

## Parallel Infrastructures and the Changing Metropolis: the Case of Lisbon

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### 1 ABSTRACT

Infrastructure has been a key element driving change in contemporary urban and metropolitan formations. The introduction of new infrastructural strata overlapping existing fabric and rustic open space is acknowledged as one of the most expressive and challenging transformation faced by urban planners and designers.

Since the 1940's, Lisbon metropolis witnessed a profound change with new highways built along old national roads, often defining parallel itineraries together with railroad lines and power and water supply infrastructures. In the last decade, Lisbon's motorway network reached a state of maturation and connectivity, based on a combination of radial, ring and tangential structures. New mobility and location patterns of a increasingly polinuclear configuration are emerging and opening up what used to be border spaces at the metropolis edge. As these infrastructures attain a rather consistent degree of development, fulfilling much of the National Road Plan 2000 programmed network, new issues arise regarding the conceptual and design interdependencies with urban development and infrastructural landscapes.

The paper addresses the issue of *infrastructural spatial mediation* – a concept being developed by the author in his ongoing PhD research – taking a closer look at the morphological characteristics of a selection of representative metropolitan structures in which parallelistic forms of infrastructure development have rendered new spatial and landscape configuration, usually unaccompanied or un-anticipated by formal planning processes.

Departing from the hypothesis that such structures may be of great potential for metropolitan planning, along with the issues of mobility and ecological networks, the paper offers a discussion and critical insight into the way how current regional planning<sup>1</sup> is dealing with this issue.

### 2 THE EVOLUTION OF LISBON METROPOLITAN AREA SEEN FROM THE ROAD

The morphological and conceptual exploration of linear infrastructural spaces has been addressed by a number of authors (Caravaggi et al, 2005; Vecslir, 2007; Donini, 2008; Farhat, 2009), highlighting its capacity for a territorial vertebration, both in its longitudinal and transversal dimensions. These explorations are framed under a wider critical review of splintered forms of design, planning and governance of the modern city's infrastructural systems. They are also a step forward in the critical renewal targeted at the understanding and design for such less canonical territories (Meijsmans, 2010).

The development of an interpretative and diachronical reading of Lisbon metropolitan area (LMA) establishing a time frame in terms of infrastructural development milestones, has been instrumental in the identification of linear urban structures along old national roads. This association is more clear in the Lisbon peninsula (northern LMA), where a relatively dense network of small and compact rural settlements has played a historical role in the territorial structure, in tandem with the capital and with several riverine urban settlements. Inversely, Setúbal peninsula (southern LMA) linear associations are sparser and relatively recent, since it was largely unoccupied in its geographical core up until the 1960's. From 1944 onward, a number of metropolitan and national motorways were built leading metropolitan planning to focus on its structural role in terms of spatial development.

This new infrastructural strata induced major changes in the urbanisation forms and functional dynamics of metropolitan Lisbon, just as had occurred with the railroad network in the nineteenth century. The modern metropolis finds its *leit motiv* in the spaces of fast mobility, in the formations linked to intersections and nodal interfaces, in the smooth organisation and parameterisation of fluxes and in reducing spatial friction. However as one deepens into the morphological transformations along these structures, one finds a concurrent and meaningful importance of the old road network in the reticulation of large scale (or arterial)

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<sup>1</sup> Lisbon Metropolis Regional Plan is currently undergoing revision, in order to accommodate new global level infrastructures such as a new international airport, a high-speed train network, and new national level logistic platforms.

metropolitan motorways. Empirical evidence shows that as arterial mobility increases, greater pressure is put on local roads. *Flows* and *places* remain tightly grounded to a territorial matrix of interdependency between new and old infrastructure.

This brings us to three main questions:

- i) is there a morphological specificity and coherence in the spaces organized along the old road network?
- ii) are these spaces relevant for the understanding and intelligibility of metropolitan territories?
- iii) are current planning tools refined in order to recognize and assume such territorial reality as a space for design and project?

### 3 METROPOLITAN LINEAR FORMATIONS AS STRUCTURAL TERRITORIES IN LMA

In the context of LMA, one can trace a number of linear formations, which have assumed a structural role in different times and following a multitude of patterns. At an embryonic stage, such formations are extremely simple and confined to the road space proper, to its contiguous rustic parcel structure and bounding walls, and to some compact settlements along its path. Over time and as the road and infrastructural networks (electricity, water, sewage, communications) gain strength and complexity, what used to simply be a space of movement also becomes a space of urbanization. It is under national and metropolitan opportunities for transformation (Morgado, 2005) that such spaces can develop into recognizable metropolitan linear formations, in line with the first of the above stated questions.

