

Roadways are the Most Dangerous Public Utilities on the Face of the Earth

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Parametrix



Roadways are the Most Dangerous Public Facilities on the Face of the Earth

- In the US, about 800 people are killed each **week**
- 17,500 Crashes each **day**
- The leading cause of death of a child between the ages of 4 and 14 is a traffic crash.



About 40% of all crashes are preventable using improved roadway design and access management

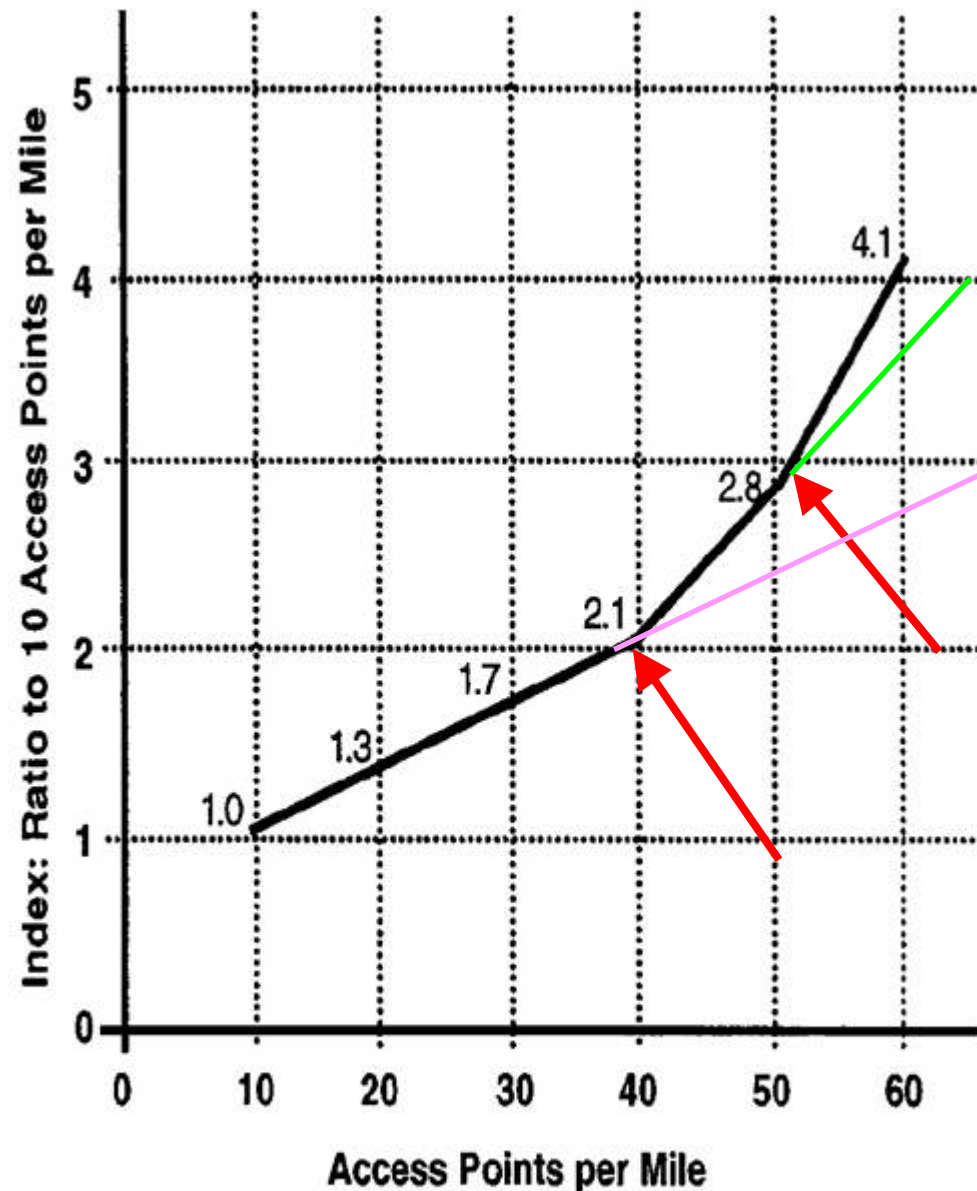
Question: Is it agency negligence not to implement a known safety strategy?

As the number of access points per mile increase, so does the frequency of total highway collisions.

The rate also increases

1 access = 4%/mile

NCHRP 420



Source: Estimated from Various Sources

Figure 15. Composite accident rate indices.

Most Access Programs have Two major elements:

- Access Standards
- and Access Categories.

Freeways

INCREASING
Travel-Time
Congestion
Collisions
Delay

Arterials

DECREASING
Capacity
Mobility
Speed
Safety

Collectors

Locals



Access Relationship Between Functional Classes



Source: Virgil Stover

Access Classification System

- Establish an access decision hierarchy of agency's system that is aligned with the adopted transportation plan.
- Ensure that each access decision is consistent with meeting the functional purpose of the roadway.
- Access category is the functional guidance on day to day access decisions impacting the performance of the roadway.



How FDOT Access Classes Fit Into the Whole Picture



Access Classifications

- The category assignment guides the decision to determine if access will be granted
- To some degree, the access related improvements required. (turn lanes)
- Determines the type of access that may be granted. (Signal, restricted turns, field approaches, temporary, emergency, other limitations)

Why another classification system:

- Over 70 years of highway planning and budgeting, several federal and state classification systems have evolved.
- Distinguishes between various levels of hierarchies capacity, regional purpose, and funding priorities.

