World News,* 13.02.04), with the Transport Minister reported as saying, 'the impossible has been achieved'. 16% of reports say that transport for the Games would, in fact, be ready for the Opening Ceremony. Specifically changes mentioned are the new metro line (9%), tram link between the new airport at Spata and the city centre (6%), the tram along the coast (9%), a modernised signalling system (4%) and overall improvements in the city's transit network that was expected to have a beneficial legacy (9%). The reports of these transport changes were largely positive, with a recognition that the city's transport infrastructure had benefitted massively from Games-hosting.

Then-IOC President Jacques Rogge was reported as saying, "Athens is a different city. You have made great preparations ('Transport: Long may the miracle last', *Kathimerini,* 10.08.04). However, this caused significant disruption to Athenians during construction and throughout the weeks of the event itself (described in 6% of reports). As described by journalist Richard Galpin, 'As the deadline for the Opening Ceremony on 13 August draws ever closer, so the pace of construction work in Athens grows increasingly frenetic. The capital now more than ever resembles a large building site.' ('Athens dashes for finish in Olympic race', *BBC World News,* 13.02.04). To cope with this, Athenians were encouraged to stay home as much as possible.

Because of the delays and rushed nature of the preparations at the end, the potential for a positive legacy was not fully realised and changes to the original plans in the city's *Transport Concept* had to be made - such as not all of the new Metro Line 3's stations being ready in time for the Games and a change to the marathon route because necessary road improvements were not completed on time. Furthermore, although Athenians were willing to change their mobility patterns during the weeks of the Games themselves, the Transport Minister's claim that, 'We have developed a new transport culture in Athens' (quoted in 'New Plan for Athens transport, *Kathimerini,* 23.09.04) appears not to have materialised. Instead, 'As soon as the Games were over … it was clear that - without the International Olympic Committee's incessant carping and with the Greeks no longer needing to put on their best face for the world … everyone went back to business as usual' ('Life after the Games, *Kathimerini,* 08.08.08). This suggests that the 16 days of the Olympics (plus 12 of the Paraympics) is not enough in itself to instigate long-term behaviour change. Finally, not all of the transport investment would be of use to residents post-Games; the most cited of this was described in a 2002 *Kathimerini* ('Games force urban makeover, 27.12.02) report as not a 'new set of clothes' but, rather, 'a

tailor-made garment to be worn once during the Olympics'. This lost opportunity for legacy is described in greater detail below.

Number of reports: *n = 47*

Theme	Mentioned in x# of reports	Mentioned in x% of reports	Comment/quote
Aim to increase the modal share of public transport use in the city	2	4	From 21% in 2002 to 42% 'in the next few years' (*Kathimerini,* 17.04.02) Increase in modal share of public transport during the Games, with the restrictions on private vehicle use (tram 7%, city buses 10-20%, metro 12%), but not maintained after (*Kathimerini,* 10.08.04)
Behind schedule	14	30	'As the deadline for the opening ceremony on 13 August draws ever closer, so the pace of construction work in Athens grows increasingly frenetic. The capital now more than ever resembles a large building sight' (*BBC World News,* 13.02.04)
IOC threats that the city might lose the Games	4	9	
Other IOC criticism	2	4	
Over budget	3	6	Tram and light rail end up being about 120m over budget (*Kathimerini,* 30.06.04) Total cost of Olympics reported as €8.95bn - almost 5x the budget of the organising committee (*Kathimerini,* 13.05.05)
Problem of congestion	1	2	'Traffic is one of the biggest problems in this city of nearly 5 million people and 2 million cars' (*Kathimerini,* 03.10.02)
Problem of illegal parking	3	6	"I never pay the tickets from the municipal police. Why should I? They are understaffed, have outdated records, how are they going to find me?" - reported by one resident (*Kathimerini,* 18.02.04)
Traffic restrictions and/or	2	4	

police crackdown during the Olympics			
Fears of long-term financial consequences	1	2	
Managing to be on schedule in the end/positive message about the readiness of the city	7	15	Not all projects: some adjustment to original plans in order to be ready for the Games (see *Impacts,* below) "Athens is a different city. You have made great preparations" - IOC president Rogge (quoted in *Kathimerini,* 10.08.04)
Backtrack on some initial plans because of schedule and/or budget concerns	7	15	Smaller no. of tram stations built (30 of the 48 planned) (*Kathimerini,* 14.10.03) Change to the marathon route because the road improvements were not completed on time (*BBC World News,* 26.03.04)
Overall improvements on city's transit network (infrastructure) - legacy	4	9	'The Games in Athens have led to a significant upgrade of the city's transit network' (*BBC World Service,* 12.07.04) Athenians and Greeks will have the Olympics, and the 2004 deadline, to thank for countless improvements to their capital, for providing a long-term economic boost that will counteract their cost, and for giving the country a welcome shot of pride' (*Kathimerini,* 02.01.04)
Athenians resuming pre-Games behaviour and mobility patterns post-Games	3	6	'As soon as the Games were over, though, it was clear that – without the International Olympic Committee's incessant carping and with the Greeks no longer needing to put on their best face for the world – there was no plan for the day after. Everyone went back to business as usual' (*Kathimerini,* 08.08.08)
New Spata (airport)-Athens connection	3	6	
Metro expansion	4	9	Metro reported to be one of the "few shining legacies of the 2004 Olympics" - one of the cleanest, safest, fastest, most punctual in the world (in stark contrast with the rest of the city's transport system). In 2013, it was carrying about

			650,000 passengers a day (*Kathimerini,* 24.01.13)
Expansion of bus network	2	4	400 new buses and 21 Olympic bus lines (*Kathimerini,* 10.08.04)
New tram along the coast	4	9	Plans to expand this further in 2006 and 2007 (*Kathimerini,* 21.05.02)
(Prospective) concerns about the legacy of this tram	1	2	
Leadership problems/disputes between officials and contractors	3	6	'Years of personal feuds and government indifference had left the project at a standstill' (*BBC World News,* 24.08.00)
New integrated traffic management	1	2	Projected to be a positive Games legacy (*Kathimerini,* 23.09.04)
Concerns about excessive bureaucracy	1	2	
Road improvements	2	4	
New airport at Spata	3	6	Opened in March 2001 (*Kathimerini,* 21.01.05)
New tram link between airport and city centre	1	2	
Mention of ORN	2	4	
Modernisation of signalling system	2	4	
Disruption to residents (construction)	3	6	Advice to stay at home as much as possible (*Kathimerini,* 17.04.02)
Disagreements with taxi drivers	1	2	
Disruption to local livelihoods during the Games/Athenians leaving the city during the Games in order to avoid this disruption	1	2	Special provisions for Olympic Family 'will make driving and parking for everyone else a nightmare' (*Kathimerini,* 18.02.04)

Impacts

As will also be seen in the cases of the other host cities, the hosting of the 2004 Games resulted in the rapid development of Athens' public transport system; this mode of transport became convenient and reliable, leading to a decreased need to rely on a private vehicle to get around. While, as noted in the media review, this did not cause an immediate increase in the modal share of public transport, it did gradually grow over

time - up to 38% in 2008 to 43% by 2011 (Kassens-Noor, 2015), meeting the 42% goal mentioned of the organising committee. New bus lanes evolved using the original Olympic network, allowing 50% of people in the inner city to travel by bus, which accounts for just 3% of the overall congestion in the city (*Ibid*). Based on these figures, Bovy (2019, n. p.) is positive about the legacy of the Athens Olympics, saying, 'All these transport projects (much by rail) provided a strong boost of sustainable transport legacy'. The experience of hosting the Games also allowed the city to have better emergency response preparedness, and a greater level of efficiency in overall transport management (Kassens-Noor, 2015). The improvements to the road network have also had a positive long-term impact, with the Attika tollway 'the most utilized and arguably the most important road legacy to come out of the catalytic Olympic process' (*Ibid*, p. 5).

However, the challenges that were faced in the lead-up to the Games had a serious impact on the transportation legacy that was left behind, with not all Olympics-driven transport changes maintained. The innovative Olympic village traffic scheme and traffic demand management schemes (along with the stricter enforcement of illegal parking regulations) that had been successful during the weeks of the Olympics were scrapped in the years afterwards (Yannis et al, 2009; Minis et al, 2009). Furthermore, as described in the media reports, 'Soon after the Games the congestion that plagued the city before the Games resumed' (Kassens-Noor, 2015, p. 3) - in spite of the expanded public transport coverage. Indeed, the economic crisis in the country had more of an impact on automobile use and congestion than the Olympics, with a 10-15% drop in the number of cars on the peripheral highway from 2009 to 2011 (*Ibid*). The tram extension along the coast has also underperformed in terms of legacy: the projected housing and retail development that the line planned to serve in the aftermath of the Games did not, in fact, take place, due to the financial crisis that hit the country in the years after the Olympics. It was also not convenient, taking three times longer than the car for point-to-point travel (*Ibid*). In this sense, as Kassens-Noor (*Ibid*) describes, this new tram line was "not future-proof": it had been built with a speculative, rather than certain, future use in mind. Indeed, as mentioned, the city's hosting of the Games has largely been blamed for the unsustainable spending and public debt that then ensued (CNBC; Boomberg; Politico). The fact that spectator ticket sales were lower than in most other Games allowed meant that the city's transport system coped better than predicted with the movement of fans - but also resulted in lower-than-expected income for the city, exacerbating this debt crisis (Bovy, 2019). Furthermore, despite the fact that Athens' dispersed network of Olympic venues allowed transport improvements to benefit most of the city's residents, Kassens-Noor (2015) explains that not all communities felt a positive impact - especially those living on the outskirts of the city and in gypsy communities. No data on public opinion could be found to quantify the perceptions of Athenians towards the Olympics-driven transport changes, besides what can be deduced from the gradual increase in the modal share of public transport in the city.

Transport changes	Impacts	Effect of the city's baseline scenario on these impacts
- 30km extension of Metro Line 1, along with new Lines 2 and 3 - New airport at Spata - New airport to city-centre rail connection	- Significant additions to Athens' public transport system led to a small increase in the modal share of public transport in the city, which continued in subsequent years - The improvement in the city's congestion levels did not remain in place after the Games were over, as Athenians who had stayed at	-The dominance of the car, and limited public transport system, at the time of bidding meant that significant investment had to be made in the city's transit system to prepare it for Games hosting - This, along with the fact that Greece is the smallest country included in this research, meant that Athens' transport

- New 23km stretch of tram that connected the city centre with venues along the coast - 40km of new urban motorways - 80km of arterial road upgrades - Temporary 160km ORN - Upgrading of the public transport fleet - Modernisation of the traffic signalling system - Temporary efforts to reduce congestion and illegal parking in the city, through incentives for workers to take holidays and a stricter implementation of the rule of law	home/left the city returned to the roads - Some claim that the Olympics were partly (or even largely) to blame for Greece's financial crisis which began in 2009, suggesting that the Games transport spending may have been unsustainable - The new tram line has been underutilised in the aftermath of the Games, as the predicted development of the waterfront did not occur due to the financial crisis	(/overall Games spending) required a significant proportion of the country's GDP, therefore contributing to the severity of the financial crisis - Even though much of the city's new transport infrastructure built in the lead-up to the Games had been planned anyway, this did not prevent political and organisational issues from plaguing the Games and ultimately resulting in rushed delivery and decision-making, resulting in a lost opportunity in terms of intangible legacy (policy and citizen behaviour)

CASE 2: Beijing 2008

Outline of city

The Beijing 2008 Summer Games was the first of the city's now two Olympic hostings (it became the first city in the world to have hosted both the Summer and Winter Games when it staged the latter in 2022). Along with Tokyo (2020/1 host), it is the most populous city ever to have hosted the event (Bovy, 2017), with a population of 17 million; in this context, the additional 1.3 million visitors that the Olympics would bring was not a huge proportional addition to the numbers that were already using the city's transport system daily - in contrast to what could be said of a much smaller city like Athens. As outlined by Bovy and Li & Jones (see Figure 6, below), the Summer Games were held during a time of rapid economic growth and motorisation in the city (*Ibid*). From 1986 to 2007, the modal distribution of cycling decreased sharply in the city, from 54% to 23% respectively (Zhang et al, 2013), while the automobile - seen as a status-symbol - began to dominate (Urich, 2017). This rapid motorisation was spurred on by government policy and attitudes; for example, in 1995 the central government 'declared that the large number of bicycles on the road caused conflicts between motorized and non-motorized vehicles, and this should be controlled' (Zhang et al, 2013, p. 318). The fact that public transport was not able to keep up with this sprawling growth further encouraged citizens' reliance on private transport to get around (Huang, 2004; see Figure 7, below). Main roads were frequently congested, and authorities had to build five new ring roads in the 90s and early 00s, constructed in concentric circles around the city centre, in order to keep up with demand (Tamawaki & Tomaz, 2019; see Figure 8, below). The successful bid to host the 2008 Games, on the other hand, presented an opportunity to overhaul the existing plan and reformulate the layout of the city towards one less dominated by the car (*Ibid*).

