

DENALI NATIONAL PARK AND PRESERVE'S TRANSPORTATION SYSTEM: HOW A DISCRETE EVENT SIMULATION MODEL CAN ENLIGHTEN COMPLEXITY

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ABSTRACT

Denali National Park and Preserve's (DNPP) Vehicle Management Plan and Environmental Impact Statement (VMP) limits road traffic to 160 vehicles permits per day. This is a tough constraint considering DNPP has 600,000 visitors per year and the park road is open about 110 days. DNPP is using analytics to study its transportation system to ensure visitor experiences are of high quality and park resources, including the historic and primitive character of the park road, remain protected under the new permit regulations. A discrete event simulation (DES) model was developed in ExtendSim to study all park traffic. The DES model arranges the complex behavior of DNPP's road user groups into a defined event sequence using both empirical data and institutional knowledge. The DES model tests traffic volume and schedule scenarios to maximize the visitor experience while still meeting all VMP compliance standards. The DES model is used to improve DNPP's ability to make science-based management decisions about its transportation system.

INTRODUCTION

Denali National Park and Preserve's (DNPP) lies in the heart of Alaska. DNPP is centered on the highest mountain range in North America, the Denali mountains. DNPP consists of six million acres bisected by a 91-mile park road. DNPP has almost 600,000 visitors per year while the park road is open only for about 110 days per year (mid May through mid September).

The DNPP General Management Plan 1986 (GMP) permits up to 10,512 vehicles to enter the park between Memorial and Labor Day. Beginning in 2016, a directive within the Final Vehicle Management Plan and Environmental Impact Statement 2012 (VMP) replaces the GMP permit system with up to 160 vehicles permits per day.

The objective of the Discrete Event Simulation model is to proactively test proposed or future vehicle schedules to maximize access (daily number of vehicles) while ensuring that the Vehicle Management Plan Indicators do not exceed their standards.

METHODS

The DES model begins with some traffic initiating at the Wilderness Access Center (WAC) however most traffic is initiated at the Savage Check Station (mile 15) where the standards and metrics begin to apply. The model ends at the Old Park Boundary (mile 87.8). The park's transit bus service is the park's principal road user; however, all traffic from all vehicle types between these two points are modeled. This includes transit buses, tour buses, lodge buses, and non-bus vehicles such as tek campers, government, construction, employee access, right of way access, wildlife techs, and ranger vehicles just to name a few.

The DES model includes scheduled transit stops at rest stops and through viewscapes as well as random stops throughout the park road. At each potential stop, vehicles had the option of continuing to the next potential stop, taking a break (with a random or scheduled duration), or turn around. This logic was set up by vehicle type and direction of travel. This was implemented using a fairly detailed internal model database.



Figure 1. DNPP Road Map

In addition to scheduled stops, the model also includes random stops throughout the park road. The random stops allow for the wildlife sightings. The wildlife events included bears, wolves, caribou, moose, sheep and others. The wildlife activity depended upon time of day and the wildlife viewing subzone. The vehicle behavior at the wildlife events depended upon the vehicle type and detection of travel. For example, the first caribou of the day you saw going into the park might have been interesting to stop for; however, when you are exiting the park at the end of a long tour day the 10th caribou sighting might not be interesting enough to stop for. Again, the vehicle behavior for the random stops was also implanted using an internal model database.

RESULTS AND KEY STANDARDS

At both random and scheduled stops, metrics are calculated. The metrics include the maximum number of vehicles and buses at each stop. The metrics also included the percent of time the maximum exceeded the standard and the hour of day the standards were exceeded. The DES model also analyzes five sheep gap locations for specific hourly gaps in traffic (so the sheep can cross the road). In all, 28 VMP metrics relating to four tier-one indicators are analyzed to precise standards. These metrics are used as the key performance measures in the model to measure the value of a tested schedule. This allows DNPP to make better informed decisions on traffic policy and tour schedules.