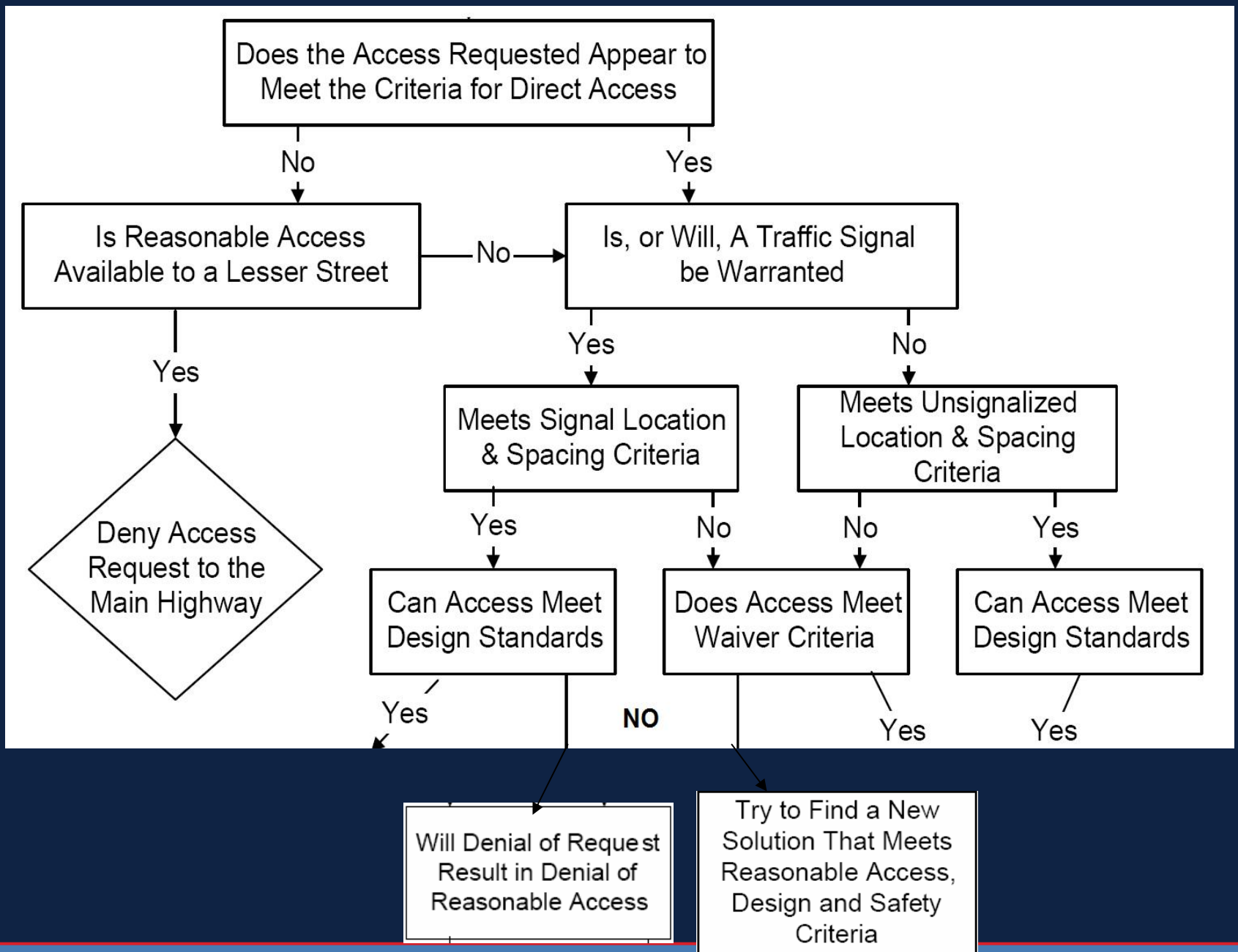
Why another classification system:

- Access Categories differ significantly from traditional classifications by focusing on access characteristics, roadside development, access controls, traffic operations, safety and design elements.
- Access Categories' do align strongly with current functional planning systems.

- Access Category systems is the pragmatic recognition of road side reality.

US 40, I-70 business, US 287, NHS





To Create a Access Classification System

- Define access management categories
- Establish standards for each category
- Create process and assign category to each segment of highway
- Adopt assignment schedule by Rule or Ordinance.

Assignment factors and basis

- adopted administrative and functional classifications
- existing and projected traffic volumes
- current and future highway capacity and levels of service
- current and predicted levels of highway safety

Match the category standards to your efforts to protect the transportation plan



Source: Virgil Stover

Assignment factors and basis

- adopted state and local transportation plans and needs
- the character of lands adjoining the highway
- adopted local land use plans and zoning
- the availability of vehicular access from local streets and roads rather than a state highway
- providing for population and business growth and needs.

Slicing the Key Elements for Levels of Performance

- Allow, or Not, private direct access
- Signal spacing: $\frac{1}{4}$, $\frac{1}{2}$, 1 mile.
- If driveway, key design elements effecting performance
 - Auxiliary lanes
 - driveway spacing,
 - type
 - Turn restrictions (medians)

Key Category Access Factors

- Intersection Spacing
- Traffic Signal Spacing
- Allowing direct access or require to obtain alternative access
- Proof of access necessity
- Turn Restrictions (median)
- Scope of access improvement, such as requiring auxiliary lanes, (decel and accel)

How Safety has Impacted Categories

- Proof of necessity – every access point granted is dangerous.
- This drives most of the program
- Why think of how to allow access when access = hazard.
- So even lower categories beg proof of necessity for access.
- Should Access ever be a given?

Hierarchy of Access Classifications

– *the most important element*

- Standards for achieving roadway intended function.
- Classification standard determines *IF* access or signal allowed, and where.
- Classify the entire system by route, segment and mile.
- Design a classification system and test it.

Colorado since 1998

Table of access categories, with approximate descriptions	
F-W Interstate System, Freeway Facilities	
E-X Expressway, Major Bypass	
Rural	Non-Rural
R-A Regional Highway	NR-A Regional Highway
R-B Rural Highway	NR-B Arterial
	NR-C Arterial
F-R Frontage Roads (both urban and rural)	

Category Descriptions

- Fully described in Text within the rule
- Samples are in the AMM appendix

3.8 CATEGORY R-A - Regional Highway

Functional Characteristics and Category Assignment Criteria

(1) This category is appropriate for use on highways that have the capacity for medium to high speeds and relatively medium to high traffic volumes over medium and long distances in an efficient and safe manner. They provide for interregional, intra-regional, and intercity travel needs. Direct access service to abutting land is subordinate to providing service to through traffic movements. This category is normally assigned to National Highway System routes, significant regional routes in rural areas, and other routes of regional or state significance.

Access Granting Criteria Including Category Related Access Location, Operation and Design Criteria

(2) When application is made, one access shall be granted per parcel or land if reasonable access cannot be obtained from the local street or road system. Reasonable local access will be determined in consultation with the appropriate local authority. A determination of reasonable access from a local street or road should include consideration of the local street or road function, purpose, capacity, operational and safety conditions and opportunities to improve the local street or road. Direct access to the highway should not be denied if the alternative local access would create a significant operational or safety problem at the alternative location and the direct access to the state highway would not be a significant problem to the highway.

(3) (a) The standard for the spacing of all intersecting public ways and other accesses that will be full movement, or are or may become signalized, is one-half mile intervals, and based upon section lines where feasible. Exceptions to this one-half mile standard shall not be permitted unless the proposal documents that there are no other reasonable alternatives to achieve a one-half mile interval, there is a documented necessity for the intersection at the proposed location, and a signal study acceptable to the Department is completed in accordance with section 2.3(5).

(b) Where it is not feasible to meet one-half mile spacing and where signal progression analysis indicates good progression (35 percent efficiency or better), or does not degrade the existing signal progression, a full movement may be allowed. Spacing to nearby intersections shall be sufficient to accommodate the 20th year left turn vehicle storage queue for both turning movements. The access location must also meet other Code access spacing, design and need requirements. If 20th year projections for the access indicate that the access volumes would be less than 75 percent of those required for M.U.T.C.D. traffic signal volume warrants, or if there are less than two nearby (within one mile either direction) accesses that are or could be signalized, the intersection location does not need to be on one-half mile spacing, nor does it need to meet progression analysis criteria.

