STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

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April 01, 2003

TO: 2002 ROADWAY DESIGN MANUAL HOLDERS

FROM: VICTOR BARBOUR, P. E.
STATE DESIGN SERVICES ENGINEER

SUBJECT: REVISED AND NEW GUIDELINES FOR THE 2002 ROADWAY DESIGN MANUAL

EFFECTIVE DATE: April 01, 2003

The following are The Revisions and New Guidelines to Part I and Part II of the Roadway Design Manual. Please insert these Revisions in your Manual in the appropriate place. These Revisions are to become effective immediately. The 2002 Roadway Design Manual on the web site has already been updated.

REVISION NO. 2

Part I - Roadway Design Manual

1. Chapter 1 - Section 4-O NCDOT Paved Shoulder Policy

NOTE: Adjustments have been made in the Freeway section to allow for 10' full depth paved shoulders for 40,000 ADT or greater. Freeway projects with less than 40,000 ADT, but greater than or equal to 15,000 ADT will have 10-foot paved outside shoulders, but only 4-foot will be full depth with the remaining 6-foot to be partial depth. Freeways with design year traffic less than 15,000 ADT will have 4-foot wide full depth outside paved shoulders. The median paved shoulder will remain 4-foot wide and be full depth. 12' paved shoulders for freeways with heavy truck traffic is also addressed.

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ENTRANCE B-2
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1. Chapter 6 - Section 5, Figure 2..Bridge Superstructure Depths

NOTE: Changes to Structure depths, to comply with Roadway Design.

2. Chapter 9 - Section 1, Figure 3A Sheets 2 to 5..Deceleration Lengths for Median Crossovers and Left Turning Movements

NOTE: Changed last sentence from Bus design to Passenger Vehicle to match Part 1, section 6-D.

3. Chapter 11 - Section 1D, Subgrade Stabilization

NOTE: Subgrade Stabilization added from Part II, Chapter 6, section 1-E.

Part II - Roadway Design Manual

4. Chapter 6 - Section 1-E, Subgrade Stabilization

NOTE: Subgrade Stabilization removed and placed in Part I, Chapter 11, section 1-D.

5. Chapter 19 - Section 3, Earthwork Balance Sheet

NOTE: Revised Earthwork Balance Sheet and Descriptions.

If you have any questions/comments about this revision or suggestions concerning the Roadway Design Manual, Please contact Robert McKeithan (rmckeithan@dot.state.nc.us) or Robert Prince (rprince@dot.state.nc.us) of the Special Services Group, Design Services Unit at (919) 250-4128.

Attachment

FIGURE 1

	NCDOT PAVED SHOULDER POLICY
INTERSTATE AND FREEWAYS 6 OR MORE LANES	10' WIDE PAVED OUTSIDE SHOULDERS & 10' WIDE PAVED MEDIAN SHOULDERS (FULL DEPTH OR AS DIRECTED BY THE PAVEMENT MANAGEMENT UNIT.)
INTERSTATE 4 LANES	10' WIDE PAVED OUTSIDE SHOULDERS (FULL DEPTH OR AS DIRECTED BY THE PAVEMENT MANAGEMENT UNIT.) AND 4' WIDE FULL DEPTH PAVED MEDIAN SHOULDERS (REMAINING WIDTH TO BE TURF.)
FREEWAYS 4 LANES (DES YR. ADT ≥ 40000)	10' WIDE PAVED OUTSIDE SHOULDERS (FULL DEPTH OR AS DIRECTED BY THE PAVEMENT MANAGEMENT UNIT) AND 4' WIDE FULL DEPTH PAVED MEDIAN SHOULDERS (REMAINING WIDTH TO BE TURF.)
(DES YR. ADT < 40000) (DES YR. ADT ≥ 15000)	10' WIDE PAVED OUTSIDE SHOULDERS (4' OF WIDTH TO BE FULL DEPTH, REMAINING PAVED WIDTH TO BE SURFACE COURSE ON ABC, OR AS DIRECTED BY THE PAVEMENT MANAGEMENT UNIT.) 4' WIDE FULL DEPTH PAVED MEDIAN SHOULDERS (REMAINING WIDTH TO BE TURF.)
(DES YR. ADT < 15000)	4' WIDE OUTSIDE AND 4' WIDE MEDIAN FULL DEPTH PAVED SHOULDERS. (REMAINING SHOULDER WIDTH TO BE TURF)
DIVIDED: ARTERIALS, COLLECTORS 6 OR MORE LANES	10' WIDE PAVED OUTSIDE SHOULDERS (4' OF WIDTH TO BE FULL DEPTH, REMAINING PAVED WIDTH TO BE SURFACE COURSE ON ABC OR AS DIRECTED BY THE PAVEMENT MANAGEMENT UNIT.) 4' WIDE FULL DEPTH MEDIAN SHOULDER. SEE NOTE 7.
DIVIDED: ARTERIALS, COLLECTORS 4 LANES (DES. YR. ADT ≥ 40000)	10' WIDE PAVED OUTSIDE SHOULDERS (4' OF WIDTH TO BE FULL DEPTH, REMAINING PAVED WIDTH TO BE SURFACE COURSE ON ABC OR AS DIRECTED BY PAVEMENT MANAGEMENT.) 4' WIDE FULL DEPTH PAVED MEDIAN SHOULDERS (REMAINING MEDIAN SHOULDER WIDTH TO BE TURF).
(DES. YR. ADT < 40000)	4' WIDE OUTSIDE & 2' WIDE MEDIAN FULL DEPTH PAVED SHOULDERS. (REMAINING SHOULDER WIDTH TO BE TURF)
MULTILANE UNDIVIDED: 4 OR MORE LANES (DES. YR. ADT ≥ 40000)	10' WIDE PAVED SHOULDERS (4' OF WIDTH TO BE FULL DEPTH. REMAINING PAVED WIDTH TO BE SURFACE COURSE ON ABC, OR AS DIRECTED BY THE PAVEMENT MANAGEMENT UNIT).
(DES. YR. ADT < 40000)	4' WIDE FULL DEPTH PAVED SHOULDERS. (REMAINING SHOULDER WIDTH TO BE TURF)
TWO LANE – TWO WAY	
(DES. YR. ADT ≥ 8000)	4' WIDE FULL DEPTH PAVED SHOULDERS. (REMAINING SHOULDER WIDTH TO BE TURF).
(DES. YR. ADT ≥ 4000)	2' WIDE FULL DEPTH PAVED SHOULDERS. (REMAINING SHOULDER WIDTH TO BE TURF).
(DES. YR. ADT < 4000)	FULL SHOULDER TO BE TURF. NOTE: 4' PAVED SHOULDER MAY BE CONSIDERED FOR BIKE ROUTES.
RAMPS	
LEFT SHOULDERS	4' WIDE FULL DEPTH PAVED SHOULDER (REMAINING SHOULDER WIDTH TO BE TURF)
RIGHT SHOULDERS	4' WIDE FULL DEPTH PAVED SHOULDER (REMAINING SHOULDER WIDTH TO BE TURF). SEE NOTE 5

