

An LOS Comparison Between HCM & Actual Freeway Data

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Theory Vs. Reality

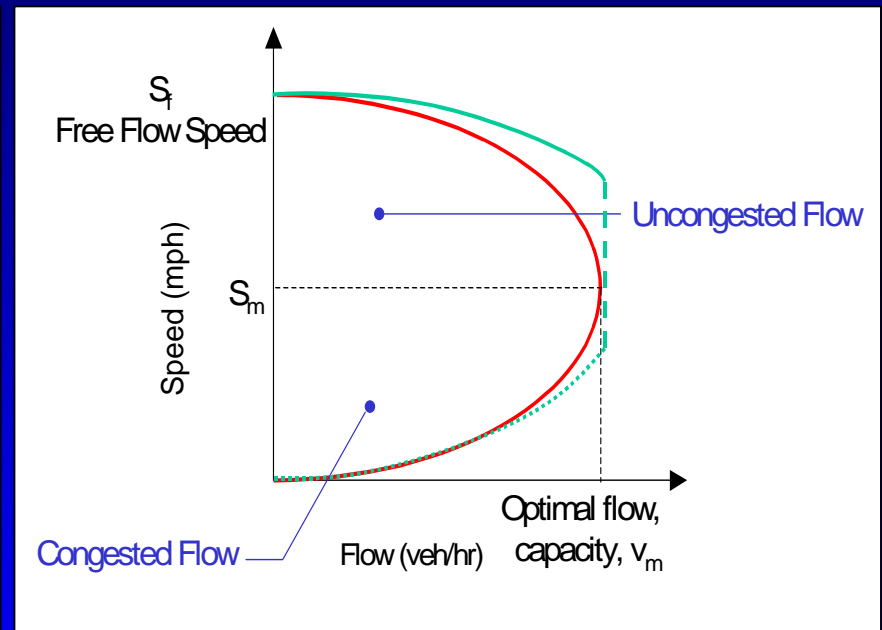
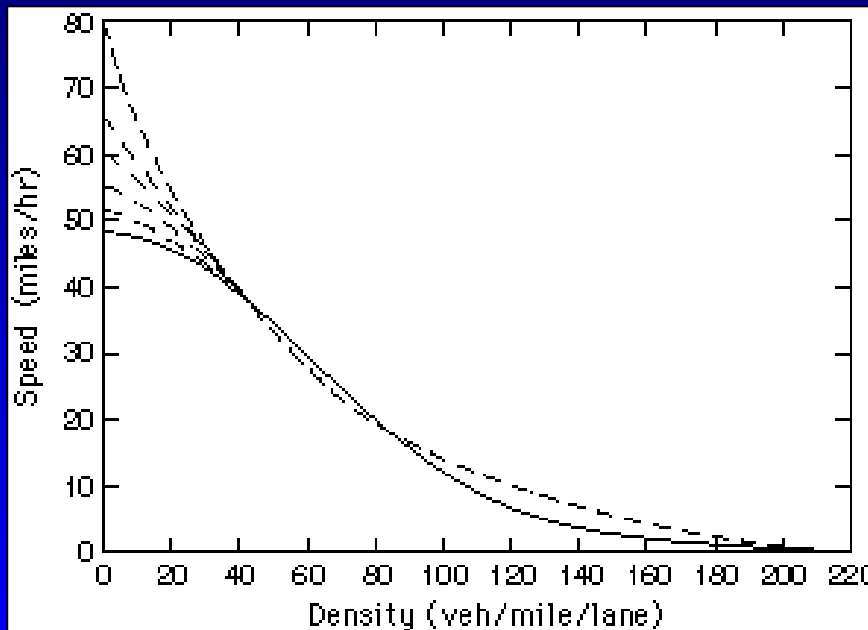
- Objectives
- Theory
- Case Study (I-395, VA)
- Analysis
- Conclusion

Objectives

- **Examine the Impact of Factors on the Relationships between Speed, Flow, and Density:**
 - **Geometry**
 - **Grade**
 - **Weather**
- **Understand the Limitations of the Highway Capacity Manual (HCM)**