(c) Where topography or other existing conditions make one-half mile intervals inappropriate or not feasible, location of the access shall be determined with consideration given to topography, established property ownerships, unique physical limitations and/or unavoidable or pre-existing historical land use patterns and physical design constraints with every attempt to achieve a spacing of one-half mile. The final location should serve as many properties and interests as possible to reduce the need for additional direct access to the state highway. In selecting locations for full movement intersections, preference shall be given to public ways that meet or may be reasonably expected to meet signal warrants in the foreseeable future.

(4) If a restrictive median exists, left turns at unsignalized intersections should be restricted, unless the restriction of these movements would cause a safety or operations problem, or cause an out-of-direction movement of greater than one mile. If a traversable median exists, left turns will be permitted unless an operational or safety problem is identified.

Auxiliary Lane Requirements

(5) Auxiliary turn lanes shall be installed according to the criteria below.

(a) A left turn deceleration lane with taper and storage length is required for any access with a projected peak hour left ingress turning volume greater than 10 vph. The taper length will be included within the required deceleration length.

(b) A right turn deceleration lane and taper length is required for any access with a projected peak hour right ingress turning volume greater than 25 vph. The taper length will be included within the required deceleration length.

(c) A right turn acceleration lane and taper length is required for any access with a projected peak hour right turning volume greater than 50 vph when the posted speed on the highway is greater than 40 mph. The taper length will be included within the required acceleration length. A right turn acceleration lane may also be required at a signalized intersection if a free-right turn is needed to maintain an appropriate level of service in the intersection.

(d) Right turn deceleration and acceleration lanes are generally not required on roadways with three or more travel lanes in the direction of the right turn except as provided in subsection 3.5.

(e) A left turn acceleration lane may be required if it would be a benefit to the safety and operation of the roadway or as determined by subsection 3.5. A left turn acceleration lane is generally not required where the posted speed is less than 45 mph, or the intersection is signalized, or the acceleration lane would interfere with the left turn ingress movements to any other access.

(6) No additional access rights shall accrue upon the splitting or dividing of existing parcels of land or contiguous parcels under or previously under the same ownership or controlling interest. All access to newly created properties shall be provided internally from any existing access or a new access determined by Code design standards or by permit application and consistent with this subsection.

(7) When an existing access meets the warrants for a traffic signal as defined in the M.U.T.C.D., and the location does not meet the requirements of subsection 3.8(5), the access shall be reconstructed to eliminate or reduce the traffic movements that cause the traffic signal warrant to be met, and the access brought into conformance with appropriate design criteria. A raised median may be required. Closure may be required if alternative reasonable access is available.

(8) With the exception of frontage roads, any new rural highway location or newly designated state highway shall be considered no less than an access category R-A highway until the Commission has specifically assigned an access category.

(9) Where frontage and service roads are present, unless otherwise specifically categorized, a category R-A shall be assumed for all at-grade rural roadway sections within Department right-of-way between frontage and service roads and the main roadway.

3.9 CATEGORY R-B - Rural Highway

Functional Characteristics and Category Assignment Criteria

(1) This category is appropriate for use on highways that have the capacity for moderate to high travel speeds and low traffic volumes providing for local rural travel needs. Speed limits vary based on roadway design, location, and travel speeds. There is a reasonable balance between safety, direct access and mobility needs within this category. This category may be assigned to low volume minor arterials, secondary collectors and local highway sections that do not normally provide for significant regional, state or interstate travel demands. These highways typically provide for rural transportation needs including, farm to market, farm to farm, and may include high speed rural frontage roads.

Access Granting Criteria Including Category Related Access Location, Operation and Design Standards

(2) When application is made, one access shall be granted to each parcel, unless the Department or issuing authority establishes that the access would create a significant safety or operational problem on the highway, or the access does not meet acceptable design standards.

(3) Turning movements shall not be restricted if the access meets sight distance requirements, and auxiliary lane design requirements are met, no restrictive median is present, and if 20-year projections indicate that the intersection volumes would be less than 75 percent of those required for M.U.T.C.D. traffic signal volume warrants. Left or right turn movements may be restricted only if, in the determination of the Department or the issuing authority, one or both movements create significant roadway congestion or safety problems or hazards or a restrictive median is already in place.

(4) Left turns shall be prohibited if a non-traversable median is already established and the proposed opening in the median does not provide the general public any significant benefits to highway traffic operations and safety or would be counter to the purpose of the median.

(5) Additional access may be granted if the size or trip generation potential of the parcel requires additional access to maintain good roadway traffic operations and land use design, unless the Department or issuing authority establishes that the access would create a significant safety or operational problem, or the access does not meet acceptable design standards including spacing. Any additional access must not interfere with the location, planning, and operation of the general street system and access to nearby properties. Where the property abuts or has primary access to a lesser function road or an internal street system or by way of dedicated rights-of-way or easements, any access to the state highway shall be considered as an additional access.

(6) The recommended spacing of all intersecting public ways and other significant accesses that will be full movement is one-half mile intervals, and based upon section lines where feasible. Where topography or other existing conditions make one-half mile intervals inappropriate or not feasible, location of the access shall be determined with consideration given to topography, established property ownerships, unique physical limitations and/or unavoidable or pre-existing historical land use patterns and physical design constraints with a reasonable attempt to achieve a spacing of one-half mile. The final location should serve as many properties and interests as possible to reduce the need for additional direct access to the state highway. In selecting locations for full movement intersections, preference shall be given to public ways that meet or may be reasonably expected to meet signal warrants in the foreseeable future.

Category Text

- Quality of the textual descriptions is critical for success
- Test Test Test the language
- Test the standards
- Avoid unintended consequences
- How will a judge/jury interpret?

