FHWA-NJ-2003-007

NJDOT Companion Manual to the 1993 AASHTO Guide for the Design of Pavement Structures

FINAL REPORT
June 2003

Submitted
by

Mr. Patrick Szary
Research Engineer and Associate Director

and

Dr. Ali Maher
Professor and Director

Dept. of Civil & Environmental Engineering
Center for Advanced Infrastructure & Transportation (CAIT)
Rutgers, The State University
Piscataway, NJ 08854-8014

NJDOT Research Project Manager
Mr. Anthony Chmiel

In cooperation with

New Jersey
Department of Transportation
Division of Research and Technology
and
U.S. Department of Transportation
Federal Highway Administration

Disclaimer Statement

"The contents of this report reflect the views of the author(s) who is (are) responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the New Jersey Department of Transportation or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation."

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the information presented herein. This document is disseminated under the sponsorship of the Department of Transportation, University Transportation Centers Program, in the interest of information exchange. The U.S. Government assumes no liability for the contents or use thereof.

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA-NJ-2003-007		

4. Title and Subtitle	5. Report Date
NJDOT Companion Manual to the 1993 AASHTO Guide for the Design of Pavement Structures	June 2003
	6. Performing Organization Code: CAIT/Rutgers
7. Author(s): Mr. Patrick Szary and Dr. Ali Maher	8. Performing Organization Report No.: FHWA-NJ-2003-007
9. Performing Organization Name and: New Jersey Department of Transportation, CN 600, Trenton, NJ 08625	10. Work Unit No.
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address: Federal Highway Administration, U.S. Department of Transportation, Washington, D.C.	13. Type of Report and Period Covered: Final Report, 1/01/2001 - 4/30/2002
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The New Jersey Department of Transportation (NJDOT) Research Division wanted to develop and implement an interactive CD-ROM as a New Jersey-specific companion manual to the 1993 AASHTO Guide for Design of Pavement Structures. The research team developed a framework for the companion manual that met NJDOT's requirements. The manual chapters, sections, and procedures were set-up similar to those in the 1993 AASHTO Guide for Design of Pavement Structures, to allow for easy referencing. New Jersey-specific values for parameters needed in the structural analysis and design of pavements were added and identified.

This document outlines the requirements for a CD-ROM based Multimedia Companion to the 1993 AASHTO Guide for Design of Pavement Structures, sponsored by NJDOT and developed by Rutgers CAIT, AID Inc. and ATC Brunswick.

17. Key Words	18. Distribution Statement
AASHTO, pavement, design, guide, companion, interactive	

19. Security Classif (of this report)	20. Security Classif. (of this page)	21. No of Pages	22. Price
Unclassified	Unclassified	48	

Form DOT F 1700.7 (8-69)

Acknowledgements

The authors wish to express their appreciation to the New Jersey Department of Transportation for the allotment of funds making this research possible. Special thanks are extended to Mr. Nicholas Vitillo and Mr. Anthony Chmiel of the NJDOT for their support and extending the opportunity to participate in such a significant and extensive research program. The authors would also like to thank Kaz Tabrizi of Advanced Infrastructure Design (AID) and Advanced Technology Concepts (ATC) of Hoboken, New Jersey for their programming efforts.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Table 1 Definitions

Definition	**Description**
Application	NJDOT Companion Manual to the 1993 AASHTO Guide for the Design of Pavement Structures
User	Person, who runs the application and works with it
Page	Graphical page with controls readable and accessible by users
Main Page	The page the application starts from
Help Page	Window with help message
Examples Page	Window with examples
Control	Anything that can be placed on a page including text messages, buttons, images, edit fields, check boxes, radio buttons, etc.
Button	Graphical sign or text message which is the only way of interaction between users and application
Module	Logical set of instructions and questions consisting of one or more pages
Main Module	Module located on the Main Page
Submodule	Any module except Main Module
Instruction	Text message informing users what to do
Question	Text message asking users about their selection with two or more available buttons
Book	1993 AASHTO Guide for the Design of Pavement Structures
CD	A compact disk with the Application

Table 2 Acronyms

Acronym	Description
NJDOT	New Jersey Department of Transportation
Rutgers CAIT	Center for Advanced Infrastructure & Transportation Rutgers, The State University
AID	Advanced Infrastructure Design (the Company hired to develop the Application Content)
ATC BRUNSWICK	Advanced Technology Concepts (the Company hired to develop the Application)
LCCA	Life Cycle Cost Analysis
PCCP	Portland Cement Concrete Pavement
HMA	Hot Mix Asphalt
AADT	Average Annual Daily Traffic
ESAL	Equivalent Single Axle Load
FWD	Falling Weight Deflectometer
SN_{eff}	Effective Structural Number
SN	Structural Number
LDF	Lane Distribution Factor
DCP	Dynamic Cone Penetrometer
CBR	California Bearing Ratio
M_R	Resilient Modulus
NJ	New Jersey
HWY	Highway

ABSTRACT

The New Jersey Department of Transportation (NJDOT) Research Division wanted to develop and implement an interactive CD-ROM as a New Jersey-specific companion manual to the 1993 AASHTO Guide for Design of Pavement Structures. The research team developed a framework for the companion manual that met NJDOT's requirements. The manual chapters, sections, and procedures were set-up similar to those in the 1993 AASHTO Guide for Design of Pavement Structures, to allow for easy referencing. New Jersey-specific values for parameters needed in the structural analysis and design of pavements were added and identified.

This document outlines the requirements for a CD-ROM based Multimedia Companion to the 1993 AASHTO Guide for Design of Pavement Structures, sponsored by NJDOT and developed by Rutgers CAIT, AID Inc. and ATC Brunswick.

BACKGROUND

Many organizations are faced with an increasing need for training, despite substantial reduction in their training budgets. As a result, training professionals are looking for alternative approaches to meet their training needs. One alternative, which is gaining broad acceptance, is multi-media training, delivered in such mediums as CD-ROMs. This technology has been evolving over the last decade and is now at a stage that it can be used efficiently for real-time applications. The driving forces for this technology are at present, the multi-media technology for course content generation and presentation, and the Internet as the on-line course delivery system.

NJDOT personnel and pavement design consultants were used to determine New Jersey-specific values for parameters needed in the structural analysis and design of pavements. The primary parameters of interest were those related to traffic, material characterization, subgrade characteristics, seasonal variation of material properties, and rehabilitation considerations. Specifically, design parameters included:

- Initial serviceability for different pavement types and classes
- Terminal serviceability for different pavement types and classes
- Reliability level different pavement types and classes
- Overall standard deviation for different pavement types and classes
- Seasonal adjustment factors
- Layer coefficients for different material types
- Back calculation subgrade correction factors
- PCC effective thickness parameters

The CD companion guide for the structural analysis of pavements utilized an "objective-oriented" approach. This approach guides the designer based on his/her objective and the

available data at-hand. In this manner, the user is guided through the companion manual without exposure to irrelevant design procedures and/or steps.

This project developed and delivered a multi-purpose, multi-media based, CD-ROM Companion to the 1993 AASHTO Guide for Design of Pavement Structures. As previously indicated, customizing and standardizing the AASHTO design procedure to reflect New Jersey conditions was a priority task.

FEATURES AND GOALS

Features of Application

- Application is a CD-ROM based e-learning tool.
- Application is a CD-ROM based guide with buttons between pages and choices
- Application is interactive.

Goals of Application

- The objective of the NJ Companion Manual is to provide pavement designers with step-by-step instructions for NJDOT application of the 1993 AASHTO Guide for the Design of Pavement Structures.

Description of Environments

- The Manual is intended to be used by Pavement Design Engineers.
- The Application will work in a P.C. based environment.
- The Application will be run from local CD-ROM, local hard drive or network file server.

GENERAL CONSTRAINTS

Access model to the guide is presented below:

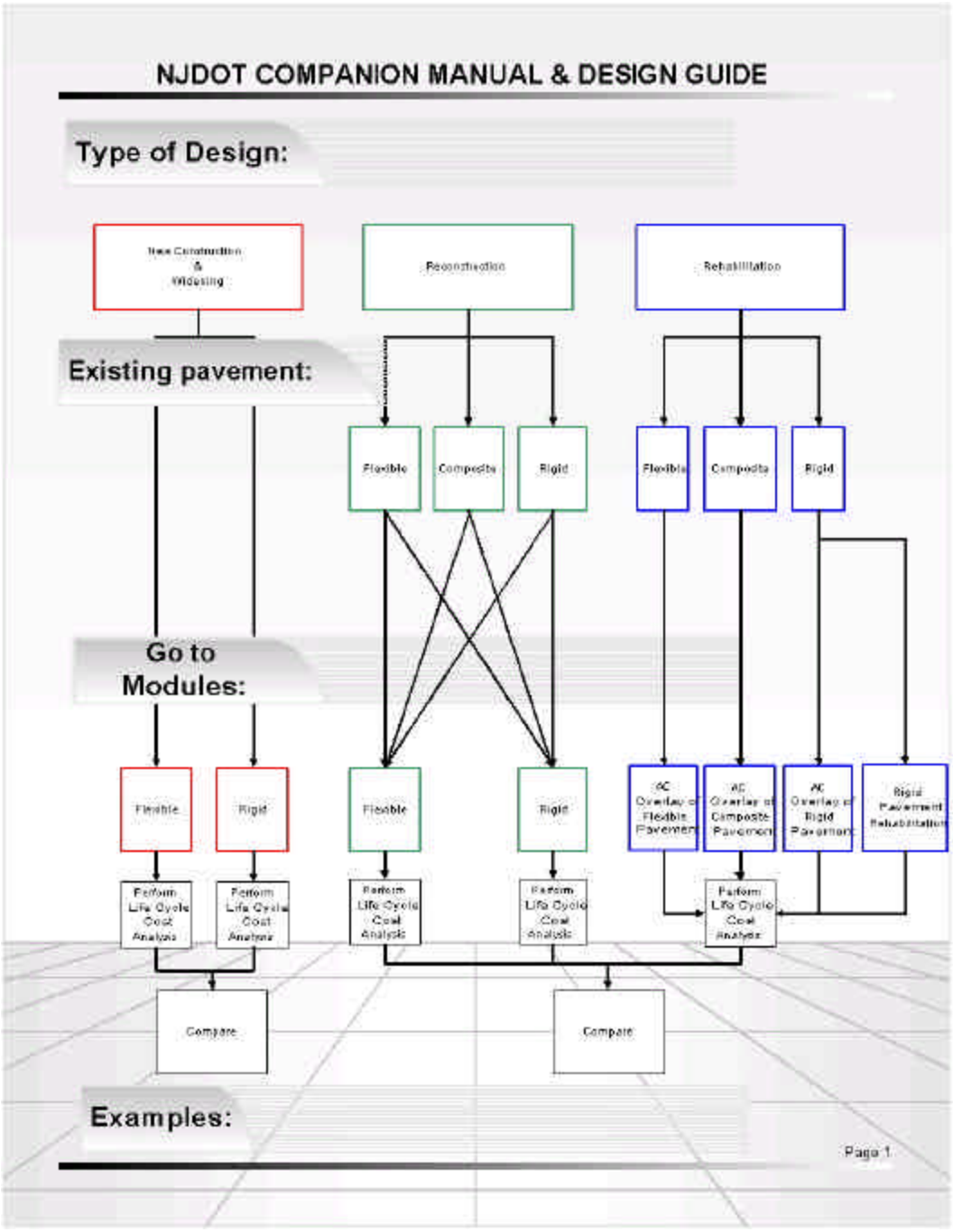


Figure 1 Access Scheme

SOFTWARE REQUIREMENTS

Table 3 Functional Requirements

Id	Description
FR_001	Application should be a graphical electronic guide to NJDOT application of the AASHTO 1993 guidelines
FR_002	Application should be run from local CD-ROM, local hard drive and network file server
FR_003	Application should be delivered on a CD-ROM
FR_004	Application will consist of one or more pages
FR_005	Application should start from the page called Main Page
FR_006	Application should guide users through AASHTO 1993 Guide for the Design of Pavement Structures
FR_007	Application should give users references to the Book
FR_008	Application should instruct users if there is only one path available
FR_009	If the path of the guide divides into two or more paths, Application should ask questions to users about their selection
FR_010	Users should follow the path by clicking buttons
FR_011	Users should be able to click only allowed buttons
FR_012	Disallowed buttons should be disabled or hidden
FR_013	Users should be able to invoke context-sensitive help by clicking “Help” button
FR_014	Users should be able to return to the previous page by clicking “Back” button
FR_015	Users should be able to return to the Main Page by clicking “Home” button
FR_016	Users should be able to choose path by clicking corresponding buttons
FR_017	Users should be able to quit Application by clicking “Exit” button
FR_018	Instructions and questions should be divided into logical Modules
FR_019	Each module should consist of one or more pages
FR_020	Main Module should be on the Main Page
FR_021	Submodules should be entered and returned from as whole entities
FR_022	Users should be able to print pages by clicking “Print” button

FR_023	Users should be able to invoke page with examples by clicking “Examples” button
FR_024	Help Page should be shown every time the application is run

Table 4 Performance Requirements

Id	Description
PR_001	After inserting the CD-ROM, the delay between beginning of loading and starting the application should not exceed 15 seconds (local CD-ROM only)
PR_002	The delay between user’s click on the button and transition should not exceed 1 second

Table 5 Interface Requirements

Id	Description
IR_001	Application should have attractive and intuitive interface
IR_002	Window header should display application name and the current submodule (or just application name if Main Module)
IR_003	Application name should be on each page
IR_004	Submodule name should be on each page of submodule
IR_005	Instructions and questions should attract attention of users
IR_006	Text messages of different types (window headers, application name, module names, instructions and questions) should be different in style, font and color
IR_007	Mouse pointer should change its look when pointing to a button
IR_008	Available buttons should differ from unavailable
IR_009	Buttons “Exit”, “Help”, “Home”, “Print”, “Examples” and “Back” should differ from those that allow users to select from multiple choices
IR_010	Buttons that point to another selection on the same page, to another page and to another module, should clearly differ from each other

Table 6 Test Requirements

Id	Description
TR_001	Quality Assurance must be carried out by ATC Brunswick, Rutgers CAIT and NJDOT.
TR_002	Bugs found during QA will be reported to ATC Brunswick and fixed prior to the Release
TR_003	Bugs reported after the Product Release will be fixed in subsequent Releases, if any.

Table 7 Documentation Requirements

Id	Description
DR_001	Instructions on how to run CD-ROM and the System Requirements must be published on the CD-ROM jewel case insert.
DR_002	Main Page should have a button “Help” with link to a Help page where application functionalities will be described
DR_003	Frequently Asked Questions file will be generated based on customer feedback and available online via Internet.
DR_004	All available information will also be published on CD-ROMs and the Internet with every new release
DR_005	The title text on CD cover should be “NJDOT Companion to the 1993 AASHTO Guide for Design of Pavement Structures”.

USE CASE SPECIFICATION

Starting the Application

- User inserts the CD-ROM into the CD-ROM drive
- Help Page is opened to describe the usage of the application.
- After a user closes Help Page, Main Page is displayed and the application awaits user's selection.

