

SPOT PRIORITIZATION FOR INTERSECTION/INTERCHANGE PROJECTS

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PATRIOT
TRANSPORTATION
ENGINEERING, PLLC



SPOT OVERVIEW

Background

- NCDOT uses a transparent, systematic, and data-driven process for prioritizing the major capital transportation in the state and making investment decisions.
- Considers all modes:
 - Highway
 - Bicycle and Pedestrian
 - Rail
 - Transit
 - Aviation
- NCDOT is currently working on the sixth generation of the Strategic Prioritization Process, known as Prioritization 6.0 (P6.0). This latest iteration is based on North Carolina's Strategic Transportation Investment Legislation, passed in June 2013.

INTERSECTION/INTERCHANGE PROJECTS

Highway Projects

- 1 – Widen Existing Roadway
- 2 – Upgrade Arterial to Freeway/Expressway
- 3 – Upgrade Expressway to Freeway
- **4 – Upgrade Arterial to Superstreet**
- 5 – Construct Roadway on New Location
- 6 – Widen Existing Roadway and Construct part on New Location
- **7 – Upgrade At-grade Intersection to Interchange or Grade Separation**
- **8 - Improve Interchange**
- 9 – Convert Grade Separation to Interchange
- **10 – Improve Intersection**
- 11 – Access Management
- 12 – Ramp Metering
- 13 – Citywide Signal System
- 14 – Closed Loop Signal System
- 15 – Install Cameras and DMS
- 16 – Modernize Roadway
- 17 – Upgrade Freeway to Interstate Standards
- 18–Widen Existing or Construct New Local (Non-State) Roadway
- **19–Improve Intersection on Local (Non-State) Roadway**
- **20–Convert Grade Separation to Interchange to Relieve Existing Congested Interchange**
- **21– Realign Multiple Intersections**
- **22–Construct Auxiliary Lanes or Other Operational Improvements**
- 23 -Construct Grade Separation at Highway/Railroad Crossing
- 24– Implement Road Diet to Improve Safety

SPOT PRIORITIZATION FOR INTERSECTION/INTERCHANGE PROJECTS

PROGRAM OVERVIEW

Project Phases

- SPOT 3.0 – June 2013-April 2014 – 285 Projects
- SPOT 4.0 – June 2015-March 2016 – 294 Projects
- SPOT 5.0 Pre-Submittal – April 2017-July 2017 – 90 Projects
- SPOT 5.0 – July 2017 – March 2019 – 291 Projects
- SPOT 6.0 Pre-Submittal – March 2019-June 2019 – 191 Projects
- SPOT 6.0 – September 2019-March 2020 - ??? Projects

PROGRAM TEAM

Program Managers



PATRIOT
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Management Team



M M
MOTT
MACDONALD

PATRIOT
TRANSPORTATION
ENGINEERING, PLLC



Project Modeling and Analysis



HNTB

Kimley **>>>** Horn

K KITTELSON
& ASSOCIATES

M M
MOTT
MACDONALD



PARSONS

PATRIOT
TRANSPORTATION
ENGINEERING, PLLC

RK&K



 **Stantec**



VHB

Vanasse Hangen Brustlin, Inc.

WSP

SPOT PRIORITIZATION FOR INTERSECTION/INTERCHANGE PROJECTS

VOLUME DEVELOPMENT

2017/2027 Volume Development

- Four Scenarios –
 - 2017 No-Build
 - 2017 Build
 - 2027 No-Build
 - 2027 Build
- Based on 2016 or 2017 NCDOT AADT Volume Data (2017/2018 in P6.0)
- Links without AADT determined by proportioning TMC volume to known AADT volume
- Turn Percentages
 - Turning Movement Count
- Conversion to Peak Hour
 - K-factor based on TMC Data
 - D-factor based on TMC Data
 - Assumes same K for AM and PM
 - AM D is inverse of PM
- Developed as Origin-Destination Matrix
- Multiple Intersections Projects have full O-D defined

SPOT PRIORITIZATION FOR INTERSECTION/INTERCHANGE PROJECTS

VOLUME DEVELOPMENT

2017/2027 Volume Development

- 2027 Volumes developed based on Growth Rates from NC Statewide Model (NCSTM)
- For Links in NCSTM
 - Compound Annual Growth Rate (CAGR) between 2015 and 2025 Existing + Committed (E+C) Network
- For Links not in NCSTM
 - Growth Rate based on the average rate for same functional class in each County

