

## ***Rio 2016 Olympic Games public transport development outstanding legacy and mobility sustainability***

***By Ph. Bovy***

***Professor of transport and mobility at EPFL  
Swiss Federal Institute of Technology at Lausanne, Switzerland  
IOC transport advisor since 1997***

### ***1. Foreword***

#### ***World sport super mega-event extraordinary high costs, contested legacies and decline of bidding Cities and countries***

IOC Olympic Summer Games and FIFA Football World Cup held alternatively every 4 years are the two world biggest sport mega-events attracting half the world TV and media audiences. Global expenditures to set-up and deliver those one-month long mega-events vary from 5 to 50 billion USD per event composed of two distinct budgets: the mega-event operating budget—generally in the black—and the mega-event sport, transport, security and other urban and logistical infrastructure massive upgrade budget mostly funded by government public resources.

Critics are systematically made against the lack of tangible legacy of those mega-event huge expenditures. Leading economists are denouncing “legacy failures” and “white elephant projects” as well as misleading political promotions pushing Cities into mega-events bidding adventures.

In democratic countries, mega-event project legacy issues and their huge financial burden are more and more fatal to aspiring bidders, particularly if citizen consultation and/or referendum are carried-out. Recent examples in Norway (Oslo), Germany (Munich-Garmisch-Partenkirchen), USA (Boston), Rome and Budapest for 2024, Switzerland (St Moritz) and many others, both for Summer and Winter Games contribute to a systematic decline in Olympic bids. The sport mega-event “wasteful investment” syndrome is often reinforced by basic fundamental critics of adverse environmental and social impacts of these ever growing mammoth mega-events.

The Olympic Games are by far the toughest global mega-event operation in terms of macro logistical and financial management with a concentration of 28 Olympic accredited world leading sports corresponding to 28 world championships to be held simultaneously on about 40-50 sites in the same Host City.

Those extraordinary large mega-events require considerable sport and transport infrastructure creation and/or renovation to sustain short one-month extreme operational pressure on sport, transport, media logistics, security and other Host City urban facilities generally with central/federal government substantial funding. The Games infrastructural and operational legacies and urban system sustainability are outstanding as shown in this

paper focusing on Host City most strategic transport Games mobility components. highlighted by the outstanding case of Rio 2016 Olympic Games.

### ***IOC--Olympic Summer Games: world biggest multi-sport mega-event***

The Summer Olympic Games are the biggest multi-sport universal mega-event with more than 205 participating countries, 11'000 athletes and 6'000-7'000 supporting staff officials, about 5'000-6'000 Olympic and International Federation officials, more than 25'000 accredited media, and 100'000 to 200'000 volunteers, paid workforce, logistical staff and security personals.

Summer Games have 6 to 9 million total ticket sales with millions of NTV-Non Ticketed Visitors attracted during the 6 week Olympic and Paralympic Games. World TV and other media audiences cover half the world population (**Figure 1**).

**Figure 1: Olympic Summer Games Los Angeles 1984 to Rio 2016, key indicators evolution**

<b>Athens 1896 to Rio 2016 Olympic Summer Games key indicators</b>									
	1.Nb NOC.	2.Nb Events	3.Nb Comp.	4.% Female	5.Nb Media	6.Nb Volunt	7.Nb Tickets	8.Nb TV.vw	9.Total TV rights
<b>1896 ATHENS</b>	<b>14</b>	<b>43</b>	<b>240</b>	<b>0</b>					
1924 Paris	44	126	3100	4					
1936 Berlin	49	129	4000	8					
1960 Rome	83	150	5300	12					
<b>1972 MUNICH</b>	<b>121</b>	<b>195</b>	<b>7100</b>	<b>15</b>					
<b>1984 LOS ANGELES</b>	<b>140</b>	<b>221</b>	<b>6800</b>	<b>23</b>	<b>9200</b>	<b>28000</b>	<b>5.7</b>	<b>2.5</b>	<b>285</b>
1988 Seoul	159	237	8500	26	11300	27000	3.3	---	400
<b>1992 BARCELONA</b>	<b>169</b>	<b>257</b>	<b>9400</b>	<b>29</b>	<b>13100</b>	<b>34000</b>	<b>3.0</b>	<b>---</b>	<b>835</b>
1996 Atlanta	197	271	10400	34	15100	47000	8.3	---	900
<b>2000 SYDNEY</b>	<b>200</b>	<b>300</b>	<b>10600</b>	<b>38</b>	<b>16000</b>	<b>47000</b>	<b>6.7</b>	<b>3.7</b>	<b>1330</b>
2004 Athens	202	301	10600	42	21500	45000	3.6	3.9	1495
<b>2008 BEIJING</b>	<b>204</b>	<b>302</b>	<b>10950</b>	<b>43</b>	<b>24600</b>	<b>70000</b>	<b>6.5</b>	<b>3.7</b>	<b>1730</b>
2012 London	204	302	10575	44	24275	70000	8.0	3.9	2600
<b>2016 RIO (10 est.)</b>	<b>206</b>	<b>306</b>	<b>11305</b>	<b>45</b>	<b>25700</b>	<b>27000</b>	<b>6.1</b>	<b>4.0</b>	<b>--?--</b>
<b>1984/2016 growth (%)*</b>	<b>45</b>	<b>35</b>	<b>65</b>	<b>95</b>	<b>175</b>	<b>0</b>	<b>5</b>	<b>60</b>	<b>--?--</b>