Sample Categories

Freeway (access rights)

Major Regional (access rights)

Rural A

Urban A

Rural B

Urban B

Rural C

Urban C

Service, Frontage and other Access roads

FDOT CLASSIFICATION SYSTEM & STANDARDS

Class 1 is freeway

Class	Medians	Connection		Median Opening		Signal
		>45mph	≤ 45mph	Directional	Full	
	GENERALLY DEVELOPING OR UNDEVELOPED					
2	Restrictive w/ Service Roads	1320	660	1320	2640	2640
3	Restrictive	660	440	1320	2640	2640
4	Non-Restrictive	660	440			2640
	GENERALLY DEVELOPED					
5	Restrictive	440	245	660	2640/1320	2640/1320
6	Non-Restrictive	440	245			1320
7	Both Median Types	125		330	660	1320

Well planned with system of service roads

Essentially the same except for medians

Essentially the same except for medians

The Urban/Suburban Strip

WSDOT

class table

Highway Classification & Definition	Permits Allowed			Minimum Access Spacing	Access Limitations
	Non-Conforming	Variance	Conforming		
Class 1* Mobility is primary function	Yes	No	No	1320'	1 access only to contiguous parcels under same ownership. Private direct access not allowed unless no other reasonable access exists. (Must use county road system if possible.)*
Class 2* Mobility Favored over Access	Yes	Yes	No	660'	1 access only to contiguous parcels under same ownership unless frontage > 1320'. Private direct access not allowed unless no other reasonable access exists. (Must use county road system if possible.)*
Class 3 Balance between Mobility and Access in areas with less than Maximum Buildout	Yes	Yes	Yes	330'	1 access only to contiguous parcels under same ownership. Joint access for subdivisions preferred, but private direct access allowed with reason.
Class 4 Balance between Mobility and Access in areas nearing Maximum Buildout	Yes	Yes	Yes	250'	1 access only to contiguous parcels under same ownership.
Class 5 Access needs may have priority over Mobility needs	Yes	Yes	Yes	125'	More than 1 connection per ownership allowed with reason.

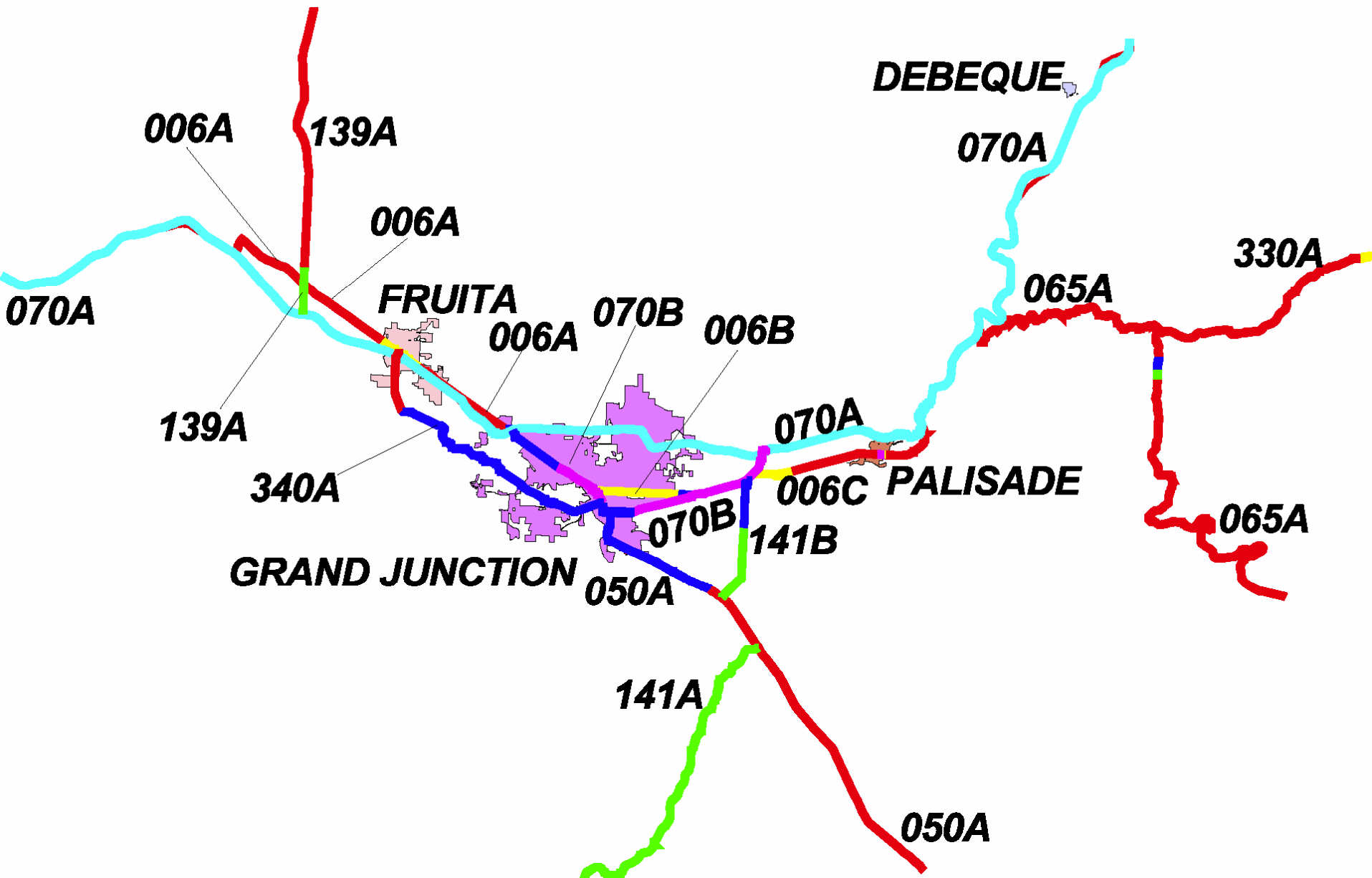
SUBCHAPTER 3. ACCESS STANDARDS

16:47-3.1 Access levels for access classifications

(a) There are hereby established the following access levels (AL) for the State highway system:

1. AL 1 - fully controlled access: Access is prohibited on interstates, toll roads, freeways, and limited access highways, except at grade-separated interchanges. Figures C-5 and C-6 of Appendix C, Access Levels Diagrams, illustrate such access.
2. AL 2 - access via street intersections or grade-separated interchanges and nonconforming lot access points, where the Department determines that alternative access is not available. The designs set forth in Figures C-7 through C-9 of Appendix C, Access Levels Diagrams, illustrate such access. For AL 2, the location standards set forth in N.J.A.C. 16:47-3.3, 3.4, and 3.5 are applicable.
3. AL 3 - right-turn access to and from an access point and left-turn access via a signalized jughandle: Figures C-10 through C-13 of Appendix C, Access Levels Diagrams, illustrate such access. The jughandle may or may not be at access point. For AL 3, the location standards set forth in N.J.A.C. 16:47-3.4 and 3.5 are applicable.
4. AL 4 - right-turn access to and from an access point, left-turn ingress via a left-turn lane, and left turn egress from an access point: Figures C-14 through C-18 of Appendix C, Access Levels Diagrams, illustrate such access. The left-turn lane may or may not be at the access point for a divided highway and will be at the access point for and undivided highway. For AL 4, the location standards set forth in N.J.A.C. 16:47-3.4 are applicable if the highway is divided or if the traffic volumes at the intersection with the State highway meet the criteria for warrants set forth in Part 4C of the "Manual on Uniform Traffic Control Devices for Streets and Highways" (U.S. Department of Transportation, Federal Highway Administration 1988 edition or superseding edition). The location standards set forth in N.J.A.C. 16:47-3.3, 3.4, and 3.5 are applicable in all other cases.
5. AL 5 - access to and from an access point: Figures C-19 through C-23 of Appendix C, Access Levels Diagrams, illustrate such access. Meeting traffic signal warrants is not required for the installation of a left-turn lane. For AL 5, the location standards set forth in N.J.A.C. 16:47-3.4 are applicable if the traffic volumes at the intersection of the access point with the State highway meet the criteria for warrants set forth in Part 4C of the "Manual on Uniform Traffic Control Devices for Streets and Highways" (U.S. Department of Transportation, Federal Highway Administration 1988 edition or superseding edition). The location standards set forth in N.J.A.C. 16:47-3.5 are applicable in all other cases.
6. AL 6 - access to and from the State highway and an access point, provided that there is an edge clearance of at least 12 feet (3.6 meters), the access point is at least 24 feet (7.2 meters) from the nearest access points, suitable sight lines exist and the access does not otherwise create a dangerous condition. The Department will include frontage roads and service roads that parallel State highways in this classification. The design set forth in Figure C-24 of Appendix C, access level diagrams, illustrates such access. For AL 6, the location standards set forth in N.J.A.C. 16:4-3.4 and 3.5 are applicable.

