

## Infrastructure –Transportation and Networks: Thoughts on the City of Tomorrow

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### Abstract

Cities, both large and small, assemble increasingly large numbers of population and activities. Acting as dynamic places of economic growth and culture production, cities thrive and their potential robustness can determine the character of each urban society and the developed social bonds. Increased population concentrations promote a big opportunity in terms of economic and societal evolution. Indeed this opportunity has still been little implemented due to segregation among different ethnicities and intense homogenization of modern activities. The terms of cultural osmosis in contemporary multicultural societies remain yet major issues. Economic development and culture present highly interrelated contexts when the economy thrives in terms of equality and solidarity as well as guarantee the alleviation of conflicts, justice and democracy. This new globalized conurbations could be less tight and more accessible, while bringing closer different traditions and experiences.

**Keywords:** Infrastructure –Transportation and Networks: Thoughts on the City of Tomorrow

### Introduction

The current poor transportation infrastructure in several cities – in reference to the European standards- constitute a critical element on the ongoing traffic suffocation. The rapid increase of private car ownership in combination to the deficient management of the transportation system add ominous evidence to the evolution of transportation planning. The completed and ongoing transportation projects can only temporary relieve overburdened networks if not combined with supplementary interventions in terms of urban policy and planning. Planning should always be driven by Cervero's rationale (1994), what matters most about cities is people and places, not travelling. The impacts of transportation engineering in the urban and spatial planning environment have not yet been thoroughly researched, however the opposite regarding the impact of the city form in mobility choices has received much attention in the urban discourse. The key arguments on this unequal interest can be summarized as being the following:

Designing transportation policies and infrastructure planning do not always require thorough examination on the potential land use impacts,

It is a common scientific belief that land use impacts deriving from transportation project implementations can be resolved in retrospect with traditional methods,

Predicting land use impacts deriving from changes in transport system is believed to be highly demanding and complicated,

Traditionally qualified engineers are not sufficiently familiar with contemporary prediction methods of such impacts.

Nowadays, cities are facing major complicated issues like accidents, air and noise pollution, urban space degradation et cetera, demanding essential transformations in terms of policies, management and technical interventions. The economy of a city can attract visitors, assets and capital, elements inextricably linked to the quality of urban space, the protection of architecture and urbanism heritage, the quantity and quality of public space assigned to pedestrians and cyclists and lastly the restrictions imposed to cars in order to tackle climate emissions and environmental capacity. The above constitute the key parameters of a sustainable city particularly from a transportation perspective, heading to sustainable urban mobility. This prospect evidently means that urban planning and transportation engineering can well be regarded as equal partners in city planning and if coordinated can overrule traditional and long established planning methodologies. Combined urban planning and transportation engineering methods in modern urbanism implies that new projects and future interventions are directed according to the city's priorities and necessities which are highly integrated in its values and social as well as economical environment. Promoting combined planning prerequisites mutual understanding of current qualities, problematics and the interrelation among space and movement. Critical problems concern the environment, social cohesion, safety and economic development.

### **Understanding the issues**

It is currently well known that the more dense and compact a city is, especially when activities are located close to public transportation stops (transit oriented development), the more opportunities will be given to its residents and visitors to travel by public transport. Mixed land use development (i.e. housing, commercial etc.) can also contribute to the use of public transport and hence decrease the travel times and costs. Planning cities for fewer cars, allows the actual social and financial needs of an urban environment to be revealed and strengthens its natural and social aspects. Productivity and development is shrinking in the contemporary Greek city for a number of reasons, including external and internal factors of the Greek economic crisis and uncertainty. Among others, arbitrary structures, poor design standards, unauthorized land uses, downgraded public and road space, consist the scenery of a typical struggle in a daily basis. Profoundly all the above discourage future visitors, investors and other stakeholders to approach such places and degradation continues. The key infrastructure of the city, namely its public places, transportation networks and systems, along with its streets, being already downgraded are further devalued and sustain the poor image of the Greek city.

Modern urban planning science –after ages of structural misconceptions- suggests higher densities, mixed used development for city centers and urban centralities, ceasing of urban sprawl and the reduction of energy consumption. Moreover, urbanists try to introduce the 'sharing economy' in the city rationale in order to enhance social and economic cohesion and restore disrupted city bonds. This article presents briefly all those major issues that could help the Greek city recover from its disadvantages, compared to the other European cities.