**Legend** 1. Number of NOC – nations / 2. Number of competition events / 3. Number of athletes ( $\pm 50$ ) / 4. Percentage female athletes ( $\pm 1\%$ ) / 5. Number accredited medias, press and broadcasters ( $\pm 100$ ) / 6. Number of volunteers ( $\pm 1000$ ) / 7. Number of spectator tickets sold ( $\pm 0,1$ million) / 8. Number world TV viewers ( $\pm 0,1$ billion) / 9. Total TV rights ( $\pm 5$  mio US\$) / 10. Dec 2016 estimates

\*LA-1984 to RIO-2016 key indicators growth over 9 Summer Games or 32 years (rounded  $\pm 5\%$ )

Considering 1984-2016 Los Angeles to Rio Olympic Games transport and mobility requirement growth trends, the biggest challenges are:

- *increased number of competition events (+35%)* taking place during a 16 day Games timespan
- *doubling to 20'000 of numbers of athletes, team officials, technical and logistical support officials*, demanding highly securitized reliable on-demand travel services
- *tripling of accredited media to 25'000-30'000* to be transported 24h/day
- *undisclosed increase of number of security forces* (probably 50'000 to 100'000 for Summer Games) in operation 24/day before and during the Games
- *400'000 -- 500'000 ticketed spectators* per peak day generating 1.2 to 2.0 million mega-event additional City daily journeys
- *uncounted growing number of non-ticketed-visitors (NTV)* enjoying the Games outside competing venues, along open venues (cycling races, marathon, triathlon, open water sports) as well as increasingly attractive large live-sites generally organized by Host Cities to offer the Olympic experience to citizens and visitors which cannot get or afford Olympic tickets

## ***2. Overview of Barcelona 1992 to Rio 2016 Games diverse after-Olympic Games urban, transport and mobility development legacies***

### ***Barcelona 1992 Games***

Well planned urban and transport Olympic infrastructure developments played an historical role in Barcelona 1992 urban regeneration by reconnecting its centre with the Mediterranean coastline. Barcelona became the most successful all year urban tourist destination of South-Western Europe.

***Barcelona 1992 Olympic legacy resume: best example of Olympic Games driven urban rehabilitation, City public open space and related transport enhancements***

### ***Atlanta 1996 Games***

Atlanta Games failed to develop any significant urban legacy. Its transport and mobility organization were insufficient to deliver reliable and adequate Olympic mobility services. At that time (with exception of Barcelona) Games legacy was not yet considered an outstanding Olympic issue sustainable development was not yet part of the development agenda. It is after the Atlanta Games that legacy and sustainability considerations were introduced in IOC bidding process and requirements

***Atlanta 1996 Olympic legacy resume: No significant urban rehabilitation and City transport system improvements generated by the 1996 Olympic Games***

### ***Sydney 2000 Games***

Sydney 2000 Games had little new transport infrastructure built for the Olympics other than a new 3-4km rail loop and Olympic rail station serving new Homebush Olympic Park and its 115'000 seat new Olympic Stadium about 20km West of downtown Sydney.

But Sydney 2000 was a major Olympic mobility success by innovating in bold temporary convivial mobility policies further applied in next Summer Olympic Games such as:

- “free 24 hour City-wide public transport” for all ticketed and accredited Olympic clients
- no spectator parking within half mile of Olympic venues, to relieve adjoining neighbourhoods of extraordinary automobile pressure and to insure convivial walking and public transport access to Olympic venues
- more than 90% spectator+ workforce+ volunteers accessing Olympic venues hubs by massively re-enforced public transport services

**Sydney 2000 Olympic legacy resume:** *No transport infrastructure development tangible legacy. Olympic transport and mobility management efficient transfer of knowledge to next Summer Games*

**Reference:** Bovy / UITP-Brussels—**“High performance Public Transport: A must for very large sport events”**, *Public Transport International, UITP Brussels, Dec 2004*

### **Athens 2004 Games**

Athens 2004 had a bold transport infrastructure development program connecting the historical City centre to a new international airport linked by motorway, metro and suburban rail connections. A new light-rail tramway connected the City centre with the southern sea coast and multiple Olympic venues.

To improve Olympic accredited client mobility, Athens 2004 introduced the first 150km network of Olympic dedicated lanes. It was an efficient traffic management low cost program combined with City centre odd-and-even license plate traffic restrictions. Overall Games mobility management worked fairly well also thanks to a rather low, below 4 million spectator Games attendance.

**Athens 2004 Olympic legacy resume:** *Multi-transport system well planned legacy---Games temporary Olympic lane network innovation insuring low-cost on-time secure movement of athletes and other accredited clients*

**Reference:** Bovy / UITP-Brussels—**“Solving outstanding mega-event transport challenges: The Olympic experience”**, *Public Transport International, UITP Brussels, March 2006*

### **Beijing 2008 Games**

With 17-18 million population, Beijing is the most populous host City of any past Olympics (with Tokyo). Beijing 2008 Games took place in a period of double digit growth of China’s economy with Beijing car motorization increasing by almost half million vehicles per year during Games preparation.

Beijing master transport development was accelerated to triple its metro system length and capacity with direct new connection to a vastly expanded Beijing Capital International Airport. Two additional expressway rings were added linking the biggest Olympic Park ever (750 ha) to all parts of the metropolis. Major Beijing traffic management innovation for the Olympics was a test in 2007—one year prior to Games—of a generalized odd-and-even license plate traffic reduction scheme to considerably help traffic smoother operations and air pollution significant abatement.

