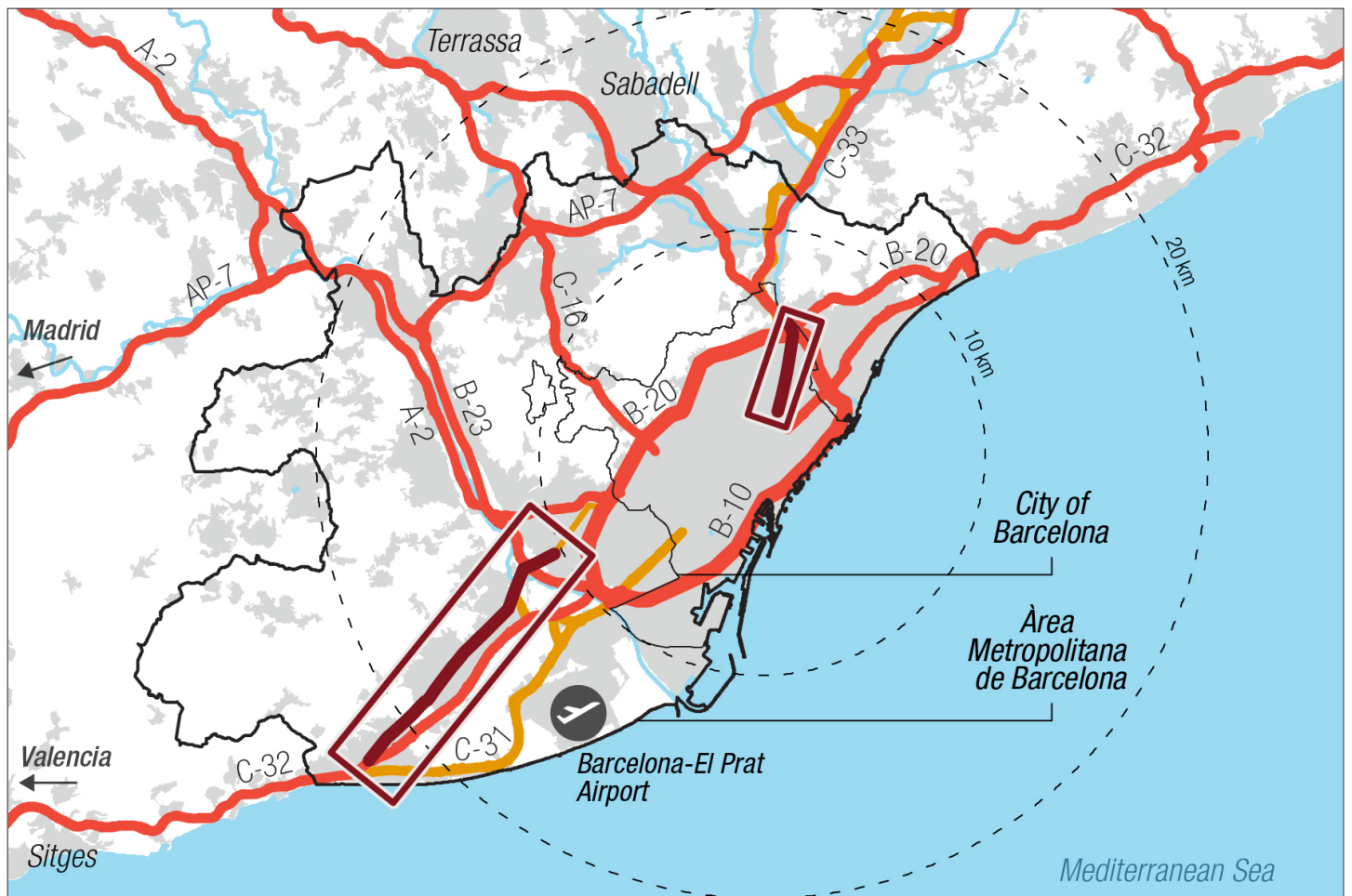


BARCELONA, METROPOLITAN AVENUES.

C-245 & MERIDIANA PROJECTS



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BARCELONA METROPOLITAN AVENUES C-245 AND MERIDIANA PROJECTS

Case Study Report for the METREX *From Roads to Streets* Expert Group
July 2023

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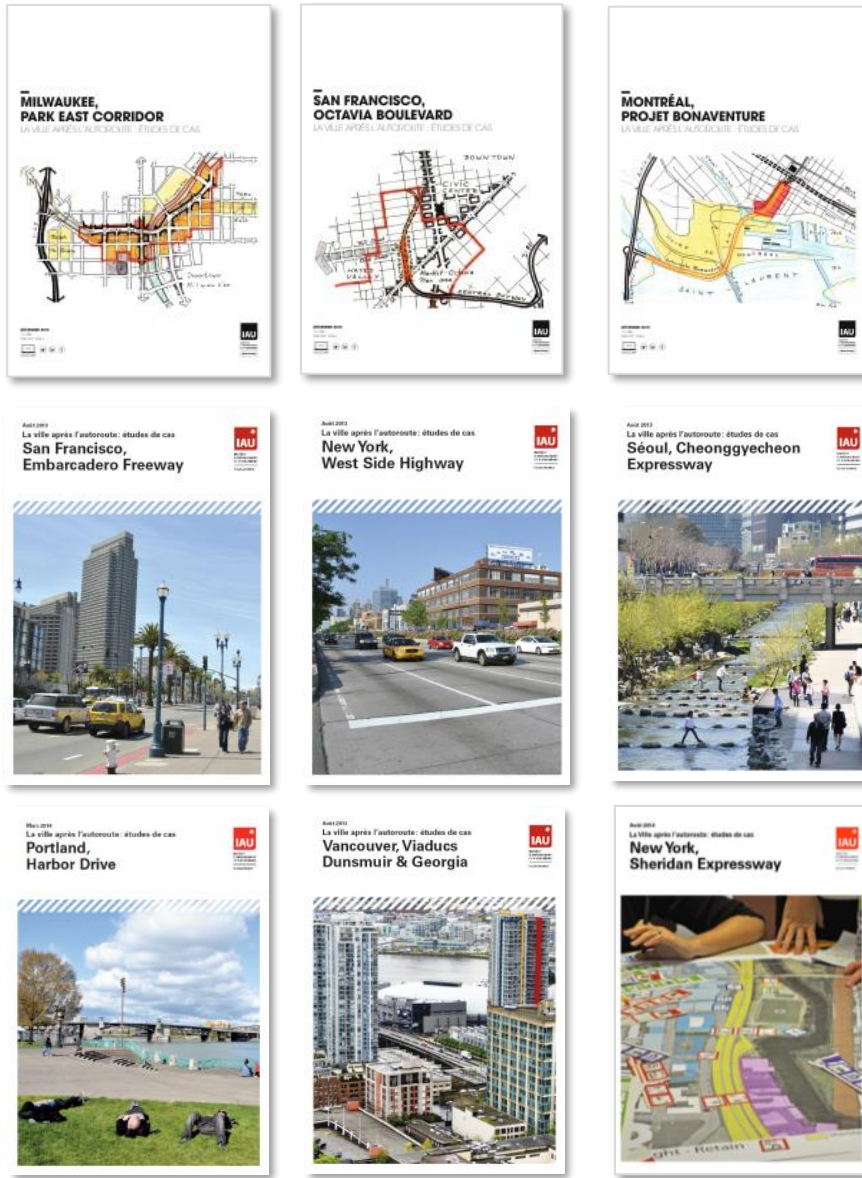
FOREWORD

CONVERTING HIGHWAYS, RETHINKING CITIES

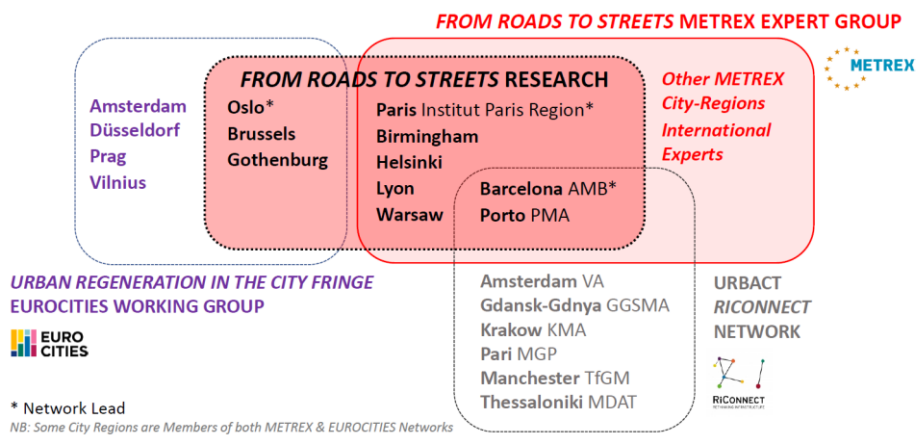
All over the world, cities and regions are confronted with an undesirable and unsustainable legacy of the 20th Century: the urban expressway and other main road designed for traffic that create barriers between neighbourhoods, limit pedestrian and bicycle movement and sever access to open space. The high volumes of traffic highways encourage are source of noise, dust and air pollution, raising health and social justice issues. Not only do they tend to reinforce social segregation, but they also hinder regeneration efforts. Urban highways and expressways often have negative impact on ecosystems, water systems and climate. On the long run, by providing seemingly easy access for vehicles, extensive highways networks tend to encourage car-centric lifestyles, urban sprawl, mono-functional uses of space, road-based logistics, which in turn leads to more traffic and congestion.

In the last decade, social and economic patterns have changed, resulting in growing aspirations for the vibrancy of city life and car-free living in denser, mix-use neighbourhoods and towns served by flexible, multi-use and greener public spaces. Cities and metropolitan regions respond to these trends by redesigning car-oriented urban and suburban fabrics with more intensive land-use supported by new metro, tramway or express bus networks. These projects are increasingly becoming catalysts of green development strategies; sustainable urban mobility plans and climate-neutral policies. Many city and metropolitan governments acknowledge the urgency of reducing drastically their automobile-based carbon footprint while restoring ecosystems with nature-based solutions. Highway transformation, removal or recycling may be part of the solution on all these issues.

The post-Covid contexts reflect a rapid and significant change in mobility, housing, working and leisure patterns, opening a new window of opportunity to reset our urban development and transport models. Highway transformation can help transitioning cities and regions towards more liveable, just and climate-neutral development patterns.



International case study reports on highway transformation
© L'Institut Paris Region



The METREX EURO CITIES URBACT *From Roads to Streets* Learning Platform in 2022
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Learning from international experience

Many cities –including Portland, New York, Seoul and, recently, Paris– have successfully removed or transformed stretches of urban highways, replacing them with multi-use boulevards lined with mixed-use new development or even new linear parks and promenades. Why are they doing that? What happens with the traffic? What are the benefits and costs? How do cities and regions manage these projects? And how do they get public support for reducing car-space?

To find answers to these questions and inform ongoing projects and reflections in the Paris region, I initiated in 2010 a long-term research programme on *Metropolitan Avenues*¹ at the *Institut Paris Region*, the urban planning and environmental agency for the Paris metropolitan region².

As part of the programme, over twenty highway-to-boulevard experiences on three continents (America, Asia and Europe) were examined. Of these, nine cases were studied on-site, with their reports published mostly in French, with some also in English (*):

- Seoul *Cheonggyecheon Expressway* (2013)
- San Francisco *Embarcadero Freeway* (2013)
- Vancouver *Viaducts* (2013)
- New York *Westside Highway* (2013)
- Portland *Harbor Drive* (2014)
- New York *Sheridan Expressway* (2014, 2020*)
- San Francisco *Octavia Boulevard* (2016)
- Milwaukee *Park East Corridor* (2016)
- Montréal *Projet Bonaventure* (2016; 2020*)

The most significant result from this research is that these strategic metropolitan projects are complex and conflictual, but have long-term positive impacts on traffic and mobility, city regeneration and the quality of the urban environment, often far beyond the project boundaries. Some results in English can be found in a paper called *Reinventing Cities: From Urban Highway to Living Space*³ (2018) reproduced in the Appendix of this report.

This research has influenced projects in France, including the Paris Seine Banks pedestrianisation (2016) and the ongoing reflections on the future of the Paris *Périphérique* and the region's highways, which started with the organisation of an International Competition on the *Future of Grand Paris' Highways* in 2018⁴.

The METREX-led *From Roads to Street* joint learning platform

In March 2020, METREX, the Network of European Metropolitan Regions and Areas, launched a “*From Roads to Streets*” expert group to serve as a platform for the exchange of knowledge and experience in the transformation of urban highways into city streets (places to move, to stay, to live and to work in), as “*a key measure to transform the urban fringes of metropolitan cities and regions*”⁵. The Institut Paris Region -Planning and Environmental Agency for Paris Metropolitan Region- is the lead partner.

The METREX *From Roads to Street* group works in close cooperation and support of the EUROCITIES *Urban Regeneration in the City Fringe*⁶ working group. This group was created in April 2020 with eight participating cities: Amsterdam, Brussels, Düsseldorf, Lyon, Prague, Vilnius, Gothenburg and Oslo as the lead partner⁷. The purpose of this group is to exchange experiences on the conditions and methods for transforming urban fringes in three main directions: overcoming highway barriers, creating high quality public spaces, and managing radical land-use mix.

¹ *Avenues métropolitaines*. www.en.institutparisregion.fr/know-how/international/rethinking-post-carbon-cities.html

² Formerly Institut d'Aménagement et d'Urbanisme de la Région Île-de-France (IAU ÎdF). www.en.institutparisregion.fr

³ Urban Design #147, Urban Design Group UK, Summer 2018.

⁴ *Les Routes du futur du Grand Paris*, Forum Métropolitain du Grand Paris, Apur, Institut Paris Region, 2019.

⁵ Henk Bouwman, General Secretary of METREX. www.eurometrex.org

⁶ *Edge of Centre Transformation II, Urban Regeneration in the City Fringe*, EUROCITIES, April 2020.

⁷ Mathias Vestgart Project leader, City of Oslo.

The METREX *From Roads to Street* group aims specifically to further investigate the question of why and how converting traffic-oriented highways into streets could contribute to an environmentally friendly mobility, help design walkable, safe, socially balanced neighbourhoods, and be a driver for the revitalisation and intensification of fragmented, mono-functional, city fringes. The group draws upon the experience and expertise of its members in this field, and brings a regional, wide angle, perspective in the discussion.

METREX and EUROCITIES groups have worked in collaboration with the URBACT *RiConnect* action planning network bringing together eight metropolitan and transport authorities: Porto (AMP), Gdansk-Gdynia-Sopot (OMGGS), Krakow (KMA), Thessaloniki (MDAT), Amsterdam (VA), Paris (MGP), Manchester (TfGM), with the Barcelona Metropolitan Area (AMB) as the lead partner⁸. Until September 2022, *RiConnect* has worked on rethinking the mobility infrastructure in combination with metropolitan and local urban planning, to reconnect people, neighbourhoods, cities, and natural spaces.

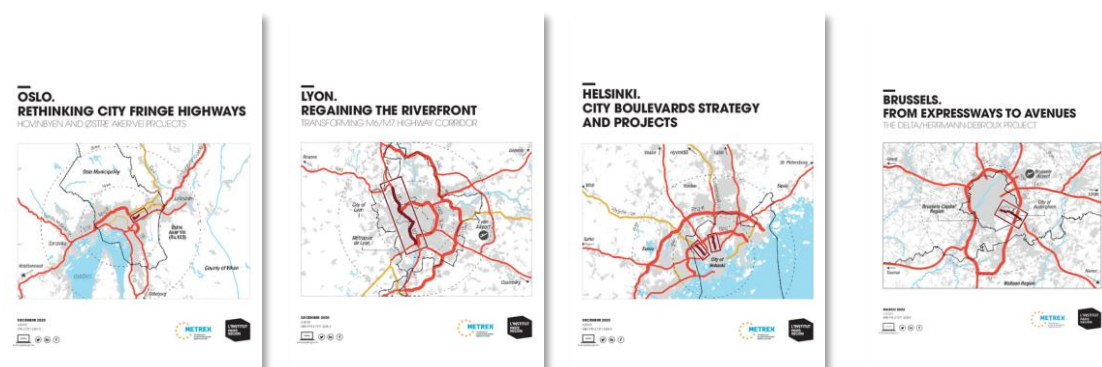
These three networks have joined forces to share knowledge, experience, and expertise on these complex issues, in order to strengthen strategic and creative planning capacities of cities and regions. The idea is for planners from different horizons both “to learn through examples, discussions and presentation of projects” and “to learn by doing, through participation of group members in the local reflection and planning processes”⁹.