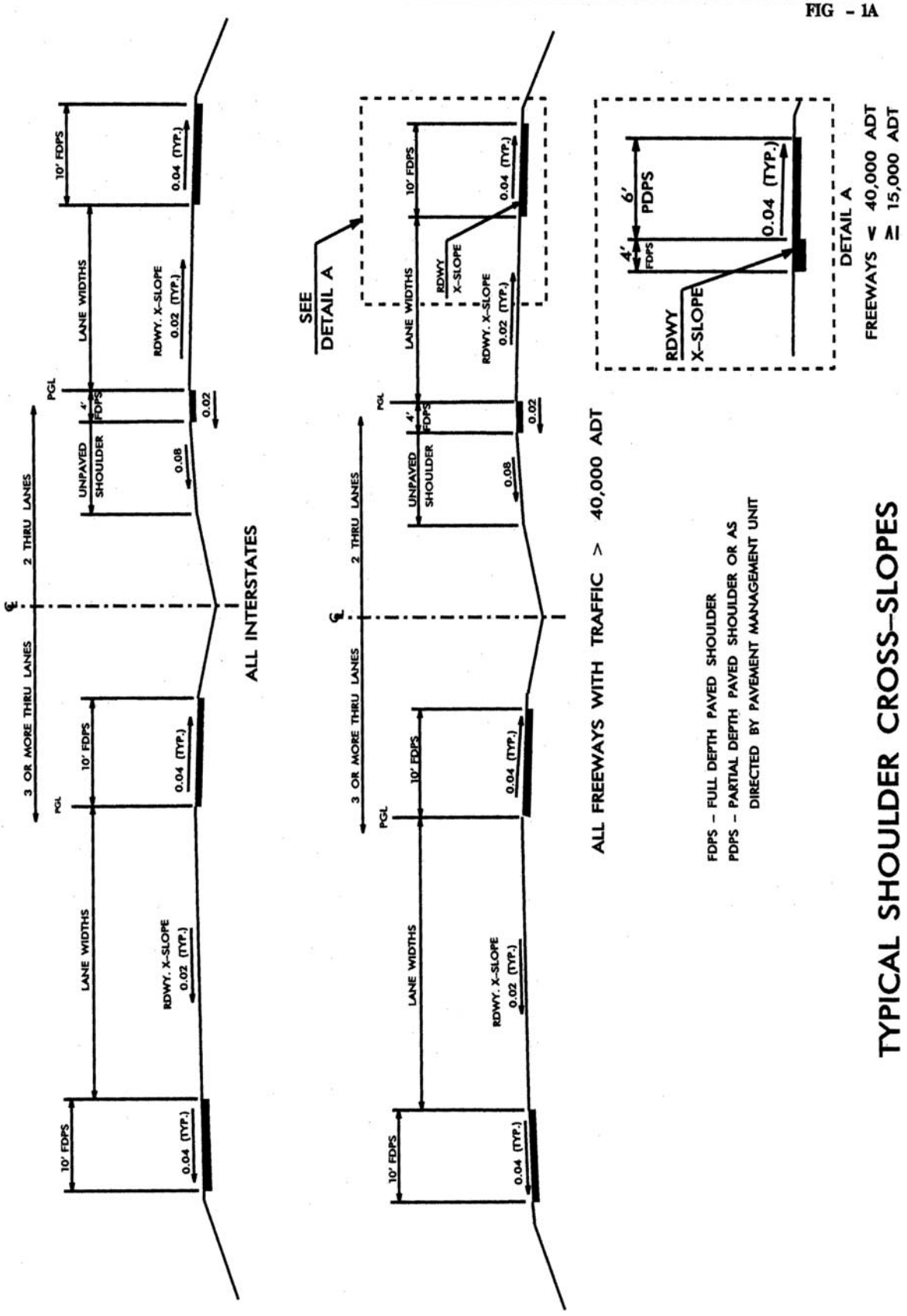
NOTES:

1. PAVED SHOULDER WIDTH SHOULD NOT EXCEED USABLE WIDTHS AS DEFINED IN ROADWAY DESIGN MANUAL EXCEPT AT GUARDRAIL LOCATIONS AS SHOWN IN STD. 862.01.
2. A 12' WIDE PAVED OUTSIDE SHOULDER SHOULD BE CONSIDERED FOR INTERSTATES AND FREEWAYS HAVING TRUCK TRAFFIC WHICH EXCEEDS 250 DDHV. A 12' WIDE PAVED MEDIAN SHOULDER SHOULD BE CONSIDERED FOR THESE FACILITIES WHICH HAVE SIX OR MORE LANES AND TRUCK TRAFFIC EXCEEDING 250 DDHV.
3. FREEWAYS THAT WARRANT 12' PAVED SHOULDERS DUE TO HEAVY TRUCK TRAFFIC AND THE DESIGN YEAR ADT ≥ 40,000 WILL BE DESIGNED WITH 12' FULL DEPTH PAVED SHOULDERS. 12' WIDE MEDIAN PAVED SHOULDERS WILL CONSIST OF 4' WIDTH FULL DEPTH WITH THE REMAINING PAVED WIDTH BEING SURFACE COURSE ON ABC OR AS DIRECTED BY THE PAVEMENT MANAGEMENT UNIT.
4. RUMBLE STRIPS, PAVEMENT TEXTURING, OR OTHER APPROVED METHODS FOR DELINEATING MAINLINE PAVEMENT SURFACES FROM SHOULDER PAVEMENT SURFACES, SHOULD BE USED ON RURAL INTERSTATE AND FREEWAY SHOULDER SURFACES
5. THE PAVEMENT MANAGEMENT UNIT SHALL DETERMINE THE PAVED SHOULDER DESIGN ON A PROJECT BY PROJECT BASIS
6. THE FULL USABLE SHOULDER WIDTH OF INDIVIDUAL RAMPS MAY BE PAVED IF A HISTORY OF EXCESSIVE SHOULDER USAGE IS APPARENT OR EXPECTED BASED UPON EXPERIENCE AT SIMILAR FACILITIES IN THE REGION. IF THE FULL USABLE WIDTH IS TO BE PAVED, THEN 4' OF THE WIDTH SHALL BE FULL DEPTH PAVEMENT AND THE REMAINING PAVED WIDTH SHALL BE SURFACE COURSE ON ABC, OR AS DIRECTED BY PAVEMENT MANAGEMENT UNIT. A RECOMMENDATION TO PAVE THE FULL USABLE WIDTH CAN BE MADE AT THE PROJECT FIELD INSPECTION AND IS TO BE APPROVED BY THE STATE ROADWAY DESIGN ENGINEER.
7. THE FULL USABLE WIDTH OF AUXILIARY LANE SHOULDERS SHALL BE PAVED IF THE AUXILIARY LANE CONNECTS INTERCHANGES OR IS LONGER THAN 2500 FEET. 4' OF THE PAVED WIDTH SHALL BE FULL DEPTH PAVEMENT AND THE REMAINING PAVED WIDTH SHALL BE SURFACE COURSE ON ABC, OR AS DIRECTED BY THE PAVEMENT MANAGEMENT UNIT.
8. CONSIDER 10' PAVED MEDIAN SHOULDERS FOR SPEEDS≥ 55 MPH.