Environment : the environmental footprint from urban development is currently well researched and proven to be a serious threat. The European Union and its member states are committed to decrease notably the levels of CO<sub>2</sub> emissions from the transportation sector until 2050 compared to those of 2000. Air pollution can be decreased locally, however research shows the long lasting impacts of microparticles. Moreover, the detection of new contaminants is always possible and concerning. Regarding the noise pollution, it is well known that the exposure to noises higher than 60dB for long periods can affect both physical and mental health. Policies against noise pollution are recognized as equally important to those from air pollution. The degradation of our visual landscapes (visual pollution) has lately been identified as a common issue in order to preserve and protect the urban heritage, as well as to reassess the consumption of public spaces. In terms of energy, numerous researchers and studies consider transport to be among the three most energy consuming activities, with the other two being the sectors of housing and food (Bakogiannis, 2016).

Social Cohesion: Traffic fatalities' indicators are showing a mild downturn in Europe, although the countries of the south present increased numbers related to vulnerable road users. Being on the road triples the probability of death, compared to any other daily activity. Policies and measures should aim at decreasing dramatically the number of all types of traffic

accidents. Despite the remarkable increase on car ownership, one in six households living in cities worldwide does not own a car. Indeed transportation policies seek to ensure their accessibility through public transportation. Heart related diseases and obesity remain serious problems and fortunately nowadays there is social consensus to mobility policies supporting a healthier lifestyle. The transport sector plays a major role in the social fabric of Europe (Extra Project, 2001), related to daily life, employment, accessibility to services, leisure and many more. Injustices in transportation sector reduce social equity and lead to long term impacts in quality of life, health, safety and land use distribution. Promoting non-motorized transport and developing fair transportation system can particularly contribute to social cohesion in planning terms. Moreover, urban planning can assist on the integration of any excluded zones or deprived areas by providing spaces that according to Schreiber and Carius (2016) increase the chances of interaction and the forming of social relations among people from differing ethnic backgrounds.

Economic development : In most European cities, after long-established policies, urban sprawl has altered the economic operation of activities and changed the roles of centralities and their appeal as well as their investment potential. Stakeholders, politicians and entrepreneurs have been convinced that problems cannot be solved with the construction of new traditional networks such as roads, and rather lately can identify that car restriction policies do not lead to deterioration of profits but instead can boost the economy. The economic sector has realized the benefits of environmental protection and saturation is encountered as priority to be tackled.

Safety: safety is a parameter that encloses accidents, fatalities, criminality as well as quality of life, comfort, accessibility et cetera. Infrastructure and transportation systems should manage to ensure safety and accessibility for all.

### **Overall Aims and Particular Strategies**

Setting generalized aims in transportation terms has led to several inconsistencies and misinterpretations as each centrality demands customised solutions and specialized timetables. The key aims arise from the formulation of a generalized strategy which should carry the special aims. Developing a strategy and setting the aims can better be applied through a bottom-up approach that has engaged the public and local stakeholders from the very initial steps of 'understanding the issues'. The progress should be recorded systematically and new objectives can be set to allow for further upgrade of the social inclusion regarding new developments.

Strategy design: The acknowledgement of good practices in urban planning and transportation engineering is proven to be a successful first step in developing a strategy. Each city should follow and comply with European, national and regional objectives, however must be allowed to develop a special framework meeting the local needs and comprehending with the general city objectives. Assessment of such strategies in terms of integrated urban and transportation planning, shall allow the use of both traditional and new models, testing of policy tools and adjustable techniques. Although a number of such models have become very complex, there is an adequate number of meta-models that can be useful for public debate and decision making.

Strategy Evaluation : The methods used for strategy evaluation have been modified lately in order to meet the wide range of objectives in integrated urban and transportation planning. Thus, instead of conventional cost-benefit analysis, emphasis should be given on multi-criteria analysis. The assessment should include weighted variables for each objective and evaluators (public, stakeholders, visitors etc.) should check the sensitivity of the overall strategy in relation to the aims. Moreover, case studies' exploration can be a useful supplementary element in all stages of research and evaluation, due to the ability to transfer real world issues and outcomes in relevant schemes. According to Bakogiannis et al. (2014), presenting a supporting case study in a similar environment, could increase the understanding of a needed transformation or inform about potential inadequacies in implementation.

Financing : While the European Committee continues financing an important part of city strategies, lot of attention is being given on the income by the pricing of transportation services. Cities can distribute financing freely, depending on their strategies. The European Committee does not anymore finance individual infrastructure projects but those integrated in an overall strategy which should be compatible with the European objectives. Cities are allowed to involve private sector in developing infrastructure however without yielding public control and allowing divergence of lawful processes.