The European Union’s policies, together with national government strategies, plays a major role in the planning, programming, and financing of highway networks in our cities and regions. The joint reflection of the networks aims at raising their awareness of the social and environmental impacts of these policies and the need to shift funding streams towards their environmental integration and urban transformation.

The METREX, EUROCITIES and URBACT networks’ learning platform has relied since 2020 on a series of events, both online and on site, such as group workshops, peer to peer cooperation; multi-actor transnational seminars; site visits; hands-on studios; and *ad hoc* and partner events including in Lyon (October 2021), Brussels (March 2022), Vilnius (June 2022), Barcelona (July 2022) and Amsterdam (October 2022). The work programme of the different networks covers a period of three years, extended to four due to Covid-19, with a final international event anticipated in 2024.

A case study-based learning process

The knowledge-based learning process is based on case studies of ongoing projects of road transformation in European partner cities. Analysis and transverse comparisons are crucial to get a common understanding of local issues, strategies, planning approaches, reflections, and conflicts. Comparing scales, ambitions, framework policies, planning processes, and delivery instruments, can nurture the creative thinking of professionals from all networks to help find innovative and bold answers to the questions raised.



European case studies on urban and highway transformation published within the METREX Expert Group
L’Institut Paris Region/METREX © L’Institut Paris Region

⁸ Joan Caba, Project Leader, Urban Planning Department, Barcelona Metropolitan Area (AMB).

⁹ *Urban Regeneration in the City Fringe Project Plan*, EUROCITIES-City of Oslo, March 2020. Revised Sept. 2020.

To trigger the process, the Institut Paris Region initiated a research based on the voluntary participation from cities and regions taking part in one or more of the three networks.

Four case studies of urban and highway transformation projects have already been published with the help of local colleagues (many thanks to all contributors!) and can be downloaded for free on the Institut Paris Region's website¹⁰:

- Helsinki. *City Boulevards Strategy and Projects (December 2020)*
- Oslo. *Rethinking City Fringe Highways. Hovinbyen and Østre Aker Vei Projects (Dec. 2020)*
- Lyon. *Regaining the Riverfront. Transforming M6/M7 Highway Corridor (Dec. 2020)*
- Brussels. *From Expressways to Avenues. Delta / Herrmann-Debroux Project (March 2022)*

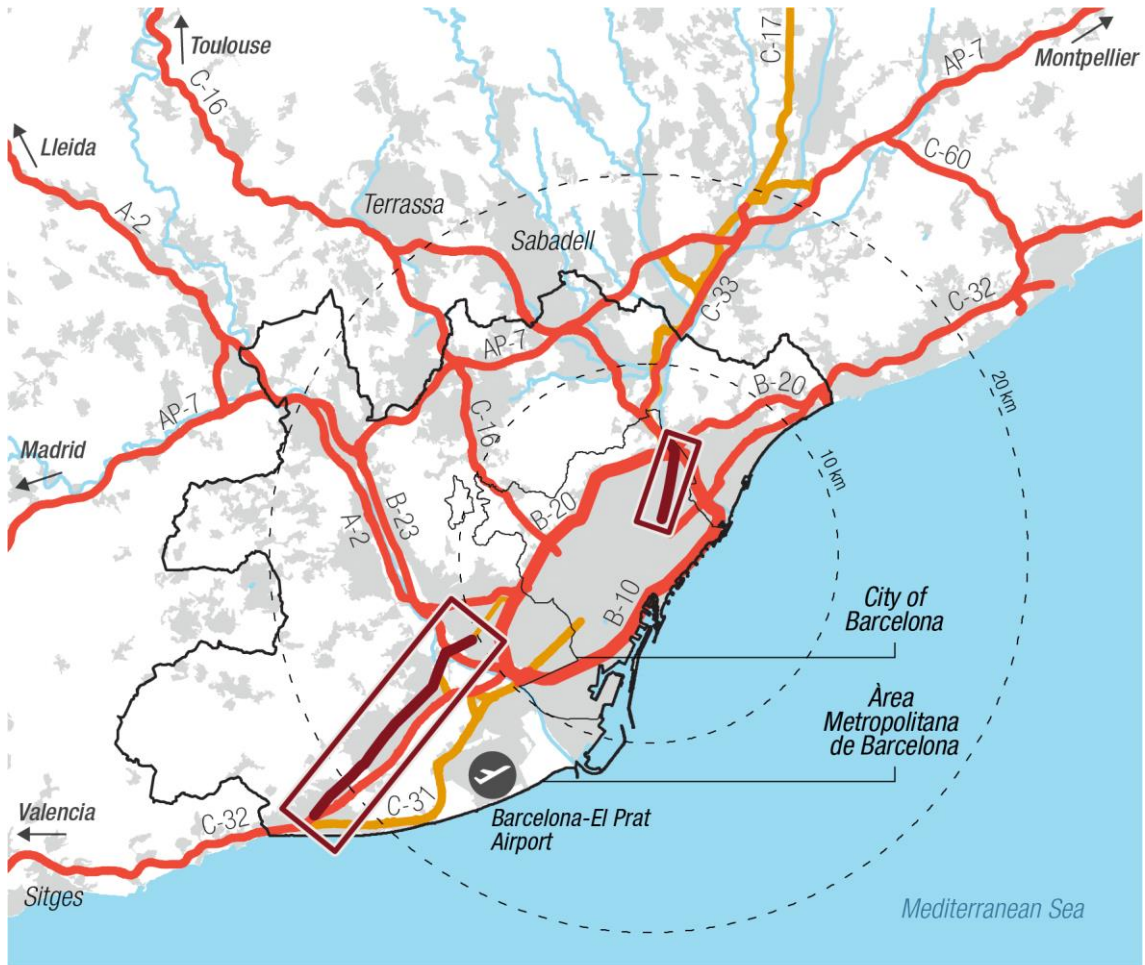
Other city-regions 'from-roads-to-streets' experience is also being documented, including those of Amsterdam, Barcelona, Birmingham, Gothenburg, Nantes, Paris, Porto, Prague, and Warsaw.

This report is about Barcelona's *Metropolitan Avenues* strategy with the C-245 Regional Road and the C-33 Meridiana Avenue as pilot-projects. The conversion of the 13-km long C-245 shows the way a metropolitan authority can help to redesign a suburban road into a civic street connecting five municipalities with a busway and a bikeway. The Meridiana Avenue story is about the 30-year long transformation of a former 1960s 7.7 km-long boulevard first into an urban expressway, in the 1990s into a heavily trafficked avenue, and now, in the 2020s, into a greener, pedestrian- and bike-friendly, avenue.

Barcelona's city and metropolitan experience offers an inspiring insight into how we can tackle these issues, now and in the future. I hope you will find food for thought and action in this report.

Paul Lecroart
Chair of the METREX *From Roads to Streets* Expert Group
July 2023

¹⁰ www.en.institutparisregion.fr/international/from-expressways-to-boulevards



- Ring highways
- Other highways
- Other main roads and expressways
- Axis subject to transformation
- Project area
- Municipal boundary (City of Barcelona)
- Metropolitan boundary (Àrea Metropolitana de Barcelona)

N 0 10Km
 © L'INSTITUT PARIS REGION 2020
 Sources: OpenStreetMap, ViaMichelin, Corine Land Cover, Institut Cartogràfic i Geològic de Catalunya



Barcelona Metropolitan Area's road network with C-245 and Meridiana project areas

© OpenStreetMap, Barcelona Metropolitan Area, Institut Paris Region



Two ways of combining public space and traffic: Diagonal rambla south of Glories (left) and Gran Via expressway.
 © Paul Lecroart Institut Paris Region

BARCELONA, METROPOLITAN AVENUES C-245 AND MERIDIANA PROJECTS

1. Background

1.1. Barcelona: City and Metropolitan Planning

Barcelona is a dense and compact city of 1.6 million people living on a small territory of 100 km² framed by the Collserola mountains, the sea and the Besos and the Llobregat rivers. Together with 35 other municipalities, it makes up for the Barcelona Metropolitan Area (*Àrea Metropolitana de Barcelona*, AMB), the metropolitan authority covering an area of 636 km² (48% built up).

With a total population of 3.3 million people, the AMB has a dense core area, which includes some large towns such as L'Hospitalet de Llobregat (254,000 inhabitants) or Badalona (215,000), smaller municipalities and a diffuse periphery. The larger metropolitan region has a current estimated population of over 5.3 million people and a territory of around 4270 km².

The Barcelona Metropolitan Area was legally established as an institution in 2010 bringing together powers in the fields of urban planning, transport, and the environment, which had been under the responsibility of different metropolitan entities since 1987. From 2010 onwards, these powers have expanded to also include mobility, housing, economic development, social cohesion, territorial planning, thus laying the foundations for the elaboration of the *Metropolitan Urban Master Plan* (PDUM) of Barcelona. The draft PDUM adopted in 2019 by the AMB is pending final approval in 2023.

The *Metropolitan Urban Master Plan* will become the main planning tool for the metropolitan area, defining the vision, guidelines, and orientations of urban development for the next 25 years. It will replace the current *Metropolitan General Plan* (PGM) approved in 1976, modified ever since, and enlarged to include nine new municipalities. The road-to-street transformations described below, such as the C-33 Meridiana Avenue and the C-245 Regional Road, are embedded in municipal urban policies as well as in metropolitan-level strategies.

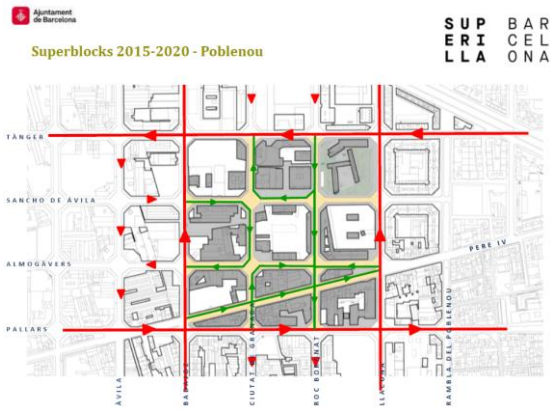
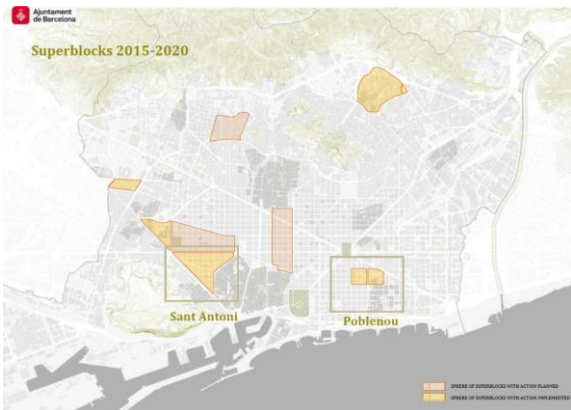
Ada Colau is both the Mayor of Barcelona and president of the Barcelona Metropolitan Area-AMB.

1.2. Green and Pedestrian Public Space in Barcelona

The municipality of Barcelona has a long experience in redesigning quality public spaces and transforming roads into streets. In the recent years Barcelona's *Urban Ecology* department has developed the *Superilles* (Superblock) strategy, originally aimed at freeing-up two thirds of streets from car-traffic, noise, air pollution and accidents, in order to encourage social uses of space and increase the green ratio (Barcelona has only 6.6 m² of public green space per inhabitant). This strategy has been implemented in different districts of Barcelona with the help of intense civic participation, tactical action, and cultural events²⁰. Due to challenges such as delivery or parking access, the city focusses now on the creation of a series of green streets connecting parks.

Barcelona also uses temporary closure of major avenues, such as the (carrer de) Sants street axis, to traffic every Saturday and Sunday to open them to multiple pedestrian-friendly uses.

²⁰ Gaucher (L.) and Gawlik (M.), *Barcelona capitalizes on its tactical experience to transform its public space*: en.institutparisregion.fr/



Superblocks 2016-2020 programme (left) and initial principle of internal pedestrianisation of 9 blocks in Poblenou (right)
 © Ajuntament de Barcelona



A Superblock programme block in Poblenou district with open street (closed to through traffic) and temporary furniture.
 © P. Lacroart / L'Institut Paris Region



The Green Streets Plan in the Eixample (central Barcelona; left). Green streets principle (right) © Ajuntament de Barcelona



Weekend Open Streets (Obrim Carrers) on the busy axis of Creu Coberta Carrer De Sants © P. Lacroart / L'Institut Paris Region

1.3. The Metropolitan Urban Master Plan

The future *Metropolitan Urban Master Plan* (PDUM, pending final approval in 2023) is steered by the Barcelona Metropolitan Area (AMB). It identifies the transformation of axes such as the Meridiana Avenue, the C-245 Road in the lower Llobregat delta or the N-150 *Avinguda del Vallès* as projects of metropolitan interest with a supra-municipal character.

Designing the Metropolitan Urban Master Plan as guidance for the development of 36 municipalities to 2042 and beyond, has opened-up a unique opportunity to rethink mobility, grey and green infrastructure, urbanisation, and long-term resilience of the metropolitan region.

Some key milestones in a process started almost ten years ago:

2013-2015. Gathering of international knowledge around the new urban planning paradigms that affect the metropolises of the 21st century with workshops, technical conferences, lectures, and presentations. This period culminates with the publication of the *Quaderns PDUM* and the *Metròpolis Barcelona* exhibition open to all citizens.

2016: The Master Plan Drafting Service (SRPD) is set up to work on the definition of the *Draft (Advance) of the Metropolitan Urban Master Plan* for the Metropolitan Area of Barcelona (PDUM).

2016-2017: Definition of two main objectives: the elaboration of planning guidelines with experts from the academic and professional world through round tables; and the definition of governance and participation tools for the drafting.

2017-2018: Elaboration of a shared diagnosis of the PDUM.

26 March 2019. Draft PDUM is adopted, opening a 9-month period of Public Information until 31 January 2020. This period was supported by a broad process of citizen participation, encompassing different actions to encourage participation at different levels. There was a close contribution with the local councils of the involved municipalities and private institutions that constitute a channel to disseminate the discourse to a wide group of actors.

2020-2023: The final document for initial approval is being prepared. The initial approval in March 2023 will be followed by a public information period to collect remarks before the final approval of the PDUM.

The PDUM is grounded on three main axes:

- A healthy metropolitan area, where citizens breathe clean air, where active life is promoted and where people enjoy quality public spaces and green areas.
- A democratic, equitable and socially just metropolitan area, which provides opportunities considering the socio-economic, gender, territorial and cultural diversity of its citizens.
- A sustainable and resilient metropolitan area, where development is framed by social justice and ecological limits.

It puts forward a spatially and socially balanced metropolitan development, less focused on international competition and attractiveness, and more on providing alternative mobility, and recycling the existing urban space, thus limiting urban expansion.



Barcelona's metropolitan landscapes. Besos river and hills at Sant Adrià
© P. Lecroart / L'Institut Paris Region

2. The *Metropolitan Avenues* Strategy

2.1. Rethinking Road Infrastructure

In the past decades, the City of Barcelona has developed an intimate know-how on the combination of road infrastructure with quality public space as a stimulus for urban regeneration. However, the city's main road infrastructure remains heavily dependent on cars as a mean of transportation. At a wider scale, Barcelona region's very extensive road and motorway networks have excessively fragmented the natural landscape and created an unwalkable archipelago of towns, business parks and commercial developments, disconnected from each other.

Rethinking this road network is one of the focusses of the Metropolitan Urban Master Plan (PDUM). In this perspective, the PDUM classifies the road network into four categories according to the urban context, the intensity of use, and the potentiality for transformations:

- *Metropolitan Avenues*, as the main structuring urban axes of the metropolis that guarantee the flows and continuity of sustainable mobility and urban development,
- *Metropolitan Streets*, local roads than have a restructuring potential,
- *Metropolitan Connectors*, designed to distribute road traffic flows from segregated high-capacity roads,
- *Metropolitan Paths*, as routes promoting pedestrian and bike mobility by recovering historical traces.

The PDUM devotes a section to the concept of *civic axes* that may incrementally be redesigned by humanizing the existing metropolitan infrastructure, encouraging mix urban uses, both supported with active and sustainable mobility.