FIGURE 1

1 - 4 0

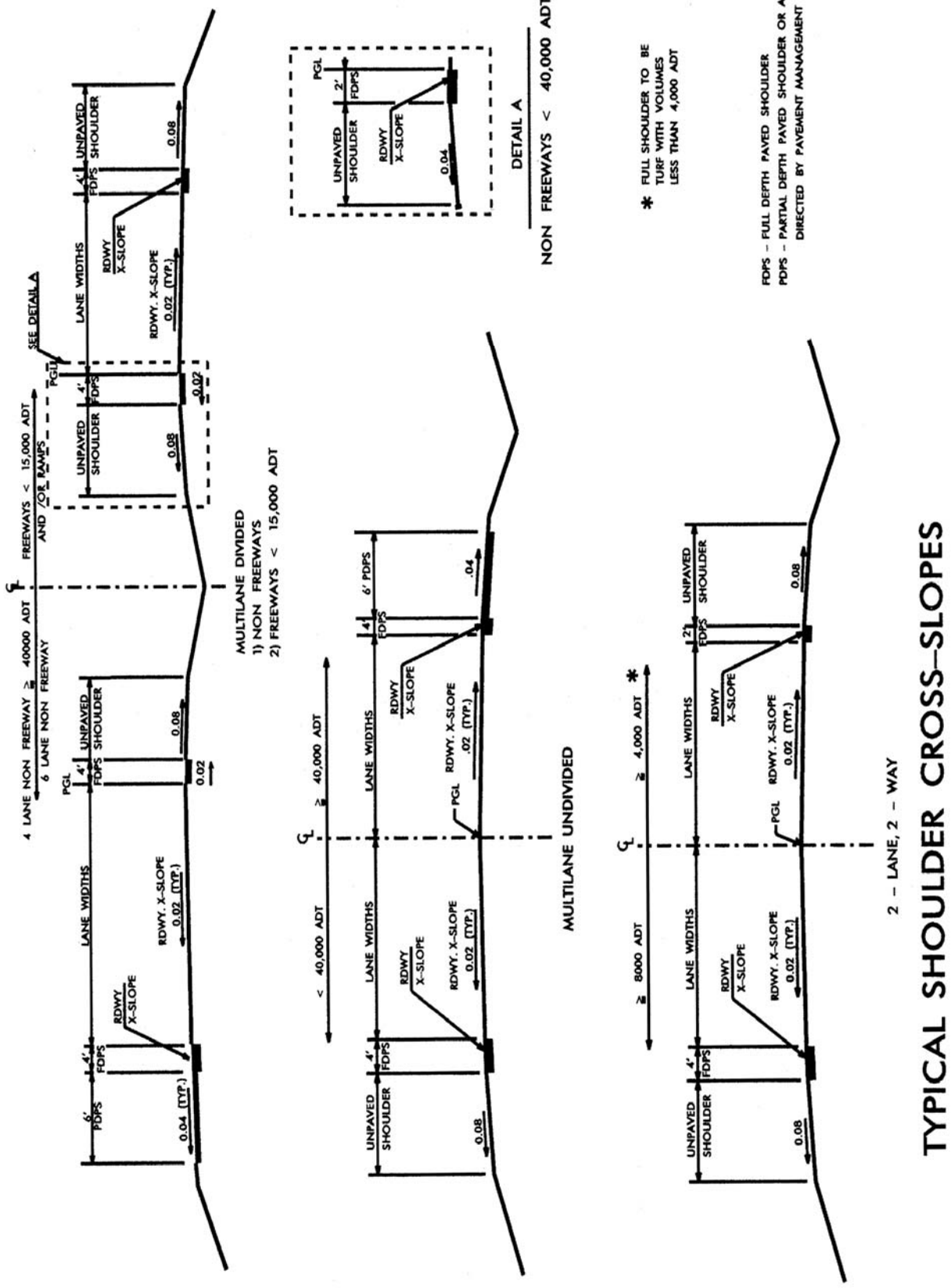
FIG - 1A



TYPICAL SHOULDER CROSS-SLOPES

FIGURE 1 1-4 0

FIG - 1B



TYPICAL SHOULDER CROSS-SLOPES

FIGURE 2 6 – 5
F – 2

BRIDGE SUPERSTRUCTURE DEPTHS
–PLATE GIRDER SUPERSTRUCTURE–

THE DEPTHS LISTED BELOW ARE BASED ON THE FOLLOWING PARAMETERS, AND IF CONDITIONS DO NOT APPEAR TO MEET THESE NORMS, IT WILL BE NECESSARY TO DISCUSS THE SUPERSTRUCTURE DEPTH WITH THE STRUCTURE DESIGN UNIT.

PARAMETERS

(a) 34′, 40′, 48′, 56′, OR 64′ ROADWAY WIDTH
(b) HS 20 LIVE LOAD
(c) SIMPLE SPAN, COMPOSITE TYPE GIRDER
(d) ASTM 588 UNPAINTED HIGH STRENGTH STEEL
(e) STAY IN PLACE METAL FORMS
(f) NO TRANSVERSE STIFFENERS
(g) CONCRETE BARRIER RAILS

DESIGN SPAN (ft.)	SUPERSTRUCTURE DEPTH (ft.)*
39′ – 0″ to 45′ – 0″	4′ – 0″
> 45′ – 0″ to 65′ – 0″	4′ – 8″
> 65′ – 0″ to 90′ – 0″	5′ – 5″
> 90′ – 0″ to 105′ – 0″	6′ – 3″
> 105′ – 0″ to 120′ – 0″	6′ – 11″
> 120′ – 0″ to 150′ – 0″	7′ – 3″
> 150′ – 0″ to 160′ – 0″	7′ – 7″
> 160′ – 0″	Consult with SDU

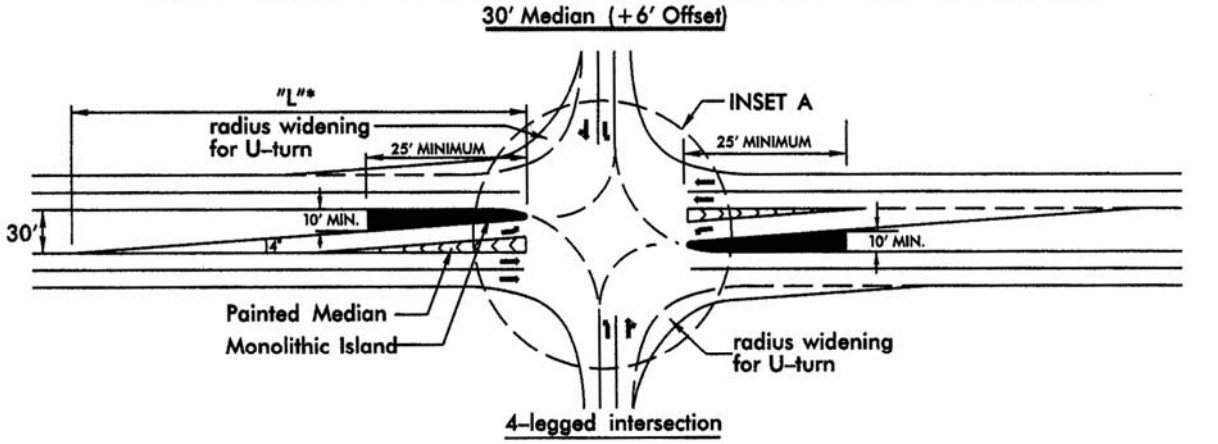
* DEPTHS SHOWN ARE FROM TOP OF SLAB DIRECTLY OVER EXTERIOR GIRDER TO BOTTOM OF DEFLECTED GIRDER. THE SUPERSTRUCTURE DEPTH MUST BE ADJUSTED FOR CROWN DROP. THESE DEPTHS ARE BASED ON SIMPLE SPAN GIRDERS. DEPTHS FOR CURVED GIRDERS OR CONTINOUS GIRDERS SHOULD BE COORDINATED WITH STRUCTURE DESIGN.

