FLORIDA DEPARTMENT OF TRANSPORTATION

LAWTON CHILES
GOVERNOR

605 Suwannee Street, Tallahassee, Florida 32399-0450

BEN G. WATTS
SECRETARY

1-1-97 Revisions
Installed 2-4-97

Design Bulletin 97-01
No Expiration Date

DATE: January 15, 1997

TO: Registered Holders of the Plans Preparation Manual

FROM: Billy Hattaway, PE
State Roadway Design Engineer

Billy J. Hattaway

SUBJECT: IMPLEMENTATION OF JANUARY 1, 1997 REVISIONS TO THE PLANS PREPARATION MANUAL, VOLUME 1

The January 1, 1997 Revisions to the Plans Preparation Manual (Metric) are to be implemented on all Metric and English projects as stated below

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Chapter 1, Section 1.9 - Design Speed

SUMMARY OF REVISION

A new section on Design Speed is added A recommended range of design speeds for facilities not on the Florida Intrastate Highway System is provided Also provided are the minimum design speeds for FIHS facilities

IMPLEMENTATION

Minimum design speeds for FIHS facilities were previously implemented (see Topic Number 525-030-250) Design Speed for non-FIHS facilities are provided for guidance and should be implemented where practical and appropriate

This change applies to both Metric and English Projects Use Appendix B, FDOT Metric Practice to determine corresponding English values

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Chapter 2, Section 2.14 - Interchanges

SUMMARY OF REVISION

Section 2 14 is revised to include discussion on the relationship of Access Management rule requirements to Limited Access limits and median openings at interchanges

IMPLEMENTATION

Requirements for Limited Access limits and the Access Management rule were previously implemented This PPM revision is intended to provide clarification and does not constitute new criteria requiring an implementation schedule

This change applies to both Metric and English Projects

Chapter 2, Table 2.2.1 - Median Width

SUMMARY OF REVISION

A definition for median width is added

IMPLEMENTATION

This revision is intended to provide clarification and does not constitute new criteria requiring an implementation schedule

This change applies to both Metric and English Projects

Chapter 3, Section 3.5.4 - Earthwork

SUMMARY OF REVISION

Section 3 5 4 is revised to restrict the use of borrow excavation pay items on projects with subsoil earthwork

IMPLEMENTATION

Effective immediately on all Metric projects with subsoil earthwork

This change DOES NOT apply to English Projects

Chapter 4, Section 4.3.3 - End Treatments

Summary of Revision

Section 4 3 3 is revised to refer the designer to the Roadway and Traffic Standards for application criteria for end treatments, and deletes the discussion on the use of the Type MELT and Type IV end treatments NOTE End treatment types and application criteria are undergoing several changes The designer should insure the latest available revisions to the Roadway and Traffic Design Standards are being used

IMPLEMENTATION

Effective immediately on all projects

This change applies to both Metric and English Projects

Chapter 10, Work Zone Traffic Control

SUMMARY OF REVISION

Chapter 10 was revised throughout to update it with current practices Key changes are as follows

- Section 10 9 Signs is revised to be consistent with new work zone sign legends which use the word "work" instead of "construction"

  IMPLEMENTATION

  This change is effective immediately on all Metric and English projects where development of a Traffic Control Plan (TCP) has not begun For projects where development of a TCP is underway or completed, this change is not mandatory and should be incorporated only to the extent practical without impact to production schedules or budgets The 1996 Standard Index 600, sheet 4 of 10 states that use of the legend "work" is preferred but either legend is acceptable

- Section 10.10.3 Variable Message Signs is revised to be consistent with current construction requirements that messages consist of no more than two displays with no more than two lines on each display

  IMPLEMENTATION

  This change is effective immediately on all Metric and English projects

- Section 10.11.2 Separation Devices, Two Lane, Two Way Operations, is revised to clarify the requirment that portable barrier wall or temporary traffic separators are used to separate opposing traffic where traffic control is maintained on one roadway of a normally divided highway

  IMPLEMENTATION

  This revision is intended to provide clarification and does not constitute new criteria requiring an implementation schedule

  This requirement applies to both Metric and English Projects

- Section 10.11 3 Channelizing Device Alternates is revised to state that the designer should not restrict the options of channelizing devices

  IMPLEMENTATION

  This PPM revision is intended to provide direction for good design practice and does not constitute new criteria requiring an implementation schedule This revision applies to both Metric and English projects

- Section 10.13.2 Portable Concrete Safety Shapes (Temporary Barrier Walls) is revised to provide additional direction on the proper placement of temporary barrier walls

  IMPLEMENTATION

  This change is effective immediately on all Metric and English projects Use Appendix B, FDOT Metric Practice to determine English unit values Use hard conversion

- Section 10 14.7 Lane Closure Analysis is revised to be consistent with current requirements for lane closure on limited access facilities

  IMPLEMENTATION

  This requirement was previously implemented by memorandum from Bill Deyo dated October 6, 1995

- Section 10 14.8 Detours, Diversions and Lane Shifts is revised to redefine "detours" and add the term "diversions" to be consistent with the MUTCD

  IMPLEMENTATION

  This change is effective immediately on all Metric and English projects where development of a Traffic Control Plan (TCP) has not begun For projects where development of a TCP is underway or completed, this change is not mandatory and should be incorporated only to the extent practical without impact to production schedules or budgets

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Chapter 16, Section B.1, Phase Submittals

SUMMARY OF REVISION

A provision for a "Notes for Reviewers" Sheet is added

IMPLEMENTATION.

The "Notes for Reviewers" Sheet is to be implemented at the discretion of each District

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Chapter 23, Section 23.2, Design Exceptions

SUMMARY OF REVISION

This section was revised to clarify when an exception is required for RRR projects

IMPLEMENTATION

This revision is intended to provide clarification and is effective immediately

This change applies to both Metric and English projects

Appendix D, Exhibits

SUMMARY OF REVISION

New exhibits are added and certain exhibits are revised All exhibits are renumbered and reprinted

- New Metric Plan Sheet Exhibits are added

  Summary of Pay Items (2 sheets)
  Summary of Drainage Structures (1 sheet)
  Optional Materials Tabulation (2 sheets)

  IMPLEMENTATION

  Use of the format depicted in these example sheets is project specific and should be used when applicable Beginning with lettings after July 1, 1997, it will be necessary to show the pipe class and/or gage in the plans since there will be no default minimum class or gage covered in the specifications This applies to both Metric and English projects

- Typical Section Sheets are revised to eliminate Friction Course alternates

  IMPLEMENTATION

  See 1997 Flexible Pavement Design Manual for implementation

- Plan and Profile Sheet (curbed section) is revised to show the length of pipe rather than show on the Drainage Structures Sheet

  IMPLEMENTATION

  Showing the length of pipe on the plan and profile sheet rather than the Drainage Structures Sheet should be implemented on all projects that have not yet begun design Implementation on projects underway is at the discretion of the District

- Drainage Structures Sheet is revised to remove pipe length information consistent with the revision to the plan and profile sheet Also, the sheet is revised to show applicable index numbers

  IMPLEMENTATION

  Showing the length of pipe on the plan and profile sheet rather than the Drainage Structures Sheet should be implemented on all projects that have not yet begun design Showing applicable index numbers on the drainage structures sheet should also be implemented on all projects that have not yet begun design Implementation on projects underway is at the discretion of the District

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Other Revisions

All other changes and revisions in the January 1, 1997 revision package involve clarification of current requirements or error corrections These are effective immediately A detailed listing of each change is provided in the revision package distribution memo

FLORIDA DEPARTMENT OF TRANSPORTATION

LAWTON CHILES
GOVERNOR

605 Suwannee Street Tallahassee Florida 32399-0450

BEN G WATTS
SECRETARY

MEMORANDUM

DATE: January 15, 1997

TO: Metric Plans Preparation Manual Holders

FROM: Bob Higginbotham

COPY:

SUBJECT: Metric Plans Preparation Manual Revisions

Attached are the approved revisions to the Metric Plans Preparation Manual A comprehensive listing of all revisions has been included for your reference All sheets were reprinted This transmittal memo should be retained for future reference concerning the dates of specific manual changes Revisions are detailed below

Table of Contents - Updated to agree with January 1, 1997 revisions

Chapter 1

Section 1 9, Design Speed, Pages 15-16 This is a new section containing recommended design speeds for non-FIHS facilities as well as minimum speeds for FIHS facilities
The Chapter 1 Table of Contents has also been updated

Chapter 2

Section 2 114, Interchanges, Pages 16 thru 18 Contains a revision to include discussion on Access Management requirements relating to Limited Access Limits and median openings
Table 2 2 1, Median Widths, Page 2-27 The table has been revised to include a definition for Median Width
The Chapter 2 Table of Contents has also been updated

Chapter 3

Section 3 5 4, Subsoil Earthwork, Pages 18-19 A paragraph has been added to the end of this section explaining the appropriate use of Subsoil Earthwork, and restricting the use of Borrow Excavation pay items on projects with subsoil earthwork

The Chapter 3 Table of Contents has also been updated

Chapter 4

Section 4 3 3, End Treatments, Pages 8-9 Deleted paragraph about MELT and Type IV End Anchorages Made reference to Indexes for application criteria

Chapter 10

This chapter has been rewritten, with numerous changes, to update it with current practices For a list of key changes refer to attached Implementation memo from Billy Hattaway All changes within the chapter are highlighted

Chapter 16

Exhibit B, Phase Submittals, Page 11 Added paragraph about "Notes for Reviewers" sheet to be included with review submittal

Chapter 23

Section 23 2, Design Exceptions, Page 2 Numbered list of design elements Added language about requirements for design exceptions on RRR projects

Exhibit 23-F, District Variation Approval Form, Page 12 Reordered and numbered design elements Changed "variance" to "variation" in sentence at bottom of sheet

The Chapter 23 Table of Contents has also been update

Appendix A

Design Element 10, Horizontal Alignment, Page 24 Corrected minimum radius for 80 km/h in table

Design Elements 11 & 12, Vertical Alignment & Stopping Sight Distance, Page 25 Combined these elements in title for table

Updated Table of Contents

Chapter 25

Table 25 4 10, Stopping Sight Distance for Vertical Curvature, Page 19 Modified footnote "d"

Appendix D, Exhibits

Added new exhibits for Summary of Pay Items (2 sheets), Summary of Drainage Structures (1 sheet), and Optional Materials Tabulation (2 sheets)

Revised Typical Section exhibits to eliminate Friction Course alternates

Plan & Profile Sheet (C&G) was revised to show the length of pipe rather than on Drainage Structure Sheet

Drainage Structure Sheet was revised by removing length of pipe and including applicable index numbers for structures

Index

Updated Index based on January 1, 1997 revisions

FLORIDA DEPARTMENT OF TRANSPORTATION
LAWTON CHILES
GOVERNOR
605 Suwannee Street, Tallahassee, Florida 32399-0450
BEN G. WATTS
SECRETARY

Design Bulletin 96-02
No Expiration Date
7-1-96 Revisions
Installed 8-6-96

DATE: July 17, 1996

TO: Registered Holders of the Plans Preparation Manual

FROM: Billy Hattaway, PE
State Roadway Design Engineer

SUBJECT: IMPLEMENTATION OF JULY 1, 1996 REVISIONS TO THE PLANS PREPARATION MANUAL, VOLUME 1

The July 1, 1996 Revisions to the Plans Preparation Manual are to be implemented as follows

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Chapter 2, Section 2.1.8 - Maximum Number of Lanes

SUMMARY OF REVISION

This section was added to comply with the Departments policy for the maximum number of lanes to be provided by Department funds.

IMPLEMENTATION

For implementation see Topic Number 000-525-040

Chapter 2, Table 2.15.1 - Lighting for Pedestrian and Bicycles

SUMMARY OF REVISION

Criteria for lighting of pedestrian and bicycle ways has been added

IMPLEMENTATION

Effective immediately on all applicable projects to the extent practical without impact to production schedules or budgets

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Chapter 5 - Utilities

SUMMARY OF REVISION·

The utilities chapter was completely re-written. Clarification on the requurements for locating utilities and definitions for levels of locates are provided.

IMPLEMENTATION

Effective immediately on all applicable projects that have not begun design survey and on other projects to the extent practical without impact to production schedules or budgets

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Chapter 7, Page 7-2, Section 7.2.1 - Overhead Sign Structures and Foundations

SUMMARY OF REVISION:

A statement was added to require that the design of overhead sign structures and foundations be included in the plans.

IMPLEMENTATION:

Effective immediately on all applicable projects

Chapter 7, Page 7-11, Section 7.4.1 - Traffic Signal Mast Arms and Foundations

SUMMARY OF REVISION.

A statement was added to require that the design of traffic signal mast arms and foundations be included in the plans.

IMPLEMENTATION·

Effective immediately on all applicable projects.

Chapter 7, Page 7-16, Section 7.4.6 - Signal Preemption

SUMMARY OF REVISION.

Increased the distance from intersections to movable span bridges and railroad crossings where signal preemption must be considered

IMPLEMENTATION

Effective immediately on all projects.

Chapter 7, Page 7-20, Section 7.4.11 - Traffic Signal Mast Arms

SUMMARY OF REVISION.

A section is added to make reference to Policy Statement Topic Number 000-625-020 which requires the use of mast arm signal supports within 10 miles of the coastline

IMPLEMENTATION.

Previously implemented in accordance with the Policy Statement

Chapters 13 through 18 - Roadway Design Process and Phase Submittals

SUMMARY OF REVISION

Chapters 13 through 18 were completely restructured and rewritten to provide clarification on the roadway design process, including engineering requirements, functional area reviews, and submittals. Initial Engineering, Final Engineering and Update Engineering Design processes are described and discussed.

IMPLEMENTATION·

Effective immediately on all projects that have not begun development of a design scope of services

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Chapter 20, Plans Processing

SUMMARY OF REVISION.

Chapter 20 was revised to require the Comp Book to be transmitted to District Construction instead of Central Office

IMPLEMENTATION.

Effective immediately on all projects.

Appendix D, Exhibit 1 - Key Sheet

SUMMARY OF REVISION.

Exhibit 1 was revised to indicate the requirement to show the consultant's vendor number for plans prepared by a prime consultant. Also, a statement was added to indicate the requirement for showing the Metric Unit note on the lead Key Sheet and all component plan Key Sheets.

IMPLEMENTATION

Effective immediately to the extent practical without impact to production schedules or budgets.

Other Revisions

All other changes and revisions in the July 1, 1996 revision package involve clarification of current requirements or error corrections. These are effective immediately. A detailed listing of each change is provided in the revision package distribution memo.

FLORIDA DEPARTMENT OF TRANSPORTATION

LAWTON CHILES
GOVERNOR

605 Suwannee Street, Tallahassee Florida 32399-0450

BEN G WATTS
SECRETARY

MEMORANDUM

DATE: July 1, 1996

TO: Metric Plans Preparation Manual Holders

FROM: Linda Seigle Linda

COPY:

SUBJECT: Metric Plans Preparation Manual Revisions

Attached are the revisions to the Metric Plans Preparation Manual approved at the March and June DDE Meetings Revisions are detailed below All revised sheets were reprinted

Table of Contents - Updated to agree with July 1, 1996 revisions

Chapter 1, Section 1 8, Page 10 - 12 - Add paragraph on access management decisions during PD&E phase Pages 11 and 12 were repaginated due to added text

Chapter 2

- Section 2 1 8 - Added section on maximum number of lanes
- Section 2 6 - Corrected location of design high water clearance (3rd Paragraph)
- Section 2 13 2 - Added section on queue lengths for unsignalized intersections
- Table 2 1 3 - Moved to previous page due to added table 2 1 4
- Table 2 1 4 - Maximum number of lanes table added
- Table 2 10 1 - note 3 revised
- Table 2 11 3 - Revised section on flush shoulders (deleted "and")
- Table 2 15 1 - Added section on lighting for pedestrians and bikes

Chapter 3 - Revised page 18 to clarify the location of the top of subsoil excavation

Chapter 4, Exhibit 4-A

Added note to figure

Pages 4-13 & 4-15 - revised sand barrels

Chapter 5 - Completely revised by Utilities committee (John Grant) Replace chapter

Chapter 7

Section 7.2 1 - Added third paragraph

Section 7 4 1 - Added first paragraph

Section 7 4 6 - Revised signal preemption distances in second paragraph

Section 7 4 11 - Added section on mast arm supports

Chapter 13 - Completely revised Replace chapter

Chapter 14 - Completely revised and added information on updating WPA system Replace chapter.

Chapter 15 - Completely revised Replace chapter,

Chapter 16 - Completely revised and incorporated information on phase reviews from Volume II, Chapter 2 of the English Plans Preparation Manual Replace chapter

Chapter 17 - (Was Chapter 18) - Deleted requirement for sending original comp book to Tallahassee. Replace chapter

Chapter 18 - Combined and revised old chapters 16 and 17 into new chapter Replace chapter

Chapter 20 - Deleted requirement for sending original comp book to Tallahassee

Appendix A was revised to agree with AASHTO (The previous edition was based on the draft of the Metric AASHTO) Revised pages are 23-14, 15, 17, 20, 21, 24, and 26 AASHTO reference page numbers were added to all pages

Exhibit B (Metric Practice) - Added # 21 to give guidelines on showing utilities in metric

Index was updated

FLORIDA
LAWTON CHILES
GOVERNOR

DEPARTMENT OF TRANSPORTATION
605 Suwannee Street Tallahassee Florida 32399-0450

BEN G WATTS
SECRETARY

Design Bulletin 96-01
No Expiration Date

1-1-96 Revisions
Installed 3-4-96

DATE: February 1, 1996

TO: Plans Preparation Manual Holders

FROM: Billy Hattaway, PE
State Roadway Design Engineer

SUBJECT: IMPLEMENTATION OF JANUARY 1, 1996 REVISIONS TO PLANS PREPARATION MANUAL VOLUME 1

The January 1, 1996 Revisions to the Plans Preparation Manual are to be implemented as follows

FACILITIES ON THE FLORIDA INTRASTATE HIGHWAY SYSTEM (Chapter 2, Section 2 0)

SUMMARY OF REVISION

Section 2 0 was revised to state that special standards and criteria apply to facilities on the Florida Intrastate Highway System (FIHS)

IMPLEMENTATION

For implementation of the FIHS see Topic Number 525-030-250

HORIZONTAL CLEARANCE - PLACEMENT OF LIGHTING IN THE MEDIAN (Chapter 2, Table 2 11 2)

SUMMARY OF REVISION

The requirement was added that light poles are not to be located in the median except in conjunction with barriers that are justified for other reasons

IMPLEMENTATION

Effective immediately on all projects

SUBSOIL EARTHWORK (Chapter 3, Section 3 1)

SUMMARY OF REVISION

This revision is a correction to be consistent with the July 1, 1995 revisions to Chapter 3

IMPLEMENTATION

Effective beginning with all metric projects Does not apply to English projects

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SAND FILLED PLASTIC BARREL CRASH CUSHIONS (Chapter 4, Sections 4 5 2, 4 5 3, Chapter 10, Section 10 13 5)

SUMMARY OF REVISION

Chapters 4 and 10 were revised to be consistent with requirements that non-redirective crash cushions be custom engineered for each independent installation

IMPLEMENTATION

This was originally implemented in 1995 See memo dated July 18, 1995 from Billy Hattaway regarding the Interim Roadway and Traffic Design Standards for information on implementation

<u>UTILITIES</u> (Chapter 5)

SUMMARY OF REVISION

Chapter 5 was revised in general for clarification Section 5 3 was specifically revised to provide added emphasis on positive verification of utility locations when a utility is expected to be located within 1 meter of proposed construction operations

IMPLEMENTATION

Effective immediately on all projects to the extent practical without impact to production schedules and budgets

<u>LAW ENFORCEMENT SERVICES</u> (Chapter 10, Section 10 17)

SUMMARY OF REVISION

Chapter 10, Section 10 17 was revised to clarify the use of law enforcement services in work zones Off duty law enforcement may now be used on limited access projects which also use on-duty FHP

IMPLEMENTATION

Effective immediately on all projects

All Other Changes and Revisions in the January 1, 1996 revision package primarily consist of clarification and/or error corrections These are effective immediately A detailed listing of all changes is provided in the revision package distribution memo

APPROVED:

Freddie Simmons 2/14/96

Freddie Simmons, PE
Director of Design

FLORIDA DEPARTMENT OF TRANSPORTATION

LAWTON CHILES
GOVERNOR

605 Suwannee Street Tallahassee Florida 32399-0450

BEN G WATTS
SECRETARY

MEMORANDUM

DATE: January 2, 1996

TO: Metric Plans Preparation Manual Holders

FROM: Linda Seigle Linda

COPY:

SUBJECT: Metric Plans Preparation Manual Revisions

Attached are the approved revisions to the Metric Plans Preparation Manual. A comprehensive listing of all revisions has been included for your reference. All sheets were reprinted. This transmittal memo should be retained for future reference concerning the dates of specific manual changes.

Chapter 2 - The changes were:

Page 2-1 - Section 2.0 - The last paragraph on criteria for the Florida Intrastate Highway System was added.

Page 2-51, Table 2.11.2 -Conventional lighting placement was revised to restrict the use of conventional lighting in medians.

Chapter 3 - The changes were:

Page 1 was revised to reflect the new pay item, subsoil earthwork.

Chapter 4 - The changes were:

Pages 13 & 15 were revised to reflect new requirements for using sand filled plastic barrels as crash cushions.

Chapter 5 - **The entire chapter was reprinted.** The changes made to conform to language in the publications of the utilities office.

Chapter 10. The following pages were changed:

Page 10-29 & 30 -reflect new requirements for using sand filled plastic barrels as crash cushions

Page 10-58 to 61 - The Section on Law Enforcement Services was revised for clarification on the use of, and payment for, on-duty FHP and off-duty law enforcement forces. **(This revision applies to English projects also.)**

Chapter 11 - **The entire chapter was reprinted.** The changes were made for clarification.

Appendix C - FDOT Metric Symbols - This section has been revised and was reprinted.

FLORIDA
LAWTON CHILES
GOVERNOR

DEPARTMENT OF TRANSPORTATION
605 Suwannee Street, Tallahassee Florida 32399-0450

BEN G WATTS
SECRETARY

Design Bulletin 95-01
No Expiration Date

7-1-95 Revisions
Installed 9-18-95

DATE: August 31, 1995

TO: Plans Preparation Manual Holders

FROM: Billy Hattaway, PE Tom Hancock
State Roadway Design Engineer

SUBJECT: IMPLEMENTATION OF JULY 1, 1995 REVISIONS TO PLANS PREPARATION MANUAL VOLUME 1

The July 1, 1995 Revisions to the Plans Preparation Manual are to be implemented as follows

BORDER WIDTH (Chapter 2, Section 2 5, Table 2 5 1 and 2 5 2)

SUMMARY OF REVISION

Curbed Sections

Previous border width criteria was 3 0 m for all facilities New border width criteria varies depending on design speed, class of facility, and presence of bike lanes or auxiliary lanes Facilities with design speeds ≥ 60 km/h are most affected Increases width to 3 6 m and 4 2 m for certain facilities (see table 2 5 2) The increased width is primarily needed to provide the room necessary for curb ramps and driveway connections that will satisfy ADA requirements without compromising vehicular and pedestrian movement

Sections with Flush Shoulders

No previous border width criteria New criteria has now been established for highways with flush shoulders The new criteria is consistent with past practice on most facilities and therefore is not expected to be a significant change

IMPLEMENTATION

Revised border width criteria shall be applied to all projects beginning PD&E phase as of January 1, 1996 For projects underway or that have progressed beyond the PD&E phase, the revised criteria can be used at the District's discretion if it does not conflict with previous right of way commitments, budget constraints, or production schedules

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HORIZONTAL CLEARANCE/CLEAR ZONE (Chapter 2, Section 2 11,2 12, Tables 2 11 1, 2 11 2, 2 11 3, 2 11 4, 2 11 5, 2 12 1, Chapter 25, Section 25 2 14, 25 4 15, Table 25 4 15)

SUMMARY OF REVISION

The term "clear zone" no longer applies to curbed sections Instead, for curbed sections, required setbacks to roadside features and obstructions are covered by horizontal clearance criteria This is primarily a change in the use of terminology However, the revision also eliminates a provision to reduce clearance to power poles from 1 2 m to 0 8 m when all alternatives are deemed impractical on new construction and reconstruction projects Clear zone will still apply to highways with flush shoulders

IMPLEMENTATION

Effective on all projects beginning design phase as of January 1, 1996

NO PASSING ZONES (Chapter 7, Section 7 2 3)

SUMMARY OF REVISION

New requirements for establishing the limit of no passing zones have been adopted For projects where vertical and horizontal alignment is to remain unaltered by construction no passing zone limits are to be established in the design phase For projects with new or altered vertical or horizontal alignment no passing zone limits are to be established as a post design service or district wide contract

IMPLEMENTATION

Effective Immediately on All Projects

<u>SUBSOIL EARTHWORK</u> (Chapter 3, Section 3 4 2, Exhibit 3a and 3b, Sections 3 4 3, 3 5 4, 3 5 6)

SUMMARY OF REVISION

Chapter 3 was revised to be consistent with the change in method of payment for backfill to replace subsoil excavation Previously, the quantity and payment for backfill to replace subsoil excavation was to be included in the embankment or borrow pay item The pay item Subsoil Earthwork includes the cost of subsoil excavation as well as the material used for backfill

IMPLEMENTATION

Effective beginning with all metric projects Does not apply to English projects

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<u>MELT END TREATMENT</u> (Chapter 4, Section 4 4 3)

SUMMARY OF REVISION

Chapter 4 was revised to incorporate new requirements for the Type MELT end treatment for guardrail, instead of the Type IV end treatment

IMPLEMENTATION

See memo dated July 18, 1995 from Billy Hattaway regarding the Interim Roadway and Traffic Design Standards for information on implementation Additional instructions are pending and will be distributed soon

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RRR CROSS SLOPE CORRECTION (Chapter 25, Section 25 4 6)

SUMMARY OF REVISION

Section 25 4 6 was revised to provide added emphasis on correcting cross slope on RRR Projects New language requires field verification of existing cross slope

IMPLEMENTATION

Effective on all projects beginning design phase as of October 1, 1995

All Other Changes and Revisions in the July 1, 1995 revision package primarily consist of clarification and/or error corrections These are effective immediately A detailed listing of all changes is provided in the revision package distribution memo

APPROVED:

Freddie Simmons 9/6/95

Freddie Simmons, PE
Director of Design

ERRATA

The footer on some pages of the revision package indicate "Proposed Revision" This is not correct All revisions have been approved

Please revise the first page of Chapter 3 as follows

(3) Embankment - Compacted fill material needed to construct the roadway, excluding the base and pavement portions of the roadway and shoulders Embankment ~~includes~~ does not include compacted backfill to replace ~~unsuitable material excavated within the lines and grades shown in the plans~~ subsoil excavation

FLORIDA DEPARTMENT OF TRANSPORTATION

LAWTON CHILES
GOVERNOR

605 Suwannee Street Tallahassee Florida 32399-0450

BEN G WATTS
SECRETARY

MEMORANDUM

DATE: July 3, 1995

TO: Metric Plans Preparation Manual Holders

FROM: Linda Seigle

COPY:

SUBJECT: Metric Plans Preparation Manual Revisions

Attached are the approved revisions to the Metric Plans Preparation Manual. A comprehensive listing of all revisions has been included for your reference. All sheets were reprinted. This transmittal memo should be retained for future reference concerning the dates of specific manual changes.

Table of Contents - Titles to Chapter 1, Section 1 5 and 13 3 were revised to be consistent with the body of the Manual text

The Plans Prep Manual - Metric procedure should be placed after the Table of Contents and before Chapter 1 The PPM Procedure was prepared to comply with requirements that FDOT Manuals must include the procedure adopting that manual. This procedure incorporates the information in the original procedure adopting all Roadway Design Manuals, with the addition of Advisory Memorandums The requirement that the DDEs approve revisions to the Manual has been retained.

Chapter 1, page 1-6 - The last sentence of the second paragraph ("RRR standards are generally less restrictive than criteria for new construction ") has been omitted

Chapter 2 - **The entire chapter was reprinted.** The changes were

Page 2-3 - Section 2 1.1 - The title was changed. Section 2 1 3 - Ramp Width section was revised to indicate proper usage of the revised table.

Page 2-5 - Added the last sentence to Section 2.2

Page 2-6 - Paragraph 1 - added the last phrase regarding paved shoulders on freeways Paragraph 4 - Revised to improve readability. Added reference to figure

Page 2-7 - Section 2 3 2, paragraph 3 - the words "other than" were added to the first sentence.

Page 2-8 - The section on borders, including the definition, was revised by the border width task team

Page 2-13 - The second sentence in the first paragraph was revised for consistency

Page 2-14 - The sections on horizontal clearance and clear zones were revised by the border width task team

Page 2-17 - Ramp Width section was added in conjunction with the change on 2-3

Page 2-20 & 21 - Definitions # 10 and # 15 were revised, # 12 was added (from AASHTO)

All tables and figures were reprinted to add page numbers

Page 2-23, Table 2 1 1 - Rural Collector through or travel lane was revised and note 6 was added.

Page 2-24, Table 2 1.2 - Note 2 was revised to include undesignated shoulder pavement

Page 2-25, Table 2 1 3 - (in conjunction with page 2-3) This table was split into 2 sections The new table 2 1 3 now lists only the pavement widths for straight or large radii sections of the ramp proper The information originally in the table was moved to Section 2 14 - Interchanges This table contains information on ramp widths for interchange ramp terminal design The column for 2-lanes, combination-type vehicle and buses was deleted There were questions about when these values were to be used. These values were for special situations where you would expect trucks to be traveling side-by-side on the ramp, such as for WIM or truck staging areas The second column for one-lane ramps was added to the table

Page 2-27, Table 2 2 1 - The design speed in note 4 was corrected from 70 to 60

Page 2-34, Table 2 4 1 - This table was revised to correct the slopes (i e 6 1 was changed to 1 6)

Pages 2-35 & 36, Tables 2.5 1, 2 5 2 - were revised by the border width task team

Page 2-39, Table 2 7 1 - The stopping sight distance for grades 2% or less, 100 km/h, for collectors was corrected from 150 to 160

Page 2-42, Table 2 8 5 - The K value for collectors with a design speed of 100 km/h was corrected from 55 to 65

Page 2-48, Table 2 9 4 - The transition length for design speeds of 60 km/h or greater was corrected to 23 m from 20 m

Page 2-51, Table 2 11 1 - The word sidewalk was added for clarification (an unobstructed sidewalk width of) The second paragraph under supports was revised to include the preferable method of removal outside the clear zone

Page 2-51, Table 2 11 2 - The word sidewalk was added for clarification (an unobstructed sidewalk width of)

Page 2-52, Table 2 11 4 - The word sidewalk was added for clarification (an unobstructed sidewalk width of) (Previous Table 2 11 4, horizontal clearance to mailboxes, was included in Table 2 11 3)

Page 2-52, Table 2 11 5 - This table is a revision of the old Table 2 11 6

Page 2-54, table 2 12 1 - was revised by the border width task team

Page 2-56, Table 2 14 1 - This table is a revision of the old table 2 3 1

Chapter 3 - **The entire chapter was reprinted.** The changes were

Chapter 3 was revised to reflect the new pay item, subsoil earthwork, which includes the backfill Pages changed were 5, 6, 7, 8 (exhibit), 18, 19, & 20 Pages 10 & 11 were revised to correct slope rates

Chapter 4 - **The entire chapter was reprinted.** The changes were

Page 2 The second paragraph under 4 1 2 was revised to reference Chapter 2 rather than the Indexes

Page 4 - The second and third paragraphs were revised to correct the slopes and the exhibit number referenced by the text

Page 6 - A reference to the Indexes was added

Pages 8 & 9 were revised to add the Type MELT end anchorage

Page 16 - The last sentence in Section 4 6 1 was moved to the middle of the paragraph for readability and clarification

Chapter 6 - page 3 was revised to reference the Indexes for crossing types

Chapter 7 -

Replace page 3&4 and add page 4 1 to incorporate a section on setting the limits of no-passing zones

Pages 16 & 17 were revised to clarify the setting of storage lengths for left turn lanes

Chapter 8 - Page 2, paragraph 1 was revised to eliminate the reference to the Florida Green Book & paragraph 2 was revised to correct the slope rate

Chapter 10 The following pages were changed

Page 10-16 - Added the first sentence re posting speed limits and distances in English

Page 10-19 - Added spacing of lights on barrier wall

Page 10-25 - Revised the second sentence regarding the use of cones at night

Page 10-32 - Added last paragraph referring to Section 10 17

Page 10-33 - In the first sentence of the first paragraph, the Index reference was corrected

Page 10-52 - The first paragraph was revised and shortened for clarity

Pages 10-54 & 55 - speed limits were revised to mph

Page 10-56 - Regulatory sign spacing was corrected for 1 km to 1 6 km The speed limit on the next-to-last line was revised from km/h to mph

Page 10-57 - Speed was corrected from km/h to mph

Page 10-58 to 61 - The Section on Law Enforcement Services was rewritten for clarification on the use of passive law enforcement services **(This revision applies to English projects also.)**

Chapter 11 - **(These revisions apply to English projects also.)** The changes are

Page 1 - The next-to-last paragraph was revised to require that the SWPPP be prepared under the direction of the District Design or Consultant Project Management Engineer

On page 3, the requirement for letter-size paper was changed to 8 5 x 11 paper

Chapter 13 - The changes are

Page 5 was revised to remove the 19 mm minimum structural overlay and refer to the Pavement Design Manual

The first paragraph on page 7 was revised to reference the use on GC project managers

Chapter 14 - The changes are

Didn [illegible] Page 2 was revised to indicate that the FDOT project number is shown on the key sheet

Page 5, Drainage Survey, was corrected to remove the implication that all the drainage information for a project is available from the survey

Chapter 15 - The changes are

The last sentence on page 2 stating that half size prints may be used for reviews has been deleted

Page 7, section 15 3 3, was revised to refer the designer to the CADD cell library for typical section approval forms

Chapter 19 page 2, section 19 2 2 was revised to remove the reference to hand-drawn sheets

Chapter 20 - The changes to the following pages were made as the result of a QA review **(This revision applies to English projects also.)**

Page 20-2 & 3,
Exhibit 20-A, page 1 (Contract File Index),
Exhibit 20-B, page 1 (Plans Transmittal Letter),
Exhibit 20-16, page 2 (Revision letter),
Exhibit 20-G (new exhibit - Transmittal/CES Lock Letter)

Chapter 23 - The changes are

Text changes were made to correct the references to the exhibits

Appendix A, AASHTO Criteria - Changes were made for clarification and utility poles were added to horizontal clearance

Chapter 24 - The changes made are

Exhibit numbers were corrected on page 8

On page 9, horizontal clearance has again been included in the controlling elements for an exception

Chapter 25 - **The entire chapter was reprinted.** The changes were

Page 6, Assess Physical Conditions, the radius, rather than degree, of curve should be checked

On page 11, section 25 4 1, the Flexible Pavement Design Manual is referenced for specific design periods

On page 13, the last paragraph was added

On page 15, the section on cross slopes was expanded to include cross slope correction

On page 16, the reference to the Indexes was corrected

Pages 23, 24, 25, 28, & 29 - Changes made as a result of border width task team Revisions made to horizontal clearance, clear zone, borders and utilities sections

Appendix B, Metric Practice, was revised and reprinted

All exhibits have been reprinted A typical section exhibit illustrating cross slope correction has been added All exhibit numbers have been revised

An index has been prepared and should be placed at the end of the manual after the appendices

Please contact me, Jim Mills or Bob Higginbotham at SC 277-1700, FAX 292-9293, or by e-mail at RD960LS, if you have any questions or concerns during the review of this material

ROADWAY

PLANS PREPARATION MANUAL

DESIGN CRITERIA AND PROCESS

(METRIC)

ROADWAY DESIGN OFFICE

TALLAHASSEE, FLORIDA

1995

18

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

SUGGESTION AND COMMENTS
ROADWAY DESIGN MANUALS

FORM 625-010-07
ROADWAY DESIGN
10/94

DOCUMENT NAME: ☐ Plans Preparation Manual (Metric) ☐ Plans Preparation Manual (English)
☐ Roadway and Traffic Design Standards

NAME OF FIRM/ FDOT DEPARTMENT: ______________________________

ADDRESS: ______________________________

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NAME OF PERSON RESPONSIBLE FOR SUGGESTIONS OR COMMENTS: ______________________________

TELEPHONE NO.: (   ) ______________________________

FAX NO.: (   ) ______________________________

SUGGESTIONS OR COMMENTS: ______________________________

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(Comments or Suggestions may be attached as marked up copies of pages from the manual)

PLEASE COMPLETE THE REQUESTED INFORMATION ON A COPY OF THIS SHEET AND RETURN TO:

FLORIDA DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN OFFICE
MAIL STATION 32
605 SUWANNEE STREET
TALLAHASSEE, FLORIDA 32399-0450
ATTN: DOCUMENTS AND TRAINING

RECYCLED PAPER

PPM - Metric

TABLE OF CONTENTS

Design Criteria and Process

Introduction

Approved

Freddie Simmons

Freddie Simmons, P.E.
State Roadway Design Engineer

Effective March 27, 1995
Office: Roadway Design
Topic Number: 625-000-005-a

PLANS PREPARATION MANUAL - METRIC

PURPOSE:

This Plans Preparation Manual - Metric sets forth roadway design criteria and procedures for Florida Department of Transportation projects.

AUTHORITY:

Section 334.044(2), Florida Statutes

SCOPE:

This procedure impacts anyone preparing construction plans for the Department.

GENERAL INFORMATION:

Chapter 334 of the Florida Statutes, known as the Florida Transportation Code, establishes the responsibilities of the State, counties, and municipalities for the planning and development of the transportation systems serving the people of Florida, with the objective of assuring development of an integrated, balanced statewide system. The Code's purpose is to protect the safety and general welfare of the people of the State and to preserve and improve all transportation facilities in Florida. Under Section 334.044, the Code sets forth the powers and duties of the Department of Transportation including to adopt rules, procedures and standards for the conduct of its business operations and the implementation of any provisions of law for which the Department is responsible.

PROCEDURE:

The criteria in this manual represent requirements for the State Highway System which must be met for the roadway design of FDOT projects unless approved variances are obtained in accordance with procedures outlined in this manual.

Roadway design is primarily a matter of sound application of acceptable engineering criteria and standards. While the criteria contained in this manual provide a basis for uniform design practice for typical roadway design situations, precise standards which would apply to individual situations must rely on good engineering practice and analyses.

Situations will exist where these criteria will not apply. THE INAPPROPRIATE USE OF AND ADHERENCE TO THESE CRITERIA DOES NOT EXEMPT THE ENGINEER FROM THE PROFESSIONAL RESPONSIBILITY OF DEVELOPING AN APPROPRIATE DESIGN. The engineer is responsible for identifying those standards which may not apply to a particular design, and for obtaining the necessary variance to achieve proper design.

(1) PLANS PREPARATION MANUAL - METRIC MANUAL ORGANIZATION

(a) Background

The 1994 Florida Department of Transportation Plans Preparation Manual - Metric was published in January 1995.

(b) Organization

The Plans Preparation Manual - Metric is a one volume manual containing metric design criteria and material describing the design process.

(2) DISTRIBUTION

This document is distributed by the Roadway Design Section to all registered holders of the 1989 Plans Preparation Manual.

Copies may be obtained from:

Florida Department of Transportation
Roadway Design Office
Mail Station 32
605 Suwannee Street
Tallahassee, FL 32399-0450

Telephone (904) 487-1700
FAX Number (904) 922-9293

(3) PROCEDURE FOR REVISIONS AND UPDATES

Plans Preparation Manual holders are encouraged to submit comments and suggestions for changes to the manual through the District ADE, the District Design Engineer, the District Project Management Engineer or the District Senior Designers Each idea or suggestion received will be reviewed by appropriate Roadway Design staff in a timely manner and will be coordinated with other offices affected by the proposed change. Items warranting immediate change will be made with the approval of the State Roadway Design Engineer in the form of a Design Bulletin.

Design Bulletins for the Plans Preparation Manual are numbered and distributed to all official Plans Preparation Manual Holders. Design Bulletins have a maximum life of (270) two hundred seventy days. Within this time period either an official manual revision will be distributed or the Design Bulletin will become void.

Advisory Memorandums will be distributed by the State Roadway Design Engineer to provide needed information which is to be incorporated into plans, but which does not require immediate implementation (i.e. those to be incorporated into plans that are at less than Phase II at the time of issuance)

Statewide meetings of District Roadway Design Engineers will be held quarterly and a statewide meeting of designers is held annually. A major agenda item at the June and December meetings will be the review of Design Bulletins, Advisory Memoranda, proposed revisions, and suggestions and comments that may warrant revisions. Based on input from these meetings, final revisions are developed

Proposed revisions are distributed in draft form to the District Design Engineers for their review and comment with the goal being to obtain a majority opinion before making a major revision. Each district will have one vote and the central office will have two votes; for a total of ten votes. Standards and Guidelines set by FHWA and AASHTO will not be subject to this majority vote.

All revisions and updates will be coordinated with the Organization and Procedures Office to ensure conformance with and incorporation into the Department's Standard Operating System.

The final revisions and addenda will be distributed to registered holders of the manual

TRAINING:

None required.

FORMS ACCESS:

None required

Chapter 1

Design Controls (Metric)

CHAPTER 1

DESIGN CONTROLS (METRIC)

1.1 General

Designs for highway and street projects are normally based on established design standards for the various elements of the project, such as width of roadway, side slopes, horizontal and vertical alignment, drainage considerations and intersecting roads Selection of the appropriate standards is influenced by traffic volume and composition, desired levels of service, terrain features, roadside developments, environmental considerations and other individual characteristics

The identification of applicable design controls is basic to providing the desired level of service, optimum safety, and cost effectiveness

1.2 Traffic

The existing and design year traffic volumes, the traffic composition, directional distribution and design speed are all essential elements to the calculation of highway capacity, levels of service and pavement structural designs This traffic information must be developed and approved during the programming and Project Development and Environmental (PD&E) studies stages of each project PD&E studies may not be performed on all projects When that is the case the necessary traffic studies must be part of the design process

Preliminary capacity analyses and levels of service calculations will produce the numbers and configurations of traffic lanes required for the project

Designs shall be based upon the projected traffic volume for the expected service life of the project The pavement design manuals should be referenced for specific information on design periods Design Hourly Volume (DHV) shall be the 30th highest hour

The following traffic design information should be available to the designer prior to or very early in the design process Depending on the project, a traffic design report should be performed

1 AADT for the current year, opening year (completion of construction) and design year
2 Existing hourly traffic volumes over minimum of 24 hour period, including peak hour turning movements and pedestrian counts
3 Projected traffic growth rate
4 Directional distribution factor (D)
5 30th highest hour as percentage of AADT (K)
6 Truck percentage (T) for daily and peak hour
7 Design speed and proposed posted speed
8 Design vehicle to be provided for by the designer
9 Existing and proposed signalized intersections

10 Special or unique traffic conditions

11 Accident history and analyses within the project limits

12 Recommendations regarding parking or other traffic restrictions

1.3 Capacity and Level of Service

The AASHTO A Policy on Geometric Design of Highways and Streets and the Transportation Research Board Highway Capacity Manual provide the detailed analysis and calculation guides necessary for the number and configurations of lanes required and the resulting levels of service provided As illustrated in those texts, gradients, roadside developments, number, spacing and types of crossings and intersections, traffic volumes, and signalization patterns all greatly influence capacity and levels of services Those factors, in addition to the roadway functional classification, have a direct influence on the design speed to be adopted at the preliminary design level

When the design speed and roadway functional classification (and the resulting geometric controls) have been established, the capacity and level of service analyses will have to be checked and adjusted against the more advanced determination of those variable factors outlined above For a detailed evaluation of a roadway's level of service, a traffic operations model should be used These models rather than planning level models should also be used to evaluate the proposed designs Special attention should be given to intersection design and operation to ensure that they do not degrade the level of service on the roadway segments

1.4 Roadway Functional Classification

The AASHTO Policy on Geometric Design presents an excellent discussion on highway functional classifications Florida Statutes, Title XXVI, Chapters 334, 335 and 336 give similar definitions, and establish classifications for road design in the State of Florida

The Systems Planning Office in compliance with Rule Chapter 14-97 and the Florida Statutes has developed a comprehensive Access Management Classification system for all segments of the State Highway System The purpose is to enhance the functional integrity of the State Highway System, protect public safety and provide improved mobility of goods and people

Functional and Access Management classification and the standards required by them are predetermined controls over which the designer has little choice

These standards are minimum values and, where possible and practical, values above the minimum should be used

1.5 RRR Design

Interstate Highways and Freeways - Design standards applicable for these facilities are new construction standards, with the following exception: The standards used for horizontal alignment, vertical alignment, and widths of median, traveled way and shoulders may be the AASHTO interstate standards that were in effect at the time of original construction or inclusion into the interstate system.

State Highway System - Design standards applicable for the State Highway System facilities, other than interstate and freeways, are contained in this manual. The chapter on Resurfacing, Restoration, and Rehabilitation (RRR) replaces the 1988 RRR Manual

1.6 Design Consistency and Driver Expectancy

Design consistency is achieved when the geometric features of the roadway are consistent with the operational characteristics expected by the driver Inconsistencies normally relate to

- changes in design speed
- changes in cross section
- incompatibility in geometry and operational requirements

Changes in design speed may occur on a given stretch of roadway because portions of the highway were built as separate projects over an extended period of time Inconsistencies may be due to a number of factors changes in standards or DOT policy, re-classification of the facility, and lack of necessary funding

There are two major types of design inconsistencies relative to cross section These are point inconsistencies and a general incompatibility between cross section and alignment A point inconsistency may be, for example, the narrowing of lane widths, a narrow bridge, a lane drop, or a change from multi-lane section to two lanes.

A cross sectional inconsistency is usually the result of upgrading a highway cross section without upgrading the alignment Sometimes pavements are widened and shoulders added on an older two lane highway The wider cross section on an old alignment might convey a conflicting message to the driver and lead to an inappropriate expectancy based on the visual aspects of the cross section, because cross section features can be more apparent than the alignment

Of course, this is not to say that widening creates unsafe conditions Widening alone can measurably improve the safety characteristics of a road, particularly on very narrow, low-volume roads Designers should, however, be aware of potential inconsistencies that frequently can be overcome with relatively low cost treatments In the case of widened roads on old alignments, pavement markings, warning signs, and delineation devices can be very helpful to the driver

Inconsistencies may also relate to incompatibility in geometric and operational requirements Occasionally elements of the design appear to have been selected for the purpose of fitting together the geometric components conveniently and economically rather than for the purpose of satisfying operational requirements An example of an inconsistency resulting from the incompatibility is a direct entry ramp which is intended to permit vehicles to enter the stream of traffic without coming to a complete stop but which, in reality, forces the vehicle to stop when a gap in the traffic stream is not immediately available

Design inconsistencies can result in driver uncertainty, an increase in response time and an increase in the probability of inappropriate driver response

Driver expectancy relates to the readiness of the driver to respond to events, situations, or the presentation of information It can be defined as an inclination, based on previous experience, to respond in a set manner to a roadway or traffic situation It should be stressed that the initial response is to the expected situation rather than the actual one

Expectancy can affect the perception and use of information In most circumstances, the expected and actual conditions are the same However, when design inconsistencies occur and a driver's expectancy is incorrect, it takes longer to respond properly, there may be no response, or the response may be inappropriate to actual conditions

There are certain elements in the design of various components of the roadway which particularly affect design consistency, driver expectancy, and vehicular operation These components include horizontal and vertical alignment, embankments and slopes, shoulders, crown and cross slope, superelevation, bridge widths, signing and delineation, guardrail and placement of utility poles or light supports

1.7 Aesthetics

Highways are built first and foremost for functional purposes, but the designer should be sensitive to how the highway will be perceived by the users. Designing-in aesthetics is more than just providing for landscape plantings. The roadway should blend into the landscape, avoiding large cuts and fills, and round side slopes into the existing terrain. Horizontal and vertical alignment should be coordinated so that a driver has an opportunity to gain a sense of the local environment. Combinations of horizontal and crest vertical curves, and broken-back curves should be avoided. Excessively long tangent sections become monotonous. Either curvature or other features should be added to maintain drivers interest.

Application of the clear zone concept discussed in the chapter on Roadside Safety will result in a clean, uncluttered and pleasing roadside. Landscaping of the roadside should be considered early in the design process, so that plantings blend in with the geometric design. The Landscaping chapter of this volume discusses landscape design criteria. At times extra right-of-way may be obtained for treatments if the need is identified early. Retention/detention ponds and other wetlands can be attractive if well-designed and placed in a location where they can be viewed from the roadway.

Vistas of exceptional beauty should be accentuated by the roadway geometrics. Ideally, such vistas should be on the outside of horizontal curves, without excessive roadside appurtenances and signs to clutter the view.

"Streetscaping" techniques in urban areas include an emphasis on pedestrian accommodation, trees and other plantings, access control, careful signing, and zoning restrictions on commercial signs. Parkways, and other roads specifically intended for pleasing aesthetics should be designed by a multi-disciplined team including landscape architects and planners.

1.8 Access Management

Unregulated access to the State Highway System was determined to be one of the contributing factors to congestion and functional deterioration of the system. Regulation of access was necessary to preserve the functional integrity of the State Highway System and to promote the safe and efficient movement of people and goods within the state. Under F.S. 335.18, the Legislature authorized the Department to develop rules to administer the "State Highway System Access Management Act." These are Rule 14-96 and 14-97. Each district has assigned various offices the responsibility to permit connections and administer other parts of the program. In order to adhere to the program, the designer must be familiar with the statute, the rules and the district program. In addition to driveway connections, features such as median openings affect safe and efficient operation. It is critical that the designer know what access classification has been assigned to the highway segment under design and to determine what roadway features and access connection modifications are appropriate to adhere to the program.

The access management classification is determined during the PD&E phase on projects for which a PD&E study is performed. During the PD&E phase, a conceptual access management plan is prepared for the preferred alternative. Access management issues are also addressed in the Preliminary Engineering (P.E.) Report. The designer should review these documents for information on access management decisions made during the PD&E process.

During the development of construction plans, the designer should evaluate the access connections within the project limits. Driveways and crossovers should be considered in the analysis of safety and operational problems. Modifications or closures to access may be the solution in certain cases. Rule 14-96.003 (3) & (4) and 14-96.015 gives the Department the authority to alter, relocate or replace connections in order to meet current Department standards. Furthermore, Section 14-96.011 of the Rule allows the FDOT to revoke a permit .... "if the connection causes a safety or operational problem on the State Highway System substantiated by an engineering study....".

Rule 14-97 also provides guidance on the treatment of existing features in the highway improvement process:

> 14-97.003(1)(b)
>
> (b) For the purpose of the interim standards for the assignment of an access classification to a segment of highway by the Department pursuant to Rule 14-97.004, permitted connections and those unpermitted connections exempted pursuant to Section 335.187(1), Florida Statutes, and existing median openings, and signals are not required to meet the interim standards of the assigned classification. Such features will generally remain in place. These features shall be brought into reasonable conformance with the standards of the assigned classification or the interim standards where new connection permits are granted for significant changes in property use, or as changes to the roadway design allow. Applicants issued permits based on the interim standards as set forth in Rule 14-97.004 shall not have to reapply for a new permit after formal classification of the roadway segment unless significant change pursuant to Rule Chapter 14-96 and Rule 14-97.002 has occurred.

Existing connections that are to remain are not required to be shown on the plans, but are to be reconstructed at their existing location in conformance to standards. Those that are to be altered or closed must be detailed in the plans. In some cases where revisions are necessary due to operational or safety problems, it may not be possible to totally upgrade the connection to the newest standards because of existing conditions or constraints. In these cases, the designer should provide the best solution possible. The designers' efforts should be coordinated with those responsible for access connection permitting in the District (i.e., the District Permits Engineer) and those responsible for access management highway classification (i.e., District Planning). Any changes or revocation of a connection must be made in accordance with Rule 14-96.011.

Every owner of property which abuts a road on the State Highway System has a right to reasonable access to the abutting state highway but does not have a right to unregulated access to such highway. A means of reasonable access cannot be denied except on the basis of safety and operational concerns as provided in s. 335.184. Nothing in s. 335.184 limits the Department's authority to restrict the operational characteristics of a particular means of access. Service roads provide reasonable access. Corner property can be given direct access by a "right-in" and/or "right-out" connection to the highway. More restricted access must be supported by a study that documents safety and operational problems.

It should be noted that if there are any conflicts between these guidelines and the statute and rules, the statute and rules shall govern.

FREEWAY INTERCHANGE SPACINGS

Access Class	Area Type	Segment Location	Interchange Spacing (kilometers)
1	AREA TYPE 1	CBD & CBD Fringe For Cities In Urbanized Areas	1 5
	AREA TYPE 2	Existing Urbanized Areas Other Than Area Type 1	3 0
	AREA TYPE 3	Transitioning Urbanized Areas And Urban Areas Other Than Area Type 1 or 2	5 0
	AREA TYPE 4	Rural Areas	10 0

ARTERIAL ACCESS MANAGEMENT CLASSIFICATIONS & STANDARDS

Access Class	Medians "Restrictive" physically prevent vehicle crossing "Non-Restrictive" allow turns across at any point	Connection Spacing (meters)		Median Opening Spacing (meters)		Signal Spacing (meters)
		>70 km/h	≤70 km/h	Direc-tional	Full	
2	Restrictive w/Service Roads	400	200	400	800	800
3	Restrictive	200	135	400	800	800
4	Non-Restrictive	200	135			800
5	Restrictive	135	75	200	*800/400	*800/400
6	Non-Restrictive	135	75			400
7	Both Median Types	40		100	200	400

* 800 meters for >70 km/h , 400 meters for ≤70 km/h

INTERIM STANDARDS (newly constructed or transferred roads)				
Posted Speed (km/h)	**Connection Spacing (meters)**	**Median Opening Spacing (meters)**		**Signal Spacing (meters)**
		Directional	**Full**	
60 km/h or less "Special Cases"	40	100	200	400
60 km/h or less	75	200	400	400
60 61-70 km/h	130 135	200	400	400
Over 70 km/h	200	400	800	400

CORNER CLEARANCE AT INTERSECTIONS ISOLATED CORNER PROPERTIES				
Median	**Position**	**Access Allowed**	**Minimum (meters)**	
RESTRICTIVE	Approaching Intersection	Right In/Out	35	Class 7 & Special Cases
	Approaching Intersection	Right In Only	25	
	Departing Intersection	Right In/Out	70	40
	Departing Intersection	Right Out Only	30	
NON-RESTRICTIVE	Approaching Intersection	Full Access	70	40
	Approaching Intersection	Right In Only	30	
	Departing Intersection	Full Access	70	40
	Departing Intersection	Right Out Only	30	

1 9 Design Speed

Design speed is a principal design control which regulates the selection of many of the project standards used to design a roadway project The selection of an appropriate design speed must consider many factors The AASHTO "A Policy on Geometric Design of Highways and Streets, 1994" has a thorough discussion on design speed and these factors

As a principal design control, design speed must be selected very early in the design process and must be documented in the project design file Every effort should be made to **use as high a design speed as practical** to attain a desired degree of safety, mobility and efficiency A design speed 10 to 15 km/h greater than the expected posted speed will generally compensate for off-peak and overrunning speeds that can be expected Design speed should never be less that the expected posted or legal speed limit While the selected design speed will establish minimum geometric requirements necessary for safe operation (e g , minimum horizontal curve radius and site distance), this does not preclude the use of improved geometry (flatter curves or greater sight distances) where such improvements can be provided as a part of economic design Increments of 10 km/h should be used when selecting design speeds

Table 1 9 1 provides a recommended range of design speeds for new construction and reconstruction projects on the State Highway System except for facilities on the Florida Intrastate Highway System (FIHS) Design Speed for facilities on the FIHS shall meet or exceed the values in Table 1 9 2 For design speed on RRR projects, see Chapter 25

Design Speed State Highway System (Non-FIHS)		
Type Facility		**Design Speed (km/h)**
Freeways	Rural	110
	Urban	80 - 110
Artenals	Rural	90 - 110
	Urban	60 - 90
Collectors	Rural	90 - 110
	Urban	60 - 80

Design Speed
State Highway System - Non-FIHS Facilities
Table 1.9.1

Minimum Design Speed Florida Intrastate Highway System		
Type Facility		**Minimum Design Speed (km/h)**
Interstate and Freeways	Rural	110
	Urban	100
Artenals	Rural	110
	Urban	80

Minimum Design Speed
Florida Intrastate Highway System Facilities
Table 1.9.2

Note Design Speeds for FIHS facilities less than the above minimums shall be addressed on a case by case basis, with final approval resting with the Secretary of Transportation

Chapter 2

Roadway Design Geometrics and Criteria (Metric)

ROADWAY DESIGN CRITERIA - TABLES & FIGURES

Chapter 2

ROADWAY DESIGN GEOMETRICS & CRITERIA (METRIC)

2.0 General

The implementation of design criteria is outlined in the following text.

1. Roadway Design Criteria: The roadway design criteria presented in this manual are intended as the principal source of criteria for the design of new or major reconstruction projects on the Florida State Highway System.

   These criteria are presented by subject for major design elements as fixed values or a range of acceptable values as defined by qualifiers

   Where design criteria appear in the Roadway and Traffic Design Standards, it will be consistent with the criteria in this manual. Some criteria will remain in the other chapters of this manual until the Roadway Design Criteria section is completed When conflicts are discovered, they should be brought to the attention of the State Roadway Design Engineer for resolution

   Design criteria for resurfacing, restoration, and rehabilitation (RRR) is presented in Chapter 25 of this manual and is applicable only on programmed RRR projects.

   Facilities on the Florida Intrastate Highway System (FIHS) are subject to special standards and criteria for number of lanes, design speed, access, level of service, and other requirements. These are identified in Topic Number 525-030-250, "Process, Criteria, and Standards for the Florida Intrastate Highway System Plan Development and Update."

2. Design Controls: Design controls are characteristics and conditions that influence or regulate the selection of the criteria for project standards. It is the designer's responsibility to recognize and apply those controls applicable to the project

3. Design Standards: The specific values selected from the roadway design criteria become the design standards for a design project These standards will be identified and documented by the designer.

4. Project Parameters The properties or specific conditions with limits which require modification of design standards within these limits. The designer is responsible for establishing and documenting any project parameters and their limits, as part of the justification for deviations from project standards

Many design standard considerations are related directly to the design speed, including vertical and horizontal geometry and required sight distances The minimum design values are very closely related to traffic safety and cannot be compromised without an approved design variation. See Chapter 23.

2.1 Lanes

FDOT criteria for lane widths and pavement slopes are given by highway type and area, through lanes, auxiliary lanes and other special lanes Conditions and controls affecting the selection of project standards are listed in the criteria tables and figures

2 1 1 Through and Travel Lanes

Standard practice is to provide lane widths as wide as practical, up to 3 6 meters

2 1 2 Other Lane Widths

Collector-distributor lanes and auxiliary lanes for speed change, turning, storage for turning, weaving and other purposes supplementary to through-traffic movement should be of the same width as the through lanes

2 1 3 Ramp Traveled Way Widths

Ramp widths for tangent and large radii sections are given in the criteria tables and figures Ramp widths in other areas such as terminals are controlled by the curvature and the vehicle type selected as the design control and are given in Table 2 14 1, Ramp Widths Typical details for ramp terminals are provided in the Roadway and Traffic Design Standards

2 1 4 Bicycle Lanes

On rural projects with no curb and gutter, the paved shoulder shall serve as a designated or undesignated bike lane

On urban curb and gutter projects, bike lanes may be designated or undesignated Urban resurfacing projects may include restriping to provide bike lanes by using reduced interior lanes or other lane combination widths

The district bicycle coordinator should be consulted during design to establish appropriate bike elements, if any, on a project by project basis

Chapter 8 contains additional guidelines for the accommodation of bicycles

2 1 5 Cross Slopes

The maximum number of lanes with cross slope in one direction is three lanes The algebraic difference in cross slope between adjacent through lanes should not exceed 0 04

The chapter on Roadside Safety Design and the chapter on Bicycle and Pedestrian Facilities contain additional procedures and guidelines on slope design

2 1 6 Roadway Pavement

The type of pavement usually is determined by analysis of the volume and composition of traffic, the soil conditions, the availability of materials, the initial cost and the estimated cost of maintenance

Criteria and procedures for selecting the type of pavement and the structural design of the various surfacing courses are discussed in the pavement design manuals.

2.1.7 Transitions of Pavement Widths

When new pavement widths are not substantially greater than the joining pavement, grade differentials are slight and future widening is expected, striped transitions may be considered. An alternative approach is an abrupt change in width, with appropriate pavement markings, reflectors and rumble strips. The Roadway and Traffic Design Standards contain additional criteria and details.

2.1.8 Maximum Number of Lanes on the State Highway System

For the maximum number of lanes on the state highway system to be provided by Department funds, see the criteria tables and figures.

2.2 Medians

Median widths are given in the criteria tables and figures.

See Policy Number 000-625-015, Multilane Facility Median Policy Statement.

2.3 Shoulders

Shoulder width, slope and superelevation criteria are provided in the criteria tables and figures. It is the Department's policy that 1.5 meter paved outside shoulders are required on all new construction, reconstruction and lane addition projects for all highways except freeways, which generally require a 3.0 meter paved outside shoulder.

Roadway and Traffic Design Standards, Index 104, provides additional details for paved shoulders.

Specific widths have also been adopted for interstate, expressway, single and double lane ramps and collector-distributor road shoulders. Total shoulder widths, paved shoulder widths, widths of paved shoulder separations between through pavement edge and the near edge of any shoulder gutter are given for both right (outside) and left (inside) edges of the roadway. See Shoulders in the criteria tables and figures.

It is desirable to pave the median section and a 3.0 meter shoulder under overpass bridges. In addition, miscellaneous asphalt should be placed from the paved shoulder to the slope pavement. This pavement will provide additional safety, enhance drainage, reduce maintenance and improve appearance. See Figure 2.3.2.

2.3.1 Limits of Friction Course on Shoulders

Friction courses on limited access facilities shall be extended 0.3 meter onto both the median and outside shoulders.

Friction courses should be extended the full width of the shoulder on free access highways because of bicyclist usage. Terminating the friction course at the edge of travel lane or within the paved shoulder is considered to be a safety problem for bicyclists since they may cross over the drop-off

2.3 2 Shoulder Warning Devices (Rumble Strips)

The safety of freeways and other limited access facilities on the State highway system is to be enhanced by the installation of shoulder warning devices in the form of rumble strips Projects on these type facilities shall include the construction of ground-in rumble strips Several types of applications have been tested. The ground-in strips provide the desired warning to the driver and consistency in application has been possible using this construction process

These ground-in strips are installed using two patterns The skip array is the standard array These are used on both inside and outside shoulders on divided highway sections The continuous array shall be constructed in advance of bridge ends for a distance of 300 meters or back to the gore recovery area for mainline interchange bridges Other areas may be specified in plans

Methods and types of application other than described above and in Roadway and Traffic Design Standards, Index 518, shall not be used unless concurred in by the State Roadway Design Engineer Approval will be considered only with sufficient documented justification for deviation from the standard

Roadway and Traffic Design Standards, Index 518 has been prepared to provide all needed details This index also gives standards for raised rumble strips for use at structures with less than full width shoulders and at intersections Notes for locations of raised rumble strip applications are also included on the index

2.4 <u>Roadside Slopes</u>

Criteria and details are included in the criteria tables and figures and in Chapter 4

2.5 <u>Borders</u>

Border widths for new construction or major reconstruction where R/W acquisition is required are provided in the criteria tables and figures (Tables 2.5.1 & 2.5.2)

On highways with flush shoulders the border is measured from the shoulder point to the right-of-way line. Border widths are to accommodate (1) roadside design components such as signing, drainage features, guardrail, fencing and recovery area, (2) the construction and maintenance of the facility and (3) permitted public utilities

On highways with curb or curb and gutter, the border is measured from the lip of the gutter (or face of curb when there is not a gutter) to the right-of-way line. The border provides space for a buffer between vehicles and pedestrians, sidewalks with ADA provisions, traffic control devices, fire hydrants, storm drainage features, bus and transit features, permitted public utilities and space for aesthetic features such as sod and other landscape items. The functional needs and safety of the urban highway are primary

On existing streets and highways where R/W cannot be acquired or where the decision has been made to simply maintain and preserve the facility, the border area must be reserved for the functional and safety needs of the facility Extraordinary design effort will be required to meet ADA requirements, driveway construction and the other essential features. Spot R/W acquisitions may be required along the corridor to accommodate these essential components The absolute minimum border under these conditions is 2.4 m

2.6 Grades

The profile grade line defines the vertical alignment for road and street construction. As with other design elements, the characteristics of vertical alignment are influenced greatly by basic controls related to design speed, traffic volumes, functional classification, drainage and terrain conditions. Within these basic controls, several general criteria must be considered.

The Department's minimum for structure clearance over all highways is given in the criteria tables and figures. Exceptions to this policy shall be permitted only when justified by extenuating circumstances and approved as a variation or exception. This clearance should be increased on new facilities to allow for resurfacing.

Clearance required above design high water for roadway base courses is given in the criteria tables and figures. The limiting relationships between shoulder/pavement elevations vs. water elevations are discussed in the FDOT Drainage Manual.

The Roadway and Traffic Design Standards lists utility clearances and minimum covers and maximum fill heights for all types of culverts.

2.7 Sight Distance

Minimum stopping and passing sight distances are given in the criteria tables and figures.

2.8 Curves

2.8.1 Horizontal Curves

Design speed is the principal factor controlling horizontal alignment. Several geometric standards related to design speed are very specific. Other criteria cannot be defined as specifically and require that judgments be made by designers in consideration of local conditions.

2.8.1.1 Supplemental Alignment Control (Mainline)

Further guidelines have been established by the Department for lengths of horizontal curves, maximum deflections without curves, redirection of through lanes at intersections and minimum transition lengths between reverse curves. The criteria given are intended for use in establishing minimum lengths for both rural and urban conditions. See criteria tables and figures.

For small deflection angles (5° or less) curves should be suitably lengthened to avoid the distracting appearance of a kink. Curves should be at least 150 m long for a central angle of 5° and the minimum increased 30 m for each 1° decrease in the central angle (270 m for a 1° central angle.) This treatment may not be practical in developed or environmentally sensitive areas or for major modifications of existing facilities.

For design, the aesthetic control given above should be considered where practical, but may be compromised where other considerations warrant such action. Discernment of alignment changes in an urban setting is normally minimal due to the masking effects of development, traffic signs, various items of interest and similar distracting stimuli.

For information on the maximum deflection without a curve, see Table 2 8 1

When superelevation is required for curves in opposite directions on a common tangent, a suitable distance is required between the curves This suitable tangent length should be determined as follows

- 80% of the transition for each curve should be located on the tangent
- The suitable tangent length is the sum of the two 80% distances, or greater
- Where alignment constraints dictate a less than desirable tangent length between curves, an adjustment of the 80/20 superelevation transition treatment is allowed (where up to 50% of the transition may be placed on the curve)

The use of compound curves in horizontal alignment should be avoided When compound curves are necessary, the radius of the flatter curve should not be more than 50% greater than the sharper curve

The length for compound curves for turning roadways when followed by a curve of one-half radius or preceded by a curve of double radius should be as shown in the table below

Length of Circular Arc (meters)

Radius (m)	30	50	60	75	100	125	≥150
Minimum length	12	15	20	25	30	35	45
Desirable length	20	20	30	35	45	55	60

2 8 1 2 Supplemental Alignment Control (Intersections)

For redirection or offset deflection of through lanes through intersections the following angular deflections may be used Curves are not required for these angular breaks However, short curves may be desirable at each end, especially if pavement markings are used through the intersection to provide positive guidance to the motorist

Design Speed (km/h)	30	40	50	60	70
Maximum deflection	16°00'	11°00'	8°00'	6°00'	3°00'

2 8 1 3 Roadway Transitions

Transition details have been developed and included in the Roadway and Traffic Design Standards Transitions on curved alignment will require special design details in the contract plans

2 8 2 Vertical Curves

Minimum lengths for crest and sag vertical curves are provided in the criteria tables and figures

2.9 Superelevation

Superelevation rates of 0 10 maximum (rural) and 0 05 maximum (urban) are used by the Department on the State Highway System Charts for these rates are in the criteria tables and figures Additional data is contained in the Roadway and Traffic Design Standards, Indexes 510 and 511

The standard superelevation transition places 80% of the transition on the tangent and 20% on the curve In special situations this treatment can be adjusted to allow up to 50% of the transition to be placed on the curve

2.10 Vertical Clearance

Minimum vertical clearances are contained in the criteria tables and figures

2.11 Horizontal Clearance

Horizontal clearances are contained in the criteria tables and figures Horizontal clearance applies to rural and urban highways with either flush shoulders or with curbs

2.12 Clear Zones

Clear zones are contained in the criteria tables and figures Clear zone applies adjacent to traveled ways with flush shoulders Clear zone does not apply when curb or curb and gutter is adjacent to the traveled way

2.13 Intersections

Design guides and criteria presented heretofore are also applicable to the proper design of intersections.

2.13.1 Circular Intersections (Roundabouts)

The circular intersection with all yield control is another design concept for the designer to consider. Two critical elements of the small circular traffic pattern with a central island are as follows:

- Entry is by gap acceptance by having a yield condition at all entry legs.
- Speeds through the intersection are 40 km/h or less

The use of this design is best for low speed facilities. Its use should be documented by a complete intersection analysis and study, including alternate types of design.

All roundabout designs must be approved by the State Roadway Design Engineer.

2.13.2 Queue Length for Unsignalized Intersections

Turn lanes should comply with Index 301 to the extent practical. The available queue length provided should be based on a traffic study For low volume intersections where a traffic study is not justified, a minimum queue length of 15.0 m (2 vehicles) should be provided for rural areas and small urban areas; for other urban areas a minimum queue length of 30.0 m (4 vehicles) should be provided.

2.14 Interchanges

Design guides and criteria presented heretofore and in the Roadway and Traffic Design Standards are also applicable to the proper design of interchanges with their inherent ramps, speed change, merging and weaving lanes.

2.14.1 Limited Access Limits at Interchanges

The following criteria will be used in establishing limited access limits along crossroads at interchanges:

For rural interchanges, limited access will extend along the crossroad to a point 90 m minimum beyond the end of the acceleration or deceleration taper. In the event these points are not opposite, the point most remote from the project will be the control and the limited access on both sides will end at that station along the crossroad. Where no taper is used, the limited access will be carried to a point 90 m minimum beyond the radius point of the return. In this case also, the radius point most remote from the project will control.

For interchanges in urban areas, the criteria given above will apply except that the limited access will end a minimum of 30 m beyond the end of taper or the radius point of the return.

For unsymmetrical interchanges such as half-diamonds and partial cloverleafs, etc., the limited access right-of-way along the cross road on that side having no ramp will extend to a point opposite that point controlled by the ramp.

Limited access along crossroads overpassing (no interchange) limited access facilities shall be extended approximately 60 meters, measured from the mainline right of way line, along the crossroad. The fence is generally tied into the crossroad structure end bent unless required along the crossroad.

Access Management Rule 14-97 standards (14-97.003(1)j) regulate the location of driveway connections and median openings in interchange areas on arterial roads. This standard should be applied in accordance with the District procedures for implementing the Rule, and should not be confused with minimum requirements for limited access right of way.

2.14.2 Median Openings at Interchanges

Median opening locations at interchanges on arterial roads must consider Access Management Rule 14-97 (14-97.003(1)(j)2) which states "The minimum distance to the first median opening shall be at least 400 m as measured from the end of the taper of the egress ramp." This standard is to be applied in accordance with the FDOT median opening decision process. As a minimum, for all cross road facilities at interchanges in both rural and urban areas, a median opening may be centered no less than 15 m beyond the end of limited access except that a minimum distance of 200 m to the ramp median opening will be required. In no case should access be permitted between the interchange proper and the median opening as established by this criteria.

2.14.3 Ramp Widths

Ramp widths for interchange ramp terminal design are given in the criteria tables and figures (Table 2.14.1).

2.15 Lighting Criteria

Lighting criteria is contained in the criteria tables and figures and in Chapter 7.

Introduction to Criteria Tables and Figures

In the application of the criteria in this manual, the following definitions are assigned for consistency of understanding and interpretation

1 Arterials Divided or undivided, relatively continuous routes that primarily serve through traffic, high traffic volumes, and long average trip lengths Traffic movement is of primary importance, with abutting land access of secondary importance Arterials include expressways without full control of access, US numbered routes and principal state routes May be classified as urban or rural

2 Auxiliary Lane: The designated widths of roadway pavement marked to separate speed change, turning, passing and climbing maneuvers from through traffic They may also provide short capacity segments

3 C-D Roads Collector-Distributor Roads are limited access roadways provided within a single interchange, or continuously through two or more interchanges on a freeway segment They provide access to and from the freeway, reduce and control the number of ingress and egress points on the through freeway They are similar to continuous frontage roads except that access to abutting property is not permitted

4 Collectors Divided or undivided routes which serve to link arterial routes with local roads or major traffic generators They serve as transition link between mobility needs and land use needs Collectors include minor state routes, major county roads, and major urban and suburban streets

5 Freeways Divided arterial highways, with full control of access Movement of traffic free of interference and conflicts is of primary importance Essential elements include medians, grade separations, interchanges, and, in some cases, collector-distributor roads and frontage roads Freeways include Interstate, toll road and expressway systems May be classified as urban or rural

6 HOV Lane Special designated widths of pavement marked to provide travel lanes for high occupancy vehicles (HOV) They may be directly adjacent to other travel lanes or separated

7 Local Roads· Routes which provide high access to abutting property, low average traffic volumes, short average trip lengths and on which through traffic movements are not of primary importance Local roads include minor county roads, minor urban and suburban subdivision streets, and graded or unimproved roads

8 Rural Areas Places outside the boundaries of concentrated populations that accommodate higher speeds, longer trip lengths and freedom of movement, and are relatively free of street and highway networks. Rural environments are surroundings of similar characteristics

9 Streets The local system which provides direct access to residential neighborhoods and business districts, connect these areas to the higher order road systems and offers the highest access to abutting property; sometimes deliberately discouraging through-traffic movement and high speeds

Note· Local roads and streets are not generally a part of the State Highway System and therefore, may not be governed by the FDOT roadway design criteria,but by the Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways

10 Traffic Lane/Traveled Way The designated widths of roadway pavement, exclusive of shoulders, marked to separate opposing traffic or vehicles traveling in the same direction Traffic lanes include through travel lanes, auxiliary lanes, turn lanes, weaving, passing, and climbing lanes They provide space for passenger cars, trucks, buses, recreational vehicles and, in some cases, bicycles

11 Travel Lane The designated widths of roadway pavement marked to carry through traffic and to separate it from opposing traffic or traffic occupying other traffic lanes Generally, travel lanes equate to the basic number of lanes for a facility

12 Roadway The portion of a highway, including shoulders, for vehicular use A divided highway has two or more roadways

13 Urban Areas. Places within boundaries of concentrated populations, where density of street and highway networks, travel speeds, nature and composition of vehicles and pedestrian traffic dictate street and highway characteristics that promote lower speeds, better circulation movements, more delineation and traffic guidance devices, shorter trip lengths and provisions for pedestrians and bicycles Urban environments are surroundings of similar characteristics

14 Urbanized Areas Transitional zones between rural and urban areas, with characteristics approaching or similar to urban areas

15 High Speed Descriptive term used to summarize all conditions governing the selection of Design Speeds greater than 80 km/h

16 Low Speed Descriptive term used to summarize all conditions governing the selection of Design Speed of 80 km/h or less

17 Truck Traffic. When significant, heavy, substantial, high percent, etc truck traffic is used as a qualifying control, it shall mean 10% of the AADT or 10% of the daily count (24 hr)

18 Low Volume and High Volume Descriptive term used to describe certain operating characteristics and driver expectancy on highways Criteria for some elements are selected according to these qualifying controls Standards for these controls are given in the following table

STANDARDS FOR LOW AND HIGH VOLUME HIGHWAYS

IN ANNUAL AVERAGE DAILY VOLUMES

HIGHWAY TYPE	LOW VOLUME AADT ≤	HIGH VOLUME AADT ≥
FREEWAY - URBAN		
4-LANE FACILITY	57,000	69,000
6-LANE FACILITY	86,000	103,000
8-LANE FACILITY	114,000	138,000
FREEWAY - RURAL		
4-LANE FACILITY	46,000	56,000
6-LANE FACILITY	69,000	83,000
8-LANE FACILITY	92,000	111,000
ARTERIALS - URBAN		
2-LANE FACILITY	16,000	20,000
4-LANE FACILITY	37,000	43,000
6-LANE FACILITY	55,000	64,000
8-LANE FACILITY	69,000	80,000
ARTERIALS - RURAL		
2-LANE FACILITY	9,000	14,000
4-LANE FACILITY	38,000	47,000
6-LANE FACILITY	58,000	71,000
COLLECTOR - URBAN		
2-LANE FACILITY	11,000	16,000
4-LANE FACILITY	37,000	45,000
COLLECTOR - RURAL		
2-LANE FACILITY	8,000	13,000
4-LANE FACILITY	30,000	38,000

<u>LOW VOLUME</u> FACILITIES ARE HIGHWAY TYPES WITH PROJECTED DESIGN YEAR AADT VOLUME EQUAL TO OR LESS THAN THE LOW VOLUME VALUES SHOWN

<u>HIGH VOLUME</u> FACILITIES ARE HIGHWAY TYPES WITH PROJECTED DESIGN YEAR AADT VOLUME EQUAL TO OR GREATER THAN THE HIGH VOLUME VALUES SHOWN

2.1 Lanes

LANE WIDTHS (METERS)							
FACILITY		THROUGH OR TRAVEL	AUXILIARY				
TYPE	AREA		SPEED CHANGE	TURNING (LT/RT/MED)	PASSING	CLIMBING
FREEWAY	Rural	3.6	3.6	—	—	3.6
	Urban	3.6	3.6	—	—	3.6
ARTERIAL	Rural	3.6	3.6	3.6	3.6	3.6
	Urban	3.6 [1]	3.6 [1]	3.6 [1,4]	3.6 [1]	3.6
COLLECTOR	Rural	3.6 [6]	3.3 [2]	3.3 [2,4]	3.3 [2,5]	3.6
	Urban	3.3 [3]	3.3 [3]	3.3 [3,4]	3.3 [3]	3.6

1. 3.3 permitted if one of these conditions exist
   - R/W and existing conditions are stringent controls
   - Facility operates on interrupted flow conditions
   - Design speed 80 km/h or less
   - Intersection capacity not adversely affected
   - Truck volume 10% or less
2. 3.6 lanes for all 2-lane rural.
3. 3.6 lanes in industrial areas when R/W is available.
4. With severe R/W controls, 3.0 turning lanes may be used where speeds are 60 km/h or less and the intersection is controlled by traffic signals. Median turn lanes shall not exceed 4.5
5. 3.6 when truck volume more than 10%
6. 3.3 for low volume AADT

LANE WIDTHS
Table 2.1.1

2.1 <u>Lanes</u>

LANE WIDTHS (METERS)					
FACILITY		SPECIAL			
TYPE	AREA	HOV[1]	BICYCLE	OFF SYSTEM DETOUR	URBAN MULTI-PURPOSE[5]
FREEWAY	Rural	3 6	—	3 3[4]	—
	Urban	3.6	—	3 3[4]	—
ARTERIAL	Rural	3 6	1 5[2]	3.3	—
	Urban	3 6	1.2[3]	3 3	2 4[6]
COLLECTOR	Rural	—	1.5[2]	3 3	—
	Urban	—	1 2[3]	3.3	2.4[6]

1 Separated or concurrent flow

2. Designated or undesignated shoulder pavement

3 Designated or undesignated

4. For Interstate highway detours, at least one 3 6 lane must be provided in each direction.

5. Urban multi-purpose lanes are usually used as refuge lanes but may be used for loading zones, bus stops, emergency access and other purposes. Parking that adversely impacts capacity or safety is to be eliminated whenever practical. Standard parking width is measured from lip of gutter, with a minimum width of 2.4 m measured from face of curb. Portions of multi-purpose lanes that are reserved for parking and access isles for the physically handicapped shall have cross slopes not exceeding 1:50 (0.02) in all directions

6. 3 0 to 3 6 lanes for commercial and transit vehicles

LANE WIDTHS
Table 2.1.2

RAMP WIDTHS (RAMP PROPER) FOR TANGENT AND LARGE RADII SECTIONS	
ONE LANE RAMPS	4 5 meters
TWO LANE RAMPS	7.2 meters

RAMP WIDTHS
Table 2.1.3

2.1 Lanes

FLORIDA INTRASTATE HIGHWAY SYSTEM (FIHS)	URBANIZED AREAS	NON-URBANIZED AREAS
Turnpike Mainline[1]	N/A	4 Lanes
Limited Access Highways[2]	10 Lanes[3]	6 Lanes
Controlled Access Highways[4]	6 Lanes (4 Minimum)	6 Lanes (4 Minimum)
FLORIDA NON-INTRASTATE HIGHWAY SYSTEM	**URBANIZED AREAS**	**NON-URBANIZED AREAS**
Limited Access Highways	10 Lanes[3]	6 Lanes
Other State Highways[5]	6 lanes	4 Lanes

Footnotes:

1 "Turnpike Mainline" - means Florida's Turnpike from the vicinity of the Palm Beach/Martin County line to Kissimmee

2 "Limited Access" includes the Interstate System, Turnpike facilities not on the Turnpike Mainline, and additional limited access facilities on the State Highway System

3 Limited access facilities will be limited to six lanes In all urbanized areas with populations greater than 200,000 persons, in addition to these six lanes, the ultimate improvement may include up to four physically separated exclusive lanes (two in each direction) for through traffic, public transit vehicles and other high occupancy vehicles Where provided, access to and egress from these exclusive lanes within the urbanized area will be restricted to public transit and high occupancy vehicles

4 Florida Intrastate Highway System (FIHS) Controlled Access facilities will be a minimum of four and a maximum of six lanes with a restricted median Interim upgrades to existing two lane facilities will be considered

5 Other non-FIHS state highways will be limited to six lanes in urbanized areas greater than 50,000 population and four lanes outside such urbanized areas

General Notes:

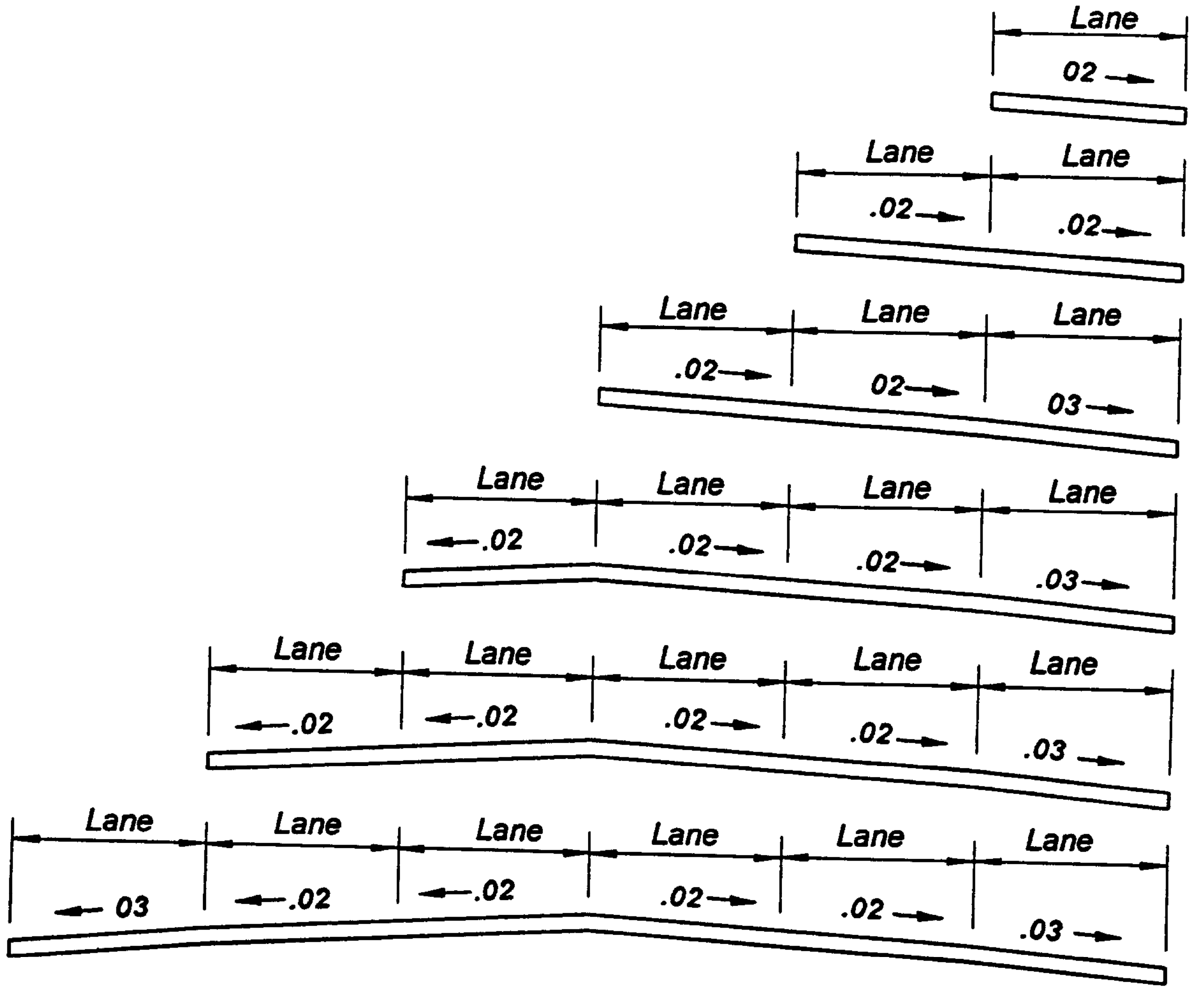
1 Any needed capacity beyond the maximum number of lanes may be provided by other transportation alternatives and strategies and acquisition of sufficient right of way for alternative transportation options Emphasis on the development of intercity rail service will be placed on the following corridors

- Tampa - Orlando
- Miami - Tampa
- Orlando - Miami
- Orlando - Jacksonville

Additional corridors may be added based on favorable rail-related market/ridership assessments

2 Exceptions to this Policy (Topic No 000-525-040-a, s 335 02(3), F S) will be addressed on a case by case basis, with final approval resting with the Secretary of Transportation

MAXIMUM NUMBER OF LANES ON THE STATE HIGHWAY SYSTEM TO BE PROVIDED BY DEPARTMENT FUNDS
Table 2.1.4



All Lanes One Direction

These sections show only the standard slopes for adjoining lanes; they do not prescribe needed lanes, lane usage or typical section requirements other than lane slope. These slopes are not applicable to parabolic crowns.