Public participation: Citizens and all interested stakeholders should be encouraged to participate in all planning stages, namely the identification of problems and objectives, prioritization of issues, formulation of possible solutions, and lastly the

planning- implementation and evaluation of the strategy. New public engagement tools should be implemented to facilitate participation processes, while special technology-related tools (i.e. social media, e- consultation, webinars) should be used to engage all commonly excluded groups of citizens. It is wellknown that public participation techniques increase the average time of planning completion and costs time and money to decision making which can lead to public conflict, political cost, implementation delays and many more. However, public commitment guarantee smooth transition to development, public acceptance and efficient implementation. Cities are lately encouraged to try innovative public procedures that involve assessment by the public, which demands deep knowledge of planning and a high level of managerial techniques in new paths of local government.

Urban policy measures: Legislative regulations shall be implemented -after the needed public engagement- in order to ensure that new urban plans and masterplans will target neglected urban zones (i.e. abandoned industrial areas) introducing new medium to high density mix-use development. The provided parking spaces should be limited and environmental friendly means must be promoted. An urban moratorium could ensure the ceasing of urban sprawl and regeneration of existing downgraded urban areas. New projects of regeneration have to design within the concept of 'cities for people', putting pedestrians, cyclists and all vulnerable road users on the core of public space. Complementary tax reductions for city center residents will also decrease the need for long distance travelling and urban sprawl.

New transport infrastructure: New transportation infrastructures have always high financial and environmental cost, and may lead to longer travel times. New design requirements should emphasize the ease of use, safety and convenience rather than speed. Environmental degradation should be kept to the minimum possible and urban cohesion should be preserved.

Management of infrastructure and public transport services: One of the key objectives regarding infrastructure management is the fair redistribution of road and public space to all users, including pedestrians, cyclists public transport users and permanently or temporarily disabled. Car circulation should be managed effectively and traffic safety should be the priority. Low cost interventions can assure improved public spaces and maintenance works are much needed especially in the countries of the South. Accessibility shall be prioritized over the traditional request on decreasing travel time and public transport systems must ensure that car users will consider it as an efficient alternative. Management of services could follow the service reform rationale from Cervero (1994) for adaptive transit.

Demand management: Encouraging the use of private car alternatives and decreasing car travel times are the key objectives on demand management. Parking management should aim at discouraging car usage in city centers and new tools, such as car pooling and car sharing, can take over the increased demand of mobility.

Information policies: Real time information systems play a leading role in convenient and effective modern transport systems, while telecommunications can become a substitute for some travels. Information services should include real time knowledge of mobility choices for users, when at home, on the way and while being at transportation stations and stops. Variable message signs (VMS) can inform car users to avoid a certain overburdened area and choose alternatives.

Urban toll systems and parking pricing: Road pricing complies with the European directive "the polluter pays", when applied according to travel length and environmental sensitivity of the used networks. The extra travel cost is used as an equivalent to the marginal social cost the commuter charges the city by his/her choice. On the contrary public transportation cost reflects the minimum cost of travel and encourages integrated movement in the city. Parking pricing systems must reflect accordingly the cost for supply and use of an urban space and can change periodically to control incoming vehicles.

Walking and cycling enhancement measures: Walking and cycling can be considered as key alternatives to private car use due to their numerous benefits in human health and environmental pollution. The redistribution of road space in favour of these users will encourage safe, convenient and pleasant travels while public transport can complementary assist cyclists to accommodate their vehicles both in car and in stations/ stops, which will ensure coherent long distance travels

Freight service measures: Freight services deal with the key issues of traffic circulation dependency and environmental repercussions. Managing to reduce travels within the city limits and through traffic within neighborhoods can lightly avoid the afore-mentioned impacts, however contemporary solutions promote the overall substitution of heavy vehicles within cities. Coordination and cooperation between different logistics companies can decrease needless travels while transshipment of goods from trucks to minivans can also minimize traffic saturation. Each city should have trucks' and

lorries' parking storage areas in their territory, whereas freight villages can be located in selected cities to manage logistics and efficient transportation of goods.

Vehicle improvement measures: The European Commission has consistently supported research on improving vehicle technology as local contamination and noise pollution should be limited. Vehicles must become more secure and environmental friendly. Emphasis should be given to reducing emissions that contribute to global warming. Tax policies should discourage buying polluting vehicles and research on new fuels and fuel cells must be continued intensively.

Integrated Strategies: Combining the afore-mentioned policies can nearly form a complete strategy that would gain social consensus. However questions remain as to the ability of civil societies to tackle the traffic saturation in cities with greener cars and to achieve the ambitious targets for reducing carbon dioxide emissions.

### **Specialized suggestions for an upgraded transportation system\***

*\* resume of specific suggestions as developed for Implementation in the Greek Transportation Sector*

According to the Green Paper on Public Transportation of the Capital City of Athens (Transport for Athens, 1998), the current policies must be reviewed in order to address the upcoming issues such as the economy, modern business activity, international experience, current and future urbanism trends. Immediate enhancement should be launched regarding an integrated transportation plan, supported by major investments and based on explicit political decision for the development and promotion of new public transport services instead of extending the current road network. Since then -1998- progress has occurred regarding the development of a thriving metro- underground train as well as the modernization of specific services, however not in an integrated way.

