FDOT

SR 400 (I-4) Project Development and Environment (PD&E) Study
FM No.: 432100-1-22-01

Pavement Type Selection Report

INTERSTATE 4 BEYOND the ULTIMATE

Segment 4: East of US 17/92 to East of SR 472 – Volusia County, Florida

July 18, 2014

HNTB Corporation
610 Crescent Executive Court
Suite 400
Lake Mary, FL 32746

4 EXPRESS

Pavement Type Selection Report

SR 400 (I-4) Project Development and Environment (PD&E) Study

Segment 4: East of US 17/92 to East of SR 472

Volusia County, Florida

Contract Number:
Financial ID Number: 432100-1-22-01
Federal Aid Project Number: 0041 227 1

Prepared For
Florida Department of Transportation
District 5
DeLand, Florida

July 18, 2014

ROBERT M. DENNEY
LICENSE
No. 58593
STATE OF FLORIDA
PROFESSIONAL ENGINEER

Prepared by:

Robert Denney, PE — Date
PE No. 58593 — 7/18/2014

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Concurrence by:

Annette K. Brennan, PE — Date
District Design Engineer, District 5

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1.0 INTRODUCTION

The Florida Department of Transportation (FDOT) is proposing to reconstruct and widen I-4 as part of the I-4 Ultimate concept. This involves the build-out of I-4 to its ultimate condition through Central Florida, including segments in Polk, Osceola, Orange, Seminole and Volusia Counties. The concept design proposes the addition of two new express lanes in each direction within the center median of I-4, resulting in the reconstruction of the existing six-lane divided urban interstate to a ten-lane divided highway. The roadway improvements also include reconstruction of 19 local service interchanges and three systems interchanges.

The SR 400 (I-4) Project Development and Environment (PD&E) Study is a reevaluation project which addresses the revision from the original design concept showing two High Occupancy Vehicle (HOV) lanes, as recommended in the Environmental Impact Statement (EIS) for I-4 from SR 528 to SR 472, to the current proposed design concept of four Express Lanes. The Express Lanes are tolled lanes and will extend the full length of the project. The proposed typical section will include three general use lanes, two express lanes, an auxiliary lane (in some areas) and shoulders in each direction, with provision for a 44' rail corridor in the center median from US 27 to SR 528. The express lanes and general use lanes will be separated by two 10- or 12- foot shoulders with a barrier wall in between the shoulders.

The overall SR 400 (I-4) PD&E project limits include a total of approximately 41 miles of roadway improvements divided into two sections east and west of the I-4 Ultimate project. The approximate limits of improvement for the west section are from US 27 in Polk County to west of SR 435 (Kirkman Road) in Orange County and for the east section, from east of SR 434 in Seminole County to east of SR 472 in Volusia County. For purposes of documentation of the SR 400 (I-4) PD&E study, the east and west sections are further subdivided into segments as shown in Table 1.

Table 1: SR 400 (I-4) PD&E Segment Limits

SR 400 (I-4) PD&E West Section	
Segment 1	CR 532 (Osceola/Polk County Line) to W. of SR 528 (Beachline Expressway) in Osceola and Orange Counties (13.5 miles)
Segment 2	W. of SR 528 (Beachline Expressway) to W. of SR 435 (Kirkman Road) in Orange County (3.6 miles)
Segment 5	US 27 to CR 532 (Osceola/Polk County Line) in Polk County (3.2 miles)
SR 400 (I-4) PD&E East Section	
Segment 3	E. of SR 434 to E. of US 17/92 in Seminole County (10.2 miles)
Segment 4	E. of US 17/92 to E. of SR 472 in Volusia County (10.1 miles)

The majority of the proposed improvements (37.4 miles) are within District 5 and a small segment (3.2 miles) is within District 1. The entire corridor is part of the state's Strategic Intermodal System (SIS).

As part of the SR 400 (I-4) PD&E Study, HNTB has prepared this Pavement Type Selection Report for I-4, Segment 4 (East of US 17/92 to East of SR 472) in Volusia County; a project location map is provided in Figure 1. The purpose of this report is to analyze, compare and select the most feasible pavement type for this project, utilizing the methods of the 1993 American Association of State Highway and Transportation Officials (AASHTO) Guide for Design of Pavement Structures, adopted by FDOT and described in detail in the FDOT Pavement Type Selection Manual (October, 2013).

2.0 PRINCIPAL FACTORS

2.1 Traffic

Pavement design for new alignment and reconstruction projects requires a structural loading forecast of the 18-KIP Equivalent Single Axle Load (ESAL). The accumulated 18-KIP ESALs are used to determine the Structural Number Required (SN_R) for flexible pavement and the Depth Required (D) for rigid pavement. While the total traffic volume is the main factor in determining roadway geometrics, the percent of commercial traffic and heavy load applications are the major influences in the structural pavement design. The I-4, Segment 4 corridor within the project area is expected to be utilized by local traffic and through traffic. To determine the ESALs for this project, traffic data was obtained from *the I-4 SAMR Update: Design Traffic Technical Memorandum (January, 2013)*. Based on this memo, truck traffic percentages for the Segment 4 corridor range from 7.70 to 11.00 for year 2011. The truck factors for 2011 were reviewed for consistency by evaluating historical data provided by the FDOT Florida Traffic Online database. Based on these considerations, this project utilizes anticipated 24-hour truck traffic of 11.00% and a 20-year design. The future traffic volume projections used in the analysis are summarized in Table 2.

Table 2: Future Traffic Projections

	Year	AADT
Opening Year	2020	115,000
Mid-Design Year	2030	128,800
Design Year	2040	142,700

The 18-KIP ESAL for the roadway is 24,720,000 for flexible pavement and 34,877,000 for rigid pavement. Based on this information, either asphaltic concrete (AC) or Portland cement concrete (PCC) pavement would be sufficient. Traffic information and ESAL calculations are provided in Appendix A.

Figure 1: Project Location Map

2.2 Soil Characteristics

Geotechnical data near the study area was available from the I-4 (SR 400) widening and rehabilitation project, FPID: 408463-1-52-01. This project is located immediately north of the I-4, Segment 4 project and included pavement design data and calculations for the I-4/SR 400 mainline. The design value for the Resilient Modulus (M_R), which indicates the stiffness or strength of the roadbed soil, was 9000 psi for the widening portion of the project. This M_R value was used in preparing the PTSR for the I-4, Segment 4 project. The pavement design summary sheet from the S.R. 400 (I-4), FPID: 408463-1-52-01 project is included in Appendix B.

2.3 Weather

High rainfall intensities are experienced in Florida during portions of the year. These rainfall conditions are expected to equally affect subsoil conditions for both flexible and rigid pavements; thus, the weather does not favor the placement of one type of pavement over the other. Additionally, cross slopes are designed to drain water off the pavement, and drainable base and edge drains were considered in the economic analysis to ensure the runoff would not negatively impact the concrete pavement. Therefore, either AC or PCC pavement type could be constructed with satisfactory wet weather performance and durability.

2.4 Construction Considerations

The interstate will be completely reconstructed. Staged construction will be necessary for either rigid or flexible type of pavement. The available right-of-way will allow for either type to be constructed satisfactorily.

2.5 Recycling

The existing roadway pavement is to be completely reconstructed; therefore, there is an opportunity to recycle the existing asphalt pavement in the initial construction. FDOT has successfully recycled rigid and flexible pavement, therefore, there are future recycling opportunities for both pavement types during rehabilitation of the pavements.

3.0 ECONOMIC ANALYSIS

The present worth method will be used to evaluate the cost of flexible pavement versus rigid pavement. All capital outlays for each alternative, including rehabilitation costs, are converted into today's dollars to compare the alternatives.

3.1 Basis of Comparison

The analysis will be based on the following assumptions:

Analysis Period: 40 years
Initial Pavement Design Life: 20 years
Discount Rate: 3.5%

The following baseline rehabilitation strategies were considered, as recommended in the *Pavement Type Selection Manual (October 2013)* for concrete pavement and from supporting data for lifecycles of asphalt pavement in Volusia County:

Concrete Pavement – Limited Access (Mainline & Shoulder)
23 Year – Concrete Pavement Rehabilitation (3% Slab Replacement)*
33 Year – Concrete Pavement Rehabilitation (5% Slab Replacement)*
*Estimate is based on the percentage of slab area in the truck lane

Asphalt Pavement - Limited Access (Mainline & Shoulder)
14 Year – Mill 3 inches
4" Structural Asphaltic Concrete
28 Year – Mill 3 inches
4" Structural Asphaltic Concrete

3.2 Pavement Data

The initial pavement designs developed for this analysis for both rigid and flexible pavement were based on the following geometry:

# of Lanes=10 (3 GUL+2 SUL in each direction)
Lane Width=12 feet
GUL: Inside Shoulder Width=12 feet, Outside Shoulder Width=12 feet
SUL: Inside Shoulder Width=6 feet, Outside Shoulder Width=10 feet
Note: GUL = general use lane, SUL = special use lane

The typical section used for this analysis is provided in Appendix C and the pavement design calculations are provided in Appendix D.

Rigid Pavement - This pavement design has been prepared in accordance with the most recent Rigid Pavement Design Manual (RPDM) (FDOT Document No. 625-010-006-e, January, 2009). This

project is located in Volusia County. Using the Mechanistic-Empirical Pavement Design Guide (MEPDG) Design Tables, the slab thickness should be 12".

