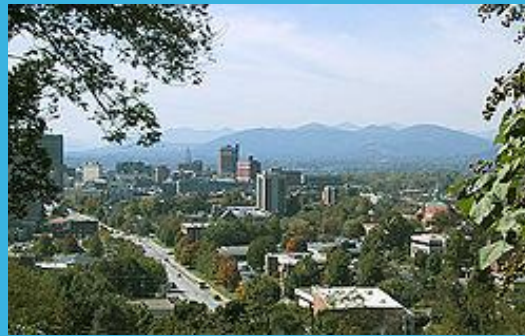


LEVEL OF SERVICE D FOR SYSTEMS LEVEL PLANNING

NCDOT - TRANSPORTATION PLANNING BRANCH



INTRODUCTION

- 2000 HIGHWAY CAPACITY MANUAL
- 2005 ITRE NCLOS SOFTWARE
VERSION 2.1
- LEVEL OF SERVICE COMMITTEE

TRAINING OUTLINE

- **LEVEL OF SERVICE/HCM 101**
 - BASIC TERMINOLOGY
 - GEOGRAPHIC AREAS (TPB REGIONS V/S GEOGRAPHIES)
 - NCLOS D STANDARDS INPUT HANDOUT
- **BREAK**
- **LOS BASELINE INFORMATION**
 - NCLOS D STANDARDS FOR SYSTEMS LEVEL PLANNING LAYOUT
 - AREA TYPE, FACILITY TYPES
 - LEVEL OF SERVICE D STANDARDS
 - INFORMATION YOU NEED TO KNOW
- **CTP EXAMPLES AND EXERCISES**
 - BASIC AND COMPLEX EXAMPLES
 - IDENTIFY FACILITY/LOS/AREA TYPES ON A COUNTY CTP NETWORK
 - IDENTIFY LOS D VALUES ON A COUNTY CTP NETWORK
- **WRAP-UP, MOVING AHEAD**
 - MODEL APPLICATION
 - HCM 2010 and ITRE NCLOS PROGRAM UPGRADE
 - NCLOS TPB COMMITTEE MEMBERS

Q & A: BASIC LOS/HCM DEFINITIONS

- Capacity – definition

- “The capacity of a facility is the maximum *hourly* rate at which persons or vehicles reasonably can be expected to traverse a point or a uniform section of a lane or roadway during a given time period under prevailing roadway, traffic, and control conditions.” (HCM 2000)

- Roadway conditions, e.g....

- number of lanes, lane width, shoulder width, development.

- Traffic Conditions, e.g....

- vehicle mix, directional and lane distribution.

- Control Conditions, e.g....

- signal phasing, cycle length, green time, coordination.

- Level of Service – definition

- “Level of service (LOS) is a quality measure describing operational conditions within a traffic stream, generally in terms of such service measures as speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience.” (HCM 2000)

- Six levels of service, A through ___

- Each LOS represents a range of conditions.

- One or more service measures determines LOS. (What are service measures for freeway, expressway, etc?)

- Safety (does/does not) determine service levels.

Q & A: BASIC LOS/HCM DEFINITIONS

- Free Flow Speed (FFS)
- Base Free Flow Speed (BFFS)
- Average Travel Speed (ATS)
- Traffic Signals Per Mile
- Interchanges Per Mile
- Access Points Per Mile
- Density
- Lane/Shoulder Width
- Lateral Clearance
- g/C Ratio
- Arrival Type
- % Time Spent Following
- % No Passing
- Truck Percentage
- Automatic Traffic Recorder (ATR) Sites
- K Factor
- D Factor
- Peak Hour Factor
- Driver Population Factor
- Terrain Type (Level/Rolling/Mountainous)

FACILITY TYPES

CTP	HCM	CTP DEFINING CHARACTERISTICS	Service Measure (LOS CRITERIA)
FREEWAY	Freeway	Full control of access	Density
EXPRESSWAY	Multilane Highway	Limited access, divided, no traffic signals	Density
BOULEVARD	Arterial	Partial access, traffic signals, divided	ATS
OTHER MAJOR THOROUGHFARES	Arterial or 2-Lane Highway	Undivided, US or NC route	ATS or ATS and PTSF
MINOR THOROUGHFARES	Arterial or 2-Lane Highway	Undivided, SR route	ATS or ATS and PTSF

TPB GEOGRAPHIC AREAS



NOT NECESSARILY TRUE
GEOGRAPHIC AREAS!!

Examples? Hickory (Piedmont) Fayetteville (Piedmont)

!!! BREAK !!!