Six case studies were selected and empirically explored, showing different patterns of intense transformation during the last decade. They are organized along the following roads (Fig. 1):

- 1. Xabregas-Sacavém-Santa Iria da Azóia (partially corresponds to N1)
- 2. Alcabideche-Linhó-Ranholas (N9)
- 3. Abóbada-Trajouce-Abrunheira (N242-4)
- 4. Loures-Tojais-Vialonga (N115 and ER19)
- 5. Setúbal-Palmela-Pinhal Novo (N252)
- 6. Setúbal-Águas de Moura (N10)

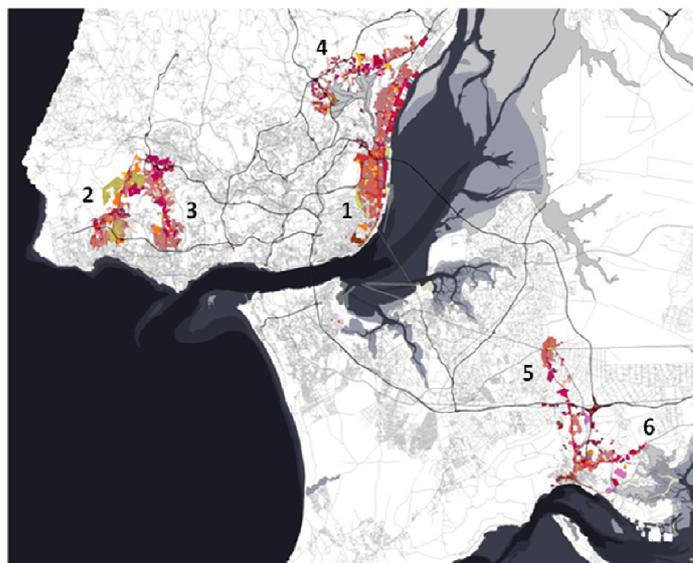


Fig. 1: location of linear and parallel structures in Lisbon metropolis. Source: author

The six road cases show that the introduction of a new motorway network in approximately parallel configurations to the original roads has triggered a land use transformation, with morphological specificities in each case. The selection of these case studies in the wider LMA context allows for a discussion over structures not only historically anchored to radial paths towards Lisbon, but also about those recently emerging in farther away locations from the capital and responding to a polynucleated metropolitan configuration made possible by the arterial road network.



Road 1 (Xabregas-Sacavém-Santa Iria, fig.2) has been one of the most important paths of approach to Lisbon from north and needs to be understood in relation to a wider and complex linear system including the Tagus river, the northern train line (to Oporto and Spain) and the A1 motorway (Portugal's main infrastructural axis).

Roads 2 (Alcabideche-Linhó-Ranholas) and 3 (Abóbada-Trajouce-Abrunheira) are parallel to each other, along two topographical divides, and transversal to two of Lisbon's main suburbanization axes, radially set towards Cascais and Sintra.

Also depicting a transversal linkage, road 4 (Loures-Vialonga) grounds itself into a territory where rustic patterns of occupation are superimposed by an inter-axial connection between A1 and A8 now supporting large scale logistic operations.

Roads 5 and 6 show two cases converging in Setúbal, a regional medium sized regional capital city, today part of LMA and undergoing a greater functional metropolitan integration associated with its port, industrial and logistic complex.

#### 4 MORPHOLOGICAL INTERPRETATION OF METROPOLITAN LINEAR FORMATIONS

As the main methodological support for this analytical work, a diachronical cartographic representation of all six cases was developed, regarding: 1) the evolution of road networks and 2) the land-use patterns in relationship with forms of spatial aggregation to infrastructure (Fig. 2). Resorting to geo-referenced and superimposed cartography from several dates since approximately 1900, it was possible to detect and systematize an interpretative matrix for metropolitan spatial development, from the point of view of *infrastructural spatial mediation* (Santos, 2009).

The result is a flexible tool which allows for the reading of specific shapes and formal patterns in a given time, as if it was a *territorial portrait*, but also as for the understanding of its dynamics by comparing changes and persistency in the metropolitan fabric. *Form* and *formation* are understood as two expressions of a morphogenic process (Tatom, 2004)

Assuming as a starting hypothesis that these formations bestow a relevant yet still *hidden* potential as tools for the intelligibility and planning of metropolitan space one must devise a transversal matrix for decoding them through morphological criteria.