Following the Links

- User clicks on one of the available buttons on a page
- Application shows/enables available path if it is on the same page, or
- If the path follows to other page, application opens it

Moving Back

- User clicks "Back" button to return to the previous page, or
- User clicks "Home" button to return to the Home Page, or
- User clicks highlighted button to get back to the previous selection

Invoking Help Page

- User clicks "Help" button and the Help Page will appear with description of usage.

Quitting the Application

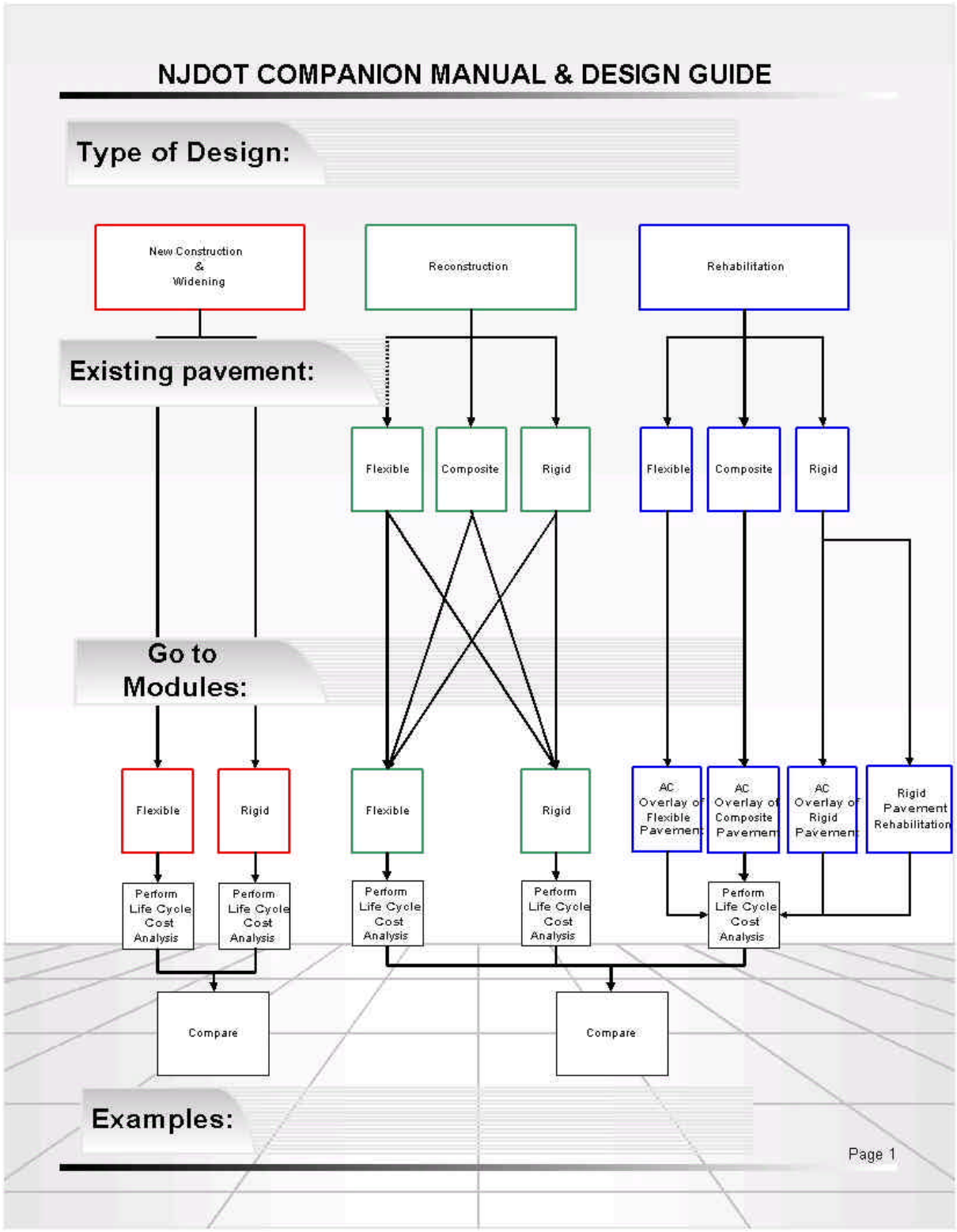
- User clicks Exit button in the window to close the application

CONCLUSION

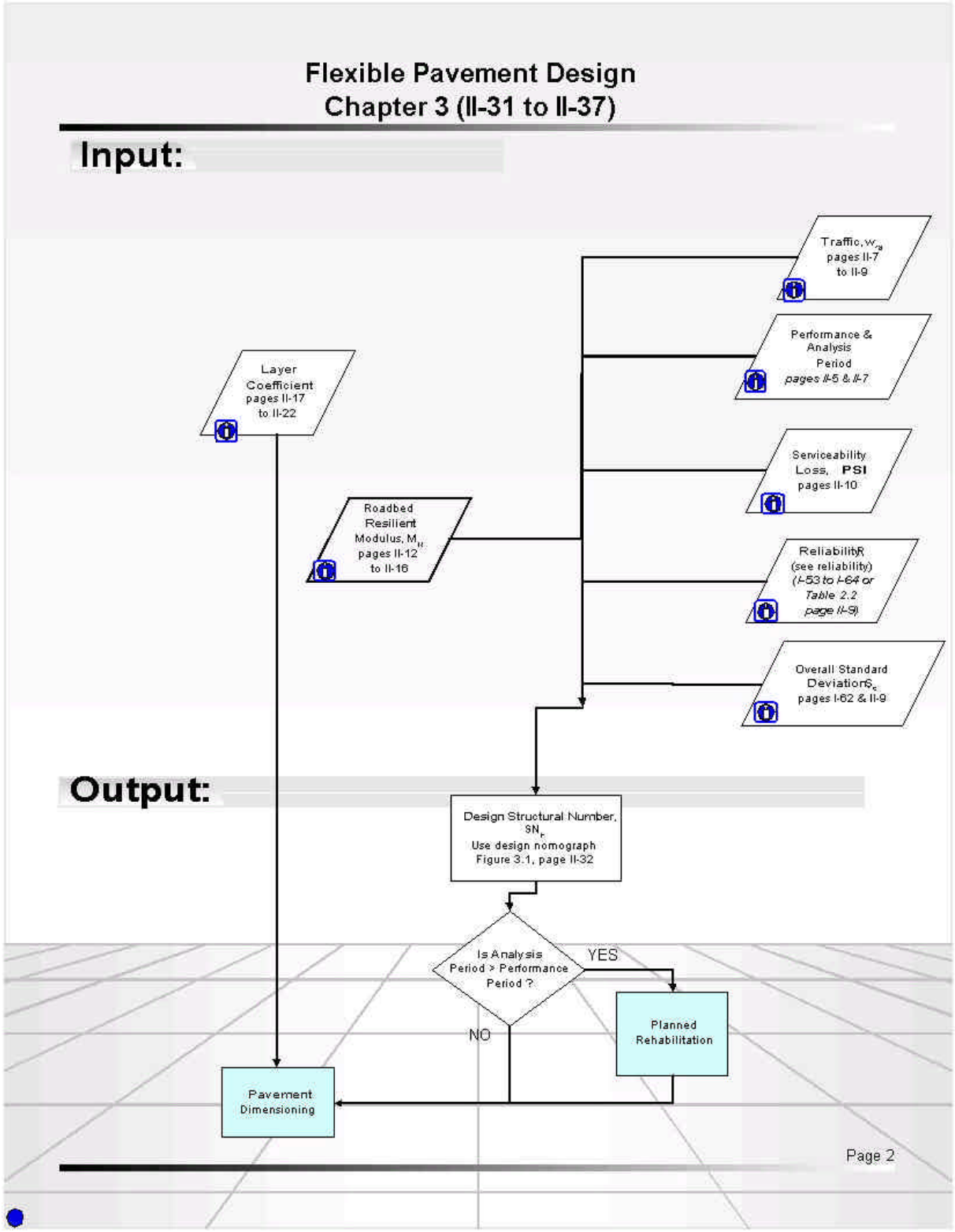
The NJDOT Research Division Companion Guide to the 1993 AASHTO Guide for Design of Pavement Structures CD-ROM project was created to develop an innovative and effective tool to assist pavement designers with step-by-step pavement design instructions. This technology based companion product is tailored toward individual designers, providing them with a self-pace of usage that utilizes their expertise, experience, and knowledge. It is based on a multi-media system with a CD-ROM delivery mechanism. The system integrates the latest distant learning tools capabilities, thus providing an effective, advanced and easy to use tool for pavement design. The program, which takes advantage of interactive-based technologies, assists pavement engineers in design and provides New Jersey-specific parameters.

APPENDIX FLOW DIAGRAMS OF CD CONTENT

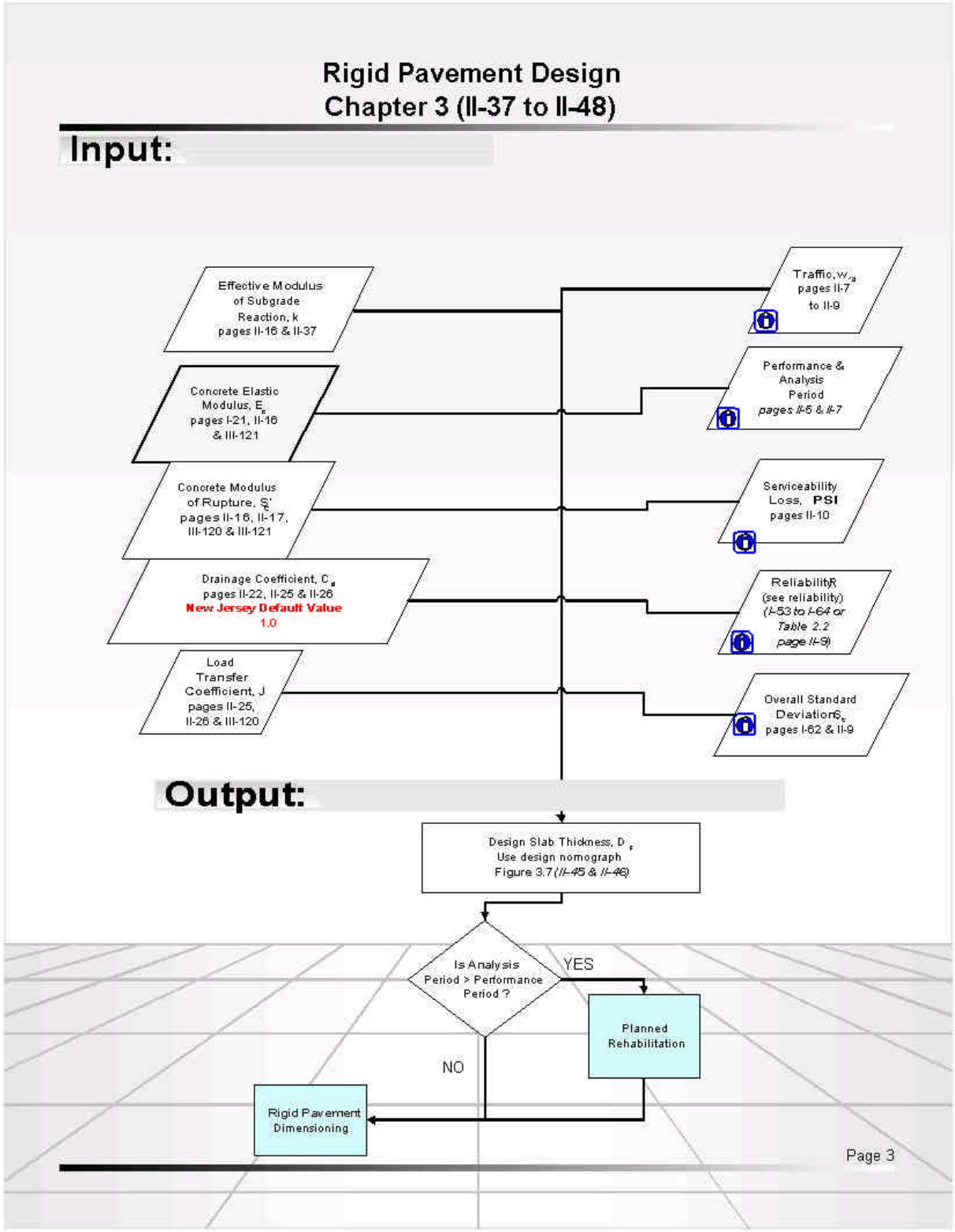
MAIN PAGE (NJDOT COMPANION MANUAL & DESIGN GUIDE)


NJDOT COMPANION MANUAL & DESIGN GUIDE
Type of Design:
New Construction & Widening
Reconstruction
Rehabilitation
Existing pavement:
Flexible
Composite
Rigid
Flexible
Composite
Rigid
Go to Modules:
Flexible
Rigid
Flexible
Rigid
AC Overlay of Flexible Pavement
AC Overlay of Composite Pavement
AC Overlay of Rigid Pavement
Rigid Pavement Rehabilitation
Perform Life Cycle Cost Analysis
Perform Life Cycle Cost Analysis
Perform Life Cycle Cost Analysis
Perform Life Cycle Cost Analysis
Perform Life Cycle Cost Analysis
Compare
Compare
Examples:
Page 1