NCLOS D LAYOUT

- Disclaimer/Basic definitions for NCLOS D Standards
- NCLOS D Standards for Systems Level Planning
- APPENDIX A – Freeways: HCM 2000 Freeway Equations and Inputs
- APPENDIX B – Expressways: HCM 2000 Multi-lane Highway Equations and Inputs
- APPENDIX C – Boulevards: HCM 2000 Urban Streets – Arterial & Collectors/Locals Equations and Inputs
- APPENDIX D – Other Major Thoroughfares: HCM 2000 Urban Streets – Arterial & Collectors/Locals Equations and Inputs
- APPENDIX E – Minor Thoroughfares: HCM 2000 Urban Streets – Arterial & Collectors/Locals Equations and Inputs
- APPENDIX F – Two-Lane Highways: HCM 2000 Two-Lane Highway Equations and Inputs

AREA TYPE

- **RURAL**
 - Areas typically outside a municipality or Extraterritorial Jurisdiction (ETJ)
- **SUBURBAN**
 - Areas typically within a municipality or ETJ, but not within an Urban area
- **URBAN**
 - Areas that are within a CBD or immediately surrounding a CBD

LEVEL OF SERVICE D VALUES

- **STANDARD CAPACITY VALUES**
 - Represents an average LOS D capacity for a given facility. A default value for a given region.
- **MINIMUM CAPACITY VALUES**
 - Represents conditions/inputs that result in a worst-case LOS D capacity for a given region.
- **MAXIMUM CAPACITY VALUES**
 - Represents conditions/inputs that result in a best-case LOS D capacity for a given region.

CTP FACILITY TYPES

- **FREEWAYS**
- **EXPRESSWAYS**
- **BOULEVARDS**
 - Divided 2-6+ lane facilities
- **OTHER MAJOR THOROUGHFARES**
 - Undivided facilities (US/NC routes = 2-5 lanes, SR/Local routes = 4-5 lanes) typically within a municipality or ETJ
- **MINOR THOROUGHFARES**
 - Undivided facilities (SR/Local routes = 2-3 lanes) within a typically municipality or ETJ
- **RURAL TWO-LANE HIGHWAYS**
 - 2-lane undivided facility outside a municipality or ETJ. These facilities are classified as **other major thoroughfares** if they are a US or NC route and **minor thoroughfares** if they are a secondary/local route.

FINALLY, Volumes shown represent the point at which traffic transitions from a LOS D to LOS E.

Q & A: DATA YOU NEED TO KNOW AND RESOURCES

- Lanes Per Direction
- Location of Facility (Urban, Suburban, Rural)
- Type of Facility *
- Divided/Undivided Facility
- K Factor
- D Factor
- Truck Percentage **
- Lane Width

* Applicable for Other Major Thoroughfares versus Minor Thoroughfares

** Applicable for Freeways, Expressways, and Rural 2-Lane Highways

USING NCLOS D STANDARDS

- **Basic Example**
- **Complex Example**
- **Your Turn!**
 - Identify CTP Facility Type
 - Identify NCLOS Facility Type
 - Identify Area Type (Urban, Suburban, Rural)
 - Find Capacity

EXAMPLE 1

- **Facility: I-40**
- **Section: From NC 210 (Exit 319) to NC 242 (Exit 325)**
- **4-lane divided cross-section**
- **Full control of access**
- **19% Trucks**



CTP Facility Type? Why?

Freeway – Multi-lane divided facility, full control of access

NCLOS Type? Why?

Freeway – Multi-lane divided, full control of access

Area Type? Why?

Rural, outside a municipality or ETJ

Capacity? Why?

58,000 – 19% Trucks, Rural

EXAMPLE 2

- Facility: Cleveland Rd (SR Route)
- Section: Barber Mill Rd to NC 210
- 3-lane undivided cross-section
- 45 MPH
- Includes driveways and traffic signals
- Lower than average K Factor/Directional



CTP Facility Type? Why?

Minor Thoroughfare – 3-lane facility, undivided, low access control

NCLOS Type? Why?

Minor Thoroughfare– 3-lane undivided, not a US/NC route

Area Type? Why?

Rural, outside a municipality or ETJ

Capacity? Why?

17,300, 3-lane, Lower than average K Factor/Directional (Maximum LOS)

YOUR TURN!



EXERCISE 1

- Facility: I-95
- Section: Brogden Rd (Exit 93) to East Anderson St (Exit 98)
- In Smithfield/Selma ETJ
- 6-lane divided cross-section
- Full control of access
- 24% Trucks



CTP Facility Type? Why?

Freeway – Multi-lane divided facility, full control of access

NCLOS Type? Why?

Freeway – Multi-lane divided facility, full control of access

Area Type? Why?

Suburban – inside the ETJ, but not in or around the CBD

Capacity? Why?

84,600 – 24% Trucks

EXERCISE 2

- Facility: US 70
- Section: US 70
Business to US 70
Alternate
- 4-lane divided cross-section
- Only interchanges and right-in/right-out access
- Rural Area
- No traffic signals
- 12% Trucks

CTP Facility Type? Why?

