SCDOT

Guidelines for School Transportation Design

TABLE OF CONTENTS

TABLES

FIGURES

INTRODUCTION

The Multi-Modal Traffic Programs' School Operation Section under the guidance of the SCDOT's Director of Traffic Engineering has developed this guidebook.

The School Operations section was established in 1994 in response to the rapid rate at which new school construction was occurring. The section coordinates with the State Department of Education's Office of School Facilities and local school districts to assure that roadway and operational improvements are made at the time of new school construction and as renovations are made to existing schools. This process includes the review of all new school site and/or renovation plans from the preliminary design phase through the final construction phase.

This guidebook is primarily to be used as a reference for school districts and their architects/engineers doing school site transportation design related to the SCDOT review and approval of Encroachment Permits. It was developed from information gathered over many years of school site transportation design experiences and sound engineering judgment.

The guidelines and design criteria described in this guidebook are compiled to serve as a supplement to the Department's Access and Roadside Management Standards (ARMS) and therefore it would be beneficial to users of this guidebook to also obtain a copy of the ARMS.

The following sections are intended to provide detailed guidance on specific subjects related to school site transportation design.

1. ON-SITE STACKING

Schools generate their highest peak traffic volume during morning take-in and afternoon dismissal times. Frequently, these periods coincide with times when traffic volumes are heaviest along roads adjacent to school sites, which further compounds congestion problems experienced at schools. It is, therefore, essential to design internal school drives in a manner that will provide sufficient on-site stacking length for both parents and buses.

Table 1-1 (Recommended On-Site Stacking Lengths) shows recommended on-site stacking lengths for elementary, middle, and high schools based on student population. It should be noted, however, that the presence of an all-day kindergarten program could create traffic flow problems in loops intended for parents dropping-off and picking-up elementary students. Therefore, if a large kindergarten student population is anticipated, it is recommended that a separate loop be constructed for this operation. However, the loop's stacking capacity can be less than what is recommended for elementary students. Additionally, if a kindergarten loop cannot be constructed, then a separate parking area for these parents should be considered.

Table 1-1 Recommended On-Site Stacking Lengths

School Type	Student Population	Loop Drive Stacking Length
Elementary	**200 – 600** **600 – 1,400**	**900 – 1,200 Linear Feet** **1,200 – 1,500 Linear Feet**
Middle	**200 – 600** **600 – 1,200**	**900 – 1,200 Linear Feet** **1,200 – 1,500 Linear Feet**
High	**400 – 800** **800 – 2,500**	**800 – 1,200 Linear Feet** **1,200 – 1,500 Linear Feet**
Note: For high school populations greater than 2,500 students, two separate student pick-up drop-off loops should be considered.		

2. NUMBER OF SCHOOL DRIVEWAYS

The number of school driveways is important in assuring proper distribution of traffic along a site's frontage. Typically, elementary and middle schools function best when they are served by two separate access drives. One driveway is needed to serve the bus loop, while the other is necessary to serve the parent drop-off/pick-up loop (Note: If a school has an all-day kindergarten program, another access drive may be necessary).

High schools should have at least three access drives. The first drive would serve the bus loop, parents would use the second drive for dropping-off and picking-up students, and the third drive would provide access to the student parking areas. For a

school with a large volume of student drivers, additional driveways may be needed for the student parking areas.

Consequently, there are circumstances when a new school has only one accessible driveway location. In these instances, it is essential that this access drive be designed to provide multiple lanes entering and exiting the site.

