

**OLYMPIC TRANSPORTATION PLANNING:
THE LEGACIES OF BARCELONA AND BEIJING**

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INTRODUCTION

Being selected as a host city for sport mega-events, such as the Olympics and the World Cup, is both a gift and a burden. Host cities are thrust into the international spotlight and must provide the stadiums, housing, transportation infrastructure and management, and crowd management needed for the games. To adequately supply transportation for the movement of millions of athletes, spectators, media, officials, workers, and volunteers; between venues, housing, and the airport; mega-events require the host city to implement a strategic transportation plan with a strict deadline. The transportation infrastructure built and policies implemented for these mega-events are an integral part of the games that can alter a city's transportation network and leave a lasting legacy.

Potential host cities are only required by the International Olympic Committee (IOC) to demonstrate their ability to provide a transportation plan that can efficiently support movement during the Olympic Games. Nowhere in a city's Olympic bid must it explain how transportation built or policies implemented will be used after the Olympics has ended. In competition with other cities to win a bid, potential host cities may drastically propose to alter their transportation networks to attract the IOC. Mega-events provide an opportunity for a host city to make major investments in infrastructure development. These opportunities can be catalytic, compressing what was already planned on being built from taking decades to implementing it in a few years, or divergent, developing infrastructure specifically designed for purposes of the mega-event that would not have otherwise been built (Kassens 2009).

The goal of a host city, in terms of its transportation legacy, should be to use the Olympics to build infrastructure or implement policies that alter a host city's transportation network to fit the IOC requirements while also supporting larger city goals beyond the Olympics. Is it possible for host cities to capitalize on the rapid growth spurt of the Olympics and provide good transportation legacies, or will host cities forever be burdened with underused infrastructure or missed opportunities?

This thesis addresses the mega-event transportation legacy by asking why some Olympic host cities have been successful in utilizing the mega-event as an impetus for transportation infrastructure development that was able to both support the high volumes of movement during the Games and align with the long-term goals of the city's transportation plans. To better understand the Olympic transportation legacy, this thesis will analyze the strategies of Barcelona, host of the 1992 Summer Games, and Beijing, host of the 2008 Summer Games, as case studies of their transportation infrastructure planning pre-Games and post-Games.

BACKGROUND

Cities that have been selected to host a sports mega-event such as the Olympics or the World Cup are put on a trajectory that according to Essex and Chalkley (2007, 7), as cited in Kassens (2009, 14), “do[es] not fit any planning model.” Host cities are required to provide the appropriate venues, housing, and transportation as outlined by the mega-event’s presiding committee. The foreseeable strain on the limitations of a host city’s existing transportation network, and the added pressure of an international audience, results in most host cities expanding and improving their transportation networks in time for the start of the events.

While concerns of travel congestion and passenger mobility are heightened during mega-events, these issues are part of transportation planning that are an essential component for both host and non-host cities. In order to understand the success of mega-event host cities transportation, two scenarios need to be identified:

1. How do cities normally conduct and finance transportation planning?
2. What factors influence changes to transportation planning of host cities?

Traditional Transportation Planning

To investigate transportation in non-host cities, I will provide a general overview of how transportation projects are planned and financed in the United States. While specifics of government entities and funding may not be applicable internationally, it will provide a basic understanding of the complex and fragmented process.

The Transportation Planning Capacity Building (TPBC) program (2007, 2) outlines the process of transportation planning as:

- **Monitoring existing conditions;**
- **Forecasting future population and employment growth**, including assessing projected land uses in the region and identifying major growth corridors;
- **Identifying current and projected future transportation problems and needs** and a analyzing, through detailed planning studies, various transportation improvement strategies to address those needs;
- **Developing long-range plans and short-range programs** of alternative capital improvement and operational strategies for moving people and goods;
- **Estimating the impact of recommended future improvements** to the transportation system on environmental features, including air quality; and
- **Developing a financial plan** for securing sufficient revenues to cover the costs of implementing strategies.

In the United States a multitude of stakeholders are involved in the transportation planning process in the public sector alone, as shown in Table 1. From the local to the federal level many entities are involved in

the planning. Metropolitan Planning Organizations (MPOs), State Department of Transportation (DOTs), and transit operators are responsible for facilitating transportation projects. These agencies use the 4-Step Modeling Process—Trip Generation, Trip Distribution, Mode Split, and Network Assignment—to model transportation demand and other tools such as Land Use Models, Emissions Models, Tour-Based Models, and Scenario Testing to assess existing conditions and identify future needs.

Table 1. Major Public Sector Stakeholders in Transportation Programs in the United States

Federal	State	Regional Transportation Planning Organizations	Local Governments	Transit Agencies
<ul style="list-style-type: none"> • U.S. Department of Transportation (DOT) • 6 Major Federal Land Management Agencies • 3 Primary Environmental Protection Agencies 	<ul style="list-style-type: none"> • 51 State Departments of Transportation (every state and in D.C.) • Other State agencies with related responsibilities 	<ul style="list-style-type: none"> • Urban: 383 Metropolitan Organizations (MPOs) (ranges from 1 to 26 per state) • Rural: 180 Regional Transportation Planning Organizations (RTPOs) 	<ul style="list-style-type: none"> • 3,034 Counties • 19,431 Municipalities • 16,504 Townships • 767 Highway Special Districts • 85 Bridge, Tunnel, and Turnpike Authorities 	<ul style="list-style-type: none"> • 640 Urban Operation Systems (600 are public agencies) • >2,000 Rural Operating Systems • 561 Federally recognized Tribal Governments (eligible for rural transit grants)

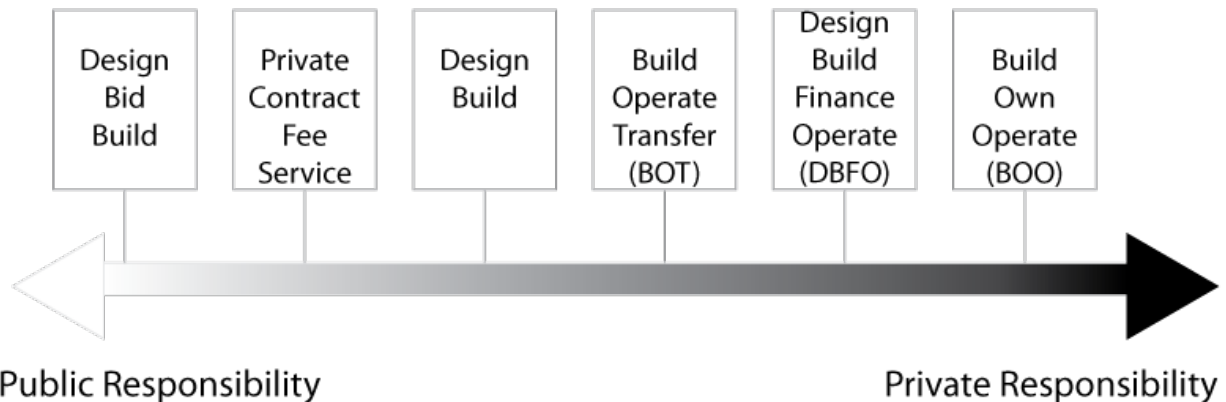
Source: Intergovernmental Forum on Transportation Finance (2008, 24).

MPOs and State DOTs use the data from these models in the formulation of key documents that are required for funding allocations at the state and federal levels. These documents outline the next steps for achieving the future policies, strategies, and projects that will address the forecasted demands on the relevant transportation systems within an agency’s reach and have varying requirements of how often they need to be updated. These reports, including the Metropolitan Transportation Plan—in which an MPO must include a financial plan that forecasts the funding for their plans from federal, state, and local sources—are the transition point from planning to financing. (TPBC 2007).

Transportation spending in the United States falls into two categories: capital investment and operations. Each of these categories is financed differently at the federal, state, and local levels. (APTA 2009). In addition to public funds, Public-Private Partnerships (PPPs) are another funding source for transportation projects. PPPs divide financial and operation responsibilities between public and private sectors at varying combinations, as shown in Figure 1. Partnerships include Design-Bid-Build in which the public sector finances all steps but private entities design, bid, and build and then the public entity manages and maintains

it; Build-Operate-Transfer, in which the public entity finances the infrastructure and then private entities provide for construction and operation; and Build-Own-Operate, in which private entities are responsible for design, development, financing, building, operation, and maintenance of a usually long-term agreement while the role of the public entity is towards regulatory framework and ensuring compliance. (Rodrigue 2009; Intergovernmental 2008)

Figure 1. Range of Public-Private Partnerships



Source: Adapted from (Rodrigue 2009).

Transportation planning involves planning, financing, building, and operating which must occur amongst multiple levels of stakeholders, both public and private. A plan for transportation infrastructure changes in a city could require planning at the local and regional levels; financing from local, regional, state, and federal governments as well as private sources; and building and operations support from public and private entities. This complex process, with political or financial obstacles, could take years, if it is to come to fruition at all. It has taken New York City's Second Avenue subway line, first proposed by the New York City Board of Transportation in 1929 to be completed by 1941, almost 80 years to finally break ground (a second time) and begin construction (MTA 2007).

New York City's bid for the 2012 Summer Olympics included the completion of the 7-line extension from Times Square with two subway stops at 34th Street and 11th Avenue and at 41st Street and 10th Avenue. Although the desire for the extension was still part of its plans, since London beat out New York City to host the Games, there was no definitive deadline of when it needed to be completed. As the start of 2012 Summer Olympic Games approaches, the 7-line extension has gone from two to one additional station with December 2013 as projected completion date (MTA 2012; IOC 2005). Without the deadline of the Olympics, the completing the extension was no longer a top city priority.

Host City Transportation Planning

While time and finance are critical components for all transportation projects in cities, unlike normal cities, host cities do not have the ability to delay a deadline for transportation project completion. For the host city scenario, I will briefly describe the Olympic transportation requirements.

At an intensified scale, host cities must forecast demand based on past attendance of mega-events. Summer Olympic host cities can expect 1.25 million additional person trips every day of the 16-day event from 4 to 9 million spectators and more than 150,000 workers and volunteers. While attendees and the workforce put a strain on public transportation, the IOC also requires specific private transportation for more than 17,000 athletes and team officials, 5,000 VIPs and other officials, 24,5000 accredited media, and 30,000 sponsor guests (Kassens 2009; Bovy 2011a).

According to the Olympic Charter (2001, 13) “the three main constituents of the Olympic Movement are the International Olympic Committee (IOC), the International Sports Federations (IFs) and the National Olympic Committees (NOCs).” In addition to the IOC, IFs, and NOCs, the Organising Committees of the Olympic Games (OCOGs) are fundamental to the organizational framework. The IOC is defined as the “supreme authority of the Olympic Movement” (Olympic Charter 2011, 2) with the role of promoting top-level sports and ensuring the regular celebration of the games. Individual countries have their own NOCs “responsible for developing and defending the Olympic movement within its country” (Olympic Charter 2011, 34) and deciding which of its cities will be proposed as a host. The IFs are responsible for monitoring the operations during the Games (Olympic Charter 2011).