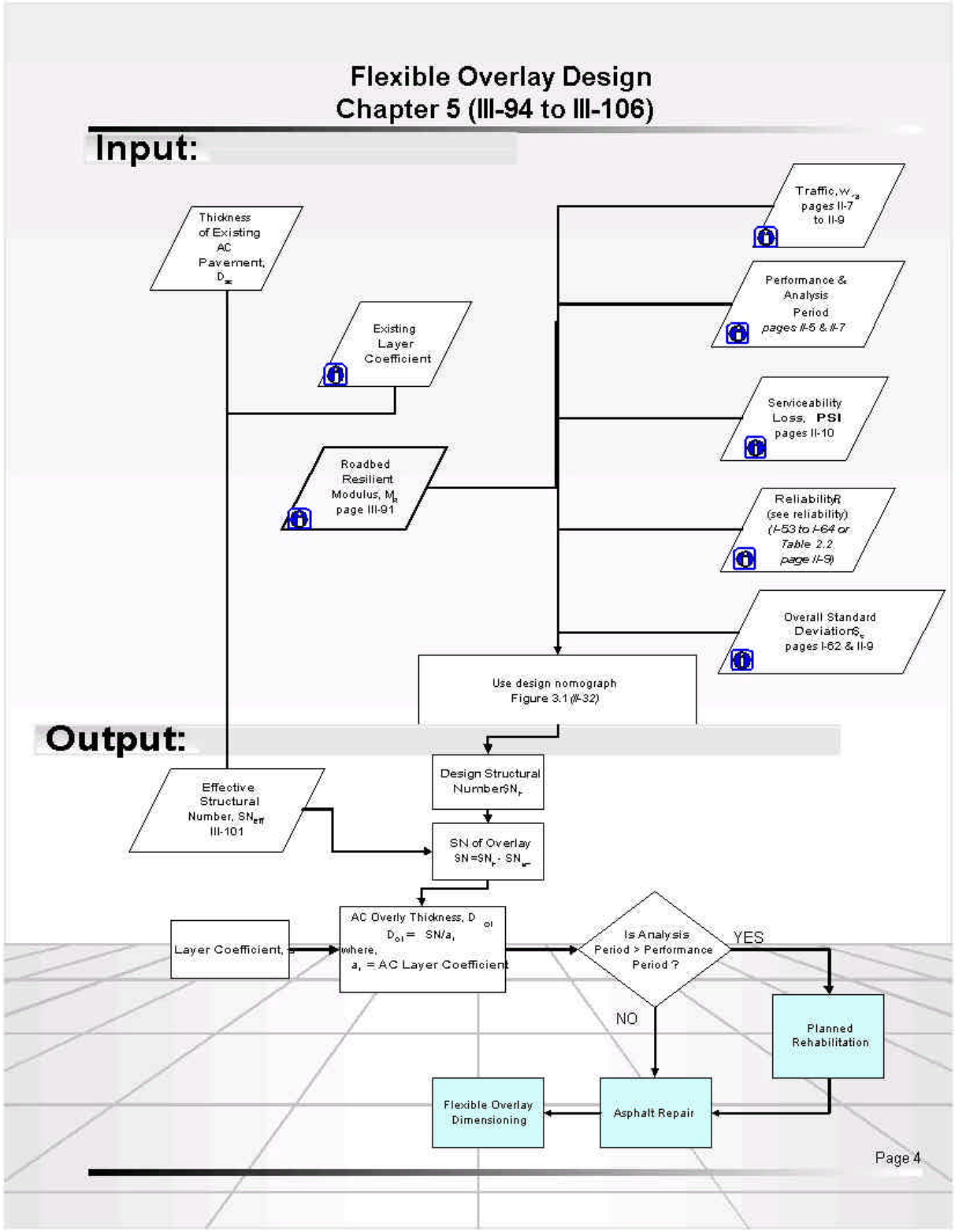
FLEXIBLE PAVEMENT DESIGN



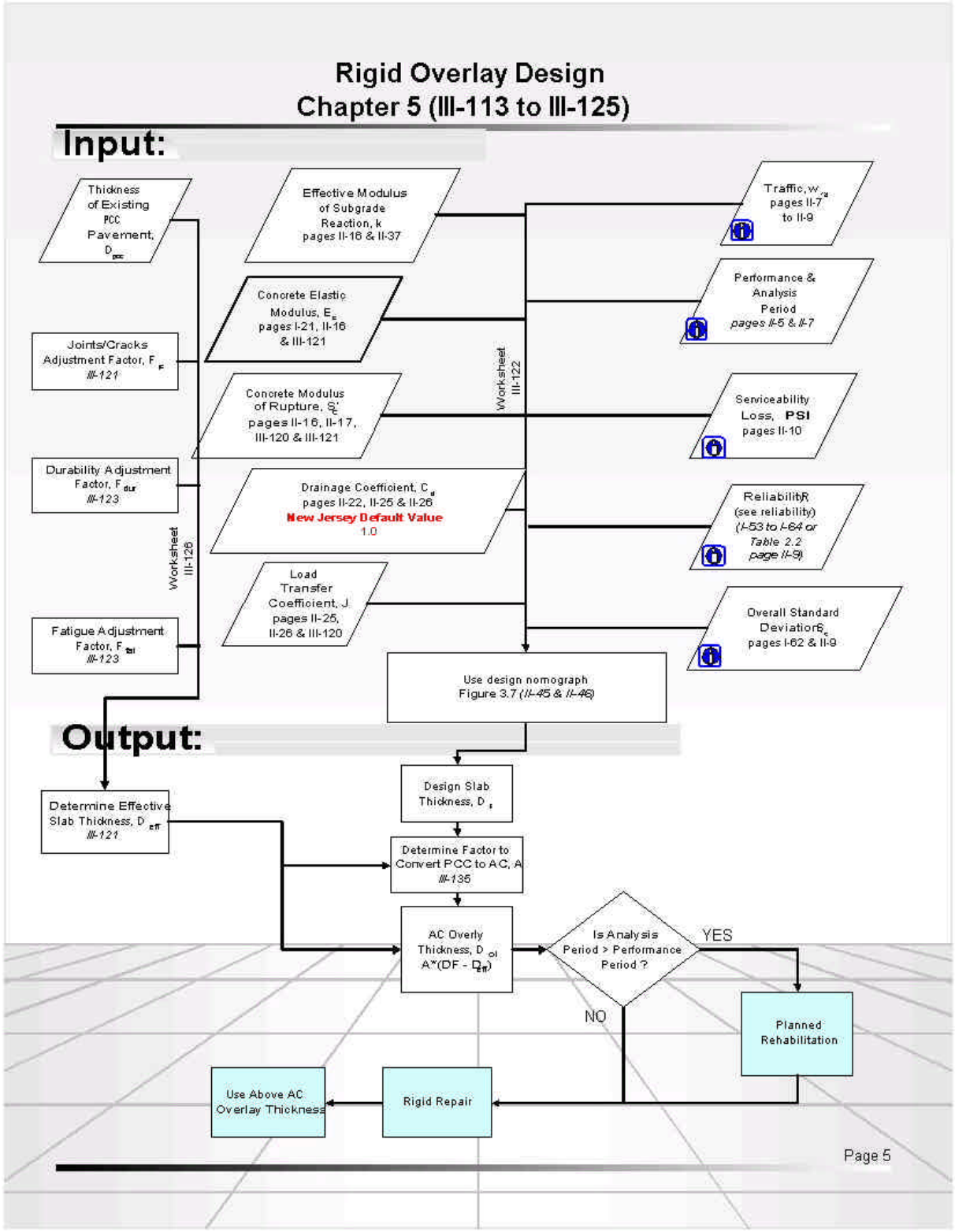
RIGID PAVEMENT DESIGN



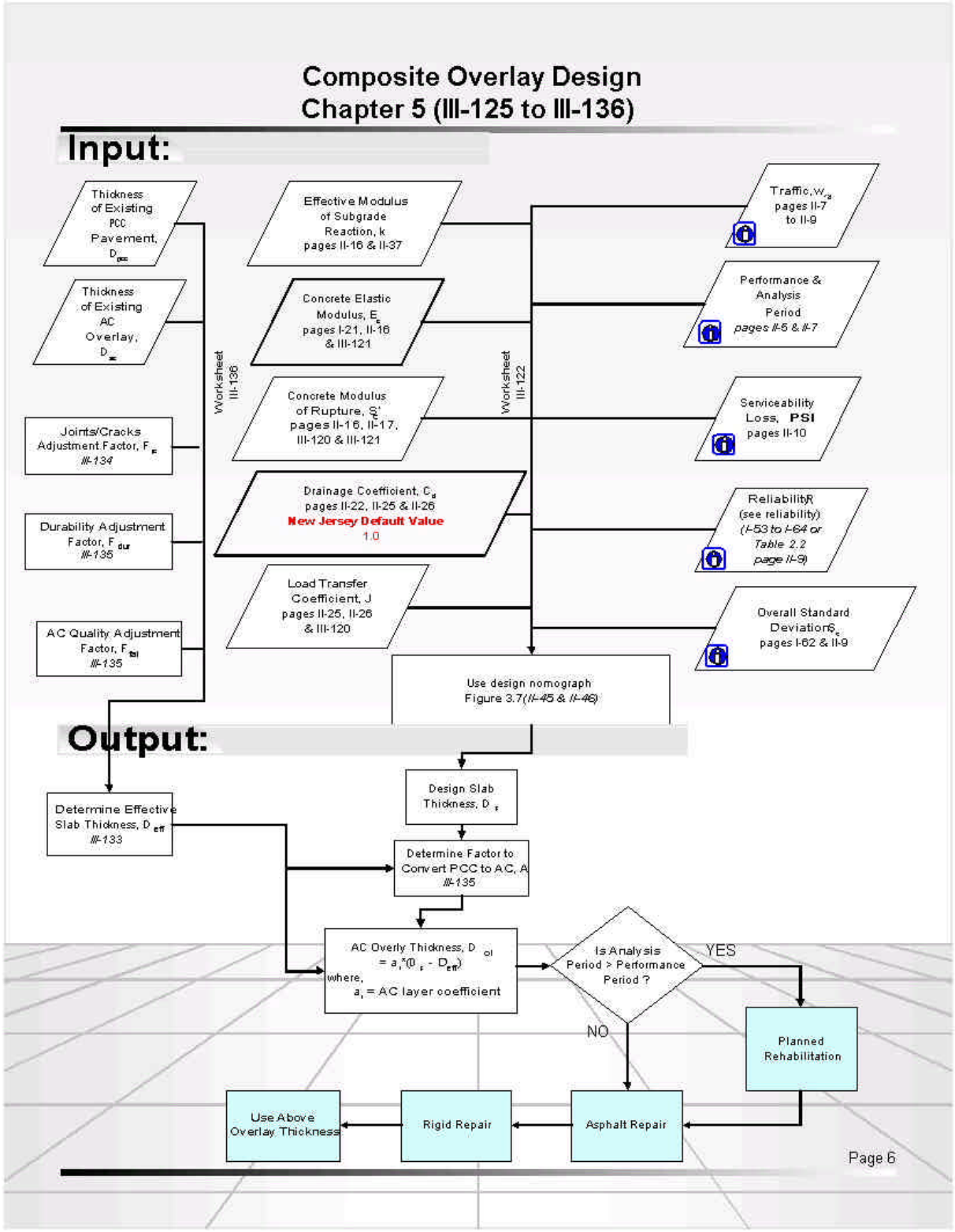
FLEXIBLE OVERLAY DESIGN



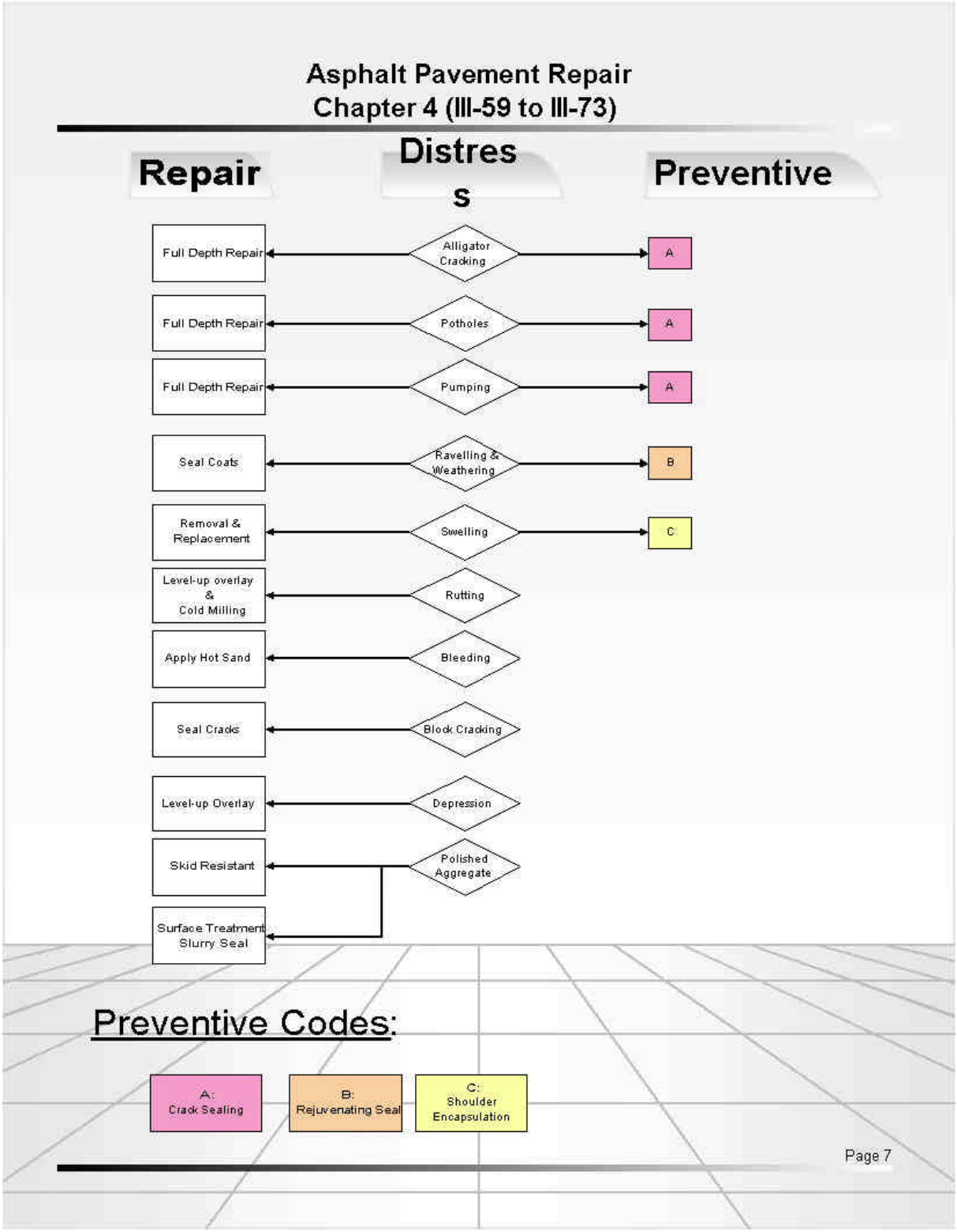
RIGID OVERLAY DESIGN



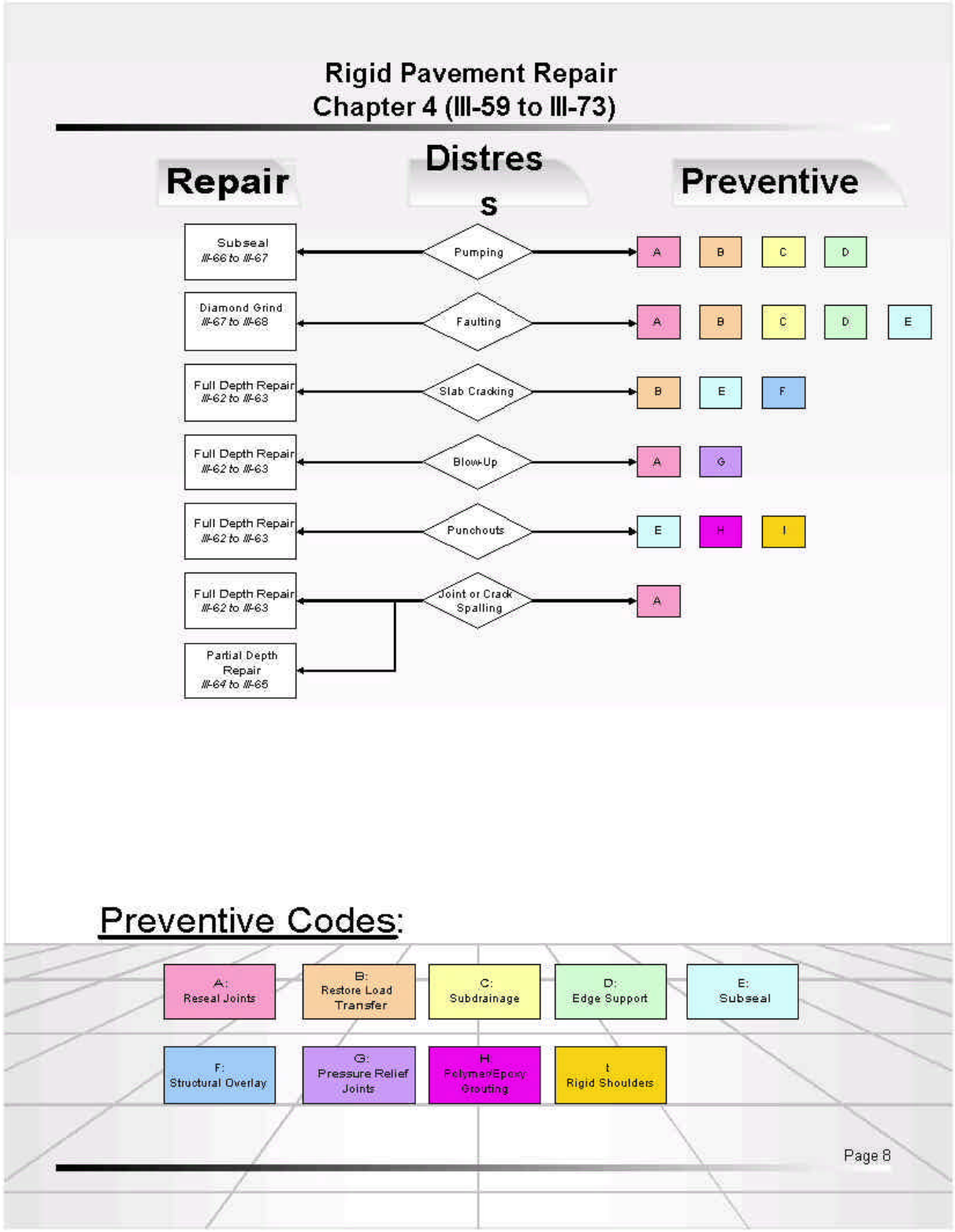
COMPOSITE OVERLAY DESIGN



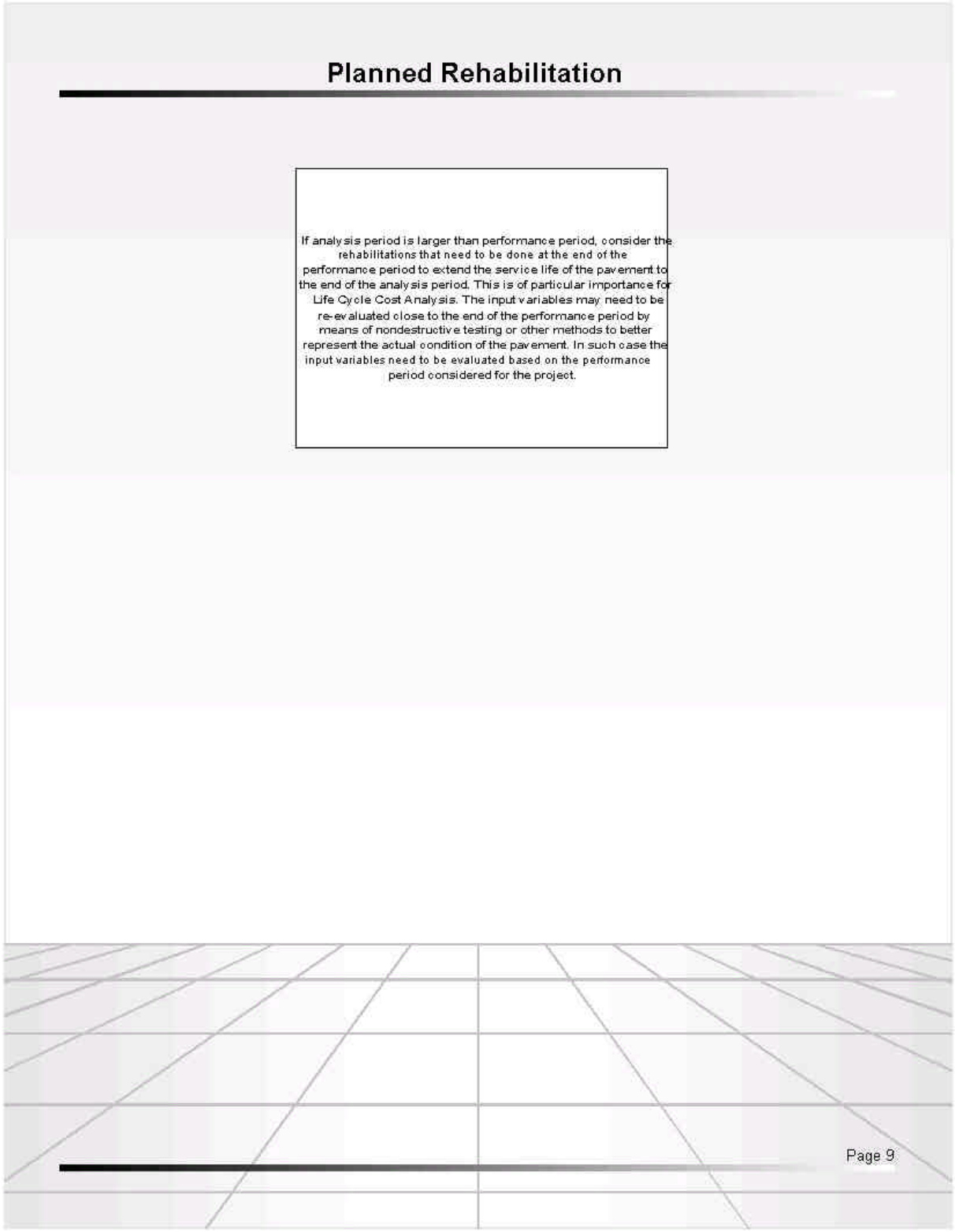
ASPHALT PAVEMENT REPAIR



RIGID PAVEMENT REPAIR



PLANNED REHABILITATION



RIVID PAVEMENT DIMENSIONING

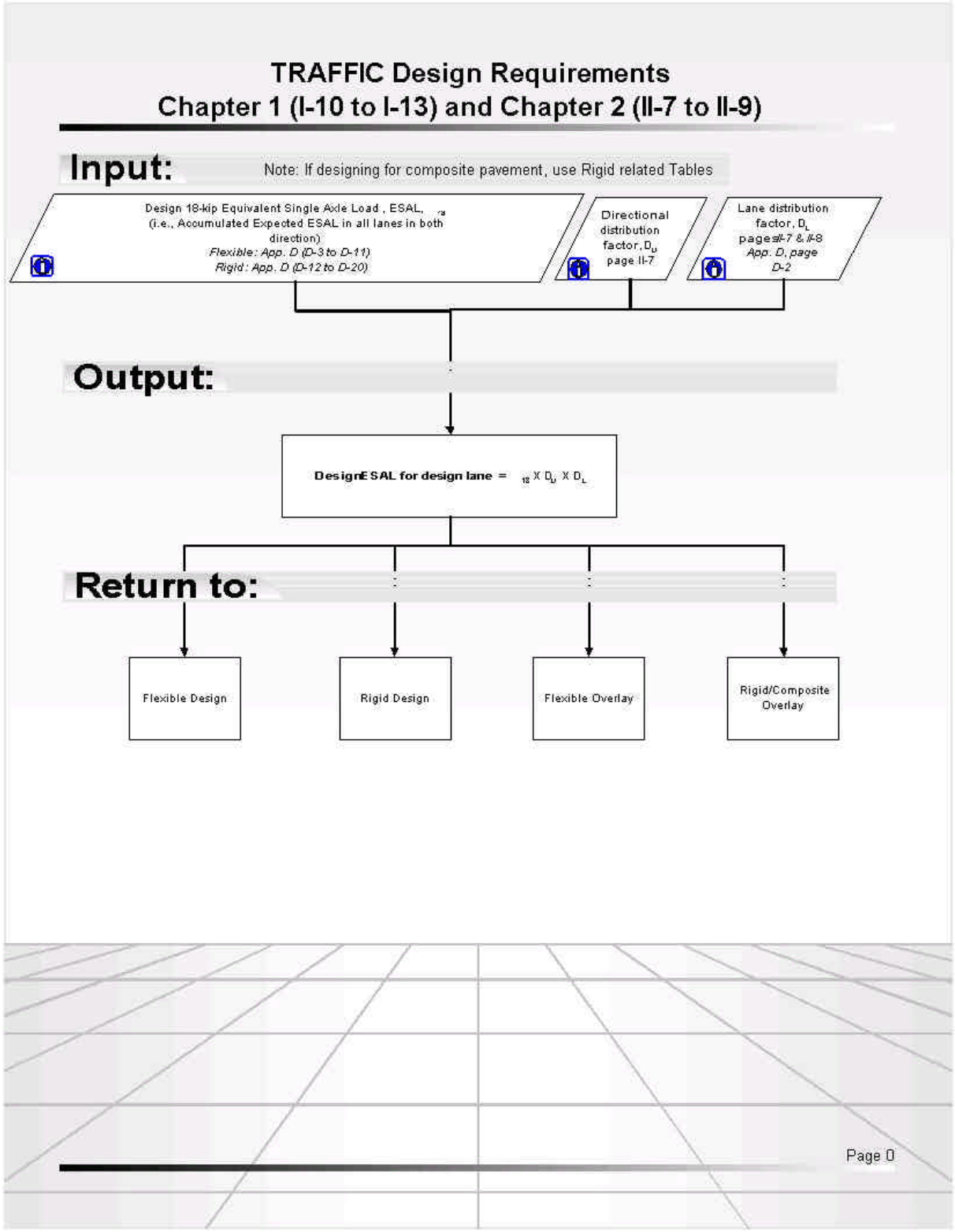
Rigid Pavement Dimensioning

Use Design Procedure in Sections 3.3 and 3.4 for Joint and Reinforcement Design
