ODOT Analysis and Traffic Simulation Manual
Overview

08/25/20
Learning Objectives

- Understand how the OATS Manual is organized
- Understand what information is provided in the OATS Manual
- Understand what’s changed - pre-OATS vs OATS
Overview of Manual

ODOT Analysis and Traffic Simulation Manual

Published in 2020 to establish uniform methodologies for performing traffic analyses and simulation for ODOT Projects

Supersedes/replaces the information in the L&D

OATS Manual ensures uniform analysis processes for all ODOT projects
OATS Manual Chapters

1. Traffic Analysis Scoping
2. Traffic Analysis Limits
3. Analysis Tool Selection
4. Data Collection
5. General Traffic Analysis
OATS Manual Chapters

6. Highway Capacity Software (HCS) and the Highway Capacity Manual
7. Traffic Simulation with TransModeler
8. Presentation of Results
9. Documentation
OATS Manual Training and Videos

- Self-paced training videos
- Short videos to supplement material in the manual

http://www.dot.state.oh.us/Divisions/Engineering/Roadway/studies/Pages/default.aspx
Traffic Analysis Scope

- Covered in Chapter 1
- PDF available on ORE webpage
- Document assumptions and methodologies
- Used to prepare man hour estimates
- Tailored to the complexity of the project
- Allows concerns to be raised and resolved EARLY in the process
Traffic Analysis Scoping Document

- Prepared by ODOT District Project Manager
- Reviewed and approved by Office of Roadway Engineering for:
  - Interchange studies
  - Feasibility Studies involving interchanges
  - Alternatives Evaluation Reports involving interchanges

**MUST BE COMPLETED IN ADVANCE OF EARLY COORDINATION MEETING WITH M&F**
Traffic Analysis Scoping Document

Scoping Document
This document is scoping guidance to be prepared by the ODOT project manager to be given to traffic analysts (either internal or consultants) for use in preparing scoping documents and final estimates. It is a Memorandum of Understanding (MOU) between ODOT and the analyst.

CONTACT INFORMATION
Prepared By: 
Prepared On: 
One Review (if necessary): 
Date: 
Project Name: 

PROJECT INFO
Project Name: 

Traffic Analysis Type: 
- Standard
- Complex

Traffic Analysis Objective: 

LOAD FROM: 
To: 

Traffic Analysis Scoping Document

Data Requirements and Data Collection Plan

Data Description (i.e., include locations, sources, techniques and schedule for each type of data if applicable):

- Turning Movement Counts: (Yes/No)
- Segment Counts: (Yes/No)
- Average Speed/Freeway Times: (Yes/No)
- Queue Lengths: (Yes/No)
- Existing Signal Settings: (Yes/No)

Should pedestrian WALK/DO/HO/WALK times be accommodated within the phase times? (Yes/No)

Additional Notes:

Additional Notes:
Scoping Elements

- Traffic analysis type
- Project description
- Traffic analysis objective
- Analysis boundary limits
- Study periods and analysis years
- Data requirements and data collection plan
- Project traffic forecasting
- Project alternatives
- Performance measures of effectiveness (MOEs)
- Analysis report and documentation
Traffic Analysis Type

**STANDARD TYPE**
- Majority of projects
- Typically uses default values or easily obtained data
- Minimal calibration and validation
- Nearly all Highway Capacity Software (HCS) analyses
- Most small TransModeler analyses

**COMPLEX TYPE**
- Involves analysis of existing conditions
- Requires calibration to match real life conditions
- Labor intensive data collection
- Large freeway corridors with multiple interchanges
- Other high-risk projects
Traffic Analysis Limits

- Covered in Chapter 2
- Boundary limits for various project types are identified in the SHAMM and Interchange Study Traffic Academy Materials.
- There are several cases when the minimum analysis boundaries are not adequate. Work with the ODOT District Staff and ORE to determine acceptable limits.
- All ODOT analyses should be a single period analysis (one hour in duration).
Analysis Boundary Limits

- Instances when the minimum limits are not sufficient:
  - Bottlenecks that affect traffic flows into or out of the study area
  - Queues at study intersections that extend past the minimum limits
  - Major interchanges just outside minimum boundary limits
  - Existing undersaturated condition that could become oversaturated by the design year
  - Adjacent intersections (because of being part of a coordinated system) may affect the formation of vehicle platoons
Highway Capacity Software (HCS)

- Computer program that implements HCM methodologies
- Analyzes capacity and LOS for uninterrupted-flow and interrupted-flow roadways
- Includes pedestrian, bicycle and transit modes
- Results for arterial traffic models can be directly imported into TransModeler
TransModeler

- Uses microsimulation through car-following and driver behavior logic to simulate traffic operations as traffic volumes and speeds fluctuate

- Several measures of effectiveness (MOEs) can be obtained from the analysis, including some that are comparable to the HCM methodologies
Is this an ODOT Path 5 or other high-profile project?

Does the study area contain any of the following?
- Mix of intersection control types
- Uneven lane distribution
- Oversaturated areas that are impractical to expand
- Closely spaced intersection

Does the study need to evaluate any of the following?
- System-wide MOEs
- ATDM strategies
- Interaction between vehicles and transit
- Traffic rerouting

Are there any of these Facility Types present?
- Freeway and arterial corridor interaction
- Alternative intersections
- Weaving section (If LOS F)
Tool Selection

Use HCS unless one of the following apply:

- Is this an ODOT Path 5 or other high-profile project?
- Does the study area contain any of the following?
  - Mix of intersection control types
  - Uneven lane distribution
  - Oversaturated areas that are impractical to expand
  - Closely spaced intersection
- Does the study need to evaluate any of the following?
  - System-wide MOEs
  - ATDM strategies
  - Interaction between vehicles and transit
  - Traffic rerouting
- Are there any of these Facility Types present?
  - Freeway and arterial corridor interaction
  - Alternative intersections
  - Weaving section
Visualization is often helpful on high-profile projects

TransModeler can provide public-ready graphics and videos to explain complex solutions
Tool Selection

Use HCS unless one of the following apply:

Is this an ODOT Path 5 or other high-profile project?

Does the study area contain any of the following?
- Mix of intersection control types
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Are there any of these Facility Types present?
- Freeway and arterial corridor interaction
- Alternative intersections
- Weaving section
Mix of Intersection Traffic Control Types

- TransModeler should be used for corridors that have intersections with a mix of traffic control types that have a significant effect on each other.
Uneven Lane Distribution

- Measure the effects of upstream vehicles favoring one lane because of a downstream turn or lane drop
Oversaturated Areas

- TransModeler is used for oversaturated areas where lengthening the project area to undersaturated conditions is impractical.
- Several additional miles or multiple intersections or interchanges is impractical.
Closely Spaced Intersections

- Evaluate queues between intersections
Tool Selection

Use HCS unless one of the following apply

Is this an ODOT Path 5 or other high-profile project?

