Roadway Capacity Adjustments

## Introduction

The goal of this document is to provide an overview of the roadway capacity adjustment function. The purpose of this function is to provide a framework that allows the user to adjust capacity of roadway facilities based on the market penetration of autonomous vehicles (AVS) and the percentage of the roadway facility that provides connectivity between vehicles. This function uses two different user input tables and tow look up tables to determine the appropriate capacity adjustment factor (CAF) to apply to each facility type.

* AV market penetration rates by level of automation
* Roadway system inputs that provide details on the base capacity and connectivity for each facility type
* Vehicle dynamics look-up table
* Capacity adjustment factor look-up table

The vehicle dynamics look-up table contains details related to dynamics of how AVs behave on a specific facility type. These behaviors are focused on the platoon capabilities of connected and autonomous vehicles (CAVs) and include the intervehicle gap (space between each AVs), maximum platoon size, and CAV interplatoon gap (space between each platoon). The capacity adjustment factor look-up table contains appropriate CAFs to use of each combination of facility type, vehicle dynamics, CAV percentage, and base roadway capacity. The use of these two look-up tables will allow users to add in additional CAFs as more empirical or micro-simulation studies are conducted to better understand the impacts of AV on roadway capacity.

## Example

The following code snippet provides an example of how to use the roadway capacity adjustment function. The relative paths to the required input files are all contained in a list that is passed to the function. The table below provides a summary of the results from the example.

source("scripts/CalculateRoadwayCapacity.R")  
  
# List to specifiy the input files  
CalculateRoadwayCapacitySpecification <- list(  
 AVMarketPenetration = list(file="data/scenario\_a/market\_penetration.csv"  
 , description="A file that summarizes the percentage of AV market penetration by level of automation (values should total to 100)"  
 , column\_names = c("av\_level", "market\_penetration")  
 , data\_types = c("character", "numeric")  
 , column\_description =c("Level of Automation", "Market Penetration Percentage"))  
 , RoadwaySystem = list(file="data/scenario\_a/RoadwaySystem\_Input.csv"  
 , description="A file that provides details on the specific roadway segement "  
 , column\_names = c("facility", "base\_capacity", "connectivity\_percentage", "percent\_av\_allowed")  
 , data\_types = c("character", "numeric", "numeric", "numeric")  
 , column\_description =c("Facility Type", "Base Capacity", "Connectivity Percentage", "AV Allowed"))  
 , VehicleDynamics = list(file="data/lookup\_tables/vehicle\_dynamics\_table.csv"  
 , description="A look table the summarizes the vehicle dynamics used in the scenario"  
 , column\_names = c("facility", "intervehicle\_gap", "max\_platoon\_size", "cav\_interplatoon\_gap")  
 , data\_types = c("character", "numeric", "numeric", "numeric")  
 , column\_description =c("Facility Type","Intervehicle Gap","Max Platoon","CAV Interplatoon Gap"))  
 , CAFLookup = list(file="data/lookup\_tables/lookup\_table.csv"  
 , description="The main lookup table used by the tool to determine which CAF to apply to the base capacity value."  
 , column\_names = c("cav\_percentage", "facility", "intervehicle\_gap", "max\_platoon\_size", "cav\_interplatoon\_gap", "base\_capacity", "caf")  
 , data\_types = c("character", "numeric", "numeric", "numeric")  
 , column\_description =c("CAV Percentage", "Facility Type", "Intervehicle Gap", "Max Platoon Size", "CAV Interplatoon Gap", "Base Capacity", "CAF"))  
 , output = list(file="data/output/scenario\_a.csv"  
 , description = "Scenario Specific Output File That will Be Generated with the Tool is Run"  
 , column\_names = c("facility","base\_capacity","cav\_percentage","caf","adjusted\_capacity")  
 , data\_types = c("character", "numeric", "numeric", "numeric", "numeric")  
 , column\_description = c("Facility Type", "Base Capacity", "CAV Percentage", "CAF", "Adjusted Capacity"))  
 )  
  
  
# Run the function to calculate the adjusted Roadway Capacity  
df <- CalculateRoadwayCapacity(CalculateRoadwayCapacitySpecification)  
  
# Print the Results of the Function in a Formated Table  
kable(df, format.args = list(big.mark=",")  
 , col.names = c("Facility Type", "Base Capacity", "% CAV", "CAF", "Adjusted Capacity")  
 , align = c('l', 'c', 'c','c', 'c'))

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Facility Type | Base Capacity | % CAV | CAF | Adjusted Capacity |
| Freeway | 2,200 | 30 | 1.056667 | 2,324.667 |
| Merge | 1,800 | 30 | 1.050000 | 1,890.000 |
| Diverge | 1,900 | 30 | 1.160000 | 2,204.000 |