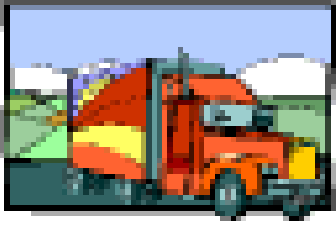


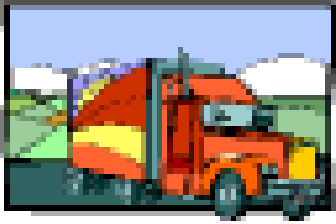
Using GIS Spatial Data to Develop Virtual Reality Transportation Applications

Kai Han, M.Sc.
Department of Civil Engineering
University of Manitoba
March 30, 2004



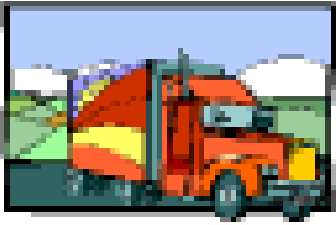
OUTLINE

- **Introduction**
 - **Visualization for Transportation**
 - **Objectives**
- **Data Sources**
- **VR modeling**
- **Demo**



VISUALIZATION

- **Visualization**
- **Visual Component of Virtual Reality (VR)**
 - **3D Modeling**
 - **View Point Control**
 - **Animation**



VISUALIZATION FOR TRANSPORTATION

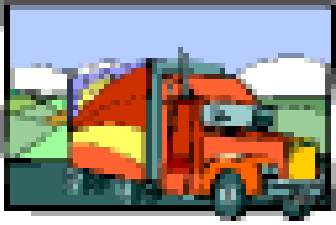
- Transportation Research Board for Visualization
- www.trbvis.org

The screenshot shows a Microsoft Internet Explorer browser window displaying the website for the Transportation Research Board for Visualization. The browser's address bar shows the URL <http://www.trbvis.org/>. The website features a navigation menu with links for Home, Case Studies, News, Events, About Us, Contact Us, Resources, and a Community Chat/Forum. The main content area includes a search bar, a "Special Welcome Message" link, and a section titled "Visualization in Transportation Task Force" with the tagline "Advancing the research and application of visualization technologies in transportation". Below this is a "Featured Case Study" section with an image of a road and a text box describing a document providing guidance for transportation system engineers and project managers on visualization applications.



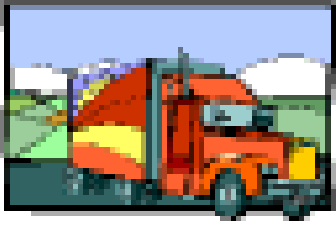
RESEARCH OBJECTIVES

- **Feasibility Study**
 - **Low-cost**
 - **Easy-to-implement**
 - **Flexible**



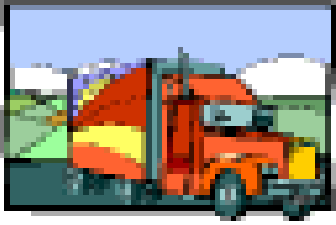
DATA SOURCES

- **Geo-referenced**
- **GIS & CAD Data Sets**
 - **Centerline, Horizontal & Vertical Geometry**
 - **Aerial photos**
 - **Digital Elevation Models**
- **Highway Inventory**



GIS/CAD SOFTWARE

- **ARC/INFO**
- **ArcView**
- **GeoMedia Pro**
- **TransCAD/Maptitude**
- **AutoCAD/Autodesk Map**



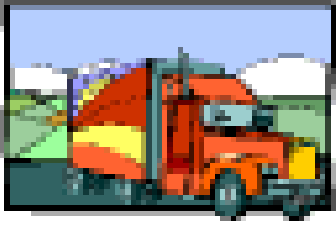
VR MODELING LANGUAGE

- **VRML (Virtual Reality Modeling Language)**
 - **Standard**
 - **Free**
 - **Open Source**
 - **Relatively Easy to Learn**
- **Free Viewer: CosmoPlayer add-on to Internet Explorer**



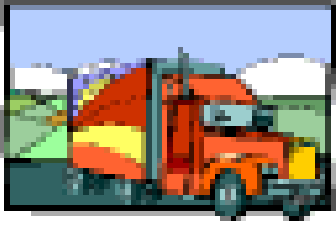
MODELING APPROACH

- **Focus on the Road**
- **Fancy vs. Accurate**
- **Road User's Perspective**
- **Modular & Incremental**



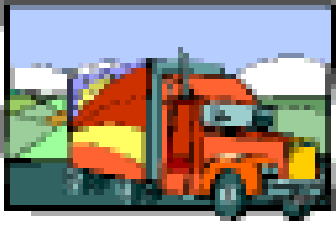
TYPICAL VISUALIZATION FLOW

- **Start with CAD**
 - **3D add-on package**
- **3D Modeling & Animation**
- **Photo-editing Software**
- **Simulation Software**



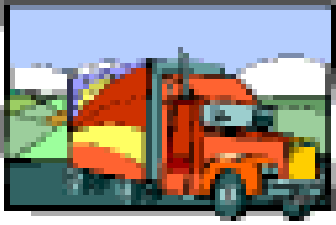
MODELING THE ROAD

- **3D Surface Construction**
- **Piece-meal Method**
- **Apply Typical Cross-section**
- **Design Considerations**
 - **Unit/Scale**
 - **Centerline, Elevation, Linear Referencing, Offsets**



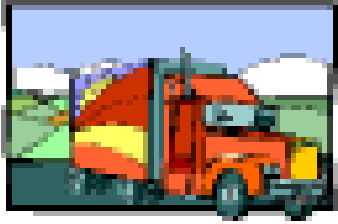
VEHICLES

- **Sharing Models**
- **Scaling**
- **Animation, Speed Control**
- **Driver's Position & Point of View**



TECHNICAL ISSUES

- **UTM Shift**
- **Road Following**
- **Fast Forward Animation**
- **Other Traffic**
- **Texture Mapping**
- **Terrain Modeling**



DEMO

➤ 48 Kilometers Northern Hydro Project Access



➤ Gravel, 100 km/h Design Speed