Maximum pavement cross slopes on tangent sections are:

0.04 for design speeds of 80 km/h or less.

0.03 for design speeds greater than 80 km/h.

The change in cross slope between adjacent through lanes shall not exceed 0 04

STANDARD PAVEMENT CROSS SLOPES
Figure 2.1.1

2.2 <u>Medians</u>

MEDIAN WIDTHS (METERS)	
TYPE FACILITY	WIDTH
FREEWAYS	
Interstate, Without Barrier	19 2 [1]
Other Freeways, Without Barrier	
Design Speed $\geq$100 km/h	18 0
Design Speed < 100 km/h	12 0
All, With Barrier, All Design Speeds	7 8 [2]
ARTERIAL AND COLLECTORS	
Design Speed > 80 km/h	12 0
Design Speed $\leq$ 80 km/h	6 6 [3]
Paved And Painted For Left Turns	3 6 [4]

Median width is the distance between the inside (median) edge of the travel lane of each roadway,

1 26 4 when future lanes planned
2 Based on 0 6 median barrier and 3 6 shoulder
3 On reconstruction projects where existing curb locations are fixed due to severe right of way constraints, the minimum width may be reduced to 6 0 for design speeds=70 km/h, and to 5 0 for design speeds $\leq$ 60 km/h
4 Restricted to 5-lane sections with design speeds $\leq$ 60 km/h On reconstruction projects where existing curb locations are fixed due to severe right of way constraints, the minimum width may be reduced to 3 0 These flush medians are to include sections of raised, restrictive islands for pedestrian refuge and to conform with the "Multilane Facilities Median Policy" and the Access Management Rules

MEDIAN WIDTHS
Table 2.2.1

2.3 Shoulders

HIGHWAY TYPE		WIDTHS (METERS)								SLOPES	
		WITHOUT SHOULDER GUTTER				WITH SHOULDER GUTTER				NORMAL ⊡	
		FULL WIDTH		PAVED WIDTH		FULL WIDTH		PAVED WIDTH			
		Outside	Median Or Left	Outside	Median Or Left	Outside	Median Or Left	Outside	Median Or Left	Outside	Median Or Left
FREEWAYS (Lanes One Way)	4-Lane Or More	3 6	3 6	3 0	3 0	4 7	4 7	2 4	2 4	06	06
	3-Lane	3 6	3 6	3 0	3 0	4 7	4 7	2 4	2 4		05
	2-Lane	3 6	2 4	3 0	1 2	4 7	4 1	2 4	1 8		
	HOV Lane	NA	4 2	NA	3 0	NA	NA	NA	NA	NA	05 ☆
	1-Lane Ramp	1 8	1 8	1 2	0 6	3 5	3 5	1 2▲	1 2	06	05
	2-Lane Ramp Non-Interstate	3 0	2 4	2 4	1 2	4 7	4 1	2 4	1 8		
	2-Lane Ramp Interstate	3 6	2 4	3 0	1 2	4 7	4 1	2 4	1 8		
	C-D Road 1-Lane	1 8	1 8	1 2	0 6	3 5	3 5	1 2	1 2		
	C-D Road 2-Lane	3 6	2 4	3 0	1 2	4 7	4 1	2 4	1 8		
	C-D Road 3-Lane	3 6	3 6	3 0	3 0	4 7	4 7	2 4	2 4		
	C-D Road > 3-Lane	3 6	3 6	3 0	3 0	4 7	4 7	2 4	2 4		06
	Auxiliary Lane Climbing & Weaving	3 6	NA	3 0	NA	4 7	NA	2 4	NA		NA
	Auxiliary Lane Mainline Terminal 1-Lane Ramp 2-Lane Ramp	2 4 3 6	NA NA	1 8 3 0	NA NA	3 5 4 7	NA NA	1 2 2 4	NA NA		NA NA
	Frontage Road	See COLLECTORS Table 2.3 4 For Local Roads And Streets See The FDOT 'Manual Of Uniform Minimum Standards For Design, Construction And Maintenance For Streets And Highways'									

⊡ Shoulders shall extend 1 2 back of shoulder gutter and have a 0 06 slope back toward the gutter

☆ 0 06 when 4 lanes or more combined

▲ Shoulder pavement less than 1 8 in width and adjoining shoulder gutter shall be the same type, depth and slope as the ramp pavement

SHOULDER WIDTHS AND SLOPES
Table 2.3.1

2.3 Shoulders

HIGHWAY TYPE		WIDTHS (METERS)								SLOPES	
		WITHOUT SHOULDER GUTTER				WITH SHOULDER GUTTER					
		FULL WIDTH		PAVED WIDTH		FULL WIDTH		PAVED WIDTH		NORMAL ◘	
		Outside	Median Or Left	☆ Outside	Median Or Left	Outside	Median Or Left	Outside	Median Or Left	Outside	Median Or Left
ARTERIALS Divided (Lanes One Way)	4-Lane	3 6 3 0 2 4	3 6 3 0 2 4	1 5 1 5 1 5	1 2 1 2 1 2	4 7 4 7 4 1	4 7 4 7 4 1	2 4 2 4 1 8	2 4 2 4 1 8		06
	3-Lane	3 6 3 0 2 4	3 6 3 0 2 4	1 5 1 5 1 5	0 0 ◊ 0 0 ◊ 0 0 ◊	4 7 4 7 4 1	4 7 4 7 4 1	2 4 2 4 1 8	2 4 2 4 1 8		
	2-Lane	3 6 3 0 2 4	2 4 2 4 1 8	1 5 1 5 1 5	0 0 ◊ 0 0 ◊ 0 0 ◊	4 7 4 7 4 1	4 1 4 1 3 5	2 4 2 4 1 8	1 8 1 8 1 2		05
	1-Lane Ramp	1 8	1 8	1 2	0 6	3 5	3 5	1 2 ▲	1 2		
	2-Lane Ramp	3 0	1 8	1 5	0 6	4 7	4 1	2 4	1 8		
	C-D Road 1-Lane	1 8	1 8	1 2	0 6	3 5	3 5	1 2	1 2		
	C-D Road 2-Lane	2 4	1 8	1 5	0 0	4 1	3 5	1 8	1 2	06	
	Auxiliary Lane Climbing & Weaving	Same As Travel Lanes	NA	Same As Travel Lanes	NA	Same As Travel Lanes	NA	Same As Travel Lanes	NA		NA
	Auxiliary Lane Mainline Terminal 1-Lane Ramp 2-Lane Ramp	2 4 3 6	NA NA	1 5 1 5	NA NA	3 5 4 7	NA NA	1 2 2 4	NA NA		NA NA
	Auxiliary Lane At-Grade Intersection	Same As Travel Lanes	Same As Travel Lanes	1 5	0 0	3 5	NA	1 2	NA		05- 06
	Frontage Road	See COLLECTORS Table 2 3 4 For Local Roads And Streets See The FDOT Manual Of Uniform Minimum Standards For Design Construction And Maintenance For Streets And Highways									

◘ Shoulders shall extend 1 2 back of shoulder gutter and have a 0 06 slope back toward the gutter

▲ Shoulder pavement less than 1 8 in width and adjoining shoulder gutter shall be the same type depth and slope as the ramp pavement

☆ Shoulder shall be paved full width through rail-highway at grade crossings, extending a minimum distance of 7 6 on each side of the crossing measured from the outside rail For additional information see Standard Index No 17882

◊ Paved 0 6 wide where turf is difficult to establish Paved 1 2 wide (a) in sag vertical curves, 30 m minimum either side of the low point, and (b) on the low side of superelevated traffic lanes extending through the curves and approximately 90 m beyond the PC and PT

X — High Volume Highways
X — Normal Volume Highways
X — Low Volume Highways
LEGEND FOR VALUES

SHOULDER WIDTHS AND SLOPES
Table 2.3.2

2.3 Shoulders

HIGHWAY TYPE		WIDTHS (METERS)				SLOPES
		WITHOUT SHOULDER GUTTER		WITH SHOULDER GUTTER		NORMAL ⊡
		FULL WIDTH	◘ PAVED WIDTH	FULL WIDTH	PAVED WIDTH	
ARTERIALS Undivided (Lanes Two-Way)	Multi-Lane ⊕	3 6 3 0 2 4	1 5 1 5 1 5	4 7 4 7 4 1	2 4 2 4 1 8	06
	2-Lane	3 6 3 0 2 4	1 5 1 5 1 5	4 7 4 7 4 1	2 4 2 4 1 8	
	Auxiliary Lane At-Grade Intersection	Same As Travel Lanes	1 5	3 5	1 2	
	Frontage Road	See COLLECTORS Table 2 3 4 For Local Roads And Streets See The FDOT 'Manual Of Uniform Minimum Standards For Design, Construction And Maintenance For Streets And Highways'				

⊡ Shoulders shall extend 1 2 back of shoulder gutter and have a 0 06 slope back toward the gutter

◘ Shoulder shall be paved full width through rail-highway at grade crossings, extending a minimum distance of 7 6 on each side of the crossing measured from the outside rail For additional information see Standard Index No 17882

⊕ All multi-lane facilities shall conform to the Department "Multilane Facilities Median Policy", Topic No 000-625-015

x — High Volume Highways
x — Normal Volume Highways
x — Low Volume Highways
LEGEND FOR VALUES

SHOULDER WIDTHS AND SLOPES
Table 2.3.3

2.3 Shoulders

HIGHWAY TYPE		WIDTHS (METERS)								SLOPES	
		WITHOUT SHOULDER GUTTER				WITH SHOULDER GUTTER					
		FULL WIDTH		PAVED WIDTH		FULL WIDTH		PAVED WIDTH		NORMAL ⊡	
		Outside	Median Or Left	◘ Outside	Median Or Left	Outside	Median Or Left	Outside	Median Or Left	Outside	Median Or Left
COLLECTORS Divided (Lanes One-Way)	3-Lane	3 6 3 0 2 4	3 6 3 0 2 4	1 5 1 5 1 5	0 0 ⊗ 0 0 ⊗ 0 0 ⊗	4 7 4 7 4 1	4 7 4 7 4 1	2 4 2 4 1 8	2 4 2 4 1 8	06	[illegible]
	2-Lane	3 6 3 0 2 4	2 4 2 4 1 8	1 5 1 5 1 5	0 0 ⊗ 0 0 ⊗ 0 0 ⊗	4 7 4 7 4 1	4 1 4 7 3 5	2 4 2 4 1 8	1 8 1 8 1 2		
	Auxiliary Lane At-Grade Intersection	Same As Travel Lanes	Same As Travel Lanes	1 5	1 2	3 5	NA	1 2	NA		
COLLECTORS Undivided (Lanes Two-Way)	Multi-Lane ⊕	3 6 3 0 2 4		1 5 1 5 1 5		4 7 4 7 3 5		2 4 2 4 1 8		06	
	2-Lane	3 6 3 0 2 4		1 5 1 5 1 5		4 7 4 7 3 5		2 4 2 4 1 8			
	Auxiliary Lane At-Grade Intersection	Same As Travel Lanes		Same As Travel Lanes		3 5		1 2			

⊡ Shoulders shall extend 1 2 back of shoulder gutter and have a 0 06 slope back toward the gutter

◘ Shoulder shall be paved full width through rail-highway at grade crossings, extending a minimum distance of 7 6 on each side of the crossing measured from the outside rail For additional information see Standard Index No 17882

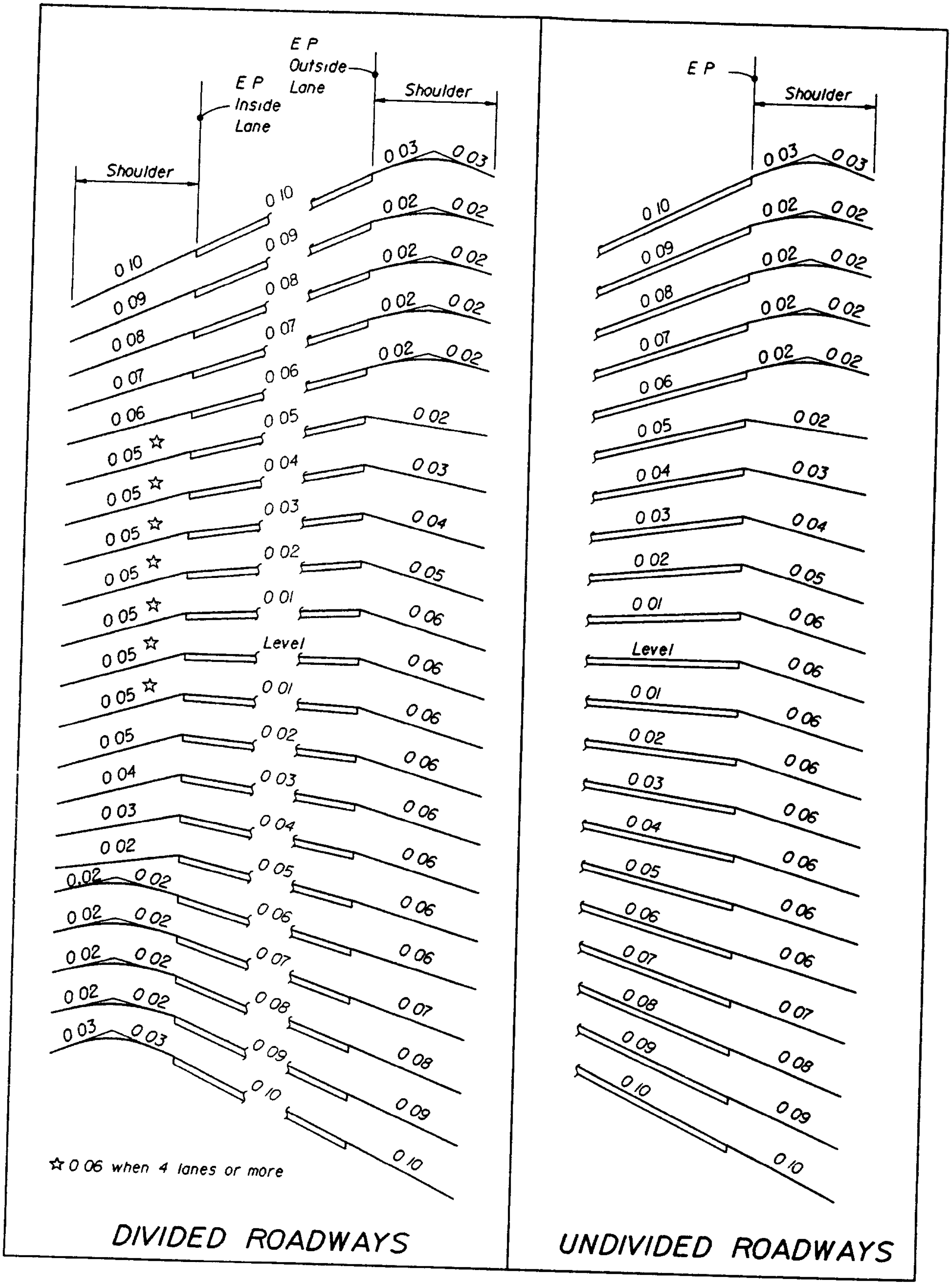
⊗ The median shoulder may be paved 0 6 wide in areas of the State where establishing and maintaining turf is difficult, however, shoulders shall be paved 1 2 wide (a) in sag vertical curves, 30 m minimum either side of the low point, and (b) on the low side of superelevated traffic lanes, extending through the curve and approximately 90 m beyond the PC and PT

⊕ All multi-lane facilities shall conform to the Department "Multilane Facilities Median Policy", Topic No 000-625-015

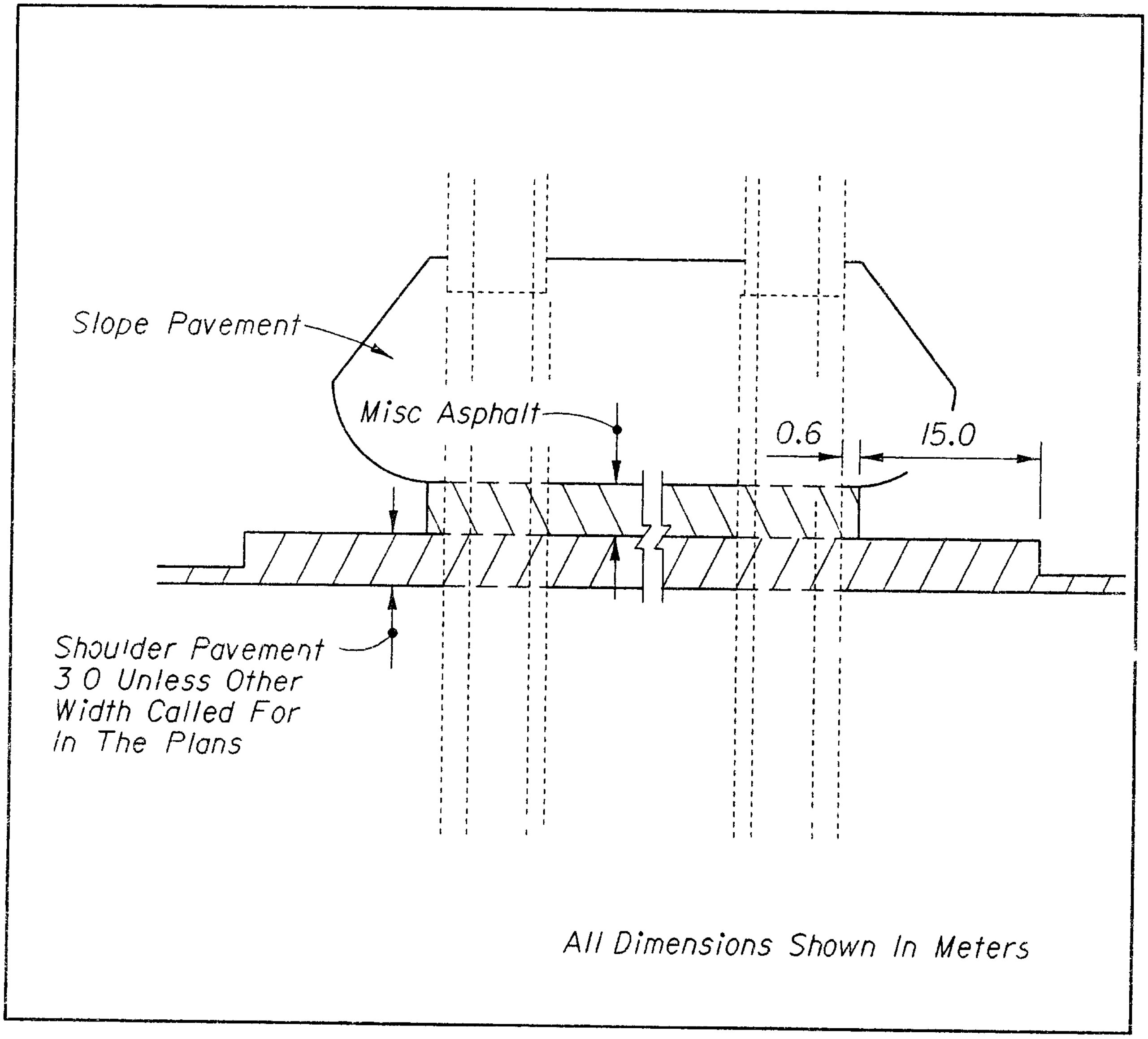
LEGEND FOR VALUES:
- x — High Volume Highways
- x — Normal Volume Highways
- x — Low Volume Highways

SHOULDER WIDTHS AND SLOPES
Table 2.3.4

2.3 Shoulders



SHOULDER SUPERELEVATION
Figure 2.3.1



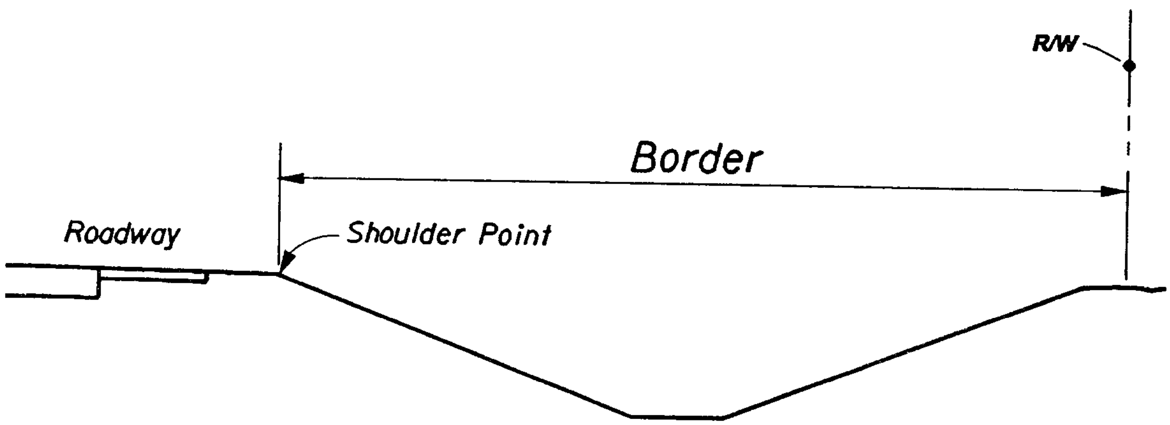
TYPICAL PAVING UNDER BRIDGE STRUCTURES
FOR OUTSIDE SHOULDERS
Figure 2.3.2

2.4 Roadside Slopes

TYPE OF FACILITY	RURAL & URBAN FREEWAYS RURAL ARTERIALS AND COLLECTORS, WITH PROJECTED 20 YEAR ADT OF 1500 OR GREATER DESIGN SPEED 80 km/h OR GREATER		RURAL ARTERIALS AND COLLECTORS WITH PROJECTED 20 YR ADT LESS THAN 1500 AND RURAL LOCALS, URBAN ARTERIALS AND COLLECTORS WITHOUT CURB & GUTTER ALL SPEEDS		URBAN ARTERIALS AND COLLECTORS WITH CURB & GUTTER DESIGN SPEED 80 km/h OR LESS	
	Height (meter)	Rate	Height (meter)	Rate	Height (meter)	Rate
Front Slope	0 0-1 5 1 5-3 0 3 0-6 0 >6 0	1 6 1 6 to edge of CZ and 1 4 1 6 to edge of CZ and 1 3 1 2 (with guardrail)	0 0-1 5 1 5-6 0	1 6 except where R/W is insufficient, then 1 6 to edge of CZ and 1 3 will be permitted 1 6 to edge of CZ and 1 3 except where R/W is insufficient then 1 2 will be permitted	All	1 2 to suit property owner, not flatter than 1 6 R/W cost must considered for high fill sections in urban areas
Back Slope	All	1 4 or 1 3 with a standard width trapezoidal ditch and 1 6 front slope	All	1 4 when R/W permits or 1 3	All	1 2 or to suit property owner Not flatter than 1 6
Transverse Slopes	All	1 10 or flatter (freeways) 1 4 (others)	All	1 4	All	1 4

Roadside Slopes
Table 2.4.1

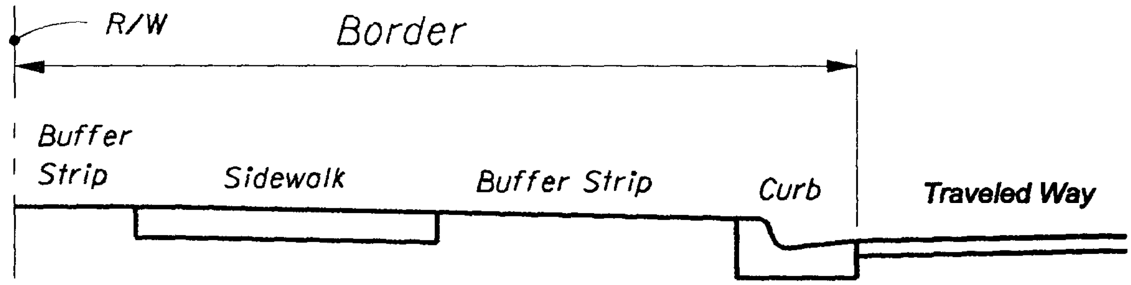
2.5 Borders



BORDER	
TYPE FACILITY	MINIMUM WIDTH (METERS)
FREEWAYS (INCLUDING INTERCHANGE RAMPS)	25.0
ARTERIALS COLLECTORS Design Speed > 80 km/h	12.0
ARTERIALS COLLECTORS Design Speed $\leq$ 80 km/h	10.0

HIGHWAYS WITH FLUSH SHOULDERS
Table 2.5.1

2.5 Borders



BORDER		
TYPE FACILITY	MINIMUM WIDTH (METERS)	
	TRAVEL LANES AT CURB	BIKE LANES OR OTHER AUXILIARY LANES AT CURB
ARTERIALS COLLECTORS Design Speed ≥ 70 km/h	4 2	3 6
ARTERIALS COLLECTORS Design Speed ≤ 60 km/h	3 6	3 0
URBAN COLLECTOR STREETS Design Speed ≤ 50 km/h	3 0	2 4

HIGHWAYS WITH CURBS AND CURB AND GUTTER
Table 2.5.2

2.6 Grades

2.6.1 Criteria For Grade Datum

1 *Roadway Base Clearance Above Design High Water Elevation*

Freeways and rural multi-lane mainline	*0 9 m*
Ramps (proper)	*0 6m*
Low point on ramps at cross roads	*0 3 m*
Rural two-lane with design year AADT greater than 1500 VPD	*0 6 m*
All other facilities including urban	*0 3 m*

2 *Bridge Vertical Clearances*
See Vertical Clearances For Bridges, Table 2 10 1

2.6.2 Length Of Grade On Curb And Gutter Sections

A minimum of 75 m between VPI's

2.6.3 Grades On Curb And Gutter Sections

A minimum grade of 0 3%

See Table 2 6 1 for maximum grades

2.6 Grades

MAXIMUM GRADES IN PERCENT															
TYPE OF HIGHWAY	AREA	DESIGN SPEED (km/h)													
		FLAT TERRAIN							ROLLING TERRAIN						
		50	60	70	80	90	100	110	50	60	70	80	90	100	110
FREEWAYS (1)	Rural Urban	—	—	4	4	3	3	3	—	—	5	5	4	4	4
ARTERIALS (3)	Rural	—	5	5	4	3	3	3	—	6	6	5	4	4	4
	Urban	8	7	7	6	5	5	—	9	8	8	7	6	6	—
COLLECTORS (3)	Rural	7	7	7	6	5	5	4	9	8	8	7	6	6	5
	Urban	9	9	9	7	6	6	5	11	10	10	8	7	7	6
	Industrial (2)	4	4	4	3	3	3	—	5	5	5	4	4	4	—
FRONTAGE ROADS	Require Same Criteria As Collectors.														

RAMPS	DESIGN SPEED (km/h)	< 30	40 to 50	60	70 to 80
	GRADES (%)	6 To 8	5 To 7	4 To 6	3 To 5

One-Way Descending Grades On Ramps May Be 2% Greater, In Special Cases

(1) Interstate designed to 110 km/h will be restricted to 3% maximum grade.

(2) Areas with significant (10% or more) heavy truck traffic

(3) On 2-lane highways critical length of upgrades shall not be exceeded. Critical lengths are those which reduce the speeds of 180 kg/kW trucks by more than 15 km/h

MAXIMUM GRADES
Table 2.6.1

DESIGN SPEED km/h	30	40	50	60	80	90	100	110
MAXIMUM CHANGE IN GRADE IN PERCENT	1.20	1.10	1.00	.80	.60	.50	.40	.20

MAXIMUM CHANGE IN GRADE WITHOUT VERTICAL CURVES
Table 2.6.2

2.7 Sight Distance

MINIMUM STOPPING SIGHT DISTANCE (METERS) (Based on height of eye of 1 070 m and height of object 0 150 m above road surface)				
DESIGN SPEED (km/h)	GRADES OF 2% OR LESS			
	FREEWAYS		ARTERIALS	COLLECTORS
	Interstate	Other		
40	—	—	—	45
50	—	—	60	60
60	—	—	85	80
70	—	110	110	100
80	—	140	120	120
90	170	150	145	140
100	190	175	170	160
110	225	210	200	—

ADJUSTMENT IN DISTANCE FOR GRADES GREATER THAN 2%														
DESIGN SPEED (km/h)	INCREASE IN LENGTH FOR DOWNGRADE (m)							DECREASE IN LENGTH FOR UPGRADE (m)						
	Grades							Grades						
	3%	4%	5%	6%	7%	8%	9%	3%	4%	5%	6%	7%	8%	9%
40	3	3	3	6	6	9	9	3	3	3	3	3	3	6
50	3	6	6	9	9	12	12	3	3	3	6	6	6	6
60	6	6	9	12	15	18	20	3	6	6	6	6	9	9
70	6	9	12	15	18	25	27	6	6	6	9	9	12	12
80	9	12	18	20	25	30	—	6	9	9	12	12	15	—
90	12	15	20	25	30	35	—	6	9	12	12	15	15	—
100	15	20	27	34	40	—	—	9	12	15	15	18	—	—
110	18	25	30	40	45	—	—	12	12	15	18	20	—	—

MINIMUM STOPPING SIGHT DISTANCE
Table 2.7.1

MINIMUM PASSING SIGHT DISTANCE (METERS) (Based on height of eye of 1 070 m and height of object 1 300 m above road surface)							
Design Speed (km/h)	40	50	60	70	80	90	100
2-Lane, 2-Way Facilities	285	345	410	485	545	605	670

MINIMUM PASSING SIGHT DISTANCE
Table 2.7.2

2.8 Curves

2.8.1 Horizontal Curves

MAXIMUM DEFLECTION WITHOUT CURVE (DMS)			
TYPE FACILITY		$V \geq 70$ km/h	$V \leq 60$ km/h
Freeways		0° 45' 00"	NA
Arterials And Collectors	Without Curb & Gutter	0° 45' 00"	2° 00' 00"
	With Curb & Gutter	1° 00' 00"	2° 00' 00"
Where V = Design Speed			

MAXIMUM DEFLECTIONS WITHOUT HORIZONTAL CURVES
Table 2.8.1

LENGTH OF CURVE (METERS)	
Freeways	6V[1]
Arterials	3V[2]
Collectors	3V[2]
Where V = Design Speed (km/h)	

1 When 6V cannot be attained, the greatest attainable length shall be used, but not less than 3V

2 When 3V cannot be attained, the greatest attainable length shall be used, but not less than 120 m

Curve length shall provide full superelevation within the curve of not less than 60 m (Rural) or 30 m (Urban).

LENGTH OF HORIZONTAL CURVES
Table 2.8.2

2.8 Curves

2.8.1 Horizontal Curves

MINIMUM RADIUS (m)			
Design Speed (km/h)	RURAL ENVIRONMENT (e max = 0.10) (R min.)	URBAN ENVIRONMENT (e max = 0.05)	
		Without Curb And Gutter (R min.)	With Curb And Gutter (R min.)
40	45.0	60 0	60.0
50	75 0	99.0	99.0
60	115 0	150 0	150 0
70	160 0	215.0	215.0
80	210.0	280 0	280.0
90	275 0	376 0	——
100	360 0	493.0	——
110	455 0	636 0	——
Interstate· 585 0 m Minimum Radius (Maximum Curvature) (e max = 0.10)			

MAXIMUM CURVATURE OF HORIZONTAL CURVE
(Using Limiting Values Of "e" and "f")

Table 2.8.3

MINIMUM RADIUS (m)	
Design Speed (km/h)	Radius
50	1165 0
60	1745 0
70	2330.0
80	2500.0
90	3495.0
100	3790.0
110	4350 0

MAXIMUM HORIZONTAL CURVATURE
USING NORMAL CROSS SLOPES

Table 2.8.4

2.8.2 Vertical Curves

K VALUES FOR CREST CURVES				
Design Speed (km/h)	FREEWAYS		ARTERIALS	COLLECTORS
	Interstate	Other		
40	---	---	5	5
50	---	---	9	9
60	---	---	18	16
70	---	30	30	25
80	---	48	36	32
90	71	56	52	48
100	90	75	70	65
110	125	110	100	---

Length, L=KA

Where L= Minimum Length (Meters)
K=Constant
A=Algebraic Differance In Grades, Percent

Interstates Lengths of crest vertical curves on Interstate mainlines are not to be less than 300 m for open highways and 550 m within interchanges

Service Interchanges K values for ramp crest vertical curves at freeway terminals are not to be less than the freeway K values K values for other ramp sag vertical curves are not to be less than arterial K values

System Interchanges K values for all crest vertical curves on systems interchanges are not to be less than the K values of the higher system

Arterials and Collectors The minimum lengths of crest vertical curves for highways with design speeds of 90 km/h or greater are as follows

Design Speed (km/h)	90	100	110
Minimum Length (m)	100	120	150

All Facilities The lengths of crest vertical curves are not to be less than 0 6 times the design speed (km/h) expressed in meters

MINIMUM LENGTHS OF CREST VERTICAL CURVES BASED ON STOPPING SIGHT DISTANCE
Table 2.8.5

2.8.2 Vertical Curves

K VALUES FOR SAG CURVES				
Design Speed (km/h)	FREEWAYS		ARTERIALS	COLLECTORS
	Interstate	Other		
40	—	—	10	10
50	—	—	12	12
60	—	—	18	18
70	—	25	25	20
80	—	30	25	25
90	40	40	35	30
100	50	45	40	40
110	52	50	45	—

Length, L=KA
Where L= Minimum Length (Meters)
K=Constant
A=Algebraic Differance In Grades, Percent

Interstates — Lengths of sag vertical curves on Interstate mainlines are not to be less than 244 m

Service Interchanges — K values for ramp sag vertical curves at freeway terminals are not to be less than the freeway K values K values for other ramp sag vertical curves are not to be less than arterial k values

System Interchanges — K values for all sag vertical curves on systems interchanges are not to be less than the K values of the higher system

Arterials and Collectors — The minimum lengths of sag vertical curves for highways with design speeds of 90 km/h or greater are as follows

Design Speed (km/h)	90	100	110
Minimum Length (m)	75	90	115

All Facilities — The lengths of sag vertical curves are not to be less than 0 6 times the design speed (km/h) expressed in meters

MINIMUM LENGTHS OF SAG VERTICAL CURVES BASED ON STOPPING SIGHT DISTANCE AND HEADLIGHT SIGHT DISTANCE
Table 2.8.6

2.9 Superelevation

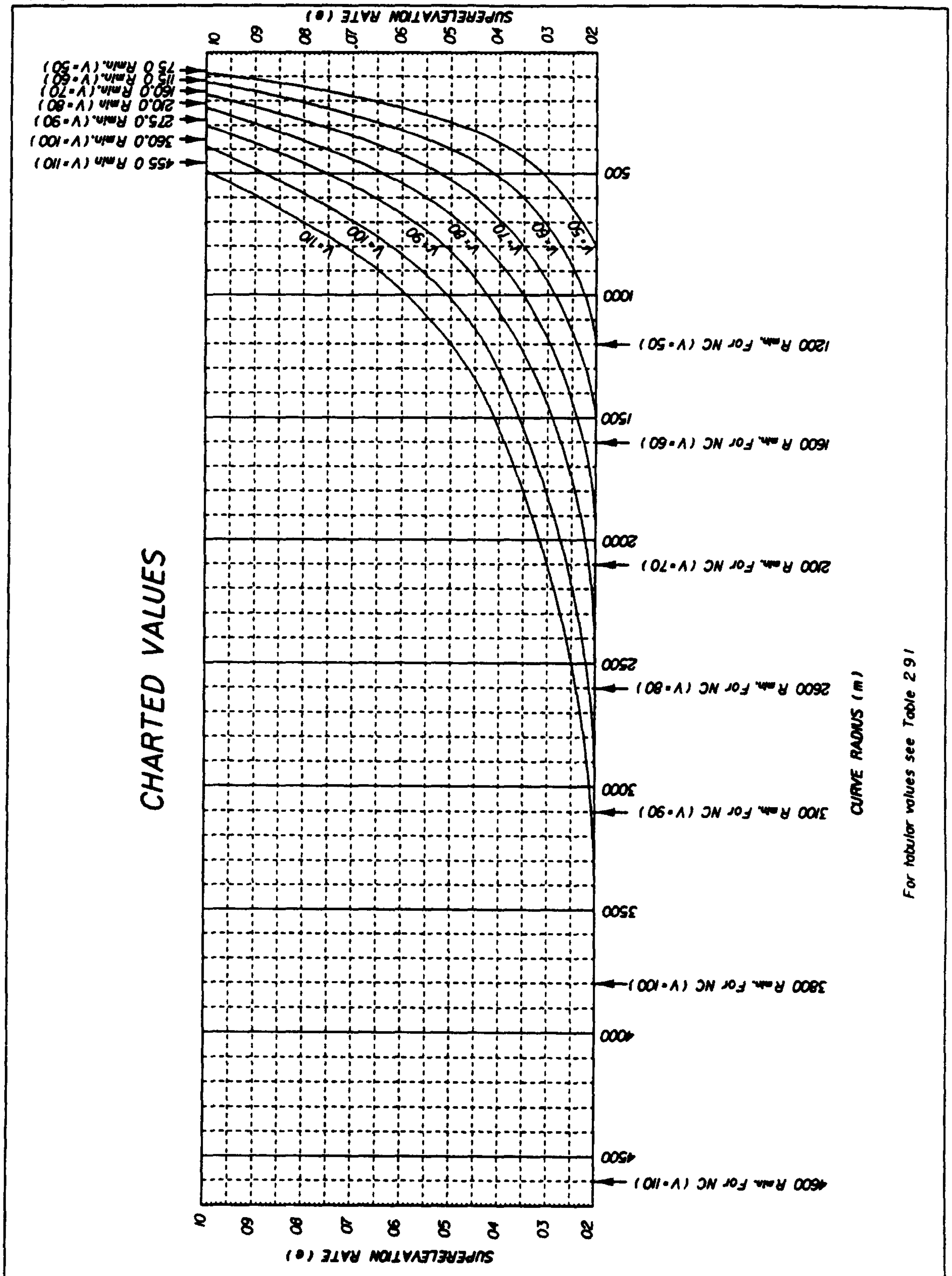
TABULATED VALUES							
Radius (m)	Design Speed (km/h)						
	50	60	70	80	90	100	110
4600	NC	NC	NC	NC	NC	NC	NC
4500							RC
4400							
4300							
4200							
4100							
4000							
3900							
3800						NC	
3700						RC	
3600							
3500							
3400							
3300							
3200							RC
3100					NC		021
3000					RC		021
2900							022
2800						RC	022
2700						021	023
2600				NC		021	024
2500				RC		022	025
2400						023	026
2300					RC	024	027
2200					021	025	029
2100			NC		.021	026	030
2000			RC		022	027	032
1900				RC	023	029	033
1800				021	024	030	035
1700				021	026	032	037
1600		NC		023	027	034	039
1500		RC	RC	024	029	036	041
1400			021	026	031	038	043
1300			022	027	033	040	046
1200	NC	RC	024	030	036	043	050
1100	RC	021	026	032	039	046	054
1000		.022	029	035	043	051	059
900		025	032	039	046	056	065
800	RC	.027	035	043	051	062	072
700	023	031	040	048	057	070	080
600	.027	035	045	055	066	078	089
500	031	041	052	064	075	088	099
450	034	045	057	069	081	093	0 10 R min = 455 0
400	038	050	063	075	087	099	
350	042	.056	069	082	093	0 10 R min = 360 0	
300	048	063	077	089	10		
250	056	071	085	096	0 10 R min = 275 0		
200	066	081	095	0 10 R min = 210 0			
175	.072	087	10				
150	.078	093	0 10 R min = 160 0				
125	.086	099					
100	094	0 10 R min = 115.0					
	0 10 R min = 75 0						

NC = Normal Crown
RC = Reverse Crown (0 02)

SUPERELEVATION RATES FOR RURAL HIGHWAYS
URBAN FREEWAYS AND HIGH SPEED URBAN HIGHWAYS
$e_{max} = 0.10$

Table 2.9.1

2.9 Superelevation



SUPERELEVATION RATES FOR RURAL HIGHWAYS, URBAN FREEWAYS AND HIGH SPEED URBAN HIGHWAYS

$e_{max} = 0.10$

Figure 2.9.1

2.9 Superelevation

TABULATED VALUES

Radius R (m)	Design Speed (km/h)			
	50	60	70	80
1000+	NC	NC	NC	NC
900				NC
800				RC
700				
600			NC	
500			RC	
450				
400		NC		RC
350		RC		0.023
300			RC	0.036
275	NC		0.021	0.046
250	RC		0.029	Rmin. = 267.9
225		RC	0.041	
200		0.020	Rmin. = 213.4	
175		0.031		
150		0.046		
125	RC	Rmin. = 146.3		
100	0.034			
	Rmin. = 87.2			

NC = Normal Crown

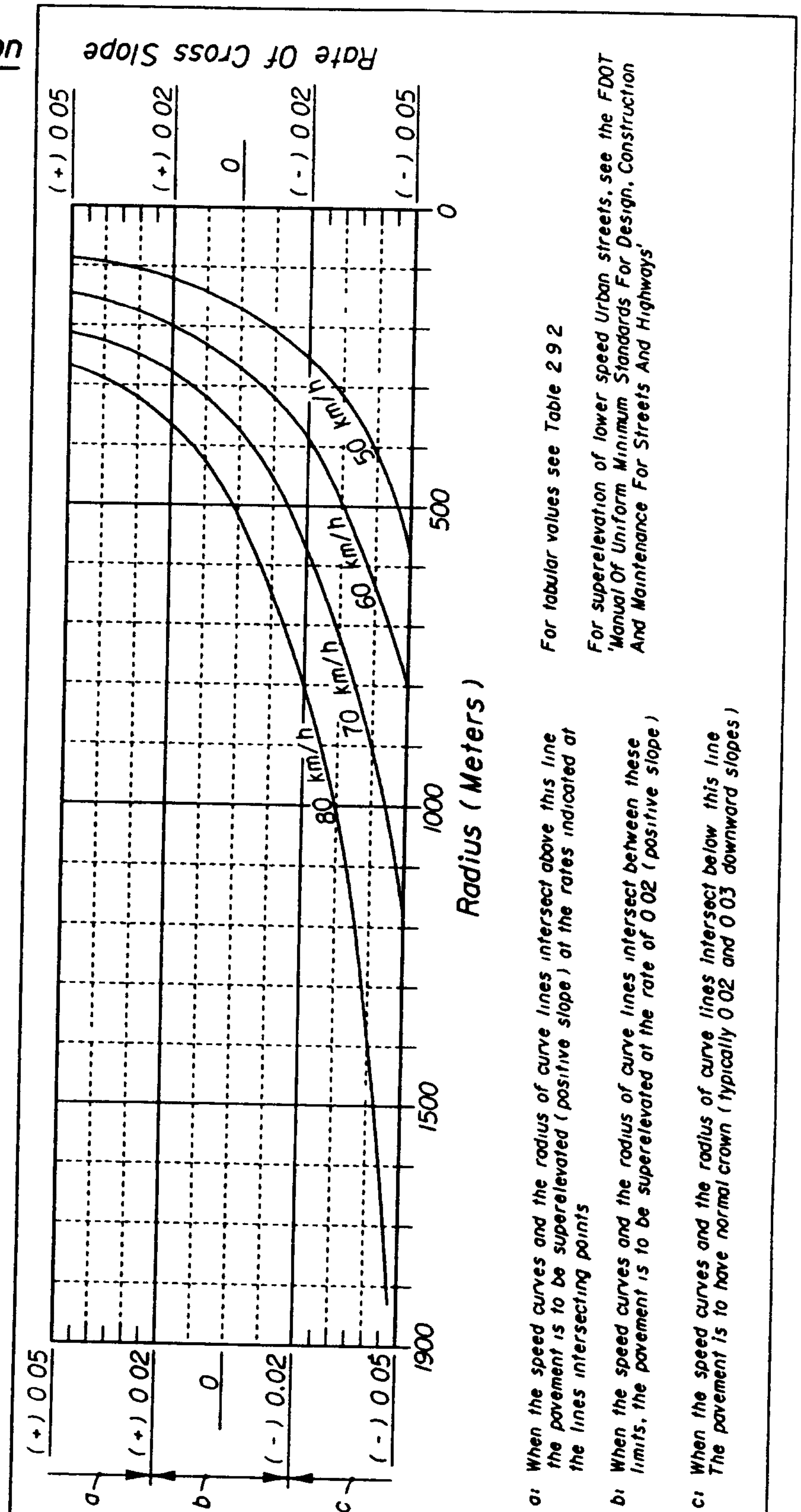
RC = Reverse Crown (0.02)

SUPERELEVATION RATES FOR URBAN HIGHWAY AND HIGH SPEED URBAN STREETS

$e_{max} = 0.05$

Table 2.9.2

2.9 Superelevation



SUPERELEVATION RATES FOR URBAN HIGHWAY AND HIGH SPEED URBAN STREETS

$e_{max} = 0.05$

Figure 2.9.2

2.9 Superelevation

SLOPE RATES FOR STRAIGHT LINE SUPERELEVATION TRANSITIONS			
SECTION	Design Speed (km/h)		
	70 - 80	90 - 100	110
	SLOPE RATES		
2 Lane & 4 Lane	1 200	1 225	1 250
6 Lane	1 160	1 180	1 200
8 Lane	1 150	1 170	1 190

The length of superlevation transition is to be determined by the relative slope rate between the travel way edge of pavement and the profile grade, except that the minimum length of transition shall be 30 m

For additional information on transitions, see the Roadway and Traffic Design Standards, Index 510

SUPERELEVATION TRANSITION SLOPE RATES FOR RURAL HIGHWAYS, URBAN FREEWAYS AND HIGH SPEED URBAN HIGHWAYS

Table 2.9.3

SLOPE RATES FOR STRAIGHT LINE SUPERELEVATION TRANSITIONS	
50 km/h	1 100
60 km/h	1 125
70 - 80 km/h $^{\Delta}$	1 150

$^{\Delta}$ 1 125 may be used for 70 km/h under restricted conditions

The length of superlevation transition is to be determined by the relative slope rate between the travel way edge of pavement and the profile grade, except that the minimum length of transition shall be 15 m for design speeds under 60 km/h and 23 m for design speeds of 60 km/h or greater For additional information on transitions, see the Roadway and Traffic Design Standards, Index 511

SUPERELEVATION TRANSITION SLOPE RATES FOR URBAN HIGHWAYS AND HIGH SPEED URBAN STREETS

Table 2.9.4

2.10 Vertical Clearances

2.10.1 Bridges

FACILITY TYPE	CLEARANCE [1,4,5] (METERS)		
	Roadway Or Railroad Over Roadway [2]	Roadway Over Railroad [3,4]	Pedestrian Over Roadway [2]
Freeways And Arterials	4.9	7.0	5.2
Collectors And Others	4.9	7.0	5.2

1 Clearance Measurement
The least vertical distance between the bridge structure and the surface of the roadway (traffic lanes and shoulders) or the top of the highest rail

2 Allowance To Be Added For Future Underpass Resurfacing On Rural Sections
100 mm over flexible pavements
150 mm over rigid pavements

3 Allowance To Be Added For Rail Resurfacing (Track Raised)
300 mm for conventional railroads
Others-see footnote No. 4.

4 Over High Speed Rail Systems
See Department guidelines and specifications for Intermediate Class Rail Operations entitled "Standard Specifications For The Design And Construction Of Railways"

5 Clearance Over Waterways
See Department 'Drainage Manual', Topic No 625-040-001, Vol 1, Ch 4

VERTICAL CLEARANCE FOR BRIDGES

2.10 Vertical Clearance

2.10.2 Signs

Overhead Sign Structures:

5.2 m over the entire width of the pavement and shoulder to the lowest sign component.

Allowance to be added for futrure resurfacing on rural sections:

100 mm over flexible pavements
150 mm over rigid pavements

2.10.3 Signals

1. *Span Wire Mounted:*

   5.2 m between the pavement and the bottom of any signal assembly.

2. *Mast Arm Mounted:*

   5.2 m over the entire width of the pavement and shoulder to the lowest signal or low point on the arm.

   Allowance to be added for future resurfacing on rural sections:

   100 mm over flexible pavements
   150 mm over rigid pavements

3. *Truss Mounted:*

   5.2 m over the entire width of the pavement and shoulders to the lowest signal or lowest member of the horizontal truss.

   Allowance to be added for future resurfacing on rural sections:

   100 mm over flexible pavements
   150 mm over rigid pavements

2.11 Horizontal Clearances

PLACEMENT	*Placement shall be in accordance with the Roadway and Traffic Design Standards Placement within sidewalks shall be such that an unobstructed sidewalk width of 1.2 m or more (not including the width of curb) is provided.*
SUPPORTS	*Supports except overhead sign supports shall be frangible or breakaway When practicable, sign supports should be located behind barriers that are justified for other reasons* *Overhead sign supports shall be located outside the clear zone unless shielded*

HORIZONTAL CLEARANCE FOR TRAFFIC CONTROL SIGNS
Table 2.11.1

CONVENTIONAL LIGHTING PLACEMENT	*Not in the median except in conjunction with barriers that are justified for other reasons* *Rural (Flush Shoulders)* *6.1 m from the travel lane, 4.3 m from auxiliary lane* *(may be clear zone width when clear zone is less than 6 1 m)* *Urban (Curb and Gutter):* *From right of way line to 1.2 m back of face of curb (may be 0.8 m back of face of curb when all other alternatives are deemed impractical) Placement within sidewalks shall be such that an unobstructed sidewalk width of 1 2 m or more (not including the width of curb) is provided.*
HIGH MAST LIGHTING	*Outside of the clear zone unless shielded*

HORIZONTAL CLEARANCE FOR LIGHT POLES
Table 2.11.2

2.11 Horizontal Clearances

Shall not be located within the limited access right of way *Shall not be located in the median.* *Flush Shoulders:* *Not within the clear zone Install as close as practical to the right of way without aerial encroachments onto private property.* *Curb or Curb and Gutter:* *At the R/W line or as close to the R/W line as practical. Must maintain 1.2 m clear from face of curb. Placement within sidewalks shall be such that an unobstructed sidewalk width of 1.2 m or more (not including the width of the curb) is provided.*
Note. Horizontal clearance to mailboxes is specified in the construction details contained in Index No 532

HORIZONTAL CLEARANCE FOR UTILITY POLES, FIRE HYDRANTS, ETC
Table 2.11.3

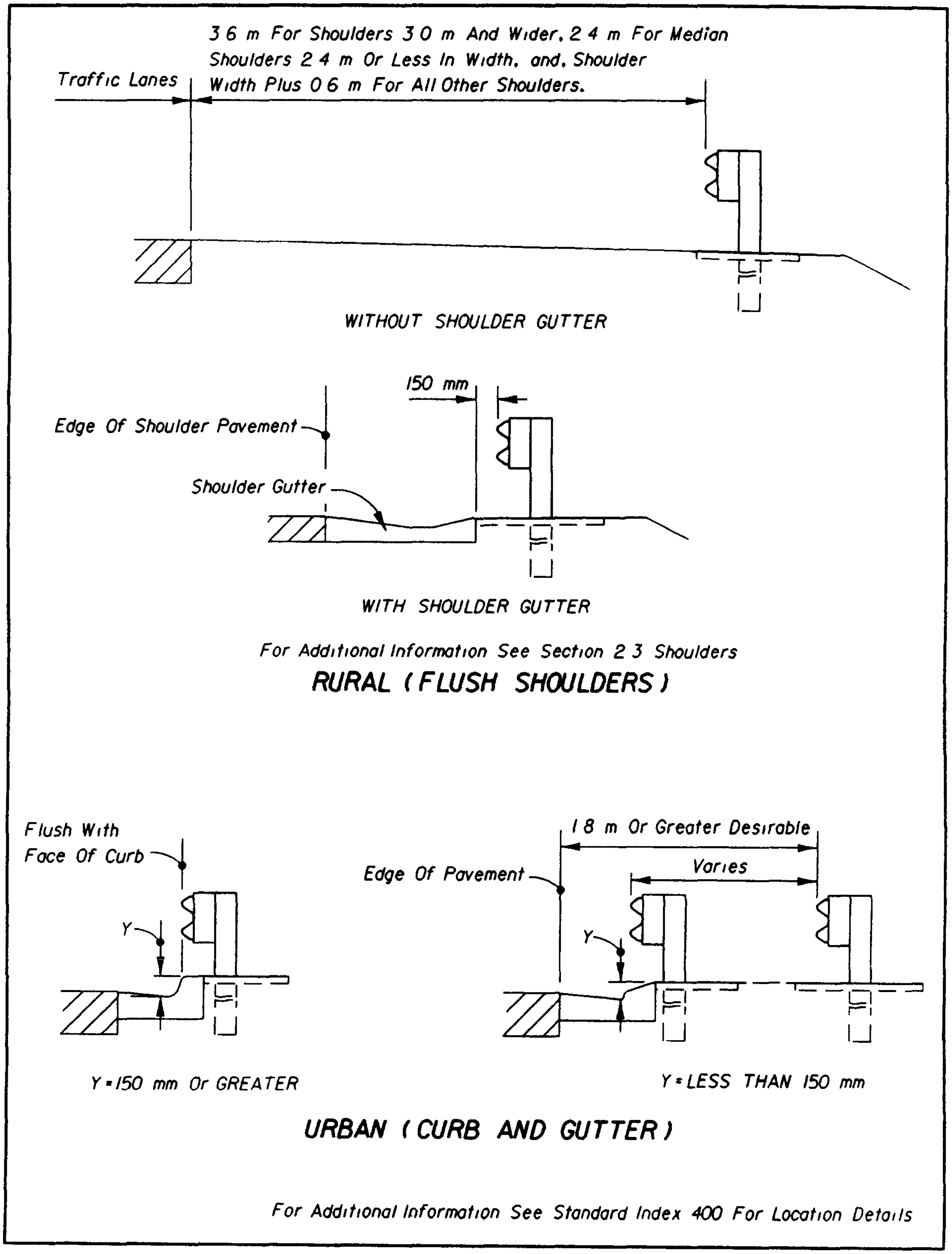
Shall not be located in medians *Should be located as far from traffic lanes as practical Placement within sidewalks shall be such that an unobstructed sidewalk width of 1 2 m or more (not including the width of curb) is provided*

HORIZONTAL CLEARANCE TO SIGNAL POLES AND CONTROLLER CABINETS FOR SIGNALS
Table 2.11.4

Horizontal Clearance to trees where the diameter is or is expected to be greater than 100 mm measured 150 mm above the ground shall be *Flush Shoulders* *outside the clear zone* *Curb or Curb and Gutter* *1 2 m from face of outside curbs* *1 8 m from edge of inside traffic lane where median curb is present*

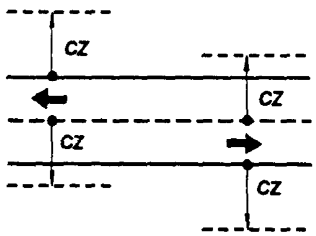
HORIZONTAL CLEARANCE TO TREES
Table 2.11.5

2.11 Horizontal Clearances

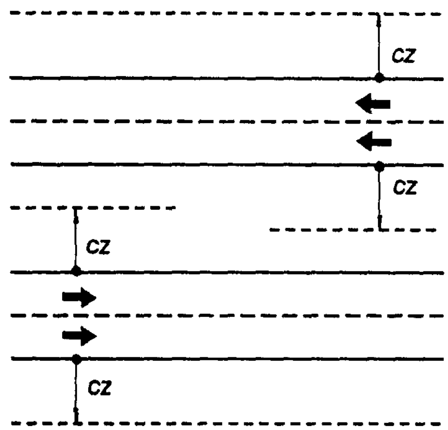


HORIZONTAL CLEARANCE TO GUARDRAIL
Figure 2.11.1

2.12 Clear Zone



TWO-LANE / TWO-WAY



MULTI-LANE

CLEAR ZONE WIDTH (METERS)				
Design Speed km/h	FLUSH SHOULDERS			
	≥1500 AADT		<1500 AADT	
	Travel Lanes & Multi-Lane Ramps	Auxiliary lanes & Single Lane Ramps	Travel Lanes & Multi-Lane Ramps	Auxiliary Lanes & Single Lane Ramps
<70	5 4	3 0	4 8	3 0
70	7 3	4 2	6 0	4 2
80	7 3	4 2	6 0	4 2
90	9 1	5 4	7 3	4 2
>90	11 0	7 3	9 1	5 4

Above clear zone widths are for side slopes of 1 4 or flatter Applies to highways with flush shoulders only May be in rural or urban locations

AADT= Mainline 20 year projected annual average daily traffic

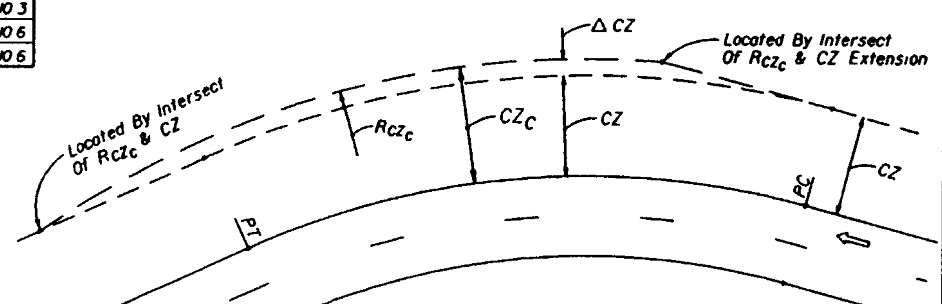
Where accident history indicates need, or where specific site investigation shows definitive accident potential, clear zone widths shall be adjusted on the outside of horizontal curves with flush shoulders in accordance with Table 2 12 2

Clear zone widths are measured from the edge of the traveled way

CLEAR ZONE WIDTHS
Table 2.12.1

CLEAR ZONE OF CURVED ALIGNMENT (CZ_c), METERS

RADIUS (METERS)	Design Speed (km/h): 50			60			70			80			90				100				110			
Tangent CZ	3.0	4.8	5.4	3.0	4.8	5.4	4.2	6.0	7.3	4.2	6.0	7.3	4.2	5.4	7.3	9.0	5.4	7.3	9.0	11.0	5.4	7.3	9.0	11.0
6985.0	3.0	4.8	5.4	3.0	4.8	5.4	4.2	6.0	7.3	4.2	6.0	7.3	4.2	5.4	7.6	9.4	5.4	7.6	9.4	11.3	5.7	7.6	9.4	11.3
3495.0	3.0	4.8	5.4	3.0	4.8	5.4	4.2	6.4	7.6	4.2	6.4	7.6	4.5	5.7	7.6	9.4	5.7	7.6	9.4	11.6	5.7	7.6	9.7	11.6
2330.0	3.0	4.8	5.4	3.0	4.8	5.7	4.5	6.4	7.6	4.5	6.4	7.6	4.5	5.7	7.6	9.7	5.7	7.9	9.7	11.9	6.0	7.9	10.0	11.9
1745.0	3.0	4.8	5.4	3.0	5.1	5.7	4.5	6.4	7.6	4.5	6.4	7.9	4.5	6.0	7.9	9.7	6.0	8.2	10.0	12.2	6.0	8.2	10.3	12.2
1165.0	3.0	4.8	5.4	3.3	5.1	5.7	4.5	6.4	7.9	4.5	6.7	7.9	4.8	6.0	8.2	10.0	6.4	8.2	10.3	12.5	6.4	8.5	10.6	12.8
875.0	3.0	5.1	5.7	3.3	5.1	5.7	4.5	6.7	7.9	4.8	7.0	8.2	4.8	6.4	8.5	10.6	6.4	8.8	11.0	13.1	6.7	8.8	11.3	13.4
700.0	3.3	5.1	5.7	3.3	5.1	6.0	4.8	6.7	8.2	5.1	7.3	8.5	5.1	6.4	8.8	11.0	6.7	9.0	11.3	13.4	7.0	9.4	11.6	14.0
585.0	3.3	5.1	5.7	3.3	5.4	6.0	4.8	7.0	8.5	5.1	7.3	8.8	5.1	6.7	9.0	11.3	7.0	9.4	11.6	14.0	7.3	9.7	12.2	14.6
500.0	3.3	5.1	5.7	3.3	5.4	6.0	4.8	7.0	8.5	5.4	7.6	9.0	5.4	7.0	9.0	11.6	7.3	9.7	12.2	14.6	7.6	10.0	12.8	15.0
455.0	3.3	5.1	6.0	3.6	5.4	6.4	5.1	7.3	8.8	5.4	7.6	9.0	5.4	7.0	9.4	11.9	7.6	10.0	12.5	14.9	7.9	10.6	13.1	15.8
360.0	3.3	5.4	6.0	3.6	5.7	6.4	5.1	7.6	9.0	5.4	7.9	9.4	5.7	7.6	10.0	12.5	7.9	10.6	13.4	15.8				
350.0	3.3	5.4	6.0	3.6	5.7	6.4	5.1	7.6	9.0	5.4	7.9	9.4	5.7	7.6	10.0	12.5	7.9	10.6	13.4	15.8				
290.0	3.3	5.4	6.0	3.6	6.0	6.7	5.4	7.9	9.4	5.7	8.2	10.0	6.0	7.9	10.6	13.1								
275.0	3.6	5.4	6.4	3.9	6.0	7.0	5.7	8.2	9.7	6.0	8.5	10.3	6.4	8.2	11.0	13.4								
250.0	3.6	5.4	6.4	3.9	6.0	7.0	5.7	8.2	9.7	6.0	8.5	10.3												
220.0	3.6	5.7	6.4	3.9	6.4	7.0	5.7	8.5	10.0	6.4	9.0	11.0												
210.0	3.6	5.7	6.4	3.9	6.4	7.3	6.0	8.8	10.3	6.4	9.0	11.0												
195.0	3.6	5.7	6.4	3.9	6.4	7.3	6.0	8.8	10.3															
175.0	3.6	5.7	6.7	4.2	6.7	7.6	6.4	8.8	10.6															
170.0	3.6	5.7	6.7	4.2	6.7	7.6	6.4	9.0	10.6															
160.0	3.6	6.0	6.7	4.2	6.7	7.6																		
145.0	3.9	6.0	7.0	4.5	7.0	7.9																		
134.0	3.9	6.0	7.0	4.5	7.3	8.2																		
132.0	3.9	6.0	7.0	4.5	7.3	8.2																		
125.0	3.9	6.4	7.0																					
115.0	3.9	6.4	7.3																					
98.0	3.9	6.7	7.6																					
97.0	4.2	6.7	7.6																					
87.0	4.2	6.7	7.6																					
79.0	4.2	7.0	7.9																					
75.0	4.5	7.3	8.2																					



Step 1 Select CZ value from Table 2.12.1

Step 2 In Table above locate the "Design Speed" and "Tangent" CZ values that match the speed and CZ value from Step 1

Step 3 Move down the radius column to the radius under consideration then across the table to the column found under Step 2 to find the CZ_c value

CZ_c

CLEAR ZONE WIDTHS ON CURVED ALIGNMENTS ON HIGHWAYS WITH FLUSH SHOULDERS

Table 2.12.2

2.14 Interchanges

RAMP WIDTHS			
RADIUS To Inside of Curve (METERS)	1-LANE		2-LANE
	Traveled Way Width[1] Case I-C	Traveled Way Width + Outside Paved Shoulder Width Case II-B	Traveled Way Width[1] Case III-A
METERS			
15 0	6 9	7 5	8 7
25 0	5 7	6 9	8 1
30 0	5 4	6 6	7 8
50 0	5 1	6 3	7 5
75 0	4 8	6 3	7 5
100 0	4 8	6 0	7 2
125 0	4 8	6 0	7 2
150 0+	4 5	6 0	7 2

These values are aplicable for interchange ramp terminal design

For case application, see AASHTO and the Roadway and Traffic Design Standards, Index 525

[1] Do not deduct for the presence of stabilized or paved shoulder

RAMP WIDTHS
Table 2.14.1

2.15 Lighting Criteria

CONVENTIONAL LIGHTING-ROADWAYS			
ROADWAY CLASSIFICATIONS	ILLUMINATION LEVEL AVERAGE INITIAL (LUX)	UNIFORMITY RATIOS	
		AVG./MIN	MAX./MIN
INTERSTATE, EXPRESSWAY, FREEWAY & MAJOR ARTERIALS	16	4:1 Or Less	10:1 Or Less
ALL OTHER ROADWAYS	11	4:1 Or Less	10:1 Or Less
* PEDESTRIAN WAYS AND BICYCLE LANES	25	4:1 OR Less	10:1 or Less

Note: These values should be considered standard, but should be increased if necessary to maintain an acceptable uniformity ratio. The maximum value should be one and one-half values

* This assumes a separate facility. Facilities adjacent to a vehicular roadway should use the levels for that roadway

Table 2.15.1

HIGHMAST LIGHTING-ROADWAYS			
ROADWAY CLASSIFICATIONS	ILLUMINATION LEVEL AVERAGE INITIAL (LUX)	UNIFORMITY RATIOS	
		AVG./MIN	MAX./MIN
INTERSTATE, EXPRESSWAY, FREEWAY & MAJOR ARTERIALS	9 to 11	3:1 Or Less	10:1 Or Less
ALL OTHER ROADWAYS	9 to 11	3:1 Or Less	10:1 Or Less

Table 2.15.2

2.15 Lighting Criteria

UNDERDECK LIGHTING- ROADWAYS		
LUMINAIRE TYPE	LIGHT SOURCE	MOUNTING LOCATION
PIER CAP	150 watt to 250 watt HPS	Pier or Pier Cap
PENDANT HUNG	150 watt to 250 watt HPS	Bridge Deck

Note: The light levels for underdeck lighting shall be equal to the adjacent roadway lighting.

Underdeck lighting is accomplished by mounting either pier cap or pendant hung fixtures under the bridge structure

Pier cap luminaires should be installed when bridge piers are located less than 4 6 meters from edg of travel lane

Pendant hung luminaires shall be mounted to the bottom of the bridge deck and should suspend where 50% of the lamp is below bridge beam

Table 2.15.3

REST AREA LIGHTING			
AREA ILLUMINATED	ILLUMINATION LEVEL AVERAGE INITIAL (LUX)	UNIFORMITY RATIOS	
		AVG./MIN	MAX./MIN
ENTRANCE & EXIT	16	4:1 Or Less	10:1 Or Less
INTERIOR ROADWAYS	16	4.1 Or Less	10 1 Or Less
PARKING AREAS	16	4 1 Or Less	10:1 Or Less

Table 2.15.4

MOUNTING HEIGHT RESTRICTIONS		
LUMINAIRE WATTAGE	LIGHT SOURCE	MOUNTING HEIGHT (MIN)
150	HIGH PRESSURE SODIUM (HPS)	7 5 METERS
200	HIGH PRESSURE SODIUM (HPS)	9 0 METERS
250	HIGH PRESSURE SODIUM (HPS)	9 0 METERS
400	HIGH PRESSURE SODIUM (HPS)	12 0 METERS
750	HIGH PRESSURE SODIUM (HPS)	15 0 METERS
1000	HIGH PRESSURE SODIUM (HPS)	24 0 METERS

Table 2 15.5

Chapter 3

Earthwork (Metric)

Chapter 3

EARTHWORK (METRIC)

3.1 General

Earthwork is a generic term for all items of work, materials and operations required to construct the excavated areas and the embankments of a highway project. Sections 120 and 125 of the Standard Specifications define the terms, method of measure, basis of payment and pay items associated with earthwork.

In general, earthwork on a highway project consists of :

(1) Classified excavation - Earthwork designated as Regular (Roadway and Borrow), Subsoil, Lateral Ditch and Channel Excavation

(2) Unclassified Excavation - Excavation, removal and disposal of material, for pipe culverts, bridge foundations, box culverts, storm sewers, inlets, manholes and similar structures where the materials are unclassified and considered as excavation regardless of the material encountered.

(3) Embankment - Compacted fill material needed to construct the roadway, excluding the base and pavement portions of the roadway and shoulders Embankment does not include compacted backfill to replace subsoil excavation.

(4) Subsoil earthwork - Excavation, removal and disposal of muck, clay, rock or any other material that is unsuitable in its original position and that is excavated below the bottom of the finished grading template, all suitable material excavated within the above limits in order to excavate the unsuitable material, and the backfill necessary to replace the excavated material

EARTHWORK

BASIC PROCESS

The most important operation involving earthwork is constructing the roadbed The roadbed is constructed by excavating soil from **CUT** sections -- and placing soil as embankments in **FILL** sections In cut sections, the roadbed is built below the natural ground -- the natural ground is excavated to the elevation of the proposed roadbed In fill sections, the roadbed is built above the natural ground -- the earth fill is on an embankment

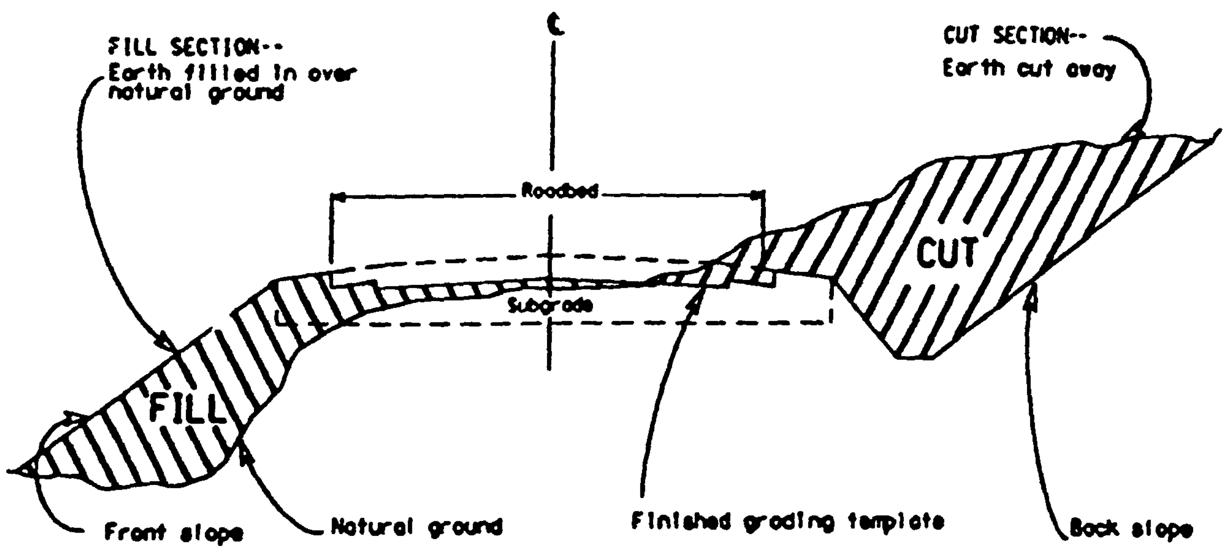


Exhibit 3-A

3.2 Classification of Soils

The Department uses a system of soil classification which places materials into groups and subgroups based on soil fracture, liquid limit and plasticity index. This classification determines if and where the materials may be placed or left in their original position on a highway project The designer cannot determine the proper removal and utilization of earthwork materials until the soils survey, testing and classification of materials has been performed by a qualified geotechnical laboratory. For more details, see the Volume II of the Plans Preparation Manual (English version) and Index 505, Roadway and Traffic Design Standards.

3.3 Removal and Utilization

Earthwork is a major cost component of highway construction. The accurate detailing, utilization and calculation of earthwork is a very important part of the design effort Earthwork is not a simple task, but with proper care and attention, very accurate quantities can be determined

3 3 1 Criteria for Earthwork Details

The details of removal and utilization of earthwork are shown on the roadway cross sections The cross sections of the existing surface are usually obtained by location field survey or photogrammetry The finished profile grades, typical section details, pavement design details, superelevation and horizontal alignments are used in combination to develop the finished roadway template at each location where an existing cross section was obtained Sometimes it is advisable to develop and plot intermediate cross sections or half-sections to accurately determine quantities

For resurfacing and minor widening and resurfacing projects, refer to Section 3 5 7 of this chapter

Additional criteria used for plotting the earthwork details are found in the Standard Specifications, Section 120, the Roadway and Traffic Design Standards, Indexes 500 and 505; and Volume II of the Plans Preparation Manual (English version)

3.3.2 Cross Sections - A Design Tool

Roadway cross-sections cannot be finalized until late in the design process. However, preliminary cross section templates, developed early in the design process, can assist the designer in establishing many of the other design elements such as guardrail, shoulder gutter, inlets and special ditch grades. Preliminary cross sections are also used in performing the Soils Survey. Cross section templates should be plotted as soon as the alignment, grades and typical section details are established.

The interval selected for showing cross sections in the plans will vary according to project specific factors For new construction and reconstruction the normal interval for cross sections is 50 meters for rural projects and 20 meters for urban projects. These intervals may also be appropriate on RRR projects depending on the variability of earthwork along the project. Other factors which may influence the frequency of cross sections include the presence of intersections, extent of driveway and turnout construction or reconstruction, ADA related work, drainage improvements, etc.