It seems that Beijingers were enthusiastic about the bid and, in particular, the changes it might bring to the city's transport system. Beijing's Bid Committee claimed that 95% of the public were in favour of the city hosting the Games, while the IOC's poll (conducted in 2001) found that 96% of urban residents were in favour). Some saw the Games as a particular opportunity for the city to improve its transport system, with

32% of respondents in a 2005 survey (published in 'Beijingers pin high hopes on 2008 Games', *China Daily,* 14.07.05) saying they hoped it would lead to better infrastructure and 23% looking forward to a better transport system overall.
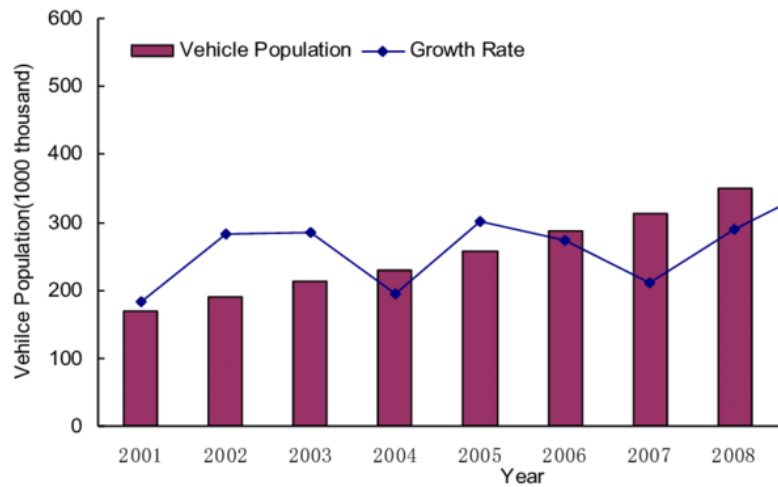

FIgure 6: Vehicle growth rate in Beijing between 2001 (the year it won its bid to host the Summer Games) and 2008 (the year it hosted them).
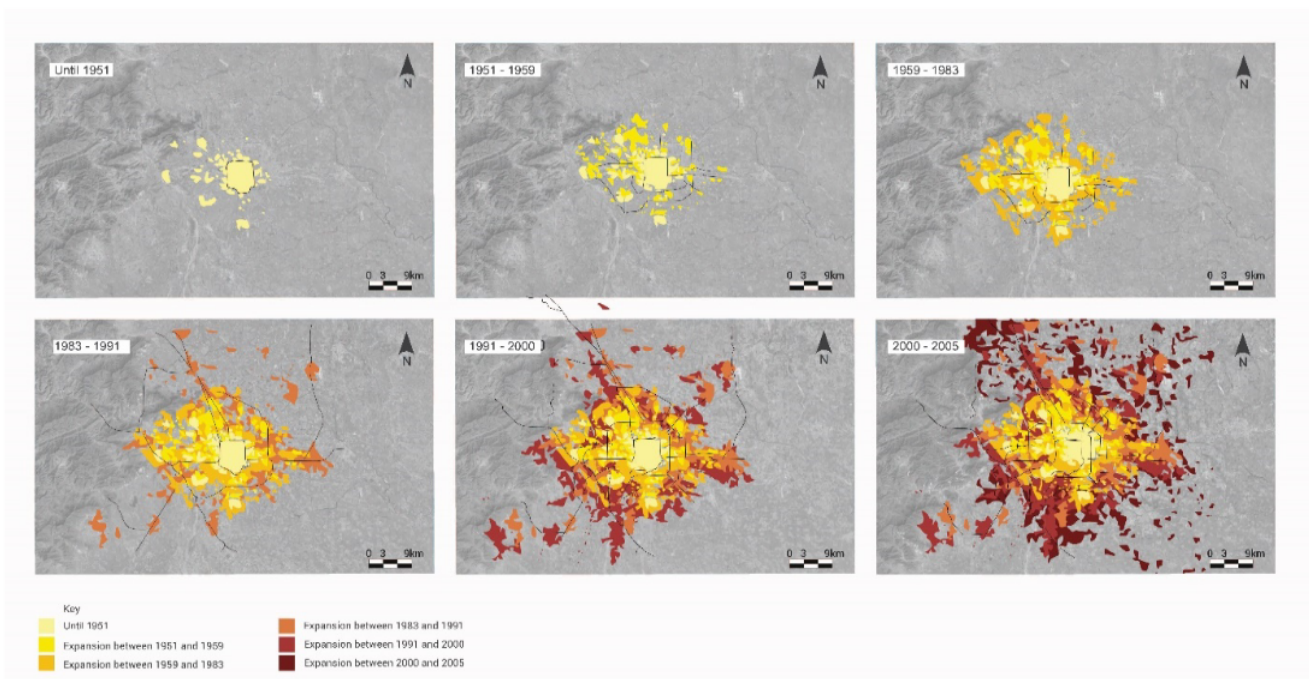
Source: Li & Jones (2015)

Figure 7 : The urban expansion of Beijing between 1951 and 2005. As the city expanded outwards, public transport coverage did not keep up with the sprawling demand.

Source: Yamawaki & Tomaz (2019, p. 4)

Figure 8: A map of Beijing showing the ring roads that were built outwards in concentric circles in the city, along with the location of the Olympic Green.

Source: Yamawaki & Tomaz (2019, p. 5)

Transport description in bidding document

Indeed, the *Transport Concept* of Beijing's 2008 Olympic bid proposed to do just this: significantly upgrade the public transit system and alter the transport trajectory of the city towards one which pivoted from the ever-increasing dominance of the car. Overall, it states that the subway capacity would be increased from 1.3 million passengers per day in 2001 to 2.66 million by 2008, and the overall capacity of ground mass transit from 9.86 million people per day to double that - 19.5 million - by the year of the Games. This would be facilitated by increasing the number of subway lines from two to seven - including the construction of an "Olympic Subway" to serve the Olympic green, with a capacity of 40,000 to 60,000 passengers per hour - and the number of bus routes from 4000 to 6500. While Athens' bid Games preparations included stricter emission standards for vehicles, Beijing's 2008 *Candidature File* was the first to make any mention of a transition to cleaner, non-traditional, fuels, stating that that, at the time of the bid in 2001, 60% of buses and 40% of taxis in the city were powered by natural gas, with a plan to increase this to 90 and 70% respectively by 2008. There was also the promise to introduce education for sustainable development and to help promote awareness of environmental issues (both of these components featured heavily in the media's reporting of the city's Games preparations, as outlined in detail below). This was part of an overriding effort to promote a "Green Games" - one of the main themes of the Beijing 2008 Games. One further additional ring road - the city's sixth - was also planned (a 93km "Olympic Traffic Ring"), along with a 105km extension of main roads and 35km of new connecting roads in the city. The *Transport Concept* also included the plan to double the number of gates at Beijing's main airport, from 36 to 72, able to serve 18,000 (up from 12,000 per hour) with a new planned Terminal 3 that would be the largest in the world.

It is worth noting here that there was no stated aim in the Candidature File to upgrade or invest in the city's cycling infrastructure, despite the fact that, as mentioned above, the city had a long tradition of biking. Furthermore, while these plans do show that the city had ambitious plans to facilitate the movement of

people during the 2008 Games, this Transport Concept is easily the least detailed of the four cities included in this research. The overall objective is particularly nebulous: 'To provide a nice and clean environment or the 19th Olympiad'. Overall, the IOC was cautiously ambitious in its review of Beijing's Transport Concept, saying, 'There exists a large legacy for Chinese sport and the city and its citizens from the venues and infrastructure improvements (2001 p. 66). However, it recognised the congestion that often plagues the city, but stated that, 'the extent of government traffic control, a comprehensive transport plan during the Games, and the ongoing major infrastructure improvement, will reduce the risks involved (IOC, 2001, p. 74).

Transport changes implemented

The transport implemented in Beijing in the years between its successful bid (in 2001) and hosting of the 2008 Summer Games was largely in line with what had been pledged in the city's *Candidature File* (Huang, 2004, n. p.)*.* Five new metro lines, a new suburban railway to the airport and the fifth ring road (105km long) as well as part of the sixth (205km) (Bovy, 2019). The new metro lines connected the two major event hubs - in the north of the city and the city centre - with the city centre core and urban areas in the outskirts of the city. These changes can be seen in Figure 9, below. Stricter emissions standards were introduced, which took heavily polluting buses and trucks off the roads. Beijing's airport capacity was increased even more than had been pledged in the *Candidature File,* tripling with the construction of the new Terminal 3 (*Ibid*). Again, despite the city's long-standing cycling culture, there was no attempt to build new infrastructure to encourage the reintroduction of this method of transport.

Several temporary measures were also put into place in order to facilitate the movement of the Olympic Family Games and improve the air quality for outdoor events like the marathon, triathlon and road cycling. These included the introduction of an ALP (Alternate Licence Plate) system over the period of 60 days leading up to, and during, the Games (*Ibid*) that had been tested and deemed successful during the China-Africa summit in 2007. This restricted the use of individual vehicles to every second day, depending on their licence plate number, and reduced background traffic by 40% during the hosting of the Olympics. A 300km ORN was also implemented during the Games.
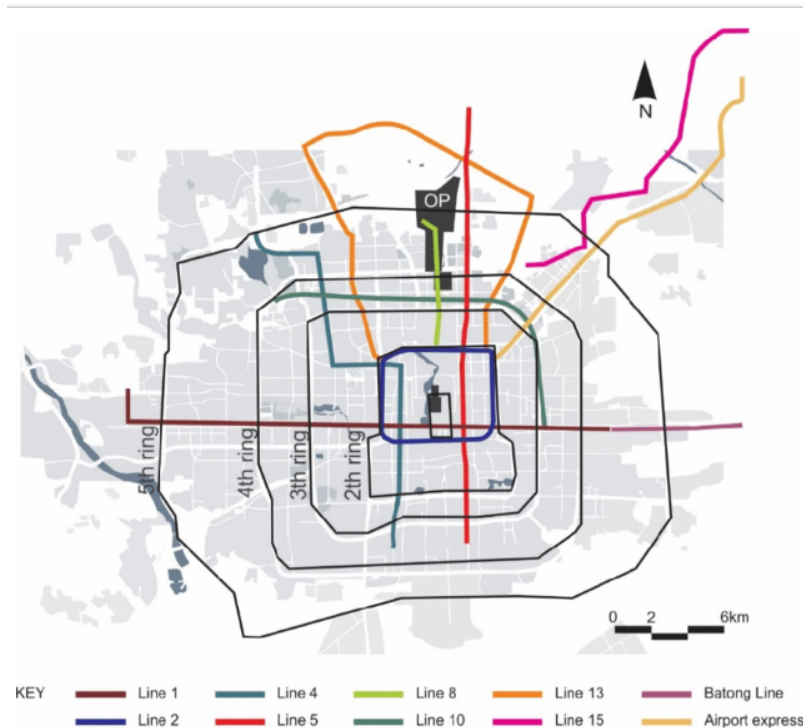
Figure 9: A map showing the main infrastructural changes implemented to Beijing's transport system in preparation for hosting the 2008 Games.

Source: Yamawaki & Tomaz (2019, p. 6)

Media review

This review of the media presents the same picture as the academic literature and *Candidature File:* that through Olympic-hosting, Beijing aimed to improve its public transport infrastructure and catalyse its urban development (mentioned specifically in 6% of reports). As described by one news report ('Curing capital's congestion by 2008', *China Daily,* 05.01.04), 'The Olympic Games is expected to become an accelerator for Beijing's development by upgrading the city's comprehensive competitiveness and speeding up its globalization and modernization'. This is mentioned within the greater context of mega-event-driven development in the city, along with the hosting of the World Expo (another of the world's mega-events) in 2010.

While the primary stated focus of Beijing's *Transport Concept* was to expand the city's public transport system, the most frequently reported themes in the news reports studied were the related problems of air pollution and congestion, as the IOC had highlighted when selecting Beijing as host city. Combined, these two themes appear in almost half (48%) of the news reports read. In particular, the city was aiming for an increase in the number of so-called "blue sky days" - those with "good" air quality (25µg/m3 of PM2.5) according to WHO standards. Part of this strategy was to introduce an ALP system, as described above. While this system only features in 2% of the reports read for this thesis, it appears to have had a significant legacy (see below). 10% of reports mention that vehicles (both cars and buses) were required to shift to cleaner fuels or comply with more stringent emission standards (essentially EU's Euro IV standard rather than its Euro III predecessor) while efforts to introduce (at the time) experimental EVs are mentioned by 5%. These efforts are linked to the "Green Games" theme (10%), with 3% specifically mentioning the education of young people about environmental issues, as described in the *Candidature File.* Mentioned also in the context of reducing air pollution in the lead-up to the Games was the movement of 167 heavy factories outside of the city.

The other main method of reducing congestion - and altering the transit system in the city to one which was becoming increasingly car-dominant - was to improve the public transport infrastructure in the city. Again, while this was the primary focus of the city's *Transport Concept,* it was mentioned less frequently in the news reports studied. The most widely-reported of these improvements were the expansion of the subway network (14%), road improvements or extensions (4%), the expansion of bus services (3%), the new high-speed railway between the airport and city centre (3%) and the new airport terminal (2%). Just one (1%) report mentioned an effort to increase cycling in the city - and this was as a means of coping with the restrictions on private car use in the city. There is no mention of any of these infrastructure projects being behind schedule or over-budget. Two (2%) reports specifically mention that this new infrastructure would expand the coverage of the network to previously underserved communities, while 5% describe improvements in accessibility for those with physical disabilities (mentioned specifically in connection with Paralympics-hosting). Mentioned in one report each were the 50% discount on public transport for the Games and the free tickets for spectators and accredited guests (in keeping with the *Candidature File* and precedent set by previous Olympic host cities). Overall, these measures appear to have been successful in achieving the "blue sky days" target by 2008 and ensuring the city's air quality was in line with IOC standards ('Beijing has fulfilled pledge – Greenpeace', *China Daily,* 29.07.08).

Alongside these issues, other themes that appeared in the transport-related news reports include the construction of the new airport terminal (2%), which - as was mentioned in the *Transport Concept* - was the biggest in the world when constructed. Four (4%) reports also mention the enthusiasm of the general public in some way - either through the 2001 Gallup poll that found that nearly 95% of Beijingers were in favour of the city hosting the Games, or by the fact that the Olympics and Paralympics volunteer scheme was highly oversubscribed (with 210,000 applicants for 100,000 places).

