Road Alignment Optimization using Heuristic Algorithms

Earthwork is the major working task in road construction projects and characterized by large quantities of earth material which have to be excavated from cut area, transported and filled in fill area, possibly over a long distance. The earthwork areas can be illustrated in 2-d vertical alignment (see Figure 1), determined by the intersection of vertical road level and terrain level. For example, the yellow-marked regions in figure 1 denote cut areas, where the terrain level is above the road level.
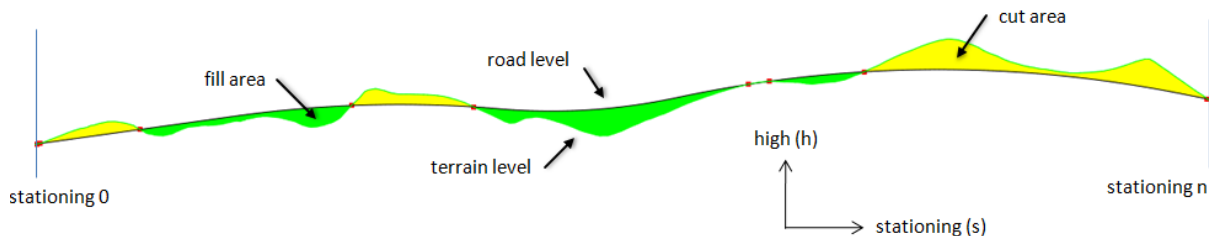

Figure 1: vertical alignment with cut and fill areas

So far, the optimization of earthwork processes focussed on minimizing earth transportation costs using mathematical optimization approaches, with fixed road design parameters. In this project, we focus on other optimization approaches which have been developed to select the optimal road design parameters, like road grades in road vertical alignment, in order to reduce the total earthwork quantities.

The objective of this project is the conception and implementation of a road alignment optimization tool using heuristic approaches like Genetic Algorithms.

The tasks of this project can be defined as follows:

1. Mathematical formulation of horizontal and vertical alignment design
2. Get familiar with Road Design System AutoCAD Civil3D 2010
3. Heuristic Optimization Algorithms
4. Conception and Implementation of the road alignment optimization toolkit

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