**OUTLINE**

- Introduction
- Problematic and Objectives
- Adopted Methodology
- Database design
- Components of the GIS prototype
- Application
- Conclusion

**INTRODUCTION**

- Roads play a strategic role in the socio-economic development of a country.
- Very useful in transporting travelers and commodities as well.

**Problematic and Objectives**

- Moroccan highway heritage counts thousands of structures (bridges, aqueducts, etc.)
- These structures change over time and in space.
- Information concerning their daily follow-up and their condition is carried out.
- Graphic and alphanumeric documents for the highways.

**Urban and rural context**

- Roads play a strategic role in the socio-economic development of a country.
- Very useful in transporting travelers and commodities as well.
  - Ensures the economic exchanges between regions
  - Ensures the economic exchanges between urban and rural centers
  - Reduces the transportation costs
  - Facilitates accessibility in the urban and rural centers.
Consequently, the decision-making concerning an operation of positioning raises enormous difficulties of management and very long time of research. Therefore, the development of a GIS then becomes a necessity.

Within this framework, and with the assistance of the Division of the By-pass Highway of Casablanca that we propose to design and implement a GIS prototype for the fulfillment of a highway's works and prepare a management system of the highway's inheritance.

For the decision makers:
- spatial data distributed and well structured in order to be able to extract some syntheses useful for the decision.

For the users:
- Data base management system for collection, storage, extraction, data query, analysis, presentation and drawing.

Objectives of the projected GIS
- set up a single reference frame concerning the geographical information of a highway
- provide a geographical support common to each entity of a highway
- provide visual aids on the highway's inheritance
- provide an access to the data of the common GIS
Objectives of highway data base

- facilitate the access and the use
- facilitate the update
- ensure a single occurrence of information
- propose coherent data
- allow a safe data use

Structure DB

Entities are classified by themes
- Road
- Cleansing,
- Earthworks,
- Structures,
- Roadway,
- general Work and inheritance.

MCD AGGAGEMENT

MCD TERRASSEMENTS

MCD OUVRAGES G ART

MCD CHAUSSEE
COMPONENTS OF HIGHWAY GIS PROTOTYPE

- A "highway Editor", it is a graphic interface of edition and configuration of a highway project
- An interface "digitalization of events"
- An interface "standard Tools of the gis" which constitutes a personalized toolbox

Module PROJECT

- Configured section
- configure a new section
- Interventions works
- Expropriations
- Journal of site (fig)
- save project
Module ROAD

Allows the management and the follow-up of work on the roadway such as:
- General information: type of roadway of each section and its features, or configure a new roadway
- Follow-up of execution: follow-up of the quantities of the layers of the roadway (GNT, GBB), and the follow-up of works of roadway (topographic, quantities... etc).
- Progress report:
  - validation of the layers of roadway (GNT, GBB, BB).
  - consult existing reports or add other validations. In this last case, the additions are dynamically reflected on the graphic.

Graphic advance:
- establish the synoptic of advance concerning the three layers (GNT, GBB, BB) of roadway. A dynamic theme is created and added to the view (fig)
- positioning specific constraints and networks: natural and artificial obstacles (line telephone, electrical, railways)

Exemple de synoptique graphique:
GNT, GBB, BB

Module EARTHWORK

- Informs about the inherent operations with the management of the highway earthworks.
- consult all information on volumes and costs of clearing and embankment material (fig)
- clearing and embankment design features: PK Departure, PK arrival, date and state of works, direction, code; volume

Suivi et consultation des remblais
Progress report: (fig)
- gives the progress reports of the embankments, clearing, as scouring (decapage), the purging and substitution, the contiguous embankments.
- consult, collect and update the data on the earthworks.
- graph of advance: (fig)
- can be modeled and posted automatically in the form of charts.

Etat d’avancement des terrassements

Exemple de graphe d’avancement

Module EARTHWORK

The most powerful module of this prototype GIS, treats
- spatial queries
- dynamic placement of events
- presents the results of the treatments.

Module DATA BASE

facilitates the interactive management of the spatial database
offers the possibilities of:
- consultation of the GIS data
- edition of structures, constraints and road work of earthwork and cleaning, general work and inheritance
- update and modification of the entities of a theme
- add, remove or refresh the fields of a theme
- consult and update rules of validation defined on entities and on attributes, the rules of connectivity
- Add data tables (Excel, DBASE, oracle) to the project

Module TREATMENT

spatial queries
- based on the spatial relations (intersection, union, inclusion in...) of the entities
- expropriation: determine the properties to be expropriated within a highway corridor, the figure shows an example
Creation of the progress reports:
- personalized reports, which can contain all information derived from the descriptive data tables of the entities.
Highway corridor

Dynamic placement of punctual or linear objects per PK:
- Creates a graphic theme from information gathered by Cartesian coordinates (x, y) stored in the database (table or text file), the theme will be added automatically to the view.

Adding CAD plans in 2 ways:
- As a drawing: viewed as conceived in the CAD software, preserving its characteristics: no analysis possible.
- As a layer: plan converted with GIS format, used as a theme and possible analysis.

Posting graphic symbols of the PK and PC:

Analysis of events:
- punctual analysis.
- linear-linear analysis.

Exemple de représentation graphique d'événements ponctuels représentant les accidents

Exemple de représentation graphique d'événements linéaires:

Quality of the roadway on different sections

Functions of the "highway Editor":
- Placement of the PK automatically on a portion of the selected road starting from the PK 0 of the road. The PK No, the origin, the scale factor.
- The user can define PKs on a new or extended road, starting from the sections where PKs are defined, PKs can be calculated for all the zones without PK No.
- Changing the order of the PKs or to change the order of the PKs and to traverse the road in the increasing or decreasing direction of the PKs or in the contrary direction.
- Change the type of the PK.

Application:

Phase II of the highway of the by-pass Casablanca:
- Length approximately 6 km.
- Connects the exchange of the RS114 at the origin of the highway CASA-EL Jadida.
- Composed of:
  - A section of highway (4.5km approximately).
  - 4 ways re-establishment
  - A junction (bifurcation)
Application to phase II of the highway of Casablanca

### Projet de la phase II

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<tr>
<th>CODE_SECTION</th>
<th>NOM_SECTION</th>
<th>TYPE_SECTION</th>
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<th>PK ARRIVE</th>
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### Extrait de la table de configuration des ouvrages d’art

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### Conclusion

- Prototype remains open to the development of other applications.
- Constitutes a first solution GIS for the phase exploitation of road and highway work.
- Tested successfully for the follow-up of a section of highway in the area of Casablanca.
- Constitutes a reliable base that allows indicators of the follow-up and measurement of the performances.

Thank you for your attention.