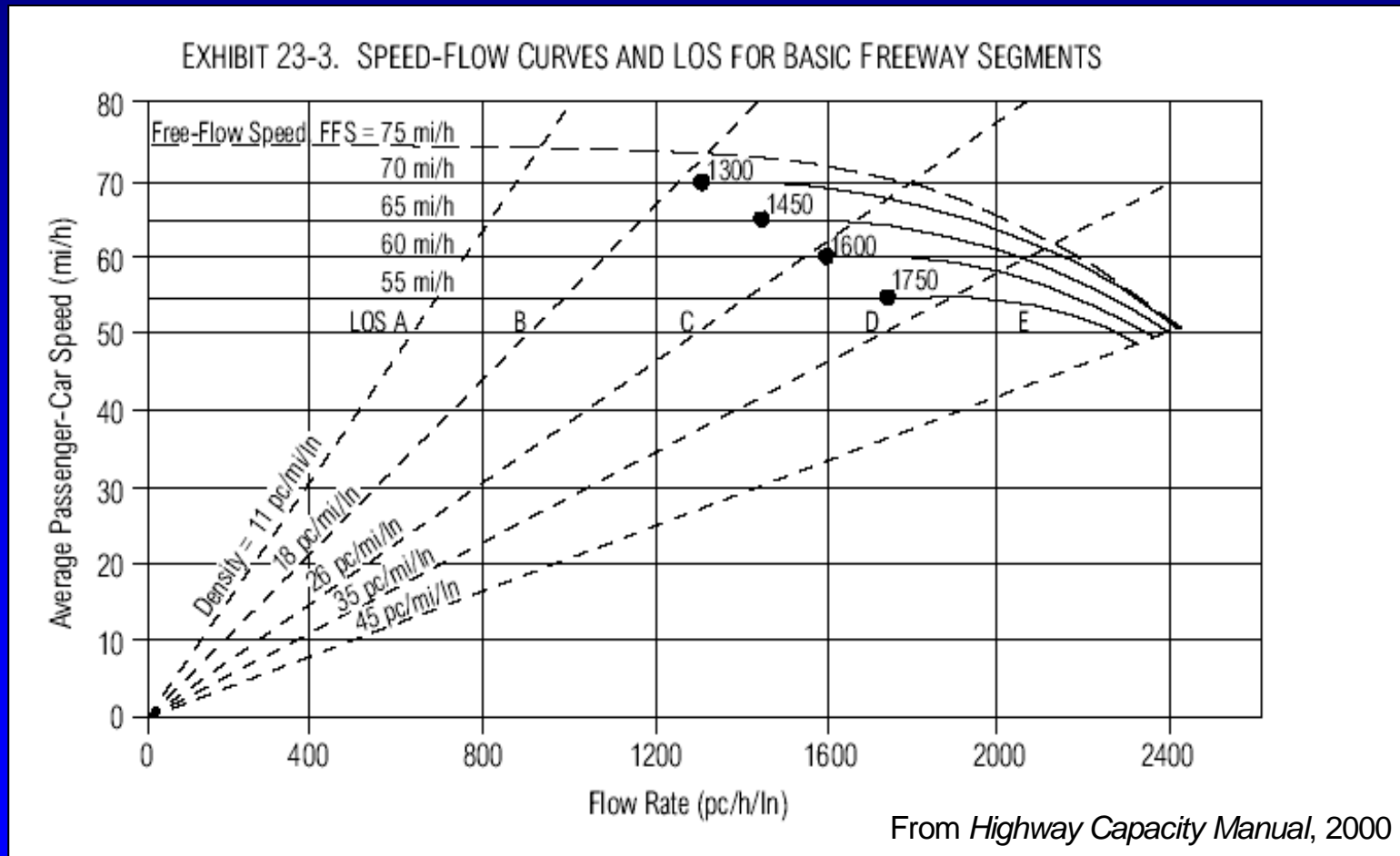
Background

Fundamental Traffic Equation: $\text{Flow} = \text{Density} \times \text{Speed}$



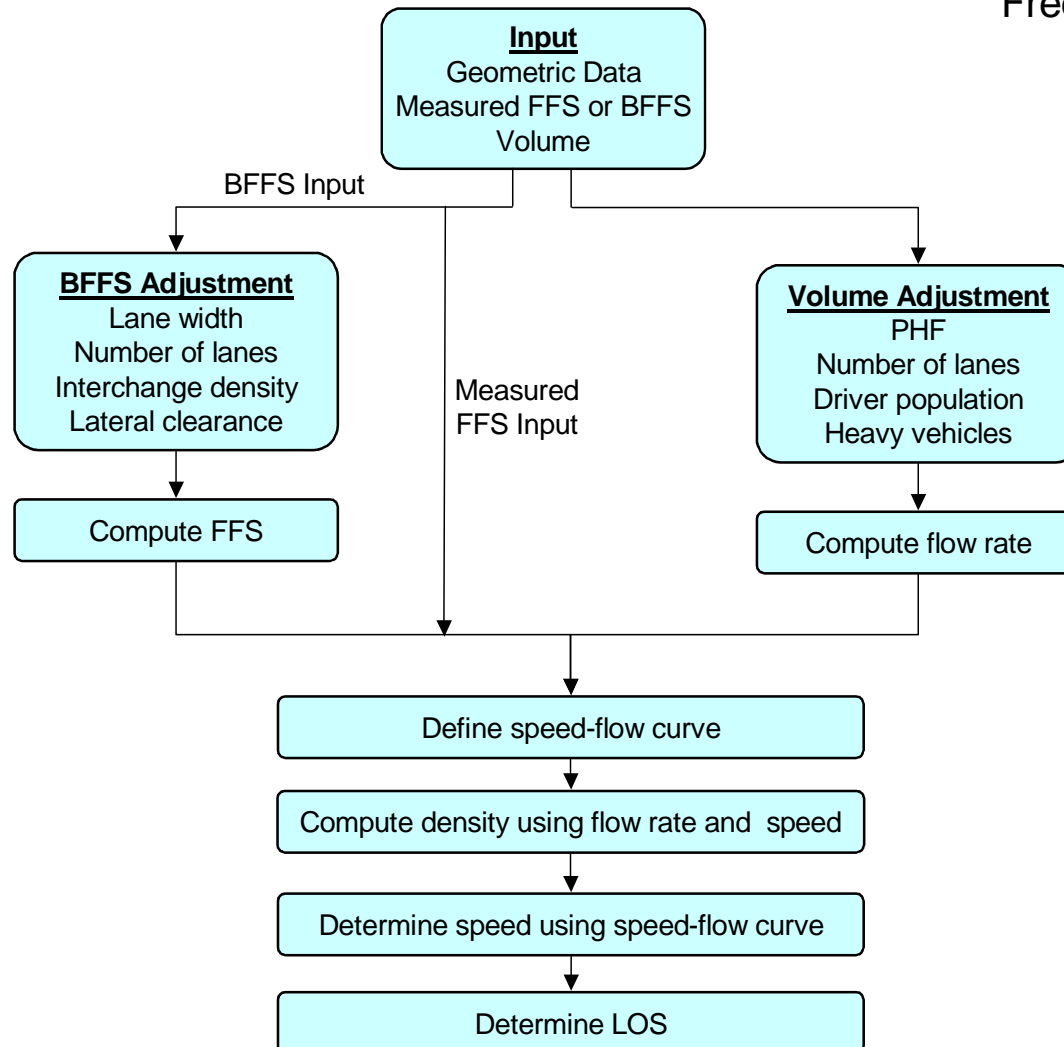