Expressway – Multi-lane divided facility, high access control, no traffic signals

NCLOS Type? Why?

Expressway – Multi-lane divided facility, high access control, no traffic signals

Area Type? Why?

Rural – outside municipality/ETJ

Capacity? Why?

56,100 – 12% Trucks



EXERCISE 3

- **Facility: US 70 Business**
- **In Clayton, leading into CBD**
- **4-lane divided cross-section**
- **Includes traffic signals and driveways**
- **45 MPH**

- CTP Facility Type? Why?**
Boulevard – Divided facility with traffic signals
- NCLOS Type? Why?**
Boulevard – Divided facility with traffic signals
- Area Type? Why?**
Urban – leading into CBD
- Capacity?**
35,100



EXERCISE 4

- **Facility: Princeton-Kenly Road (SR Route)**
- **Section: Truckstop Road to NC 222**
- **In Kenly ETJ**
- **2-lane cross-section with driveways**
- **10-foot lanes**
- **35 MPH**



CTP Facility Type? Why?

Minor Thoroughfare– 2-lane undivided, low access control

NCLOS Type? Why?

Minor Thoroughfare – 2-lane undivided facility, not a US/NC route, low access control

Area Type? Why?

Suburban – Within an ETJ

Capacity? Why?

9,500 – 10-foot lanes

EXERCISE 5

- **Facility: US 701**
- **Section: Sticklands Crossroad to county line, outside any ETJ**
- **2-lane cross-section with driveways**
- **12-foot lanes**
- **55 MPH**
- **Average conditions**



CTP Facility Type? Why?

Major Thoroughfare – US route, undivided

NCLOS Type? Why?

Rural 2-lane Highway – 2-lane undivided facility, outside a municipality or ETJ

Area Type? Why?

N/A – Uses Rural 2-lane Highway Methodology

Capacity? Why?

12,400 – 12-foot lanes

EXERCISE 6

- **Facility: Devils Racetrack Road (SR Route)**
- **Section: US 701 to county line, outside ETJ**
- **2-lane cross-section with driveways**
- **10-foot lanes**
- **55 MPH**
- **Extremely tight curves with less than average travel conditions**



CTP Facility Type? Why?

Minor Thoroughfare – SR route, 2-lanes, undivided

NCLOS Type? Why?

Rural 2-lane Highway – 2-lane undivided facility, outside a municipality or ETJ

Area Type? Why?

N/A – Uses Rural 2-lane Highway Methodology

Capacity? Why?

9,000 – 10-foot lanes/less than average travel conditions (Minimum LOS)

EXERCISE 7

- Facility: NC 39
- Section: US 301 to CAMPO boundary
- 2-lane cross-section
- In Selma ETJ
- 12-foot lanes
- 45 MPH
- Higher than average K factor and directional flow/lower than average Peak Hour Factor



CTP Facility Type? Why?

Major Thoroughfare – NC route, 2-lanes, undivided

NCLOS Type? Why?

Major Thoroughfare – NC route, inside an ETJ

Area Type? Why?

Suburban – Inside an ETJ, not near or in a CBD

Capacity? Why?

11,800 – 2-lanes, higher than average K factor and directional flow (Minimum LOS)

EXERCISE 8

- Facility: NC 42
- Section: US 70
Business to Buffalo Rd
- 2-lane divided cross-section
- In Clayton ETJ
- Includes traffic signals and driveways
- 45 MPH

CTP Facility Type? Why?

Boulevard– Divided facility with traffic signals

NCLOS Type? Why?

Boulevard– Divided facility with traffic signals

Area Type? Why?

Suburban – Inside an ETJ, not near or in a CBD

Capacity? Why?

18,300 – 2-lanes divided



THAT'S A WRAP/MOVING AHEAD

- NCLOS D Standards in Small Urban Model Development
- One-Way Pairs (They still exist!)
- Current NCLOS D Standards for Systems Level Planning Based on HCM 2000 and the 2005 ITRE NCLOS Version 2.1. ITRE and NCDOT to update NCLOS based on HCM 2010, which is slated to be complete by the end of 2012. Some of the LOS Committee Members are members of this Steering Committee and Implementation Team.
- When the new ITRE NCLOS Program is released, the NCLOS D Standards for Systems Level Planning will be updated and expanded.

THANK YOU FOR YOUR PARTICIPATION!

NCLOS Committee Members:

- **Jamal Alavi, PE**
 - **Pam Cook, PE**
 - **Scott Walston, PE**
 - **David Keilson, PE, Presenter**
 - **Sarah Lee, EI, Presenter**
 - **Mark Eatman, EI**
 - **Hong Qi Lu**
 - **J. Andy Bailey**
- 