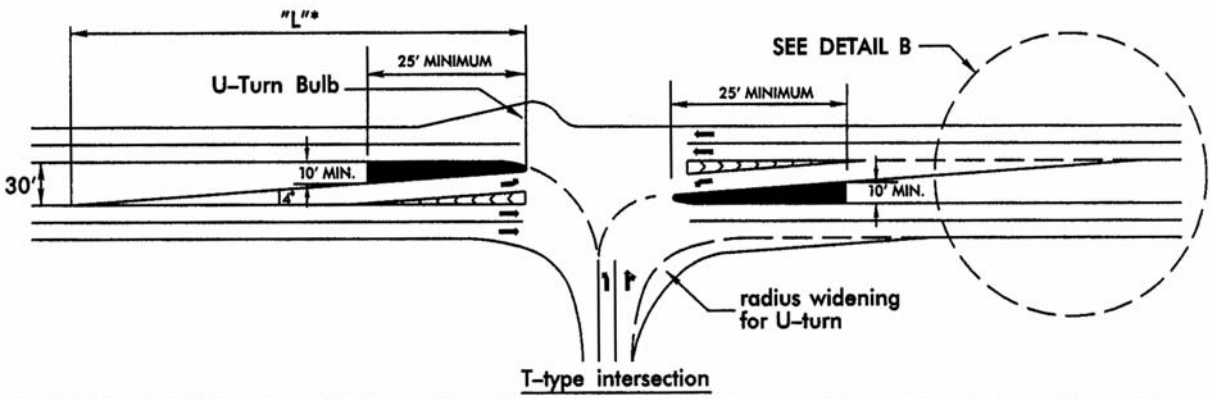
* FOR SPAN LENGTH UP TO 160 ft., ADEQUATE VERTICAL CLEARANCE SHOULD HAVE BEEN PROVIDED TO ALLOW FLEXIBILITY IN SELECTING THE TYPE OF SUPERSTRUCTURE.

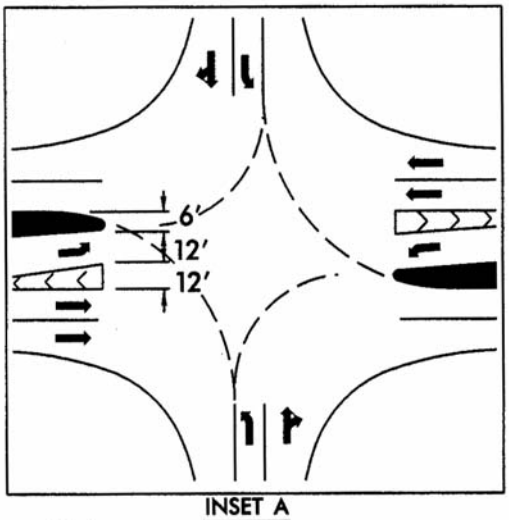
FIGURE 3A **9-1**

F - 3A - 2

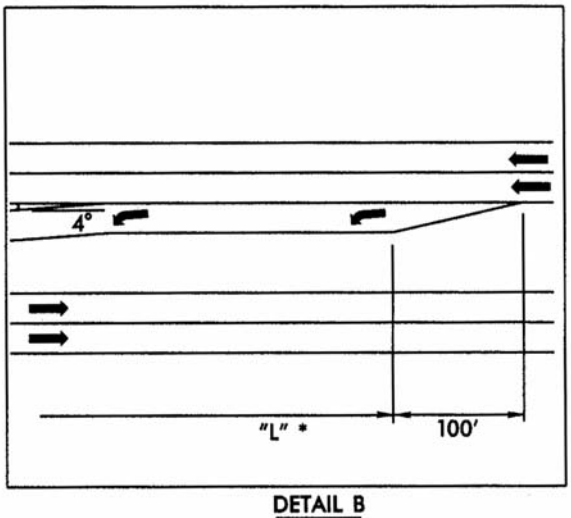
GUIDELINES FOR OFFSETTING OPPOSING LEFT–TURN LANES ON DIVIDED ROADWAYS







INSET A



DETAIL B

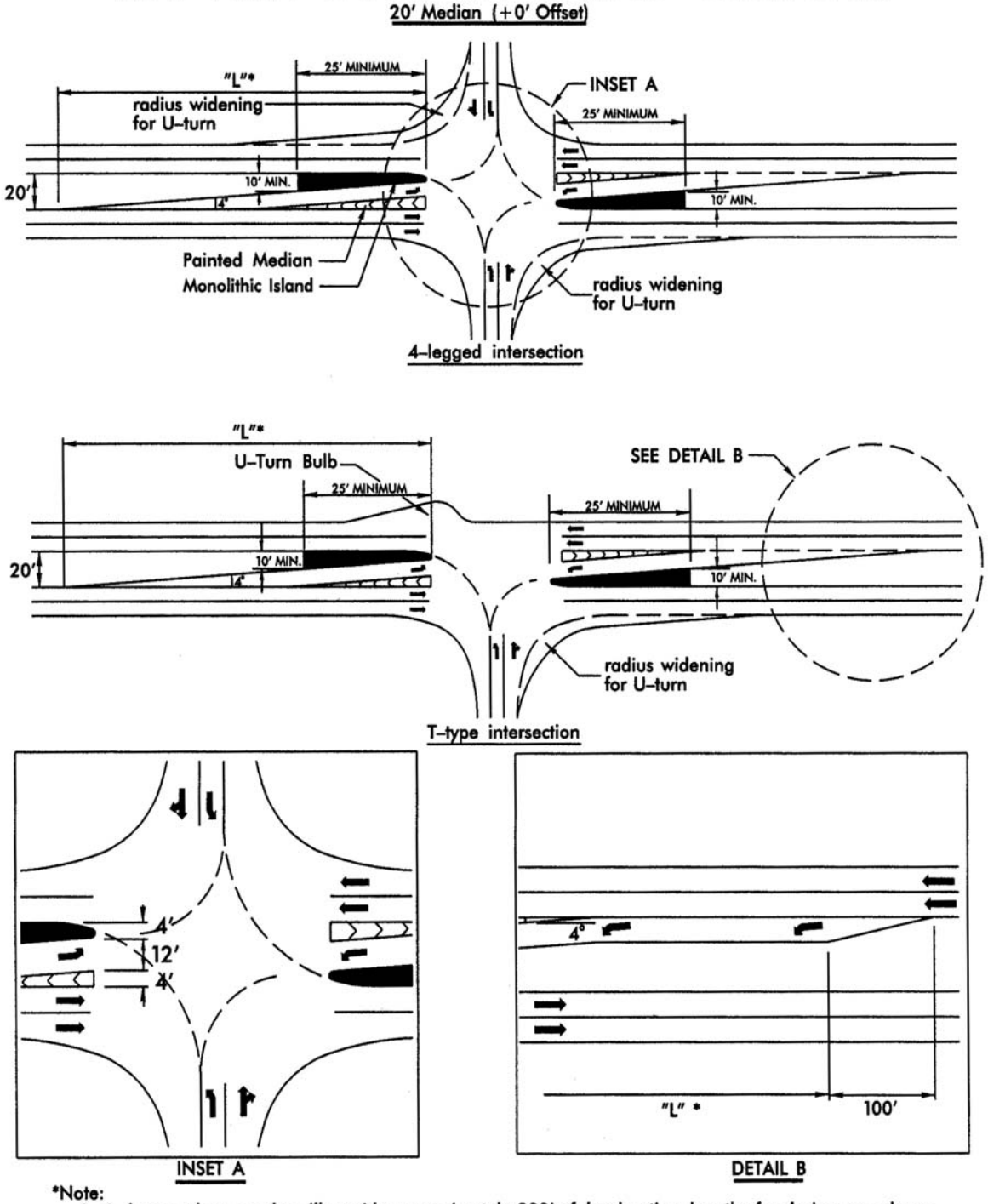
*Note:
A 4 degree skew angle will provide approximately 340' of deceleration lengths for design speeds up to 40 mph. A parallel deceleration lane can be incorporated for design speeds 50 mph and higher or where additional storage length is required. See Detail B

Design U–turns for passenger vehicles unless project information dictates otherwise.