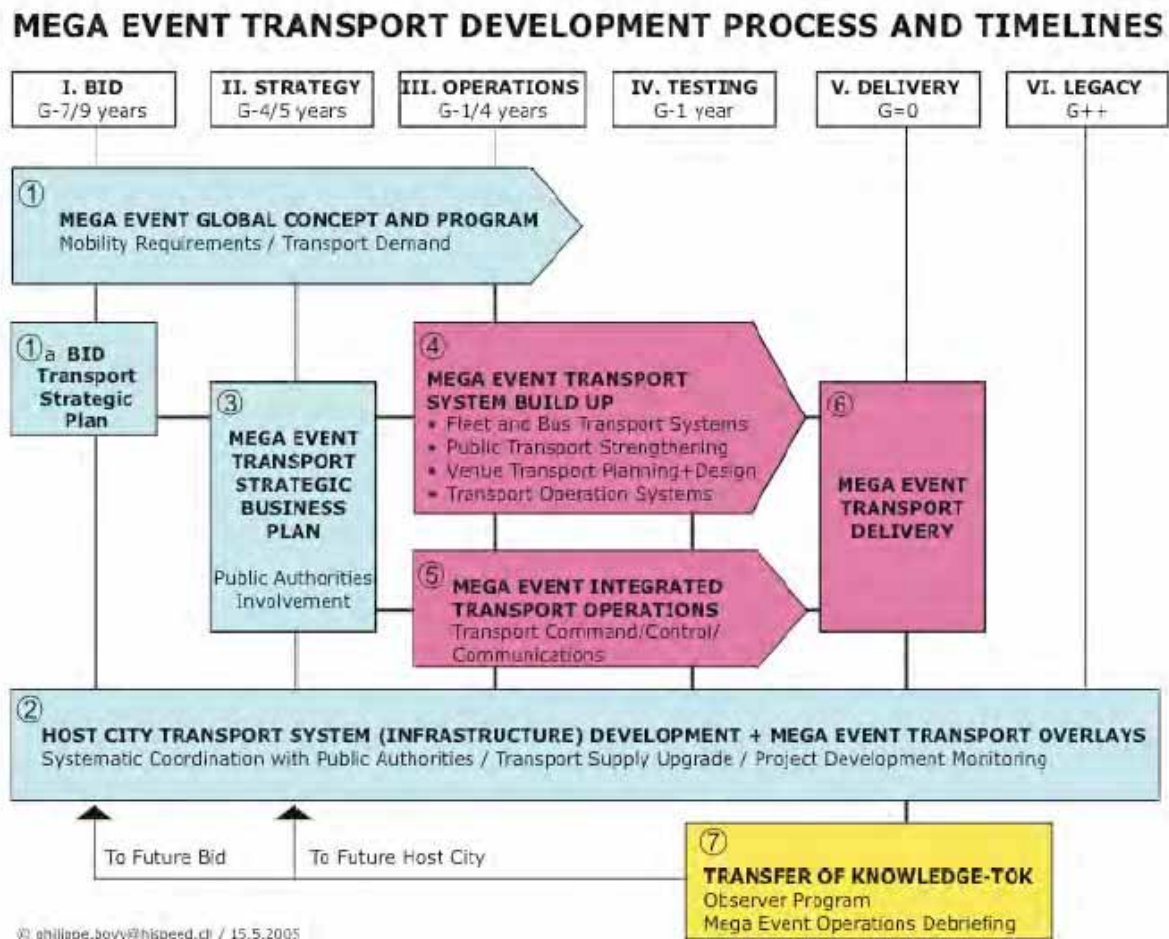
Candidate cities are required to prepare a bid to present to the IOC. If multiple cities in a country prepare bids, the country’s NOC determines which city will present to the IOC. The bids are put together by a city’s OCOG and must inform the IOC how the city intends to meet the requirements of the 18 themes outlined by the IOC. The Candidature File for 2008 candidate cities contained 149 questions on categories including: National, Regional and Candidate City characteristics; Customs and immigration formalities; Sports; Olympic Village; Security; and Transport. Once a city has been selected, the planning transitions from a city’s OCOG to a city’s Olympic Committee (Kassens 2009; IOC 2000a, IOC 2000b).

There are four phases in the host city’s planning cycle: bid, preparation, delivery, and legacy. The bid process happens approximately 7 to 8 years before the Games with the legacy beginning once the games have ended, as shown in Figure 2. For the 2008 Olympics, IOC approved candidate cities in August 2000, submissions of Candidature Files from cities was due to the IOC in January 2001 and the host city was elected in July

2001. Once this proposal has been submitted and a candidature city is selected as a host city, no changes or deviations from the Olympic bid, including transportation modifications, can be made without the consent of the IOC. The “Transfer of Knowledge” component in the planning cycle is critical for future candidate and host cities in evaluating the positive and negative choices and outcomes of former host cities and modifying their proposals and plans based on previous successes and failures (Olympic.org; Malfas 2004; Bovy 2011b).

Figure 2. Mega Event Transport Development Process and Timelines

Source: Bovy, (2005, 46).



The Candidature File for the 2008 games (IOC 200b,76) outlines four categories of users that will determine the demand for transportation:

- The Olympic family—including athletes and officials
- Media
- The Organising Committee for the Games, logistical support staff, and volunteers
- Spectators

The Candidature File then asks questions based on a city’s Offer, Demand, Concept, and Planning Management, as shown in Table 2. The Offer is broken down by Air Transport; Motorways; main roads and parking; Public transport system; and Summary of distances and journey times. Demand is broken down into Overall needs and Spectators. Concept is divided into Strategic transport plan and Strategic Planning. Questions about Planning and Management are addressed in categories of Authorities and Information. The IOC asks both about current and proposed changes. The candidates are evaluated based on their Candidature File, IOC visits to the candidate cities, and presentations by the OCOGs to IOC. For candidate cities, the ability of a city to provide sports venues and the Olympic Village are the most heavily weighted parts of a city’s bid. This is followed by the city’s ability to provide adequate transportation. The IOC’s decision is also based on factors of concept, safety, security, finance, and legacy.

Table 2. Candidature File Transportation Requirements for 2008 Olympic Host City Candidates

	Category/Strategy	Strategy	Requirements
Offer	Air Transport	14.1 Airport Data	<ul style="list-style-type: none"> • The number of national and international departure gates, the capacity of the terminal (passengers/hour), the capacity of the runway(s) (movements/hour), the limits on night flights, if applicable, improvements that will be made for the Games
		14.2 Flight Network	<ul style="list-style-type: none"> • The number of national international regular direct flights • The distribution between the continents and the cities served by your airport(s) with regular flights (for at least the five years), with the number of flights per week
	Motorways, main roads and parking	14.3 Network	<ul style="list-style-type: none"> • Referring to Map B (existing general and sport infrastructures) and Map C (general sport infrastructures planned regardless of your candidature), describe the road and motorway network adopted for the Games • Indicate what projects are underway • Indicate what the average and peak season daily traffic flow (vehicles/day) • Indicate whether or not there are tolls
		14.4 Main parking areas	<ul style="list-style-type: none"> • Current availability in terms of parking • Estimate of additional needs during the Games at key sites • Illustrate location of these parking areas, their capacity (cars, buses), and potential users
	Public Transport System	14.5 Network	<ul style="list-style-type: none"> • Referring to Maps B and C, describe your public transport system (rail, underground, tram, bus, shuttle services, taxis, ferries, etc.) and the network for linking the sites • Indicate the different ways of reaching these places • Indicate what improvements will be available at the time of the Games

		14.6 Vehicles and traffic	<ul style="list-style-type: none"> • Provide information on the fleet and rolling stock (vehicles) of the main transport companies, current traffic (passengers, passengers/km) together with the capacity of the main lines (passengers/hour)
	Summary of distances and journey times	14.7 Table of distances and journey times	<ul style="list-style-type: none"> • In response to 14.1 and 14.6 and traffic indicate up-to-date distance (km) and the average and peak-hour journey time recorded during the day (minutes), specify the journey time by car and by public transport
		14.8 Maps	<ul style="list-style-type: none"> • Plot all the elements mentioned above on a map (airports, public transport network, road network, sites that will generate traffic during the Games—the Olympic stadium, competition and training venues, IBC/MPC, Olympic village, media village, IOC hotels, etc.) and indicate the links that would be used during the game
Demand	14.9 Overall Needs		<ul style="list-style-type: none"> • What personnel will be used for transport, communication and logistics • Describe recruitment and training programmes for the Games
	14.10 Spectators		<ul style="list-style-type: none"> • Estimate the average and maximum number of spectators for each multisport venue (spectators/day), together with the transport resources that will be allocated to them • Indicate how these will be distributed in relation to the source of the spectators, i.e. the Host City, the host country or abroad
Concept	Strategic transport plan	14.11 Main Objectives	<ul style="list-style-type: none"> • List with regard to traffic during the Games what constraints will be inherent to the project and what emergency plan you will have in the event of a change of timetable, or an unexpected demand
	Strategic Planning	14.12 Organisation	<ul style="list-style-type: none"> • What transport principles are applied for each category named in part 1; distinguish between the logistics for arrival, departure and during the Games, the areas considered and the demand that needs to met (people, horses, equipment and delivery)
		14.13 Measures	<ul style="list-style-type: none"> • Describe the measures envisaged to facilitate the traffic flow link to the Games (customs formalities, combined identity cards, and lanes reserved for Olympic traffic) and to restrict normal traffic • What additional measures can you implement to guarantee punctuality of Olympic traffic
		14.14 Ticketing	<ul style="list-style-type: none"> • Do you propose to offer combined, electronic or telephone ticketing
		14.15 Test event and training phases	<ul style="list-style-type: none"> • A list of events intended for training and testing staff and facilities respectively before the Games

Planning	14.16 Authorities		<ul style="list-style-type: none"> • Which authorities (state, region, city, etc.) will be responsible for controlling and managing transport activities in the Olympic Zone? • Will you use a transport control centre? • What authority will be put in charge of monitoring the transport plan?
	14.17 Information		<ul style="list-style-type: none"> • Describe the telematics, information technology and communications equipment designed to provide information on traffic conditions, delays, diversion routes, etc.
	14.18 Projects		<ul style="list-style-type: none"> • For all the projects you mention cite all the required authorizations, the bodies that deliver them, the deadlines given and the guarantees already provided when the bid file is submitted

Source: International Olympic Committee (2000b, 76-80).

All questions in the transportation section of the Candidature File are limited by scope to the time frame culminating with the Olympics itself. There is nothing in the File requiring cities to elaborate on how the proposed transportation plan aligns with long-term goals of its city. The introduction given to the transportation section of the Candidature File highlights the emphasis of game-time efficiency (International Olympic Committee 2000, 76):

“The experience of previous editions of the Games shows that one of the keys to their success is an efficient transport system. The faultless running of the Games depends on effective organisation. The slightest negligence may have serious repercussions which may be extremely damaging to the image and smooth running of the Games. It is therefore necessary to have highly qualified and trained personnel, who are perfectly acquainted with the needs of the athletes, team officials, IF delegates, media representatives and the hundreds of thousands of spectators who attend the Games.

In view of what is at stake, it is essential that a detailed analysis of the transport and logistical organisation at previous Games is carried out and the crucial elements are drawn upon when preparing the Candidature. The planning and management tasks involved are extremely complex, culminating during a period of approximately three weeks.”

While the IOC requires each candidate city to have a transportation plan as part of its bid, there are no specific requirements as to what public transit modes need to be provided for the spectator categories. There are however private transportation requirements for the other users: Olympic Family, Media, and Organising Committee.