Rigid Pavement Design Parameters
18-KIP ESAL=34,877,000
Modulus of Subgrade Reaction (K_G)=200 pci
Reliability (%R)=90%

Mainline
12" Concrete Depth
4" Optional Base Group 1 (Type B-12.5 Only)
12" Type B Stabilization

Shoulder
1.5" Type SP Structural Course (Traffic B)
Optional Base Group 8 (9.5" LBR 100)
12" Type B Stabilization

Asphalt Pavement - This pavement design has been prepared in accordance with the most recent Flexible Pavement Design Manual (FPDM) (FDOT Document No. 625-010-002-g, March, 2008).

Flexible Pavement Design Parameters
18-KIP ESAL=24,720,000 (Traffic Level D)
18-KIP ESAL for shoulders=3% of mainline=741,600 (Traffic Level B)
Resilient Modulus (M_R)=9,000 psi
Reliability (%R)=90%

Mainline
SN_R =5.31
0.75" Friction Course FC-5 (PG76-22) (Not included in the Life Cycle Cost Analysis)
2" Type SP Structural Course (Traffic D) (PG76-22)
3" Type SP Structural Course (Traffic D)
Optional Base Group 12 (12.5" Limerock, LBR 100)
12" Type B Stabilization
SN_C =5.41

Shoulder
SN_R=3.08
1.5" Type SP Structural Course (Traffic B)
Optional Base Group 8 (9.5" LBR 100)
12" Type B Stabilization
SN_C=3.33

3.3 Cost Data for Economic Analysis

The unit prices used for this economic analysis are weighted averages obtained from FDOT's statewide item average unit costs from 03/01/2013 to 02/28/2014, current 12-month moving area averages for Area 6 (Alachua, Marion and Volusia Counties) and/or from D5 estimates provided by FDOT. The unit costs used are provided in Appendix E and are summarized in Table 3.

Table 3: Pavement Unit Prices

Item	Price	Unit
Type B Stabilized (LBR 40)	$3.25	Sq. Yd
OBG-1, Type B-12.5	$9.42	Sq. Yd
OBG-8	$14.64	Sq. Yd
OBG-12	$15.00	Sq. Yd
Milling 1" Avg. Depth	$2.24	Sq. Yd
Milling 3" Avg. Depth	$1.17	Sq. Yd
Type SP Traffic Level B	$85.00	Ton
Type SP Traffic Level D	$85.00	Ton
Type SP Traffic Level D PG76-22	$92.00	Ton
JPCP	$55.00	Sq. Yd
CPR - Slab Replacement (3%)	$400.00	Cu. Yd
CPR - Slab Replacement (5%)	$400.00	Cu. Yd
Edgedrain (Draincrete)	$26.72	Ft
Edgedrain Outlet Pipe (4 in)	$30.67	Ft

Source: FDOT 12 month moving statewide averages, 12-month moving area averages for Area 6 and FDOT - D5 estimates.

3.4 Cost Comparison

A life cycle economic analysis per mile of concrete pavement and asphalt pavement was performed using an analysis period of 40 years and a discount rate of 3.5%. Based on the life cycle cost analysis, the total present worth costs for concrete pavement is $6,935,327 and for flexible pavement, $6,034,332. The results of the analysis are summarized in Table 4. The details of the analysis are included in Appendix E.

4.0 SECONDARY FACTORS

4.1 Performance of similar pavements in the area

The existing pavement sections, west and east of the I-4 Segment 4 section are both constructed with AC pavement. In general, these sections have not experienced any areas of premature distress and maintenance resurfacing is not excessively disruptive. The average age to

rehabilitation for flexible pavements in Volusia County was reviewed. The average age to rehabilitation over the last 8 years in Volusia County ranged from 11.4 years to 17.5 years. In addition, the average age to rehabilitation for flexible pavements in Seminole County was also reviewed. The average age to rehabilitation over the 8-year period ending in 2013 for Seminole County ranged from 12.8 years to 22.1 years.

Table 4: Pavement Type Selection Economic Analysis

Concrete Pavement (PCC)

			Cost		P / F		PRESENT WORTH
	Initial	2020	$6,413,778	*	1.00000	=	$6,413,778
23	Year	2043	$590,219	*	0.45329	=	$267,538
33	Year	2053	$790,468	*	0.32134	=	$254,011
					TOTAL AGENCY COSTS	**=**	**$6,935,327**
					USER COSTS	**=**	**N/A**
					SALVAGE VALUE	**=**	**N/A**
					TOTAL PRESENT WORTH LIFE-CYCLE COSTS	**=**	**$6,935,327**

Asphalt Pavement (AC)

			Cost		P / F		PRESENT WORTH
	Initial	2020	$4,130,309	*	1.00000	=	$4,130,309
14	Year	2034	$1,976,451	*	0.61778	=	$1,221,015
28	Year	2048	$1,976,451	*	0.38165	=	$754,321
					TOTAL AGENCY COSTS	**=**	**$6,105,646**
					USER COSTS	**=**	**N/A**
					SALVAGE VALUE	**=**	**$71,314**
					TOTAL PRESENT WORTH LIFE-CYCLE COSTS	**=**	**$6,034,332**

Performance of concrete pavement in Central Florida was also reviewed. In the Orlando area within Orange County, concrete pavement was originally constructed on I-4 through the downtown area. This concrete pavement section has been in service for approximately 50 years and has undergone two major rehabilitations. Other concrete pavement sections in the Central Florida region were reviewed, including the average age to rehabilitation for concrete pavement in Hillsborough County. This data showed that over a 3 year period between 2006 and 2008, the average age for the rehabilitation cycle for these pavements within Hillsborough County were 20 years, 25 years and 22 years. Pavement performance and rehabilitation data is provided in Appendix F.

4.2 Adjacent Existing Pavements

The existing roadway sections, adjacent to the I-4 Segment 4 section are both constructed with flexible pavements. In addition, recent widening and rehabilitation projects throughout the corridor have been constructed with flexible pavement. The I-4, Segment 3 section, immediately west of Segment 4, is currently being evaluated for pavement type selection as part of the SR 400 (I-4) PD&E study.

4.3 Conservation of Materials and Energy

There are no significant differences in the energy consumption used to produce, transport or construct either type of pavement.

4.4 Availability of Local Materials or Contractor Capabilities

Materials are available locally for both pavement types. However, the majority of contractors in the Central Florida region are more familiar with asphalt pavement, since it is more commonly used in roadway projects in the area. FDOT District 5 also has prequalified contractors that have experience placing concrete pavement on major projects. Neither of the pavement types uses materials that are particularly scarce in Central Florida.

4.5 Traffic Safety

Current FDOT design guidelines and specifications for both the AC pavement and PCC pavement alternatives provide similar characteristics for wearing course, delineation through pavement and shoulder contrast, reflectivity under highway lighting and the maintenance of a nonskid surface.

4.6 Incorporation of Experimental Features

There are no experimental features included in this pavement type selection report.

4.7 Stimulation of Competition

Stimulation of competition is encouraged to avoid monopoly situations and improve products and methods in the projection of paving products. However, neither pavement type currently indicates a distinct advantage to provide more stimulation of competition over the other.

4.8 Municipal Preference, Participating Local Government Preference, and Recognition of Local Industry

No preferences apparent for pavement type by FDOT, which will be maintaining and operating this roadway facility.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the preceding life cycle cost analysis and considering all other design factors evaluated in this report, AC pavement has a long term owner's cost advantage of 13%. Therefore, it is recommended that asphalt pavement be considered as the pavement type for the SR 400 (I-4) Segment 4 corridor.

APPENDICES

APPENDIX A

TRAFFIC INFORMATION

FLORIDA DEPARTMENT OF TRANSPORTATION
TRANSPORTATION STATISTICS OFFICE
2012 HISTORICAL AADT REPORT

COUNTY: 79 - VOLUSIA

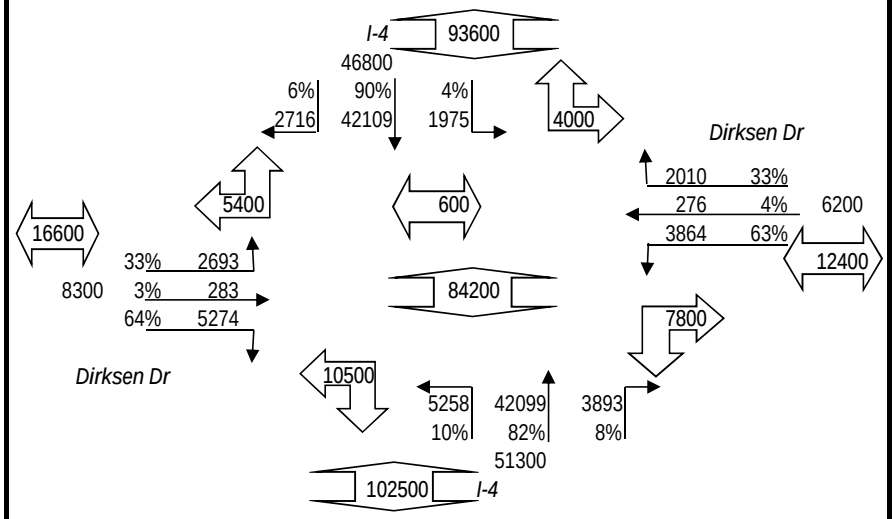
SITE: 0484 - ON I-4, 0.337 MI E. OF ST. JOHNS RIVER BRIDGE (ITS)