Four mechanisms of *infrastructural mediation* were singled out, revealing specific interlockings between infrastructure, urban space and the metropolitan landscape: longitudinal and transversal relation to the physiography and hydrography and to some outstanding open spaces; spatial production through contiguous and transversal aggregation; capacity to functionally polarise spaces around nodes with specialized uses; capacity to structure a larger space through parallelistic vertebration with other linear infrastructures.

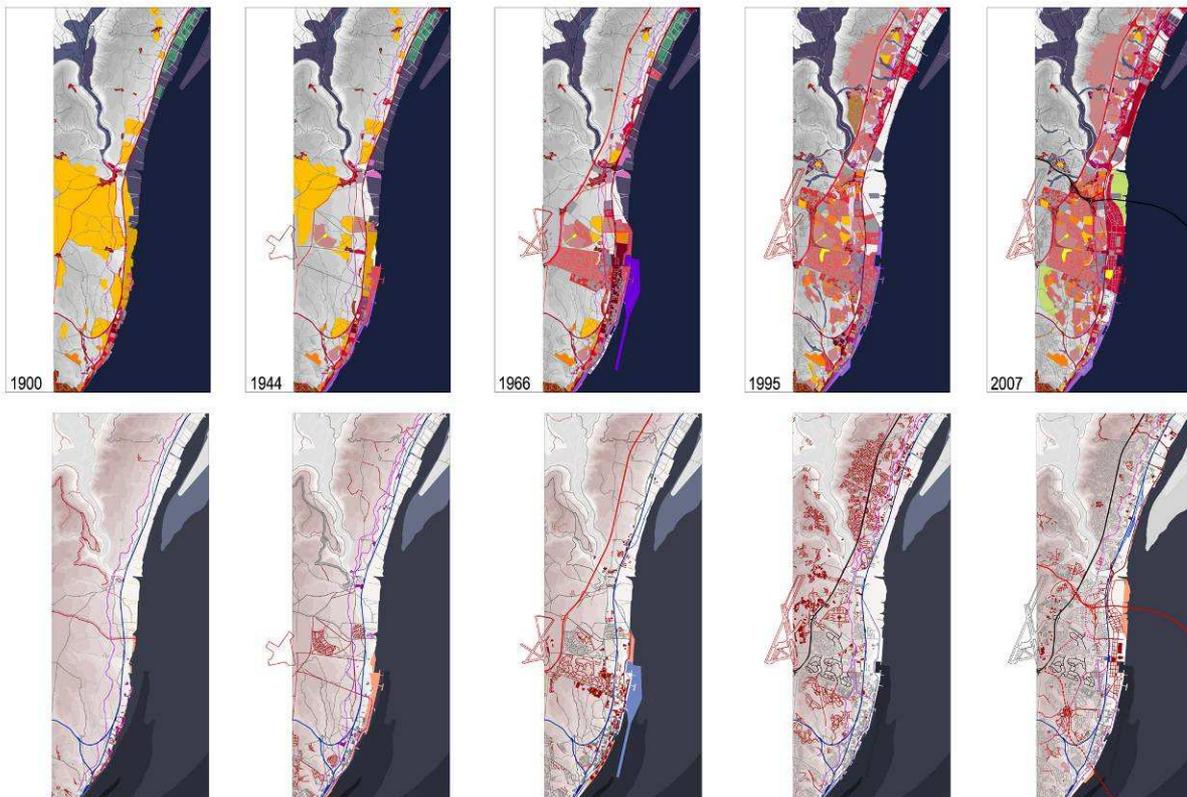


Fig. 2: Infrastructural and urban transformations associated to parallel infrastructures along Xabregas-Sacavém-Santa Iria da Azóia road (1900, 1944, 1966, 1995, 2007). Source: author

#### 4.1 The physiography/hydrography relationship

All cases show a very clear association with the territory's physical shape and waterline structure, in some cases working along the river banks, stream valleys, crest and divide lines, or accompanying hillside contours. This relationship establishes a first territorial configuration for the infrastructure in itself, introducing communication lines and land-use patterns operating at a geographical scale, often beyond the metropolitan boundaries. An embryonic *urban* differentiation is produced at the spaces and along the lines where transport pathways find favourable topography, sometimes combined with navigable waterways. Military strongholds, rustic parcellation, and thinner landscapes features are combined to form a rhythmic and humanized pattern along those linear landforms. Even in the case where urban growth has completely absorbed old settlements, much of its original morphogenic elements continue to be detected: intersections and crossroads, vantage points, elongated strips, bridges, quays.

