

Application of GIS in Administration of West-East Gas Pipeline Project

⁽¹⁾ Yuxiang Li ⁽²⁾ Yu Yueyang ⁽³⁾ Wang Hong ⁽⁴⁾ Wang Junfang
yuxiang@public3.bta.net.cn xq-yyy@hq.cnpc.com.cn hongwang@bj163.com wjf_gis@china.com

(1) (3)

Chinese Academy of Surveying & Mapping
16 Beitaping Road, Beijing 100039
People's Republic of China

(2)

West-East Natural Gas Transportation Project Management Organization
81A Heping Road Langfang Hebei 065000
People's Republic of China

(4)

The Central Institute Geotechnical Investigation MMI
No.13 Dongfeng Center Road, Baoding City Hebei
People's Republic of China

Abstract:

The West-East Natural Gas Transportation Pipeline Project ("West-East Gas Pipeline Project") is to transport natural gas from both Tarim gas fields and Changqing gas field in west China through a pipeline to Shanghai in east China. The total length of the pipeline is about four thousand kilometers, with the designed capacity of 12 billion cubic meters (BCM) annually. WEGPP, as a most important part of the Central Government's strategy in development of West China, has gone into the stage of implement.

Because the pipeline is divided into many sections and constructed by many companies, how to administrate design progress, flow of materials and construction progress, and how to supervise progress and quality of the project, a kind of integrated information management system should be adopted before starting to construct. Out of question, the information about the project management mostly is related to the pipeline spatial information. In another words taking advantage of GIS in administration of West-East Gas Pipeline Project is helpful to improve the level of project management.

In this paper, some technologies in achieving the WEGPP GIS are put forward.

1. Multi scale and multi projection of maps seamless displaying, roaming, and management. WEGPP GIS deals with multi scale spatial data sources from small scale 1:4,000,000, 1,000,000, to middle scale 1: 50,000 and large scale 1:500. Structure of the multi scale vector database organization is discussed.

2. Spatial database and relational attributes database complex management.

Also raster data, for example, DEM and pipeline attributes database are very important data sources in the WEGPP GIS. Methods in integrated management of raster database, vector database and relational database are brought out and discussed.

3. Visualizing the progress control, quality control and material flow management of project. Statistical analyzing and thematic mapping automatically are the basis of project management and progress optimization. Various analysis and thematic mapping ways are developed and their advantages and disadvantages are compared.