HCM Freeway LOS

Freeway LOS based on Density of Segment

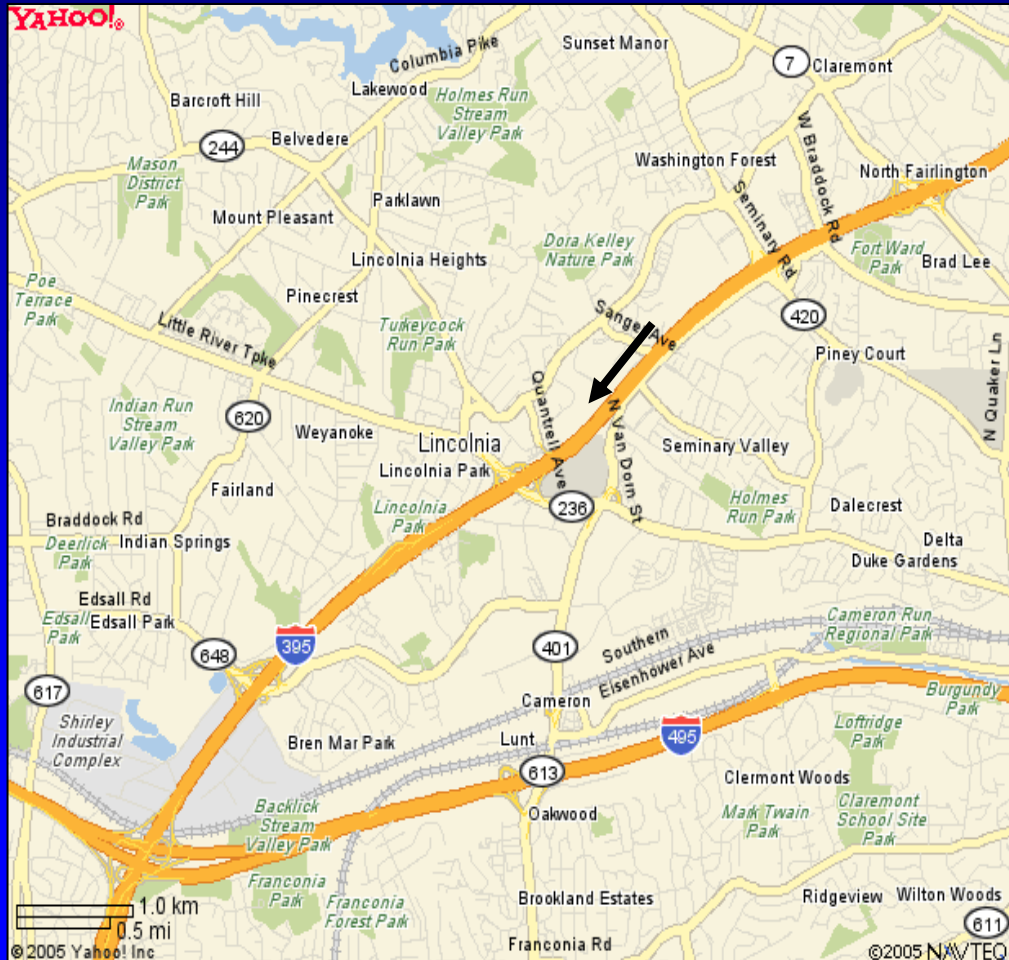


HCM LOS Approach

Freeway LOS



Case Study



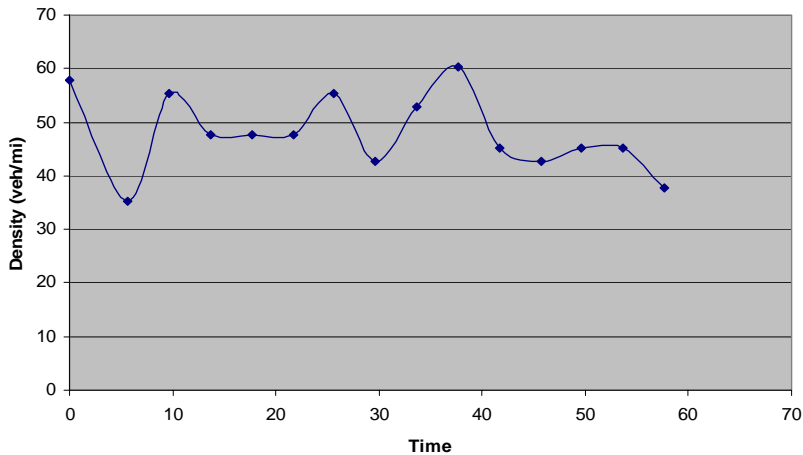
- Freeway Site: I-395 (Shirley Hwy)
- 3 lanes
- 2000 foot incline
 - +4% constant grade
- Broken up into 3 zones
 - 0-680,
 - 680-1300,
 - 1300-2000
- Afternoon Peak Hour
- HOV excluded

