A Policy on Geometric Design of Highways and Streets (Green Book)
AASHTO, 7th Edition

SAME Workshop
Adventure Science Center
October 12, 2017

Jeff Jones, P.E.
Tennessee Department of Transportation
Topics to Cover

- AASHTO / TCGD
- Green Book, 7th Edition (GB7)
- Green Book, 8th Edition (GB8)
- Questions and Answers
<table>
<thead>
<tr>
<th>Number</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>State Departments of Transportation (4 Per AASHTO Region)</td>
</tr>
<tr>
<td>1</td>
<td>National Association of County Engineers</td>
</tr>
<tr>
<td>1</td>
<td>National League of Cities</td>
</tr>
<tr>
<td>1</td>
<td>American Public Works Association</td>
</tr>
<tr>
<td>1</td>
<td>Port Authority of NY, NJ</td>
</tr>
<tr>
<td>1</td>
<td>Federal Highway Administration</td>
</tr>
</tbody>
</table>
3. A Policy on Geometric Design of Highways and Streets (Green Book), 2011 *(underway)*
5. Guide for Development of Rest Areas on Major Arterials and Freeways, 2001
8. Geometric Design of Very Low-Volume Local Roads (ADT≤400), 2001 *(underway)*
What is the Green Book?

- AASHTO Policy... Becomes Design Standard for NHS when adopted by FHWA
- New Construction and Reconstruction
- Based on Research or Emerging Practices
- State of Practice (*historically*) vs State of Art
- Not a process manual
Six Previous Editions of the Green Book
• **General Changes**
• Chapter 1: Highway Functions
• Chapter 2: Design Controls and Criteria
• Chapter 3: Elements of Design
• Chapter 4: Cross Section Elements
• Chapter 5: Local Roads and Streets
• Chapter 6: Collector Roads and Streets
• Chapter 7: Arterials
• Chapter 8: Freeways
• Chapter 9: Intersections
• Chapter 10: Grade Separations and Interchanges
General Changes

• Retaining Dual Units

• Flipping order to English [Metric]
GB7 Ballot Version

- General Changes
- **Chapter 1: Highway Functions**
- Chapter 2: Design Controls and Criteria
- Chapter 3: Elements of Design
- Chapter 4: Cross Section Elements
- Chapter 5: Local Roads and Streets
- Chapter 6: Collector Roads and Streets
- Chapter 7: Arterials
- Chapter 8: Freeways
- Chapter 9: Intersections
- Chapter 10: Grade Separations and Interchanges
Chapter 1: **Total rewrite**  Subject of 20-7 project to incorporate Performance Based Design (NCHRP Report 785) and a Context Sensitive Functional Classification System into the Green book (NCHRP 15-52)

Chapter 1: **Retitled**

**Currently:** “New Framework for Geometric Design”
Chapter 1 - Highway Functions

Based on NCHRP 15-52:

Going from 2 to 5 Context Classes

Two Rural (Rural and Rural Town)

Three Urban (Urban, Urban Core and Suburban)
Chapter 1 - Highway Functions

NCHRP Report 785: Performance-Based Analysis of Geometric Design of Highways and Streets

Performance Measures (GB1 - GB6)

Vehicular mobility....

- 20 year traffic projections
- v/c ratio or LOS
Possible Performance Measures (GB7 / GB8)

Based on Project Purpose and Need

1) mobility / speed / v/c ratio or LOS
2) safety performance
3) surface condition
4) freight movement
5) economic development
6) quality of service for bike, peds, transit vehicles
Chapter 3 - Elements of Design

High Speed Design Criteria.. Up to 80 mph

Criteria for High Design Speed Facilities, TTI 2007

NCHRP 774 Superelevation for sharp horizontal curves on steep grades.
Chapter 4 - Cross Section Elements