Reports: n = 101

Theme	Mentioned in x# of reports	Mentioned in x% of reports	Comment/Quote
Air pollution/smog/"blue sky" days	30	30	New air quality monitoring programme
Congestion (and efforts to improve it)/high number of cars in the city	28	28	'Traffic in Beijing will not be a headache at all but rather will become an enjoyable experience by 2008' (*China Daily,* 05.01.04)

'We believe that cutting down on driving is helpful to the general Olympic spirit' (*China Daily*, 06.11.06)

Test-run of the ALP system during the 2007 China-Africa summit deemed a success |
| ALP system specifically | 2 | 2 | |
| Restrictions on private vehicle use | 1 | 1 | |

Improvements in accessibility of public transport (for physically impaired)	5	5	Specific mention of the link between this and the Paralympics
Shift to cleaner fuels or more stringent emission standards	10	10	Cars and buses - switch from Euro IV standard rather than III. Ban on diesel vehicles also
Experimental EVs	5	5	Cars and buses
New airport terminal - the biggest in the world	2	2	
New high speed rail between airport and city centre	3	3	Called the 'Skyline'
High-speed rail between Beijing and Tianjin	1	1	
Road improvements/expansion	4	4	
Expansion of subway network + New fleet and renovation of some stations	14	14	First time in the world that three new lines would be added simultaneously Metro expansion continued post-Games: Beijing had the world's longest metro by 2016 Longer term plan also to continue increasing the size of the metro network (from 114km at time of bidding to 200 in 2008 and then 1000 by 2036)
Expansion of bus services	3	3	
Free public transport for accredited guests	1	1	
Discounts on public transport during the Games	1	1	
(Efforts to encourage a) long-term shift in public transport use - Games seen as a "tremendous opportunity"	11	11	'Cars shouldn't be a hallmark of prosperity' (*China Daily,* 06.06.06) - as much a question of psyche as it is one of the capacity and coverage of public transport in the city

			'Beijing Municipal Transportation Committee hoping the Olympics are the beginning of better transport system for the capital' (*China Daily*, 09.10.06)
Expansion of the coverage of public transport (to previously underserved neighbourhoods)	2	2	
(Efforts to) increase cycling as a form of transport	1	1	
Reference to the "Green Games"	10	10	"Green, scientific and human-oriented Games" (*China Daily*, 05.01.04)
Mention of the hope that the Games would have an environmental legacy	3	3	Including education of the youth about environmental issues
General public very enthusiastic about the hosting of the Games	4	4	Gallup poll in 2001: nearly 95% of Beijingers in favour (*China Daily*, 07.08.06) Volunteer scheme highly oversubscribed (210,000 applications for 100,000 places) (*China Daily*, 01.09.06)
Mention of using the Games specifically to spur development/investment in the city/increase tourism numbers	6	6	Also World Expo in 2010

Impacts

From reading Beijing's *Candidature File* and the news reports, two clear focus points for for the city's transport legacy and impact of hosting the Games can be seen: 1) An increase in the coverage, capacity and usage of the city's public transit system, and 2) A decrease in the congestion and air pollution levels. For both of these, Beijing's authorities have been largely successful - with mixed impacts on the experiences of transport-users.

1) As outlined above, preparations for the Olympics included a significant expansion of the city's metro system, from two lines (both of which were in the central district) to seven by the time of the Games in 2008. This continued to expand to 22 by 2016, covering a total of 143km and expanding out beyond the central

core into different districts of the city. As described by the IOC (2019, n.p.): 'The Olympic Games Beijing 2008 accelerated investment in the city's infrastructure … These transport improvements continue to be used by millions in their daily commute.' These new metro lines have also allowed - as was projected - a shift in the city from having one to multiple centres: 'The contribution made by the OG [Olympic Games] to consolidating the multicenter structure was therefore to promote public and private interest by putting the planned urban transformations into practice' (Yamawaki & Tomaz, 2019, pp. 17-18). Overall, given that these new lines filled a clear need and served residential and commercial locations, they have been well-incorporated into the city's transport network and continued to be widely used. Furthermore, the city's halving of the cost of public transport tickets in the lead-up to the Games was maintained afterwards, thus allowing residents across the income scale to benefit from these transport improvements.

While it was not possible to source data on public attitudes towards the Olympics-driven transport changes, therefore, it seems that their impact was to increase the affordability, capacity and coverage of the city's public transport system. This is reflected in the modal distribution, with almost 50% of journeys made by public transport in 2017 (Fan et al, 2019), compared to 39% in 2008 (Zhou & Long, 2015) (data for all years was not possible to source).

2) The second major aspect of Beijing's transport-related preparations for the Games - though not initially stated in the city's *Candidature File* - was restrictions on private vehicle use in order to reduce congestion and improve air quality. While the ALP system had only been intended as a temporary measure during the Games, it was re-introduced in 2013 during periods of particularly heavy pollution (Agence France Presse, 2013). Figure 10, below, visualises the sharp decrease in congestion that was achieved through this measure. While congestion rose again after the Games ended (as cars were only required to remain off the road one day per week (Chen et al, 2011)), this graph shows that it has never again reached pre-Olympics levels. The second dip in the graph occurred as a result of an annual quota for new car registrations introduced by the city authorities in January 2011 (Du, 2020). A citizen can only buy a car if it "wins" the lottery, with the winners becoming a smaller and smaller proportion of the overall entrants: in 2020, for example, only 6,366 of 1.84 million people were awarded one of the licence plates.

While this system has successfully limited the number of cars in an already-congested city (decreasing the annual growth rate of private vehicles from 23% in 2010 to less than 3% per annum between 2014 and 2018 (Qin et al, 2021)), the impact on transport-users has not been equal, with some families owning more than one car and others having none; and bribery and a soaring black market for the buying and selling of licence plates. Indeed, Qin et al (*Ibid*) carried out a survey on the welfare costs of this lottery policy, concluding that the social benefits of lower congestion and pollution roughly equal the costs to private welfare.

For this component, therefore, the long-term impact of Olympics-hosting on transport users has been stricter restrictions on private vehicle ownership and use, which helped to rescue the city's congestion but also resulted in socioeconomic inequalities. Furthermore, it has not eliminated the issue of congestion by any means: in 2018, drivers in Beijing still spent about half of their travel time in traffic jams during peak hours (*Ibid*).
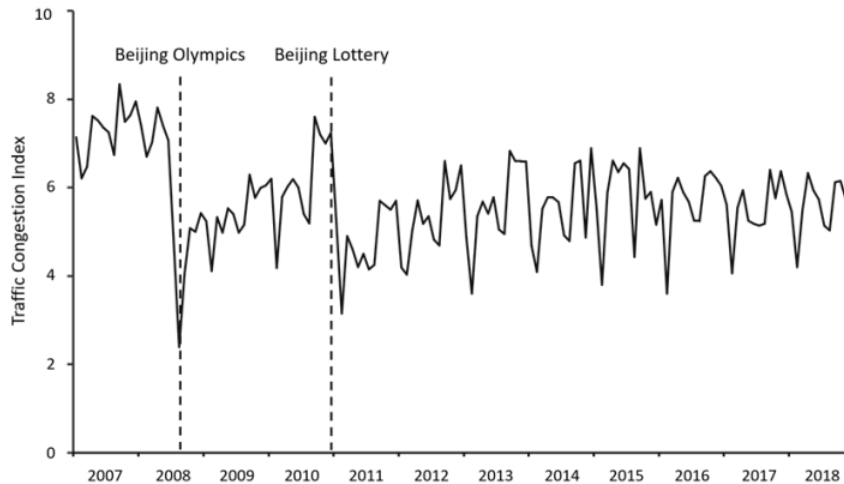
Figure 10 : Traffic congestion index in Beijing, 2007-2018

Source: Qin et al (2021, p. 4)

The legacy and impacts of Olympics-driven efforts to reduce air pollution are more contested. Chen et al (2011) argue that these improvements in air quality in the lead-up to the Games were 'real but temporary', and also question the accuracy of China's air pollution metrics, given that external scientists were not allowed into the city to evaluate. However, the longer-term trajectory - based on figures from the WHO and UN - suggest that the city's air quality has continued to improve in more recent years, largely due to the restrictions on private vehicle purchase and use noted above (as well as coal-fired-pollution control). This is corroborated by reports from the United Nations Environment Programme (UNEP), in 2009 and 2019, praising Beijing's success in reducing air pollution (which were at an annual average of 33µg/m3 in 2021). While this is not wholly due to measures driven by the hosting of the 2008 Games, the UNEP does stress the impact preparations for this event had. Again, although there does not appear to be a public opinion survey on the perceptions of this improvement, it is fair to assume that it had a positive impact, given the associated impacts of air quality on human health.

Transport changes between successful bid and Games hosting	Impacts	Effect of the city's baseline scenario on these impacts
- Massive expansion of the metro system: went from two lines in 2001 at the time of the bid to seven by the time of the Games. Some stations were also renovated and the transport fleet modernised - ALP system (along with the removal of 167 factories to the outskirts of the city) was introduced in order to reduce congestion and successfully bring down air pollution to WHO-acceptable levels	-Metro expansion continued in the aftermath of the Games to a total of 22 lines by 2016. -This expansion, and the fact that it was designed to provide public transport to the Olympic venues, meant that the coverage of public transport in Beijing expanded to include many more communities beyond the central core that was all that had been served previously. The reduction in the price of public transport tickets added to Beijingers	- Given that public transport had not kept up with demand in the decades preceding Beijing's successful 2008 Olympic bid, this was a key focus of the city's transport preparations for the Games - and meant that these new transport connections served previously unconnected areas of the city

-Construction of a sixth ring road around the city to cope with ever-increasing vehicle numbers, along with a 105km extension of main roads and 35km of new connecting roads in the city -New Terminal 3 added to Beijing Daxing Airport was the largest in the world - New high-speed rail between airport and city centre -Expansion of bus services -Increase in accessibility of metro and bus fleet for those with physical disabilities -ORN system temporarily introduced to transport the Olympic Family -The prices of public transport tickets were halved in lead-up to the Games; this price cut was maintained afterwards - Efforts to encourage public transport use were linked to the "Green Games" tagline and the introduction of education for sustainable development among young people in the city	ability to make use of these new lines (unlike in Rio, below) -Growth in private vehicle numbers (and resulting congestion) continued in the aftermath of the Games but with the implementation of additional, stricter restrictions on vehicle ownership, this growth was reduced and congestion and air pollution improved again. While some reports indicate that citizens were in favour of measures to maintain improved air quality measures, these new restrictions have severely limited individual freedoms -Given the lack of surveys or public opinion polls in Beijing on their perceptions of the changes to the transport system, it is hard to be sure of how they were viewed by citizens. However, the expanded and more affordable public transport system, along with improved air quality, would likely improve these perceptions, while limits on individuals' freedom to purchase or use a private vehicle might worsen them	-The IOC's prediction that China's strict governance structure would result in a successful reduction in congestion and air pollution proved true -Although the city had a long tradition of cycling, this did not encourage Beijing's OGOC to promote cycling as an alternative to driving; public transport use was instead encouraged as an alternative to the status symbol of the private car

CASE 3: London 2012

Outline of city

London is the only city to host the Summer Olympics three times: 1908, 1948 and 2012. When it won the bid to host the 2012 Games in 2005, its population was 7.5 million; by the time of hosting, this had risen to 8.3 million (UN, 2022). London was already well-known for its excellent public transport system long before bidding for the 2012 Games: it has strong historical roots, with horse-drawn carriages in the 1830s (Sumner, 2012); it was also the first city in the world to have an underground rail network, which first opened in 1863 (Transport for London, 2023). This predominance of public transport has remained, even in an industrialised era: the city has the lowest motorisation in the UK (327 cars per 1000 people in 2004, compared to 498 in the country as a whole (Centre d'Etudes Olympiques, 2005)) and highest per capita public transport use: in 2005, 36% of journey stages were taken by public transport with another 23% completed by active mobility (TfL, 2006). This indicates not only a well-functioning and extensive public transit system, but also well-established citizen behaviour - across the full spectrum of socio-economic groups - to use this system. It was also the first city in the world to implement congestion charging and a low-emission zone (in 2008) (and, more recently, an ultra low emission zone, in 2019) within the city.

From reviewing the academic and grey literature, Candidature File and media reports for this city, one of the insights that emerges is that London 2012 was not primarily a case of mega-event driven development, particularly in the field of transport, with most infrastructure already in place. Instead the city appears to have bid for the Olympics primarily because of a desire to stage the world's biggest mega-event - and had the support of the majority of the British public to do so (the IOC's 2005 Opinion Poll found that 68% of Londoners and 70% of Britons were in favour of the city hosting the Games). With that said, the Games did still present the opportunity for the city to regenerate the previously underdeveloped area of the city - East London - where the Olympic park was built as well as increasing the capacity of its existing public transport system. However, overall, the city represents an interesting contrast in this thesis, providing insight into how the impact of mega-event hosting on the transit system may differ in a city that bid from a much more established baseline.

Transport description in bidding document

Of the four Olympic case studies in this thesis, London's *Transport Concept* - and plans for the Games overall - is the most focused on legacy and least on building new infrastructure. Instead, the focus was on planning the Olympic venues in order to make best use of the infrastructure that was already in place, or was already to be built, independent of whether or not the city would be selected to host the Games. For example, all of these venues were to be within walking distance of two public transport stops in order to encourage the dispersal of spectators, with 90% promised to be served by three or more public transport options. Instead of building new rail lines, the focus would instead be on increasing the capacity and frequency of underground, overground and DLR (Docklands Light Railway) rail systems. The Olympic Park in particular would be strategically located, within walking distance of 10 different railway lines and three main stations, which would have a combined capacity of 240,000 people per hour - more than enough to cope with Games traffic. One of the few planned new projects - the Olympic "Javelin" (a high speed rail line) was proposed to transport people to the Olympic Village in East London from St Pancras International station in the centre-north of the city. London's main event venues can be seen in Figure 11, below.

London's *Transport Concept* expresses confidence in the ability of the city's existing public transport system to cope with Olympics-hosting, given the 20% seasonal drop in the 12m daily ridership in August, thus leaving 'ample scope and capacity for the 5% additional demand generated for the Games' (Centre d'Etudes Olympiques 2005, p. 99). In this sense, it is similar to Beijing: while the Olympics place a strain on any transit system, it would only be a minimal increase proportional to existing transport pressure in the city. London also planned to invest in upgrades to the existing network, with USD30bn pledged for the refurbishment and modernisation of all Underground stations; expansion of the Overground to East London; and 50% increase in capacity across the DLR (Docklands Light Railway - a driverless train network in east and south-east London). As has become the norm since Sydney 2000, there was no provision for car parking at the Olympic venues and ticketed guests had free use of the city's public transport system; 7000 cycling docking points were also planned in and around the Olympic Park (Ieromonachou et al, 2010), and several temporary park-and-ride stations set up. The Olympic family was to be transported by means of private shuttle between accommodation and sports venues, with a ORN of 240km planned. The *Candidature File assured that,* 'The UK's law-abiding road culture means that drivers will readily accept and adapt to the ORN'.