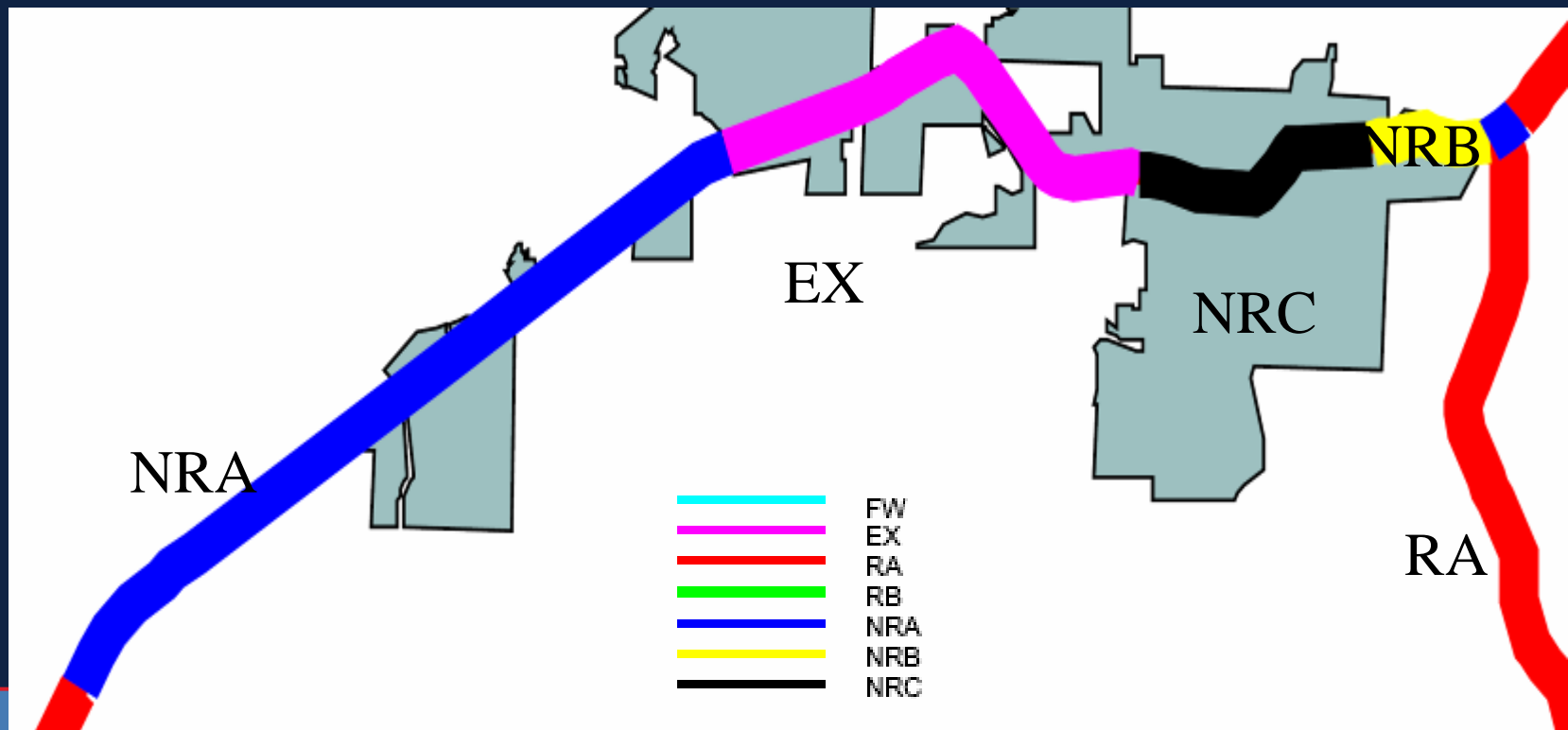
Grand Junction Area



STATE HIGHWAY ACCESS CATEGORY ASSIGNMENT SCHEDULE
SECTION TWO, ACCESS CATEGORY ASSIGNMENTS
Revised January 18, 2001

Highway	Beg_MP	End_MP	CO	CAT	PHYSICAL DESCRIPTION OF THE CATEGORY SEGMENT
001A	0.000	9.157	069	RB	FROM JCT SH 287 (COLLEGE AVE) IN FORT COLLINS TO 2ND ST IN WELLINGTON
001A	9.157	9.405	069	NRA	FROM 2ND ST TO 1ST ST IN WELLINGTON
001A	9.405	9.960	069	NRB	FROM 1ST ST IN WELLINGTON TO I-25 INTERCHANGE, END SH 1A
002A	0.000	2.146	031	NRB	FROM JCT SH 285 (HAMPDEN AVE), ALONG COLO BLVD, TO I-25 INTERCHANGE IN DENVER
002A	2.146	4.468	031	NRB	FROM I-25 INTERCHANGE TO JCT SH 83 (LEETSDALE DR)
002A	4.468	6.000	031	NRB	FROM JCT SH 83 (LEETSDALE DR), ALONG COLO BLVD TO JCT SH 40 (COLFAX AVE) IN DENVER
002A	6.000	8.310	031	NRB	FROM JCT SH 40 (COLFAX AVE) TO JCT SH 33 (40TH AVE) IN DENVER
002A	8.310	8.579	031	NRB	FROM JCT SH 33 (40TH AVE) TO SMITH RD INTERCHANGE IN DENVER
002A	8.579	8.774	031	NRB	FROM SMITH RD INTERCHANGE TO I-70 INTERCHANGE IN DENVER
002A	8.774	9.478	031	NRB	FROM I-70 INTERCHANGE TO SH 6 INTERCHANGE (VASQUEZ BLVD)
002A	9.587	9.842	001	EX	FROM JCT SH 6 (VASQUEZ BLVD) TO JCT SH 6 (VASQUEZ BLVD) AT ADAMS/DENVER CO LINE, END SH 2A
002B	11.001	11.209	001	NRC	FROM JCT SH 6 (VASQUEZ BLVD) IN COMMERCE CITY TO SH 6 INTERCHANGE (VASQUEZ BLVD)
002B	11.209	13.345	001	NRC	FROM SH 6 INTERCHANGE (VASQUEZ BLVD) TO QUEBEC ST, END SH 2B
002C	12.895	17.000	001	NRA	FROM QUEBEC ST TO JCT SH 44 (104TH AVE)
002C	17.000	18.999	001	NRA	FROM JCT SH 44 (104TH AVE) TO I-76 INTERCHANGE IN COMMERCE CITY, END SH 2C
002D	0.000	1.000	001	RB	FROM I-76 INTERCHANGE TO JCT SH 22 (124TH AVE)
002D	1.000	4.092	001	RB	FROM JCT SH 22 (124TH AVE) TO BROMLEY LANE IN BRIGHTON
002D	4.092	4.999	001	NRC	FROM BROMLEY LANE TO JCT SH 7 (BRIDGE ST) IN BRIGHTON, END SH 2D
003A	0.000	2.194	067	NRB	FROM JCT SH 160 IN DURANGO TO 2ND ST, END SH 3A
005A	0.000	14.894	019	RA	FROM JCT SH 103 (ECHO LAKE) TO SUMMIT OF MT EVANS, END SH 5A
006A	11.212	15.449	077	RA	FROM I-70 INTERCHANGE (MACK) TO JCT SH 139 (LOMA)
006A	15.449	19.210	077	RA	FROM JCT SH 139 (LOMA) TO K.00 RD
006A	19.210	19.955	077	NRB	FROM K.00 RD TO JCT SH 340 (ASPEN ST) IN FRUITA
006A	19.955	21.261	077	NRB	FROM SH 340 (ASPEN ST) TO PINE ST IN FRUITA
006A	21.261	25.772	077	RA	FROM PINE ST IN FRUITA TO PERSIGO WASH STR H-02-D
006A	25.772	25.998	077	NRA	FROM PERSIGO WASH STR H-02-D TO I-70 INTERCHANGE, END SH 6A