Table 2-1 Recommended Numbers of School Driveways

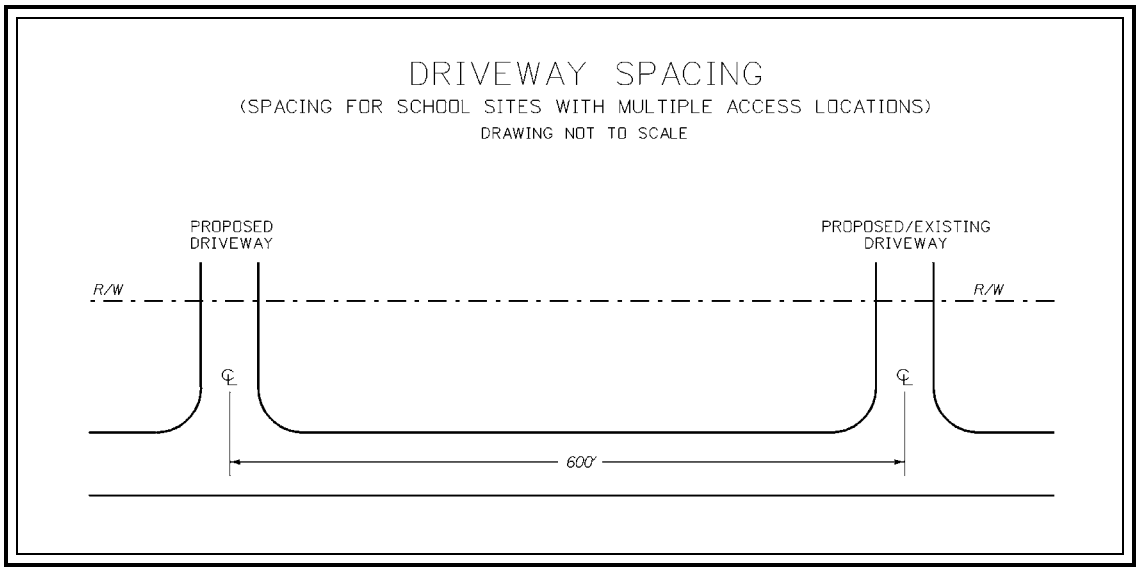
School Type	Number of Driveways
Elementary	**2 – 3**
Middle	**2**
High	**3 – 4**

3 SCHOOL DRIVEWAY STANDARDS

3A. Driveway Spacing

The desirable distance between school driveways is 600 feet or greater. This spacing allows for adequate left-turn lane development along the roadway (see Figure 3-1 Driveway Spacing).

Figure 3-1 Driveway Spacing



3B. Driveway Location

Although school driveway access locations are limited to points along a site's frontage where sight lines are optimum, there are other items that also dictate a driveway's location.

When a driveway is to be constructed near the intersection of two roads the minimum radius offset should be 75 feet as measured from the intersecting roads nearest edge.

Also, when a driveway radius approaches a site's property line the radius should not be located closer than 5-feet, as measured parallel to the roadway, from the intersection of the highway right-of-way and the property line. If this is not feasible and the radius encroaches into the adjacent property's frontage located along the roadway, then it will be necessary for the permit applicant to obtain a letter of permission from the adjacent property owner(s). This letter shall be attached to and made part of the Application for Encroachment Permit submitted for the new drive. If a radius actually encroaches into the adjacent property, then the permit applicant should purchase a triangular area of property large enough to contain the encroachment and assure adequate sight distance. This needs to occur prior to submitting the encroachment permit.

See Figure 3-2 Minimum Driveway Location, page 5.

3C. Driveway Lane Widths and Corner Radii

Driveway corner radii should be designed to safely accommodate the turning movement of the largest vehicle that will regularly use the drive. The minimum corner radii for a school drive to accommodate automobile access should be 25 feet. The minimum corner radius for a school bus driveway is 40 feet.

Also, a school driveway should have an 18-foot wide entrance lane to provide sufficient pavement to prevent vehicles entering right into the drive from running off the pavement or turning into the opposing exit lane. This same treatment should be applied to the roadway to accommodate buses turning right out of the school drive.

See Figure 3-3 Driveway Lane Widths and Corner Radii, page 6.