The OCOG is responsible for creating a solution for the predicted transportation problems in its city’s bid. The OCOG works with an operating budget from the revenues of broadcast rights, sponsoring, merchandising, and ticketing. However, it is the responsibility of non-OCOG entities—government, the private sector, or a combination—to finance the investments for infrastructure changes to venues, transportation, [and] accommodation) (Olympic.org; Malfas 2004; Bovy 2011b).

According to IOC transport consultant Phillippe Bovy, as cited in Kassens (2009, 56), the transport of the Olympics is to fulfill six fundamental objectives:

- Transport must be safe and secure.
- Transport must be “absolutely” reliable.
- Transport must be efficient, comfortable, convivial and must guarantee short travel time especially for athletes and the media.
- Transport must be flexible to mitigate risk of interruptions.
- Transport shall be environmentally friendly.
- Transport shall contribute to a strong host city and regional mobility legacy.

The IOC also advises a hierarchy of transportation services to be provided during the games. The priority list is Athletes first, then Media, Olympic Family, Sponsors, Spectators, and then lastly, the General Public. For the 2004 Athens Games, according to the Athens Olympic Games Organising Committee, as cited by Kassens (2009, 61) the IOC required five levels of service; the top four levels being private vehicle service and the last level being public transit. The top three levels were designated for VIPs, International Federations, IOC, NOC, and the Organizing Committee. The highest level required an accredited car and driver for exclusive use by a single passenger, the second level required use by up to three passengers. The fourth level was designated for Athletes, Team Officials, Technicians, Media, and Sponsors that required accredited Olympic Family bus transportation. At the last level for Staff, Volunteers, and Spectators, transportation must be 100% public (Kassens 2009, Bovy 2011a).

In addition to its bid, host cities since 2001 must provide the IOC a four-part Olympic Games Global Impact (OGGI) report. Host cities are required to report on over 150 economic, environment, and social indicators with the first reports due about seven years before the games and the final report due two years post-event (Bovy 2006). The OGGI indicators look at both event-specific and context indicators. Table 3 highlights the indicators directly related to transportation planning required by the OGGI.

Table 2. A Selection of Olympic Games Global Impact Indicators

Sustainability Component	Event Indicators	Context Indicators
Environmental	• Average journey times between Olympic sites	• Land Use • Transportation networks • Daily travelling distance • Road Congestion
Social	(No indicators directly related)	(No indicators directly related)
Economic	• Breakdown of operating expenditure • Breakdown of capital expenditure	• Structure of the transport system

Source: (IOC 2006, 18-20).

The reports are an evaluation of how relevant each indicator is to both to the event and in the greater context of the city and a measurement of how much of an impact each indicator had on the city. For their Pre-Games OGGI Impact Studies, Vancouver and London used a scoring system that showed the relevance, rating, and confidence of each indicator. The relevance of an indicator was given a score of High (1), Medium (0.5), or Low (0). Its rating was either Green/positive impact (+1), Yellow/small or indeterminate impact (0), or Red/negative impact (-1). Confidence was scored as High (1), Medium (0.5) or Low (0). While the OGGI reports require a post-game analysis of impacts, these reports are informative of what the impacts were rather than a regulation from the IOC of what benchmarks host cities should be reaching (ESRC 2010).

Just as transportation funding in the United States varies from state to state, host cities and candidate cities have used different combinations of public and private funding sources. According to Abatan et al., as cited in Mendez (2010, 25) the funding sources for the 2016 Olympic candidate cities varied from Chicago and Rio de Janeiro proposing 100% public sources; Prague with 93% public, 7% private; Baku and Dahu with 92% public, 8% private; Tokyo with 56% public, 44% private; and Madrid with 10% public, 90% private.

Host cities must comply with the transportation guidelines defined or outlined by the event's organization committee. This extra layer of parameters is placed atop an already complex arrangement of stakeholders and projects. It is up to the city and its OCOG to determine how its bid, including its transportation network changes, are either a catalyst or deviant to its pre-mega-event transportation plan.

LITERATURE REVIEW

“Legacy is our raison d’être. It ensures that the Olympic Games are more than metres and medals... Once an Olympic City, always an Olympic City. Wherever the Games have appeared, cities are changed forever.” – Jacques Rogge, President, International Olympic Committee

Mega events can leave both hard and soft legacies on a host city. Hard or tangible legacies can include sports facilities, housing, and other infrastructure while soft or intangible legacies include things like prestige, community spirit, and place promotion. These tangible and intangible legacies can be further categorized as economic, social, political, technological, environmental, legal, physical, psychological, and cultural (Alberts 2011; Sadd and Jones 2009). To understand how the planned tangible impacts of the Olympic Games have created intangible impacts, I will evaluate what research has been done on analyzing the post-game impact on Olympic cities based on the effects to the overall urban landscape and the transportation network.

The relationship between the Olympic Games and the infrastructural impact on a host city has continued to

increase over time. In their investigation of the relationship between the Olympics and urban transportation, Essex and Chalkley (2003) divided the modern Olympic Games into four phases based on the infrastructural impact that the games had on the host city. As shown in Table 4, the games have gone from having small-scale, low impacts to large-scale, major impacts. Kennel et al. (2009, 13) also describes the games during the period from 1960 to 1992 as having “an increasing emphasis on non-sports legacy relative to sports legacy” highlighting the great urban renewal impacts of the 1992 Barcelona games of which 80% of funding went to urban improvements not sport-facility related including the re-routing of the coastal railway to provide access to the sea. Kennel et al. (2009) further add the component of environmental impact and sustainability awareness that arose in the late 1990s thereby affecting the infrastructure development of the 2000 Sydney Games and future games. Liao and Pitts (2006, 8) categorize the games from 1960 to 2012 as “The Age of Urban Transformation” describing them as having more ambitious and wider impacts (Essex and Chalkley 2003; Kennel et al. 2009; Liao and Pitts 2006).

Table 4. Infrastructural Impact of the Summer Olympic Games

	Phase			
	One	Two	Three	Four
Years	1896-1904	1908-1932	1936-1956	1960-1996
Scale	Small	Small	Large	Large
Organization	Poor	Fair	Great	Great
New Development	Not necessarily involving any	Involving construction of purpose built sport facilities	Involving construction of purpose built sport facilities with some impact on urban infrastructure	Involving construction of purpose built sports facilities with significant impacts on urban infrastructure

Source: Essex and Chalkley, 2003, 7.

While the relationship of infrastructure development has generally increased as the games have progressed, specific games have left significant legacies not necessarily correlated to what phase they were in. Essex and Chalkley (2003) have categorized these types of infrastructural impacts. The first set is described as the games having a minimal impact of new infrastructure built, both successful and unsuccessful, such as 1948 London with its “post-war austerity” (Chalkley and Essex 2003, 8); 1984 Los Angeles (entirely private-sector funded) which used existing facilities including its 1932 Olympic Stadiums and university dormitories for residences; and 1996 Atlanta which Essex and Chalkley (2003, 8) describe as the “failure of American private-public partnerships because of the lack of wider investment in the city’s infrastructure beyond the sports venues”.

The second set of cities had major infrastructure change but mostly for sports facilities including 1908 London,

1912 Stockholm, and 1936 Berlin. The final set had much larger transformations in the urban environment beyond sports facilities including transportation, accommodations, and other physical improvements. For the 1964 games, Tokyo built 22 new highways and two underground railways; 1988 Seoul built three subway lines, had 47 bus route extensions, and enlarged their airport; and 2004 Athens constructed or improved 210 kilometers of roads and highway, 25 kilometers of new light rail, and two new underground lines (Essex and Chalkley 2003).

Physical legacies have usually focused on the venues built for the games. The literature on venues focuses on the failures described by Kassens (2004, 34) as “white elephants”, a phrase originating from South East Asia in the 1880s when receiving a white elephant was seen as both a blessing and a curse because the white elephant was sacred and because the animal had to be worshipped and fed it could not be put to practical use to offset the cost of maintaining it. The 91,000-seat Bird’s Nest built for the 2008 Beijing Games was an iconic symbol of the games but with only a handful of events having taken place there post-Olympics, the venue’s lack of future programming has marked it as a white elephant (Mendez 2010).

Planning for the Olympics can be divided into four stages: Bid, Preparation, Event, and Post-Event. Much of the attention is directed at the Preparation and Event portions of the cycle while the long-term and Post-Event impacts have been neglected (Hiller 2006). Cashman (2012, 12) describes some host cities as going through a stage of “post-Game depression”. The transportation aspect of the Olympic cycle is no different with much of the literature addresses the failures and successes of the traffic and transit issues during the games, as opposed to post-games. Table 5 highlights the transportation changes completed by modern Summer Olympic Games host cities in preparation for their respective games.

Going beyond description, Bovy (2006, 1) has addressed the need for more effective “transfer knowledge programme(s)” to ensure efficient and safe transportation conditions for mega-events. The IOC has recognized the need for these knowledge transfers and has taken a more active role in ensuring this knowledge is part of a games’ legacy (Bovy 2006; Cashman 2002). Bovy (2006) briefly describes the transportation legacies of the 2000 Sydney Games as having no significant operational legacy. Many of the policies to decrease congestion, such as no parking provided at any of the venues, were event-specific and not implemented as a post-event strategy. Bovy calls the 2004 Athens transportation legacy undoubtedly great because of the consolidation of the major road system and rail transit improvement since Athens used the Olympics as an opportunity to fix the transportation infrastructure it had neglected prior to its bid (Bovy 2006).

Table 5. Summer Olympics and Transportation Infrastructure (1960–2008)

Year	Host City	Road Changes	Public Transit Changes	Major Projects
1960	Rome	Major	Minor	• Olympic Way road network that connected venues to the city
1964	Tokyo	Major	Major	• 22 motor links, 73 km of subways, 13.2 km of monorail, 500 km of the Shinkansen (bullet train)
1968	Mexico City	n/a	n/a	• Olympic bid stimulated city's metro system but it was not built until 1969
1972	Munich	n/a	n/a	• Centralized approach on a concentrated area
1976	Montreal	Minor	Major	• 20 km extension of metro lines, new air terminal
1980	Moscow	n/a	n/a	• 6-zone venue design
1984	Los Angeles	n/a	n/a	• Minimal infrastructural impact
1988	Seoul	Major	Major	• 3 subway lines, 47 bus route extensions, enlarged airport
1992	Barcelona	Major	Major	• 5.2 km barrier-free coastal strip, rondas
1996	Atlanta	n/a	n/a	• Most venues located within a 3 km circle of the city center
2000	Sydney	Major	Major	• Established the Olympic Road and Transport Authority (ORTA)
2004	Athens	Major	Major	• New international airport, 2 metro line extensions, new suburban rail system, new tramway line
2008	Beijing	Major	Major	• 5 new metro lines, 200 km of Olympic lanes; BRT

Sources: Liao and Pitts, 2006; Bovy, 2008

The significance of knowledge transfer between host cities has come to the forefront for the upcoming 2012 London Games. Public transportation in the games relies heavily on learning from what has been successful in past cities. The London games have been dubbed the “Public Transport Games” by Ieromonachou et al. (2010, 4).

Beginning with the 2008 Beijing Games, the IOC implemented the four-phase Olympic Games Global Impact (OGGI) program to evaluate the impacts. According to the IOC (2006, 15) the OGGI was initiated by the IOC “to measure the long-term implications of Games organization, in order to analyse the global impact of the Games on a given Host City. Based on the findings, the IOC [would integrate] the appropriate changes to maintain the long-term viability and success of the Games in keeping with the ideas of the Olympic Movement.” In its required indicators, the OGGI includes factors directly related to the Games such as venues and the Olympic Village as well as contextual facts such as road networks and telecommunication systems (Bovy 2006; IOC 2006). While the OGGI reports are required of host cities, they only requirement is to indicate if there were impacts to a city and not how those impacts align with or do not align with greater goals of the city or nation.