YEAR	AADT	DIRECTION 1	DIRECTION 2	*K FACTOR	D FACTOR	T FACTOR
2012	106500 C	E 53000	W 53500	9.00	54.00	11.10
2011	102500 C	E 51500	W 51000	9.00	54.30	11.00
2010	111500 C	E 56000	W 55500	8.65	53.65	11.70
2009	107500 C	E 53500	W 54000	8.67	54.57	11.70
2008	115000 T	E 58000	W 57000	8.60	54.07	13.30
2007	118500 S	E 59500	W 59000	8.30	56.39	10.80
2006	115500 F	E 58000	W 57500	8.32	52.47	14.30
2005	111500 C	E 56000	W 55500	8.40	52.60	7.10
2004	47000 C	E 25000	W 22000	8.50	51.90	9.80
2001	84000 E	E 42000	W 42000	11.20	56.30	7.60
2000	84000 C	E 42000	W 42000	11.40	56.50	10.00
1999	65500 C	E 35000	W 30500	11.00	57.00	18.40
1998	86000 C	E 43000	W 43000	12.00	55.30	20.50
1997	74800 E	E 35200	W 39600	11.90	53.90	7.30

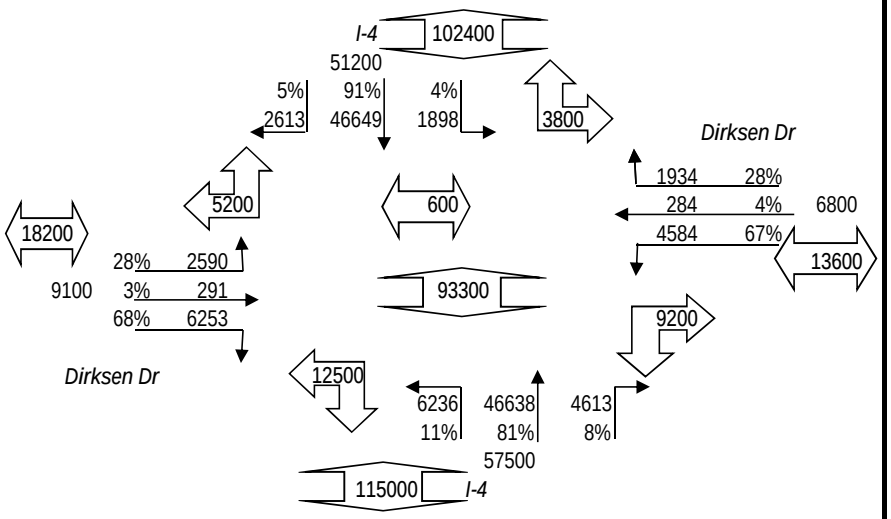
AADT FLAGS: C = COMPUTED; E = MANUAL ESTIMATE; F = FIRST YEAR ESTIMATE
S = SECOND YEAR ESTIMATE; T = THIRD YEAR ESTIMATE; X = UNKNOWN
*K FACTOR: STARTING WITH YEAR 2011 IS STANDARDK, PRIOR YEARS ARE K30 VALUES

PROJECT TRAFFIC FOR I-4 AT Dirksen Dr: TO

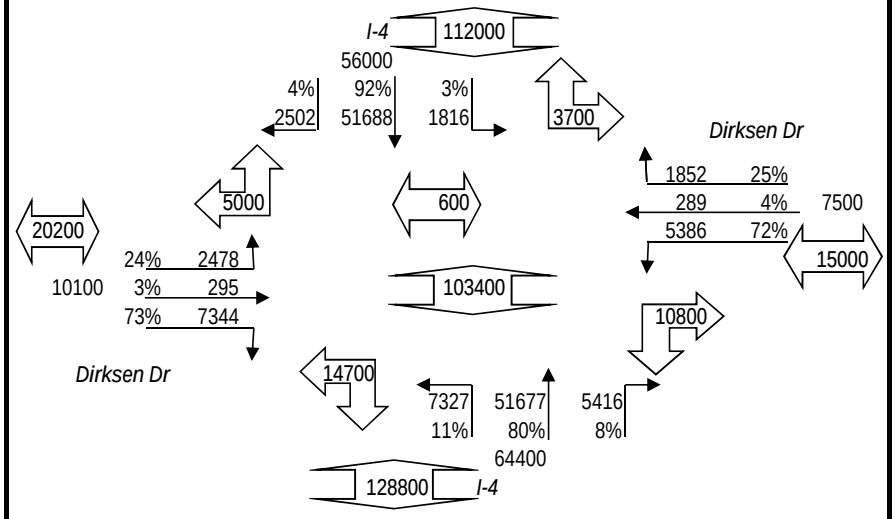
2-WAY AADT TURNING MOVEMENTS IN YEAR 2011



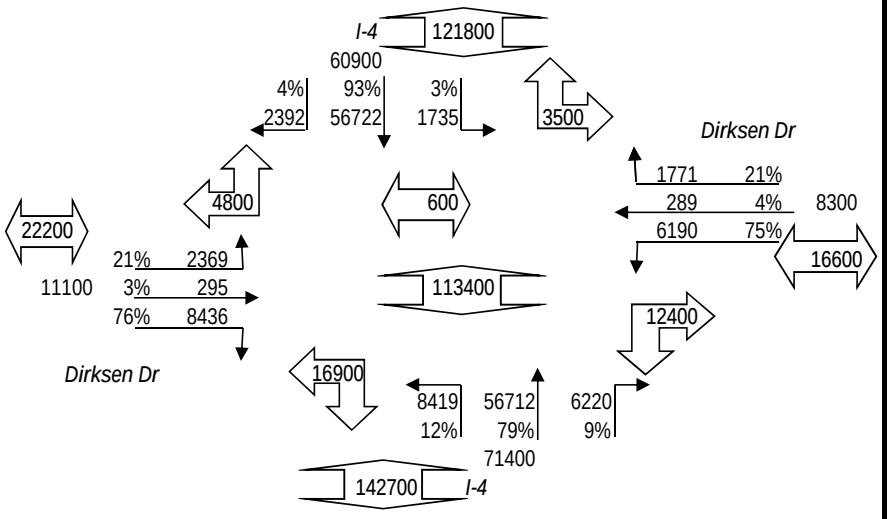
2-WAY AADT TURNING MOVEMENTS IN YEAR 2020



2-WAY AADT TURNING MOVEMENTS IN YEAR 2030



2-WAY AADT TURNING MOVEMENTS IN YEAR 2040



18 kip EQUIVALENT SINGLE AXLE LOAD ANALYSIS

PROJECT TRAFFIC FOR PD&E and DESIGN ANALYSIS INFO / FACTORS

SECTION #: 771190000
SEGMENT #: ML
ITEM #: 0
PROJECT DESCRIPTION: SR 400 (I-4) - S. of Dirksen Drive

LOCATION #: 1

LOCATION DESCRIPTION: Mainline

GROWTH RATE FORMULA

A: Interpolation
B: Enter Growth Rate
C: Enter All AADTs
D: New Facility

If "A" select an interpolation function
If "B" enter rate as decimals (1%=1.01)
If ""C", or "D" continue to next section

Choose A, B, C, or D here: C

Linear Growth Rate ____ %
Compounded Growth Rate ____ %
Decaying Growth Rate ____ %
(select one)

DESIGN INFORMATION

		AADT
Existing Year	2011	102500
Opening Year	2020	115000
Mid-Design Year	2030	128800
Design Year	2040	142700

Daily Direction Split (50% or 100%): 50%
Lanes in One Direction: 3

T24 values
Existing to Opening Year: 11.00%
Opening to Mid-Year: 11.00%
Mid-Year to Design-Year: 11.00%

1995 EQUIVALENCY FACTORS |u(1)|

(selected with an X)	FLEXIBLE PAVEMENT SN = 5/THICK		RIGID PAVEMENT SN = 12/THICK	
RURAL FREEWAY:	1.050		1.600	
URBAN FREEWAY:	0.900	X	1.270	X
RURAL HIGHWAY:	0.960		1.350	
URBAN HIGHWAY:	0.890		1.220	
OTHER (Enter Factor and X):				

(1) Equivalency Factors are based on Updated Pavement Damage Factors Memorandum, dated July 2, 1998.
Lane Factors developed by Copes equation

I have reviewed the 18 kip Equivalent Single Axle Loads (ESAL's) to be used for pavement design on this project. I hereby attest that these have been developed in accordance with the FDOT Project Traffic Forecasting Procedure using historical traffic data and other available information.