Does the study area contain any of the following?
- Mix of intersection control types
- Uneven lane distribution
- Oversaturated areas that are impractical to expand
- Closely spaced intersection

Does the study need to evaluate any of the following?
- System-wide MOEs
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- Interaction between vehicles and transit
- Traffic rerouting

Are there any of these Facility Types present?
- Freeway and arterial corridor interaction
- Alternative intersections
- Weaving section
System-wide Measures of Effectiveness

- System-wide metrics:
  - Travel time
  - Average speeds
  - Vehicle-hours delay
ATDM Applications

- HCS cannot accurately analyze Active Transportation and Demand Management (ATDM) strategies.
Interactions between Vehicles and Transit

- TransModeler should be used to accurately measure the effects of transit stopping in the travel lanes or receiving priority at signals.
Traffic Rerouting

- Dynamically rerouting traffic through the roadway network
- Used when improvement options change or close access to freeway segments or add new connectors that may shorten travel time or distance
Tool Selection

Use HCS unless one of the following apply

- Is this an ODOT Path 5 or other high-profile project?
- Does the study area contain any of the following?
  - Mix of intersection control types
  - Uneven lane distribution
  - Oversaturated areas that are impractical to expand
  - Closely spaced intersection
- Does the study need to evaluate any of the following?
  - System-wide MOEs
  - ATDM strategies
  - Interaction between vehicles and transit
  - Traffic rerouting
- Are there any of these Facility Types present?
  - Freeway and arterial corridor interaction
  - Alternative intersections
  - Weaving section
Freeway and Arterial Corridor Interactions

- When the analysis of interactions between interstate facilities and arterial corridors is critical, TransModeler should be used.
Alternative Intersections

- TransModeler results are more reliable than HCS results for complex intersections:
  - Diverging Diamond Interchanges
  - Continuous Flow Intersections
  - R-cut Intersections
  - Five-legged Intersections
  - Three-lane Roundabouts
Weaving Section

- TransModeler should supplement HCS results when LOS F
- Only the freeway direction containing the weaving section and the weave itself should be analyzed.
Other Important Notes:

- If TransModeler is used for one alternative, it should be used for all alternatives (including No-Build)
- If TransModeler has been selected as the appropriate analysis tool and the entire project is modeled in TransModeler, HCS analysis is not required
- Both HCS and TransModeler can be used on the same project
Comparing Results

- Cautioned against comparing simulation results to HCM derived results
- For basic analyses of mainline freeways, merges, diverges, and arterial intersections and segments, the results between HCS and TransModeler are consistent
- Results for weave segments can vary greatly between HCS and TransModeler

Weaving analysis from HCS resulting in LOS F should be supplemented with TransModeler
Analysis Tool Selection

- HCS is required for all analyses except for conditions where HCS cannot adequately analyze project elements
- If TransModeler is used for one alternative, it should be used for all alternatives
- If TransModeler is selected as the appropriate tool and the entire project area is modeled, HCS is not required
- Both HCS and TransModeler can be used on the same project
- All weaving analyses from HCS resulting in LOS F should be supplemented with TransModeler
### Data Needs Summary - Signalized and Unsignalized Intersections

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Notes and Potential Data Needs/Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intersection Geometry and Configuration</td>
<td></td>
</tr>
</tbody>
</table>
  - Number of lanes on each approach, lane markings, and turn lane lengths  
  - Aerial maps/photography  
  - Photolog/Google Streetview  
  - Confirm with field reviews as appropriate |
| Turning Movement Counts            |  
  - Historical counts not older than 3 years can be used (from ODOT TMMS or other local sources)  
  - Collected on Tuesday, Wednesday, or Thursday on weeks that do not contain a holiday  
  - 15-minute intervals typically between 6:00 AM and 7:00 PM  
  - Vehicle classification included  
  - Collect segment counts to determine demand  
  - Pedestrian counts for high pedestrian areas |
| Queue Lengths (Complex Type)      |  
  - Field measured when demand is known to exceed capacity |
| Existing Signal Timings (Signalized Only) |  
  - Obtained from maintaining agency  
  - Field measured when timings are not available |
| Lane Utilization                  |  
  - Field measured for a 15-minute period during the analysis period at locations where lanes are not equally utilized. |
# Data Needs Summary - Urban/Rural Corridor

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Notes and Potential Data Needs/Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadway Geometry and Configuration</td>
<td>▪ Speed Limit, number of lanes&lt;br&gt;▪ Aerial maps/photography&lt;br&gt;▪ Photolog/Google Streetview&lt;br&gt;▪ Confirm with field reviews as appropriate</td>
</tr>
<tr>
<td>Intersection Data</td>
<td>▪ Assemble signalized and unsignalized intersection data shown above at all intersections</td>
</tr>
<tr>
<td>Average Speed/Travel Time (Complex Type)</td>
<td>▪ Obtained from INRIX or StreetLight data&lt;br&gt;▪ Field measured if INRIX or StreetLight data is not available</td>
</tr>
<tr>
<td>Free-Flow Speed</td>
<td>▪ Posted Speed Limit + 5 mph</td>
</tr>
</tbody>
</table>
## Data Needs Summary - Freeway

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Notes and Potential Data Needs/Sources</th>
</tr>
</thead>
</table>
| Highway Geometry and Configuration | ▪ Speed limit, number of lanes, auxiliary lanes, and merge/diverge/weave locations, weave lengths, acceleration/deceleration lengths  
▪ Aerial maps/photography  
▪ Photolog/Google Streetview  
▪ Confirm with field reviews as appropriate |
| Ramp Terminal Intersection Data     | ▪ Assemble signalized and unsignalized intersection data shown above at all intersections                             |
| Mainline Traffic Counts         | ▪ Can be obtained from ODOT continuous counters if located within study area and ramp volume and/or ramp terminal intersection volumes are known  
▪ If collected, must be collected for 24-48 hours in 15-minute intervals on a Tuesday, Wednesday, or Thursday during a week that does not contain a holiday |
| Average Speed/Travel Time (Complex Type) | ▪ Obtained from INRIX or StreetLight data  
▪ Field measured if INRIX or StreetLight data is not available |
| Free-Flow Speed                | ▪ Posted Speed Limit + 5 mph                                                                                   |
Chapter 5 - General Traffic Analysis

- Identify the general inputs that go into the traffic analysis
- Understand when default factors should and should not be used for ODOT analyses
- Differentiate between calibration and validation
Grade

- Considered when it exceeds 3% for longer than a half-mile
- Default grade should be “level”
- Field measure grades or estimate on Google Earth
- Grade for ramps shall be zero
Peak Hour Factor

- Peak Hour Factor (PHF) measures the traffic demand fluctuations over the analysis hour

\[
PHF = \frac{V}{4 \times V_{15}}
\]

\(V\) = peak hour volume (veh/hour)
\(V_{15}\) = volume during the peak 15 minutes of the peak hour (veh/15 minutes)
PHF = 1.0

Period 1  |  Period 2  |  Period 3  |  Period 4

PHF = 0.50

Period 1  |  Period 2  |  Period 3  |  Period 4

PHFs generally range from 0.80 to 0.98 in typical urban areas
Peak Hour Factor

- Calculate existing PHF at study intersections
  - Calculated for the intersection as a whole
  - Minimum of 0.80 unless justified by peaked demands
  - PHF for design year is the same as the calculated PHF for the existing year
- Default PHF for Freeways = 0.94
- Ramp PHF will be the PHF calculated for the ramp terminal intersection
- If counts are not available, default PHF should be used:
  - 0.94 for ramps
  - 0.92 for arterials
Peak Hour Factor

- Accounted for in one of the following:
  - Enter volumes in 15-minute periods
  - Enter the hourly volumes and calculated PHF in the Turning Movement Table Settings
  - When using an O-D matrix, create a curve-based time distribution based on calculated PHF
- Only one PHF can be used for the whole project. A critical study intersection or high-volume intersection should be used to determine the PHF. If the majority of the study area is freeway, PHF should be 0.94

Include all PHF calculations in the report appendix
Saturation Flow Rate

- Maximum number of vehicles from a lane group that can pass through the intersection during one hour of continuous green under the prevailing traffic and roadway conditions
Saturation Flow Rate

- Default saturation flow rates should be used for the analysis

<table>
<thead>
<tr>
<th>Area Type</th>
<th>Base Saturation Flow Rate (pc/h/ln)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban Area</td>
<td>1,900</td>
</tr>
<tr>
<td>Otherwise</td>
<td>1,750</td>
</tr>
</tbody>
</table>
Saturation Flow Rate