Kassens (2009) investigated the transportation issues in all phases of the Olympic cycle from Bid through Post-Event in a comparative study of four Summer Olympic Games: 1992 Barcelona, 1996 Atlanta, 2000 Sydney, and 2004 Athens. Her in-depth study frames the investigation of the conflict between the influence of the IOC and long-term planning of a host-city. Kassens' analysis of the host cities was dichotomized into transportation developments completed that were already part of a city's master plan (i.e. catalytic) and development that deviated from the master plan as shown in Table 6.

I want to investigate whether the transportation changes implemented were successful in the long-term, regardless of the IOC influence. I also want to further research how the intangible legacies of transportation systems have effected host cities including changes to public transit ridership and traffic management strategies.

Table 6. Transportation Infrastructure Developments of the Summer Olympics (1992-2004)

Year	Host City	In Urban Master Plan (Catalytic)	Not In Urban Master Plan (Deviant)
1992	Barcelona	<ul style="list-style-type: none"> • Renfe rail tracks • Rondas 	<ul style="list-style-type: none"> • Escalators • Subway Stop: Villa Olympics • Funiculars
1996	Atlanta	<ul style="list-style-type: none"> • MARTA extensions • HOV lanes • IVHS 	<ul style="list-style-type: none"> • Exit I-78
2000	Sydney	<ul style="list-style-type: none"> • Eastern Distributor • Rail to the airport 	<ul style="list-style-type: none"> • Rail loop • Monorail Ultimo-Pyrmont • Roads around Homebush
2004	Athens	<ul style="list-style-type: none"> • Metro line 2 • Attiki Odos • Suburban Rail 	<ul style="list-style-type: none"> • Tram (different route) • Metro line 3 (different route) • Roads around Olympic Ring

Source: Kassens, 2009, 174-5.

While the existing literature contains a lot of research on what changes have been made to the physical landscape of host cities, the analyses are more descriptive of what was built and not necessarily how effective or necessary the changes have been. Comparing cities just by what was or was not built is not enough to measure the legacy of the games. Further analysis needs to be done to understand why certain host cities were successful in their choices of what infrastructure to develop.

RESEARCH DESIGN

To investigate if cities are able to successfully create a post-mega-event transportation legacy, I used two recent Summer Olympic host cities as case studies: 1992 Barcelona and 2008 Beijing. I investigated each city's unique model for the Olympic Games and the model's role as a facilitator for transportation infrastructure

development. My analysis of the case studies is focused on understanding what was built, what was not built, policies changed, and how the built infrastructure and policy changes have fared since the closing of the games.

I have chosen to study Summer Olympic cases because they provide a repeated format for a comparative investigation but with unique parameters for each host city. Of the major international sport mega events—Summer Olympics, Winter Olympics, World Cup—the Summer Olympics require the most planning to meet the peak demand during the games at the city level because it has the most athletes and visitors to accommodate at the highest concentrations. With higher peak demands, Summer Olympic host cities have the most opportunity to build transformative transportation facilities and implement traffic management policies at the city level.

While a typical event can be defined simply as happening at a specific time and place, mega-events are unique because of the large number of visitors they draw over a defined period of time which requires special transportation, security, and logistical needs (Potier 2002). The Olympics is the quintessential mega event because it requires an international target market, a national level of public involvement, and the establishment of special authorities (Hall 1989).

While transportation planning is critical in both the Summer and Winter Olympics, there are differences in the transportation network needs. Due to the specificities required for sports venues of the Winter Olympics, certain sport competitions must be held outside of the city limits. The alpine skiing, bobsled, luge, skeleton, biathlon, cross-country-skiing, Nordic combined, and ski jumping events of the 2010 Vancouver Games took place in Whistler, about seventy miles from Vancouver (Alberts 2011). In comparison, for the 2008 Beijing Summer Games, all venues were within about 10 miles of the city's center. Transportation for the Winter Games has a greater focus on regional movement and not just within the host city.

As for the World Cup, FIFA, the organizing equivalent of the IOC for the World Cup, requires a host country to hold the games at nine different cities across the country to highlight the point that the game is considered a nationwide event (Host City Agreement 2010). Therefore while individual cities in a host country might make minor transportation changes, major transportation connections between multiple venues within a city are not the primary focus.

Therefore I have chosen to investigate the Summer Olympics rather than the Winter Olympics or the World Cup. The Summer Olympics with the highest concentration of sports, venues, and spectators places the

greatest strain on the host city's transportation network making it ideal to evaluate how cities have reacted to this challenge.

Cases

Eva Kassens (2009) wrote her doctoral dissertation on the influence of the IOC on transportation development of the Summer Olympics. Evaluating four case studies—1992 Barcelona, 1996 Atlanta, 2000 Sydney, and 2004 Athens—she investigated the differences between host cities' original metropolitan plans and how much they deviated from the plans in terms of transportation infrastructure built for the Olympics. Continuing on her work, I have chosen to further evaluate transportation legacies by analyzing master plans and their overall strategies for infrastructure development of Barcelona, Spain host of the Olympic Games in July and August of 1992 and Beijing, China, host of the Olympic Games in August 2008.

Other Summer Olympic Host Cities that were considered for my research were 1996 Atlanta, 2000 Sydney, 2004 Athens, and 2012 London. I chose not to consider Atlanta as one of its case studies since there was minimal investment made to transportation infrastructure for the games. While the other three potential case study cities did have major transportation infrastructure projects, Sydney's venue choice resulted in many of the events taking place outside of the city center and therefore transportation investments focused more on connecting the two areas, Sydney and Homebush, rather than in Sydney itself. While Athens built a lot of rail and road infrastructure for the games, its process was delayed because of internal government feuds "because responsibilities for building and running the infrastructure had not been clearly assigned before the bid" (Kassens 2009, 141). The first three years of construction and preparation for the games were delayed due to these conflicts and at one point the IOC threatened to take the games away from Athens if they could not resolve their issues. London has also made major changes to its transportation network but since the 2012 games have not yet taken place, its legacy cannot be evaluated.

The two case studies were chosen to draw upon and continue Kassens' work. I wanted to do a comparative study of two cities following a similar format so I chose one city that Kassens had already investigated, Barcelona, and a city that she had not investigated, Beijing. These host cities are also significant because of the international attention their respective events received. Barcelona has been highly regarded as an "inspirational model for future Olympic hosts, setting the highest standards on how to use the Olympic games as a stimulator for urban development and competitor in the global realm" (Kassens 2009, 73) with the successful plan of the games commonly referred to as the Barcelona Model. Beijing's role as host symbolized China's continual move towards modernization and international openness. The Olympics were a way for Beijing to rapidly develop its urban infrastructure with the government aiming "to transform Beijing into a

truly global city through major regeneration programmes that tackle the city's inherent environmental and infrastructural problems and leave a lasting legacy" (Gold and Gold 2007, 161). The difference of sixteen years between the host cities implementation also signify the time period when the IOC began to demand more of candidate and host cities in terms of what will be built and with a growing concern for sustainability and legacy issues including the implementation of OGGI reports.

Methods

The availability of historical and current ridership and performance data for the host cities was too limiting for my investigation. Of the data I was able to find, it was difficult to isolate changes in ridership or usage due to Olympic development versus changes or growth not due to the Olympics. Therefore I decided to take a more qualitative approach to understand the strategies that host cities undertook for infrastructure development and its outcomes.

For the two case study cities, my focal points to understanding their legacies were:

- What was the overall strategy for infrastructure development for the games?
- What transportation projects were planned before the city was chosen to host the Olympics?
- What transportation projects were actually built for the games?
- What were the missed opportunities in infrastructure and policies due to Olympic development?
- How are the transportation projects built for the games currently being used?

For Barcelona, I drew heavily from Kassens' (2009) dissertation and the resources she cited since she had been given special access to Olympic Bid documents¹ and planning department resources that are not made available to the general public. While the original bid document was not publically available, I was able to use data from the Official Olympic Reports of the host cities, made publically available by the LA84 Foundation, which provides the IOC-mandated reports of all Olympic host cities held since 1896. For Beijing, I used data from their published Candidature File found on the official website of the Games of the XXIX Olympiad.

Due to the 25-year embargo on documents relating to a host city's Candidature, it was difficult to acquire primary documents for research. Therefore in addition to the aforementioned documents I used secondary sources published post-event to support the data. Sources include reports that looked at certain aspects of a host city's investment including economic analysis and infrastructure development choice. For secondary

¹The International Olympic Committee (IOC) places a 25-year embargo on documents related to an Olympic host city's candidature. IOC President Jacques Rogge lifted the embargo and granted special permission for Eva Kassensø to use unpublished resources from the Olympic Archives for her research.

data I also looked at international newspaper articles, published both before and after a host city held the games, to garner a better understanding of the impact of development.

The International Olympic Committee (IOC) places a 25-year embargo on documents related to an Olympic host city’s candidature. IOC President Jacques Rogge lifted the embargo and granted special permission for Eva Kassens to use unpublished resources from the Olympic Archives for her research.

CASE STUDIES

Barcelona and Beijing, hosts of the Summer Olympic Games in 1992 and 2008, respectively, made major investments to their transportation infrastructure as part of their preparations for the Games. As shown in Table 7, both cities added to their rail and road networks to accommodate the large influx of visitors during the mega-event. What was planned, what was built, and what transportation infrastructure are still positive legacies to the cities’ transportation networks?

Table 7. Comparison of Case Study Cities: Barcelona and Beijing

Host City	Barcelona	Beijing
Country	Spain	China
Dates of Olympics	July 25 – August 9, 1992	August 8 – August 24, 2008
Year Selected	1986	2001
Number of Visitors	3.03 million	6.50 million
Number of Athletes	9,356	10,942
Number of Events	257	302
Number of Volunteers	34,548	70,000
Number of Media Personnel	13,082	24,652
Public Transport Modes Before Olympics	3 train companies, 4 metro lines, buses	2 metro lines, buses
Major infrastructure Projects Built for Olympics	Rondas, re-routing of renfe	5 metro lines, ring roads, expanded airport

Sources: Kassens 2009, 72, Olympic.Org.

Case Study: Barcelona

“What does it mean for Barcelona to hold the Olympic 1992? It won’t be exaggerated to say that a brand new city will come out of this event.” Pasqual Maragall, Barcelona Mayor, 1982 – 1997, (Montjüic Olimpic, 1984)

History

Barcelona’s relationship between large-scale urban planning and mega-events began long before it was chosen to host the Games of the XXV Olympics, held from July 26 to August 29 in 1992. The beginning of modern

planning in Barcelona is largely associated with engineer Ildefons Cerda's plan for urban renewal. In 1859 Cerda introduced his Plan for the Reform and Extension of Barcelona, shown in Figure 3, which would transform the city into a regular grid pattern of vies (thoroughfares) running both parallel and perpendicular creating 100 meter x 100 meter intervies (blocks) that would provide adequate sunlight and access for housing structures. (Barcelona Official Olympic Report (BCNOOR) 2009; Generalitat de Catalunya 2000)

Figure 3. 1859 Plan for the Reform and Extension of Barcelona



Source: Marshall 2004, 14.