006B	30.270	30.407	077	NRA	FROM I-70 GRAND JUNCTION BUS LOOP INTERCHANGE TO THE RAMP ON IN GRAND JUNCTION
006B	30.407	33.753	077	NRB	FROM THE RAMP ON TO MORNING GLORY LANE IN GRAND JUNCTION
006B	33.753	34.375	077	NRA	FROM MORNING GLORY LANE TO JCT I-70 GRAND JUNCTION BUS LOOP, END SH 6B
006C	37.496	39.229	077	NRB	FROM JCT I-70 GRAND JCT BUS LOOP TO 34.00 RD
006C	39.229	42.894	077	RA	FROM 34.00 RD TO 333 FEET WEST FROM IOWA AVE IN PALISADE
006C	42.894	43.212	077	EX	FROM 333 FEET WEST FROM IOWA AVE TO MAIN ST IN PALISADE
006C	43.212	43.257	077	NRB	FROM MAIN ST TO COLORADO RIVER STR H-03-E IN PALISADE
006C	43.257	45.824	077	RA	FROM COLORADO RIVER STR H-03-E TO I-70 INTERCHANGE, END SH 6C
006D	92.001	92.151	045	NRB	FROM JCT SH 13 IN RIFLE TO 6732 FEET WEST OF COUNTY RD 210
006D	92.151	98.659	045	RA	FROM 6732 FEET WEST OF COUNTY RD 210 TO FIRST ST IN SILT
006D	98.659	99.232	045	NRB	FROM FIRST ST IN SILT TO JCT I-70 SILT BUS SPUR
006D	99.232	105.000	045	RA	FROM JCT I-70 SILT BUS SPUR TO 4219 FEET WEST FROM ELK CREEK STR F-06-A
006D	105.000	105.799	045	RB	FROM 4219 FEET WEST FROM ELK CREEK STR F-06-A TO ELK CREEK STR F-06-A IN NEW CASTLE
006D	105.799	107.000	045	NRB	FROM ELK CREEK STR F-06-A IN NEW CASTLE TO 554 FEET WEST OF COUNTY RD 240
006D	107.000	107.105	045	RB	FROM MILEPOINT 107 TO COUNTY RD 240
006D	107.105	110.799	045	RA	FROM COUNTY RD 240 TO I-70 INTERCHANGE, END SH 6D
006E	142.001	142.608	037	NRB	FROM I-70 INTERCHANGE IN GYPSUM TO VALLEY RD
006E	142.608	148.930	037	RA	FROM VALLEY RD TO 1130 FEET WEST OF FIFTH ST
006E	148.930	149.666	037	NRB	FROM 1130 FEET WEST OF FIFTH ST TO JCT I-70 EAGLE BUS SPUR

160A	111.371	121.527	007	EX	FROM LA PLATA/ARCHULETA CO LINE TO COUNTY RD 9.20 (PIEDRA)
160A	121.527	126.968	007	RA	FROM COUNTY RD 9.20 (PIEDRA) TO JCT SH 151
160A	126.968	137.399	007	RA	FROM JCT SH 151 TO COUNTY RD 22.50
160A	137.399	140.882	007	NRA	FROM COUNTY RD 22.50 TO COUNTY RD 25.00 WEST OF PAGOSA SPRINGS
160A	140.882	142.944	007	EX	FROM COUNTY RD 25.00 TO 10TH ST IN PAGOSA SPRINGS
160A	142.944	143.990	007	NRC	FROM 10TH ST TO SAN JUAN RIVER STR O-08-A IN PAGOSA SPRINGS
160A	143.990	144.459	007	NRB	FROM SAN JUAN RIVER STR O-08-A IN PAGOSA SPRINGS TO JCT SH 84



Washington DOT Access Classification. “This shows the speed limit, managed access (M/A) class, if a highway is limited access (L/A), where WSDOT has planned for limited access and other information.”