ROBERT M. DENNEY — LICENSED BY — No. 58593 — STATE OF FLORIDA — PROFESSIONAL ENGINEER

Prepared by: HNTB — 610 Crescent Executive Ct, Suite 400, Lake Mary, FL 32746 — Robert Denney, PE — 4/7/2014
Org. Unit or Firm — Name — Date

Signature

Reviewed by: Mark Robinson, PE — District 5 Design — FDOT - D5
Name — Title — Org. Unit or Firm — Date

Signature

18 kip EQUIVALENT SINGLE AXLE LOAD ANALYSIS - LOCATION 1

PROJECT TRAFFIC FOR PD&E and DESIGN ANALYSIS INFO / FACTORS

YEARS: *2011 to 2040*

SECTION #: 771190000 **SEGMENT #:** ML **ITEM #:** 0

FLEXIBLE PAVEMENT URBAN FREEWAY 0.900

SN=5/THICK SR 400 (I-4) - S. of Dirksen Drive C

YEAR	AADT	ESAL (1000S)	ACCUM (1000s)	D	T	LF	EF
2011	102500	1015	0	0.5	11.00%	0.548	0.900
2012	103800	1025	0	0.5	11.00%	0.547	0.900
2013	105200	1037	0	0.5	11.00%	0.545	0.900
2014	106600	1049	0	0.5	11.00%	0.544	0.900
2015	108000	1061	0	0.5	11.00%	0.543	0.900
2016	109400	1072	0	0.5	11.00%	0.542	0.900
2017	110800	1084	0	0.5	11.00%	0.541	0.900
2018	112200	1095	0	0.5	11.00%	0.540	0.900
2019	113600	1107	0	0.5	11.00%	0.539	0.900
2020	115000	1118	1118	0.5	11.00%	0.538	0.900
2021	116300	1129	2247	0.5	11.00%	0.537	0.900
2022	117700	1141	3388	0.5	11.00%	0.536	0.900
2023	119100	1152	4540	0.5	11.00%	0.535	0.900
2024	120500	1164	5704	0.5	11.00%	0.534	0.900
2025	121900	1175	6879	0.5	11.00%	0.533	0.900
2026	123200	1186	8065	0.5	11.00%	0.532	0.900
2027	124600	1197	9262	0.5	11.00%	0.531	0.900
2028	126000	1208	10470	0.5	11.00%	0.531	0.900
2029	127400	1220	11690	0.5	11.00%	0.530	0.900
2030	128800	1231	12921	0.5	11.00%	0.529	0.900
2031	130100	1241	14162	0.5	11.00%	0.528	0.900
2032	131500	1253	15415	0.5	11.00%	0.527	0.900
2033	132900	1264	16679	0.5	11.00%	0.526	0.900
2034	134300	1275	17954	0.5	11.00%	0.525	0.900
2035	135700	1286	19240	0.5	11.00%	0.524	0.900
2036	137100	1297	20537	0.5	11.00%	0.524	0.900
2037	138500	1308	21845	0.5	11.00%	0.523	0.900
2038	139900	1320	23165	0.5	11.00%	0.522	0.900
2039	141300	1331	24496	0.5	11.00%	0.521	0.900
2040	142700	1342	25838	0.5	11.00%	0.520	0.900

Opening to Mid Design Year ESAL Accumulation (1000s): 11803

Opening to Design Year ESAL Accumulation (1000s): 24720

I have reviewed the 18 kip Equivalent Single Axle Loads (ESAL's) to be used for pavement design on this project. I hereby attest that these have been developed in accordance with the FDOT Project historical traffic data and other available information.

Prepared by: HNTB 610 Crescent Executive Ct, Suite 400 Lake Mary, FL 32746 Robert Denney, PE 4/7/2014

Org. Unit or Firm Name Date

Signature

Reviewed by: Mark Robinson, PE District 5 Design FDOT - D5

Name Title Org.Unit or Firm Date

Signature

ROBERT M. DENNEY LICENSE KY No. 28193 STATE OF FLORIDA PROFESSIONAL ENGINEER

18 kip EQUIVALENT SINGLE AXLE LOAD ANALYSIS - LOCATION 1

PROJECT TRAFFIC FOR PD&E and DESIGN ANALYSIS INFO / FACTORS

YEARS: *2011 to 2040*

SECTION #: 771190000 **SEGMENT #:** ML **ITEM #:** 0

RIGID PAVEMENT URBAN FREEWAY 1.270

SN=12/THICK SR 400 (I-4) - S. of Dirksen Drive C

YEAR	AADT	ESAL (1000S)	ACCUM (1000s)	D	T	LF	EF
2011	102500	1431	0	0.5	11.00%	0.548	1.270
2012	103800	1447	0	0.5	11.00%	0.547	1.270
2013	105200	1463	0	0.5	11.00%	0.545	1.270
2014	106600	1480	0	0.5	11.00%	0.544	1.270
2015	108000	1496	0	0.5	11.00%	0.543	1.270
2016	109400	1513	0	0.5	11.00%	0.542	1.270
2017	110800	1529	0	0.5	11.00%	0.541	1.270
2018	112200	1545	0	0.5	11.00%	0.540	1.270
2019	113600	1562	0	0.5	11.00%	0.539	1.270
2020	115000	1578	1578	0.5	11.00%	0.538	1.270
2021	116300	1593	3171	0.5	11.00%	0.537	1.270
2022	117700	1609	4780	0.5	11.00%	0.536	1.270
2023	119100	1626	6406	0.5	11.00%	0.535	1.270
2024	120500	1642	8048	0.5	11.00%	0.534	1.270
2025	121900	1658	9706	0.5	11.00%	0.533	1.270
2026	123200	1673	11379	0.5	11.00%	0.532	1.270
2027	124600	1689	13068	0.5	11.00%	0.531	1.270
2028	126000	1705	14773	0.5	11.00%	0.531	1.270
2029	127400	1721	16494	0.5	11.00%	0.530	1.270
2030	128800	1737	18231	0.5	11.00%	0.529	1.270
2031	130100	1751	19982	0.5	11.00%	0.528	1.270
2032	131500	1767	21749	0.5	11.00%	0.527	1.270
2033	132900	1783	23532	0.5	11.00%	0.526	1.270
2034	134300	1799	25331	0.5	11.00%	0.525	1.270
2035	135700	1815	27146	0.5	11.00%	0.524	1.270
2036	137100	1830	28976	0.5	11.00%	0.524	1.270
2037	138500	1846	30822	0.5	11.00%	0.523	1.270
2038	139900	1862	32684	0.5	11.00%	0.522	1.270
2039	141300	1878	34562	0.5	11.00%	0.521	1.270
2040	142700	1893	36455	0.5	11.00%	0.520	1.270

Opening to Mid-Design Year ESAL Accumulation (1000s): 16653

Opening to Design Year ESAL Accumulation (1000s): 34877

I have reviewed the 18 kip Equivalent Single Axle Loads (ESAL's) to be used for pavement design on this project. I hereby attest that these have been developed in accordance with the FDOT Project Traffic Forecasting Procedure using historical traffic data and other available information.

Prepared by: HNTB 610 Crescent Executive Ct, Suite 400 Lake Mary, FL 32746 Robert Denney, PE 4/7/2014

Org. Unit or Firm Name Date

Signature

ROBERT M. DENNEY LICENSE NO. 56503 STATE OF FLORIDA PROFESSIONAL ENGINEER

Reviewed by: Mark Robinson, PE District 5 Design FDOT - D5

Name Title Org.Unit or Firm Date

Signature

APPENDIX B

GEOTECHNICAL INFORMATION

Florida Department of Transportation
Flexible Pavement Design Summary Sheet

Prepared By:	Edward G. Wolfson, P.E.	**Date Prepared:**	7-Jan-05
Financial Project ID:	408463-1-52-01	**U.S. No.:**	I-4 **S.R. No.:** 400
FAP No.:	N/A	**From:**	East of SR 472
Section No:	79110	**To:**	West of SR 44
County:	Volusia	**Begin Mp:**	10.254
Project Length:	17,900' (3.390 Mi)	**End Mp:**	13.644
Type of Work:	Mill, Resurf. & Widening	**%R:**	95%
Opening Year:	2010	**M_r:**	25,000 resurfacing / 9,000 widening
Design Year:	2030	**Design Speed:**	70 MPH
$ESAL_D$:	24,808,000	**Design Seq No.:**	N/A
SN_R:	3.95 resurf / 5.59 widening	**Project Name:**	SR 400 from East of SR 472 to West of SR 44

S.R. 400 Mainline Existing Pavement: (Good Condition)

LAYER	THICKNESS (in.)	COEFF	SN
FC-2	1/2	0.00	0.00
Type S Asphaltic Concrete	3	0.34	1.02
Type I	1	0.15	0.15
Binder	2	0.15	0.30
Limerock Base Course	10 1/2	0.18	1.89
Stabilized Subgrade	12	0.08	0.96
		Existing SN:	4.32

Recommended Widening Pavement Design:

LAYER	THICKNESS (in.)	COEFF	SN
FC-5 (PG 76-22)	3/4	0.00	0.00
Type SP Asphalt Concrete (Traffic Level D)*	6 1/2	0.44	2.86
OBG 9	10	0.18	1.80
Stabilized Subgrade (LBR 40)	12	0.08	0.96
		SN:	5.62

Recommended Milling and Resurfacing Design[+]:

LAYER	THICKNESS (in.)	COEFF	SN
Existing Pavement (See Above)			4.32
Milling (3-3/4" depth) [++]	3 1/4	-0.34	-1.11
FC-5 (PG 76-22)	3/4	0.00	0.00
Type SP Asphalt Concrete (Traffic Level D)*	3	0.44	1.32
		SN:	4.54

* (PG 76-22) is to be used in the top structural course

[+] The milling and resurfacing for this project is intended for the purpose of facilitating the proper construction of the proposed widening and for the purpose of providing a consistent surface across the proposed typical section.

[++] The milling depth that is specified is 3-3/4" however, 1/2" of this depth is the existing FC-2 therefore only 3-1/4" of structural asphalt is being removed.