II-48 to II-51

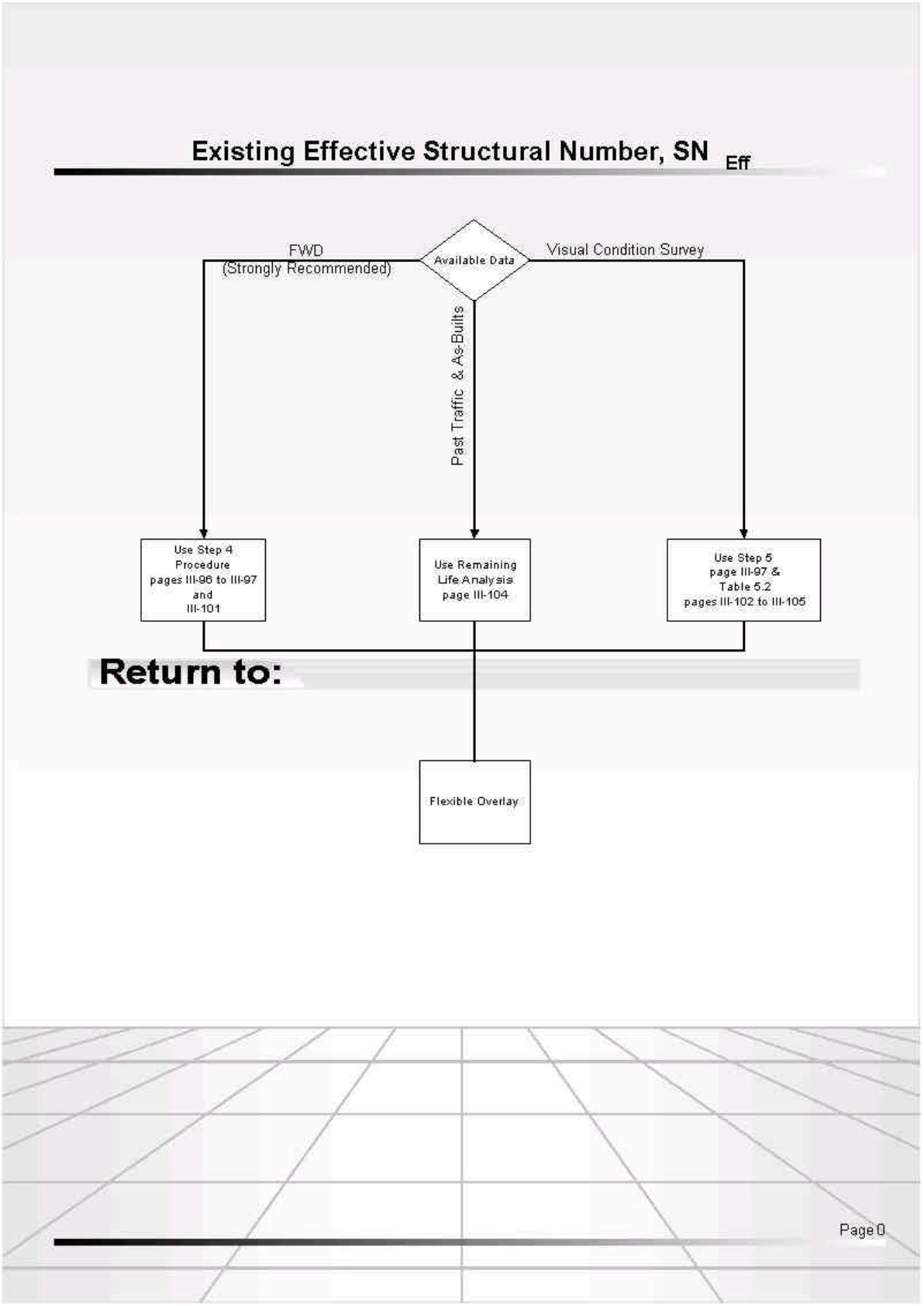
NJDOT constructs Jointed Reinforced Concrete Pavement, JRCP, with the following general specifications (for detailed information consult NJDOT Standard Specification):

Slab length: 78 feet, 2 inches or project specific
Joint layout: perpendicular to centerline of the roadway
Joint type: expansion joint or project specific
Joint dimension: consult construction detail
Joint sealant: consult standard specification
Dowels: consult construction detail
Temperature/Reinforcing steel: consult construction detail