Data

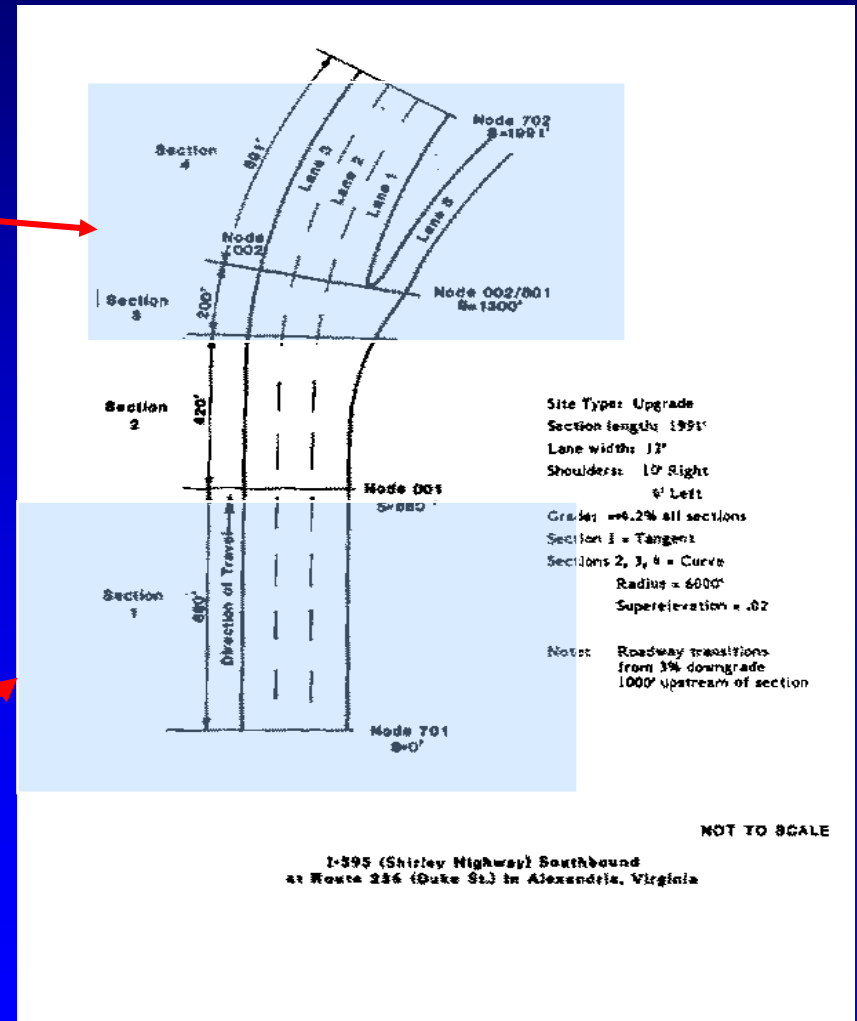
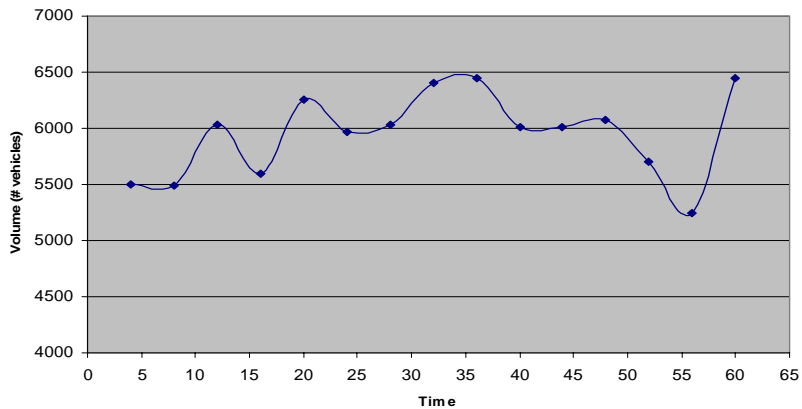
- **FHWA - Different Sites with Different Characteristics (Grade, Lane Drops, Weaves)**
- **Aerial Photography with Low Flying Aircraft**
- **1 frame per second for 1 hour**
- **Vehicle trajectories every second**