- Direct input into HCS
- The same saturation flow rate should be used for all movements at the intersections unless there is a specific reason not to (which should be documented)
Saturation Flow Rate

- TransModeler has no direct entry of the saturation flow rate
- Refer to Section 7.3.5.2
Right Turn Treatments

- In HCS, RTOR flow rates should be 0 unless RTOR movements are a significant component in intersection operations in which case TransModeler should be used.
- Demand for yield-controlled or free-flowing movements that are not affected by queueing should be included in the analysis:
  - “Unsignalized Movement” box checked
  - “Unsignalized Delay” should be 0
Right Turn Treatments

- TransModeler can simulate RTOR flow rates through car following and gap acceptance algorithms
- Visual inspection should be performed to ensure the model matches existing conditions
Heavy Vehicle Percentages

- Single Unit Trucks, Buses, RVs and tractor/trailers (Type B&C)

Heavy Vehicle Percentage = \[
\frac{\text{Count of Heavy Vehicles that arrive during the analysis period}}{\text{Total Vehicle Count for same period}}
\]
Heavy Vehicle Percentages

- Calculated based on existing counts
- By approach not individual movements
- Existing heavy vehicle percentage used for future conditions unless justification can be provided as to why it would differ
Fleet Characteristics can be adjusted based on heavy vehicle percentages (see Section 7.2.3.2)
Lane Utilization Factors

- The lane utilization factor accounts for the unequal distribution of traffic among lanes.
Lane Utilization Factors

- Existing lane utilization factors should be calculated from video or field observations
  - If lane uses are the same, the existing factor can be assumed for future conditions
  - If one alternative changes the lanes so they become more utilized, the default lane utilization factors can be used
  - If one alternative involves a lane drop downstream of an intersection where the existing does not, lane utilization factors for the future condition should be calculated.
## Lane Utilization Factors

<table>
<thead>
<tr>
<th>Intersection</th>
<th>EBL</th>
<th>EBT</th>
<th>EBR</th>
<th>WBL</th>
<th>WBT</th>
<th>WBR</th>
<th>NBL</th>
<th>NBT</th>
<th>NBR</th>
<th>SBL</th>
<th>SBT</th>
<th>SBR</th>
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<td>Shared Lane</td>
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<tr>
<td>Percent Unopposed Left Turns</td>
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<tr>
<td>Heaviest Lane Volume, veh/h</td>
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<td>Walk Interval, s</td>
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<td>Opposing Right-Turn Lane Influence</td>
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<td>Field Proportion Arriving on Green</td>
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</tbody>
</table>
Lane Utilization Factors

- TransModeler accounts for lane utilization characteristics through driver behavior parameters
- If the model needs further adjusted, refer to Section 7.3.5.2
Signal Timing

- Existing signal timings should be used whenever existing signal analysis is performed
- Refer to Section 4.5 for information on obtaining signal timings
- Future year analyses should be conducted using optimized signal timings
- Refer to Section 6.2.2.1 for HCS inputs and Section 7.1.4.1 for TransModeler inputs
Optimizing Signal Timings

- General guidelines for optimizing signal timings for future year analyses

While these are guidelines and not standards, deviations from these guidelines should be approved by ODOT on a project by project basis.
Optimizing Signal Timings

- Synchro, HCS, or TransModeler can be used to optimize signal timing
- No matter what software is being used for optimization, the resulting signal timings should be entered into the software being used for the analysis
If existing traffic signals are coordinated, they should be modeled as coordinated in future year analyses.
Optimizing Signal Timings

- Cycle Lengths:
  - Can differ between existing and future conditions
  - Typically between 60 and 120 seconds
  - Longer than 120 seconds for oversaturated intersections
  - Coordinated intersections must have same cycle length
  - Half or double cycle lengths (60 seconds in a corridor of signals with 120 second cycle lengths) are not permitted
Optimizing Signal Timings

- Yellow clearance - 4 seconds
- All-red clearance - 2 seconds
- Min. green for major street through movements - 20 seconds
- Min. green for minor street through movements - 10 seconds
- Min. green for protected left turn phases - 7 seconds
Optimizing Signal Timings

- Alternative intersections can be much wider than traditional intersections.
- In this case, the all-red time may need to be longer than 2 seconds to allow for a vehicle to clear the intersection.
Optimizing Signal Timings

- Pedestrian Crossing Times
  - Minimum green times should be extended to accommodate Walk and Flashing Don’t Walk intervals (if needed)
  - If pedestrian crossing times are not known:
    - Walk interval - 7 seconds
    - Flashing Don’t Walk interval - 10 seconds
Optimizing Signal Timings

- Left turn phases should be leading
- Lagging left turn phases are only allowed if both of the following are true:
  - The opposing left turn lanes are protected only phasing
  - The queues for the lagging left turn do not impact the adjacent through lane
Optimizing Signal Timings

LEADING SIDE  LAGGING SIDE

LEADING SIDE  LAGGING SIDE

LEADING SIDE  LAGGING SIDE

LEADING SIDE  LAGGING SIDE

LEADING SIDE  LAGGING SIDE

LEADING SIDE  LAGGING SIDE

LEADING SIDE  LAGGING SIDE

LEADING SIDE  LAGGING SIDE
Optimizing Signal Timings

▪ Overall Intersection Operations
  ▪ LOS D or better within the boundaries of an MPO
  ▪ LOS C or better for other locations

▪ Approach Operations
  ▪ LOS E or better
  ▪ No movement with v/c greater than 0.93
  ▪ No movement with Queue-Storage-Ratio greater than 1.0
Optimizing Signal Timings

- Minor street will often have more delay than the major street.
- The minor street v/c ratio should not be significantly higher than the major street v/c ratio.
- For oversaturated conditions, v/c ratios will be above 1.0 for both major and minor streets.
Optimizing Signal Timings

For more information refer to these chapters

HCS
Chapter 6

Chapter 7
Calibration

- Demonstrating that the model is a reasonably accurate representation of observed conditions
Validation

- Proving (usually with a second data source) that a calibrated model can provide realistic results under different input data and scenarios
Calibration and Validation

- Build confidence in the model so when conditions that cannot be observed change, the model is an accurate prediction of operations.
Calibration and Validation

- Potential Pitfalls
  - Discrepancies between field conditions and modeled conditions
  - Unrealistic driving behavior
  - Discrepancies between field measured traffic volumes and the amount of traffic served in the microsimulation model
  - Creation of false bottlenecks
  - Unreasonable routings of vehicles through network
Calibration and Validation

- Formal calibration and validation is not required on Standard Type projects, but a visual inspection or logical output check should be performed to ensure models are an accurate representation of real-world conditions.
Calibration and Validation

- Measures and targets for calibration should be established based on purpose and need of the project
- Output/metrics used to compare field measurements to a model:
  - Volume throughput
  - Speed
  - Travel Time
  - Queues
At a minimum, it is suggested that volume throughput and speeds (or travel times) are used as metrics during calibration.

Queue lengths should be used to calibrate the analysis model.