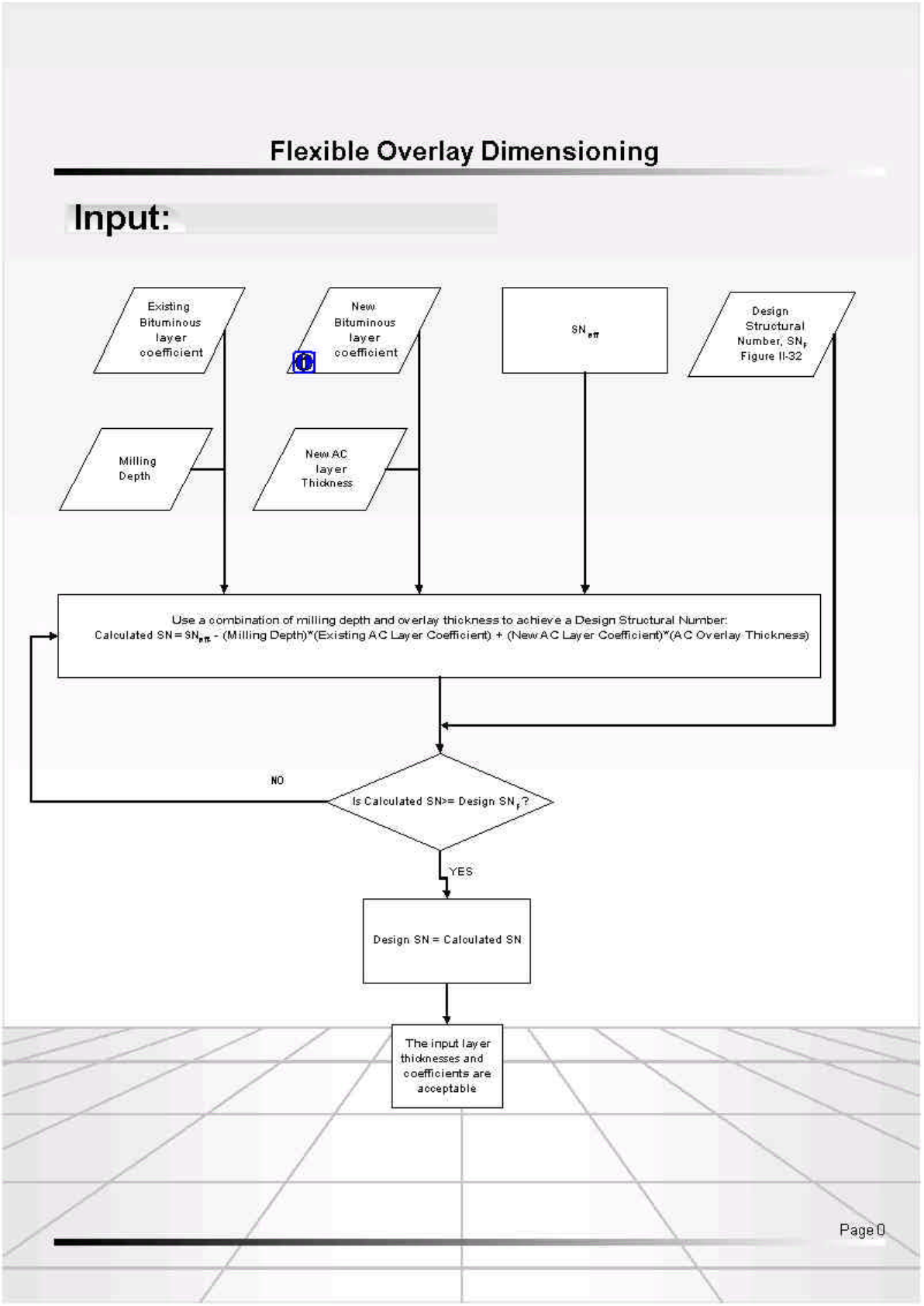
TRAFFIC DESIGN REQUIREMENTS



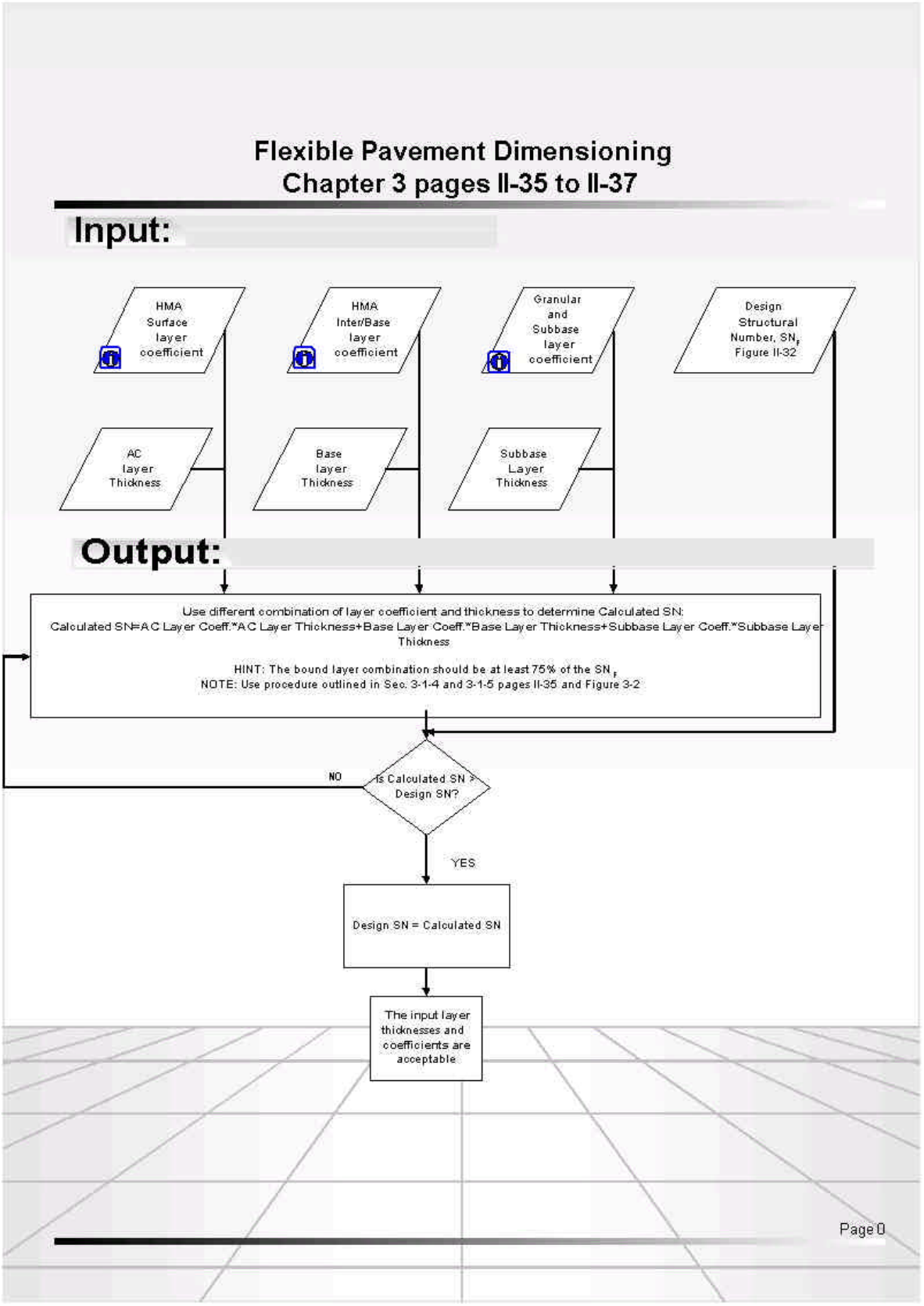
EXISTING EFFECTIVE STRUCTURAL NUMBER, SN_{EFF}



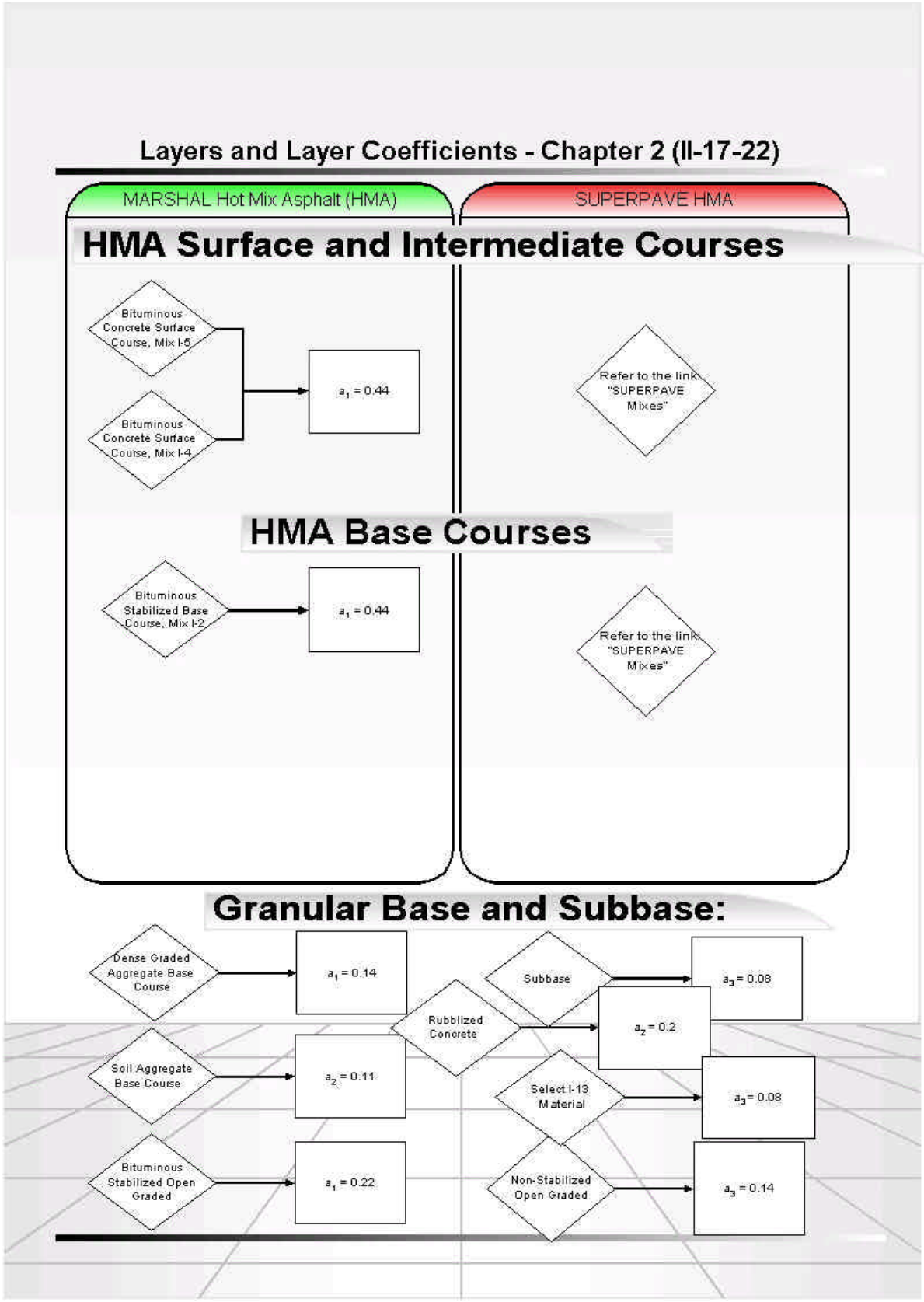
FLEXIBLE OVERLAY DIMENSIONING



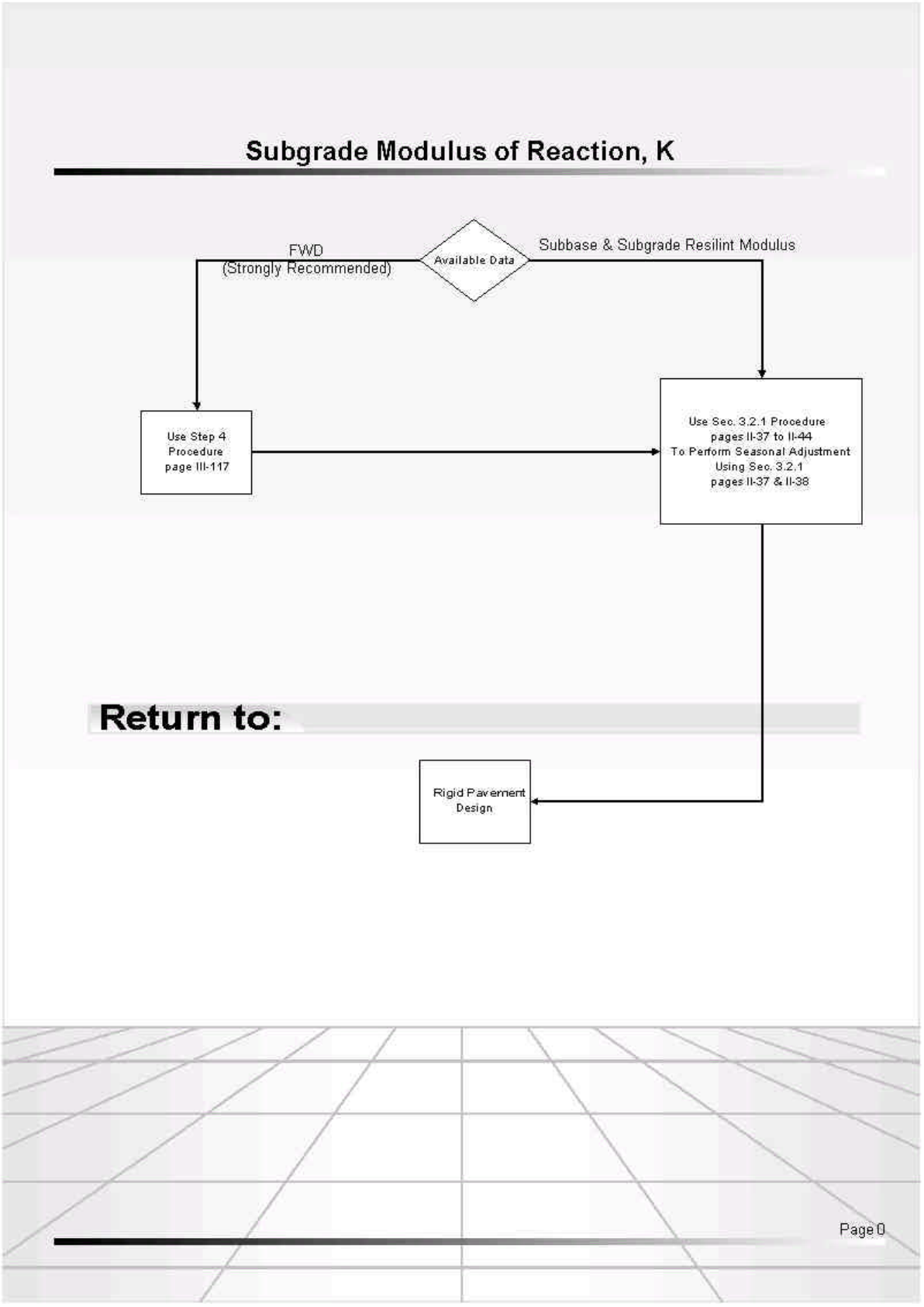
FLEXIBLE PAVEMENT DIMENSIONING



LAYERS AND LAYER COEFFICIENTS



SUBGRADE MODULUS OF REACTION, K



ESAL

Design 18-kip ESAL

Contact NJDOT Project Manager and obtain the following parameters:

ADT_o = 2-way ADT (Year of Project completion)
ADT_f = 2-way ADT (Projected over performance period)
y = Number of years in performance period
TT% = % Total Trucks
HT% = % Heavy Trucks. FHWA classes 6-13 are classified as Heavy Trucks
LT% = % Light Trucks. FHWA classes 4-5 are classified as Light Trucks
Car% = % cars. FHWA classes 1-3 are classified as cars
TT_f = Total Truck Factor, or average ESAL per truck
HTF = Heavy Truck Factor
LTF = Light Truck Factor
Car_f = Car Factor
(Note: TT_f, HT_f, LT_f and Car_f can also be obtained on line:
http://www.state.nj.us/transportation/count/vclass/wimdata/18kips2001.pdf)