Table 3-1: Growth Rate by County and Functional Classification

County	Freeway	Arterial	Collector	Local	County	Freeway	Arterial	Collector	Local
Alamance	1.3%	1.1%	0.9%	1.1%	Johnston	2.0%	2.5%	2.2%	2.3%
Alexander	N/A	1.1%	1.3%	1.3%	Jones	0.4%	1.5%	1.4%	1.5%
Alleghany	N/A	1.0%	0.9%	0.9%	Lee	1.6%	1.6%	1.5%	1.6%
Anson	N/A	1.4%	1.3%	1.2%	Lenoir	0.9%	0.7%	0.6%	0.2%
Ashe	N/A	1.4%	1.2%	1.2%	Lincoln	1.2%	1.2%	0.9%	0.7%
Avery	N/A	1.4%	1.4%	1.4%	Macon	N/A	1.6%	1.5%	1.9%
Beaufort	N/A	0.7%	0.6%	0.4%	Madison	1.5%	1.3%	1.2%	1.8%
Bertie	N/A	0.7%	0.2%	0.5%	Martin	N/A	0.8%	0.5%	0.4%
Bladen	N/A	1.2%	1.2%	1.1%	McDowell	1.6%	1.1%	1.0%	1.0%
Brunswick	3.0%	2.2%	1.4%	1.2%	Mecklenburg	0.9%	1.7%	1.4%	1.2%
Buncombe	0.8%	0.9%	0.9%	0.4%	Mitchell	N/A	0.9%	0.9%	0.8%
Burke	1.1%	1.1%	1.1%	0.6%	Montgomery	1.4%	1.0%	0.6%	0.7%
Cabarrus	1.0%	1.4%	1.5%	1.2%	Moore	1.9%	1.8%	1.7%	1.7%
Caldwell	1.2%	0.9%	1.3%	0.7%	Nash	1.4%	1.5%	1.9%	0.1%
Camden	N/A	1.2%	1.2%	0.9%	New Hanover	1.8%	0.9%	1.6%	1.3%
Carteret	1.1%	1.8%	1.4%	0.9%	Northampton	1.8%	0.9%	1.3%	1.3%
Caswell	N/A	1.3%	0.8%	1.3%	Onslow	1.4%	1.3%	1.7%	1.7%
Catawba	0.8%	0.8%	1.2%	0.5%	Orange	1.5%	1.6%	2.3%	1.2%
Chatham	N/A	2.0%	2.1%	2.3%	Pamlico	N/A	0.7%	0.7%	0.7%
Cherokee	N/A	1.0%	0.9%	0.7%	Pasquotank	N/A	0.9%	0.5%	0.6%
Chowan	1.0%	0.6%	0.5%	0.4%	Pender	2.1%	1.6%	1.9%	1.9%
Clay	N/A	1.6%	1.6%	1.6%	Perquimans	N/A	1.0%	0.6%	0.6%
Cleveland	1.4%	0.9%	0.9%	1.1%	Person	N/A	1.1%	1.1%	0.6%

VOLUME DEVELOPMENT

SPOT ID: H090285 **TIP No.:** US 17 **County:** Perquimans **Division:** 1

Route No.: US 17 **Cross Street/Limits:** US 17 Business/ SR 1300

Base Year: 2016 (19,800 trips/day)
 Future Year: 2026 (21,700 trips/day)
 Area Type: Rural
 Terrain: Level

ADT Source:
 A - NCDOT ADT Map at Intersection
 B - NCDOT ADT Map - Adjacent Segment
 C - Based on Traffic Count Proportions
 D - Based on Traffic Forecast Proportions
 E - Based on Engineering Judgment
 F - Other - See Notes

Turning Percentage Source:
 I - Turning Movement Count
 II - Traffic Forecast
 III - Travel Demand Model
 IV - Engineering Judgment
 V - Other - See Notes

Node ID: 1
2016 AADT: 20,000
Source: A
PM Peak Dir: INBOUND
No. of Lanes: 4
Facility Type: Multi-lane
Classification: Arterial

Growth Source: NCSTIM
Annual Growth %: 0.9%
Change in Turn %: No
2026 AADT: 21,900

2016 **2026**
 19.2% 19.2%
 13.5% 13.5%
 80.4% 80.4%
 86.3% 86.3%

2016 **2026**
 0.4% 0.4%
 0.2% 0.2%

V/C Ratio:
 1 0.28
 2 0.09
 3 0.26
 4 0.20

Over/Under Capacity:
 Under
 Under
 Under
 Under

% of Links Over Capacity:

SPOT ID: H171804 **TIP No.:** I-277 **County:** Mecklenburg **Division:** 10

Route No.: I-277 **Cross Street/Limits:** Kenilworth Avenue to North Davidson Street