3.4 Earthwork Quantities

3.4.1 Method of Calculating

Earthwork quantities can be accurately determined by computer or by plan calculation, if proper care is taken. Therefore, the specifications allow it to be designated for payment as the original plan quantity unless determined to be substantially in error Earthwork quantities are calculated by the method of average end areas

$$CUBIC\ METERS = \frac{EA1 + EA2}{2} \times LENGTH$$

Each set of end areas for the different types of earthwork (cut, fill, subsoil, etc) are calculated separately and shown in the appropriate column on the cross section sheets, as indicated in Volume II of the Plans Preparation Manual (English version)

3.4.2 Suitable and Unsuitable Materials

Select material or suitable material and plastic, muck or unsuitable materials are calculated and tabulated separately Material is also summarized in pay item categories as Roadway Excavation, Subsoil Earthwork, and Embankment or Fill The designer must be familiar with the material classes, basis of payment and the specifications for earthwork operations in order to properly delineate and calculate earthwork quantities

TABULATION OF UNSUITABLE MATERIAL ON LEFT SIDE OF CROSS SECTION SHEETS

(1) A-7 MATERIAL A-8 MATERIAL A-2-5, A-2-7, A-5 MATERIAL					
(2) SUBSOIL EXC		(3) RDWY EXC		(4) FILL	
A	V	A	V	A	V

TABULATION OF SUITABLE MATERIAL ON RIGHT SIDE OF CROSS SECTION SHEETS

(5) A-2, A-3 MATERIAL					
(6) SUBSOIL EXC		(7) RDWY EXC		(8) FILL	
A	V	A	V	A	V

(1) UNSUITABLE MATERIAL on a project may consist of one or more of the classifications shown The tabulation should be "titled" with the actual classification for the given project as documented by the soil survey

(2) SUBSOIL EXCAVATION (UNSUITABLE) is material that does not meet the specification requirements in its original position so it must be excavated and backfilled with suitable material It must also be below the finished grading template to be subsoil excavation The Pay Item "Subsoil Earthwork" includes the backfill required to replace all subsoil excavation

(3) ROADWAY EXCAVATION (UNSUITABLE) is material that may be used in the earthwork only as stipulated in the standards and specifications, if allowed at all It will be removed by excavating to the lines and grades of the finished grading template It must be above the bottom of the finished grading template to be roadway excavation

(4) FILL (UNSUITABLE) is material that does not meet the requirements for suitable material but may be utilized in certain areas of the embankment as indicated in the Roadway and Traffic Design Standards, Index 505

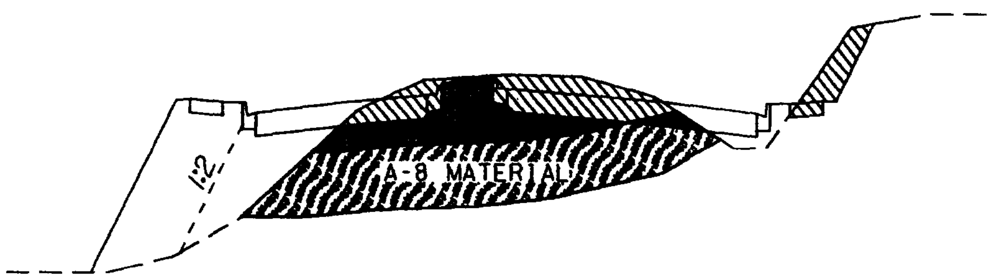
(5) SUITABLE MATERIAL consists of those classifications that have been determined to be acceptable for construction of the roadbed, shoulders and other embankments of the highway

(6) SUBSOIL EXCAVATION (SUITABLE) is material that would be acceptable in its original position, but it must be excavated below the finished grading template in order to remove material below it that is unsuitable in its original position (The Pay Item "Subsoil Earthwork" includes the backfill required to replace all subsoil excavation)

(7) ROADWAY EXCAVATION (SUITABLE) is the good or acceptable material removed by excavating to the bottom of the finished grading template

(8) FILL (SUITABLE) is the material utilized in the embankment in those areas calling for select material by the Standards and Specifications Fill material is placed above the natural ground surface up to the bottom of the finished grading template

SEE STANDARD INDEXES 500 AND 505



CUT
AREA BELOW NATURAL GROUND LINE AND ABOVE THE BOTTOM OF THE PROPOSED ROADWAY TEMPLATE

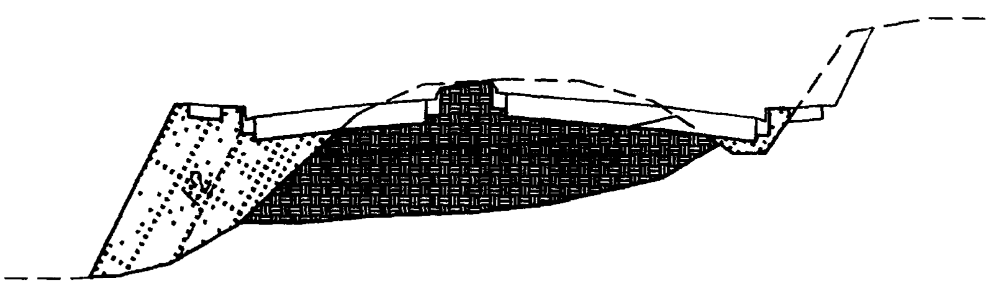
REGULAR EXCAVATION -- SUITABLE MATERIAL

REGULAR EXCAVATION -- UNSUITABLE MATERIAL

SUBSOIL EXCAVATION
ALL SUITABLE AND UNSUITABLE MATERIAL BELOW THE BOTTOM OF THE PROPOSED ROADWAY TEMPLATE AND ABOVE THE BOTTOM OF THE LAYER OF UNSUITABLE MATERIAL
THIS EXCAVATION IS PAID FOR AS SUBSOIL EARTHWORK

SUBSOIL EXCAVATION -- SUITABLE MATERIAL

SUBSOIL EXCAVATION -- UNSUITABLE MATERIAL



FILL
AREA BELOW THE BOTTOM OF THE PROPOSED ROADWAY TEMPLATE AND ABOVE THE BOTTOM LAYER OF UNSUITABLE MATERIAL

FILL - SUITABLE MATERIAL (PAID FOR AS EMBANKMENT)

FILL - SUITABLE MATERIAL (PAID FOR AS SUBSOIL EARTHWORK)

Exhibit 3-B

3.4.3 Earthwork Accuracy

There are two methods of documenting the earthwork quantities for projects The most accurate and preferred method involves the preparation of cross-sections to define the quantities of earthwork involved. This method is mandatory on all new construction and major reconstruction projects. The other method, using working typical sections, is only to be used on RRR type projects where it has been determined that the project is a candidate for payment by Regular Excavation, Lump Sum It is critical that the designer choose which method is best suited for their project with input from construction

The calculation of earthwork volumes is not simple but, when performed with care and properly checked, many of the inaccuracies common in earthwork quantity calculations can be avoided. The primary causes for inaccurate earthwork quantities are found to be errors in calculating end areas and choosing inappropriate intervals between the cross sections Correct methods and techniques for computing earthwork quantities will eliminate the gross errors

3.4 3 1 Projects with horizontal and vertical controlled cross sections

1. Calculate end areas and volumes by computer, when possible, and print the calculations for verification and future use by others

2 Plot cross section details at the largest scale the sheets will permit This is especially critical if plotting is done manually and the end areas are to be calculated from the plotted sections. Care should also be taken when plotting slopes that extend over long distances

3. If end areas are calculated from cross sections manually, show the breakdown of areas, etc on work sheets and include these as backup in the computation book

4 When computing volumes, determine lengths between sets of end areas to compensate for volumes that do not run the entire lengths between the normal station lengths.

5 Properly use match lines and turning lines to divide end areas when separate lengths should be used to calculate volumes

6 Reduce the interval between cross sections to 10 meters or less on ramps or sharp turning roadways, or determine and use the centroid of the section as the length for computing volumes

7 Proper use of cross section pattern sheets to determine where cross sections should be taken, will help yield more accurate volumes

8. Exclude bridge spans, large culverts or other exceptions where earthwork is not required

9 Include quantities for fill slopes under bridges, at guardrail installations and at culvert extensions. Show extended shoulder slope on cross sections at guardrail locations (not steeper than 1 to 10 per Roadway and Traffic Design Standards, Index 400).

10 Make sure that backfill for all subsoil excavation is included in the subsoil earthwork item and **not** added to the fill quantities

11. Separate all Suitable and Unsuitable Subsoil Excavation Calculate Roadway Excavation as Suitable and Unsuitable quantities Show these end areas and tabulations on the work sheets so they can be verified and used by others Make sure these quantities are tabulated in the proper columns on the cross section sheets.

3.4.3.2 Projects without horizontal and vertical controlled cross sections

1. Include working typical cross sections in the computation book at all locations where there is a change in either the existing or proposed templates

2. Working typicals should include the station limits of the typical, and the end areas of all cut and fill sections. Working typicals may be placed in the plans, but are not required.

3. The thickness of the base box shall be calculated on the most probable base option. A plan note should also be shown in the plans stating which option was used for calculating the earthwork quantities.

4. Extra fill material needed for the extended shoulder for guardrail placement should be documented in the computation book with the final quantity being tabulated on the summary of earthwork The quantity should be based on working typical sections showing the extended shoulder slope on cross sections at guardrail locations (not steeper than 1 to 10 per Roadway and Traffic Design Standards, Index 400)

3 4.4 Variation in Quantities

When detailing and determining earthwork quantities, the designer should use the most probable base option within the optional base group, as identified in the pavement design and indicated on the typical section A plan note should also be shown in the plans stating which option was used for plotting the cross sections and calculating the earthwork quantities. The Specifications do not allow adjustment of the earthwork quantities that were designated to be paid as plan quantity because a base of different depth was chosen during construction

3.4.5 Sequence of Construction

The designer must be aware of the Traffic Control Plan and, to some extent, the most likely sequence of construction for the project when figuring earthwork utilization. If the contractor cannot excavate material because of a detour or other TCP requirements, different provisions may need to be made in the earthwork items for the project

EXAMPLE A project has balanced earthwork quantities, i e , embankment is balanced by sufficient excavation to offset it The embankment is required in Phase I of the construction During this Phase, the area where the excavation is to be obtained is still under traffic and can NOT be excavated. Unless this is realized and taken care of by design, a Supplemental Agreement will most likely be required to establish a pay item for the materials and work. It could even result in the contractor filing a claim for delay of the work

SOLUTION The designer should change the TCP and construction sequence to ensure that the material in the excavation area is available when it is needed, if possible Or, if the project is not a balanced job and already has Borrow set up as a pay item, make sure the quantity includes a sufficient amount to cover the embankment in Phase I The

Excavation could then be used to reduce Borrow later in the project, when it is free of traffic and could be excavated. Or, it may be necessary to set up an item for Borrow and then pay for the excavation as Regular Excavation and waste it

3.4.6 Earthwork by Computer

The Department has several options for computing earthwork quantities by computer, In detailing the cross sections on the CADD or other automated system, the requirements and techniques noted above are just as applicable and necessary for accuracy.

3.5 Earthwork Items of Payment

3.5 1 Regular Excavation

This is the most general classification of earthwork excavation When Lateral Ditch or other excavation pay items are not called for in the plans, the total quantity of all excavation shall be paid for as regular excavation Roadway Excavation consists of the net volume of material excavated between the original ground surface and the bottom of the proposed roadway template

Retention or detention areas that require considerable excavation should be summarized separately and added into the Regular Excavation This is especially important if there is a large quantity and the area is removed from the project by some distance

Projects where the predominate earthwork item is roadway excavation should designate Regular Excavation as the pay item, then the embankment would not be paid for as a separate item, as a general rule

3 5 2 Borrow Excavation

Borrow Excavation is the pay item used to indicate that the contractor is to furnish earthwork material from areas provided by him and generally outside the project limits, including material with a specific minimum bearing value for building up existing shoulders, when appropriate for the project.

Borrow material, if available, may be obtained from within the right of way of the project, including those projects where the material is to be paid for under the embankment pay item Each project must be analyzed to determine if this option is feasible FHWA concurrence is required on federal-aid projects prior to utilization of the right of way as a source of borrow.

Obtaining material from the project right of way shall not create an unsafe condition or unprotected hazard. Proper design criteria shall be applied to proposed excavated areas which will fill with water.

The proposed borrow areas shall be reviewed and coordinated with the District Environmental Coordinator to minimize environmental disturbance and promote a future natural appearance.

The designer has two options for designating the method of payment for borrow material on highway projects. With either option, a fill adjustment must be made to the net total fill material calculated from the plans, to allow for handling Recommendations on fill adjustment percentages should always be obtained from the District Materials and Construction Offices during the design process Because the final measurement procedures are very labor intense, the designer should always check with construction before setting up a project for Borrow Excavation (Pit Measure)

1. Borrow Excavation (Pit Measure) - When the designer, with input and recommendations from construction, determines that the borrow material shall be measured by pit measure, the Earthwork Summary should show the adjusted quantity of borrow material estimated to be required

<u>EXAMPLE</u>:	Fill (From Cross Section Totals)	253 m^3
	Fill Adjustment (+35%) (253 x 0 35)	<u>89 m^3</u>
	Total fill	342 m^3
	Roadway Excavation (Select) Deducted	<u>115 m^3</u>
	Borrow Excavation (Pay Item Total)	227 m^3

2 Borrow Excavation (Truck Measure) - The designer's second option for designating how borrow material shall be bid and paid on projects is truck measure. Truck measure should be specified only for projects which require small amounts of borrow material Typical types of projects are small resurfacing projects, widening and safety projects When this option is designated, an <u>additional adjustment</u> (truck) is added to obtain a representative volume of material required. This is not a plan quantity item, but it is very important that the most realistic determination of quantities possible be calculated by the designer

<u>EXAMPLE</u>.	Borrow Excavation (As Above)	227 m^3
	Truck Adjustment (+25%) (227 x 0 25)	<u>57 m^3</u>
	Borrow Excavation (Pay Item)	284 m^3

On some projects it is desirable that construction have the flexibility to pay for the item of borrow by pit measure, but determine the volume by loose truck measure When this method of measurement is requested by construction, it will be necessary for the designer to calculate a percentage by which the truck measured quantity will be adjusted to determine the pit measured volume This percentage compensates for the truck adjustment and converts the quantity back to its in-place volume A pay item note similar to the following should be shown in the plans

At the contractor's option, and with the approval of the engineer, measurement of borrow material may be based on loose truck volumes In this case, payment will be made on ____% of the truck measured quantity

The percentage for the above note is calculated as follows.

<u>EXAMPLE</u>:	Borrow Excavation	227 m^3
	Truck Adjustment (+25%)	<u>57 m^3</u>
	Total Borrow	284 m^3

Percentage (%) is obtained from: $227\ m^3 - 284\ m^3 = 80\%$

3.5.3 <u>Lateral Ditch Excavation</u>

Excavation required to construct inlet and outlet ditches at structures, changes in channels of streams and ditches parallel to the right of way, but separated from the roadway template, may be designated by the designer as Lateral Ditch Excavation

On projects with very little of this type of excavation, this earthwork is usually included in the Regular or roadway Excavation If there is a significant amount of Lateral Ditch Excavation, it should be detailed, calculated and summarized on separate cross section sheets and shown separately in the Earthwork Summary. For more details on lateral ditch cross sections, see the Plans Preparation Manual, Volume II (English version).

Excavation included for payment or that will be bid as work under Section 125 (Excavation for Structures) must not be included again in Lateral Ditch or other Excavation pay items.

3.5.4 Subsoil Earthwork

Subsoil excavation, consists of the excavation and disposal of muck, clay, rock or any other material that is unsuitable in its original position and that is excavated below the bottom of the finished grading template or natural ground, whichever is lower. Subsoil Excavation also includes all suitable material (usually above the unsuitable material, i.e., overburden) excavated within the above limits in order to excavate the unsuitable material. The pay item "Subsoil Earthwork" includes all subsoil excavation and the backfill necessary to replace the excavated material.

The soils investigation survey must document the limits of any unsuitable material found on the project. Likewise, the cross sections and the earthwork calculations must use these limits in determining the quantities for Subsoil Earthwork.

Unsuitable subsoil areas and volumes shall be tabulated on the left side of the cross section sheets, and areas and volumes for the suitable subsoil excavation shall be tabulated on the right side of the cross section sheets. The fill quantities (areas and volumes) on the right shall **not** include areas and volumes required to backfill the excavated areas created by subsoil removal. See example given in Section 3.4.2 of this chapter.

The payment for Subsoil Earthwork should NEVER be included in the pay quantities for other items no matter how small the subsoil quantities. The Borrow Excavation pay items should not be used on the same project where the Subsoil Earthwork pay item is used Construction field personnel would not be able to determine if a truck filled with suitable material was intended for the replacement of subsoil excavation or for borrow material needed on the project The pay item for the predominant earthwork operation Embankment (fill) or Regular Excavation (cut) should be used in conjunction with the pay item Subsoil Earthwork Both Embankment and Regular Excavation quantities are based on line and grades shown in the plans and would allow construction personnel to field verify the quantities of material used on a project

3.5.5 Channel Excavation

The pay item for Channel Excavation consists of the excavation and satisfactory disposal of all material from the limits of the channel as shown in the plans. This work is generally called for by the plans and has lines, grades, typical sections and other details shown for excavating a channel change or a major modification to an existing channel or stream. This work may be significantly different from regular excavation or lateral ditch excavation, requiring draglines, barges or other special equipment. It should be detailed, calculated and summarized separately, in most cases.

3.5.6 Embankment

This item includes placing material above the original ground line and within the lines and grades indicated by the plans.

When the work of constructing the embankment is shown to be paid for as Embankment, such price and payment shall be full pay for all the earthwork specified in Section 120, including all excavating, dredging, pumping, placing, compacting, dressing, and protection of the completed earthwork. So, when Embankment (pay item) is used, no other earthwork items are generally required. Subsoil, however, will always be paid for as a separate item. Also, if there are large amounts of lateral ditch or channel excavation, these should be specified to be paid for as separate items of work.

The decision to use Embankment or Borrow Excavation as items of payment should be made with recommendation from the responsible District Construction Office. This decision will have an impact on the manpower required to control the work and document the final estimate records.

Generally, Embankment should be used as the pay item when the project is predominately a fill earthwork project. Most new construction and major reconstruction projects should be considered for payment under this earthwork item. The Summary of Earthwork quantities will show the net fill quantity, with no shrinkage applied.

Only when the project has very little embankment or when construction specifically requests it, should the borrow excavation pay item be used. (See borrow excavation, Section 3.5.2.)

SUMMARY OF EARTHWORK (CUBIC METERS)		
ROADWAY EXCAVATION, A-2, A-3 MATERIAL	=	10 000
ROADWAY EXCAVATION, A-7 MATERIAL	=	800
ROADWAY EXCAVATION, A-8 MATERIAL	=	1 005
EXCAVATION FROM LATERAL DITCHES	=	5 000
TOTAL ROADWAY EXCAVATION (ROADWAY AND DITCH)	=	16 805
EMBANKMENT	=	27 000
SUBSOIL EXCAVATION, A-2, A-3 MATERIAL	=	980
SUBSOIL EXCAVATION, A-7 MATERIAL	=	1 400
SUBSOIL EXCAVATION, A-8 MATERIAL	=	800
TOTAL SUBSOIL EXCAVATION	=	3 180

3.5.7 Regular Excavation - Lump Sum (RRR Projects only)

The Pay Item for Regular Excavation - Lump Sum (RRR Projects only) is to be used only on resurfacing or minor widening and resurfacing projects which conform to the same guidelines given in the Plans Preparation Manual, Volume II, Chapter 1, Section 1.5.

Earthwork will be paid for as Borrow Excavation (Truck Measure) and Regular Excavation - Lump Sum (RRR Projects only). The designer will calculate these quantities based on information obtained from the field and the proposed typical section. The designer must conduct a through field review to ensure existing field conditions are accurately reflected in earthwork estimates.

The designer will continue to show the Summary of Earthwork in the plans The summary should show all quantities and adjustments.

SUMMARY OF EARTHWORK (CUBIC METERS)		
FILL	=	253
GUARDRAIL LOCATIONS	=	70
CROSS DRAINS	=	100
		423
FILL ADJUSTMENT (35%) (423 x 0 35)	=	148
TOTAL FILL	=	571
REGULAR EXCAVATION	=	-215
BORROW EXCAVATION	=	356
TRUCK ADJUSTMENT (25%) (356 x 0 25)	=	89
TOTAL BORROW EXCAVATION	=	445

The pay items used will be : Regular Excavation - Lump Sum

Borrow Excavation (Truck Measure) 445 M3

3.6 Summary

Regardless of the decisions made about establishing the items of pay for the earthwork on a project, it is imperative that the designer

1. Obtain good soil survey data, especially the limits of unsuitable material within the project limits

2. Accurately detail the earthwork on cross sections

3 Determine the areas and volumes of the different earthwork items (Roadway, Subsoil, Lateral Ditch, & Channel Excavation) and embankment very accurately

4. Show on the Summary of Earthwork all the different types of earthwork operations the contractor must consider.

5. Use plan notes and pay item notes to explain any unusual conditions or treatments which are not apparent, not to repeat or modify Specifications

6. Make a decision on how to pay for earthwork items with the input and recommendations of the district construction office

Chapter 4

Roadside Safety (Metric)

Chapter 4

ROADSIDE SAFETY (METRIC)

4.1 Clear Zone

4.1.1 Clear Zone Concept

A significant number of accidents involve a single vehicle leaving the roadway and either overturning or colliding with a fixed object. A roadside that is traversable and unobstructed by fixed objects will allow vehicles that leave the roadway to recover safely The designer should provide as much traversable and unobstructed area (clear zone) as practical.

Roadsides are considered traversable if a vehicle can traverse them without seriously endangering the occupants. Roadsides are considered recoverable if there is a reasonable probability of regaining control of a vehicle or bringing it to a safe stop.

If natural or man-made hazards, including slopes steeper than 1 3, occur within the clear zone, the designer should attempt the following treatments, in order of priority:

1. Eliminate the hazard.
   - A. Remove the hazard
   - B. Relocate the hazard outside the clear zone
   - C. Make the hazard traversable or crashworthy

2. Shield the hazard with a longitudinal barrier or crash cushion. This treatment should only be taken if the barrier or crash cushion presents a lesser hazard.

3. Leave the hazard unshielded. This treatment should be taken only if a barrier or crash cushion is more hazardous than the hazard, if the likelihood of striking the hazard is very small or if the expense of treatment outweighs the benefits in terms of accident reduction

If accident data or safety reports indicate that early treatment of the hazards will result in fewer or less severe accidents, designers should consider directing that those treatments be accomplished as the first order of work, if feasible and practical

4 1 2 Clear Zone Criteria

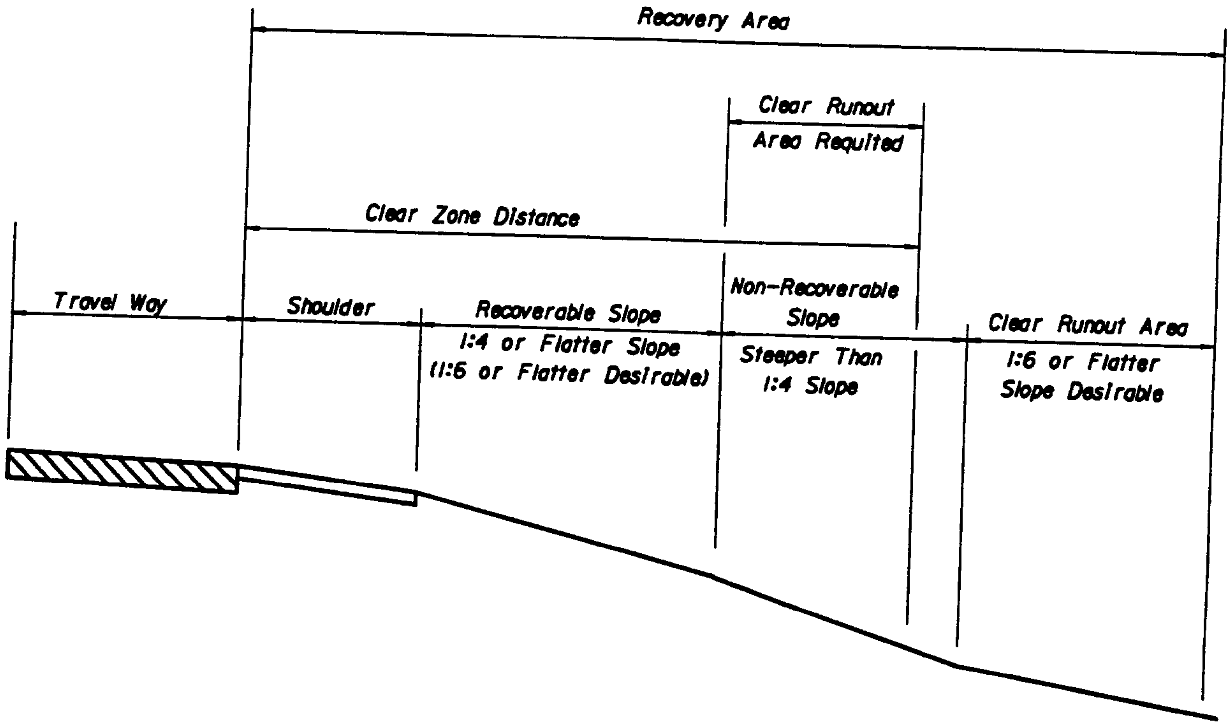
Criteria have been developed with the objective of providing the necessary recovery area for the vehicles that might leave the roadway. The criteria are based on limited empirical data which was then extrapolated for a wide range of conditions The criteria represent a reasonable degree of roadside safety, but they are neither absolute nor precise These criteria must be applied with judgement. In some cases, the clear zone can be adjusted higher or lower than shown. In all cases, the most clear zone that can be practically provided is desirable.

Chapter 2 includes criteria for clear zones, as well as other design criteria related to highway safety for new construction or reconstruction projects

If a non-recoverable slope encroaches the clear zone, then a clear runout area should be provided beyond the toe of slope equal to the width of the encroachment A minimum of 3 0 meters of clear runout area beyond the toe of slope should be provided

Chapter 25 provides clear zone criteria for RRR type projects

Recovery Area And Clear Zone Distance



Note: These slope values are for nomenclature only.
See Chapter 2, Table 2.4.1 for new construction slope criteria.
See Chapter 25 for RRR slope criteria.

Example of a Parallel Embankment Slope Design. This figure illustrates a recoverable slope followed by a non-recoverable slope. Since the clear zone distance extends onto a non-recoverable slope, the portion of the clear zone distance on such a slope may be provided beyond the non-recoverable slope if practical. This clear runout area would then be included in the total recovery area. The clear runout may be reduced in width based on existing conditions or site investigations. Such a variable sloped typical section is often used as a compromise between roadside safety and economics. By Providing a relatively flat recovery area immediately adjacent to the roadway most errant motorists can recover before reaching the steeper slope beyond.

Exhibit 4-A

4.2 Canal Hazard Standards

Canals are defined as an open ditch parallel to the roadway for a minimum distance of 300 meters and with a seasonal water depth in excess of one meter for extended periods of time (24 hours or more).

The distance from the outside edge of the through travel lane to the top of the canal side slope nearest the road will be no less than 18 meters for highways with design speeds of 80 km/h or greater. For highways with design speeds less than 80 km/h this minimum distance may be reduced to 15 meters for rural highways or 12 meters for urban (curb and gutter) highways. When new canal or roadway alignment is required, distances greater than these above should be provided, if possible, to accommodate possible future improvements to the roadway (widening, etc.).

On fill sections, a flat berm (maximum 1:10 slope) of width no less than 6 meters will be provided between the toe of the roadway front slope and the top of the canal side slope nearest the roadway. This minimum berm width applies to all types of highways, both rural and urban (curb and gutter) construction. (See Exhibit 4-B)

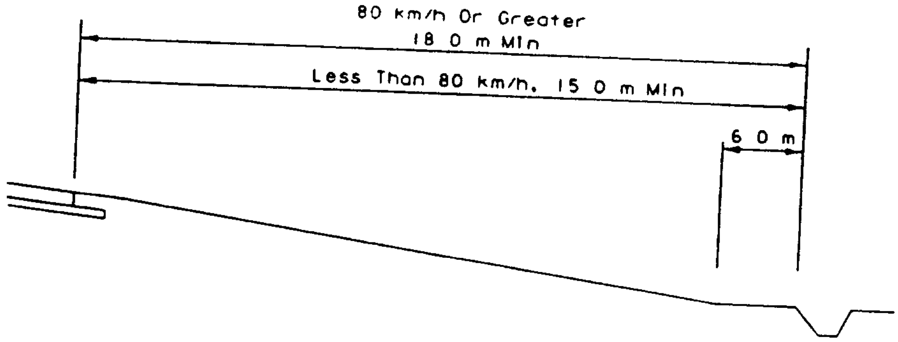
When the slope between the roadway and the "extended period of time" water surface is 1:6 or flatter, the minimum distance can be measured from the edge of the through lane to the "extended period of time" water surface and a berm is not required.

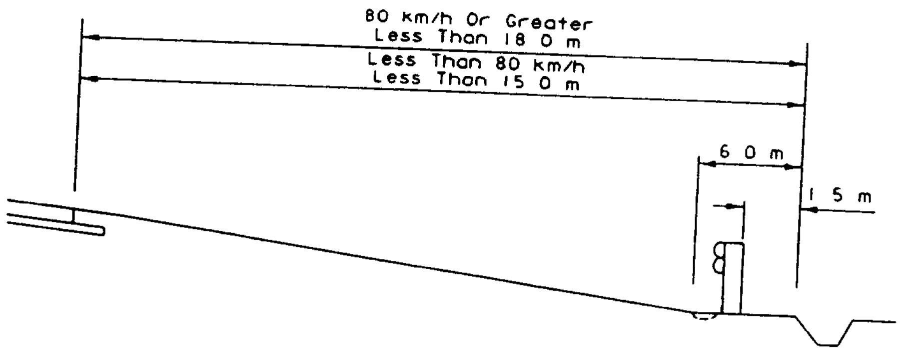
In sections with ditch cuts 6 meters will be provided between the toe of the front slope and the top of the canal.

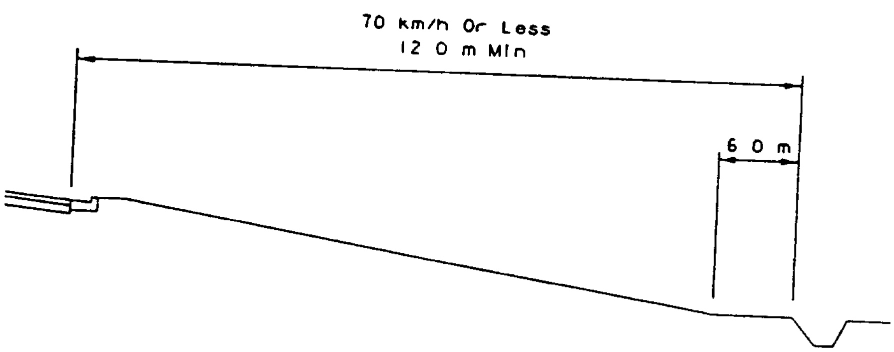
Guardrail, or other protective devices shall be installed 1.5 meters from the canal front slope where it is not possible to meet the above minimum criteria. The design is complicated when clear zone and slope criteria are combined with canal hazard criteria. Extreme caution must be taken to ensure that all criteria are met.

If the minimum standards for canal hazards cannot be met, then the standard guardrail treatments as provided in the Roadway and Traffic Design Standards should be used

MINIMUM STANDARDS FOR CANAL HAZARDS







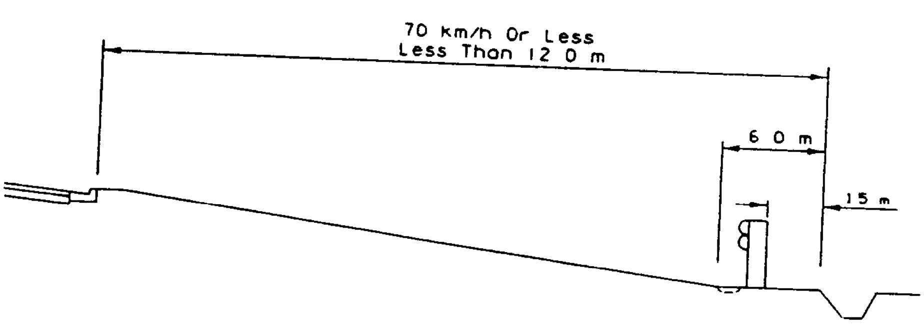


Exhibit 4-B

4.3 Roadside Barriers

4.3.1 Warrants

Roadside barriers are warranted when hazards exist within the clear zone, cannot be cost effectively eliminated or corrected and collisions with the hazards will be more serious than collisions with the barriers.

The length of advancement and length of need necessary to properly shield the hazard must be determined on an installation by installation basis as indicated in the Roadway and Traffic Design Standards.

The following conditions within the clear zone are normally considered more hazardous than a roadside barrier:

- Fill slopes steeper than 1:3.
- Bridge piers, abutments and railing ends.
- Large, non-traversable culverts, pipes and headwalls
- Non-traversable parallel or perpendicular ditches and canals
- Bodies of water other than parallel ditches and canals that the engineer determines to be hazardous.
- Parallel retaining walls with protrusions or other potential snagging features.
- Retaining walls at an approach angle with the edge of pavement larger than 7 degrees (1:8).
- Non-breakaway sign or luminaire supports.
- Trees greater than 100 mm in diameter measured 150 mm above the ground at maturity. (See Roadway and Traffic Design Standards, Index 546.)
- Utility poles.
- Rigid protrusions above the ground in excess of 100 mm in height.

In addition to the above hazards, there may be other situations that warrant barrier consideration, such as nearby pedestrian or bicycle facilities, schools, residents or businesses.

4.3.2 Barrier Selection

Acceptable standard roadside barriers are detailed in the Roadway and Traffic Design Standards. They include:

- Standard blocked-out W-beam on wood post (strong post).
- Standard blocked-out W-beam on "C" steel post (strong post).
- Standard blocked-out W-beam on wide flange steel post (strong post)
- Blocked-out Thrie-Beam on any of the above post systems.
- Standard concrete barrier wall.

Most guardrail installations will be blocked-out W-beam on wood or steel posts. The Thrie-Beam guardrail should be considered when additional rail depth is needed because of a potential to under-ride the rail or because additional height may be needed. A special design detail shall be approved by the State Roadway Design Engineer prior to inclusion of Thrie-Beam in the plans. Concrete barrier wall may be used in locations where no barrier deflection can be tolerated. Other barrier designs may be required by specific site conditions. These must be called for and detailed on a project by project basis.

4.3.3 End Treatments

Non-crashworthy longitudinal barrier ends can present serious hazards if they terminate within the clear zone. The F.D.O.T.'s crashworthy end treatments and application criteria are detailed in the Roadway and Traffic Design Standards. Other end treatments may be required under special circumstances. Special details will be required in the plans, when this is the case.

- It is very important that the flare with offset be provided exactly as shown in the Roadway and Traffic Design Standards. The end offset should be measured off a projection of the face of guardrail alignment immediately downstream. If the guardrail alignment is on a flare off the roadway or curve, the terminal flare is an additional flare. The maximum allowable cross slope in front of the rail is 1:10, including the area in front of and the upstream approach to the end anchorage assembly.
- Non-crashworthy end treatments will be used outside the clear zone, and at downstream terminations which are outside the clear zone of the opposing traffic flow. The Type II end anchorage is non-crashworthy and, therefore, may NOT be used as an approach terminal end treatment unless other end sheilding is provided.
- Thrie-beam and concrete barrier wall will be terminated as shown in the Roadway and Traffic Design Standards.

4.3 4 Transitions

Whenever standard W-beam or Thrie-beam guardrail transitions into bridge rail or concrete barrier wall, a transition section is necessary. Transitions for W-beam guardrail must include sound structural connections, nested beams and additional posts for increased stiffness; as shown in the Roadway and Traffic Design Standards. Transitions for Thrie beams must be included in the plans Standard flares should be introduced upstream of the transition section. Care must be taken in the details of the junction of the two barrier types to avoid snag points.

4.3.5 Placement

The primary design factors associated with guardrail placement are:

- o Lateral offset from the edge of pavement
- o Terrain effects
- o Flare rate
- o Length of advancement
- o Length of need

The standard offset is the shoulder width plus 0.6 m, not to exceed 3.6 m. Alternate guardrail offset locations are shown in the Roadway and Traffic Design Standards

A 0.6 m distance from the back of the barrier posts to the shoulder line or slope break is desirable for post support.

The length of advancement is dependent on the design speed, the offset distance to the face of guardrail and the lesser distance (a) to the back of the hazard or (b) to the clear zone needed. The designer must establish this advancement need for all installations on the project. On all facilities the guardrail needs must consider traffic from both directions.

A barrier should not be located so close to the hazard that it is shielding that it is within the dynamic deflection distance of the barrier. The dynamic deflection of standard barriers are shown in Table 4.3-1.

Table 4.3-1

Minimum Offset of Barriers

(Measured from the face of the barrier)

Barrier Type	Offset (m)
W-beam, Strong Post	1 2
Thrie-Beam, Strong Post	0 6
Barrier Wall	0
Double Wbeams (Nested) w/ strong Post spacing @ 0.476 m	0 15

Curbs shall not be placed in the front of barriers When guardrail is necessary, the guardrail shall be located at the face of the curb or in front of it

Barriers should not be placed on slopes steeper than 1.10 This is particularly important on the approach to the standard flare of the End Anchorage Type IV

4.3 6 Resetting Guardrail

For those projects that include the resetting of guardrail, refer to the Standard Specifications, the Basis of Estimate and the Roadway and Traffic Design Standards for pay items, notes and quantity calculations

4.4 Median Barriers

4 4 1 Warrants

A median barrier shall be provided on Interstate and expressway facilities where reconstruction reduces the median width to less than the standard for the facility No variances or exceptions to this criteria will be approved

4 4 2 Selection

The same barrier types as discussed in Section 4 3 2 are available as median barriers In general, the concrete barrier wall is preferable in narrow medians

4 4 3 End Treatments

Median barriers can be terminated with any of the treatments discussed in 4 3 3

4.5 Crash Cushions

Crash cushions are attenuating devices that may be non-redirective or redirective.

4.5.1 Warrants

Hazards within the clear zone which present a more serious collision potential than a crash cushion, are warrants for the installation of a crash cushion.

4.5.2 Selection

The following types of crash cushions are currently standardized for use:

- Hex-Foam Sandwich System
- Guardrail Energy Absorbing Terminal (G-R-E-A-T)
- Crash Attenuating Terminal (CAT)
- Brakemaster
- Inertial Impact Attenuators (Sand Barrels)
- Work Zone Attenuator (G-R-E-A-T-cz)
- Vehicle Arresting Barrier (DRAGNET)
- React 350

The Roadway and Traffic Design Standards and manufacturer's publications provide detailed information about these systems. Each system has its own unique physical and functional characteristics. The designer shall indicate in the plans the system to be used at each location. The design engineer shall consider the following factors when selecting a system for a particular location:

- Site characteristics
- Structural and safety characteristics of candidate systems
- Initial and replacement/repair costs
- Expected frequency of collisions
- Maintenance characteristics

Site characteristics and economics dictate the crash cushion selection. Sand barrels are relatively low in initial cost, but usually must be completely replaced when struck, so are more appropriate in locations with a low likelihood of collision. The other systems have higher initial costs but can be repaired after collisions relatively cheaply, so are more appropriate where frequent collisions are expected. The ability of maintenance forces to perform routine maintenance and to place a crashed system back into service quickly should be a major consideration. Crash cushions that require stocking unusual and expensive parts or that are complex to replace should not be selected.

4.5.3 Design

Crash cushion suppliers normally provide design assistance for their system. These systems must decelerate both large and small automobiles from the established design speed of the facility to a gradual stop. If the AASHTO Roadside Design Guide charts are used, the maximum average deceleration level should not exceed approximately 7 g's.

All terrain within the likely approach of a vehicle should be relatively flat. An impacting vehicle should strike the unit at normal height, with the vehicle's suspension system neither collapsed nor extended. Curbs exceeding 100 mm in height shall not be used in the approach area of a crash cushion.

Sand barrels do not have redirection capability. They may be used for temporary barrier wall end shielding in accordance with Standard Index 415. For shielding on other temporary and all permanent installations, they must be custom engineered for each independent installation and detailed in the plans.

Care must be taken that the design of a crash cushion system does not create a hazard to opposing traffic.

The nose of all crash cushions shall be delineated with reflective material or standard object markers, as indicated in the Roadway and Traffic Design Standards.

4.6 Roadside Appurtenances

4.6.1 Sign Supports

All sign supports, except overhead cantilever, truss type or bridge or barrier wall mounted, shall be either breakaway or frangible as defined in the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals and the AASHTO Roadside Design Guide. Sign supports shall be of an acceptable and crashworthy design as described in the Roadway and Traffic Design Standards. Supports not meeting the frangibility or breakaway criteria should not be installed within the clear zone. Sign supports not meeting these requirements which must be installed within the clear zone shall be protected by a barrier or crash cushion.

4.6.2 Mailbox Supports

Mailbox supports shall be of an acceptable crashworthy design, as described in Roadway and Traffic Design Standards.

4.6.3 Other Appurtenances

The Roadway and Traffic Design Standards contain design criteria for numerous other roadside appurtenances.

4.6.4 Location Criteria

Most breakaway mechanisms are designed to be impacted at bumper height, typically about 500 mm above the ground. If impacted at a significantly higher point, the bending moment in the breakaway base may be sufficient to bind the mechanism, resulting in non-activation of the breakaway device. For this reason, it is important that breakaway supports not be located in ditches or on steep slopes where a vehicle is likely to be partially airborne at the time of impact.

4.6.5 Bus Benches and Transit Shelters

These features are discussed in Section III of the Florida Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways (Green Book).

Chapter 5

Utilities

Chapter 5

UTILITIES

5.1 General

The Department has the responsibility to maintain state highways as necessary to preserve the integrity, operational safety and function of the highway facility. Since the manner in which utilities cross or otherwise occupy highway right of way can materially affect the safe operation, maintenance and appearance of the highway, it is necessary that such use of the right-of-way be authorized and reasonably regulated. By Florida Statutes, utilities, whether public or privately owned, aerial or underground are permitted by the Department to be accommodated within the right-of-way on the State Highway System. For limited access highways, parallel utilities within the right-of-way are not allowed except for utilities serving facilities required for operating the transportation system. Lateral crossings are allowed by permit only (see Utilities Topic # 710-020-001, Utility Accommodation Manual).

The designer should make every effort to design a project that will accommodate all existing utilities and new utilities to be constructed concurrently with the project. The selection of typical section features, horizontal alignment and location of storm sewer lines are areas that can sometimes be varied without violating safety standards and design criteria. Design features which reduce or avoid utility conflicts may involve increased cost; however, those costs may be offset by savings in construction time and the total associated cost savings for the FDOT project and the utilities.

5.2 Utility Accommodation Manual

Utility owners are required to obtain utility permits for the installation and maintenance of utility facilities within the right-of-way of any State Highway System. These permits will be issued and approved by FDOT in conformity with the Utility Accommodation Manual. This includes utility work required by FDOT projects. The designer may be involved in the coordination of this process.

The Department's Utility Accommodation Manual is established to regulate the location, manner, installation and adjustment of utility facilities along, across, under or on right-of-way under the jurisdiction of the FDOT. This manual also establishes the process for issuing permits for such work which is in the interest of safety, protection, utilization and future development of the highways with due consideration given to public service afforded by adequate and economical utility installations as authorized under Section 337.403, Florida Statutes and Florida Administrative Code Rule 14-46.001. Adherence shall be required under the circumstances set forth in the Utility Accommodation Manual.

Additional guidance for accommodating utilities within the highway rights-of-way are given in the AASHTO publications A Guide for Accommodating Utilities within Highway Right-of-Way and A Policy on Geometric Design of Highways and Streets and in the TRB publication Policies for Accommodation of Utilities on Highway Rights-of-Way.

5.3 Location of Existing Utilities

Determining the location of existing utilities on State highway right-of-way is a cooperative effort between the FDOT and the utility owners. The degree of effort on the part of the FDOT and the utility owner will vary with the type of project, the utility, and availability of existing location information. As a minimum the location of existing major utilities is required on new construction, reconstruction, and add lane projects.

Major existing utilities are those principal underground and aerial utilities that potentially conflict with construction activities and scheduling. The presence of major utilities shall be determined on each project by the utility owner. Service connections and laterals are not normally considered major utilities.

It is the responsibility of the design engineer with the assistance of the District Utility Engineer and construction personnel to determine the locations and levels of locate where utility information is needed. Levels of locates are defined in section 5.3.1. It is the responsibility of the utility owner to provide up through a Level "B" locate on request. In some instances the utility owner can provide Level "A" locate information. If Level "A" locate information is necessary and cannot be provided by the utility owner, the measurement and documentation for the level "A" locate will be obtained by the FDOT, consultants, or others by established agreement.

Existing major underground utilities which are suspected to be located within one meter of proposed construction operations which would threaten the utility should be considered for Level "A" locate information. The decision to allow utilities to remain within one meter of new construction operations should be made by the Design Engineer in consultation with the District Utility Engineer and appropriate construction personnel.

5.3.1 Levels of Utility Locates

The following identifies the level of utility locates in ascending order:

Level "D" - Existing Records

Level "C" - Surface Visible Feature Survey

Level "B" - Designating

Level "A" - Locating

Level "D" locates - Information obtained solely from a review of utility records. The comprehensiveness and accuracy of such information is highly limited. Even when existing information for a utility in a particular area is accurate, there are often other underground systems that are not shown on any records. Level "D" may be appropriately used early in the development of a project to determine the presence of utilities.

Level "C" locates - Information obtained to augment Level "D" information. This involves topographic surveying of visible, above-ground utility features -- poles, hydrants, valve boxes, circuit breakers, etc. -- and entering the topographic data into the CADD system. Level "C" may be appropriately used early in the development of a project and will provide better data than Level "D" information alone. Designers must be very cautious when working on projects using information for underground utilities that is based only on Levels "D" and "C" locates.

Level "B" locates - Information obtained through the use of designating technologies (e.g. geophysical prospecting technologies). This is an application using scanning technologies, most of which have very specific capabilities. Applying a variety of techniques is essential to the process of preparing a comprehensive *horizontal* map of utilities and other underground structures on the site. Designating technologies are capable of providing good horizontal information but provide limited vertical information.

Level "A" locates - Provide the highest level of accuracy of utility locations in three dimensions. This level may apply manual, mechanical or nondestructive (e.g., vacuum excavation) methods to physically expose utilities for measurement and data recording. Levels "B", "C", and "D" locates are incorporated in Level "A" locates. The designer should obtain Level "A" locates at highway/utility conflict points where verified information is necessary.

5.4 Subsurface Utility Engineering

Subsurface utility engineering (SUE) is an established engineering technology that can provide horizontal and vertical locations of underground utilities to produce an accurate picture of underground infrastructure. The techniques of SUE may be appropriate for certain FDOT projects where Levels "A" and "B" locates are determined to be essential.

5.5 Coordination Process

Coordination between the Department and the utility owners is to be accomplished through the District Utility Engineer during the initial and final engineering design processes. Refer to Chapters 13 through 16 of this manual for the design and review processes.

Chapter 6

RAILROAD CROSSING (METRIC)

Chapter 6

RAILROAD CROSSING (METRIC)

6.1 General

A railroad-highway crossing, like any highway-highway intersection, involves either a separation of grades or a crossing at grade The geometrics of a highway and structure that entails the overcrossing or undercrossing of a railroad are substantially the same as those for a highway grade separation without ramps

Selection of the warning devices to be used is a function of the geometrics of railroad-highway grade crossing, including the alignment, profile, sight distance and cross section of both the roadway and the railroad Railroad grade crossing angles should be as near 90 degrees as practical

Design Criteria and Standards are given in the Florida Green Book and the Department's Railroad Procedures Manual Volume III Design considerations are discussed in Chapter IX of the AASHTO policy on Geometric Design

6.2 Devices

Traffic control devices for railroad-highway grade crossings consist primarily of signs, pavement markings, flashing light signals and automatic gates A large number of significant variables must be considered in determining the types of warning device to be installed at a railroad grade crossing The type of highway, volume of vehicular traffic, volume of railroad traffic, speed of vehicular traffic, volume of pedestrian traffic, accident record, and geometrics of the crossing are some of the factors influencing the choice of warning devices to be provided at the railroad crossing Standards and criteria for design placement, installment and operation of these devices are covered in the MUTCD and the Department's Railroad Procedure Manual Volume III The Department's Roadway and Traffic Design Standards should also be consulted in the design of railroad crossings

6.3 Surfaces

The highway traveled way at a railroad crossing should be constructed for a suitable length with all-weather surfacing. A roadway section equal to the current or proposed cross section of the approach roadway should be carried across the crossing The crossing surface itself should have a riding quality equivalent to that of the approach roadway When selecting the type of crossing and the material to be used in its construction, consideration should be given to the character and volume of traffic using the highway The Department's Highway-Railroad Grade Crossing Material Selection Handbook should be consulted in selecting the material.

The Roadway and Traffic Design Standards, Index 560 contains details for the construction of crossings.

6.4 Clearances at Railroad/Highway Structures

An offset horizontal dimension to the abutment slope of up to 6 m from the centerline of tracks requires no special justification. Horizontal offsets in excess of 6 m should be justified based on individual site conditions. Vertical clearances up to 7 2 m require no special justification Greater vertical clearances can be justified based on special site conditions or the need to meet documented railroad electrification plans The horizontal clearance to an obstruction is a minimum of 2 7 m Greater clearances may be necessary to preclude the placement of piers in drainage ditches The Roadway and Traffic Design Standards, Index 280 contains additional criteria for culvert clearances below railroads

Chapter 7

Signing, Marking, Lighting and Signals (Metric)

Chapter 7

SIGNING, MARKING, LIGHTING AND SIGNALS (METRIC)

7.1 General

Traffic control devices are necessary to help ensure highway safety by providing the orderly and predictable movement of all traffic, motorized and non-motorized, throughout the highway transportation system, and to provide such guidance and warnings as are needed to ensure the safe and informed operation of individual elements of the traffic stream. The design and layout of signs, signals, pavement marking and lighting should complement the basic highway design.

7.2 Signing and Marking

The designer responsible for a signing and marking project should be aware that the design must comply with various standards. In addition to Department Standard Specifications, the following standards should be consulted:

> Manual on Uniform Traffic Control Devices (MUTCD) - The MUTCD was adopted by the Department as the uniform system of traffic control for use on the streets and highways of the State. This action was in compliance with Chapter 316.0745 of the Florida Statutes. The MUTCD is therefore the basic guide for signing and marking. The requirements of the MUTCD must be met, as a minimum, on all roads in the State.
>
> Standard Highway Signs, FHWA - This manual contains detailed drawings of all standard highway signs. Each sign is identified by a unique designation. Signs not included in this manual or in the Roadway and Traffic Design Standards must be detailed in the plans.

Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, AASHTO and Structures Design Guidelines, FDOT - These documents provide structural design criteria.

Roadway and Traffic Design Standards - These standards are composed of a number of standard drawings or indexes which address specific situations which occur on a large majority of construction projects.

Manual on Uniform Traffic Studies (MUTS) - This is a Department publication containing documentation for several types of traffic studies. This manual provides a systematic data collection procedure for the studies described.

7.2.1 Design Criteria

The MUTCD and the Roadway and Traffic Design Standards should be consulted for sign location. All signs not bridge or barrier wall mounted and installed within the clear recovery zone, must be frangible or protected by an approved barrier. The Roadside Safety chapter of this manual contains detailed instructions on safety design.

Post sizes for single column signs are covered in the Roadway and Traffic Design Standards. The supports for multi-post signs are not in that reference and must be included in the plans. The designer must provide post sizes and length for each multi-post sign. The Structures Design Office has written a program for personal computers that calculates post sizes and length for multi-post signs. This program may be used for these calculations.

The design for all overhead sign structures and foundations shall be included in the plans. Refer to Section 7.5, Foundation Design, and the Structures Design Guidelines for more information.

When specified, signs will be illuminated with 175 watt mercury vapor Deluxe White Lamps. The following table gives the number of luminaires for various sign widths. See Roadway and Traffic Design Standard Index 17505 for spacing details and mounting location.

Sign Width (m)	To 3.0	To 6.3	To 9.6	To 12.9
Luminaires	1	2	3	4

7.2.2 Wind Loading Criteria - Signs

The wind loadings given below were taken from the AASHTO Standard Specification For Structural Supports For Highway Signs, Luminaires and Traffic Signals. The Counties are listed by wind loading for the appropriate sign type.

GROUND SIGNS

100 km/h Alachua, Baker, Bay, Bradford, Calhoun, Clay, Columbia, Escambia, Gadsden, Gilchrist, Hamilton, Holmes, Lafayette, Lake, Leon, Liberty, Jackson, Jefferson, Madison, Marion, Okaloosa, Putnam, Santa Rosa, Sumter, Suwannee, Union, Walton, Washington

115 km/h Citrus, DeSoto, Dixie, Duval, Flagler, Franklin, Glades, Gulf, Hardee, Hendry, Hernando, Highlands, Hillsborough, Levy, Nassau, Okeechobee, Orange, Osceola, Pasco, Pinellas, Polk, Seminole, St. Johns, Taylor, Wakulla

130 km/h Brevard, Charlotte, Collier, Indian River, Lee, Manatee, Martin, Palm Beach, Sarasota, St. Lucie, Volusia

145 km/h Broward, Dade, Monroe

OVERHEAD SIGNS

See Structures Design Guidelines

7.2.3 No-passing Zones

The procedures required by the Department for determining the limits of no-passing zones are contained in the "Manual on Uniform Traffic Studies", (MUTS). The requirements of this manual must be followed.

Limits of pavement markings for no-passing zones shall be established by one of the following methods:

1. On projects where existing roadway conditions (vertical and horizontal alignments) are to remain unaltered by construction, the no-passing zones study shall be accomplished as part of the design phase. This will be either by in-house staff or included in design consultant contracts.

   The limits of the no-passing zones shall be included in the contract documents, and a note to this effect shown on the plans.

2. On projects with new or altered vertical and horizontal alignments, limits for no-passing zones shall be established during construction. The required traffic study and field determination of limits shall be performed through the design consultant as a post-design service, or as part of a district-wide consultant contract for such services.

   When this service is included as part of post-design services, sufficient time shall be included to accomplish the required field operations without delaying or interfering with the construction process.

7.2.4 Project Coordination

Coordination with other offices and other agencies is a very important aspect of project design. The offices discussed in this section are not intended to be an all inclusive list with which the designer should coordinate, but are those that are typically involved in a signing and marking project.

Roadway Design - The designer of a signing and marking project receives the base sheets for design from the roadway designer, who can also provide any required cross sections. If the signing project is not an active roadway design project, base sheets may be obtained from existing plans or aerial photographs.

Utilities - The District Utilities Engineer provides the coordination between the designer and the various utilities involved in the project. The Utilities Section can also identify potential conflicts with overhead and underground utilities or verify those which have previously been identified. The District Utilities Engineer should be contacted as early in the design phase as possible.

7.2.5 Foundation Criteria

Refer to Section 7.5, Foundation Design, for geotechnical requirements.

7.3 Lighting

The designer responsible for a highway lighting project should be aware that the design must comply with various standards. In addition to the Department's Standard Specifications, the following standards should be consulted:

An Information Guide for Roadway Lighting, AASHTO -- This is the basic guide for highway lighting. It includes information on warranting conditions and design criteria.

Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, AASHTO -- This specification contains the strength requirements of the poles and bracket arms for the various wind loadings in Florida as well as the frangibility requirements. All Luminaire supports, poles and bracket arms must be in compliance with these specifications.

Roadway and Traffic Design Standards -- These indexes are composed of a number of standard drawings or indexes which address specific situations which occur on a large majority of construction projects.

7.3.1 Design Criteria

The AASHTO Guide for Roadway Lighting permits either the illuminance technique or the luminance technique to be used in the design of highway lighting. The luminance technique requires a more complex design process and a knowledge of the reflective characteristics of the pavement surface used. These reflective characteristics change as the pavement ages and with variations in weather conditions. The Department has elected to use the illuminance technique for lighting design. The design values for light levels given by the AASHTO Guide for Roadway Lighting are maintained values. The light levels given in this criteria have been adjusted and are listed as average initial lux. This, in effect, sets the maintenance factor to be used in the calculation process to a value of 1.

Mounting height (M.H.) for conventional lighting is the vertical distance from the roadway to the light source, regardless of lateral placement of the pole. Pole setback is the horizontal distance from the edge of the travel lane to the pole.

7.3.2 Pole Design Criteria

Roadway and Traffic Design Standards Index 700 and the criteria section of this manual specify minimum horizontal clearances for light poles. A 6.0 meter minimum should be used where possible. Poles should be located at least 1.2 meters behind the face of guard rail and from the face of curbs. High mast lighting poles should be located as far from the travelled way as possible and in no case shall they be within the clear zone unless the pole is protected by barrier wall or guardrail. High mast lighting poles should not be located in gore areas within the runout length as defined in the AASHTO Roadside Design Guide. Engineering judgement should be used when locating high mast poles adjacent to bridges and high fills. All conventional height poles shall be frangible unless bridge or barrier wall mounted.

Frangible pole installations shall not be used in areas of heavy pedestrian traffic where the hazard of a falling pole is a greater hazard to others than it is to the motorist. See Roadway and Traffic Design Standards for frangibility requirements.

The installation of lighting in certain locations (e.g. adjacent to residential areas) may require the luminaires to be shielded. This is especially true for high mast poles.

Poles on bridges over open bodies of water or on causeway sections should be considered for dampers. These poles are subject to sustained winds of a critical velocity which may induce vibrations in the pole.

7.3.3 Foundations Criteria

Refer to Section 7.5, Foundation Design, for geotechnical requirements and to the Structures Design Guidelines for additional design information.

For projects allowing the screw type foundation as an alternate, the geotechnical engineer shall verify that the soil characteristics meet the requirements of Section 715 of the specifications. If the soil conditions do not allow the screw type of foundation shown in Section 715, either a note shall be added to the plans stating: "The screw type foundation is not allowed on this project", or an appropriate design shall be provided.

Foundations for high mast poles are not standard and the designs must be provided for each project. Boring data must be obtained to provide a basis for the design. A boring data sheet is to be included in the plans.

7.3.4 Wind Loading Criteria - Lighting

See the Structures Design Guidelines.

7.3.5 Lighting Project Coordination

Coordination with other offices and other agencies is a very important aspect of project design. The offices discussed in this section are not intended to be an all inclusive list with which the designer should coordinate, instead it includes offices that are normally involved in projects.

o Roadway Design - Normally the designer of a lighting project receives the base sheets for lighting design from the roadway designer. The roadway designer can also provide any required cross sections. If the lighting project is not an active roadway design project, base sheets may be obtained from existing plans or aerial photographs. If copies of existing plans are used for base sheets, the drainage maps are usually a good choice.

o Utilities - The District Utilities Engineer provides the coordination between the designer and the various utilities involved in the project. This usually is limited to agreements with the power company for electrical service. The Utilities Section can also identify potential conflicts with overhead and underground utilities or verify those which have previously been identified.

The Utilities Engineer should be contacted as soon as pole locations are set and the electrical load has been determined. The designer should indicate a preferred location for the electrical service location.

o Soils - Conventional height poles require the standard base shown in the Roadway and Traffic Design Standards, and only require foundation designs in special cases. High mast poles, on the other hand, require foundation designs for each location. Soil Borings are required for the design of the foundations. The District Soils Engineer should be requested to provide soils data as soon as high mast pole locations are determined.

o Drainage - When the locations of high mast poles are established, they should be checked with the Drainage Section to determine if high water level is a problem. High mast poles are often located in the center of interchange loops. These same areas may be used as drainage retention areas. Coordination with the Drainage Section will alleviate this type problem.

Chapter 14-64 of the Department Rules established the maintenance responsibility of lighting systems not on limited access or toll facilities as a local government function.

Normally the District Traffic Operations Engineer in conjunction with the District Utilities Engineer obtain the required maintenance agreements. The designer should coordinate with these offices to ensure that this activity is either underway or scheduled.

Any lighting project, especially high mast, adjacent to or in the vicinity of an airport, may be a potential problem. Any lighting project within 5 kilometers of an airport should be discussed with the Office of Public Transportation, Aviation Office to determine if a problem exists.

7.3.6 Voltage Drop Criteria

When determining conductor sizes for lighting circuits, the maximum allowable voltage drop from the service point on any one circuit is 7%.

7.4 Traffic Signals

The designer responsible for a traffic signal project should be aware that the design must comply with various standards. In addition to the Department's Standard Specifications, the following standards should be consulted:

Manual on Uniform Traffic Control Devices (MUTCD), FHWA - The MUTCD was adopted by the Department as the uniform system of traffic control for use on the streets and highways of the State. The action was in compliance with Chapter 316.0745 of the Florida Statutes. The MUTCD is therefore the basic guide for traffic signals. The requirements of the MUTCD must be met, as a minimum, on all roads in the State.

Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals AASHTO and Structures Design Guidelines, FDOT - These documents provide structural design criteria.

Roadway and Traffic Design Standards - These standards are composed of a number of standard drawings or indexes which address specific situations which occur on a large majority of constructions.

7.4.1 Design Criteria

The design of traffic signal mast arms and foundations shall be included in the plans. Refer to Section 7.5, Foundation Design, and the Structures Design Guidelines for more information.

The MUTCD, as noted above, has been adopted as the uniform system of traffic control for use on the streets and highways of the state. The MUTCD is the basic guide for traffic signal design; therefore, the traffic signal designer should be familiar with this document. The criteria below supplements the MUTCD.

7.4.2 Certification and Specialty Items

Traffic signal equipment installed in Florida is required to be certified by the Department. The Office of Traffic Engineering in the Central Office is charged with the responsibility of certifying traffic control equipment. The designer of a traffic signal project, if requiring new equipment types or types not normally used, should contact Traffic Engineering in Tallahassee to determine the certification status of the equipment. Non-certified equipment cannot be used.

Standard specifications have not been developed for all signal equipment. Some items are project dependent and the development of standard specifications is difficult. Specifications for these items must be developed on a project by project basis and included in the contract as a special provision. Some of these specialty items are included on the Department's approved products list. For these items, detailed specifications are not required. The Office of Traffic Engineering should be consulted on these items.

7.4.3 Stop Line Location

A stop line which is not properly located invites violation by the motorist. The MUTCD specifies the minimum and maximum distances from the signal head to the stop line for adequate visibility. The traffic signal designer must insure that this requirement is met.

Instead of relocating the signal heads, the stop lines at many intersections have been moved from their proper location to comply with these requirements. The tendency for the motorist is not to stop at the new stop line location, but rather to creep beyond the stop line. This could in some cases result in valid calls being dropped, thereby increasing delay and decreasing the overall efficiency of the intersection.

The first step in the design process should be to locate crosswalks and stop lines properly. Then the signal head location should be determined to meet the MUTCD requirements. This may require changing the mounting configuration. A box span, for example, may be required where a diagonal span would normally be installed.

7.4.4 Controller Timings

The development of controller timings is a basic part of traffic signal design. A recent ruling from the Board of Professional Engineers stated that the development of timings is considered engineering and therefore requires the signature and seal of a professional engineer.

All traffic signal designs prepared for or by the Department shall include initial timings of all controllers. This is also true for signals to be included in local systems. If the timings in the plans are not implemented, it will be the responsibility of the agency providing the timings to insure they were prepared under the supervision of a professional engineer.

7.4.5 Left Turn Treatments

The guidelines given below should be followed when determining signal treatments for left turns.

- Single Turn Lane

Restrictive/Permissive Phasing - A five-section cluster should be used for this location. The head should be installed over the lane line between the left turn lane and through lane. The five-section cluster can serve as one of the two indications required for the through traffic.

Restrictive Phasing - A separate signal head for the left turn lane with red, yellow and green arrow indications should be positioned over the center of the left turn lane.

- <u>Dual Turn Lanes</u>

Only restrictive phasing should be used. Permissive movements should not be allowed for dual turn lanes. A single three section head with red, yellow, and green arrow indications should be centered over each turn lane. These heads are in addition to the dual indications required for the thru movement.

- <u>Separated Turn and Thru Lanes</u>

Turn lanes that are separated from the thru lanes more than 3.6 meters by a raised or painted island shall not be operated in the permissive mode.

- <u>Single Lane Approach on Stem of "T"</u>

Two three-section heads are required as minimum. All indications must be circular in this situation.

- <u>Two Approach Lanes on Stem of "T"</u>

<u>Option #1:</u> The approach may display two three-section heads with circular indications on all sections.

<u>Option #2 :</u> The approach may display a five-section cluster in conjunction with a three-section head. If the lanes are exclusive left and right turn lanes, then the five-

section cluster should be placed over the center of the lane line and the three-section head over the major movement lane. If one of the lanes is a shared left and right lane, then the five-section cluster should be placed over the center of this lane and the three-section head over the center of the other lane.

Option #3: The approach may display two three-section heads for the major movement and a single three-section head for the secondary movement

o Three Approach lanes on Stem of "T"

Option #1: The approach may display two three section heads for the major movement and one for the secondary movement (Exclusive left and right turn lanes).

Option #2: The approach may display a five-section cluster in conjunction with three-section head (exclusive left and right turn lanes). The five-section cluster should be placed over the center of the lane line separating the left turn lane(s) from the right turn lane(s). The three-section head should be placed over the other lane line to provide dual indication for the major movement.

Option #3: When the middle lane is a shared left and right turn lane, then a five-section cluster should be placed over the center of this lane and a three section head placed over each of the other two lanes. Each head must contain green and yellow arrow indications in this situation.

NOTE:

1. For all cases, the approach shall display "dual indications". This means that there must be at least two heads with identical indications on the major approach. For example, if a green arrow is displayed on one head of the

major movement or approach then a green arrow must be displayed on the second head.

2. The same signal display option should be used throughout an urban area to provide consistency in display to the motorist.

3. The use of advance and/or overhead lane use signs should be used as a supplement to pavement arrows on stems of signalized "T" intersections.

7.4.6 Signal Preemption

The engineer responsible for the design of a traffic signal project should, as a matter of routine, check each intersection to determine if the need for signal preemption is present.

Intersections located within 150 meters of moveable span bridges or railroad crossings should be considered for preemption. Those located at distances greater than 150 meters should also be considered if the queues frequently extend to the moveable span or crossing.

Intersections near fire stations require individual study. This is necessary to determine the interaction between the fire station vehicles and the intersection operation. This information must be known before the preemption sequence can be developed.

7.4.7 Intersection Design - Lane Configuration

The engineer responsible for the traffic signal design may be asked to verify the number and configuration of traffic lanes required for an intersection to function properly when signalized.

The results are dependent upon the traffic volumes used in the analysis. The traffic used for this calculation shall be the design hourly volume based on the 30th highest hour (k factor) and not a peak to daily (P/D) ration based on a 24 hour count. The k factor volumes account for traffic variations through the year, and, in most case,are higher than P/D volumes.

The K, D, and T factors covert the two-way AADT volumes to a one-way Design Hour Volume (DHV). This is appropriate for the total approach movements. The AM and PM peak turning movement counts on each approach should be addressed individually. Current turning movement counts should be taken to determine the percentage of turns for each approach. These percentages should then be applied to the DHV for each approach volume to determine the turning volumes which should be used for the turn lane design calculations. These values should be compared to the movement counts supplied by Planning and the greater of the two values used for the design of turn lanes. The District Planning Office should be contacted to determine if recent counts are available and also if any use changes are planned which would require adjustments to the turn percentages found in the current counts.

Storage lanes for left turns can affect the capacity and safety of intersections. The storage length of a left turn lane is a critical design element. The queue of left turn vehicles in a storage lane of inadequate length may extend into the through lanes. The result is loss of capacity for the through lanes. The queue of through vehicles may also extend beyond the entrance of a short left turn storage lane blocking access to the storage lane. Either case results in a less efficient operation of the intersection and may cause last minute lane changes, thereby increasing the possibility of conflicts.

The important factors which determine the length needed for a left turn storage lane are:

- o The design year volume for the peak hour (see discussion above).

- o An estimate for the number of cycles per hour.

  NOTE: If the cycle length increases, the length of the storage for the same traffic also increases.
- o The signal phasing and timing.

There are several techniques used to determine necessary storage length. The following are suggested guidelines for left turn lanes.

- o Where protected left turn phasing is provided, an exclusive turn lane should be provided.
- o Left turn lanes should be provided when turn volumes exceed 100 vph and may be considered for lesser volumes if space permits.
- o For signalized intersections, the signal phasing and timing is developed using computer programs such as TRANSYT-7F. One of the outputs of these programs is the queue length. These signal timing programs provide a valuable reference for determining the length of left turn lanes. Computer runs using both the AM and PM peak traffic volumes and turning movement counts should be reviewed.

  For those cases where the above information is unavailable, the following formula may be used, assuming an average vehicle length of 7.5 meters.

$$L = \frac{(2.0)\ (DHV)\ (7.5)}{N}$$

Where

L = design length for left turn storage in meters

DHV = left turn volume during design peak hour, in vph

N = number of cycles per hour for peak hour, use N = 30 as default.

- Where left turn volumes exceed 300 vph, a double left turn should be considered.
- When right of way has already been purchased, and the designer has to choose between a long wide grass median or a long left turn lane, the storage length for the left turn should be as long as practical without hindering other access.

Right turn lanes are provided for many of the same reasons as left turn lanes. Right turns, are, however, generally made more efficiently than left turns. Right turn storage lanes should be considered when right turn volume exceeds 300 vph and the adjacent through volume also exceeds 300 vphpl.

7.4.8 Signal Loops

Traffic signal loops are detailed in Roadway and Traffic Design Standard, Index 17781. These loops are standard and will be appropriate for most locations.

The traffic signals for each intersection should be individually designed. The requirement for type and placement of loops is a part of this design. The above standard allows for some variation in size and placement of the standard loops. These modifications are intended to be used only when required by the design of a particular location.

7.4.9 Wind Loading - Traffic Signals

See the Structures Design Guidelines.

7.4.10 Foundation Criteria

Refer to Section 7.5, Foundation Design, for geotechnical requirements.

7.4.11 Mast Arm Supports

The Department's Traffic Signal Support Policy Statement (Topic No. 000-625-020-a) states that all new signals installed by the Department on the State Highway System that are within ten miles of the coastline shall be supported by mast arms with the signal head(s) rigidly attached to the mast arm.

The designer should be familiar with this policy statement. Exceptions to this Policy must be approved by the State Highway Engineer.

7.5 Foundation Design

Foundation design of strain poles, mastarms, high mast light poles, and overhead sign structures requires that the following information be provided by the project's geotechnical engineer:

1) The soil type. Is it cohesive or cohesionless, rock, etc.?
2) For cohesive soils, the value of the cohesion.
3) For cohesionless soils, the effective friction angle of the soil.
4) The effective unit weight of the soil.
5) The seasonal high water elevation.

The geotechnical engineer shall establish the required soils information from SPT borings, auger borings or cone soundings as deemed appropriate and shall determine the number and location of borings required. Borings taken for the roadway and other structures can also be used for this information if appropriate.

The above information shall be included in the plans. It may be shown on an appropriate pole, mast arm, or sign location or detail sheet, if space permits. A separate sheet may be required, such as a boring data sheet for high mast lighting.

Chapter 8

Bicycles and Pedestrian Facilities (Metric)

Chapter 8

BICYCLES AND PEDESTRIAN FACILITIES (METRIC)

8.1 General

Pedestrians and bicycle riders may often wish to travel between the same locations as other vehicular traffic. When this occurs, the designer should consider the effects on the safety and operation of the roadway system A special effort should be made to provide the greatest degree of safety within the economic constraints that must always be considered

Additional special bicycle and pedestrian facilities should be provided where the use of travel lanes or wide paved shoulders is deemed unacceptable or unsafe for the pedestrian or bicycle rider

Pedestrian facilities include sidewalks, crosswalks, traffic control features, special walkways, curb cut ramps for the handicapped and bus facilities

8.2 Sidewalks

The design of sidewalks is affected by pedestrian volume, traffic volume, average pedestrian age, walking rate, required level of service, location, etc. The AASHTO Policy on Geometric Design presents the various factors that influence the design of sidewalks and other pedestrian facilities

All urban projects that have sufficient right-of-way to provide adequate lane, median, sidewalk and border widths should be thoroughly evaluated to provide a reasonably safe and cost effective design A distance of as little as 0 6 meter between the back of sidewalk and right-of-way can be effective in minimizing construction easements by using a 0 3 meter berm and 1 2 slope or a 1 4 slope between the sidewalk and right-of-way Differences in elevation up to 150 mm can be accommodated in this manner Caution must be exercised in using this treatment at connections to driveways since this distance and slope will not assure adequate vehicular connections (see the Roadway and Traffic Design Standards, Index 515)

Sidewalks should be constructed in conjunction with all new construction, major reconstruction and lane addition curb and gutter projects As a general practice, sidewalks should be constructed along both sides of arterial streets that are not provided with shoulders, even though pedestrian traffic may be light Exceptions may be made to the construction of sidewalks on both sides of the street when the roadway parallels a railroad or drainage canal and pedestrians would not be expected and in some cases on bridges If sidewalks are constructed on the approaches to bridges, they should be continued across the structure

The standard width for sidewalks is 1.5 meters when separated from the curb by a buffer strip When sidewalks are constructed adjacent to the curb, the minimum width should be 1 8 meters Additional width of sidewalk should be provided for high pedestrian volumes, i e sidewalks in close proximity to schools Separation between the curb and sidewalk should be provided when traffic volumes, truck volumes or vehicular speeds are high The Department's Bicycle Facilities

Planning and Design Manual states that it is important to recognize that the development of wide sidewalks does not necessarily add to the safety of sidewalk bicycle travel. Wide sidewalks encourage higher-speed bicycle use and can increase the potential for conflicts with motor vehicles at intersections, as well as with pedestrians and fixed objects Both the AASHTO Guide for Bicycle Facilities and the Florida Green Book state that bicycle riding on sidewalks can be expected in residential areas with young children who are too inexperienced to ride in the street This type of bicycle use is generally accepted, but it is not appropriate to sign a sidewalk as a bicycle path Separate bike lanes should be provided when warranted to accommodate bicycle traffic Standard width sidewalks are to be provided unless greater widths are justified for pedestrian use A method for determining pedestrian facility needs is given in the Highway Capacity Manual

8.3 Disabled Access

Pedestrian facilities such as walkways and sidewalks must be designed to accommodate the physically disabled persons whose mobility is dependent on wheelchairs and other devices Street intersections with steep-faced curbs are one form of obstacle that can be alleviated while still providing reasonable mobility for the disabled without sacrificing the mobility of others

In areas with sidewalks, curb cut ramps must be incorporated at locations where a marked crosswalk adjoins the sidewalk The basic ramp type and design application depends on the geometrical characteristics of the intersection Standard Index No 304 sets forth the requirements and standards of curb cut ramps for use in Florida Placement of inlets should not conflict with curb cut ramps

All Department facilities (roadway, parking lots, rest areas, buildings, pedestrian bridges, etc) must be designed in compliance with Florida statutes, rules and regulations and Florida Americans with Disabilities Accessibility Implementation Act Design must also meet minimum requirements of the American National Standards Institute (ANSI 117 1 - 1986) for accommodation of the disabled

8.4 Bicycle Facilities

The bicycle has become an important element for consideration in the highway design process In recent years the emphasis in bicycle system planning has changed from attempts to provide completely separate facilities for bicyclists to the growing recognition that bicyclists are legitimate users of the roadway Recent studies have shown that in many cases shared roadway facilities afford greater safety for the bicyclists than sidewalk facilities because of the increased visibility and maneuverability Certain measures such as

- o Paved shoulders, either designated or undesignated as bike lanes
- o Full bike lanes adjacent to curb and gutter, either designated or undesignated
- o Bicycle-safe drainage grates
- o Adjusting manhole covers to grade
- o Maintaining a smooth, clean riding surface
- o Bicycle corridors on off system routes

can considerably enhance a route's safety and capacity for bicycle traffic without impacting the service for motor vehicles on the roadway

Planning and design consideration for bicycle facilities are given in the AASHTO Policy on Geometric Design and the AASHTO Guide for Development of New Bicycle Facilities

The Department's current policy is to consider the needs of bicyclists on all projects, except limited access facilities This policy will generally provide for the construction of bicycle lanes or paved shoulders for the needs of bicyclists in conjunction with other planned roadway improvements The lack of adequate right of way and the cost associated with its acquisition in built up areas may not allow provision of the additional width for bicyclists on all projects The inclusion of bicycle facilities on roadway improvements should be reviewed on a case-by-case basis analyzing anticipated bicycle travel and the need for wider pavement or paved shoulders Anticipated bicycle travel should be considered of sufficient volume when the roadway section is identified for bicycle improvements in the Transportation Improvement Program, the State Transportation Plan (Bicycle Elements) or other approved Community Comprehensive Bicycle Transportation Plans Planning for bicycle routes through local government contact is essential

The Chapter 2 of this volume discusses shoulder width criteria when bicycle use is anticipated

Chapter 9

Landscaping (Metric)

Chapter 9

LANDSCAPING (METRIC)

9.1 General

The complete highway is one wherein the elements of design, construction and maintenance have been integrated to provide a facility that possesses utility, safety, beauty and economy The highway should be considered as an element of the total environment, not apart from it or in conflict with it All highway-oriented disciplines should collaborate at each stage of highway corridor selection, location, and design to obtain the maximum beneficial potential of the highway, its roadsides, and its environment

The highway roadside is an integral unit of a total highway facility The term "roadside" generally refers to the area between the outer edge of the roadway and the right-of-way boundary It could include extensive areas in a wide median of a divided highway Roadside development is the treatment given to the roadside to conserve, enhance, and effectively display the natural beauty of the landscape through which the highway passes It should provide safety, utility, economy, and highway-related recreation facilities by means of proper location, design, construction, and maintenance

Because the potential for conflict between the highway and environmental values is greatest in urban areas, it is essential that special attention be given to the multiple use-joint development possibilities in areas over, under, and adjacent to the highway to ensure that land and space above the highway provides the greatest benefit to the greatest number

Landscape development should be in keeping with the character of the highway and its environment Programs include the following general areas of improvement

- Preservation of existing vegetation
- Transplanting of existing vegetation where feasible
- Planting of new vegetation
- Selective clearing and thinning
- Regeneration of natural plant species and material

The objectives in planting or the retention and preservation of natural growth on roadsides are closely related In essence, they are to provide vegetation that will be an aid to esthetics and safety, aid in lowering construction and maintenance costs, and create interest, usefulness, and beauty for the pleasure and satisfaction of the traveling public

Landscaping of urban highways and streets assumes additional importance by mitigating many of the nuisances associated with urban traffic Landscaping should be arranged to permit sufficiently wide, clear, and safe pedestrian walkways Combinations of turf, shrubs, and trees are desirable in border areas along the roadway However, care should be exercised to ensure that requirements for sight distances and clearance to obstructions are observed, especially at intersections

Further information concerning landscape development and erosion control is presented in AASHTO's A Guide for Highway Landscape and Environmental Design The Department's Roadway and Traffic Design Standards Booklet sets forth specific criteria and standards for erosion control and roadside landscaping The Department's Landscaping Guidelines (document No 650-050--001) provides the general criteria for use in the development of landscaping plans for roadway projects

Chapter 10

Work Zone Traffic Control

Exhibits

Chapter 10

WORK ZONE TRAFFIC CONTROL

10.1 General

The need to improve the capacity of, and to rehabilitate Florida's highways, has greatly increased the frequency of highway construction taking place immediately adjacent to or under traffic. The traveling public, as well as construction and inspection personnel, are exposed to conflicts that may become hazardous. In addition to the safety issue, the potential delays to the public, as traffic is interrupted by construction, can be significant. As a result, the Department places a great deal of emphasis upon ensuring that traffic can be accommodated through construction zones with minimum delay and exposure to unsafe conditions.