Following the implementation of Cerda's Eixample, Barcelona hosted the 1888 World Exhibition and 1929 World Exhibition. For each mega-event, the city implemented vast public improvements including to the Parallel, Passeig de Coln, and Rambla de Catalunya thoroughfares for 1888 and the complex of building and funiculars built on Montjuïc for 1929 (BCNOOR 2009, Kassens 2009).

Under the rule of Francisco Franco from 1936 until his death in 1976, Barcelona continued to experience rapid industrial and economic growth, as shown with its expanding urbanization in Figure 4. However, this rapid growth coincided with a government that paid little attention towards outlining its overall planning agenda. Therefore, public infrastructure, including Barcelona's transportation network, was severely neglected during Franco's reign. (Kassens 2009).

Metropolitan Plan Prior to Olympics

While still under the dictator of Franco in the 1960s, international influence on urban renewal and city planning generated discussion amongst the architects, planners, and engineers. Two planning initiatives were

the major forces behind the urban planning strategies prior to the 1992 Olympics: the 1976 Pla General de Metropolitano—General Metropolitan Plan—(PGM) and the Arees de Nova Centralitat—Plans for the New Center Areas—(ANC) (Esteban 1999).

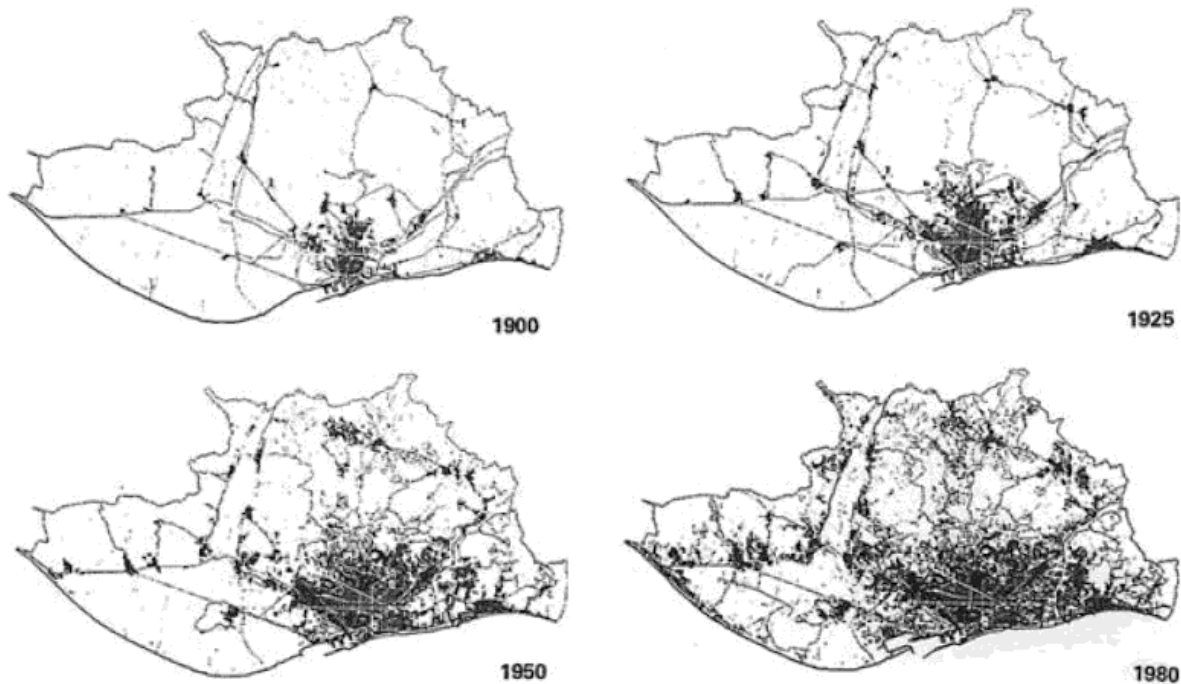


Figure 4. Urbanization of Barcelona in 1900, 1925, 1950, and 1980

Source: Marshall 2004, 5.

The PGM, shown in Figure 5, instituted change for Barcelona and 26 surrounding municipalities, developed from the Plan Comarcal of 1953. Following a regime of unfiltered growth, the PGM had strict urban development policies targeting the organization of public open space and the road network. “For 50 years, Barcelona had almost no investment...The city never stopped growing, but there was no investment in its streets and plazas. [The] idea was to restore balance to the city” (Former Architect of Barcelona Josep Anton Acebillo as cited in Riding 1991, A11). The land reserve implemented through PGM allowed over 56 hectares of formerly industrial sites, including railways and port installations, to be acquired by the government for green zones and public facilities and for the development of Barcelona’s ring roads; both of which would be crucial for the sites and transport movement of the 1992 Olympics (Esteban 1999; Gold and Gold 2007).

The ANC plans selected ten sites within Barcelona and its periphery to be targeted for rejuvenation through concentration of public services and facilities. The goal was to create new vital centers within Barcelona making the selected areas focal points of the city that would complement the principal foci of Barcelona: Ciutat Vell and Eixample. The proposed ten, shown in Figure 6, were chosen either because of a vast amount

Figure 6. Map showing 10 Sites chosen for the New Center Areas Plan



Source: Kassens 2009, 77.

of open space available or because the existing space had become obsolete. Many of the sites were already along built or proposed transportation corridors. Of the ten proposed ANC areas, two of them ended up becoming Olympic Areas: Vall d'Hebron (#8 in Figure 6) and Villa Olimpica (#5 in Figure 6), while the other two Olympic areas—Montjüic and Diagonal, were added later to the original ten. (Kassens 2009)

Olympic Development Strategy

Prior to being chosen as the host city for the 1992 Games, Barcelona had tried four times to be an Olympic host. In its bid for 1924, Barcelona was beaten by Paris (speculation is that chairman of the IOC at the time, Baron Pierre de Coubertin, a native Parisian, pushed for his city). For the 1936 games, expressed fears of civil war in Spain led to the awarding of the games to Berlin. Barcelona also competed for the 1940 Olympics, however the games were cancelled because of the onset of World War II. For the 1972 games, in a joint effort with Madrid, Barcelona was outbid by Munich (Schumacher 1986).

In 1981, the Barcelona Mayor at the time, Narcis Serra, officially announced Barcelona's desire to host the 1992 Olympics, which was quickly and unanimously supported by the City Council. By 1982, the Cuyas Report, the first draft of Barcelona's Olympic proposal, was created (Esteban 1999, Kassens 2009). Barcelona's bid drew greatly upon the policies and goals set out by the General Metropolitan Plan and the New Center Areas as described by Esteban (1999, 14):

- Open the city to the sea
- Distribute spatially the improvement and equipment and re-equip its sporting facilities
- Promote communication infrastructures, especially the road network

On October 17, 1986, the IOC, led by Barcelona-born and raised president Juan Antonio Samaranch, voted Barcelona as the 1992 Summer Olympic host edging out Paris, Brisbane, Belgrade, Birmingham (GB), and Amsterdam. In March 1987, the Comité Organizador Olimpico de Barcelona '92 (COOB'92) was created.

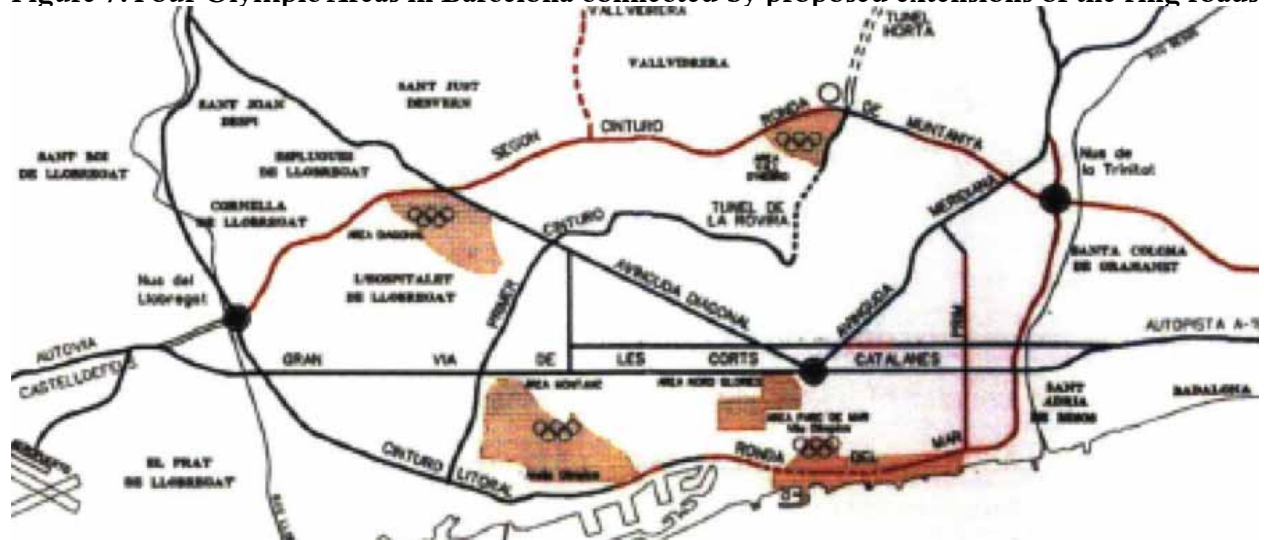
The Olympic plan for Barcelona was highlighted by its four-area cluster approach which the new mayor, Pasqual Maragall, described as ensuring “that the usage of the Olympic structures and equipment isn't limited to the celebration of the Games” and that by “scattering these very same structures and equipment, their use by the general public becomes easier and at the same time the city is obliged to provide the appropriate improvements in the road system and public transport facilities amongst the different Olympic areas” (Montjüic Olimpica 1983, 8). Additionally, in its bid, Barcelona claimed that only 15 new arenas would be required for the games and that over 88 percent of the necessary sport facilities already existed. Less than 20 percent of investments went towards sports facilities, the majority of investments for the Games went towards overall urban improvements (Gold and Gold 2007).

The four Olympic areas were Montjuïc, Vall d'Hebron, Parc de Mar (Villa Olímpica) and Diagonal, shown in Figure 7. Two of the four sites had already been chosen as areas for strategic growth in the ANC plan and all four sites would greatly benefit by being connected to the new ring road proposed by the GMP. (Kassens 2009; Martorell et al. 1991) The already existing metro lines 3 and 4 would provide public transport access to the major venues. In addition to the metro lines, Barcelona's bus network provided transport for visitors. The four Olympic areas were within a radius of five kilometers and the travel time between sites, for either public or private transportation, would be less than twenty minutes. (Kassens 2009. BNCOOR 1992)

Located in the southwest, Montjuïc had been the site of the 1929 Exhibition. The mountain area would house the Olympic Ring including the Olympic Stadium (site of the Opening and Closing Ceremonies with capacity for over 60,000 spectators) and venues for fencing, swimming, weightlifting, gymnastics, and wrestling. The site had been made accessible by public transportation for the 1929 Exhibition when the funiculars (mountain train) were opened (Kassens 2009; Martorell et al. 1999; Nevius 1992).

The Parc de Mar area, in the southwest neighborhood known as Poblenou, would be the site of the Olympic Village. This area was chosen as part of Barcelona's efforts to revitalize its 40 kilometers of waterfront, as recognized in the ANC, with the objective of the "opening of the city to the sea" (Gold and Gold 2007, 227). The industrial area had been separated from the Mediterranean Sea by a Renfe rail line. In order to serve as the housing site for athletes as well as host Olympic events the railway was moved, a kilometer long beach seafront was created, and changes were made to both local and through automobile traffic (Kassens 2009; Martorell et al. 1999).