Sample Results

Zone 3 - Density

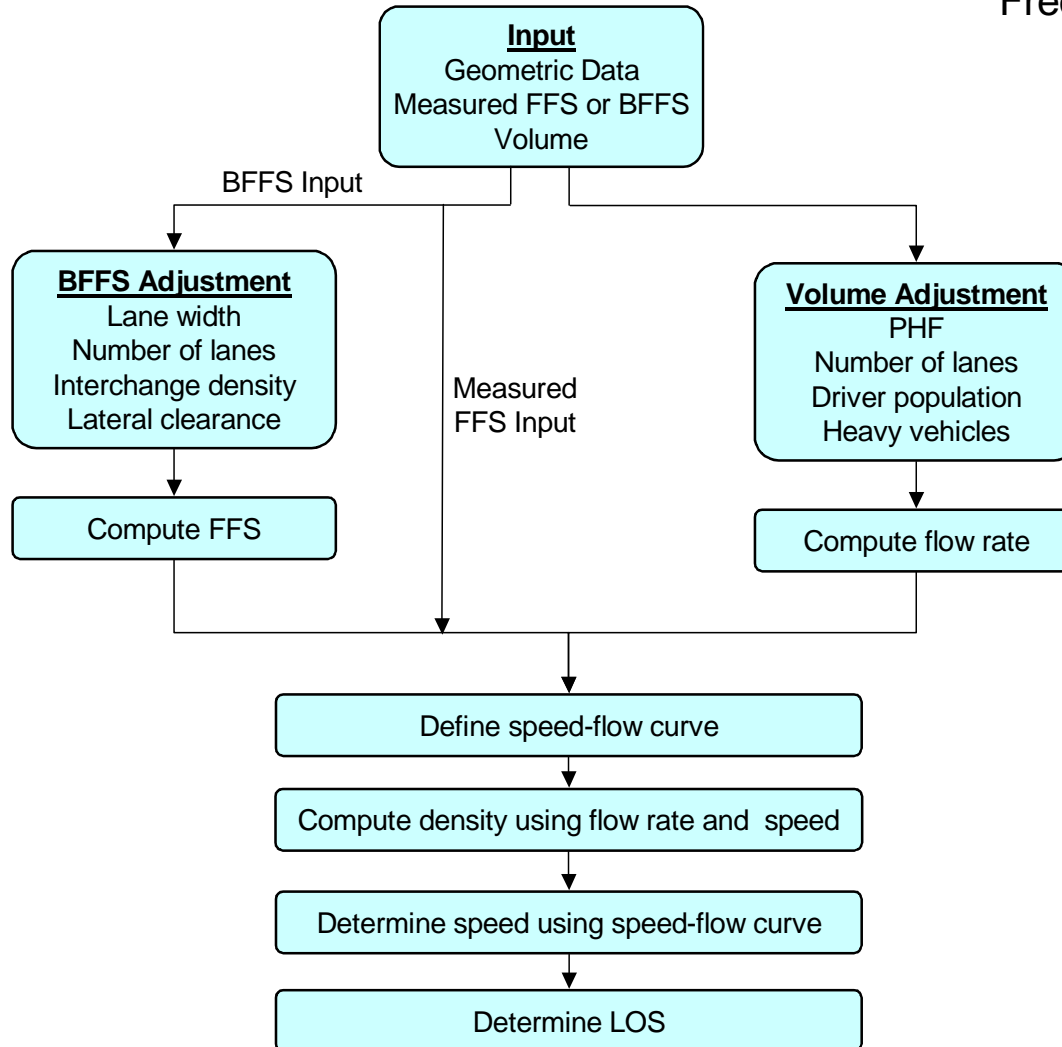


Zone 1 - Raw Volumes



HCM LOS Approach

Freeway LOS



HCM Calculations

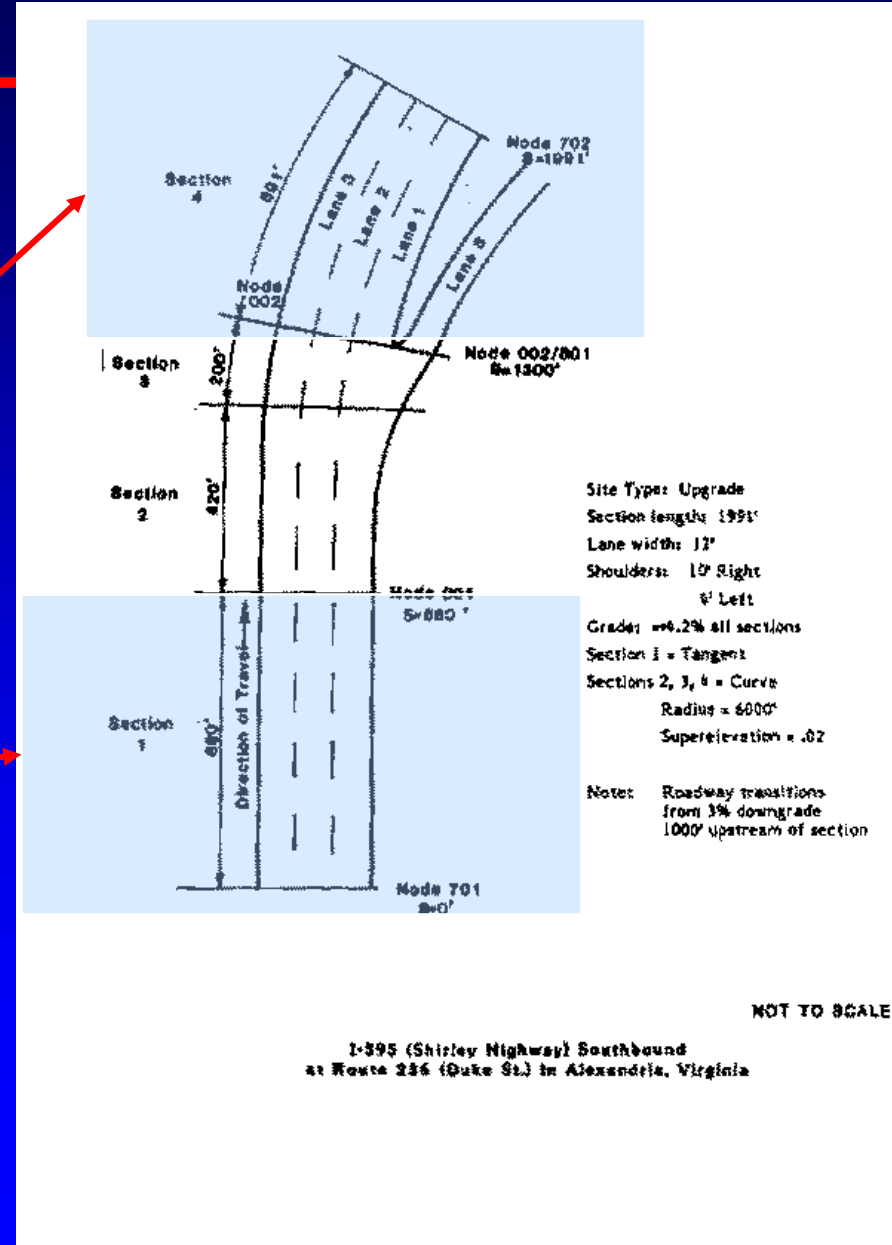
- **Urban BFFS = 70 mph**
- **BFFS Adjustments:**
 - 3 Lanes
 - 5 interchanges in 5 miles
 - 12' Lanes
 - No Lateral Clearance Issues
- **Volume at 340' = 5867, Volume at 1650' = 5780**
- **Volume Adjustments:**
 - ~6% HV
 - 3 Lanes
 - Driver Adjustment = Commuters

