TDOT Highway System Access Manual

Introduction

Tennessee Department of Transportation | January 29, 2021

INTRODUCTION
V.1.0

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A cross section of Tennessee Department of Transportation (TDOT) and Federal Highway Administration (FHWA) staff took part in regular working group meetings to develop the materials found in TDOT's Highway System Access Manual (HSAM).

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Acronyms

Acronyms and abbreviations used in the Highway System Access Manual are as follows:

A/C	Actual to Critical
A/SW	Actual to Statewide
AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
ADT	Average Daily Traffic
AIIR	Alternative Intersections/Interchanges: Informational Report
CAP-X	Capacity Analysis for Planning of Junctions
CF	Calibration Factors
CMA	Corridor Management Agreement
CMAQ	Congestion Mitigation and Air Quality
CMF	Crash Modification Factors
CUTR	Center for Urban Transportation Research
DDVH	Directional Design Hour Volume
DHV	Design Hourly Volume
DOT	Department of Transportation
E-TRIMS	Enhanced Tennessee Roadway Information Management System
FDOT	Florida Department of Transportation
FHWA	Federal Highway Administration
GHG	Greenhouse Gas
HCS	Highway Capacity Software
HSAM	Highway System Access Manual
HSM	Highway Safety Manual
ICE	Intersection Control Evaluation
ICM	Integrated Corridor Management
IHSDM	Interactive Highway Safety Design Module
IIE	Intersection and Interchange Evaluation
ISATe	Enhanced Interchange Safety Analysis Tool
LCCET	Life-Cycle Cost Estimating Tool
LDR	Land Development Regulations
LOS	Level of Service
MOU	Memorandum of Understanding
MPH	Miles Per Hour
MPO	Metropolitan Planning Organization
MUT	Median U-Turn
MUTCD	Manual of Uniform Traffic Control Devices

NCHRP	National Cooperative Highway Research Program
NHS	National Highway System
NPV	Net Present Value
OCT	Office of Community Transportation
PCE	Passenger Car Equivalent
PIN	Project Identification Number
PUD	Planned Unit Development
RCUT	Restricted Crossing U-Turn
RPO	Rural Planning Organization
SHS	State Highway System
SPF	Safety Performance Functions
SPICE	Safety Performance for Intersection Control Evaluation
SR	State Route
STIP	State Transportation Improvement Program
SW	Statewide
TACIR	Tennessee Advisory Commission of Intergovernmental Relations
T.C.A.	Tennessee Code Annotated
TDEC	Tennessee Department of Environment and Conservation
TDOT	Tennessee Department of Transportation
TIP	Transportation Improvement Program
TIS	Traffic Impact Study
TITAN	Tennessee Integrated Traffic Analysis Network
TMC	Turning Movement Counts
TMV	Turning Movement Volumes
TPM	Transportation Performance Management
TPO	Transportation Planning Organization
TRB	Transportation Research Board
TWLTL	Two -Way Left-Turn Lanes
UDO	Unified Development Ordinance
V/C	Volume to Capacity
VPD	Vehicles Per Day
VEH/H	Vehicles Per Hour

Introduction

Purpose of Access Management

Access regulations are necessary to preserve the functional integrity of Tennessee's State Routes and to promote the safe and efficient movement of people and goods while providing reasonable access to adjoining property owners. ***Reasonable access means that a property owner will have access to the public highway system, but it does not mean that potential patrons are guaranteed the most direct or convenient access from a specific roadway to the owner's property.***

Every access point constructed on a roadway increases the crash risk and deteriorates traffic operations. The cumulative impact of closely spaced access points over time is one of the largest contributors to high crash rates and congestion on State Routes.

Transportation / Land Use Cycle

Without access management, the function and character of major roadway corridors can deteriorate rapidly. The result is a cycle of events demonstrated in Figure INTRO-1 that begins with arterial improvements that increase the accessibility of developable land. Transportation projects, especially those that increase capacity or provide access to new areas, can affect the growth rate and development patterns of those areas. Land values increase as greater regional accessibility stimulates real estate interest. Land use changes occur as commercial or industrial uses seek locations on arterials and near highway interchanges, and as developers of low-density subdivisions build on nearby land made more accessible to job centers.