By outlining the spatial features of this relationship, one may not only get closer to understand the genetic code of metropolitan territories, but may also open the door into potential mechanisms of spatial planning. The combination of linear road and settlement structures with the ecological network may define areas for urban and environmental interweaving in cases like the ones in the basins of Loures, Setúbal and Lisbon's west coast. This opportunity may well be explored in the future, as the Metropolitan Regional Plan of Lisbon is defining the implementation of *metropolitan parks*, structured along large water lines, for some of these areas.

#### 4.2 Contiguity and transversal aggregation

For a morphological analysis of spaces associated to the road network, one must acknowledge the reciprocal relationship between its path and the adjacent parcellation matrix. Transformations induced by easier road accessibility, operate over this parcellation matrix, usually maintaining its rustic characteristics in shape and size; linear sequencing and transversal depth of building occupation are accordingly defined. The case of Lisbon's linear formations are representative of a specific form of metropolitan spatial production, in which multiple land transactions – informal subdivision, assembly followed by formal subdivision, plot truncation – continue to be determined by the persistence of a pre-existing matrix. In these cases, the absence of a formal and designed plan to support urbanization along old roadway territories, gives shape to a landscape of

linearly contiguous and transversal occupation, modelled on land property patterns. Even in the case of recent transformations, in the context of first generation of municipal masterplans – from mid 1990's onwards –, regulations and land-use zoning tools have remained incapable of redefining the basic processes concerning parcel geometry changes.

It is over the structural persistence of this parcellation stratus that individual building processes occur, resorting to a highly diversified range of typologies. Economic and timing opportunity criteria are combined with morphological parameterisation criteria, especially those concerning sectoral planning and legislation, such as rights-of-way and stand-backs, to produce a rather splintered urban and pavilion-based fabric.

Contiguous subdivision of perpendicular parcels is common in the case of Loures-Vialonga road (no. 4), with very limited side relationship and continuity between adjacent parcels. Many different morpho-typological layouts are adopted in a sequence where the only common feature is the rhythm of crossing streams and the persistent traces of old large farm estate boundaries. Such pattern can also be identified in the northern area of Lisbon city, in the road Xabregas-Santa Iria (no. 1), where one finds an interspersed track of historical buildings such as aristocratical villas, farm and recreational estates and former convents, aligned to what used to be the old river line. Although much of these estates underwent major transformations since the 19<sup>th</sup> century, its boundaries remain recognizable, even despite its filling with industrial and large urban facilities.

Regarding the topic of transversal aggregation, it is important to distinguish those forms resulting from a rather rudimentary process of standardised and regularly laden subdivision, often missing proper planning permits and poor in infrastructure – a process occurring in various areas of Lisbon's metropolitan area, after the social and political changes in the 70's and 80's –, from those where a rather volumetrical urban layout derives from the optimisation of repetitive typological building and constructive solutions (i.e. pre-fabrication or standard architectural designs), under regulation by zoning plot ratios. Both occur along Loures-Vialonga road (no. 4).

Building and parcel densification is identifiable in Cascais roads (no. 2 and 3), in the vicinities of old rural settlements, in which a thinner matrix absorbs an embryonic urban growth before the emergence of detached subdivision developments. Such process contrasts with the cases where large scale industrial, logistic and infrastructural development are superimposed, skipping that first step of rustic densification, as one may detect in Xabregas-Santa Iria (no. 1) and Setúbal (no. 6), taking advantage of opportunities associated to the presence of national infrastructures (port, airport, national motorways).

Differentiation across linear and parallelistic formations may also arise from different kinds of boundaries and limits. Sacavém, in the Xabregas-Santa Iria road (no. 1), is an exemplary case. The natural limit carved by Trancão River's valley, is reinforced by the overlapping of a large fortified line encircling Lisbon and its neighbouring municipalities, established in late 19<sup>th</sup> century, and made up several forts and trenches, all connected by a military road. The result was the definition of a sort of buffer area on either side of the road, used for military facilities protecting the Trancão River's bridge crossing, just as it used to happen in the old fortified city, next to its walls and doors. In this case, contiguity and linearity are combined to produce spatial aggregation, functional specialization and boundary making.