Figure 7. Four Olympic Areas in Barcelona connected by proposed extensions of the ring roads



Source: Kassens 2009, 81.

The area Val d'Hebron, in the northeast, housed the Municipal Velodrome, originally built for the 1984 World Cycling Championship, among other venues for competitions including tennis and archery. Diagonal in the northwest hosted the football and equestrian competitions, among other events. Both Val d'Hebron and Diagonal were easily accessible by metro lines 3 and 4 in addition to access via the ring roads (Martorell et al. 1999; Nevius 1992; BCNOOR 2009).

Transportation Infrastructure Built for Olympic Games

While prior strategic planning of where to locate the venues and Olympic Village had already been established, COOB'92 was responsible for transporting the "Olympic Family", that required moving over 4,500 people in 2,100 vehicles over 200 regular routes between 8,000 departure and destination points. The games were seen "as a way of putting the city on the world map but also as the perfect excuse for modernizing its infrastructure" (Riding 1992, A1). The transportation planners of the game wanted to make sure that athletes and visitors would be able to move quickly between the four areas but also that the infrastructure would be useful after the games. The major transportation investments made in Barcelona for the Games were the new ring roads and the public transit access to Montjuïc (Kassens 2009; BCNOOR 2009).

Thoroughfares connecting Barcelona already existed including Gran Via, Diagonal, Ronda del Mig, and Meridiana. As part of the comprehensive road network of the GMP of 1976, and part of earlier city plans, and as a way of connecting the four Olympic areas, two new ring roads were completed in time for the Games. Ronda de Dalt, also known as the second or "mountain" ring road, would provide a connecting along the northern half of Barcelona projected to handle between 130,000 and 140,000 vehicles per day. Ronda Litoral, also known as the "coastal" ring road, was designed to carry 80,000 to 90,000 vehicles per day along the southwestern portion of Barcelona, in particular the Olympic Village. The new ring roads would help to alleviate traffic flows along other major routes in Barcelona, highlighted in red in Figure 8 (BCNOOR 2009).

While the ring roads were a critical part of Barcelona's Olympic plan, not all Barcelonans supported construction. The residents of the Nou Barris neighborhood protested the construction of the Ronda de Dalt. Residents were not keen on the plan for a major highway to cut through their neighborhood, so they advocated for metro lines rather than a highway. Similarly in Poblenou, residents near the proposed Ronda Litoral, organized in 1987 under the slogan "Volem ser consultants" ("We want to be consulted") to gain attention from the Council to hear their concerns about the rondas effect on neighborhood connectivity (Sanchez et al. 2007, 44-45).

In addition to the ring roads, the Vallvidera, connecting Barcelona with its northern suburbs of Terrasa and Collserola, were opened in 1991. Although it was not a part of the GMP of 1976, it was a part of the plan that had preceded it, Plan Comarcal of 1953. (Kassens 2009).

Barcelona prided itself in its bid for emphasizing that it already had much of the stadia infrastructure built to host the Games and therefore had more to spend on other public infrastructure with only about 18% of investments going to Olympic-specific structures and the rest to general urban improvements. However, the split between roads for private transport and infrastructure for public transport was quite uneven, with 95% of transportation infrastructure going towards roads for private transport (calculated from Brunet 1993 as cited in Kassens 2009, 90). While the investment in roads was the focus of the transportation project, public infrastructure investments were also undertaken, primarily access to the Montjüic Olympic area. Because of the restriction on private cars during the Games, the difficulty in accessing the mountain of Montjüic, and the high crowds expected, three public transit services were provided (Kassens 2009, 83–84):

- A bus shuttle service from the Plaza Espana
- Mechanical escalators embedded in the slopes of the mountain
- Montjüic Funiculars, mountain train from the Paral-lel metro station

Three escalators were built into the Montjüic slopes, designed to carry 14,000 people an hour. The escalators created a 15-minute commute between Plaza de Espana and the Olympic Ring. The flexibility of the escalators was highly regarded for its functionality during the Games. The Montjüic Funiculars had originally opened in 1928 for the 1929 World Exhibition. In order to prepare for the high numbers of visitors during the Games, the funiculars were completely renovated. Covering a distance of over 750 meters, the funiculars have a capacity for 400 passengers per train set and were able to move 8,000 people per hour. The travel time is only two minutes along an 18 percent steep slope as it rises from 4 meters at Paral-lel metro station to 80 meters at Parc de Montjüic. (Kassens 2009; TMB 2005)

Missed Opportunities

An alternative public transit access proposed for the Montjüic area was the renovation of an abandoned section of the Metro Line 2, Sagrada Familia to Para-lel, and the a continuation of the line under Montjüic mountain and all the way to the El Prat airport. Both Mayor Maragall and the Barcelona transport committee were in support of the metro option especially because of forecasts predicting the increased demand of the line after the Olympics. Until March 1990, the plan for the Line 2 revitalization was still part of Barcelona's transportation plan. Josep Miguel Abad, head of COOB'92, was referenced in the *The Advertiser* (1990) printed on March 31st that "the Montjüic metro can be built if a decision is reached by the end of April...If

not, COOB will provide a shuttle service or build escalators up the hill.” And According to documents from the Olympic Archives, the short time frame and presence of cheaper alternatives (escalators and funiculars) sidelined the Line 2 project (Kassens 2009).

Three years after the closing of the Games, discussion of the Line 2 revitalization was re-proposed. By 1997 the line was opened east of Paral·lel to Sagrada Família and on to La Paz, as shown in Figure 9. The proposed extension for Line 2 west of Paral·lel under the Montjuïc mountain and to the El Prat airport, has also remained in the discussion. However, the extension is not scheduled for completion until 2015.

Figure 8. Barcelona Metro Line 2 Completed and Planned Extensions



Source: Patalin 2011.

Post-Game Olympic Transportation Legacy

Although the additional ring roads had been suggested decades before the Games, the deadline of the Olympics catalyzed their construction. In May 1997, then mayor Maragall, noted the continued success of the rondas describing them as “the giant ring around the city [that] has left the heart of old Barcelona untouched by heavy traffic” (Owens 2007, 49). Also in 1997, the Fundacio Barcelona Olimpica’s survey of Barcelonan satisfaction with Olympic infrastructure ranked the Ronda de Dalt and Ronda Litoral the most important Olympic infrastructural change in Barcelona (Anguer Argilaga and Gomez Benito 1997 as referenced in Kassens 2009).

The rondas implemented for Barcelona appeared to have achieved positive legacy effects for its residents. However, these positives might have been short-lived. Although the 48 miles of roads built for the 1992 Games received many accolades, by 2006, the Barcelona council had already started the discussion for addressing the congestion that the rondas can no longer accommodate (Keeley 2006).

The Funiculars de Montjuïc were built to accommodate visitor access to the Olympic site were not part of Barcelona's plan prior to its bid. However since its refurbishment for the 1992 Games, ridership levels have nearly doubled. (Kassens 2009). Although the Funiculars have been successful post-Olympics it provides transport mostly for tourists in a very limited scope. With the majority of transportation investment going towards the rondas, larger-scale public transit was not facilitated by the Games.

Summary

Barcelona "pursued a sophisticated strategy of tackling the city's physical drawbacks by directing the Olympic project toward sensitive sites" (Belsie 1992, 10) that were already planned prior to its winning of the bid. The rondas, opening of the waterfront, and access to Montjuïc had been discussed in the past but had been neglected during the Franco reign. The four Olympic areas and the ring roads that would facilitate their connections were critical not only during the 16 days of the Games but to facilitate traffic movement around the city after the games were over and were part of Barcelona's plans regardless of winning the bid.

While Barcelona's Olympic redevelopment has been praised for its massive urban renewal of the metropolitan area, its positive transportation effects may have only lasted a decade. As congestion continues to become a problem on the ring roads and the lack of investment to metro extensions during its preparations led to the postponement of line 2. What is the time horizon for a transportation legacy?

Case Study: Beijing

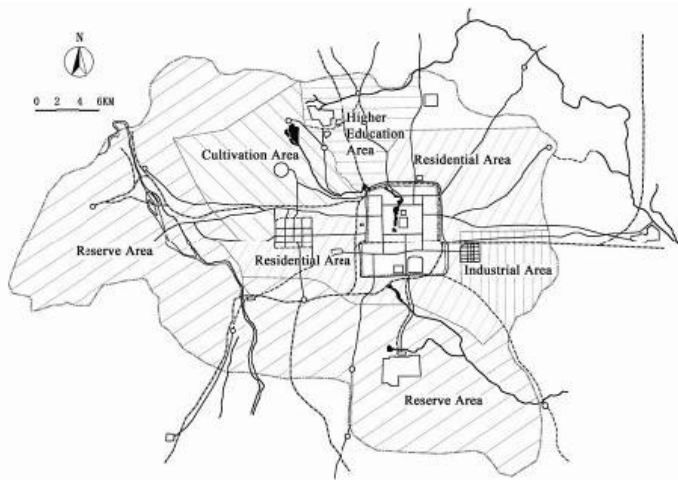
"When will it be possible for China to send an athlete to the Olympic Games? When will it be possible for China to send a team of athletes to the Olympic Games? And when will it be possible for China to enjoy the privilege of hosting the Olympic Games?" (quote from an a 1908 article in 'Tientsin Young Men' as quoted in the Beijing Official Olympic Report (BJOOR) 2011a, 3).

History

Beijing had a long journey, and much to overcome, before participating in the Olympics and finally hosting the Games of the XXIX Olympiad from August 8 to August 24 in 2008. The Communist Party of China led by Mao Zedong took control of the nation establishing it as the People's Republic of China in 1949 and chose Beijing as its capital. Under Mao's rule, Beijing developed into an "austere, drab producer city heavily influence[d] by the Soviet style of planning with wide thoroughfares, mid-rise flats on a large scale, occasional grand buildings, and the expansion of Tiananmen Square" (Gold and Gold 2007, 289), as shown one of earlier master plans for Beijing in Figure 9. The 1953 master plan, Chang-guan-lou Plan, promoted industry and production as its center with the goal of striving for "the rise of efficiency in the working people's labor and production" (Chaolin et al. 2010, 11).

With the death of Mao in 1976, China's closed-off approach to international engagement began to dissipate. Rather than focusing on the producer-city model, more regional planning approaches were implemented with "Four Modernization" and "Open Door" policies (Chaolin et al. 2010, 14). Along with the emergence of reformer Deng Xiaoping and China's National Policy of Reform launch in 1978, massive urban change and modernization changed Beijing as well as greater China. Under Deng, Beijing developed into a commodity economy providing new housing developments, offices, hotels, and cultural centres along with subway and road infrastructures to support the growth, as shown in its expanding metropolitan plans in Figure 10. (BJOOR 2011a; Chaolin et al. 2010)

Figure 9. 1950 Baranukov Proposal for Beijing



Source: Chaolin et al. 2010, 11

Figure 10. Master Plans for Beijing in 1982 (left) and 1992 (right)



Source: Chaolin et al. 2010, 15 and 18

The modernization of Beijing's infrastructure and interest in opening up its city were highlighted by two major events that predated Beijing's Olympic host city bid: the 1990 Asian Games and People's Republic

of China 50th Anniversary Celebration in 1999. The 11th Asian Games held in Beijing in September 1990 drew international attention for its organization and cultural legacy. In preparation for its 50th Anniversary, Beijing made major renovations to its road and public transport infrastructure including a new subway line and airport terminal (BJOOR 2011a; Kunstel and Albright 1999).