The strategy aims to reduce car-use and create a resilient structure for the future:

- emphasise public transport as the structuring element of metropolitan mobility,
- restore metropolitan continuities linked to the urban fabric by quality public space and promoting urban intensity around them,
- rationalise private mobility and facilitate infrastructures that allow users to transfer from private vehicles to public transport.

The PDUM emphasises the organisation of its territory according to a polycentric structure, based on existing and new centres of different levels of supply and intensity. The fragmentation of urban spaces created by segregated road infrastructure, combined with a lack of strong urban centres served by public transport, impacts several municipalities. It requires a coordinated action plans to build coherent and unitary projects along main road axis and their adjacent territories.



Visualisation of the Metropolitan Avenues (left), the Metropolitan Streets and the Metropolitan Paths.
© Barcelona Metropolitan Area, Felipe Ibarz (PDUM, 2019)



Centralities and urban structure of the Barcelona Metropolitan Area in the draft Urban Master Plan. Metropolitan Avenues are in orange, including C-245, C-33 Meridiana and R-150 Avinguda del Vallès (boxes, from left to right). © Barcelona Metropolitan Area (PDUM, 2019)



Metropolitan Avenues support opportunity areas, metropolitan centres and regeneration areas. Boxes refer to C-245 Road, C-33 Meridiana Avenue, and R-150 Avinguda des Vallès. © Barcelona Metropolitan Area (PDUM, 2019)

The Metropolitan Urban Master Plan strategies are supported by the actions and transport projects included in the *Urban Mobility Metropolitan Master Plan 2019-2024* (PMMU) aiming to improve the environmental conditions in the region (air quality is poor) and to encourage a shift in transport modes from private vehicles to public transport or active modes.

Funding of new projects for grey and green infrastructure, such as the transformation of the C-245 into a civic axis, is framed by the *Metropolitan Investment Programme* (MIP) approved by AMB. With a budget of EUR 316.15 million, the latest MIP includes the 2020-2023 *Programme of Actions in Natural and Urban Landscapes* (PSG). The PSG has a budget of EUR 8.4 million and plans to invest in the recovery of river spaces, degraded areas, and the urban integration of existing infrastructures. The AMB has also approved the *Environmental Sustainability Plan* (PSA), with a budget of 110 million euros and two main axes: sustainable urban mobility and ecological and energy transition.

To stimulate new ideas about how to rethink infrastructure, the AMB launched an international ideas competition "*The Future of Infrastructure, nodes and crossings*" in 2020-2021, linked to the drafting of the PDUM. It explores the paradigm shift of the role of expressways and their interchanges in a metropolitan context. Six locations (map) within the AMB were proposed for the reception of proposals aiming at rethinking the automobile infrastructures towards a better integration in their urban or natural contexts. The winning ideas should be integrated into the PDUM or in future projects.



Selected sites for *The Future of Infrastructure, nodes and crossings* competition. The C-245 is #6, N-150 is #3.
© Barcelona Metropolitan Area (AMB)



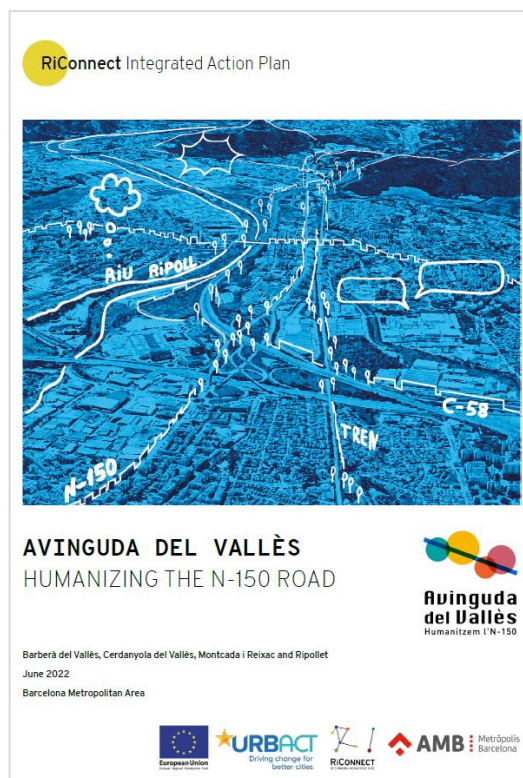
Metropolitan Bikeway along the Diagonal highway. © P. Lacroart / L'Institut Paris Region

2.2. Ongoing Metropolitan Avenues Projects

The AMB has established a first list of its priority corridors for the *Metropolitan Avenues* strategy, some projects have already started.

These priority corridors fall into two broad categories (some hybrid axes may be part of both):

- Segregated motorways (or expressways) in need of integration in their urban and suburban environment without changing their status for now. This can include introducing new busways and mobility hubs, improving public space and housing, creating new side streets for local traffic and bikes, or bringing more mix land-use in their neighbourhoods. Examples: Grand Via project in Barcelona, C-31 project at Plaça de l'Europa in l'Hospitalet del Llobregat, C-31 project in Sant Adria de Besos and Badalona in the east of Barcelona, B-23 in l'Esplugues de Llobregat in the west.
- Major historic roads in car-oriented, fragmented, unwalkable, suburban environments in need of upgrading and humanizing. Example: The N-150 *Avinguda del Vallès* in the northern suburbs of Barcelona currently under reflection as part of the Metropolitan Urban Plan with temporary actions started within the *Urbact RiConnect* Integrated Action Plan in 2022.



Avinguda del Vallès R-150 projects map and Action Plan as part of the URBACT RiConnect programme in 2020-2022.



From 1964 to 1967 the *avenida Meridiana* was transformed into an urban expressway with 12 traffic lanes, narrow sidewalks, and segregated central highway. Pedestrians had to cross the road using one of three uncomfortable footbridges. These features gradually attracted induced traffic, people buying cars and using them to access or cross the city of Barcelona at a very high environmental price for the local residents.

© DR



The Meridiana quasi-expressway in the 1970s at peak time. In the late 1990s, vehicular traffic peaked at 145,000 vehicles per day. It still reaches 125,000 vehicles per day today in the north of Barcelona

© DR

3. Transforming the Meridiana Avenue 1964-2024+

Barcelona has a long and rich experience in trying to combine high traffic roads with public space and civic life on which the *Metropolitan Avenues* strategy can build-up. In this perspective the Meridiana Avenue's metamorphosis over six decades is interesting to observe. Initially designed by engineer-urbanist Cerda in 1859 as a major north-south axis of the city (its first section is aligned on the Dunkirk-Barcelona meridian and it connects to France), the 7.7 km long avenue was built in the 1950s as a 50 m-wide major thoroughway of the city.

With the first metro line of the city (L1) built under the surface of the avenue, the axis became the backbone of the north-eastern extension of the city with 10-story high housing blocks gradually lining-up along the avenue -and acting as a kind of screen for the low-rise, industrial suburbs on both sides.

3.1. 1960s: Converting the Meridiana into a Motorway

From 1964 to 1967, the Meridiana was transformed into an 12-lane highway with six segregated central lanes for fast traffic lanes connecting with the AP-7 northern motorway (and later to the C-17, C-33 and C-58 expressways) and six side lanes for local traffic. The narrow sidewalks (pavements) allowed little social and commercial activity, and had almost no trees.

In order to keep cars moving, few pedestrian crossings were allowed and three footbridges were built to connect the two sides of the road. As an urban motorway, the Meridiana created a strong barrier between neighbourhoods, particularly Clot and Sant Andreu. The high level of car-traffic (around 120,000 vehicles per day in the early 1990s) travelling at high speeds contributed to create a noisy, unsafe and poor quality living environment²¹.

3.2. 1990s: Restructuring the Meridiana

By 1989, the newly elected democratic government of Barcelona initiated the process of humanizing the Meridiana highway. In 1990 the section of the avenue between Plaça de les Glòries and Carrer de València was fitted with a central promenade (rambla). By 1993, the three pedestrian overpasses were replaced by level-crossings managed by traffic lights.

In 1995, after the Olympics and the completion of the B-20 Ring Road, the City reduced the number of traffic lanes from 12 to 8 (4+4 lanes), with the roadway shrunk from 44m to 26.5 m, the lateral barriers were removed and new crossroads were designed to connect to local streets. Sidewalks were widened from 3m to 11.5 m on each side with light paving and new trees giving quality and unity to the new boulevard (almost 50/50 pedestrian space/roadway space). Later on, 2 lanes out of 8 were reserved for busses and taxis.

By 1997, traffic volumes peaked to the very high level of 144,000 vehicles per day (mostly cars) north of the Meridiana (Trinitat) and around 100,000 in the south (between Mallorca and Valencia streets). With the improvement of the public transport network, changes in the economy and society, traffic declined to 109,000 vehicles per day in 2016 in the Trinitat area (-25% since 1997) and 85,700 at Mallorca and Valencia (-14%)²². Flow of traffic to the south has decreased significantly in the past years as an effect of the works leading to the transformation of Plaça de les Glòries into a park and the redistribution of traffic in Cerda's grid.

Despite this evolution and the fairly good metro connections (5 metro stations are located along the avenue, including a regional train station), the Meridiana remains a highly polluted road and a major barrier between neighbourhoods for pedestrians and cyclists. According to the ²⁴ On average, 10,000 people cross the avenue at the major hubs such metro stations, with up to 23,500 pedestrian per day at the Fabra i Pui crossing. And up to 14,000 pedestrians walk along the busiest section of the avenue every day.

Today 100,000 residents live within 200 m of the road, and 377,000 people in the 16 neighbourhoods intersected by the Meridiana. They suffer from its heavy traffic, noise and barrier effect.

²¹ Remodelling of a main traffic entry road in the city of Barcelona (1998), Imma Piñol, Àngels Moya, Elpidi Pedreny, Public Space, Centre of Contemporary Culture of Barcelona (CCCB), 2018.

²² *Anuari Stàtic de la Ciutat de Barcelona*, Oficina Municipal de Dades, Ajuntament de Barcelona, 1997-2020.

²⁴ *Avinguda Meridiana, Eix estructurant del Nord-Est de Barcelona*, Ajuntament de Barcelona, 10 Novembre de 2016.



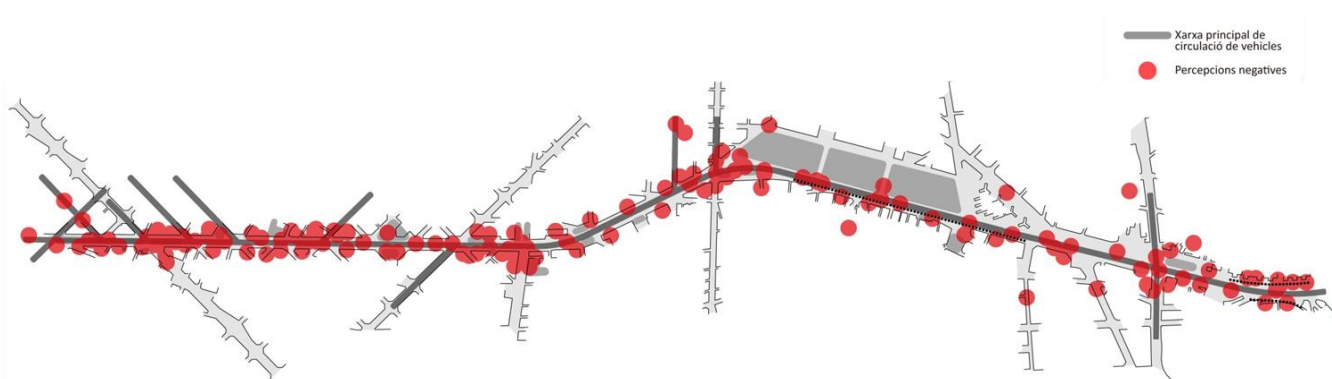
Left, Meridiana with 12 lanes for car-traffic in the 1980s. Right in 1998 after reduction to 8 lanes and 11.5 m sidewalks.
© DR



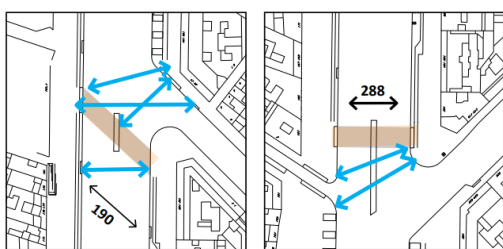
Left, Meridiana with separated central lanes (3+3) and side lanes (3+3) in the early 1990s. Right in 1998 after reduction to 4+4 lanes with tree-lined sidewalks. © DR / Montserrat-Periel Arquitecte (up right)



The central stretch of the Meridiana with Cerda's extension blocks south (left) and organic urban fabric north (right)
 © Ajuntament de Barcelona 2016



The Meridiana workshops pinpointed negative perceptions by users (red dots) including: too many cars, lack of safe and comfortable crossings, conflictual bike lanes, inadequacy of street lighting and the poor esthetic design of the axis
 © Ajuntament de Barcelona



Workshops identified many issues including the lack of pedestrian crossings (in blue above, jaywalking as desire lines; the '190' and '288' figures show the average number of pedestrian per hour which is very significant).
 © Ajuntament de Barcelona / Urbaning 2016



Cross sections of a typical section of the Meridana *before* (left) with 4+4 traffic lanes (including 2 bus lanes) and *after* with a narrow median for a bike lane and 4+3 traffic lanes including 2 bus lanes (right)
 © Ajuntament de Barcelona



Evolution of the Plaça de les Glories over three decades: in 1990 (left top), in the late 1990s (left bottom) and after the creation of Gran Via tunnel and the Park in the 2020s (right). Barcelona is now trying to repair some of the infrastructural integration mistakes related to the 1992 Olympics
 © DR (left top). Ajuntament de Barcelona (left bottom). P. Lecroart / L'Institut Paris Region (right)

3.3. 2020s: Towards a Green and Civic Avenue?

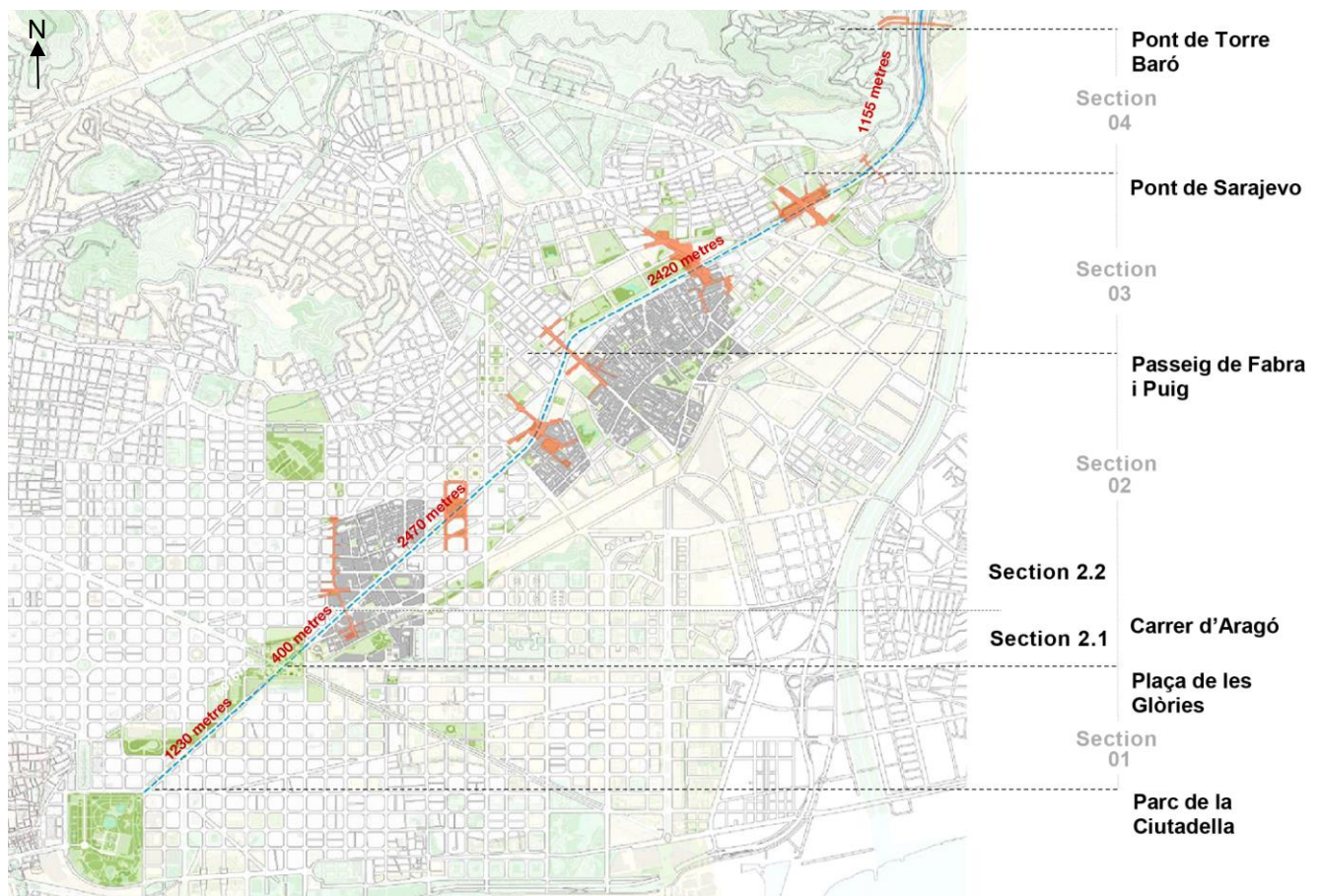
In 2015, the *Urban Ecology* department of the City of Barcelona, in charge of the urban planning and infrastructure, launched an open participative process to initiate a future transformation of the Meridiana. This was an answer to the pressure for change made by SOM Meridiana, a federation of neighbourhood associations.