FIGURE 3-A 9-1

F - 3A - 3

GUIDELINES FOR OFFSETTING OPPOSING LEFT–TURN LANES ON DIVIDED ROADWAYS



*Note:
A 4 degree skew angle will provide approximately 230′ of deceleration lengths for design speeds up to 30 mph. A parallel deceleration lane can be incorporated for design speeds 40 mph and higher or where additional storage length is required. See Detail B

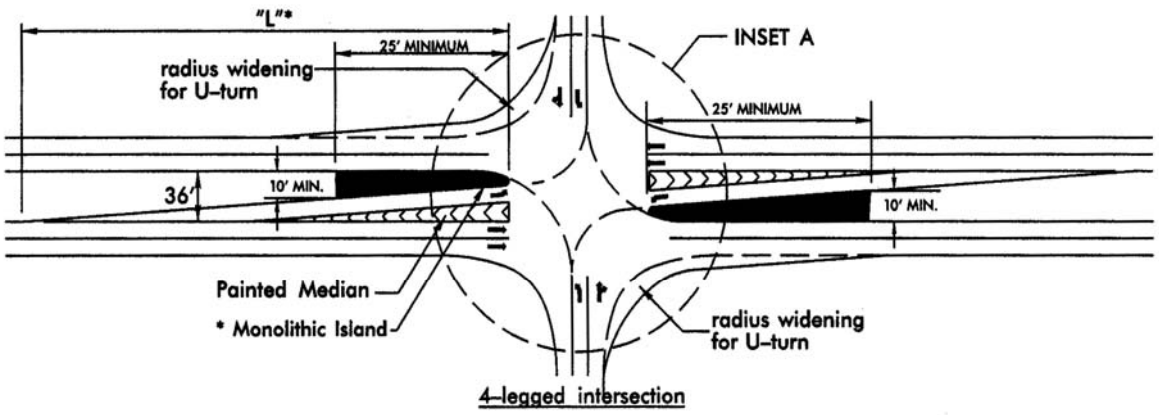
Design U–turns for passenger vehicles unless project information dictates otherwise.

FIGURE 3-A **9-1**

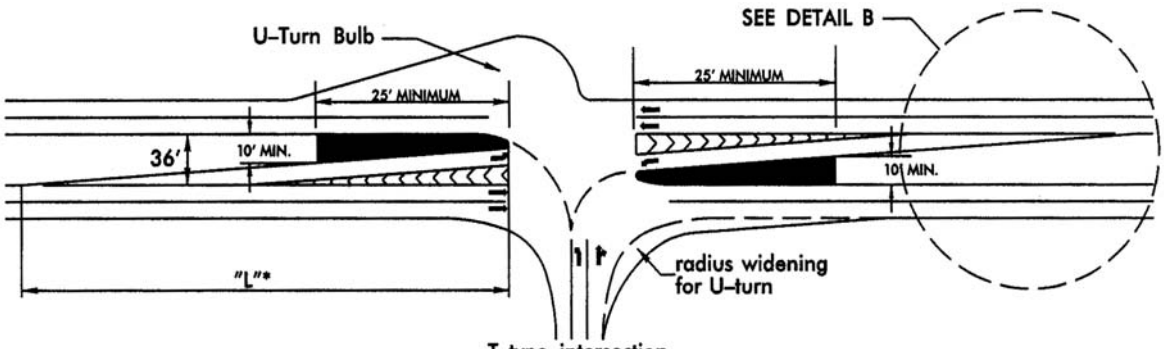
F - 3A - 4

GUIDELINES FOR OFFSETTING OPPOSING LEFT–TURN LANES ON DIVIDED ROADWAYS

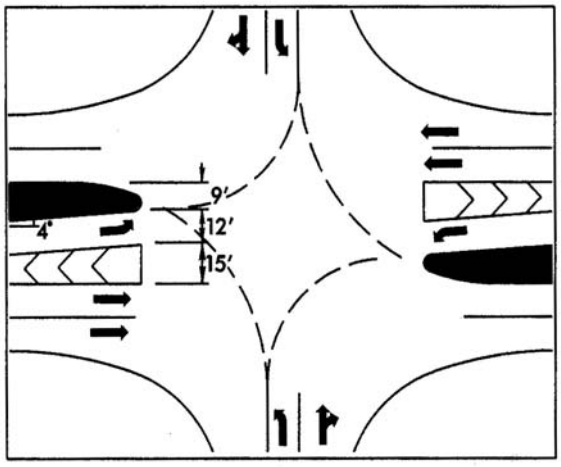
36′ Median (+6′ Offset)



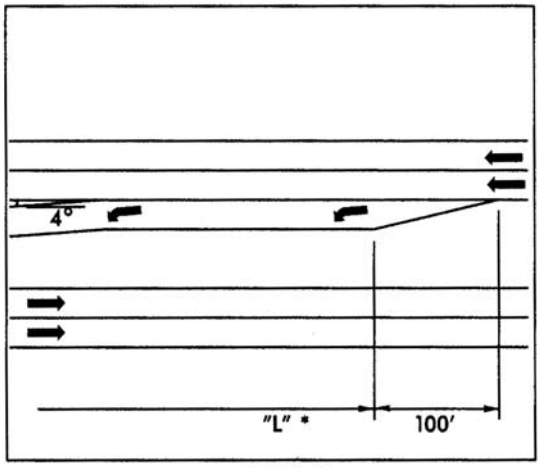
4–legged intersection



T–type intersection



INSET A



DETAIL B

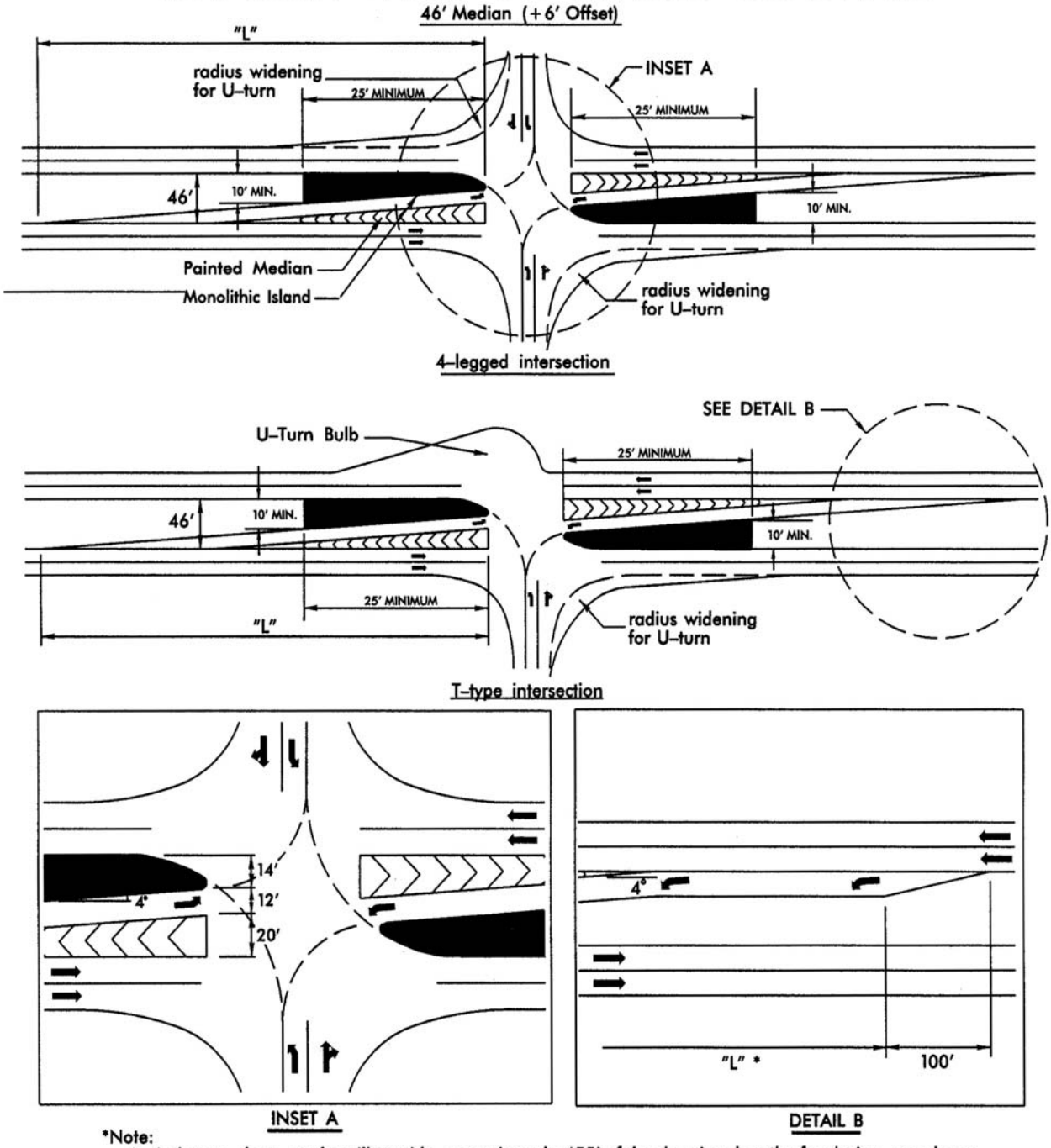
*Note:
A 4 degree skew angle will provide approximately 385′ of deceleration lengths for design speeds up to 40 mph. A parallel deceleration lane can be incorporated for design speeds 50 mph and higher or where additional storage length is required. See Detail B

