

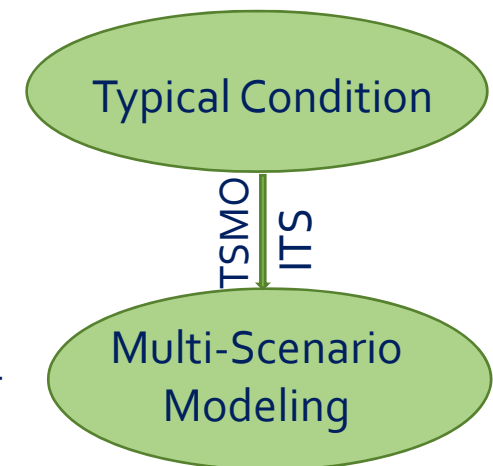
# Pattern Recognition Using Clustering Analysis to Support Freeway Management, Operations, and Modeling.

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## Background

- The assessment of transportation systems including management and operation strategies are currently limited to one scenario.
- With the advancements of TSMO programs and the associated ITS technology deployments, the FHWA realizes the need for multi-scenario modeling by updating their guidance for utilizing AMS to include clustering analysis.



## What are the Available Techniques ??



## Agencies have limited information about:

- Appropriate Clustering Method(s)
- Associated Parameters
- Optimal number of Clusters
- Representative scenarios

# Objectives

- ❖ Investigate and demonstrate the use of a number of existing clustering methods for traffic pattern identifications.
- ❖ Support transportation agencies in identifying operational scenarios.

# Data and Variables Used

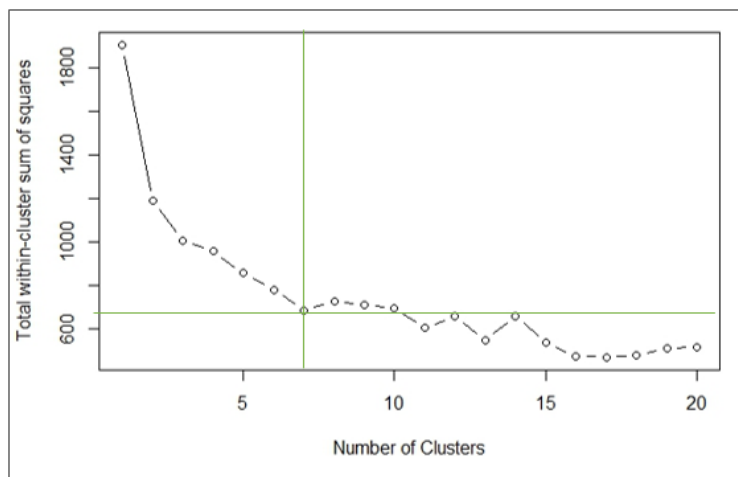


- ❑ **Freeway:** I-95, SB, AM Peak Period
- ❑ **Location:** Fort Lauderdale
- ❑ **Horizon:** 1/1/2017-12/31/2017 (excluding weekends and holidays)
- ❑ **Resolution:** 15 mins
- ❑ **Continuous Variables: Traffic Data**
  - i. Count Volume,
  - ii. Speed,
  - iii. Occupancy
- ❑ **Categorical Variables:**
  - i. Travel Lane Blockage,
  - ii. Incident Severity,
  - iii. Precipitation

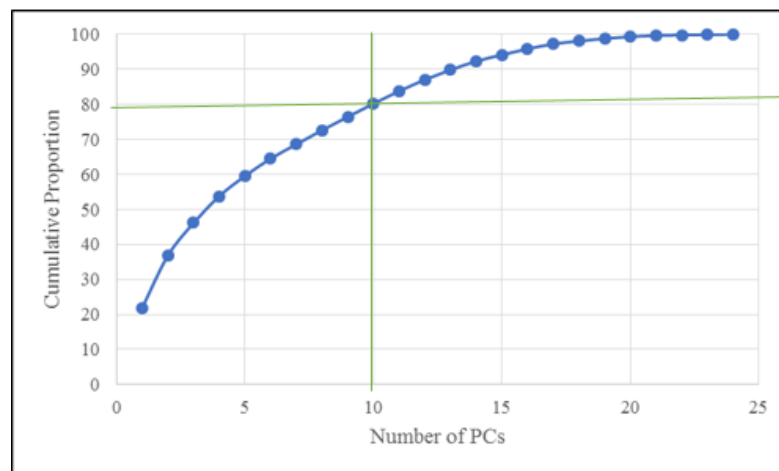
# Clustering Methods

K-prototype, K-medoids, Four variations of Hierarchical Clustering, K-means with PCs