**Beijing 2008 Olympic legacy resume:** *Olympic plan was imbedded in Beijing Master development plan in particular around Beijing Olympic Park. Considerable public rail and expressway developments were accelerated for the Games. Highly successful background*

*bold traffic reduction (minus 40%) scheme was introduced to optimize mobility and reduce air pollution during the two month Games period.*

**Reference:** Bovy / UITP-Brussels, "Beijing 2008 Olympic Games success: massive public transport developments and major road traffic reduction", *Public Transport International*, UITP May-June 2009

### **London 2012 Games**

Most important London 2012 Olympics winning bid feature was the rehabilitation of part of East London to create a new large London Park (Queen Elisabeth Park) hosting a substantial part of Olympic Games venues. To accompany this massive urban and sport facility redevelopment program, a bold multi-billion public transport improvement program was delivered to substantially upgrade East London transport systems: Jubilee Line capacity increase, Dockland Railway expansion and Stratford National and International East London strongest rail hub complex upgrade.

Olympic 2012 Games plan had most London Olympic venues accessible from at least two Tube stations, providing exceptionally good public transport accessibility. London Tube system carried the largest ever traffic loads during the 2012 Games, both on the existing network and on the massively improved parts of East London transport system.

**London 2012 Olympic legacy resume:** *East London urban revitalization and its multi-billion public transport upgrade are long lasting legacies that only the Olympics could help trigger in such short 2005-2012 time frame.*

**Reference:** Bovy / AISTS website-mobility, "London 2012: Best public transport Olympics ever", [www.mobility-bovy.ch](http://www.mobility-bovy.ch), 2013

### **Rio 2016 Games**

Rio de Janeiro bided three times in 25 years before being selected in Copenhagen 2009 for the 2016 Games. Rio four major handicaps:

- Rio superb mountain-sea-bay landscape (**Figures 2 and 3**) and complex geography made Games venue planning very difficult due to Tijuca National Park, world largest urban park, located in the middle of Rio. The Olympic concept had to disperse Olympic venues on Park edges making transport connectivity longer and more difficult than previous Games
- Rio under-developed expressway system positioned Rio as one of the world worst congested City, a tremendous handicap for the Games and for Rio
- Rio non integrated multi-operator public transport system very poor performance with only 16% of all public transport services considered of acceptable quality levels
- Rio very few existing sport facilities of modern standing available for the 2016 Games such as Maracana and J. Havelange Stadia as well as other 2007 Pan American sport facilities

**Rio 2016 Olympic legacy resume:** Chapter 3 below explains how Rio major Games strategic planning handicaps were overcome in Games delivery to have Rio new public transport as a most successful legacy in Games history.

**Reference** Bovy / AISTS- October 2016, «World multi-sport mega-event transport development and mobility global management: the Olympics », AISTS-Oct 2016

*Figure 2 : Rio 2016 brand sign on Copacabana beach*



**Figure 3: Rio superb iconic mountain-sea-bay landscape making intra-City transport extraordinarily difficult**



### **3. Rio 2016 Olympic Plan structured on Rio massive transport developments and search for legacies**

Looking at Olympic Host City development induced legacy, one has to understand the interactions between the proposed Olympic Games concept and Rio City development in particular Rio public transport system considerable performance upgrade to respond to the highest traffic demands ever forecasted and observed in Rio City history.

#### **3.1 Rio 2016 Olympic Games concept aligned with Rio urban master development plan structured on extensive public transport improvements**

Rio has an outstanding geography—see **Figure 4**. The City Centre is not in the centre. Tijuca National Park, a mountainous subtropical forest and world largest urban park with an area similar to Paris (105km<sup>2</sup>), occupies the geographical centre of Rio. Mountain topographical barriers subdivide Rio in four sectors:

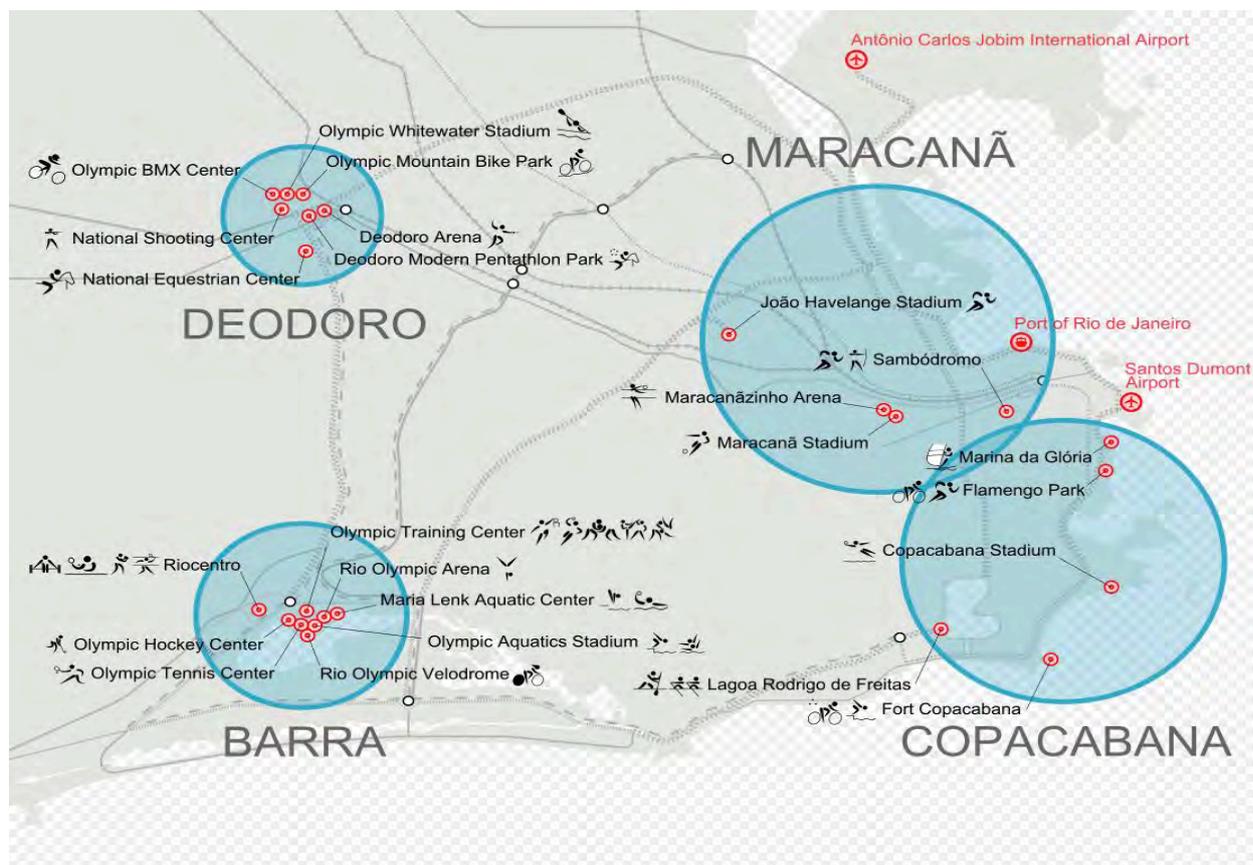
- East-North-East with Rio downtown and Maracana or Olympic Zone 1
- South with Copacabana-Ipanema-Lagoa Rodrigo or Olympic zone 2 adjacent to zone 1
- West with Barra de Tijuca or Olympic zone 3 – the furthest away 30-40km to the West
- North-West with Deodoro or Olympic Zone 4 also the furthest away from Rio Centre

