ROAD DESIGN BY EVOLUTIONARY MODELLING OF ROUTES

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Abstract

Traditionally, roads were relatively narrow and could be easily adapted to the topography of the terrain, sometimes giving rise to paths of discussible safety. Nowadays, this picture has changed due to more *agressive* technics of road implementation and social and environmental, impacts taking a greater relevance on road design and implementation than before. Therefore road route design is a task that goes beyond technical specifications and economical considerations, and should include dimensions other than just those into its assessment. In the methodology developed and presented in this poster a multi-dimensional evaluation methodology - multi-criteria evaluation - was combined with the robustness of a search methodology - genetic algorithms - to generate alternative road routes that take into consideration a number of criteria referenced to the physical space where the road is to be placed and so this methodology is embedded into the GIS GRASS. This is illustrated with the design of a route section of a motorway in a Portuguese region.

1 GENETIC ALGORITHMS FOR MODELLING ROAD ROUTES

In this study a route was defined as the path that a linear structure or facility follows in the terrain. Linear structures comprise facilities such as roads, motorways, railways, pipelines, etc., each of these structures requiring specific technical parameters in what concerns the geometry of the path and having different effects on the territory. Hence, to model routes by means of GAs' data structures, each route is imagined as a sequence of (bit) tuples of the plan view's geometric elements (linear and curvilinear), each characterised for its parameters, as many times as the necessary to reach the length between the target points. The de-codification of the strings is made in a three-phase process. After the route's ending co-ordinates are computed, the geometric parameters are de-codified, their values and the coherence amongst them being checked against the feasible ranges of the technical criteria previously set. The route is then adjusted for the axe that links the target co-ordinates. Finally the route traversal cells are derived, with reference to the initial target co-ordinate. In this way the route is assessed for its technical characteristics, as well as for its *geo-referenced* characteristics. (See: Guimarães Pereira, A. (1998)).

2 MULTI-CRITERIA EVALUATION

Alternatives routes are compared in pairwise comparison fashion for each of the criteria with all alternatives in the GA population. The comparison consists in computing the difference between the intensity of preference on each criterion for each pair of alternatives.

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References

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