Approved by:	Concurrence by:	Concurrence by:	Concurrence by:
Rhet L. Schmidt, P.E.	Donald M. Barnhouse	Derek A. Fusco, P.E.	Annette K. Brennan, P.E.
Responsible Engineer	Dist Pavt Design Engineer	FHWA Area Engineer	Dist Design Engineer
Date: _____	Date: _____	Date: _____	Date: _____

APPENDIX C

TYPICAL SECTION

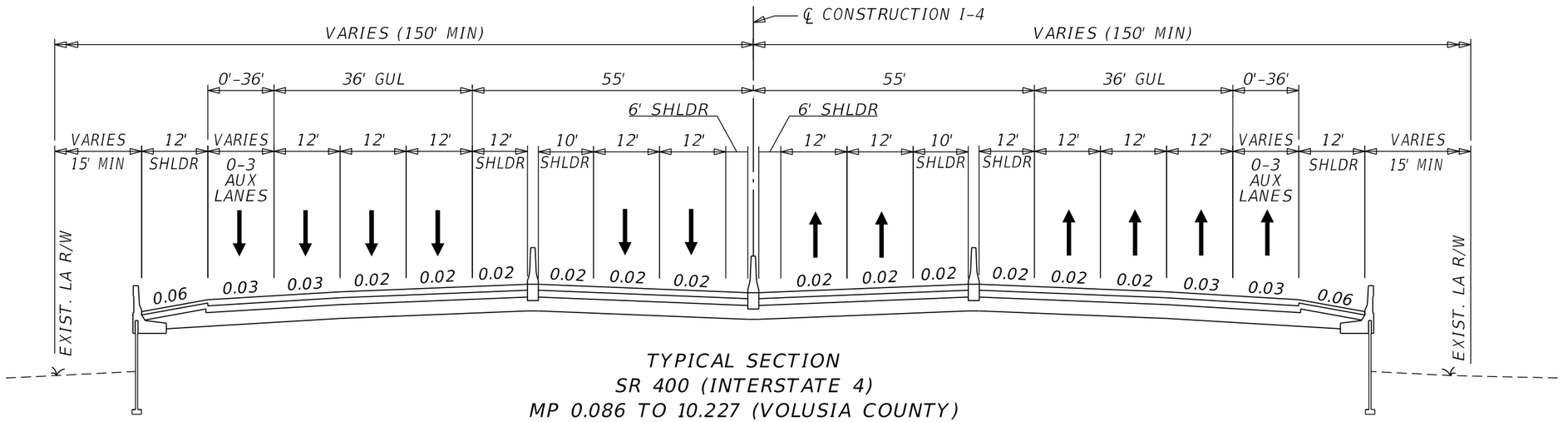
PROJECT IDENTIFICATION

FINANCIAL PROJECT ID 432100-1-22-01 FEDERAL AID PROJECT NO. N/A COUNTY NAME VOLUSIA

SECTION NO. 79110 ROAD DESIGNATION I-4 (SR 400) LIMITS/MILEPOST MP 0.086 - 10.227 (VOLUSIA)

PROJECT DESCRIPTION I-4 WIDENING FROM EAST OF US 17-92 TO EAST OF SR 472.

PROPOSED ROADWAY TYPICAL SECTION



TYPICAL SECTION
SR 400 (INTERSTATE 4)
MP 0.086 TO 10.227 (VOLUSIA COUNTY)
(STA. 2583+00.00 TO STA. 3118+46.00)
DESIGN SPEED = 70 MPH

APPROVED BY:	FDOT CONCURRENCE	FHWA CONCURRENCE
ROBERT M. DENNEY, P.E. Date Engineer Of Record 58593 HNTB CORPORATION 610 CRESCENT EXECUTIVE CT. SUITE 400 LAKE MARY, FL 32746 (407) 805-0355 CERT OF AUTH NO 6500	ANNETTE K. BRENNAN, P.E. Date FDOT District Design Engineer	FHWA Transportation Engineer Date

smoss 3/24/2014 11:18:02 AM U:\Jobs\59219 - I4 SAMR\TECHPROD\43210012201\Segment 4\roadway\TYPDRD401.DGN

APPENDIX D

PAVEMENT DESIGN CALCULATIONS

Pavement Design For New Pavement (Flexible)

Project: SR 400 (I-4) Mainline

Opening + 20 years =

Given: $ESAL_D$ = 24,720,000 — Traffic Level D

M_R = 9,000 psi

Assume a 90% reliability

1.0 From table 5.3, the Structural Number Required (SN_R) = 5.31

2.0

SN_R	=	SN_C										
5.31	=	a_1	D_1	+	a_2	D_2	+	a_3	D_3	+	a_4	D_4
5.31	=	0	0.75	+	a_2	D_2	+	a_3	D_3	+	0.08	12
5.31	=		0.00	+	a_2	D_2	+	a_3	D_3	+		0.96
4.35	=				a_2	D_2	+	a_3	D_3			

3.0 With the following eqn. find the base group from table 5.9

4.35	=	a_2	D_2	+	a_3	D_3

Base group 12 yields a 5.00 inch structural course with an SN of 4.45

Note: the structural number found in table 5.9 must be slightly larger than the $a_2D_2 + a_3D_3$ ratio

4.0

Calculate the Structural number (SN_C), so that it is equal to or larger than SN_R.

Material	Thickness	Coefficient	SN_C	
Structural Course	5.00	0.44	2.20	see table 5.4
Base (OBG 12 - 12.5" Limerock - LBR 100)	12.50	0.18	2.25	see table 5.6
Stabilization (LBR 40)	12.00	0.08	0.96	

Total thickness 29.50 inches SN_C= 5.41

$SN_C \geq SN_R$

$5.41 \geq 5.31$

New Pavement Design (Modulus of Subgrade Reaction = 200) (Rigid)

REQUIRED DEPTH (D_R) FOR 90% RELIABILITY — From table 3.2

ESAL 34,877,000

ESAL's — Depth — Region: 3 — Table E.3

35,000,000 — 11.5" — Table E.8 from the 2009 FDOT Rigid Pavement Design Manual - Based on MEPDG with Tied Concrete Shoulders

use: **12"** — When an ashphalt shoulder is used, Mainline Slab thickness must be increased by 1/2" and a 14' wide slab used.

Pavement Design For New Pavement (Flexible)

Project: SR 400 (I-4) Mainline Shoulder

Opening Year 2020

Design Year 2040

Given: $ESAL_D$ = 741,600 Traffic Level B

M_R = 9,000 psi

Assume a 90% reliability

1.0 From table 5.3 (or A.4a), the Structural Number Required (SN_R) = 3.08

2.0

SN_R	=	SN_C										
3.08	=	a_1	D_1	+	a_2	D_2	+	a_3	D_3	+	a_4	D_4
3.08	=	0	0.75	+	a_2	D_2	+	a_3	D_3	+	0.08	12
3.08	=	0.00		+	a_2	D_2	+	a_3	D_3	+	0.96	
2.12	=				a_2	D_2	+	a_3	D_3			

3.0 With the following eqn. find the base group from table 5.9

2.12	=	a_2	D_2	+	a_3	D_3

Base group 8 yields a 1.50 inch structural course with an SN of 2.28

Note: the structural number found in table 5.9 must be slightly larger than the $a_2D_2 + a_3D_3$ ratio

4.0 Calculate the Structural number (SN_C), so that it is equal to or larger than SN_R.

Material	Thickness	Coefficient	SN_C	
Structural Course (Traffic Level B)	1.50	0.44	0.66	see table 5.4
Base (OBG 8- LBR 100)	9.50	0.18	1.71	see table 5.6
Stabilization (LBR 40)	12.00	0.08	0.96	

SN_C= 3.33

$SN_C \geq SN_R$

3.33 ≥ 3.08

APPENDIX E

LIFE CYCLE COST ANALYSIS

FLORIDA DEPARTMENT OF TRANSPORTATION

PAVEMENT TYPE SELECTION SPREADSHEET

PROJECT DESCRIPTION:

Financial Project ID:	432100-1-22-01
State Road Number:	SR 400
County:	Volusia
Project Length:	10 Miles
Roadway ID:	79110000
Begining MP:	
Ending MP:	
Transportation System:	
Type of Work	
Design Version	

432100-1-22-01				
LIST OF CONSTRUCTION ITEMS				
Pay Item	**Description**	**Mean Price**	**St. Deviation**	**Unit**
160 4	Type B Stabilized (LBR 40)	$3.25		Sq. Yd
285 7	OBG-1, Type B-12.5	$9.42		Sq. Yd
285 7	OBG-8	$14.64		Sq. Yd
285 7	OBG-12	$15.00		Sq. Yd
327 70	Milling 1" Avg. Depth	$2.24		Sq. Yd
327 70	Milling 3" Avg. Depth	$1.17		Sq. Yd
334 1	Type SP Traffic Level B	$85.00		Ton
334 1	Type SP Traffic Level D	$85.00		Ton
334 1	Type SP Traffic Level D PG76-22	$92.00		Ton
350 1	JPCP	$55.00		Sq. Yd
353 70	CPR - Slab Replacement (3%)	$400.00		Cu. Yd
353 70	CPR - Slab Replacement (5%)	$400.00		Cu. Yd
446 1	Edgedrain (Draincrete)	$26.72		Ft
446 71	Edgedrain Outlet Pipe (4 in)	$30.67		Ft

LIFE CYCLE COST ANALYSIS

JOINTED PLAIN CONCRETE PAVEMENT DESIGN (RIGID PAVEMENT)

Financial Project ID:432100-1-22-01, SR No.-SR 400, County:Volusia

Project Length: 10 Miles, Roadway ID: 79110000

Begining MP: , Ending MP:

Definitions:

Length of Section:	5280	Ft			Analysis Period:	40	
Passing Lane Width:	12	Ft			Discount Rate:	3.5	
Travel Lane Width:	14	Ft			Initial Year of Construction:	2020	
Inside Shoulder Width:	18	Ft			No. of Passing Lanes:	3	
Outside Shoulder Width:	18	Ft			No. of Travel Lanes:	2	
Total Pavement Area:	675,840	Sq. Ft			No. of Travel Directions:	2	
Total Shoulder Area:	380,160	Sq. Ft	63,360	Long. Concrete Joints (Ft)	45,056	Trans. Concrete Joints (Ft)	