**Figure 4: Rio urban expansion on three sides of Tijuca National Forest—**



Instead of concentrating most new or/and rehabilitated Olympic venues in one City sector, Rio Olympic Games concept dispersed Olympic venue developments in four Olympic zones to help catalyse urban development of all City sectors (**Figure 5**).

**Figure 5: Rio 2016 Olympic Games concept de-centralised on four Zones on each side of Tijuca National Park**



That “dispersed” multi-zone Olympic concept implied longer travel distances than in most former Olympic Games. To overcome that fundamental handicap, a bold system of public transport and expressway rings was planned and built as key elements of Rio long term transport system serving all parts of Rio.

### **3.2 Rio public transport development strongest surge of all past Summer Olympic Games since 1980**

As direct consequence of Rio geography difficulties and former Rio failed bids, a bold program of public transport new lines and links and massive capacity and service upgrades were planned and built on all four sides of Tijuca National Park.

Taking advantage of bid success momentum and good Brazilian economic conditions of the 2009-2011 era, about 75% more public transport infrastructure was built or very strongly upgraded and delivered prior to August 2016 than promised in the Rio 2009 bid.

From 100km of bid promised infrastructure, the delivered system reached 170km improving public transport accessibility to Rio poorly served areas in particular its Northern and North Western sectors. In addition, two non-bid-committed transport projects started in 2015-2016 might be delivered after the Games in 2018 if project continuation is approved by Rio post 2016 Municipality (**figure 6**).

**Figure 6: Rio 2009 transport infrastructure evolution****RIO new transport infrastructures and major rehabilitations from 2009 bid to 2016 Games and planned for 2018**

	<b>2009 bid</b>	<b>Delivered</b>	<b>Difference</b>
<b>A. Public Transport 2016</b>	<b>(km)</b>	<b>(km)</b>	<b>(km)</b>
<b>Network lines delivered 2010 to Aug. 2016:</b> Metro extension line 4, SuperVia system rehabilitation, 3 new BRT lines, VLT line A			
<b>Subtotal 2016</b>	<b>101</b>	<b>170</b>	<b>+69</b>
<b>B. Public transport planned projects extensions 2016- 2018</b> BRT TransBrasil extension and VLT Line B			
<b>Subtotal 2016-2018</b>	<b>0</b>	<b>40</b>	<b>+40</b>
<b>C. Rio 2010 to 2018 public transport system expansion</b>			
<b>Grand total (km)</b>	<b>101</b>	<b>210</b>	<b>+109</b>
<b>D. Roadway expansion works 2010 to Aug. 2016</b> TransOlimpico Expressway, Joa new link (2 lanes), Rio downtown bypass			
<b>Total (km)</b>	<b>13</b>	<b>22</b>	<b>+9</b>

Rio and Lausanne: November 2016

Source: City of Rio SMTR and Prof. Bovy IOC transport advisor

ANNEX A provides Figure 6 description of full transport system 2010 -2018 evolution. Metro 15km extension line 4—by far biggest transport investment for Rio 2016 -- was not part of Rio 2009 bid. It was replacing a planned BRT between South Zone and Barra area. Biggest other public transport infrastructure addition to the 2009 bid was a BRT TransCarioca extension to GIG, making this airport the first Brazilian international airport connected to high performance public transport (one BRT line in 2014 and potentially a second line to Rio downtown in 2018 ).

Main four components of Rio new public transport system (**map Figure 7**):

**(A) 120km of new high performance BRT system** composed of three lines—a fourth line in construction for 2018 opening will push the BRT system to 150km, one of the most extensive in the world under centralised command and control.