**Calibration and Validation**
## Calibration and Targets

<table>
<thead>
<tr>
<th>Calibration Item</th>
<th>Calibration Target</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Volume Throughput</strong></td>
<td></td>
</tr>
<tr>
<td>Individual movement flows ≤ 700 veh/hr</td>
<td>Within 100 vehicles of field data for more than 85% of movements in model area</td>
</tr>
<tr>
<td>Individual movement flows between 700 and 2,700 veh/hr</td>
<td>Within 15% of field data for more than 85% of movements in model area</td>
</tr>
<tr>
<td>Individual movement flows &gt; 2,700 veh/hr</td>
<td>Within 400 vehicles of field data for more than 85% of movements in model area</td>
</tr>
<tr>
<td><strong>Speed</strong></td>
<td></td>
</tr>
<tr>
<td>Link Speed</td>
<td>Within 10 mph of field data for more than 85% of network links</td>
</tr>
<tr>
<td><strong>Travel Times</strong></td>
<td></td>
</tr>
<tr>
<td>Field travel times ≤ 7 minutes</td>
<td>Within 1 minute of field data for more than 85% of travel time segments</td>
</tr>
<tr>
<td>Field travel times &gt; 7 minutes</td>
<td>Within 15% of field data for more than 85% of travel time segments</td>
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<tr>
<td><strong>Queues</strong></td>
<td></td>
</tr>
<tr>
<td>Queues formed in free flow areas</td>
<td>All locations with formed queues are modeled</td>
</tr>
<tr>
<td>Queue length</td>
<td>Within 20% of field measured queue length</td>
</tr>
</tbody>
</table>
General Traffic Analysis

- Refer to Chapter 5 for details regarding analysis inputs
- HCS and TransModeler have different input requirements
- Only Complex Type analyses have a robust calibration and validation procedure
- Standard Type analyses should be reviewed for logical and reasonable results compared to field-observed conditions
Chapter 6 - Highway Capacity Software

- Includes input guides for
  - Freeway Facilities
  - Streets (signalized intersections)
  - Roundabouts
  - All-Way Stop Control
  - Two-Way Stop Control
Freeway Facilities Analysis

- Creating a new analysis
- Freeway facility segmentation
- Basic, merge, diverge, weave, and overlap segment details
- Results and reporting
Sample Project
Creating a New Analysis
Creating a New Analysis
Creating a New Analysis

Freeways

Select New File Type

- Basic
- Merge
- Diverge
- Weaving
- Facility
- Facility by Segmentation
- Facility Planning

OK
General

Project Properties
- Analyst
- Agency
- Analysis Year: 2020
- Project Description

Jurisdiction
- Time Period Analyzed
- Date

Facility Global Inputs
- Jam Density: pc.mi/ln: 190.0
- Queue Discharge Capacity Drop, %: 7
- Managed Lane
- Systems Analysis

Area Type: Urban
- Demand Factor: 1.000
- Mixed Flow Model

Segments Global Inputs
- Freeway Lanes: 3
- Freeway FFS, mi/h: 75.4
- Freeway Terrain Type: Level
- Freeway Peak Hour Factor: 0.94
- Freeway Total Trucks, %: 0.00
- Driver Population: All Familiar

Ramp Lanes: 1
- Ramp FFS, mi/h: 35.0
- Ramp Terrain Type: Level
- Ramp Peak Hour Factor: 0.94
- Ramp Total Trucks, %: 0.00
- Weather Type: Non-Severe Weather

Select All □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ A
General

The image shows a screenshot of a software interface for traffic simulation. The interface includes fields for project properties such as Analyst, Agency, Analysis Year, Jurisdiction, and Time Period Analyzed. Additionally, there are sections for facility and segment global inputs, detailing aspects like Lane Capacity, Demand Factor, and Ramp Details. The interface appears to be part of the ODOT Analysis and Traffic Simulation Manual, as indicated by the title and logo at the top of the page.
## Segments

![Segments Input](image)

### Segments Input

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Length, ft</th>
<th>Lanes</th>
<th>Demand, vph</th>
<th>Volume, vph</th>
<th>Segment Analysis Details</th>
<th>Events List</th>
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<tbody>
<tr>
<td>Basic</td>
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**Facility**

<table>
<thead>
<tr>
<th>Type</th>
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<th>Segment ID</th>
<th>Lanes</th>
</tr>
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<tbody>
<tr>
<td>Basic</td>
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<td>3</td>
</tr>
</tbody>
</table>

**Time Periods List**

- Start Time: 07:00
Segmentation

- Painted nose of gore to painted nose of gore
- Length to downstream ramp gore

- N. BROADWAY: 4,720’
- HENDERSON RD: 5,320’
- BETHEL RD: 7,500’

- 2,200’
- 1,720’
- 2,480’

NOT TO SCALE
Segmentation

(a) Merge Influence Area

(b) Diverge Influence Area

(c) Weaving Influence Area
Segmentation

- Merge/Diverge
- Weave
- Basic Freeway

NOT TO SCALE
Segmentation

1. Merge/Diverge
2. Weave
3. Basic Freeway

NOT TO SCALE
Segmentation

1. N. BROADWAY
2. HENDERSON RD
3. BETHEL RD

Merge/Diverge
Weave
Basic Freeway

Distances:
- 4,720’
- 5,320’
- 2,320’
- 1,500’
- 1,700’
- 2,200’
- 1,720’
- 2,480’
- 1,980’
- 1,500’
- 6,000’
- 7,500’

NOT TO SCALE
Segmentation

1. Merge/Diverge
2. Weave
3. Basic Freeway
4. Basic Freeway

Distance:
- N. BROADWAY: 4,720'
- HENDERSON RD: 2,200'
- BETHEL RD: 1,720'
- N. BROADWAY: 1,500'
- HENDERSON RD: 2,480'
- BETHEL RD: 1,980'
- N. BROADWAY: 7,500'
- HENDERSON RD: 2,320'
- BETHEL RD: 2,720'
- N. BROADWAY: 5,320'
- HENDERSON RD: 1,700'
- BETHEL RD: 1,980'

NOT TO SCALE
Segmentation

1. Merge/Diverge
2. Weave
3. Basic Freeway

NOT TO SCALE
Segmentation

1. Merge/Diverge
2. Weave
3. Basic Freeway

N. BROADWAY
HENDERSON RD
BETHEL RD

4,720’ 1,500’ 2,320’ 1,500’ 1,700’ 2,720’ 1,980’ 1,500’ 6,000’ 7,500’
Segmentation

1. Merge/Diverge
2. Weave
3. Basic Freeway

Distances:
- N. BROADWAY to HENDERSON RD: 4,720’
- HENDERSON RD to BETHEL RD: 6,000’
- BETHEL RD: 1,500’
- Total: 7,500’

NOT TO SCALE
**Segmentation**

1. N. BROADWAY
2. Merge/Diverge
3. Weave
4. Basic Freeway
5. HENDERSON RD
6. BETHEL RD

- N. BROADWAY: 4,720’
- Merge/Diverge: 1,500’
- Weave: 2,320’
- Basic Freeway: 1,500’
- HENDERSON RD: 1,700’
- BETHEL RD: 2,720’

**Distance:**
- N. BROADWAY to Merge/Diverge: 4,720’
- Merge/Diverge to Weave: 5,320’
- Weave to Basic Freeway: 2,200’
- Basic Freeway to HENDERSON RD: 1,720’
- HENDERSON RD to BETHEL RD: 2,480’
- BETHEL RD to 6,000’: 1,500’

**Total Distance:** 7,500’
Segmentation

1. Merge/Diverge
2. Weave
3. Basic Freeway

N. BROADWAY
HENDERSON RD
BETHEL RD

NOT TO SCALE
Time Period

Segments Input

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<th>Type</th>
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<th>Demand, veh/h</th>
<th>Volume, veh/h</th>
<th>Segment Analysis Details</th>
<th>Events List</th>
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Facility

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Start Time: 17:00
Segments

Segments Input

- Type: Basic
- Name: NB SR 315, South of N. Broadway on-ramp
- Length, ft: 4720
- Lanes: 3
- Demand, veh/h: 5570

Facility:
- Type: Basic
- Length, ft: 4720
- Segment ID: 1
- Lanes: 3
## Segments