Figure 3-2 Minimum Driveway Location

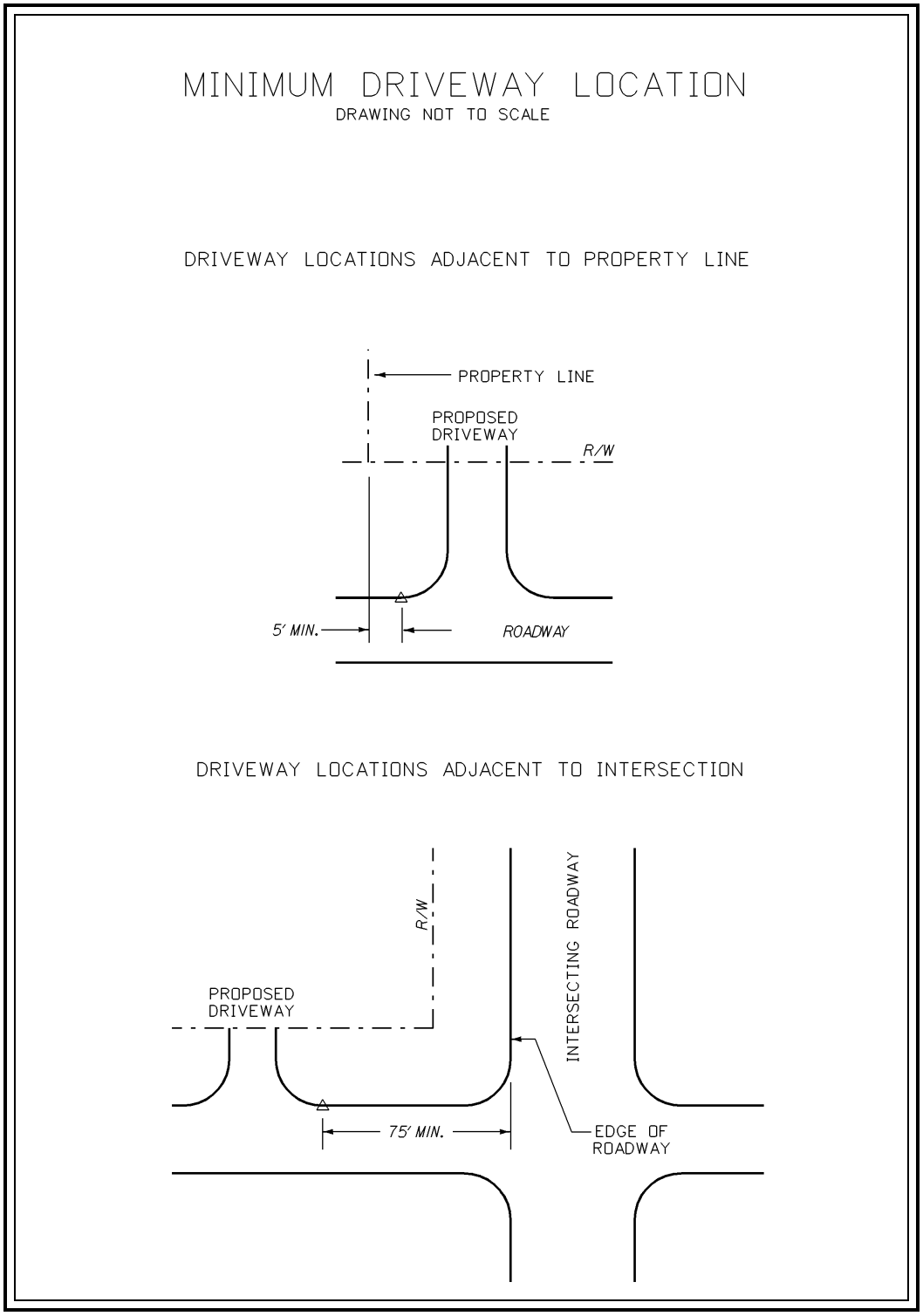