Design Process

The project building process was based on both qualitative and quantitative research, building on a series of site visits, information meetings and participative workshops with citizens from different neighbourhoods and background. Over 700 citizens took part in over 30 meetings. This allowed for a comprehensive diagnosis of the dysfunctions, including issues of road safety, lighting, crossing, green space, noise, air pollution, deliveries, etc²⁵. The starting point consisted in commissioning a functional and perception study of the avenue from a pedestrian or cyclist's point a view -and not from a car driver or traffic engineer's view²⁶.

From 2015 to 2018 a large public consultation was held with the co-building of different scenarios for change that were analysed and discussed with local residents and NGOs. A series of public meetings and workshops were held with neighbourhood associations, with groups of women or youngsters, with shopkeepers etc. Many proposals were made about traffic, safety, pedestrian needs, public transport services or the future layout of the avenue.

As a first response to the issues raised by citizens, the City of Barcelona implemented small-scale, temporary, safety improvements along the Meridiana.



The 7.6 km long Meridiana Avenue Project in its urban context with the four sections numbered from south to north
© Ajuntament de Barcelona

25 *Avinguda Meridiana Eix estructurant del Nord-Est de Barcelona*, Ajuntament de Barcelona, November 2016.

26 *Avinguda Meridiana : Evaluació funcional i aforaments de vianants i ciclistes*, Ajuntament de Barcelona, URBAning, April 2016.

Project Design

The Meridiana Project is split up into four sections (see p.23).

Section 1. (1.2 km long) is located between Ciutadella Park and Plaça de les Glòries. Currently under study, this low-traffic section should be redesigned in the future as a green street connecting parks.

Section 2. (2.8 km long) is divided into two phases: sub-section 2.1. between Glòries and Mallorca street was delivered in 2019 with a wide planted rambla and a bike lane replacing two vehicular lanes (photo p. 26). Sub-section 2.2. from Mallorca street to Fabra i Puig passage envisions a new distribution layout with a 7 m to 9.5 m-wide central rambla incorporating a 4.3 m-wide 2-way bike lane (metropolitan bikeway Bicivia 6) framed by planted beds on both sides (south) or just on one side (north). Where possible, one or two new rows of trees should provide shade and cooling during the summer (see cross-sections p. 22 and 26). Two traffic lanes are to be removed leaving 4 traffic lanes (2+2) in southern parts and 6 lanes (3+3) and 1+1 bus lanes to the north (photos p. 28).



The Meridiana at #180 in 2015 before project with 8 large lanes, including 2 bus lanes. Bike lanes are on sidewalks
© P. Lecroart / L'Institut Paris Region



The redesigned southern section of the Meridiana in 2022. New pedestrian crossings follow pedestrian desire lines
© P. Lecroart / L'Institut Paris Region

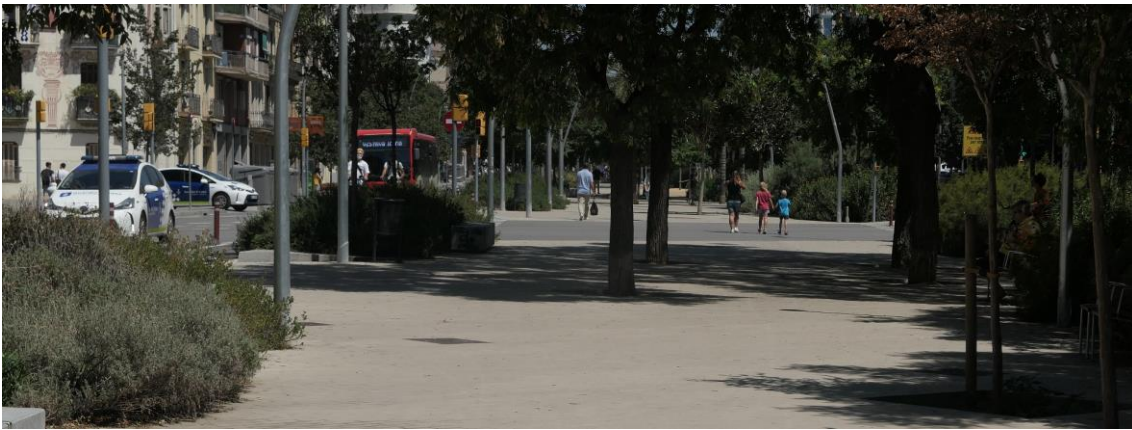


Between Plaça de les Glories and Arago street, the Meridiana layout, designed with SBS Simón i Blanco (engineers) and Batlleiroig (architects & landscape architects), features a large shaded promenade with trees serving as a refuge for birds and flower gardens attracting butterflies. Notice the large and comfortable pedestrian crossings and the quality of the design. The bike lane is along the roadway here (it is integrated into the central rambla further north)

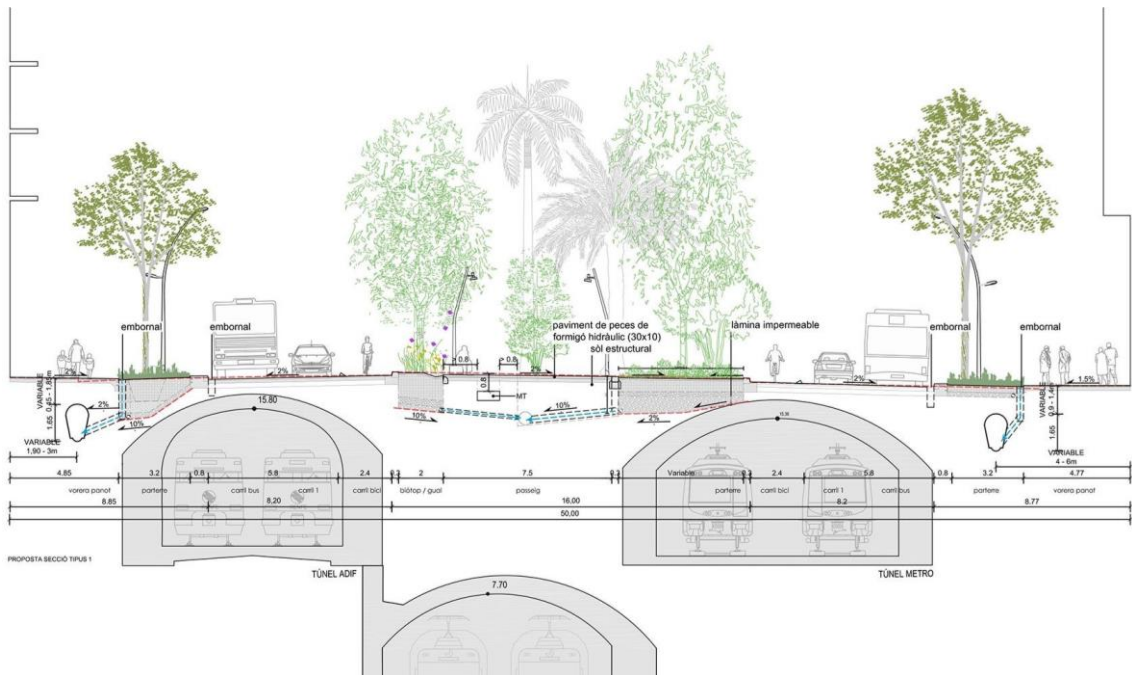
© SBS Simón i Blanco & Batlleiroig / Photo Antonio Navarro Wijkmark



Central rambla sections are connected together by wide pedestrian crossings © P. Lecroart / L'Institut Paris Region



The rambla south of Arago delivered in 2019 provides shade and cooling for neighbourhoods © P. Lecroart / L'Institut Paris Region



Section of Meridiana south of Arago showing the underground constraints to planting due to train and metro tunnels © SBS Simón i Blanco & Batlleiroig



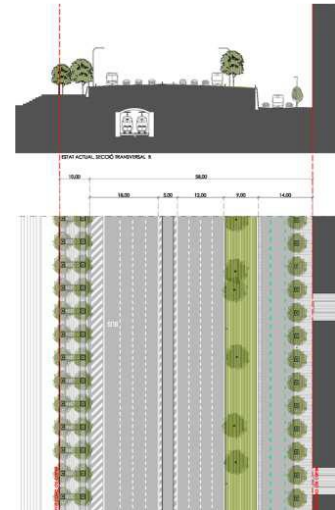
The 8-lane wide avinguda Meridiana at carrer de Mallorca before transformation
© Ajuntament de Barcelona



The Meridiana at carrer de Mallorca after transformation in 2022 with a large planted central median, a central 2-way bike lane, 2+2 lanes for vehicles, 2+1 lanes for busses and larger sidewalks with plant beds
© Ajuntament de Barcelona



Meridiana *after*, Section 2. The planted median bikeway narrows to the north as the road supports heavier traffic
 © Ajuntament de Barcelona



Cross section sketch at Can Drago/Sant Andreu (section 3) to the north of Meridiana *before* with 4+4 traffic lanes (1 for busses) built above the train tracks with a blank wall separation from the side street
 © Ajuntament de Barcelona



One option for the future cross section of Meridiana *after* at the same place (section 3) with 3+3 traffic lanes, the replacement of the wall by a sloped median (linear park) and the relocation of the northbound roadway.
 © Ajuntament de Barcelona

Section 3 runs from Fabra i Puig passage to the Pont de Sarajevo where the 8 or 9-lane roadway is built on an platform on top of the railtracks separated eastwards from the dense neighbourhood of Sant Andreu by a high wall and a side street. Here, four different options were studied with a preferred option to lower the road level with a slope replacing the wall and a linear park 15-m median. This reconnects both sides of the avenue with new pedestrian connections. When and if this project goes forward, the stretch should benefit from 18 pedestrian and bike crossings instead of 9 today: one crossing per 130 m *after* as compared to 1 for 300 m of road stretch today (see images pp. 28-29).



Left, the wall at Sant Andreu *before*. Right, the proposal to lower the platform opens up new connections between neighbourhoods. Images © Ajuntament de Barcelona



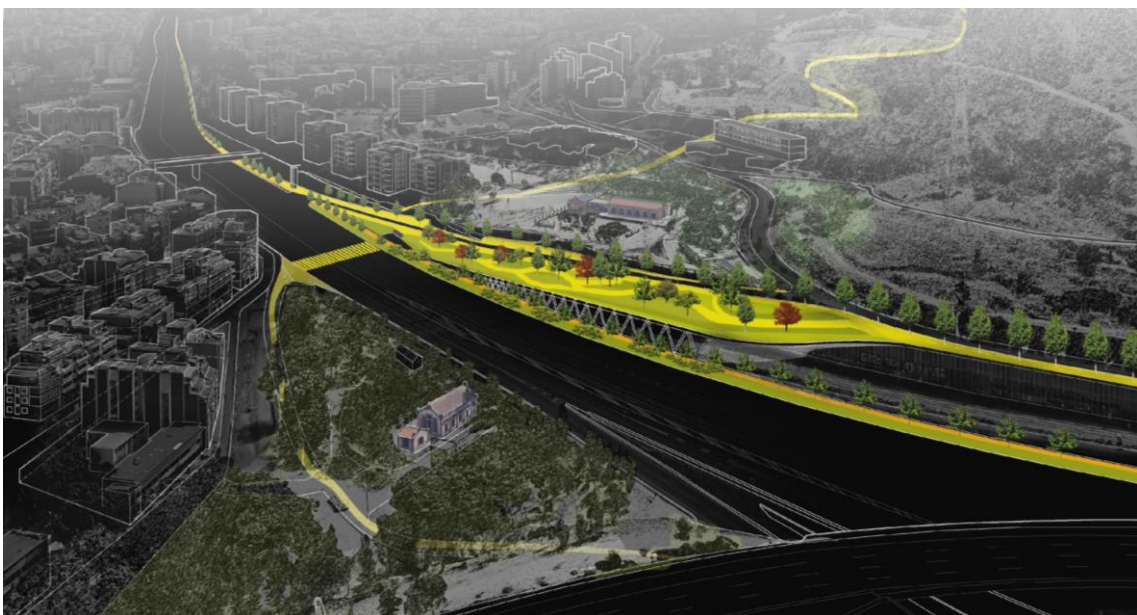
Top: Meridiana as an elevated quasi-expressway in Sant Andreu at Valldaura. Bottom : a vision of the lowering of northbound roadway to create connections between neighbourhoods. Images © Ajuntament de Barcelona

Section 4 north of the B-20 Ring Road interchange between the Sarajevo bridge to the Torre Baró bridge is where the Meridiana becomes a 10-lane highway (C-33), including two bus and high occupancy vehicles lanes (HOV or VAO in Catalan) with over 125,000 vehicles per day in 2015. It merges then with the C-17 and C-58 expressways to create a 20-lane wide system supporting very heavy traffic. It is a major disruption between the socially deprived suburban neighbourhoods of Torre Baró/Ciutat Meridiana and Vallbona and the banks of the river Besos.

In this section constrained by a sharp topography, the challenges are to protect the residents from the noise, improve the environment and reduce the barrier effect of the highway. A major issue is also to restore an ecological corridor between the Collserola mountains, the Besos river and the Marina hills. This section is currently under study: the vision here would be to create new connections from one side of the infrastructure to the other. A bold possibility would be to create a new pedestrian and bike crossing on the expressway, as well as bike lane along it, as a first move to change the highway into a real avenue (see below). The project does not go beyond the city limits.



The Meridiana as the C-33 expressway at Pont de Torre Baró today: a noisy and brutal barrier between neighbourhoods
© Ajuntament de Barcelona



A transformation vision of the C-33 Meridiana at Pont de Torre Baró in the outskirts of Barcelona with a potential linear park and a new pedestrian and bike crossing on the expressway motorway itself re connecting two neighbourhoods
© Ajuntament de Barcelona

Project Delivery and Key Figures

Since 2018, the Meridiana project is incrementally being delivered by BIMSA, the Barcelona Municipal Infrastructure Agency. Phasing of delivery goes from south to north from section 2 to section 4 (or *tram* in Catalan; see p.22): the section 1. south of Glories, was redeveloped in 2004 as a tramway boulevard and will be the last to be redesigned. The short section 2.1. designed by SBS Simón i Blanco and Batlleiroig³⁰ with the *Urban Projects Department* of the city, was delivered in April 2019. Delayed by the Covid-19 pandemic, the remaining parts of section 2. have been delivered partly in 2022 and will be finalized by 2023. Section 3. is anticipated for delivery beyond 2024 after approval of execution plans. Section 4. is currently under study and no decision has been taken yet.

In summary, the 7,7 km long Meridiana Avenue Project aims to reduce the number of general traffic space of the axis by over 1/3, taking away at least two lanes from general traffic and at some places more. If everything goes as envisioned, this may allow to give over 10 hectares of roadway back to green space (trees, plant beds, rain-water gardens). In the completed and decided sections, 38% of tarmacked roadway on average is due to be removed and 6.4 hectares of green will be created.