### Segments Input

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### Facility

<table>
<thead>
<tr>
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<th>Length, ft</th>
<th>Segment ID</th>
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</table>

---

104 | Overview of Manual
# Segments

## Segments Input

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<th>Type</th>
<th>Name</th>
<th>Length, ft</th>
<th>Lanes</th>
<th>Demand, veh/h</th>
<th>Volume, veh/h</th>
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<tbody>
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 startups with adding new segments, inserting time periods, and deleting segments as needed.
Segments

Segments Input

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<tr>
<th>Type</th>
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<th>Demand, veh/h</th>
<th>Volume, veh/h</th>
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<th>Events List</th>
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<tr>
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Facility

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Start Time: 17:00
Segments

Segments Input

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<td>Merge North Broadway on-ramp</td>
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<td>3</td>
<td>5570</td>
<td>5926</td>
<td>Details</td>
</tr>
<tr>
<td>3</td>
<td>Basic NB SR 315, South of Henderson off-ramp</td>
<td>2320</td>
<td>3</td>
<td>5570</td>
<td>5926</td>
<td>Details</td>
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Facility

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<th>Type</th>
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<tr>
<td>Diverge</td>
<td>1500</td>
<td>4</td>
<td>3</td>
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</table>
Segments

1. Basic: NB SR 315, South of N. Broadway on-ramp
   - Length: 4720 ft
   - Lanes: 3
   - Demand, veh/h: 5570
   - Volume, veh/h: 5926

2. Merge: North Broadway on-ramp
   - Length: 1500 ft
   - Lanes: 3
   - Demand, veh/h: 5570
   - Volume, veh/h: 5926

3. Basic: NB SR 315, South of Henderson off-ramp
   - Length: 2220 ft
   - Lanes: 3
   - Demand, veh/h: 5570
   - Volume, veh/h: 5926

4. Diverge: Henderson off-ramp
   - Length: 1500 ft
   - Lanes: 3
   - Demand, veh/h: 5570
   - Volume, veh/h: 5926

5. Basic: NB SR 315, South of Henderson on-ramp
   - Length: 1700 ft
   - Lanes: 3
   - Demand, veh/h: 5570
   - Volume, veh/h: 5926

- Henderson on-ramp to Bethel off-ramp
  - Length: 720 ft
  - Lanes: 3
  - Demand, veh/h: 5570
  - Volume, veh/h: 5926

**Facility**

<table>
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<th>Lanes</th>
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# Segments

## Segments Input

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Segmentation - Overlap

- ROAD A
  - 1: 900'
  - 2: 600'
  - 3: 900'

- ROAD B

- Merge/Diverge Overlap
  - 1,500'
  - 2,400'
  - 1,500'
Segmentation - Overlap

### Segments Input

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ODOT Analysis and Traffic Simulation Manual

111 | Overview of Manual
Global Factors

Facility Global Inputs

- Jam Density, pc/mi/in: 190.0
- Queue Discharge Capacity Drop, %: 7
- Area Type: Urban
- Demand Factor: 1.000

Segments Global Inputs

- Freeway Lanes: 3
- Freeway FFS, mi/h: 70.0
- Freeway Terrain Type: Level
- Freeway Peak Hour Factor: 0.94
- Freeway Total Trucks, %: 8.00
- Ramp Lanes: 1
- Ramp FFS, mi/h: 55.0
- Ramp Terrain Type: Level
- Ramp Peak Hour Factor: 0.94
- Ramp Total Trucks, %: 3.00
- Weather Type: Non-Severe
# Global Factors

**Project Properties**

<table>
<thead>
<tr>
<th>Analyst</th>
<th>Bob Smith</th>
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<tbody>
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<td>Agency</td>
<td>Acme Engineering</td>
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<tr>
<td>Analysis Year</td>
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<td>Date</td>
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**Facility Global Inputs**

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**Segments Global Inputs**

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<td>Ramp Peak Hour Factor</td>
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<td>Ramp Total Trucks, %</td>
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<tr>
<td>Driver Population</td>
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<td>Weather Type</td>
<td>Non-Severe Weather</td>
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Global Factors

Project Properties
- Analyst: Bob Smith
- Agency: Acme Engineering
- Analysis Year: 2040 No-Build
- Project Description: OATS Manual Training
- Jurisdiction: ODOT D6
- Time Period Analyzed: PM Northbound
- Date: 6/1/2020

Facility Global Inputs
- Jam Density, pc/mi/in: 190.0
- Queue Discharge Capacity Drop, %: 7
- Managed Lane: No
- Systems Analysis: No
- Area Type: Urban
- Demand Factor: 1.000
- Mixed Flow Model: No

Segments Global Inputs
- Freeway Lanes: 3
- Freeway FFS, mi/h: 70.0
- Freeway Terrain Type: Level
- Freeway Peak Hour Factor: 0.94
- Freeway Total Trucks, %: 8.00
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- Ramp Terrain Type: Level
- Ramp Peak Hour Factor: 0.94
- Ramp Total Trucks, %: 3.00
- Weather Type: Non-Severe Weather
Global Factors

Project Properties
- Analyst: Bob Smith
- Agency: Acme Engineering
- Analysis Year: 2040
- Project Description: OATS Manual Training
- Jurisdiction: ODOT D6
- Time Period Analyzed: PM Northbound
- Date: 6/1/2020

Facility Global Inputs
- Jam Density: 190.0 pc/mi/in
- Queue Discharge Capacity Drop: 7%
- Area Type: Urban
- Demand Factor: 1.000
- Mixed Flow Model: No

Segments Global Inputs
- Freeway Lanes: 3
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Select All |  |  | Apply Global Inputs

Back  |  |  | Next
# Global Factors

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## Segments Global Inputs

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Global Factors

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Select All ☑ | Apply Global Inputs
### Global Factors

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[Apply Global Inputs]
Details - Basic Freeway Segment

Segment Data

- Segment: NB SR 315, South of N. Broadway on-ramp
- Time Period: 17:00 - 17:15

analyzed lane

Geometric Data

- Number of Lanes: 3
- Measured FFS: ✔
- Free Flow Speed, m/h: 70.0
- Length, ft: 4720
- Lane Width, ft: -
- Managed Lane: -

Terrain Type
- Percent Grade, %: -
- Grade Length, mi: -
- Right Side Clearance, ft: -
- Total Ramp Density, ramps/mi: 0.83
### Details - Basic Freeway Segment

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Details - Merge Segment

Segment Data
- Segment: Merge
- Time Period: 17:00-17:15

Geometric Data
- Number of Lanes: 3
- Freeway FFS, mi/h: 70.0
- Freeway Length, ft: 1500
- Freeway Terrain Type: Level
- Freeway Grade, %: -
- Freeway Grade Length, mi: -
- Highway or C-D Roadway: No
- Managed Lane: No
- Cross-Weaving Effects: No

- Ramp Lanes: 1
- Ramp FFS, mi/h: 55.0
- Ramp Side: Right
- Ramp Terrain Type: Level
- Ramp Grade, %: -
- Ramp Grade Length, mi: -
- Length of First Accel. Lane (LA), ft: 730
- Length of Second Accel. Lane (LA2), ft: -
Acceleration Lane Length
Details - Merge Segment

### Demand Data

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeway Demand, veh/h</td>
<td>5570</td>
</tr>
<tr>
<td>Freeway Peak Hour Factor</td>
<td>0.94</td>
</tr>
<tr>
<td>Freeway Total Trucks, %</td>
<td>8.00</td>
</tr>
<tr>
<td>Freeway Single-Unit Trucks (SUT), %</td>
<td>-</td>
</tr>
<tr>
<td>Freeway Tractor-Trailers (TT), %</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Merge Demand, veh/h</td>
<td>880</td>
</tr>
<tr>
<td>Ramp Peak Hour Factor</td>
<td>0.94</td>
</tr>
</tbody>
</table>