10.2 References

The following references contain the basic criteria and other required information for work zone traffic control in Florida:

The Manual on Uniform Traffic Control Devices for Streets and Highways, (MUTCD), Federal Highway Administration. Part VI of the MUTCD deals specifically with work zone traffic control. Other parts of the MUTCD may also be useful in designing a traffic control plan.

Policy on Geometric Design of Highways and Streets, AASHTO

Roadside Design Guide, AASHTO, Chapter 9.

Roadway and Traffic Design Standard Index Series 600, 415

Standard Specifications for Road and Bridge Construction

Basis of Estimate Handbook

10.3 Comprehensive Work Zone Traffic Control Planning

Consideration of traffic control must begin at the Project Development and Environmental (PD&E) study stage. Impacts on traffic, traffic handling options, constructability, and design features and constraints, as they affect traffic, are to be evaluated for each alternate alignment studied. The preliminary engineering report must specifically address work zone traffic control.

Traffic control considerations must begin in the early stages of design, using the work zone traffic control material from the PD&E study as the basis. As the design progresses, the following should be considered:

Design features and constraints. Length of the project, lane configuration, and grade differentials between existing and proposed, interchanges and intersections, pavement materials, storm sewers, roadway lighting, utilities and bridge features are some of the design element decisions that might be influenced by work zone traffic control considerations

Contract specifications. Provisions such as time restrictions on construction activities; incentive-disincentive clauses; daily, weekly and seasonal restrictions and special materials may be necessary. Public relations activities such as media releases, television and radio spots, hand bills, and highway advisory radio may be specified.

Other actions. Actions may need to be taken by the Department prior to or during construction that may not be a contract requirement. Examples are dealing with the media and local businesses, provisions for mass transit options to commuters, service patrols, improvements to alternate routes, coordination with other projects and maintenance activities, and special inspection requirements.

Public input. On very large and complicated projects, it may be necessary to involve the public through informal public meetings to be held early in the design of a project. Close coordination with city and county officials may be necessary Citizen and business advisory committees may be established as sources of input.

Utility work. If contract utility work is anticipated in conjunction with or during the highway construction, the Traffic Control Plan (TCP) must account for and adequately protect all work activities. The phasing of construction activities must be compatible with the utility work. Utilities, whose work affects traffic, are required to have a TCP by FHWA. This requires early and effective coordination with utilities.

10.4 Traffic Control Plans (TCP)

A TCP is a set of specific plan sheets, references to standard (typical) layouts, and/or notes on roadway plans describing how traffic will be controlled through a work zone. All projects and work on highways, roads and streets shall have a traffic control plan, as required by Florida Statute and Federal regulations. All work shall be executed under the established plan and Department approved procedures. The TCP is the result of considerations and investigations made in the development of a comprehensive plan for accommodating traffic through the construction zone. These considerations include the design itself, contract specifications, and plan sheets.

TCP sheets detail the proper delineation of traffic through the work zone during all construction phases. The complexity of the TCP varies with the complexity of the traffic problems associated with a project. Many situations can be covered adequately with references to specific sections from the Manual on Uniform Traffic Control Devices (MUTCD), or Roadway and Traffic Design Standards, Series 600. Specific TCP sheets shall be required in the plans set whenever project conditions are not specifically addressed in a typical layout from the manuals noted above. This is usually the case for complex projects, and therefore references to the Roadway and Traffic Design Standards, as well as specific TCP sheets, will both likely be necessary.

A traffic control plan should address the appropriate following information for the mainline and any affected cross roads, side streets, and ramps:

(1) the location of all advance warning signs and lighting units
(2) temporary pavement markings, (including RPM's)
(3) location of temporary barriers and attenuators
(4) temporary drainage design
(5) channelizing devices at special locations
(6) locations for special devices such as variable message signs (VMS), arrow panels, and temporary signals
(7) VMS messages for each phase

(8) signal timing for each phase, including method of temporary actuation if needed (Check with Traffic Operations Engineer)

(9) location and geometry for transitions, and detours, and diversions

(10) typical sections for each phase of work on all projects, except simple resurfacing projects, in order to show lane widths, offsets, barrier locations and other features influencing traffic control

(11) the proposed regulatory speed(s) for each phase

(12) reference to appropriate Roadway and Traffic Design Standards or MUTCD drawings whenever applicable.

(13) appropriate quantities, pay items and pay item notes

(14) resolve any conflicts between permanent signing and markings and work zone signing and markings

(15) key strategies such as service patrol, police, public service announcements, Highway Advisory Radio, night work

(16) good plan notes

(17) address the need for maintaining existing roadway lighting

(18) work area access plan

Chapter 19, Volume II, Plans Preparation and Assembly, explains the required information for specific TCP sheets.

Consideration must also be given to adjoining, intersecting or sequential work zones. This can be a particular problem with maintenance operations, bridge or roadway projects under different contracts, operations of other jurisdictions or utilities. When such work must take place, the operations must be coordinated and taken into account in the TCP so that the motorist encounters one, consistently designed, work zone.

TCP's for project designs "on the shelf" must be updated prior to contract letting.

10.5 TCP Development

The following step-by-step process should be followed by designers when preparing traffic control plans.

STEP #1 Understand the Project

- o Field reviews by designers should be required
- o Review the scope
- o Examine the plans (Phase I to Phase II)
- o Look at plan-profiles and cross-sections for general understanding.
- o Review PD&E study for any constraints
- o Consider bicycle/pedestrian needs during construction
- o For complex projects consider developing a TCP study and other possible strategies such as public awareness campaigns, alternate route improvements, service patrols, etc.

STEP #2 Develop Project Specific Objectives

What are your objectives? Examples might be:

- o use barrier wall to separate workers from traffic
- o close road if adequate detour exists
- o maintaining 2-way traffic at all times.
- o maintaining existing roadway capacity during peaks
- o maintaining business/resident access
- o provide bike/pedestrian access
- o minimize wetland impacts
- o expedite construction

STEP #3 Brainstorm TCP Alternatives

Develop some rough alternatives, considering what could be used to accomplish the work, such as constructing temporary pavement and/or temporary detours, using auxiliary lanes, placing 2-way traffic on one side of divided facility, using detour routes, etc. Also, south side as opposed to north side on an east-west roadway. Don't worry that an alternate doesn't meet all objectives.

Designers should check condition of any proposed detour routes. If off state system, may need agreement with locals.

STEP #4 Develop a Construction Phasing Concept

- o Examine existing facility versus what is to be built. This is a major task on jobs other than resurfacing.
- o Coordinate with bridge designers
- o Color or mark the plan and profile sheets to show existing roadway versus new construction. Then, check station by station, the plan sheet against cross-section sheets. Make notes on plan sheets as to dropoffs or other problems. Use profile grade lines or centerlines for reference points.
- o List out major tasks to be completed, such as:

    construct new WB Roadway
    construct new EB Roadway
    construct frontage roads
    construct bridge/flyover

  NOTE: The designer may need input from construction personnel or even contractors representatives in determining construction phases
- o Make notes on plan sheets or notepad as to "decisions" that you make along the way.

STEP #5 Examine/Analyze Alternatives Which Meet Objectives (for each phase).

Next, consider how you could achieve the proposed alternatives and meet the stated objectives.

Examine pros and cons of various alternatives.

Consider how much work and expense is involved for each alternative.

Consider detour/transition locations, signal operations during construction, how to handle alternate modes of transportation-buses, bikes, pedestrians, service vehicles, etc.

STEP #6 Develop Detailed TCP

Select the most feasible alternative for each phase. Add details such as:

- o detour/transition geometrics and locations.
- o if lane closures are needed, use the lane closure technique discussed in 10.15.7 to determine time frame for closures,
- o advanced signing scheme and locations, revisions needed to existing signs - including guide signs, and proposed signs for all work activities - lane closures, detours, etc., on mainline, side roads, x-roads and ramps
- o need for portable traffic signals, variable message signs, and barriers,
- o how existing operations will be maintained - side streets, businesses, residents, bikes, pedestrians, buses - bus stops, etc.,
- o revisions to signal phasing and/or timing during each TCP phase,
- o regulatory speed desired for each phase,
- o all pay items and quantities needed for TCP.
- o how existing Auxiliary lanes will be used and any restriction necessary during construction.
- o typical sections for each phase

- o outline key strategies to be used
  - (a) service patrol
  - (b) police
  - (c) public service announcements
  - (d) Highway Advisory Radio
  - (e) night work
- o need for Alternate route improvements

10.6 Coordination

Work zone traffic control can be a complex undertaking that requires the coordination of a number of agencies and other interested parties. Planning and coordination must begin early in a project design.

Traffic control is a joint responsibility of design (both roadway and bridge), construction and traffic operations personnel. Coordination is necessary by all three parties in the development of TCPs. Both traffic operations and construction personnel must routinely review TCPs during Initial Engineering (Phase I to Phase II plans) to ensure that the plan is sound and constructable and bid items are complete and quantities reasonable. With subsequent reviews of phase III plans, Designers are also encouraged to contact contractors for ideas on Traffic Control Plans.

Traffic control plans should also be reviewed with other appropriate offices such as maintenance, FHWA, community awareness teams, public, businesses, freeway coordinator management teams, and local agencies. Initial reviews should be made by construction and traffic operations no later than the Phase II plans stage with subsequent reviews of Phase III plans. Input from local engineering and law enforcement agencies should be obtained early in the process, such as during the PD&E study and the Phase I plans stage.

Adjoining work zones may not have sufficient spacing for standard placement of signs and other traffic control devices within their traffic control zones. These situations can occur when separate contracts adjoin each other (separate bridge and roadway contracts are a typical example), utility work performed separately from roadway work or when maintenance activities are performed adjacent to a construction project. Where such restraints or conflicts occur, or are likely to occur, the designer should try to resolve the conflicts in order to prevent misunderstanding on the part of the traveling public.

10.6.1 Phase Submittals

TCP phase submittals should include the following.

Phase I - a typical section for each phase as well as a description of the phasing sequence and work involved

Phase II - a majority of the TCP completed (≈75-90%) including the information outlined in section 4 of this chapter (Section 10.4) and a list of the pay items needed

Phase III - a final TCP, including all notes, pay items and preliminary quantities (Note: The construction office estimates the duration for each phase of construction during Phase III review. The designer will finalize the quantities in the plans, comp book, and CES after receiving the estimated durations for construction.)

10.7 Work Zone Traffic Control Training

10.7.1 Background

Work zone traffic control is an important function affecting the safety of the traveling public, contractor personnel and equipment, and department employees. Every reasonable effort should be made to eliminate or reduce involvement in accidents within work zones. Proper traffic control training is vital to achieving this objective.

The Department's Maintenance of Traffic Committee consists of representatives from Roadway Design, Construction, Safety, Maintenance, Traffic Engineering, Value Engineering and FHWA. Its purpose is to develop, review or revise procedures, standards and specifications regarding work zone traffic control to maximize efficiency and enhance safety of motorists, pedestrians, and workers in these zones.

10.7.2 Training Requirements

The Department's Maintenance of Traffic Committee has prescribed work zone traffic control training requirements for Department employees and shall furnish training course information and requirements to each District's Human Resource Development Manager.

Every employee, including consultants, whose activities affect maintenance and construction work zone safety, from upper-level management through construction and maintenance field personnel, shall complete appropriate training as prescribed above and as required by Department procedure number 750-030-006.

District Design, Construction, and Maintenance Engineers shall ensure that employees, including consultant personnel, who are responsible for traffic control plan design, implementation, inspection or supervision of the design, selection, placement, or maintenance of traffic control schemes and devices in work zones have been certified under the provisions of this procedure.

10.8 Traffic Control Devices

Traffic control devices/methods that are available for use include:

- Signs (warning, regulatory and guide)
- Lighting units (arrow panels, barricade and sign lights, illumination devices, temporary signals and variable message signs)
- Channelizing devices (cones, tubular markers, plastic drums, vertical panels, Types I, II and III barricades)
- Markings (pavement markings, raised pavement markings, delineators, and removal of conflicting markings)
- Safety appurtenances (portable concrete barriers, guardrail and crash cushions) - See AASHTO Roadside Design Guide (Chapter 9).
- Flaggers
- Law Enforcement
- Guardrail attached to barrels for work zones $\leq$ 70 km/h - See AASHTO Roadside Design Guide.

The MUTCD contains detailed instructions on the use of traffic control devices. Special design considerations applicable to Florida are discussed in the following sections.

10.9 Signs

Sign messages for speed limits and distances are to be posted in English units.

10.9.1 Advance Warning Signs

The TCP should identify the advance construction warning signs, including legends and location. These include signs such as "Road Work Ahead", and "Road Work One Mile". The TCP should provide the advanced warning signs, legends and locations for all proposed operations which require signing These include diversions, detours, lane closures, and lane shifts, on the mainline as well as crossroads. The sequence for advance signing should be from general to more specific. As an example: Road Work Ahead (general), Left Lane Closed Ahead (more specific), Merge Right (specific).

10 9.2 Length of Construction Sign

The length of construction sign (G20-1) bearing the legend "Road Work Next ___ Miles" is required for all projects of more than 3.2 kilometers in length. The sign shall be located at begin construction points.

10.9.3 Existing Signs

Existing (regulatory, warning, etc.) signs that conflict with the TCP shall be removed or relocated to compliment the work zone conditions (i e. if a stop sign on an existing side road is needed, use the existing sign and show the location that it is to be relocated to). Existing guide signs should be modified as necessary. It is good practice to revise existing guide signs by using black on orange panels to show changes made necessary by the construction operations.

If permanent guide signs are to be removed during construction, provisions should be made for temporary guide signing. The temporary sign should be black on orange with the legend designed in accordance with MUTCD requirements for permanent guide signing whenever possible.

10.10 Lighting Units

10.10.1 Warning Lights

Warning lights shall be in accordance with Standard Index 600 (3 of 10).

Type A Flashing

To be mounted on Vertical Panel, Barricade, or Drums to mark an obstruction adjacent to or in the intended travel way. It is to be paid for as part of the device that it is mounted on.

Type B Flashing

To be mounted on the first and second advanced warning signs where two or more signs are used, as well as on advanced warning signs of intersecting roads. Type B Warning lights are to be paid for as High Intensity Flashing Lights (Temporary-Type B).

Steady-Burn Type C

Steady Burn lights are to be placed on channelizing devices and barrier wall to delineate the traveled way on lane closures, lane changes, diversion curves and other similar conditions. On channelizing devices (Vertical Panels, Barricades, and Drums), their payment is included as part of the device. For use on Barrier wall, they are to be paid for separately as Lights, Temporary, Barrier Wall Mount (Type C, Steady Burn). Their spacing on barrier wall is as follows

Transitions - 15 meters on center
Curves - 30 meters on center
Tangents -60 meters on center(Note: Curves flat enough to maintain a normal 2% cross-slope are to have steady burn lights placed at the same spacing as tangents.)

10.10.2 Advance Warning Arrow Panels

Arrow panels shall be used to supplement other devices for all lane closures on high-speed (90 km/h or greater) and high-traffic density multi-lane roadways. The use of arrow panels should be considered for all other multi-lane closures. These devices are also useful for short-term operations, such as during work zone installation and removal. Arrow panels should not be used in lane shift situations. Research has shown that motorists tend to change lanes (on multi-lane facilities) whenever an arrow panel is used to indicate a lane shift. Since this "response" is not desired, the arrow panel should not be used for lane shift situations on multi-lane roadways. Refer to MUTCD 6E-7 for further information.

Arrow panel locations shall be shown on the TCP, along with any necessary notes concerning the use of this device.

10.10.3 Variable Message Signs

Variable message signs may be used to supplement a traffic control zone. As a supplemental device, it cannot be used to replace any required sign or other device. These devices can be useful in providing information to the motorist about construction schedules, alternate routes, expected delays, and detours. Variable message signs should be considered for use in complex, high-density work zones. Messages must be simple, with a minimum number of words and lines and should require no more than two displays of no more than two lines each. The TCP shall include the location and messages to be displayed.

The message displayed should be visible and legible to the motorist at a minimum distance of 270 meters on approach to the signs. All messages should be cycled so that two message cycles are displayed to a driver while approaching the sign from 270 meters at 90 km/h.

The VMS units may be used:

- To supplement conventional traffic control devices in construction work areas and should be placed approximately 150 to 250 meters in advance of potential traffic problems, or

- 1-3 kilometers in advance of complex traffic control schemes which require new and/or unusual traffic patterns for the motorists.

<u>Message Selection</u>

Programmed messages should provide appropriate messages for the conditions likely to be encountered. The following items must be carefully considered in the development of a message:

(1) Message elements - not necessarily in order
   (a) problem statement (where?)
   (b) effect statement (what?)
   (c) attention statement (who?)
   (d) action statement (do?)

(2) <u>Message format</u>

   (a) will vary depending on content
   (b) "where" or "what" will generally lead
   (c) "who" and "do" follow in that order
   (d) "who" often understood from "where"

(3) Message length

(a) limited by reading time (e g., 270 m at 90 km/h provides about 11 seconds of reading time)
(b) limited by driver's processing capability
(c) 4 word maximum, one part message
(d) 8 word desirable max if two or three sequence message is used
(e) shorter messages desirable to permit multiple readings
(f) if two or three sequence messages is programmed, allow for off-time between messages.

(4) Display format

(a) discrete with entire message displayed at once is most desirable
(b) sequential is OK, 2 part maximum
(c) run-on moving displays prohibited
(d) one abbreviation per panel display desirable, two abbreviations are maximum. Route designation is considered as one abbreviation and one word.

Typical Conditions

Consistent with the factors described above, VMS messages should be considered under the following conditions:

(1) Road closures
(2) Ramp closures
(3) Delays one hour or longer created by
   (a) congestion
   (b) accidents
   (c) lane closures
   (d) two-way traffic on divided highway

(e) multiple lane closures

(f) unexpected shifts in alignment

10.10.4 Traffic Signals

Frequently portable or temporary traffic signals will be a preferred alternative to a flagger. Also, existing signal operations may need to be revised to accommodate the construction operations. The TCP should identify the specific alterations (physical location and timing) necessary for existing signals and the location and timing of portable signals. Signal displays and location must meet MUTCD requirements.

Temporary Signal Plans or modification to existing signals should be reviewed by the appropriate section in the district for structural soundness and signal function

10.11 Channelizing Devices

10.11.1 Type III Barricades

Two Type III barricades should be used to block off or close a roadway Whenever two barricades are used together, only one warning light is required on each barricade.

10.11.2 Separation Devices

Placing two lane two-way operations (traffic) (TLTWO) on one roadway of a normally divided highway should be a last resort (see MUTCD, Part VI, 6G-9.b) and should be done with special care.

When traffic control must be maintained on one roadway of a normally divided highway, opposing traffic shall be separated either with portable barrier wall or Temporary Traffic Separators (see Standard Index 614). The use of striping, raised pavement markers, and complementary signing, either alone or in combination is not considered acceptable for separation purposes.

10.11.3 Channelizing Device Alternates

It is intended that cones, Type I and II barricades, vertical panels, drums and tubular markers be considered as alternative channelizing devices to be used at the contractor's option. The only exceptions to this are that tubular markers are not allowed at night and the use of cones at night is restricted. (See the Roadway and Traffic Design Standards, Index 600 & 614). The designer should not further restrict the options of channelizing devices.

10.12 Pavement Markings

10.12.1 Removing Pavement Markings

Existing pavement markings that conflict with temporary work zone traffic patterns must be obliterated where operations will exceed one work period. Painting over existing pavement markings is not permitted.

10.12 2 Reflectorized Raised Pavement Marker (RPM)

Temporary RPMs are required on the lane lines of all transitions, crossovers, and diversions to delineate temporary gore areas within the work zone The spacing shall be 12.0 m on tangent sections and 6.0 m on transitions, curves, and crossovers

The designer should also use temporary RPMs on temporary lane lines to supplement the striping on all projects.

10.12.3 Work Zone Markings

Markings for work zones include "Removable" and "Non-Removable" markings. Section 102-3.3 of the Specifications describes when each type is required. A separate pay item number is used for each. The designer should be aware of this information and provide appropriate pay items in the plans.

The designer should also consider using Type S Asphalt and/or milling with Type S Asphalt for covering/removing unneeded markings, especially in areas such as diversions or crossovers. Some construction phase durations may be long enough to require use of interim friction courses. When these type issues arise, the designer should work with the

District Pavement Design Engineer, to determine what combination of pavement options best complements the Maintenance of Traffic with the final pavement design.

10.13 Safety Appurtenances for Work Zones

10.13.1 Traffic Barriers

Work zone traffic barriers are designed either as permanent barriers or as temporary barriers that can be easily relocated. They have four specific functions: to protect traffic from entering work areas, such as excavations or material storage sites; to provide positive protection for workers, to separate two-way traffic; and to protect construction such as false work for bridges and other exposed objects. The designer should anticipate when and where barriers will be needed and include this information and the quantities on the plans.

10 13.2 Portable Concrete Safety Shape (Temporary Barrier Walls)

Portable concrete safety shape barriers, also known as portable concrete barriers (PCB's), are widely used in work zones to protect motorists as well as workers. However, improper use of these barriers can provide a "false sense of security" for both the motorist and the worker. Therefore, care must be taken in their design, installation and maintenance. Installation instructions and flare rates are given in the Roadway and Traffic Design Standards, Index 415 and Index 600.

To perform properly and redirect vehicles, the PCB system must be capable of withstanding severe impacts. The PCB's weakest point is its connector which includes the physical connection and mating faces of adjoining barriers or guardrail. When a PCB system is used to mitigate a dropoff condition, the surface that the PCB is placed on shall have a cross-slope of 1:10 or flatter carried a minimum of 0.6 meter behind the barrier. When the designer proposes temporary barrier walls, the cross-slope should be checked and temporary earthwork shown in the plans if necessary for the proper placement of the barrier system. If 0.6 meter is not available for the lateral displacement of the barrier wall upon impact, the barrier wall should be anchored to the ground as shown in Standard Index 415. Similarly, when PCB's are used on bridges, it should connect to the bridge deck as shown by the special detail on Standard Index 415.

The designer should show or note the location of all temporary barrier wall in the plans. The plans should also include a work area access plan for those projects with median work which is shielded with barrier wall.

10.13 3 End Treatments

The desirable treatments for exposed ends of barriers are·

- connecting to an existing barrier (smooth, structural connections are required - Refer to the Roadway and Traffic Design Standards, Indexes 410 and 415) or
- attaching a crashworthy terminal such as a crash cushion or
- flaring away to the edge of the clear zone (For Work Zone Clear zones, see Standard Index 600)

10.13.4 Modifications of Existing Barriers

When 2-way traffic is placed on a facility that is normally one-way, the existing permanent or temporary barriers will be modified as necessary to ensure their proper crash worthiness during the temporary situation. This will include eliminating non-crashworthy end-treatments, snag points or other protrusions normally angled away or hidden from approaching vehicles.

10.13.5 Crash Cushions

Crash cushions in work zones may be used in the same manner as at permanent highway installations. Crash cushions are used to protect the motorists from the exposed ends of barriers, fixed objects and other hazards within the clear zone. Two types of stationary crash cushions are commonly used, Inertia Attenuators (i.e sand filled plastic barrel systems); and redirective systems such as the GREAT CZ or the REACT 350.

The designer must determine the need for crash cushions, select the appropriate type, and provide the necessary details and quantities in the plans. Selection of a system should be the result of an analysis of site condition (i.e. space and need). The GREAT and REACT 350 will shield a hazard by redirecting vehicles or absorbing end-on hits. Sand barrels do not have redirection capability and can only shield a hazard by absorbing end-on hits. End protection other than approved redirective crash cushions must be custom engineered for each independent installation and detailed in the plans. The Roadway and Traffic Design Standards and the AASHTO Roadside Design Guide can be consulted for more information.

10.14 Traffic Control Plan Details

The Roadway and Traffic Design Standards, Indexes 601 through 660, are layouts of work zone traffic control for typical conditions. These indexes should be referenced only if project conditions are nearly the same as the typical layout. Otherwise, specific plan sheets or details must be prepared. Some conditions that will require specific plan sheets include.

- Construction work zones near railroad crossings.
- Work not covered by a typical layout.
- Nighttime work requiring special lighting, oversized or additional devices.
- Ramps and intersections that interrupt the standard layout.
- Sight distance restrictions such as horizontal or vertical curves.
- Lane or shoulder configurations that do not match the standards.
- Special considerations during installation, intermediate traffic shifts and removal
- Complex projects, including add-lane projects, that involve many phases, traffic shifts, entrances and exits.

When designing layouts, the following shall be considered.

10.14.1 Taper Lengths

Minimum taper lengths shall be calculated by the formulas for transition distances given on the Roadway and Traffic Design Standards, Index 600, 8 of 10.

"L" is the length of the taper, "W" is the width of the closed lane and "S" is the posted regulatory speed for the work zone. Both L and W are measured in meters. Speeds are given in the Index in MPH and kilometers per hour.

The following table (taken from MUTCD 6C-2) gives the criteria for the lengths of the various taper types:

Table 10.14.1

Taper Length Criteria for Work Zones	
Type of Taper	Taper Length
UPSTREAM TAPERS	
Merging Taper	L Minimum
Shifting Taper	½ L Minimum
Shoulder Taper	1/3 L Minimum
Two-way Traffic Taper	30 m Maximum
DOWNSTREAM TAPERS	
	30 m per lane (use is optional)

10.14.2 Intersecting Road Signing and Signals

Signing for the control of traffic entering and leaving work zones by way of intersecting highways, roads and streets shall be adequate to make drivers aware of work zone conditions. Under no condition will intersecting leg signing be less than a "Road Work Ahead" sign for approaching vehicles and an "End Construction" sign for departure vehicles. The designer should remember to include these signs in the estimated quantity for Construction warning signs.

Existing traffic signal operations that require modification in order to carry out work zone traffic control shall be as approved by the District Traffic Operations Engineer. If lane shifts occur, signal heads may have to be adjusted to maintain proper position. The DTOE should also determine the need for temporary loops for traffic actuated signals. The TCP should include all necessary signal adjustments.

10.14.3 Sight Distance To Delineation Devices

Merging (lane closure) tapers should be obvious to drivers. If restricted sight distance is a problem (e.g., a sharp vertical or horizontal curve approaching the closed lane), the taper should begin well in advance of the view obstruction. The beginning of tapers should not be hidden behind curves.

10.14.4 Pedestrians and Bicyclists

The designer should always discuss the project with the District Pedestrian/Bicycle Coordinator to insure that adequate accommodations are made through the work zone for pedestrians and bicyclists. The designer needs to remember that when pedestrians and/or bicyclists are accommodated on the existing facility (mainline or side street), provisions must be included in the TCP to accommodate them during construction. Pedestrian accommodations through the work zone must include provisions for the disabled.

10.14.5 Superelevation

Horizontal curves constructed in conjunction with temporary work zone diversions, transitions, and crossovers should have the required superelevation. Under conditions where superelevation is not used, the minimum radii that can be applied are listed in the Table 10.14.2. Superelevation must be included with the design whenever the minimum radii cannot be achieved.

TABLE 10.14.2

MINIMUM RADII FOR NORMAL 2% CROSS SLOPES	
SPEED (km/h)	MINIMUM RADIUS (meters)
110	955
100	730
90	560
80	425
70	330
60	185
50	131

10.14.6 Lane Widths

Existing lane widths of through roadways should be maintained through work zone travel ways wherever practical. The minimum widths for work zone travel lanes shall be 3.0 meters for all roadways other than Interstate. On Interstate highways the minimum width for work zone travel lanes shall be 3.3 m except at least one 3.6 m lane in each direction shall be provided.

10.14 7 Lane Closure Analysis

The lane closure analysis is a process used by designers to calculate the peak hour traffic volume and the restricted capacity for open road and signalized intersections. The analysis will determine if a lane closure should or should not be allowed and the time of day or night a lane closure could occur without excessive travel delay.

For all projects under reconstruction, the existing number of lanes shall remain open to traffic when construction is not active.

For construction on Limited Access facilities, the Traffic Control Plan will keep the existing number of traffic lanes open at all times throughout the duration of the construction project. No lane closures in excess of one work day shall be permitted on Limited Access construction where only two traveled lanes in one direction exist. If it becomes necessary to have a long term lane closure on a four lane Interstate, sufficient documentation shall be provided to the District Secretary for her/his approval.

Exhibit 10-A includes the Lane Closure Analysis Worksheets and two sample analyses The Sample Lane Closure Worksheet (Exhibit 10-A, sheet 3 of 11) has been cross-referenced to the Lane Closure Symbols and Definitions Sheet (Exhibit 10-A, sheets 1 & 2 of 11) with circled numbers. The circled numbers correspond to the numbers of the symbols and definitions. The symbols and definition sheet shows the designer where to find the necessary information to fill out the Lane Closure Worksheet.

Fill out the top part of the Lane Closure Worksheet and complete the formulas to calculate the hourly percentage of traffic at which a lane closure will be permitted. Transfer these percentages to the graph on the Lane Closure 24 Hour Counts Sheet (Exhibit 10-A, sheet

5 of 11). Draw a line across the graph representing the percentage for both open road and signalized intersections (see Exhibit 10-A, sheet 7 of 11). Plot the hourly percentages (hourly volume divided by total volume) on the graph. Any hourly percentage extending above the restricted capacity percentage lines for open road or signalized intersections indicated lane closure problems. The bottom of the graph gives times for AM and PM. By coordinating the lane closure problem areas to the time of day, a designer knows when to restrict lane closure.

Many of Florida's roadways have directional peak hour traffic volumes, with inbound morning traffic and outbound afternoon traffic. Doing a composite lane closure analysis would in many cases require night work. However, if a separate lane closure analysis is calculated for inbound and outbound separately, a lane closure may be allowed and the contractor could work in daylight hours. (See Exhibits 10-A, sheet 10 of 11 and 10-A, sheet 11 of 11.)

LANE CLOSURES

Symbols and Definitions

1. ATC = Actual Traffic Counts. Use current traffic counts. Traffic counts can be obtained from the Office of Planning, or you may need to get traffic counts done The designer needs hourly traffic volumes with a total traffic volume for a 24 hour period (see exhibit 10-A, sheet 7 of 11).

2. P/D = Peak Traffic to Daily Traffic Ratio. Highest hourly volume divided by the total twenty four hour volume. Convert the percentage to a decimal on the Lane Closure Worksheet (see exhibit 10-A, sheet 7 of 11).

3. D = Directional Distribution of peak hour traffic on multi-laned roads. This factor does not apply to a two lane roadway converted to two way, one lane. The directional distribution can be obtained from the Office of Planning.

4. PMF = Peak Month Factor. Many counties in Florida have a significant variance in monthly traffic volumes and since the actual date of a lane closure would be difficult to estimate, the designer should use the highest monthly factor in calculating the volume on the Lane Closure Worksheet. The Office of Planning has tables showing monthly traffic factors for every county in Florida (see sample table on Exhibit 10-A, sheet 4 of 11).

5. RTF = Remaining Traffic Factor is the percentage of traffic that will not be diverted onto other facilities during a lane closure. Convert the percentage to a decimal on the Lane Closure Worksheet. This is an estimate that the designer must make on his own, or with help from the Office of Planning. Range 0% for all traffic diverted to 100% for none diverted.

6. G/C = Ratio of Green to Cycle Time. This factor is to be applied when lane closure is through or within 180 meters of a signalized intersection. The Office of Traffic Engineering has timing cycles for all traffic signals.

7. V = Peak Hour Traffic Volume. The designer calculates the peak hour traffic volume by multiplying the actual traffic count, times peak to daily traffic ratio, times directional factor, times peak month factor, times remaining traffic factor. This calculation will give the designer the expected traffic volume of a roadway at the anticipated time of a lane closure.

Exhibit 10-A
Sheet 1 of 11

Symbols and Definitions

8. C = Capacity of a 2L, 4L or 6L roadway with one lane closed, and the remaining lane(s) unrestricted by lateral obstructions. The capacity of a 4L or 6L roadway is based on lane closure in only one direction (see Lane Closure Capacity Table on Exhibit 10-A, sheet 3 of 11).

9. RC = Restricting Capacity of the above facilities by site specific limitations detailed in the MOT plans which apply to travel lane width, lateral clearance and the work zone factor. The work zone factor only applies to two lane roadways (see the tables on Exhibit 10-A, sheet 4 of 11 to obtain the Obstruction Factor and Work Zone Factor).

10. OF = Obstruction Factor which reduces the capacity of the remaining travel lane(s) by restricting one or both of the following components: Travel lane width less than 3 6 m and lateral clearance less than 1.8 m (see MOT plans and Obstruction Factor Table in Exhibit 10-A, sheet 4 of 11).

11. WZF = Work Zone Factor (WZF) is directly proportional to the work zone length (WZL). The capacity is reduced by restricting traffic movement to a single lane while opposing traffic queues. The WZF and WZL only apply to a two lane roadway converted to two way, one lane (see the Work Zone Factor Table on Exhibit 10-A, sheet 4 of 11).

12. TLW = Travel Lane Width is used to determine the obstruction factor (see MOT plans and the Obstruction Factor Table on Exhibit 10-A, sheet 4 of 11).

13. LC = Lateral Clearance is the distance from the edge of the travel lane to the obstruction. The lateral clearance is used to determine the obstruction factor (see MOT plans and Obstruction Factor Table on Exhibit 10-A, sheet 4 of 11).

Exhibit 10-A
Sheet 2 of 11

LANE CLOSURE WORKSHEET

STATE PROJECT NO.:____________________ FAP NO.:____________________

WPI NO.:__________COUNTY:__________DESIGNER:____________________

NO. EXISTING LANES:___ SCOPE OF WORK:____________________

Calculate the peak hour traffic volume (V)

V=ATC__1__X P/D__2__X D__3__X PMF__4__X RTF__5__ = __7__

LANE CLOSURE CAPACITY TABLE

Capacity© of an Existing 2 Lane-Converted to 2 Way, 1 Lane = 1400VPH
Capacity© of an Existing 4 Lane-Converted to 1 Way, 1 Lane = 1800VPH
Capacity© of an Existing 6 Lane-Converted to 1 Way, 2 Lane = 3600VPH

Factors restricting Capacity:

TLW__12__ LC__13__ WZL__11__ G/C__6__

Calculate the Restricted Capacity (RC) at the Lane Closure Site by multiplying the appropriate 2L, 4L, or 6L Capacity © from the Table above by the Obstruction Factor (OF) and the Work Zone Factor(WZF). If the Lane Closure is through or within 180.0 m of a signalized intersection, multiply the RC by the G/C Ratio.

RC (Open Road) = C__8__ X OF__10__ X WZF__11__ = __9__

RC (Signalized) = RC (Open Road)__9__ X G/C__6__= __9__

If V ≤ RC, there is no restriction on Lane Closure
If V > RC, calculate the hourly percentage of ADT at which Lane Closure will be permitted

$$\% = \frac{\text{RC (Open Road) } \underline{\ 9\ }}{\text{ATC}\underline{\ 1\ }\text{ X D}\underline{\ 3\ }\text{ X PMF}\underline{\ 4\ }\text{ X RTF}\underline{\ 5\ }} = \underline{\qquad}\ \%$$

Signalized % = Open Road %__________ X G/C__6__ = ________

Plot 24 hour traffic to determine when Lane Closure permitted. (See Exhibit 10-A, Sheet 5 of 11)

NOTE: For Existing 2 Lane Roadways, D = 1.00.
Work Zone Factor (WZF) applies only to 2 Lane Roadways.
For RTF < 1 00, briefly describe alternate route:____________________

Exhibit 10-A
Sheet 3 of 11

CAPACITY ADJUSTMENT FACTORS

PMF SAMPLE

Tropic County Monthly Factors			
January	1 12	July	0 88
February	1 20	August	0 85
March	1 18	September	0 88
April	1 12	October	0 94
May	1 05	November	1 00
June	0 95	December	1 06

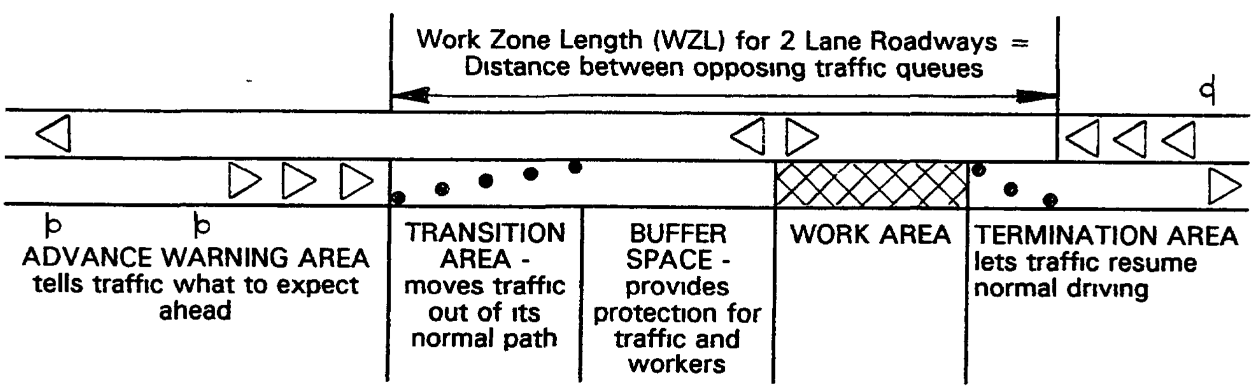
Note February is the peak month in Tropic County, therefore the PMF in the 2L and 4L samples is 1 20 – 1 00 The counts were taken in November

OBSTRUCTION FACTORS (OF)

Lateral Clearance (LC) (meters)	Travel Lane Width (TLW) (meters)			
	3 6	3 3	3 0	2 7
1 8	1 00	0 96	0 90	0 80
1 2	0 98	0 94	0 87	0 77
0 6	0 94	0 90	0 83	0 72
0 0	0 86	0 82	0 75	0 65

WORK ZONE FACTORS (WZF)

WZL (m)	WZF	WZL (m)	WZF	WZL (m)	WZF
60	0 98	660	0 81	1260	0 64
120	0 97	720	0 80	1320	0 63
180	0 95	780	0 78	1380	0 61
240	0 93	840	0 76	1440	0 59
300	0 92	900	0 74	1500	0 57
360	0 90	960	0 73	1560	0 56
420	0 88	1020	0 71	1620	0 54
480	0 86	1080	0 69	1680	0 53
540	0 85	1140	0 68	1740	0 51
600	0 83	1200	0 66	1800	0 50



LANE CLOSURES

24 HOUR COUNTS

TIME	AM HOURLY VOLUME	ATC %		PM HOURLY VOLUME	ATC %
12 - 1					
1 - 2					
2 - 3					
3 - 4					
4 - 5					
5 - 6					
6 - 7					
7 - 8					
8 - 9					
9 - 10					
10 - 11					
11 - 12					
			TOTAL		

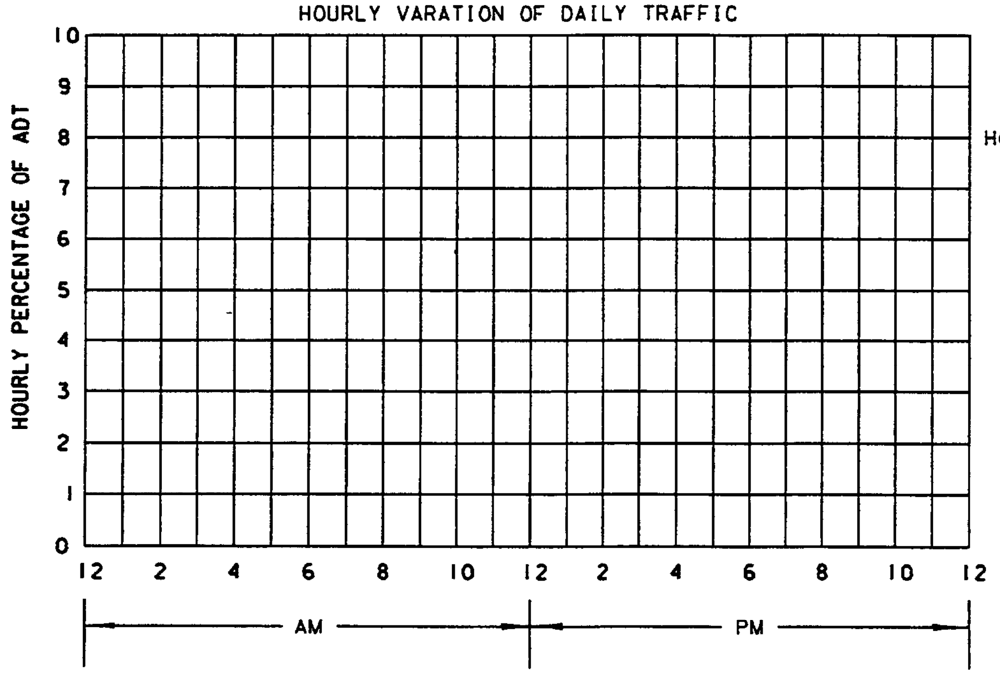
DATE:

DESIGNER:

PROJECT NO.:

LOCATION:

HOURLY VARATION OF DAILY TRAFFIC



-CONCLUSION-

ROUND TO THE NEAREST 1/2 HOUR CONSERVATIVELY

OPEN ROAD LANE CLOSURE

SIGNALIZED LANE CLOSURE

EX-1-10-A
5 OF 11

LANE CLOSURE WORKSHEET

STATE PROJECT NO.: 12345-6789 FAP NO.: NA

WPI NO.: 1234567 COUNTY: TROPIC DESIGNER: YATES

NO. EXISTING LANES: 2 SCOPE OF WORK: Widen and Resurface

Calculate the peak hour traffic volume (V)

V=ATC 15000 X P/D 0.083 X D NA X PMF 1.20 X RTF 0.75 = 1120

LANE CLOSURE CAPACITY TABLE

Capacity© of an Existing 2 Lane-Converted to 2 Way, 1 Lane = 1400VPH
Capacity© of an Existing 4 Lane-Converted to 1 Way, 1 Lane = 1800VPH
Capacity© of an Existing 6 Lane-Converted to 1 Way, 2 Lane = 3600VPH

Factors restricting Capacity:

TLW 3.0 LC 1.2 WZL 630 G/C 0.64

Calculate the Restricted Capacity (RC) at the Lane Closure Site by multiplying the appropriate 2L, 4L, or 6L Capacity © from the Table above by the Obstruction Factor (OF) and the Work Zone Factor(WZF). If the Lane Closure is through or within 180.0 m of a signalized intersection, multiply the RC by the G/C Ratio.

RC (Open Road) = C 1400 X OF 0.87 X WZF 0.82 = 999

RC (Signalized) = RC (Open Road) 999 X G/C 0.64 = 639

If V ≤ RC, there is no restriction on Lane Closure
If V > RC, calculate the hourly percentage of ADT at which Lane Closure will be permitted

$$\% = \frac{\text{RC (Open Road) } 999}{\text{ATC } 15000 \text{ X D } 1.00 \text{ X PMF } 1.20 \text{ X RTF } 0.75} = 7.40\ \%$$

Signalized % = Open Road % 7.40 X G/C 0.64 = 4.74

Plot 24 hour traffic to determine when Lane Closure permitted. (See Exhibit 10-A, Sheet 5 of 11)

NOTE. For Existing 2 Lane Roadways, D = 1.00.
Work Zone Factor (WZF) applies only to 2 Lane Roadways.
For RTF < 1 00, briefly describe alternate route: 25% of existing traffic diverted on Bullard Blvd., north on Newhall Lane, then east on Xanders Expressway.

Exhibit 10-A
Sheet 6 of 11

LANE CLOSURES

24 HOUR COUNTS

TIME	AM HOURLY VOLUME	ATC %	PM HOURLY VOLUME	ATC %
12 - 1	160	1.1	960	6.4
1 - 2	90	0.6	830	5.5
2 - 3	30	0.2	810	5.4
3 - 4	25	0.2	1080	7.2
4 - 5	30	0.2	1190	7.9
5 - 6	130	0.9	1240	8.3
6 - 7	525	3.5	930	6.2
7 - 8	1135	7.6	680	4.5
8 - 9	910	6.1	530	3.5
9 - 10	870	5.8	425	2.8
10 - 11	825	5.5	365	2.4
11 - 12	960	6.4	270	1.8
		TOTAL	15,000	100.0

P/D =.083

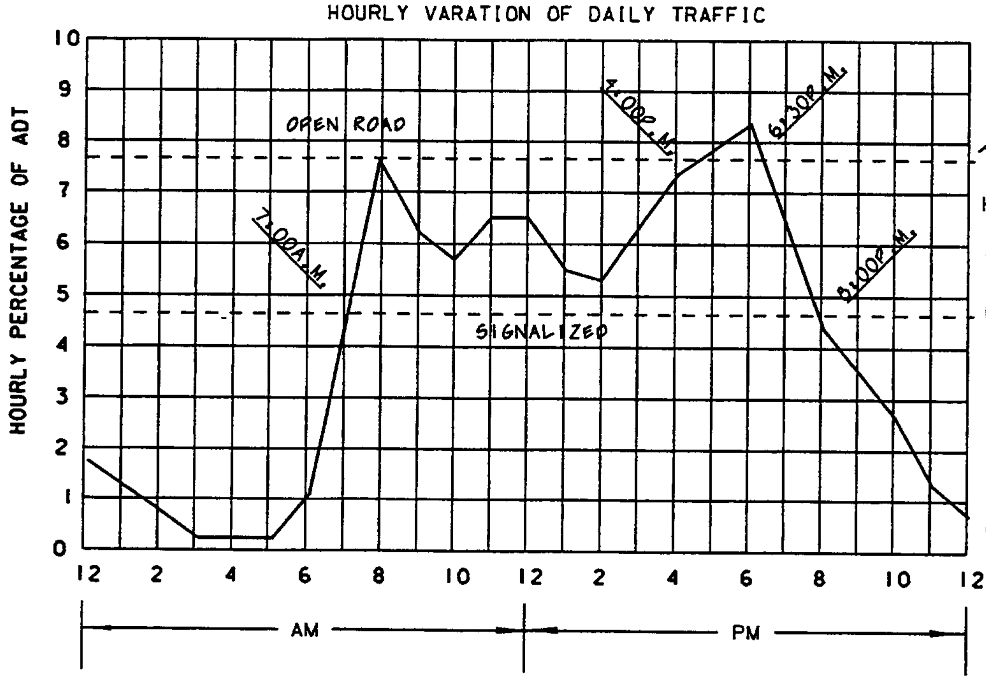
DATE: FEB - 1988

DESIGNER: YATES

PROJECT NO.: 12345-6789

LOCATION: BUCK LAKE RD.

HOURLY VARATION OF DAILY TRAFFIC



-CONCLUSION-

ROUND TO THE NEAREST 1/2 HOUR CONSERVATIVELY

6:30P.M.-4:00P.M.

OPEN ROAD LANE CLOSURE

SIGNALIZED LANE CLOSURE

8:00P.M.-7:00A.M.

EX-1-10-A
7 OF 11

LANE CLOSURE WORKSHEET

STATE PROJECT NO : 12345-6789 FAP NO.: NA

WPI NO.: 1234567 COUNTY: Tropic DESIGNER: Giddens

NO. EXISTING LANES: 4 SCOPE OF WORK: Resurface

Calculate the peak hour traffic volume (V)

V=ATC 30000 X P/D 0.083 X D 0.55 X PMF 1.20 X RTF 1.00 = 1643

LANE CLOSURE CAPACITY TABLE

Capacity© of an Existing 2 Lane-Converted to 2 Way, 1 Lane = 1400VPH
Capacity© of an Existing 4 Lane-Converted to 1 Way, 1 Lane = 1800VPH
Capacity© of an Existing 6 Lane-Converted to 1 Way, 2 Lane = 3600VPH

Factors restricting Capacity:

TLW 3.3 LC 1.8 WZL NA for 4L G/C 0.74

Calculate the Restricted Capacity (RC) at the Lane Closure Site by multiplying the appropriate 2L, 4L, or 6L Capacity © from the Table above by the Obstruction Factor (OF) and the Work Zone Factor(WZF). If the Lane Closure is through or within 180.0 m of a signalized intersection, multiply the RC by the G/C Ratio.

RC (Open Road) = C 1800 X OF 0.96 X WZF 1.00 = 2817

RC (Signalized) = RC (Open Road) 1728 X G/C 0.74 = 1279

If V ≤ RC, there is no restriction on Lane Closure
If V > RC, calculate the hourly percentage of ADT at which Lane Closure will be permitted

$$\% = \frac{\text{RC (Open Road) } 1728}{\text{ATC } 30000 \text{ X D } 0.55 \text{ X PMF } 1.20 \text{ X RTF } 1.00} = 8.73\ \%$$

Signalized % = Open Road % 8.73 X G/C 0.74 = 6.46

Plot 24 hour traffic to determine when Lane Closure permitted. (See Exhibit 10-A, Sheet 5 of 11)

NOTE: For Existing 2 Lane Roadways, D = 1.00.
Work Zone Factor (WZF) applies only to 2 Lane Roadways.
For RTF < 1.00, briefly describe alternate route: NA

Exhibit 10-A
Sheet 8 of 11

LANE CLOSURES

24 HOUR COUNTS

TIME	AM HOURLY VOLUME	ATC %	PM HOURLY VOLUME	ATC %
12 - 1	320	1.1	1920	6.4
1 - 2	180	0.6	1660	5.5
2 - 3	60	0.2	1620	5.4
3 - 4	50	0.2	2160	7.2
4 - 5	60	0.2	2380	7.9
5 - 6	260	0.9	2480	8.3
6 - 7	1050	3.5	1860	6.2
7 - 8	2270	7.6	1360	4.5
8 - 9	1820	6.1	1060	3.5
9 - 10	1740	5.8	850	2.8
10 - 11	1650	5.5	730	2.4
11 - 12	1920	6.4	540	1.8
		TOTAL	30,000	100.0

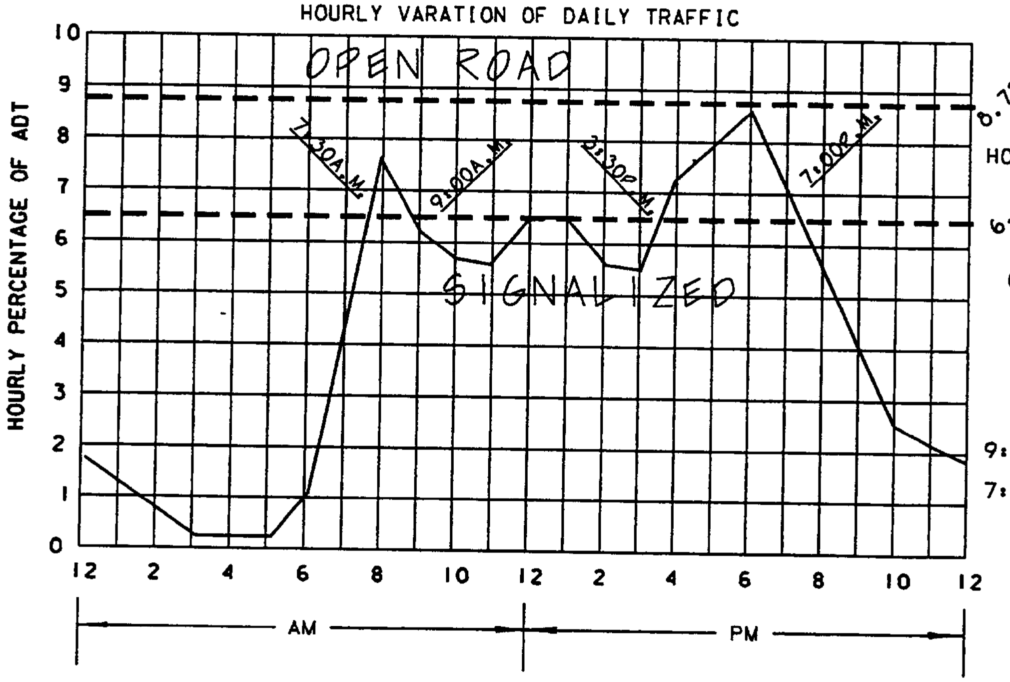
DATE: FEB - 1988

DESIGNER: GIDDENS

PROJECT NO.: 12345-6789

LOCATION: BUCK LAKE RD.

HOURLY VARATION OF DAILY TRAFFIC



-CONCLUSION-

ROUND TO THE NEAREST 1/2 HOUR CONSERVATIVELY

OPEN ROAD LANE CLOSURE

NO RESTRICTION

SIGNALIZED LANE CLOSURE

9:00A.M. - 3:30P.M.

7:00P.M. - 7:30A.M.

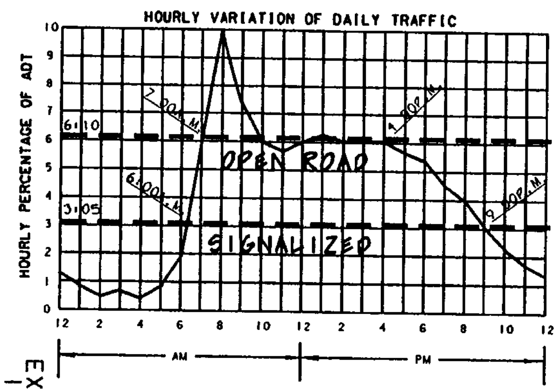
EX-1-10-A
9 OF 11

SAMPLE 4 LANE SITE • SR 60 AT US 301 EAST OF TAMPA - HILLSBOROUGH CO.

INBOUND LANE CLOSURES

24 HOUR COUNTS

TIME	AM HOURLY VOLUME	ATC %	PM HOURLY VOLUME	ATC %
12 - 1	146	0 7	1437	6 6
1 - 2	80	0.4	1387	6 4
2 - 3	99	0 5	1357	6 2
3 - 4	94	0 4	1356	6 2
4 - 5	156	0.7	1261	5.8
5 - 6	392	1.8	1106	5.5
6 - 7	1377	6 3	998	4 6
7 - 8	2235	10.3	901	4 1
8 - 9	1602	7 4	594	2 7
9 - 10	1339	6.2	518	2.4
10 - 11	1276	5 9	380	1 7
11 - 12	1316	6 0	259	1 2
		TOTAL	21,760	100 0

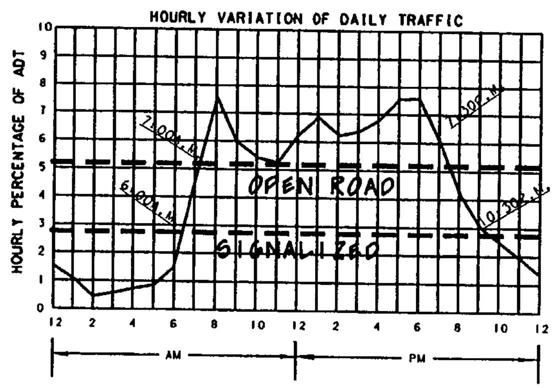


HOUR OF DAY

COMPOSITE LANE CLOSURES

24 HOUR COUNTS

TIME	AM HOURLY VOLUME	ATC %	PM HOURLY VOLUME	ATC %
12 - 1	444	1 1	2836	6 7
1 - 2	232	0 5	2594	6 1
2 - 3	195	0 5	2644	6 3
3 - 4	245	0 6	2823	6 7
4 - 5	294	0.7	3066	7 3
5 - 6	599	1 4	3080	7 3
6 - 7	1895	4 5	2362	5 6
7 - 8	3070	7 3	1775	4 2
8 - 9	2559	6 1	1291	3 0
9 - 10	2403	5 7	1212	2 8
10 - 11	2367	5 6	890	2 1
11 - 12	2694	6 4	662	1 5
		TOTAL	42,232	100 0

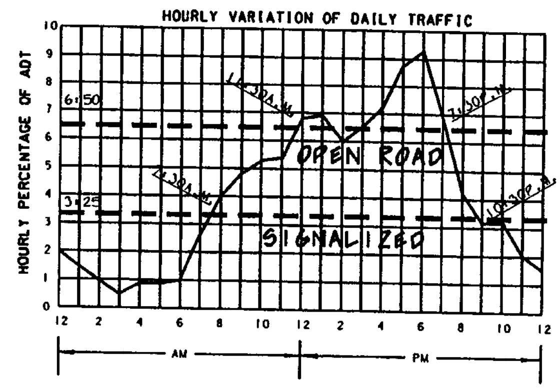


HOUR OF DAY

OUTBOUND LANE CLOSURES

24 HOUR COUNTS

TIME	AM HOURLY VOLUME	ATC %	PM HOURLY VOLUME	ATC %
12 - 1	298	1 5	1399	6 8
1 - 2	144	0 7	1207	5.9
2 - 3	96	0.5	1287	6 3
3 - 4	151	0 7	1465	7.2
4 - 5	136	0 7	1805	8.8
5 - 6	207	1.0	1892	9 2
6 - 7	518	2 5	1364	6.7
7 - 8	835	4 1	874	4 3
8 - 9	957	4 7	697	3 4
9 - 10	1064	5 2	694	3.4
10 - 11	1091	5 3	510	2 5
11 - 12	1376	6 7	403	2.0
		TOTAL	20,472	100 0



HOUR OF DAY

EX-1-10-A
10 OF 11

LANE CLOSURE WORKSHEET SUMMARY LANE SAMPLE WITH SIGNIFICANT AM-PM PEAKS SAMPLES = INBOUND (WB), COMPOSITE (EB & WB), OUTBOUND (EB) SITE = SR 60 @ US 301 EAST OF TAMPA, HILLSBOROUGH CO			
COMPONENT	INBOUND	COMPOSITE	OUTBOUND
ADT	*21 760*	*42 232*	*20 472*
P/D	*0.103*	*0.073*	*0.092*
D	*1.00*	*0.60*	*1.00*
PMF	*1.17*	*1.17*	*1.17*
RTF	*1.00*	*1.00*	*1.00*
V	*2622*	*2164*	*2203*
TLW	*3.6*	*3.6*	*3.6*
LC	*0*	*0*	*0*
C	*1800*	*1800*	*1800*
OF	*0.86*	*0.86*	*0.86*
RC (OPEN ROAD)	*1548*	*1548*	*1548*
G/C	*0.50*	*0.50*	*0.50*
RC (SIGNAL)	*774*	*774*	*774*
% OPEN ROAD	*6.10*	*5.20*	*6.50*
% SIGNAL	*3.05*	*2.60*	*3.25*
LANE CLOSURE (OPEN ROAD)	*7:00 A.M.* *4:00 P.M.*	*7:00 A.M.* *7:30 P.M.*	*11:30 A.M.* *7:30 P.M.*
LANE CLOSURE (SIGNAL)	*6:00 A.M.* *9:00 P.M.*	*6:00 A.M.* *10:30 P.M.*	*7:30 A.M.* *10:30 P.M.*

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10.14.8 Detours, Diversions, & Lane Shifts

A **detour** is the redirection of traffic onto an alternate route, using state roads, county roads, or city streets, to bypass the work zone. A **diversion** is a special detour onto a temporary roadway adjacent to the existing or permanent roadway. A **lane shift** is the redirection of traffic onto a section of the permanent roadway or shoulder.

Detour signing is usually done under the direction of the traffic engineer who has authority over the roadway to be used. The detour should be signed clearly so drivers can traverse the entire detour and return to the original roadway. When detours are required, the geometry of the detour route should be compared against the type of traffic being routed through the detour. For example, detouring of traffic which includes large trucks will require certain pavement widths, turning radius, and overhead clearance (including low power lines, span wires, and low hanging tree limbs). The structural capacity of the detour pavement should also be considered and additional structure provided if necessary.

The designer has two methods of paying for diversions: by (1) using the "special detour" lump sum pay item or (2) using the lump sum MOT pay item. When the special detour pay item is used, the work and quantities included for pay under the item are to be tabulated and noted in the plans. The special detour pay item is intended to be used in all situations where traffic is shifted one lane width or more onto temporary pavement

A Diversion, which is to be signed as a lane shift, will be paid for under Special Detour, Pay Item 2102-2 (Lump Sum). The Basis of Estimates Manual should be referenced to make sure that the appropriate items are included in this lump sum.

TCPs shall include sufficient detail for diversion geometry. Diversions should be designed with shoulders (0.6 m min) whenever practical. The radius of curvature and taper lengths shall be shown. Diversions should be designed and operated as close to the normal speed as possible. When speed reductions are necessary, the reduction should be in 10 km/h increments. The recommended minimum radius of curvature (without superelevation) for diversions is shown in Table 10.14.2

10.14.9 Above Ground Hazards

An above ground hazard is anything that is greater than 100 mm in height and is firm and unyielding or doesn't meet breakaway requirements. For treatment of an above ground hazard, see Standard Index 600.

10.14.10 Drop-offs in Work Zones

Acceptable warning and barrier devices for traffic control at drop-offs in work areas are detailed in the Roadway and Traffic Design Standards, Index 600.

The designer should anticipate dropoffs which are likely to occur during construction and provide the appropriate devices. For those projects where barrier wall would be needed and yet it is not practical - such as highly developed urban areas where numerous driveways exist - the designer should consider adding plan notes that require conditions be returned to acceptable grade by the end of the day's operation.

10.14.11 Narrow Bridges and Roadways

Simultaneously working on both sides of a bridge (bridge widening, etc.) Or roadway may be hazardous due to the narrow widths of some bridges and roads. Consideration should be given to specifying that work be done only on one side at a time, particularly on high speed roadways. In some situations, the installation of barrier wall on both shoulders can totally eliminate any shoulder or refuge area. The designer should consider whether or not this restriction of the effective width is acceptable and consistent with the desired operational ability of the facility.

10.14.12 Existing Highway Lighting

If the project has existing roadway lighting, the designer shall prepare a specification that completely describes what is to be done with the existing lighting during all phases of construction Give detailed information on any poles that have to be relocated or any new conduit or conductors that would have to be installed. A field survey should be conducted to establish the condition of the existing system and what responsibility the contractor will have in bringing the existing lighting system back to an acceptable condition.

The designer should use the appropriate pay items and quantities for all work to be done for maintaining existing lighting throughout construction.

10.14.13 Work Area Access

The TCP may need to include a work area access plan, if necessary. This is a constructability issue in which the designer addresses the question of how the contractor is to get materials and equipment into the work area safely. This is a particularly critical issue on high speed facilities (such as the Interstate) where barrier wall is used to protect median work areas. Some consideration may be given to the design and construction of temporary acceleration and deceleration lanes for the construction equipment.

10.14.14 Railroads

Railroad crossings that are affected by a construction project must be evaluated to ensure that the Traffic Control Plan does not cause queuing of traffic across the railroad tracks. Evaluate the Plan's signal timing, tapers, lane closures and distance to intersections as compared to projected peak traffic volumes. The effects of the traffic control plan on interconnected traffic signals and railroad signals must be evaluated to avoid conflicting or ineffective signal controls.

10.14.15 Pay Items and Quantities

The Basis of Estimates Handbook has been updated to provide better instructions on calculating many of the MOT quantities.

10.15 Speed Zoning

10.15.1 Regulatory Speeds in Work Zones

The goal of traffic control plans for construction, maintenance, and utility operations is to route traffic through such areas in a manner comparable to normal highway conditions. Changes to the existing posted speed limits should only be made after consideration of actual or anticipated field conditions, including: vehicular volumes, congestion, TCP phasing, lane restrictions, type of construction, closeness of traffic to workers, equipment, flagger usage, pedestrians, geometrics, and physical conditions. By virtue of F.S. 316.187, all regulatory speeds must be established on the basis of a traffic and engineering investigation. The justification for establishing work zone regulatory speeds different from normal speed limits must be included in the project file.

When developing a TCP, the considerations noted above must be addressed in determining the appropriate regulatory speeds. The TCP and the project file will suffice as the traffic and engineering investigations. TCPs for all projects must show specific regulatory speeds for each phase of work. This can either be the existing posted speed or a reduced speed. The speed shall be noted in the TCP. Guidelines for determining the appropriate speed reduction are given in Table 10.15.1

If field conditions warrant speed reductions greater than those shown in the Traffic Control Plan (TCP), then the contractor may submit to the project engineer for approval by the Department, a signed and sealed study to justify the need for further reducing the posted speed or the engineer may request the District Traffic Operations Engineer (DTOE) to investigate the need. It will not be necessary for the DTOE to issue regulations for regulatory speeds in work zones due to the revised provisions of F.S. 316.0745(2)(b). However, all other regulatory signs, work zone or permanent, require issuance of a regulation by the DTOE.

Table 10.15.1

REGULATORY SPEED REDUCTIONS
FOR USE IN CONSTRUCTION AND MAINTENANCE OPERATIONS

CONDITIONS	TYPICAL APPLICATIONS	DURATION OF WORK	REDUCTIONS TO EXISTING REGULATORY SPEEDS	SUGGESTED AMOUNT OF SPEED REDUCTION
Activities are more than 4.5 m from the edge of pavement	Landscaping Work Utility Work Fencing Work Cleaning Drainage Structures Reworking Ditches	Any time period	SHOULD NOT BE USED*	N/A
Activities which encroach the area closer than 4.5 m but not closer than 0.6 m to the edge of pavement	Utility Work Culvert Extensions Side Slope Work Guardrail Maintenance Landscaping Work Cleaning Drainage Structures Reworking Ditches Sign Installation and Maintenance Shoulder Work	One daylight period or less Greater than one daylight period	SHOULD NOT BE USED* MAY BE USED	N/A 10 mph
Activities which encroach the area from the edge of the pavement to 0.6 m from the edge of pavement	Utility Work Guardrail Maintenance Shoulder Work	One daylight period or less Greater than one daylight period	SHOULD NOT BE USED* MAY BE USED	N/A 10 mph

NOTE Regulatory Speed signs shall meet all requirements of the Manual on Uniform Traffic Control Devices (MUTCD)

* Unless drop-offs or other situations create hazardous conditions for motorists, pedestrians or workers

Table 10.15.1
(continued)

REGULATORY SPEED REDUCTIONS
FOR USE IN CONSTRUCTION AND MAINTENANCE OPERATIONS

CONDITIONS	TYPICAL APPLICATIONS	DURATION OF WORK	REDUCTIONS TO EXISTING REGULATORY SPEEDS	SUGGESTED AMOUNT OF SPEED REDUCTION
Activities are encroach the area between the centerline and the edge of pavement (lane closures)	Pavement Marking Pavement Resurfacing Pavement Repair Utility Work Bridge Repair Widening	One hour or less Greater than one hour	SHOULD NOT BE USED* MAY BE USED	N/A 10 mph
Activities which require intermittent or moving operation on the shoulder	Shoulder and Slope Utility Work Guardrail Maintenance Landscape Work Delineator Installation Widening	One hour or less Greater than one hour	SHOULD NOT BE USED* SHOULD NOT BE USED*	N/A N/A
Activities requiring a temporary detour to be constructed **	Bridge Construction Subgrade Restoration Culvert Repair Roadway Construction	Any time period	MAY BE USED	10 mph
Activities which encroach the area beyond either the centerline of a roadway or lane line of a multi-lane highway	Pavement Marking Pavement Resurfacing Use of Temporary Barrier Wall Installation of Drainage Laterals	Any time period	MAY BE USED	10 mph

NOTE Regulatory Speed signs shall meet all requirements of the Manual on Uniform Traffic Control Devices (MUTCD)

* Unless drop-offs or other situations create hazardous conditions for motorists, pedestrians or workers

**Detour and transition geometrics which meet the existing regulatory speed should be provided whenever possible

NOTE The designer should realize that NO "SHALL" conditions exists in this chart in regards to Speed Reductions It has been found that it is best not to reduce the speed unless the conditions definitely warrant such a reduction To randomly reduce speed limits does not automatically induce a safer work zone

Regulatory speed signs in rural areas (Interstate and Non-Interstate) are to be preceded by a "Reduce Speed Ahead" sign positioned as follows:

Interstate (Rural)	-	300 m in advance
Non-Interstate (Rural)	-	150 m in advance

All urban areas do not require an advance sign, however, it may be included at the designer's option.

The "Regulatory Speed" and "Reduce Speed Ahead" signs are to be paid for under the pay item for Temporary Construction Signs (per each per day)

If the existing regulatory speed is to be used, consideration should be given to supplementing the existing signs when the construction work zone is between existing regulatory speed signs. For projects greater than 1.6 kilometer in length for rural areas (Non-Interstate) and on Rural or Urban Interstate, additional regulatory signs are to be placed at no more than 1.6 kilometer intervals For urban situations (Non-Interstate) regulatory speed signs are to be placed at a maximum of 300 m apart.

The 85 percentile speed used to establish normal regulatory speeds does not apply for construction zones. Changes to the existing speed should be made on actual or anticipated field conditions such as: vehicular volumes, congestion, TCP phasing, lane restrictions, type of construction, closeness of traffic to workers, equipment, flagger usage, pedestrians, geometrics and physical conditions. This is interpreted to mean, using engineering judgement, the responsible designer is to establish the regulatory speed and so note in the plans and project file, after considering the above conditions and the degree to which warning devices are required.

In general, the regulatory speed should be established to route vehicles safely through the work zone as close to normal conditions as possible. The regulatory speed should not be reduced more than 10 mph below the posted speed without the approval of the District

Traffic Operations Engineer and the appropriate District Director. (See the Roadway and Traffic Design Standards, Index 600).

To ensure credibility with motorists and enforcement agencies, reductions in the existing posted speed shall be removed as soon as the conditions requiring the reduced speed no longer exist. On longer projects, such as interstate resurfacing, the speed reductions should be located in proximity to the activities which merit a reduced speed and not "blanketed" for the entire project.

When the regulatory speed is changed in a work zone, the permanent speed limit signs are to be removed or covered during the period when the work zone regulatory speed zones are in effect.

Once the work zone regulatory speeds are removed, the regulatory speed existing prior to construction will automatically go back into effect unless a new regulation is issued by the DTOE to revise the previous speed.

10.16 Law Enforcement Services

Work zones may require law enforcement services to protect both the workers and motorists during construction or maintenance activities. The need for these services should be considered during the development of the Traffic Control Plan. The service needed could involve On-duty FHP for speed enforcement (limited access only), Off-duty law enforcement for traffic control, or a combination of the two.

A contractual agreement between the FDOT and the Florida Department of Highway Safety and Motor Vehicles (DHSMV) was entered into for the use of On-duty FHP to exclusively enforce the speed limit in specified work zones. (REF. Contract #B-8970)

Off-duty law enforcement services are to be used for traffic control only. The off-duty law enforcement officers may be acquired from local law enforcement agencies or by the hire-back of off-duty Florida Highway Patrol officers. Such off-duty law enforcement services shall not include patrolling or speed enforcement. It should never be assumed that the presence of off-duty law enforcement will deter speeding. The use of off-duty law enforcement may be called for on a project which also uses On-duty FHP

10.16.1 Use of On-Duty FHP (Limited Access Only)

The Department has determined that construction or maintenance activities on limited access facilities that divert, restrict, or significantly impair vehicular movement through work zones may require patrolling of On-duty FHP specifically for ***speed enforcement*** to provide a safer environment for both workers and motorists. Speed enforcement by On-duty FHP may also be warranted, for the safety of the motorists, through some work zones during times when construction or maintenance activities are not in progress.

Conditions on limited access facilities to consider for the use of On-duty FHP may include, but not be limited to:

- a work zone requiring reduced speeds;
- work zones where barrier wall is used adjacent to through traffic;
- night time work zones,
- areas with intense commuter use where peak hour traffic will require speed enforcement;
- a work zone in which workers are exposed to nearby high speed traffic;
- work zones similar to Standard Indexes 609, 613, 616, and 651 as they would apply to limited access facilities.

10.16.2 Use of Off-Duty Law Enforcement

There are certain construction activities that impede traffic flows such that supplemental ***traffic control*** is desirable. Uniformed law enforcement officers are respected by motorists; therefore, it may be in the best interest of the situation to utilize off-duty law enforcement officer(s) as a supplement to traffic control devices to assist the motorists and provide a safer work zone

Conditions to consider for the use of off-duty law enforcement may include, but not be limited to:

- work within high use signalized intersections;
- high volume urban roadways with lane closures during peak hour traffic;
- any work zone in highly congested urban areas, including areas where traffic is in close proximity to construction workers and equipment.

10.16.3 Coordination, Documentation and Payment

On each individual project, the designer and/or the project manager shall coordinate with the district construction office to determine if law enforcement services will be justified. On limited access projects, the associated FHP Troop commander shall also be included in the coordination.

Once the determination has been made that law enforcement will be used on a project, the designer/project manager and the construction engineer shall develop supporting documentation for each MOT phase including the conditions requiring the law enforcement services, the number of personnel, the man-hours, and any other requirements that may be established. The supporting documentation for On-duty FHP and off-duty law enforcement will be kept separate.

The documentation for on-duty FHP will be shown in the Computation Book only and there will be no reference made to these services in the plans except as shown on the CES On-duty FHP will be paid for under pay item 2999-1(metric) or 999-1(English).

For off-duty law enforcement, the TCP shall clearly indicate the intended use of the officer(s) during each phase of construction, the need for the service, the number of officers needed, and the required man-hours. Off-duty law enforcement will be paid for under pay item 2102-10(metric) or 102-10(English). Complete documentation that complies with the TCP shall be included in the Computation Book.

The initial coordination between the designer/project manager and construction shall take place prior to Phase II. The final determination of man-hours and final documentation shall be accomplished at the same time that construction days are set.

10.16.4 Other Uses of Law Enforcement

The contractor may choose to use law enforcement services beyond the details of the TCP for situations that assist with mobilization, de-mobilization, MOT set-up, and other instances where he prefers the use of law enforcement.

The contractor is responsible for the coordination of these uses and will be included under the Lump Sum Maintenance of Traffic pay item. These contractor required services are not to be included in the Department's contract pay items for law enforcement services.

Chapter 11

Storm Water Pollution Prevention Plan (Metric)

Chapter 11

STORM WATER POLLUTION PREVENTION PLAN

11.1 General

A Storm Water Pollution Prevention Plan (SWPPP) shall be developed as part of the contract plans for each FDOT construction project site that disturbs two or more hectares of total land area and that discharges to waters of the United States

The site specific SWPPP is a requirement of the Florida General Permit issued and made effective by the Environmental Protection Agency (EPA) on September 25, 1992. In order to use the General Permit the FDOT must:

1. Prepare a plan that assures compliance with the terms and conditions of the General Permit, which includes the State of Florida Department of Environmental Protection (DEP) requirements. This includes obtaining a storm water quality permit, if appropriate.

2. File a Notice of Intent (NOI) which documents our intent to be authorized as a permittee under the terms and conditions of the General Permit.

The SWPPP will be prepared by the responsible design engineer under the direction of the District Design Engineer or the District Consultant Project Management Supervisor (if this person reports directly to the Director of Production). The SWPPP will be prepared in consultation with Drainage, Construction and Environmental personnel, as required.

Distribution of the NOI, SWPPP and signed certification statements will be in accordance with Environmental Management procedures.

The objectives of the SWPPP are to:

- Prevent erosion where construction activities are occurring
- Prevent pollutants from mixing with storm water
- Prevent pollutants from being discharged by trapping them on-site, before they can affect the receiving waters

The SWPPP consists of three major phases listed below. The first two (2) are performed during the design phase and are a joint effort between design, construction, and other departments, as necessary. The third is the responsibility of Construction and the contractor.

1. Site evaluation and characterization
2. Assessment, selection/description of control measures and design details to address the objectives
3. Implementation of actions, schedules and design details

The SWPPP will include a narrative description, outlined in Section 11.2, and a site map, described in Section 11.3. Additional information can be found in the FDOT Erosion and Sediment Control Handbook and in workshop training material.

11.2 Narrative Description

The SWPPP shall identify potential sources of pollution which may reasonably be expected to affect the quality of storm water discharges from the construction site. In addition, the SWPPP shall describe and ensure the implementation of practices which will be used to reduce the pollutants in storm water discharges and assure compliance with the terms and conditions of the General Permit.

Prepare the SWPPP narrative on 8.5" X 11" paper to be included in the specifications package or as a series of notes on a plan sheet (sheets) Use the following outline to prepare the narrative:

Storm Water Pollution Prevention Plan

1. Site Description
    - a. Nature of Construction Activity
    - b. Sequence of Major Soil Disturbing Activities
    - c. Area Estimates
    - d. Runoff Data
    - e. Site Map
    - f. Receiving Waters
2. Controls
    - a. Erosion and Sediment Controls
        - (1) Stabilization Practices
        - (2) Structural Practices
    - b. Storm Water Management
    - c. Other Controls
        - (1) Waste Disposal
        - (2) Off-Site Vehicle Tracking
        - (3) State or Local Regulations
        - (4) Application of Fertilizers and Pesticides

d. State and Local Plans

3. Maintenance

4. Inspection

5. Non-Storm Water Discharges

11.2.1 Site Description

The SWPPP shall provide a description of the site, construction activities, and potential pollutant sources. The area estimates shall include the total project area and the area expected to be disturbed. The runoff data shall include the rational runoff coefficient before, during, and after construction, the drainage area for each outfall, and existing data describing the soil or the quality of discharge from the site. The narrative discussion of the site map is discussed in section 11.3. The name of the receiving waters shall be given, as well as the wetland area on the site.

11.2.2 Controls

The SWPPP shall include a description of the controls that will be implemented at the construction site. For each of the major activities identified in part 1.b. of the site description narrative, describe the timing of the implementation of control measures during the construction process. Also describe the storm water management measures that will be installed during construction to control pollutants in the storm water discharges that will occur after construction.

The narrative for some of the other controls will be supplied by the contractor at the pre-construction conference. A plan for off-site vehicle tracking is an exception and must be included in the SWPPP prepared during design.

Any Water Management District or Local Water Management permits obtained in connection with the project should be noted.

11.2.3 Maintenance, Inspection and Non-Storm Water Discharges

Include a description of any maintenance requirements that are not stated in the standard specifications. Include the inspection requirements, which will be either requirements of EPA or the applicable requirements of another regulatory agency, whichever is more stringent. If special procedures have been developed to minimize turbidity associated with normal construction dewatering, include a description of those procedures.

11.3 Site Map

The following information shall be shown on a site map

- Drainage patterns
- Approximate slopes
- Areas of soil disturbance
- Areas that may not be disturbed
- Locations of major controls identified in the plan
- Areas that are to be stabilized against erosion
- Surface waters (including wetlands)
- Locations where storm water is discharged to a surface water

There are three methods that may be used to develop the required site map.

1. Use the construction plans as the site map.
2. Use the construction plans with some additional special sheets.
3. Prepare a site map separately from the construction plans.

All the information required above is shown in a typical set of construction plans except the drainage patterns and the locations of major temporary controls If an optional Drainage Map is included in the construction plans, then the drainage patterns will also be shown. Use method two or three if the Drainage Map is not included.

Method one can be used if the Drainage Maps are included and the major temporary controls are shown somewhere in the construction plans. The preferred location to show the controls is on the Maintenance of Traffic (MOT) sheets. If the MOT sheets are not adequate, then the controls may be shown on the Plan and Profile sheets. If they are not adequate or are too cluttered, then use method two or three.

Method two uses special sheets to show information required by the General Permit that is not shown any other place in the construction plans. This will usually be the locations of the controls and the drainage patterns Use a plan view with baseline information and sufficient topo to locate the controls.

Method three will be used when Plan and Profile sheets are not prepared for the project A topographic map or aerial photo must be prepared as a base for the site map. Maps of the vicinity of the site may be available from the local government or the Water Management District. As a last resort, a USGS quadrangle map may be used as the base map.

The narrative description of the site map (part 1.e of the outline) shall describe the option chosen for the site map. If options 1 or 2 are chosen, the narrative shall list the construction plan sheet numbers where the site map information required by the General Permit can be found.

Regardless of the method used to prepare the site map, details should be prepared for all controls that are not detailed in the Roadway and Traffic Design Standards. The details should show the work intended, where and how the control is to be placed, and any other special design details required. Any Technical Special Provisions required by the erosion control items of work should be prepared as part of the specifications package.

11.4 Summary of Quantities

The Summary of Quantities - Erosion Control items shall be prepared to document what, where and how much material and work is required for the contractor to implement all phases of the Plan. These items shall be input to the CES with the regular roadway quantities.