### 4.3 Polarisation

Lisbon's metropolitan scale motorways were essentially programmed according to sectoral criteria – for instance through national guidelines such as the National Road Programme 2000 – and seldom part of a multi-level spatial planning approach. This network has allowed for a dual and concurrent process of urban development, supporting dispersion and capillarity patterns as well as very intense forms of land-use polarisation in the vicinities of major nodal intersections. Such polarisation is becoming the incremental driver for emerging centres of economic as well as leisure and recreation activities, rivalling with traditional city centres and downtowns. Although logistics and retailing are the dominant sectors in this field, new multi-functional facilities, often associated to advanced tertiary, are increasingly taking advantage of premium IT connectivity usually laid along major motorways. This trend is clearer in the western sector of Lisbon metropolis, where Alcabideche-Linhó and Abóbada-Ranholas roads (no. 2 and no. 3) are located.

Although much older, these roads intersect two metropolitan motorways which were instrumental in supporting a major suburbanization trend, especially from the 1960's to the 1990's. The spaces around these

intersections, which up until the 1980's were essentially unoccupied and rustic, have witnessed a major change into some of the largest areas of industrial and retail activities. At a first stage, this concentration occurs in a similar way as in other peripheral areas in Lisbon, in which an improving car and truck accessibility provided by a dense network of small roads and a few national roads was associated to low land costs. Small and medium sized agglomerations of pavilion buildings emerged, still in a rather precarious layout and poorly serviced milieu. On a second stage, clearer after the mid 1990's when the above mentioned motorways were completed, new large retail and shopping malls offering generous parking and easy car access directly from dedicated roads, start to occupy vacant land, then completely void of any agricultural use.

At the century's turn, new real-estate products offering a wider range of consumer and corporate services, become increasingly entangled in a kind of cluster district, supported by new layers of intermediate roads and connections, although missing integrated management or planning schemes. In this process, existing splinters of rustic and residential fabric are coalesced into a continuous but fragmented and diversified urban mosaic. Evidence of a new metropolitan configuration comes with the recent building of large scale public facilities such as a regional hospital and several university campuses, showing not only the importance of regional accessibility as determinant of location criteria, but also the acknowledgement of a what used to be peripheral areas as legitimate and meaningful for strategic urban development and social cohesion.

#### 4.4 Parallelistic- vertebration

The first traces of parallel vertebration patterns of urban development in Lisbon metropolis may be identified after the introduction of railroad lines after 1856. The northern line is Portugal's railroad backbone, connecting Lisbon to Oporto and to Spain, following a parallel path to the old royal road and to Tagus River, formerly the main navigation and trade route to inland regions and up until today, the *raison d'être* of Lisbon as the country's capital and main port city. It is precisely in the in-between spaces formed along the old road, the railroad line and the coast line that some of the first modern industries are developed, many times directly serviced by private railroad branches and port facilities. In fact, Lisbon's northern line is representative of what we may call a *plexiform* pattern, in which multiple parallel infrastructures (water, electricity, and gas supply, road, motorway, railroad, port and logistical facilities) are laid along a very narrow and topographically constrained space, producing a splintered and interstitial fabric. Although one may still detect the shapes of former rustic parcellation, the ruptures made by crossing infrastructures clearly differentiate its land-use configurations, often shaped by the residual geometries of protection rights-of-way.

Even today and after almost three decades of sharp deindustrialisation, emergent forms of post industrial development – such as residential and tertiary redevelopment of former factory sites – continue to take advantage of excellent connectivity to railroad, now regarded as a driver for larger scale regeneration and a key to metropolitan-wide strategies of transport multimodality. Although it is a long and interspersed process, the Expo98 site and recent public space operations are reshaping metropolitan riverfronts. They may testify to the will of having linear and continuous urban, infrastructural and landscape structures as a kind of conjunctive tissue weaving through what is still a much splintered metropolitan space.

Going hand in hand with the transformation of former industrial sites into environmentally qualified urban districts, the reassessment of infrastructural space is increasingly becoming at the core of planning and design concerns. With the exception of some conventional roads, metropolitan and intercity motorways are becoming the only roads listed in the national road network, managed by central government. Many of those which were once listed are being declassified and transferred to municipal authorities, opening the door to a closer relationship between infrastructure and spatial planning. Setúbal (roads no. 5 and 6) and Lisbon (road no. 1) are, in fact, engaging in studies to turn some of the old national roads into enjoyable urban avenues, not only from the stand point of spatial aesthetics but fundamentally as a critical reassessment of a structural framework at the city-scale and at the urban-metropolitan interfacing.