Introduction

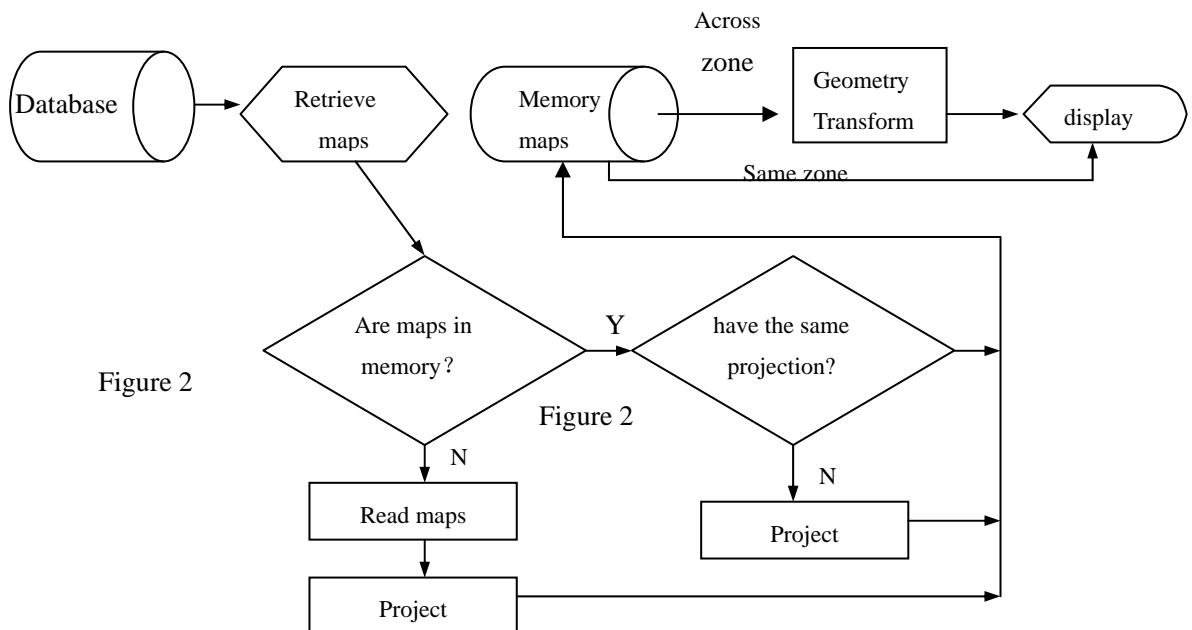
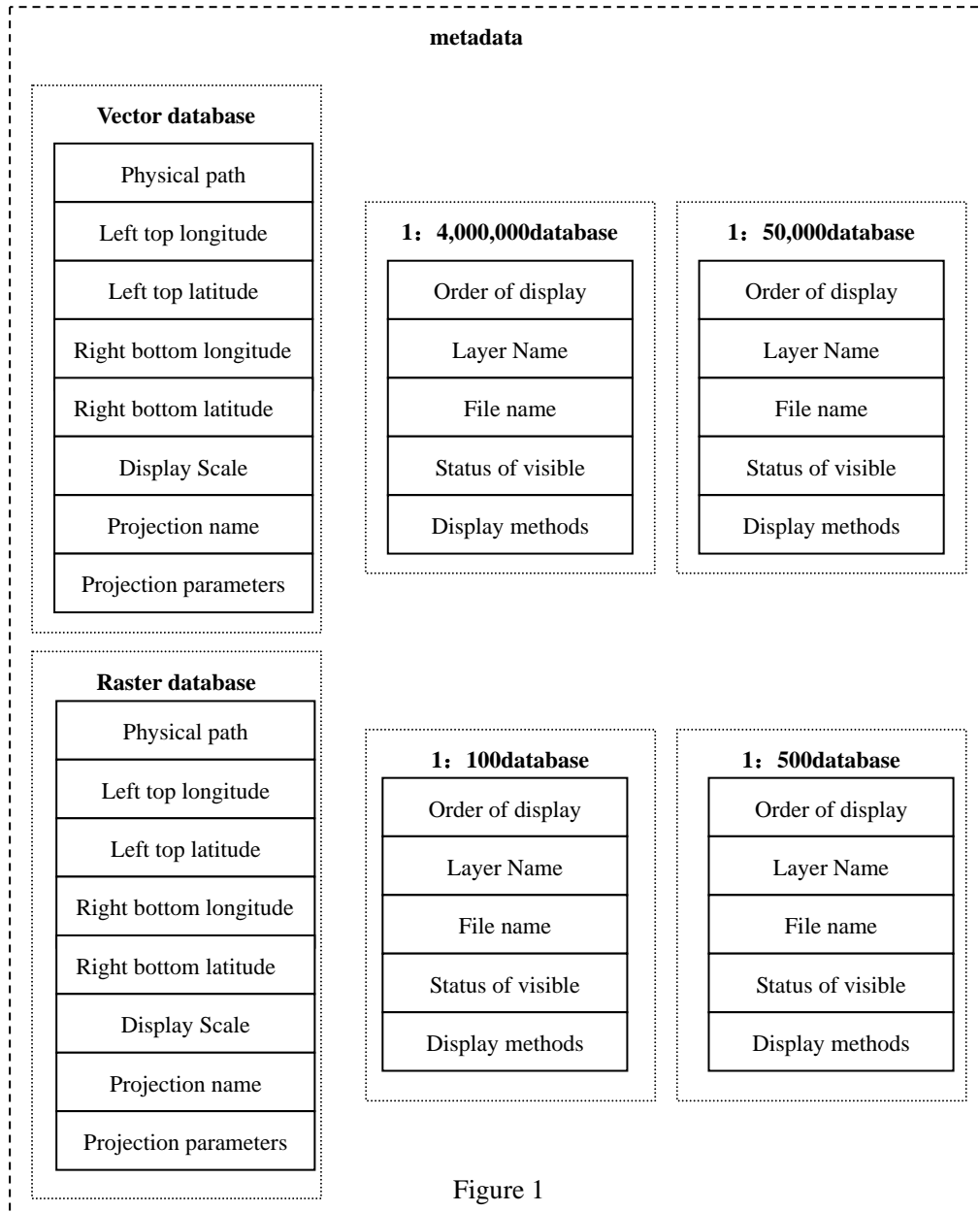
WEGPP is ready to start constructing, and the data about project management such as thousands of constructing maps is flood tide far and near. The information made from the data is valuable for making decision. The project information is coming from separate sources, huge amount and associated with space, especially dynamic and temporal. Therefore WEGPP management system is a kind of spatial and temporal information system, which has the functions including collecting, transferring, managing, manipulating and displaying spatial and associated information.