**(B) 15km of new Metro line** connecting Rio South Zone to Barra da Tijuca, largest new expansion zone of Rio

**(C) 30km of suburban rail system substantial upgrades** with capacity expansion, quality of service improvements, six fully renovated main Olympic stations such as Olympic Stadium and Maracana stations. These improvements will benefit large northern areas of Rio population highly dependent on better public transport

**(D) 15km of City harbour new Light Rail system** first phase linking two major Rio gateways: Santos Dumont Airport and Novo Rio Rodoviaria terminal, Rio long distance bus station. A second line in 2017-2018 will double the system to better connect Rio Centre to ferries serving populous East Bay.

Before 2010, Rio had only 40km of metro, one of the smallest systems for a City of 6-7 million. Those bold public transport improvements increased dramatically the four Olympic Zone system interconnectivity (**Figure 7**).

To complement this public transport development surge, three significant road and expressway links were built:

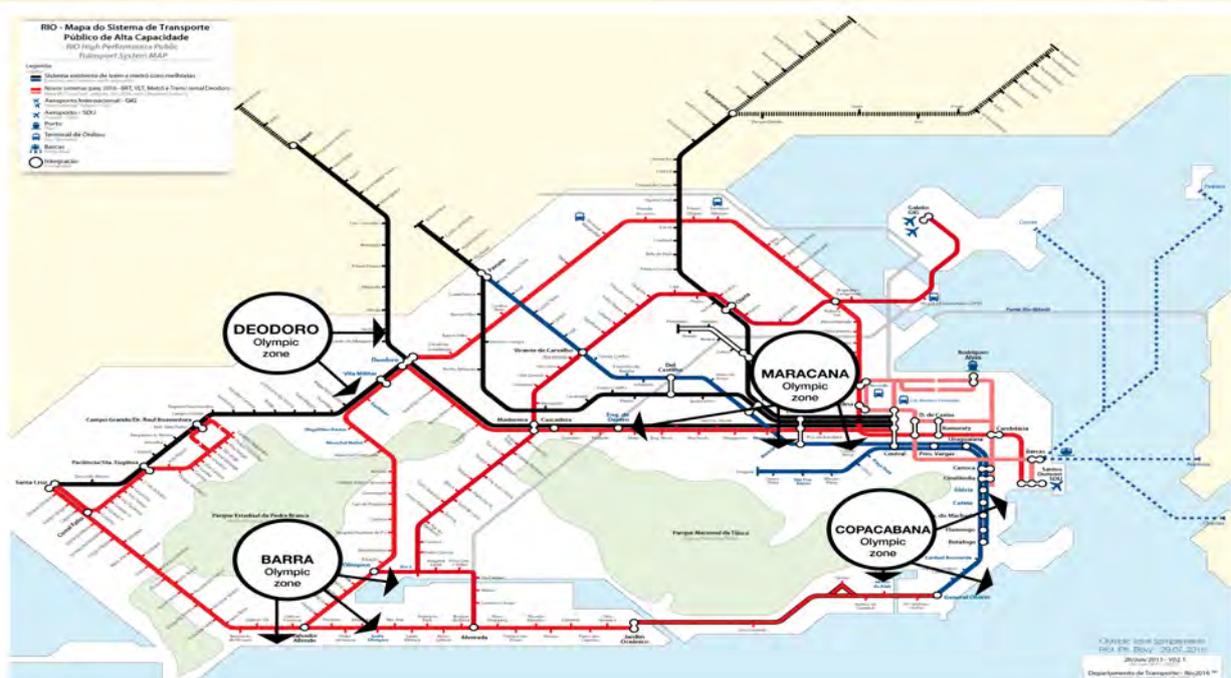
- **Western TransOlimpica Expressway** linking Barra to Deodoro across the Pedra Branca mountain chain, also includes a median BRT TransOlimpica to provide much needed tangential North-South public transport connectivity in Western Rio
- **Southern Viaduto do Joa** additional 2 road lanes connecting Barra to South Zone
- **Eastern City Centre expressway underground bypass** replacing harbour elevated structure and allowing new VLT tramway line 1 surface operations

This 10 to 12 billion US\$ transport infrastructure program delivered in six years instead of 25 years is one of the biggest public transport improvement legacy ever in Summer Olympic Games history.

Two new major transport infrastructures might be open in 2018:

- **30km BRT TransBrasil** high capacity full 4 lane corridor from Deodoro multi-modal interchange to Rio City centre with GIG BRT branch interconnexion
- **Second Rio VLT line connecting Rio centre** with Praca XV and ferry terminal
- All those elements are illustrated by map **figure 7**