CONSTRUCTION ITEMS	THK.	QTY.	UNIT	UNIT PRICE	ST DEV	COST	PRESENT WORTH
INITIAL CONSTRUCTION IN YEAR:	**0**						
MAINLINE:							
JPCP	12	75,093.3	Sq. Yd	$55.00	$0.00	$4,130,133	$4,130,133
OBG-1, Type B-12.5	4	75,093.3	Sq. Yd	$9.42	$0.00	$707,379	$707,379
Type B Stabilized (LBR 40)	12	75,093.3	Sq. Yd	$3.25	$0.00	$244,053	$244,053
Edgedrain (Draincrete)	1	10,560.0	Ft	$26.72	$0.00	$282,163	$282,163
Edgedrain Outlet Pipe (4 in)	1	50.0	Ft	$30.67	$0.00	$1,534	$1,534
SHOULDER:							
Type SP Traffic Level B	1.5	3,445.2	Ton	$85.00	$0.00	$292,842	$292,842
OBG-8	9.5	42,240.0	Sq. Yd	$14.64	$0.00	$618,394	$618,394
Type B Stabilized (LBR 40)	12	42,240.0	Sq. Yd	$3.25	$0.00	$137,280	$137,280
DESIGN COSTS:			Subtotal				
MOT COSTS:			Subtotal				
CEI COSTS:			Subtotal				
REHABILITATION IN YEAR:	**23**						
MAINLINE:							
CPR - Slab Replacement (3%)	12	750.9	Cu. Yd	$400.00	$0.00	$300,373	$136,155
SHOULDER:							
Milling 1" Avg. Depth	1	42,240.0	Sq. Yd	$2.24	$0.00	$94,618	$42,889
Type SP Traffic Level B	1	2,296.8	Ton	$85.00	$0.00	$195,228	$88,494
DESIGN COSTS:			Subtotal				
MOT COSTS:			Subtotal				
CEI COSTS:			Subtotal				

LIFE CYCLE COST ANALYSIS

JOINTED PLAIN CONCRETE PAVEMENT DESIGN (RIGID PAVEMENT)

Financial Project ID:432100-1-22-01, SR No.-SR 400, County:Volusia

Project Length: 10 Miles, Roadway ID: 79110000

Begining MP: , Ending MP:

Definitions:

Length of Section:	5280	Ft			Analysis Period:	40	
Passing Lane Width:	12	Ft			Discount Rate:	3.5	
Travel Lane Width:	14	Ft			Initial Year of Construction:	2020	
Inside Shoulder Width:	18	Ft			No. of Passing Lanes:	3	
Outside Shoulder Width:	18	Ft			No. of Travel Lanes:	2	
Total Pavement Area:	675,840	Sq. Ft			No. of Travel Directions:	2	
Total Shoulder Area:	380,160	Sq. Ft	63,360	Long. Concrete Joints (Ft)	45,056	Trans. Concrete Joints (Ft)	

CONSTRUCTION ITEMS	THK.	QTY.	UNIT	UNIT PRICE	ST DEV	COST	PRESENT WORTH
REHABILITATION IN YEAR:	**33**						
MAINLINE:							
CPR - Slab Replacement (5%)	12	1,251.6	Cu. Yd	$400.00	$0.00	$500,622	$160,871
SHOULDER:							
Milling 1" Avg. Depth	1	42,240.0	Sq. Yd	$2.24	$0.00	$94,618	$30,405
Type SP Traffic Level B	1	2,296.8	Ton	$85.00	$0.00	$195,228	$62,735
DESIGN COSTS:			Subtotal				
MOT COSTS:			Subtotal				
CEI COSTS:			Subtotal				
REHABILITATION IN YEAR:	**40**						
MAINLINE:							
SHOULDER:							
DESIGN COSTS:			Subtotal				
MOT COSTS:			Subtotal				
CEI COSTS:			Subtotal				
REHABILITATION IN YEAR:							

TOTAL INITIAL CONSTRUCTION COST (YEAR 2020):	$6,413,778
TOTAL PRESENT WORTH REHABILITATION COST:	$521,549
TOTAL PRESENT WORTH SALVAGE VALUE:	$0
PRESENT WORTH:	$6,935,327

LIFE CYCLE COST ANALYSIS

ASPHALT CONCRETE PAVEMENT DESIGN (FLEXIBLE PAVEMENT)

Financial Project ID:432100-1-22-01, SR No.-SR 400, County:Volusia

Project Length: 10 Miles, Roadway ID: 79110000

Begining MP: , Ending MP:

Definitions:

Length of Section:	5280	Ft	Analysis Period:	40
Passing Lane Width:	12	Ft	Discount Rate:	3.5
Travel Lane Width:	12	Ft	Initial Year of Construction:	2020
Inside Shoulder Width:	18	Ft	No. of Passing Lanes:	5
Outside Shoulder Width:	22	Ft	No. of Travel Lanes:	
Total Pavement Area:	633,600	Sq. Ft	No. of Travel Directions:	2
Total Shoulder Area:	422,400	Sq. Ft		

CONSTRUCTION ITEMS	THK.	QTY.	UNIT	UNIT PRICE	ST DEV	COST	PRESENT WORTH
INITIAL CONSTRUCTION IN YEAR:	**0**						
MAINLINE:							
Type SP Traffic Level D PG76-22	2	7,656.0	Ton	$92.00	$0.00	$704,352	$704,352
Type SP Traffic Level D	3	11,484.0	Ton	$85.00	$0.00	$976,140	$976,140
OBG-12	12.5	70,400.0	Sq. Yd	$15.00	$0.00	$1,056,000	$1,056,000
Type B Stabilized (LBR 40)	12	70,400.0	Sq. Yd	$3.25	$0.00	$228,800	$228,800
SHOULDER:							
Type SP Traffic Level B	1.5	3,828.0	Ton	$85.00	$0.00	$325,380	$325,380
OBG-8	9.5	46,933.3	Sq. Yd	$14.64	$0.00	$687,104	$687,104
Type B Stabilized (LBR 40)	12	46,933.3	Sq. Yd	$3.25	$0.00	$152,533	$152,533
DESIGN COSTS:			Subtotal				
MOT COSTS:			Subtotal				
CEI COSTS:			Subtotal				
REHABILITATION IN YEAR:	**14**						
MAINLINE:							
Milling 3" Avg. Depth	3	70,400.0	Sq. Yd	$1.17	$0.00	$82,368	$50,885
Type SP Traffic Level D PG76-22	2	7,656.0	Ton	$92.00	$0.00	$704,352	$435,136
Type SP Traffic Level D	2	7,656.0	Ton	$85.00	$0.00	$650,760	$402,028
SHOULDER:							
Milling 1" Avg. Depth	1	46,933.3	Sq. Yd	$2.24	$0.00	$105,131	$64,948
Type SP Traffic Level B	2	5,104.0	Ton	$85.00	$0.00	$433,840	$268,018
DESIGN COSTS:			Subtotal				
MOT COSTS:			Subtotal				
CEI COSTS:			Subtotal				

LIFE CYCLE COST ANALYSIS

ASPHALT CONCRETE PAVEMENT DESIGN (FLEXIBLE PAVEMENT)

Financial Project ID:432100-1-22-01, SR No.-SR 400, County:Volusia

Project Length: 10 Miles, Roadway ID: 79110000

Begining MP: , Ending MP:

Definitions:

Length of Section:	5280	Ft	Analysis Period:	40
Passing Lane Width:	12	Ft	Discount Rate:	3.5
Travel Lane Width:	12	Ft	Initial Year of Construction:	2020
Inside Shoulder Width:	18	Ft	No. of Passing Lanes:	5
Outside Shoulder Width:	22	Ft	No. of Travel Lanes:	
Total Pavement Area:	633,600	Sq. Ft	No. of Travel Directions:	2
Total Shoulder Area:	422,400	Sq. Ft		

CONSTRUCTION ITEMS	THK.	QTY.	UNIT	UNIT PRICE	ST DEV	COST	PRESENT WORTH
REHABILITATION IN YEAR:	**28**						
MAINLINE:							
Milling 3" Avg. Depth	3	70,400.0	Sq. Yd	$1.17	$0.00	$82,368	$31,436
Type SP Traffic Level D PG76-22	2	7,656.0	Ton	$92.00	$0.00	$704,352	$268,819
Type SP Traffic Level D	2	7,656.0	Ton	$85.00	$0.00	$650,760	$248,365
SHOULDER:							
Milling 1" Avg. Depth	1	46,933.3	Sq. Yd	$2.24	$0.00	$105,131	$40,124
Type SP Traffic Level B	2	5,104.0	Ton	$85.00	$0.00	$433,840	$165,577
DESIGN COSTS:			Subtotal				
MOT COSTS:			Subtotal				
CEI COSTS:			Subtotal				
REHABILITATION IN YEAR:	**42**						
MAINLINE:							
SHOULDER:							
DESIGN COSTS:			Subtotal				
MOT COSTS:			Subtotal				
CEI COSTS:			Subtotal				
REHABILITATION IN YEAR:							

TOTAL INITIAL CONSTRUCTION COST (YEAR 2020):	$4,130,309
TOTAL PRESENT WORTH REHABILITATION COST:	$1,975,336
TOTAL PRESENT WORTH SALVAGE VALUE:	$71,314
PRESENT WORTH:	$6,034,332