1. Multi scale and multi projection of maps seamless displaying, roaming, and management.

The pipeline starts from west Xinjiang Province and ends at east Shanghai city, spans 4000 kilometers. And the administration not only controls the general progress of the project, but also the plan of each project team. Therefore the basic database can't be a unique scale and a unique projection. In this management system there are one sheet of 1:4,000,000 map, 79 sheets of 1:1,000,000 maps, and more than 70 sheets of 1:50,000 maps.

The issue is how to manage, display, and roam these different scale maps. Our technique is making up a metadata. Figure 1 shows the structure of the metadata files.

The management system could automatically calculate which scale maps should be retrieved and displayed according to the displayed area. All these processes are achieved in Oracle database by SQL language. When displaying area which span two different projection zones, instead of doing projection we just shift and rotate needed maps to display the joint maps quickly. The raster data such as remote sensing image or 3D terrain are to be managed and organized in the same way. Figure 2 shows the flow of retrieving and displaying the maps.



3. Spatial database and relational attributes database complex management:

The WEGPP management system not only deal with topographic maps, remote sensing images and 3D terrain, but also the most important task is to administrate and control the local and the general project progress, such as the conditions of constructing team etc. In another words from attribute database or tables spatial information could be retrieved and vice versa.

The pipeline is the key both in spatial database and attribute database. The whole pipeline is separated into more than 30 segments. Each segment is also divided into many pegs. Each pegs is a straight line from one construction node to another and the from_ node and to_ node is coded and has a unique key number. Therefore whatever spatial or attribute data is under the control of relational database system. Figure 3 shows the data structure for pipeline spatial and attribute information.