It is too early to get an overview of final costs as some parts have already been delivered, others are in execution and others are under study. An estimation by the city of Barcelona for the 1.7 km from plaça de les Glories to Felip II street put the figure at 28.4 million euros (M€), with 6 M€ provided by the European Union's *Next Generation* funds³¹. This would bring the cost to 16,7 M€ per km. These costs are significant, reflecting the high quality of the ambitions and delivery. However, these costs were reduced by the decision of not removing the current curb of sidewalks and of recycling the existing granite paving on site.

All stretches don't have equal costs. For section 2.2. from Arago to Fabra I Puig (2.1 km, see map p.23) early estimations put the long-term preferred option at around 11.5 M€ (4,6 M€/km); section 3 Fabra I Puig to Sarajevo bridge (2.4 km) early estimations put the figure at 45,8 million euros (19 M€/km) as it requires deconstructing part of the existing infrastructure and wall.



Section 2. Before (left) and after (right) where two traffic lanes are removed, a central bikeway and two more rows of trees are created (north is at top)

© Ajuntament de Barcelona

30 SBS Simón i Blanco engineers and Batlleiroig architects: Enric Batlle Durany, Joan Roig i Duran and Iván Sánchez Fabra

31 *La transformación de la avenida Meridiana*, Barcelona.cat, October 2022.



- Highways
- Expressways
- Axis subject to transformation (C-245)
- Municipal boundary (City of Barcelona)
- Metropolitan boundary (Àrea Metropolitana de Barcelona)
- City centre

N 0 5 Km

© L'INSTITUT PARIS REGION 2020
Sources : OpenStreetMap, ViaMichelin,
Àrea Metropolitana de Barcelona



The C-245 road linking Castelldefels to Barcelona via the towns Cornellà, Sant Boi, Viladecans and Gavà
© Institut Paris Region, Barcelona Metropolitan Area



The C-245 in Metropolitan Urban Master Plan with two future centres at Sant Boi and Viladecans (extract of PDUM)
© Barcelona Metropolitan Area (AMB), 2019. (north is to the right)

4. The Urban Integration of C-245 Road

4.1. A Historical Regional Axis

The historical road C-245 currently managed by the regional government, the Generalitat de Catalunya, is the backbone of the urbanisation of the lower Llobregat delta in the southwestern periphery of Barcelona. This roman road, redesigned in 1844, connects Barcelona and l'Esplugues de Llobregat (via the Diagonal) to the municipalities Cornellà de Llobregat, Sant Boi de Llobregat, Viladecans, Gavà and Castelldefels.

The rapid urban and industrial growth that occurred between 1950 and 1975, has resulted in the construction of a parallel highway in the 1990s, the C-32. By relieving the C-245 from heavy through traffic, it has changed radically its role as a secondary axis serving local towns. With its six exchanges, the C-32 motorway has encouraged the expansion of a strip of 'big box' business and commercial parks on the southern side of the C-245. Town centres and dense residential neighbourhoods tend to be located on the northern side of the road.

Together, the five suburban towns aligned along the C-245 are home to 345,000 inhabitants: Cornellà (86,000), Sant Boi (82,000), Viladecans (66,000), Castelldefels (65,000) and Gavà (46,000). Today the C-245 is an important axis for commuters with more than 21,600 daily users by car and 14,300 by bus (20 bus lines) connecting with the transport hubs of Cornellà and Castelldefels.

Until 2020 the C-245 is a road, not a street: it has suburban road-type features (protections, distances, signage, lack of crossings and sidewalks). The speed limit is 50 km/h in town and up to 90 km/h outside urban areas, with very few crossings and major safety issues for pedestrian and cyclists. Large roundabouts built in the 1990s would disrupt the city fabric and pedestrian movement. Between Sant Boi and Cornellà, as the road crosses the Llobregat river and the agricultural park, the C-245 becomes an expressway with interchanges and no sidewalks or bike lane. The road has also no sidewalks between Castelldefels and Viladecans.

Although the topography is flat and the road is in straight line, the C-245 suffers from the piecemeal development with a very irregular layout: road width varies from 16 m to 50 m in Castelldefels, 22 m in Gavà, 15 m to 55 m in Viladecans, 50 m to 65 m (including ramblas) in Sant Boi de Llobregat. The typical layout of the 50 m-sections is a 12 m wide roadway allowing four lanes for traffic (2+2) and two wide side streets (1+1 or more). The northern side street serves the residential neighbourhoods and the southern side street lane distribute the commercial areas. Both accommodate large parking lots.

The territory crossed by the road suffers from important physical discontinuities and social segregation. However, the C-245 does play an important structuring role in the territory, both for the connection of metropolitan centres and internally between neighbourhoods.

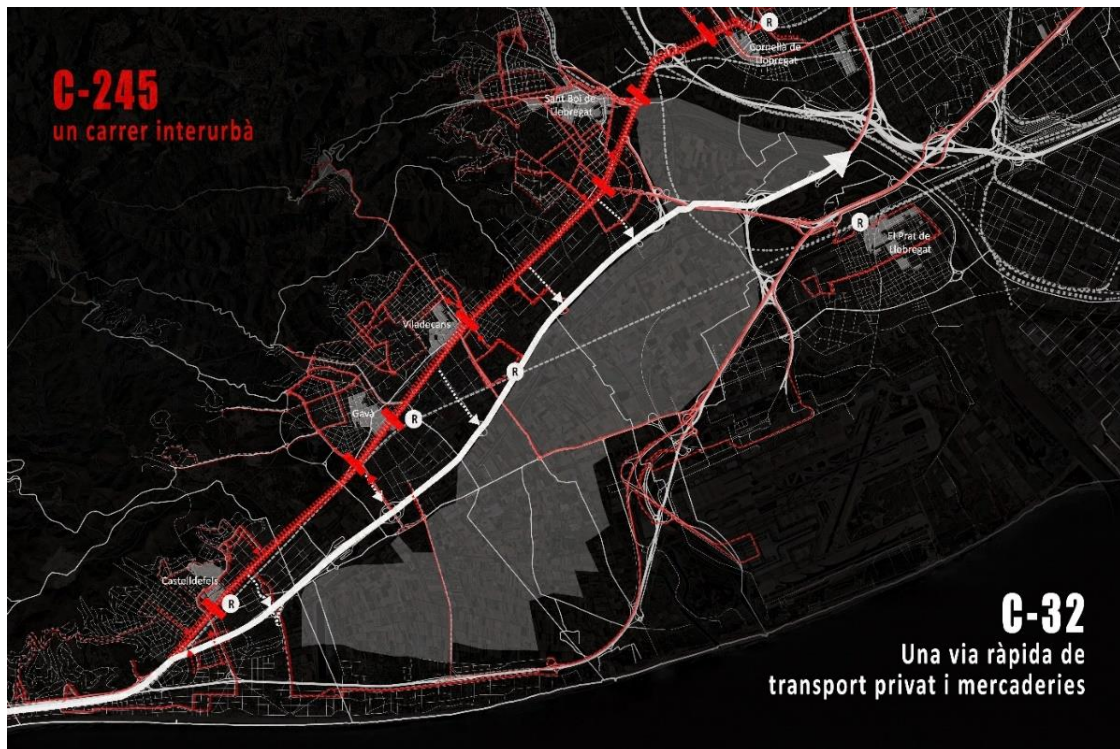


The C-245 Road as a dual carriageway in the municipality of Gavà
© P. Lacroart / L'Institut Paris Region



The C-245 in 2022 after delivery of the new design in Sant Boi de Llobregat with two central lanes for general traffic and two bus lanes with planted separators on both sides. Notice the narrow lanes (2.80 m for general traffic and 3.20 m for the busses) and the new lighting features.

© P. Lecoart / L'Institut Paris Region



The C-245, a historical road linking suburban towns with the C-32 expressway running parallel to it

© Barcelona Metropolitan Area

4.2. The Transformation Timeline

Over the past decades, the C-245 has been the subject of various studies and projects in response to the demand of local councils to transform the road into a better connected, people-friendly, street.

2005-2010. The initial idea was the extension of the tramway T1 line from Cornellà to Castelldefels regional train station as an expansion of the Barcelona Diagonal-Baix Llobregat Tranbaix (tram) project. The tram option was costly and did not fit the safety and commercial requirements of ATM, the Metropolitan Transport Authority, that trams should be fully segregated from traffic in the Barcelona region. In 2008, a Busway for lower Llobregat project was designed³⁴ suggesting a BRT platform and bike lane with a new bridge on the Llobregat. The project is abandoned for financial reasons.

2014-2017. Studies are carried out at the initiative of the Metropolitan Area of Barcelona's Mobility department. By combining elements from different studies, the AMB makes a first unitary project for the whole C-245 axis, using the new busway as the backbone of a future "civic axis". Together with the *Catalan Coordination of Cyclists*, local cycling groups start action over the lack of ambition of the bike provisions in the project. *Car-Free Sundays* actions are also set up by some municipalities. In parallel, the AMB leads the process of preparing both a Metropolitan Bike Plan (*Bicivía*) and a Metropolitan Urban Master Plan (PDUM), identifying the transformation of the C-245 as a project of metropolitan interest. The project is finally promoted by the *Department of Territory and Sustainability* of the Generalitat of Catalunya, the Catalan government.

2018-2019. The bidding process to select a design team for defining a busway and a bikeway along the C-245 takes place under the steering of Infrastructures of the Generalitat of Catalunya, with the technical support of the Barcelona Metropolitan Area (AMB) and the collaboration of the five municipalities. Independent public consultations are carried out by the municipalities, each one putting forward specific needs some of which are integrated in the final project. In November 2019, an agreement is reached between the regional, metropolitan, and municipal governments.

2020-2023. Project delivery is initiated from west to east starting at Castelldefels and moving towards Sant Boi. Works are delayed by Covid, but they are currently on track to be delivered in 2023. Section between Sant Boi and Cornellà may be delivered beyond 2024 depending on the pace of B-25 project.



The 4 lane (2+2) C-245 in the Llobregat plain (looking south) between Cornellà and Sant Boi, with the future B-25 expressway bypass in construction and the commercial developments south of the road
© Generalitat de Catalunya

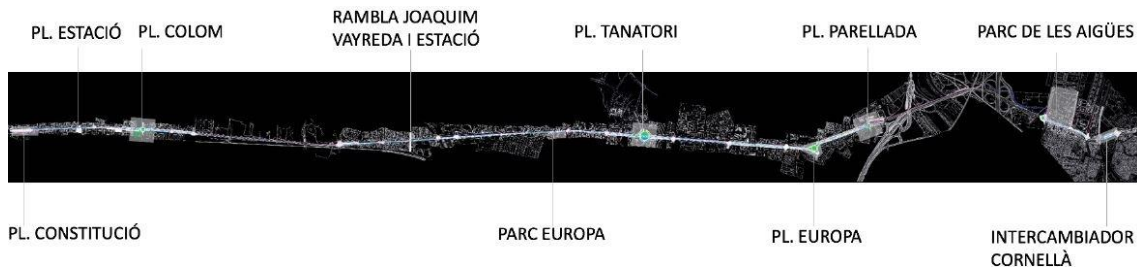
³⁴ Busbaix project by Batlle i Roig Arquitectes: <https://www.batlleiroig.com/es/proyectos/buxbaix/>

4.3. A Unitary Programme

The C-245 project is 13-km long, from plaça Constitució in Castelldefels to the multimodal train and tramway interchange in Cornellà. One of the main characteristics of the road is its supra-municipal nature, as it connects five municipalities in the Llobregat delta to the city of Barcelona.

The official name of the transformation project: *Project for a new busway and bike lane on C-245 road* reflects the focus of the Generalitat as project leader in charge of roads and mobility. The main initial goal of the project is to improve the public transport offer by increasing its speed, frequency, comfort, and reliability: giving priority to a frequent high-capacity bus service by reserving two lanes for the new express bus line M8.

A secondary goal emerged during the preparation of the project, in line with the Barcelona Metropolitan Area (AMB) *Bicivía Plan 2016* (Bikeway Plan): to create a continuous new metropolitan bike connector along the route. All this fits into the idea pushed by the AMB of a unitary (intermunicipal) project aiming at improving the quality of public space, providing a better integration of the road into the urban and social fabric, and supporting the two futures centralities suggested in the Metropolitan Urban Master Plan for Gavà-Viladecans and Sant Boi.



Structure of the new C-245 metropolitan busway avenue with key locations
 © Barcelona Metropolitan Area, DesolaGori Architects (2019)



Originally a historical road linking villages, the C-245 gradually evolved as a car-oriented suburban road
 © Cristina Diestro



A narrow section of C-245 in the centre of Gavà in 2022 during the works. Here all traffic will share the same space
 © P. Lacroart / L'Institut Paris Region



Project design for Plaça Colom in Castelldefels. Existing roundabouts are redesigned with the busway cutting through.
 © Barcelona Metropolitan Area (AMB), Juan Dialante Corbin, DeSola-Gori Architects (2019)



Project design for Plaça del Tanatori in Viladecans with a water tank. Roundabouts remain barriers for active modes
 © Barcelona Metropolitan Area (AMB), Juan Dialante Corbin, DeSola-Gori Architects (2019)



The B-25 expressway project is planned to take over the historical C-245 road between Sant Boi and Cornellà in the Lower Llobregat Agricultural Park increasing the physical disconnection between both cities
© Generalitat de Catalunya



A new bikeway and pedestrian path (in red) in the spaghetti junction exchange linking the C-245 quasi-expressway and A-2 motorway in Cornellà.
© Generalitat de Catalunya

However, the project did at first not include the crossing of the Llobregat river and the Lower Llobregat Agricultural Park as this section is affected by the pending the B-25 expressway project between the C-32 and A-2 motorways and connecting to the BV-2002 road in Sant Boi. This project from the 1990s has been stopped for years for financial reasons. But this bypass is considered by the municipality of Sant Boi as needed to alleviate traffic in town on the C-245 (Perellada roundabout) and on the BV-2002 road. The AMB pushed the Spanish government in charge of this project to modify the design to include a 3 m platform for bikes and pedestrians on both sides of the expressway. This may help to redesign the highway as a civic avenue in the future.

As works for the building of the B-25 have not resumed yet, the AMB suggested to create a new bikeway and pedestrian connection by re-designing an existing roadway passing through the A2/C-245 junction in the lower Llobregat plain (images pp.40-41). This link has been well designed and partly implemented in 2022 as part of the C-245 project. It provides a safe connection, though not direct, between Cornellà and the Lower Llobregat towns.