The IOC's report on the 2012 candidate cities was cautiously optimistic about how London's public transport system would cope, stating that, 'Provided that this proposed programme of public transport improvements is fully delivered on schedule before 2012 and the extensive Olympic Route Network is implemented, the Commission believes that London would be capable of coping with Games-time traffic' (IOC, 2005, p. 78). This report also expresses confidence in the positive legacy the London 2012 Games would bring to East London. In the end, despite the fact that the ORN was controversial and only partially implemented, the city's transport system coped much better than expected - as described in greater detail below.
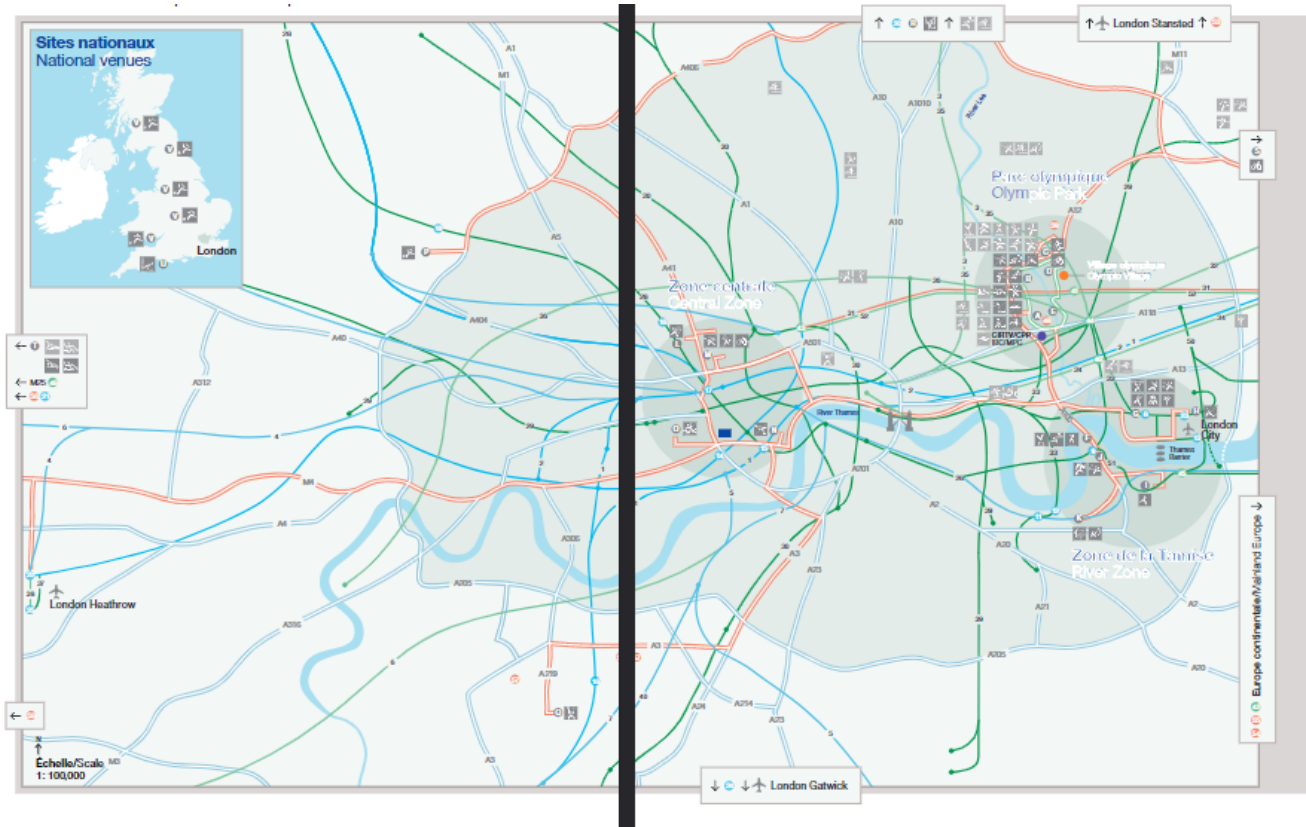
Figure 11: Locations of, and transport to, London's Olympic event venues. The Olympic Park can be seen in the right of this picture, the "River Zone" below it and the "Central Zone" to the left - the three venue hubs within the city of London

Source: Centre d'Etudes Olympiques, 2005, p. 103-4

Transport changes implemented

London implemented the transport changes described in its Candidature File, most two years ahead of schedule (Sumner, 2012) - in contrast with Athens and Rio, below. While most public transport improvements had already been planned, the Games acted as a catalyst to accelerate their implementation. In addition to these upgrades and the construction of the new Olympic Javelin, new cycling and walking routes were developed; the Mayor of London's office also sought to communicate directly with the London Boroughs in order to actively maintain and improve these routes over time, for example installing additional signage if necessary (Mayor of London, 2012). 75% of all money spent on the UK Olympic Delivery Authority's capital projects went towards long-term regeneration (Sumner, 2012), with a focus on legacy throughout the planning and delivery process. Indeed, the vast majority of these projects were implemented by the end of 2010, almost two years before the Games (Ibid) - in direct contrast with the rushed nature of Athens and Rio.

Because of the success of the congestion charge scheme that was already in place in the city, there was no need to introduce an ALP system, as had been implemented in Beijing. A public information campaign was carried out in the weeks preceding the Olympics to inform the public about likely increased traffic and public transport ridership, and suggest means for them to "Get ahead of the Games", as the campaign was called. The aim of this was to reduce Londoners' use of private vehicles and public transport (through walking, cycling, changing their commuting routes or staying at home) by 30% in order to accommodate Games

demand (higher than had been predicted in the city's *Candidature File*), and up to 60% in some travel hotspots. Examples of some of these posters are included in Figure 12, below.

As outlined in London's *Transport Concept,* the one sense in which Olympics-hosting was a deliberate case of mega-event driven development (and which was not planned to be carried out anyway, had the city not been successful in its bid) was the East London regeneration project. This mostly related to overall infrastructure (the Olympic Stadium and Village was built in this area of the city, which had previously lagged behind in its development - and on a particular patch of land that had previously been wasteland) but also included an upgrade of its transport system. In contrast to other areas of London, this development would focus on mixed land use, with more area devoted to public transport, walking and cycling (Mayor of London, 2012).

Figure 12: Images from the Mayor of London's Get Ahead of the Games *public information campaign.*

Source: pinterest.com (London's OGOC has discontinued the original 'Get ahead of the Games' website)

Media review

As London's *Candidature File* indicated, so too do the media reports demonstrate that the hosting of the 2012 Games was not a case of intentional "mega-event driven development" - at least with regard to transport infrastructure - but, rather, a celebration of sport. The idea of ensuring that the Games (and London as a city) were remembered for the "right reasons" was repeatedly mentioned - with the explicit aim of making the Olympics about "sport rather than transport" (quoted in 5% of reports). There was concern about how the city's transport system would cope: in 9% of reports, transport was referred to as the biggest challenge of London 2012 preparations; 5% specifically mentioned concerns about whether or not the public transit system would be able to cope with the increased capacity, with 9% citing concern for particular travel hotspots. 16% of reports mention reassurances from politicians - in most cases from then Mayor of London Boris Johnson - that the system would be able to deal with this additional demand. 2% of reports mentioned the new Olympic Javelin service, with another 2% describing the "long-overdue" upgrades to the Underground Jubilee line being carried out in preparation for the Games.

The "Get Ahead of the Games" public information campaign described above featured widely in these media reports, with 18% mentioning it in some way. However, there was public skepticism about whether this campaign would do enough to facilitate Games pressures: 5% of reports expressed concern that it was a highly speculative and insufficient strategy. These concerns also spread to the fear of motorway gridlock, particularly during the night of the opening ceremony; 16% of reports mentioned fear of this so-called "perfect storm" of traffic chaos that could ensue with the first night of the Olympics coinciding with rush hour Friday evening traffic among commuters, and the weekend exodus of people leaving the city for vacation. Politicians, IOC personnel and other high-profile guests were encouraged to leave their private vehicles behind and travel to event venues using public transport (as is mentioned in 7% of reports).

Despite the assurances in the city's *Candidature File,* the ORN system was not accepted as uncritically in London as it had been in other cities: there was concern about its "undemocratic" nature, creating a two-tiered road system between Olympics accredited guests and regular road users. Indeed, this Olympic

lane system is the most heavily-featured theme across London's media reports, mentioned by 25% of them, with 16% describing their controversial nature. The combination of a fixed core of 80km of ORN and a further 120km of flexible "Games Lanes" - to be activated only in time of heavy traffic - was ultimately accepted as a compromise. This is perhaps indicative that a "one size fits all" approach to Games transport does not work in all cities. The other major transport-related controversy in the lead-up to the Games was disputes with the unions, with 5% of reports mentioning repeated strikes by transport workers demanding higher pay for working during the event. These disputes were eventually settled with an agreed set of bonuses paid out to transport workers during the weeks of the Games.

Additional transport themes that appeared multiple times in the news reports included: new park-and-ride facilities that would allow spectators from other parts of the UK to leave their cars and travel into the city using public transport (7%) and concerns about the cost of these facilities (2%); the impact of Olympics travel restrictions – particularly in towns outside of London that hosted events like the sailing – on local businesses (9%); and the claim that not enough was being done to encourage cycling (5%).

While the sentiment in the lead-up to the Games was almost uniquely negative and sceptical - the reassurances of politicians and transport leaders were the only dissenting voices - there is a dramatic change in tone as soon as the Games begin. Of the reports that were written during or after the event, only one mentioned any form of transport challenge – with some delays experienced by athletes coming in from the airport. The only other concern mentioned during the Games was, ironically, a concern that the public information campaign had gone too far, with reductions of up to a third in visitor numbers to London's non-Olympic tourist attractions reported ('Deserted London 2012: Shops, theatres and businesses all empty as visitor levels fall by a third over fears of Games travel chaos', *The Daily Mail,* 30.07.12).

Overall, however, London's transport system coped much better with Games traffic than anticipated by either the media or the IOC thanks to the success of its public information campaign, increases to the capacity of its public transport network, and planning of Games venues to be accessible by multiple modes of transport.

Total # of news reports: n = 44

Theme	Mentioned in x# of reports	Mentioned in x% of reports (rounded to the nearest %)	Comment/Quote
Test events ahead of the Games	1	2	
"Sport not transport"	2	5	
Ahead of schedule/typical Olympic timeline	3	7	

Concerns about public transport capacity/ability to meet Games requirements	2	5	'The city's transport network … [is] … already running at near-full capacity' (*BBC*, 15.04.11)
Reassurances from politicians/transport authorities that the system would be able to meet the demand	7	16	"The sceptre of traffic chaos will be the Olympic dog that does the equivalent of the millennium bug, and doesn't bark" - then-Mayor Boris Johnson, quoted in *The Guardian* (30.01.12)
Strikes by/disagreements with transport unions to ask for higher pay	2	5	
Warnings of traffic disruption (the so-called "perfect storm")	7	16	
"Get ahead of the Games" public information campaign/requirement for 30% of Londoners to change their travel habits	8	18	
Concern that this campaign was highly speculative/would not be enough	2	5	
During Games: concern that this went too far	1	2	
Mention of ORN/Games Lanes	12	25	
Controversy surrounding	6	14	

ORN/Games Lanes			
Transport seen as the biggest issue of the Games	4	9	Transport seen as the "biggest risk" for London's hosting of the Games (*BBC*, 15.04.11)
Particular demand on certain travel hotspots	4	9	Predicted to be Bank, Earl's Court and London Bridge (*BBC*, 03.07.12)
During and post-Games: transport deemed a success, with record capacity on public transport	6	14	
New "javelin" train service	1	2	
Upgrades to Jubilee line (had been in the works for a long time)	1	2	
Not enough being done to encourage cycling	2	5	'Cycling lobby still waiting for London to turn into a genuinely cycle-friendly city' (*BBC*, 19.12.12)
New park and ride facilities	3	7	
Concerns about cost of new park and ride facilities	1	2	
Impact of Olympics transport plans on local businesses/London's non-Olympic tourism	4	9	Reports of one third reduction in visitor numbers (*The Daily Mail,* 30.07.12)
Politicians, IOC and other public figures encouraged or required to use public transport	3	7	'Boris Johnson has also urged members of the International Olympic Committee to forego the dedicated Games Lanes available to them during the Olympics and to get on the Jubilee Line - "because they'll love it"' (*BBC,* 06.02.12)

Impacts

As with any Olympic city, London's residents experienced some disruption to their daily travel habits as a result of Games-driven transport changes. However, the city's OGOC relied on voluntary changes in behaviour, which was very successful in this case. This was in contrast to the punitive restrictions on private vehicle use in Beijing and widespread disruption during the frantic construction of new travel lines in Athens. The "Get Ahead of the Games" public information campaign also appears to have had a longer-term impact: according to a poll by GLA Opinion Research in March 2013, 35% of Londoners said they had been encouraged to walk more, 23% to cycle more and 27% to use public transport more as a result of the Games.