Calculation Note:
The accumulated expected 18 kip Equivalent Single Axle Load, Design ESAL, is calculated by one of the two methods below:

Design ESAL = $((ADT_o+ADT_f)/2)*(TT\%)*(T_f)*(y)*365$,
or
Design ESAL = $((ADT_o+ADT_f)/2)*[(LT\%)*(LT_f)+(HT\%)*(HT_f)+(Car\%)*(Car_f)]*(y)*365$

Note: ADT_f can be replaced with $ADT_o * GF$,
where $GF = 0.5 * [1+(1+r)^y]$,
GF is the growth factor, and
r = Growth Rate

DIRECTIONAL DISTRIBUTION

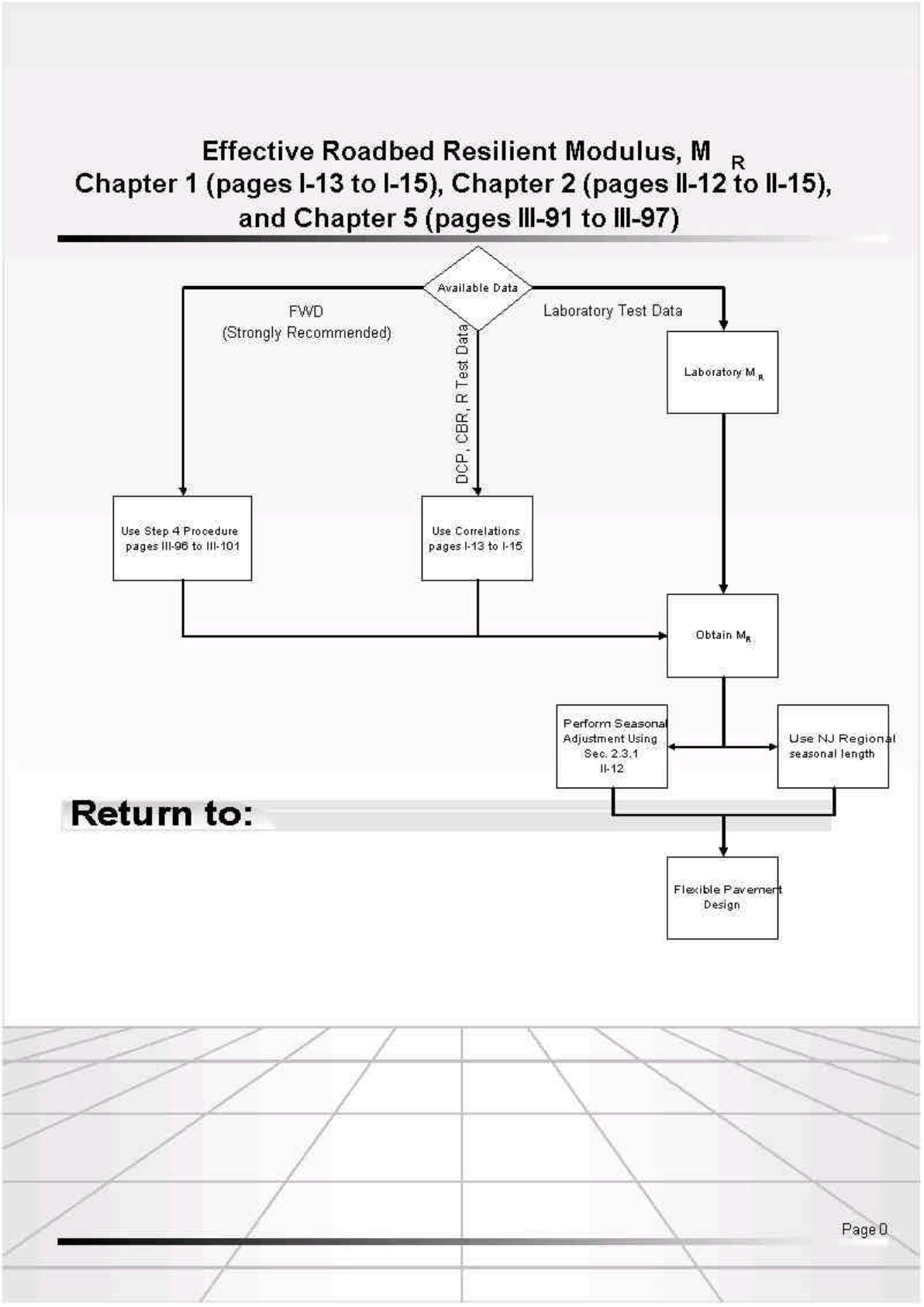
Use $D_D = 0.5$ unless otherwise directed by NJDOT.

LANE DISTRIBUTION

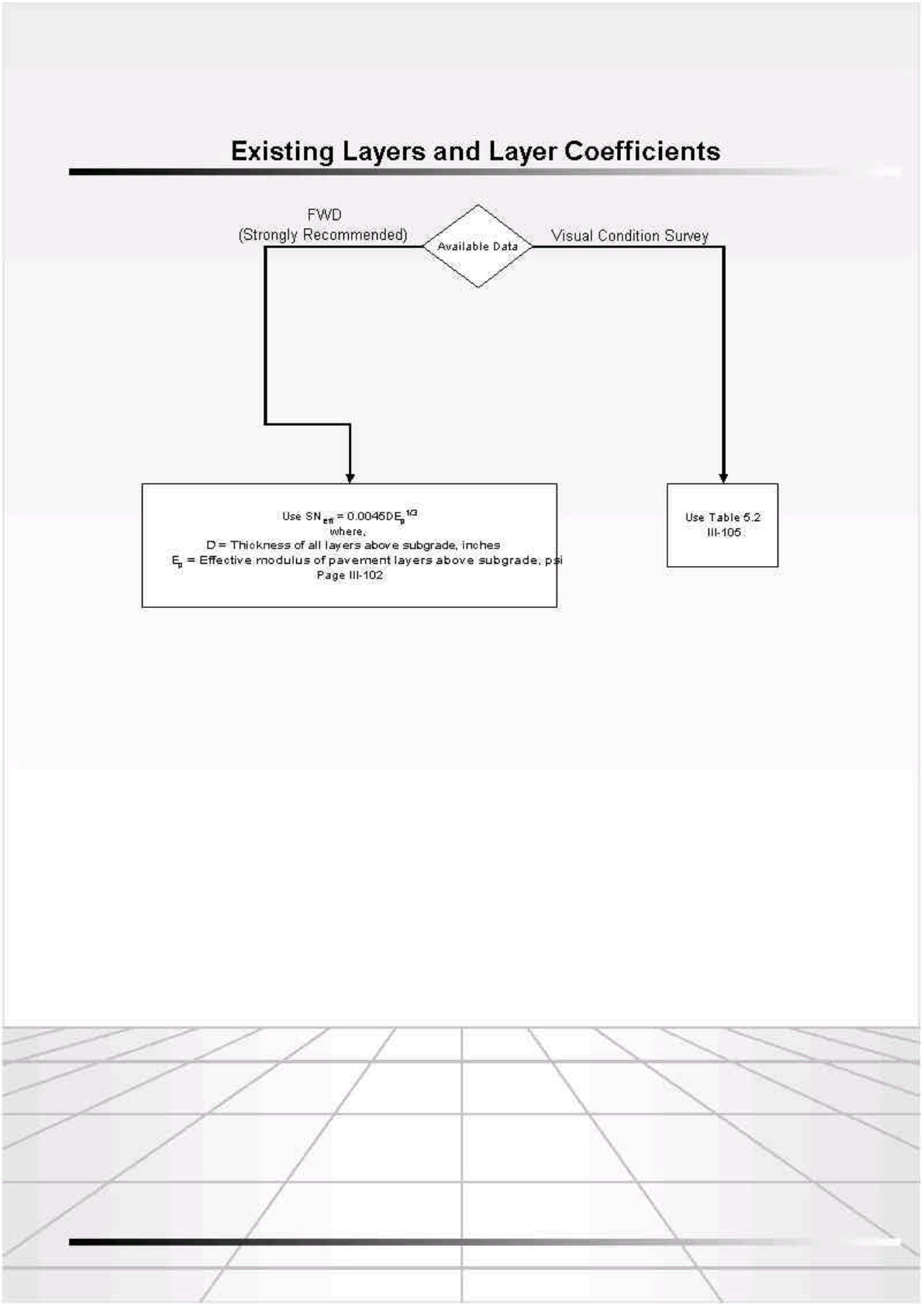
Use the following Table unless otherwise directed by NJDOT

No. of Lanes in Each Direction	D_L
1	100%
2	100%
3	80%
4	75%

EFFECTIVE ROADBED RESILIENT MODULUS, M_R



EXISTING LAYERS AND LAYER COEFFICIENTS



PERFORMANCE AND ANALYSIS PERIOD

For High Volume Interstate Highways: Use a 30 year design & analysis life
All others: Use a 20 year design & analysis life

SERVICEABILITY LOSS, ?PSI

P_o = Initial Serviceability Index
P_t = Terminal Serviceability Index
$?_{PSI}$= Serviceability Loss = P_o - P_t

Road Type	P_t		
		P_o	P_o
		Concrete	HMA
Interstate	3.0	4.5	4.2
State NWY	2.5	4.5	4.2
County	2.0	4.5	4.2

STANDARD DEVIATION, S_0

For HMA: Use 0.45 unless otherwise stated by NJDOT
For Concrete: Use 0.35 unless otherwise stated by NJDOT

SUPERPAVE LAYER INFORMATION

SUPERPAVE Layer Information

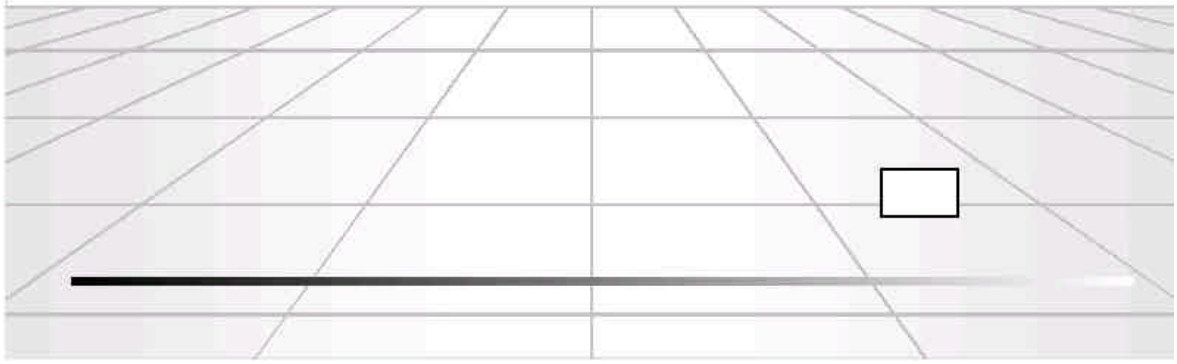
HMA Surface and Intermediate Courses:

Layer	Suggested Lift (in)	Superpave Mix Size (mm)	Design Application	Similar to	a_1=
Superpave Hot Mix Asphalt 9.5M64 Surface Course	1.5	9.5	Surface	Mix I-5	0.44
Superpave Hot Mix Asphalt 12.5M64 Surface Course	2	12.5	Surface	Mix I-4	0.44
Superpave Hot Mix Asphalt 12.5H64 Surface Course	2	12.5	Surface	Mix I-4	0.44
Superpave Hot Mix Asphalt 12.5H76 Surface Course	2	12.5	Surface	Mix I-4	0.44
Superpave Hot Mix Asphalt 12.5V76 Surface Course	2	12.5	Surface	Mix I-4	0.44
Superpave Hot Mix Asphalt 19V76 Surface Course	2.5-3	19	Surface	Mix I-4	0.44
Superpave Hot Mix Asphalt 19M64 Intermediate Course	2.5-3	19	Intermediate, Patching	Mix I-4 HD	0.44
Superpave Hot Mix Asphalt 19H64 Intermediate Course	2.5-3	19	Intermediate, Patching	Mix I-4 HD	0.44
Superpave Hot Mix Asphalt 19V76 Intermediate Course	2.5-3	19	Intermediate, Patching	Mix I-4 HD	0.44

HMA base Courses:

Layer	Suggested Lift (in)	Superpave Mix Size (mm)	Design Application	Similar to	a_1=
Superpave Hot Mix Asphalt 25L64 Base Course	3-4	25	Base, Patching	Mix I-2	0.44
Superpave Hot Mix Asphalt 25M64 Base Course	3-4	25	Base, Patching	Mix I-2	0.44
Superpave Hot Mix Asphalt 25H64 Base Course	3-4	25	Base, Patching	Mix I-2	0.44
Superpave Hot Mix Asphalt 37.5H70 Base Course	4.5-6	37.5	Base, Patching	Mix I-2	0.44

Note: Lift thickness should be not less than 3 times or more than 5 times the nominal maximum aggregate size (except for 37.5 mm)