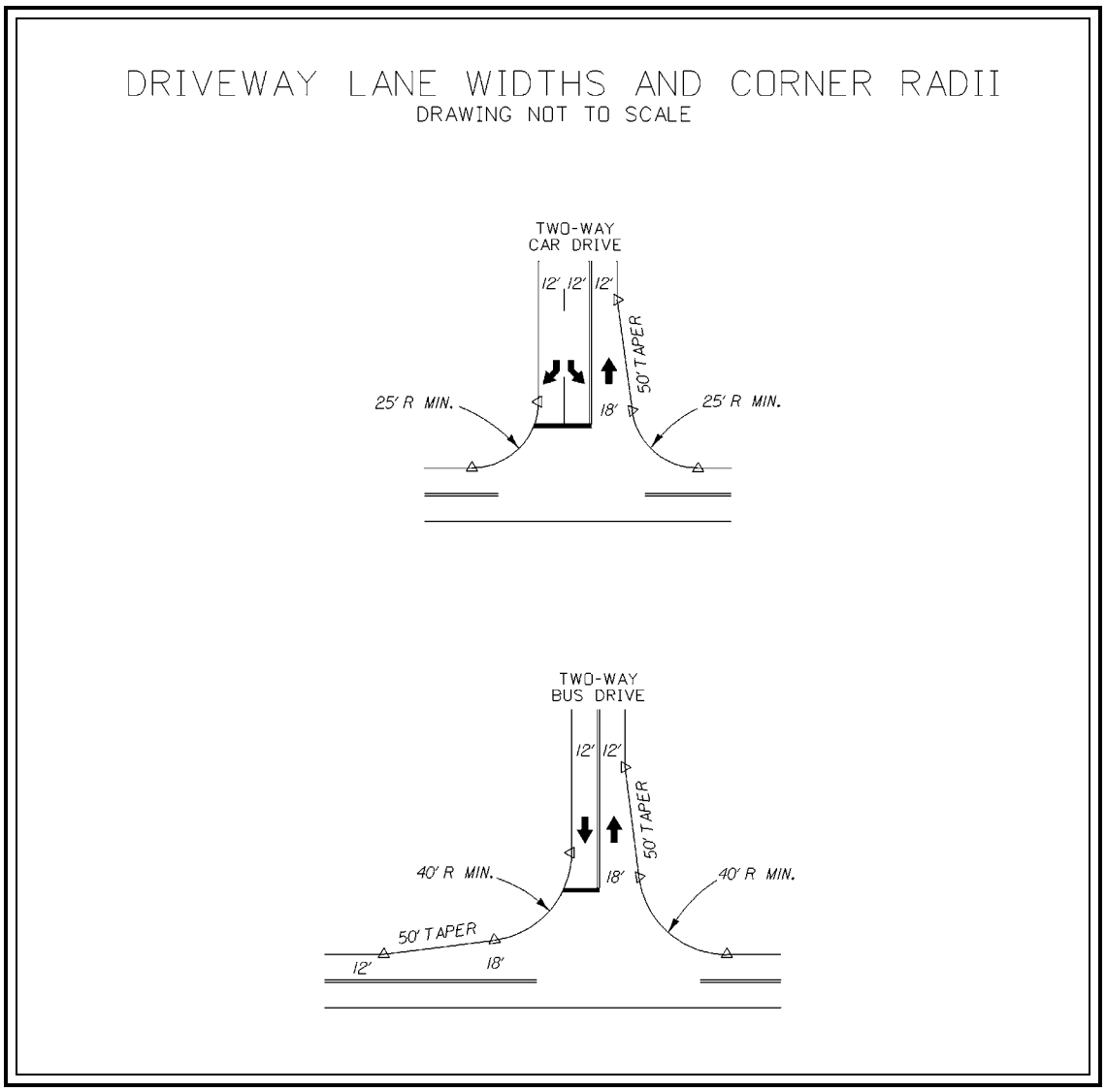