This increase in cycling in particular may have been aided by the efforts of the Mayor of London's office to increase this form of transport's modal share as a major legacy of the Games. The stated aim of the *Mayor's vision for cycling in London: An Olympic legacy for all Londoners* (2013) was to capitalise on the publicity brought by the UK's successful Olympic cyclists to encourage more cycling in Central London. In Boris Johnson's words: 'The main cross-London physical legacy of the 2012 Olympic Games will be a proper network of cycle routes throughout the city, a substantial increase in cycling, and all the benefits - fitness, enjoyment and easy travel for millions, cleaner air and less traffic for all - that will follow' *Ibid*, p. 4). These plans included the doubling of the city's cycling budget to bring it almost in line with the spending in The Netherlands per capita; the creation of a "tube network" for bikes in the city; addition of extra rental bikes; and the installation of an additional 80,000 bike parking spaces. In more recent years, Transport for London (TfL) has continued to build on this legacy, with cycling skills classes offered in schools, more than 450km of cycleways on track for construction between 2022 and 2024, and grants offered to community groups in Greater London that proposed projects aiming to promote walking or cycling (TfL, 2022). The combined impact of these measures can be seen in Figure 13, below. While it is impossible to prove whether the increases from 2005 (the year of London's successful bid) or 2012 (the year of the London Games) was directly attributable to Olympics-driven changes, it is clear that cycling has become a greater priority for TfL and a more popular form of transport for Londoners over this period and beyond - particularly in Central London, as was the Mayor's aim.
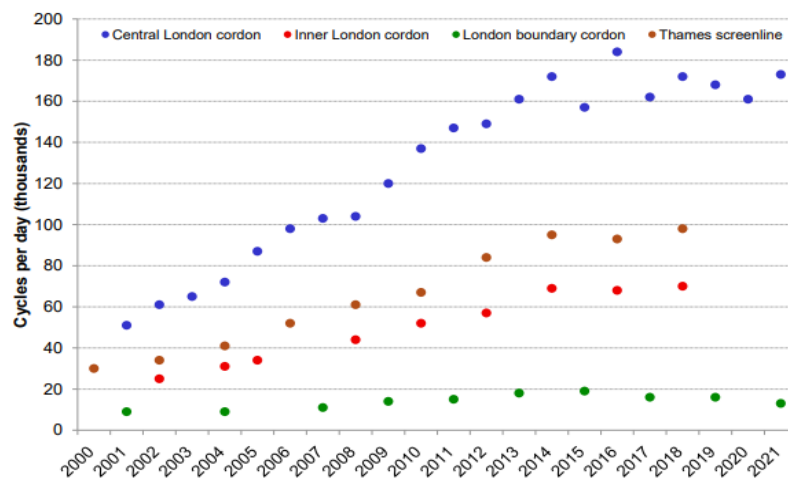

Figure 13: Cycling trends in the different cordons of London, 2000-2021. The graph shows an increase over time in the number of cycling trips per day, particularly in Central London (some counts in 2020 were cancelled due to pandemic restrictions).

Source: TfL, 2022

The other particular focus of London's Olympics-driven transport changes was in the regeneration and improved connectivity of East London. With regards to transport specifically, this appears to have been successful: Overground services to the area have 25% higher capacity in peak times, and the Lea Valley (which runs from East London to the north-east of part of the Greater London area) corridor rail connections have been enhanced (TfL, 2013). This greater connectivity - and overall modernisation of the area's infrastructure - has attracted businesses and real estate companies to invest in the area. The IOC claims that, 'The results of this investment have been transformational, changing the face of the area and bringing new economic life and opportunities to the local community' (IOC, 2020, n. p.). However, the viewpoints of some of the area's residents present a different picture, with media reports complaining of gentrification, as soaring house prices have excluded residents who grew up in the area from accessing the property market - such as 'London Olympics has brought regeneration, but at a price locals can't afford (*The Guardian,* 30.08.16) and 'Olympic legacy in East London: Displacement and gentrification' (*Rio on Watch,* 25.01.03).

While there has been some disquiet about the impact of Olympics-driven changes to East London, the incremental investments in the rest of London's transport system - in increasing the capacity and accessibility of the city's network - have been easily incorporated after the Games. The Olympics-driven "Javelin" rail service has become a part of the high-speed rail fleet of the *Southeastern* rail operator. These trains have helped cut commuter times by over 50% on some services in onward connections to Kent and continental Europe (IOC, 2021). The combined impact of these changes on Londoners' perceptions of their transport system has been positive, with 56% in 2013 saying the Olympics had already, or would improve public transport in the city (up from 49% before the event) (GLA Opinion Research).

Transport changes	Impacts	Effect of the city's baseline scenario on these impacts
-Urban renewal of East London - both in terms of transport and in general, with Overground services having 25% higher capacity during peak hours than before the Games -High-speed "Olympic Javelin" line has decreased commuting times by over 50% on some services in onward connections to Kent and continental Europe -New (and upgraded) roads, cycle paths and walkways were built -Increases to the frequency and capacity of existing Underground, Overground and DLR lines -Public information campaign in the lead-up to the Games that aimed (successfully) to reduce the use of public transport by Londoners to help	-Long-term impact on East London is the most significant Olympics legacy for the city. While this has led to greater connectivity for the area's residents, it has also come with complaints about gentrification, with residents who grew up in the area priced out of the property market -Public information campaign during the Games was deemed "too successful" by some: had an impact on local businesses and non-Olympics tourist attractions -The Mayor of London's specific focus on using the Games to increase the modal share of cycling appears to have been successful -Londoners' perception of their public transport system improved	-Relatively little new transport infrastructure was built because of the extensiveness of what already existed; this meant that authorities could focus on successfully implementing changes to one area of the city (East London) and more incremental improvements (in terms of capacity and frequency) of existing services. Relatively little new transport construction also meant minimal disruption to Londoners' livelihoods, apart from the voluntary "Get ahead of the Games" campaign transport advice -The fact that London already had an established culture of public transport use and an existing congestion scheme

accommodate the influx of Games visitors -The ORN laid out in London's Candidature File was only partially implemented because it was deemed "undemocratic" by the Mayor of London and general public; this is despite the fact that the *Candidature File* was confident in its implementation	as a result of how well it functioned during the Games	meant no new restrictions on private vehicle use needed to be introduced

CASE 4: Rio de Janeiro 2016

City outline

Rio de Janeiro is the second biggest city in Brazil, with a population of 6.4 million at the time it hosted the Olympic Games in 2016 (Bovy, 2019). Rio was the first South American Olympic city and Brazil is one of the prime examples of a country that specifically targeted mega-event hosting in order to catalyse its urban development, staging the PanAmerican Games, FIFA World Cup and Summer Olympics over a space of nine years (between 2007 and 2016). Kassens-Noor (2012) explains that this resulted in sporting events driving Rio's infrastructure planning "for better or worse" over a 20-year period. As Sanchez & Broudehoux (2013) explain, city authorities openly justified the bidding process for these mega events with the notion that they would help to spur development in the city; this was also not the first time it had bid for the Summer Games, having previously been a candidate city in both 2004 and 2012 (Maiolino, 2017). Sanchez & Broudehoux (2013, p. 132) summarise: 'Mega events are being instrumentalized by local political and economic elites, especially by a coalition of ambitious civic leaders, private entrepreneurs, and local real estate interests, who exploit the event-related sense of urgency, mobilisation, and consensus in order to remake the city in their own image'. It seems the public at large supported the city's Olympic bid: 85% of the urban population and 69% of the country overall was in favour of the Games being held in Rio (according to the IOC's 2009 public opinion poll).

In Rio's initial two Olympic bids, urban mobility was highlighted by the IOC as one of the issues "not well punctuated" during the bidding process (Maiolino, 2017, p. 6). At the time of making its 2016 bid (in 2009), the city's transit system presented some challenges: it had a metro network of just 49 km for a city of almost 6.5 million, severe congestion (the third worst in the world) (Bovy, 2019) - the average commuting times for workers were among the highest globally - and, according to the WHO, unacceptable levels of air pollution (Pereira & Schwanen, 2013). Despite the small size of the metro line, three quarters of trips were already being made using public transport - mostly on buses - with the motorisation rate (number of cars per 1000 people) at just 233 in 2005 according to Rio's *Candidature File*. However, the public transport system was fragmented, without an integrated fare system; this fragmentation also extended to responsibilities and jurisdiction in terms of both transport policies and data collection in the city (Pereira, 2018). While this is an outlier among the four host cities in this thesis, it is common among lower or middle-income cities, where public transport or active mobility is the predominant means of getting from place to place, especially among the poorer sectors of the population. In Rio, almost 60% of trips were made on foot among the poorest in the city at the time of its 2009 bid (Motte-Baumbol & Nassi, 2012).

Transport description in bidding document

While Rio's previous two Olympic bids had received criticism for its underdeveloped transport concept, the same could not be said of its 2016 bid. Of the four host city case studies in this thesis, the *Transport Concept* for the Rio 2016 bid is the most detailed, with ambitious plans to make rapid upgrades to its road network and public transport system. The IOC, in its *Report of the 2016 IOC Evaluation Commission,* was highly positive about Rio's bid and the legacy it would have for the city, saying that the Olympics 'would act as a vehicle for new facilities, transport and other infrastructure and physical regeneration, particularly of the city's waterways and key development zones of the city' (IOC, 2009a, p. 84). 'As such, the Federal Government considers the investment required for infrastructure to be worthwhile and that the Games would leave an affordable and significant legacy' (*Ibid*).

The specifics of Rio's plans for the movement of spectators and accredited guests follows the same pattern as is common for all the cities researched for this thesis. Members of the "Olympic Family" would be transported using free, 24 hour private shuttles along a 150km ORN. This was similar to what had been implemented during the PanAmerican Games in 2007 "with the full support of Rio's citizens" (Centre d'Etudes Olympiques, 2009, p. 143); the bid also mentions the prospective 2014 FIFA World Cup (which had already been awarded to Brazil at the time of writing) as an opportunity to test its transport system for the event. In response to combat the city's notorious congestion, the *Candidature File* stresses the intention to reduce the amount of overall background traffic and congestion during the weeks of the Games - for example encouraging workers to take holidays or work from home if possible, and moving the school and winter holidays from July to August (during the time of the Games). Also stated are plans to increase the capacity of the city's main airport (Galeao International Airport), with runway and terminal upgrades. A free park and ride system was also planned for spectators coming by car from outside of the city, along with an ALP system in the part of the city affected by the Games and that would reduce traffic by an estimated 30%. Zero-emission public transport was promised in the Olympic Village for the first time by a successful bidding city.

While these changes were planned to facilitate transport during the Games, the city's main transport focus - and that which was projected to have a significant positive social legacy - was on improving the public transport system - and expanding the metro network in particular. The *Candidature File* describes the specific infrastructural projects that were proposed, and the IOC's report on the candidate cities describes the projected investment in five major transport projects: 1) new rolling stock for suburban rail (70%), metro (15%) and BRT buses (15%) that would be accessible for those with physical disabilities (USD 1.35 billion); 2) extension and capacity improvements of suburban rail and metro (USD 1.31 billion); 3) development of three BRT lines totalling 70 km connecting the four Olympic zones to Barra Olympic Park (USD 1.23 billion); 4) extending and upgrading Rio International Airport (USD 400 million); 5) completing the Rio motorway bypass and other road projects in the Barra area and around João Havelange Stadium (USD 600 million). In an effort to get the general public on board with these plans, a communications strategy would be put in place, along with newly integrated, electronic ticketing. The Games venues were to be placed in four different clusters (Barra, Deodoro, Copacabana and Maracanã), in order to spread the Games - and the associated mobility projects - over a significant area of the city. These transport upgrades that connected these four clusters would form a "High Performance Public Transport Ring" (HPPTR). Rio's OGOC stressed the anticipated positive impact of these plans: 'The network will be integrated at multiple transfer stations and will connect all four Games zones with critical city areas, transforming the city and leaving a legacy with a significant social impact' (Centre d'Etudes Olympiques, 2019). The IOC was similarly convinced, saying, 'Construction and operation of Rio de Janeiro's public transport ring would be a significant infrastructure and social legacy for Rio, improving the connection of disadvantaged areas of the city with areas offering employment, recreation and leisure opportunities (IOC, 2009a, p. 61).
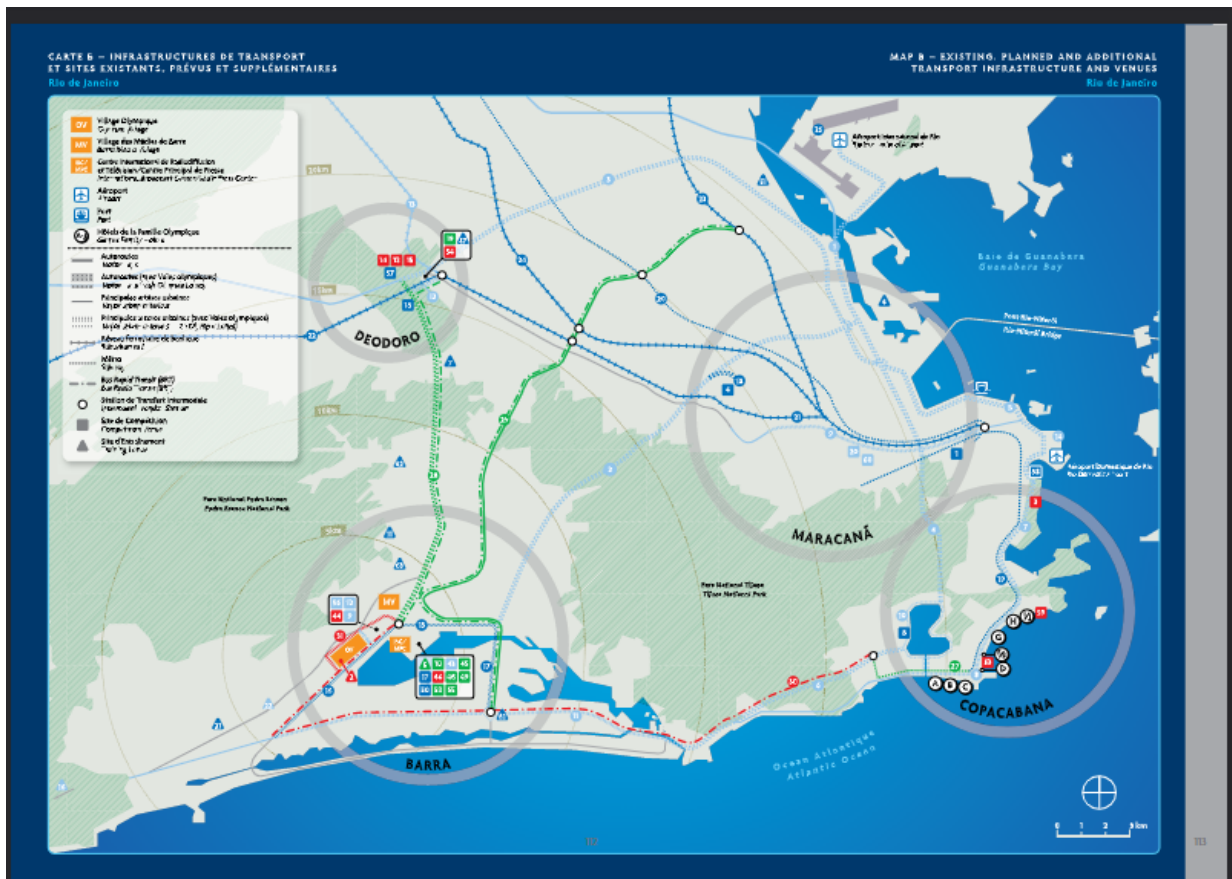
FIgure 14: The plans for the transport connections between the four main venue clusters (Deodoro, Barra, Maracanã and Copacabana) for the 2016 Rio Games.