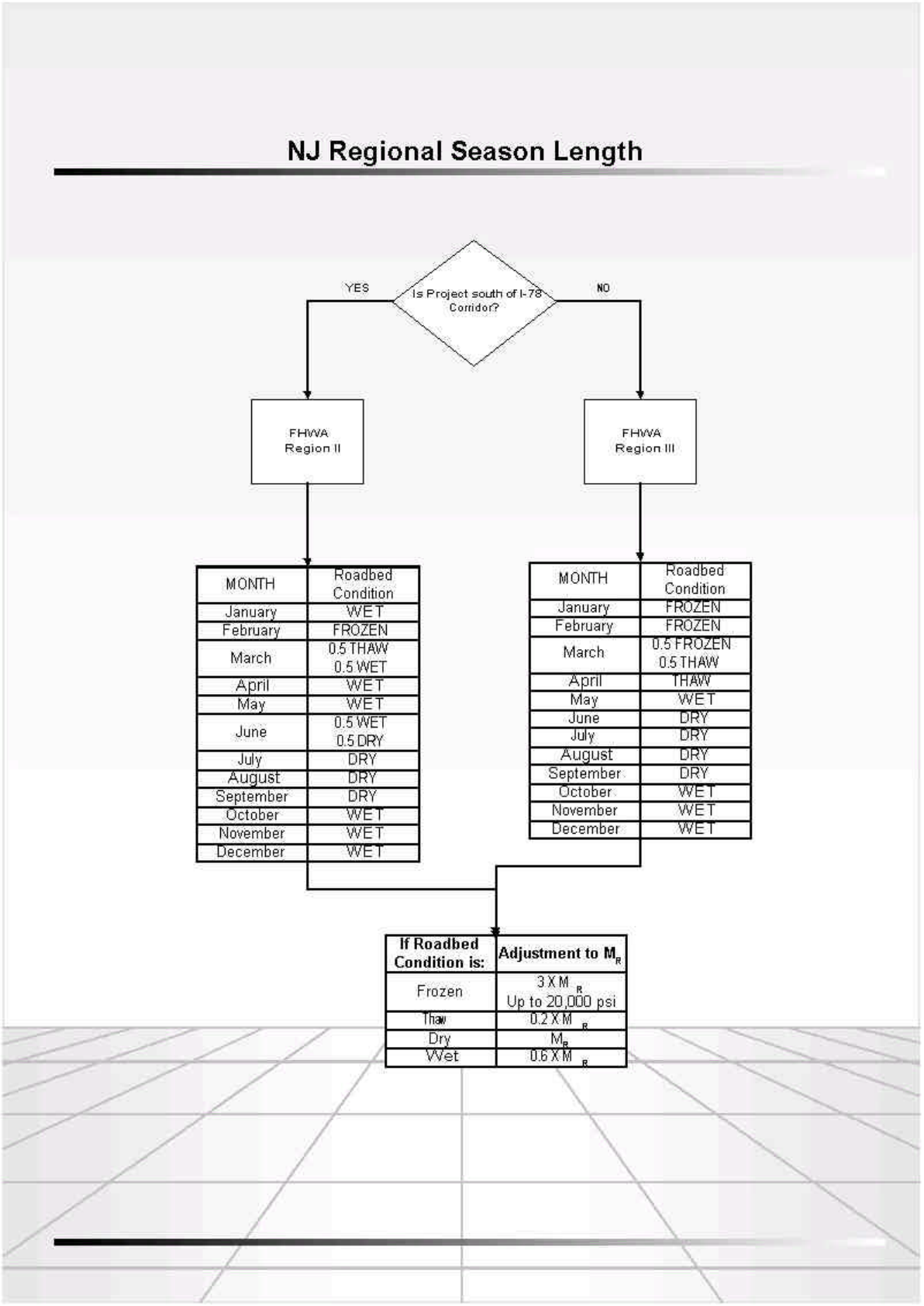


LABORATORY M_R DATA

Laboratory M_R Data

AASHTO Class	Description	New Jersey Specific Laboratory Resilient Modulus (psi)	Laboratory Resilient Modulus (psi)
Coarse-grained soils:			
A-1-a, well graded	gravel		10000-20000
A-1-a, poorly graded	gravel		10000-20000
A-1-b	coarse sand	9500-19600	6000-15000
A-3	fine sand	7500-16800	5000-12000
A-2 soils (granular materials with high fines):			
A-2-4	silty sand	7900-16500	
A-2-4	silty sand	7200-16200	
A-2-4, gravelly	silty gravel		10000-30000
A-2-5, gravelly	silty sandy gravel		10000-30000
A-2-4, sandy	silty sand		10000-20000
A-2-5, sandy	silty gravelly sand		10000-20000
A-2-6, gravelly	clayey gravel		8000-20000
A-2-7, gravelly	clayey sandy gravel		8000-20000
A-2-6, sandy	clayey sand		5000-15000
A-2-7, sandy	clayey gravelly sand		5000-15000
Fine-grained soils:			
A-4	sandy silt	7600-15900	
A-4	sandy silt	7100-16100	
A-4	silt		2000-6000
A-4	silt/sand/gravel mixture		4000-8000
A-5	poorly graded silt		2000-6000
A-6	plastic clay		2000-10000
A-7-5	moderately plastic elastic clay		2000-10000
A-7-6	highly plastic elastic clay		4000-10000

NJ REGIONAL SEASON LENGTH



MONTH	Roadbed Condition
January	WET
February	FROZEN
March	0.5 THAW 0.5 WET
April	WET
May	WET
June	0.5 WET 0.5 DRY
July	DRY
August	DRY
September	DRY
October	WET
November	WET
December	WET

MONTH	Roadbed Condition
January	FROZEN
February	FROZEN
March	0.5 FROZEN 0.5 THAW
April	THAW
May	WET
June	DRY
July	DRY
August	DRY
September	DRY
October	WET
November	WET
December	WET

If Roadbed Condition is:	Adjustment to M_R
Frozen	$3 \times M_R$ Up to 20,000 psi
Thaw	$0.2 \times M_R$
Dry	M_R
Wet	$0.6 \times M_R$

RELIABILITY, R

Use the following values for Reliability, R, unless otherwise stated by NJDOT:

For Urban Interstate and Freeways: R=95%
For Rural Interstate and Principal Arterials: R=90%
For Collectors and Local Roadways: R=85%

LABORATORY RESILIENT MODULUS AND ELASTIC K-VALUE

Recommended laboratory (ideal conditions) resilient modulus and elastic k-value ranges for various soil types

AASHTO Class	Description	Unified Class	Dry Density (lb/ft^3)	CBR (persent)	k- value (psi/in)	Lab Resilient Modulus (psi)
Coarse-grained soils:						
A-1-a, well graded	Glavel	GW,GP	125-140	60-80	300-450	10000-20000
A-1-a, poorly graded			120-130	35-60	300-400	10000-20000
A-1-b	Coarse sand	SW	110-130	20-40	200-400	6000-15000
A-3	Fine sand	SP	105-120	15-25	150-300	5000-12000
A-2 soils (granular materials with high fines):						
A-2-4, gravelly	Silty gravel	GM	130-145	40-80	300-500	10000-30000
A-2-5, gravelly	Silty sandy gravel					
A-2-4, sandy	Silty sand	SM	120-135	20-40	300-400	10000-20000
A-2-5, sandy	Silty gravelly sand					
A-2-6, gravely	Clayey gravel	GC	120-140	20-40	200-450	8000-20000
A-2-7, gravelly	Clayey sandy gravel					
A-2-6, sandy	Clayey sand	SC	105-130	10-20	150-350	5000-15000
A-2-7, sandy	Clayey gravelly sand					
Fine-grained soils:*						
A-4	Silt	ML,OL	90-105	4-8	25-165	2000-6000
	Silt/sand/gravel mixture		100-125	5-15	40-220	4000-8000
A-5	Poorly graded silt	MH	80-100	4-8	25-190	2000-6000
A-6	Plastic clay	CL	100-125	5-15	25-255	2000-10000
A-7-5	Moderately plastic elastic clay	CL,OL	90-125	4-15	25-215	2000-10000
A-7-6	Highly plastic elastic clay	CH,OH	80-110	3-5	40-220	4000-10000

* Elastic k-value and resilient modulus of fine-grained soil are highly dependent on degree of saturation.

1 lb/ft^3 = 16.018 kg/m^3, 1 psi/in = 0.271 kPa/mm

APPENDIX IMAGES FROM CD-ROM

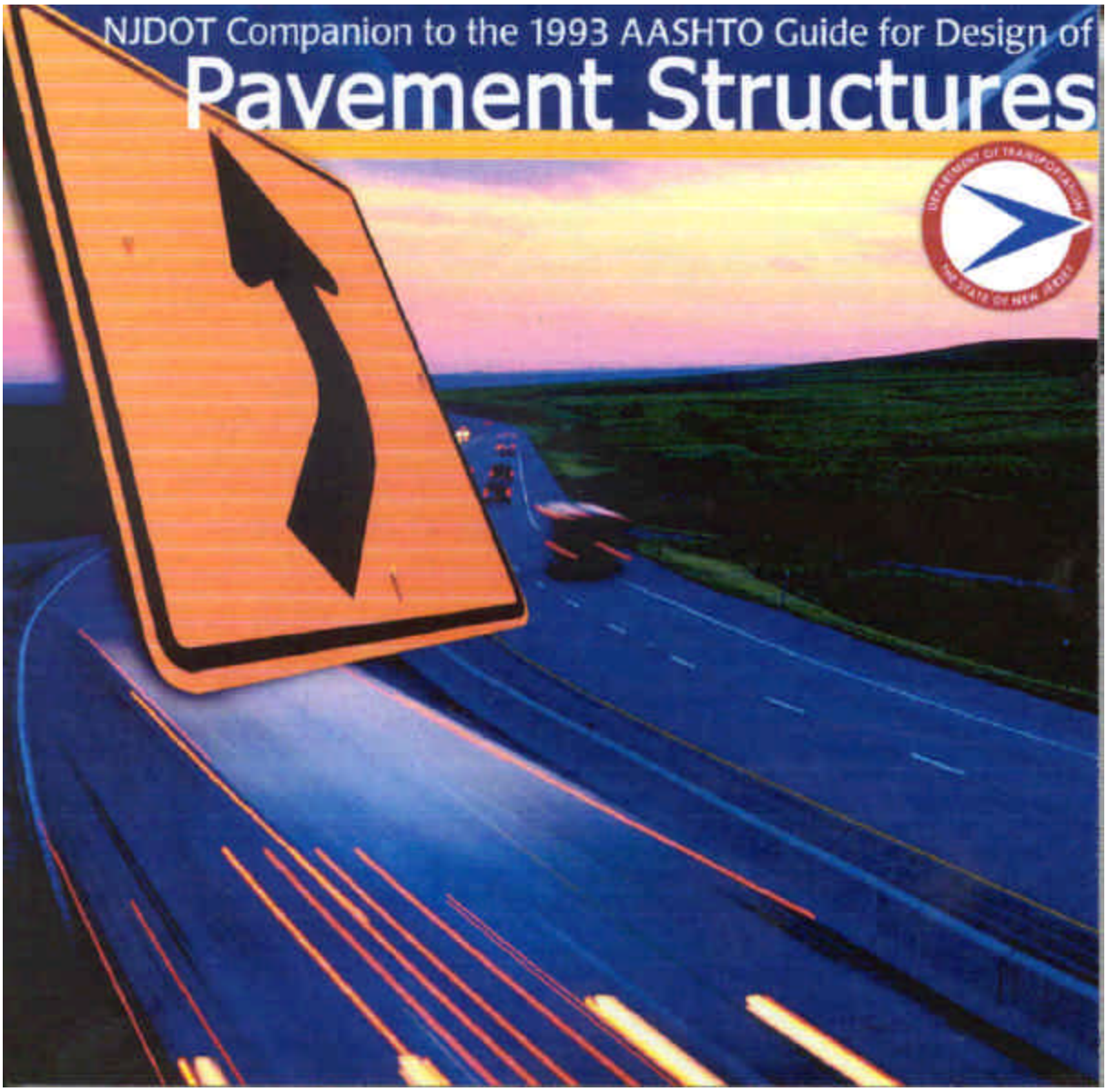


Figure 2 Cover of CD-ROM Jewel Case.

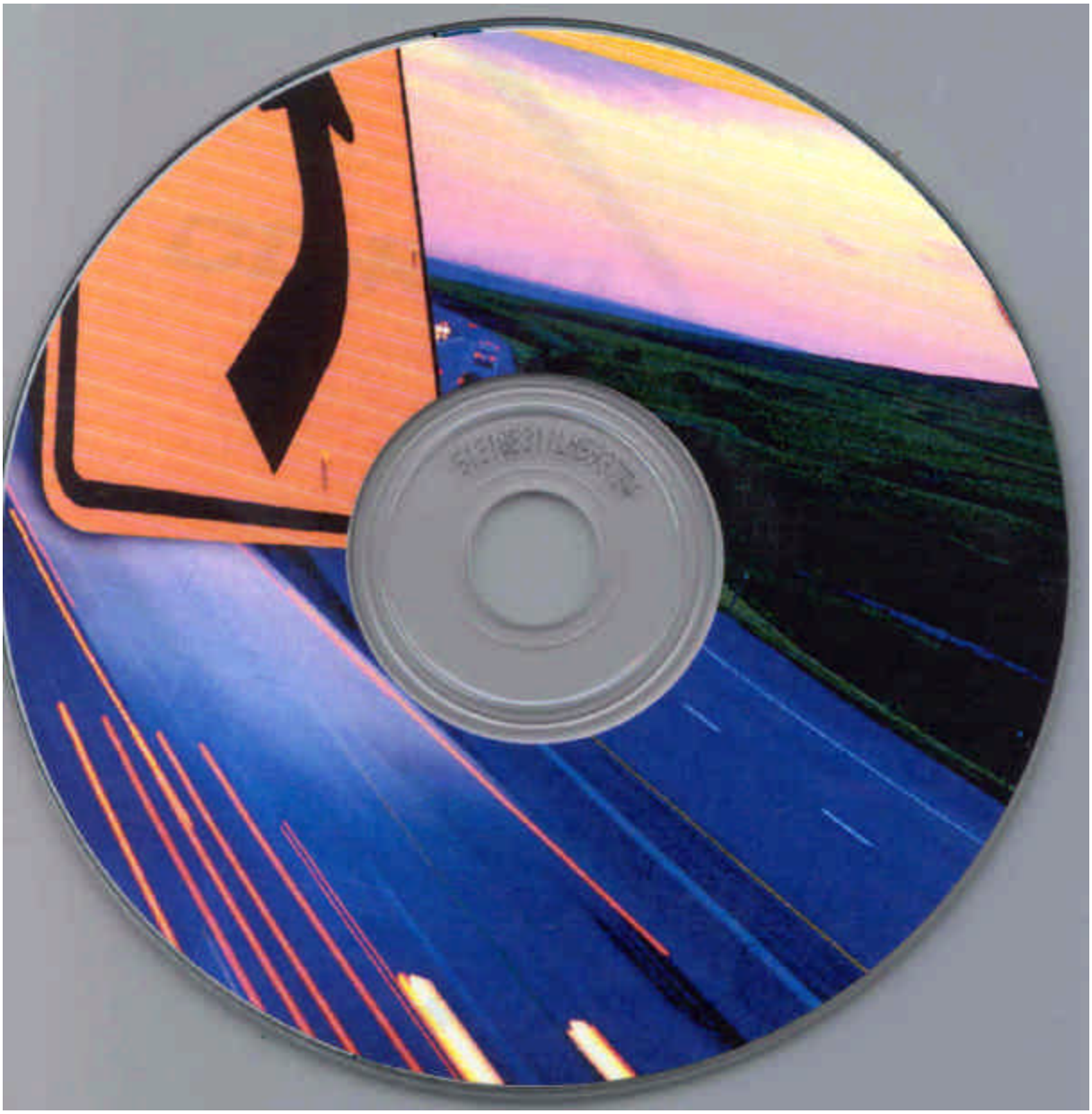


Figure 3 Label on CD-ROM.