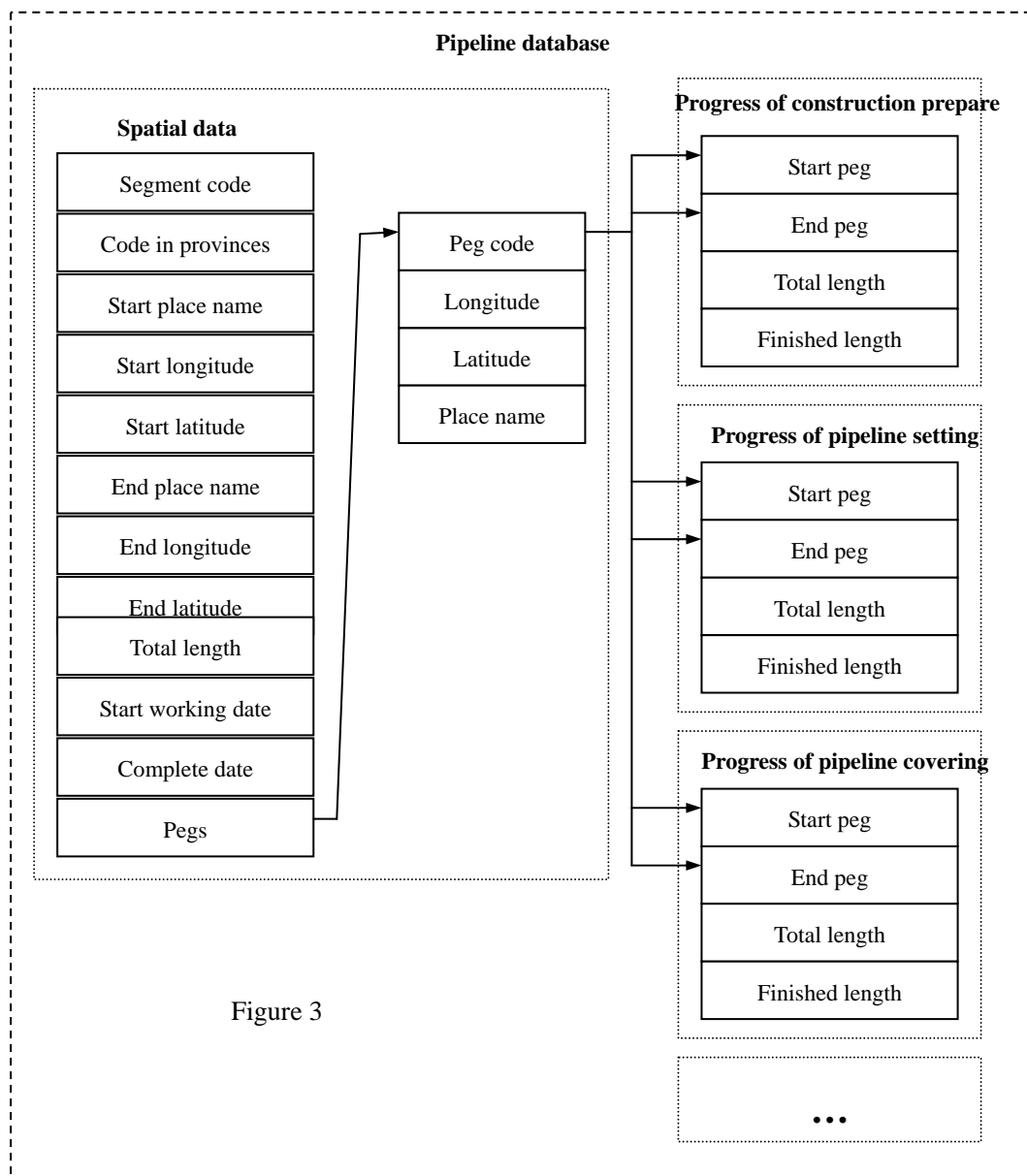


Figure 3

The spatial data for pipeline are stored in geographic coordinates, so it can be freely projected and displayed automatically at real time. The query flow (see figure 4) is reversing the display

flow showed in figure 2. When the mouse click down, the position is recorded and transformed to longitude and latitude coordinate , then query the pipeline spatial database and retrieve the nearest segment, and then by the key item peg code get all the related data, lastly visualize all the needed information by tables, diagrams etc.

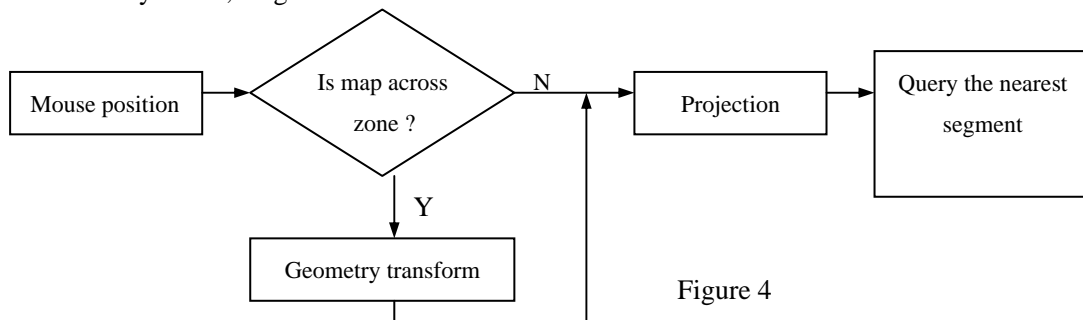


Figure 4

4. Visualizing the progress control, quality control and material flow management of project.

It is important how to visualize the information user needed however it is achieved by complex system.

In WEGPP management system, some visualization methods are designed to display the information users care about. One of them is moving line. Using 5 lines with different width and color to show the progress of design, lineation, excavation, jointing and filling from Liuyuan point to Wuwei point . See figure 5.

Another one is the pointed statistical diagram. Figure 6 is an example to show the progress of pipeline conditions including supplying, requirement, transportation etc.