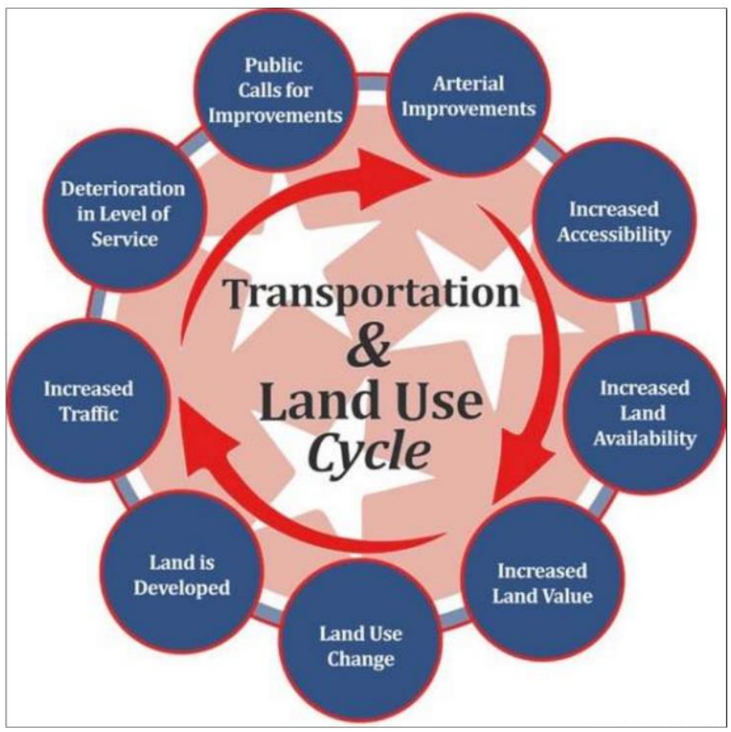

Figure INTRO-1: Transportation and Land Use Cycle

An effective access management program can slow or reduce the cycle shown in Figure INTRO-1 without adversely affecting economic development. Effective access management programs can reduce crashes by 50 percent, increase roadway capacity by 45 percent and reduce travel time and delay by 60 percent.[1] Most non-freeway travel delay is caused by access connections – turning movements interfering with through traffic and traffic signals stopping traffic on the main road for the benefit of side road traffic entering. Access connections are the most significant roadway design feature for both safety and operations.

Improved Safety

As access density increases, crash rates increase. Figure INTRO-2 from Transportation Research Board's (TRB's) *Access Management Manual, 2nd Edition*[2] shows the relationship between access density and crashes. It shows the composite crash rate indexes that were derived from an analysis of 37,500 crashes. The indexes were developed by correlating crash rates with access density – the crash rate for 10 access points per mile was used as a base – and then averaging crash rates for each access density threshold. The indexes suggest that an increase from 10 driveways to 20 driveways per mile would increase crash rates by roughly 30 percent.