Source: Rio 2016 Candidature File (Centre d'Etudes Olympiques, 2009)

Transport changes implemented

For the most part, the infrastructural changes to Rio's transport system described in its *Candidature File* were implemented - as shown in Figure 15, below. The metro was expanded, new BRT lines built, the public transport fleet modernised and made more accessible, the airport capacity increased, and road projects completed in Barra. Bovy (2019) claims that the Rio Games were an "outstanding catalyst" to make a 25-year jump forward in public transport performance in the seven years leading up to the Games, with massive improvements made to the public transport system. Maolina (2017, p. 6), with similar enthusiasm, says that 'The transport-structured network was one of the most benefited by the Games'.
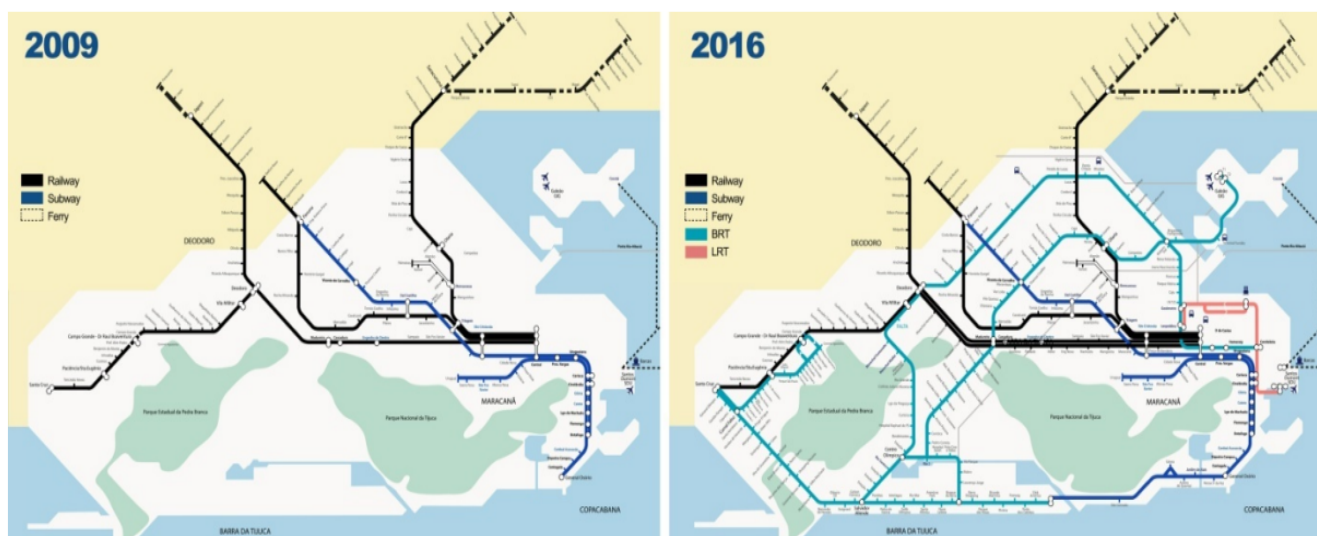
Figure 15: Rio's metro network in 2009 (left, the year it successfully bid for the Games) and in 2016 (right, the year it hosted the Games).
Source: Adapted from Bovy (2019)

However, the transport preparations for the Rio Games were far from perfect. The ALP system described in the city's *Candidature File* was never implemented in the end, meaning congestion was a persistent issue during the Games and impairing ORN operations (Bovy, 2019). The zero-emission transport promised the Olympic Village did not materialise, though some Games vehicles were run on a "B20 biodiesel" mix, which contained 20% recycled cooking oil. While most of the infrastructure projects were completed in the end, they cost more than twice the planned budget - with USD 10bn invested in the HPPTR and were also subject to corruption allegations (Ribeiro & Almeida, 2020). Furthermore, as described in further detail in the media review (below, the delivery of these infrastructure projects was very rushed, with doubts as to the readiness of the new Metro Line 4 and light rail (VLT) systems until the last minute. In the end, only ticketed visitors were permitted to use these forms of transport during the Olympics due to capacity concerns.

Media review

These media reports studied for this thesis focus predominantly on the infrastructural changes implemented in the city in preparations for the Games. Among the changes mentioned are: the new Metro Line 4 to Barra (18% of reports) and other new metro stations (4%); the new VLT (12%) and BRT (6%) systems; airport expansions (2%); the new real-time public transport app that was launched (2%) and the increased public transport coverage more generally (4%).

However, these reports also describe the challenges the city faced in preparing for the Games, including: concerns that transport infrastructure would not be ready on time (16%), would exceed the planned budget (10%) and was the subject of corruption concerns (2%). Indeed, Rio's Olympics preparations overall were reported as being 43% over budget ('Rio's Olympics expected to run 43% over budget', *The Rio Times,* 26.07.16). Concerns from the IOC about this cost, as well as the time frame of transport changes - "Some timelines remain very, very tight" ('IOC appraises Rio 2016 preparations', quoted in *The Rio Times,* 03.09.13) were also reported (4%). As noted in the academic literature, the eviction of residents of informal settlements (*favelas*) in order to make space for new transport infrastructure was also mentioned (4%). Condemnation of these evictions - and the insufficient compensation paid to from the UN and Amnesty

International was described by one report ('Rio Olympics: Favela poor evicted as city spruced up', *BBC World News,* 01.07.11).

There is no mention of increasing the accessibility of the public transport fleet, despite this being promised in the Rio's *Transport Concept.* One report expressed concern about this, particularly in light of the Paralympics coming to the city ('Is Rio's transport up to the paralympic challenge?', *BBC World News,* 08.10.05). Unlike the promises in the city's bid - and the precedent set by other host cities - ticketed guests would have to pay to use Rio's public transport system (mentioned in 4% of reports); and, as noted, the new VLT and Metro Line 4 would only be available for ticketed guests during the period of the Games (2%). Indeed, there was much uncertainty about the completion of the new Line 4 in particular, with the Mayor of Rio reportedly informing the IOC that it might not be ready in time for the Games ('Opinion: Rio's "unfinished" metro line 4' *The Rio Times,* 22.02.16). However, in the end, 8% of reports (all published days before the Opening Ceremony) stated that it would, in fact, be open to spectators.

Total number of reports: n = 49

Theme	Mentioned in x# of reports	Mentioned in x% of reports	Comment/quote
Over-budget	5	10	Reportedly 43% over budget (*The Rio Times,* 26.07.16)
IOC concerns	2	4	"Some timelines remain very, very tight" - IOC inspectors (reported in *The Rio Times,* 03.09.13) Budget concerns also
Positive legacy of transport improvement	1	2	'Olympic construction transforms public transport in Rio de Janeiro' (*The Rio Times,* 05.08.15)
Dislocation (/eviction) of residents of informal settlements (favelas) in order to make room for new transport infrastructure	2	4	
New public transport app - suggestions based on real-time data	1	2	
Airport expansion	1	2	At Galeao
New VLT	6	12	A second line was opened in February 2017 (legacy rather than behind schedule)
New metro line to Barra (line 4)	9	18	

Other new metro stations	2	4	e.g. Ipanema, Jardim de Alah and Antero de Quental
New bus routes	3	6	Including BRT - "bus rapid transit"
Reduction in number of bus routes	1	2	Aim to "streamline" the system
New public transport (initially) only for ticket holders, athletes and other accredited guests	1	2	
Special transport ticket for spectators (not free)	2	4	
Certain transport would (/might) not be ready for the Games/running behind schedule	8	16	Lots of uncertainty about the new metro line 4. Some contingency plans were discussed, such as buses as an alternative transport option
Running to schedule/will be ready for Games in the end	4	8	
Increased public transport coverage	2	4	
Claims of corruption within management of subway, train and in Agetranspo	1	2	Agetrasnpo = regulatory agency for public transport in the state)
Mention of (potential) "white elephants"	1	2	
Redevelopment project in Porto Maravilha	1	2	

Impacts

Along with Beijing, Rio's targeting of the 2016 Games presents a clear case of mega-event-driven development. While Olympics preparations did catalyse rapid developments in the city's public transport infrastructure - with a new rapid bus and light rail system, and expansions to its metro network - it was largely unsuccessful in fulfilling its aforementioned stated aim of 'improving the connection of disadvantaged areas of the city with areas offering employment, recreation and leisure opportunities' (IOC, 2009a, p. 61). In fact, Pereira (2018) argues that social inequalities were actually exacerbated by the new infrastructure that was implemented for the Games, with some of the city's poorer residents unable to afford traveling on these

new lines. This is because, despite the promises in Rio's *Transport Concept* to integrate the fare system for its public transport network, it remains fragmented to this day. Residents of the city continue to complain about the lack of buses and long waiting times for public transport (Ribeiro & Almeida, 2020). This is in addition to the extreme disruption to local livelihoods (evictions) during the construction of new transport infrastructure.

It would appear that Rio's baseline scenario had a significant effect on these impacts: the transport changes described in the city's 2016 *Candidature File* were highly ambitious given the limited nature of its public transport system at the time of bidding - too ambitious, it would seem. As noted widely in the academic literature and media reports, Rio's transport preparations for the 2016 Games ran considerably over budget and were not fully completed in time for the Olympics. Indeed, the unfinished BRT stations were subsequently viewed by some to be a transport "white elephant" (Ribeiro & Almeida, 2020). As these authors explain, the overall result of these factors was that Rio's residents' perception of their transport system actually worsened as a result of Games-driven developments. They conducted a pre- and post-Games survey of 925 of Rio's residents and found that, in four out the five criteria investigated (planning, infrastructure, insecurity and urban mobility), residents had a more negative perception of the city's public transport system after the Games were over. Only in relation to the information factor did this perception improve. As the authors describe, this improvement may be indicative of the success of the real-time information app that was launched as part of Games preparations.

Overall, therefore, there was a significant disparity between the expectations of Rio's residents when the city won its 2016 bid and the actual impact of Olympics-driven transport changes (Gaffney (2016); Rekow (2016)). While Rio's transport system was rapidly expanded and modernised, the city's bid and subsequent preparations for the 2016 Olympics appear to include some of the components of Müller's "mega-event syndrome", with over-promised benefits to citizens, under-estimated costs and corruption claims.

Transport changes	Impacts	Effect of the city's baseline scenario on these impacts
-Significant expansion of metro system: a new Line 4 to Barra along with other new metro stations, including Ipanema, Jardim de Alah and Antero de Quental -New VLT (light rai) system between Novo Rio Bus Terminal and Santos Dumont Airport -New BRT system -Temporary ORN implemented for the transport of the Olympic Family	-Rio's public transit system expanded dramatically as a result of Olympics-driven changes, and has continued to grow since (with further additions to the VLT) -However, residents did not benefit from the expanded metro and new VLT system as they were more expensive than the existing bus system; long waiting times persisted for the latter - Disruption to livelihoods for the construction of new metro line and VLT system -Evictions of people living in informal settlements (*favelas*) for the construction of new roads -Perception of Rio residents towards their transport system worsened as a result of Olympics-driven changes: the transport system was built for the purposes of transporting athletes and spectators between event venues and from the airport into	-While Rio's hosting of the Games drove rapid improvements to the city's transport system, their implementation was rushed and they were ultimately not completed in time for the Games. In this case, it appears the length of time between the successful bid and the Olympics was not long enough to implement such dramatic changes, given the limited infrastructure in place at the time of bidding -As a middle-income country, the cost of Olympics-hosting (as well as the PanAmerican Games and World Cup in the same decade) placed a

	the city centre rather than specifically for the needs of residents -Congestion remained a significant problem in the city, despite the expanded public transport system -Overall, it appears that the experiences of Rio's residents did not meet the expectations set during the bidding process; they did not benefit in the way the IOC predicted in its report on Candidate Cities (a clear case of Muller's "mega-event syndrome")	significant strain on public finances -The fragmentation of Rio's fare system at the time of bidding was maintained during and after it hosted the Games, which contributed to lower-income residents being unable to afford the new modes of transport

Overall insights & discussion

The findings described above for each individual city have answered *(RQ1): What Olympics-driven transport changes were implemented in Athens, Beijing, London and Rio?* Overall, as Kassens-Noor's 2013 paper explains, these changes ultimately had a similar focus, given the demands that Olympics-hosting places on a city's transit system. However, while her paper emphasises expanded airports and improved roads and airport-city centre connections, the findings here suggest that, while these transport changes are still commonplace, the focus of host cities has increasingly been on expanding their public transport network coverage and capacity. It is also this aspect of mega-event driven transport changes that has the most tangible legacy. Efforts to decrease congestion and improve air quality, and increase the modal share of sustainable transport - along with the implementation of ORN lanes for the Olympic Family - are usually more temporary in nature. There are exceptions to this, however, if new policies are implemented that build upon the Games' legacy, such as tightened restrictions on private vehicle ownership in Beijing or that aim to increase the modal share of cycling in London.