Chapter 12

Right-of-Way (Metric)

Chapter 12

RIGHT OF WAY (METRIC)

12.1 <u>General</u>:

To assist the roadway designer's understanding of right of way (R/W) requirements which must be addressed during the project development and design phases of projects, the following terms are briefly defined as an introduction

<u>Right of Way</u> is the real property estate rights, donated or acquired by purchase or condemnation, to accommodate permanent transportation improvements Fee simple right of way is the strongest estate available to the Department and is sought for most permanent highway facilities When improvements are designed which will fall outside of the existing R/W boundaries, additional lands must be identified and purchased as fee simple right of way for the improved facility Purchased, condemned or donated R/W transfers ownership and estate rights to the Department Right of Way donations are always to be considered

<u>Limited Access R/W</u> is purchased for facilities such as Interstate and Expressways This limits public access to interchange connection-points designed with entrance and exit ramps and limits access to motorized vehicular traffic Pedestrians and bicycles are restricted in the interest of traffic capacity and safety

<u>Controlled Access R/W</u> is acquired for the remaining State Highway System This permits the general public and land owners along the corridors reasonable access, but in a controlled pattern that will facilitate the movement of through traffic A mainline roadway with fully controlled access and parallel service roads to serve local traffic is

the type of facility that best meets both objectives This type of acquisition is encouraged for high volume corridors at major intersections, especially if adjacent property is vacant at the time of the proposed improvement This allows sufficient right-of-way for urban interchange design

Perpetual Easements (perpetual right of use over, under or through the property of another) are used when permanent structures or improvements are to be constructed and maintained on parcels where acquisition of fee title would be impractical, i e , when acquisition of the fee would cause excessive severance damages due to green area or setback requirements or where underground structures are to be constructed which will not impair the surface utility of the land A sight triangle or drainage facility are examples of features that may require a perpetual easement Condemnation powers may be utilized to acquire necessary perpetual easements

Temporary Easements (a temporary right of use over, under or through the property of another) are used when it is necessary to temporarily occupy a parcel for a specific purpose such as construction of temporary detours, stock piling materials or parking equipment No improvement which requires maintenance by the Department beyond the term of the easement can be constructed on a temporary easement

License Agreements (permission to do a particular thing which without the license would not be allowable) are used to gain access to adjoining properties for sloping, grading, tying in, harmonizing and reconnecting existing features of the licensor's property with the highway improvements to be constructed This work is solely for the benefit of the property owner The Department does not compensate for license agreements If the owner refuses to execute the agreement, the Department will not perform the work

Licenses are included here as real property interests for convenience, but they are not real property interests A license, with respect to real property, is a privilege to go on the premises for a certain purpose but does not vest any title in the licensee

Examples of license agreements are right of entry agreements and restoration agreements Right of entry agreements are for a specific purpose such as to demolish the remainder of a severed building that has no value or to enter a property before the formal permanent documents can be executed Restoration agreements are permissions to enter the property and perform minor grading, grassing, planting, etc , to harmonize and restore conditions

12.2 Procedures for Establishing R/W Requirements:

The procedures for addressing R/W requirements in design are an integral part of the engineering analyses, economic comparisons and professional judgements the designer must make Consultation with R/W appraisers and acquisition personnel will be necessary, if the best decisions are to be expected One excellent method of providing the consultation is the "R/W partnering" concept with all parties that have a vested interest participating in the decision making process

12 2 1 Open Cut and Fill Roadway Sections

R/W requirements along the project boundaries are dictated by the actual construction limits plus a reasonable maintenance buffer The roadway cut and fill slopes, drainage ditch slopes and other construction elements are used to define the construction limits, which are generally shown on the roadway cross sections R/W requirements are determined by reviewing the plotted cross sections after the roadway and drainage design elements have been permanently established and major revisions are highly unlikely

The procedures should, at this point, include a joint review of the proposed R/W including a field review if necessary The design details and the property information must be reviewed by the designer, personnel from the R/W Office and the R/W Mapping Office This review should be scheduled during the Phase II design process as defined in the Plans Preparation and Assembly Manual and should address such issues as

1 Will additional R/W be required for project access or maintenance of the facility? Check pond sites, high embankment slopes, bridges, outfalls, canals and similar sites

2 Can fee takings be avoided on certain key parcels where the fill would cause substantial damages to the parcel or to an existing business by designing a retaining wall?

3 Can the grade of the roadway be revised or slopes adjusted on specific parcels to minimize damages or to reduce the difference in elevation between the remainder and the project grade at the R/W line? Review potential claims relating to driveway modifications or severe elevation differences

4 Can the roadway grades be revised or connections relocated so access to the remainders can be constructed without impairing the use of the remainder, thereby avoiding huge severance and business damages caused by impairment of access?

5 Can drainage facilities (outfalls, ponds, ditches, etc) be maintained without additional R/W space? Can uneconomical remainders be used for stormwater treatment?

6 Check the suitability and cost effectiveness of stormwater treatment facilities and the status of permit approval

7 What type of legal instruments are likely to be required to secure the appropriate property rights for the project?

8 Review the status of R/W activities by others in the project area Avoid "double takes" at ramp terminals, intersections and by future FDOT projects

9 Check for potentials of hazardous materials, "4F" parcels, utility easements, landlocked remainders and parcels which could be eliminated from takings

10 Check for acquisitions involving existing treatment systems which could be mitigated within the FDOT system

11 Discuss any means available to protect R/W requirements against development prior to acquisition

12 Check for unrecognized work which will fall outside of R/W such as trenching, wall forms, or equipment maneuvering space

13 Check for availability of offsite property owned by FDOT which could be used for mitigation sites

14 Discuss status of "maintained R/W" maps

15 Discuss alternatives and cost effectiveness of excessive damages or parcel acquisitions

12 2 2 Curb and Gutter Roadway Section

Establishing R/W requirements in urban sections will generally follow very similar procedures as the open roadway section projects The analysis and decision making is complicated by more property owners, generally higher property values and more complex access management problems

The roadway and drainage design must be developed to a point where all major elements of the project (including signalization poles, lighting poles and overhead sign foundations) are firmly fixed On projects with sidewalks and driveway connections, the design elements can be accurately established ONLY if proper survey data has been obtained for the designer's use Profile elevations along the proposed R/W line and back of sidewalk and half-sections or profiles at each driveway location should be obtained as a minimum standard practice

The design engineer must perform the design work required to establish the project profile grades and the back of sidewalk grades to minimize the grade differences at the R/W line Areas of superelevation must be analyzed very carefully Split profile grades or other design strategies may be required to accommodate the proposed construction of the facility within the minimum R/W limits

The developed drainage and roadway design elements should be plotted on the plan sheets and the cross sections, which will establish the preliminary R/W requirements along the project boundaries as indicated by the construction limits A good quality control review and a joint review with R/W appraisers and R/W Mapping personnel at this time will assist in determining the final R/W requirements The same issues listed earlier in these procedures should be addressed

The design engineer cannot assume the property owner's intentions or disposition with respect to his property The designer must design the highway facility within the existing R/W or request acquisition of R/W to accommodate the project elements The most economical means of constructing the project should always be the objective Alternate design studies will be required in many locations to determine if additional R/W should be purchased, a retaining wall constructed or modified slopes and barrier system should be considered A reasonable estimate of R/W costs or damages expected must be obtained from the R/W Office in order to make such a design study Alternate construction methods may be shown on the plans as preferred and alternate methods

12 2 3 <u>Driveway Connections</u>

Access to the Department's facilities is an important element of the design and R/W determination procedures The designer must understand and follow the Access

Management Rules (14-96 and 14-97) and the standards adopted to implement the objectives of those rules

1 The access classification of the roadway segment and the connection category of the driveways must be determined The designer must be aware of the nature, type, frequency of trips and number of vehicles utilizing the driveway

2 The designer must make a determination as to which driveways are in conformance, which are to be maintained, which are to be closed and which are to be modified to bring them into compliance

3 The designer must obtain sufficient field survey data to establish the highway grades, horizontal alignment and the existing ground elevations in the vicinity of the driveway location The data necessary to accurately design the driveway connection and determine an acceptable tie-in with the existing surface should be obtained as a minimum

4 The designer should develop the most economical driveway design which will conform to the standards and the requirements of the access management objectives Alternate designs and locations may be required to meet the property owners needs and to reduce the costs of business damages Generally, the best option can be reached by negotiating with the property owner in a give and take atmosphere

Driveway connections must be addressed in consultation with R/W personnel, generally appraisers or review appraisers This fact should not be overlooked on projects such as resurfacing, etc on which there may not be any other R/W requirements R/W related decisions to be made about driveway connections, probably on a case by case basis, include

1 If the driveway can be harmonized without impacting the value or the utility of the property, the Department should make a good faith offer to provide a suitable connection, at FDOT expense, in exchange for the permission to enter the land during construction for the purpose of doing the construction If this offer is refused by the owner, the Department should provide a reasonable temporary commercial base material connection and place the burden for constructing the connection on the owner The designer must make sure he can provide a traversable connection

2 If providing the driveway connection reduces the remainder value or utility of the property and no other acquisition of that property is contemplated for the project, a temporary easement will be requested and shown on the plans. The Office of R/W will see that the proper instruments are executed to enter onto the property for purposes of construction and to compensate the owner for damages, if any are due If other acquisition of that property is proposed, these instruments should include the entry and compensation, if any, for the driveway

3 If it can not be determined during design that the harmonization work will reduce the remainder value or utility of the property, the owner can negotiate or claim damages through inverse condemnation during construction This is not a desirable position for the Department, therefore the decision to employ this approach should be carefully considered

4 Design should always, in their consultation with R/W personnel, make a determination if a fee taking or permanent easement is in the public interest to protect the facility If a permanent easement will protect the facility and still give the owner some utility in the easement area, this may reduce the severance and business damages incurred

12 2 4 Procedures for Decision Making

To assist in the decision process related to R/W requirements and instruments to be used the following guidelines from the Office of Right of Way may be used during the joint review process

1 License agreements (Restoration and Right of Entry) should be used only if the following conditions can be met

- The improvements or changes contemplated are minor in nature and are for the benefit of the property owner,

- No compensation will be offered to the property owner, except the benefits derived from the improvements or changes

- None of the improvements are required for the construction of the transportation facility and removal of, or change to the improvements will not be detrimental to the facility,

- The property owner is or will be fully informed of the nature and extent of the proposed improvements and has no objections, and,

- The transportation facility can be constructed without adverse impact on safety or operation

2 Temporary Easements should be used under the following conditions

- The improvements or harmonization work are primarily for the benefit of the property owner, but to properly construct the improvements the remainder value or some utility of the property is reduced, and there is no other acquisition of that property involved in the construction of the project

o The contemplated improvements or uses of the property owner's land are required only during the period of construction of the transportation facility,

o The changes or improvements to the property owner's land are temporary and removal or alteration of the property subsequent to construction would not be detrimental to the facility; and,

o After construction is complete, there will be no need for periodic re-entry onto the property for maintenance or other purposes

3 Fee Simple R/W purchase should be used when the following conditions exist

o The planned improvements to the property owner's land are required as a part of construction of the transportation facility,

o The improvement on that land must remain in place as a part of the facility, and,

o Periodic re-entry to the property is required for maintenance or repair

4 Perpetual Easements may be considered as an alternative to fee simple purchase in the R/W process

o If the property estate rights are not required to be as complete as a fee simple taking and the owner may continue to enjoy some benefits of the property without impairing the Department's interest The costs associated with the easements must be much less than a fee simple purchase before it becomes a viable alternate

12 2 5 Transmittal of R/W Requirements

R/W requirements should be finalized before transmitting them to the R/W Mapping Office for preparation of R/W maps All R/W requirement transmittals should be in writing and clearly indicate in the memo and on the plans which parcels have been finalized and which parcels are still pending An effort should be made to transmit final R/W requirements in usable segments recognizing that it is not practical to contract for appraisals, etc , on small project segments Priority should be given to the major, expensive or complex acquisitions that are going to require more time to acquire and complete the relocation of the occupants Advanced design effort and final R/W requirement determination may expedite meeting production ready dates It is desirable to transmit requirements as early as possible in the plans development

R/W requirement submittals must be coordinated with the production management staff and scheduled in advance

All R/W requirements that are firm (primarily mainline construction limits) should be transmitted by Phase II All other requirements that generally involve more detailed design completion (i e , outfalls, pond locations, corner clips, access needs, etc) must be submitted by the Phase III stage completion of the roadway design plans

All R/W requirements must be transmitted by the completion of the Phase III roadway design plans

12.3 Process for Establishing Right of Way Requirements:

Establishing right of way requirements is a design process, but requires close coordination with other functions that have input to the project development and design of the project

The Engineer of Record is responsible and must ensure that representatives from the appropriate functional areas are involved in the determination process They must also ensure that a review of the final R/W requirements is performed The "R/W Partnering" concept is an excellent method of ensuring that the proper consultation and input is received

Generally, the R/W needs-determination will involve Roadway, Bridge and Drainage Design, Permits, Utilities, R/W appraisers, R/W Mapping and Legal functions On consultant designed projects, the project manager's role as lead coordinator is especially critical

12 3 1 New or Major Reconstruction Projects

These projects generally have Project Development and Environmental (P D & E) activities and Right of Way activities identified in the Work Program

The project development process must address R/W requirements and perform sufficient preliminary engineering design to obtain preliminary cost estimates from the R/W Office This may require that the P D & E consultant or in-house scope of services include work such as

1 Preliminary roadway grades & geometric design
2 Conceptual Drainage design and layout
3 Analysis of major access management issues
4 R/W Survey, property lines and limited Topo
5 R/W Mapping and property research activities
6 Preliminary R/W cost estimates work

These activities should also be performed by in-house staff doing preliminary engineering on projects This early identification of potential R/W requirements, approximate costs and work effort to complete R/W Administration activities will greatly improve both cost estimates and schedules of projects Also, involving R/W mapping and appraisers for value judgements will assist in developing better project alternatives

R/W requirements identified during the project development phase should not be considered firmly set The R/W Office cannot be requested to begin R/W mapping or appraisal activities based on these requirements, without extraordinary efforts by the designer to support the acquisition process as in advance acquisition Normally, the final design process will establish final R/W requirements well before the completion of the Phase III design activities

12 3 2 Reconstruction Projects With Anticipated R/W Requirements

These projects may not have a formal P D & E study, but they were determined during Work Program development to require some R/W acquisition Most projects will require some environmental re-evaluation effort and all projects should have some preliminary engineering to better define objectives, scope and R/W requirements The following general process, as it relates to R/W requirements should be established by design

PHASE I (See the Plans Preparation and Assembly Volume)

1 R/W Mapping will provide preliminary maps showing properties and all existing R/W lines for the project These should be requested by the designer or by the project manager, on consultant projects

2 Roadway Design will define project horizontal and vertical alignment and relate the existing R/W lines to the project as necessary to set R/W limits

PHASE II

1 Roadway Design will identify proposed R/W requirements as indicated by the completed design details such as the following

- Limits of construction slopes for roadway and bridges
- Cross section elements, ditches, curb returns and sidewalks
- Driveway and street connections

2 Drainage will identify proposed R/W requirements as indicated by the completed drainage features

- Retention or Detention Ponds
- Mitigation of environmental issues
- Drainage outfalls, sediment basins, etc

The designer will review all proposed R/W requirements with the R/W Mapping Office This should be performed during the Phase II design activities in order to make decisions on how each parcel of proposed R/W will be acquired These decisions will impact which design approach is taken The issues to be discussed and decisions to be considered are detailed in Section 12 2 of these procedures

3 As R/W requirements are determined, the information is furnished to the R/W Mapping Office by memo documenting clearly which R/W is final and which is pending The R/W Mapping Office will use only the final requirements transmitted to prepare R/W maps See Section 12 2 5

PHASE III

1 By the completion of Phase III design, all R/W requirements will be identified and transmitted to the R/W Mapping Office

2 After transmittal of final R/W requirements to the R/W Mapping Office, design changes that affect R/W must be coordinated with the R/W Mapping Office, in a timely manner

<u>The R/W shown on the roadway plans must be in exact agreement with the R/W Maps</u>

It is essential that close coordination be maintained with R/W personnel in order to ensure that design changes affecting R/W are transmitted promptly

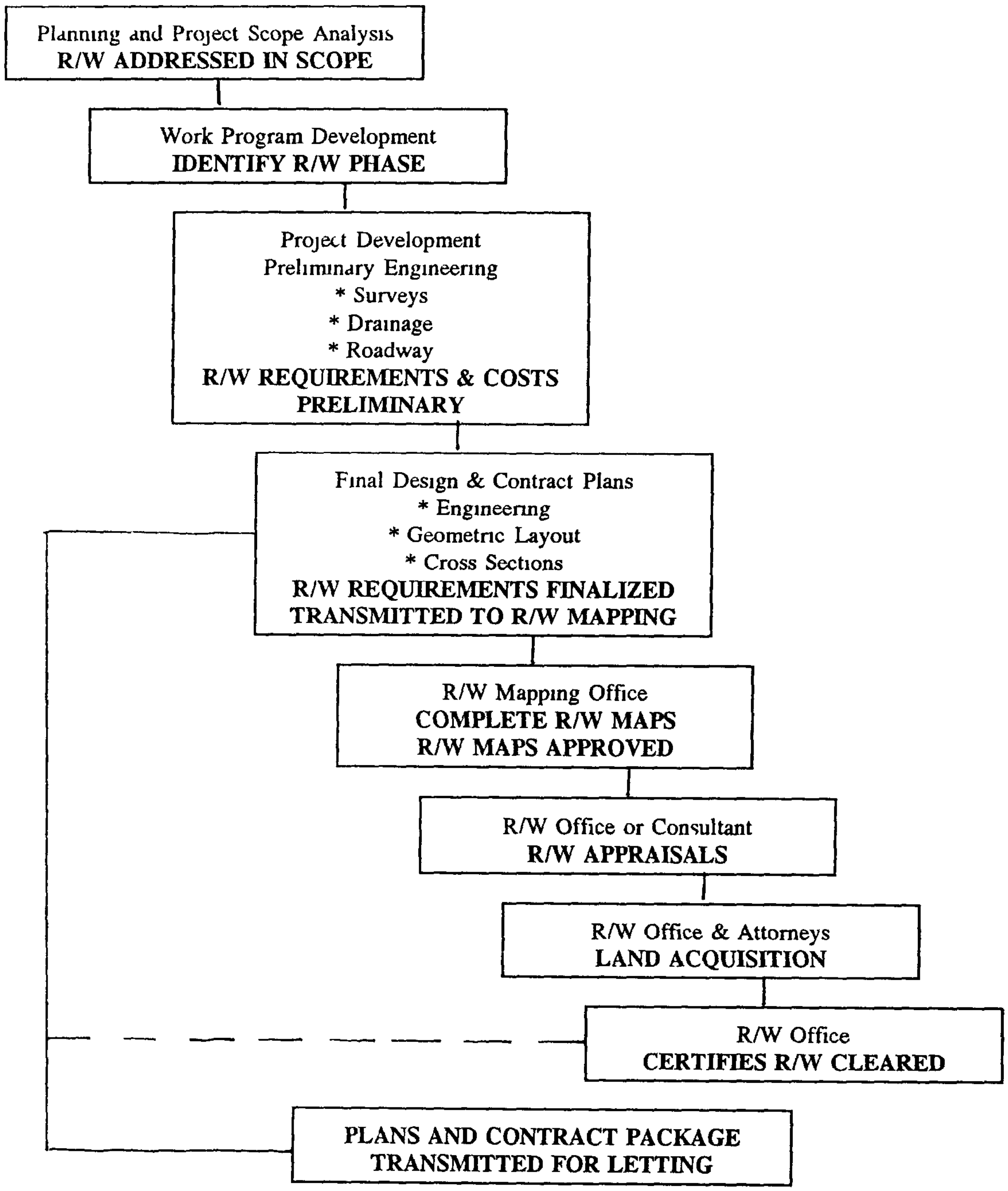
12 3 3 <u>Projects Without an Identified R/W Phase</u>

Many improvements to highway projects are <u>intended</u> to be accomplished within the existing R/W The widening or widening and resurfacing projects are examples Such projects must be evaluated very carefully and very early in the roadway design process The addition of R/W requirements can have a tremendous impact on the schedule and on the anticipated costs of a highway improvement project

R/W Mapping should be consulted on all resurfacing projects to ensure that a maintenance survey is not required

If unanticipated R/W requirements are identified during design, the production management staff and the R/W Mapping Office should be notified as soon as the requirements are determined The production management staff will then give direction as to continuing with the design and acquisition If acquisition continues, it will follow the previously discussed procedures

R/W REQUIREMENTS
GENERALIZED PROCESS FLOW DIAGRAM
(Each function must have well defined written procedures for the development, quality control, coordination and regular exchange of product evaluation)



Chapter 13

Initial Engineering Design Process

MAJOR ACTIVITIES - INITIAL ENGINEERING DESIGN PROCESS

Review & Confirm.
- Project objectives/scope
- PD&E study results
- Typical section data accuracy
- Environmental evaluation
- Budget (WP) & staff-hour estimates
- Schedule & production dates
- Approvals & authorizations

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Prepare, Document & Approve.
1. Typical section standards
2. Design controls - speed, design period, vehicle, traffic volumes, LOS, access class & function bike & pedestrian LOS, ADA
3. Design project standards & assumptions

↓

Compare & Confirm.
- Project design standards vs R/W
- PD&E study vs standards
- Design controls vs standards
- Objectives & scope vs standards
- Documentation & approval

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Field Review and Verify:
- Adequacy of survey data
- Updates required
- Transfer survey data to design files
- Adequacy of R/W survey data

Surveyor signs off on location files.

↓

Review, Confirm & Approve.
- Alignment and topo in CADD
- Alignment VS standards
- New alignments, CL construction
- Exceptions & variations

Initiate utility contact.

↓

Review & Establish Needs.
- Environmental issues
- Retention/outfalls
- Permits, mitigation R/W field review

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Develop.
Preliminary project layout. grades, superelevation rates, transitions, vertical curves, geometry calculations

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Review:
- Grades vs soil data vs DHW
- Clearances above and below
- Existing drainage structure size used on existing facility vs grades

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Develop.
- Existing ground cross sections
- Approval of alignment & grades along project computations
- Soil data on existing ground cross sections
- Utility locations & potential conflicts

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Develop.
- Roadway cross section templates
- Special ditch profiles
- Check impact on utilities
- Drainage outfalls

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Develop.
- Geometric layout - intersections interchanges transitions & connections
- Verify and confirm access management design
- Confirm bike, pedestrian & ADA needs vs project standards

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Field Review:
- All preliminary engineering activities & decisions
- Approvals documented

↓

Finalize.
- Alignments grades geometry reports

Begin.
- R/W requirements CES pay items

↓

Review & Confirm
- Preliminary project design report
- Project objectives/scope
- Project design controls/standards
- Environmental issues/permits
- Budget, staff-hour estimate & production dates
- Engineering support data & services

↓

To Final Engineering Design

Chapter 13

INITIAL ENGINEERING DESIGN PROCESS

13.1 General

The engineering design process (Final Design Phase), as discussed in this and following chapters, is the development and contract preparation phase of highway construction projects. It begins with the approval of the Project Location/Design and ends with the construction letting. It also includes the update process when the construction plans and specifications are ready and on hold in the district and require revising to make them contract ready. Throughout this design process, quality control will be exercised by those responsible for the engineering design and plans preparation activities by having a plan, do, check routine for each and every significant task or operation.

The engineering and design activities and the schedules depend on the type of project and the required effort to accomplish the desired objectives. Projects can be designated as three basic types:

- New Construction - A highway or bridge project along a new corridor on new alignments, horizontal and vertical.

- Add Lanes and Reconstruct - A highway project along an existing facility to add lanes, widen or add bridges, improve intersections, and, in general, upgrade and improve the capacity and safety of the facility.

- Other Projects - May include Resurfacing, Restoration and Rehabilitation (RRR), Local Agency Program (LAP), or other projects such as a highway and/or enhancement projects - A highway and/or bridge project undertaken to extend the service life of an existing facility and to enhance the safety of the facility. These projects generally do not require a PD&E phase. The scopes are so varied that it is difficult to define them, except project by project. They can vary in magnitude from installing highway lighting for enhanced safety or resurfacing pavement to extend the service life, to minor lane and shoulder widening, bridge rail modification or intersection improvements. These projects may also include bike paths, sidewalks and landscaping projects.

13.2 Initial Engineering Design (Phase I)

It is important to distinguish the initial engineering design activities from planning and the preliminary engineering done during the Project Development (PD&E) phase. If a PD&E phase has been completed, some of the activities discussed here may have been performed to varying levels during that phase. The information contained in the preliminary engineering report should be considered as the starting point for the initial engineering phase. In the case where there was not a PD&E phase, the initial engineering design activities must establish the project scope, controls and standards, R/W needs, and major design elements necessary to determine that we have a viable project and R/W can be cleared.

Generally, the initial engineering process should accomplish or complete the following activities:

- Completely and fully define and document the objectives of the project and the scope of activities to accomplish them. This will almost always require an on-site review.

- Develop and document a realistic staff-hour estimate and production schedule to accomplish the scope of activities identified.

- Establish and document the design controls, assumptions, project design standards, exceptions, and variations. Significant changes to previously approved PD&E elements may result in a re-evaluation of the environmental document. Discuss with the District Environmental Office.

- Identify and document additional engineering and support services.

- Determine and document the structural design requirements.

- Determine and document if R/W is required.

- Establish and document the review procedure and number of submittals, if different from guidelines provided in this manual.

- Establish preliminary geometry, grades, and cross sections.

13.3 Scope, Objectives, Schedule and Budget

The project manager and other FDOT managers are responsible for the development, review and approval of the project objectives, scope of work, and schedule in accordance with the Project Management Guidelines. They also must verify that required funds are in the work program. The project objectives and scope are best confirmed and/or completed by:

1. Reviewing the PD&E study recommendations, conclusions and commitments, if they exist.

2. Performing a field review of the project with the project manager, and personnel from other FDOT offices, such as Roadway Design, Traffic Operations, R/W Engineering, Utilities, Maintenance and Construction, as appropriate

3. Requesting a review of the draft scope of services activities by FDOT offices, such as maintenance, construction, design, traffic operations, access management, etc.

4. Developing the scope of services sufficient to advertise for professional services. After the scope of services is completed and approved, the schedule and budget may be confirmed and/or updated by the engineer/project manager and approved by the appropriate district manager.

5. After consultant selection or in-house assignment, the designer or consultant should review and confirm the scope by completing steps one through four above.

13.4 Project Design Controls and Standards

Among the activities the Engineer of Record will accomplish on a project are the identification of the given design controls and the selection of the appropriate design standards. These will be documented in the project file(s).

The design controls as addressed in this manual and AASHTO include such things as design speed, design vehicle, design period, traffic volume and service level, functional classification of the corridor, the access class, and other factors that control the selection of project standards that will ensure the facility will function safely at the level desired and expected by the motorists.

Establishing the project standards is one of the first requirements of the engineering design process. The decisions, assumptions and calculations for the design are based on these factors. All project standards shall be documented in the project file(s).

The preliminary engineering report (PD&E) or concept report may include some of the controls and standards to be used on the project. These values should be reviewed, confirmed as valid and consistent with the overall corridor or system, and documented. Significant changes to approved PD&E elements of design may require a re-evaluation of the environmental document.

If project standards must be used that do not meet recommended values, these must be documented and receive approval/concurrence by the appropriate FDOT and/or FHWA engineer. These are either exceptions or variances as described in Chapter 23 of this manual and must be maintained in the project file(s).

When all project standards are selected, documented, and agreed upon, the engineer should get the District Design Engineer to concur that the appropriate standards are being used. The Typical Section package will include some of the project standards. Those not included, and all known exception/variance justification shall be documented in the project file(s).

13.5 Support Services

Any information or support services that have been provided must be reviewed by the Engineer of Record to determine the completeness of the information. Conditions and data may have changed drastically if they are not current.

Technical data required for the design of a roadway project can be available from various sources, such as:

- Surveys - design, topographical, aerial, drainage, right-of-way location, soil, utilities
- Traffic Data
- Pavement Design
- Environmental Documents
- Original Plans
- Accident Data
- Access Managment Classification

During the design process, the project will require coordination with different sections or departments. When engineering decisions, information, or other support services are required from FDOT functional areas, it is the project manager's responsibility to coordinate and facilitate the request and expedite a timely response. The functional areas include:

- Planning and Programs
- Surveying and Mapping
- Traffic Plans
- Geotechnical
- Drainage
- Maintenance
- Construction
- Utilities
- Estimates and Specifications
- Right-Of-Way
- FHWA
- Value Engineering
- Traffic Operations
- E.M.O.
- Access Management
- Structures
- Safety
- Plans Review

13.5.1 Aviation Office Coordination

Federal law requires that notice of construction must go to the Federal Aviation Administration (FAA) under the following circumstances:

1) Any construction or alteration of more than 200 feet[1] (60.96 m) in height above the ground level at its site; or

2) Any construction or alteration of greater height than an imaginary surface extending outward and upward at 100 to 1 (1:100) for a horizontal distance of 20,000 feet (6096 m) from the nearest point of the nearest runway of any public or military airport.

For assistance, contact:

F.D.O.T. Aviation Office
605 Suwannee Street, M.S. 46
Tallahassee, FL 32399-0450
(904) 488-8444 SC 278-8444

[1]Horizontal and vertical distances are given in English units due to current FAA policy that only English units of measure are to be used for airport facilities.

13.6 Preliminary Geometry, Grades, and Cross Sections

To establish geometry, grades, and cross-sections, the following activities should be accomplished or near completion.

- Supporting data such as surveys, traffic and pavement evaluation data.
- Typical sections and pavement design.
- Standards, variations and exceptions.
- PD&E and environmental commitments addressed and if necessary, re-evaluation.
- Need for R/W phase addressed.
- Utility initial contact and survey data.

The initial engineering design activities to establish the preliminary project plans are:

- Set and calculate the horizontal alignment.
- Set the proposed profile grade lines.
- Develop preliminary cross sections at selected intervals or control locations.
- Develop preliminary layout of roadway, intersections, interchanges, transitions, and connections.
- Field review all proposed preliminary engineering layout and decisions for conflicts, R/W needs, connections, updates and additional needs.

The initial engineering review (Phase I) is used to obtain confirmation and approval of the objectives, scope, standards, decisions, and assumptions to be used as the basis for the engineering and design. The Engineer now has the decisions and direction necessary to perform final engineering. If this is not the case, the necessary initial engineering activities must be accomplished before continuing to the final design process.

The results of the above activities should be that:

- Structures can now be given the horizontal and vertical alignment and clearance requirements for bridges.
- R/W Engineering can be furnished with mainline R/W requirements for the project.
- Plan and profile sheets can be clipped.
- Traffic plans development can be initiated.
- Cross sections, grades and alignments, as required, can be provided to the drainage section.
- Work sheets, as needed, can be provided to the permits section for initial evaluation.
- Utility owners can be provided plans, profiles and cross sections as required to identify/verify and designate their existing utilities.
- The CES pay item listing can be initiated by identifying the items of work involved at this point.

Chapter 14

Final Engineering Design Process

MAJOR ACTIVITIES

FINAL ENGINEERING DESIGN PROCESS

Perform Final Engineering.
- Horizontal & vertical geometry
- Geometric layout & calculations
  - intersections, interchanges, side roads
  - connections, transitions
- Access management design

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Coordinate Disciplines.
- Horizontal & vertical geometry to bridges
- Foundation studies
- Roadway geotechnical data
- Utility meetings & design
- Permits meetings & design
- BHR & BDR to Structures
- Drainage requirements
- R/W requirements for title search activities
- Traffic design plans signals, markings, lighting

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Develop Final Drainage Design
- Project surface runoff
- Storm drain systems
- Retention pond sites
- Outfalls
- Grades & special ditches
- Reports & calculations

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Perform Roadway Structural Design.
- Box culverts
- Retaining walls - M S E
- Foundations, lighting, mast arms, etc
- Buildings, parking & toll plaza facilities
- Approach slabs

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Coordinate and Advance.
- Roadway engineering & plans
- Bridge engineering & plans
- Traffic control plan design
- Mitigation plan design
- Utility adjustment design
- CES pay items listing
- Estimated quantities & tabulations
- R/W & agreements design
- Permit design & engineering
- Building & site design
- Special design & details

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Finalize Design & Plans.
- Roadway & bridge design
- Drainage - design, tabulations & reports
- Permit approvals
- Traffic guidance plans design
- TCP plase plans design
- Mitigation designs
- R/W & agreements
- Pay items, quantities & comp book
- Assembly of plans components
- Utility adjustment design, agreements & plan details

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Finalize Specification Package.
- Standard & Supplemental Specs
- Technical Spec Provisions
- Method of measurement & payment
- Constructability and biddability review

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Prepare and Document.
- Contract plans package
- Plan pay items - CES - Specifications
- Transmittal package

Chapter 14

FINAL ENGINEERING DESIGN PROCESS

14.1 General

The final engineering design process follows the initial engineering design process and review (see Chapters 13 and 16). The final engineering design phase should be roughly 50% of the total effort. The primary objective of the final engineering design phase is to prepare contract plans and specifications that can be used to bid and construct the project with a minimum of field changes, delays, and cost overruns.

14.2 Final Engineering Design

The Engineer and Project Manager must coordinate all activities to ensure that the quality, accuracy, and appropriate decisions go into the performance of each step. The project quality control should include a plan-do-check routine for each set of activities or operations.

The major design activities include, but are not limited to, the following:

- Pavement design
- Drainage design
- Structural (bridge) design
- Structural (roadway) design
- Roadway design including access management, earthwork, geometrics, etc.
- Traffic plans design including signing, marking, signals, lighting, etc.
- Utility adjustment design
- Permit preparation design including ponds, mitigation, etc.
- Traffic control plans (work zone) design
- R/W requirements design
- Building and site design including landscaping, ADA, etc.
- Estimates and computation book preparation
- Specifications and special provisions
- Landscaping design

Project stationing information is to be checked and entered into the Work Program Administration (WPA) system during final engineering design. This information is important for tying construction records, such as material coring, sampling and testing to other databases. The information is entered by stations which are related to roadway mile post for later information retrieval. Conversion of databases from mile posts to kilometer points is not yet scheduled due to resource limitations.

The project designer is responsible for finalizing the project stationing. The District Design Engineer should designate an individual to be responsible for coordinating the input of stationing information into the WPA system.

The station equations and begin/end stations are entered into the WPATS27A computer screen under IMS on DOTNET. Update access to this screen is granted through the Work Program Development Office in Tallahassee. While entering the station information, it is important to check to see if the mile post limits in WPA are still accurate. This can be accomplished by reviewing the WPATS27A computer screen. If the project length has changed, the District Work Program Office should be advised to correct the mile posts.

This information will become increasingly important as Geographic Information Systems increase in use and project locations are automatically mapped based on mile post limits.

14.3 Contract Plans Preparation

The outcomes of the engineering design activities are component sets of contract plans developed using CADD. The major component sets may include:

- Roadway
- Signing and pavement marking
- Signalization
- Highway lighting
- Landscape
- Utility contract (J.P.A.)
- Architectural
- Structural

These component sets, the specifications package, and the CES pay item listing and quantities are assembled and packaged as the construction contract letting documents.

14.4 Specifications and Special Provisions

The Engineer of Record must develop engineering designs that can be constructed, controlled, measured and paid for under the current edition of the FDOT Standard Specifications for Road and Bridge Construction. In the event the work required is not covered by the standard specifications or the supplements and special provisions thereto, the Engineer must develop Technical Special Provisions to be made part of the contract for this project. The Engineer can obtain Department procedural guidance to assist with the preparation.

14.5 Pay Items and Summaries of Quantities

As the engineering plans and specifications are prepared, the quantities are calculated, tabulated, and summarized by Pay Item (of work) as stipulated by specifications and the Basis of Estimates Handbook. The Contract Estimating System (CES) is updated as quantities are determined and summarized.

14.6 Assemble Contract Plans Package

The completed plans, specifications, and District estimate are transmitted to the central office for letting or they are assembled and held in the district for district advertisement and letting. Chapter 20 of this manual provides further guidance on the contents of the transmittal.

Chapter 15

Update Engineering Design Process

MAJOR ACTIVITIES

UPDATE ENGINEERING DESIGN PROCESS

Review and Confirm
- Project objectives and scope
- Environmental evaluation
- Project design standards
- Engineer of Record
- R/W requirements and status
- WP budget & staff-hour estimate
- Schedule and production date
- Approvals and authorizations
- In-house & consultant activities

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Field review and verify
- Location survey adequacy
- Contract drawings adequacy
- Permit dates and adequacy
- Scope of required revisions
- Required exceptions/vatiations

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Update and Document:
- Project design report
- Plans, specifications and estimate
- R/W and agreements
- Utility adjustments & agreements
- Permits and agreements
- MOT plans and estimate
- Special provisions

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Assemble, Review and Update
- Transmittal package
- Electronic deliverables
- Plans, CES, specifications

Chapter 15

UPDATE ENGINEERING DESIGN PROCESS

15.1 General

The update engineering design process begins when a final contract plans, specification and estimates (PS&E) package has been on the shelf for any significant period (approximately nine months). The update process depends on the type of project, the adequacy and appropriateness of the original design controls and standards, and the original scope and objectives. The extent of the update process should be determined based on both engineering and management input.

15.2 Design Update Review and Decision Process

An engineering review of the PS&E and proposed contract documents must be made to determine the activities required to update the package and get it ready for letting.

- The original project objectives, scope and standards must be reviewed and compared with current corridor conditions, as well as growth rate and patterns, to determine if the project design is still valid.
- Original environmental evaluations and commitments must be weighed against current requirements.
- Permit date and terms must be weighed against current requirements.
- R/W certifications and agreements must be reviewed and the status of documents confirmed.
- Contract plans must be reviewed for current requirements, including standard indexes, specifications, pay items and design criteria.
- Agreements with outside entities such as utility owners, maintaining agencies and local agencies must be reviewed.

If the decision is that engineering updates are required, the scope, staff-hour estimate, schedule, cost estimate, and other activities described in Chapter 13 of this manual should be followed to the extent necessary to define the scope and schedule for the update process.

15.3 Updating Engineering Design and Documents

The actual engineering design activities necessary to update the plans package will vary from project to project. They must be fully described in the professional services contract, if one is to be used. If done in-house, a fully defined scope of work must be developed to determine resources and schedule needed for the update.

All reports, calculations, assumptions, and engineering decisions that support the changes to plans, specifications, or other documents must be signed and sealed by the Engineer updating the engineering plans, specifications and documents. All changes to the plans must be approved by the responsible engineer in charge of the work and receive the concurrence of the District Design Engineer, Structures Engineer, or Consultant Project Management Engineer, as appropriate for the type of change. Updated documentation of all approvals and concurrences shall be in the project file.

15.4 Revised Contract Plans Package

In addition to the required engineering changes which may be necessary, the contract transmittal package must be reviewed and updated to current status.

- All component plans sets are made current, signed, dated and sealed.
- Specifications and special provisions are made current.
- The CADD electronic files are revised.
- The CES, computation book, and pay item summaries are made current.
- The contract file is made current.

Chapter 16

Design Submittals

Chapter 16

DESIGN SUBMITTALS

16.1 General

The design process will require various submittals to transfer technical information and decisions between the Engineer and functional areas. The Project Manager is responsible for the adequacy of the submittals or requests and for the timely review or response by all areas. To the extent practical, the contract scope of work should list the information to be furnished by FDOT functional areas and submittals (number and type) required of the Engineer. Exhibit A is a partial list of functional areas with typical submittals and requests.

16.2 Design Documentation Submittals

16.2.1 Field Survey Data

- Design location survey data including horizontal and vertical control, alignments, reference points, utilities, natural and manmade features, and topography or general shape of the terrain.
- Digitized aerial survey data, especially for large areas such as drainage maps.
- Drainage design survey data from site inspection and historical records.
- Right of Way and related property (land) survey data, including property owners and acreage.
- Geotechnical studies and foundation and soils report, including physical properties and classifications of soils, together with recommendations related to foundations, pavement and drainage design.
- Bridge data sheet surveys and channel alignment survey data.

16.2.2 Design Traffic

In the development of roadway plans, design traffic is primarily used to justify the number of through lanes, geometric improvements to intersections, traffic signal timings, and pavement design. The number of through lanes is usually determined during the project development phase, based on Average Annual Daily Traffic (AADT) and factors included in the typical section. Vehicular traffic data provided in the plans typical section includes AADT for the current year, opening year and the design year. Also included are the design hour factor (K is the proportion of AADT occurring during the 30th highest hour of the year), the directional distribution (D is the percent of two way peak hour traffic that occurs in the peak direction), and truck factors (T is the percent that trucks constitute of vehicular traffic) for the peak hour and a 24 hour period. The source and methods used to produce this data must be documented.

Intersection improvements and signal timings require additional information on turning volumes. The FDOT Design Traffic Handbook describes the input data required, explains the procedure to forecast turning volumes, and provides examples. A Design Traffic Report may be required. Manual and mechanical counts provide input on the number of vehicles and pedestrians using an intersection. At proposed (non-existing) major intersections, turning volumes are estimated using transportation planning models or other means. Forecasts provide designers the information required to determine the need for turning lanes, turning bay length, signal timings, and pedestrian crossings. Also, the designer establishes right-of-way requirements based on documented needs to satisfy design year volumes.

In pavement design, the designer requires AADT forecasts for the year a project opens to traffic and for the design year. AADT, together with percent trucks (24 hour period) and other factors used by the Department, provides information on the pavement loadings used in pavement design. The FDOT Design Traffic Handbook provides additional information.

16.2.3 Typical Section Package

The proposed typical sections for roadway and bridges are to be approved by the responsible engineer and submitted for concurrence by the District Design Engineer. Concurrence by the District Structures Engineer may also be required on unusual bridge typical sections.

All projects except intersection improvements and state funded resurfacing projects require approval of the typical section. Usually, only typical sections for the main roadway and bridges are necessary. Additional approved typical sections may be necessary when, for example, more information is needed to set mainline bridge lengths or if major work is being done on an intersecting roadway. Typical section package submittal must be one of the first submittals of the initial engineering design process to permit the establishment of alignment and grades. The appropriate forms are in the CADD cell library and can be obtained through the Project Manager.

16.2.4 Preliminary Geometry and Grades

On projects where connections to the facility make grades a critical element, back of sidewalk profiles, project profile grades, driveways, and side street geometry may be a required preliminary submittal.

16.2.5 Pavement Selection and Design

The pavement selection and design should be completed as early in the process as possible. The Rigid and Flexible Pavement Design Manuals are available through the Maps & Publications Section.

16.3 Structures Submittals

Structures design elements also go through decision-making reviews at various stages of the design as listed below:

16.3.1 Request for Structural Design - (Bridges and Retaining Walls)

All requests for structural design should include roadway plan and profile sheets showing horizontal and vertical alignment and cross sections within 150 meters on each end of the bridge or ends of retaining walls. Horizontal curvature that is on or near the end of the bridge or retaining wall must be shown. Superelevation transition details or other special profiles must be included with the transmittal if any part or all of the transition is on the bridge or wall. The approved typical section should be included with the transmittal.

Provisions for access to property near the end of bridges and adjustments to avoid costly right-of-way takings should be resolved prior to submittal. An attempt should be made to avoid horizontal and vertical curvature on the bridge, if possible, without sacrificing safety.

16.3.2 Bridges

Bridge design begins when the foundation investigation is complete and proceeds on a schedule which allows simultaneous review of the final (90%) bridge plans and the Phase III roadway plans. All structures design work is coordinated through the District Structures Engineer or the State Structures Design Office in the Central Office, depending on the category or complexity of the structure. A typical section of the facility crossing, horizontal and vertical clearances required and the profile grades shall be determined prior to beginning structures design. For complete details and requirements for structural designs and plans preparation, the reader is referred to the Structures Design Guidelines (Topic: 625-020-150) and the Structures Detailing Manual (625-020-200) issued by the State Structures Design Office.

Generally, the completion and review of bridge designs are accomplished in three phases as listed below. These reviews do not necessarily coincide with the phase reviews of the roadway plans, except for the Final (90%) as noted above.

Preliminary - (30%)
Final (90%)
Tracings (100%)

Typical Section Package - The typical section approval package should include a section showing width of bridge that is to be provided for all bridges. The structural design should not proceed until the typical section has been approved by the District Design Office.

Coordination of Final Plans - The District will review bridge plans and roadway plans to ensure that roadway and bridge plans are consistent, i.e., widths, superelevation transitions, vertical and horizontal alignment, and work zone traffic control agree.

16.3.3 Other Structural Submittals and Reviews

In addition to bridge plans, structures plans may include retaining walls, sheet piling, noise barrier walls, box culverts, pedestrian overpasses, and special structural appurtenances.

For projects where bridges and other structure plans are involved, preliminary and final plan submittals (usually along with bridge plans) should be handled according to the instructions for current and future handling of structures tracings (reproducibles) for both Category 1 and 2 structures from the Structures Design Office.

For projects where retaining walls are required along with roadway plans only (no bridge in the project), the engineer shall be responsible for development of wall plans, proper reviews and submittal of preliminary and final plans and submittals to the FDOT prequalified wall companies, if applicable.

16.3.4 Mechanically Stabilized Earth Walls

After appropriate structural and geotechnical review, the wall plans are submitted directly to all appropriate prequalified wall companies for their bidding information. The FDOT District Office is responsible for the structural and geotechnical review prior to submitting these plans for review. The submittal of detailed control plans should occur as early in the design process as possible to give companies plenty of time to prepare a good construction bid proposal.

Where the District Office cannot carry out the structural review or verify the review as proper by a consultant, such review may be requested from the Structures Design Office.

The wall companies only claim responsibility for their system, the wall and soil mass engaged - thus the geotechnical review must include analysis of the boundary soil conditions. Chapter 18 of the Structures Design Guidelines contains the procedures and requirements for the engineering and geotechnical design of retaining walls.

Contact should be made early in the initial engineering design phase, so any change in the scope of work can be accommodated in the design.

16.4 Plans Phase Reviews

The number of submittals and phase reviews shall be determined on a project-by-project basis and shall be defined in the scope. Submittals allow functional areas to review the development of the project as contained in the scope.

Formal plans phase review requirements are covered in the District Quality Control Plan. All reviews will include personnel from Design, Construction, Maintenance, Safety, FHWA (for Federal Aid Projects which are not CA or exempt) and all other internal and external functional area representatives who can provide review input. Reviews are complete when the comments from all the various offices have been resolved and have been documented as required in Chapter 24.

Constructability and biddability reviews by the District Construction Office shall be included at appropriate stages of the phase review process. Procedures for these reviews are provided in the Construction Project Administration Manual (Topic No. 700-000-000).

Minor projects, such as resurfacing, will typically have two plans phase reviews. The two reviews should consist of a decision-making phase review on the scope and intent of the project and a final plans phase review for constructability/biddability. One of these will be an on-site review.

On complex projects plans phase reviews may be required at the Phase I, II and III stages and a final check at Phase IV. Two on-site reviews will be required. Generally these are held early in the initial phase with personnel from the offices noted above.

Exhibit B outlines the plans phase reviews.

EXHIBIT A - List of Requests and Contacts

During the design process, various items of information may be required from different sections or departments The following is a list of some of those items and their source

A) Planning

Request pavement design (80 kN ESAL)
Request design traffic
Request turning movements for intersections
Request updates of design traffic (as needed)
Railroad contact (Phase I and III)
Plans transmittal letter data (railroad)
Notification that project is in vicinity of a traffic monitoring site

B) Traffic Plans

Request turns and counts for intersection design
Notification that project includes milling
Signing & pavement marking plans (Phase I, II, III)
Traffic signal plans (Phase I, II, III) & signal warrant
Lighting plans (Phase I, II) & justification report
Pedestrian and bicycle design traffic
Safety review of design plans & response
Operational and capacity review of design plans

C) Geotechnical

Request pavement design soil information
Request roadway soil survey
Soils data
Request foundation investigations
Request dynaflect testing
Phase III review, if unsuitable soils exist
Soils and foundation recommendations
PH and soils resistivity for culvert material selection
Request pavement composition and milling recommendations
Review if any changes are made in alignment, grade or typical section

D) Surveying and Mapping

Request survey

E) Drainage

Request grade and high water review
Conceptual drainage plan & assumptions
Bridge Hydraulics Report
Request drainage design
Request final drainage review
Permit review
SWPPP
Erosion Control Plan

F) Maintenance

Pavement design comments
Phase I Plans review & response
Phase II Plans review & response
Phase III Plans review & response

G) Construction

Pavement design comments
Phase I Plans review & response
Phase II Plans review (Constructability) & response
Phase III Plans review (Biddability) & response
Submit traffic control plan request
Contract time

H) R/W Surveying and Mapping

Submit title search request
Request existing right-of-way maps
Transmit right-of-way requirements
Final right-of-way check
Plans transmittal letter data

I) Utilities

Preliminary (First) contact (Phase I)
Pre-Design conference and contact (Phase II)
Final contact (Phase III)
Horizontal and vertical verification of utilities
Plans transmittal letter data (utilities)
Number of sets of final prints for utility companies

J) Estimates and Specifications

Preliminary estimate (LRE)
Preliminary estimate (Phase I)
Preliminary estimate (Phase II)
Preliminary estimate (Phase III)
Complete estimate (Phase IV)

K) Right-Of-Way Department

Project schedule updates as needed
R/W estimates as needed
Pre-Proposal appraisal conference
Field questions from R/W agents as needed
Plans transmittal letter data
Phase I Plans Review (by Appraiser)
Phase II Plans Review (by Appraiser)
Phase III Plans Review (by Appraiser)
Phase IV Plans Review (by Appraiser)

L) FHWA (if not CA or exempt)

Phase I Plans review & response
Phase II Plans review & response
Phase III Plans review & response
Phase IV Plans Review & response
Submit for typical section approval
Submit for pavement design approval
Submit exception request letters
R/W review

M) Value Engineering ($2,000,000+)

Phase I & II reviews

N) Environmental

Hazardous waste determinatin
SWPPP
Erosion Control Plan
Mitigation Plans

EXHIBIT B

PHASE SUBMITTALS

B.1 General

This exhibit outlines the usual sequence of engineering and roadway plans preparation and assembly, a typical review process and the minimum information to be presented on the various plan sheets at the various phases of submission on a project

The phase submittals are as follows

SUBMITTAL PHASES
Phase I
Phase II
Phase III
Phase IV

Minor projects should typically have two phase reviews

Figure B-1 summarizes the plans sheet status for each submittal No phase is complete until all review comments have been resolved and documented

Prior to submitting the plans for a formal DOT Phase review, the design organization (in-house or consultant) shall conduct a review to ensure technically correct and complete plans Any revisions or corrections noted during the review shall be incorporated into the plans before submittal for the formal Phase review

When deemed necessary by the designer, or as requested by the district, phase submittals may include an additional plan sheet titled "Notes for Reviewers " This sheet is placed as the second sheet in the submittal package It contains information pertinent to design criteria and special project requirements, as well as other details or notes which call the reviewer's attention to issues and features unique to the project design The sheet is to be used only in the review process and is not included in the final plans

FIGURE B-1
SUMMARY OF PHASE SUBMITTALS

PLAN SHEETS	PHASE I	PHASE II	PHASE III	PHASE IV
Key Sheet	P	P	C	F
Summary of Pay Items		P	C	F
Box Culvert Data			C	F
Drainage Map	P	P	C	F
Interchange Drainage Map	P	P	C	F
Typical Section	P	C	C	F
Summary of Quantities			C	F
Summary of Drainage Structures			C	F
Project Layout	P	C	C	F
Roadway Plan-Profile	P	P	C	F
Special Profile	P	P	C	F
Back-of-Sidewalk Profile	P	C	C	F
Interchange Layout	P	P	C	F
Ramp Terminal Details		P	C	F
Intersection Layout/Detail	P	P	C	F
Drainage Structures		P	C	F
Lateral Ditch Plan/Profile		P	C	F
Lateral Ditch Cross Section		P	C	F
Retention/Detention Ponds		P	C	F
Cross Section Pattern Sheet		P	C	F
Roadway Soil Survey,		P	C	F
Cross Sections	P	P	C	F
Traffic Control Plans	P	P	C	F
Utility Contract Plan-Profile		P	C	F
Utility Adjustment		P	C	F
Selective Clearing and Grubbing		P	C	F
Roadway Structural Plans		P	C	F
Signing and Marking Plans		P	C	F
Signalization Plans		P	C	F
Highway Lighting Plans		P	C	F
Landscape Plans	P	P	C	F
Mitigation Plans		P	C	F
SWPPP Plans		P	C	F
Computation Book			C	F
Contract Time			P	F

Status Key
P - Preliminary
C - Complete but subject to change
F - Final

B.2 Requirements for Phase I Submittal

The number of submittals and phase reviews shall be determined on a project-by-project basis and shall be defined in the scope Submittals allow functional areas to review the development of the project as contained in the scope

The following elements are required for a Phase I set of plans

KEY SHEET.
Location Map w/ location of project on map
All applicable project numbers
(Federal Funds) notation, if applicable
Exceptions & Equations
County Name
State Road Number
Length of project box
North arrow and scale
Approval signature lines
Railroad crossing (if applicable)
Revision box
Standards date
Project Manager's Name
Begin & end project station with begin kp
Begin & end bridge & bridge culvert stations
Consultant's name, address and vendor number (if applicable)
State, Federal, county highway numbers (as appropriate)

DRAINAGE MAP - PLAN VIEW
North arrow and scale
Drainage divides and ground elevations
Drainage areas and flow direction arrows
Equations
High water information as required
Preliminary horizontal alignment
Section, township, range lines
Street names
Begin & end stations of project, bridge, bridge culverts & exceptions
Existing structures & pipes with relevant information

DRAINAGE MAP - PROFILE VIEW
Preliminary profile grade & existing ground line
Horizontal & vertical scale
Begin & end stations of project, bridges, bridge culverts & exceptions
Equations

INTERCHANGE DRAINAGE MAP
North arrow and scale
Stationing along baselines
Ramp baselines with nomenclature
Begin and end bridge stationing
Preliminary interchange configuration
R/W lines
Preliminary interchange drainage with drainage areas and flow direction arrows

TYPICAL SECTIONS
Mainline and crossroad typicals
R/W lines
Special details (bifurcated sections, high fills, etc)
Traffic data

PROJECT LAYOUT / Reference Points
Plan-profile sheet sequence (mainline and crossroads)
Reference points (if layout sheet is required)

Exhibit B, cont
Phase I Submittal, Page 2 of 2

PLAN AND PROFILE - PLAN VIEW
North arrow and scale
Baseline of survey, equations
Curve data (including superelevation)
Existing topography including utilities
Preliminary horizontal geometrics/dimensions
Existing & proposed R/W lines (if available)
Centerline of construction (if different from the baseline of survey)
Begin and end stations for the project, bridges, bridge culverts and exceptions
Reference points (if project layout sheet not included in plans set)

PLAN AND PROFILE - PROFILE VIEW
Scale
Appropriate existing utilities
Bench mark information
Preliminary profile grade line
Equations
Existing ground line with elevations at each end of sheet
Begin and End Stations for the Project, bridges, bridge culverts and exceptions

SPECIAL PROFILE
Scale
Ramp profile worksheet including nose sections
Existing ground line of intersections
Preliminary grade line of intersections
Preliminary curb return profiles, if applicable

BACK-OF-SIDEWALK PROFILE (Worksheet)
Scale
Begin and end project stations
Begin and end sidewalk stations
Cross-street locations and elevations
Drainage flow direction arrows
Mainline equations
Existing driveway locations and details
Superelevation details
Back-of-sidewalk profile grades and vertical curve information
Building floor elevations with offset distance left and right
Gradeline notation Specifically the numeric difference relative to roadway profile gradeline

INTERCHANGE DETAIL
North arrow and scale
Schematic of traffic flow and volumes
Proposed bridge limits
R/W lines
Preliminary configuration and geometrics
Quadrant Identification
Ramp Labels

INTERSECTION LAYOUT
North arrow and scale
Existing topography (if applicable)
Proposed R/W limits
Length of turn lanes
Taper lengths
Existing Utilities
Geometric dimensions (radii, offsets, widths)

CROSS SECTIONS
Scale
Existing ground line
Existing survey baseline elevations
Station numbers
Baseline of survey labeled
Existing utilities
Proposed template with profile grade elevations along mainline and cross-streets as necessary

TRAFFIC CONTROL SHEETS
Project specific

Other worksheets as necessary to convey concept and scope

B.3 Requirements for Phase II Submittal

The number of submittals and phase reviews shall be determined on a project-by-project basis and shall be defined in the scope Submittals allow functional areas to review the development of the project as contained in the scope

The following elements are required for a Phase II set of plans

KEY SHEET
Index of sheets
Contract plans and component plans list
Date of governing specifications

SUMMARY OF PAY ITEMS
Item numbers with descriptions

DRAINAGE MAP - PLAN VIEW
Proposed structures with structure numbers
Proposed storm sewer pipes
Flow arrows along proposed ditches
Retention/Detention ponds, pond number and area size
Cross drains with pipe sizes and structure numbers
Bridges/bridge culverts with begin and end stations
Flood data (if applicable)
Standard alternate materials note

DRAINAGE MAP - PROFILE VIEW
Ditch gradients including DPI's
Final roadway profile grade line
Mainline storm sewer pipes
Mainline flow line elevations
Mainline structures with structure numbers and pipes
Bridge, Bridge Culvert
Cross drains with pipe sizes, structure numbers and flow line elevation

INTERCHANGE DRAINAGE MAP
Final geometrics including P C and P T
Proposed structures with structure numbers
Proposed storm sewer pipes
Special ditches with DPI and elevation

TYPICAL SECTIONS
Pavement Design

PROJECT LAYOUT
Complete

PLAN AND PROFILE - PLAN VIEW
Curb return numbers, station ties and elevations
Proposed drainage structures with structure no.
Proposed R/W lines
Existing utilities (verified)
Proposed side drain pipe requirements (including size) for access and intersections
Final geometrics and dimensions including radii, station pluses, widths, taper/transition lengths, curve data
General notes (if project layout sheet not included)
Flood data if not shown elsewhere

PLAN AND PROFILE - PROFILE VIEW
Final profile grades and vertical curve data
Mainline storm sewer pipes
Proposed special ditches
Ditch gradients with DPI station and elevation
Non-standard superelevation transition details
High water elevations
Existing utilities (verified)
Mainline drainage structures with structure numbers
Cross drains with structure number, size and flow line elevations

SPECIAL PROFILE
Final intersection profile grades
Final curb return profiles (if applicable)
Superelevation diagrams as required
Final ramp profile grades including nose sections
Preliminary access and frontage road profiles (may contain one or more types of special profiles)

BACK-OF-SIDEWALK PROFILE
Complete

INTERCHANGE LAYOUT
Curve data including superelevation and design speed
Coordinate data, stationing and ties
Access and/or frontage roads with dimensions and R/W
Fence location
Ramp identification

RAMP TERMINAL DETAILS
Preliminary geometrics
Radii, transition/taper lengths
Ramp identification

INTERSECTION LAYOUT
Limits of proposed construction along side roads
Applicable notes
Cross drains with structure numbers and pipe sizes
Storm sewer pipes including sizes
Final geometrics including dimensions, radii, offsets, station pluses and taper/transition lengths

DRAINAGE STRUCTURES
Vertical and horizontal scale
Roadway template with profile grade elevation
Underground utilities
Special sections at conflict points
R/W lines (at critical locations)
Storm sewer construction notes
Flow arrows
Applicable notes
Structure numbers and location station along right side of sheet
Drainage structures with numbers in numerical order, type, size, location and flowline elevations

OUTFALL/LATERAL DITCH SYSTEM - PLAN VIEW
North arrow and scale
Roadway centerline
Existing and/or survey ditch centerline
Proposed ditch centerline with stationing
Begin and end ditch stations
Equations
Ditch centerline intersection stations
R/W lines
Bearings of ditch and mainline centerlines
Proposed storm sewer pipes
Ditch PI stations with deflection angle left or right
Proposed drainage structures with structure numbers
Existing topography, drainage structures, utilities

OUTFALL/LATERAL DITCH SYSTEM - PROFILE VIEW
Bench mark information
Scale
Existing ground line
Proposed ditch profile with grades
Begin and end ditch stations
High water elevations
Proposed storm sewer pipes with size
Existing Utilities
Overland flow or overtopping elevations
Proposed drainage structures with structure numbers
Typical section can be placed in either plan or profile

LATERAL DITCH CROSS SECTIONS
Horizontal and vertical scale
Existing ground line
Station numbers
Survey centerline and elevation
R/W
Begin and end ditch stations
Begin and end excavation stations
Earthwork quantities
Existing utilities
Total earthwork quantity in cubic yard (C Y)
Proposed template with ditch bottom elevation

CROSS SECTION PATTERN SHEET
North arrow and scale
Interchange layout
Access and frontage roads
Mainline and ramp stationing
Begin and end bridge stations
Cross section location lines
Ramp baselines with nomenclature and stationing

ROADWAY SOIL SURVEY
Soil data
Project specific

CROSS SECTIONS
R/W
Special ditch bottom elevations
Equivalent stations for ramps and mainline
Mainline equation stations
Soil borings
Water table
Extent of unsuitable material
Proposed template with profile grade elevation
Earthwork Columns
Begin and end stationing for project, construction and earthwork, bridge and bridge culvert
Existing utilities affected by the template and where unsuitable materials are present

TRAFFIC CONTROL SHEETS
Preliminary traffic control plan
Detour plan
Phasing plan
R/W - existing and additional if required
Existing Utilities

UTILITY ADJUSTMENT
All existing utilities highlighted

UTILITY CONTRACT PLANS (JPA)
Key Sheet
Mainline plan-profile
Proposed utility horizontal and vertical locations

SIGNING AND PAVEMENT MARKING PLANS - KEY SHEET
W.P.I Number
State Project Number
(Federal Funds) notation, if applicable
State Road Number
County Name
FDOT Project Manager's Name
Begin/end stations & exceptions
Station Equations (if location map is shown)
Roadway and Traffic Design Standards Date
Engineer of Record
Consultants name & address, if applicable

SIGNING AND PAVEMENT MARKING PLANS - TABULATION OF QUANTITIES
Project Specific

SIGNING AND PAVEMENT MARKING PLANS - PLAN SHEETS
North arrow and Scale
Basic Roadway Geometrics
Begin/End Stations and Exceptions
Station equations
Conflicting utilities, lighting or drainage
Pavement markings
Sign locations
Applicable pay items

SIGNING AND PAVEMENT MARKING PLANS - SIGN DETAIL SHEETS
GUIDE SIGN WORK SHEETS
Project Specific

SIGNALIZATION PLANS - KEY SHEET
W P I Number
State Project Number
(Federal Funds) notation, if applicable
State Road Number
County Name
FDOT Project Manager's Name
Begin/end stations & exceptions
Station Equations (if location map is shown)
Roadway and Traffic Design Standards Date
Engineer of Record
Consultants name & address, if applicable

SIGNALIZATION PLANS - PLAN SHEET
North arrow and Scale
Basic Roadway Geometrics
Begin/End Stations and Exceptions
Station Equations
Conflicting utilities, lighting or drainage
Signal Pole Location
Type and location of loops
Type and location of signal heads
Pedestrian Signal
Location of Stop Bars
Location of Pedestrian Crosswalks
Sheet Title
Applicable pay items

SIGNALIZATION PLANS - POLE SCHEDULE
Pole location, number, type
Pole dimensions
Pay item number and quantity
Joint use pole details, if applicable
Foundation design

SIGNALIZATION PLANS - INTERCONNECT/COMMUNICATION CABLE PLAN
Placement of interconnect/communication cable
Conflicting utilities, lighting or drainage
Other project specific details

HIGHWAY LIGHTING PLANS - KEY SHEET
W.P.I and State Project Numbers
(Federal Funds) notation, if applicable
State Road Number
County Name
FDOT Project Manager's Name
Begin/end stations & exceptions
Station Equations (if location map is shown)
Roadway and Traffic Design Standards Date
Engineer of Record
Consultants name & address, if applicable

HIGHWAY LIGHTING PLANS - POLE DATA AND LEGEND SHEET
Each pole by number with location, arm length, mounting height and luminaire wattage noted
Design value for light intensities and uniformity ratios shown
Legend and Sheet title

HIGHWAY LIGHTING PLANS - PLAN SHEETS
North arrow and scale
Basic Roadway Geometrics
Begin/End Stations and Equations
Station Equations
Conflicting utilities, lighting or drainage
Sheet title
Applicable pay items
Pole symbols shown at correct station location and approximate offset

HIGHWAY LIGHTING PLANS - HIGH MAST
Foundation detail sheets (project specific)
Boring data sheets (project specific)
Conflicting utilities, drainage, lighting

LANDSCAPE PLANS - KEY SHEET

LANDSCAPE PLANS - STANDARD DETAIL SHEET
Applicable standard details

LANDSCAPE PLANS - PLAN SHEETS
Roadway and sidewalk plan
Plant placement by symbol
Legend for plant symbols
Existing utilities
Sight Triangles

LANDSCAPE PLANS - IRRIGATION PLAN (if applicable)
Type of system
Location and size of pipes
Type and location of heads

LANDSCAPE PLANS - SPECIFICATIONS PLAN SHEET
Project specific

SELECTIVE CLEARING AND GRUBBING
Limits by station and dimension of selective clearing and grubbing

ROADWAY STRUCTURAL PLANS
Retaining walls
Mechanically stabilized earth (MSE) walls
Approach slabs

MITIGATION PLANS

SWPPP PLANS

B.4 Phase III Plans Submittal

The number of submittals and phase reviews shall be determined on a project-by-project basis and shall be defined in the scope Submittals allow functional areas to review the development of the project as contained in the scope.

The only other remaining work to be done will be to comply with comments received as a result of the review The Work Zone Traffic Control items paid for on a 'per day' basis shall be estimated by the design organization and included in the Phase III submittal The DOT construction department will make a biddability review and will establish construction duration as a part of the phase III review after receiving the comp book This information shall be included in the phase III review comments transmitted back to the design organization The estimated pay items for Work Zone Traffic Control shall be revised as necessary based on the established construction duration

All plan sheets and computation books are complete and the WPA system has been updated Final drainage tabulations shall also be furnished for review

A plans checking team will perform a formal checking of the design plans submitted for the formal phase review. The plans will be checked for completeness and conformance to DOT standards and criteria. The technical accuracy required for the design is the designer's responsibility A "marked up" set of the plans and review comments shall be returned to the designer for incorporation of the comments into the plans When the review comments have been resolved and documented by the designer, the plans are ready to proceed to completion

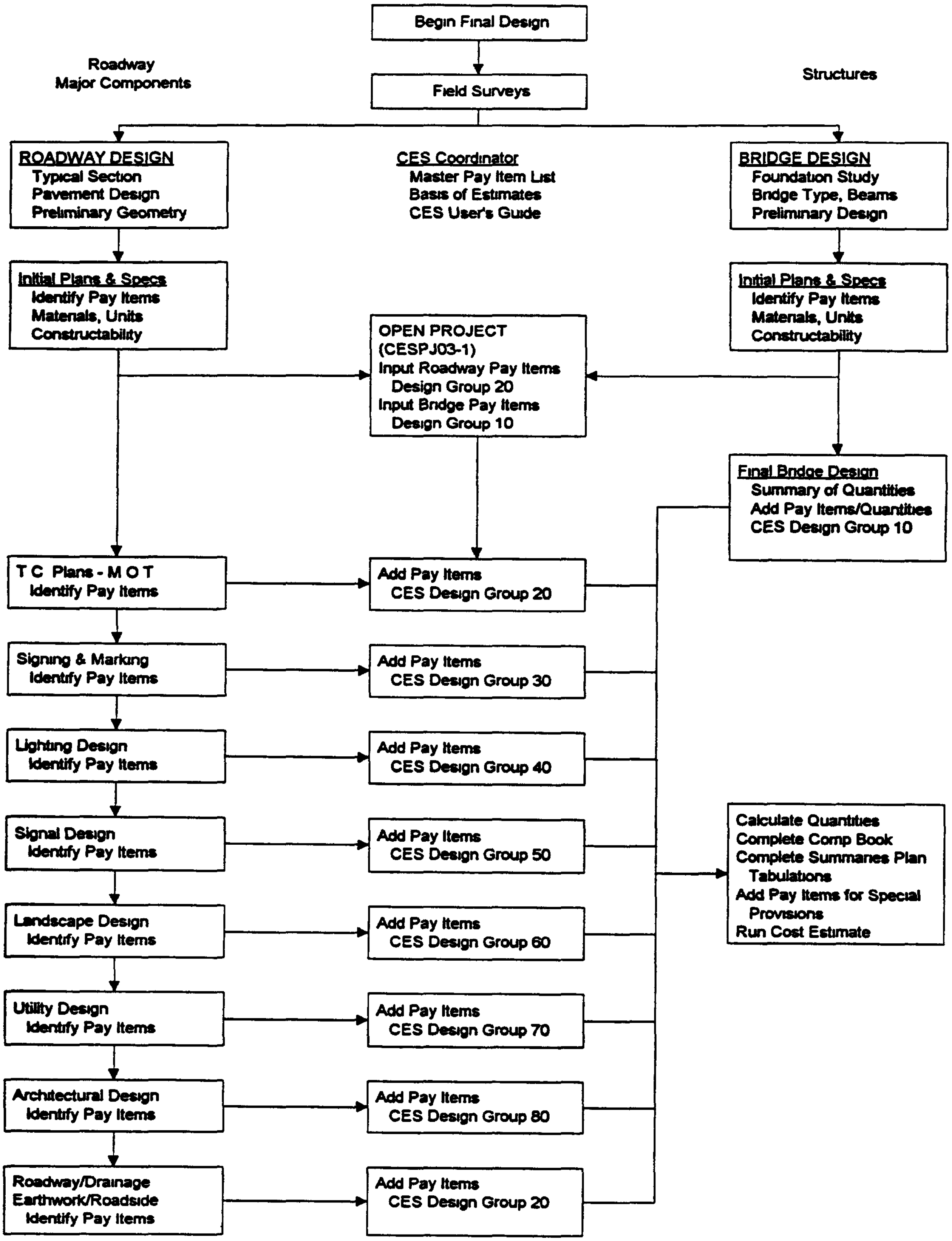
B.5 Phase IV Plans Submittal

After all corrections noted in the Phase III submittal are complete and the cost estimate is complete, the plans are considered final Chapter 20 contains instructions for the final plans submittal for letting.

Chapters 17

Engineering Design Estimate Process

ENGINEERING DESIGN ESTIMATE PROCESS
MAJOR ACTIVITIES



Chapter 17

ENGINEERING DESIGN ESTIMATE PROCESS

17.1 General

The engineer's estimate of construction cost and contract time is one of the last activities performed on roadway and bridge design projects.

To do a quality cost estimate, the engineer must have available the following:

- the complete contract plans set, including all component sets such as structures, architectural, etc.;
- the complete specifications, including the supplemental specifications and technical special provisions;
- the Roadway and Traffic Design Standards booklet referenced on the key sheet of the contract plans;
- the completed computation book for the roadway and bridge plans; and
- the current Basis of Estimates Handbook.

17.2 Pay Item List

The Specifications establish the method of measurement, basis of payment and payment items for work specified for road and bridge construction. The Basis of Estimate Handbook contains a Master Pay Item List as of the cutoff date for the current issue. The only source of current information about OPEN pay items is the Master Pay Item List on the CES computer data base. The Basis of Estimate Handbook also contains design aids, notes, and computation information to aid the engineer in preparing the cost estimate.

Pay items for the various categories of construction work should be identified as those components are completed. For example, pay items for base and pavement work may be identified as the pavement design is completed. Signal pay items may be identified as the signal design is completed. The engineer doing the design and specifications is knowledgeable about what work is to be done and which pay items are needed. The quantity take-off is generally done at a later date when the plans are final and the tabulations and calculations are done. The persons doing the quantity take-off should also be alert to ensure all pay items have been identified.

The Master Pay List shall be utilized to identify payment items on all types of projects, including resurfacing, widening, safety, bridge, etc. If any work on a project is not covered by existing specifications, then a technical special provision and possibly a new pay item description, unit of measure, and basis of payment may be required. Establishing new pay items is highly regulated and before it is undertaken, the District CES Coordinator where the project is located should be consulted. See Section 17.6 for more details.

Participating and non-participating portions of work should be determined when identifying pay items so quantity summaries can be set up properly in the CES and computation book.

17.3 Contract Estimating System (CES)

The CES is used to compile and complete a contract cost estimate in the same manner a contractor may prepare a bid, by using labor, equipment and material costs. Procedures and training on the CES programs are available from the Engineering Support Services section of the State Estimates Office in Tallahassee. Contact your District CES Coordinator for more information.

17.4 Estimated Quantities

17.4.1 Computation Book and Summary of Quantities

Quantities for pay items are tabulated and computed by two methods. They are tabulated and totaled on Summary of Quantity sheets in the plans. If they are not in the plans, then they must be tabulated and calculated on standard computation forms as described in Section I of the Basis of Estimates Handbook. The computation book contains all calculations and summary of quantities organized in pay item sequence for the project. Backup calculations and computer output that substantiate the summary should be filed directly behind the forms. Items calculated using the standard basis of estimate from the Basis of Estimate Handbook or from Standard Index drawings should be clearly shown in the comp book, especially if several intermediate computations are necessary to arrive at the total quantity. All nonstandard methods should be clearly and completely documented by showing all calculations and the basis of estimating the quantities and a pay item note should be shown in the plans indicating the basis of estimate used.

The original computation book, including the Structures computation book and all backup calculations for roadway and bridge quantities, shall be transmitted to the District Construction Office when the plans are sent for letting.

17.4.2 Breakdown of Quantities

For projects that have partial federal funds, adequate distinction should be clearly made between participating (included in federal aid) and nonparticipating (not included in federal-aid) items. All nonparticipating items with quantities should be identified in the CES and the Computation Book. The method of presenting this information must be of sufficient detail for project personnel to readily distinguish between participating and nonparticipating work, including its physical location on the project. Project personnel must be able to properly account for the necessary separation of quantities. These separated quantities should be properly identified as to participating and nonparticipating work when entered into CES. In a few cases certain lump sum items such as mobilization, maintenance of traffic, etc. may be at least partially Federal Aid nonparticipating depending upon the nature of other nonparticipating items which must be separated. Where it is determined that certain lump sum items should be partially nonparticipating, the percentage assignment of nonparticipating should be negotiated with the FHWA. Upon mutual agreement, this percentage should be reflected when entering data into CES. These items should be determined during early stages of project development.

Where joint project agreements are involved between the Department and a City or County, appropriate participation information regarding this particular phase of the work should be so noted.

When a contract contains more than one State Project Number, with or without participating/nonparticipating quantities, the Summary of Pay Items and Summary of Quantities must show the separate quantities for each project. The computation book should clearly distinguish the location of each part of the work.

17.4.3 Utility Contract Plans (Joint Project Agreements)

Utility contract plans which have a 6000 job number, and are let in the contract, need to have special attention given to the establishment of pay items and loading CES. Items of work related to the utility work shall be included in the CES under 6000 project numbers. Lump sum items such as Mobilization and Maintenance of traffic should not be loaded for both the roadway work (3000 series project number) and utility work (6000 series project number). Maintenance of Traffic (MOT) pay items that are not paid for by Lump Sum are to be included under the 6000 project when the work is clearly done separately from the roadway construction work. If the utility work is done concurrently with the roadway work, individual MOT items are not required under the 6000.

17.4.4 Plan Notes

Plan notes are intended to be used to clarify design detail, construction practices or method for payment. In general, plan notes should be kept to a minimum. Only those notes which are job specific should be used. Many of the "old" standard notes have been eliminated recently and incorporated into the specifications. Notes which restate the standard specifications or standard indexes should not be used. This will help to place proper emphasis on those notes that are job specific and avoid discrepancy of documents.

17.5 Specifications (Method of Measurement)

The Department's current practice is to provide for final payment under the plan quantity concept for a large number of commonly used items. This concept requires that the estimated quantities be calculated and documented as accurately as possible. (See Article 9-3.2 of the Specifications,)

The documentation for quantities must be accurate and clear to the contractor. Plan limits, stations and offsets, coordinates, etc. must be detailed so the contractor can stake, layout and control the construction exactly as the engineer calculated the quantities.

Metric ton items are not included in the plan quantity concept. Base and stabilization items for resurfacing, widening and intersection improvement projects may be evaluated for payment under final measurement on a project by project basis. Projects for which the Districts desire to have these items paid under final measurement shall include in the plans transmittal package to Tallahassee, a letter to the Engineer of Specifications, listing the specific items desired to be paid by final measurement.

Allowing final measurement on these items does not release the designer from calculating the quantities as accurately as possible. Field reviews and design surveys are still required, when necessary, to define or establish scope and/or essential topography.

For plan quantity items, the designer shall sign the computation sheet verifying that all backup data and computations are included in the computation book.

17.6 New Pay Items

Before a new pay item is requested, the designer should contact the District CES coordinator to determine if an existing pay item or a pay item that has been blocked temporarily is available to cover the anticipated work.

New construction material and new uses of existing construction materials require specifications and new pay item definitions. The Department has established the following procedure to establish new pay items:

The originator of a new pay item should submit a draft of the pay items specification, any manufacturer's brochures, estimated material and labor cost, a Pay Item Request form, Form 600-000-02, available through the CICS Forms Menu, and any other relevant data to the District CES coordinator. This package will be reviewed and forwarded to the Central Office Design CES coordinator. Any inquiries arising during the review will be addressed to the originator through the appropriate CES coordinator. Upon successful completion of review, the package will be forwarded to the specifications office for further review, approval and pay item number assignment, after which it is transmitted to the estimates office for review, approval and entry into the data base system. After the pay item number is entered into the estimates office's database system, the District and Central Office CES coordinators will be notified of the approval.

17.7 Contract Time

After completion of the design project including the completion of the cost estimate, the plans package is submitted to the district construction office scheduling engineer for establishing the contract duration. Contract duration is the time required for the complete construction of the contract. A copy of the contract time is submitted to the Central Office in Tallahassee with the plans transmittal package. Certain large complex projects should have the desired contract duration established earlier in the design process.

Once the contract time has been established for federal-aid projects, trainee manhours should be computed. The Basis of Estimates Handbook has instructions for computing the number of trainees and the number of manhours required. Contract time is also used in calculating quantities for maintenance of traffic items.

17.8 Shop Drawings

For non-structural shop drawings, the Engineer of Record that will be responsible for the review must be listed on the key sheet of the specific plans, along with the mailing address.

Example:

Engineer of Record
Lighting Shop Drawings
Pat Doe, P.E.
111 S. Avery Street
Tallahassee, FL 32301

Chapter 18

Quality Assurance & Quality Control

Chapter 18

QUALITY ASSURANCE & QUALITY CONTROL

18.1 General

Quality Assurance and **Quality Control** are two processes used to ensure the public receives a quality product. Quality Assurance is the responsibility of, and performed by the Central Office. Quality Control is a responsibility of the District Offices, and is performed by the Districts and their Agents (Consultants), as appropriate.

18.2 Quality Assurance

Quality Assurance is the planned, coordinated and continued activities performed to measure processes against predetermined critical requirements. The objective of Quality Assurance is the continual improvement of the total delivery process to enhance quality, productivity and user satisfaction.

18.2.1 Authority

Florida Statutes Section 20.23(3)(a) requires a **Quality Assurance Process.** It requires the Central Office to establish departmental policies, rules, procedures and standards and to monitor the implementation in order to ensure uniform compliance and quality performance by the District and Central Office units that implement transportation programs. Also, Florida Statutes, Section 334.048 states the Legislative intent with respect to the Central Office role in the Department's management accountability and monitoring systems, including corrective actions when appropriate.

18.2.2 Accountability

The State Roadway Design monitoring plan identifies the process, critical areas, criteria used to measure compliance, report format, method of monitoring and tracking, and procedure for follow-up of unresolved issues. The results of the Quality Assurance monitoring activities are reported to management in exit interviews and reports. The reports identify areas needing improvement, provide feedback on the effectiveness and appropriateness of established policies, procedures and standards, and recognize areas of outstanding quality. The reports are also used to share improvement ideas between districts, and to maintain consistency in process and practice.