SR	Spur or Couplet	Begin MP	Begin Eq	End MP	End Eq	Plan Title	Speed Limit	Current Access	M/A Class	Established L/A	Planned L/A	L/A Acquired	Modification Date
2		0		.33		SR 5, Everett: Pacific Ave to Snohomish River		L/A		Full L/A		Yes - All	9/3/2003
2		.33		2.6		Jct. SR 5 to Jct. SR 204 Vic.	55	L/A		Full L/A		Yes - All	5/28/2003
2		2.6		3.73		Cavalero's Corner to Fobes Hill	55-60	L/A		Full L/A		Yes - All	5/28/2003
2		3.73		9.27		Fobes Hill to Westwick Road	60			Full L/A		Yes - All	9/3/2003
2		9.27		14.08		Snohomish to Monroe	45-60	M/A		Full L/A			12/31/2003
2		14.08		14.41		No information	45	L/A		Full L/A		Yes - All	9/19/2003
2		14.41		15.21		Snohomish to Monroe	35-45	M/A		Full L/A			12/31/2003
2		14.92		15.08		Snohomish to Monroe	35	L/A on LT		Full L/A			12/31/2003
2		15.21		16.12		Monroe to Sultan	35-55	???		Full L/A			12/31/2003
2		16.12		21.57		Monroe to Sultan	35-55	M/A	Class 2 M/A		Modified L/A		12/31/2003
2		21.57		22.85		Sultan River Bridge & Approaches	35	M/A	Class 2 M/A		Modified L/A		12/31/2003
2		22.85		25.2		Sultan To Startup	35-50	M/A	Class 2 M/A		Modified L/A		12/31/2003
2		25.2		26.15		Sultan To Startup	35-50	M/A	Class 3 M/A		Modified L/A		12/31/2003
2		26.15		26.98		Wallace River Bridge Vicinity	35-50	M/A	Class 3 M/A		Modified L/A		12/31/2003
2		26.98		28.57		Startup to Goldbar	40-50	M/A	Class 3 M/A		Modified L/A		12/31/2003
2		28.57		28.72		Index to Goldbar	40	M/A	Class 3 M/A		Modified L/A		12/31/2003
2		28.72		30.11		Index to Goldbar	40-55	M/A	Class 1 M/A		Modified L/A		12/31/2003
2		30.11		30.38		Skykomish River Bridge Vicinity	55	M/A	Class 1 M/A		Modified L/A		12/31/2003
2		30.38		35.49		Index to Goldbar	55-60	M/A	Class 1 M/A		Modified L/A		12/31/2003
2		35.49		36.93		Index - East - Section A	60	M/A	Class 1 M/A		Modified L/A		12/31/2003
2		36.93		39.72		Index - East - Section B	60	M/A	Class 1 M/A		Modified L/A		12/31/2003
2		39.72		42.74		Money Creek to Halford	60	M/A	Class 1 M/A		Modified L/A		12/31/2003
2		42.74		43.33		B.N.R.R. Overcrossing	60	M/A	Class 1 M/A		Modified L/A		12/31/2003
2		43.35		45.58		Money Creek to Halford	60	M/A	Class 1 M/A		Modified L/A		12/31/2003
2		45.58		50.31		Stevens Pass Auto Camp to Money Cr. Park	60	M/A	Class 1 M/A		Modified L/A		12/31/2003
2		50.31		54.04		Stevens Pass Auto Camp - Easterly	60	M/A	Class 1 M/A		Modified L/A		12/31/2003
2		54.04		56.69		Forest Boundary - West	60	L/A		Modified L/A		Yes - All	9/3/2003
5		139.5		140.44		Pierce Co. Line to Jct. SSH No. 5-A	60	L/A		Full L/A		Yes - All	12/31/2003
5		140.44		140.99		Pierce Co. Line to Jct. SR 516 Rest Area	60	L/A		Full L/A		Yes - All	12/31/2003
5		140.99		149.35		Pierce Co. Line to Jct SSH No. 5-A	60	L/A		Full L/A		Yes - All	12/31/2003
5		149.35		153.25		Jct. SSH No. 5-A to So. 126th St.	60	L/A		Full L/A		Yes - All	12/31/2003
5		153.25		156.47		So. 178th St. to So. 126th St.	60	L/A		Full L/A		Yes - All	12/31/2003
5		156.47		158.4		So. 126th St. to Norfolk St.	60	L/A		Full L/A		Yes - All	12/31/2003
5		158.4		163.55		Seattle Freeway: Norfolk St. to Bayview St.	60	L/A		Full L/A		Yes - All	12/31/2003
5		163.55		163.9		Seattle Freeway Bayview St to Plum St.	60	L/A		Full L/A		Yes - All	12/31/2003
5		163.9		164.82		Seattle Freeway Plum St. to Jackson St.	60	L/A		Full L/A		Yes - All	12/31/2003

An aerial photograph of a multi-lane freeway, likely a major highway, running vertically through the center of the frame. The freeway has several overpasses and interchanges, with cars visible on the lanes. The surrounding area is densely populated with residential houses, commercial buildings, and parking lots. A large, rectangular, light-colored building is visible on the left side of the freeway. The overall scene depicts a complex urban infrastructure project.

Freeways

Rural Expressway



An aerial photograph showing a multi-lane urban expressway with a complex interchange. The highway runs vertically through the center of the frame. To the left, there are large green agricultural fields and some industrial buildings. To the right, there is a dense residential neighborhood with many small houses. The sky is clear and blue.