Figure 3-3 Driveway Lane Widths and Corner Radii



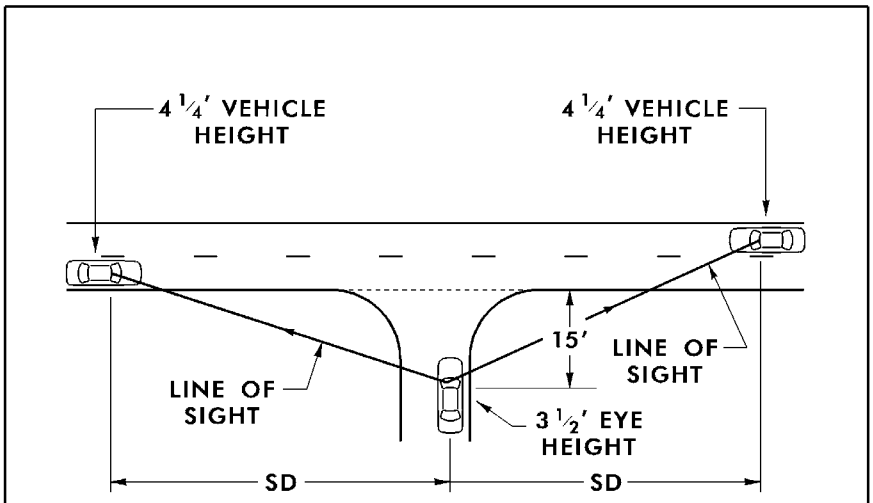
4. SIGHT DISTANCE REQUIREMENTS

Sight distance is defined as the distance that should be available to the operator of a vehicle, approaching an at-grade intersection, to have an unobstructed view of the entire intersection, and sufficient lengths of the intersecting highway, to permit control of the vehicle to avoid a collision. Hence, school driveways should be located along a road where optimum sight lines occur. Often times, a school's access drive location is determined by these sight distance requirements.

See Figure 4-1 Sight Distance Requirements, page 7.

Figure 4-1 Sight Distance Requirements

SIGHT DISTANCE REQUIREMENTS
(DISTANCES GIVEN ARE FOR FLAT GRADES)



(DRAWING NOT TO SCALE)

DESIGN VEHICLE ENTERING ARTERIAL	SIGHT DISTANCE (SD) PER 10 MPH OF ARTERIAL SPEED FOR ARTERIAL WIDTH OF:		
	2 LANES	4 LANES	6 LANES
	FEET	FEET	FEET
PASSENGER CAR	100	120	130
SCHOOL BUS	130	150	170

5. ROADWAY WIDENING IMPROVEMENTS

Implementing roadway improvements at and adjacent to new schools is an essential part of the overall site design. Since schools generate high traffic volumes during take-in and dismissal times, they often create heavy congestion at their drives and as a result, at adjacent intersections (especially when these times coincide with peak traffic demands of non-school traffic along the highway). Additionally, school driveways generate high volumes of turning traffic, which can interfere with the safe and efficient movement of traffic along a roadway. Therefore, the SCDOT recommends construction of turning lanes at most all new school sites on a statewide basis. Widening may also be recommended at adjacent intersections if the traffic introduced by a new school (or school addition) creates a more hazardous condition or is projected to cause a failure in the safe and efficient traffic operation of that intersection.

Following are tables for recommended taper lengths (Table 5-1), right-turn lane lengths (Table 5-2), a "Symmetrical Reverse Radius" diagram (Figure 5-1) and some examples of typical roadway improvements at and adjacent to school sites (Figures 5-2A and 5-2B).

Table 5-1 Recommended Taper Lengths

AMOUNT OF WIDENING (feet)

