# SPLINE USE IN VIRTUAL ENVIRONMENTS: MODELING INTERCONNECTED HIGHWAY SYSTEMS

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## Abstract

An important aspect of virtual environments is the design of roads. Traditional methods are laborious. They require a designer to patch together each piece of the road, an approach likened to cutting various pieces of construction paper and laying them down to form the desired path. This thesis presents an improved method built upon the usage of splines. Splines are continuous curves defined by a series of control points. Using this technique, each road is represented as a spline containing a set of attributes describing its appearance (e.g. number of lanes, lane markings, etc). These descriptions allow the software to dynamically generate road geometry and also create interchanges at any point where two splines intersect. Such a method facilitates design revisions, since a change to a road only requires the user to drag and drop a control point to a new spot. Furthermore, each control point has an associated height value, which is used to create a height map resulting in smooth terrain that lies underneath the road system. Because this system is aware of road connectivity, it is easy to apply path-finding algorithms that allow for intelligent autonomous traffic. Such intelligent vehicles are given starting and ending positions, and then will navigate on their own. The sum total of these spline based and AI techniques is a robust and easy to design virtual driving environment.

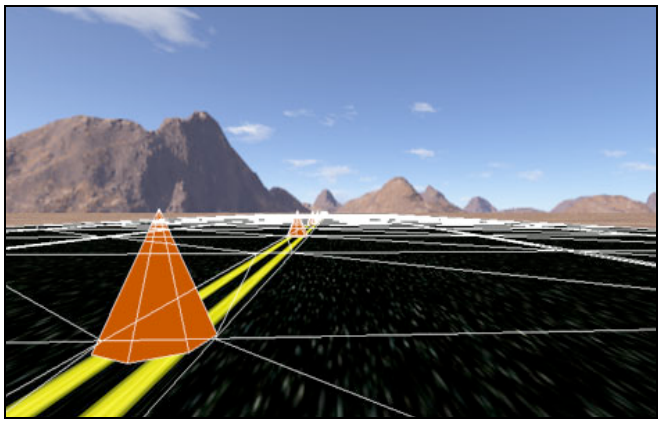

***Figure 1.*** *A spline based road with a wireframe overlay, the orange cones represent control points*