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Denali National Park and Preserve

Standard Operating Procedure (SOP) 4: Data analysis methods version 1.0

Vehicle Management Plan Monitoring Protocol *Denali National Park and Preserve*

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The main narrative for the Protocol for Monitoring related to the Vehicle Management Plan is available from the NPS Integrated Resource Management Applications (IRMA) Data Store: (<https://irma.nps.gov/DataStore/Reference/Profile/2258365>).

SOP 4 – Data analysis methods

Version 1.0 (December 2018)

Revision History Log:

Previous Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
Add rows as needed for each change or set of changes associated with each version.					

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SOP 4.0 – Introduction

SOP 4 outlines the procedures used by program staff to analyze the National Park Service Observation (NPSO), Ride Observer and Record (ROAR), traffic counter, and concessionaire data collected to evaluate the 1- and 5-year standards established in the Vehicle Management Plan (VMP). SOP 1 describes our datasets.

SOP 4.1 – Data Analysis

SOP 4.1.1 – Wildlife data

Wildlife data are summarized in Excel (Microsoft, Redmond, WA, USA). The basic VMP standard, which is the proportion of observed instances traffic volumes are below thresholds defined in the VMP for each Wildlife Viewing Subzone (WVS) compared to the total observations for that WVS, is calculated as:

$$\frac{\text{number of wildlife stops with } < \text{threshold number of vehicles}}{\text{total wildlife stops}}.$$

We divide the observed number of wildlife stops by WVS lengths to report density of wildlife stops:

$$\frac{\text{number of wildlife stops within a Subzone}}{\text{WVS length (miles)}}.$$

Often, two ROAR observers are in the field on the same day and overlapping time. To reduce pseudo-replication, same-day observations of: the same species occurring within a three minute window and less than a half mile apart and collected by different observers are considered duplicate observations. Only one of these data points is included in analysis. We use data quality (e.g. completeness) to determine which point is included. When data quality is equal the record considered duplicate is chosen at random and discounted.

SOP 4.1.2 – Rest stop data

Rest stop data are summarized in Excel by site and vehicle category. The basic VMP standard requires analysis of both total vehicle and total bus maximums. These are completed using Excel: = MAX(*cell range*), where the cell range is the summation columns of total vehicles and total buses of an individual observation. Additional analyses are conducted to provide better context including averages and standard deviations.

To respond better to management issues, we also analyze rest stop data by day-of-week, week-of-year, hour block, and subseason to examine temporal trends and patterns at each site. Temporal analyses are examined on a per-observation basis using the calculation:

$$\frac{\text{number of vehicle observations}}{\text{total number of observation periods}}.$$

Rest stop data are not continuous counts but maximums within 2-minute intervals. Thus, temporal analyses only provide a relative sense of traffic pattern. Relative traffic at a rest stop is calculated by:

$$\frac{\text{number of vehicles recorded}}{\text{total number of observations}}$$

SOP 4.1.3 – Viewscape data

Viewscape data are summarized in Excel by site. Zero values are included in viewscape analyses because visitors may see no vehicles in the landscape. Calculations for the basic VMP standard, which is the proportion of observed time traffic volumes meet the standard defined in the VMP for a given WVS, is calculated as:

$$\frac{\text{total observed time with fewer than } (>) \text{ threshold number of vehicles}}{\text{total observed time}}.$$

To respond better to management issues, we also analyze viewscape data by day-of-week, week-of-year, hour block, and subseason to analyze temporal trends and patterns at each site. Temporal analyses are examined on a per-observation basis. Viewscape data are not continuous counts but maximums within 2-minute intervals. Thus, temporal analyses only provide a relative sense of traffic pattern. Temporal analysis of viewscape data are calculated in two ways that reveal different results:

1. (for a time period: $\frac{\text{number of vehicles recorded}}{\text{number of samples}}$) i.e. average number of vehicles recorded by time period.
2. (for a time period: $\frac{\text{maximum vehicles of observation}}{\text{number of observations for the time period}}$) i.e. average maximum value recorded by time period.

SOP 4.1.4 – Sheep gap data

For each sheep gap location, the number of hours monitored that included a minimum of one 10-minute break in traffic was tallied in Excel. The basic VMP standard, which is the proportion of observed hour blocks that traffic volumes achieved a minimum of a 10-minute break in traffic, is calculated as:

$$\frac{\text{number of hours achieving a 10-minute gap in traffic}}{\text{total number of hours observed}}.$$

To respond better to management issues, we also analyze sheep gap data by day-of-week, week-of-year, hour block, and subseason to find temporal trends and patterns at each site. Temporal analyses are examined using contingency tables, where the rejection of the null hypothesis (H_0) indicates a temporal pattern other than random between maintenance of 10-minute gaps and the period examined.

SOP 4.1.5 – Hiker wait time data

Hiker wait time standards are calculated from EVC dispatch, VTS manifests, and ROAR observations. ROAR data are duplicative of VTS manifest data but are used as a spot check of accuracy.