Design U–turns for passenger vehicles unless project information dictates otherwise.

FIGURE 3-A **9-1**

F - 3A - 5

GUIDELINES FOR OFFSETTING OPPOSING LEFT–TURN LANES ON DIVIDED ROADWAYS



*Note:
A 4 degree skew angle will provide approximately 455′ of deceleration lengths for design speeds up to 50 mph. A parallel deceleration lane can be incorporated for design speeds 60 mph and higher or where additional storage length is required. See Detail B

Design U–turns for passenger vehicles unless project information dictates otherwise.

AGGREGATE BASE COURSE (ABC) 11-1B

When all calculations are completed and totaled, the following procedures shall be used in the computation of ABC quantities.

0 TO 1000 TONS OF ABC – ADD 10%
1001 TO 5000 TONS OF ABC – ADD 5%
5001 TONS OF ABC AND ABOVE – ROUND OFF TO NEXT 100 TONS

PRIME COAT 11-1C

Section 600 of the Standard Specifications For Roads and Structures states that prime coat will not be required unless called for on the plans and in the estimate.

Areas where prime coat should be included on a project are as follows:

1. On mainline and/or -Y- line paving areas when requested by Division Engineer, if approved by the Pavement Management Unit.

2. On any paving project (including detours and paved shoulders) when the bituminous concrete thickness is less than 2″.

3. In conjunction with 10′ paved shoulders, if the remainder of the shoulder is all ABC, this area should be primed at a rate of 0.5 gallons per Sq. Yd.

Areas to be primed are shown on the typical sections.

SUBGRADE STABILIZATION 11-1D

When stabilized Subgrade is specified in the Geotechnical Recommendations for Pavement Design, it shall be included in the Pavement Schedule and shall be shown on the applicable typical sections.(See Pavement Schedule in this manual, Part II, 6-lD, F-1.) The following widths shall be used for stabilization:

(1) Width in curb and gutter sections - Edge of pavement to edge of pavement.
(2) Width in shoulder sections - One foot outside the top edges of the full depth pavement structure. (Include full depth paved shoulders.)
(3) Do not use stabilization on pavement widths less than six feet.

The most commonly recommended subgrade stabilization's are as follows:

1. Lime Stabilization requires the pay item "Lime Treated Soil (Slurry Method)," "Lime Treated Soil (Quicklime)," or "Lime Treated Soil (Hydrated Lime)." Lime Stabilization also requires pay items "Lime for Lime Treated Soil," "Asphalt Curing Seal," and "Blotting Sand." The blotting sand quantity is shown in the Geotechnical Recommendations for Pavement Design.
2. Cement Stabilization requires the pay items "Soil Cement Base," "Portland Cement for Soil Cement Base," "Asphalt Curing Seal" and "Blotting Sand." The blotting sand quantity is shown in the Geotechnical Recommendations for Pavement Design.
3. Aggregate Base Course for the Cement Area requires the pay item "Aggregate for Soil Cement Base." This pay item is only used when it is specified that a percentage of the cement stabilized area also requires aggregate base course.
4. Aggregate for Aggregate Stabilization recommendations requires the pay item "Stabilizer Aggregate."

Deviations from the Geotechnical Recommendations for Pavement Design shall be documented by the Pavement Design Engineer in the Pavement Management Unit.

PAVEMENT SCHEDULE (continued) 6-1D
F-1

R3 8″ x 6″ Concrete Curb

R4 ____″ x ____″ Concrete Curb

R5 5″ Monolithic Concrete Island (surface mounted)

R6 5″ Monolithic Concrete Island (keyed in)

R7 3″ Concrete Island Cover

R8 ____″ Concrete Island Cover

S 4″ Concrete Sidewalk

T Earth Material

U Existing Pavement

W Variable Depth Asphalt Pavement (See Standard Wedging Detail Sheet No. ____)

X Permeable Asphalt Drainage Course - Type P-____

CHAPTER 19

EARTHWORK

PLOTTING OF CROSS-SECTION SHEETS 19-1

For most projects, cross-sections are plotted on a horizontal and vertical scale of 1″= 10′. On mountainous projects with extremely high cuts and fills 1″ = 20′ might be more practical. In all cases horizontal and vertical scales should be the same. Half-size plots are sent out with plans having over 30 cross-section sheets. Full-size plots are sent out on projects with 30 or less cross-section sheets. If the Division request full-size plots for stake out and construction purposes, these should be provided.

USE OF CADD FOR EARTHWORK 19-2

Most cross sections will be created from a DTM (Digital Terrain Model) originating from Location and Surveys Unit or the Photogrammetry Unit. Geopak can be utilized to plot existing cross-sections, and complete proposed templates and earthwork. (Refer to Geopak Reference Manuals for procedures.)

EARTHWORK BALANCE SHEET 19-3

An earthwork balance sheet is required in the project file. Furnish a copy to the Geotechnical Unit on projects with available subsurface plans. Adhere to the following guidelines when preparing the Earthwork Balance Sheet:

A. BREAKDOWN QUANTITIES AS FOLLOWS:

1. Summary points at every 3,000’ ±.
2. Summary points end/begin at each bridge (stream or grade separation).
3. Summary points end/begin near each major at-grade multi-lane intersection or at-grade railroad crossing.
4. Separate Y line, ramp, loop and other major construction items from mainline earthwork, but include in the respective summary.
5. On widening projects, respective summaries are provided for right and left side if the material cannot be hauled across traffic.
6. On existing divided facilities to be widened, respective summaries are provided for right side, left side and median widening if the material cannot be hauled across traffic.
7. Projects with complex construction phasing plans may require phasing of the summary points. Coordinate phasing with the Division and Traffic Engineering.

B. Include recommendations from the Geotechnical Unit and/or the Soils and Foundation Section as follows:

1. Shrinkage Factor - Use the figure recommended by the Soils and Foundation Section when available.

2. Loss Due to Clearing and Grubbing - This volume is estimated for loss in cuts of up to one (1) foot in depth. Any loss in fills is included in the shrinkage factor.

3. Undercut Excavation - A recommendation for excavating benches at grade points and removing unsuitable material below subgrade. This normally should be wasted, but in certain conditions can be used in embankments.

4. Top Soil on Borrow Pits - On projects requiring borrow material, an additional 5% of the total borrow should be computed for replacing the top soil on the borrow pit.