FLORIDA DEPARTMENT OF TRANSPORTATION
PAVEMENT TYPE SELECTION
ECONOMIC ANALYSIS
COST PER MILE

Analysis Period: 40 Years Discount Rate: 3.5%

PCC PAVEMENT

		Cost		P / F		PRESENT WORTH
	Initial	$6,413,778	*	1.00000	=	$6,413,778
23	Year	$590,219	*	0.45329	=	$267,538
33	Year	$790,468	*	0.32134	=	$254,011
40	Year		*		=	
	Year					
				TOTAL AGENCY COSTS	=	**$6,935,327**
				USER COSTS	=	
		Remaining Service Life		**PW of Last Rehab at Year 40**		
SALVAGE VALUE		0 / 7	*	$199,650	=	**$0**
				TOTAL PRESENT WORTH LIFE-CYCLE COSTS	=	**$6,935,327**

AC PAVEMENT

		Cost		P / F		PRESENT WORTH
	Initial	$4,130,309	*	1.00000	=	$4,130,309
14	Year	$1,976,451	*	0.61778	=	$1,221,015
28	Year	$1,976,451	*	0.38165	=	$754,321
42	Year		*		=	
	Year					
				TOTAL AGENCY COSTS	=	**$6,105,646**
				USER COSTS	=	
		Remaining Service Life		**PW of Last Rehab at Year 40**		
SALVAGE VALUE		2 / 14	*	$499,197	=	**$71,314**
				TOTAL PRESENT WORTH LIFE-CYCLE COSTS	=	**$6,034,332**

COST COMPARISON

DIFFERENCE IN TOTAL PRESENT WORTH LIFE-CYCLE COSTS	=	**$900,995**
AVERAGE TOTAL PRESENT WORTH	=	**$6,484,829**
PERCENT DIFFERENCE IN TOTAL PRESENT WORTH	=	**13.9%**
DIFFERENCE IN ESTIMATED INITIAL COSTS	=	**$2,283,469**
PERCENT DIFFERENCE IN ESTIMATED INITIAL COSTS	=	**55.3%**
TOTAL PRESENT WORTH COST OF REHAB FOR PCC PAVEMENT	=	**$521,549**
TOTAL PRESENT WORTH COST OF REHAB FOR AC PAVEMENT	=	**$1,975,336**
DIFFERENCE IN TOTAL PRESENT WORTH OF REHAB COSTS (LCCF)	=	**$1,453,787**

Florida Department of Transportation
Item Average Unit Cost
From 2013/03/01 to 2014/02/28

Contract Type: CC AREAS: 06
Displaying: VALID ITEMS WITH HITS
From: 0102 1 To: 9999999

Item	No. of Conts	Weighted Average	Total Amount	Total Quantity	Unit Meas	Obs?	Description
0102 1	3	$230.48	$299,618.40	1,300.000	DA	N	MAINTENANCE OF TRAFFIC
0102 14	1	$50.00	$3,200.00	64.000	MH	N	TRAFFIC CONTROL OFFICER
0102 60	2	$.31	$9,310.80	29,712.000	ED	N	WORK ZONE SIGN
0102 74 1	2	$.19	$11,907.22	63,830.000	ED	N	TEMP BARR-TYPS I,II,DI,VP, DRUM, LC
0102 76	2	$7.46	$4,590.00	615.000	ED	N	ARROW BOARD /ADVANCE WARNING ARROW PANEL
0102 77	2	$.33	$4,652.05	14,069.000	ED	N	HIGH INTENSITY FLASH LI,TEMP,TYP B
0102 78	1	$2.15	$6,450.00	3,000.000	EA	N	TEMPORARY RETROREFLECTIVE PAVT MARKER
0102 99	2	$13.67	$17,044.00	1,247.000	ED	N	PORTABLE CHANGEABLE MESSAGE SIGN,TEMP
0102150 1	2	$8.24	$10,130.00	1,230.000	ED	N	PORTABLE REGULATORY,SIGN
0102150 2	2	$8.24	$10,130.00	1,230.000	ED	N	RADAR SPEED DISPLAY UNIT
0104 10 3	2	$1.00	$20,359.75	20,387.000	LF	N	SEDIMENT BARRIER
0104 18	2	$77.64	$3,261.00	42.000	EA	N	INLET PROTECTION SYSTEM
0107 1	1	$15.00	$16,800.00	1,120.000	AC	N	LITTER REMOVAL
0107 2	1	$20.00	$22,400.00	1,120.000	AC	N	MOWING
0110 1 1	2	$9,218.67	$27,656.00	3.000	AC	N	CLEARING & GRUBBING
0110 4	1	$19.00	$6,099.00	321.000	SY	N	REMOVAL OF EXISTING CONCRETE PAVEMENT
0110 7 1	1	$110.00	$1,320.00	12.000	EA	N	MAILBOX, F&I SINGLE
0120 2 2	1	$12.82	$179,736.40	14,020.000	CY	N	BORROW EXCAVATION, TRUCK MEASURE
0120 71	1	$55,562.86	$55,562.86	1.000	LS	N	REGULAR EXCAVATION (3-R PROJECTS ONLY)
0162 1 11	1	$.27	$65,870.82	243,966.000	SY	N	PREPARED SOIL LAYER, FINISH SOIL, 6"
0285709	1	$15.38	$207,630.00	13,500.000	SY	N	OPTIONAL BASE,BASE GROUP 09
0327 70 4	1	$1.17	$62,736.57	53,621.000	SY	N	MILLING EXIST ASPH PAVT, 3" AVG DEPTH
0327 70 6	1	$1.90	$84,080.70	44,253.000	SY	N	MILLING EXIST ASPH PAVT,1 1/2" AVG DEPTH
0327 70 11	1	$.68	$288,856.52	424,789.000	SY	N	MILLING EXIST ASPH PAVT,2 1/4" AVG DEPTH
0334 1 23	1	$85.98	$3,778,906.98	43,951.000	TN	N	SUPERPAVE ASPH CONC, TRAF C, PG76-22,PMA
0337 7 22	1	$113.00	$1,856,861.20	16,432.400	TN	N	ASPH CONC FC,INC BIT,FC-5,PG76-22,PMA
0337 7 43	1	$95.20	$788,941.44	8,287.200	TN	N	ASPH CONC FC,TRAFFIC C,FC-12.5,PG 76-22
0339 1	2	$132.22	$6,240.92	47.200	TN	N	MISCELLANEOUS ASPHALT PAVEMENT
0400 32	1	$14,800.00	$128,760.00	8.700	CY	N	CONCRETE FOR JOINT REPAIR
0401 70 1	1	$100.00	$2,000.00	20.000	CF	N	RESTORE SPALLED AREAS, EPOXY
0413151	1	$100.00	$756,700.00	7,567.000	GA	N	METHACRYLATE MONOMER
0413154	1	$.30	$226,907.40	756,358.000	SF	N	CLEAN & SEAL CONC- PENETR OR METHACR
0415 1 4	1	$2.60	$5,150.60	1,981.000	LB	N	REINF STEEL- SUPERSTRUCTURE
0425 6	1	$390.00	$390.00	1.000	EA	N	VALVE BOXES, ADJUST
0430174118	1	$51.42	$31,674.72	616.000	LF	N	PIPE CULV, OPT MATL, ROUND,18"SD
0430174124	1	$55.60	$16,902.40	304.000	LF	N	PIPE CULV, OPT MATL, ROUND,24"SD
0430174130	1	$65.29	$6,267.84	96.000	LF	N	PIPE CULV, OPT MATL, ROUND,30"SD
0430174215	1	$49.27	$3,941.60	80.000	LF	N	PIPE CULV, OPT MATL, OTHER, 15"SD
0430174218	1	$51.55	$1,649.60	32.000	LF	N	PIPE CULV, OPT MATL, OTHER, 18"SD
0430984125	1	$894.00	$31,290.00	35.000	EA	N	MITERED END SECT, OPTIONAL RD, 18" SD

Florida Department of Transportation
Item Average Unit Cost
From 2013/03/01 to 2014/02/28

Contract Type: CC STATEWIDE
Displaying: VALID ITEMS WITH HITS
From: 0102 1 To: 9999999