**Figure 7: New public transport delivered for 2016 Games deadline and 2018 projects**



### 3.3 Multi-public transport service integration—first Rio comprehensive public transport map

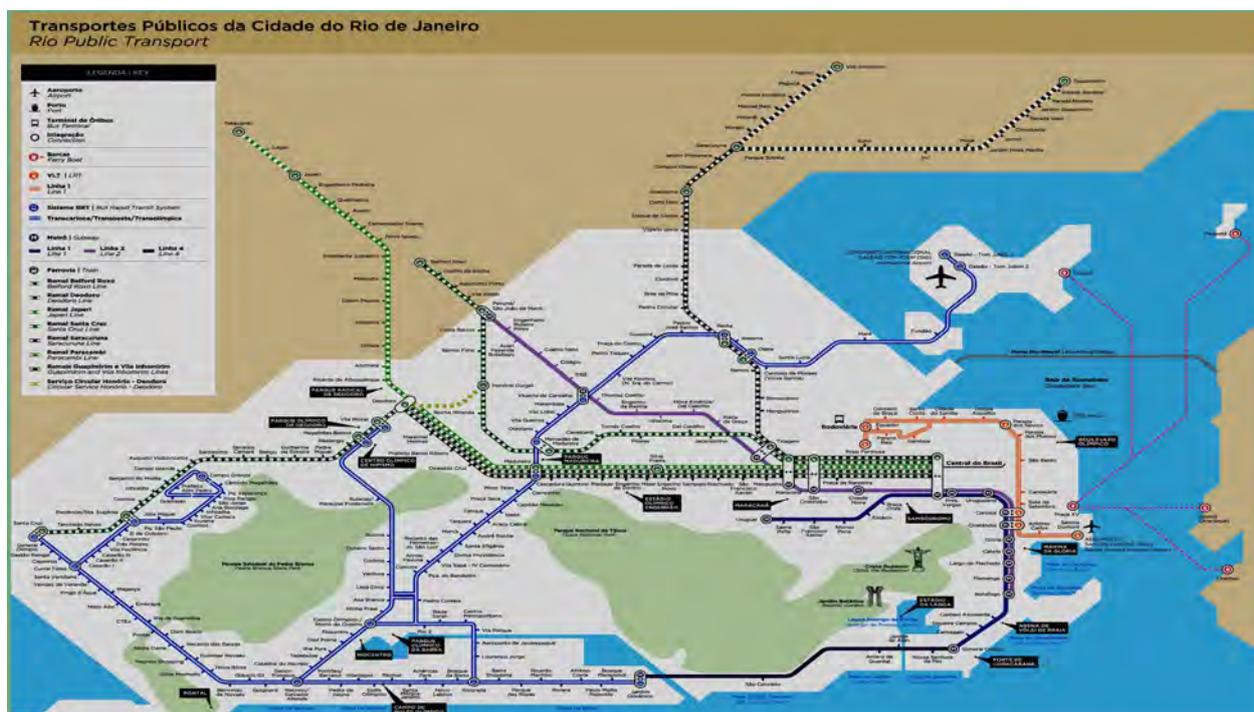
Rio has a history of “non-integrated” systems where each public transport operator sees others as direct competitors. The experience of 2016 Games show that metro could never have carried a record 1’000’000 daily passengers without its integration at specific interchange hubs with new BRT line system carrying 850’000 passengers per peak day. The reverse is true for new BRT high traffic loadings brought by Metro-BRT transfer stations.

About 20 new public transport Interchange hubs (**figure 8**) will play a major role improving Rio population more direct, quicker and comfortable routes throughout Rio.

Until recently Rio had separate maps for Metro, SuperVia suburban trains, BRT lines since 2013, standard bus networks and Transbay ferries. Rio public transport global architecture is now expressed by the **new Rio public transport map**—first such integrated map of Rio (**figure 8**).

For the Games all Olympic venues and venue clusters were shown. Like London 2012 with the Tube, all Rio Olympic venues were connected to its new high performance public transport system.

**Figure 8: Rio new public transport map with 2016 Olympic Games venues in black**



### 3.4 Rio five year (2011-2016) outstanding jump in high performance public transport attendance

Five year, 2011-2016 expansion of the Rio public transport system generated fast changes of public transport system usage as expressed by figure 9.

Massive improvements of its public transport system and services allowed Rio to have high performance travel 2011 for 1.1 million daily trips climbing to 2.3 million per day in 2016. Better public transport benefiting 1.2 million users a day is a tremendous progress.

If further public transport projects are realized by 2018, additional 1.3 million Rio users per day will have far better mobility conditions to reach 3.6 million high performance travel journeys per average day or 48% of Rio total public transport mobility (**Figure 9**).

According to those estimates, 2018 public transport high performance total travel flows would surpass daily total road mobility of about 3.0 million trips per day.

**Figure 9: Changes of public transport mobility structure with strong growth of high performance public transport: rail and BRT systems**

### Rio mobility evolution 2011 to after-Games 2016 and 2018

Transport modes	2011		Fall 2016		2018	
	Mio trips		Mio trips		Mio trips	
• Standard bus	5.6	84%	4.7	67%	3.9	52%
• BRT	0.0	00%	0.6	9%	1.3	17%
• Rail systems	1.1	16%	1.7	24%	2.3	31%
• <b>Total PT</b>	<b>6.7</b>	<b>100%</b>	<b>7.0</b>	<b>100%</b>	<b>7.5</b>	<b>100%</b>
• <i>BRT +Rail</i>	<i>1.1</i>	<i>16%</i>	<i>2.3</i>	<i>33%</i>	<i>3.6</i>	<i>48%</i>
• Road traffic	3.0		3.0		3.0	
• <b>Grand total</b>	<b>9.7</b>		<b>10.0</b>		<b>10.5</b>	

**Note:** values in million daily trips in Rio per average weekday in 2011-- 2016 after Games and estimated 2018

**Source:** City of Rio-SMTR-Dec 2016

### 3.5 Rio Centre of Operations (COR), extension of road transport surveillance command centre to integrate all urban mobility systems

Management of car/motorcycles/bus/minibus/truck and commercial delivery traffic in RIO is done by COR (Centre operations of Rio).

Thanks to Olympic Games operations and experience under high traffic conditions, COR has extended its services from road based system surveillance to multiple transport modes (bus, BRT, suburban rail, metro, VLT, ferries, cableways) represented by Rio public transport operators for the first time present at COR during the Games under the CIMU label.

CIMU or Rio Integrated Urban Mobility Centre corresponds to the “experimental” launching of a true Rio global mobility operational Centre incorporating all travel modes including main pedestrian flows in critical high flow density interchange hubs. The issue of travel reliability, comfort and safety are among CIMU outstanding tasks.