Urban Expressway

Urban Expressway





NRA



Demosthenes









Rural Principal



Urban Mixed

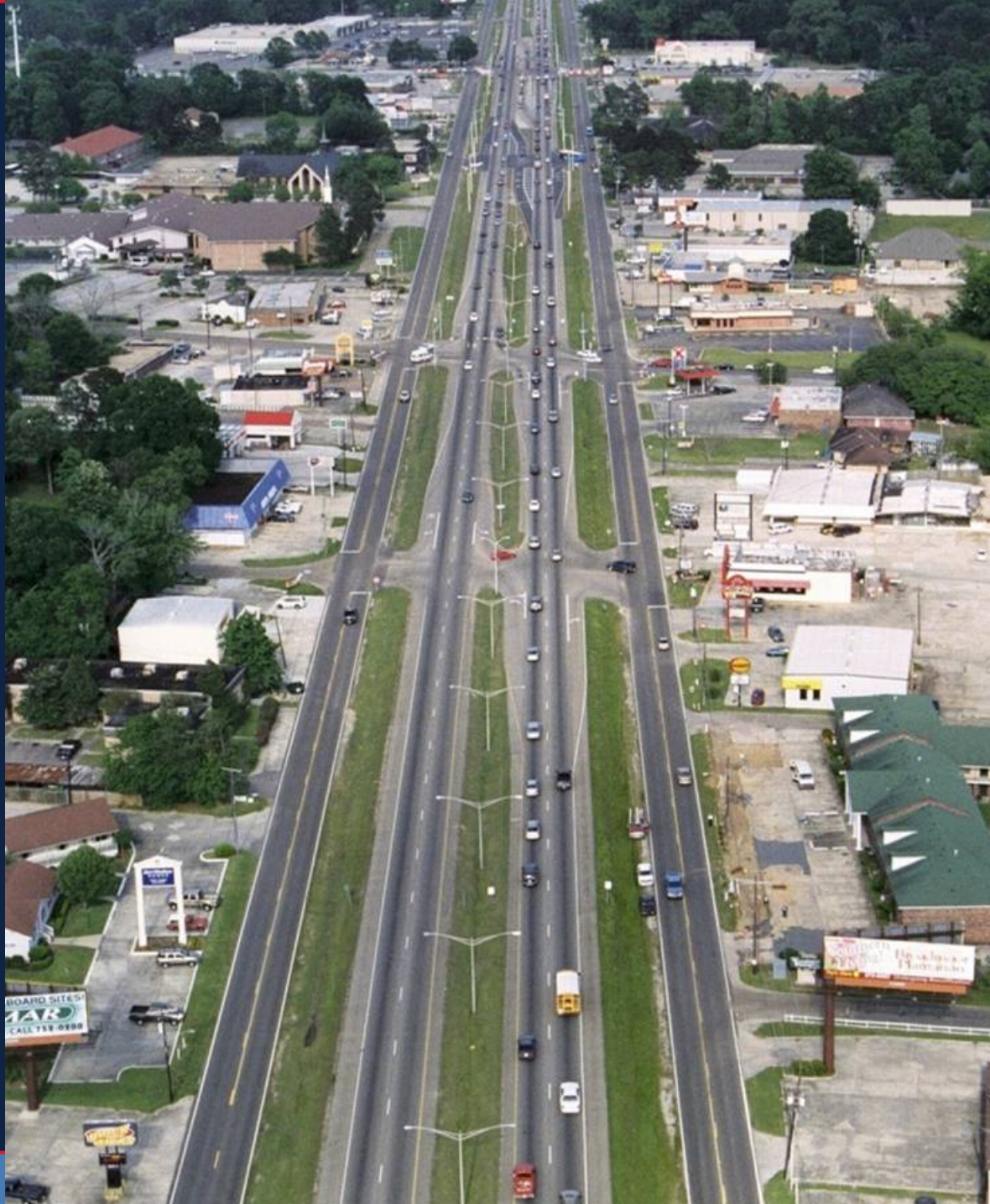




Urban Secondary



Service & Frontage Roads



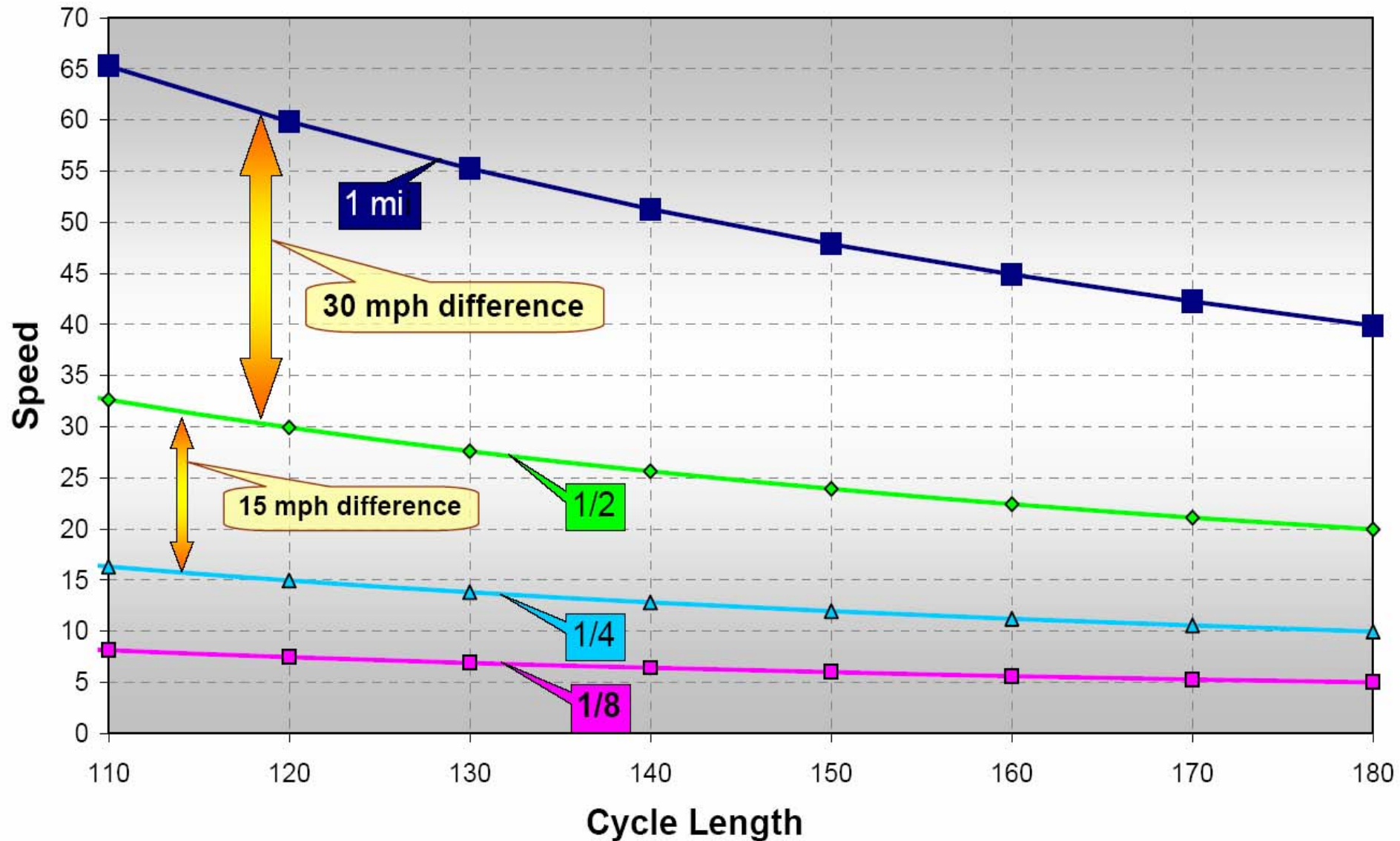
Similar Capacity

- 4 Lane divided roadway with 1/2 mile signal spacing
- 6 Lane divided roadway with 1/4 mile signal spacing
- 4 signals per mile compared to 2 per mile means about a 16% increase in travel time
- 4 signals means about 50% crash increase

Estimated Savings in Travel time & Delay - 1/2 Vs. 1/4 Signals + Side Friction in 5 Miles

	Travel Speed MPH	Total Travel Time Veh-H/H	Total Delay Time Veh-H/H
Access Controlled Segment	22	542	275
Unrestricted Segment	13	942	675
Percent Change		- 42%	- 59%

Cycle Length and Progression Speed for 1/8, 1/4, 1/2 and 1 mile Signal Spacing



Relative crash frequency

- 0.7 per year at rural unsignalized intersections
- 1.4 per year at urban unsignalized intersections
- 4.8 per year for rural signalized intersections
- 6.2 per year at urban signalized intersections

PARAMETRIX

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