A comprehensive strategy combining several factors is required regarding the overall enhancement of transportation infrastructure and services as well as the economic viability of the new system. According to the Hellenic Institute of Transportation Engineers (2002), the current state of Athens' transport system seems to be the beginning of a continued deterioration in terms of traffic suffocation. The rapid growth of car ownership rate combined with the deficient infrastructure and management of the current transport system are ominous signs for the evolution of the current situation, if serious and consistent action is not considered. The currently scheduled transportation projects -if not combined with a series of complementary interventions - will only relieve traffic suffocation in a temporary basis. Adding to this, Vlastos et al. (2004) argue that any reversal in the Greek transportation sector will only be managed if substantial changes in infrastructure are complemented with courage and persistence in decision making as well as the introduction of information and awareness policies for the general public.

*Suggested Interventions include:*

Unified management and planning of the transport systems that can ensure an effective control of all involved institutions and stakeholders (Ministries, Municipalities, Road Police Authorities, Public Transport Bodies etc.). The foundation of a robust coordinating body – from the merging of current complex or not authorities- will assist on a new integrated start with specific responsibilities and duties.

These may include:

Configuration of Policy and Planning

Planning of investments and priority setting

Configuration of pricing policy for the use of transport systems (public transport, parking, road pricing etc.)

General supervision and control of implementation planning ( project implementation and operation of systems) based on specific requirements and timetables

Establishment of substantial and sufficiently financed participation of citizens in all phases of planning, design, implementation, operation and management of transportation projects and measures to create communication offices in all the services of transport operators

Institutional regulations for controlling illegal parking by independent authorities, collection of fines, rationalization of fines (frequent checks and lower fines)

Establishing a street hierarchy which will correspond to the street operation and its role in urban fabric. Ensuring high operational characteristics to primary roads (suitable signaling, parking restrictions and land use control) and appropriate assembly of different types of roads.

Completion of current construction works and promotion of progressive ring roads (internal, intermediary, exterior). Emphasis should be given on their integration to the overall road network.

Promotion of specific traffic regulations in the local road network in areas with exclusive residential use for ensuring road safety and the quality of life. Developing pedestrian and cycling networks in central areas will ease the movement residents and will upgrade the visual and environmental image of the city.

Appraisal and effective implementation of appropriate smart telematics systems for car restriction in peak hours with separate parking priorities for residents, employees, visitors etc.

Development of an integrated bus network with proper intervention in bus lanes and optimization of passenger information systems.

Drastic re-adjustment of public transportation pricing to address all groups of travelers and implementation of a single ticket system.

Development of park and ride areas in Transport stations located close to the outskirts of cities for the upgrade of multimodal transportation.

Traffic management policies and monitoring solutions for special supply and emergency vehicles. A special institutional framework should include apart from specific regulations, special interventions (i.e. speed bumps, boom barriers, vehicle access points etc.).

Development of an integrated both static and dynamic information system for public transport users, including public and customized announcement of timetables, operational signaling of urban highways, important nodes etc.

The improvement of environmental conditions, as needed for urban sustainability, requires a radical revision of the overall urban practices and processes of developing urban forms. It is common knowledge that a well-planned city can enhance socialization, multiculturalism, happiness, health and safety conditions as well as realize the needs of its residents for free time and urban spaces. Reducing energy consumption remains yet a determinant factor in modern wellbeing and urban structure can contribute highly in these terms. Haugton and Hunter (1994) argue that changing the shape, size, housing density, design and siting of activities in cities, can differentiate energy demand for around 150%.

## Conclusions

Cities, being ultimately dynamic organizations, can accept a certain amount of motor vehicles without consequences (capacity), managing to enrich somehow their urban environment. Beyond this specific amount, vehicles should be replaced with other forms of sustainable modes in order to keep their vitality and spatial distribution. Removing this excess amount of vehicles (travelling and especially parked ones), is the great 21<sup>st</sup> century's challenge, as recognized by several authorities and organizations. If achieved, the city would alter its form, its air and visual environment. Sustainable mobility, as a scientific term, addresses this contemporary challenge: managing to achieve the sustainable compact city with fewer private cars, preserving its history and identity through a healthy lifestyle. Streets are not traffic pipelines, but instead the foundations of social life. Sustainable city is the compact city that ensures its capacity within viability terms, covers its housing and commercial needs and provides street life in a human scale.

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