The C-245 as an expressway between Cornellà and Sant Boi (left) with the new bikeway and sidewalk
© P. Lacroart / L'Institut Paris Region



The new metropolitan bikeway Bicivia 7 and sidewalk in the lower Llobregat. C-245 road is to the left
© P. Lacroart / L'Institut Paris Region



The side streets such as to the right were not part of the C-245 project, only the central roadway and bus lane to the left.
© P. Lecroart / L'Institut Paris Region



The C-245 project follows high quality design and delivery requirements. Notice the details of the pavement design.
© P. Lecroart / L'Institut Paris Region

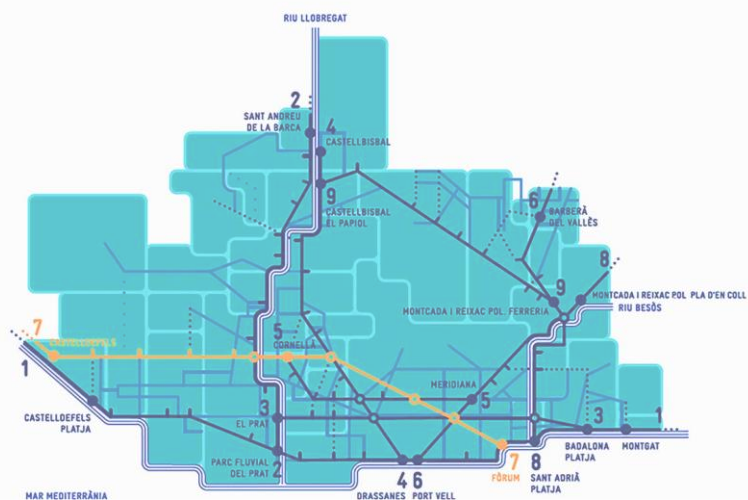
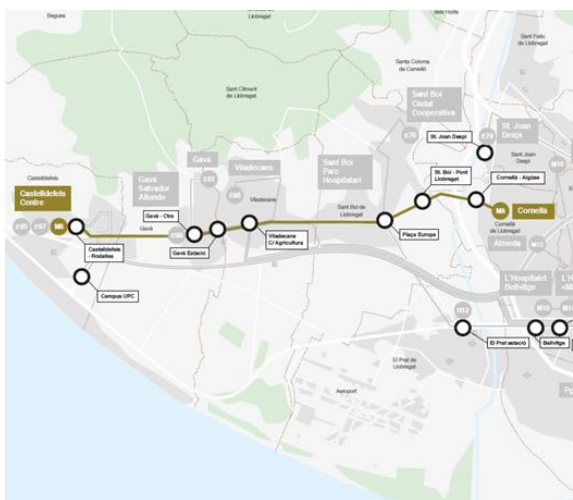
The current ongoing C-245 project includes the following components:

1. A dedicated busway along most of the route with centralised bus stops and a bus priority system for traffic-lights: this should increase commercial speed by 25% in the urban sections. A high-performance metropolitan bus system with a fleet of 12 articulated buses, initially hybrid and later electric will be implemented. Between Castelldefels y Cornellà, the travel time is assumed to be reduced by 15 minutes. The service frequency should be 10 minutes and a 10% increase in passengers is expected. The improvement of public transport on the C-245 is expected to have an impact on the reduction of road traffic and the improvement of air quality and urban comfort in the surrounding public space.
2. Inter-mobility with existing transport hubs (metro, tram, or regional express train network) and with secure bicycle parking facilities (AMB *Bicibox*).
3. Integration of the *Bicivia 7* metropolitan bikeway with a continuous and separate cycle lane. This bikeway will be extended beyond the project linking Castelldefels to Barcelona.
4. Redesigning of the central roadway (but not the side lanes) and enlarging the sidewalks along the road with quality paving material and new lighting furniture.
5. Increasing the number of pedestrian crossings as a contribution to the cohesion and unity of the project and the surrounding urban areas (see photos p.46).
6. From a legibility perspective, the new urban axis will be structured around three large (lightly) redesigned roundabouts: Plaça Colom (Castelldefels), Plaça del Tanatori (Viladecans) and Plaça Parellada (Sant Boi de Llobregat). They are seen as singular points along the avenue.

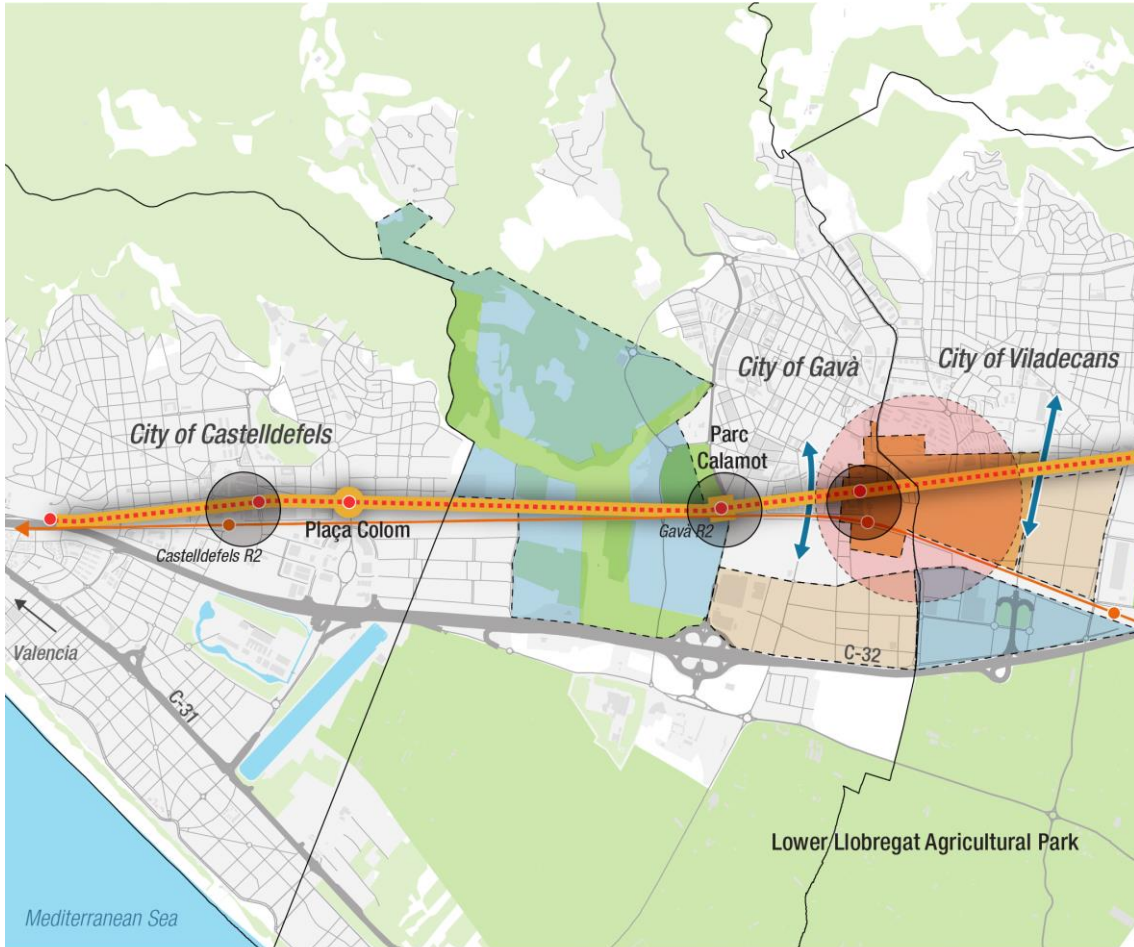
The unitary design of the 13-km stretch of the C-245 relies on the agreement of all stakeholders, including the five municipalities, to follow common guidelines such as:

- Bus priority with a continuous 2-lane busway with a bus stop every 400 m
- Reduced speed limit: 30 km/h in town and 50 km/h outside (50 km/h to 90 km/h before),
- Pedestrian crossings every 80 to 100 m,
- Continuous generally 2.4 m-wide metropolitan bikeway,
- Same street paving and furniture,
- Unitary street LED lighting
- More trees and greenery.

The project focuses on the road itself, and not on the urban transformation of the surroundings, although it may be the starting point of a regeneration and intensification process. Beyond the C-245 project, specific actions were taken on by some municipalities. For example, Castelldefels approved an *Alternative Parking Plan* creating over 1,000 Park & Ride spaces connected to a new walkway to encourage people to leave their cars.

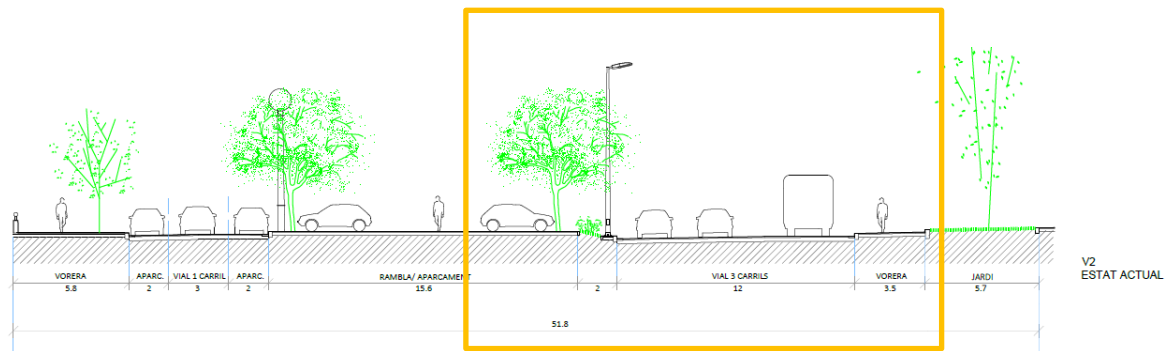


C-245 will host the express MetroBus M8 (left, red line) and the Bicivia 7 of the Metropolitan Bikeway Plan (right, red) © Ajuntament de Castelldefels (left); Barcelona Metropolitan Area-AMB (right)

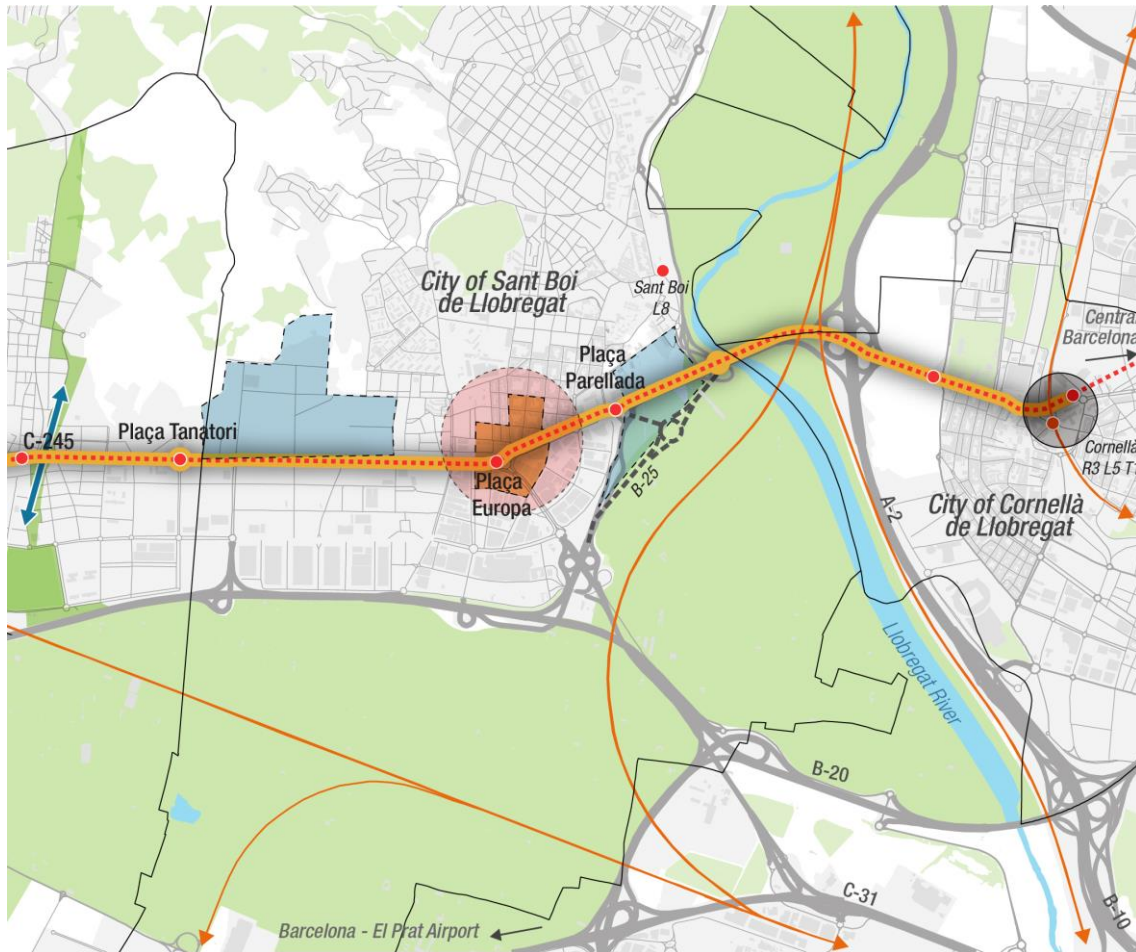


- C-245 Urban boulevard
- Regional train
- Future M8 busway
- New highway section
- Municipal boundary
- Intensification area
- Regeneration area
- Extension area
- Green structure
- Train station
- Main M8 bus station
- Transport node
- Future urban centrality

Project design for the transformation of the C-245 (west)
 © L'Institut Paris Region, AMB



C-245 road section 50 m-wide in Villadecans before
 © Generalitat de Catalunya, DeSola-Gori Architects (March 2018)



N 0 1 Km
 © L'INSTITUT PARIS REGION 2020
 Sources : OpenStreetMap,
 Àrea Metropolitana de Barcelona
 L'INSTITUT
 PARIS
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Project design for the transformation of the C-245 (east)
 © AMB / Institut Paris Région



C-245 road section 50 m-wide in Viladecans after with 3.2m- bus lanes and a 2.4m bike lane
 © Generalitat de Catalunya, DeSola-Gori Architects (March 2018)



The new bikeway and sidewalk in Sant Boi. The side streets and parking lots are not part of the project
© P. Lacroart / L'Institut Paris Region



One of the new pedestrian crossings on C-245
© P. Lacroart / L'Institut Paris Region

4.4. Project Design and Delivery

4.4.1. Five Contextualised Sections

The project is divided into five different operational lots, one for each of the five municipalities involved. Each lot is then further subdivided into different sections to maintain service during work period.

Castelldefels: 1834 m. From Av. Ciutat de Màlaga to the city limit. The western section of the road will consist of a two-lane avenue (1+1) shared by cars and buses, and a separated bicycle lane on the seaward side. From Pau Casals onwards, the number of lanes increases to 2+2, reserving the central lanes for bus transit, and the cycle path runs along mountain side.

A difficult point on this stretch is Plaça Colom, where the roundabout is reduced in size and shape to become circular. It will be crossed by the bus via a new central line.

Gavà. 2800 m. Three main sectors are identified in Gavà. In the west, the Gavà Ponent sector (1.7 km) between Castelldefels and the Calamot park includes a new cycle lane on the mountainside and two new pedestrian crossings.

From there on, the road becomes urban maintaining a four-lane section (2+2) and a bike lane on the mountainside. The sidewalks are widened and improved. From the Rambla sector onwards, the section becomes three-lane (2+1) with a bus lane in the direction of Castelldefels. This section includes a regularisation of facade alignments on the seaward side.

Viladecans: 2480 m. The project in Viladecans affects the entire C-245 as it passes through the town. In the western section, a four-lane roadway is proposed (1+1 general traffic and 1+1 bus). The bikeway runs along the existing median. In the second section, between Carrer del Noi del Sucre and Pi Margall, the avenue is reduced to 3 lanes, leaving a shared lane towards Castelldefels and two lanes towards Cornellà.

The third section begins where a 16m roadway is reduced to two lanes, with a shared bus+car+bike platform that goes from Pi i Margall to the Passeig de la Marina roundabout. Past the crossing, the fourth section expands to four lanes to a roundabout cut through to make way for the priority busway.

Sant Boi de Llobregat: 2533 m. The most important urban transformation will take place in the area at the junction of the C-245 and Pere Tarrès, around La Parellada. Two alternatives are proposed to cross the Llobregat river, taking into account the future link between the A-2 motorway and the C-32. The less unsuitable one is re-using the existing bridge with less impact on the river and on bus speeds.

Cornellà de Llobregat: 1000 m. From the Llobregat junction to the beginning of the urban area, the bike lane has been delivered using an existing path. The work on the C-245 begins at the Avinguda del Baix Llobregat roundabout where a busway is created. Afterwards, the section maintains its current configuration, until the project ends at Cornellà mobility hub (train R3, metro L5 and Trambaix T1).



The new C-245 with widened sidewalks, 2+1 bus lanes and 2+1 lanes for general traffic
© P. Lacroart / L'Institut Paris Region

4.4.2. A Decentralised Project Delivery

The initiative of approaching the transformation of the C-245 through a unitary project was taken on by the Barcelona Metropolitan Area (AMB). The project is now steered by the Department of Territory and Sustainability of the Generalitat of Catalonia, the institution in charge of the road and carrying out the work. The coordination of the local municipal councils is supported by the AMB. Ownership and management of the road will be transferred to the municipalities once the work is completed.

The drafting of the construction project for the urban integration and mobility improvement of the C-245 was awarded after competition for 531,000 € to the BAC Engineering Consultancy Group with Bernardo De Sola – Angela Gori as lead architects and urbanists. The architecture firm played a key role in defining the overall image of the metropolitan avenue, focusing on the definition of public space and mobility needs.

Governance consists of technical validation by the Generalitat and the AMB for each section. As the management of the road is different in each of the concerned municipalities, the detailed design process has been divided into five sections and public consultations were differently conducted in the municipalities involved.

Each section of the project was discussed locally by the municipalities, who saw the unitary project as a tool to contribute solving local problems. This led to new requirements being incorporated into the initial design, with a consequent increase in the initial budget. Communication and public information were carried out by the municipalities.