Overall, while there are some caveats to these Olympics-driven transport changes, it is worth noting that **the hosting of this mega-event does result in the accelerated development of a host city's public transport system**. Because of the requirement to include funding and permission guarantees from the relevant authorities for any new infrastructure - and the ongoing surveillance of progress by the IOC - host cities do, for the most part, keep to their pledges in their *Candidature Files.* The hard deadline of the Opening Ceremony acts as a **focusing event** for the transport pledges to be completed, even if they had been planned independent of Games-hosting; this was particularly true of Athens. In some cases, the Olympics can also catalyse a long-term shift in the city's transport trajectory. In Beijing, the authorities successfully leveraged the Olympics to pivot from an increasing reliance on the private car to one in which the public transport system was extensive, affordable and convenient - and whose network continued to expand after the Games. This indicates that the links back to the **path dependency** theory outlined above: that once a city sets off on a certain trajectory, it is likely to continue along this trajectory, even once the initial stimulus is over. This is reinforced with policy like further restrictions on private vehicle ownership and use in Beijing, or additional incentives for cycling in London.

While these Olympics-driven transport changes are clear, the impacts of these changes was a gap in the research up until this point. The findings of the media reviews, available public opinion surveys, academic papers for individual cities and data on modal distribution have sought to answer *(RQ2): How did these*

changes affect the behaviour, perceptions and livelihoods of residents interacting with these systems? The answer to this is more variable, depending on the host city in question.

First, the (temporary and permanent) **transport changes** that are implemented by a prospective Olympics host city **can cause disruption to local livelihoods and businesses.** This may be during the construction of new transport lines - such as in Rio, where residents of informal settlements were evicted from their homes - or during the weeks of the Games themselves while road diversions and advice to avoid non-Games-related travel may result in local businesses and non-Olympics tourist attractions losing money (as was the case in London).

Second, **while new transport lines may increase the overall coverage of a city's public transport network, this may not be of benefit to all inhabitants of a city**. In Rio, for example, a fragmented payment system means that poorer residents do not benefit from the more expensive new metro line. New lines built to and from Games venues may not serve a purpose after the event is over, if the legacy has not been clearly defined in advance or - as was in the case in Athens - housing and commercial developments did not progress as had been anticipated. This - along with Rio's BRT stations - is one of the few possible examples of transport "white elephants" that have been uncovered with this thesis. New transport infrastructure also comes at an opportunity cost: a focus on expanding airports and improving the airport-to-city-centre connection may facilitate the arrival of foreign guests but not benefit residents of the city itself. This relates back to the argument by Fitzgerald & Maharaj (2022, p. 181), that, 'A major public concern is that the money that is spent on infrastructure development could alternatively be used to address the social challenges in the host city and country'. The high cost of these Olympics-driven transport changes also adds to a public sentiment that the event was at least partially to blame for subsequent financial crises (as was the case in Rio and Athens).

Third, **new infrastructure and citizen behaviour change during the weeks of the Games may lead to a long-term shift in the modal distribution of different transport methods, though this is not guaranteed.** While public information campaigns - such as in Athens or London - are successful in encouraging more use of sustainable transport methods (or just staying at home) during the weeks of the Olympics and Paralympics, this is not enough time in itself to instigate long-term behavioural shifts. In order to cement such a shift - such as in Beijing - restrictive policies can be maintained or even tightened. Less draconian measures can also be successful: London managed to build on the Olympics' legacy by further promoting cycling as a mode of transport after the Games through additional infrastructure, education and funding. Athens, too, was able to build on its Olympics transport legacy in the long term; while residents demonstrated little interest in changing their choice of transport mode in the immediate aftermath of the Games, this slowly changed over time as public transit infrastructure continued to develop.

Finally, these **Olympics-driven transport changes can have a positive or negative impact on residents' perception of their transport system**. While Londoners' impressions of the city's public transit network improved after it coped better than expected with Games-pressure, Rio's residents became more dissatisfied as a result of Olympics-driven changes. Although no opinion polls could be sourced for Beijing, it is fair to assume that improved air quality was a positive impact, but one offset somewhat by the restrictions on individuals' ability to buy or use private vehicles.

These findings also relate to the final sub-research questions, *(RQ3): How do these changes and their effects differ by each city's* baseline scenario *- the state of their transport system at the time it successfully bids for the Games?.* While - as Kassens-Noor also outlined - the focus and final result of different host cities transport preparations for the Games was similar (from these four case studies found to focus predominantly on an expanded public transport network, but also increased airport capacity,

improved airport-to-city centre connections and temporary measures to improve the flow of traffic and reduce pollution), the pathway towards getting to this point varied widely by city, depending on its baseline scenario. Although the changes to London's public transport system were relatively small- thus allowing them to be completed on time and without accruing a large public debt - the same cannot be said of Athens and Rio. Cities with a limited transport system at the time of bidding experience the most dramatic improvements during preparations for the Games; this could be said of Rio, Beijing and Athens. However, the level of disruption to livelihoods and unsustainable public spending is strongly correlated with how much of this infrastructure needs to be built from scratch. Finally, governance structure also matters: as predicted by the IOC, Beijing's policies to reduce congestion and air pollution have been, and remained, successful, though at the cost of individual liberties, which would not be accepted in other cities.

Additional insights & future outlook

While they do not relate directly to the initial research question, some additional insights have emerged over the course of this research. First, by reading the *Candidature Files* in sequence, the progression over time of cities' *Transport Concept* stands out: they have become increasingly comprehensive and ambitious. Having shifted from focusing predominantly on expanding airports and improving roads to building new public transport infrastructure so no spectators are travelling to venues by car, the stress appears to be increasingly placed on zero-emission vehicles and active mobility. While Beijing tightened the emission standards of its vehicles in the lead-up to the Games and Rio was the first to mention efforts to decarbonise its transport fleet in its *Transport Concept* (even though this did not fully materialise), Tokyo (2020/1 host) was the first to implement fully zero-emissions transport in the Athlete Village while Paris' (2024 host) plans include building a new bridge across the River Seine for "soft" (=active) mobility (as described in their *Candidature Files: Centre d'Etudes Olympiques 2013 & 2017*).

Recommendations for (potential) future host cities

1. In order for a city to ensure a successful transport legacy, it must incorporate this planning at every step of the process: from the initial bid through to after the Closing Ceremony. As Kassens-Noor (2015, p. 9) summarises: 'A strategic planning approach has to be adopted already during the bidding stage'. It is vital that any new transport infrastructure that is built for the Games has a clear and realistic purpose after the event is over. If the city also aims to use the Olympics as a catalyst for an intangible transport legacy like behavioural change it must work extra hard, because the weeks of the Games are not enough in themselves to crystallise citizen behaviour change. Instead, policies that remain in place - and are further built upon - after the Closing Ceremony are required.
2. While a city that has an under-developed transport system needs to be ambitious in order to win its bid, it is also important that these ambitions do not exceed the time and resources available in the lead up to the Games. Although Olympics hosting does catalyse the rapid development of a city's transit system, particularly one which is underdeveloped at the time of bidding, it can also place a significant strain on public finances, often resulting in debt.
3. Although the IOC's OGKM programme does facilitate the transfer of knowledge between previous and prospective host cities, it focuses on "top-to-top" interactions, among organisers and leaders. In order for Olympics-driven transport changes to best serve the needs of city residents and succeed in realising behaviour changes, close collaboration and dialogue with community groups and other people on the ground is also essential. The case of London provides a good example of how this can be done effectively.

Limitations

The nature of the breadth of this research is that it is difficult to provide a fully exhaustive account of the four case studies. Furthermore, given that this research has all been conducted remotely and retrospectively, some elements of the "on-the-ground" situation may have been overlooked. I was also unable to source any expert interviewees who may have been able to give further explanation of Olympics-driven transport changes, the rationale behind them, any externalities that may have incurred and whether or not all of the impacts described above were indeed a direct result of Olympic-hosting of if there were any other factors at play. This also relates to another limitation: the fact that it is impossible to prove that these mega-event-driven transport changes would not have occurred anyway, without the influence of the Games. However, the direct comparison between the pledges in each city's *Candidature File* and the transport changes implemented in the lead-up to the bid was included in order to try and focus only on **Olympics-driven** transport changes.

The method of the media review also presents a limitation: the fact that the reports included here may not present an exhaustive account of the impact of Olympics-driven transport changes. While there was an effort to include as many viewpoints as possible, time, language and (lack of) availability of online reports were all limitations that may have affected the balance of viewpoints featured.

A final limitation of the findings of this thesis - particularly for prospective host cities - is that the IOC's bidding/candidature process has changed somewhat for the 2032 Games (and, it would appear, onwards). Instead of a collection of interested cities submitting their *Candidature File* to the IOC in the hope of being selected to host the Games, the Committee is now engaging in so-called "targeted dialogue" with cities it believes would be good candidates; this is how Brisbane was selected to host the 2032 Games. While this process may be an effective approach by the IOC to combat declining interest among cities to host the Olympics, it also results in reduced transparency as to the candidature and election process.

Further research

This is a huge field into which relatively little research has been done thus far, and which would thus benefit from further research.

First, a possible means of investigating whether or not the transport changes that were implemented between the bid and the Games (and after) were indeed a direct consequence of being awarded the Olympics would be to compare host cities with similar places that have never hosted the event. This could take the form of a comparison across various quantitative measures at the time of bidding, hosting and in the aftermath of the Games between Olympic and non-Olympic cities. With that said, the biggest barrier to such research would likely be the availability of data: while it is easily accessible for London, for example, it is much more difficult to source for Beijing.

Second, in order to confirm whether or not other factors were at play in the transport changes that were made - or their impacts - it would be useful to conduct interviews with experts in the field: that is, individuals who were involved in the planning and delivery of the transport component of the Olympics. This would also provide further insight into any knock-on effects or externalities that have emerged from Olympics-driven transport changes.

Finally, follow-up research in the coming years that would provide a similar analysis of the transport legacy of future Olympic Games would be interesting in order to see if the trend towards a greater focus on

zero-emission fuels and active mobility will continue, and the impact this has on a city's overall transport system.

Conclusion & broader relevance

This thesis has provided an insight into mega-event-driven development of a city's transport system, and its impacts, through the analysis of four previous Olympic host cities, Athens, Beijing, London and Rio. Despite the fact that these cities each came from a different baseline when winning their bid, the focus of their Olympics-driven transport changes was similar: to improve the coverage and capacity of their public transport system. Airport expansions and road improvements were also common. The hard deadline of the Opening Ceremony is a significant focusing event, and the scrutiny of the IOC and global audiences a particular motivator, for host cities' public transport systems to develop at a much greater speed than they would likely have otherwise. However, there is a cost to this rapid development: financial, which can result in public debt; opportunity, given the possible alternative uses of this money; and to the lives and livelihoods of a host city's residents, which are disrupted - often very significantly - by Games hosting. While Olympics-driven transport changes can improve perceptions and change the behaviour of transport-users in the long-term, this is only achieved through planning that thinks beyond the Games from the very outset, and policy that sustains long after the Closing Ceremony.

Overall - although there is plenty of nuance - cities with the least-developed transport systems at the time of bidding undergo the most rapid improvements to these systems, but are also most likely to experience the aforementioned costs, and vice versa. This is of particular relevance when looking to the future of the Olympics and other mega-events. With wealthy countries displaying a decreased appetite to host such occasions - indicated by the many failed referendums recently - the baton seems to be passing to BRICS and Middle Eastern (particularly given the precedent set by Qatar's hosting of the 2022 World Cup) countries in the future. Given the findings of this thesis, it is imperative that future host cities - as well as international organisations like the IOC - are mindful of the costs of mega-event-hosting and plan with the long-term interests of all of their residents (rather than just of short-term visitors) in mind.

Bibliography

A full list of the 241 news reports included in the media review is available from the author on request.

Atlas of Public Management. (n. d.). Focusing event: A core concept used in Policy Analysis and Process and Atlas 101. Retrieved on September 18th, 2022 from: https://www.atlas101.ca/pm/concepts/focusing-event/

Bason, T. & Grix, J. (2017). Planning to fail?: Leveraging the Olympic bid. *Marketing Intelligence & Planning 36*(1), 138-151. https://dx.doi.org/10.1108/MIP-06-2017-0106

Béland, D. & Howlett, M. (2016). The role and impact of the multiple-streams approach in comparative policy analysis. *Journal of Comparative Policy Analysis: Research and Practice,* 18(3), 221-227. https://doi.org/10.1080/13876988.2016.1174410

Bovy, P. (2017). Rio 2016 Olympic Games public transport development outstanding legacy and mobility sustainability*.* Retrieved on July 17th, 2022 from: https://www.mobility-bovy.ch/resources/Resources/A-Rio-2016-Transport-legacy.pdf

Bovy, Philippe. (2019). Since Sydney 2000 Olympics are catalysts for more sustainable mobility: Towards Olympics 4.0. *IVT Institute for Transport Planning Systems Seminar* (November 5, 2019). Retrieved on July 17th, 2022 from: https://ethz.ch/content/dam/ethz/special-interest/baug/ivt/ivt-dam/events/2019/11/05/ioc-bovy-olympics-40.pdf

Boukas, N. et al. (2015). Olympic legacy & cultural tourism: Exploring the facets of Athens' Olympic Heritage. In S. Gammon et al (Eds.). *Heritage and the Olympics: People, place and performance* (pp. 85 - 110). Routledge, Oxfordshire, UK. DOI: http://dx.doi.org/10.4324/9781315093000-7

Cashman, R. (2010). *Impact of the Games on Olympic host cities: University lecture on the Olympics.* Barcelona: Centre d'Estudis Olimpics (UAB). Retrieved on September 16th, 2022 from: http://ceo.uab.cat/pdf/cashman_eng.pdf

Centre d'Etudes Olympiques. (1997). *Athens 2004 Candidate City - Candidature File - Volume 3.* Retrieved on July 15th, 2022 from: https://library.olympics.com/Default/doc/SYRACUSE/53479/athens-2004-candidate-city-athens-2004-olympic-bid-committee