## Number of Clusters and PCs selection

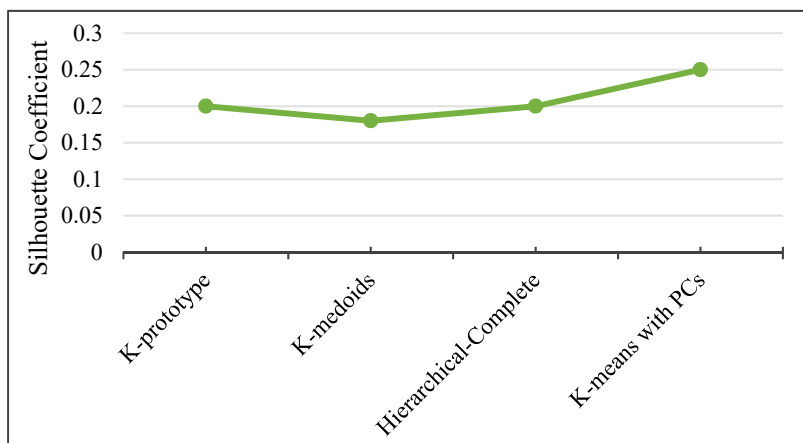


Optimal number of Cluster

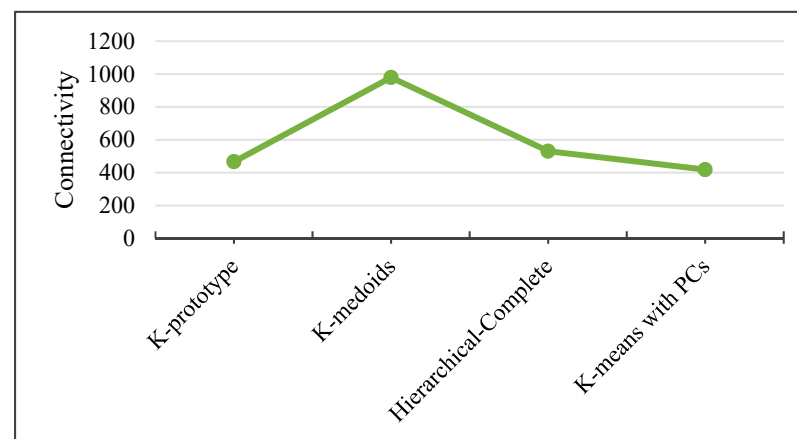


Optimal number of PCs

## Internal Performance Measures

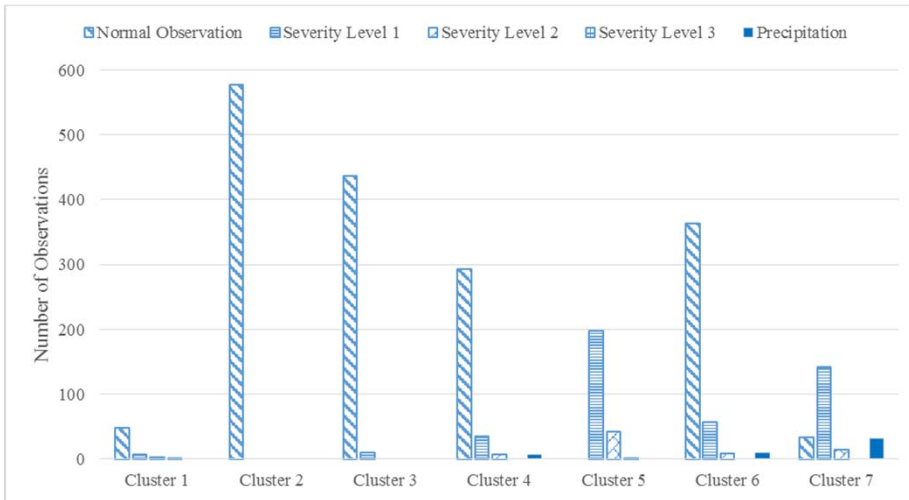


Silhouette Coefficient

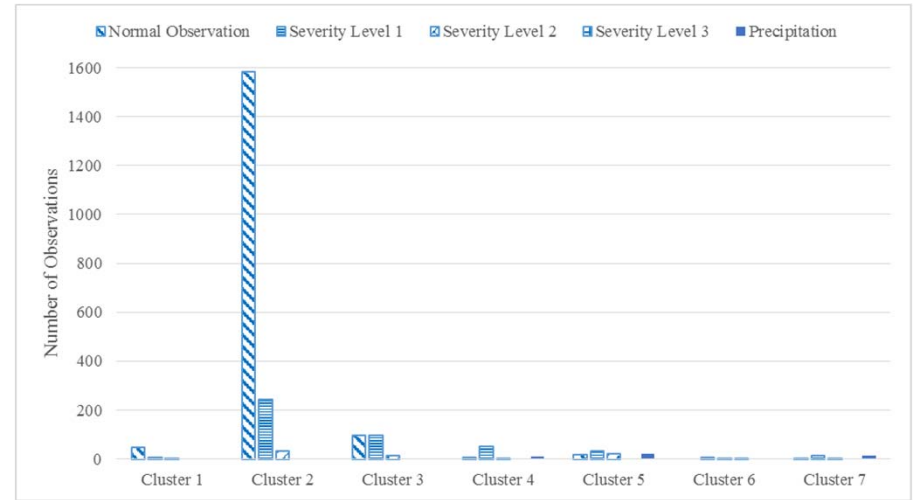


Connectivity

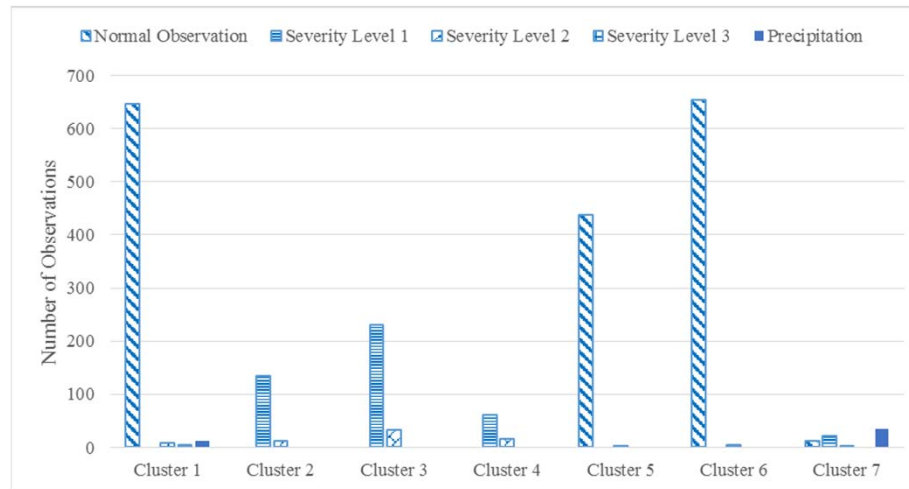
# External Performance Measures



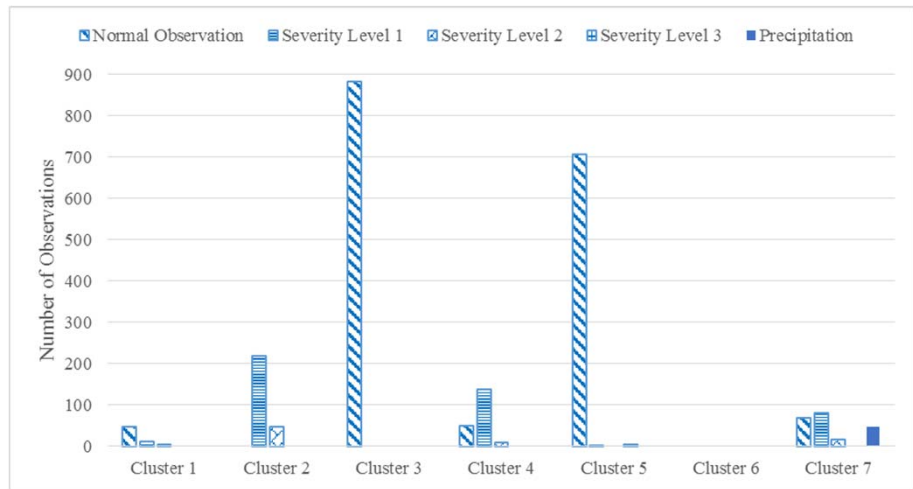