### ***3.6 Rio missed opportunity to help fix its utterly congested road and expressway***

Rio notoriously bad road and expressway traffic record of ***4th most congested City in the world (ANNEX B)*** with worst traffic conditions than all former Olympic Games Cities was a major handicap for Rio Games.

That led Rio 2009 bid to officially propose a 30% Alternate License Plate (ALP) scheme to reduce background 2016 Games traffic by 30% (similar to traffic reductions of 30% for London 2012 and 35-40% for Beijing 2008) to guarantee reliable travel times on the Olympic Lane Network (OLN) between the four distant main Rio Olympic zone hubs, Rio City Centre and Rio GIG international Airport.

Rio City government did not respect that promise. It was replaced by an insufficient 10-12% traffic reduction scheme based on holiday extensions for various Rio citizens groups but none for Rio metropolitan area commuters.

As predicted, during the Games, traffic conditions were bad with systematic congested expressways, longer travel times than announced and a prevailing sense of Rio global traffic unreliability. Lack of sufficient background traffic reduction hampered good functioning of one-third of the 240km otherwise excellent Olympic line network (OLN) where Olympic accredited traffic was mixed with congested sections of Rio expressway and major arterial roads.

That issue is a Rio endemic problem. A 2014 Rio study of traffic congestion economic and associated social costs showed an extraordinary high 12 billion USD annual Rio congestion cost or 8.1% of Rio GDP, a cost severely impacting Rio depressed economy.

The burden of Rio extremely high road congestion economic and social costs cannot last forever. The Games could have been a “golden” opportunity to implement more efficient and more economical traffic management schemes. It would have cost very little—probably less than 1/1000<sup>th</sup> of Rio transport total infrastructure investments for 2016-- to experiment with a Rodizio type traffic reduction scheme.

Experienced Rio Municipal traffic management teams had all the know-how and the central traffic command centre to do it, like Sao Paulo did successfully already 15 years ago (Sao Paulo occupies the 55<sup>th</sup> rank of world most congested Cities compared to Rio 4<sup>th</sup> worst rank).

Although formally promised for the Games as earlier indicated, the Rio 30% Rodizio traffic reduction scheme was rejected for electoral reasons (Municipal elections took place 2 months after Games). Endemic Rio traffic congestion is a major handicap for Rio more sustainable mobility future.

Too bad that the 2016 Games poor road traffic performance overshadowed the otherwise truly outstanding Rio public transport performance and Rio legacy.

## **4. Rio 2016 four outstanding transport and mobility legacy achievements and one counter legacy performance**

### **4.1 Strongest Games public transport system development legacy of all former Olympic Summer Games**

*The 2016 Games offered Rio a tremendous opportunity to break 2-3 decades of public transport system under-development. A “6 year instead of 25 year” public transport infrastructure development successfully catalysed by the 2016 Olympics provided strong Citywide public transport legacies. Rio 2016 did even better than the last two Olympics-- London 2012 and Beijing 2008 –in delivering an efficient City wide high performance public transport structured system serving all areas of Rio even the currently worst connected. It is a bold “one in every half century” strong public transport legacy for Rio.*

### **4.2 Rio public transport doubling and tripling quality performance in 6 years**

*As main result of the tremendous public transport infrastructure system, the share of Rio users benefitting from high performance public transport jumped from 16% in 2011 to 32% in 2016. It might climb to 48% if on-going public transport projects are completed by 2018. It is an outstanding progress of transferring 1.2 million Rio users from poor to high performance public transport in 2016 and 2.3 millions in 2018 if the new Rio Municipality completes on-going projects such as BRT-TransBrasil.*

### **4.3 Rio 2016 first public transport map**

*Rio waited for the 2016 Olympic Games to have a new integrated public transport map like Paris, London, New York and Tokyo metropolitan areas. It is another legacy of the 2016 Games and a new era for Rio much improved high performance and better quality public transport services offered to a much greater share of Rio population.*

### **4.4 Rehabilitation of Rio centre Guanabara Bay port frontage through obsolete elevated motorway demolition**

*Many City centre were cut of their harbour front by motorways built in the 1960’s such as San Francisco, Barcelona and many others.*

*Rio took advantage of the Olympic Games urban regeneration and transport rehabilitation dynamics to push the re-conquest of urban water front public spaces and plazas. This is illustrated by Rio Praça Maua pedestrian platform, the new Museum do Amanha on its harbour pier both served by Rio new VLT lightrail. **ANNEX C and D.***

### **4.5 Rio 2016 Games “missed opportunity” to implement traffic reduction solutions to help solve Rio unbearable chaotic traffic conditions**

*Rio missed the tremendous opportunity of solving its world 4<sup>th</sup> most chaotic road and expressway traffic conditions by refusing to cut background traffic by 30% as formally promised in 2009 winning bid. Failure to respect bid promises led to severe Games traffic malfunctioning and bad world publicity for Rio traffic conditions. The economic and social cost of Rio notorious congestion are staggering and refusal to attempt to solve this issue is a highly negative signal for Rio’s future.*

## 5. Bibliography

Brazilian Olympic Committee - COB; **“Transport Strategic Plan for Rio 2016 Games”**, COB, Rio de Janeiro, March 2009

Bovy Philippe / UITP-Brussels—**“High performance Public Transport: A must for very large sport events”**, Public Transport International—PTI N°2/2004, UITP Brussels, March 2004

Bovy Philippe, **“Olympic mega-event sustainable transport planning”**, *Mobilidade e Sustentabilidade*, ANTP Conference, Sao Paulo, June 2005