Centre d'Etudes Olympiques. (2001). *Beijing 2008 Candidate City - Candidature File - Volume 3.* Retrieved on July 18th, 2022 from: https://library.olympics.com/Default/doc/SYRACUSE/42147/beijing-2008-candidate-city-comite-pour-la-candidature-de-beijing-aux-jeux-olympiques-de-2008

Centre d'Etudes Olympiques. (2005). *London 2012 Candidate City - Candidature File - Volume 3.* Retrieved on July 21st, 2022 from: https://library.olympics.com/Default/doc/SYRACUSE/28313/london-2012-candidate-city-dossier-de-candidature-london-2012-candidate-city-candidature-file-comite

Centre d'Etudes Olympiques. (2009). *Rio 2016 Candidate City - Candidature File - Volume 3.* Retrieved on July 24th, 2022 from: https://library.olympics.com/Default/search.aspx#/Detail/(query:(Id:'0_OFFSET_0',Index:1,NBResults:2,PageRange:3,SearchQuery:(ExceptTotalFacet:!t,FacetFilter:%7B%7D,ForceSearch:!f,HiddenFacetFilter:%7B%7D,InitialSearch:!f,Page:0,PageRange:3,QueryGuid:d644c504-2854-43fc-b677-5bce02b7e93b,QueryString:'%20Subject_idx:(%E2%80%9CDossiers%20de%20candidature%E2%80%9D%20AND%20%22Rio%22%20AND%20%22

2016%22)',ResultSize:10,ScenarioCode:CATALOGUE,ScenarioDisplayMode:display-standard,SearchContext:1
4,SearchGridFieldsShownOnResultsDTO:!(),SearchLabel:'Official%20candidature%20files%20Rio%202016',Se
archTerms:'Subject_idx%20Dossiers%20de%20candidature%20AND%20Rio%202016',SortField:!n,SortOrder:
0,TemplateParams:(Scenario:'',Scope:Default,Size:!n,Source:'',Support:'',UseCompact:!f),UseSpellChecking:!n
)))

Centre d'Etudes Olympiques. (2013). *Tokyo 2020 Candidate City - Candidature File - Volume 3.* Retrieved on July 30th, 2022 from:
https://library.olympics.com/Default/doc/SYRACUSE/70447/tokyo-2020-discover-tomorrow-tokyo-2020-oly
mpic-games-bid-committee

Centre d'Etudes Olympiques. (2017). *Paris 2024 Candidate City - Candidature File - Volume 3.* Retrieved on August 4th, 2022 from:
https://library.olympics.com/Default/doc/SYRACUSE/171681/candidature-file-paris-candidate-city-olympic-g
ames-2024

Chen, Y. et al. (2013). Framing the long-term impact of mega-event strategies on the development of Olympic host cities. *Planning Practice & Research, 28* (3), 340-359.
https://doi.org/10.1080/02697459.2013.750072

Coaffee, J. (2007). Urban regeneration and renewal. In J. R. Gold & M. M. Gold (Eds.). *Olympic Cities city agendas, planning and the world's games, 1896–2012*. New York, NY, USA: Routledge

Crotty, J. (2009). Structural causes of the new global financial crisis: A critical assessment of the "new financial architecture". *Cambridge Journal of Economics* 33(4), 563-580. https://doi.org/10.1093/cje/bep023

Duignan, M. B. (2021). Utilizing field theory to examine mega-event-led development. *Event Management 24*(6): 795-720. https://doi.org/10.3727/152599520X15894679115583

Fan, A. et al. (2019). How have travelers changed mode choices for first/last mile trips after the introduction of bicycle sharing systems: An empirical study in Beijing, China. *Journal of Advanced Transportation*.
https://doi.org/10.1155/2019/5426080

Fitzgerald, T. & Maharaj, B. (2022). Chapter 13: Mega-event trends and impacts. In: N. Wise & K. Maguire (Eds.) *A research agenda for event impacts.* Northampton, MA, USA: Edward Elgar Publishing.
https://doi.org/10.4337/9781839109256.00022

Georgiakis, S. & Nauright, J. (2012). Creating the "Scarecrow": The 2004 Athens Olympic Games and the Greek Financial Crisis. *The George Mason University Center for the Study of Sport and Leisure in Society's Sports and Society Working Papers Series (2012): Working Paper #3*. Retrieved on September 17th, 2022 from:
https://www.academia.edu/1922581/Creating_The_Scarecrow_The_2004_Athens_Olympic_Games_and_th
e_Greek_Financial_Crisis

Gössling, S. (2020). Why cities need to take road space from cars - and how this could be done'. *Journal of Urban Design* 25 (4), 443-448. https://doi.org/10.1080/13574809.2020.1727318

GLA Opinion Research. (2013). London 2012 Opinion Research. Retrieved on January 9th, 2023 from:
https://data.london.gov.uk/dataset/london-2012-opinion-research

Ieromonachou, P. et al. (2010). The Olympic transport legacy. *Town and Country Planning* 79(7), 331-336.

International Olympic Committee. (2020). Here East: How the Olympic Games London 2012 created new opportunities for a community. Retrieved on January 9th, 2022 from:
https://olympics.com/ioc/news/here-east-how-the-olympic-games-london-2012-created-new-opportunities-

for-a-community/#:~:text=For%20the%20Olympic%20Games%20London%202012%2C%20legacy%20was,and%20create%20lasting%20positive%20impacts%20for%20future%20generations.

its magazine. (2010). "No transport white elephants": Mobility planning for mega-events. Retrieved on July 15th, 2022 from: https://www.mobility-bovy.ch/resources/03.Transport.no.elephants-2010.PDF

Karamichas, J. 'A source of crisis? Assessing Athens 2004'. In: Lenskyj, H. J., Wagg, S. (eds.) *The Palgrave Handbook of Olympic Studies*. London, UK: Palgrave Macmillan. https://doi.org/10.1057/9780230367463_11

Kassens, E. (2009). Transportation planning for mega events: A model of urban change. Doctoral thesis. MIT, Massachusetts, USA.

Kassens-Noor, E. (2010). Sustaining the momentum: The Olympics as potential catalysts for enhancing urban transport. *Transportation research record: Journal of the transportation research board 2187*(1), 106-113. https://doi.org/10.3141/2187-14

Kassens-Noor, E. (2013). Transport legacy of the Olympic Games, 1992-2012. *Journal of Urban Affairs 35*(4), 393-416. https://doi.org/10.1111/j.1467-9906.2012.00626.x

Kassens-Noor, E. (2015). The legacy of the 2004 Olympics for Athens' transport system. In: R. Holt and D. Ruta (Eds.) *The Routledge handbook of sport and legacy: Meeting the challenge of major sports events.* Oxfordshire, UK: Routledge.

Li, P. & Jones, S. (2015). Vehicle restrictions and CO2 emissions in Beijing - A simple projection using available data. Transportation Research Part D Transport and Environment 41: 467-476. DOI:10.1016/j.trd.2015.09.020

Livingstone, R. (2018). BidWeek: A short history of Olympic bid referendums. Retrieved on January 9th, 2022 from:
https://gamesbids.com/eng/winter-olympic-bids/2026-olympic-bid-news/bidweek-a-short-history-of-olympic-bid-referendums/#:~:text=The%20only%20city%20to%20reject%20a%20Games%20that,60%20percent%20voted%20against%20financing%20the%20Winter%20Olympics.

Martins Rodrigues, J. (2014). Urban mobility in the "Olympic City: A transportation revolution in Rio de Janeiro? In L. Cesar de Queiroz Ribeiro (Ed.). *The metropolis of Rio de Janeiro: A space in transition,* pp. 279-198. Rio de Janeiro, Brazil: Letra Capital Editor.

Masterman, G. (2008). Losing bids, winning legacies: An examination of the need to plan for Olympic legacies prior to the bidding. In *Proceedings: International Symposium for Olympic Research.* Lausanne, Switzerland: International Centre for Olympic Studies.

Matteson, V. & Zimbalist, A. (2021). Why cities no longer clamor to host the Olympic Games. *Georgetown Journal of International Affairs.* Retrieved on September 12th, 2022 from:
https://gjia.georgetown.edu/2021/04/19/why-cities-no-longer-clamor-to-host-the-olympic-games/#:~:text=The%20answer%20is%20spiraling%20costs,become%20an%20exceptionally%20expensive%20affair.

Mayor of London & Transport for London. (2013). *The Mayor's vision for cycling in London: An Olympic legacy for all Londoners.* London, UK: Greater London Authority.

Minis, I. et al. (2009). 'Car fleet planning and management models for large event transport: The Athens 2004 Olympic Games'. *Transportation Planning & Technology,* 32(2): 135-61.

Müller, M. (2015). The Mega-Event Syndrome: Why so much goes wrong in mega-event planning and what to do about it. *Journal of the American Planning Association, 81*(1), 6-17*.*
https://www.tandfonline.com/action/showCitFormats?doi=10.1080/01944363.2015.1038292

Panagiotopoulou, R. (2013). The legacies of the Athens 2004 Olympic Games: A bitter-sweet burden. *Journal of the Academy of Social Sciences* 9(2), 173-195. https://doi.org/10.1080/21582041.2013.838297

Peiheng, L. & Jones, S. (2015). Vehicle restrictions and CO2 emissions in Beijing - A simple projection using available data. *Transport Research Part D Transport and Environment 41* (Dec 2015), 467-476. http://dx.doi.org/10.1016/j.trd.2015.09.020

Pereira, R. H. M. (2020). Transport legacy of mega-events and inequalities in access to opportunities in Rio de Janeiro. In M. Neri (Ed.). *Evaluating the local impacts of the Rio Olympics,* pp. 151-174. Oxfordshire, UK: Routledge.

Reis, A. C. et al. (2017). Sport participation legacy and the Olympic Games: The case of Sydney 2000, London 2012, and Rio 2016. In *Event Management 21*(2), 139-158. http://dx.doi.org/10.3727/152599517X14878772869568

Ribeiro, T. & Almida, V. (2020) The Rio's transport legacy: Pre- and post-Games resident perceptions. *International Journal of Sports Marketing and Sponsorship* (ahead-of-print). http://dx.doi.org/10.1108/IJSMS-04-2020-0073

Robinson, J. A. & Torvik, R. (2004). White Elephants. *Journal of Public Economics 89*(2-3): 197-210. doi:10.1016/j.jpubeco.2004.05.004

Sanchez, F. & Broudehoux, A-M. (2013). Mega-events and urban regeneration in Rio de Janeiro: Planning in a state of emergency. *International Journal of Urban Sustainable Development* 5(2): 132153. https://doi.org/10.1080/19463138.2013.839450

Seetharaman, G. Why is it difficult to come up with a viable transport model for all cities? *ET Bureau: The Economic Times.* Retrieved on September 16th, 2022 from: https://economictimes.indiatimes.com/news/economy/infrastructure/why-it-is-difficult-to-come-up-with-a-viable-public-transport-model-for-all-cities/articleshow/66101927.cms?from=mdr

Silvestre, G. (2008). The social impacts of mega-events: Towards a framework. *Esporte e Sociedade 4*(10): 1-26. Retrieved on October 30th, 2022 from: https://periodicos.uff.br/esportesociedade/article/view/48287/28003

Stevens, A. (2008). 2012 London Olympics to regenerate one of the poorest areas of the capital. *City Mayors Report.* Retrieved on January 9th, 2023 from: http://citymayors.com/sport/2012-olympics-london.html

Taha, B. S. (2020). Hosting mega event - Drive towards sustainable planning for public transport - Case study: Metro line route 2020. *Transportation Research Procedia* 48: 2176-2186. https://doi.org/10.1016/j.trpro.2020.08.274

Transport for London. (2013). *London Travel Report 2006.* Mayor of London Office: London, UK.

Transport for London. (2022). Encouraging walking & cycling. Retrieved on January 9th, 2023 from: https://tfl.gov.uk/corporate/about-tfl/how-we-work/planning-for-the-future/encouraging-cycling-and-walking

Transport for London. (2023). A brief history of the Underground. Accessed on January 7th, 2023 from: https://tfl.gov.uk/corporate/about-tfl/culture-and-heritage/londons-transport-a-history/london-underground/a-brief-history-of-the-underground

Trouvé, H. et al. (2010). The path dependency theory: Analytical framework to study institutional integration. The case of France. *International Journal of Integrated Care 10*(2): None. http://doi.org/10.5334/ijic.544

Turro, M. & Penyalver, D. (2019). Hunting white elephants on the road. A practical procedure to detect harmful projects of transport infrastructure. *Research in Transportation Economics* 75(June 2019), 3-20. https://doi.org/10.1016/j.retrec.2019.03.001

United Nations. (2022). World Population Prospects. Retrieved on December 29th, 2022 from: https://population.un.org/wpp/

United Nations Environment Programme. (2019). *A review of 20 years' air pollution control in Beijing.* Nairobi, Kenya: UNEP.

Varrel, A. & Kennedy, L. (2011). *Mega-events and mega-projects*. Chance 2 Sustain Policy Brief, June 2011. Bonn, Germany: EADI.

West Midlands Combined Authority & Transport for West Midlands. (2022). *2022 Commonwealth Games: Games Transport Plan.* Retrieved on September 18th, 2022 from: https://www.tfwm.org.uk/media/30vhr1zh/games-transport-plan-january-2022.pdf

Yamawaki, Y. & Tomaz, J. (2019). The transport infrastructure contribution to the urban legacy of the Beijing Olympic Games. *urbe. Revista Brasileira de Gestão Urbana*, 11, e20180044. https://doi.org/10.1590/2175-3369.011.e20180044

Yannis, G. et al. (2009). Integrated scheme for Olympic village traffic and parking arrangements. *Journal of Infrastructure Systems,* 15(1): 40-9.

YouGov. (2017). How left or right wing are the UK's newspapers? Retrieved on January 1st, 2023 from: https://yougov.co.uk/topics/politics/articles-reports/2017/03/07/how-left-or-right-wing-are-uks-newspapers

Zhou, J. & Long, Y. Losers and pareto optimality in optimising commuting patterns. *Urban Studies* 53(12). DOI: http://dx.doi.org/10.1177/0042098015594072