The Central Office shall furnish all the planned and systematic actions necessary to provide adequate direction to the Districts so that all design products will be the result of predetermined requirements. This involves the establishment of design policies, procedures, standards and guidelines, training, and the monitoring and review of District compliance with these items.

The Central Office shall review each design process and its associated components for assurance that the Districts have adequate control measures in place and are complying with policy, procedures, standards, guidelines and processes. It will also be used for identifying any areas of excellence, noncompliance and need.

18.2.3 Critical Areas to be Monitored

Critical areas to be monitored by the Central Office are based on well-established roadway design policy and practice. These policies, guidelines and accepted practices formulate the criteria used to measure compliance in the areas critical to quality. The minimum frequency of review for a critical area is three years. However, latitude is allowed for the depth and frequency of reviews, based on the individual District's observed performance, review findings or the needs of District management.

The State Roadway Design monitoring plan for Quality Assurance lists the following critical areas to be monitored.

1. <u>Initial Engineering Design Process</u> (See Chapter 13)

   A) Quality Control Activities,
   B) Scope Activities,
   C) Standards Activities,
   D) Design Support Activities.
   E) Project Activities

2. <u>Final Engineering Design Process</u> (See Chapter 14)

   A) Quality Control Activities,
   B) Review Initial Engineering Design Activities,
   C) Engineering Activities,
   D) Support Activities.

3. <u>Update Engineering Design Process</u> (See Chapter 15)

   A) Quality Control Activities,
   B) Scope Activities,
   C) Standards Activities,
   D) Engineering Activities,
   E) Support Activities.

18.2.4 Documentation

The Quality Assurance findings and recommendations will be documented in a report that will be distributed to the District Secretaries and other affected offices. A brief summary of the data will also be entered in the Quality Assurance Reporting (QAR) data base. Summaries of significant issues will be prepared quarterly for upper management.

18.2.5 Training

Training and assistance are also a mandated role of the Central Office units and the Quality Assurance program.

A. Development: The Central Office Roadway Design will formulate a training plan based upon District requests or needs as determined by the Quality Assurance reviews.

B. Delivery: The Central Office will manage or conduct training courses for District and Consultant personnel as requested, with schedules and locations sensitive to budgets and production schedules.

18.3 Quality Control

Quality Control is the process performed to ensure conformance with valid requirements. This process includes quality planning, training, providing clear decisions and directions, constant supervision, immediate review of completed activities for accuracy and completeness, and documenting all decisions, assumptions and recommendations

Each District shall have a **District Quality Control Plan** for Roadway Design and the other production units which addresses broad overall quality initiative. The District Quality Control plan shall identify the organization, responsibility, and accountability used to perform and document overall quality control, including the requirement for a **Project Quality Control Plan** on all projects. All Project Quality Control Plans must address any project specific scope of service needs and be approved by the Project Manager or District Design Engineer as appropriate.

In-house and consultant designers and reviewers must recognize quality is the result of several processes. It requires many individuals performing many appropriate activities at the right time during the plans development process. Quality control does not solely consist of a review after a product is completed. Quality requires performing all activities in conformance with valid requirements, no matter how large or small their overall contribution to the design process. Good CADD techniques, attention to details and ensuring the plans are correct and useful to the contractor are also essential to quality.

18.3.1 Authority

Florida Statue 20.23(4)(b) requires a **Quality Control Process.** It requires that each District shall be accountable for ensuring their District's quality of performance and compliance with all laws, rules, policies, and procedures related to the operation of the department.

18.3.2 Accountability

A) The District shall follow established design policies, procedures, standards and guidelines in the review and preparation of all design products; and review Consultant prepared individual engineering and design for compliance and good engineering practice.

B) The Consultant is an agent for the District with the primary responsibility for preparation of contract plans. Consultants must ensure quality and adherence to established design policies, procedures, standards and guidelines in the review and preparation of all design products for compliance and good engineering practice as directed by the District.

18.3.3 Critical Areas to be Monitored

The District shall monitor the Quality Control efforts used by in-house staff and its consultant services units. The District shall assure project scopes include an adequate Project Quality Control Plan.

18.3.4 Documentation

The Districts shall maintain a file containing the current District Quality Control Plan and shall furnish Central Office Design with a copy to be used as part of the critical areas to be reviewed. Every project file will contain a Project Quality Control Plan at the beginning of the Initial Engineering Design Process.

18.3.5 Training

The District shall identify and coordinate training needs of in-house and Consultant services through the appropriate Central Office units.

Chapter 19

Signing and Sealing Design Drawings

Chapter 19

SIGNING AND SEALING DESIGN DRAWINGS

19.1 General

The Florida State Board of Professional Engineers has reviewed this Chapter and is in concurrence with its requirements. To assure continued concurrence, the Board will have the opportunity to review future changes

Section 334.175 of the Florida Statutes, requires that all design drawings prepared by or for the Department be signed, sealed and dated by the professional engineer in responsible charge of the project work, in accordance with Chapter 471, Rules 21H-19, 21H-23 and 21H-26 Such professional engineer must be duly registered in this state. Responsible charge means direct control and personal supervision of engineering work done by oneself or by others over whom the engineer exercises supervisory authority.

This chapter will outline the proper procedures of signing and sealing the Department's drawings and engineering documents It shall be the District's responsibility to ensure that all record sets and documents are properly signed, sealed and dated

19.2 Signing and Sealing of Plans

19 2.1 Original Plans

No signatures or seals are to be placed on the original sheets of a plan set. Filling out the title block with initials and dates is optional If the "Approved by" box is used, the name shall be printed

The key sheet for each component set (i.e , roadway, signing, etc) shall have the responsible professional engineer's name (printed or leroyed) The professional engineer's registration number shall be placed under the completion date The following format shall be used·

Roadway Plans Approved By	______ ______________
Date	______ ______________
P E No	______ ______________

For the other components, "Roadway" should be substituted with the title of the component set, such as "Signing and Marking".

19.2 2 Record Set

The Record Set shall be either a CADD plot or a xerographic copy of the CADD originals Each sheet of the Record Set must be signed and sealed by the responsible professional engineer in charge The date shall be placed immediately under the signature and the embossed seal placed over the signature and date. For convenience of storage, it is recommended that the location of this seal be varied across the bottom area of the sheet

19.3 Signing and Sealing Other Engineering Documents

Engineering Documents are defined as any reports, computations, or recommendations that influence or limit the design engineer's decisions in the development of design plans Bound Engineering Documents must be signed and sealed on a signature page or cover letter by each professional engineer who is in responsible charge of any portion of the document The date shall be placed immediately under the signature and the embossed seal placed over the signature and date Any document, report or computations not bound shall require all sheets to be signed and sealed

A signed and sealed record copy of the following Engineering Documents shall be placed in the District Project Records File

- Specifications & Special Provisions
- Pavement Design Package
- Typical Section Package
- Drainage Computations
- Hydraulics Reports
- Traffic Engineering Reports and Recommendations
- Environmental Reports and Recommendations
- Soil Survey Reports and Geotechnical Analysis
- Value Engineering Record
- Roadway and Traffic Design Standards
- All other Engineering Reports
- Permit Documentation

19.4 <u>Signing and Sealing of Revisions</u>

Whenever practical, the original responsible professional engineer shall prepare the revisions If revisions are made by a professional engineer other than the original responsible professional engineer, a signed and sealed record set of revised sheets shall be forwarded to the original responsible professional engineer, or to the appropriate consulting firm

19 4 1 <u>Revisions to Plans</u>

The revisions to the original sheets shall be prepared as outlined in the Plans Processing and Revisions chapter and the revision blocks filled out A record set of the revised sheets shall be signed and sealed and placed behind the key sheet of the original Record Set In addition to the signature, date and seal, the responsible professional engineer shall add above his signature, "Revisions Dated ____________ Approved "

19 4 2 <u>Revisions to Engineering Documents</u>

Each revised sheet shall be signed, sealed and dated by the responsible professional engineer who prepared the revision All revision sheets shall be placed behind the cover sheet of the Record Copy of the document

19.5 Information Requiring Certification

Engineering decisions are often made on the basis of support data furnished by non-engineering staff or offices These data are to be certified as being obtained in accordance with official Department procedures The following data are to have the noted certification attached when submitted for use in engineering related work

19 5 1 80 kN Equivalent Single Axle Loads (ESAL)

"I have reviewed the Traffic Forecasting Procedure, adopted by the Florida Department of Transportation, and have arrived at the projected 80 kN ESAL volume I have found these to be consistent with the historical traffic data and other available information "

____

Name

____

Signature

____

Title

____

Organizational Unit

____

Date

19 5 2 <u>Project Traffic (Traffic to be used for Design)</u>

"I have reviewed the Traffic Forecasting Procedure, adopted by the Florida Department of Transportation, and arrived at the project traffic volumes I have found these to be consistent with the historical traffic data and other available information "

____

Name

____

Signature

____

Title

____

Organizational Unit

____

Date

Chapter 20

Plans Processing and Revisions

Exhibits

Chapter 20

PLANS PROCESSING AND REVISIONS

20.1 General

The central office plans processing activities required to get funds authorized, advertisements prepared and to receive bids on construction contracts are on a critical schedule. Activities in the process are concurrent and there may be any number of project plans going through the process at the same time. The time-frame for processing plans through all Central Office activities is approximately 4 weeks. The advertisement period for contract bids is 6 weeks. From the time the plans for a contract are received in the central office on the Plans to Tallahassee date until the letting is ten (10) weeks and three (3) days.

This chapter describes in general terms the critical activities required to process the contract plans, specifications and estimate (P.S.& E.). It also identifies the various offices that have responsibilities in the process. Also, revisions to plans, specifications or other contract documents during this critical period must be performed and documented in a consistent and timely manner. The requirements and responsibilities for performing and documenting such revisions are outlined in Section 20.3 of this chapter.

20.2 Plans Processing Responsibilities

20.2.1 District Activities

Development of the plans and specifications is a district responsibility and is accomplished with in-house staff or by professional services contracts with qualified design consultant firms.

The four weeks prior to the Contract Package to Tallahassee Date (CPT) is the District Specifications Phase (242) of a project. During this time the Preliminary Estimates Office in Tallahassee is also beginning their work on the official estimate. Therefore, it is necessary at the beginning of this phase for the Project Manager/Designer to send to Tallahassee a Transmittal/CES Lock Letter (Exhibit 20-G) and a "B" size (11" x 17") copy of the plans. This submittal shall be made to the Plans Processing Section at Mail Station 32. The CES will be locked upon receipt of this package.

Any modification to the plans or quantities during this four weeks will be referred to as Plan Changes. These changes are not revisions. Revisions are modifications to the plans or specifications made after the Plans Transmittal Package has been mailed to Tallahassee. Plan Changes may be made any time during the four week period. However, the Estimates Office has requested that all quantity changes be held until the last week of this phase. The exception to this rule is that significant changes to the quantities which would affect the estimate by greater than 20 per cent should be handled immediately.

A Plans Change Letter (see Exhibit 20-E) is required to let the District Specification and Estimates Sections and the Tallahassee Estimates Office know of any changes to the plans. On changes that involve quantities, this letter should be faxed or mailed to the Plans Processing Section during the week prior to the CPT date to open the CES.

The Plans Change Letter also requires a sign-off by the District Specifications Engineer to ensure that all the changes have been coordinated with that office.

The Plans Change Letter, along with a copy (for Estimates) of all the changed plans sheets, shall be sent to Tallahassee as part of the Plans Transmittal Package.

The designer or project manager shall prepare a contract file either during design or before plans transmittal to Tallahassee. The Contract File Index (Exhibit 20-A) lists all documents which must be in the contract file that is transmitted with the plans package for letting.

The district is responsible for ensuring the completeness, legibility and contents of all final plans packages. The plans package transmitted to the Roadway Design Office in Tallahassee shall include:

> The Transmittal Letter (Exhibit 20-B).
> The Contract File (Exhibit 20-A) with listed documents.
> The Contract Plans Set (11" x 17") (an unsigned CADD plot)
> The Record Set (CADD plot or Xerographic copy signed & sealed by Engineer of Record).
> The Specifications Package (signed & sealed with transmittal letter).
> Copy of the Spec Package (2 copies for all federally funded projects).
> Copy of the plans (2 copies for all federally funded projects).
> Copy of all changed plans sheets (for Estimates).
> Plans Change Letter

At this time, the designer shall also send copies of the plans and specifications package and the original computation book to the District Construction Engineer.

20.2.2 State Roadway Design Office Activities

When the plans package is received by the Plans Processing Section in Tallahassee, they are logged in. The contract file is checked to be sure that all required documents are included in the file. If the file is incomplete, the District Director of Production and the Tallahassee Production Management Office are notified.

The Tallahassee Plans Processing Section then distributes the Plans Transmittal Package as follows:

Specifications Office

Specifications Package (with Specs Transmittal Letter)

Checks the package for completeness and forwards it to Reprographics for printing. The Specifications Transmittal Letter attached to the package is given to the Contracts Office for preparation of the Contract Proposal.

Estimates

Copy of the Specifications

Plans Change Letter & Plans

JPA(s)

Prepares the Official Estimate, which is only given to the Federal Aid Office for the PS&E package.

Federal Aid Office

Copy of the Specifications

'B' size copy of the plans

Contract file

Estimate (from Estimates)

Prepares the P S & E package and submits to Federal Highway for authorization and obligation of Federal Funds.

Reprographics

Contract Plans

Specifications Package (from Specifications office)

Prints the plans and specifications for distribution to the contractors.

Contracts

Specifications Transmittal Letter (from Specifications Office)

Prepares the Advertisement and Contract Proposal.

File Room

Signed and Sealed Plans

Contract Plans (from Reprographics)

Stores the Signed and Sealed plans and mails the Contract Plans to the District Construction Office upon award of the contract.

Production Management Office

Environmental Permits Transmittal Letter (from Contract File)

Tracks the project through the Tallahassee process by monitoring the Critical Dates List and the progress and completeness of the plans.

As the project is processed through Tallahassee, all documents are removed from the contract file and incorporated into the Plans, Specifications and Estimates (PS&E) package. Therefore, processing cannot be completed until all items listed on the Contract File Index are received in Tallahassee. Documents not included with the original submittal shall be sent to the Plans Processing Section, Mail Station 32. The District should keep a copy of all contract file documents in their project file for future needs.

20.3 Revisions to Contract Documents

Revisions are occasionally necessary to change plans or other documents. Any change to the plans or specifications, between the time the submittal package is received in Tallahassee and the letting date is considered a revision.

Making revisions to the plans and specifications is the responsibility of the Districts. **All revisions shall be processed through the Plans Processing Section, Mail Station 32, in the State Roadway Design Office.**

The engineer making the revisions to plans, specifications or other documents that affect the engineer's estimate, pay items or quantities will be responsible for up-dating the Computation Book, Pay Item Listing and Contract Estimating System (CES).

20.3.1 Revision Process

When changes to the plans or other contract documents are necessary after they have been submitted to Tallahassee, a revision letter is required. The revision process is as follows:

1. For non-CADD plans, plans must be requested to be returned to the District for both in-house and consultant plans. When consultant-prepared plans are returned for revision, the District will be responsible for sending plans to the Consultant.

2. If the project involves federal funds and is not exempt from FHWA oversight under CA or the ISTEA (1991) exemptions, concurrence must be obtained by the District Office from the responsible FHWA Engineer prior to making the revisions. FHWA concurrence is not required on minor quantity changes.

3. The District Design Engineer or Project Manager/ Designer will generally be the contact person for revisions on in-house or consultant plans respectively.

4. A revision letter is required (see Exhibit 20-C) and the date shown shall match the date on the revised sheets and the revision listing on the lead key sheet. This is the official revision date. For revision involving CES changes the date should be the day you fax the revision letter to Tallahassee to unlock the CES. On revisions not involving pay items or quantity changes the date should be the approximate date you anticipate mailing the revision to Tallahassee.

5. Whenever a revision involves pay items and/or quantities, the CES will be unlocked for 24 hours once the revision letter is received. All quantities, pay items, computation books, etc., shall be updated as part of the revision. To open the CES, fax the completed revision letter to Plans Processing at SC number 292-9293.

6. The lead key sheet shall have all the revisions noted in the revision listing in the lower left hand corner of the sheet. (Revisions to the Key Sheet are noted on the right side of the sheet in the revision block.)

7. When the project contains other components such as signing and pavement markings or signalization plans, the revisions shall be made on the plan sheets, and all the revisions, along with the other component revisions, noted on the lead key sheet only.

8. The responsible professional engineer making the revision shall complete the revision block on all revised sheets and sign and seal record prints, as noted in the Signing and Sealing chapter.

9. The revision package submitted to Tallahassee shall include the following:
   - Revised contract plans sheets including the Key Sheet
   - Revised CES (if applicable)
   - Signed and sealed CADD plots or xerographic bond copies of all revised sheets including the revised CES
   - Revised signed and sealed Specifications (if applicable)
   - Revision letter.

10. If time remaining until letting date is fifteen working days or less by the time the revision will reach the Central Office, processing of the revision must be approved by the State Roadway Design Engineer or his designee.

11. No revisions are allowed within five working days of letting. After this date, the project must be let as is or withdrawn from the letting, unless otherwise approved by the State Highway Engineer and the District Secretary. Withdrawal of the plans package after advertisement requires the approval of the State Highway Engineer and the District Secretary.

12. All revisions, including those that deal with specifications only, shall be sent to the Plans Processing Section, Mail Station 32.

20.3.2 Complete Project Revisions

If an entire project is requested to be returned to the District for revisions before the letting, the following steps will be required for resubmittal:

1. The plans shall be resubmitted with a new contract file containing those items which need to be updated.

2. The lead Key Sheet shall be noted "Plans Completely Revised" in the lower left corner and dated. This note implies that a project has been pulled from letting, rejected, or that a sufficient number of sheets have been revised to warrant a total reprinting. The revision block on each sheet that is revised shall be completed by the revisor and dated.

3. The revision letter should state that the project has been completely revised.

4. A copy of each plans sheet that is revised shall be signed and sealed in accordance with the Signing and Sealing chapter. The signed and sealed sheets will be included with the Record Set in the Central Office.

CONTRACT FILE INDEX

Project # ____________

WPI # ______________________

	Number Reqd	Included in File
District Prepared Specification Package		______
Calendar Days Recommendation		______
Preliminary Engineering Certification		______
Utility Certification		______
Environmental Certification (Exhibit 20-D)		______
Environmental Permit Transmittal Letter (required for all projects)		______
Maintenance Agreement where appropriate	______	______
Joint Project Agreements (J.P.A.)		
Reimbursable	______	______
Non-reimbursable	______	______
FA Project Certification to Standards		______

Form - 37 (on-line form for Form FHWA-37) has been electronically transmitted	Yes___ No___
This project was developed under Certification Acceptance procedure	Yes___ No___
Project exempt from FHWA oversight per request under ISTEA, 1991	Yes___ No___
If CA, there are special features that require FHWA review and concurrence (Ch 24)	Yes___ No___
R/W Certification has been forwarded to Tallahassee R/W Office	Yes___ No___

Name: __________________________ Sig ______________________________
Project Manager/Designer

Note: All Contract File Documents are due on Contract Package to Tallahassee date.

Exhibit 20-A, Page 1 of 2

REMINDER

CONTRACT FILE

- Put in order of file list
- Show number of agreements
- Show anticipated date of arrival on any item not included in file
- R/W Certification is required on all projects
  - R/W Certifications shall be forwarded directly to the Tallahassee R/W Office
  - Attn: State Administrator, R/W Work Program & Production Reporting, Mail Sta 22
- Send late documents to Plans Processing (M S 32)

Exhibit 20-A, Page 2 of 2

DATE

TO Director, Office of Design

Attn. State Roadway Design Engineer

FROM District Director of Production

COPIES TO

SUBJECT **TRANSMITTAL OF PLANS** - Scheduled Letting Date ____Mo.—Yr

WPI NO ____________ (GOES WITH ____________)

LEAD STATE JOB NO ____________

P E Job Number ____________

* F A NO ____________

DESCRIPTION ____________

WORK TYPE/MIX ____________

Other work to be performed by Contractor via J P A

Job #____________ Description ____________

Information contained herein has been checked and verified as needed A plans package, suitable for processing, which consists of the following is forwarded under separate cover

Contract Plans	**Plans Copy "B" Size (11x17)
Record plans set	**Specifications Copy (without worksheets)
Specifications Package	Copy of all changed plan sheets ("B" Size)
Contract File	

** Two copies for Federally funded projects

The affixed signatures below indicate and attest that.

1. The plans package is complete, free of known errors and has been reviewed for constructibility and biddability and is ready for processing to an advertisement status.
2. The contract file is complete as noted on the Contract File Index, is accurate and contains all documentation required for the PS&E package.
3. The Record plans set represents a true copy of the contract plans set as produced by the Engineer of Record
4. WPA and CES project descriptive information is correct for advertisement purposes.
5. Where appropriate, I certify that the project was designed in compliance with the Certification Acceptance Agreement dated July 30, 1990 or with the request for exemption under ISTEA, 1991

Name: ____________ Sig ____________
Project Manager/Designer

Name: ____________ Sig ____________
District Director - Production

*Place a block letter "F" (25mm X 25mm) in the upper right corner for· (1) I Funds completion, new or reconstruction projects > $1M or (2) NHS (Off Interstate) new or reconstruction > $5M

Exhibit 20-B, Page 1 of 2

REMINDER

TRANSMITTAL PACKAGE

S&S Xerox copies on bond (no bluelines)
Punch and pin all plans (no staples - 2 holes)
All plans and plans components must be the same size
Check for missing sheets
Check reproducibility of all sheets, especially aerials
On strung jobs, all pay item sheets go in lead job
Make sure bridge pay item sheets show bridge numbers and the quantity breakdowns

Exhibit 20-B, Page 2 of 2

DATE: ________________

TO: State Roadway Design Engineer, Attn: Plans Processing

APPROVAL: , Responsible Engineer

CONCURRENCE: , District Design Engineer

COPIES TO: Specs, Contracts, FA, Estimates, Reprographics, District Construction |

SUBJECT: Revision Package

W.P.I. No.(s) ______________ Letting (mo./yr) ______________

State Project No. (s) ______________ F.A. Project Yes __ No __

County ____________________________ S.R. No. ______________

This is to advise you that a revision was made to the plans and/or special provisions and the sheets listed below will require reprinting and the Record Set will need to be updated. The revision package includes:

___ Specifications

___ Updated Original Comp Sheet(s) (District Construction only) |

___ Contract Plan Sheet(s)

___ Signed and Sealed Print(s) |

This revision has been reviewed for its impact to the Specifications Package and a Specifications Revision is ___ is not ___ required.__________________ Date_______

District Specification Engineer

PREPARED BY: __________________ PROCESSED BY: ____________________

AUTHORIZED BY:FHWA ______________________________ DATE: __________

APPROVAL IF WITHIN 15 WORKING DAYS OF LETTING:

SIG. ____ DATE:__________

State Roadway Design Engineer

APPROVAL IF WITHIN 5 WORKING DAYS OF LETTING:

SIG. ____ DATE:__________

District Secretary

SIG. ____ DATE:__________

State Highway Engineer

Sheets No.(s)	Description of Revision
___________	____
___________	____
___________	____
___________	____

Exhibit 20-C, Page 1 of 3

REMINDER

REVISION DEFINITION- Changes to plans or other contract documents after Plans have been submitted to Tallahassee

PROCESS

Notify Tallahassee of pending revisions and determine if sufficient time exists to complete and process revision.
Determine who is to do revision? Tally or D O
Request necessary sheets to be returned (Revisions to CADD sheets shall be done in district)
Make changes to plans sheets
Calculate quantities, if applicable.
If quantities are involved FAX completed revision letter to S.C. 292-9293 to have CES unlocked
Make changes to CES
Submit revision to plans processing in Tallahassee, M.S 32

REVISION PACKAGE

Letter
Revised sheets including CES
S&S copies of revised sheets
Two half size copies
Revised S&S specifications if applicable, must accompany revision to Tallahassee (2 copies if F.A., 1 copy if non-F.A.)
Specifications Transmittal Letter (original and 4 copies)

REVISION LETTER REMINDERS

On quantity changes, letter shall show,

New pay item numbers with quantity
Deleted pay item numbers only
Changes to quantities shall show pay items number with old and new quantities
FHWA approval on oversight projects is the District's responsibility
Key Sheet is only listed on the letter and shown on the revision listing when it is actually revised, but is included in the package for all revisions to the plans.
Date on the letter must match the date on plans.

REVISED SHEET REMINDERS

Include CES Sheets in revision listing on Key Sheet and furnish new CES and S&S CES.
Show Revision Date on all revised sheets including CES, Box Culvert Shts. etc.
Revision date must match date on letter.
If adding or deleting a pay item, revise the complete CES for that Design Group because of rollover.
Change CES in System and then pass to CADD if CADD CES is used. (Do not change CADD CES sheets manually)

SIGNED AND SEALED COPIES

Signed and sealed copies must be bond or Xerox
On Consultant projects, S&S revised sheets may be sent to Tallahassee a few days after the rest of the revision

COMP BOOK

Show project number on revised comp book sheets and mail originals to District Construction.

Exhibit 20-C, Page 2 of 3

DATE. ____________ __ OF __

PROJECT NO _________

Sheets No.(s)	Description of Revision

Exhibit 20-C, Page 3 of 3

Project No. ________________

WPI No. ________________

ENVIRONMENTAL CERTIFICATION

1. The project is a Categorical Exclusion under (check one):
(__) 23 CFR 771.117(c) (Type 1) or
(__) "Programmatic" list approved by FHWA, reevaluated in accordance with 23 CFR 771.129 on ________________, and the determination remains valid.

2. The environmental document for this project was a (check one):
(__) Categorical Exclusion under 23 CFR 771.117(d) (Type 2) approved on ____________,
(__) FONSI under 23 CFR 771 121 approved on ____________,
(__) Final Negative Declaration approved on ____________), or
(__) Final Environmental Impact Statement under 23 CFR 771.125 approved on ____________
A reevaluation in accordance with 23 CFR 771.129 was approved on ______________.

Name: ________________________________
Environmental Administrator

Signature: ________________________________

Date: ________________________________

Exhibit 20-D

DATE: ________________

TO: State Roadway Design Engineer, Attn: Plans Processing

FROM:

COPIES TO: District Specifications Engineer, District Estimates Engineer

SUBJECT: Plans Change Letter

W.P.I. No.(s) ____________________

Letting (mo./yr) ____________________

State Project No. (s) ____________________

F.A. Project (y)______ (n)______

County ____________________ S.R. No. ____________

The changes listed below have been incorporated into the specs package ____________________

District Specifications Engineer

This is to advise you that the following changes were made to the plans during the District Specifications Phase prior to submitting the Plans Package to Tallahassee. This submittal includes the sheets on which changes occurred and are intended to replace the similar sheets from the Central Office Preliminary Estimates copy.

Sheets No.(s)	Description of Revision

Exhibit 20-E, Page 1 of 3

REMINDER

Change Definition: Changes are modifications to the plans which occur during the four (4) week Specifications Phase and which must be tracked to ensure that both Specs and Estimates incorporate them into their final packages. These changes are not listed on the Key Sheet nor noted in the Revision Blocks of the Plans sheets.

___ Show all changed plans sheets including CES.

___ List all quantity changes, additions or deletions.

___ Fax to (904) 922-9293, (Suncom 292-9293) or mail to M.S. 32.

___ Coordinate all changes with Specifications and get DSE's sign-off.

___ Include letter and copies of all changed sheets in Plans Transmittal Package.

Exhibit 20-E, Page 2 of 3

DATE: ____________ __ OF __

PROJECT NO. _________

Sheets No.(s)	Description of Change

Exhibit 20-E , Page 3 of 3

W.P.I. NO: ______________________

STATE PROJECT NO. ______________________

F.A. PROJECT NO. ______________________

County ______________ S.R. No. _____

____ The District Director of Production certifies that all work will meet or exceed the standards approved by the Secretary of The U.S. Department of Transportation under 23 U.S.C.109(c).

I do, hereby, certify to the above statement:

______________________________ ______________________

District Director of Production Date

____ The District Director of Production certifies that all work will meet or exceed, except as noted below, the standards approved by the Secretary of The U.S. Department of Transportation under 23 U.S.C.109(c).

I do, hereby, certify to the above statement and listed below are the exceptions/variances to the standards:

______________________________ ______________________

District Director of Production Date

LIST OF EXCEPTIONS/VARIANCES	DATE OF APPROVAL

Exhibit 20-F

DATE: ____________

TO: State Roadway Design Engineer, Attn: Plans Processing

FROM: , Responsible Engineer

COPIES TO:

SUBJECT: Transmittal/CES Lock Letter

W.P.I. No.(s) ____________

Letting (mo./yr) ____________

State Project No. (s) ____________

F.A. Project Yes ______ No ______

County ____________ S.R. No. ____________

The above mentioned project has entered the Specifications phase. I am therefore submitting a copy of the plans for use by Central Office Estimates.

Exhibit 20-G

DATE: ________________

TO: , District Construction Engineer

FROM: , Responsible Engineer

COPIES TO: State Final Estimates Engineer (letter only)

SUBJECT: Transmittal - Original Comp Book

W.P.I. No.(s) ____

Letting (mo./yr) ____

State Project No. (s) ______________________________________

F.A. Project Yes _____ No _____

County __________________________ S.R. No. _______________

The above mentioned project is being processed for letting. I am therefore submitting the original computation book and copies of the Specifications package and the plans for use by Construction.

Exhibit 20-H

Chapter 21

Consultant Project Management

Chapter 21

CONSULTANT PROJECT MANAGEMENT

21.1 General

The Florida DOT may elect to use a consultant to provide all or a portion of the engineering services required for a transportation project. Guidelines for use in acquiring and managing such a consultant are contained in the Florida DOT Project Management Guidelines

21.2 Consultant Acquisition

Consultant acquisition is accomplished according to established rules and procedures and includes, requests for proposals, proposal evaluation, negotiation and contract execution Each of these are further explained in the Project Management Guidelines and in the procedures of the Contractual Services Office

Chapter 22

ARCHITECTURAL PLANS (METRIC)

(PENDING)

Chapter 23

Design Exceptions and Variations (Metric)

Exhibits

Chapter 23

DESIGN EXCEPTIONS AND VARIATIONS (METRIC)

23.1 General

The Department's roadway design criteria and standards are contained in this volume. The values given in those chapters have been accepted by FHWA and are usually within the desirable ranges established by AASHTO.

Occasionally, it becomes necessary to deviate from the standard criteria used in the design process. When this is the case, early documentation and approval is required. Two specific deviations may occur. (1) design exception (2) design variation.

It is very important that the correct term is used when it becomes necessary to deviate from standard criteria. This chapter includes specific requirements for the proper treatment of both design exceptions and design variations. In both cases, the design project file should clearly document the action taken and approval given.

23.2 Design Exceptions

Design Exceptions are required when design criteria are applied which do not meet AASHTO or FDOT RRR criteria, when applicable, for the following 13 controlling design elements:

1) Design speed
2) Lane widths
3) Shoulder widths
4) Bridge widths
5) Structural capacity
6) Vertical clearance
7) Grades
8) Cross slope
9) Superelevation
10) Horizontal alignment
11) Vertical alignment
12) Stopping sight distance
13) Horizontal Clearance

On RRR projects, when the selected design criteria meet neither AASHTO criteria nor FDOT RRR Criteria (Chapter 25), an exception is required.

In the few cases where design criteria selected on RRR projects meet AASHTO criteria, but do not meet FDOT RRR criteria, a Design Variation is required (see Section 23.4).

Any request for exception must address the following items as a minimum.

1) the effect of the deviation from the design criteria on the safety (including clear recovery area) and operation of the facility, and safety mitigating measures considered and provided;
2) the compatibility of the design and operation with adjacent sections;
3) amount and character of traffic using the facility;
4) accident history (type, location, severity, etc.);
5) comparative cost of AASHTO criteria vs. the proposed criteria;
6) the long term effect of the proposed criteria vs AASHTO criteria (effect of capacity reduction);
7) difficulty in obtaining AASHTO criteria (cost, R/W involvement, delay, environmental impacts, etc.);
8) level of service for AASHTO criteria vs. proposed criteria; and
9) any other design criteria that is not being met, i.e., cumulative effect of more than one criterion that is being proposed.

In addition to the items listed above, requests for design exceptions shall include any background information which documents and/or justifies the request.

In order to allow time to research alternatives and begin the required documentation process, it is critical that design exceptions be identified as early in the plans process as possible. This is preferably done during the PD&E phase.

When the need for a design exception has been determined, it is required that approval be requested no later than Phase II for major projects, and the initial phase for minor projects.

As an aid to the designer, Appendix "A", Pages 23-13 through 23-26 are given in the back of this chapter. **The information displayed in these exhibits may be used as a reference for determining when a design exception is required (based on AASHTO criteria), but is in no way intended to replace FDOT design criteria.**

23.3 Routing for Exceptions

The chart below gives the required routing and distribution schedule for design exception requests.

Project Type	District	State Roadway Design Engineer	Director FDOT Office of Design	FHWA	Approval	Concurred *	See Exhibit
District Let ≤ $250,000	XXXX				LOCAL**		23-E
District Let $250,000 - $1 Million	XXXX	XXXX			DDE	SRDE	23-B
State Projects (non-FA)	XXXX	XXXX			DDE	SRDE	23-B
Exempt Projects***	XXXX	XXXX	XXXX		DDE	SRDE, DOD	23-C
CA Projects New/Reconst $1-5 Million	XXXX	XXXX		XXXX	FHWA	SRDE	23-A
New/Reconst. Interstate >$1 Million	XXXX	XXXX		XXXX	FHWA	SRDE	23-A
All Projects which reduce Interstate Vert. Clear to < 4.9 m	XXXX	XXXX		XXXX	FHWA	SRDE	23-A
All Non-RRR FA Projects >$5 Million	XXXX	XXXX		XXXX	FHWA	SRDE	23-A

* Any issue impacting the geometry, vertical clearance or layout of structures or any exception to criteria in Article 10.21 of the Structures Design Guidelines shall be concurred in by the appropriate Structures Staff.

** For District let projects, the approval of the District Design (or Project Management) Engineer, with concurrence by the District Director of Production, is required. This approval shall be documented in the project file.

*** Projects exempt from FHWA oversight are defined as follows:
All RRR projects, including interstate (project-by-project);
All Non-National Highway System projects; and
All FA < $1 Million, including new and reconstruction interstate projects.
For further information, see the Federal Aid Project Certification Chapter.

DDE = District Design Engineer
DOD = Director, Office of Design
SRDE = State Roadway Design Engineer

23.4 Design Variation

A Design Variation is required when design criteria are applied which fall below Department established criteria and the deviation is not covered by the Design Exception definition.

A Design Variation request must address:

- Design criteria vs proposed criteria;
- Reason the design criteria is not appropriate; and
- Justification for the proposed criteria.

In addition to the items listed above, requests for design variations should include any background information which documents and/or justifies the request.

Requests begin with the Responsible Professional Engineer Requests are submitted to the District Design Engineer for approval. Copies of the approved variation and Exhibit 23-F are then sent to the State Roadway Design Engineer.

For approvals of design variations on projects to be let by the District equal to or less than $250,000 construction costs, the approval of the District Design Engineer is required This approval shall be documented in the project file.

As with design exceptions, it is critical that design variations be identified as early in the plans process as possible, preferably during the PD&E phase

When the need for a design variation has been determined, it is required that approval be requested no later than Phase II for major projects, and the initial phase for minor projects

23.5 Routing for Variations

The chart below gives the required routing, distribution and approval schedule for design variation requests.

PROJECT TYPE	DISTRICT	REQUEST / APPROVAL	COPIES TO SRDE	SEE EXHIBIT
District Let Projects <$250,000	XXXX	RPE / DDE		23-E
All Others	XXXX	RPE / DDE	XXXX	23-D

* Any issue impacting the geometry, vertical clearance or layout of structures or any variation to criteria in Article 10 21 of the Structures Design Guidelines shall be concurred in by the appropriate Structures Staff.

** For District let projects, the project file must contain the justification for the variation as developed by the Responsible Professional Engineer

RPE = Responsible Professional Engineer

DDE = District Design Engineer

SRDE = State Roadway Design Engineer

23.6 Permit Variations

For design variations related to permits (maintenance, drainage, utility, etc), request must be by the Responsible Professional Engineer, with approval by the District Design Engineer

Date

Mr J R Skinner
Division Administrator
Federal Highway Administration
227 North Bronough Street, Room 2015
Tallahassee, Florida 32302

SUBJECT Design Exception

REF W P I Number
State Project Number
Federal Project Number
County

Include a brief background statement concerning project and item(s) of concern.

Indicate design element(s) requiring exception and specific exception requested

Address each of the nine items listed under Section 23 2

Also, include justification, supporting documentation, etc

REQUESTED BY

____
District Secretary or Production Director

CONCURRENCE	APPROVAL
______________________________	______________________________
State Roadway Design Engineer	Division Administrator Federal Highway Administration

Exhibit 23-A

DATE

TO District Design Engineer

FROM

COPIES

SUBJECT Design Exception

REF W P I Number
State Project Number
County

Include a brief background statement concerning project and item(s) of concern

Indicate design element(s) requiring exception and specific exception requested

Address each of the nine items listed under Section 23 2

Also, include justification, supporting documentation, etc

RECOMMENDED BY

Responsible Professional Engineer
(Name of Consultant Firm)

APPROVAL

District Design Engineer

CONCURRENCE

State Roadway Design Engineer

Exhibit 23-B

DATE

TO District Design Engineer

FROM

COPIES

SUBJECT Design Exception

REF W P I. Number
State Project Number
F A Project Number
County

Include a brief background statement concerning project and item(s) of concern

Indicate design element(s) requiring exception and specific exception requested

Address each of the nine items listed under Section 23 2

Also, include justification, supporting documentation, etc

RECOMMENDED BY	APPROVAL
______________________	______________________
Responsible Professional Engineer (Name of Consultant Firm)	District Design Engineer
CONCURRENCE	CONCURRENCE.
______________________	______________________
State Roadway Design Engineer	Director of Design

Exhibit 23-C

DATE.

TO District Design Engineer

FROM

COPIES. State Roadway Design Engineer

SUBJECT Design Variation

REF. W.P I. Number
State Project Number
F A. Project Number
County

Include a brief background statement concerning project and item(s) of concern

Indicate design element(s) for which variation is requested, along with specific variation description.

Address each of the items listed under Section 23 4.

Also, include other supporting documentation, etc

RECOMMENDED BY

____

Responsible Professional Engineer
(Name of Consultant Firm)

APPROVAL

____

District Design Engineer

Exhibit 23-D

DATE:

TO: District Design Engineer

FROM:

COPIES: State Roadway Design Engineer

SUBJECT: Design Exception (*Variation*)

REF: W.P.I Number
State Project Number
County

Include a brief background statement concerning project and item(s) of concern.

Indicate design element(s) requiring exception/variation and specific deviation requested.

Address each of the nine items listed under Section 23.2.

Also, include justification, supporting documentation, etc.

RECOMMENDED BY:

____

Responsible Professional Engineer
(Name of Consultant Firm)

APPROVAL:

____

District Design Engineer
or Project Management Engineer

Exhibit 23-E

DISTRICT VARIATION APPROVAL FORM

DATE

TO , State Roadway Design Engineer

FROM , District Design Engineer

COPIES , Engineer of Record

SUBJECT Design Variation
WPI Number ______________________
State Project Number ______________________
State Road Number ______________________
Project Description ______________________
____
New Construction. ________ RRR ____________

CRITICAL VARIATION ELEMENTS (Verify that an exception is not required for these critical elements)

1	Design Speed	_____	8	Cross Slope	_____
2	Lane Widths	_____	9	Superelevation	_____
3	Shoulder Widths	_____	10	Horizontal Alignment	_____
4	Bridge Widths	_____	11	Vertical Alignment	_____
5	Structural Capacity	_____	12	Stopping Sight Distance	_____
6	Vertical Clearance	_____	13	Horizontal Clearance	_____
7	Grades	_____			

ADDITIONAL ELEMENTS

1	Border Width	_____	5	Pavt Marking Criteria	_____
2	Clear Zone	_____	6	Signing Criteria	_____
3	Drainage Criteria	_____	7	Auxil Lane Criteria	_____
4	Pavt Design Criteria	_____	8	Other	_____

APPROVAL

Remarks/Basis of Recommendations

____
____
____
____
____

The above approved variation has been documented appropriately in the project file Justification for not meeting the subject design criteria is sufficient for the approval granted

Signed ______________________________
District Design Engineer

Exhibit 23-F

APPENDIX

A

The information displayed in this appendix may be used as a reference for determining when a design exception is required (based on AASHTO criteria), but is in no way intended to replace FDOT design criteria.

Appendix A (AASHTO Metric Criteria for determining the need for a design exception)

Note: AASHTO page numbers references are a starting point for researching project specific criteria.

METRIC DESIGN CRITERIA
(TAKEN FROM 1994 AASHTO)
FOR DETERMINING DESIGN EXCEPTIONS

1. DESIGN SPEED (MINIMUM)

Type Facility	Design Speed (km/h)	Page Number
Freeway - Rural	110	556
- Urban	80	556
Major Urban Arterials	50	67
Other Urban Arterials	50	67
CBD (major or minor)	50	471
Rural Arterials	100 (Level Terrain)	484
	80 (Rolling Terrain)	484
Urban Collectors	50	471

Rural Collectors:	ADT			
	0-400	400-2000	≥2000	
Level	60	80	100	461, Tbl VI-1
Rolling	50	60	80	461, Tbl VI-1

Ramps:	Design Speed (km/h)								
Highway	50	60	70	80	90	100	110	120	918
Ramp	20	30	40	40	50	50	60	70	918

Loop Ramps	40 km/h (45 m radius)	918
Semi-Direct Connections	50 km/h	918
Direct Connections	60 km/h	918

METRIC DESIGN CRITERIA
(TAKEN FROM 1994 AASHTO)
FOR DETERMINING DESIGN EXCEPTIONS

2. LANE WIDTHS (MINIMUM)

Type Facility	Lane Width (m)	Page No.
Freeways	3.6	557
Rural Arterial	3.3	335
Urban Arterial	3.0	515
Urban Collectors	3.0	474
Rural Collectors	3.0	465, Tbl VI-4
Low Speed	3.0	335
Residential	2.7	335
Auxiliary	3.0	335, 474
Continuous TWLTL	3.0	335

METRIC DESIGN CRITERIA

(TAKEN FROM 1994 AASHTO)

FOR DETERMINING DESIGN EXCEPTIONS

3. SHOULDER WIDTHS (MINIMUM)

Type Facility	Other Factor	Right	Median	Page No.
Freeways	4 lanes	3 0 m	1 2 m	557
	6 lanes	3 0 m	3.0 m	557
Rural Arterial	DHV > 200	2 4 m		488 Tbl VII-2
	ADT 400-2000	1 8 m		
	ADT < 400	1 2 m		
	Divided highway· 4 lanes	2 4 m	1.2 m	497
	6 lanes	2 4 m	2.4 m (1.2 m with rigid constraints)	498
Urban Arterial	Low Type	0 6 m		338
	High Type	3 0 m		338
	If barrier curb is used	1 8 m		520
Heavily Traveled	High Speed (≥80 km/h)	3 0 m		338
Rural & Urban Collectors	ADT > 2000	2 4 m		465 Tbl VI-4
	ADT 1500-2000	1 8 m		
	ADT 400-1500	1 5 m		
	ADT < 400	0 6 m		

METRIC DESIGN CRITERIA
(TAKEN FROM 1994 AASHTO)
FOR DETERMINING DESIGN EXCEPTIONS

4. BRIDGE WIDTHS (MINIMUM)

Type Facility	Other Factor	Bridge Width		Page No
Freeways	New Bridges	Approach Roadway Width		559
Rural Arterial	New Bridges (Short)	Approach Roadway Width		487
	Long Bridges (≥ 60 m)	Travel Lanes + 1.2m each side		487
	Remain in Place	Travel Lanes + 0 6m each side		487
Urban Arterial	Long	Travel lanes + 1.2m each side		524
	Short	Curb to Curb Width of Street (New Bridges)		524
Collectors		New/Reconstruction[1]	To Remain in Place (≤30m)[2]	
Rural	Under 400 ADT	Traveled Way + 0 6m each side	6.6m	467
Urban	ADT 400-1500[1]	Traveled Way + 1 0m each side	6.6m	467
	ADT 1500-2000[1]	Traveled Way + 1.2m each side[3]	7.2m	467
	ADT >2000[1]	Approach Roadway Width[3]	8 4m	467

[1] If the approach roadway has paved shoulders, then the surfaced width shall be carried across the bridge.

[2] Bridges longer than 30 m are to be analyzed individually.

[3] For bridges ≥ 30 m in length, the minimum bridge width of traveled way plus 1.0 m on each side is acceptable.

METRIC DESIGN CRITERIA
(TAKEN FROM 1994 AASHTO)
FOR DETERMINING DESIGN EXCEPTIONS

5. STRUCTURAL CAPACITY (MINIMUM LOADINGS)

Type Facility	Other Factor	Loading	Page No.
Freeway	-	MS 18	558
Rural Arterial	-	MS 18	487
Urban Arterial	-	MS 18	
Local Roads	New & Reconstruction Bridges	MS 18	423, Tbl V-7
	Existing	MS 13.5	424, Tbl V-8
Collectors	New & Reconstruction Bridges	MS 18	467, Tbl VI-5
	Existing	MS 13.5	467, Tbl VI-6

METRIC DESIGN CRITERIA
(TAKEN FROM 1994 AASHTO)
FOR DETERMINING DESIGN EXCEPTIONS

6. VERTICAL CLEARANCE (MINIMUM)

Type Facility	Vertical Clearance (m)	Page No.
Freeways	4.9[1 2]	559, 828
Arterials:		
Rural	4.9[1 2]	487, 559, 828
Urban	4.9[1 2]	515, 559, 828
Other Highways	4.3[2]	468, 559, 828
Sign Trusses	5.1[2]	559
Pedestrian Overpass	5.1[2]	559
Tunnels:		
Freeways	4.9[2]	388
Other Highways	4.3[2]	388
Railroads	6.6	574

[1]4.3 m allowed in highly developed urban areas if alternate route has 4.9 m.

[2]Minimum value that can be used without an exception. An allowance of 150 mm should be added to vertical clearance to accommodate future resurfacing.

METRIC DESIGN CRITERIA

(TAKEN FROM 1994 AASHTO)

FOR DETERMINING DESIGN EXCEPTIONS

7. GRADES (MAXIMUM)

Type Facility	Type Terrain	Grades (%) For Design Speed (km/h) 50	60	70	80	90	100	110	Page No.
Freeway*:									
	Level	—	—	—	4	4	3	3	559
	Rolling	—	—	—	5	5	4	4	Tbl VIII-1
Rural Arterial.									
	Level	—	5	5	4	4	3	3	486
	Rolling	—	6	6	5	5	4	4	Tbl VII-1
Urban Arterial:									
	Level	8	7	6	6	5	5	—	514
	Rolling	9	8	7	7	6	6	—	Tbl VII-4
Rural Collector**:									
	Level	7	7	7	6	6	5	4	463
	Rolling	9	8	8	7	7	6	5	Tbl VI-3
Urban Collector**									
	Level	9	9	8	7	7	6	5	463
	Rolling	11	10	9	8	8	7	6	Tbl VI-3

* Grades one percent steeper than the values shown may be used for extreme cases in urban areas where development precludes the use of flatter grades and for one-way down grades.

** Maximum grades shown for rural and urban conditions of short lengths (less than 150 m) on one-way down grades and on low-volume rural collectors may be 2% steeper.

GRADES (MINIMUM) URBAN CURB & GUTTER

Type Facility	Minimum %	Page No.
Arterials	as required for adequate drainage	514
Collector Roads & Streets	0 30	472
Local Roads & Streets	0 20	430

METRIC DESIGN CRITERIA
(TAKEN FROM 1994 AASHTO)
FOR DETERMINING DESIGN EXCEPTIONS

8. CROSS SLOPE (MINIMUM AND MAXIMUM)

Type Facility		Cross Slope Minimum	Cross Slope Maximum	Page No.
Freeway		0.015	0.025*	557
Arterials:	Rural	0.015	0.02*	487
	Urban	0.015	0.03	514
Divided Highway		0.015	0.02*	497
Collectors:	Rural	0.015	0.03	464
	Urban	0.015	0.03	472
Shoulders:	Paved	0.02	0.06	339
	Gravel	0.04	0.06	339
	Turf	about 0.08**		339

* The values given are for up to two lanes in one direction. Additional outside lanes may have a cross slope of 0.03.

** Shoulder cross slopes which meet FDOT criteria do not require an exception.

METRIC DESIGN CRITERIA

(TAKEN FROM 1994 AASHTO)

FOR DETERMINING DESIGN EXCEPTIONS

9. SUPERELEVATION (MAXIMUM)

Type Facility	Super Elevation Rate	Page No.
Open Highways (Rural)	0 12	152
Urban	0 06	152
Low Speed Urban w/severe constraints	None	152
Ramps	See Table Below	

Radius (meters)	Range in Superelevation Rate for Intersection Curves with Design Speed (km/h) of 20	30	40	50	60	70
15	.02 - 10	---	---	---	---	---
25	.02 - 07	02 - 10	---	---	---	---
50	.02 - 05	02 - 08	04 - 10	---	---	---
70	.02 - 04	02 - 06	03 - 08	06 - 10	---	---
100	.02 - 03	02 - 04	03 - 06	05 - 09	08 - .10	---
150	.02 - 03	02 - 03	03 - 05	04 - 07	06 - 09	09 - 10
200	.02	02 - 03	02 - 04	03 - 05	05 - 07	07 - 09
300	02	02 - 03	02 - 03	03 - 04	04 - 05	05 - 06
500	02	02	02	02 - 03	03 - 04	04 - 05
700	02	02	02	02	02 - .03	03 - 04
1000	02	02	02	02	.02	02 - 03

Note: Preferably use superelevation rate in the upper half or third of the indicated range For design speeds greater than 70 km/h see the superelevation chart for roadways. **These rates are taken from 1994 AASHTO table IX-12, page 730.**

METRIC DESIGN CRITERIA
(TAKEN FROM 1994 AASHTO)
FOR DETERMINING DESIGN EXCEPTIONS

10 HORIZONTAL ALIGNMENT

A. Minimum Radius (m) with Superelevation (page 156, Table III-6)

Type Facility	Super-Elevation Rate	Minimum Curve Radius (m) for Design Speed (km/h) 30	40	50	60	70	80	90	100	110	120
Rural Hwys & High Speed Urban Streets	04	35	60	100	150	215	280	375	490	635	870
	06	30	55	90	135	195	250	335	435	560	755
	08	30	50	80	125	175	230	305	395	500	665
	10	25	45	75	115	160	210	275	360	455	595
	12	25	45	70	105	150	195	255	330	415	540

B. Minimum Radius (m) for Section with Normal Cross Slope (page 172, Table III-12)

Type Facility	Minimum Curve Radius (m) for Design Speed (km/h) 30	40	50	60	70	80	90	100	110	120
All*	450	800	1110	1520	2000	2480	3010	3680	4240	4690

*Minimum curve radii which comply with FDOT criteria (Section 2 9) do not require an exception

C. Passing Sight Distance (minimum) (page 462, Table VI-2B)

Design Speed (km/h) 30	40	50	60	70	80	90	100	110
217	285	345	407	482	541	605	670	728

METRIC DESIGN CRITERIA
(TAKEN FROM 1994 AASHTO)
FOR DETERMINING DESIGN EXCEPTIONS

11. VERTICAL ALIGNMENT & 12. STOPPING SIGHT DISTANCE |

(Taken from page 462, Table VI-2A)

Design Speed (km/h)	Stopping Sight Distance Computed for Design (m)	K Value* for Vertical Curves Rounded for Design Crest	Sag
30	29.6	3	4
40	44 4	5	8
50	57.4	9	11
60	74.3	14	15
70	94.1	22	20
80	112 8	32	25
90	131.2	43	30
100	157 0	62	37
110	179.5	80	43

*K Value is a coefficient by which the algebraic difference in grade may be multiplied to determine the length in meters of the vertical curve which will provide minimum stopping sight distance.

METRIC DESIGN CRITERIA
(TAKEN FROM 1994 AASHTO)
FOR DETERMINING DESIGN EXCEPTIONS

12. HORIZONTAL CLEARANCE (MINIMUM)

Feature	Clearance	Page No
Bridges	See Page A-5	
Tunnels	1.1 m from edge of traffic lane	387
Underpasses	2-lane· Normal shoulder width (to edge of barrier*)	827, Fig X-5
	Divided Roadway Normal shoulder (outside or median) width (to edge of barrier*)	827, Fig X-5
Barrier Wall & Guardrail	Normal shoulder width	827, Fig X-5
Light Poles	Rural: Outside Clear Zone	310
	Urban (Curb & Gutter) 0 5 m from face of curb	344, 438, 477
Sign Supports	Outside clear zone (if non-breakaway)	314
Utility Poles	Rural (Flush Shoulders). Outside Clear Zone	312
	Urban (Curb & Gutter)· 0.5 m from face of curb	344, 438, 477
Building Line	4 5 m from elevated roadway (wall)	574

* for metal guardrail, add deflection distance

CHAPTER 24

FEDERAL AID PROJECT CERTIFICATION

The values (pages 24-2 and 24-3) in this chapter have not been converted to metric. The CA agreement with FHWA is being revised and this chapter will be updated when the new agreement has been approved

CHAPTER 24

FEDERAL AID PROJECT CERTIFICATION

24.1 General

Certification Acceptance (C A) is an agreement between the Department and the Federal Highway Administration (FHWA) Under this agreement FHWA accepts the Department's certification that the design and construction phases of specific Federal-Aid highway projects have been carried out in accordance with all appropriate Federal and State laws, regulations and standards Under C A the Department assumes the oversight responsibilities and duties previously performed by FHWA during the final design, award and construction of federal funded projects

Exemptions from the Federal Highway Administration (FHWA) oversight were also granted in accordance with the Secretary's request, dated March 20, 1992 per Title 23 USC 106(b) as amended by Section 1016(6) of the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991

24.2 Certification Acceptance Coverage

C A applies to the design phases for Roadway, Signing, Marking, Lighting, Signalization, Structural, Landscaping and Architectural plans on National Highway System (NHS) off-Interstate system projects C A also applies to the award and construction activities on these NHS projects where the official cost estimate for construction is less than five million dollars Final design and plans preparation for projects will be developed under C A after FHWA's acceptance of the project's location and design concepts (see chapters 3, 5 and 7 of the PD&E Manual) FHWA reviews and approvals are not required during the final design phases for any projects developed under C A , up to and including the authorization to advertise for bids The agreement is documented in Topic No 625-010-000

24 2 1 Areas not Included

The final design phases of some Federal-Aid projects are not included under C A and will be developed with routine FHWA involvement These types of projects are projects on the Interstate system with an estimated construction cost greater than $1 0 million as well as projects that affect the Interstate system Projects affecting the Interstate might involve a crossing of the Interstate or work associated on a cross road at the ramp terminals, regardless of the source of funding If there are questions as to whether a project affects the Interstate system, the appropriate Area Design Engineer should be consulted

In addition to the above projects that are not included in C A , there are special project features that require FHWA reviews and concurrences These special features are

A Individual structures with an estimated total deck area greater than 125,000 square feet, unusual or moveable bridges, tunnels and unusual hydraulic or geotechnical structures

B Major storm drainage systems designed to carry more than 200 cfs, or regardless of quantity of discharge, systems which have a surface detention storage system with an accumulated volume greater than five acre feet

C Storm water pumping facilities designed to discharge more than 20 cfs

D Major channel changes which may significantly change the stream regimen or ecology

E Experimental features in the project design, including materials or construction methods

F Traffic surveillance and control systems with an estimated construction cost greater than $1 million

G The use of proprietary or sole source items or materials

H Operational plans for motorist-aid systems

Projects including these features may be developed under C A , however, the design of these features must be coordinated with FHWA to obtain the necessary reviews and approvals Current and accurate areas, discharges and cost estimates must be used to determine if FHWA involvement is required FHWA should be involved in a project as soon as it is evident that any of the above features will be included

C A also does not apply to the processing of the environmental document for a project (including reevaluations), any right-of-way phases, construction activities on projects where the official cost estimate is greater than five million dollars, or the acquisition of professional services, including authorizations for in-house design FHWA should be kept fully involved in these phases of Federal-Aid projects in accordance with current procedures Hazard elimination projects (HES funded) and railroad grade crossing improvement projects (RRP/RRS funded) are covered under alternate C A procedures approved by FHWA on 9-12-88 (HES) and 11-17-88 (RRP/RRS)

24.3 Exemptions under ISTEA

Exemptions granted under the ISTEA of 1991 apply to the design, award and construction activities and require that the FDOT certify that all work will meet or exceed the design and construction standards approved by FHWA.

24 3 1 Interstate

New or reconstruction projects, with any funding source except Interstate Completion, and which are less than $1 0 M in construction cost are exempt from FHWA oversight per 106(b)(2) of Title 23 and the Secretary's request of March 20, 1992

24 3 2 Interstate, RRR

On all projects, regardless of cost, FDOT will elect on the PR1240/PR2 to exempt itself from FHWA oversight per 106(b)(1) of Title 23 and the Secretary's request of March 20, 1992

24 3 3 NHS off "I" System (Non-RRR)

New or reconstruction projects, any funding source, $0 to $1 0 M in construction cost are exempt from FHWA oversight per 106(b)(2) of Title 23 and the Secretary's request of March 20, 1992 All other projects are covered under Certification Acceptance per section 24 2

24 3 4 NHS off "I" System, RRR

All projects regardless of cost or funding, FDOT will elect on the PR1240/PR2 to exempt itself from FHWA oversight per 106(b)(1) of Title 23, and the Secretary's request of March 20, 1992

24 3 5 Non-NHS Projects

All projects of any funding source are exempt from FHWA oversight per 106(b)(2) of Title 23 and the Secretary's request of March 20, 1992

24.4 Certification Responsibilities

The final design documents, reports and plans for projects exempt from FHWA oversight will be developed in accordance with all applicable Department manuals, guidelines and procedures, and in compliance with all applicable Federal Statutes, Regulations, Executive Orders, and FHWA Directives and Standards. The Department is responsible for assuring that all appropriate criteria has been adhered to, and for documenting its findings in lieu of FHWA reviews Several of the major areas and the method to be used by the Department to document the acceptability of various final design activities in place of an FHWA review are

A Typical Section Package

The typical section package should be prepared as described in Chapter 15 3 3 of this volume Concurrence by the District Design Engineer documents the acceptability of the package Concurrence from the District Structures Engineer may also be required on unusual bridge typical sections

B Pavement Design Package

The pavement design is developed and approved by the responsible professional engineer in accordance with Department pavement design procedures Concurrence from the District Design Engineer is required to document the acceptability of the package in lieu of FHWA review and concurrence

C Bridge Hydraulics Report

The hydraulics report is developed and approved by the responsible professional engineer in accordance with appropriate design standards Concurrence from the District Drainage Engineer is required to document the acceptability of the package in lieu of FHWA review and concurrence

D Bridge Development Report

The bridge development report is developed and approved by the responsible professional engineer in accordance with appropriate design standards. Concurrence from the District Design, Structures, or Project Management Engineer is required to document the acceptability of the report in lieu of FHWA review and concurrence

E Design Plans Phase Reviews

Plan reviews should be conducted as described in chapters 15 2, 15.3 1, and 16 of this volume Concurrence in the resolution of phase review comments from the District Design, Structures, or Project Management Engineer is required to document the acceptability of the reviews in lieu of FHWA review and concurrence (See Exhibit 24-C)

F Roadside Safety

Roadside safety should be a consideration in the design process, as is discussed in Chapter 4 of this volume. The District Safety Engineer is required to review all project designs to ensure and document that all accident and safety problems have been addressed in lieu of FHWA compliance reviews

G. Design Variations

Design variations described in Chapter 23 of this volume must be approved by the District Design Engineer A copy of the approved variation must be sent to the State Roadway Design Engineer to document the acceptability of the variation in lieu of FHWA concurrence (See Exhibit 24-D)

H Design Exceptions

For projects subject to FHWA oversight or prepared under CA procedures, design exceptions, as described in chapter 23 of this volume, still require approval by

FHWA. A design exception is required when less than minimum AASHTO criteria is used for any of the following 13 controlling design elements design speed, lane width, shoulder width, bridge width, structural capacity, vertical clearance, horizontal clearance, vertical alignment, horizontal alignment, stopping sight distance, cross slope, superelevation and grade A request to allow a design exception must be documented, justified and submitted to FHWA by the District Secretary or the District Production Director, with concurrence from the State Roadway Design Engineer.

I. Special Provisions

Special provisions, which include project specific and technical special provisions, will be developed and approved by the responsible professional engineer Concurrence from the District Design, Structures (or, for Category II structures, the State Structures Engineer), or Project Management Engineer is required to document the acceptability of the special provisions in lieu of FHWA review and concurrence (See Exhibit 24-E)

J. Plans, Specifications and Estimate

The plans package, specification package and contract file will be transmitted to Tallahassee as described in chapter 20 of this volume The District Production Director will sign the transmittal letter certifying that the design and plans have been prepared according to the appropriate certification procedures The specifications package will be approved by the District Specifications Engineer The Department's official estimate will be approved by the State Estimates Engineer

K Authorization to Advertise.

The letter requesting FHWA authorization to advertise for bids and the PS&E package, including reimbursable utility agreements, will be submitted to FHWA by the Federal Aid Office The Federal Aid Manager will certify in the letter to FHWA that the package was prepared under the appropriate certification procedures An FHWA PS&E checklist (the Contract File Index, filled out by the District and submitted with the plans package) will be submitted to FHWA

L. Revisions

Revisions to the PS&E will be processed as described in chapter 20 of this volume. Concurrence from the District Design, Structures, or Project Management Engineer is required to document the acceptability of the revision in lieu of FHWA review and concurrence

In special cases where programs or projects are developed in the Central Office, an appropriate Central Office Manager will provide any necessary concurrences in lieu of a District Manager Exhibit 24-A outlines the approval and concurrence procedures used in the C A process

24.5 Certification Documentation and Reviews

FHWA will perform periodic reviews of projects developed under C A and other exemption agreements and may have access to review project phases and records at any time. To support the exemption program, adequate documentation throughout the design phase is critical All approvals and concurrences outlined in the previous section must be sufficiently documented. A complete, well-organized design project file should be able to support a compliance review. All correspondence and documents must include the federal aid project number. The Quality Assurance procedures described in chapter 17 of this volume will be used by the Central Office to monitor district compliance with the certification requirements

24.6 Certification Statement

The following statement will be furnished by the District (in the Contract File, see Chapter 20 exhibits) when plans are transmitted for letting The same statement will be included in the letter requesting authorization (PR1240/PR2)

> "The Florida Department of Transportation certifies that all work will meet or exceed, except as noted below, the standards approved by the Secretary of the U S Department of Transportation under 23 USC (109)(c) "

A list of all design exceptions, the dates requested and the dates approved must be immediately below the statement If there were no exceptions on the project, a statement to that effect must be shown immediately below the statement Copies of the approved design exceptions may be requested, if the Central Office files do not contain copies

CERTIFICATION ACCEPTANCE APPROVAL AND CONCURRENCE PROCESS

TYPICAL SECTION PACKAGE Approved 6 Concurrence 3 or 4 (PPM Vol I, Chap 15 3 3)	PAVEMENT DESIGN PACKAGE Approved 6 Concurrence 3 (Pav't Design Manual)	DESIGN CRITERIA DESIGN EXCEPTIONS Requested 1 or 2 Concurrence 8 Approved FHWA or 11 DESIGN VARIATION Recommended 6 Approved 3 (PPM Vol I Chap 23)	BRIDGE HYDRAULICS REPORT Approved 6 Concurrence Dist Drainage Engr (Drainage Manual Vol 2, Chap 9)
BRIDGE DEVELOPMENT REPORT Approved 6 Concurrence 3 4 5 or 7 (Struct Design Guidelines Chap 3 3)	APPROVAL OF PHASE REVIEW PLANS (Roadway and Structures) Approved 6 Concurrence 3 4 5 or 7 (PPM Vol I Chap 15)	PLANS, SPECIFICATIONS AND ESTIMATE PLANS PACKAGE Approved 2 SPECIFICATIONS PACKAGE Approved 9 OFFICIAL ENGINEERS ESTIMATE Approved 10 (PPM Vol 1 Chap 20 1)	REVISIONS TO PS & E Approved 6 Concurrence 3 4 or 5 (PPM Vol I, Chap 20 2)
ACCIDENT/SAFETY REVIEW Approved Dist Safety Engr	SPECIAL PROVISIONS Approved 6 Concurrence 3 4 or 5		ASSEMBLY OF PS & E & CERTIFICATION OF OTHER REPORTS AS REQUIRED Responsibility FA Manager

1 DISTRICT SECRETARY
2 DISTRICT PRODUCTION DIRECTOR
3 DISTRICT DESIGN ENGINEER
4 DISTRICT STRUCTURES DESIGN ENGINEER
5 DISTRICT PROJECT MANAGEMENT ENGINEER
6 RESPONSIBLE PROFESSIONAL ENGINEER
7 STATE STRUCTURES DESIGN ENGINEER
8 STATE ROADWAY DESIGN ENGINEER
9 DISTRICT SPECIFICATIONS ENGINEER
10 STATE ESTIMATES ENGINEER
11 STATE DIRECTOR OF DESIGN (for exempt projects)

NOTE
In special cases where programs or projects are developed in the Central Office, an appropriate Central Office Manager will provide concurrence in lieu of the District Manager

Exhibit I-24-A

DESIGN OVERSIGHT

DUTIES AND RESPONSIBILITIES
FEDERAL-AID PROJECTS

PROJECT TYPE	FHWA OVERSIGHT	FDOT DESIGN RESPONSIBILITIES
INTERSTATE SYSTEM		
COMPLETION PROJECTS	REQUIRED	COORDINATE FHWA REVIEWS/APPROVALS
NEW/RECONSTR ⟩ $ 1M	REQUIRED	OBTAIN APPROVALS FOR EXCEPTIONS
NEW/RECONSTR ⟨ $ 1M	EXEMPT ISTEA	PERFORM ALL OVERSIGHT REVIEWS DOCUMENT EXCEPTIONS/VARIANCES CERTIFY TO DESIGN STANDARDS
R-R-R PROJECTS ALL ON I-SYSTEM	EXEMPT PROJ BY PROJ ISTEA	REQUEST EXEMPTION PR1240/PR2 PERFORM ALL OVERSIGHT REVIEWS DOCUMENT EXCEPTIONS/VARIANCES CERTIFY TO DESIGN STANDARDS
NATIONAL HWY SYSTEM OFF-INTERSTATE	C A AGREEMENT	
NEW/RECONSTR ⟩ $ 1M SEE "NOTE"	REQUIRED FOR SPECIAL FEATURES ONLY	PERFORM ALL OVERSIGHT REVIEWS COORDINATE SPECIAL FEATURES W/FHWA DOCUMENT EXCEPTIONS/VARIANCES AGREED APPROVALS/CONCURRENCES
NEW/RECONSTR ⟨ $ 1M	EXEMPT ISTEA	PERFORM ALL OVERSIGHT REVIEWS DOCUMENT EXCEPTIONS/VARIATIONS CERTIFY TO DESIGN STANDARDS
R-R-R PROJECTS ALL ON NHS	EXEMPT PROJ BY PROJ ISTEA	REQUEST EXEMPTION PR1240/PR2 PERFORM ALL OVERSIGHT REVIEWS DOCUMENT EXCEPTIONS/VARIANCES CERTIFY TO DESIGN STANDARDS
NON-NHS ALL PROJECTS	NO FHWA OVERSIGHT	PERFORM ALL OVERSIGHT DUTIES DOCUMENT EXCEPTIONS/VARIANCES

"NOTE" C A DOES NOT APPLY TO CONSTRUCTION ACTIVITIES ON PROJECTS WITH CONSTRUCTION COSTS OF $ 5M OR GREATER

EX I-24-B

DATE:

TO: (See Below)*

FROM:

COPIES:

SUBJECT: Response to ________ Phase Review

REF: W.P.I. Number
State Project Number
F.A. Project Number
County

In content of letter include a statement confirming that all review comments have been responded to or satisfactorily resolved.

Include appropriate copies of review comments, responses and other pertinent data.

APPROVED:

____
Responsible Professional Eng.
(Name of Consultant Firm)

CONCURRENCE:

____
* District Design Engineer
* District Structures Engineer
* District Project Mgmt. Eng

* As appropriate

EX I-24-C

DATE:

TO: District Design Engineer

FROM:

COPIES: State Roadway Design Engineer

SUBJECT: Design Variation

REF: W.P.I. Number
State Project Number
F.A. Project Number
County

Include a brief background statement concerning project and item(s) of concern.

Indicate design element(s) for which variation is requested, along with specific variation description.

Also, include justification, supporting documentation, etc.

RECOMMENDED BY:

____
Responsible Professional Engineer
(Name of Consultant Firm)

APPROVED BY:

____
District Design Engineer

EX I-24-D

DATE:

TO: District Design, Structures or
Project Management Engineer

FROM:

COPIES: State Specifications Engineer

SUBJECT: Special Provisions

REF: W.P.I. Number
State Project Number
F.A. Project Number
County

Include detailed information concerning special provisions required.

Appropriate section(s) of F.D.O.T. Standard Specifications should be referenced.

Questions concerning format and content should be directed to the Specifications Office of F.D.O.T.

APPROVED: CONCURRENCE:

_______________________________ _______________________________

Responsible Professional Eng.
(Name of Consultant Firm)

* District Design Engineer
* District Structures Engineer
* District Project Mgmt. Eng

* As appropriate

EX I-24-E

Chapter 25

Florida's Design Standards for Resurfacing, Restoration and Rehabilitation (RRR) of Streets and Highways

Chapter 25

FLORIDA'S DESIGN CRITERIA FOR RESURFACING, RESTORATION AND REHABILITATION (RRR) OF STREETS AND HIGHWAYS

25.1 Introduction

25.1.1 General

Resurfacing, restoration and rehabilitation (RRR) work is defined as work undertaken to extend the service life of an existing highway and/or enhance highway safety This includes the placement of additional surface materials and/or other work necessary to return an existing roadway to a condition of structural and functional adequacy Many of the RRR Standards used by the Department are derived from the National Academy of Sciences "Special Report 214" This publication contains many of the methods necessary to make the safety and cost effective evaluations required by this chapter

RRR projects must be designed and constructed in a manner that will comply with the accessibility standards and requirements set forth in the Americans with Disabilities Act of 1990 (ADA).

25.1.2 Application

The criteria included herein are for all RRR projects except Interstate and freeways, and are not intended to apply to new construction or major modifications of existing facilities Interstate and freeway RRR projects are designed using new construction criteria except that the standards used for horizontal alignment, vertical alignment, and widths of median, traveled way and shoulders may be the AASHTO interstate standards that were in effect at the time of original construction or inclusion into the interstate system..

The RRR criteria may be used for establishing the minimum requirements for intersection improvement projects with the understanding that when right-of-way is adequate, new construction criteria will be used to the maximum extent feasible

25.2 Planning and Programming RRR Projects

RRR projects must balance a number of competing objectives, the principal ones being the preservation of highways, improved service levels and enhancement of safety. The success in meeting these objectives depends on the quality of individual project designs and project programming decisions

25.2.1 Projects Requiring Right-of-Way

Facilities programmed for RRR projects should be given a review of the existing right-of-way, roadway, access management, drainage design elements and other improvements to identify locations which require additional right-of-way For such locations, the design should be expedited to determine actual right-of-way requirements The designer must coordinate the requirements with the Right-of-Way Office so that necessary areas will be cleared before the project is ready for letting

25.2.2 Projects with Bridges within Project Limits

Bridges must be reviewed in sufficient detail to clearly establish the cost effective and appropriate changes to be included in the project design effort

25 2 3 Project Features Requiring Exceptions and Variations

Projects may have features below criteria values which have not been programmed and/or which are determined not to be appropriate to accomplish under this design project These usually require design exception or variation approval, as appropriate See Sections 25 3 5 and 25 5

25.3 RRR Project Design Process

Significant improvements in overall safety can be brought about by a systematic safety conscious design process The design process is a team effort which requires the expertise of persons familiar with design, safety, maintenance, traffic operations and others To assure that safety issues are fully addressed on RRR projects, in addition to the usual design process, the following are also required·

A review of the purpose for which the RRR project was programmed

An assessment of current safety conditions

A final scope of work with recommendations for specific safety improvements

Documentation of the safety design decisions

Reviews of the design for safety issues

25 3 1 Review of Project Purpose

A RRR project is generated by specific needs or conditions The designer must become familiar with these needs or conditions at the very beginning of involvement with the project in order to assure that the final scope of work and final design actually accomplish the original purpose of the project This may involve research of background data or other information that provide the reason, the proposed improvements, estimated project cost and project priority

25 3 1 1 Principal Reason(s) for the RRR Project

The following list indicates some, but not all, of the principal reasons that can generate a RRR project

a To preserve or extend the life of the existing pavement

b Improve capacity (without adding continuous through lanes)

c Improve operating characteristics

d. Site specific accident reduction

e Section wide accident reduction.

f. General safety modifications

25.3 1 2 <u>General Nature of Proposed Improvements (Type of Work)</u>

In addition to resurfacing, restoration and rehabilitation a project may include one or more of the following types of work as a general improvement The list is not all inclusive

a. Widen roadway and bridge lanes

b Widen or add roadway and bridge shoulders

c Provide disability access

d Provide clear zone

e Upgrade pavement markings.

f Add, update or remove traffic signals

g Correct skid hazards

h Replace bridges rated "insufficient"

i. Upgrade bridge rail

j. Upgrade to current Access Management requirements

k Provide non-vehicular transportation needs

l Add or extend auxiliary lanes to a roadway

m Add turn lanes at an intersection or on a roadway

n Realign an intersection or roadway

o Replacement of bridges which cannot be widened economically

p Upgrade at-grade railroad crossings

q Intersection improvements

r Removal of parking lanes

s. Other safety improvements

25 3 1 3 Review Project Budget and Priority

The design and construction of a RRR project must be accomplished with expediency and at reasonable cost Nevertheless, the project design must address all issues of safety, plus preservation of investment, and service to the user Conditions which are discovered but cannot be resolved within the programmed budget and schedule must be addressed and the decisions documented

25 3 2 Assessment of Conditions

Before beginning actual design of the project, the designer shall assess current conditions on the project This assessment shall include both physical conditions and operating conditions plus a safety assessment Office reviews and field reviews shall be performed as part of the assessment

25 3 2 1 Office Reviews

Office reviews shall be conducted to assimilate and analyze data that may be pertinent to the improvements that can be made on the project

a) Assess Physical Conditions

This assessment should include

- geometrics,
- radius, length, and superelevation of curves,
- typical shoulder treatments,
- cross drain and structure locations,
- location and design of intersections, etc

A review of old plans, as built drawings, Straight Line Diagrams, and other historical records will determine many of the existing conditions b.) Assess Operating Conditions

This assessment should include

A summary of legal posted speeds on the project

Drainage and Maintenance section's verbal or written concerns of past, present and/or anticipated future problems.

Conditions attributable to current control of access.

c.) Assess Safety

A review of historical accident and travel statistics shall be performed by a qualified safety specialist. This assessment, with written recommendations, should include:

Identification of significant accident locations, with:

(a) possible causes

(b) suggested corrective measures

Review of correspondence files for letters of public concern

25.3 2.2 Field Reviews

A field review shall be performed by a multi-discipline team This review should assess physical, operational and safety conditions

a.) Assess Geometric and Physical Conditions

Verify office review findings

Check roadway features such as·

alignment

cross slope

superelevation

lane width

existing traffic control markings and signs
side slopes
clear zones
shoulder type and width
intersection elements
sight distances
drainage (including erosion problems)
pavement condition
highway appurtenances
other features.

b.) Assess Operating Conditions
verification of posted regulatory speeds
verification of posted advisory speeds
verification of reported problems
observation of operating conditions
evaluation of access features

c.) Assess Safety Conditions
observation of known accident locations
indications of unsafe operations, such as run-off-the-road indications or previous repairs

25 3.3 Project Scopes

Utilizing the office and field review findings, prepare a final scope of work by incorporating, where appropriate, other work including engineering and surveying services not identified in the original scope Improvements other than resurfacing, restoration or rehabilitation to be considered are listed below The list is not all inclusive

Remove, relocate or make crashworthy roadside obstacles

Remove unwarranted guardrail.