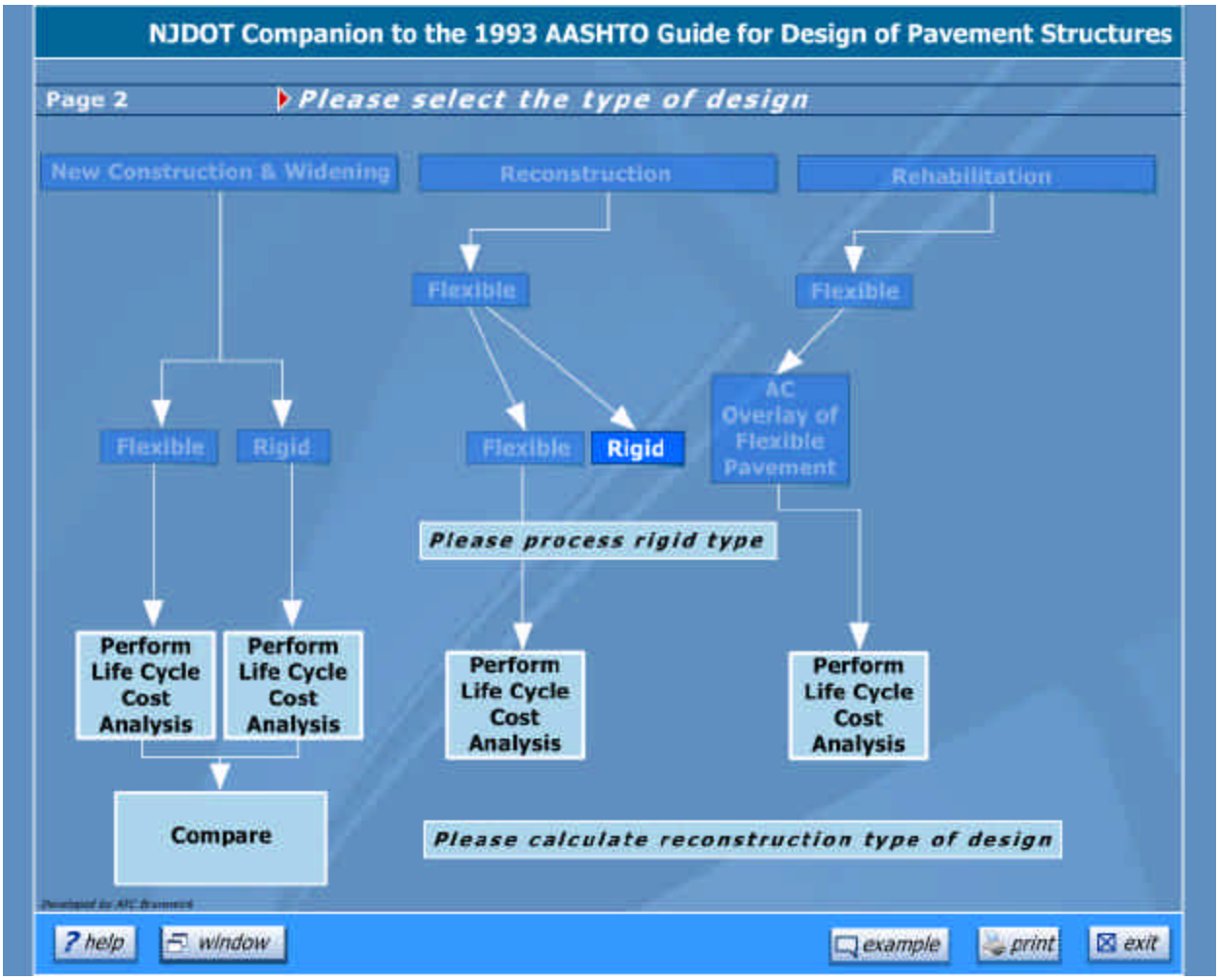


Figure 4 Opening Navigation Screen (interactive menu to guide the pavement engineer through the design process).

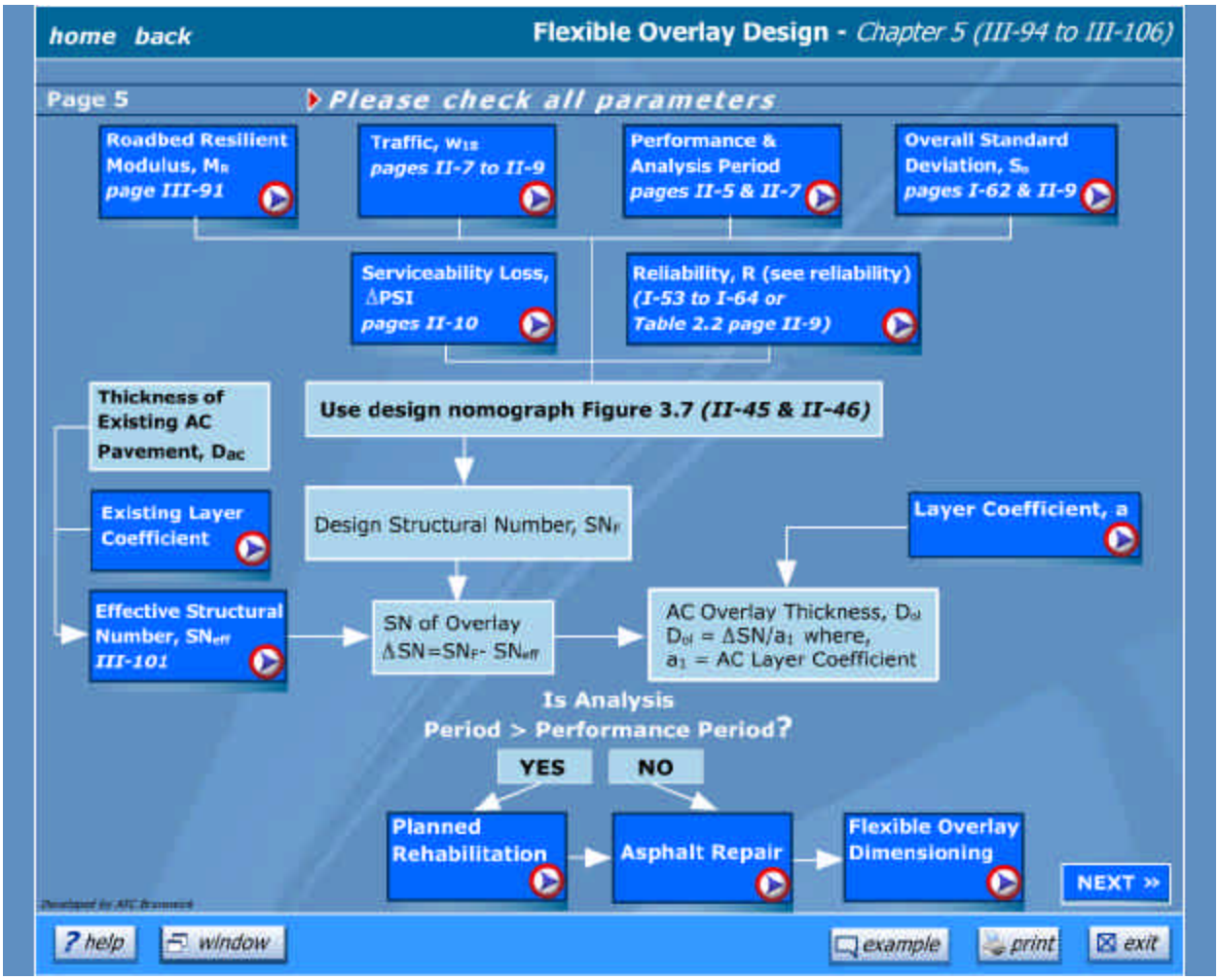


Figure 5 Submodule, the boxes with the NJDOT logo in the right corner have additional New Jersey-specific information (NJ parameters can be obtained by clicking on the box with the NJDOT logos).

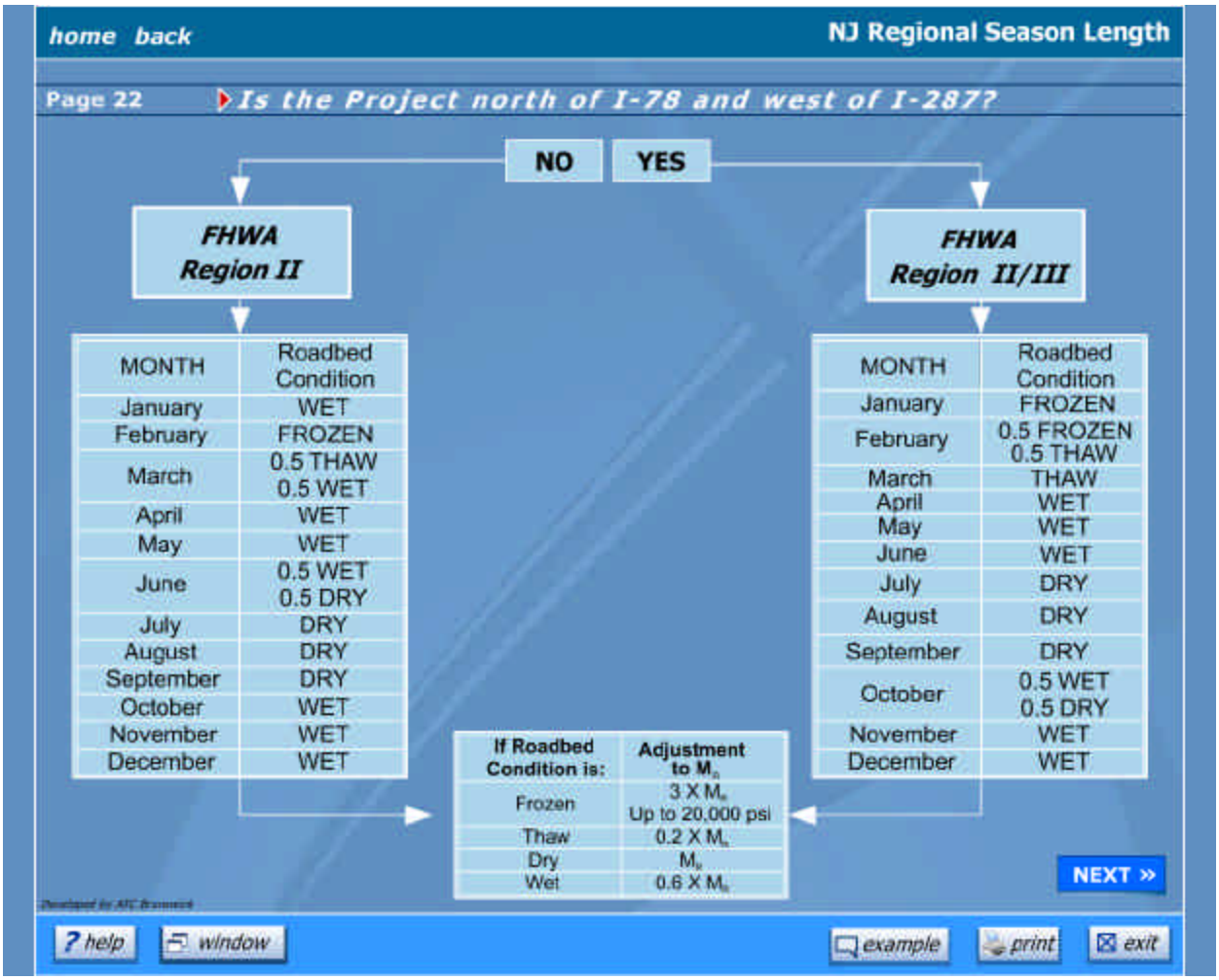
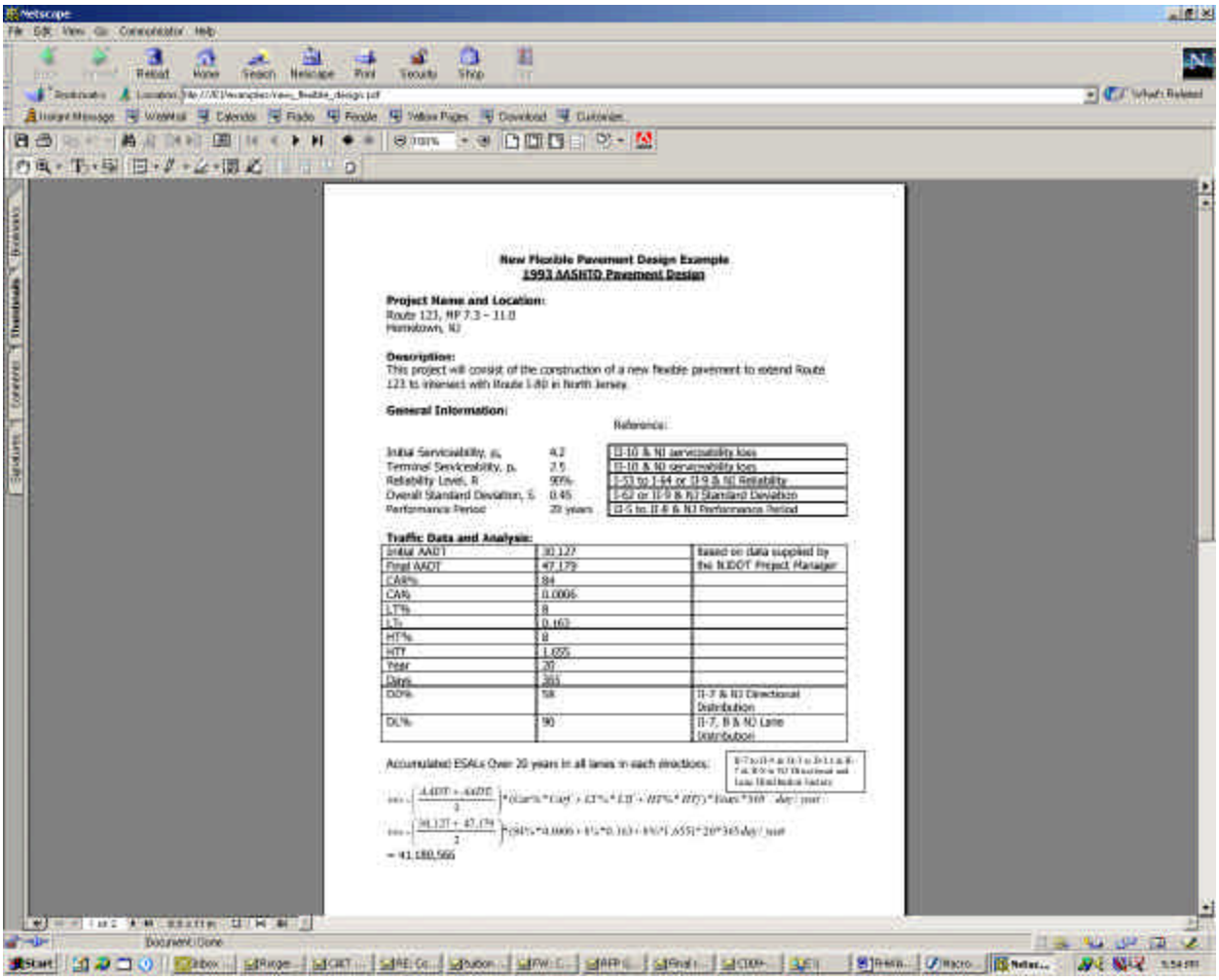


Figure 6 New Jersey-specific parameters (note how the information is dislayed based on whether the project is “north of I-78 and west of I-287).



New Flexible Pavement Design Example

1993 AASHTO Pavement Design

Project Name and Location:
Route 123, MP 7.3 - 11.0
Hometown, NJ

Description:
This project will consist of the construction of a new flexible pavement to extend Route 123 to intersect with Route I-80 in North Jersey.

General Information:

		Reference:
Initial Serviceability, p_o	4.2	II-10 & NJ serviceability loss
Terminal Serviceability, p_t	2.5	II-10 & NJ serviceability loss
Reliability Level, R	90%	I-53 to I-54 or II-9 & NJ Reliability
Overall Standard Deviation, S	0.45	I-62 or II-9 & NJ Standard Deviation
Performance Period	20 years	II-5 to II-6 & NJ Performance Period

Traffic Data and Analysis:

Initial AADT	30,127	Based on data supplied by the NJDOT Project Manager
Final AADT	47,179	
CAR%	84	
CAR	0.0006	
LT%	8	
LT	0.163	
HT%	8	
HT	1.655	
Year	20	
Days	365	
DD%	58	II-7 & NJ Directional Distribution
DL%	90	II-7, 8 & NJ Lane Distribution

Accumulated ESALs Over 20 years in all lanes in each directions:

$$= 41,180,566$$