# THE ROLE AND BENEFITS OF VISUALIZATION IN 3-D STREET AND BRIDGE DESIGN

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*Abstract:* The role and benefits of visualization in street and bridge design is introduced and evaluated on account of real experiments in some Finnish design projects. New 3-D design methods and CAD tools offer total new possibilities for cooperative design as well as concurrent design. The features of MicroStation CAD and Tekla Structures CAD programs are described through practical design cases operated in Finland. First results of experimenting were outlined and discussed. The benefits occurred were estimated.

*Keywords:* Cooperative visualization, Concurrent design, Construction, street design, bridge design.

## 1 Introduction

Visualization is a new aid tool also for the design of different infrastructures. Traditionally the design drawings have not visualized the object of design. Different visualizations have typically been done in separate working phases – not as a part of normal design process. This paper describes new methods of integrated design having also visualization included in design process. Two application areas i.e. street and bridge design as well the main features of visualization methods are introduced.

## 2 Visualization methods and examples

### 2.1 Visualization in street design

One of the aims of the project ”Intelligent street” was to develop visualization methods for street design. The idea was to execute visualization in a concurrent street design process. Since today the different drawings produced as results of street design do not visualize the design objects. Through visualization it is possible to contour the final realization of the object on site environmental. In street construction it is also very important to produce easily understandable information for inhabitants and customers, what kind of structures will be constructed.

*Fig. 1. An example of visualization: road and tunnel area, Vuoli project, Helsinki. (MicroStation, Particle Trace rendering method, Finnmap Infra Ltd, Finland).*

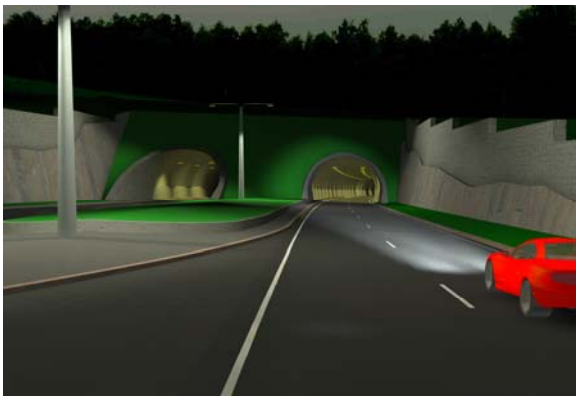

*Fig. 2. Visualized street design (MicroStation, Finnmap Infra Ltd, Finland).*

### 2.2 Visualization in bridge design

In the “Intelligent bridge” project MicroStation was used as a software

environment for the application development. New 3-D modeling methods were developed and tested. The determined new CAD tools were programmed by utilizing the newest 3-D modeling features of MicroStation. The most essential working applications are different extrusion tools, with which most of the different types of bridge structures can be modeled. Also visualization methods for bridge design needs were studied and developed by WSP Consulting KORTES Ltd.

The aim of visualization in the general phase of bridge design is to produce a conception how the bridge model will be fit to its planned location on site. Even a draft model will produce a better comprehension than traditional 2-D drawings. Thorough visualization the compatibility of spans and length of bridge can easily be verified.

*Fig. 3. Visualization in bridge design – general planning phase (Bridge Länsisatamankatu, Helsinki, WSP Consulting KORTES Ltd).*

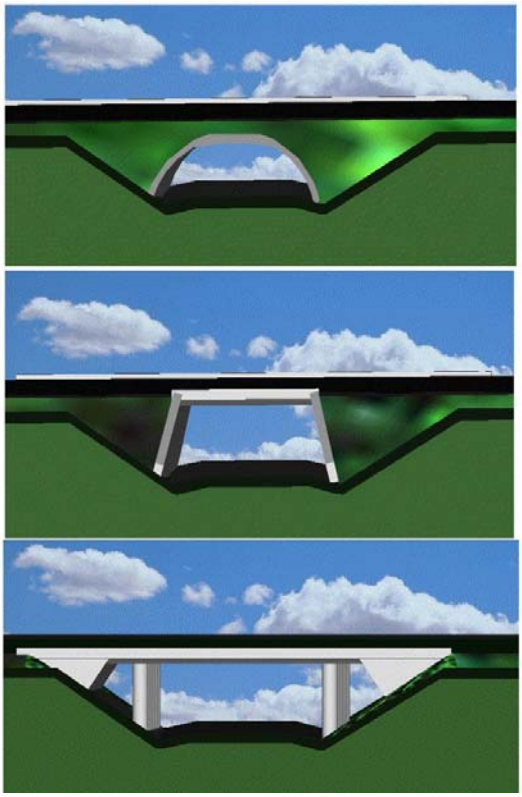

*Fig. 4. Comparison between three alternative bridge types – a real bridge design & construction project carried out in Oulu, Finland 2004. Visualization with MicroSation (WSP Consulting KORTES Ltd).*

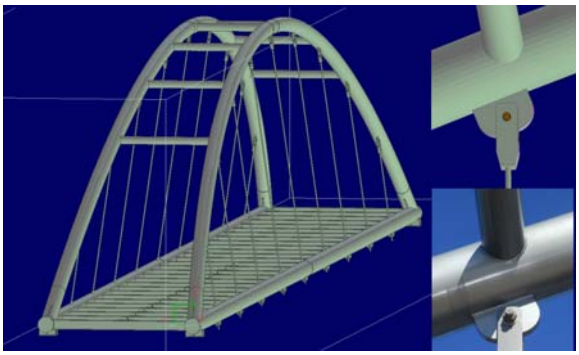

*Fig. 4. The remarkable role of visualization in detailed bridge design. The lower photo right is taken from the constructed structure, the upper one is visualized during design phase (WSP Consulting KORTES Ltd).*

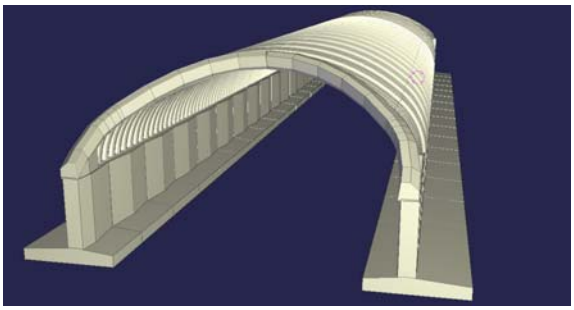

*Fig 5. A visualization of Joutsentie Brigde, Oulu. The model can be viewed and examined via internet (WSP Consulting KORTES Ltd.*

*Fig. 6. Visualized bridge design (Case Chenab Bridge, India, WSP Consulting KORTES Ltd).*

## 3 Conclusion

Visualization is a comprehensive aid tool for design of both streets and bridges. Best visualization facilitates and effectives the design processes. It is very essential that the process of visualization should be integrated into the design processes. The CAD tools and design methods should be developed to have a real integration with design process in deep. An idea is that visualizations will be created throughout the normal design process – not as results of separate visualization work.

According to the test results the new 3-D concept seems to be very efficient in the domain of concrete bridge engineering. Working in 3-D space was evaluated to decrease design errors. The labor productivity of design work was also evaluated to be improved. Still more important was proven to be the possibility to connect models directly to 3-D site measurements. This eliminates transfer errors due to human factors and format conversions

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