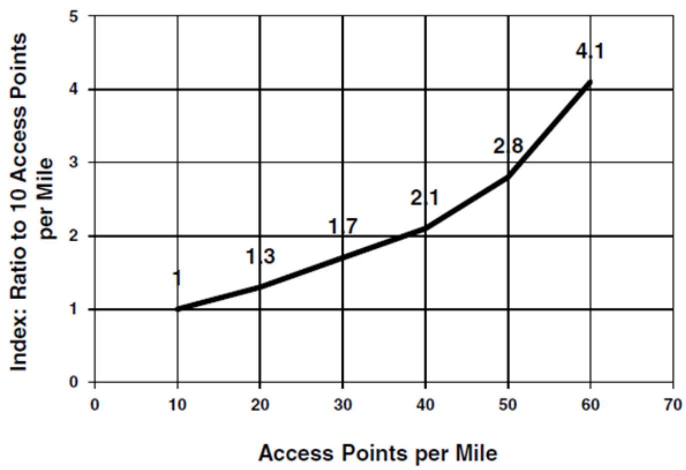

Figure INTRO-2: Composite Crash Rate Indexes

Improved Operations and Economic Benefits

Efficient transportation with reliable travel times is a vital public resource. Access management supports the economy by keeping transportation costs low for all business types by preserving the efficiency of the Tennessee State Route network. The cost of every item at its point of sale is determined in part by the cost of transportation. In a highly competitive national and global economy, the cost of travel delay affects the price at the point of sale.

Studies of the effects of access management on roadway operations have assessed the influence of access spacing on travel time through the use of a variety of analysis techniques. The studies

[1] TRB Access Management Manual 2nd Edition, 2014, pg. 5
[2] TRB Access Management Manual 2nd Edition, 2014, pg. 26

indicate that access management helps to increase capacity, maintain desired free-flow speed, and reduce delays. For example, minimizing the number of traffic signals and promoting uniform signal spacing significantly improves travel times. Each traffic signal per mile added to a roadway reduces speed by two to three miles per hour[3].

Purpose of Access Management Summary

By managing highway access, TDOT is extending the life of Tennessee's State Routes, improving public safety, reducing traffic congestion, and improving the appearance and the quality of travel. Not only does access management preserve the transportation functions of a highway, it also helps preserve long-term property values and the economic viability of abutting development. From an environmental perspective, improved traffic flow translates into greater fuel efficiency and reduced vehicular emissions. The need to establish new major highways on new alignments is reduced by preserving the capacity, reliability, and travel efficiency of existing highways, thus avoiding taking and damaging rural landscapes and environmentally sensitive areas and acquiring private property.

[3] TRB Access Management Manual 2nd Edition, 2014, pg. 32

Example Access Management Techniques

Table INTRO-1 summarizes common access management techniques and their associated safety and operational effects for motor vehicles. Some techniques may have negative effects for pedestrians and bicyclists and should be evaluated in land use contexts where those users could be present.

Table INTRO-1: Effects of Access Management Techniques

Summary of Research on Effects of Access Management Techniques	
Treatment	**Effect**
Add continuous Two-Way Left-Turn Lane (TWLTL)	35% reduction in total crashes 30% decrease in delay 30% increase in capacity
Add non-traversable median	> 55% reduction in total crashes 30% decrease in delay 30% increase in capacity
Replace TWLTL with non-traversable median	15% to 57% reduction in crashes on four-lane roads 25% to 50% reduction in crashes on six-lane roads
Add left-turn bay	25% to 50% reduction in crashes on four-lane roads Up to 75% reduction in total crashes at unsignalized access 25% increase in capacity
Type of left-turn improvement - Painted - Separator or raised divider	 32% reduction in total crashes 67% reduction in total crashes
Add right-turn bay	20% reduction in total crashes Limit right-turn interference with platooned flow, increased capacity
Visual cue at driveways, driveway illumination	42% reduction in crashes
Long signal spacing with limited access	42% reduction in total vehicle hours of travel 59% reduction in delay 57,500 gallons of fuel saved per mile per year
Source: TRB Access Management Manual 2nd Edition, 2014, pg. 30	

Who Benefits from Access Management?

TDOT's HSAM guidance considers all modes of travel, not just motor vehicle users. The economic vitality of communities and a corridor's viability to support business owners is considered in the guidance. The guidance is tailored to different land use contexts. Table INTRO-2 lists ways access management programs can benefit different users.

Table INTRO-2: Who Benefits from Access Management?