Regarding the execution of the construction, the five different lots of the project were awarded to five different companies to carry out the work. This unusual formula requires a strict coordination and control by both the Generalitat and the lead designers. The project is currently underway. Work started in 2021 and is expected to end in 2023.



A site visit of the works on C-245 road with Joan Caba Roset (AMB) and Bernardo de Sola, lead architect in July 2022
© P. Lecroart / L'Institut Paris Region

4.4.3. Budget

The total cost is estimated at €39 million for 13 km, including 4 million euros (M€) for expropriation of private parcels needed to widen the roadway. This is less than the initial estimations of costs in the early 2010s for the busway project option requiring a new bridge on the Llobregat river: 73,8 M€ for 15,7 km.

The Generalitat of Catalunya will contribute up to 10 M€: this amount corresponds to the 50% of the initial planned budget (just over 20 M€). The rest of the budget will be paid by the five municipalities who accepted to pay more for an improved project, more adapted to the local needs. For instance, Gavà will pay 4.6 M€ and Viladecans 5.6 M€. The Barcelona Metropolitan Area (AMB) lends the sums to those municipalities who do not have the capital with a loan returning period of 10 years.

The EU will also contribute through its FEDER Regional Development Funds as part of the Post-Covid Recovery with 9.6 M€. On top of that, the AMB anticipates to invest around €5.7 million in the mobile equipment for the new M8 bus line.

The told cost of the C-245 project amounts to 3 M€ per km, which is relatively cheap compared to European standards. The reduction of costs is also linked to the focus of project on the busway and bikeway, leaving the side lanes for the municipalities to deal with.

However, it is interesting to note that while Generalitat of Catalunya is investing 10 M€ (0.8 M€/km for a new sustainable transport and civic axis on the C-245, the Spanish government's Ministry of Transport, Mobility and Urban Agenda has recently (2022) taken the decision to proceed with the delivery of the B-25 expressway project in Sant Boi linking the C-32 to the A-2 and Ronda Littoral (B-20) motorways. This questionable transport project, initially estimated to cost 63 M€ for 2.25 km plus interchanges, is now evaluated at 76.4 M€ (over 33 M€ per kilometre).



The European Union recently agreed to contribute to the project as part of the Post-Covid Recovery Fund. EU sticker was added to the signpost in 2022

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5. Discussion and Take-Aways

5.1. Metropolitan Avenues & Streets: A Pioneer Initiative

The city of Barcelona has been a pioneer in building quality public space out of road infrastructure. For a long time, this policy went hand in hand with also widening and improving roads for car traffic. The new policy is clearly to try and reduce car-use and car-space, make streets comfortable for all (pedestrians, women, children, old people, ...), and building an efficient metropolitan bike infrastructure while greening the city. Responding to social and climate needs for the future may be the biggest challenge and, potentially, the biggest game changer for the city.

The city-region has heavily relied on the Catalan government's investment in car-oriented road and motorway infrastructure in the 1990s and 2000s. The result is that many suburban historical roads are unwalkable and unsuitable for living along, and the metropolitan territory is criss-crossed by large national motorways doubled up by regional expressways, all badly integrated into their environment. More expressways projects are still under construction or planned in the metropolitan area.

By putting forward its *Metropolitan Avenues* and *Metropolitan Streets* strategy within its new *Metropolitan Urban Master Plan* to 2042, Barcelona Metropolitan Area (AMB) could be a pioneer. The task is huge and will be challenging and costly. However, at this stage, AMB's agenda is not, yet, to transform segregated expressways into urban or "green" avenues, but to better integrate them in the urban fabric and provide alternatives for car such as busways and bikeways along.

5.2. Learning from the Meridiana Transformation

The Meridiana Avenue in Barcelona tells the story about how the thinking of traffic and the design of movement in cities has changed over the decades: imagined as an avenue by Cerda in 1859, built from scratch as boulevard in the 1950s, transformed into a quasi-expressway in the 1960s and humanised as a high traffic avenue in the 1990s. It is currently in the 2020s in the process of being changed in a greener, people-friendlier, civic connector while still designed to supporting high volumes of cars, busses, and trucks.

Barcelona's remarkable experience gives food for thought for cities and regions who wish to humanise car-oriented highways into 'greener' avenues and boulevards.

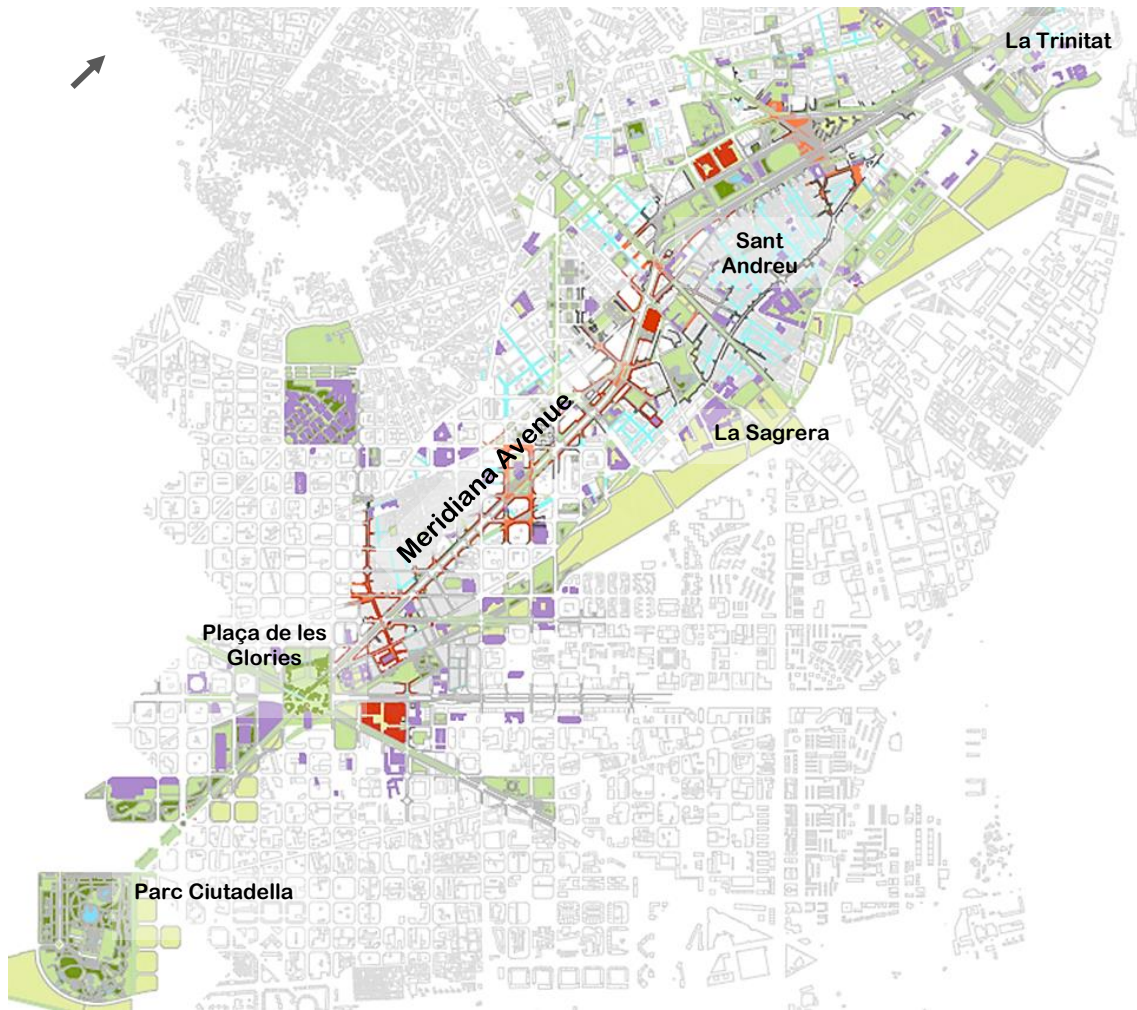
A City Strategy. Unlike the C-245 regional road, the Meridiana plays a distinctly metropolitan role but is entirely located within the city boundaries with little involvement from AMB. It is owned and managed by the municipality making the transformation decision-taking smoother. However, local districts councils have their say in decisions, and neighbourhood associations are also very active.

By engaging the participative transformation of both the Diagonal avenue and the 7.7 km heavy trafficked Meridiana avenue, the city Barcelona is pursuing a long-term strategy imbedded in this Urban Mobility Plan to adapt its large infrastructure to both the needs of citizens of today and those living in the city in 20 or 30 years. Not an easy task as public participation, and indeed some elected officials, often tends to focus on local, short-term, issues and solutions.

Data mapping and participation. The city of Barcelona innovates by fuelling the participative process with new approaches, such as a baseline study of the diagnosis focussing on pedestrians and bike-user issues such as unformal crossing, safety, connectivity, space, comfort, shade, quiet, clean air, etc. with a remarkable data collection and mapping. Public meetings and neighbourhood workshops use 3D visualisation of different scenarios for each section of the avenue to help choose the best solution, with a cost-benefit analysis of each scenario debated in public.

Park-lane avenue. Greening the avenue to help cool down the corridor and improving pedestrian and bike movement both came out as a high priority of both the city. More space has been given to trees, lower planted beds, and hard surfaces for leisure, by removing 2 lanes of traffic, reducing the width of lanes from 3.05 m to a remarkable 2.60 m width and relocating the bike lane: the net increase in public space could be estimated at 10 hectares which is significant as it is located where people really live.

The neat overall design of the public realm and the plantations should indeed make the Meridiana an attractive monumental park-like avenue. The new axis is starting to go back to its originally designed role as a multi-use avenue. It should now help to regenerate the northeast of the city, including the large urban redevelopment around the future Sagrera fast train station.



The Meridiana Avenue project is a major component of a wide range of urban and social transformational projects in the north of Barcelona reconnecting the avenue with transversal civic axes and its wider environment.

© Ajuntament de Barcelona 2015



Data on the impact of Meridiana transformation for section 2 (above) and section 3 (below) in terms of reduction in the number of car lanes, increase in the number of pedestrian crossings and amplification of tree planting and accessible green space © Source: Ajuntament de Barcelona / adapted by L'Institut Paris Region



Mineral sidewalks of the Meridiana before transformation in 2015. Conflicting with pedestrian movement, the bike lane has been relocated in the centre of the avenue as part of the project. This also makes room for more greenery
© P. Lecroart / L'Institut Paris Region



The new 2+2 lane Meridiana avenue as it arrives on at the plaça de les Gloriès in 2022 with it's wide central rambla promenade built out of regenerated soil
© P. Lecroart / L'Institut Paris Region

Pedestrian-Friendliness. Many wide diagonal pedestrian crossings were added to meet the desire lines of people, adding to the existing straight crossings: the increased density of crossings (1 every 80 m south; 1 every 130 m north) is quite exceptional for such a major axis. Traffic signals are managed so to leave time for pedestrians to cross. Urban design work has been done to appease and green the streets and squares diagonally crossing the Meridiana leading to schools or other facilities.

Bikeway and design. A new fast bike lane is being implemented in the centre of the avenue: this option is interesting for long-distance fast cyclists preventing them to come into conflict with right-turning vehicles and delivery vans. It may somewhat be uncomfortable for some cyclists as they are surrounded by three 50 km/h lanes of traffic on both sides. The building of a central median and green separators on both sides of roadways may perhaps lead also to a slight increase of the speed of cars ("tunnel effect"), despite the narrowing of the lanes.

However, some of the design features of the new avenue seem quite influenced by the "needs" of vehicular traffic: where traffic is low, south of Majorca or Arago streets, the central rambla is green and wide; but as you go up towards the north where traffic is heavier, the rambla becomes a narrow strip. The future number of lanes will vary from north to south from 4 lanes (2+2) to 7 lanes (3+4 including 2 bus lanes), and over 10 lanes where Meridiana merges in the expressway system.

The removal of two or more traffic lanes will help reducing the traffic that has already shrunk by 13% between 2015 and 2019. The city figures suggest that the new completed sections have already reduced the traffic volumes by 17,000 vehicles a day. The goal was to reduce the private mobility by 21% on this axis, but the long-term impact of the transformation on the modal shift from cars and trucks to alternative modes remains to be confirmed. Impact on traffic speed, noise, air pollution, cooling and biodiversity will need to be monitored. The project could possibly have experimented a further cut of the number of general traffic lanes all along.

Delivery. Section 1 south of Gloriès (1.4 km) is under study. The short section of the project between the Plaça de les Glories and Arago street was delivered in 2019, while most of section 2 (1.7 km) should be delivered in 2023, three years after the start of the project due to Covid. Section 3 (2.4 km) should come next. The capacity of the city to engage with citizens, decide and deliver quickly is remarkable. The *Superblock* and *Green Axis* projects in Barcelona are being incrementally tested with a tactical approach. The Meridiana project follows as a definitive "no-regret delivery" pathway, perhaps making its future adaptation to changing needs more difficult.

Costs. The project needs to proceed forward before we can get a correct view of the costs involved. However, a draft estimate of the investment for the first three phases based on figures provided by the City of Barcelona suggest that the total costs for the combined sections 2 and 3 may reach 79,7 M€ once the first 5.3 km of the project is completed beyond 2024. This which amounts to just over 15 M€/km.

This represents five times the cost per km of the C-245 project (but only about twice the cost per square metre) which gives an idea of the high-quality requirements. This very significant investment is legitimised by the important role of the Meridiana as the second most important road access to the city, its monumental scale and the poor environmental situation of the 100,000 residents living along the avenue. Redesigning a climate-proof, people-friendly, Meridiana Avenue could indeed become a flagship project showing the pathway for the future of other large quasi urban highways such as Diagonal in Barcelona, or similar axes in other cities.

A major challenge in the future. The most technically challenging stretch to design and deliver (section 4) lies at the northern entrance of the city where the Meridiana becomes the C-33 expressway and directly connects to the both C-17 and C-58 expressways, gradually widening to 20 traffic road lanes.

This section currently under study faces major issues, related to the high costs and difficulty of transforming a largely artificial and complex layout of platforms, bridges, ramps and flyovers in a suburban, fragmented environment (see photos).

After three or four decades of highway building and suburban sprawl, after one decade of -yet unsuccessfully- trying to reduce solo commuter traffic by investing in impressive high occupancy vehicles and reserved bus lanes (HOV/VAO), Barcelona city, metropolitan and regional authorities are now facing the huge challenge to reintegrate these infrastructures in their urban, suburban, and natural environments. This will mean finding ways to reduce the volumes of commuting traffic beyond the existing Low Emission Zone. It may also mean creating new attractive centres in the periphery.



The entrance of Barcelona on the Meridiana avenue north of Ring Road (Ronda de Dalt) looking south. Notice the sheer size of the roadway (11 lanes in total here), including the bus & high occupancy vehicle lanes (HOV/VAO) coming from the C-58 expressway.

© Laura Guerrero



Barcelona's regional authorities have prioritised the building of expressways in the last decades. The unsuccessful attempt at reducing solo car-use has also given birth to more infrastructure with new segregated high occupancy vehicle and bus lanes (HOV/VAO) along the C-58 expressway leading to the Meridiana (here in construction in 2015)

© P. Lecroart / L'Institut Paris Region



The Meridiana at Arago street transformed into a 12-lane expressway in 1965 with no trees, very narrow sidewalks and little groundfloor activity (view looking north). Almost 90 % of space is devoted to vehicular traffic. Note the pedestrians standing on separators and on the footbridges
 © DR



The Meridiana at the same place in 2019 as green and civic axis with only two lanes for car traffic, two bus & taxi lanes, two bicycle lanes, large planted sidewalks and a wide central green rambla. Traffic has been reduced dramatically since the late 1990s and the social use of space has increased sharply. Only 23% of space is now devoted to vehicular traffic and 67% is for the people, fauna, flora, soil and water. This kind of street greening may help Barcelona to mitigate the summer climate heat in the future.
 © Ajuntament de Barcelona

5.3. From Suburban Road to Civic Axis: Learning From C-245

The *Project for a new busway and bike lane on C-245 road* is on tracks to be delivered in 2023 (but for the Sant Boi-Cornellà section), almost two decades after the first reflections were initiated: considering the economic ups and downs (the lengthy post-2008 crisis recovery in Spain followed by the Covid-19 pandemic) and considering the challenge of bringing different political agendas to convergence, including those of the regional government (Generalitat), the metropolitan government (AMB) and the five municipal councils, 18 years from idea to implementation may not be unreasonable. However, one of the consequences of this quite lengthy process is that some of the design features of the C-245 project may be now already outdated.