Parallel vertebration may also be the supporting mechanism of complementarity functional differentiation occurring between two roads. Cascais roads are an example, in which the one connecting Alcabideche to Linhó (no. 2) supports a number of urban development operations associated to gated-community residence, tertiary (shopping, SME district) and leisure (golf courses, speedway) land-uses, whereas the road from Abóbada to Abrunheira (no. 3) is essentially occupied by a contiguous track of SMI pavilions. In the first case, the key to understand such forms of urbanisation is the existing parcellation structure, made up of very



large old aristocratical and religious estates in the foot of romantically landscaped Sintra hills, making easier for single property transactions and large scale, designed and rather ‘affluent’ development. The classification of that road as 1<sup>st</sup> class in the 1945 National Roads Plan, has also allowed for a hierarchical differentiation when compared to the parallel Abóbada-Abrunheira road. In this case, the persistence of a fragmented rustic parcellation and the classification as a secondary road dictated its predominant role as an industrial strip. In the last decade, an interesting phenomenon is starting to emerge in this parallel formation, with the coalescence of transversal links between the two roads, although it still remains largely interspersed by open spaces.

Table 1, shows a preliminary interpretative systematisation of mediation relationships discussed in the various cases.

	Xabregas-Saerwém-Srª Iria da Azóia (no. 1)	Alcabideche-Linhó-Ranholas (no. 2)	Abóbada-Trajouce-Abrunheira (no. 3)	Loures-Tojats-Vialonga (no. 4)	Setúbal-Palmela-Finhal Novo (no. 5)	Setúbal-Águas de Moura (no. 6)
<b>Physiography/hydrography relationship</b>						
Hillside / contour line				•	•	•
Crest and divide line		•	•			
Valley, coast line, or river bank	•					
Spaces determined by water features	•			•	•	
<b>Contiguity and transversal aggregation</b>						
Linear elongation of urban settlement	•				•	•
Linear contiguous aggregation _ residential	•					
Linear contiguous aggregation _ pavilion			•			•
Relationship with remarkable open space	•	•		•	•	
Densification of rustic matrix		•	•	•		
Transversal subdivision _ grid	•	•		•		•
Transversal subdivision _ type-volumetric layout				•		•
Transversal subdivision _ polygonal pavilion layout			•	•		
Inter-axial urban development	•					
Multifunctional urban development		•				•
<b>Infrastructural polarisation</b>						
IP/IC (arterial motorways) intersections	•	•	•	•	•	•
Commercial and logistic poles		•		•		•
Port / Airport	•					•
<b>Parallelistic vertebration</b>						
Armature for discontinuous urban fabrics		•	•		•	•
Building of intermediate road network	•	•		•		•
Pavilion/industrial site redevelopment into commercial space with parking	•					•
Declassification and integration of national roads into the urban structure	•				•	•
Conversion of bounded open spaces (villas/estates) into gated-community real-estate		•				
Specialization and functional differentiation a)	PI+LI	GC+MF	PI+PC	PI+LI	PC	PC

a) PI – Pavilion/industrial PC – Pavilion/Commercial GC – Gated-community residential MF – Multifunctional LI – Logistic/Industrial

Table 1: Interpretative matrix for infrastructural mediation mechanisms associated to parallel infrastructures

## 5 ACKNOWLEDGING PARALLEL INFRASTRUCTURES IN METROPOLITAN SCALE PLANNING: AN ASSESSMENT OF THE METROPOLITAN REGIONAL PLAN OF LISBON

To address the third of our earlier questions – the acknowledgement of metropolitan formations determined by parallel infrastructure as spaces for project and design – we’ll offer an account of the Regional Plan of Lisbon, currently undergoing the final stages of revision. Although approved in 2002, the Plan went into revision in 2008 after changes in national policy concerning the location of new international infrastructures in Lisbon metropolitan area. A synthetic account of its structure may arise from the confrontation between its conceptual premises and goals and the policy and instrumental framework through which such concepts gain expression.