Metropolitan Plan Prior to Olympics

The People’s Republic of China created its first Five-Year Plan for the years 1953 to 1957. The goals of the Five-Year Plans were to recognize economic and social initiatives to be achieved in that period. Prior to its efforts towards hosting the 2008 Games, Beijing was already in its 9th Five Year Plan (1996–2000) and preparing for the formulation of its 10th (2001–2005). China’s 10th plan included continuing the economic growth of China through its GDP, increasing the urban population, and funding infrastructure improvements (Chaolin et al. 2010; Ong 2004).

By 2001, Beijing had three completed ring roads for automobile transportation along with a 2-line subway system, which had opened in 1969, and an extensive bus network (Ong 2004). Plans for expansion of both the road and rail infrastructure were already in discussion to alleviate increasing congestion. The rapid motorization of Beijing, from 0.6 million automobiles in 1986 to 3.4 million in 2008, placed a strain on the road network, as shown in Table 8. The increase of vehicles was a major contributing factor to the decreasing levels of air quality. (Bovy 2006; Mao 2008) Although Beijing had already begun the candidature process for hosting the games at the time, Liu Jingmin, Vice Mayor of Beijing and spokesman for the 2008 Beijing Olympic Games Bid Committee (BOBICO) made it clear in February 2001 that the municipal government had already committed to expanding the expressway network and ring roads regardless of the outcome of its Olympic bid. Jingmin (2001 as quoted by Xinhua News Agency, 1) added, “These investments will not only ensure Beijing’s readiness and [that] infrastructure to host the 2008 Games are second to none, but also, permanently improve the quality of life of Beijing’s 12 million residents.”

Table 8. Modal Shares of Daily Trips in Beijing from 1986 to 2005

Mode	1986	2000	2005
Car	5.0	23.2	29.8
Public transit	28.2	26.5	29.8
Bicycle	62.7	38.5	30.3
Taxi	0.3	8.8	7.6
Others	3.8	3.0	2.5

Source: Ong 2004.

Olympic Development Strategy

Beijing's first attempt at hosting the Olympics began on the opening day of the 11th Asian Games in 1990 when then Chinese President, Yang Shangkun, expressed his nation's desire to bid for the 2000 Olympics to IOC President Juan Antonio Samaranch (BJOOR 2011a). Beijing submitted its first application in 1992. Although infrastructure investments for both venues and transportation and China's growing international role in both the Olympics and world economy were seen as positives by IOC, the candidate city received international criticism because of its "human rights" legacy and sub-par environmental status, in particular Beijing's poor air quality. In Monte Carlo on September 23, 1993 by a vote of 45 to 43, Sydney was chosen over Beijing to host the 2000 Olympics.

By the time Beijing would apply to be a host city again, new rules initiated by the IOC would require a longer and more detailed process, however, Beijing was ready for the challenge. Potential host cities would now have to go through the process of being first an Applicant City, completing a questionnaire (22 questions on six themes) about their overall goals of their bid and then a Candidate City, producing a candidature file detailing what is currently available and what will be done in order for the city to meet the Olympic requirements (BJOOR 2011a).

In 1998, China's NOC accepted Beijing as its representative Applicant City for the 2008 Olympics. Beijing's bid had full support by the Chinese Central Government and then Chinese President, Jiana Zemin, wrote several times to IOC President Samaranch endorsing Beijing's bid. The Chinese response to the bid was very positive with 94.9 percent of Beijing citizens voting in favor of the city's bid for the Games in a Gallup Poll conducted in November 2000 (BJOOR 2001a).

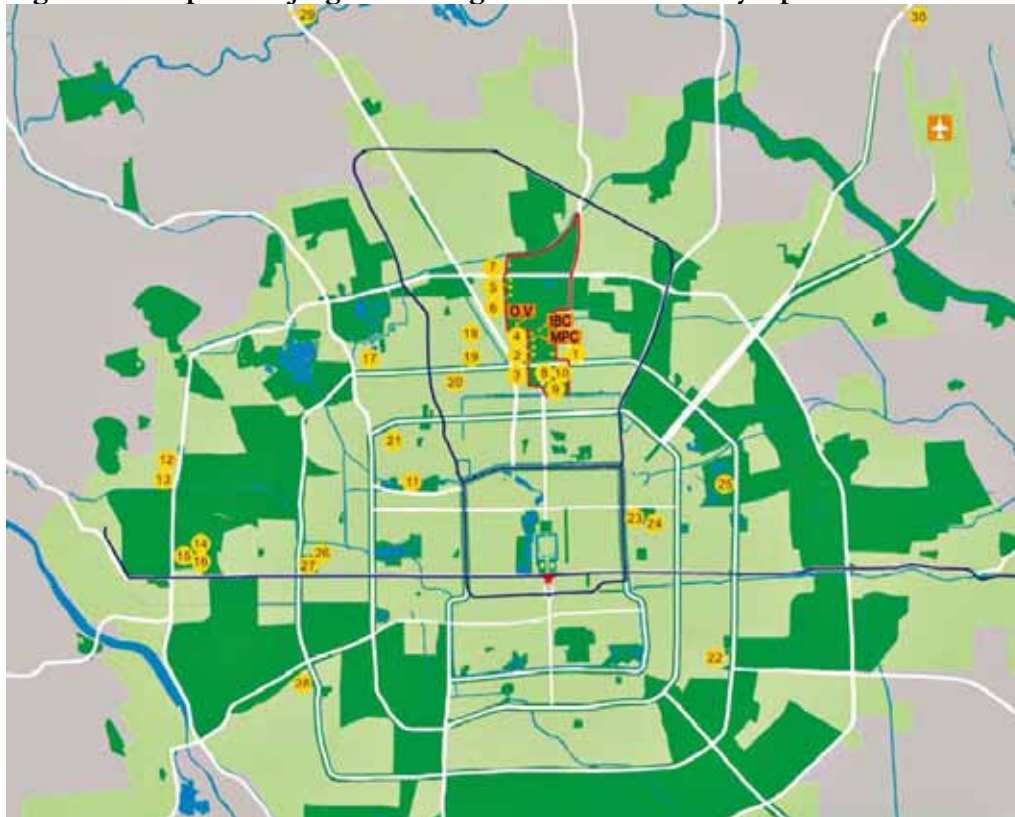
Beijing had a three-prong strategy for its approach to the vision of the Games: Green Olympics, High-Tech Olympics, and People's Olympics. The three concepts were critically applied to all aspects of Olympic planning including its transportation infrastructure in both its Applicant City questionnaire and Candidate City candidature file. With the slogan "New Beijing, Great Olympics", the IOC announced Beijing as the host of the 2008 Olympics on July 31, 2001 in Moscow. Beijing outbid Toronto, Istanbul, Paris, and Osaka. Although the IOC recognized that many major issues including a clean environment and the reduction of traffic congestion were necessary to Beijing's success, the committee was confident that the combined ambitious efforts and strong capacity of Beijing's government would be able to meet the task recognizing that all planned transportation projects were already budgeted by Beijing as part of the 10th Five-Year Plan (BJOOR 2011a; Ong 2004; IOC 2001).

In December 2001, the Beijing Organizing Committee for the Olympic Games (BOCOG'08) was established. For its venue site selection, Beijing elected a “dispersion supplemented with centralization” pattern of four major areas—the Olympic Central Area, the Western Community Area, and the North Scenic Area—with the four principles (BJOOR 2011a, 71):

- Achieving separation of the venues within a reasonable distance
- Planning the Olympic venues compatible to city development
- Combining Games-time operations with post-Games use
- Balancing venue construction and environmental protection

14 of the venues would be within a 5-minute drive from the Olympic Village in northern Beijing, 10 other venues could be reached within 20 minutes, and the remaining eight would be accessible by a 30-minute drive, as shown in Figure 11. The compact layout was supplemented by Beijing’s commitment to have complete bus accessibility to all venues and 80 percent accessibility by subway. Initiatives to combat poor air quality included the goal of having 90 percent of the buses and 70 percent of the taxi fleet to run on clean fuel and for driving policy restrictions to be implemented leading up to and during the Games (BJOOR 2011a; BJOOR 2011b).

Figure 11. Map of Beijing Indicating the Location of Olympic Venues



Source: BJOOR 2011a.

Transportation Infrastructure Built for Olympic Games

In its Applicant Questionnaire, Beijing addressed major plans for development to both its road and rail networks. For its roads, Beijing proposed to complete the Fourth Ring Road and expressways linking the current network, Highway Belt One, with construction or renovation on almost 300 kilometers of roads. For its rails, Beijing proposed that it would add to its 2-line subway system with the Line 5 and Batong Line. Light rail additions were proposed for the line to the Summer Palace and the Capital Airport in addition to a regional link between Dongzhimen and Xizhimen (BJOOR 2011a).

Major planned road and rail transport developments were restated in its candidature file as shown in Table 9 and Figure 12. The file stated that the current subway lines, Loop Line and Line 1, had a capacity of 481 million passengers per year, connecting east and west Beijing. By 2008, regardless of its selection as host city, the subway would be expanded to seven lines with the capacity for 1.74 billion passengers per year providing more extensive service to the central and suburban areas of Beijing. In its candidature file, Beijing noted that if was selected, the Olympic Line would also be built with a capacity of 60,000 passengers per hour to service the Olympic Green. In terms of its road network, the bid declared that regardless of its selection, construction plan for Beijing, already in progress, included the creation of the 93 kilometer Fifth Ring Road, 35 kilometers of connecting roads, and another 100 kilometers of road expansion (BOBICO 2000).