Dispatchers at the EVC record passenger wait times leaving the EVC. VTS bus drivers pick up hikers at any point along the road beyond mile 17 and record their location and hiker-reported wait time (< 30 min, >30 and < 60 min, >60 and < 90 min, or ≥ 90 min) along 12 road segments (e.g. Teklanika rest stop to Tattler Creek) and two nodes (Toklat and EVC). ROAR observers recorded hiker wait time while traveling the park road on VTS buses. The basic VMP standard for hiker wait time, which is the calculation of the proportion of number of observed individuals in a wait time category compared to the all individuals, is calculated as:

$$\frac{\text{\# of individuals in wait time category (i.e. < 30 minutes)}}{\text{total number of individuals observed}}.$$

Beginning in 2015, ROAR observers recorded the instances when a bus was full and unable to pick up waiting hikers. VTS drivers also record these data.

SOP 4.1.6 – Nighttime traffic

Six International Road Dynamics Inc. Traffic Recording System (TRS; Saskatoon, Canada) 8-Loop inductive loop traffic counter detect signals of magnetic interference from passing vehicles and record count and headway (direction of travel). Westbound and eastbound traffic is recorded in 10-minute bins; the Grassy counter records vehicle passes in 1-minute bins. The data collection period for each site is dictated by the road opening schedule. The basic VMP standard, which is the proportion of nights when traffic rates at each site meet the nighttime traffic standards, is calculated as:

$$\frac{\text{nights of } < 3 \text{ vehicle passes per hour}}{\text{total number of nights sampled}}$$

$$\text{and } \frac{\text{nights with zero hours with } > 6 \text{ vehicle passes}}{\text{total number of nights sampled}}.$$

We conduct additional analyses to provide more information and better understanding how to address management issues. All data are considered to analyze traffic volume and averages. Only periods of collection when all counters are functioning are considered when examining park-wide trends and patterns. The VMP considers this indicator only on a pass/fail basis along the whole length of road (i.e. not on a per collection site basis – e.g. Toklat vs. Sable). However, we assert that failures at one location do not convict other locations to failure if the offending traffic volume does not propagate to other locations. The spatial context of nighttime traffic is important because sound disturbance, a primary concern of nighttime traffic, is inextricable to its location.

SOP 4.1.7 – Large Vehicle traffic

Large vehicle traffic is defined by weight rather than dimension, requiring a scale system to evaluate this standard. This is a practical challenge for a remote gravel road underlain with discontinuous permafrost and has not been fully implemented.

SOP 4.1.8 – Five-year data

Wildlife stops, viewscales, sheep gaps, and hiker wait time have 5-year standards in addition to annual standards. The 5-yr VMP standards are calculated using weighted averages to account for sample size variation between monitoring years:

$$\sum_{i=x-5}^5 X_i = \left(\frac{\text{sample size of individual year}}{\text{total sample size of all years}} \right) (\text{proportion of time an individual year met standard}),$$

Where: x is the current year.

SOP 4.1.9 – Wildlife Sighting Analysis

ROAR wildlife stop and wildlife “nostop” data are used to estimate the likelihood of observing wildlife along the park road.

Process in RStudio:

1. From the previous year’s directory, copy the previous year’s processing file (...R_processing_script_YYYY.r) into the current year’s directory and rename for the current year
2. Open R Studio > Open file > R_processing_script_YYYY.r (from the previous step)
3. In line 12 of the code:
 - Set the working directory as
T:/ResMgmt/Road_Ecology/Data/Wildlife/WildlifeObs/Processing/YYYYROAR/
(note that the backward slashes have changed to forward slashes)
4. Click Source – upper right/middle – to start processing the data
 - The script will ask for information
 - Enter the year of the data (i.e. YYYY)
 - Select the files (created in SOP 2) :
 1. ...ROARYYYY_AllfilesforR.csv
 2. ...TripsYYYY.csv
 - You may have to close the RStudio window to get to the screen to select the .csv files.
5. Check the working directory for the output files. Spot-check for errors.

SOP 4.1.10 – Capacity Limits

The Savage Check Station (SCS) database is queried to determine compliance with Code of Federal Regulations (CFR) 10,512 seasonal limits and VMP daily limits. CFR 10,512 includes all traffic traveling beyond the SCS except in-service emergency vehicles, the Denali Natural History Tour (DNHT), and NPS contractor vehicles during the regulatory season (NPS 1986). The VMP daily limit includes all traffic travelling beyond the SCS except in-service emergency vehicles during the regulatory season (NPS 2012).

Literature Cited

National Park Service (NPS). 1986. General management plan, Denali National Park and Preserve. National Park Service, Denali National Park, Alaska.

National Park Service (NPS). 2012. Denali Park Road final vehicle management plan and environmental impact statement. Denali National Park and Preserve. National Park Service, Denali National Park, Alaska.