5. Rock – "Hard Rock" is only shown on the Earthwork Balance Sheet. All rock on the project should be used in embankments before using suitable excavation and should be computed on a one-to-one basis unless recommendations specify otherwise.

The earthwork balance sheet, shown in Part II, 19-3, F-2, (with numbered columns) is for use with the descriptions below.

C. The information for a basic Earthwork Balance Sheet should be listed as follows:

1. List, in column one, the survey line reference and beginning station for each summary point.
2. Record, in column two, the ending station for each summary point.
3. Show, in column three, the volume of all material excavated between summary point stations (except material covered by other excavation pay items such as undercut excavation and drainage ditch excavation).
4. Column four contains volumes of "hard" rock that is excavated as a part of unclassified excavation.
5. Record, in column five, volumes of material excavated beneath the roadway subgrade.
6. Show, in column six, volumes of any unclassified excavation that is not suitable for roadway embankments.

7. Column seven contains Unclassified Excavation (less "hard" rock) volumes that are suitable for constructing roadway embankments.
8. List the total embankment (include backfill for undercut) in column eight. This figure is the volume of all the different materials used (do not include shrinkage or swell factors).
9. Show, in column nine, the volume of embankment that is to be constructed from "hard" rock. Use the "hard" rock portion of unclassified excavation, before the earth, to construct embankments within each summary point.
10. Show, in column ten, the volume of embankment that is to be constructed from earth.
11. Column eleven reflects the actual volume of material needed to construct the embankment. A shrinkage factor must be applied to the earth portion and then the "hard" rock is added if applicable. Shrinkage and swell factors do no apply to "hard" rock unless specified by the Geotechnical Unit.
12. Column twelve shows the amount of borrow material needed to construct embankments after the suitable excavation (rock and earth) has been utilized within the summary points.
13. Any "hard" rock excavation not utilized in embankments must have the volume listed in column thirteen.
14. Record, in column fourteen, the volume of any suitable excavation (undercut or unclassified) not utilized in embankments. Exclude "hard" rock.
15. In column fifteen, record the volume of excavation (unclassified or undercut) that does not have the necessary properties to be used in embankments.
16. Column sixteen shows the summation of volumes recorded in columns thirteen, fourteen, and fifteen.

After the listing of the summary points is completed, a "TOTAL" is needed. Total each respective column, three through sixteen. Make earthwork adjustments after the "TOTAL" as follows:

1. "Loss due to clearing and grubbing" volumes, recommended by the Geotechnical Unit, are to be deducted from columns three and seven. This figure also needs to be deducted from columns fourteen and sixteen on waste projects or added to column twelve on borrow projects.
2. "Hard" rock waste, used to replace borrow, is to be added in column nine. It must be deducted from columns ten, twelve, thirteen and sixteen.

3. Another line of adjustment is needed to "Adjust for rock waste." The volume of rock used to replace borrow should have the shrinkage factor applied (example: a project with 20% shrinkage should have this volume multiplied by 0.20). This adjustment must be deducted from columns eleven and twelve because the shrinkage factor was applied to the material within the summary points, but hard rock is not subject to the shrinkage factor.
4. Any earth waste to replace borrow should be deducted from columns twelve, fourteen, and sixteen.
5. Borrow projects with graded shoulder sections require a line of adjustment with volumes for shoulder material shown in columns eight and ten. These volumes, increased by the shrinkage factor, should show in columns eleven and twelve. Curb and gutter or shoulder trench sections do not need to be included. Projects, with enough usable waste material to build the graded shoulder section, should have a separate pay item of "Shoulder Borrow" which reflects this volume. Do not cover shoulder borrow within the earthwork balance sheet. This should be shown at the bottom of the sheet (below the grand total of earthwork balance sheet items). Do not use the "Shoulder Borrow" pay item on projects with the "Borrow Excavation" pay item.
6. Additional undercut (undercut not shown on plans such as grade point undercut, contingency undercut, etc.) should have an earthwork adjustment line if other undercut is shown within the summary points. This volume is to show in columns five, eight, ten, fifteen and sixteen. List this volume in column fourteen (instead of fifteen) if undercut is suitable. Show this volume, increased by the shrinkage factor, in columns eleven and twelve. Projects with no undercut shown within the summary points can have this volume listed, as estimated undercut, at the bottom of the sheet (below the grand total of earthwork balance sheet items). Using this method should result in the undercut quantity shown on the earthwork summary and the quantity on the summary of quantities being identical.

Other adjustments (select borrow, rock swell, flyash, etc.) may be warranted on select projects. The method of including this information on the earthwork balance sheet can vary due to recommendation format.

Total each respective column, three through sixteen, after the above adjustments are complete. This will be the "Grand Totals" on waste projects and "Project Totals" on borrow projects. Borrow projects need an additional 5% added to the figure shown in column twelve of the " Project Totals" line. This is an "Estimated 5% for Replacing Topsoil on Borrow Pits" which must be included in the "Grand Total" of borrow projects.

EARTHWORK BALANCE SHEET (continued) 19-3

"Say" quantities should be shown beneath the "Grand Totals" for any volumes shown in columns that require a pay item.

The “Earthwork Summary” shown in the Roadway Plans shall be restricted to information shown in columns one, two, three, five, eleven, twelve and sixteen of the Earthwork Balance Sheet (Part II, 19-3, F-2). Do not show the shrinkage factor in the embankment +% column (eleven) of the Earthwork Summary in the plans.

An example of the earthwork balance sheet for a “Borrow” project shows in Part II, 19-3, F-3. See Part II, 19-3, F-4 for an example showing a “Waste” project.

The Plan Review Section of the Design Services Unit will assist you at your request.

NOTE ON CROSS SECTIONS (EXCLUDING LUMP SUM GRADING PROJECTS) 19-4

The following note shall be shown on the first cross-section sheet:
Note: “Quantities are approximate only. The Resident Engineer will re-cross-section the work accurately when the project is staked out. These cross-section notes will be used in computing the final quantities for which the contractor will be paid.”

NOTE FOR LUMP SUM GRADING 19-5

The following note shall be shown on the first cross-section sheet, the Earthwork Summary, and the Pavement Removal Summary on Lump Sum Grading projects:

Note: Approximate quantities only. Unclassified Excavation, Borrow Excavation, Shoulder Borrow, Fine Grading, Clearing and Grubbing, Breaking of Existing Pavement, and Removal of Existing Pavement will be paid for at the contract lump sum price for “Grading.”

For additional information, see Chapter 11 of the Policy and Procedure Manual.