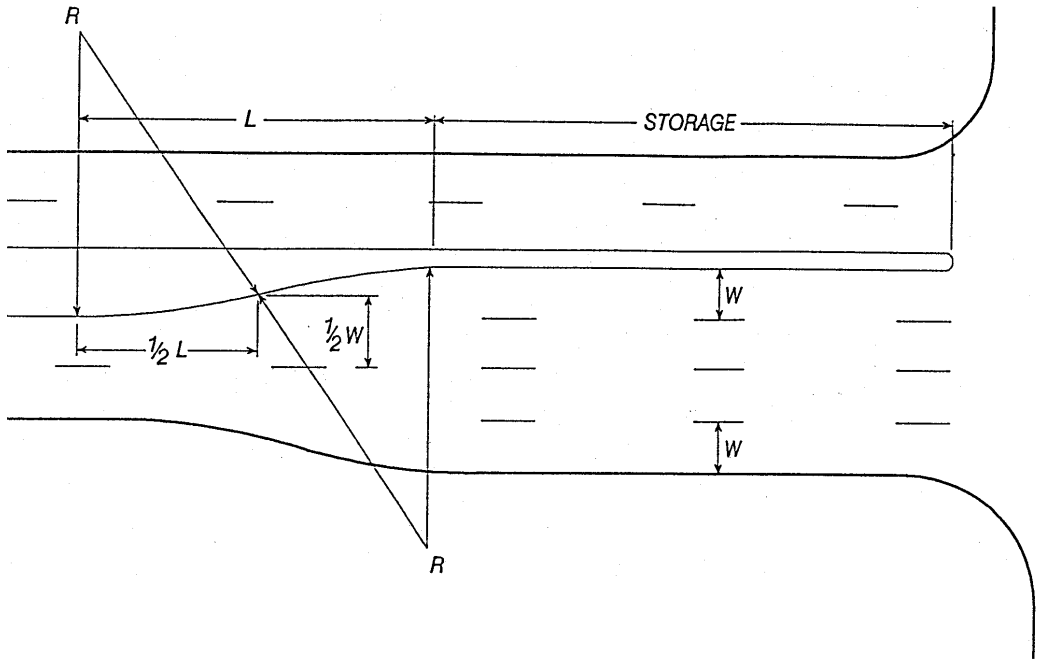
SPEED (mph)	6	7	8	9	10	11	12	13	14	15	16	17	18	19
35	*	*	*	*	204	225	245	265	286	306	327	347	368	388
40	*	*	213	240	267	293	320	347	373	400	427	453	480	507
45	270	315	360	405	450	495	540	585	630	675	720	765	810	855
50	300	350	400	450	500	550	600	650	700	750	800	850	900	950
55	330	385	440	495	550	605	660	715	770	825	880	935	990	1045
60	360	420	480	540	600	660	720	780	840	900	960	1020	1080	1140
65	390	455	520	585	650	715	780	845	910	975	1040	1105	1170	1235

* 200' MINIMUM LENGTH OF TAPER

Table 5-2 Right-Turn Lane and Associated Taper

ROADWAY DESIGN SPEED	MINIMUM LENGTH OF TAPER	MINIMUM LENGTH OF OF FULL WIDTH LANE
40 MPH AND LESS	150'	150'
45 AND 50 MPH	180'	200'
55 MPH AND ABOVE	200'	250'

Figure 5-1 Symmetrical Reverse Radius Diagram



(R) RADIUS	DESIGN SPEED	LENGTH (L) NEEDED FOR VARIOUS WIDTHS (W)				
		W=9' **	W=10'	W=11'	W=12'	W=13'
300'	≤ 30 MPH	104'	109'	115'	120'	124'
480'	≤ 40 MPH	131'	138'	145'	152'	158'
670'	≤ 50 MPH	155'	163'	171'	179'	186'
840'	≤ 60 MPH	174'	183'	192'	201'	209'
150'	*	73'	77'	81'	85'	88'

* SUBSTANDARD: USE ONLY WHEN SPACE BETWEEN INTERSECTIONS WILL NOT PERMIT GREATER DESIGN.