Compactness, functional diversification and strengthening of central districts are presented as major goals in terms of metropolitan configuration. To achieve them, the plan claims for the mobility system’s rationalization, stronger restrictions to building in agricultural and forest land and support in inner city regeneration. Resorting to the concept of a ‘city of cities’, the Plan vision resorts to the polycentricity agenda, along with the definition of a network of metropolitan links, defined in terms of hierarchy and complementarity (Fig. 3).

On the other hand, its instrumental framework is structured upon a systematic identification of territorial units (Fig. 4), detecting land-use patterns and establishing a clear distinction between urban and agro-forestry spaces, over which four structural systems are layered: 1) urban system, 2) economic system, 3) environmental system, and 4) mobility and accessibility system.

Such framework stems from a territorial interpretation based on a nucleated and urban-rural duality, actually being a cornerstone in current planning legislation in Portugal. The acknowledgement of linear formations as both as a specific territorial reality and as a potential tool for metropolitan spatial planning is extremely difficult under this framework, given its morphological characteristics contradictory with the compact and bounded urban model. In that respect, one may argue that the Regional Plan is missing the ‘lens’ to detect and recognize many of the specificities in Lisbon’s metropolitan territory.

Although it is legally defined as a strategic planning tool, Lisbon’s Regional Plan has some very detailed and normative guidelines, especially in the field of metropolitan ecological networks (Fig. 5). In fact, it is so well defined that municipal masterplans are required to adapt to its layout. On the other hand, this formal refining is not transversal to any of the other guidelines. The need to reinforce internal linkages, especially in some small and frail settlements is stated but misses the identification and assessment of concrete spaces where those links may be strengthened.

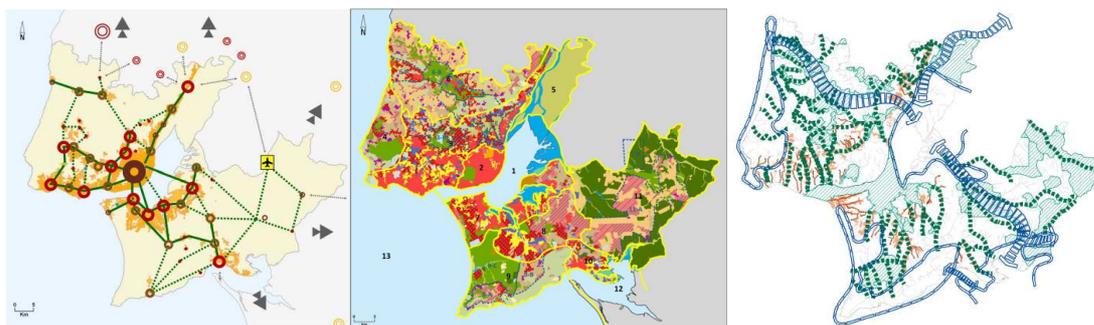


Fig. 3, 4 and 5: Metropolitan Urban System, Territorial Units and Sub-units, Metropolitan Ecological Network. Source: Metropolitan Regional Plan of Lisbon, Revised Technical Proposal, CCDRLVT, Nov/2010

It is precisely in the topic of metropolitan inner links that linear formations and parallel infrastructures may play a key role within specific planning guidelines. Given its intrinsic characteristics as transversal structures, crossing multiple layers of urban fabric and landscape, they offer to opportunity to interact with other spatial and functional systems. In Table 2, a simple exercise is made, addressing potential fields of relationship and refinement: on one hand, the morphologically assessed mediation mechanisms; on the other the strategic topics of Lisbon’s Regional Plan.

Mechanisms of infrastructural mediation	Potential topics for assessment with Metropolitan Regional Plan of Lisbon
Physiography/hydrography relationship	Environmental System / Metropolitan Ecological Network
Contiguity and transversal aggregation	Territorial Model / Territorial Units (and sub-units)
Polarisation	Centrality Systems / Structural Poles and Mobility and Accessibility System
Parallelistic vertebration	Mobility and Accessibility System

Table 2: Relationship assessment between *mechanisms of infrastructural mediation* and Lisbon Metropolitan Regional Plan’s planning topics