### Adjustment Factors

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeway Driver Population</td>
<td>All Familiar</td>
</tr>
<tr>
<td>Freeway Weather Type</td>
<td>Non-Severe Weather</td>
</tr>
<tr>
<td>Freeway Speed Adjustment Factor</td>
<td>1.000</td>
</tr>
<tr>
<td>Freeway Capacity Adjustment Factor</td>
<td>1.000</td>
</tr>
<tr>
<td>Incident Demand Adjustment Factor</td>
<td>1.000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ramp Driver Population</td>
<td>All Familiar</td>
</tr>
<tr>
<td>Ramp Weather Type</td>
<td>Non-Severe Weather</td>
</tr>
<tr>
<td>Ramp Speed Adjustment Factor</td>
<td>1.000</td>
</tr>
<tr>
<td>Ramp Capacity Adjustment Factor</td>
<td>1.000</td>
</tr>
<tr>
<td>Ramp Demand Adjustment Factor</td>
<td>1.000</td>
</tr>
</tbody>
</table>
Details - Diverge Segment
Deceleration Lane Length
Details - Weaving Segment

Segment Data

Segment: 60 Henderson on-ramp to Bethel off-ramp

Time Period: 17:00-17:15

Coded Type: Weaving

Analyzed Type: Weaving

Segment

Type |
---|
Basic |
Merge 1500 |
Basic 2120 |
Diverge 1900 |
Basic 1700 |
Weaving 2720 |
Basic 1900 |
Merge 1500 |
Basic 0000 |

<table>
<thead>
<tr>
<th>Length, ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>9</td>
</tr>
</tbody>
</table>

Weaving Configuration: One-Sided

Number of Lanes: 4
Free Flow Speed, mi/h: 70.0
Terrain Type: Percent Grade, %
Grade Length, mi: Minimum FR Lane Changes
Minimum RF Lane Changes: Minimum RR Lane Changes
Highway or C-D Roadway: 

Interchange Density, int/mi: 0.83
Managed Lane: 

Freeway Geometric Data

Number of Maneuver Lanes: 
Short Length (LS), ft: 1160

Back | Next
Short Length
## Details - Weaving Segment

### Ramp Geometric Data

<table>
<thead>
<tr>
<th>On-Ramp</th>
<th>Off-Ramp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Lanes</td>
<td>1</td>
</tr>
<tr>
<td>Free Flow Speed, m/h</td>
<td>55.0</td>
</tr>
<tr>
<td>Terrain Type</td>
<td>Level</td>
</tr>
<tr>
<td>Grade, %</td>
<td>-</td>
</tr>
<tr>
<td>Grade Length, mi</td>
<td>-</td>
</tr>
</tbody>
</table>

### Demand Data

<table>
<thead>
<tr>
<th>Freeway-to-Freeway</th>
<th>Ramp-to-Freeway</th>
<th>Ramp-to-Ramp</th>
<th>Freeway-to-Ramp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand, veh/h</td>
<td>47.40</td>
<td>520</td>
<td>870</td>
</tr>
<tr>
<td>Demand Adjustment Factor</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
</tr>
<tr>
<td>Peak Hour Factor</td>
<td>0.94</td>
<td>0.98</td>
<td>0.95</td>
</tr>
<tr>
<td>Total Trucks, %</td>
<td>8.00</td>
<td>3.00</td>
<td>3.00</td>
</tr>
<tr>
<td>Single-Unit Trucks (SUT), %</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Tractor-Trailers (TT), %</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

### Freeway Adjustment Factors

<table>
<thead>
<tr>
<th>Driver Population</th>
<th>Speed Adjustment Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Familiar</td>
<td>1.000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weather Type</th>
<th>Capacity Adjustment Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Severe Weather</td>
<td>1.000</td>
</tr>
</tbody>
</table>

| Incident Type | |
|---------------| |
| No Incident | |
### Results

**Segment Data**

<table>
<thead>
<tr>
<th>Segment</th>
<th>Time Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1→ NB SR 315, South of N. Broadway on-ramp</td>
<td>17:00-17:15</td>
</tr>
</tbody>
</table>

**Coded Type**

- Basic

**Type**

- None
- Lane
- merge
- Diverge
- basic
- merge
- basic
- basic

**Level**

- Basic
- Lane Width, ft: 10 ft
- Length, ft: 4720
- Right Side Clearance, ft: 6

**Geometric Data**

- Number of Lanes (N), ln: 3
- Percent Grade, %: -
- Free Flow Speed, mi/h: 70.0
- Speed Adjustment Factor: 1.000

**Demand and Capacity**

- Demand, veh/h: 5570
- Peak Hour Factor (PHF): 0.94
- Total Trucks, %: 8.00
- Single-Unit Trucks (SUT), %: -
- Tractor-Trailers (TT), %: -
- Passenger Car Equivalent (ET): 2.000
- Heavy Vehicle Factor (THV): 0.926
- Traffic Analysis Factor (DAF): 1.000
- Adjusted Capacity (scadj), pc/h: 7200
- Flow Rate (V), pc/h: 6399
- Capacity (C), pc/h: 7200
- Capacity Adjustment Factor: 1.000
- Volume-to-Capacity Ratio (v/c): 0.88

**Demand-to-Capacity Ratio (d/c)**

- Peak Hour Factor (PHF): 0.94
- Total Trucks, %: 8.00
- Single-Unit Trucks (SUT), %: -
- Tractor-Trailers (TT), %: -
- Passenger Car Equivalent (ET): 2.000
- Heavy Vehicle Factor (THV): 0.926
- Traffic Analysis Factor (DAF): 1.000
- Adjusted Capacity (scadj), pc/h: 7200
- Flow Rate (V), pc/h: 6399
- Capacity (C), pc/h: 7200
- Capacity Adjustment Factor: 1.000
- Volume-to-Capacity Ratio (v/c): 0.88

**Speed and Density**

- Lane Width Adjustment Factor (LWA): -
- Right Side Adjustment Factor (RSC): -
- Ramp Density Adjustment Factor: -
- Adjusted FFS (FFSadj), mi/h: 70.0
- Average Speed (S), mi/h: 60.4
- Density, veh/mi/ln: 32.3
- Density(D), pc/mi/ln: 34.9
- Level of Service (LOS): D
- Demand-Based LOS: -
- Queue, ft: 1163

*Note: This time period uses the calculated values of Flow instead of the input Demand values, as per the guidance in the HCM for the oversaturated procedure.*
ODOT Analysis and Traffic Simulation Manual

Results

Segment
- None
- Flow
- Speed
- Density
- LOS

Type, Length, ft
Segment ID
Lanes
Basic
Merge
Basic
Diverge
Basic
Weaving
Basic
Merge
Basic
A720
2320
1500
5
2
3
4
6
8
9
Density ≤ 11
11 ≤ Density ≤ 18
18 ≤ Density ≤ 26
26 ≤ Density ≤ 35
35 ≤ Density ≤ 45
Density > 45

Type, Length, ft
Segment ID
Lanes
Basic
Merge
Basic
Diverge
Basic
Weaving
Basic
Merge
Basic
A720
2320
1500
5
2
3
4
6
8
9
Speed 40 ≤ Speed ≤ 50
50 ≤ Speed ≤ 60
60 ≤ Speed ≤ 70
70 ≤ Speed ≤ 80
Speed ≤ 70