Upgrade or replace non-standard guardrail

Replace or retrofit obsolete bridge rails

Improve side slopes, slope flattening/stabilizing

Correct shoulder drop off

Pave shoulders

Improve pavement cross slope

Provide side drain safety modifications

Increase sight distance at intersections

Improve pavement markings

Improve pavement drainage

Provide or upgrade sidewalks and bikeways

Upgrade railroad crossings

Provide or upgrade signalization

Provide or upgrade lighting

Upgrade signing and other traffic control devices

Provide or upgrade curb cuts, ramps and other disability access features

Reconstruct or close driveways to comply with Access Management standards

25 3 4 <u>Review Project Plans</u>

RRR design plans are reviewed by other disciplines including a safety specialist These reviews are detailed in the Scheduled Submittals chapter of this manual

25.3 5 Document the Design Process

The designer shall include in the design file all documentation that substantiates the design process and decisions made, including the following information

1 A short paragraph which states the overall project purpose Factors such as principal reason for the project, anticipated project cost, principal work type, general right-of-way needs or provisions, and any special project priorities are appropriately addressed here

2 Documents that detail the existing conditions on the project Findings of office reviews, field reviews and surveys are assembled here, to document existing geometric and roadside features, operating conditions, traffic volumes, posted speeds, existing pavement markings, signing, safety, etc A brief overall summary of findings is recommended

3 Document the selected standards based on project intent and conditions When RRR criteria cannot be met, a design exception/variation is required

4 A summary of safety issues that have been identified for the project and the recommended solution of those issues

5 Reviews of the project design for safety improvements, documenting what was finally accomplished or ruled out of the project subsequent to the scope of work having been completed

6 Those items in the original scope of work for the project which cannot be reasonably accomplished and must be deleted or delayed

25.4 RRR Design Criteria

Design values and decisions for roadway features should reflect the anticipated service life of the project The designer has the responsibility to choose the specific design value to be used, taking into consideration its cost-effectiveness, which can range from the minimum RRR Criteria presented herein, to new construction criteria. Design values in the following sub-sections apply to RRR projects only. When specific values are not provided, the standards used in the original construction or subsequent enhancements may be retained except when an upgrade is identified in the project scope. Designers are encouraged to make a deliberate selection of design values by explicitly addressing issues of safety cost-effectiveness, overall highway consistency in geometric design, design of adjoining segments and expected trends in traffic growth and truck use before specifying design values The design values indicated in this chapter usually reflect a cost-effective basis for evaluating existing roadway characteristics to determine which features require upgrading

The design values presented herein are the minimum to be used for a RRR project on the State Highway System without obtaining an exception or variation See Section 25 5

25 4 1 Design Period

Improvements should be evaluated using a design period which is consistent with the design period selected for the pavement rehabilitation The design period (service life) for RRR projects should be from 8 - 12 years for projects without milling and 12 - 20 years for projects with milling See the Flexible Pavement Manual for specific design periods For skid hazard projects, where other improvements are not made, the design year is the expected year of construction

25 4 2 Design Traffic Volume

The design year for traffic volume is the same design year as the year established for service life   Traffic data to be used for design

1 ADT and DHV for mainline (current, post construction and design year),
2 K, D and T factors,
3 Peak turning movements at signalized and problem intersections and major traffic generators,
4 Movements for future traffic generators that are scheduled during the service life should be considered

25 4 3 Pavement Design

The pavement design procedures are found in

Flexible Pavement

Document 625-010-002, Flexible Pavement Design Manual For New Construction And Pavement Rehabilitation

Rigid Pavement

Document 625-010-005, Rigid Pavement Rehabilitation

Document 625-010-006, Jointed Plain Concrete Pavement Design Manual

25 4 4 Design Speed

Most highway features are based on design speed Design speed is the maximum safe speed that can be maintained when conditions are so favorable that the design features of the highway govern. Selection of the design speed must be logical for the type and location of the highway. Design speed must not be less than the legal posted speed. Design speed must not be dictated by an isolated geometric feature

The design speed used in the original design of the highway should be used for RRR projects. If that is not practical, the design speed used should be consistent with comparable projects For urban curb and gutter projects with an original design speed of 45 mph, 80 km/h design speed shall be used to evaluate geometric features

Regardless of the original design speed or posted speed, the following are the minimum design speeds

Rural Facilities 90 km/h

Urban Facilities 50 km/h

Note Values for design speeds less than these minimums have been provided in the following tables in the event that lower design speeds can be justified Design speed values are provided for 65 and 105 km/h (40 and 65 mph) in the design tables These design speeds are to be used to evaluate existing conditions If reconstruction is indicated, the design speed used for design should be selected from those provided in the Roadway Design Criteria chapter of this manual

25 4 5 Lane and Shoulder Widths

The minimum lane and shoulder widths to be used are provided in Tables 25 4 5 1 - 25 4 5 3

On resurfacing projects, hard convert typical section dimensions where existing conditions permit. Exception Use direct mathematical (soft) conversion (Appendix B, Rule 2) for existing pavement widths in curbed sections, existing right of way widths, and existing median widths

Lane and Shoulder Widths

Rural Multilane			
Design Year ADT	Design Speed (km/h)	Minimum Lane Width (m)	Minimum Shoulder Width (m)
ALL	ALL	3.6	1.8

Table 25.4.5.1

Two Lane Rural and Urban, Without Curb and Gutter			
Design Year ADT	Design Speed (km/h)	Minimum Lane Width (m)	Minimum Shoulder Width (m)
1 - 750	ALL	3.0[1]	1.8
751 - 2000	< 80	3.3[2]	1.8
	≥ 80	3.6[2]	1.8
> 2000	ALL	3.6[2]	1.8

(1) For rural and urban projects without curb and gutter (regardless of traffic volume), when widening is required, a minimum lane width of 3.3 m is required

(2) May be reduced by 0.3 m if trucks < 10% of design year traffic

Table 25.4.5.2

Urban Multilane or 2 Lane with Curb and Gutter				
Design Year ADT	Design Speed (km/h)	Minimum Thru Lane (m)	Minimum Turn Lane (m)	Minimum Parking Lane (m)
ALL	ALL	3.0[1]	2.7[2]	2.1[3]

(1) 3.3 m if Trucks are >10% of Design Year Traffic

(2) 3.0 m for 2 Way Left Turn Lanes

(3) A minimum width of 2.1 m measured from face of curb may be left in place. Otherwise provide 2.4 m minimum, measured from face of curb

Table 25.4.5.3

25 4 6 Cross-Slopes

The existing pavement cross slope shall be reviewed for compliance with criteria. Existing pavement cross slopes shall be field verified by the design location survey. Whenever practical, pavement cross-slope shall be constructed to new construction criteria. When new construction cross slope criteria cannot be met, documentation in the design file is required and the normal non-superelevated cross-slope used shall be consistent with the values in Table 25 4 6 Superelevation requirements are covered in Section 25.4 7

When cross slope correction is necessary, the designer must work closely with the Pavement Design Engineer and the District Bituminous Engineer to determine the appropriate method of correction and ensure constructability Special milling and layering details showing the method of correction shall be shown in the plans For projects with superelevated sections, details shall address how the transition from normal cross slope to superelevation is to be achieved Since this type work will often involve variable depth milling and/or asphalt layers, special care in estimating quantities for milling, overbuild, and structural courses will be necessary

Roadway Cross-Slopes

Feature	Standard	Range
Travel Lanes	0 02	0 02 - 0 04[1]
Shoulders	0.06	0 03 - 0 08[2]
Parking Lanes	0 05	0 03 - 0 05

[1] Existing multi-lane curb and gutter sections originally constructed with a parabolic crown section may be resurfaced using a series of tangents with a cross-slope range from 0 015 to 0 05

[2] When existing shoulders are to remain, the algebraic difference between the shoulder slope and adjoining roadway pavement slope shall be ≤ 0.07

Table 25.4.6

25 4 7 Superelevation

Roadway and shoulder superelevation shall be provided in accordance with the Roadway and Traffic Design Standards, Index 510 for rural curves and Index 511 for urban curves, consistent with Section 25 4 11(b)

25.4 8 Shoulder Treatment

On projects with rural type (without curb) construction, shoulders, erosion control, sodding and reworking shoulders shall be provided consistent with the criteria for new construction Paved shoulders shall be provided in accordance with new construction criteria; however the widening of existing 1 2 m paved shoulders is optional For new construction paved shoulder criteria, refer to the Roadway Design Criteria chapter of this manual

25 4.9 Side Slopes

The values selected shall be the flattest that are practical On RRR projects where existing ditches can be modified for stormwater management purposes, the use of steeper than standard side slopes and additional depth may be cost-effective but would require a variation. Justification must fully address safety, water depth, frequency and duration, as well as cost-effectiveness The decision to shield steep side slopes shall be made consistent with the guidelines in the AASHTO Roadside Design Guide

Front Slopes·

1 6 are desirable

1·4 may be constructed within the clear zone

1 3 may be constructed outside the clear zone

Existing front slopes 1 3 or flatter may remain within the clear zone Shielding may be required

Steeper than 1·3 shall be shielded as per Roadway and Traffic Design Standards, Index 400, General Notes

Consideration should be given to flattening slopes of 1 3 or steeper at locations where run-off-road type accidents are likely to occur (e.g., on the outsides of horizontal curves)

The proposed construction should not result in slopes steeper than the existing slopes in violation of the above values

Back Slopes:

1.4 are desirable

1 3 may be constructed in the clear zone

1·2 may be constructed outside the clear zone without shielding

Existing back slopes 1:2 and flatter may remain

Existing back slopes steeper than 1 3 within the clear zone may require shielding

25.4.10 Vertical Alignment

Vertical alignment must be reviewed together with the horizontal alignment to assure that the necessary balance of standards is realized and that the combination is both safe and pleasing.

The alignment should be reviewed to see if the following principles are generally satisfied by the existing vertical alignment:

the sight distance provided meets or exceeds the values in Table 25 4 10, column B

grades do not significantly affect truck operations

there are no hidden dips which could obscure traffic or hazards steep grades and sharp vertical curves do not exist at or near an intersection

sufficient grades and, when necessary, special gutter grades exist to adequately drain urban projects

adequate sight distance exists for traffic signals, e g beyond overpasses, etc

When any of the above conditions do not exist, the designer should evaluate for hazardous conditions and determine if corrective measures are warranted

25.4.10 1 Vertical Curvature

The designer shall use the method given in Table 25 4 10 to check the sufficiency of vertical curves and provide any indicated corrective measures, When an evaluation is required, it shall consider

the nature of potential hazards hidden by a hill crest,

the location of the hazard in relation to the portion of the highway where sight distance falls below new construction criteria

effectiveness of other options such as relocating or correcting the hazard providing warning signs.

25 4 10 2 Grades

Grades which satisfied the standards in effect at the time of construction may be used provided the result is consistent with the design principles in 25 4.10 Grades which are not consistent with these design principles must be evaluated

Stopping Sight Distance for Vertical Curvature

DESIGN SPEED (km/h)	STOPPING SIGHT DISTANCE (m) (1)		
	A	B	C
50	60	60	55
60	75	75	70
65	90	85	75
70	110	95	85
80	120	115	100
90	145	135	115
100	170	160	130
105	185	170	140

For the design speed, compare the length of the available sight distance to the tabulated values.

a. If the length is equal to or greater than the "A" value, the curve is satisfactory.

b If the curve is equal to or greater than the "B" value but less than the "A" value, a study **should** be made to evaluate possible mitigation of hazards requiring driver reaction and/or appropriate treatment such as relocation of the hazard, hazard warning signs, reduced safe speed signs, etc..

c. If the length is equal to or greater than the "C" value but less than the "B value, a study **shall** be made and appropriate treatment such as relocation of the hazard, hazard warning signs, reduced safe speed signs, etc. provided. Possible reconstruction of the curve should be considered.

d. If the value is less than the "C" value, **reconstruction** of the curve is required, or an exception must be obtained.

(1) Based on height of eye of 1070 mm and height of object of 15 mm above road surface.

Table 25.4.10

25.4.11 Horizontal Alignment

Vertical and horizontal alignment must be reviewed together to assure that the necessary balance of standards is realized and the combination is both safe and pleasing.

The designer should review the alignment to identify that the existing alignment generally adheres to the following guidelines:

consistent with no sudden changes from easy to sharp curvature.

sufficient tangent length between reverse curves.

superelevation transitions provided.

maximum curvature is not used:

on high fills or elevated structures;

at or near crest in grade;

at or near low points in grade;

at the end of long tangents;

at or near intersections or points of access or egress;

at or near decision points.

At all locations where the existing alignment does not adhere to these conditions, the designer should evaluate for hazardous conditions and determine if corrective measures are warranted.

25.4.11.1 Horizontal Curves

Horizontal curves shall be reviewed for horizontal curvature and superelevation. Review existing curves against the values in Table 25.4.11.1. Every practical attempt shall be made to upgrade curves which are below State Highway System (SHS) minimum values for new construction. The review should also include an on-site review for evidence of near accidents or operational problems.

a) Horizontal Curvature

Condition #1 - Horizontal curves which meet or exceed the SHS minimum radius values are satisfactory unless there is evidence of safety or operational problems

Condition #2 - Curves which are below the SHS minimum radius values but meet or exceed the RRR minimum radius values shall be reviewed for specific safety problems at the curve If the review indicated significant operational or safety problems exist, the curve must be reconstructed If problems are identified but reconstruction is not warranted, corrective measures shall be included in the project

Condition #3 - Those curves which do not meet the RRR minimum radius values must be reconstructed Reconstructed curves shall meet the criteria for new construction contained in Chapter 2 Sufficient time and budget must be programmed into the RRR project to obtain any right-of-way necessary for reconstruction of the curve

b) Superelevation

Rural Curves - Existing rural curves not having the indicated superelevation rate on Standard Index 510 shall be corrected to that rate Other measures appropriate to correct or improve identified safety or operational problems shall be provided

Urban Curves - Existing urban (C&G) curves not having the indicated superelevation rate on Standard Index 511 shall be corrected to that rate by reconstruction of the curve or curb adjustment to accommodate overbuild, if practical Other measures appropriate to correct or improve identified safety or operational problems shall be provided

SAFE CRITERIA FOR STATE HIGHWAY SYSTEM WITH MAXIMUM SUPERELEVATION				
DESIGN SPEED (km/h)	e_{max} = 0 10		e_{max} = 0.05	
	SHS	RRR	SHS	RRR
	R_{min} (m)	R_{min} (m)	R_{min} (m)	R_{min} (m)
50	75	57	87	68
60	115	84	123	101
65*	135	118	163	143
70	160	159	212	194
80	210	205	269	259
90	275	259	N/A	N/A
100	360	318	N/A	N/A
105*	411	388	N/A	N/A
* Not to be used for design (reconstruction)				

Table 25.4.11.1

25 4 11 2 Stopping Sight Distance

Stopping sight distance shall be provided for all horizontal curvature in accordance with Table 25 4 11 2

DESIGN SPEED (km/h)	STOPPING SIGHT DISTANCE (m) for Horizontal Curvature
50	55
60	70
65	75
70	85
80	100
90	115
100	130
105	140

Table 25.4.11.2

25.4.12 Stopping Sight Distance

Stopping sight distance requirements are provided in Sections 25.4.10, Vertical Alignment and 25.4.11, Horizontal Alignment.

25.4.13 Vertical Clearance

The following clearances apply to highway bridges and other roadway features over the entire roadway. Entire roadway includes lanes and shoulders

Underpass Clearance - For roadways passing under existing bridges, vertical clearance shall be at least 4 267 m over the entire roadway Signing and warning features shall be provided whenever vertical clearance is less than 4 420 m

Signs and Traffic Control Devices - Clearances shall be provided consistent with new construction standards

Bridges - Vertical clearance requirements are provided in Section 25.4.25 4

25 4 14 Horizontal Clearance

For RRR projects, new construction horizontal clearance criteria shall be used where practical. On low speed (80 km/h or less) urban projects with curb or curb and gutter, where new construction clearances to obstructions cannot reasonably be obtained and other alternatives are deemed impractical, the clearance may be reduced to 0 5 m from the face of the curb to the nearest edge of the obstruction Documentation is required in the project file. Any horizontal clearance to an obstruction less than 0 5 m from the face of the curb must be justified as an exception

25.4.15 Clear Zone:

Clear Zone requirements for RRR projects with flush shoulders are outlined in Table 25.4.15. Any obstruction located within the clear zone should be removed, shielded or made crashworthy. See the Roadside Safety chapter of this manual

Clear zone applies adjacent to traveled ways with flush shoulders Clear zone does not apply when curb or curb and gutter is adjacent to the traveled way

CLEAR ZONE (meters)		
FLUSH SHOULDERS		
DESIGN SPEED (km/h)	TRAVEL LANES & MULTI-LANE RAMPS	AUXILIARY LANES & SINGLE LANE RAMPS
< 70	1.8	1 8
70 (5)	4 2	2 4
>70	5 5	2 4

GENERAL NOTES·

1 When relocation is required to meet minimum clear zone requirements, consideration should be given to providing new construction widths

2 Clear zone widths are for side slopes 1 4 and flatter For steeper slopes, provide a clear runout area at toe of fill according to the Roadside Safety chapter of this manual

3 When accident history indicates need, or where specific site investigation shows definitive accident potential, clear zone widths shall be adjusted on the outside of horizontal curves with flush shoulders in accordance with Table 2 12 2

4 Clear zone width is measured from the edge of the traveled way

5 May be reduced to <70 km/h widths if conditions more nearly approach those for low speed (70 km/h or less).

Table 25 4 15

25 4 16 Border

The minimum border width shall be the greatest of the following

The border width used in the original project,

The border width required to satisfy ADA accessibility standards,

2 4 m

When right of way is being acquired for other reasons, the minimum border width shall be that used for new construction projects, however, the minimum length of wider border width shall be a segment of sufficient length to provide reasonable continuity

25 4.17 Intersections

Intersections shall be evaluated to determine those that need a traffic engineering study The following items should be considered

- Addition of right and left turning lanes
- Realignment of intersection
- Adequate turning radii for left and right turning lanes
- Use of channelization to reduce excessive areas of conflict at large intersections
- Placement of crosswalks as related to sidewalks and stop bars
- Locations of pedestrian facilities
- Locations of utilities, signal poles, controller cabinets, lighting poles and drainage structures as related to sidewalks and curbcut ramps
- Warrants for traffic control systems
- Installation of buried conduit for future traffic control systems
- Lighting for intersection illumination
- Adequate sight distance
- ADA needs

25.4.18 Drainage

The designer or drainage specialist must evaluate the hydraulic and physical adequacy of the existing drainage system. This requires examination of the existing drainage in the field and by consulting with maintenance personnel and records. If there are apparent problems with the existing drainage system, additional evaluation is required to determine the extent and type of improvements necessary to upgrade the system. The Drainage Manual contains design criteria and methods which provide guidance in formulating suitable drainage features, either through modification or replacement

Prior to selecting any plan of highway improvement, the designer should consult with drainage and environmental permitting specialists since almost all roadway modifications reduce storage and infiltration and increase discharge rates and volumes. Stormwater retention and detention for quality, rate and volume may be required. Theoretical evaluation of proposed changes to existing and new drainage features necessary to correct operational deficiencies should be referred to a drainage specialist The drainage specialist will provide the necessary drainage design, flood data information, Storm Water Pollution Prevention Plan (SWPPP) and any stormwater permit computations

25.4 19 Pedestrian and Bicyclist Needs

Many existing corridors do not provide for pedestrian or bicyclist needs. Whenever a RRR project is undertaken, pedestrian and bicyclist needs must be addressed. Recommendations by the District Bicycle/Pedestrian Coordinator shall be obtained. Local government contact in developing these recommendations is essential This should be part of the project scoping and programming effort

Pedestrian Needs

Sidewalks - Upgrading sidewalks to meet ADA accessibility standards shall be included

Medians - Medians shall be evaluated to determine if modifications such as pedestrian refuge sections are necessary 5-lane and 7-lane sections are restricted or eliminated under current policy, usually by the introduction of a raised or restrictive median, which enhances the opportunity to accommodate pedestrian needs. Traffic separators with a width sufficient to provide refuge should be used at intersections where possible. When adequate pedestrian refuge cannot be provided at the intersection, mid-block islands should be provided.

Design details for disability access features including sidewalk, curb cuts and ramps are found in the Roadway and Traffic Design Standards. Additional standards for ADA are found in the regulations and design guidelines issued by the Secretary of the U.S. Department of Transportation

Bicyclist Needs - Features to provide for identified bicycle traffic needs must be incorporated into the project or as a planned off-system route Design criteria for bicycle lanes are found in other chapters of this manual For existing curbed sections where no widening is planned, consideration should be given to reducing lane widths; e.g. 3.3 m through and 3 0 m turn lanes on sections with 4 267 or 4 572 m wide lanes.

25.4.20 Utilities (Underground and Overhead)

Where utilities are involved on RRR projects, the clear zone and horizontal clearance criteria in this chapter, the Utility Accommodation Manual, and the Utilities chapter of this manual shall be followed.

Relocation or adjustment is required if (a) the minimum clear zone or horizontal clearance requirements are not met or (b) the utility system conflicts with proposed RRR improvements and sufficient right-of-way is available

In some cases, the utility system on RRR projects may be retained without adjustment or relocation if (a) the accident history does not indicate the existance of a hazard or (b) the system has demonstrated adequate performance and does not conflict with proposed improvements. This decision should be made by the District Design Engineer, in consultation with the District Utility and Safety Engineers, using accident data and field investigation to support the decision

25 4 21 At-grade Railroad Crossings

When highway improvements are undertaken that include at-grade railroad crossings, the physical and operational characteristics shall be reviewed and upgraded to meet minimum standards. Recommendations shall be made by the District Railroad Coordinator for incorporation into the project

25 4 22 Aesthetics and Landscaping

Landscaping, including median and intersection treatment, shall be consistent with Standard Indexes 546 and 700

25 4 23 Highway Lighting

Lighting may be installed at specific locations to improve safety For example

- Reducing the effects of ambient light conditions,
- Busy or high accident intersections,
- Bus stops,

Channelized intersections,

Car pool parking lots,

Pedestrian and bicycle crossings,

Ramp terminals

Any lighting, existing or proposed, shall be reviewed by the District Lighting Engineer to determine specific needs. Lighting shall meet new lighting criteria, found in the Signing, Marking, Lighting and Signals chapter of this manual

25 4.24 Highway Traffic Control Devices

Traffic control devices such as signals, signing, and pavement markings shall be updated as required to comply with the Manual on Uniform Traffic Control Devices, the Manual on Uniform Traffic Studies, the Department's Roadway and Traffic Design Standards, and the ADA design guidelines issued by the Secretary of the U S Department of Transportation The District Traffic Operations Engineer (or staff) shall determine any new or additional devices required

25 4 25 Bridges

On each project, a determination must be made as to whether an existing bridge should remain as is, be rehabilitated or be replaced The decision shall be made based on an assessment of the bridge's structural and functional adequacy for the type and volume of traffic over the structure's design life

Any structure which has been identified and is scheduled for rehabilitation or replacement in the 5 year work program should be considered for an exception (or variance) from widening or rail retrofit. A detailed accident history must be included in the justification

25.4.25 1 Bridge Loading

Bridges shall have an Inventory Load Rating equal to or greater than the following load requirements

TYPE	LOAD REQUIREMENT
Collector Facilities	MS-13 5
Arterial Facilities	MS-18

25 4 25 2 Bridge Width

Bridges shall meet or exceed the following clear width criteria If lane widening is planned as part of the RRR project, the minimum useable bridge width shall be determined using the width of approach lanes after widening

Design Year ADT	Minimum Usable Bridge Width (m)
UNDIVIDED	
0 - 750	Total width of approach lanes + 1 2 m
751 +	Total width of approach lanes + 2 4 m
DIVIDED	
ALL	Total width of approach lanes + 1 7 (median separator) *
	Total width of approach lanes + 2 0 (median barrier wall)**
	* 0.5 m median and 1 2 m outside shoulder
	** 0 8 m median and 1 2 m outside shoulder

If widening is required, it shall be in accordance with the Structures Design Guidelines and meet the geometric requirements for new construction

25.4 25 3 Bridge Railing

Bridge railing shall be both structurally and functionally adequate. Bridge railing which will not contain vehicles is considered structurally inadequate. Bridge railing which will not redirect vehicles without snagging or vaulting is considered functionally obsolete

All safety shape rails, New Jersey or F-Shape, are structurally and functionally adequate All other former FDOT standard bridge rail designs are inadequate

Only when it is determined appropriate for an existing inadequate handrail to remain in place may the details provided by Scheme 1 in Standard 401 be considered. Refer to the General and Design notes on Sheet 1 of that Standard Other retrofit concepts may be used when judged to meet performance expectations

Rails to be replaced shall be designed using the criteria in the Structures Design Guidelines.

25 4 25 4 Vertical Clearance

The following clearances apply to existing bridges to remain or be modified only Replacement structures shall be to new construction standards

Underpassing Clearance - Vertical Clearance for roadways passing under existing bridges shall be at least 4 267 m over the entire roadway The existing vertical clearance shall not be reduced by the RRR project if the existing clearance is 4.877 m or less.

Low Member Clearance - Existing bridges with sway bracing members over the bridge deck shall have at least 4.267 m clearance over the entire roadway.

Signing and warning features shall be provided whenever vertical clearance is less than 4.420 m.

25.4.25.5 Considerations

When evaluating bridge replacement or widening, the following should be considered:

a. Cost of replacing the existing bridge with a wider bridge designed to new bridge criteria,

b. Cost of widening the existing bridge (if widening is practical), including life cycle costs of maintaining a widened bridge,

c The number of accidents that would be eliminated by replacement or widening;

d The hydraulic sufficiency and the risk of failure due to scour and/or ship impact as well as the consequences of failure

25.5 Design Exceptions and Variances

Every effort should be made to adhere to the desirable criteria stated herein. However, under unusual conditions, it may be necessary and appropriate to use values that are less than the minimum values shown. If lesser values are proposed for use, these shall be identified and the necessary approval and concurrence obtained at the earliest possible time, but not later than Phase II, so that the denial of any such request will not alter the project letting date Refer to the Design Exceptions and Variations chapter of this manual for the necessary procedure.

APPENDIX

B

FDOT Metric Practice

FDOT METRIC PRACTICE

ROADWAY DESIGN

SUMMARY OF RULES

1. Convert values related to surveys, right of way and other geometric alignment using the U. S. Survey Foot taken to a minimum of 8 decimal places:

$$1 \text{ foot} = \frac{12 \text{ inches/foot}}{39.37 \text{ inches/meter}} = 0.304\,800\,61 \text{ meters}$$

   For other direct mathematical conversions use the SI definition. 1 foot = 0.3048 meters

2. Display direct mathematical (soft) converted values to the nearest 0.001 m or 1 mm.

3. Do not use commas to separate digits if a number has more than 4 digits. For numbers with more than 4 digits either right or left of the decimal, leave a space when practical. (Where the displayed number must be used in a mathematical operation on a computer the space may not be recognized properly and should not be used).

   Example 10 000 <u>or</u> 0.609 35 <u>or</u> 13 471.359

4. To the extent practical, use the following rules for dimensioning roadway plans.

   - For dimensions in meters, display values to at least one decimal place.
   - For dimensions in millimeters, display values as whole numbers with no decimal place.
   - Do not use the centimeter.

   Using the above rules, do not show the unit symbols "m" and "mm" unless needed for clarification. Show even dimensions in meters with a decimal and following zero digit, e.g. 300.0 to avoid confusion with 300 mm.

5. If a dimensioned item has a numerical quantity that is part of a group of numbers in a different range, select the unit that most adequately covers the range without unduly large or small numbers. For example, if 300 mm is part of a group of numbers shown in meters, show it as 0.3 m.

6 Show long dimensions, including all horizontal and vertical geometry, wall lengths, bridge span lengths and box culvert lengths, spans and heights in meters

7 In general, show cross section dimensions of structural members in millimeters. This will normally include most drainage structures (except box culverts), drainage pipe, and special drainage structure details. (Note: The actual size of drainage pipe and standard drainage structure boxes will remain the same. However, label these items in nominal size based on 1" = 25 mm. Example· Label 24" pipe as 600 mm pipe; Label a 4' diameter structure as a 1200 mm structure.)

8. Show pavement thickness descriptions in millimeters.

9. Use 0 1 m for both base extension on rural sections (formerly 3") and for stabilization extension on curbed sections (formerly 6").

10 On typical sections, show type of curb, "E" or "F", not the dimension.

11. As a general rule, display metric dimensions to one more decimal place than the corresponding dimension in English units

- Typical Section Elements, including lane widths and shoulder widths - in meters, generally to 1 decimal place.
- Horizontal control points on plans, including survey centerline, baseline, intersections and alignment - in meters to 3 decimal places. The normal station interval for centerlines and baselines is 100 meters. (1 + 00.000 = 100 m)
- Vertical alignment control points, (PVC, PVI, PVT) and profile grade elevations - in meters to 3 decimal places.
- Profile Grade - in percent to 4 decimal places.
- Proposed flow lines - in meters to 2 decimal places.
- Manhole tops and grate elevations - in meters to 2 decimal places.
- Ditch elevations - in meters to 2 decimal places

- Box Culvert Spans and Heights - in meters to 1 decimal for new construction; in meters to 2 decimal places for extensions of existing box culverts originally constructed to english dimensions.

12. Where practical, round short radius curves (<150.0 m), including curb returns and control radii, to the nearest meter. Round longer radius curves to the nearest 5 meters. (See attached tables.)

13. Display alignment bearings and delta angles in curve data in degrees, minutes and seconds, rounded to the nearest second.

14. Omit "degree of curvature" from curve data. It has no definition in the metric system. Instead, use the radius definition. Equations:

$$\textit{Tangent} \qquad T = R \tan\left(\frac{\Delta}{2}\right)$$

$$\textit{Length} \qquad L = R\,(\Delta \textit{ in Radians})$$

$$\textit{Long Chord} \qquad LC = 2\,R \sin\left(\frac{\Delta}{2}\right)$$

15. On resurfacing projects, hard convert typical section dimensions (lane widths, shoulder widths, etc.) where existing conditions permit. Exception: Use direct mathematical (soft) conversion (Rule Number 2) for existing pavement widths in curbed sections, existing right of way widths, and existing median widths.

16. Continue to post sign messages for speed limits and distances in English units. Note: The posted speed for curb and gutter sections with design speed of 80 km/h (corresponds to 50 mph), should not exceed 45 mph.

17. A "hard" metric project is defined as one where metric standard index drawings and metric specifications are used, and the design complies with adopted metric criteria.

18. Beginning with metric projects express slope ratios in vertical to horizontal (V:H) format. For example, show roadside slopes as 1:6, 1:4, rather than past convention as 6:1 or 4:1.

19. As a general guideline for new construction and reconstruction, show cross sections in 20 meter intervals for urban projects and 50 meter intervals for rural projects. Project specific factors may dictate greater or lessor intervals.

20. When project limits are identified by kilometer point location on the Key Sheet, show the equivalent milepost using direct mathematical conversion.
(example: kp 1.609 = MP 1.000)

21. Label existing and proposed utilities in metric. Use the FDOT Basis of Estimates Manual utility pay item list of metric sizes as a guide.

PLAN SCALES

ENGLISH SCALE	METRIC SCALE
1" = 2'	1 : 25
1" = 5'	1 : 50
1" = 10'	1 : 100
1" = 20'	1 : 200
1" = 40'	1 . 400 or 1 500
1" = 50'	1 : 500
1" = 100'	1 : 1000
1 = 200'	1 : 2000
1" = 400'	1 . 5000

Plan sheet size will remain the same. The viewing area of a plan sheet will be 800 mm long on "D" size sheets and 400 mm on "B" size sheets. Allowing for open space at each side, this provides a coverage of 140 m at 1:400 scale, 350 m at 1:1000 and 700 m at 1:2000 on "B" size sheets.

Plan/Profiles.

	Sheet Size	Horizontal	Vertical
Rural -	D	1·1000	1 50 or 1 100
	B	1.2000	1 100 or 1 200
Urban -	D	1:200	1·50
	B	1·400 or 1·500	1 50 or 1 100

Show centerline major tick Marks at each station. Show centerline minor tick marks at 20 meter intervals when using 1 200 and 1·400 scale, and at 25 meter intervals when using 1 500 scale.

Cross Sections·

	Sheet Size	Horizontal	Vertical
Normal	D	1:50	1 25
	B	1 100	1 50
Wide Sections	D	1·100	1 25 or 1 50
	B	1.200	1.50 or 1 100
Narrow Sections	D	1:25	1 25
	B	1:50	1 50

As a guideline, the normal interval for cross sections is 20 meters for urban projects and 50 meters for rural projects.

LANE WIDTHS

CURRENT	SOFT	HARD
8 ft	2.438 m	2.4 m
9 ft	2.743 m	2.7 m
10 ft	3.048 m	3.0 m
11 ft	3 353 m	3 3 m
12 ft	3.658 m	3.6 m
14 ft	4.267 m	4.2 m
15 ft	4.572 m	4.5 m

BIKE LANE WIDTHS

4 ft	1.219 m	1.2 m
5 ft	1.524 m	1.5 m

SIDEWALK AND UTILITY STRIP WIDTHS

CURRENT	SOFT	HARD
2 FT	0.610 m	0.6 m
3 FT	0.914 m	0.9 m
4 FT	1.219 m	1.2 m
5 ft	1.524 m	1.5 m
6 ft	1.829 m	1.8 m
7 FT	2.134 m	2.1 m
8 FT	2.438 m	2.4 m
9 FT	2.743 m	2.7 m
10 FT	3.048 m	3.0 m

CURB AND GUTTER WIDTHS

TYPE	CURRENT	SOFT	HARD
E	2.25 ft	686 mm	675 mm
F	2.00 ft	610 mm	600 mm
Shoulder Gutter	3.50 ft	1067 mm	1050 mm

SHOULDER WIDTHS

CURRENT	SOFT	HARD
2 ft	0.610 m	0.6 m
4 ft	1.219 m	1.2 m
5 ft	1.524 m	1 5 m
6 ft	1.829 m	1.8 m
8 ft	2.438 m	2.4 m
10 ft	3.048 m	3.0 m
12 ft	3.658 m	3.6 m

TRAFFIC SEPARATOR WIDTHS

CURRENT	SOFT	HARD
4 ft	1.219 m	1.2 m
6 ft	1.829 m	1.8 m
8.5 ft	2.591 m	2.6 m

MEDIAN WIDTHS

CURRENT	SOFT	HARD
15.5 ft	4.724 m	5.0 m
17.5 ft	5.334 m	N/A
19.5 ft	5.944 m	6.0 m
22 ft	6.706 m	6.6 m
26 ft	7.925 m	7.8 m
30 ft	9.144 m	9.0 m
40 ft	12.192 m	12.0 m
50 ft	15.240 m	15.0 m
60 ft	18.288 m	18.0 m
64 ft	19.507 m	19.2 m
88 ft	26.822 m	26.4 m

DITCH WIDTHS

CURRENT	SOFT	HARD
3 ft	0.914 m	0.9 m
3.5 ft	1.067 m	1.0 m
4 ft	1.219 m	1.2 m
5 ft	1.524 m	1.5 m

DESIGN SPEED

CURRENT mph	METRIC km/h	
20	30	
25	40	
30	50	
35	60	low speed
40	60	
45	70	
50	80	⇑
55	90	⇓
60	100	high speed
65	110	
70	110	

METRIC CONVERSIONS

RETURN RADII
CONTROL RADII
SHORT RADIUS CURVE RADII

TURNING SPEED mph	RADIUS (feet)	SOFT (meters)	HARD (meters)	TURNING SPEED km/h	RADIUS (meters)	
	15	4.572	5.0			
	20	6.096	6.0			
10	25	7.620	8.0	15	7.0	
	30	9.144	9.0	20	10.0	
	35	10.668	11.0			
	40	12.192	12.0			
	45	13.716	14.0			
15	50	15.240	15.0			
	60	18.288	18.0			
	75	22.860	23.0			
20	90	27.432	27.0	30	25.0	
	100	30.480	30.0			
25	150	45.720	46.0	40	50.0	
30	230	70.104	70.0	50	80.0	
35	310	94.488	94.0	60	115.0	Small
40	430	131.064	131.0	60	115.0	Radii ⇑
	550	167.640	170.0			⇓
	690	210.312	210.0			Large
	840	256.032	255.0			Radii
	1040	316.992	315.0			

Note: Selection of appropriate radii should also consider design vehicle.

Conversions on this sheet and the next are accomplished as follows:

- Radius in feet x (12 - 39.37) = radius in meters (soft)
- Values for metric turning speeds based on proposed AASHTO metric criteria.

DEGREE OF CURVE TO RADIUS VALUES			
DEGREE	RADIUS (feet)	RADIUS-Soft (meters)	RADIUS-Hard (meters)
0°-15'	22918.31	6985.515	6985.0
0°-30'	11459.16	3492.758	3495.0
0°-45'	7639.44	2328.505	2330.0
1°-00'	5729.58	1746.379	1745.0
1°-15'	4583.66	1397.103	1395.0
1°-30'	3819.72	1164.253	1165.0
1°-45'	3274.04	997.931	1000.0
2°-00'	2864.79	873.189	875.0
2°-15'	2546.48	776.168	775.0
2°-30'	2291.83	698.552	700.0
2°-45'	2083.48	635.047	635.0
3°-00'	1909.86	582.126	580.0
3°-15'	1762.95	537.347	535.0
3°-30'	1637.02	498.965	500.0
3°-45'	1527.89	465.701	465.0
4°-00'	1432.39	436.595	435.0
4°-15'	1348.14	410.913	410.0
4°-30'	1273.24	388.084	390.0
4°-45'	1206.23	367.659	370.0
5°-00'	1145.92	349.276	350.0
5°-30'	1041.74	317.523	320.0
6°-00'	954.93	291.063	290.0
7°-00'	818.51	249.483	250.0
8°-00'	716.20	218.297	220.0
9°-00'	636.62	194.042	195.0
10°-00'	572.96	174.638	175.0

Note: Degree of Curvature is not used in the Metric System.

GENERAL METRIC INFORMATION

SI PREFIXES

M	mega	10^6 = 1 000 000
k	kilo	10^3 = 1 000
m	milli	10^{-3} = 0.001

RECOMMENDED PRONUNCIATION

mega - as in megaphone

kilo - kill' oh

milli - as in military

joule - rhyme with tool

kilometer - kill' oh meter

pascal - rhyme with rascal

Base SI Units			Related Units		
Quantity	Unit	Symbol	Unit	Symbol	Relation
length	meter	m	millimeter kilometer	mm km	=0.001 m (10^{-3} m) =1000 m (10^3 m)
mass	kilogram	kg	gram megagram metric ton	g Mg t	=0.001 kg (10^{-3} kg) =1000 kg (10^3 kg) =1000 kg (10^3 kg)
time	second	s	hour	h	=3600 s

DERIVED SI UNITS WITH SPECIAL NAMES

Quantity	Unit	Symbol	Formula
force	newton	N	kg•m/s^2
pressure	pascal	Pa	N/m^2
moment	newton meter	N•m	N•m
Temperature	degree Celsius	°C	

Common Derived Units of SI			Related Units		
Quantity	**Unit**	**Symbol**	**Unit**	**Symbol**	**Relation**
acceleration	meter/second^2	m/s^2			
area	square meter	m^2	sq millimeter	mm^2	=0 000 001 m^2 [illegible]
			hectare	ha	=10 000 m^2 [illegible]
			sq kilometer	km^2	=1 000 000 m^2 [illegible]
density, mass	kilogram/cubic meter	kg/m^3			
velocity	meter/second	m/s	kilometer/hour	km/h	=0 2778 m/s
volume	cubic meter	m^3	liter	L	=0 001 m^3 [illegible]
			milliliter	mL	=0 000 001 m^3 [illegible]

SOFT CONVERSION FACTORS

CLASS	MULTIPLY	BY		TO GET
LENGTH	inches	25.400 000		mm
	inches	0.025 400		m
	feet	0.304 800	**	m
	yards	0.914 400		m
	miles	1609.344 000		m
	miles	1.609 344		km
AREA	sq inches	645.160 000		mm^2
	sq feet	0.092 903		m^2
	sq yard	0.836 127		m^2
	acres	4046.873 000		m^2
	sq miles	2.589 988		km^2
VOLUME	board foot	0.002 360		m^3
	cubic feet	0.028 317		m^3
	cubic yard	0.764 555		m^3
	gallon (fluid)	3.785 412		L
	ounce (fluid)	29.573 530		mL
	bushels	0.035 239		m^3
MASS	ounce	0.028 350		kg
	pound	0.453 592		kg
	ton	907.184 700		kg
	lb/ft	1.488 164		kg/m
	lb/ft^2	4.882 425		kg/m^2
	lb/ft^3	16.018 460		kg/m^3
	$ounces/ft^2$	0.305 152		kg/m^2
FORCE	pound (force)	4.448 222		N
	lb/ft	14.593 900		N/m
	lb/ft^2	47.880 260		N/m^2
	lb/ft^3	157.087 5		N/m^3
STRESS	psi	6894.757 000		Pa
	$kips/in^2$	6.894 757		N/mm^2
VELOCITY	fps	0.304 800		m/s
	mph	0.447 040		m/s
	mph	1.609 344		km/h

TEMPERATURE $(^0F-32) - 1.8 = {}^0C$

ANGLES (no change) deg,min,sec

** For conversion from U.S. Geodetic Survey, the U.S. survey foot equals 0.304 800 610 m

APPENDIX

C

FDOT Metric Symbols

FDOT
METRIC
SYMBOLS

Revised November 1, 1995

FDOT METRIC SYMBOL STANDARDS

QUANTITY	UNIT	FDOT SPECS/ ROADWAY & TRAFFIC SYMBOLS	ASTM E380	2 CHARACTERS (i e , PAY UNITS)	3 CHARACTERS (i e , CQR FORMAT)
Length	millimeter	mm	mm		MM
	centimeter		cm	CM	CM
	meter	m	m	M1	M1
	kilometer	km	km	KM	KM
	lane kilometer	lane km		LK	LK
	net kilometer	net km		NK	NK
	gross kilometer	gross km		GK	GK
	kilometer point	kp			
Area	square meter	m^2	m^2	M2	M2
	hectare*	ha	ha	HA	HA
Volume	cubic meter	m^3	m^3	M3	M3
	liter	L	L	LI	LI
	kiloliter	kL		KL	KL
Mass (in the in - lb system called weight)	milligram	mg	mg		MGS
	gram		g	G	G
	kilogram	kg	kg	KG	KG
	metric ton*	t	t	MT	MT
Density	kg/cubic meter	kg/m^3	kg/m^3		KG3
Temperature	degree Celsius	°C	°C	DC	DC
	kelvin	K	K		K
Time	month*			MO	MON
	day*		d	DA	DAY
	hour*	h	h	HR	HR
	minute*	min	min		MIN
	second	s	s	SE	SEC
Plane Angle	radian	rad	rad		RD
	degree*	°	°	DG	DG
	minute*	'			MIN
	second*	"	"	SE	SEC
Frequency	hertz	Hz	Hz		HZ
Force	newton	N	N	N	N
	kilogram force	kgf	kgf		KGF
Viscosity, dynamic	pascal second	Pa • s	Pa • s		PAS
Viscosity, kinematic	centistokes		m^2/s		M2S

FDOT METRIC SYMBOL STANDARDS

QUANTITY	UNIT	FDOT SPECS/ ROADWAY & TRAFFIC SYMBOLS	ASTM E380	2 CHARACTERS (i e , PAY UNITS)	3 CHARACTERS (i e , CQR FORMAT)
Pressure, Stress	pascal	Pa	Pa	PZ	PZ
	megapascal	MPa	MPa		MPA
	bar*	bar	bar		BR
Torque	newton-meter	N • m	N • m	N1	N1
Energy Work	joule	J	J		J
	kilowatthour*	kWh	kWh		KWH
Power Radiant Flux	watt	W	W		W
Electric Current	ampere	A	A		A
Electric Charge, Quantity	coulomb	C	C		C
Electric Potential	volt	V	V		V
Capacitance	farad	F	F		F
Electric Resistance	ohm	Ω	Ω		OHM
Electric Conductance	seimens	S	S		S
Magnetic Flux	weber	Wb	Wb		WB
Magnetic Flux Density	tesla	T	T		T
Inductance	henry	H	H		H
Luminous Intensity	candela	cd	cd	CA	CA
Luminous Flux	lumen	lm	lm	LN	LN
Illuminance	lux	lx	lx		LX
	millicandela/ lux• square meter	mcd/lx• m^2	mcd/lx• m^2		MCD
Speed, Velocity	kilometer/hour	km/h	km/h	KH	KMH
	meter/second	m/s	m/s		M1S
	knot*	kn	kn		KN
Spread	square meter/ kilogram	m^2/kg	m^2/kg		M/K
Rotational Frequency	radian/second	rad/s	rad/s		RDS
	rev/second*	r/s	r/s		RPS
	rev/minute*	r/min	r/min		RPM
Activity	becquerel	Bq	Bq		BQ
Absorbed Dose	gray	Gy	Gy		GY
Dose Equivelant	sievert	Sv	Sv		SV
Amt of Substance	mole	mol	mol		MOL

non-SI units approved for use

OTHER FDOT METRIC DERIVED SYMBOLS USED IN SPECS

UNIT	SYMBOL
blows per meter	blows/m
blows per millimeter	blows/mm
candelas per lux per square meter	cd/(lx•m²)
cubic meter per second	m³/s
gram per liter	g/L
kilogram per linear meter	kg/m
kilogram per metric ton (US dollar per liter) per kilogram per liter	kg/t ($/L) /kg/L
kilogram per millimeter	kg/mm
kilogram per square meter	kg/m²
kilogram per square meter x millimeter per kilogram per liter (US dollar per liter)	kg/m³ • mm/kg/L ($/L)
kilojoule per kilogram	kJ/kg
kilojoule per millimeter	kJ/mm
kilojoule per square meter	kJ/m²
kilonewton millimeter	J
liter per cubic meter	L/m³
liter per kilogram	L/kg
liter per second	L/s
liter per square meter	L/m²
lux per millimeter	lx/mm
meganewton per square meter	MN/m²
meter per minute	m/min
millicandelas per lux square meter	mcd/(lx• m²)
milligram per centimeter	mg/cm
millimeter per meter	mm/m
millimeter per millimeter per degree Celsius	mm/mm/°C
millimeter per second	mm/s
nanogram per pascal second square meter	ng/(Pa•s•m²)
newton per millimeter	N/mm
square meter per liter	m²/L
square millimeter per square meter	mm²/m²
US dollars per cubic meter	$/m³
US dollars per liter	$/L
US dollars per metric ton	$/t
US dollars per square meter	$/m²

APPENDIX

D

Sample Metric Plans Sheets

INDEX

FISCAL YEAR	SHEET NO

THIS CONTRACT PLAN SET INCLUDES

ROADWAY PLANS
SIGNING AND PAVEMENT MARKING PLANS
SIGNALIZATION PLANS
ROADWAY LIGHTING PLANS
LANDSCAPE PLANS
ARCHITECTURAL PLANS
STRUCTURE PLANS

CONTRACT/CONSTRUCTION PLAN SET MAY OR MAY NOT CONTAIN ALL OF THE LISTED COMPONENTS/SHEETS

A DETAILED INDEX APPEARS ON THE KEY SHEET OF EACH COMPONENT SET OF PLANS

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

PLANS OF PROPOSED
STATE HIGHWAY

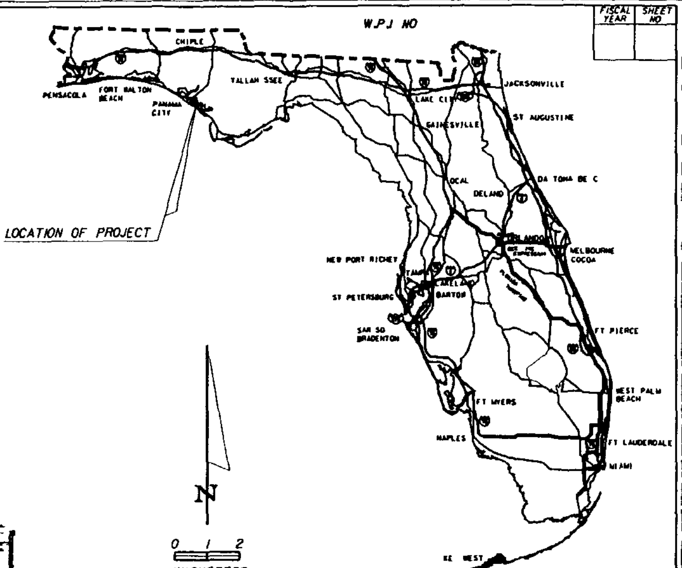
STATE PROJECT NO 00001-3502
(FEDERAL FUNDS)
BAY COUNTY

STATE ROAD NO 220

INDEX OF ROADWAY PLANS

SHEET NO	SHEET DESCRIPTION
1	KEY SHEET
2 - 4	SUMMARY OF PAY ITEMS
5 - 9	BOX CULVERT DATA SHEETS
10	DRAINAGE MAP
11 - 12	TYPICAL SECTIONS
13	TYPICAL SECTION DETAILS
14	SUMMARY OF QUANTITIES
15 - 16	SUMMARY OF DRAINAGE STRUCTURES
17	PROJECT LAYOUT
18 - 22	ROADWAY PLAN-PROFILES
23 - 24	SPECIAL PROFILES
25	INTERSECTION LAYOUT/DETAIL
26- 32	DRAINAGE STRUCTURES
33	LATERAL DITCH PLAN-PROFILES
34	LATERAL DITCH CROSS SECTIONS
35	SPECIAL DETAILS
36	ROADWAY SOIL SURVEY
37 - 47	CROSS SECTIONS
48 - 52	TRAFFIC CONTROL SHEETS
53 - 57	UTILITY ADJUSTMENTS
58 62	SELECTIVE CLEARING AND GRUBBING
63	APPROACH SLAB

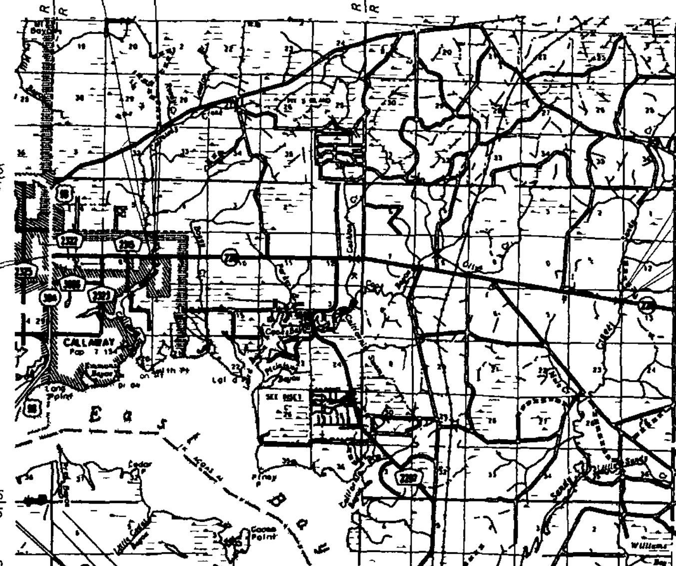
W.P.J NO



LOCATION OF PROJECT

N

0 1 2
KILOMETERS
1 150 000



ROADWAY SHOP DRAWINGS TO BE SUBMITTED TO

NAME(S) AND ADDRESS(ES) OF ENGINEER(S) RESPONSIBLE FOR REVIEW OF SHOP DRAWINGS WHEN REQUIRED

PLANS PREPARED BY

NAME ADDRESS AND VENDOR NUMBER OF THE CONSULTANT FIRM WHEN THE PLANS ARE PREPARED BY A CONSULTANT

A LOCATION SKETCH ON THE KEY SHEET IS NOT REQUIRED ON ANY PROJECT CONTAINING PLAN/PROFILE SHEETS THAT COVER RR CROSSING LOCATIONS

RR CROSSING NO 628323-W
MP NO B & O-1029 85
B & O INC RR

THESE PLANS HAVE BEEN PREPARED IN ACCORDANCE WITH AND ARE GOVERNED BY THE STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION ROADWAY AND TRAFFIC DESIGN STANDARDS (BOOKLET DATED JANUARY 199_)

ATTENTION IS DIRECTED TO THE FACT THAT THESE PLANS MAY HAVE BEEN ALTERED IN SIZE BY REPRODUCTION THIS MUST BE CONSIDERED WHEN OBTAINING SCALED DATA

GOVERNING SPECIFICATIONS STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS DATED 199 SUPPLEMENTS AND SPECIAL PROVISIONS THERETO IF NOTED IN THE CONTRACT SPECIFICATIONS FOR THIS PROJECT

NOTE THIS IS A METRIC UNIT PROJECT

METRIC UNIT NOTE TO BE PLACED ON THE LEAD KEY SHEET AND ALL COMPONENT PLAN KEY SHEETS

REVISIONS

Roadway Sheets 1 6 7 & 13 (Revised 3 30 96)
Signing & Pavement Marking Sheets S 2 & S 3 (Revised 3 30 96)
Signalization Sheets T 1 & T 2 (Revised 11 31 96)
Roadway Sheets 14 & 33 (Revised 3 31 96)
Summary Of Pay Items (Revised 3 31 96)

NAME OF FDOT PROJECT MANAGER OR COORDINATOR AS APPROPRIATE

RECYCLED PAPER

LENGTH OF PROJECT	
	METERS
ROADWAY	19 408 780
BRIDGES	100 406
NET LENGTH OF PROJ	19 509 186
EXCEPTIONS	
GROSS LENGTH OF PROJ	19 509 186

FDOT PROJECT MANAGER

REVISIONS		
DATE	#	DESCRIPTION
3-96	JBW	Revised sequence of contract plans

ROADWAY PLANS
ENGINEER OF RECORD ____________
DATE ____________
P E NO ____________

EXHIBIT 1
Date 7/1/96

1 11/18/96
CES0154

CESPJ15 4
PAGE 01 OF 01

99000 3011

SUMMARY OF BRIDGE PAY ITEMS

ALT	SPC	ITEM NUMBER	ITEM	UNIT	99000 3011 BR 991234 FA NON PART				QUANTITY TOTAL
	1	2110 3	STRUCTURES REMOVAL OF EXISTING	LS	1 000				1 000
	1	2400 7	BRIDGE FLOOR GROOVING	M2	2374 000				2374 000
	2	2400 148 1	TRAFFIC RAILING (F81)(BARRIER)	MI	748 000				748 000
	1	2415 1 4	REINFORCING STEEL (SUPERSTRUCTURE)	KG	193952 000				193952 000
	1	2415 1 5	REINFORCING STEEL (SUBSTRUCTURE)	KG	28964 000				28964 000
	1	2455 3 2	PILING FURNISHED (PRESTRESSED CONCRETE)(455MM SO	MI	1680 000				1680 000
	1	2455 4 2	PILING DRIVEN (PRESTRESSED CONCRETE)(455MM SO)	MI	1680 000				1680 000
	1	2455 16	PILE HOLE PREFORMED	EA	8 000				8 000
	1	2455 17 2	PILE SPLICES (455MM)	EA	4 000				4 000
	1	2455 85 11	PILE EXTRACTION (0 15M PENETRATION) (455MM SO)	EA	4 000				4 000
	1	2455 115	PILE REDRIVE	EA	4 000				4 000
	1	2455 137	TEST LOAD (DYNAMIC)	EA	8 000				8 000
	1	2455 140 12	TEST PILES FURNISHED (455MM SO)	MI	380 000				380 000
	1	2455 141 12	TEST PILES DRIVEN (455MM SO)	MI	380 000				380 000
	1	2530 3 3	RIPRAP (RUBBLE) (BANK AND SHORE)	MT	2571 000				2571 000
AA	1	2400 2 4	CONCRETE CLASS II (SUPERSTRUCTURE)	M3	832 400				832 400
AB	1	2400 4 4	CONCRETE CLASS IV (SUPERSTRUCTURE)	M3	832 400				832 400
BA	1	2400 2 5	CONCRETE CLASS II (SUBSTRUCTURE)	M3	243 800				243 800
BB	1	2400 4 5	CONCRETE CLASS IV (SUBSTRUCTURE)	M3	243 800				243 800

NOTE IDENTIFIES ITEMS NORMALLY REQUIRING SHOP DRAWINGS CONTRACTOR SHALL DETERMINE OTHER ITEMS REQUIRING SHOP DRAWINGS

1 11/18/96
CES0152

CESPJ15 2
PAGE 01 OF 01

99000 3011

SUMMARY OF ROADWAY PAY ITEMS

ALT	SPC	ITEM NUMBER	ITEM	UNIT	99000 3011 FA NON PART				QUANTITY TOTAL
	1	2101 1	MOBILIZATION	LS	1 000				1 000
	1	2102 1	MAINTENANCE OF TRAFFIC	LS	1 000				1 000
	1	2102 2 1	SPECIAL DETOUR (DETOUR 1)	LS	1 000				1 000
	2	2102 70 11	BARRIER WALL (TEMP) (F81)(STANDARD)(CONCRETE)	MI	1180 000				1180 000
	2	2102 70 21	BARRIER WALL (TEMP) (REL)(STANDARD)(CONCRETE)	MI	1180 000				1180 000
	2	2102 74 1	BARRICADE (TEMPORARY)(TYPES I II VP 8 DRUM)	ED	217000 000				217000 000
	3	2102 75 1	SIGNS CONSTRUCTION (TEMP POST MOUNTED) (0 8 M2)	ED	71610 000				71610 000
	2	2102 76	PANELS ARROW ADVANCE WARNING	ED	2604 000				2604 000
	2	2102 79	LIGHTS(TEMP BARR WALL MOUNT)(TYPE C STEADY BURN)	ED	25606 000				25606 000
	2	2102 81 1	IMPACT ATTENUATOR MODULES VEHIC (INERTIA)(TEMP)	EA	20 000				20 000
	4	2102 89 1	IMPACT ATTEN VEHIC (TEMP)(GREAT CZ)	LO	2 000				2 000
	1	2104 10	HAY OR STRAW BALED	MT	5 000				5 000
	1	2104 13 1	SILT FENCE STAKED (TYPE III)	MI	910 000				910 000
	2	2110 7 1	MAILBOX (F81) (SINGLE)	EA	5 000				5 000
	3	2120 1	EXCAVATION REGULAR	M3	6411 000				6411 000
	1	2160 4	STABILIZATION TYPE B	M2	29549 000				29549 000
	1	2285 708	BASE OPTIONAL (BASE GROUP M8)	M2	8619 000				8619 000
	1	2285 715	BASE OPTIONAL (BASE GROUP M15)	M2	44381 000				44381 000
	1	2300 1 3	BITUMINOUS MATERIAL (TACK COAT)	LI	12047 000				12047 000
	1	2327 70 040	MILLING EXISTING ASPHALT PAVT (40MM AVG DEPTH)	M2	291635 000				291635 000
	3	2331 2	ASPHALTIC CONCRETE TYPE S	MT	41559 800				41559 800
	1	2337 5 2	ASPH CONC FRICTION COURSE (INC RUBBER)(15MM FC 2)	M2	334619 000				334619 000
	1	2339 1	ASPHALT PAVEMENT MISCELLANEOUS	MT	84 600				84 600
	1	2360 1	APPROACH SLABS CONCRETE	EA	8 000				8 000
	1	2425 1 525	INLETS (DT BOT) (TYPE C) (PARTIAL)	EA	3 000				3 000
	1	2425 1 541	INLETS (DT BOT) (TYPE D) (3M)	EA	4 000				4 000
	1	2425 1 543	INLETS (DT BOT) (TYPE D) (J BOTTOM 3M)	EA	34 000				34 000
	1	2425 1 701	INLETS (GUTTER) (TYPE S) (3M)	EA	2 000				2 000
	1	2430 171 23	PIPE STORM SEWER CULV (OPTIONAL MATERIAL)(375MM)	MI	55 500				55 500
	1	2430 171 25	PIPE STORM SEWER CULV (OPTIONAL MATERIAL)(450MM)	MI	92 500				92 500
	1	2430 171 29	PIPE STORM SEWER CULV (OPTIONAL MATERIAL)(600MM)	MI	43 000				43 000
	1	2430 171 33	PIPE STORM SEWER CULV (OPTIONAL MATERIAL)(750MM)	MI	103 400				103 400
	1	2430 171 38	PIPE STORM SEWER CULV (OPTIONAL MATERIAL)(900MM)	MI	139 100				139 100
	1	2430 171 40	PIPE STORM SEWER CULV (OPTIONAL MATERIAL)(1050MM)	MI	82 300				82 300
	1	2430 172 33	PIPE CROSS DRAIN CULV (OPTIONAL MATERIAL)(750MM)	MI	37 200				37 200
	1	2520 6	GUTTER SHOULDER CONCRETE	MI	1109 000				1109 000
	1	2524 1 2	DITCH PAVEMENT CONCRETE (100MM THICK)	M2	468 000				468 000
	1	2536 1 1	GUARDRAIL (ROADWAY)	MI	1800 000				1800 000
	2	2536 73	GUARDRAIL REMOVAL	MI	150 000				150 000
	4	2536 85 1	GUARDRAIL END ANCHORAGE ASSEMBLY TYPE II	EA	4 000				4 000
	4	2536 85 5	GUARDRAIL END ANCHORAGE ASSEMBLY TYPE MELT	EA	4 000				4 000
	1	2570 2	SEEDING AND MULCHING	M2	209396 000				209396 000
	1	2570 3	SEED GRASS (PERMANENT TYPE)	KG	649 000				649 000
	1	2570 4	MULCH MATERIAL	MT	173 100				173 100
	1	2570 5	FERTILIZER	MT	19 500				19 500
	1	2570 9	WATER FOR GRASSING	KL	1168 000				1168 000
	1	2570 10	SEED GRASS (QUICK GROWING TYPE)	KG	866 000				866 000
	1	2575 1 3	SODDING (ARGENTIA BAHIA)	M2	13996 000				13996 000
	1	2710 21	TRAFFIC STRIPE SKIP (WHITE/BLACK/BLUE)	GK	57 600				57 600
	3	2710 23 61	TRAFFIC STRIPE SOLID (WHITE/BLACK/BLUE 150MM)	NK	115 200				115 200

STATE PROJ NO	SHEET NO

EXHIBIT 2
Date 1/1/97
SHEET 1 of 2

REVISIONS											
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

FLORIDA DEPARTMENT OF TRANSPORTATION

SUMMARY OF PAY ITEMS

STATE PROJ NO	SHEET NO

1 11/18/96
CES0152

CESPJ15 2
PAGE 02 OF 01

99000 3011

SUMMARY OF ROADWAY PAY ITEMS CONTRACT ITEMS CONTINUED

ALT	SPC	ITEM NUMBER	ITEM	UNIT	99000 3011 FA NON PART				QUANTITY TOTAL
	1	2710 29	REFLECTIVE PAINT (ISLAND NOSE)(WHITE)	M2	814 000				814 000

NOTE IDENTIFIES ITEMS NORMALLY REQUIRING SHOP DRAWINGS CONTRACTOR SHALL DETERMINE OTHER ITEMS REQUIRING SHOP DRAWINGS

1 11/18/96
CES0152

CESPJ15 2
PAGE 01 OF 01

99000 3011

SUMMARY OF SIGNING PAY ITEMS

ALT	SPC	ITEM NUMBER	ITEM	UNIT	99000 3011 FA NON PART				QUANTITY TOTAL
	1	2700 40 1	SIGN SINGLE POST (1 25)	AS	159 000				159 000
	1	2700 40 2	SIGN SINGLE POST (1 25 OR GREATER)	AS	11 000				11 000
	1	2700 41 1	SIGN MULTI POST (10 0 OR LESS)	AS	5 000				5 000
	1	2700 46 11	SIGN EXISTING (REMOVAL) (SINGLE POST)	AS	157 000				157 000
	1	2700 46 12	SIGN EXISTING (REMOVAL) (MULTI POST)	AS	6 000				6 000
	3	2705 2	DELINEATOR DOUBLE UNIT	EA	88 000				88 000
	1	2706 1 12	MARKER PAVEMENT REFLECTIVE(F8I) (CLASS B)	EA	2456 000				2456 000
	1	2711 3	PAVEMENT MESSAGE (THERMOPLASTIC)	EA	40 000				40 000
	1	2711 4	DIRECTIONAL ARROW (THERMOPLASTIC)	EA	45 000				45 000
	3	2711 31	TRAFFIC STRIPE SKIP (THERMOPLASTIC) (WHITE)	GK	25 050				25 050
	3	2711 35 181	TRAFFIC STRIPE SOLID(THERMOPLASTIC WHITE) (450MM)	MI	971 000				971 000
	3	2711 35 241	TRAFFIC STRIPE SOLID(THERMOPLASTIC WHITE) (600MM)	MI	407 000				407 000
	3	2711 37 61	TRAFFIC STRIPE SOLID(THERMOPLASTIC WHITE) (150MM)	NK	35 560				35 560

NOTE IDENTIFIES ITEMS NORMALLY REQUIRING SHOP DRAWINGS CONTRACTOR SHALL DETERMINE OTHER ITEMS REQUIRING SHOP DRAWINGS

EXHIBIT 2
Date 1/1/97
SHEET 2 of 2

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

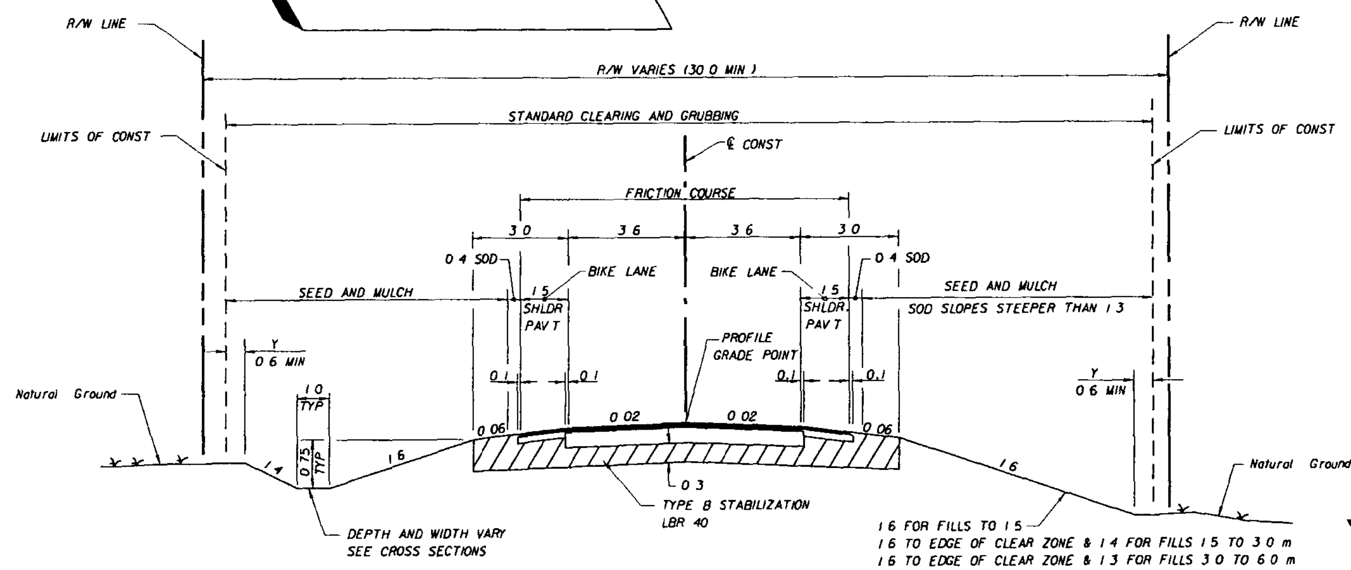
FLORIDA DEPARTMENT OF TRANSPORTATION

SUMMARY OF PAY ITEMS

STATE PROJ NO	SHEET NO
00000-0000	00

DESIGNATED BIKE LANES ARE TO BE LABELED ON TYPICAL UNDESIGNATED BIKE LANES SHOULD NOT BE LABELED ON TYPICAL

2-LANE (2-WAY)
ARTERIAL/COLLECTOR
NEW CONSTRUCTION
RURAL
WITH DESIGNATED OR
UNDESIGNATED BIKE LANE
DESIGN SPEED 90 km/h
OR GREATER
WITH PROJECTED
20 YR AADT OF 1500
OR GREATER



Y THE AREA DISTURBED BY CONSTRUCTION VARIES

TYPICAL SECTION
SR 10 (U.S. 90-A)
STA. 10+00.000 TO STA. 30+00.000

TRAFFIC DATA

CURRENT YEAR ESTIMATE = 1994 AADT = 6800
OPENING YEAR ESTIMATE = 1998 AADT = 7600
DESIGN YEAR ESTIMATE = 2018 AADT = 15000
K = 10/ D = 57/ T = 8/ (24 HOUR)
DESIGN HOUR T = 4/
DESIGN SPEED = 90 km/h

NEW CONSTRUCTION

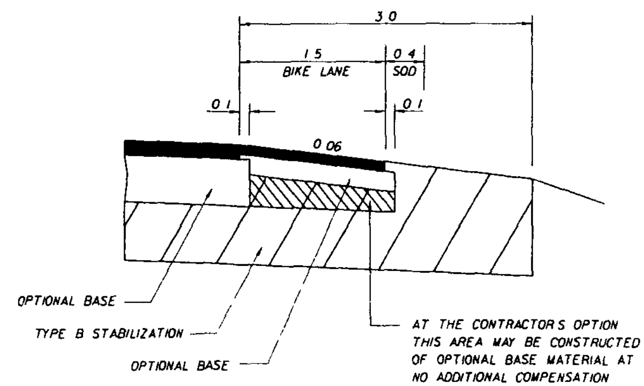
OPTIONAL BASE GROUP 8 WITH
TYPE S STRUCTURAL COURSE (60 mm)
AND FRICTION COURSE FC-2 (15 mm) (RUBBER)

SHOULDER PAVEMENT

OPTIONAL BASE GROUP 1 WITH
TYPE S STRUCTURAL COURSE (30 mm)
AND FRICTION COURSE FC-2 (15 mm) (RUBBER)

TRAFFIC DATA IS REQUIRED TO BE NOTED FOR CURRENT YEAR OPENING YEAR AND DESIGN YEAR POSTED SPEED (MPH) IS OPTIONAL

PPM II-6 3 STANDARD NOTES FOR TYPICAL SECTION SHEETS NOTES SHALL BE SHOWN ON TYPICAL SECTION AS APPLICABLE



SHOULDER PAVEMENT DETAIL

EXHIBIT 3
Date 1/1/97

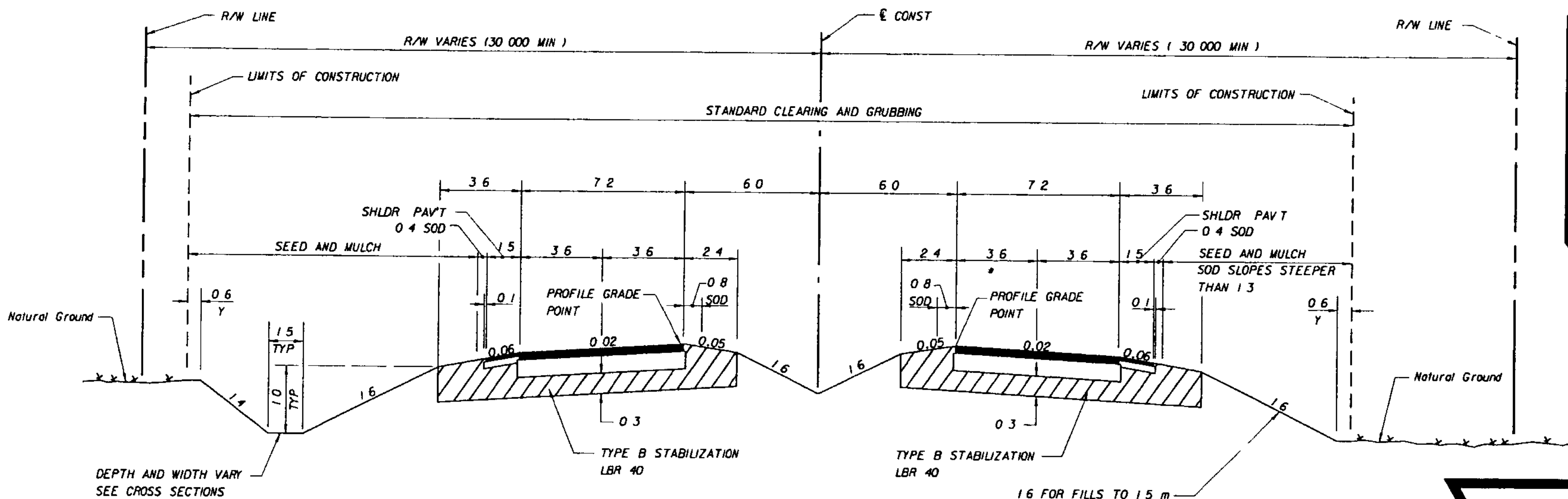
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	CONSULTANT FIRM NAME IF APPLICABLE	FLORIDA DEPARTMENT OF TRANSPORTATION	TYPICAL SECTION

REVISIONS

STATE PROJ NO	SHEET NO
00000-0000	00

DESIGNATED BIKE LANES ARE TO BE LABELED ON TYPICAL UNDESIGNATED BIKE LANES SHOULD NOT BE LABELED ON TYPICAL

4 LANE
ARTERIAL/COLLECTOR
NEW CONSTRUCTION
DIVIDED
RURAL
WITH DESIGNATED OR UNDESIGNATED BIKE LANE
WITH PROJECTED 20 YR AADT OF 1500 OR GREATER
DESIGN SPEED GREATER THAN 80 km/h



Y THE AREA DISTURBED BY CONSTRUCTION VARIES

TRAFFIC DATA

CURRENT YEAR ESTIMATE = 1994 AADT = 22300
OPENING YEAR ESTIMATE = 1996 AADT = 23300
DESIGN YEAR ESTIMATE = 2016 AADT = 51500
K = 9% D = 56% T = 10% (24 HOUR)
DESIGN HOUR T = 5%
DESIGN SPEED = 110 km/h

TYPICAL SECTION
SR 500
STA. 63+65.420 TO STA. 189+65.140

NEW CONSTRUCTION

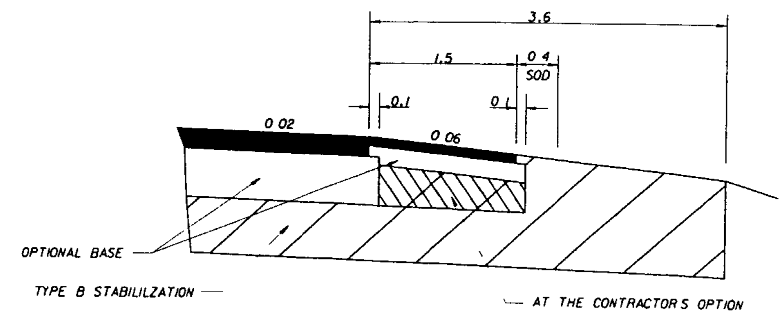
OPTIONAL BASE GROUP 9 WITH
TYPE S STRUCTURAL COURSE (90 mm) AND
FRICTION COURSE FC-2 (15 mm) (RUBBER)

SHOULDER PAVEMENT

OPTIONAL BASE GROUP 1 WITH
TYPE S STRUCTURAL COURSE (30mm) AND
FRICTION COURSE FC-2 (15 mm) (RUBBER)

TRAFFIC DATA IS REQUIRED TO BE NOTED FOR CURRENT YEAR OPENING YEAR AND DESIGN YEAR POSTED SPEED (MPH) IS OPTIONAL

PPM II-6 3 STANDARD NOTES FOR TYPICAL SECTION SHEETS NOTES SHALL BE SHOWN ON TYPICAL SECTION SHEETS AS APPLICABLE



SHOULDER PAVEMENT DETAIL

EXHIBIT 4
Date 1/1/97

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	CONSULTANT FIRM NAME IF APPLICABLE	FLORIDA DEPARTMENT OF TRANSPORTATION	TYPICAL SECTION

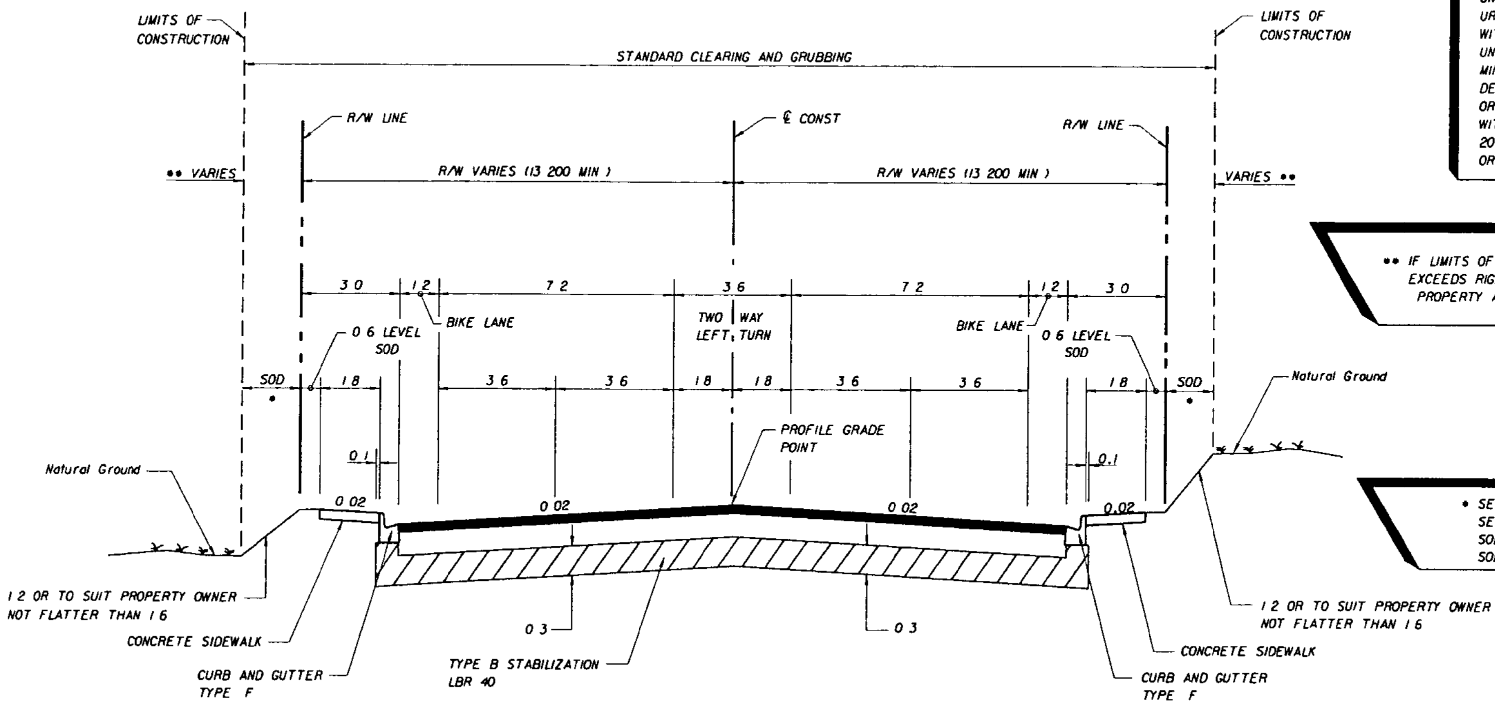
REVISIONS

STATE PROJ NO	SHEET NO
00000-0000	00

DESIGNATED BIKE LANES ARE TO BE LABELED ON TYPICAL UNDESIGNATED BIKE LANES SHOULD NOT BE LABELED ON TYPICAL

5-LANE SECTIONS ARE TO INCLUDE SECTIONS OF RAISED OR RESTRICTIVE MEDIAN SEE PPM TABLE 2 2 1

5-LANE
ARTERIAL/COLLECTOR
NEW CONSTRUCTION
UNDIVIDED
URBAN
WITH DESIGNATED OR UNDESIGNATED BIKE LANE
MINIMUM RIGHT OF WAY
DESIGN SPEED 60 km/h OR LESS
WITH PROJECTED 20 YR AADT OF 1500 OR GREATER



•• IF LIMITS OF CONSTRUCTION EXCEEDS RIGHT OF WAY A PROPERTY AGREEMENT IS REQUIRED

• SEED
SEED AND MULCH
SOD OR SEED
SOD

TRAFFIC DATA

CURRENT YEAR ESTIMATE = 1994 AADT = 9900
OPENING YEAR ESTIMATE = 1998 AADT = 10600
DESIGN YEAR ESTIMATE = 2018 AADT = 14000
K = 10/ D = 55/ T = 4/ (24 HOUR)
DESIGN HOUR T - 2/
DESIGN SPEED = 60 km/h

TYPICAL SECTION
S R 000 (DUVAL STREET)
STA. 300+12.000 TO STA. 353+19.000

NEW CONSTRUCTION

OPTIONAL BASE GROUP 8 WITH
TYPE S STRUCTURAL COURSE (60 mm) AND
FRICTION COURSE FC-3 (25 mm) (RUBBER)

PPM II-6 3 STANDARD NOTES FOR TYPICAL SECTION SHEETS NOTES SHALL BE SHOWN ON TYPICAL SECTION AS APPLICABLE

TRAFFIC DATA IS REQUIRED TO BE NOTED FOR CURRENT YEAR OPENING YEAR AND DESIGN YEAR POSTED SPEED (MPH) IS OPTIONAL

EXHIBIT 5
Date 1/1/97

REVISIONS

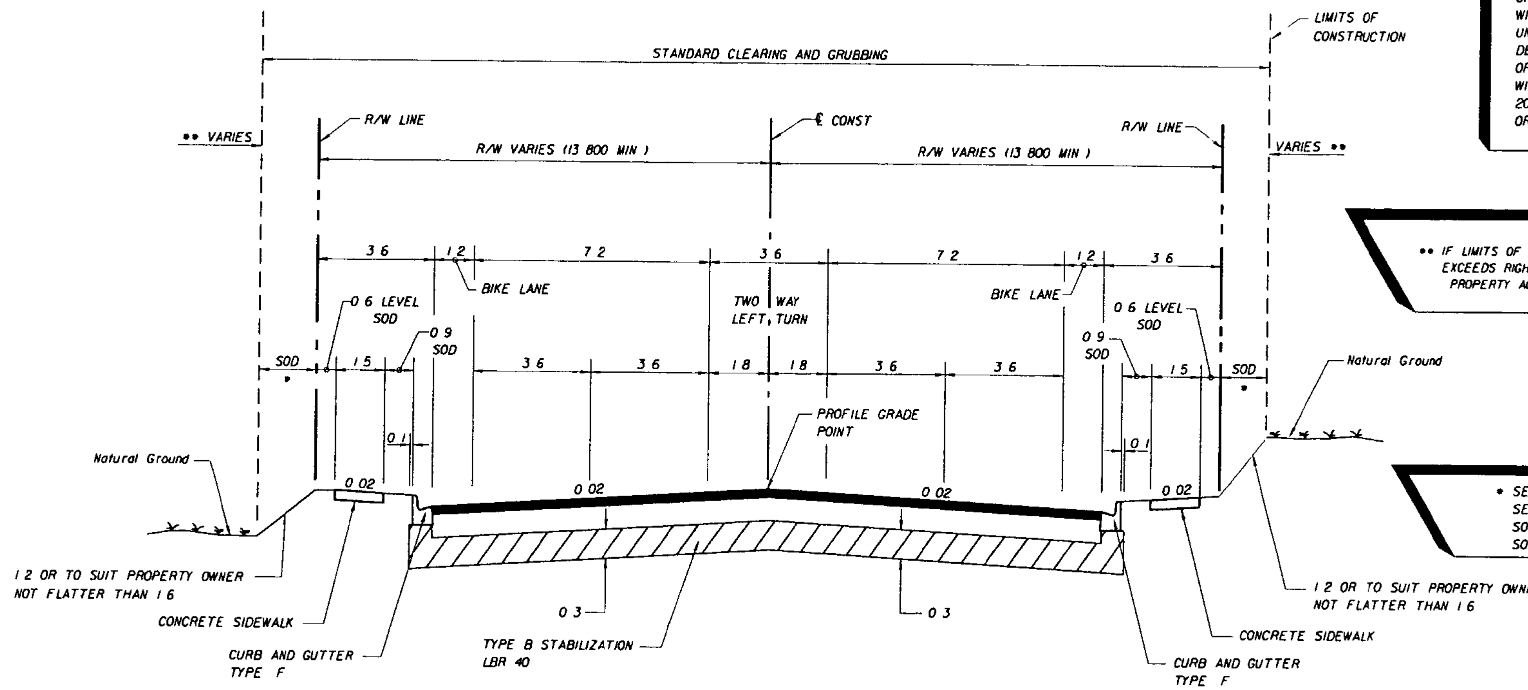
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	CONSULTANT FIRM NAME IF APPLICABLE	FLORIDA DEPARTMENT OF TRANSPORTATION	TYPICAL SECTION