Bovy Philippe / UITP-Brussels—**“Solving outstanding mega-event transport challenges: the Olympic experience”**, Public Transport International—PTI N°6/2006, UITP-Brussels, Dec 2006

Bovy Philippe / UITP-Brussels, **“Beijing 2008 Olympic Games success :massive public transport developments and major road traffic reduction”**, Public Transport International—PTI N°3/2009, UITP-Brussels, May-June 2009

Bovy Philippe / UITP Latin America Division-Recife, **Mega-eventos: Catalisadores para transporte mais sustavel nas Cidades**, Latin America Division Conference in Recife, Brazil, Recife, November 2009

Bovy Philippe / Website-mobility 2013, **“London 2012: Best public transport Olympics ever”** in [www.mobility-bovy.ch](http://www.mobility-bovy.ch), **Mega-event transport** bibliography, Lausanne 2013

Maiolino Carlos, **“The legacy of urban mobility improvements for Rio 2016 Games—Intermediate 2014 review”**, Special Advisor SMTR Secretary of Transport City of Rio 2009-2016, in *“Depois dos Jogos – pensando o Rio para o pos 2016”*, Editoria Campus, Rio 2015

Lindau Toni and Felin Bruno/ WRI **“Rio Olympics’ Legacy: Urban Mobility”**, World Resources Institute, Washington DC, August 22, 2016

Bovy Philippe / AISTS, **«World multi-sport mega-event transport developments and mobility global management : The Olympics »** AISTS, Lausanne-International Academy of Sport Management and Technology-Lausanne, Lausanne- October 2016

***RIO transport system 2010-2018 transformations comparing Rio 2009 bid promises and delivered projects for 2016 Games and 2018 horizon***

<b>A. Public Transport 2016</b>	<b>2009 bid (km)</b>	<b>Delivered 2016 (km)</b>	<b>Difference (km)</b>
<b>Network lines delivered 2010 to Aug. 2016</b>			
1. Metro line 4	4	15	+11
2. SuperVia - Deodoro upgrade	25	25	+0
3. BRT Barra-South Zone	29	0	-29
4. BRT TransOeste	0	58	+58
5. BRT TransCarioca	28	39	+11
6. BRT TransOlimpica	15	25	+10
7. Light Rail-Phase 1	0	8	+8
<b>Subtotal 2016</b>	<b>101</b>	<b>170</b>	<b>+69</b>
<b>B. Public transp. planned works scheduled for 2017-2018</b>			
8. BRT TransBrasil	0	33	+33
9. Light Rail- phase 2	0	7	+7
<b>Subtotal 2017-2018</b>	<b>0</b>	<b>40</b>	<b>+40</b>
<b>C. Overall 2010 to 2017/2018 Rio Public transport system expansion</b>			
<b>Grand total (km)</b>	<b>101</b>	<b>210</b>	<b>109</b>
<b>D. Roadway expansion works 2010 to Aug. 2016</b>			
10. TransOlimpico Expressway	13	13	+0
11. Joa new link (2 lanes)	0	4	+4
12. Rio downtown bypass	0	5	+5
<b>Total (km)</b>	<b>13</b>	<b>22</b>	<b>+9</b>

Rio, Lausanne: November 1, 2016

Source: City of Rio SMTR and Prof. Bovy IOC transport advisor

**ANNEX B**

## WORLD MOST CONGESTED CITIES in relation to MEGA-EVENTS

### 2014 Tomtom Gps Navigation Traffic Congestion Index for 220 World Cities

General congestion index: 00%  
 Peak hour congestion: 00%, most critical am or pm peaks  
 Olympic host and candidate cities after 2000: **in bold italics**  
 Next Summer Olympics: **in bold italics red - Rio**

Ranking (from most congested to least)		Congestion index 2014 (%)	
		Gen level	Peak (am or pm)
<b>Congestion index &gt; 50</b>			
1.	Istanbul (multiple cand / last 2020)	58	109-pm
2.	Mexico City (S. Olympics 1976)	55	93-am
<b>3.</b>	<b>Rio de Janeiro (S. Olympics 2016)</b>	<b>51</b>	<b>81-pm</b>
4.	Moscow (S. Olympics 1984 / 2018 WCup)**	50	103-pm
<b>Congestion index 35-50</b>			
7.	St Petersburg (2018 Football World Cup)**	44	96-pm
10.	Los Angeles (S. Olympics 1984)	39	80-pm
13.	Rome (Candidate S. Olympics 2024)	38	71-am
<b>15.</b>	<b>Beijing (S. Olympics 2008)</b>	<b>37</b>	<b>74-pm</b>
<b>16.</b>	<b>London (S. Olympics 2012)</b>	<b>37</b>	<b>67-pm</b>
<b>20.</b>	<b>Vancouver (W. Olympics 2010)*</b>	<b>35</b>	<b>66-pm</b>
<b>Congestion index 25-35</b>			
<b>21.</b>	<b>Sydney (S. Olympics 2000)</b>	<b>35</b>	<b>66-am</b>
22.	Paris (multiple cand / last 2012)	35	64

## ANNEX C

Comparing Rio-harbour-Praça Maua 2011 at left  
 And Praça Maua 2016 at right—an urban highly prized legacy



## ANNEX D

## ***Rio Praça Maua and Museum of Tomorrow***

***Rio 2016 Games most important legacies are not the Games themselves but what was built in Rio for cariocas and visitor's long term enjoyment as well as much improved urban and metropolitan public transport mobility***



---

**Prof. Philippe Bovy / Lausanne / 03.03.2017  
With thanks to Rio municipal traffic team positive  
contributions for this paper preparation**