Area Type: URBAN
 Terrain: URBAN

Node ID: 1
2016 AADT: 18,000
Source: A
PM Peak Dir: INBOUND
No. of Lanes: 4
Facility Type: Multi-lane
Classification: Arterial

Growth Source: NCSTIM
Annual Growth %: 0.9%
Change in Turn %: No
2026 AADT: 21,900

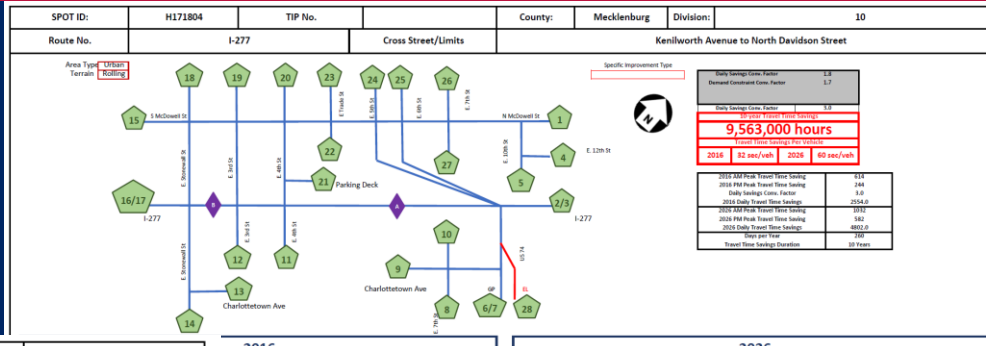
2016 **2026**
 19.2% 19.2%
 13.5% 13.5%
 80.4% 80.4%
 86.3% 86.3%

2016 **2026**
 0.4% 0.4%
 0.2% 0.2%

V/C Ratio:
 1 0.28
 2 0.09
 3 0.26
 4 0.20

Over/Under Capacity:
 Under
 Under
 Under
 Under

% of Links Over Capacity:



Node ID: 4 **AM** **PM**
2016 AADT: 3,100 **2016** **2026** **73.3%** **68.8%**
Source: A **2016** **2026** **73.3%** **68.8%**

PM Peak Dir: OUTBOUND
No. of Lanes: 2 **2016** **2026** **9.7%** **16.0%**
Facility Type: Arterial **2016** **2026** **9.7%** **16.0%**
Classification: Collector

Growth Source: NCSTIM
Annual Growth %: 0.5%
Change in Turn %: No
2026 AADT: 3,300

2016 **2026**
 17.0% 15.2%
 17.0% 15.2%

K = 0.09
D (AM) = 0.45
D (PM) = 0.40

2016 **2026**
 7.9% 2.9%
 8.7% 8.7%

2016 **2026**
 87.2% 87.2%
 6.3% 6.3%

Node ID: 3
2016 AADT: 15,000
Source: A
PM Peak Dir: OUTBOUND
No. of Lanes: 4
Facility Type: Multi-lane
Classification: Arterial

Growth Source: NCSTIM
Annual Growth %: 1.0%
Change in Turn %: No
2026 AADT: 16,600

2016 **2026**
 17.0% 15.2%
 17.0% 15.2%

K = 0.09
D (AM) = 0.55
D (PM) = 0.45

2016 **2026**
 7.9% 2.9%
 8.7% 8.7%

2016 **2026**
 87.2% 87.2%
 6.3% 6.3%

Node ID: 1
2016 AADT: 15,000
Source: A
PM Peak Dir: OUTBOUND
No. of Lanes: 4
Facility Type: Multi-lane
Classification: Arterial

Growth Source: NCSTIM
Annual Growth %: 1.0%
Change in Turn %: No
2026 AADT: 16,600

2016 **2026**
 17.0% 15.2%
 17.0% 15.2%

K = 0.09
D (AM) = 0.55
D (PM) = 0.45

2016 **2026**
 7.9% 2.9%
 8.7% 8.7%

2016 **2026**
 87.2% 87.2%
 6.3% 6.3%

SPOT ID: H150380 **TIP No.:** NC 53 **County:** Onslow **Division:** 3

Route No.: NC 53 (Western Blvd) **Cross Street/Limits:** SR 1308 (Gum Branch Rd) to US 17 (Marine Blvd)

Area Type: URBAN
 Terrain: URBAN

Node ID: 1
2016 AADT: 15,000
Source: A
PM Peak Dir: INBOUND
No. of Lanes: 4
Facility Type: Multi-lane
Classification: Arterial

Growth Source: NCSTIM
Annual Growth %: 1.0%
Change in Turn %: No
2026 AADT: 16,600