## 6 TWO REMARKS AND A CONCLUSION

### 6.1 Parallelistic formations require intermediation between *network* and *fabric*

One of the morphological traces of metropolisation is the upgrading of old linear spaces, usually structured along historically defined itineraries, into more complex and transversally differentiated formations, often supported by the interaction of parallel infrastructure. Although this parallelistic combination negotiates



different kinds of path geometries, flow capacity or sideways permeability, it becomes stronger and more resilient resorting to redundancy and intermediate stratification between superimposed levels and scales of infrastructure. One may speak of a sort of reticulation being developed at the middle scale levels of metropolitan fabric; in the case of linear formations, polarization and parallelistic vertebration processes are the mechanisms supporting it. Nodal polarization has been detected in many metropolitan contexts worldwide. However, evidence from Lisbon shows that specific land-uses such as shopping centres and SME/SMI districts, rest on this intermediate level of infrastructure for the purpose of *grounding* (Read and Bruyns, 2007) into the spatial frame of formerly open space. In a certain way, intermediate reticulation becomes the new stratus or matrix that makes metropolitan nodal formations so distinct.

Functional specialization and spatial polarization are both the product of and the agencies that produce territorial reticulation. It is an incremental, cumulative, and dynamic process in which 1) the overlapping of a given infrastructural network sets in motion a number of land-use changes in a first stage, and 2) triggering a second moment of infrastructural reinforcement in response and adaptation to increased flow demands. Although a schematic representation of a node as point of connection in the field of a network, Lisbon's metropolitan reality shows that polarisation can only take place if and when it can be weaved as a *fabric*, meaning that it is the result of an interdependent relationship between roadway, parcellation, and building. Nodes become thinner networks themselves (Dematteis, 1995; Pavia, 2002), negotiating across overlapping levels of infrastructure and land parcels. When combined into linear and parallelistic formations, its potential can be multiplied across a vast territorial range, going beyond the constraints and frailties of administrative, sectoral and municipal boundaries.

## 6.2 Parallelistic formations are spatial laboratories for metropolisation research and planning

Parallel infrastructural formations are just one of potentially rich topics for research in metropolitan morphology and design. They support the mobility of everyday life; they feed the metropolis with the energy and information it needs to thrive; they are the contemporary heirs of historical itineraries and remarkable road landscapes. Its patterns shaped new forms of spatial production in many metropolises (i.e. the French *feaubourgs*, the Scandinavian *transit-oriented* growth, the American *parkway* and *strip*). They have also been the models for remarkable proposals in the past (i.e. Henard's *Rue Future*, Soria y Mata's, Miliutin's and May's *linear cities*, Hilberseimer's linear Detroit) and continue to be today's urban laboratories (i.e. Barcelona's *rondas*, Ruhr's A40, Netherlands's *rainbow highway* A12).

And yet, they continue to be rather elusive to contemporary planning and urban design disciplines.

What appears as distinctive in Lisbon is the intertwining of older road formations with a new and denser network of intermediate metropolitan motorways and dedicated roads. In the in-between spaces produced by this intermediate reticulation one may find splinters of landscape, no longer intelligible in its association to coherent territorial structures. And yet, many of these detached fragments carry the genetic code upon which the metropolis emerged. In a sense, one may consider them as a specific kind of heritage in the realm of contemporary metropolis.

As such, as argued at the beginning, linear and parallel formations combine the spatial, functional and landscape qualities of *flow* and *place*, in a constrained and tense (un)balance. More than often this duality between the logics of the *system* and the logics of the *agora* (Sieverts, 2001) – after all a defining feature of metropolisation – has been reproduced in the professions and practices of urban and infrastructural planning. A re-balance of these logics has been widely claimed (Ben-Joseph, 2005; Smets, 2005; Mossop, 2006), requiring refreshed tools for interpretation and design, sensitive to the specificities of our unconventional territories.

## 6.3 Parallelistic formations are territories yet to be discovered

Going back to the three initial questions and trying to have some concluding answers...

i) It is possible to identify specific morphologic characteristics in shape, formation process and mediation mechanisms in linear and parallelistic structures. They become more than just the axial sequencing of various spatial products; in the context of metropolisation, they are combined into a sort of *fibrous* or *plexiform* fabric, produced by the overlapping redundancies of multiple infrastructural lines.

- ii) The relevance of acknowledging and researching these territories stems from the argument of Castells that networked spaces of flows are as determinant to the contemporary city and society as the spaces of places were to the industrial metropolis; by understanding their logics and how they related between each other, one may get closer to the difficult task of making today's splintered metropolitan landscape more intelligible.
- iii) As far as Lisbon is concerned, currently metropolitan planning is still lacking the morphological refinement needed to pin-point the spaces and processes by which this landscape is made. Its interpretative lenses remain strongly biased by a nucleated understanding of the city.

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