

# Geomatics Techniques for Urban Transport Planning

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**Abstract**—The major urban centers are all facing rapid growth is most often associated with spreading urbanization, social status of the car has also changed: it has become a commodity of mass consumption. There are currently about 5 million and 260 cars in Algeria (2008), this number increases every year 200,000 new cars. These phenomena induce a demand for greater mobility and a significant need for transport infrastructure. Faced with these problems and development of the growing use of the automobile, central governments and local authorities in charge of urban transport issues are aware of the need to develop their urban transport systems but often lack opportunities.

Urban Transport Plans (PDU) were born in reaction to the "culture of automobile." Their existence in the world the '80s, however, they had little success before laws on air and rational use of energy in 90 years does not alter substantially their content and make mandatory their implementation in cities of over 100,000 inhabitants (Abroad) [1].

The objective of this work is to use the tool and specifically Geomatics techniques as decision support in the organization and management of travel while taking into consideration the influence, which will then translate by National Urban Transport Plan.

**Keywords**—Geomatic, GIS, PDU, planning, transport.

## I. INTRODUCTION

**M**ASSIVE urbanization and urban sprawl that has resulted, multiplied distances, so that the car has emerged as the mode of transport best suited for travel within cities. The search for low-cost land outside city centers has accentuated this phenomenon has led to the urbanization of areas previously isolated and accessible only by car, it is also very much an instrument essential to the exercise of individual liberty, the mobility and independence it provides to its owner [1].

This favorable to the automobile has long been supported by the government; locally as national politicians acted to accommodate the automobile, cities that were built and developed without it.

Promote access and traffic in urban areas was (and still is in many cases) designed as the indispensable condition for the survival and vitality of cities.

The establishment of urban travel plans PDU is the result of awareness by the public authorities, of the disadvantages generated by over-reliance on the automobile city. This document shall be the instrument of a policy of restricting car

traffic through comprehensive planning integrating all data for urban transport [1].

## II. THE PROBLEM

Problems of public safety and traffic flow fall within the Highway Code, and especially the police power of mayors, and therefore are treated locally. Although the skills available to the municipal authority has been progressively extended to environmental concerns, the main disadvantage of this approach is highly regulated in their character: they cannot be exercised within communal, while urban transport is can be understood on a wider scale, in addition, the action of the mayor is limited by the strict conditions of legality which are peculiar to any police measure. Thus, the police power of mayors does not seem to be the instrument best adapted to the definition of a restriction policy of car use in urban areas [1].

This applies to planning documents, which if they have some influence on the configuration of urban transport, are not as essential objective their organization. Thus, the Land Use Plan (POS), as well as his probable successor, the Local Development Plan (PLU) can certainly provide in their rules restrictions on the construction of parking areas or the modulation of building density as a function of service by public transport, depending on the service of public transport, but their primary purpose remains the regulation of the use and management of soils. As to the Masterplans of Urban Planning and Development (SDAU) Future Schematics Territorial Coherence (SCT), which are developed on a intercommunal scale more appropriate, they deal not only with urban transport, and they generally fall within more than one logic of balanced development of infrastructure an approach to environmental protection [1].

Creating PDU became necessary because of the inadequacy of legal instruments. Too much sectoral, which existed before and could only bring disparate responses to the multiple problems of traffic in urban areas [2].

After the creation and manipulation of geographic databases GDB, the exploitation of the latter remains an essential element but also sensitive to the collection of information on the subject studied.

In order to develop a Travel Plan Urban adequate to the structure and needs of the road network, we will build a Windows application (standalone) to GIS database (Geographic Information System), which is responsible for the management of data traffic, which will participate in the decision at the final design of the PDU.

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### III. GEOGRAPHICAL INFORMATION SYSTEM

Broadly, a geographical information system (GIS) is a computer system, whereby physical or socioeconomic data are dealt with. These data can be related to a located entity.

This system is characterized by a set of more or less developed functionalities.

- Functionality of entering data,
- Functionality of management, storage and consultation,
- Functionality of analysis, count and statistics,
- Functionality of output of reports and maps.