2016 **2026**
 17.0% 15.2%
 17.0% 15.2%

K = 0.09
D (AM) = 0.55
D (PM) = 0.45

2016 **2026**
 7.9% 2.9%
 8.7% 8.7%

2016 **2026**
 87.2% 87.2%
 6.3% 6.3%

Node ID: 1
2016 AADT: 15,000
Source: A
PM Peak Dir: INBOUND
No. of Lanes: 4
Facility Type: Multi-lane
Classification: Arterial

Growth Source: NCSTIM
Annual Growth %: 1.0%
Change in Turn %: No
2026 AADT: 16,600

2016 **2026**
 17.0% 15.2%
 17.0% 15.2%

K = 0.09
D (AM) = 0.55
D (PM) = 0.45

2016 **2026**
 7.9% 2.9%
 8.7% 8.7%

2016 **2026**
 87.2% 87.2%
 6.3% 6.3%

2016 **2026**
 18 sec/veh 18 sec/veh
 60 sec/veh 60 sec/veh

9,565,000 hours
 Travel Time Savings Per Vehicle

2016 **2026**
 71 sec/veh 212 sec/veh

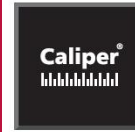
AM Peak O-D Matrix

From \ To	1	2	3	4	Total
1	1	2	3	4	10
2	1	699	109	809	1617
3	1	56	31	87	174
4	123	16	20	768	927
Total	755	64	794	204	1807

PM Peak O-D Matrix

From \ To	1	2	3	4	Total
1	1	2	3	4	10
2	1	34	12	47	94
3	530	60	18	608	1216
4	77	18	17	312	424
Total	608	82	47	1077	1814

SPOT PRIORITIZATION FOR INTERSECTION / INTERCHANGE PROJECTS



TransModeler[®]
Traffic Simulation Software

TRANSMODELER

Caliper TransModeler 5.0

- Traffic Simulation Software
- Integrates with TransCAD
- GIS Based
- Models Freeway and Arterials
- Signal Optimization
- Numerous Outputs and Measures of Effectiveness
- Models Roundabouts
- Transit Integration
- Toll Integration
- Macroscopic, Mesoscopic and Hybrid Simulation
- TransModeler SE for smaller projects

SPOT PRIORITIZATION FOR INTERSECTION/INTERCHANGE PROJECTS

MODEL DEVELOPMENT

Default Parameters – Consistency is Essential

- Modeled AM and PM peak hours
- Vehicle fleet based on collected data
- Truck percentages based on facility and land use type
- Speed distributions based on collected data and engineering judgment
- Facilities coded based on posted speed limit
- Signalized Intersections
 - Used Signal Plan for phasing
 - Optimized based on volumes
 - Used Standard NCDOT defaults for yellow, all-red, lost time, etc.
 - Fully actuated signals with advance detectors and stop bar detectors
- Each Model Run 10 times for each scenario
- Vehicle Hours Traveled (VHT) was the primary output

SPOT PRIORITIZATION FOR INTERSECTION/INTERCHANGE PROJECTS

TRAVEL TIME SAVINGS

$$TTS_{10-yr} = \left[(\min(2017 TT, 2027 TT) * 10) + \frac{|2027 TT - 2017 TT| * 10}{2} \right] * CF_1 * CF_2 * 260 \text{ days/year}$$

- VHT for AM and PM Peak for No-Build and Build Scenarios
- Assumes 260 weekdays per year over 10-year period
- Conversion Factor 1 – Developed to extrapolate peak hour savings to a daily value
- Conversion Factor 2 – Developed for over capacity segments
 - Compares AADT volume to capacity of segment for each approach
 - Capacity based on facility type, area type and number of lanes
 - Conversion Factor is based on percentage of segments that are considered to be over capacity
 - v/c threshold varied based on topography

DOCUMENTATION

Program Management Report

- Concept Overview
- Detailed Program Management Approach
 - Volume Development Methodology
 - TransModeler Default Parameters
 - TransModeler Model Development Guidelines
- Results

To be completed at end of P6.0



SPOT PRIORITIZATION FOR INTERSECTION/INTERCHANGE PROJECTS

SUMMARY

Summary of Program

- Developed 960 Projects in 4 rounds of SPOT w/ 190 currently being developed in P6.0 Pre-Submittal Phase
- Each round of SPOT runs from roughly October through February (~20 weeks)
- Collect new traffic counts for all projects
- Utilizes 14 Private Engineering Firms
- Program Manager responsible for scoping, tracking progress, quality control review of volumes and modeling

Sustainable – All models can be re-used in future rounds of SPOT and for STIP Projects

SPOT PRIORITIZATION FOR INTERSECTION/INTERCHANGE PROJECTS

QUESTIONS

Questions?

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