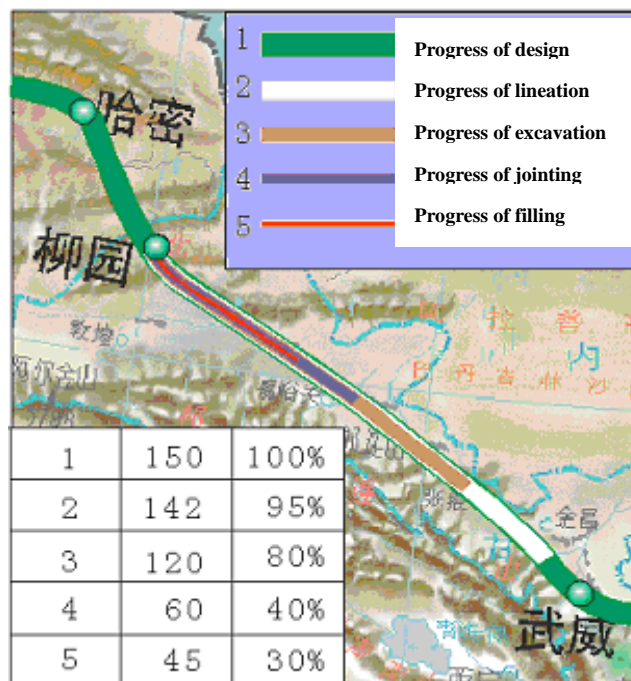


Figure 5

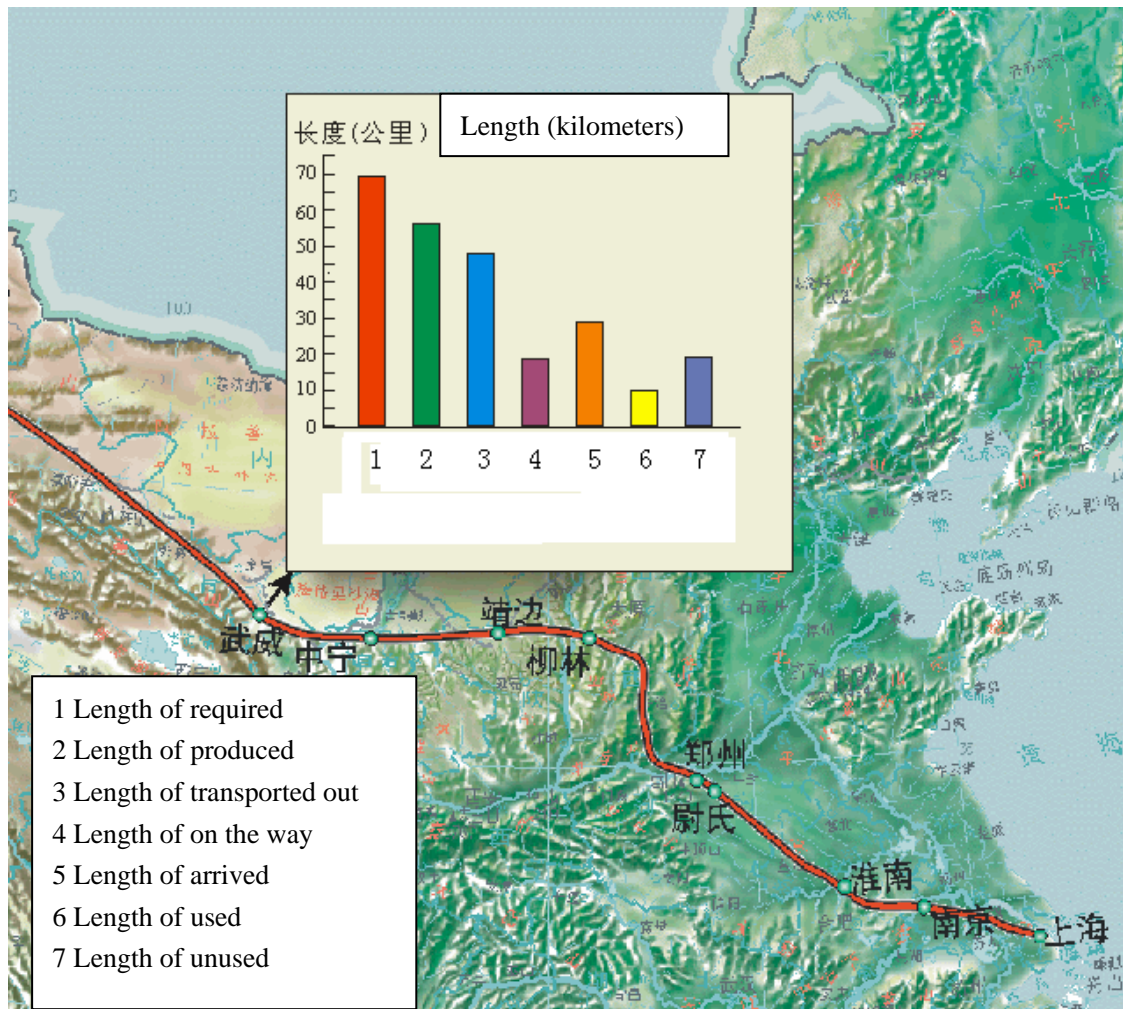


Figure 6

Conclusion

In this paper we put forward and discussed some issues in preparing and achieving WEGPP management system. The WEGPP is ready to start constructing and we should perfect the management system and contribute something to the west development.

Reference

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