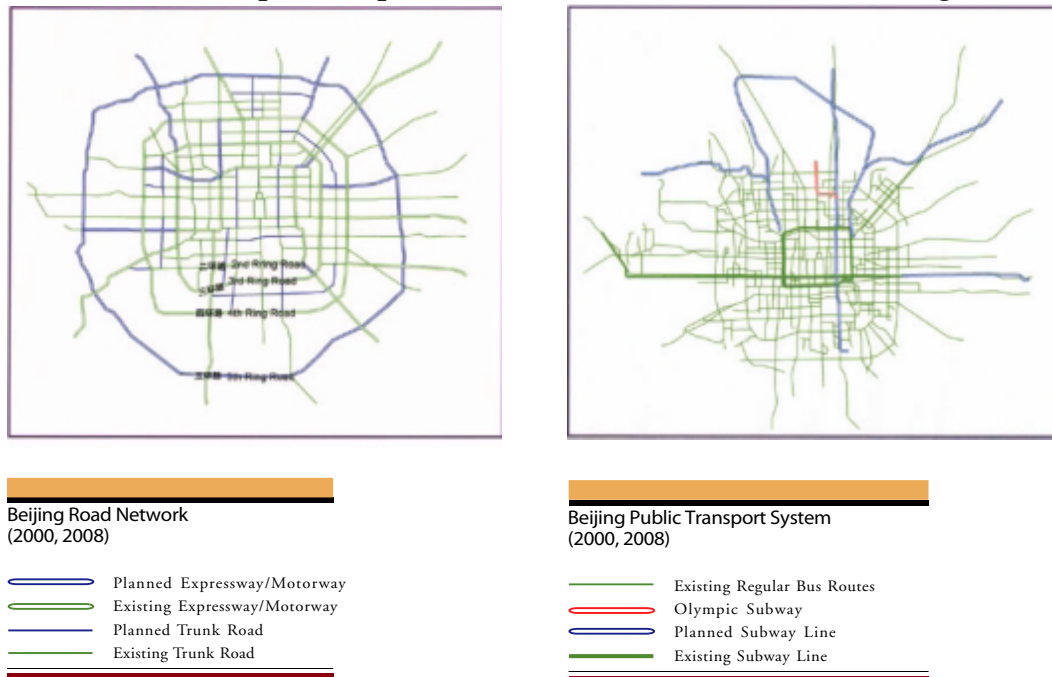
Table 9. Proposed Road and Railway Transport in Beijing's Bid

	Projects	Sources of Funds	Ways of Financing	Date of Completion
Road Transport	Fourth Ring Road and expressways linking the ring roads (100km)	Government & corporations	Government appropriation, Bank loans, Corporation investment	2001
	Highway Belt One (93km)	Municipal & district governments	Government appropriation	2005
	Major urban road construction and renovation (105km)			2002
Rail Transport	Suburban light railway from Dongzhimen to Xizhiman (40.5km)	Government & corporations	Government appropriation, Bank loans, Corporation investment	2002
	Light railway feeder line to the Summer Palace (8km)	Corporations	Bank loans, Corporation investment	2005
	Light railway to the Capital Airport (16km)			2005
	Subway Line 5 (27.8km)	Government & corporations	Government appropriation, Bank loans, Corporation investment	2005
	Subway Baton Line (17.2km)			2002

Source: BJOOR 2011a

In addition to its major infrastructure additions, policies to combat both congestion and pollution were implemented before and during the Games. Zhou Zhengyu, spokesman for BOCOG’s transport department stated, as quoted in Mulvenney (2008), “Smooth traffic and good air quality are important factors in hosting a successful Olympic Games and also fulfilling Beijing’s promises to the International Olympic Committee.” It was estimated that there would be 45 percent fewer vehicles on the road, and a total ban on the most polluting vehicles, which would reduce air pollution by about 63 percent during the policy implementation (Hooker 2008).

Figure 11. Candidature Maps of Proposed Additions to Road (left) and Rail (right) Networks



Source: BOBICO 2000.

In preparation for the games, from July 1 to 19, 2008, vehicles that failed to meet the standard exhaust emissions were forbidden from the roads at all times. In addition there was a reduction of approximately 70 percent of 300,000 government official automobile use during the two months. From July 20th to September 1st 2008, all vehicles (with the exception of vehicles for police, fire trucks, ambulances, buses, sanitation, etc.) had to comply with an even-odd number rule determining specific days based on the last number of their license plate in which cars would be banned from the roads. The even-odd system banned license plates ending in zero or five from the roads on Mondays, those ending in one or six on Tuesdays, two or seven on Wednesdays, three or eight on Thursdays, and four or nine on Fridays; the system did not apply on weekends or holidays (Hooker 2008; Liu et al. 2008; Times of Oman 2009). These were not the first attempts to reduce the number of automobiles on the road in China. In 2006, drivers had started the campaign of “Driving One

Day Less Each Month” and on September 22, 2007, China had its first “Car Free Day” where drivers were persuaded to find alternate means of transportation including public transit.(BJOOR 2011b).

Missed Opportunities

While Beijing used the Olympics as an accelerant for adding infrastructure projects to both its road and rail networks its investments, policy changes to persuade public transit use over private automobile use may have been underutilized. Although temporary restrictions on driving were instated, no reforms were created to restrict car ownership and parking costs in the city center remained very low. Expansion of the metro system aided in the increase of public transportation use but its time efficiency in comparison with personal automobile has come under scrutiny (Mao 2008).

Post-Game Olympic Transportation Legacy

In preparation for the Olympic Games, Beijing undertook massive infrastructure development to both its road and rail infrastructure. Beijing officials claimed that the projects would have been completed, perhaps with the exception of the Olympic subway line, as part of the city’s master plans to combat congestion and air pollution and to support its growing population. In 2008, Beijing was predicted to have 18.9 million residents by 2012 and 20.9 million by 2015 and the goal of the city was to increase the share of public transit to 40 percent (29.8 percent in 2005), with rail accounting for 10 percent, and to insure that 85 percent of travel on the Fifth Ring Road would be under 50 minutes (Mao 2008).

While transit ridership has increased in Beijing and the metro now has twelve lines, rapid automobile ownership and usage is still of critical concern. In 2004, Zhou Ghanzi, former Minister of China’s Ministry of Construction, had warned Beijing not to rely on infrastructure alone to solve road congestion problems. He was in favor of BOCOG paying close attention to transportation management along with the new construction calling the Games a “special ‘rush hour’, in which heavy traffic is compact within a particular period and certain area. That doesn’t last long and is not likely to re-appear in the following years. That’s why we can’t develop the city transport construction simply according to the Olympic standard” (Xinhua New Agency 2004,1).

The policies reducing car usage during the two months before and during the 2008 Games led to both reduced traffic and air pollution for Beijing. However the lack of continuity of those policies post-Olympics have caused a backwards slide for congestion and air quality. After the closing ceremonies in August, a less strict even-odd license plate system was lifted from all roads except the areas beyond the Fifth Ring Road. Since 2010, Beijing has begun restrictions on license granting to slow down the total automobile volume in

the city but congestion and air quality still remain an issue (Jiangtao 2009).

Summary

Beijing's Olympic approach was based on continual nationwide efforts to modernize the country and expand its international relations that were in place before its Olympic bid. Additional roads, five new subway lines, and an expanded airport were built to facilitate movement both during and after the Games. The ridership on Beijing's subway lines has continued to increase since the end of the Olympics and its subway system has now expanded to twelve lines. Policy restrictions on personal automobile use leading up to and during the Games led to better air quality conditions and decreased congestion. However since the Olympics, automobile ownership has continued to rapidly increase thereby only adding to the congestion issues of the city. Beijing was able to construct many infrastructure projects in preparation for the Games, but is its transportation management detrimental to its legacy?

CONCLUSIONS

Transportation infrastructure development for cities are part of a complex stakeholder and financing process in which projects may take years or decades, if ever, to be constructed. Political motivations, public-private partnerships might alter or sideline projects as other priorities arise or as financing changes. While all cities must include transportation planning as part of their master plans for growth and development, host cities of mega-events are propositioned with an opportunity to drastically alter their infrastructure landscape in a relatively short time period. Olympic host cities can use the development for the games for positive effects on its transportation network if planned for longevity rather than short-term benefits.

A positive Olympic transportation legacy should be defined as when a host city was able to use the Olympics to build infrastructure or implement policies that altered a host city's transportation network to accomplish city goals beyond the Olympics, both directly and indirectly related to transportation. The type or amount of infrastructure built is not directly correlated to whether a legacy is positive or negative; legacy is not a quantitative measure of how much was built but how much the Olympic changes contributed towards long-term city improvement. Positive legacies can be either tangible or intangible, the completion of an infrastructural project or the reduction of greenhouse gas emissions could both be positive factors.

This feat may be difficult to achieve because of the competition amongst candidate cities to be the next host of the games. As Olympic cities continue the trend of large transformations of their urban landscapes with large infrastructure projects, both sports facilities related and of general city infrastructure, candidate cities

may try to outdo each other with proposals for large developments to gain attention from the IOC. For the IOC, the competition amongst potential hosts prioritizes game-time efficiency over post-game sustainability, another potential obstacle for a positive transportation legacy.

How long does a transportation legacy last in order for it to be considered successful? City, regional, state, and national governments create 5-year, 10-year, 20-year plans, etc. but does the cyclic nature of transportation planning—accommodating for population and city growth—limit the time horizon for success? How has the Olympics aided in the creation of positive transportation legacies? What potential legacies are hindered because of Olympic constraints?

In their legacy period, Barcelona and Beijing have received accolades on their improvements to their transportation networks both during and since the Olympics. By IOC standards, both cities were able to supply appropriate transportation infrastructure and minimize congestion during the games. How successful are their transportation legacies?

The positives of the transportation legacies of Barcelona and Beijing as host cities are that each city was able to expedite projects already planned and chose their venues strategically for future growth. Barcelona's plans were targeted at areas of the city as part of a larger urban renewal plan. Beijing's plans were focused on expanding its network to alleviate already existing congestion and to remediate for future congestion that would coincide with its rapid population and car ownership growth. Both cities used a cluster approach for their venues, locating them within the city, along major transportation networks, road and rail. While the cities were able to use the Olympics to build large infrastructure projects, their Olympic priorities and decisions still resulted in missed opportunities for other development and policy changes.

For Barcelona, the construction of the new ring roads was part of their positive legacy in that as part of its long-term goals, it helped to alleviate congestion from the city center and provide connectivity to new areas of development. However, the priority of the ring roads over metro alternatives and expansions highlights the double-edge sword of the Olympics. The strict timeline of the games forced Barcelona to prioritize what would be constructed, so even though there was political and community support for metro alternatives, the ring roads were allowed to bypass those concerns.

For Beijing, the rapid construction of new road infrastructure added to their positive legacy because it was part of long-term plans for city growth. However, the lack of corresponding traffic management and policies for car ownership and car use to complement the increased road infrastructure has had negative effects on

their legacy as congestion and air pollution are still large concerns in Beijing.

While the Olympics provides host cities a platform to rapidly develop sports and city infrastructure, the strict deadlines and the priorities of the IOC facilitate certain transportation developments over others. Large infrastructure developments that can be rapidly implemented in time for the games may be pushed ahead of other projects host cities as they hope to attract the IOC and international attention. Host cities are forced to prioritize what is developed and while there may be positive aspects to its transportation legacy, there will inevitably be missed opportunities that host cities will have to address and mitigate in their post-game period.

Recommendations for Future Host Cities

As potential host cities prepare their bids to the IOC for future games, it is important that they utilize the transfer of knowledge from past Olympic cities. Candidate cities should already have a firm transportation network plan in place prior to undertaking a bid to be considered as a host city. A city's bid should align with this pre-Olympic plan, drawing from projects already proposed, and the strategic placement of their Olympic venues, rather than relying on creating solely new projects or new locations for development. Large infrastructural projects might be part of some city's long-term goals but a successful Olympic transportation legacy should not always require large infrastructure development. More efficient management of existing capital and infrastructure could have as much as a positive impact as a new infrastructure project. While cities must appeal to the IOC in their bids, potential hosts should be critical of whether proposed projects have benefits in both the short- and long-term.

Since the IOC has taken measures to address the legacies of host cities with transfer of knowledge programs such as the Olympic Games Global Impact reports, host cities should fully utilize these required reports to outline, facilitate, and monitor how policy and development changes for transportation for the games align with city-wide goals and whether those goals were achieved. The attention to the effects and achievement of goals during the legacy period, should be of critical concern in a host city's bid, planning, and event phase.

Finally, potential Olympics cities must decide if the benefits of being a mega-event host are worth undertaking at the cost of missed opportunities. Applicant cities should consider the potential consequences of their proposals for Olympic developments: the projects that might be delayed or bypassed and the other policies and traffic management that would need to be implemented to coincide with the proposed changes. Olympic development can lead to positive legacies for the transportation network of a host city but it requires a city to proactively consider longevity of infrastructure and policy implications as part of the Olympic host timeframe.

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