The GIS serve as supports to applications that handle geographical data such as urban planning, dealing with natural resources, cadastral survey, traffic management, etc... They are information systems whose objective is an information for relationship between an object (or a phenomenon) and its referenced location on the earth surface.

Therefore, the GIS are computer systems allowing, from different sources, to gather and organize geographical located information. They also allow certain operations about these informations such as managing, analyzing, combining, elaborating and presenting them. A GIS, as any other system, does not exist and can not exist alone, it must be integrated in a general context and for that it is necessary to have an organized structure including people, equipment, etc [3].

### IV. URBAN TRANSPORT PLAN PDU

The Urban Transport Plan is a planning process over 10 years, which requires coordination between all relevant actors to develop a comprehensive project on land use and travel. It thus provides a framework tool to promote:

- The development of harmonious and controlled territory.
- The emergence of a common culture and inter-urban travel [5].

This plan determines, within a perimeter of urban transport (PTU), the organization of transportation of people and goods, traffic and parking. All modes of transport are concerned, which is reflected in the implementation of actions in favor of alternative modes of transport to the private car (VP) public transport (PT), two wheels, walking...[5].

The PDU is part of a sustainable development: it aims to favor the use of transport less polluting and more energy efficient [6].

### V. OBJECTIVES OF THE PDU

The ambition of the PDU is to ensure a sustainable balance between the mobility needs of people and the protection of their surrounding and their health. Measures to put in place concerning

- Improving the safety of all trips
- The decrease in traffic (or traffic)
- The development of collective transport and means of travel efficient and less polluting to the environment, including the use of cycling and walking
- The development and exploitation of networks of cities and roads, to make them more effective, particularly in the sharing between different modes of transport and

promoting the implementation of actions to traffic information

- The organization of on-street parking and parking lots
- The transport and delivery of goods, while streamlining the supply conditions of the agglomeration to maintain commercial and craft activities
- Setting up of a pricing and integrated ticketing for all travel
- Encouragement for businesses and communities to promote public transport staff, including the use of public transportation and carpooling, conducting a business travel plan.

The urban transport plan must be evaluated after 5 years, and its revision, in case of PTU modification, must be made within a maximum of 3 years [7].

### VI. STAGES OF DEVELOPMENT

**-Issues and framing the process, constitution of the Steering Committee and the Technical Committee:** The precise definition of the framework of the PDU and the establishment of structures to ensure optimal consultation between various actors are key to the success of the approach PDU.

**-Pre-diagnosis:** This phase should make it possible to take on the reflections, studies or projects, realized or not, in urban planning and transport.

**-Analysis and diagnosis:** The analysis demonstrates the strengths and dysfunctions of travel modes, their complementarity and coherence of the whole, of their relationship with the environment, coordination with planning. The diagnosis is a summary of issues raised by the analysis makes it more "readable" and less technically possible.

**-Formalization of objectives:** This formalization of objectives is achieved by the Steering Committee following the implementation of a depth comparison of the different actors.

**-Developing and comparing scenarios:** Approach PDU must enroll in a logical prospective distinguishing itself from the development trend "over the water." It is therefore appropriate at this stage to analyze and compare different scenarios of action which must constitute real alternatives and not simple variants.

**-Scenario selection and definition of the strategy:** Following further consultation between all stakeholders, the Steering Committee will decide on the choice of a scenario or a new scenario of synthesis defining the strategy.

**-The conception project PDU:** This project represents the deepening of the chosen scenario based on defined criteria. It includes proposals by action levels (infrastructure, organization of supply, regulations, traffic control, pricing, communication) to capture in an integrated manner all modes of transportation and parking, transportation and deliveries of goods. At this stage, proposals for financial programming and simulation must be developed. In addition, an evaluation should be performed to check the coherence of the project with the objectives [8].

## VII. URBAN TRANSPORT PLANNING

Modeling of urban transport brings decision support for the development of urban transport policies, in terms of planning and programming. In particular, modeling is a tool often necessary when the questions become too complex to answer "expert opinion" [9].

Planning models are often called forecast models, because their use is often focused on forecasts of the use of transport infrastructure.