**NCHRP Synthesis 432** “Recent Roadway Design Research for Improved Safety and Operations”

- Adding discussion regarding lane width and safety

**NCHRP 794** Median Cross Section for Rural Divided Highway

**NCHRP 790** Factors Contributing to median encroachments and cross-median cross overs

**Guide for the Development of Bicycle Facilities, AASHTO**

- Bicycle Facilities was rewritten to be more "proactive/positive" in tone and on the discussion of bicycling as a mode of transportation.
<table>
<thead>
<tr>
<th>NCHRP 794 - Median Cross-Section Design for Rural Divided Highways</th>
</tr>
</thead>
<tbody>
<tr>
<td>AASHTO Guide for the Development of Bicycle Facilities</td>
</tr>
<tr>
<td>NCHRP 193 - Development of Left-Turn Warrants for Unsignalized Intersections</td>
</tr>
<tr>
<td>NCHRP 790 - Factors Contributing to Median Encroachments and Cross-Median Crashes</td>
</tr>
<tr>
<td>NCHRP 659 - Guide for the Geometric Design of Driveways</td>
</tr>
<tr>
<td>NCHRP 780 - Design Guidance for Intersection Auxiliary Lanes</td>
</tr>
<tr>
<td>AASHTO Guide for Geometric Design of Transit Facilities on Highways and Streets</td>
</tr>
</tbody>
</table>
Chapter 9 - Intersections

1. **NCHRP 650**: Median Intersection Design for Rural High-Speed Divided Highways
2. **NCHRP 659**: Guide for the Geometric Design of Driveways
3. **NCHRP 672**: Roundabouts: An Informational Guide
4. **NCHRP (Web-Only) Document 208**: Design Guidance for Channelized Right-Turn Lanes
5. **NCHRP 707**: Guidelines on the Use of Auxiliary Through Lanes at Signalized Intersections
6. **NCHRP 745**: Left-Turn Accommodations at Unsignalized Intersections
1. Discussion/Guidance regarding other modes such as bicycle and pedestrian
2. FHWA-HRT-07-048, FHWA-SA-14-067
   Diverging Diamond Interchanges
   NCHRP 03-113 (Signals / Geometrics at DDIs)
3. NTSB-SIR-12.01 / Other Studies
   Additional content on wrong-way entry
4. NCHRP Report 687 / FHWA-HRT-07-031:
   Content on Interchange spacing
5. NCHRP Report 730:
   Content on ramp terminals (exits and entrances)
6. NCHRP 3-105:
   On-going research on Design Guidance for Interchange Loop Ramps
Green Book, 7th Edition
Completion Schedule

- Presentation at SCOD in Des Moines  July 2017

- Chapters provided to AASHTO Subcommittee on Design members for review and comments  July 2017
Over 700 Comments Received from SCOD

- **Chapter 1** – 134 **Highway Functions**
- **Chapter 2** – 58 **Design Controls and Criteria**
- **Chapter 3** – 44 **Elements of Design**
- **Chapter 4** – 42 **Cross Sectional Elements**
- **Chapter 5** – 51 **Local Roads and Streets**
- **Chapter 6** – 26 **Collector Roads and Streets**
- **Chapter 7** – 44 **Rural and Urban Arterials**
- **Chapter 8** – 25 **Freeways**
- **Chapter 9** – 255 **Intersections**
- **Chapter 10** – 41 **Grade Separations and Interchanges**
- Ballot to **TCGD** in October 2017
- Ballot to **SCOD** late Fall 2017
- Ballot to **SCOH** late Early 2018
### NCHRP 15-52:
Developing a Context-Sensitive Functional Classification System for More Flexibility in Geometric Design