User	Benefit
Motorists	Fewer decision points results in improved safety and less delay
Cyclists	Fewer conflicts with turning vehicles improving safety
Pedestrians	Fewer conflicts with fewer driveways, medians provide refuge
Transit Riders	Less transit delay, safer for pedestrian access, connectivity to stops
Business Owners	Improved access and stable or increasing property values
Communities	Enhanced business environment, property values, greater fuel efficiency with reduced emissions, livable roadway corridors

Organization of TDOT's HSAM

TDOT's HSAM is composed of three volumes.: 1. Planning, 2. Intersection and Interchange Evaluation, and 3. Geometric Design Criteria.

Volume 1: Planning

TDOT's HSAM Planning volume provides Land Development Regulation (LDR) and Corridor Management Agreement (CMA) guidance. The intended audience includes planners and government officials of local jurisdictions seeking to strengthen their community's access management standards. While design and permitting on the state highway system falls under the purview of TDOT, local jurisdictions can play an integral role in effective access management. In addition to the safety and operation of arterial and collector roadways, local jurisdictions can promote a range of access management policies and strategies through their LDRs and CMAs. Strategic land use controls, in congress with state access management efforts, can help improve the transportation system for users of all ages and abilities. As such, TDOT is increasingly partnering with local jurisdictions to coordinate land use and transportation decisions as they relate to access management. However, neither TDOT nor any other state agency has the authority to dictate land development policy to local jurisdictions. As such, the guidance contained in this volume is purely voluntary and may be modified as needed to fit local needs and conditions.

Volume 2: Intersection and Interchange Evaluation

TDOT's Intersection and Interchange Evaluation (IIE) process helps practitioners select the best intersection or interchange design at a given location. TDOT's IIE utilizes FHWA's Intersection Control Evaluation (ICE) guidance as its foundation. As with ICE, TDOT's IIE is a data-driven, performance-based approach to objectively screen intersection and interchange options. In lay terms, IIE is a documented approach to "good traffic engineering." It is not intended to be a rigid selector of intersection or interchange control; it is a process to ensure practitioners consider all reasonable improvement options. It helps eliminate individual practitioner's bias and provides an institutionalized approach to intersection and interchange option selection. It allows innovative intersection and interchange options to be more broadly considered, placing them on equal footing with standard intersection or interchange control options such as signalized intersections.

Volume 3: Geometric Design Criteria

TDOT's HSAM Geometric Design Criteria were developed such that each access related decision is in alignment with the functional purpose and land use context of the roadway. Volume 3 provides design criteria related to intersection spacing, intersection design, driveway design, medians, and turn lanes. The design criteria establish a descending hierarchy of access standards and techniques matched to the level of roadway functional classification and land use context. The functional classification and context system utilized in TDOT's HSAM mirrors the classification system found in the American Association of State Highway and Transportation Officials (AASHTO) *A Policy on Geometric Design of Highways and Streets, 7th Edition* (also known as the Green Book).

Primary Sources

The primary sources used to develop TDOT's HSAM include:

- TDOT's Roadway Design Guidelines
- TDOT's Manual for Constructing Driveway Entrances on State Highways
- TRB's *Access Management Manual 2nd Edition*
- The University of Tennessee, Knoxville's *Access Management Report*
- AASHTO's *A Policy on Geometric Design of Highways and Streets, 7th Edition*
- FHWA's *Alternative Intersections/Interchanges Informational Report*
- National Cooperative Highway Research Program (NCHRP) 337 *Cooperative Agreements for Corridor Management*
- Center for Urban Transportation Research's *Model Access Management Policies and Regulations for Florida Cities and Counties, 2nd Edition*
- FHWA, Georgia Department of Transportation, Virginia Department of Transportation, and Florida Department of Transportation

The University of Tennessee Knoxville's *Access Management Report* was developed for TDOT in December 2017. It summarized national best practices in access management recommendations that laid the foundation for TDOT's HSAM. Of note, it assigned access management criteria along roadway classifications labeled as roman Numerals I through V. The HSAM built upon these classifications by associating them with the highway functional classifications and land use context classifications found in the AASHTO's *A Policy on Geometric Design of Highways and Streets, 7th Edition*. This brings consistency across TDOT and AASHTO design guidance.