STATE PROJ NO	SHEET NO
00000-0000	00

DESIGNATED BIKE LANES ARE TO BE LABELED ON TYPICAL UNDESIGNATED BIKE LANES SHOULD NOT BE LABELED ON TYPICAL

5-LANE SECTIONS ARE TO INCLUDE SECTIONS OF RAISED OR RESTRICTIVE MEDIAN SEE PPM TABLE 2 2 1

5-LANE
ARTERIAL/COLLECTOR
NEW CONSTRUCTION
UNDIVIDED
URBAN
WITH DESIGNATED OR UNDESIGNATED BIKE LANE
DESIGN SPEED 60 km/h OR LESS
WITH PROJECTED 20 YR AADT OF 1500 OR GREATER



•• IF LIMITS OF CONSTRUCTION EXCEEDS RIGHT OF WAY A PROPERTY AGREEMENT IS REQUIRED

• SEED
SEED AND MULCH
SOD OR SEED
SOD

TRAFFIC DATA

CURRENT YEAR ESTIMATE = 1994 ADT = 20819
OPENING YEAR ESTIMATE = 1999 ADT = 24100
DESIGN YEAR ESTIMATE = 2019 ADT = 24900
K - 9/ D = 60/ T = 2/ (24 HOUR)
DESIGN HOUR T = 2/
DESIGN SPEED = 60 km/h

TYPICAL SECTION
SR 000 (MATTHEWS STREET)
STA. 202+42.000 TO STA. 253+29.000

NEW CONSTRUCTION

OPTIONAL BASE GROUP 8 WITH
TYPE S STRUCTURAL COURSE (60 mm) AND
FRICTION COURSE FC-3 (25 mm) (RUBBER)

PPM II-6 3 STANDARD NOTES FOR TYPICAL SECTION SHEETS NOTES SHALL BE SHOWN ON TYPICAL SECTION AS APPLICABLE

TRAFFIC DATA IS REQUIRED TO BE NOTED FOR CURRENT YEAR OPENING YEAR AND DESIGN YEAR POSTED SPEED (MPH) IS OPTIONAL

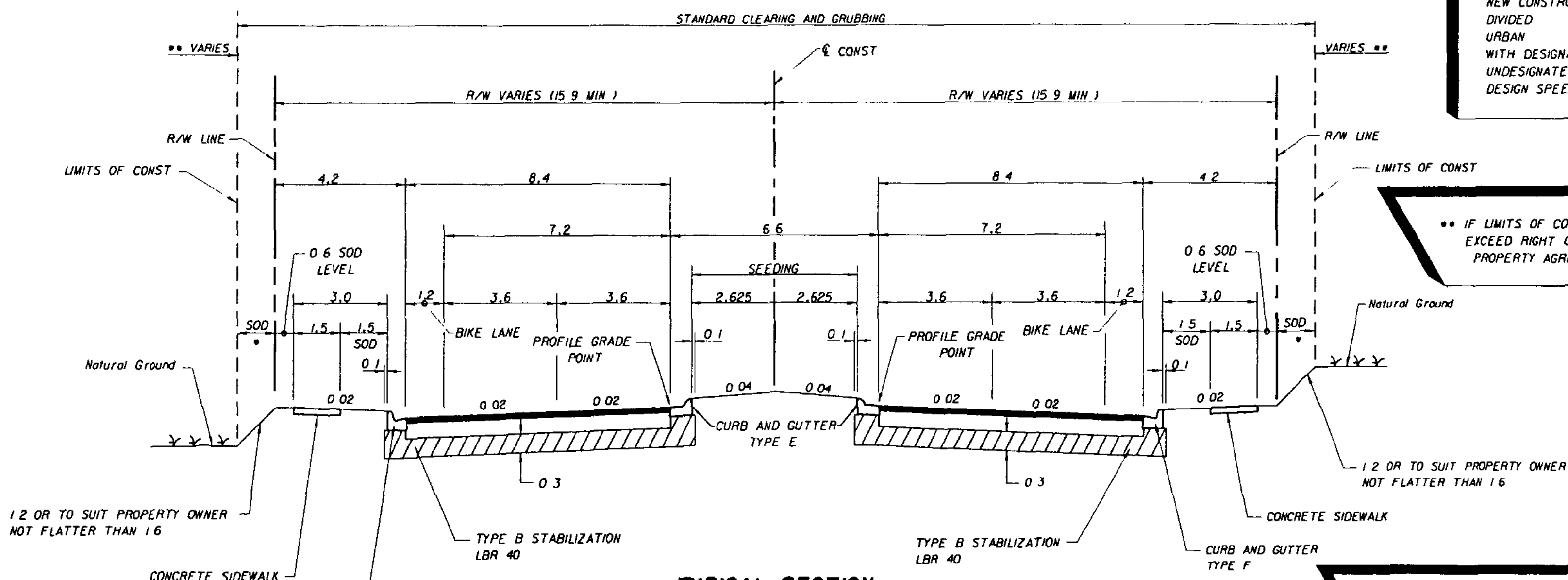
EXHIBIT 6
Date 1/1/97

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	CONSULTANT FIRM NAME IF APPLICABLE	FLORIDA DEPARTMENT OF TRANSPORTATION	TYPICAL SECTION

STATE PROJ NO	SHEET NO
00000-0000	00

DESIGNATED BIKE LANES ARE TO BE LABELED ON TYPICAL UNDESIGNATED BIKE LANES SHOULD NOT BE LABELED ON TYPICAL

4-LANE
ARTERIAL
NEW CONSTRUCTION
DIVIDED
URBAN
WITH DESIGNATED OR
UNDESIGNATED BIKE LANE
DESIGN SPEED 80 km/h OR LESS



•• IF LIMITS OF CONSTRUCTION EXCEED RIGHT OF WAY A PROPERTY AGREEMENT IS REQUIRED

• SEED
SEED AND MULCH
SOD OR SEED
SOD

TYPICAL SECTION
SR 000 (MATTHEWS STREET)
STA. 98+40.000 TO STA. 102+33.000

TRAFFIC DATA

CURRENT YEAR ESTIMATE = 1994 AADT = 22800
OPENING YEAR ESTIMATE = 1996 AADT = 25800
DESIGN YEAR ESTIMATE = 2016 AADT = 30600
K = 6% D = 55% T = 2% (24 HOUR)
DESIGN HOUR T = 1%
DESIGN SPEED = 70 km/h

NEW CONSTRUCTION

OPTIONAL BASE GROUP 9 WITH
TYPE S STRUCTURAL COURSE (60 mm) AND
FRICTION COURSE FC-3 (25 mm) (RUBBER)

PPM II-6 3 STANDARD NOTES FOR TYPICAL SECTION SHEETS NOTES SHALL BE SHOWN ON TYPICAL SECTION AS APPLICABLE

TRAFFIC DATA IS REQUIRED TO BE NOTED FOR CURRENT YEAR OPENING YEAR AND DESIGN YEAR POSTED SPEED (MPH) IS OPTIONAL

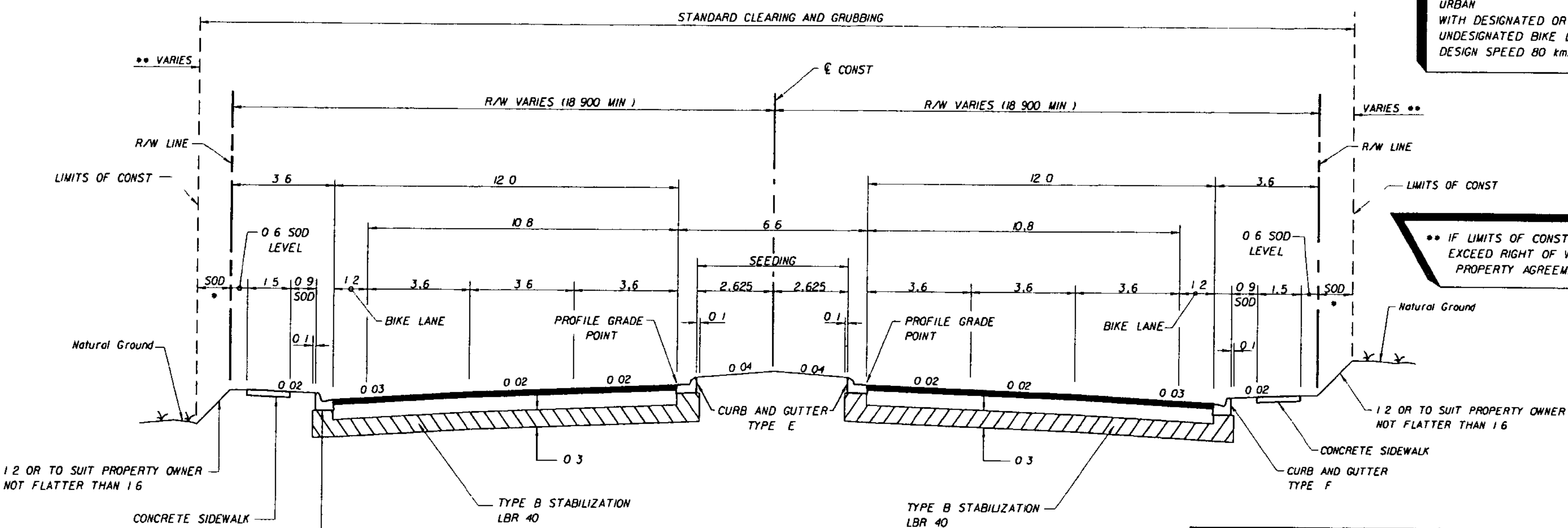
EXHIBIT 7
Date 1/1/97

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	CONSULTANT FIRM NAME IF APPLICABLE	FLORIDA DEPARTMENT OF TRANSPORTATION	TYPICAL SECTION

STATE PROJ NO	SHEET NO
00000-0000	00

DESIGNATED BIKE LANES ARE TO BE LABELED ON TYPICAL UNDESIGNATED BIKE LANES SHOULD NOT BE LABELED ON TYPICAL

6-LANE
ARTERIAL
NEW CONSTRUCTION
DIVIDED
URBAN
WITH DESIGNATED OR
UNDESIGNATED BIKE LANE
DESIGN SPEED 80 km/h OR LESS



•• IF LIMITS OF CONSTRUCTION EXCEED RIGHT OF WAY A PROPERTY AGREEMENT IS REQUIRED

TYPICAL SECTION
SR 000 (JACKSON STREET)
STA. 101+21.000 TO STA. 121+44.000

• SEED
SEED AND MULCH
SOD OR SEED
SOD

TRAFFIC DATA

CURRENT YEAR ESTIMATE = 1994 ADT = 22800
OPENING YEAR ESTIMATE = 1996 ADT = 25800
DESIGN YEAR ESTIMATE = 2016 ADT - 30600
K = 6/ D = 55/ T = 2/ (24 HOUR)
DESIGN HOUR T = 1 ⁄
DESIGN SPEED - 80 km/h

NEW CONSTRUCTION

OPTIONAL BASE GROUP 9 WITH
TYPE S STRUCTURAL COURSE (70 mm) AND
FRICTION COURSE FC-3 (25 mm) (RUBBER)

PPM II-6 3 STANDARD NOTES FOR TYPICAL SECTION SHEETS NOTES SHALL BE SHOWN ON TYPICAL SECTION AS APPLICABLE

TRAFFIC DATA IS REQUIRED TO BE NOTED FOR CURRENT YEAR OPENING YEAR AND DESIGN YEAR

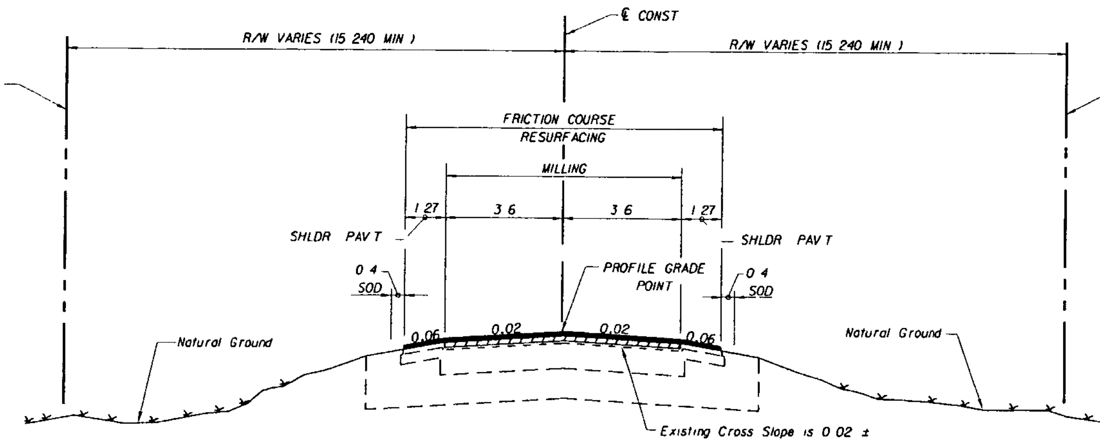
EXHIBIT 8
Date 1/1/97

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	CONSULTANT FIRM NAME IF APPLICABLE	FLORIDA DEPARTMENT OF TRANSPORTATION	TYPICAL SECTION

STATE PROJ NO	SHEET NO
00000-0000	00

DESIGNATED BIKE LANES ARE TO BE LABELED UNDESIGNATED BIKE LANES ARE NOT TO BE LABELED ON TYPICAL

EXISTING
2-LANE (2-WAY)
ARTERIAL/COLLECTOR
MILLING AND RESURFACING
NO CROSS SLOPE
CORRECTION REQUIRED
UNDIVIDED
RURAL
(WITH DESIGNATED OR
UNDESIGNATED BIKE LANE
EXISTING)
WITH PROJECTED 20 YR
AADT OF 1500 OR GREATER



SOME PROJECTS MAY REQUIRE SHOULDER WORK WHEN REQUIRED THIS SHOULD BE IDENTIFIED ON THE TYPICAL SECTION SHEET

TYPICAL SECTION
SR 000
STA. 10+53.000 TO STA. 30+77.000
STA. 36+82.280 TO STA. 48+41.210

PPM II-6 3 STANDARD NOTES FOR TYPICAL SECTION SHEETS NOTES SHALL BE SHOWN ON TYPICAL SECTION AS APPLICABLE

TRAFFIC DATA

STA 10+53 000 TO STA 30+77 100

CURRENT YEAR ESTIMATE = 1994 AADT = 9670
OPENING YEAR ESTIMATE = 1996 AADT = 11900
DESIGN YEAR ESTIMATE = 2010 AADT = 20200
K = 10% D = 60% T = 7% (24 HOUR)
DESIGN HOUR T = 3%
DESIGN SPEED = 90 km/h

STA 36+82 280 TO 48+41 210

CURRENT YEAR ESTIMATE = 1994 AADT = 6835
OPENING YEAR ESTIMATE = 1996 AADT = 8600
DESIGN YEAR ESTIMATE = 2010 AADT = 15100
K = 10% D = 65% T = 7% (24 HOUR)
DESIGN HOUR T = 3%
DESIGN SPEED = 90 km/h

MILLING

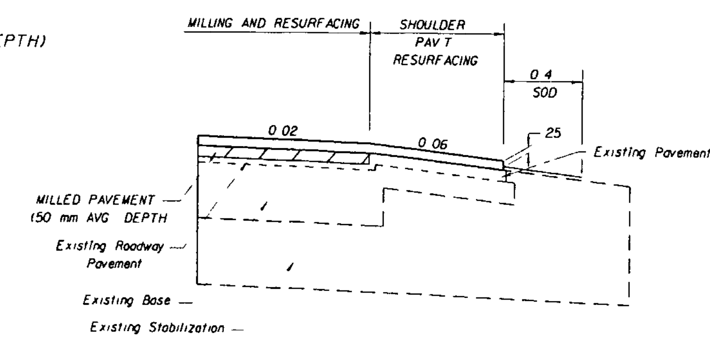
MILL EXISTING ASPHALT CONCRETE PAVEMENT (50 mm AVG DEPTH)

RESURFACING

TYPE S STRUCTURAL COURSE (176 kg/m²)
AND FRICTION COURSE FC-2 (15 mm) (RUBBER)

SHOULDER PAVEMENT RESURFACING

TYPE S STRUCTURAL COURSE (66 kg/m²)
AND FRICTION COURSE FC-2 (15 mm) (RUBBER)



SHOULDER PAVEMENT DETAIL

TRAFFIC DATA IS REQUIRED TO BE NOTED FOR CURRENT YEAR OPENING YEAR AND DESIGN YEAR

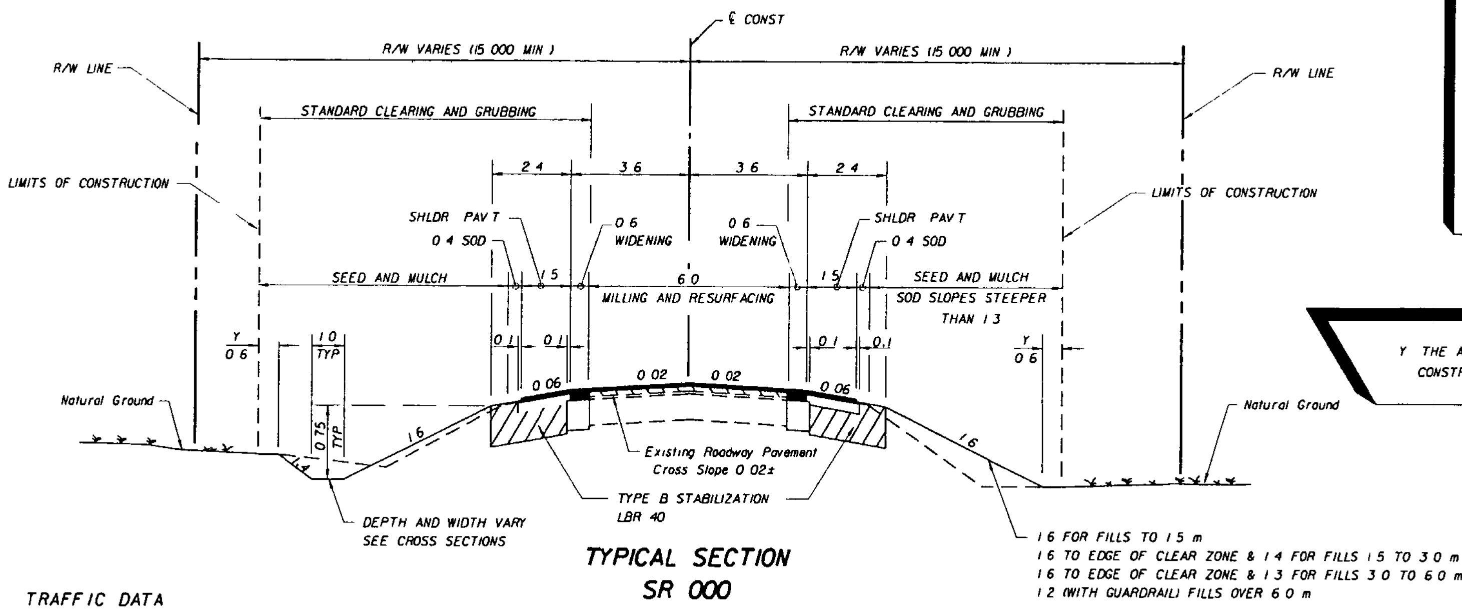
EXHIBIT 9
Date 1/1/97

C E	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	C E	BY	DESCRIPTION	CONSULTANT FIRM NAME IF APPLICABLE	FLORIDA DEPARTMENT OF TRANSPORTATION	TYPICAL SECTION

STATE PROJ NO	SHEET NO
00000-0000	00

DESIGNATED BIKE LANES ARE TO BE LABELED ON TYPICAL UNDESIGNATED BIKE LANES SHOULD NOT BE LABELED ON TYPICAL

EXISTING
2-LANE (2-WAY)
ARTERIAL/COLLECTOR
WIDENING
MILLING AND RESURFACING
UNDIVIDED
RURAL
CONST 1 5 SHOULDER PAVEMENT OR BIKE LANE
WITH PROJECTED 20 YR
AADT OF 1500 OR GREATER
DESIGN SPEED GREATER THAN 80 km/h



Y THE AREA DISTURBED BY CONSTRUCTION VARIES

TYPICAL SECTION
SR 000
STA. 10+53.000 TO STA. 30+77.000
STA. 36+82.280 TO STA. 48+41.210

TRAFFIC DATA
STA 10+53 000 TO STA 30+77 100

CURRENT YEAR ESTIMATE = 1994 AADT = 8700
OPENING YEAR ESTIMATE = 1996 AADT = 9200
DESIGN YEAR ESTIMATE = 2016 AADT = 23600
K = 10/ D = 56/ T = 5/
DESIGN HOUR T = 3/
DESIGN SPEED = 90 km/h

STA 36+82 280 TO 48+41 210

CURRENT YEAR ESTIMATE = 1994 AADT = 6835
OPENING YEAR ESTIMATE = 1996 AADT = 8600
DESIGN YEAR ESTIMATE = 2016 AADT = 17200
K - 10/ D - 65⁄ T = 7/ (24 HOUR)
DESIGN HOUR T = 3 /
DESIGN SPEED = 90 km/h

TRAFFIC DATA IS REQUIRED TO BE NOTED FOR CURRENT YEAR OPENING YEAR AND DESIGN YEAR

MILLING

MILL EXISTING ASPHALT CONCRETE PAVEMENT (50 mm AVG DEPTH)

RESURFACING

TYPE S STRUCTURAL COURSE (154 kg/m^2) AND
FRICTION COURSE FC-2 (15 mm) (RUBBER)

WIDENING

OPTIONAL BASE GROUP II WITH
TYPE S STRUCTURAL COURSE (154 kg/m^2) AND
FRICTION COURSE FC-2 (15 mm) (RUBBER) ALT AB

PPM II-6 3 STANDARD NOTES FOR TYPICAL SECTION SHEETS NOTES SHALL BE SHOWN ON TYPICAL SECTION AS APPLICABLE

SEE SHEET 2 OF 2 FOR WIDENING AND SHOULDER PAVEMENT DETAIL

EXHIBIT 10-A
Date 1/1/97

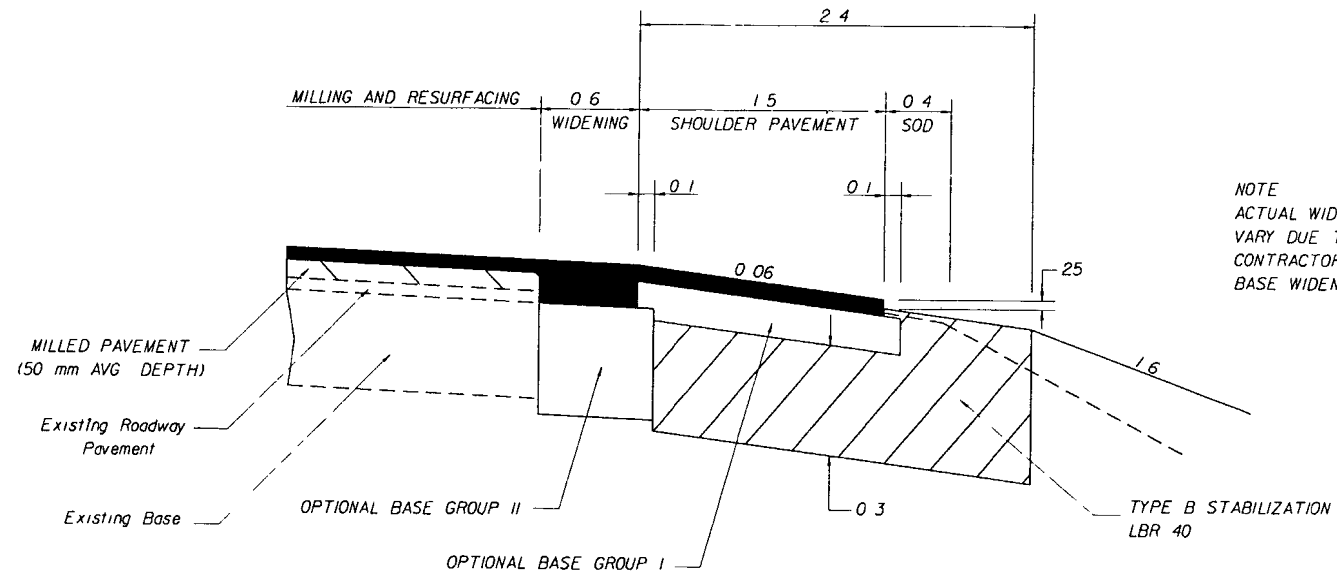
SHEET 1 OF 2

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	CONSULTANT FIRM NAME IF APPLICABLE	FLORIDA DEPARTMENT OF TRANSPORTATION	TYPICAL SECTION

STATE PROJ NO	SHEET NO
00000-0000	00

DESIGNATED BIKE LANES ARE TO BE LABELED ON TYPICAL UNDESIGNATED BIKE LANES SHOULD NOT BE LABELED ON TYPICAL

THE NEED FOR STABILIZATION IN THE SHOULDER AREA ON RRR PROJECTS IS SITE SPECIFIC AND NOT ALWAYS REQUIRED THE USE OF STABILIZING IN NARROW TRENCH WIDENING STRIPS IS NOT RECOMMENDED GENERALLY SEE THE FLEXIBLE PAVEMENT DESIGN MANUAL FOR FURTHER CRITERIA



NOTE
ACTUAL WIDTH OF BASE WIDENING MAY VARY DUE TO ACTUAL PAVEMENT WIDTH CONTRACTOR MAY ELECT TO PLACE UNIFORM BASE WIDENING AT NO ADDITIONAL COST

SHOULDER PAVEMENT DETAIL
WIDENING

SHOULDER PAVEMENT

OPTIONAL BASE GROUP I WITH
TYPE S STRUCTURAL COURSE 66 kg/m² AVG
AND FRICTION COURSE FC-2 (15 mm) (RUBBER)

PPM II-6 3 STANDARD NOTES FOR TYPICAL SECTION SHEETS NOTES SHALL BE SHOWN ON TYPICAL SECTION AS APPLICABLE

EXHIBIT 10-B
Date 1/1/97

Sheet 2 of 2

CONSULTANT FIRM NAME IF APPLICABLE

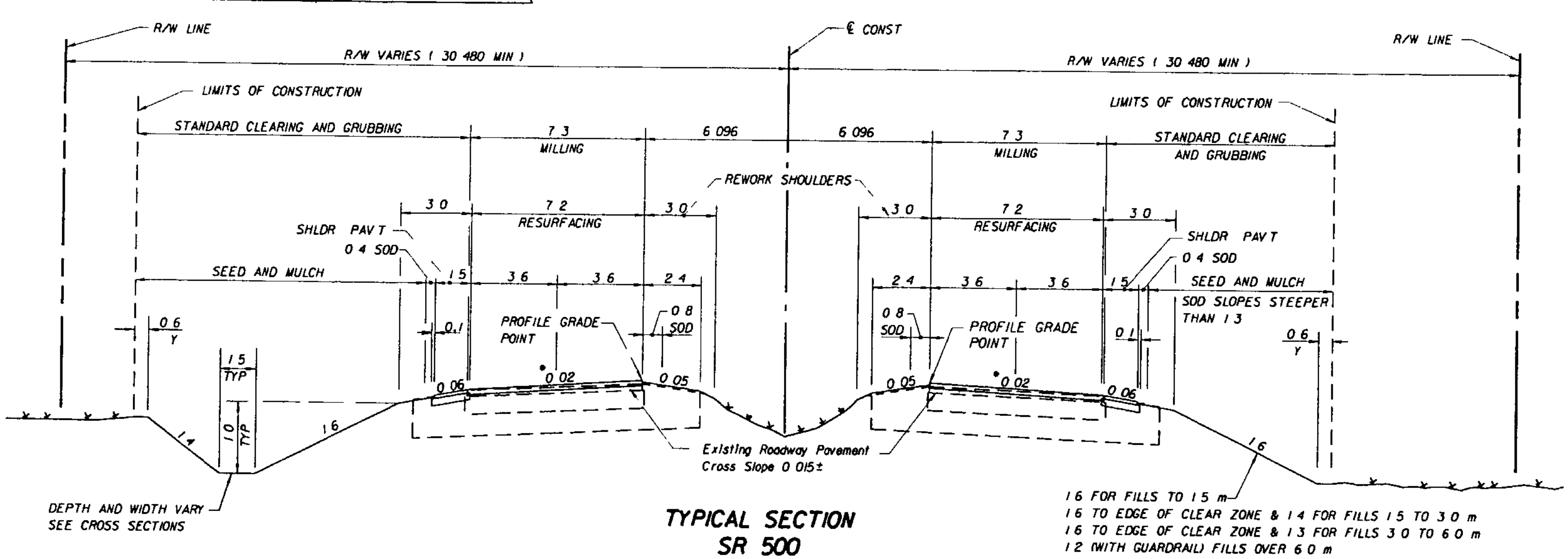
FLORIDA DEPARTMENT OF TRANSPORTATION

TYPICAL SECTION

STATE PROJ NO	SHEET NO
00000-0000	00

DESIGNATED BIKE LANES ARE TO BE LABELED ON TYPICAL UNDESIGNATED BIKE LANES SHOULD NOT BE LABELED ON TYPICAL

4 LANE
ARTERIAL/COLLECTOR
MILLING & RESURFACING
CROSS SLOPE CORRECTION BY MILLING
CONST 1 5 m SHLDR PAV T
DIVIDED
RURAL
DRAINAGE IMPROVEMENTS
SAFETY IMPROVEMENTS
WITH DESIGNATED OR UNDESIGNATED BIKE LANE
WITH PROJECTED 20 YR AADT OF 1500 OR GREATER
DESIGN SPEED 70 km/h OR GREATER



TYPICAL SECTION
SR 500
STA. 129+81.430 TO STA. 155+60.470

MILLING

MILL EXISTING ASPHALT CONCRETE PAVEMENT (40 mm AVG DEPTH)

RESURFACING

TYPE S STRUCTURAL COURSE (132 kg/m² AVG) AND FRICTION COURSE FC-2 (15 mm) (RUBBER)

SHOULDER PAVEMENT

OPTIONAL BASE GROUP I WITH TYPE S STRUCTURAL COURSE (66 kg/m² AVG) AND FRICTION COURSE FC-2 (15 mm) (RUBBER)

STA 235+60 470 TO STA. 300+00 000

MILLING

MILL EXISTING ASPHALT CONCRETE PAVEMENT (50 mm AVG DEPTH)

RESURFACING

TYPE S STRUCTURAL COURSE (176 kg/m² AVG) AND FRICTION COURSE FC-2 (15 mm) (RUBBER)

SHOULDER PAVEMENT

OPTIONAL BASE GROUP I WITH TYPE S STRUCTURAL COURSE (66 kg/m² AVG) AND FRICTION COURSE FC-2 (15 mm) (RUBBER)

TRAFFIC DATA

CURRENT YEAR ESTIMATE = 1994 AADT = 18100
OPENING YEAR ESTIMATE = 1996 AADT = 21000
DESIGN YEAR ESTIMATE = 2010 AADT = 30900
K = 11% D = 58% T = 23% (24 HOUR)
DESIGN HOUR T = 11%
DESIGN SPEED = 100 km/h
POSTED SPEED = 55 MPH

TRAFFIC DATA IS REQUIRED TO BE NOTED FOR CURRENT YEAR OPENING YEAR AND DESIGN YEAR POSTED SPEED (MPH) IS OPTIONAL

• WHEN CROSS SLOPE CORRECTION IS NECESSARY SPECIAL MILLING AND LAYERING DETAILS MUST BE PROVIDED TO SUPPLEMENT TYPICAL SECTION

Y THE AREA DISTURBED BY CONSTRUCTION VARIES

PPM II-6 3 STANDARD NOTES FOR TYPICAL SECTION SHEETS NOTES SHALL BE SHOWN ON TYPICAL SECTION SHEETS AS APPLICABLE

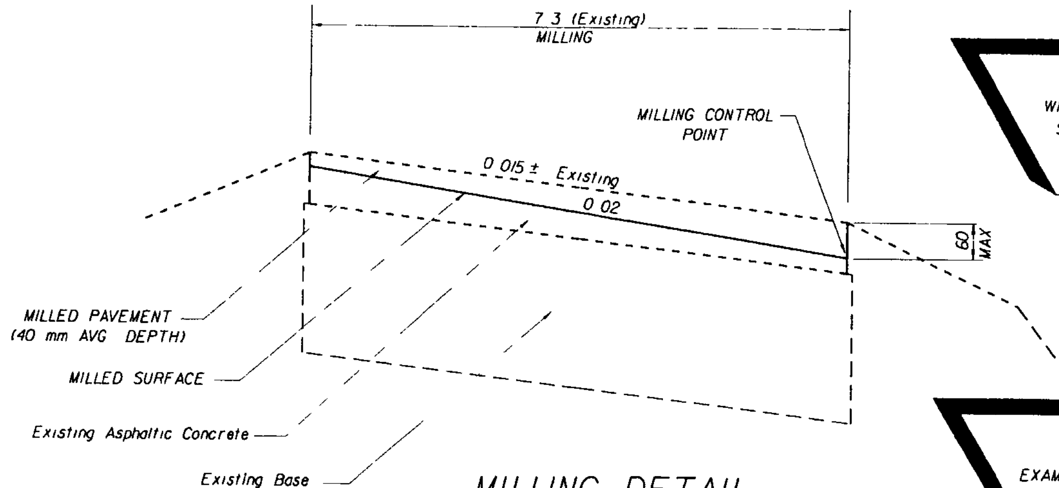
FOR MILLING AND RESURFACING DETAILS SEE TYPICAL SECTION DETAILS SHEET 2 AND 3

EXHIBIT II-A
Date 1/1/97

SHEET 1 OF 3

REVISIONS												CONSULTANT FIRM NAME IF APPLICABLE	FLORIDA DEPARTMENT OF TRANSPORTATION	TYPICAL SECTION
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION			

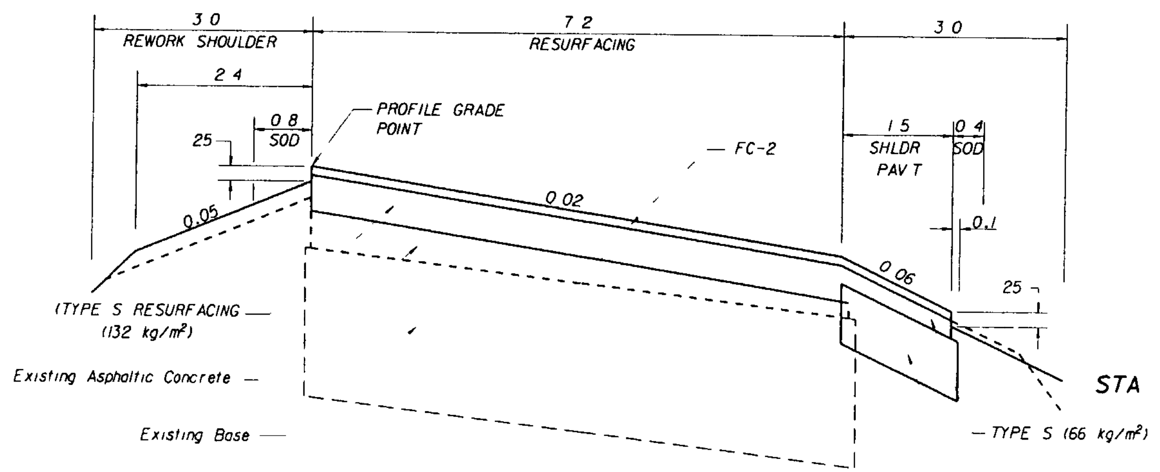
STATE PROJ NO	SHEET NO
00000-0000	00



MILLING DETAIL

WHEN CROSS SLOPE CORRECTION IS NECESSARY SPECIAL MILLING AND LAYERING DETAILS MUST BE PROVIDED TO SUPPLEMENT TYPICAL SECTION

EXAMPLE OF CROSS SLOPE CORRECTION BY MILLING



STA 129+81 430 TO STA 155+60 470

RESURFACING DETAIL

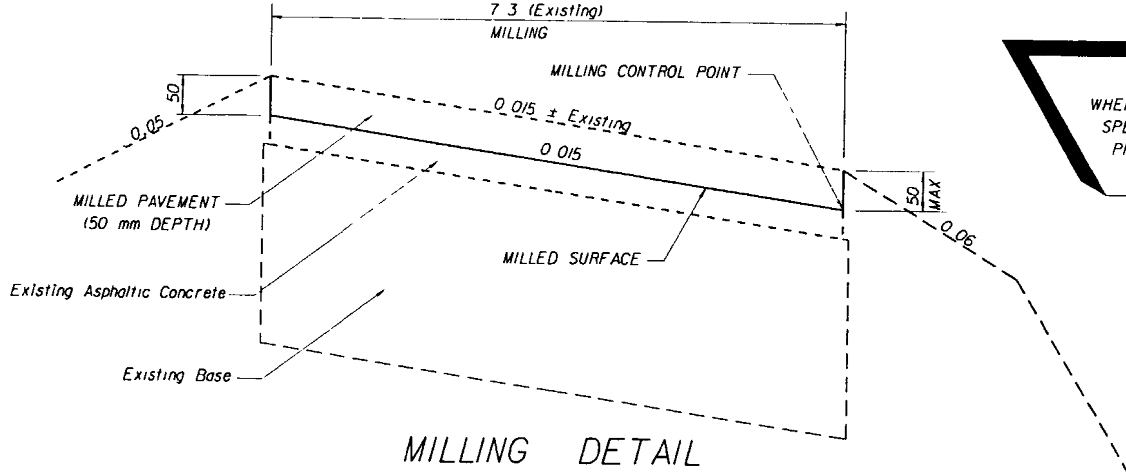
EXHIBIT II-B
Date 1/1/97

SHEET 2 OF 3

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	CONSULTANT FIRM NAME IF APPLICABLE	FLORIDA DEPARTMENT OF TRANSPORTATION	TYPICAL SECTION DETAILS

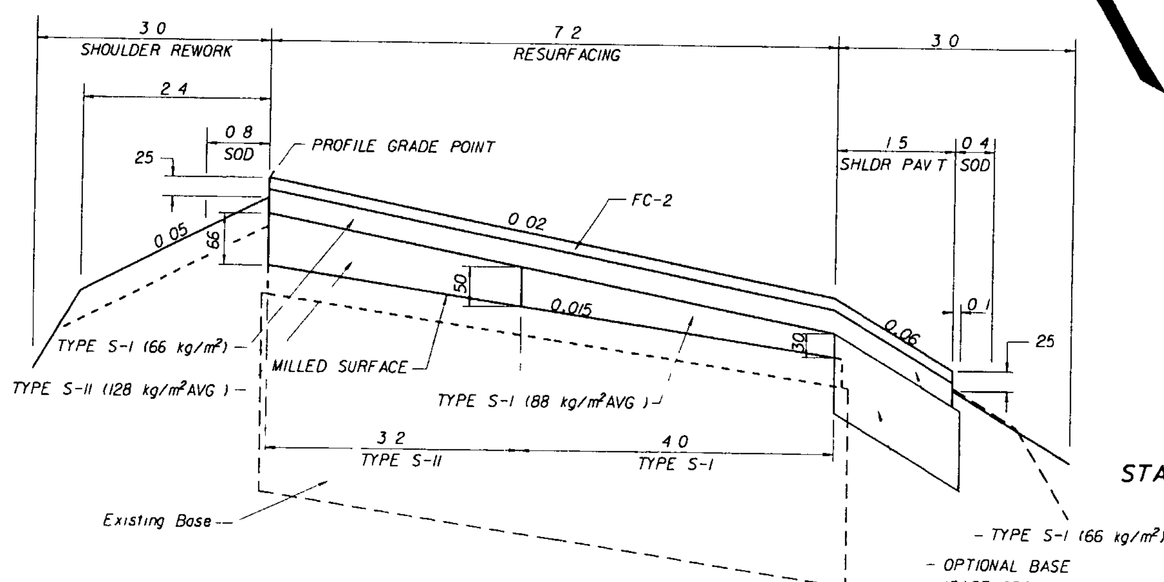
STATE PROJ NO	SHEET NO
00000-0000	00

WHEN CROSS SLOPE CORRECTION IS NECESSARY SPECIAL MILLING AND LAYERING DETAILS MUST BE PROVIDED TO SUPPLEMENT TYPICAL SECTION



MILLING DETAIL

EXAMPLE OF CROSS SLOPE CORRECTION BY SPECIAL LAYERING



RESURFACING DETAIL

STA 235+60 470 TO STA 300+00 000

EXHIBIT II-C
Date 1/1/97

SHEET 3 OF 3

BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	CONSULTANT FIRM NAME IF APPLICABLE	FLORIDA DEPARTMENT OF TRANSPORTATION	TYPICAL SECTION DETAILS

STATE PROJ NO	SHEET NO
00000-0000	00

SUMMARY OF SODDING

FORM 625 000 29
ROADWAY DESIGN 03 94

LOCATION STA TO STA	SIDE	P L	P W	P M2	F L	F W	F M2	FIELD BOOK REFERENCE
N B I-00								
570+00 - 580+62	MED	1062 0	0 4	424 8				
570+00 - 574+57	RT	457 0	0 4	182 8				
575+45 576+80	RT	135 0	0 4	54 0				
576+80 579+95	RT	315 0	17 5	5512 5				
579+95 - 580+62	RT	67 0	10 6	710 2				
580+62 - 586+37	MED	575 0	0 4	230 0				
580+62 - 586+37	RT	575 0	0 4	230 0				
S B I-00								
570+00 - 580+62	MED	1062 0	0 4	424 8				
570+00 - 574+57	LT	457 0	0 4	182 8				
575+45 577+25	LT	180 0	0 4	72 0				
577+25 - 580+62	LT	309 0	14 8	4573 2				
580+34 - 580+62	LT	28 0	11 3	316 4				
580+62 - 586+37	MED	575 0	0 4	230 0				
580+62 - 586+37	LT	575 0	0 4	230 0				
RAMP A								
182+99 - 187+24	LT	425 0	0 4	170 0				
180+87 - 187+74	RT	687 0	0 4	274 8				
RAMP B								
276+62 - 281+75	LT	513 0	0 4	205 2				
274+47 - 280+29	RT	582 0	0 4	232 8				
RAMP C								
382+45 - 386+88	RT	443 0	0 4	177 2				
381+95 388+30	LT	635 0	0 4	254 0				
RAMP D								
481+05 - 485+63	LT	458 0	0 4	183 2				
480+64 487+31	RT	667 0	0 4	266 8				
DRAINAGE STRUCTURES				246 0				
PAVED DITCHES				85 0				
TOTAL				15 469				

SUMMARY OF SIDEDRAIN & MITERED END SECTIONS

FORM 625 000 30 ROADWAY DESIGN 07 94

	LOCATION STA TO STA	SIDE	375 mm	MES (EA)	450 mm	MES (EA)	600 mm	MES (EA)	750 mm	MES (EA)	900 mm	MES (EA)
			PIPE LENGTH (M)									
P	150+10 - 150+31	RT	20 5	2								
F												
P	160+85 161+02	LT			16 7	2						
F												
P	176+36 - 176+54	LT							18 5	2		
F												
P	181+46 181+60	RT					14 2	2				
F												
P	192+69 - 192+82	LT	13 0	2								
F												
P	194+50 194+75	RT									25 0	2
F												
P												
F												
P	TOTAL		33 5	4	16 7	2	14 2	2	18 5	2	25 0	2
F												
P												
F												
P												
F												

SUMMARY OF EARTHWORK

FORM 625 000 28
ROADWAY DESIGN 03 94

DESCRIPTION	P M3	F M3
ROADWAY EXCAVATION (A-2 A-3 MATERIAL)	34 265	
ROADWAY EXCAVATION (A-8 MUCK)	260	
TOTAL ROADWAY EXCAVATION	34 525	
EMBANKMENT	441 877	
SUBSOIL EXCAVATION (A-8 MATERIAL)	11 945	
SUBSOIL EXCAVATION (A-2 A-3 MATERIAL)	2 493	
TOTAL SUBSOIL EARTHWORK •	14 438	

• PAY ITEM FOR SUBSOIL EARTHWORK INCLUDES TOTAL SUBSOIL EXCAVATION AND BACKFILL

EXHIBIT 12
Date 1/1/97

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	CONSULTANT FIRM NAME IF APPLICABLE	FLORIDA DEPARTMENT OF TRANSPORTATION	SUMMARY OF QUANTITIES

REVISIONS

STATE PROJ NO	SHEET NO
00000-0000	00

SUMMARY OF DITCH PAVEMENT AND SODDING

FORM 625 000 26
ROADWAY DESIGN 03 94

LOCATION		RIPRAP (SAND CEMENT)		RIPRAP (RUBBLE)		CONCRETE		SODDING		REMARKS	FIELD BOOK REFERENCE
STA TO STA	SIDE	M3		MT		M2		M2			
		P	F	P	F	P	F	P	F		
613+00	LT	18 4									
613+35	RT	20 2									
895+00 (S 12)	LT					23		6			
18+00 (S-24)	LT					31		8			
158+00 (S-25)	LT/RT					105		34			
25+00 (S-27)	LT					33		7			
405+00 (S-31)	RT					107		6			
188+12 (S 33)	RT					48		15			
10+42 (S-44)	LT					13		5			
12+40 (S-45)	RT					13		4			
TOTAL		38 6				373		85			

SUMMARY OF GUARDRAIL

FORM 625 000 25
ROADWAY DESIGN 03 94

LOCATION		GUARDRAIL		END ANCHORAGE TYPE II		END ANCHORAGE TYPE MELT		FIELD BOOK REFERENCE
STA TO STA	SIDE	M		EA		EA		
		P	F	P	F	P	F	
600+50 - 601+26	RT	76 20				1		
600+10 - 601+24	LT	114 30		1				
602+25 - 603+20	RT	95 25				1		
603+75 - 604+24	LT	49 53		1				
610+34 - 610+88	LT	53 34				1		
615+53 - 616+22	RT	68 58		1		1		
620+46 621+34	LT	87 63		1		1		
TOTAL		544 8		4		5		

EXHIBIT 13
Date- 1/1/97

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	CONSULTANT FIRM NAME IF APPLICABLE	FLORIDA DEPARTMENT OF TRANSPORTATION	SUMMARY OF QUANTITIES

STATE PROJ NO	SHEET NO

QUANTITY	STR NO	STATION	DESCRIPTION	BARRELS	SIZE (mm)	LENGTH (m)	CROSS DRAIN OPTIONAL TYPE						STORM DRAIN OPTIONAL TYPE						GUTTER DRAIN OPT TYPE	CURB INLETS				MH	DITCH BOTTOM INLETS				GUTTER INLET		FLARED END SECTION			MITERED END SECTION		SOD	CLASS I CONC	CLASS II CONC	REINF STEEL	SAND CEMENT RIPRAP	REMARKS
																				P 1	P 2	J 1	J 2	J-7	A	B	C	D	S												
							375	450	600	750	1200	1500	375	450	600	750	900	1050	375	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	375	450	750	450	600	M2	M3	M3	Kg	M3	
P	1	146 50	Pipe	1	450	3 7												3 7																							Const Conc Jacket
F																																									
P	2	146+54 1	Pipe	1	450	78 6												78 6																							Const Collar
F																																									
P	3	147+33 8	Inlet,Pipe	1	375	27 1							27 1							1																					
F																																									
P	4	147 61	Inlet,Pipe	1	900	54 3											54 3						1																		
F																																									
P	5	148 15 9	Inlet,Pipe	1	375	28 4							28 4								1																				Alt A Brick
F																																									
P	6	148 45 3	MH Pipe	1	900	54 3											54 3							1																	Mod Height
F																																									
P	7	148 77 5	Inlet,Pipe	1	900	30 5											30 5						1																		RCP CLASS II
F																																									
P	8	148 77 5	EW,Pipe	1	450	3 8								3 8																						33	1 19				
F																																									
P	9	149 35	Inlet,Pipe	1	750	56 5										56 5						1																			
F																																									
P	10	149 35	Inlet,Pipe	1	450	16 0								16 0						1																					
F																																									Mod Height
P	11	454 18 2 & Leg A	MES Pipe	1	450	23 2								23 2																				1		21					
F																																									
P	12	150 27	EW	1	600	92 5									92 5																					22				3 3	RCP CLASS II
F																																									
P	13	203 00	FES Pipe	1	750	46 9				46 9																								2			28					RCP CLASS II
F																																									
P	14	5+00 Ramp A	EW,Pipe,Inlet	1	750	22 0				22 0																					1						33	2 49				
F																																									
P	14A	5+00 Ramp A	Pipe,EW	1	750	15 2				15 2																											33	2 49				
F																																									
P	15	15+00 Ramp A	Inlet,Pipe,EW	1	375	6 4													6 4										1							14	1 23		50		
F																																									
P	16	214+00	EW,Pipe	2	1200	48 2					96 4																										112	8 36				Const Collar Pipe Ahead
F																																									
P	17	214+14	Inlet,Pipe	1	450	2 4		2 4																				1									8					
F																																									
P	18	219 00	Inlet,Pipe,FES	1	450	54 3		54 3																					1				1				10					
F																																									
P	19	229+00	EW,Pipe,Inlet	1	1500	30 5						30 5														1											94		10 61	587		
F																																									
P	19A	229+00	Pipe,EW	2	1500	29 9						59 8																									94		10 61	587		Alt B
F																																									
P	19B	229+00	Pipe	1	1500	61 3						61 3																														
F																																									
P	20	229 20	MES,Pipe	1	600	12 2			12 2																										1	8					Const Collar
F																																									
P	21	240+00	MES,Pipe,Inlet	1	450	26 2		26 2																				1							1		21					
F																																									
P	22	260 00	FES,Pipe,Inlet	1	375	26 5	26 5																			1						1					10					
F																																									
P	23	281 00	Inlet,Pipe,FES	1	375	27 1	27 1																			1						1					10					
F																																									
P																																									
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TOTALS		PLAN QUANTITY					53 6	82 9	12 2	84 1	96 4	151 6	55 5	43 0	92 5	56 5	139 1	82 3	6 4	2	1	1	2	1	2	1	2	1	1	1	2	1	2	2	1	551	15 76	21 22	1224	3 3	
		FINAL QUANTITY																																							

EXHIBIT 14
Date 1/1/97

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	CONSULTANT FIRM NAME IF APPLICABLE	FLORIDA DEPARTMENT OF TRANSPORTATION	SUMMARY OF DRAINAGE STRUCTURES

R E   G N S

FORM 625-000-16
ROADWAY DESIGN 04-93

STATE PROJ NO	SHEET NO

GENERAL NOTES

1 The Contractor may use any of the optional pipe materials tabulated for a given structure Only the material options tabulated for a given structure can be used

2 Adjustment to the bid quantities prices and payment will not be allowed due to increase or decrease in structure size shape length width depth or accessory construction necessary to accommodate the use of an optional pipe material other than the plotted option likewise there will be no added or reduced compensation for structure alterations required to relieve utility conflicts which arise from the use of an optional material other than the plotted option

3 Adjustment to the bid quantities prices and payment will not be allowed due to increased or decreased excavation bedding borrow backfilling compaction special installation requirements or disposal of excess materials due to use of any of the pipe optional materials Likewise adjustment in the quantities prices and payment will not be allowed due to differences in end treatment size or types pipe length alternate jointing and connecting materials saddles cradles filter fabrics shoring or similar features due to the use of an optional material other than the plotted option

4 If adjustments are required due to plan errors or omissions or authorized field changes the plotted' material and not the material elected by the Contractor would be used to establish new pay quantities

5 The Contractor shall notify the Department in writing as to which optional pipe materials he chooses to use at the preconstruction conference Once identified the Contractor may not change pipe material selected without the approval of the Engineer

This example should be used when pipe flow lines lengths and/or sizes for individual options are not the same (See Structure Nos 14 14A)

STR NO	DSL YEARS	SIZE (mm)	LENGTH (m)	PLOTTED	MATERIAL & THICKNESS	F L	F L	AS BUILT	REMARKS
1	100	450	3 7	x	RCP CLASS II				
2	100	450	78 6	x	RCP CLASS II				
3	100	375	27 1	X	RCP CLASS II	2 13			
					SRAP				
4	100	900	54 3	X	RCP CLASS II	1 74			
					SRSP 12 GA				
					SRAP 12 GA				
					SRASP 16 GA				
5	100	375	28 4	X	RCP CLASS II	2 35			
					SRAP				
6	100	900	54 3	X	RCP CLASS II	1 95	1 74		
					SRSP 12 GA				
					SRAP 12 GA				
					SRASP 16 GA				
7	100	900	30 5	X	RCP CLASS II	1 98	1 95		
8	100	450	3 8	X	RCP CLASS II	2 41	2 35		
					SRAP				
					SRSP				
9	100	750	56 5	X	RCP CLASS II	2 07	1 98		
					SRAP 16 GA				
					SRSP 16 GA				
10	100	450	16 0	X	RCP CLASS II	2 32	2 19		
					SRAP 16 GA				
					SRSP 14 GA				
					SRASP 16 GA				
11	100	450	23 2	X	RCP CLASS II	2 44	2 32		
					SRAP 16 GA				
					SRSP 14 GA				
					SRASP 16 GA				
12	100	600	92 5	X	RCP CLASS III				END WALL
13	100	750	46 9	X	RCP CLASS II	3 17	3 14		
14	50	750	22 0	X	RCP CLASS III	1 83	1 8		
					SRASP 14 GA				
					SRAP 14 GA				
		900	21 7		CAP 16 GA	1 80	1 77		
		900	21 7		CSP 16 GA BIT COATED	1 80	1 77		
14A	50	750	15 2	X	RCP CLASS III	1 80	1 77		
					SRASP 14 GA				
					SRAP 14 GA				
		900	14 9		CAP 16 GA	1 77	1 74		
		900	14 9		CSP 16 GA BIT COATED	1 77	1 74		

EXHIBIT 15
Date 1/1/97

Sheet 1 of 2

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

CONSULTANT FIRM NAME IF APPLICABLE

FLORIDA DEPARTMENT OF TRANSPORTATION

OPTIONAL MATERIALS TABULATION

FORM 625-000-16
ROADWAY DESIGN 04 93

STATE PROJ NO	SHEET NO

GENERAL NOTES

1 The Contractor may use any of the optional pipe materials tabulated for a given structure Only the material options tabulated for a given structure can be used

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3 Adjustment to the bid quantities prices and payment will not be allowed due to increased or decreased excavation bedding barrow backfilling compaction special installation requirements or disposal of excess materials due to use of any of the pipe optional materials Likewise adjustment in the quantities prices and payment will not be allowed due to differences in end treatment size or types pipe length alternate jointing and connecting materials saddles cradles filter fabrics shoring or similar features due to the use of an optional material other than the plotted option

4 If adjustments are required due to plan errors or omissions or authorized field changes the plotted material and not the material elected by the Contractor would be used to establish new pay quantities

5 The Contractor shall notify the Department in writing as to which optional pipe materials he chooses to use at the preconstruction conference Once identified the Contractor may not change pipe material selected without the approval of the Engineer

This example should be used when pipe flow lines lengths and/or sizes for individual options are the same

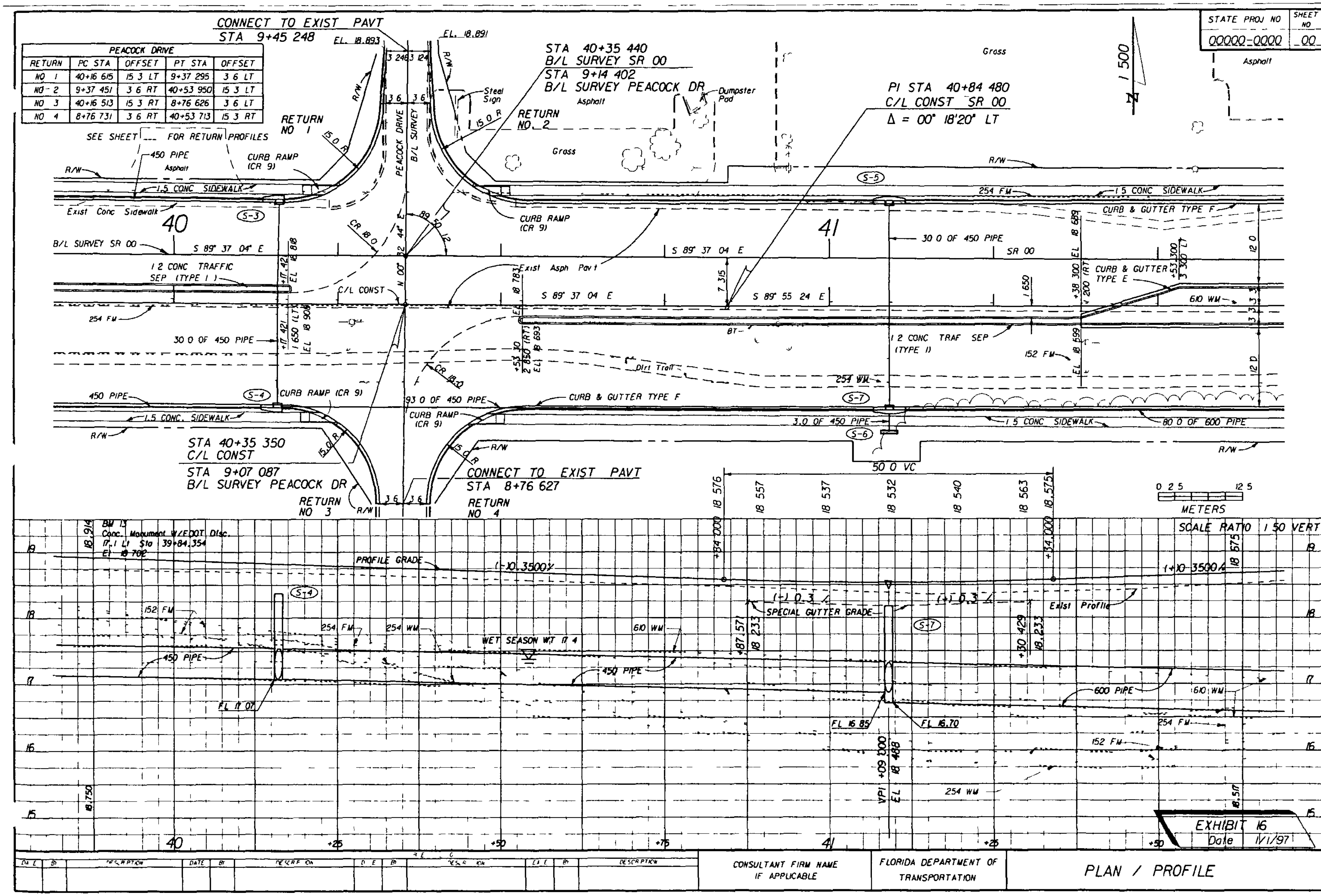
STORM DRAIN - SYSTEM A
STRUCTURES 1-MA

STRUCTURE	SIZE	MATERIAL	PLOTTED	AS BUILT	REMARKS
	375	RCP CLASS II	X		
		SRAP 14 GA			
EXCEPTION	450	RCP CLASS II	X		
S 1 & S 2		SRAP 16 GA			
RCP CLASS II		SRSP 14 GA			
ONLY		SRASP 16 GA			
EXCEPTION	600	RCP CLASS III	X		
S 12		SRAP 16 GA			
RCP CLASS III		SRSP 16 GA			
ONLY		SRASP 16 GA			
EXCEPTION	750	RCP CLASS III	X		
S 13		SRAP 14 GA			
RCP CLASS III		SRASP 14 GA			
ONLY					
EXCEPTION	900	RCP CLASS II	X		
S-7		SRAP 14 GA			
RCP CLASS II		SRSP 12 GA			
ONLY		SRASP 16 GA			

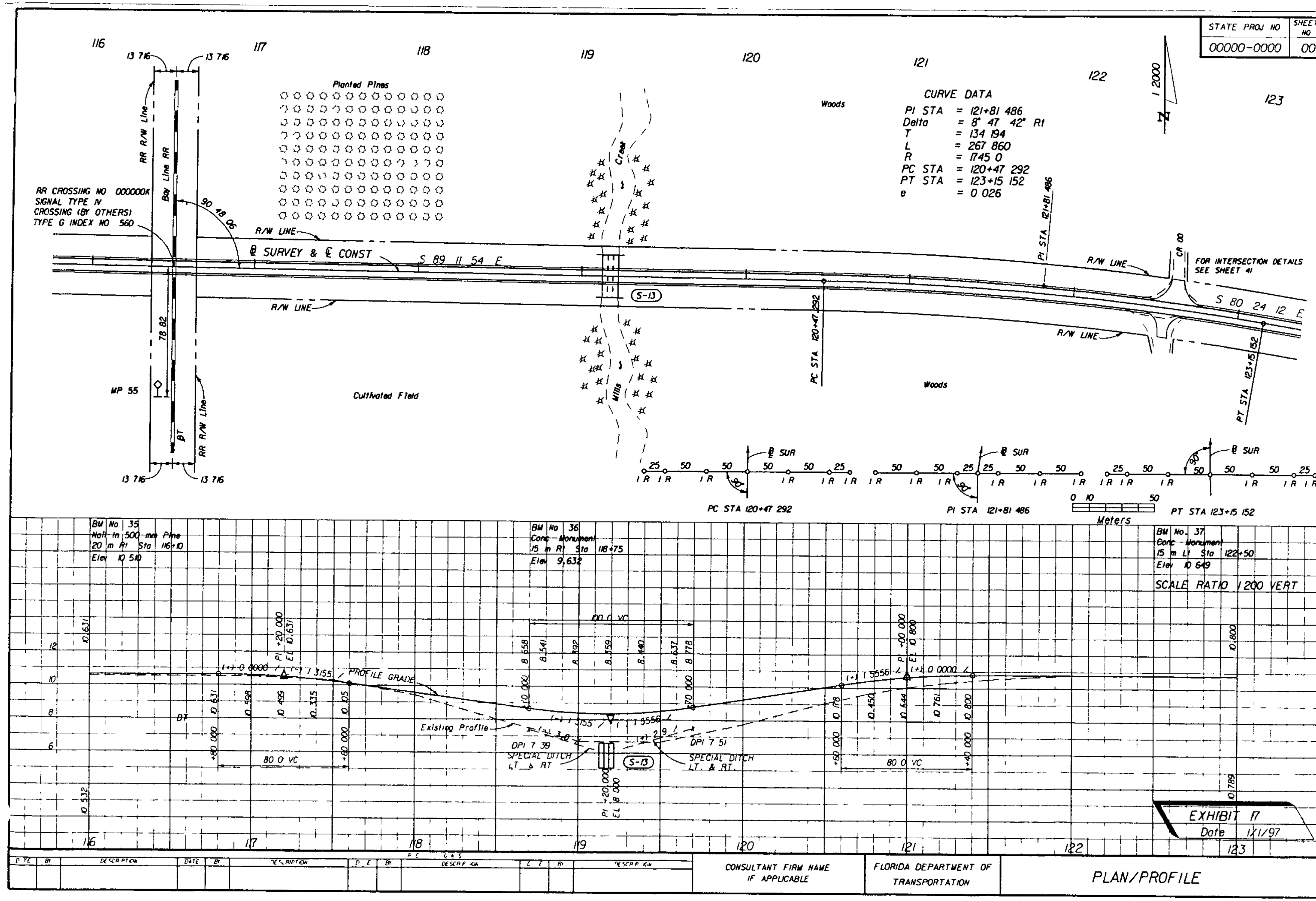
EXHIBIT 15
Date 1/1/97

Sheet 2 of 2

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	CONSULTANT FIRM NAME IF APPLICABLE	FLORIDA DEPARTMENT OF TRANSPORTATION	OPTIONAL MATERIALS TABULATION



PEACOCK DRIVE				
RETURN	PC STA	OFFSET	PT STA	OFFSET
NO 1	40+16 615	15 3 LT	9+37 295	3 6 LT
NO 2	9+37 451	3 6 RT	40+53 950	15 3 LT
NO 3	40+16 513	15 3 RT	8+76 626	3 6 LT
NO 4	8+76 731	3 6 RT	40+53 713	15 3 RT


STATE PROJ NO 00000-0000
SHEET NO 00
CURVE DATA
PI STA = 121+81 486
Delta = 8° 47 42" Rt
T = 134 194
L = 267 860
R = 1745 0
PC STA = 120+47 292
PT STA = 123+15 152
e = 0 026
1 2000
Planted Pines
Woods
Cultivated Field
Creek
Mills
RR CROSSING NO 000000K
SIGNAL TYPE IV
CROSSING (BY OTHERS)
TYPE G INDEX NO 560
RR R/W Line
Bay Line RR
MP 55
R/W LINE
℄ SURVEY & ℄ CONST
S 89 11 54 E
S 80 24 12 E
CR 00
FOR INTERSECTION DETAILS
SEE SHEET 41
PC STA 120+47 292
PI STA 121+81 486
PT STA 123+15 152
℄ SUR
Meters
BM No 35
Nail in 500 mm Pine
20 m Rt Sta 116+10
Elev 10 510
BM No 36
Conc Monument
15 m Rt Sta 118+75
Elev 9,632
BM No 37
Conc Monument
15 m Lt Sta 122+50
Elev 10 649
SCALE RATIO 1 200 VERT
PROFILE GRADE
Existing Profile
80 0 VC
100 0 VC
PI +20 000
EL 10 631
PI +00 000
EL 10 800
PI +20 000
EL 8 000
DPI 7 39
DPI 7 51
SPECIAL DITCH
LT & RT
EXHIBIT 17
Date 1/1/97
CONSULTANT FIRM NAME
IF APPLICABLE
FLORIDA DEPARTMENT OF
TRANSPORTATION
PLAN/PROFILE

STATE PROJ NO	SHEET NO
00000-0000	00

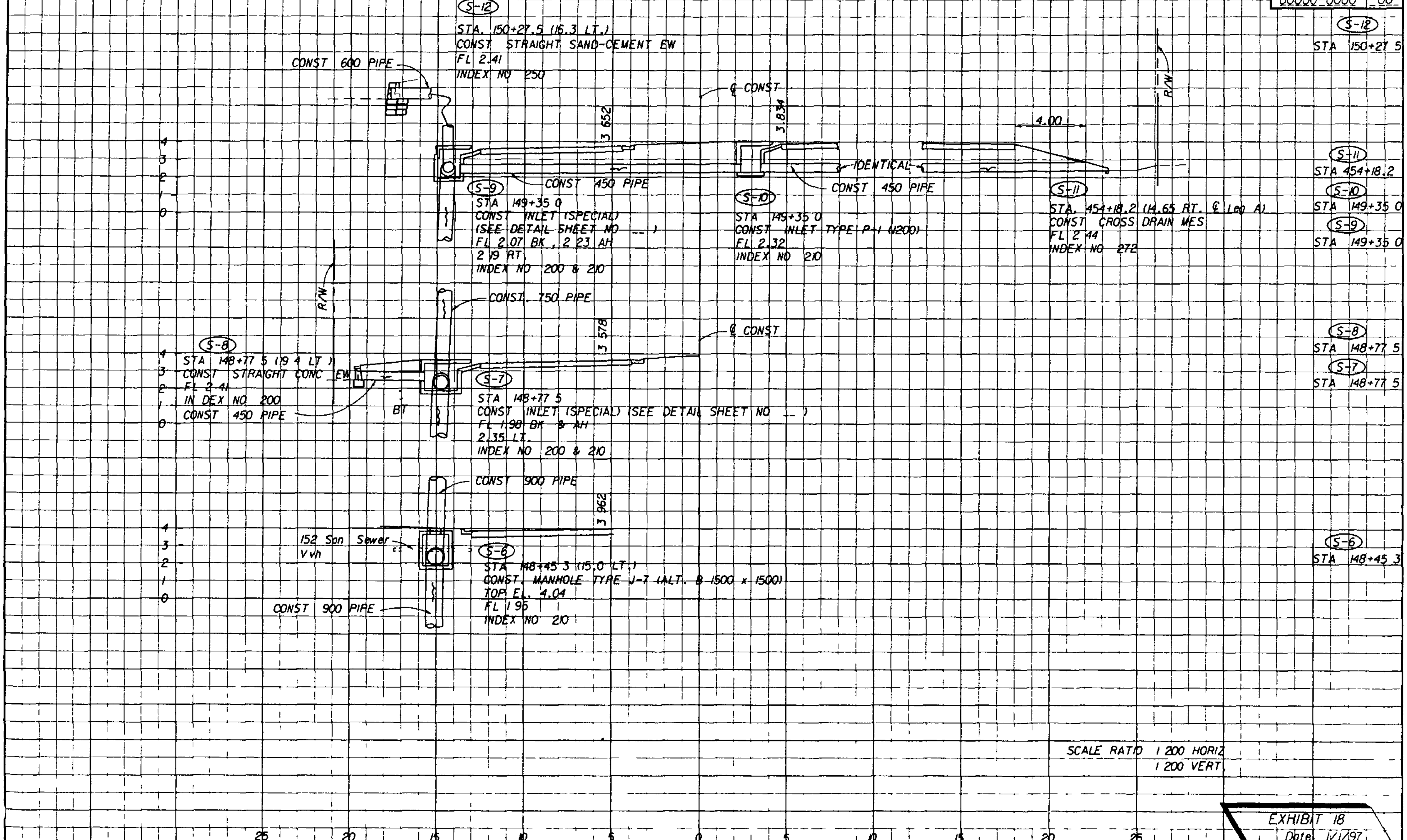


EXHIBIT 18
Date 1/1/97

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
REVISIONS											

CONSULTANT FIRM NAME IF APPLICABLE

FLORIDA DEPARTMENT OF TRANSPORTATION

DRAINAGE STRUCTURES

STATE PROJ NO	SHEET NO
00000-0000	00

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

DATE OF SURVEY 2/15/95 -5/1/95
SURVEY MADE BY HOSFORD TESTING COMPANY
SUBMITTED BY LARRY BULL, P.E.

PROJECT NO 56555-3505

DISTRICT 3
ROAD NO S.R. 20
COUNTY LIBERTY

CROSS SECTION SOIL SURVEY FOR THE DESIGN OF ROADS

SURVEY BEGINS STA 400+00 SURVEY ENDS STA 554+00

	ORGANIC CONTENT			SIEVE ANALYSIS RESULTS / PASS						ATTERBERG LIMITS (/)					CORROSION TEST RESULTS				
STRATUM NO.	NO OF TESTS	% ORGANIC	MOISTURE CONTENT	NO OF TESTS	10 MESH	40 MESH	60 MESH	100 MESH	200 MESH	NO OF TESTS	LIQUID LIMIT	PLASTIC INDEX	AASHTO GROUP	DESCRIPTION	NO OF TESTS	RESISTIVITY ohms cm	CHLORIDE ppm	SULFATES ppm	pH
1												N P		ROCK BASE ASPHALTIC CONCRETE					
2				4	98 87	93-77	82-59	55-44	10 3			N P	A 3	SUBGRADE (GRAY & TAN SAND W/TRACE SILT L R & SHELL)					
3	7	3 5-2 5		7	100-94	94 86	71-65	45-34	21 15			N P	A-2-4	FILL (DARK BROWN SAND W/SOME SILT & TRACE L R)	7	43000 34000	60 40	72 18	8 3-6 4
4	3	1 5-1 9		4	100 84	93 71	90-60	82 53	45 37	4	38 25	9 5	A 4	GRAY AND BROWN SILTY SAND W/TRACE CLAY AND L R	4	26000-23000	120-60	96 84	8 9 8 4
5				3	100	100-99	98 96	80 75	34 30	3	44 42	15-11	A 2-7	TAN AND LIGHT GRAY SILTY SAND W/SOME CLAY AND TRACE SHELL	3	8000 6600	120-60	216 156	8 2 7 5
6	3	18 2 40	20 60						46 30	3	33 25	15-10	A 8	MUCK (DARK BROWN SILTY SAND W/SOME CLAY					
7				3	100	92 88	79-73	69-60	55-51	3	61-55	53 38	A 7	YELLOW AND GRAY SILTY SAND CLAY					
8	3	15 5 20	20 58	3	100-99	99 97	97-88	80-77	15 10			N P	A-8	MUCK (BROWN SAND W/SOME ORGANIC AND TRACE SHELL	3	35000 20000	120	120	5 2-4 6

EMBANKMENT AND SUBGRADE MATERIAL
STRATA BOUNDARIES ARE APPROXIMATE MAKE FINAL CHECK AFTER GRADING
▽ - WATER TABLE ENCOUNTERED
GNE - GROUND WATER NOT ENCOUNTERED

The material from Stratum Number 1 is Rock Base under Asphaltic Concrete

The material from Stratum Number 2 appears satisfactory for use in the embankment when utilized in accordance with Index 505

The material from Stratum Number 3 appears satisfactory for use in the embankment when utilized in accordance with Index 505 However this material is likely to retain excess moisture and be difficult to dry and compact It should be used in the embankment above the water level existing at the time of construction This material may not be used in the subgrade portion of the roadbed due to its organic content

The materials from Stratum Numbers 4 and 5 are plastic materials and shall be removed in accordance with Index 500 They may be placed above the existing water level at the time of construction to within 4 Feet of the proposed base They should be placed uniformly in the lower portion of the embankment for some distances along the project rather than full depths for short distances

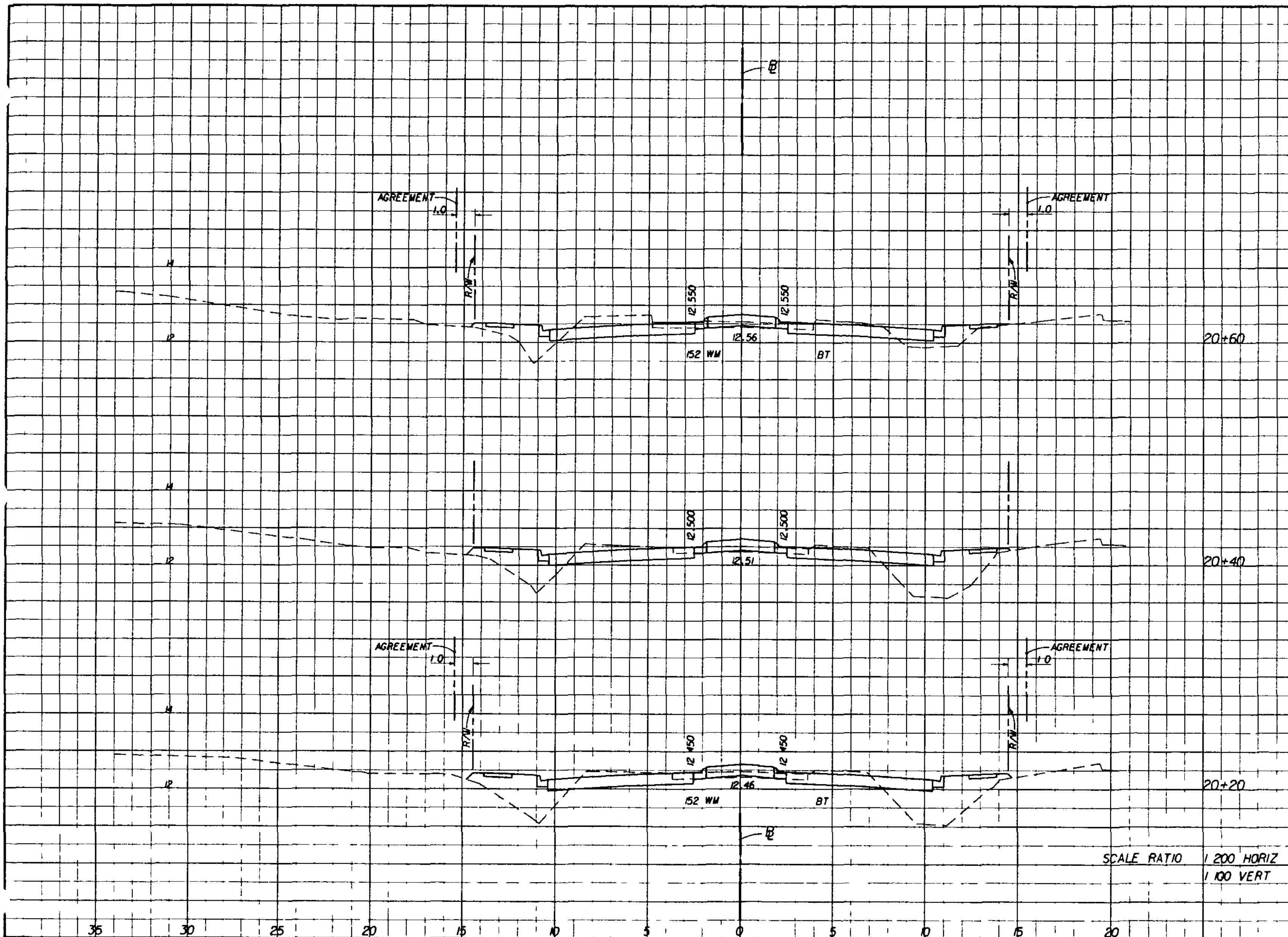
The material from Stratum Number 6 is ORGANIC/A-8 material and shall be removed in accordance with Index 500

The material from Stratum Number 7 is Highly Plastic material and shall be removed in accordance with Index 500 It may be used within the project limits as indicated in index 505 only when excavated within the project limits and is not to be used when obtained from outside the project limits

The material from Stratum Number 8 is ORGANIC/A-8 material and will be removed during clearing and grubbing

EXHIBIT 19
Date 1/1/97

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	P E C N S D E	BY	DESCRIPTION	TE	BY	DESCRIPTION	CONSULTANT FIRM NAME IF APPLICABLE	FLORIDA DEPARTMENT OF TRANSPORTATION	ROADWAY SOILS SURVEY



STATE PROJ NO			SHEET NO
00000-0000			00
A-2 A-3 MATL			
RDWY EXC		FILL	
A	V	A	V
18		29	
	30		100
12		71	
	23		148
11		77	
	19		158

EXHIBIT 20
Date: 1/1/97

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

REVISIONS

CONSULTANT FIRM NAME
If Applicable

FLORIDA DEPARTMENT OF TRANSPORTATION

CROSS SECTIONS