K-medoids



Hierarchical-Complete

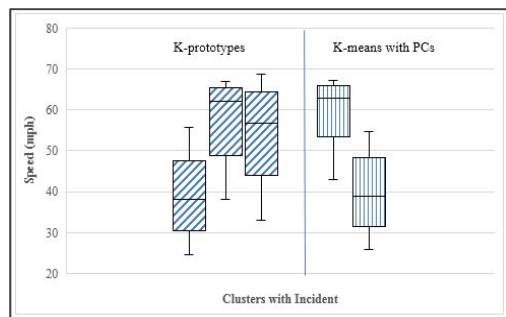
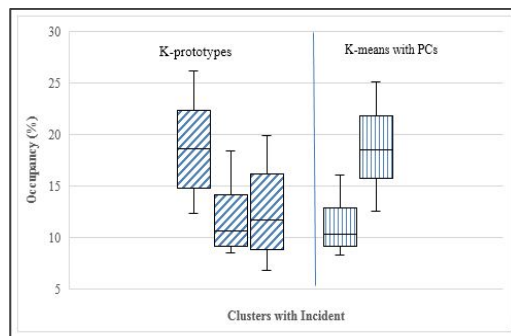


K-prototype



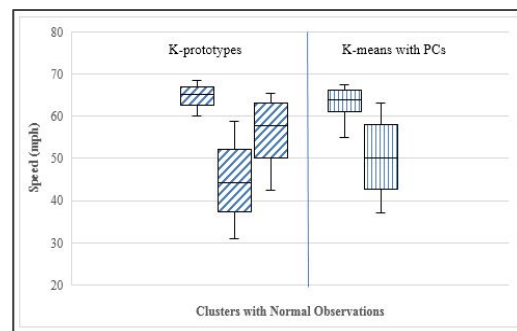
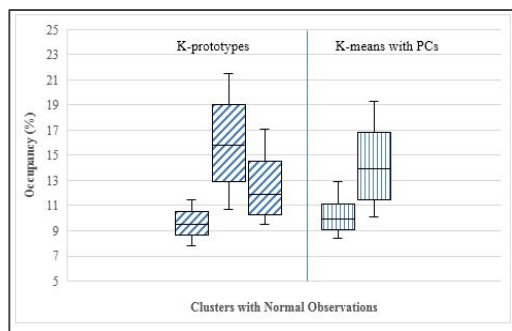
K-means with PCs

## Patterns during Incident and Precipitations



- Minor incident with high volume, moderate to high speed, and low to medium occupancy.
- Moderate incident with high volume, medium speed, and medium occupancy.
- Major incident with low volume, low speed, and high occupancy.
- High precipitation impacted traffic pattern with low volume, low speed, and high occupancy.
- Major incident and medium precipitation impacted traffic pattern with low volume, low speed, and high occupancy.

## Patterns during Normal Condition



- High volume, high speed, and low occupancy.
- High volume, medium speed, and medium occupancy.
- High volume, low speed, and high occupancy.