** WIDTH OF 9' IS NOT USUALLY USED FOR DESIGN.

Figure 5-2A Roadway Widening Typical

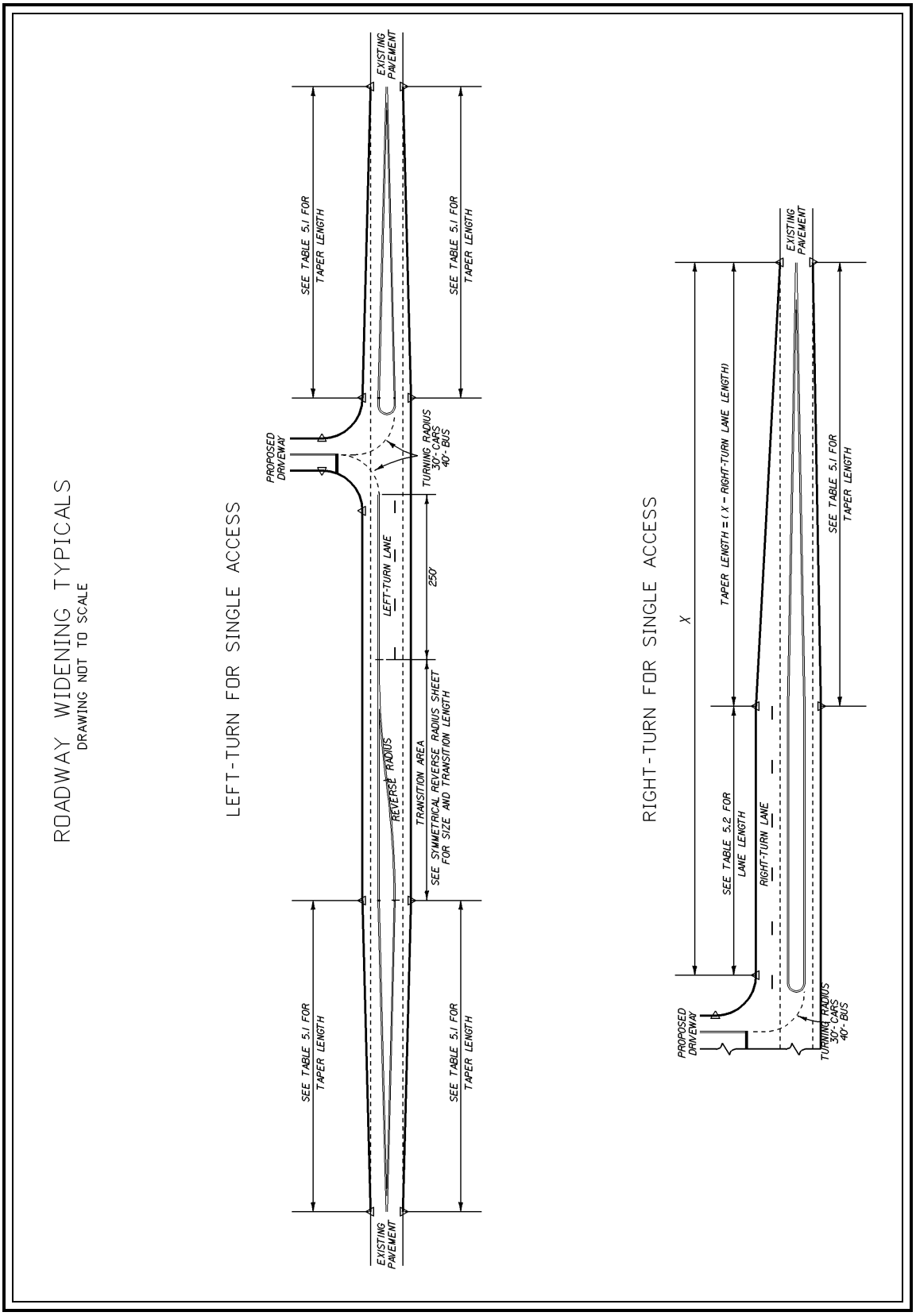
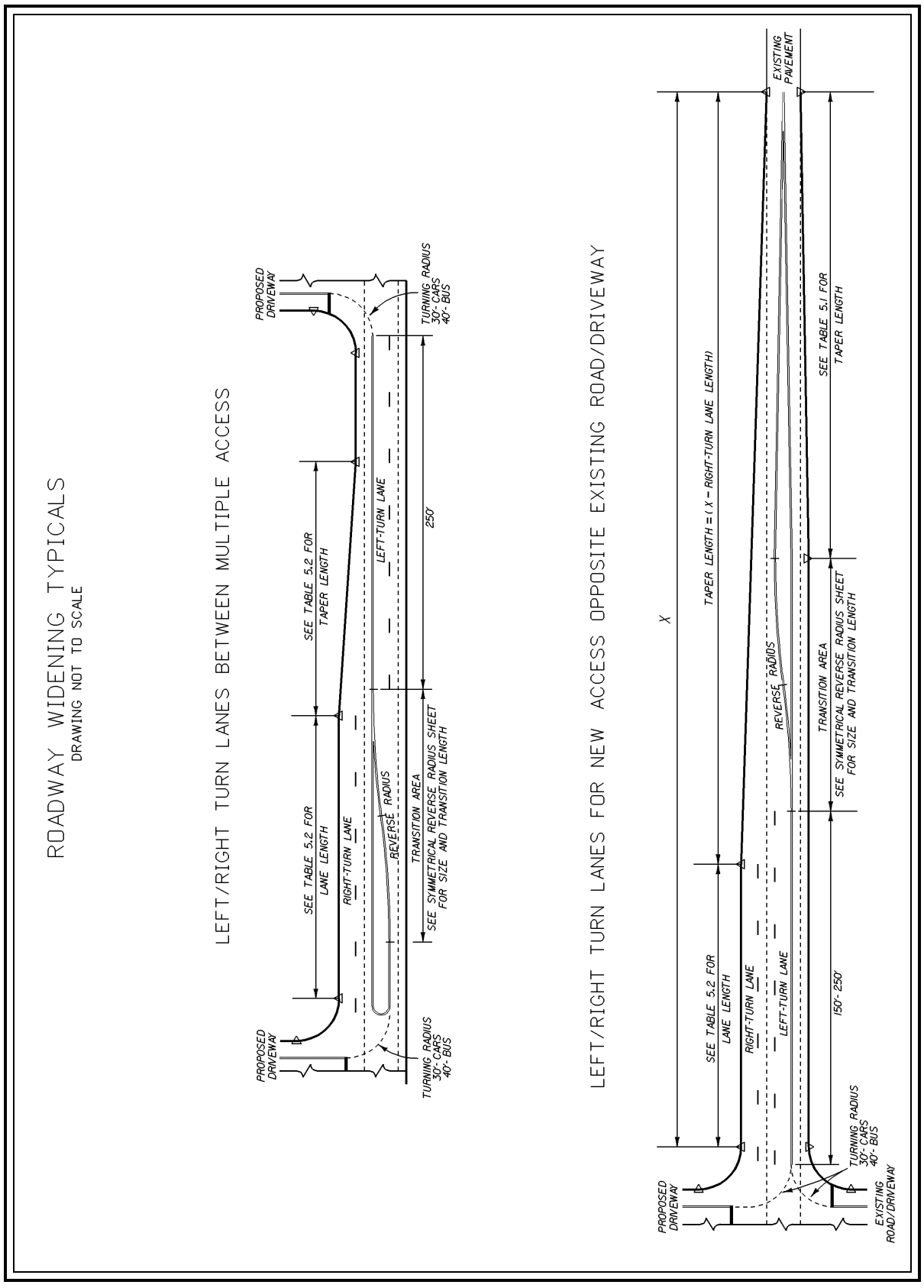


Figure 5-2B Roadway Widening Typical



6. MISCELLANEOUS SITE TRANSPORTATION RECOMMENDATIONS

- The area where parents drop-off and pick-up students should be located separately from bus loading/unloading operations. This is accomplished by constructing loops and driveways that function separately.

- Automobile and bus loop traffic should circulate in a counterclockwise direction so that student loading and unloading occurs from a vehicle's passenger side next to the curb.

- Parking stalls placed along loop drives should be constructed in an angle type fashion to facilitate a one-way traffic flow pattern and discourage wrong way use.

- School buildings should be set back on a site a sufficient distance from the adjacent roadway to insure safe and adequate on-site storage for the stacking of loading and unloading vehicles.

- Pedestrians and bicyclists shall have a designated safe path between any road and the school building.

- The layout of the bus circulation and parking areas shall be designed to prohibit the backing-up of buses on a school site.

- Parking stalls for a full size bus shall be a minimum of 15 feet wide. Smaller spaces may be provided for mini-buses and other specifically sized vehicles used to transport students.

- Student parking areas shall be separated from staff/visitor/bus parking and student loading/unloading areas.