In fact, models simplify reality and are therefore vitiated by error. Forecasts are more or less reliable, depending on the model chosen, the quality of data, research officer, etc.

In any event, the models are primarily tools for decision support, which serve to illuminate the planner's choices, which is why we prefer the notion of planning model, more general and less misleading on the results that can be expected [10].

## VIII. DIFFERENT FAMILIES OF MODELS:

Models can be classified into 4 main categories:

**Sequential models** are more traditional, they are especially designed to evaluate infrastructure projects at scales more or less fine. The word sequence is that the model is divided into successive sequences: generation, distribution, modal choice assignment.

**Strategic models**, little used, aim to test contrasting policies of transport on the scale of a city.

**Disaggregated models** whose principle is to directly use the travel surveys to parameterize the model, without aggregating data. They are used to study behavior.

**Interactive models of land use – transportation**, model the relationship between the transport system and the location of people and activities in the study area. It is therefore possible to represent the localization strategy populations and jobs that will then generate travel [10].

## IX. ADVANTAGES OF PDU

\* Protect the environment by improving air quality in the Scope of Urban Transport (PTU):

- Limiting the use of personal vehicles,
- The rationalization of freight transport,
- By developing land permit the implementation of these initiatives.

\* Reorganize the territory of a demographic point of view (less sprawl, increased accessibility throughout ...) to consider mobility as resulting urban policy.

\* Improve coordination and networking between local actors associated with travel,

\* Raise awareness regarding "environmental practices"

## X. THE APPLICATION

### Choice of Softwares

The study area is the city of Oran (Algeria).

We Register ArcGIS Engine components in their integrated development environment (Microsoft Visual Studio), then create an application (independent) with screens, adding

ArcGIS Engine components and writing code in the application development.

The use of C # language (in the Visual Studio environment) to connect tables \*. Dbf (table recognized by ArcGIS 9.3) converted from the MapInfo files, and to write Sql queries exploitative data.

### Deployment of Arcgis Engine Applications:

When completed, ArcGIS Engine applications can be installed on two types of post ArcGIS

- ArcGIS Engine Runtime posts for run ArcGIS Engine applications,

- ArcGIS Desktop existing posts (ie posts running ArcView, ArcEditor or ArcInfo), planned to run ArcGIS Engine applications.

ArcGIS Engine Runtime software can be installed and configured on multiple computers. To activate the functions of ArcGIS Engine, an authorization file is required on each computer. The ArcGIS Engine Runtime extensions can be enabled by adding a line in the authorization file [4].



Fig. 1 Tool bare main window

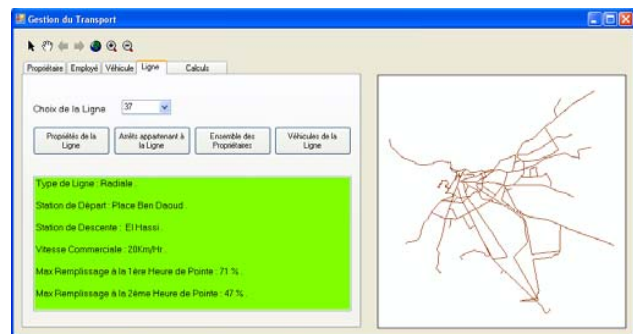


Fig. 2 Window "Gestion du transport" (management of travel)

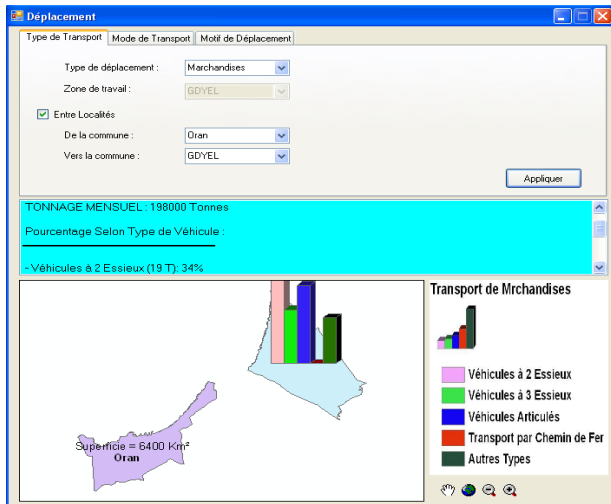


Fig. 3 Window "Déplacement" (transport)