FIGURE 1 **19-3 F-1**

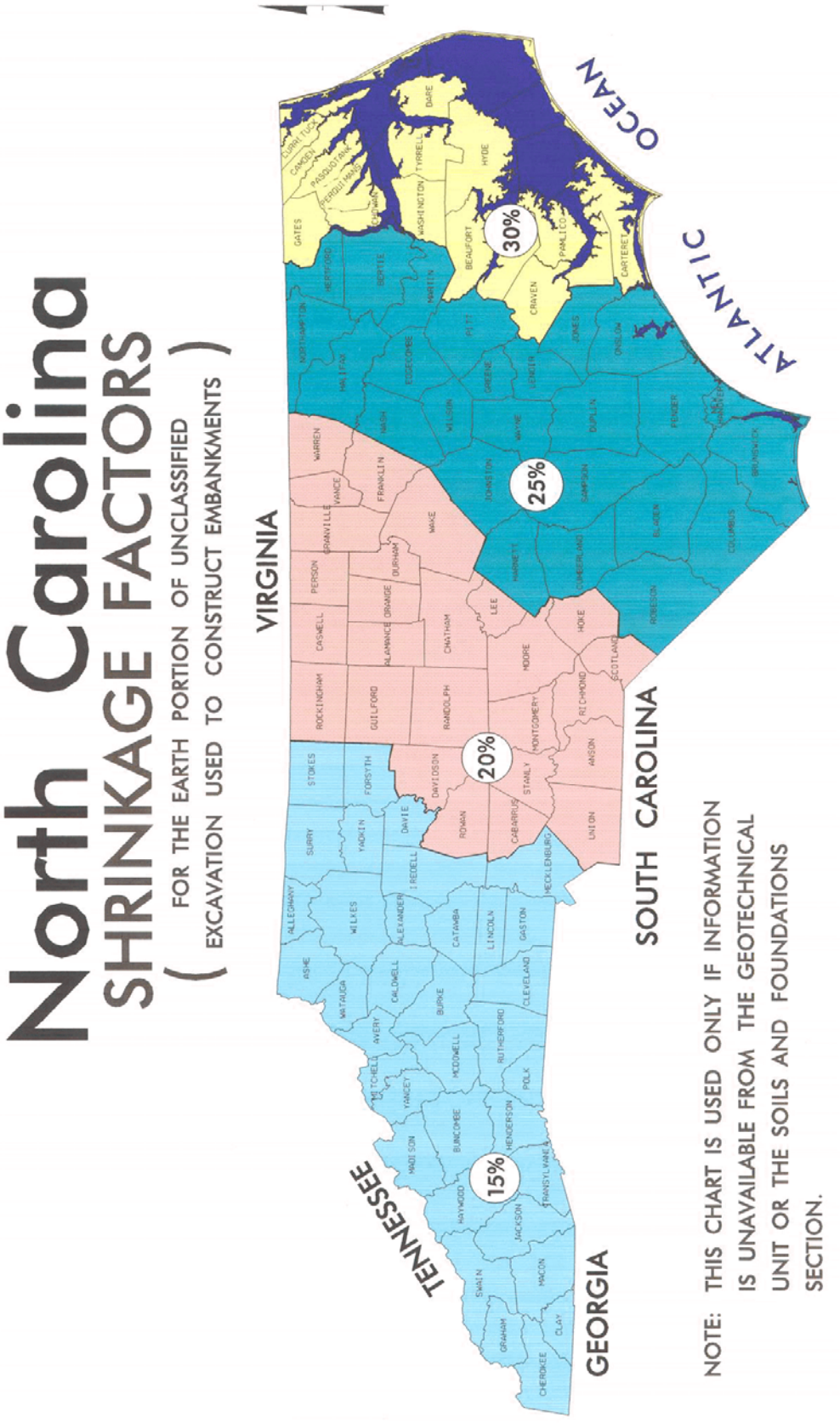


FIGURE 2 19-3 F-2

Volumes in Cubic ____

PROJECT________ COUNTY________________ DATE ________________ COMPILED BY: ____________ SHEET _______ OF _______ SHEETS

STATION	STATION	EXCAVATION					EMBANKMENT				BORROW	WASTE			
		TOTAL UNCLASS.	ROCK	UNDERCUT	UNSUIT. UNCLASS.	SUITABLE UNCLASS.	TOTAL	ROCK	EARTH	EMBANK. (+) __%		ROCK	SUITABLE	UNSUIT.	TOTAL
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

FIGURE 3 **19-3**
F-3

PROJECT_____ COUNTY_____ Volumes in Cubic ____
DATE _____ COMPILED BY:_____ SHEET _____ OF _____ SHEETS

STATION	STATION	EXCAVATION					EMBANKMENT				BORROW	WASTE			
		TOTAL UNCLASS.	ROCK	UNDERCUT	UNSUIT. UNCLASS.	SUITABLE UNCLASS.	TOTAL	ROCK	EARTH	EMBANK. (+) 20 %		ROCK	SUITABLE	UNSUIT.	TOTAL
L 120+00	150+00	60,000	5,000	3,000	7,000	48,000	75,000	5,000	70,000	89,000	36,000			10,000	10,000
Y1 10+00	20+00	10,000				10,000	8,000		8,000	9,600			400		400
	SUBTOTAL	70,000	5,000	3,000	7,000	58,000	83,000	5,000	78,000	98,600	36,000		400	10,000	10,400
L 150+00	180+00	50,000	10,000			40,000	7,000	7,000		7,000		3,000	40,000		43,000
	SUBTOTAL	50,000	10,000			40,000	7,000	7,000		7,000		3,000	40,000		43,000
L 180+00	210+00	40,000			8,000	32,000	80,000		80,000	96,000	64,000			8,000	8,000
Y2 20+00	30+00	20,000		7,000		20,000	25,000		25,000	30,000	10,000			7,000	7,000
	SUBTOTAL	60,000		7,000	8,000	52,000	105,000		105,000	126,000	74,000			15,000	15,000
TOTAL		180,000	15,000	10,000	15,000	150,000	195,000	12,000	183,000	231,600	110,000	3,000	40,400	25,000	68,400
Loss due to clear. & grub.		-5,000				-5,000					5,000				
Rock waste to repl. bor.							3,000	-3,000			-3,000	-3,000			-3,000
Adjust for rock waste										-600	-600				
Earth waste to repl. bor.											-40,400		-40,400		-40,400
Est. Shoulder Material							12,000		12,000	14,400	14,400				
Additional Undercut				5,000			5,000		5,000	6,000	6,000			5,000	5,000
PROJECT	TOTALS	175,000	15,000	15,000	15,000	145,000	212,000	15,000	197,000	251,400	91,400			30,000	30,000
Est. for repl. Topsoil											4,570				
on borrow pits															
GRAND	TOTALS	175,000									95,970				
SAY		175,500									96,500				

FIGURE 4 **19-3 F-4**

PROJECT_____ COUNTY_____ Volumes in Cubic _____
DATE _____ COMPILED BY: _____ SHEET _____ OF _____ SHEETS

STATION	STATION	EXCAVATION					EMBANKMENT				BORROW	WASTE			
		TOTAL UNCLASS.	ROCK	UNDERCUT	UNSUIT. UNCLASS.	SUITABLE UNCLASS.	TOTAL	ROCK	EARTH	EMBANK. (+) 20 %		ROCK	SUITABLE	UNSUIT.	TOTAL
L 220+00	250+00	75,000	10,000	5,000	1,000	64,000	60,000	10,000	50,000	70,000			4,000	6,000	10,000
Y10 15+00	25+00	8,000				8,000	10,000		10,000	12,000	4,000				
	SUBTOTAL	83,000	10,000	5,000	1,000	72,000	70,000	10,000	60,000	82,000	4,000		4,000	6,000	10,000
L 250+00	280+00	14,000	2,000			12,000	20,000	2,000	18,000	23,600	9,600				
	SUBTOTAL	14,000	2,000			12,000	20,000	2,000	18,000	23,600	9,600				
L 280+00	310+00	80,000		12,000	68,000		40,000		40,000	48,000			20,000	12,000	32,000
Y11 27+00	39+00	20,000	1,000	7,000	19,000		3,000	1,000	2,000	3,400			16,600	7,000	23,600
	SUBTOTAL	100,000	1,000	7,000	12,000	87,000	43,000	1,000	42,000	51,400			36,600	19,000	55,600
TOTAL		197,000	13,000	12,000	13,000	171,000	133,000	13,000	120,000	157,000	13,600		40,600	25,000	65,600
Loss due to clear. & grub.		-5,000				-5,000							-5,000		-5,000
Adjust undercut				5,000			5,000		5,000	6,000	6,000			5,000	5,000
Waste to repl. Borrow											-19,600		-19,600		-19,600
GRAND	TOTALS	192,000	13,000	17,000	13,000	166,000	138,000	13,000	125,000	163,000			16,000	30,000	46,000
SAY		192,500													