Type, Length, ft
Segment ID
Lanes
Basic
Merge
Basic
Diverge
Basic
Weaving
Basic
Merge
Basic
A720
2320
1500
5
2
3
4
6
8
9
Flow Rate ≤ 1600
1600 < Flow Rate ≤ 2000
2000 < Flow Rate ≤ 2400
Flow Rate > 2400

Type, Length, ft
Segment ID
Lanes
Basic
Merge
Basic
Diverge
Basic
Weaving
Basic
Merge
Basic
A720
2320
1500
5
2
3
4
6
8
9
Speed 30 ≤ Speed ≤ 40
40 ≤ Speed ≤ 50
50 ≤ Speed ≤ 60
60 ≤ Speed ≤ 70
Speed ≤ 70
### Facility Time Period Results

<table>
<thead>
<tr>
<th>T</th>
<th>Speed, mi/h</th>
<th>Density, pc/mln</th>
<th>Density, veh/mln</th>
<th>Travel Time, min</th>
<th>LOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>61.3</td>
<td>31.3</td>
<td>29.0</td>
<td>4.40</td>
<td>F</td>
</tr>
</tbody>
</table>

### Facility Overall Results

<table>
<thead>
<tr>
<th>Space Mean Speed, mi/h</th>
<th>Density, veh/mln</th>
<th>Average Travel Time, min</th>
<th>Density, pc/mln</th>
</tr>
</thead>
<tbody>
<tr>
<td>61.3</td>
<td>29.0</td>
<td>4.40</td>
<td>31.3</td>
</tr>
</tbody>
</table>

### Messages

**WARNING**

Oversaturated conditions currently exist in boundary time period 1. Results may not be reliable. Consider expanding analysis in time and/or space to resolve this warning.

### Comments

### Volume Distribution

<table>
<thead>
<tr>
<th>Volume (pc/mln)</th>
<th>Segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>7000</td>
<td>1</td>
</tr>
<tr>
<td>6500</td>
<td>2</td>
</tr>
<tr>
<td>6000</td>
<td>3</td>
</tr>
<tr>
<td>5500</td>
<td>4</td>
</tr>
<tr>
<td>5000</td>
<td>5</td>
</tr>
<tr>
<td>4500</td>
<td>6</td>
</tr>
<tr>
<td>4000</td>
<td>7</td>
</tr>
<tr>
<td>3500</td>
<td>8</td>
</tr>
<tr>
<td>3000</td>
<td>9</td>
</tr>
</tbody>
</table>

### Facility Segment Data

<table>
<thead>
<tr>
<th>No.</th>
<th>Coded</th>
<th>Analyzed</th>
<th>Name</th>
<th>Length, ft</th>
<th>Lanes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Basic</td>
<td>Basic</td>
<td>NB SR 315, South of N. Broadway on-ramp</td>
<td>4720</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Merge</td>
<td>Merge</td>
<td>North Broadway on-ramp</td>
<td>1500</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Basic</td>
<td>Basic</td>
<td>NB SR 315, South of Henderson off-ramp</td>
<td>2320</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Merge</td>
<td>Merge</td>
<td>Henderson off-ramp</td>
<td>1500</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Basic</td>
<td>Basic</td>
<td>NB SR 315, South of Henderson on-ramp</td>
<td>1700</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Merge</td>
<td>Merge</td>
<td>Henderson on-ramp to Bethel off-ramp</td>
<td>2720</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>Basic</td>
<td>Basic</td>
<td>NB SR 315, South of Bethel on-ramp</td>
<td>1980</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Merge</td>
<td>Merge</td>
<td>Bethel on-ramp</td>
<td>1500</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>Basic</td>
<td>Basic</td>
<td>NB SR 315, North of Bethel</td>
<td>6000</td>
<td>3</td>
</tr>
</tbody>
</table>
# HC57 Basic Freeway Report

## Project Information

<table>
<thead>
<tr>
<th>Analyst</th>
<th>Bob Smith</th>
<th>Date</th>
<th>6/1/2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agency</td>
<td>Acton Engineering</td>
<td>Analysis Year</td>
<td>2040 No-Build</td>
</tr>
<tr>
<td>Jurisdiction</td>
<td>ODOT D6</td>
<td>Time Period Analyzed</td>
<td>I-71 Northbound</td>
</tr>
<tr>
<td>Project Description</td>
<td>OATS Manual Training</td>
<td></td>
<td>United States Customary</td>
</tr>
<tr>
<td>Segment Number</td>
<td>1</td>
<td>Segment Name</td>
<td>I-370, SR 315, South of I-71 Broadway on-ramp</td>
</tr>
<tr>
<td>Time Period Number</td>
<td>1</td>
<td>Segment Analysis Time Period</td>
<td>17:00-17:15</td>
</tr>
</tbody>
</table>

## Geometric Data

<table>
<thead>
<tr>
<th>Number of Lanes, ln</th>
<th>3</th>
<th>Terrain Type</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Segment Length (L), ft</td>
<td>4720</td>
<td>Percent Grade, %</td>
<td>-</td>
</tr>
<tr>
<td>Measured or Base Free-Flow Speed</td>
<td>70.0</td>
<td>Grade Length, mi</td>
<td>-</td>
</tr>
<tr>
<td>Base Free-Flow Speed (BFFS), mi/h</td>
<td>70.0</td>
<td>Total Ramp Density (TRD), ramps/mi</td>
<td>0.83</td>
</tr>
<tr>
<td>Lane Width, ft</td>
<td>-</td>
<td>Free-Flow Speed (FFS), mi/h</td>
<td>70.0</td>
</tr>
<tr>
<td>Right-Side Lateral Clearance, ft</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Adjustment Factors

- Driver Population: All Familiar  Final Speed Adjustment Factor (SAF) 1.000
- Weather Type: Non-Severe Weather  Final Capacity Adjustment Factor (CAF) 1.000
- Incident Type: No Incident  Demand Adjustment Factor (DAF) 1.000

## Demand and Capacity

- Demand Volume veh/h: 5570  Heavy Vehicle Adjustment Factor (hmv) 0.926
- Peak Hour Factor: 0.94  Flow Rate (V), p/c/h/l 2169
- Total Trucks, %: 8.00  Capacity (c), p/c/h/l 2400
- Single-Unit Trucks (SU), %: -  Adjusted Capacity (ca), p/c/h/l 2400
- Tractor-Trailers (TT), %: -  Volume-to-Capacity Ratio (v/c) 0.88
- Passenger Car Equivalent (E): 2.000

---

**Note:** Details from the ODOT Analysis and Traffic Simulation Manual, page 133.
Oversaturated conditions currently exist in boundary time period 1. Results may not be reliable. Consider expanding analysis in time and/or space to resolve this warning.
Report - No-Build vs. Build

No-Build Conditions

Build Conditions
Freeway Facilities Analysis

http://www.dot.state.oh.us/Divisions/Engineering/Roadway/studies
Signalized Intersection Analysis

- Creating a new file
- Data input
- Signal timing optimization
- Reporting
Optimization

[Image of a software interface with options for optimization settings, including objective functions like Balanced Delay, Delay & Safety, etc.]
Optimization

Full Optimization

Input Parameters

- **Optimization**
  - Include this intersection in Optimization
  - Objective Function: Balanced Delay
  - Cycle Length
    - Safety and Emission
  - Splits
    - Phasing Sequence
  - Offsets
    - Dallas Phasing

- **Number of Generations**: 50

- **Population Size**: 10
- **Crossover Probability, %**: 10
- **Mutation Probability, %**: 30
- **Convergence Threshold, %**: 1.0
- **Random Number Seed**: 7761