A potential game changer. It is too early to assess the C-245 project as the new street and new express bus system are not fully in service. However, after many decades as a suburban road, the C-245 will soon become the 13-km long unified avenue of the Lower Llobregat -it could be re-branded as such. For the local communities as well as for the Metropolitan Area (AMB), this is a game changer and a huge step forward: the new bus and bike avenue integrates four suburban towns as part of metropolis (Cornellà is already integrated). It significantly improves the quality of public space, supporting new social uses and better walkability, as a potential driver for urban regeneration and new development.

The role of the AMB as initiator and coordinator of the entire project has been very significant, while the part of the regional government was an operational pilot and important funding contributor. Both players have been driving forces in aligning five mayors and other players such as the transport authority (AMT) along the process. At the start of the project, the Generalitat had an exclusive mobility approach and AMB a more integrated approach. Finally, the project's name changed into "*Initiation of the urban integration and mobility improvement of C-245*"³⁵, enlarging its scope and ambition from a transport improvement to the transformation of a road into a civic (metropolitan) avenue. This stresses the importance of approaching from the start this entire road axis as a single project.

The decision to create a metropolitan bikeway (*Bicivía 7*) along the axis and to prioritise the C-245 as a pilot-project for the new *Metropolitan Avenues* strategy of the Metropolitan Urban Master Plan was a booster. The project is now a blueprint for the transformation of other roads into streets (N-2 North, B-23 integration, N-150 *Vallès Avenue*).



Roundabouts take a lot of space and are not pedestrian-friendly, especially when multiple roads converge
© P. Lecroart / L'Institut Paris Region

³⁵ In Catalan: Inici de la integració urbana i millora de la mobilitat de la C-245



A typical stretch of the C-245 after project was delivered. Notice the details of the paving and the speed limit (30 km/h).
© P. Lacroart / L'Institut Paris Region



The C-245 quasi-expressway stretch between Cornellà and Sant Boi could be redesigned as a civic avenue.
© P. Lacroart / L'Institut Paris Region

Local adaptation. Each of the five municipalities had the voice and power to complete and adapt the features of the plan, embedding local needs into the overall project. Public participation was encouraged by most municipalities involved and may have played a key role in the general acceptance of the intervention by the population.

Design coordination. Selected after competition, the experienced private urban design team played a central role in keeping up the ambitions of the project from the design table up to the delivery. The overall design of the axis (busway for *Metrobus 8*, roadway, sidewalks, and urban furniture) has helped to create a common identity for the entire avenue, despite the initial discrepancies in the profile of the road. The architectural team's work supported by AMB shows up in the somewhat unusual high quality of the implementation.

Low cost, high benefits. For the AMB, the cost/benefit of the entire project is excellent with a 13-km fragmented road transformed at reasonable costs (3 M€ per km, 5 times cheaper than the Meridiana). This is in part due to the decision of not upgrading the whole section of the axis: where the axis is 50 m wide, only about 20 m are part of the project. Working from façade-to-façade may have given extra consistency for the creation of a uniform public space; it may have offered the opportunity to use the side streets for general traffic, thus potentially reducing the roadway and giving more space to pedestrians. But it may have slowed down the decision process with anticipated negotiation of alternative solutions for parking, delivery, access, with many local stakeholders such as businesses and residents.

Design choices: The general features of the new avenue (space distribution, paving, crossings, plantings, etc) show good design. Some options such as the design of the bikeway or of pedestrian space may have needed more thinking. The choice of retaining most of the pre-existing car-oriented unfriendly roundabouts may have eased the process, but it could limit the potential of these important nodes to become civic squares. Some alternatives may have been interesting to study, such as using the side streets as a tool to reduce the central roadway and create a unified bus-oriented avenue.

Potential impacts. Although the project aims at reducing bus travel times by 15 to 25 minutes at rush hour (up to 45% less than today), it only anticipates a 25 % increase in daily ridership (with little or no shift to alternative modes) and a 30% reduction of CO2 emissions with the future hybrid-electric articulated busses. A global assessment of impacts 2 to 5 years after delivery would be useful.



Scope of project. The strategy focussed on the C-245 axis leaving to other instruments the task of rethinking and planning the urban and social regeneration along the corridor. Specific planning regulations for the corridor as a *Metropolitan Avenue* are imbedded in the future Metropolitan Urban Master Plan (PDU).

B-25 issue. Between Cornellà and Sant Boi the C-245 is already a quasi-expressway but it still has a strong potential to be restored and upgraded as a civic avenue. An alternative to the current B-25 expressway project steered by central government could be the redesigning of the spaghetti junctions with A-2 and BV-2002 as urban crossroads managed by traffic-lights. The decision to build the new motorway B-25 may contradict the objectives of both the C-245 project and the metropolitan plans to give priority to alternatives to vehicle-use and to better integrate infrastructure in their urban and rural environments.

The current project of the B-25 in Sant Boi taking over the C-245 right of way (yellow). © DR



The Meridiana project is a flagship of the Metropolitan Avenues' strategy. It is remarkable in terms of public participation, design and delivery. Current traffic volumes and traffic plans of the 1970s however still strongly influence the distribution of space. Here, the shape of curbs is determined by the heavy traffic flows towards the one-way Arago street.

© BatlleRoig Architects/Photo Antonio Navarro Wijkmark

APPENDIX

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Reinventing Cities: From Urban Highway to Living Space

Paul Lecroart shows the many benefits of transforming urban highways into people-friendly boulevards



In 1974 Portland replaced its Harbor Drive with a waterfront park; in 1991 the Embarcadero Freeway in San Francisco was dismantled; in 2001 New York rebuilt the 12th Avenue where an elevated highway had stood; in 2005 the Cheonggyecheon Expressway in Seoul made way for the river hidden underneath; and between 2013 and 2017 Paris pedestrianised the Seine riverbank highway. Now Paris Metropolitan Region is launching an international design competition to rethink the *Périphérique* and the *Grand Paris* motorway network.

So will segregated highways become a thing of the past in the post-car and carbon city? Research by the Planning Agency for the Paris Region (IAU) suggests that converting stretches of highways into multi-use boulevards and public spaces may open up new avenues for rethinking our cities in terms of liveability, mobility and resilience.

HIGHWAY-TO-BOULEVARD CASE STUDIES

Functionalist thinking and post-war planning have left many large cities, including London and Paris, with extensive, yet unfinished networks of urban highways. As they were built they were used, and still have a role in moving people and goods

within metropolitan areas. However, these limited-access grade-separated roads create physical barriers, tend to devitalise centres, neighbourhoods and waterfronts, and hinder regeneration. The high levels of traffic they support generate noise, dust and air pollution, raising health and social justice issues. By providing seemingly easy access for cars, extensive highways networks tend to encourage car-centric lifestyles, urban sprawl, and more traffic congestion.

In the last decades, many cities have successfully started tearing down obsolete urban highways and replacing them with multi-use boulevards lined with mixed use new development, or new linear parks. Why are they doing that? What happens with the traffic? What are the benefits and costs? Are these projects backed by public support?

1 Seoul: the Cheonggyecheon River, formerly a highway carrying 168,000 cars a day; removal of the viaduct and restoration of the river significantly reduced traffic. Image by Paul Lecroart IAU

To find answers to these questions and others, I have looked into over 20 highway-to-boulevard experiences either fully completed or planned in cities worldwide. Of these, nine cases were studied in depth on-site with reports published (in French): Seoul (Cheonggyecheon Expressway), Portland (Harbor Drive), San Francisco (Embarcadero, Octavia), New York (West Side, Sheridan), Milwaukee (Park East), Montreal (Bonaventure), and Vancouver (Northern False Creek Viaducts).

Most of these cases involve fairly central stretches of highways supporting heavy traffic volumes (in the range of 50,000 to 150,000+ vehicles per day), before being replaced by a boulevard and/or a linear park. This research is reference material to inform highway transformation strategies and projects in the Paris Region.

WHY DO CITIES GET RID OF URBAN HIGHWAYS?

Depending on the physical context and circumstances, city authorities decide to remove highway stretches for quite a pragmatic combination of reasons, including:

- **Aging infrastructure and rebuilding costs.** In San Francisco, Seoul, New York (West Side), or Toronto (East Gardiner), it appeared cheaper to dismantle crumbling elevated highways than to rebuild or bury them. Recycling viaducts into pedestrian connections can also give a new life to obsolete infrastructure cheaply, as in Seoul (Seoullo 7017) and Paris (La Défense Boulevard).
- **Revitalising blighted areas and unlocking redevelopment opportunities.** This is a main driver for change in Vancouver, Milwaukee, Montreal, Birmingham (Inner Ring Road), Lyons (A43 Mermoz), and Oakland (I-980).
- **Reclaiming the waterfront.** Transport engineers enjoyed building highways along river or seafronts, but these created barriers and therefore suppressed real estate values. Reconnecting cities with their historic setting and 'giving the waterfront back to the people', residents and visitors alike, often means converting the highways, such as in Portland, Seoul, New York and Paris.
- **Reducing through traffic and related nuisances.** This is central to the strategy supporting the Seoul, Paris, Lyons (A6/A7 Confluence), and Strasbourg (A35) reconstructions.

These context-specific goals are usually part of wider urban intensification policies, eco-friendly transport plans and economic strategies. However, many highway removal projects were accidental: both the Embarcadero and Central Freeway viaducts in San Francisco were closed after being damaged by the Loma Prieta earthquake in 1989, and New York's West Side elevated highway collapsed when a maintenance truck went through the viaduct in 1973!

DOES HIGHWAY TRANSFORMATION REALLY HELP REGENERATE CITIES?

Evidence from research shows that redesigning highway corridors can be a powerful driver for regenerating blighted or abandoned parts of cities, with a lasting positive impact on the city as a whole. Removing visual barriers, reconnecting streets, and improving the quality of the environment has changed the face of Portland, San Francisco, Seoul, Milwaukee and Birmingham. Replacing interchanges and ramps by straightforward crossroads unlocks vast pieces of land that can be reconverted into denser mixed use districts and parks.

WHERE DO THE CARS GO?

To many traffic engineers' surprise, closing highways does not usually create traffic chaos beyond initial adjustments. Where spare road capacity did exist in some of the cases studied (Seoul, San Francisco, New York), car traffic switched to local street networks. Traffic thus gets distributed more evenly on a larger number of streets. Congestion remained limited and less than forecast.



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Average daily traffic in the road corridor may decrease dramatically after removal – from 20 per cent in Portland to up to 82 per cent in Seoul. When accounting for trips diverted to alternative roads or to public transport, a significant share of earlier traffic appears to have simply evaporated, typically in the range of 10-25 per cent in the cases studied. Faced with a reduction of road capacity and speed, a proportion of motorists change their routes, time of travel, trip frequency or activity programme, while others switch to alternative modes. Changing conditions makes car drivers think twice, leading some to change destination or give up less essential trips.

INCREASED CONNECTIVITY FOR EVERYONE

Some cities back up removal projects with specific alternative transport and travel management strategies. While reducing road supply on the Cheonggyecheon corridor, Seoul increased metro and express bus services, and discouraged solo car use through infrastructure tolls and parking policy. Local accessibility often improves with the removal of detours. A decrease of vehicular trips may mean increased accessibility for people as a whole.

Pedestrian and cycle mobility and static uses of public space for enjoyment increase sharply. However, more people on streets with still heavy car-traffic

2 San Francisco: Embarcadero Freeway in the 1960s, photo Tim Pharoah

3 The same area after the removal of the Freeway gave back the Bayfront to the people. Image by Paul Lacroart IAU

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levels (80,000 vehicles a day on New York's 12th Avenue today) may result in more car-pedestrian or car-cyclist collisions: the careful design of multi-lane boulevards is critical to their overall success. Ultimately, what we may see is a shift from a system providing off-peak fast travel for some (the motorists) to a 24/7 system of slower accessibility for all.

ENVIRONMENTAL EFFECTS

A reduction in the volume of motorised traffic and distances travelled tends to reduce fuel consumption, as well as CO₂ and fine particle emissions. Perceptions of noise levels decrease, even when actual levels remain high. Some highway-to-boulevard projects providing more greening may have a positive impact on the local climate: in Seoul, summer temperatures along the former highway corridor are now a welcome 5°C lower than on other arterial roads.

A FAVOURABLE COST-BENEFIT RATIO?

Transforming highways has a cost: in the cases studied, capital investment was in the range of €35-70 million (about £30-60 million) per kilometre. In view of the costs of maintaining or rebuilding infrastructure nearing the end of its life, transformation often proves cheaper. It may be a more affordable and longer-term solution than capping or tunnelling. Land freed for redevelopment can contribute to meet the costs.

COMPLEX PROCESSES, PUBLIC SUPPORT?

Redesigning a highway into a boulevard is always a lengthy, complex, and uncertain process in which open technical expertise,

citizen participation, and political will play key roles. Convincing car-users and business interests requires lots of data, meetings and leadership. While controversial to begin with, these projects often win over the public during the process... or not, as in the case of Seattle (Alaskan Way). Just as in the 1970s, extensive highway plans were defeated by public opinion in San Francisco, London and other cities, many smart grass-roots coalitions are pressing governments today to remove existing highways and flyovers in cities including Paris, New York, Denver, Dallas and Sao Paulo.

SYMBOLIC ACTIONS OR PARADIGM SHIFTS?

Highway transformation projects have a strong symbolic impact because they affect objects traditionally connected with the idea of freedom and modernity. They bring us back to some of the fundamentals of city development, such as nature, heritage, parcels and streets, and into a more holistic way of thinking.

LEARNING FROM INTERNATIONAL EXPERIENCE

From an urban planner and designer's perspective, the main lessons can be summarised in four points:

- Transforming urban highways into boulevards encourages people to change their travel patterns: less essential car trips tend to disappear and eco-friendly transport modes tend to increase. This can free-up road capacity for other needs, such as higher added value car trips or goods distribution. Improving local accessibility is not detrimental to longer-distance metropolitan or regional trips.
- An integrated boulevard offers a comprehensive metropolitan level of services connecting people and activities, moving as many people, if not more, than a highway, but at a slower, smoother speed. Boulevards enable social and cultural interactions to take place, ultimately the

4 New York: plan for the Sheridan Expressway in the South Bronx. Highway-to-boulevard projects can help deprived neighbourhoods while maintaining road capacity. Image by New York City Department of City Planning-ARR
5 New York: the boulevard replacing the Westside Freeway (2001): spectacular growth in bike and pedestrian traffic. Image by Paul Lecroart IAU



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raison d'être of cities and a key to their economic performance.

- Replacing a highway with a well-connected high-quality multi-use boulevard creates value and can unlock the mixed use regeneration of deprived urban spaces and improve the liveability of the city as a whole.

- As a tool in the sustainable planner's kit, highway conversion can be used pragmatically, for instance to leverage the revitalisation of a specific area. Successful tactical action on a short stretch where the highway is easy and cheap to change rapidly will help garner support for the transformation of longer stretches in the future. This is the strategy chosen by New York City for the Sheridan Expressway (by the Bronx River). In the United States, the country of the automobile *par excellence*, the success of removal projects stimulates many other cities to redesign obsolete highways. Seoul has removed 16 flyovers since 2005.

International successes in highway-to-boulevard transformation offer food for a wider rethinking of the functions, uses and status of urban highways in city regions. Profound changes are affecting the behaviour patterns of people and businesses, and the way that cities and regions are organised. Many developed cities worldwide, including Paris, New York, Los Angeles, Tokyo, London and Stockholm, have experienced an overall reduction in car use, traffic levels, and car ownership over the last decade.

Redesigning the existing urban highway network of large cities may be a smart way to address citizens' aspirations and metropolitan development challenges, including global warming related issues. It is not just about design: it is about rethinking the planning, movement, lifestyles, and wealth creation of cities and regions. This is a major trans-disciplinary task for the coming decades. ●

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Highway transformation projects have a strong symbolic impact because they affect objects traditionally connected with the idea of freedom and modernity.



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6-7 Montreal: the Buonaventure Highway, before and after the viaduct was demolished with a positive impact on the environment.

8 Paris: former Left Bank Expressway, now a pedestrian and cyclist promenade. Image by Paul Lecroart, IAU



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