### NCHRP Report 785:
Performance-Based Analysis of Geometric Design of Highways and Streets

<table>
<thead>
<tr>
<th>Context</th>
<th>Rural</th>
<th>Rural Town</th>
<th>Suburban</th>
<th>Urban</th>
<th>Urban Core</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Principal Arterial</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>High speed</td>
<td>Low speed</td>
<td>High speed</td>
<td>Low speed</td>
<td>Low speed</td>
</tr>
<tr>
<td></td>
<td>M mobility + access</td>
<td>M mobility - access</td>
<td>M mobility - access</td>
<td>M mobility + access</td>
<td>M mobility - access</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Minor Arterial</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>High speed</td>
<td>Low speed</td>
<td>High speed</td>
<td>Low speed</td>
<td>Low speed</td>
</tr>
<tr>
<td></td>
<td>M mobility + access</td>
<td>M mobility - access</td>
<td>M mobility + access</td>
<td>M mobility - access</td>
<td>M mobility + access</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Collector</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>High speed</td>
<td>Low speed</td>
<td>High speed</td>
<td>Low speed</td>
<td>Low speed</td>
</tr>
<tr>
<td></td>
<td>M mobility + access</td>
<td>M mobility - access</td>
<td>M mobility + access</td>
<td>M mobility - access</td>
<td>M mobility - access</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Local</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>High speed</td>
<td>Low speed</td>
<td>High speed</td>
<td>Low speed</td>
<td>Low speed</td>
</tr>
<tr>
<td></td>
<td>M mobility + access</td>
<td>M mobility - access</td>
<td>M mobility + access</td>
<td>M mobility - access</td>
<td>M mobility + access</td>
</tr>
</tbody>
</table>
Part I—Fundamentals of Geometric Design

Chapter 1—Geometric Design and Project Development
Chapter 2—The Geometric Design Framework
Chapter 3—Road User Performance Characteristics
Chapter 4—Elements of Geometric Design—Alignment and Cross Section
Chapter 5—Elements of Geometric Design—Intersections and Roundabouts
Chapter 6—Elements of Geometric Design—Interchanges and Interchange Ramps
Chapter 7—Integration of Technology with Geometric Design
Chapter 8—Overview of the Roadway Geometric Design Process
Part II—Geometric Design Process for New Roads

- Chapter 9—New Construction Design Process Overview
- Chapter 10—New Local and Collector Roads in Rural Context Zones
- Chapter 11—New Arterial Roads in Rural Context Zones
- Chapter 12—New Freeways and Fully Controlled Access Highways in Rural Context Zones
- Chapter 13—New Local and Collector Roads in Suburban Context Zones
- Chapter 14—New Arterial Roads in Suburban Context Zones
- Chapter 15—New Freeways and Fully Controlled Access Highways in Suburban Context Zones
- Chapter 16—New Local and Collector Roads in Urban Context Zones
- Chapter 17—New Arterial Roads in Urban Context Zones
- Chapter 18—New Freeways and Fully Controlled Access Highways in Urban Context Zones
Part III—Geometric Design Process for Roads to Be Reconstructed

Chapter 19—Reconstruction Design Process Overview
Chapter 20—Reconstructed Local and Collector Roads in Rural Context Zones
Chapter 21—Reconstructed Arterial Roads in Rural Context Zones
Chapter 22—Reconstructed Freeways and Controlled Access Facilities in Rural Context Zones
Chapter 23—Reconstructed Local and Collector Roads in Suburban Context Zones
Chapter 24—Reconstructed Arterial Roads in Suburban Context Zones
Chapter 25—Reconstructed Freeways and Controlled Access Facilities in Suburban Context Zones
Chapter 26—Reconstructed Local and Collector Roads in Urban Context Zones
Chapter 27—Reconstructed Arterial Roads in Urban Context Zones
Chapter 28—Reconstructed Freeways and Controlled Access Facilities in Urban Context Zones
Chapter 29—3R Design Process for All Road Types and Contexts
Thank You!

Jeff C. Jones, P.E.
Asst. Chief Engineer - Design
Tennessee Department of Transportation
Suite 700, James K. Polk Bldg.
Nashville, TN 37243-1402
(615) 741-2831
jeff.c.jones@tn.gov