Optimization Status

- Diagnostic Messages
- Safety, Emission, Delay Values

Save | Cancel
Optimization

**Balanced Delay**
- Original: 5.8 delta
- Optimum: 5.8 delta
- Average: 6.5 delta
- Improvement: 0.0%

**Run Status**
- Generation Number: 8 out of 50
- Generation Optimum: 1
- Total Time Elapsed: 5 sec

**Optimization in progress ...**

**Balanced Delay**
- Original: 5.8 delta
- Optimum: 2.3 delta
- Average: 9.1 delta
- Improvement: 60.6%

**Run Status**
- Generation Number: 50 out of 50
- Generation Optimum: 39
- Total Time Elapsed: 31 sec

**Termination via max number of generations**

**Save**
Conversion to TransModeler
Additional Resources

- HCM Signalized Intersection Chapter
- OATS Manual Section 6.2.2.1
- OATS Training Video
- HCS Help Manual
- McTrans Video Tutorials - mctrans.ce.ufl.edu/hcs

Streets Tutorial

Download the Tutorial
Chapter 7 - Traffic Simulation with TransModeler

Streets
- Create Roadways & Intersections
- Customize Network Features to Ground-Truth Detail

Intersections*
- Create & Edit Signal Timing Settings
- Add Turning Movement Volumes

Simulation
- Visually Audit with Animation
- Calibrate for Behavior & MOE's
- Generate Outputs

Output
- Create Summary Reports
- Visualize Performance Measures

*not required for every project
TransModeler Topics

- Model Development, File Organization & Network Coding
- Traffic Control & Management
- Road Classification & Naming Streets and Centroids
- Superlinks & Selection Sets
- Demand Input Development
- Calibration and Validation
- Output and Performance Measures
- Presentation requirements
TransModeler Training Videos

- Coding a network
- Importing from External File Formats
- Exporting from Statewide Database
- Road Editing (Freeway, Intersection & Roundabout)
- Turning Movements
- Multi-Period Demand
- Intersection Operations
- Isolated Signal Optimization
- Corridor Signal Optimization
- Road Classes
- Vehicle Classes
- Vehicle Departure Rates
TransModeler Training Videos - Coming Soon

- Overview of User Interface
- Importing Cube Networks
- Calibration & Validation
- Output Reports

http://www.dot.state.oh.us/Divisions/Engineering/Roadway/studies/Pages/default.aspx
Chapter 8 - Presentation of Results

- Results can be presented in the following formats:
  - Tabular format
  - Graphical format
  - Animation (microsimulation analysis only)

All results should be presented in a concise and understandable manner
# Tabular Summaries - Intersections

<table>
<thead>
<tr>
<th>Intersection A</th>
<th>No Build - AM</th>
<th>Alternative 1 - AM</th>
<th>Alternative 2 - AM</th>
<th>Alternative 3 - AM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOS</td>
<td>Delay</td>
<td>LOS</td>
<td>Delay</td>
</tr>
<tr>
<td>NB</td>
<td>E</td>
<td>57.5</td>
<td>E</td>
<td>60.8</td>
</tr>
<tr>
<td>SB</td>
<td>F</td>
<td>97.0</td>
<td>D</td>
<td>54.4</td>
</tr>
<tr>
<td>EB</td>
<td>E</td>
<td>64.9</td>
<td>D</td>
<td>48.3</td>
</tr>
<tr>
<td>WB</td>
<td>F</td>
<td>97.2</td>
<td>E</td>
<td>60.5</td>
</tr>
<tr>
<td>Overall Int.</td>
<td>F</td>
<td>80.0</td>
<td>D</td>
<td>56.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intersection B</th>
<th>No Build - AM</th>
<th>Alternative 1 - AM</th>
<th>Alternative 2 - AM</th>
<th>Alternative 3 - AM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOS</td>
<td>Delay</td>
<td>LOS</td>
<td>Delay</td>
</tr>
<tr>
<td>NB</td>
<td>D</td>
<td>37.5</td>
<td>D</td>
<td>40.7</td>
</tr>
<tr>
<td>SB</td>
<td>D</td>
<td>49.5</td>
<td>D</td>
<td>54.3</td>
</tr>
<tr>
<td>EB</td>
<td>D</td>
<td>49.0</td>
<td>C</td>
<td>26.6</td>
</tr>
<tr>
<td>WB</td>
<td>D</td>
<td>36.7</td>
<td>D</td>
<td>52.1</td>
</tr>
<tr>
<td>Overall Int.</td>
<td>D</td>
<td>43.9</td>
<td>D</td>
<td>44.2</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Intersection C</th>
<th>No Build - AM</th>
<th>Alternative 1 - AM</th>
<th>Alternative 2 - AM</th>
<th>Alternative 3 - AM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOS</td>
<td>Delay</td>
<td>LOS</td>
<td>Delay</td>
</tr>
<tr>
<td>NB</td>
<td>B</td>
<td>18.3</td>
<td>B</td>
<td>15.9</td>
</tr>
<tr>
<td>SB</td>
<td>C</td>
<td>27.5</td>
<td>C</td>
<td>20.8</td>
</tr>
<tr>
<td>EB</td>
<td>C</td>
<td>29.1</td>
<td>C</td>
<td>21.4</td>
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<tr>
<td>WB</td>
<td>N/A</td>
<td>N/A</td>
<td>B</td>
<td>17.7</td>
</tr>
<tr>
<td>Overall Int.</td>
<td>C</td>
<td>25.4</td>
<td>B</td>
<td>19.9</td>
</tr>
</tbody>
</table>
Graphical Presentation - IMS/IJS

- **Operational Results**
  - Segment Number
  - Analysis Type
  - Location
  - LOS
  - D/C
Graphical Presentation - IMS/IJS

- Geometric Data
  - Number of mainline lanes
  - On-ramps/Off-ramps lanes
  - Merge/Diverge/Weave configurations
  - Interchanges labeled
  - Ramp metering for No-Build/Build condition
  - Speed limits
  - Clear distinction between No-Build/Build
Graphical Presentation - IOS/Feasibility Studies/Corridor Studies/TIS

- **Operational Results**
  - Graphical presentation typically not necessary

- **Geometric Data - Overall Network**
  - Stick figure of Study Area
  - Streets labeled
  - Speed limit(s)
  - Distance between intersections
  - Clear distinction between No-Build/Build
Chapter 9 - Documentation

- Streamlines review and allows for replication of the analysis
- Documents calibration and validation process and resulting changes to the base model
- Provides justification for any changes in default parameters
- Supportive statistics which compares field-measured and calibration MOEs
Analysis Documentation

- Model Development Documentation form
  - Must be completed for all Complex Type projects
  - Must be completed for any Standard Type project where ODOT default values were changed
  - When not needed, a statement should be included that no default values were changed
  - Included with the traffic analysis submission
Reviewer Checklist

- PDF on ORE Studies webpage
- Ensures quality control on all ODOT analyses
  - Parameters and assumptions match the study requirements
  - Analyses are performed appropriately
  - Models are properly calibrated
  - Results are reasonable
  - All required files are submitted as part of the review
Reviewer Checklist

- Should be filled out by the consultant team prior to the submittal to ODOT
Documentation

- Model Development Documentation
  - Documents model parameters that deviate from default values and the calibration and validation process

- Reviewer Checklist
  - Ensures quality control on ODOT analyses
Questions

http://www.dot.state.oh.us/Divisions/Engineering/Roadway/studies/Pages/default.aspx


- ODOT Form - Model Documentation July 2020.pdf
- ODOT Form - Reviewer Checklist July 2020.pdf
- ODOT Form- Scoping July 2020.pdf

OATS Training Videos

- TransModeler Database Files - Ohio.zip

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Gary Harrington
Districts 5, 6, 7, 11

Mary Bapu-Tamaskar
Districts 2, 3, 8, 9