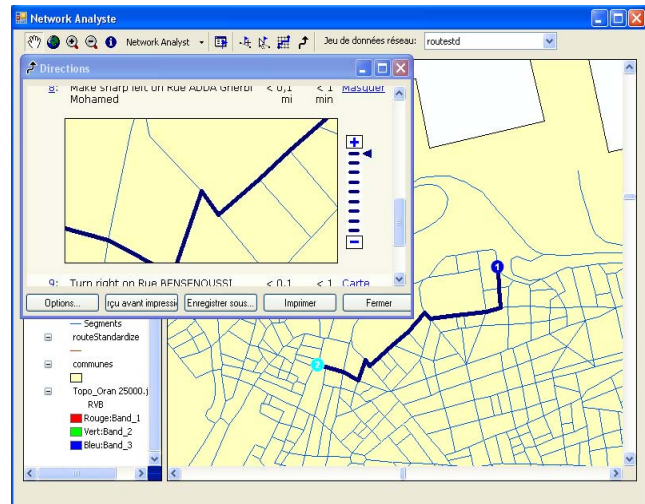


Fig. 4 Window "Network Analyst"

**ArcGIS Network Analyst** provides network-based spatial analysis, such as routing, fleet routing, travel directions, closest facility, service area, and location-allocation. Using ArcGIS Network Analyst, you can dynamically model realistic network conditions, including one-way streets, turn and height restrictions, speed limits, and variable travel speeds based on traffic. You can easily build networks from your GIS data by using a sophisticated network data model [4].

The routing solvers within Network Analyst—namely, the Route, Closest Facility, and OD Cost Matrix solvers—are based on the well-known **Dijkstra's** algorithm for finding shortest paths. Each of these three solvers implements two types of path-finding algorithms. The first type is the exact shortest path, and the second is a hierarchical path solver for faster performance. The classic **Dijkstra's** algorithm solves a shortest-path problem on an undirected, nonnegative weighted graph. To use it within the context of real-world transportation data, this algorithm is modified to respect user settings such as one-way restrictions, turn restrictions, junction impedances, barriers, and side-of-street constraints while minimizing a user-specified cost attribute. The performance of **Dijkstra's** algorithm is further improved by using better data structures such as d-heaps. In addition, the algorithm needs to be able to model the locations anywhere along an edge, not just on junctions [4].

## XI. CONCLUSION

There are clearly at international level willingness to make the PDU document to set all issues related to urban transport, in a logic of promoting sustainable development. However, despite its legal status and its ambitious goals, the success of the PDU is not guaranteed. The process that underlies it, is hampered by local policies favorable to the automobile traditionally. However, it is up to local officials in the first place that comes to apply the PDU.

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## REFERENCES

- [1] Les plans de déplacements urbains : Bilan et perspectives : Gaël de ROTALIER, Mémoire DEA de droit de l'environnement, Universités Paris I- Paris II Année 1999-2000.
- [2] Mémoire magistère 2010 : Planification Des Déplacement Urbains ; organisation d'une BDG routières pour les besoins de plan de déplacement urbains(PDU) et intégration à l'aide d'un système d'information géographique, Brahmia Nadjet.
- [3] Vectorial Road Data Structuring According To A Conceptual Model Case Of The R\_Road Project (Réseau Routier Algérien Digitalisé) Hocine Nechniche, Kouider Brahimi. International Archives Of Photogrammetry And Remote Sensing. Vol. Xxxiii, Part B4. Amsterdam 2000.
- [4] www.esri.com.
- [5] www.actu-environnement.com.
- [6] www.vedura.fr.
- [7] http://fr.wikipedia.org.
- [8] Certu Les Procédures D'élaboration Et De Révision Du PDU, Nicolas JOUVE Septembre 2007.
- [9] Modélisation Des Déplacements Urbains Centre D'études Technique De Lyon 2005.
- [10] Les Logiciels De Planification Des Déplacements Urbains – Catalogue –

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