HCM Calculations

- Urban BFFS = 70mph
- 6% HV
- PHF ~0.95

- **Zone 3**
 - Volume = 5,780 veh/hr

- **Zone 1**
 - Volume = 5,867 veh/hr



Analysis

Density Results

HCM

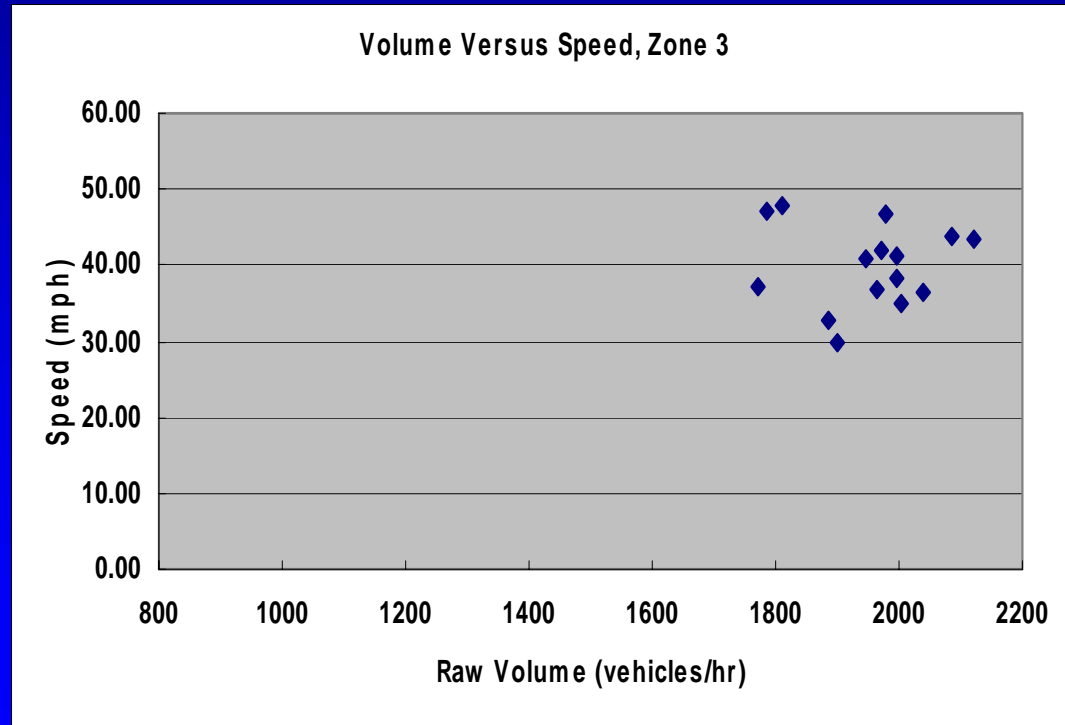
- Zone 1, 35.6 pc/pl/mi
- Zone 3, 35.1 pc/pl/mi

Actual

- Zone 1, 45.2 veh/pl/mi
- Zone 3, 47.3 veh/pl/mi

LOS E = 32.0 - 46.0

LOS F = >46.0



Discussion

- **Effect of Grade Underestimated**
- **Calculation of FFS is not adjusted for grade**
- **BFFS may be too optimistic**
- **Driver Behavior**
- **One Site**

Conclusions

- There was a difference between theoretical and empirical at this site
- Multiple factors may contribute to the difference
- More analysis needed to understand effect of geometric factors on speed/density/flow relationship and LOS

Thank you for your attention

Questions?