Item	No. of Conts	Weighted Average	Total Amount	Total Quantity	Unit Meas	Obs?	Description
0125 1	5	$12.25	$189,709.27	15,484.000	CY	N	EXCAVATION FOR STRUCTURES
0142 70	2	$8.30	$254,775.45	30,698.900	CY	N	FILL SAND
0145 1	1	$2.80	$34,034.00	12,155.000	SF	N	GEOSYNTHETIC REINFORCED SOIL SLOPE
0145 2	5	$4.13	$128,153.92	31,015.000	SY	N	GEOSYNTHETIC REINF FND OVER SOFT SOIL
0145 71	1	$3.30	$20,697.60	6,272.000	SY	N	REINFORCEMENT GRID FOR SOIL STABILIZAT
0160 4	75	$3.06	$6,414,990.51	2,099,340.600	SY	N	TYPE B STABILIZATION
0162 1 11	47	$.80	$1,311,291.19	1,639,557.500	SY	N	PREPARED SOIL LAYER, FINISH SOIL, 6"
0162 1 12	3	$6.73	$192,723.16	28,643.000	SY	N	PREPARED SOIL LAYER, FINISH SOIL, 12"
0162 1 33	2	$6.47	$19,914.72	3,078.000	SY	N	PREPARED SOIL LAYER, BLANKET, SPECIAL
0210 1 1	3	$.84	$15,497.22	18,428.000	SY	N	REWORKING LIMEROCK BASE, 6"
0210 1 8	1	$5.25	$7,612.50	1,450.000	SY	N	REWORKING LIMEROCK BASE, 4"
0210 2	2	$27.26	$13,902.33	510.000	CY	N	LIMEROCK-NEW MATERIAL FOR REWORKING BASE
0285701	50	$9.42	$2,282,760.45	242,216.300	SY	N	OPTIONAL BASE,BASE GROUP 01
0285702	6	$8.78	$985,403.12	112,285.600	SY	N	OPTIONAL BASE,BASE GROUP 02
0285703	4	$20.07	$424,418.92	21,145.000	SY	N	OPTIONAL BASE,BASE GROUP 03
0285704	16	$12.37	$1,641,097.48	132,698.100	SY	N	OPTIONAL BASE,BASE GROUP 04
0285705	5	$9.81	$215,501.27	21,972.500	SY	N	OPTIONAL BASE,BASE GROUP 05
0285706	23	$16.77	$2,573,079.32	153,469.000	SY	N	OPTIONAL BASE,BASE GROUP 06
0285707	6	$16.12	$571,196.20	35,437.000	SY	N	OPTIONAL BASE,BASE GROUP 07
0285708	3	$14.64	$94,931.10	6,484.000	SY	N	OPTIONAL BASE,BASE GROUP 08
0285709	43	$19.73	$6,878,342.28	348,549.700	SY	N	OPTIONAL BASE,BASE GROUP 09
0285710	11	$11.93	$2,185,574.32	183,246.000	SY	N	OPTIONAL BASE,BASE GROUP 10
0285711	14	$12.95	$7,824,233.51	604,391.000	SY	N	OPTIONAL BASE,BASE GROUP 11
0285712	7	$21.90	$431,998.20	19,729.000	SY	N	OPTIONAL BASE,BASE GROUP 12
0285713	7	$39.77	$1,296,066.58	32,589.000	SY	N	OPTIONAL BASE,BASE GROUP 13
0285715	14	$45.07	$3,044,657.79	67,555.900	SY	N	OPTIONAL BASE,BASE GROUP 15
0286 1	26	$13.26	$1,031,742.02	77,795.600	SY	N	TURNOUT CONSTRUCTION
0286 2	2	$151.17	$48,737.50	322.400	TN	N	TURNOUT CONSTRUCTION-ASPHALT
0287 1	1	$160.00	$929,600.00	5,810.000	CY	N	ASPHALT TREATED PERMEABLE BASE
0288001	1	$800.00	$357,600.00	447.000	CY	N	CEMENT TREATED PERMEABLE BASE
0327 70 1	49	$2.24	$2,747,112.05	1,226,732.900	SY	N	MILLING EXIST ASPH PAVT, 1" AVG DEPTH
0327 70 2	9	$2.10	$965,982.91	459,819.000	SY	N	MILLING EXIST ASPH PAVT,3 1/2" AVG DEPTH
0327 70 4	20	$1.99	$2,218,028.11	1,113,562.100	SY	N	MILLING EXIST ASPH PAVT, 3" AVG DEPTH
0327 70 5	34	$2.31	$2,885,791.32	1,248,080.000	SY	N	MILLING EXIST ASPH PAVT, 2" AVG DEPTH
0327 70 6	59	$1.49	$3,636,071.26	2,436,213.940	SY	N	MILLING EXIST ASPH PAVT,1 1/2" AVG DEPTH
0327 70 7	4	$3.93	$499,059.98	126,869.000	SY	N	MILLING EXIST ASPH PAVT, 4" AVG DEPTH
0327 70 8	17	$1.74	$1,462,074.05	838,132.000	SY	N	MILLING EXIST ASPH PAVT,2 1/2" AVG DEPTH
0327 70 10	1	$8.00	$15,888.00	1,986.000	SY	N	MILLING EXIST ASPH PAVT, 5" AVG DEPTH
0327 70 11	14	$1.57	$2,308,746.06	1,472,431.000	SY	N	MILLING EXIST ASPH PAVT,2 1/4" AVG DEPTH
0327 70 12	6	$1.75	$161,377.52	92,371.000	SY	N	MILLING EXIST ASPH PAVT,1 1/4" AVG DEPTH

Florida Department of Transportation
Item Average Unit Cost
From 2013/03/01 to 2014/02/28

Contract Type: CC STATEWIDE
Displaying: VALID ITEMS WITH HITS
From: 0102 1 To: 9999999

Item	No. of Conts	Weighted Average	Total Amount	Total Quantity	Unit Meas	Obs?	Description
0443 70 6	2	$170.95	$77,099.50	451.000	LF	N	FRENCH DRAIN, 36"
0444 70 11	1	$151.17	$3,023.40	20.000	LF	N	DEEP WELL- OPEN HOLE, 24"
0444 71 11	1	$251.95	$22,675.50	90.000	LF	N	DEEP WELL CASING, 24"
0446 1 1	2	$26.72	$213,892.08	8,004.000	LF	N	EDGEDRAIN DRAINCRETE, STANDARD
0446 71 1	4	$30.67	$56,408.70	1,839.000	LF	N	EDGEDRAIN OUTLET PIPE, 4"
0448 73	1	$873,909.95	$873,909.95	1.000	LS	N	PUMPING STATION- DRAINAGE
0450 1251	1	$175.00	$253,750.00	1,450.000	LF	N	PREST BEAMS, INVERTED T FROM FIB, 26.5"
0450 2 36	5	$237.53	$3,113,565.00	13,108.000	LF	N	PREST BEAMS: FLORIDA-I BEAM 36"
0450 2 45	5	$192.11	$1,749,757.99	9,108.000	LF	N	PREST BEAMS: FLORIDA-I BEAM 45"
0450 2 54	1	$210.00	$1,180,830.00	5,623.000	LF	N	PREST BEAMS: FLORIDA-I BEAM 54"
0450 2 63	1	$215.00	$365,930.00	1,702.000	LF	N	PREST BEAMS: FLORIDA-I BEAM 63"
0450 2 84	1	$250.00	$332,250.00	1,329.000	LF	N	PREST BEAMS: FLORIDA-I BEAM 84"
0450 3 15	1	$160.00	$50,240.00	314.000	LF	N	PRESTRESSED SLAB UNITS,48" X 15"
0450 3 25	1	$160.00	$150,400.00	940.000	LF	N	PRESTRESSED SLAB UNITS,60" X 15"
0450 3 95	1	$160.00	$50,240.00	314.000	LF	N	PRESTRESSED SLAB UNITS,VAR WI 30-47", 15
0450 82	1	$400.00	$90,000.00	225.000	LF	N	BEAM REPAIR
0450 83 1	2	$597.84	$57,392.40	96.000	EA	N	BEAM REPAIR, STRAND SPLICES
0450 88 20	1	$71.00	$127,161.00	1,791.000	SF	N	PRESTR SLAB UNITS TRANSV POST TENS, 20"
0455 2	1	$1.00	$4,230.00	4,230.000	LF	N	TREATED TIMBER PILING
0455 14 3	2	$89.64	$520,335.80	5,805.000	LF	N	CONC SHEET PILING, 10"X30"
0455 14 4	1	$379.05	$191,041.20	504.000	LF	N	CONC SHEET PILING, 12"X30"
0455 18	7	$21,232.12	$148,624.82	7.000	LS	N	PROTECTION OF EXISTING STRUCTURES
0455 34 2	2	$72.14	$1,206,550.00	16,726.000	LF	N	PRESTRESSED CONCRETE PILING, 14" SQ.
0455 34 3	6	$78.40	$2,009,045.75	25,624.000	LF	N	PRESTRESSED CONCRETE PILING, 18" SQ
0455 34 5	9	$102.39	$4,084,021.40	39,887.000	LF	N	PRESTRESSED CONCRETE PILING, 24" SQ
0455 35 6	1	$80.00	$9,680.00	121.000	LF	N	STEEL PILING, HP 14 X 89
0455 35 8	1	$152.45	$134,156.00	880.000	LF	N	STEEL PILING, HP 14 X 117
0455 35 21	1	$166.92	$238,862.52	1,431.000	LF	N	STEEL PILING, 20" DIA. PIPE
0455 35 22	3	$117.76	$627,170.00	5,326.000	LF	N	STEEL PILING, 24" DIA. PIPE
0455 81101	1	$5,000.00	$20,000.00	4.000	EA	N	CATHODIC PROT,F&I,PILE,ZINC ANODE ASSEM
0455 81105	1	$6,875.00	$385,000.00	56.000	EA	N	CATHODIC PROT,F&I,PIER,TITANIUM ANODE
0455 87	3	$368.90	$29,881.30	81.000	EA	N	ANCHOR BAR, STEEL
0455 88 5	1	$335.72	$692,926.08	2,064.000	LF	N	DRILLED SHAFT, 48" DIA
0455 88 6	1	$150.00	$167,700.00	1,118.000	LF	N	DRILLED SHAFT, 60" DIA
0455101 1	1	$215,459.75	$215,459.75	1.000	EA	N	TEST LOAD, OSTERBERG CELL, < FIVE CELLS
0455107 5	1	$169.99	$34,677.96	204.000	LF	N	DRILLED SHAFT CASING, 48" DIA
0455107 6	1	$231.00	$160,776.00	696.000	LF	N	DRILLED SHAFT CASING, 60" DIA
0455111	2	$75.24	$265,580.00	3,530.000	LF	N	CORE-PILOT HOLE,DRILLED SHAFT EXCAV
0455120 7	3	$677.78	$67,100.00	99.000	EA	N	PILE POINT PROTECTION, 24" ROUND
0455122 5	1	$199.17	$379,219.68	1,904.000	LF	N	UNCLASSIFIED SHAFT EXCAVATION, 48" DIA

APPENDIX F

PAVEMENT PERFORMANCE DATA

Rehabilitation Age by Year

For Volusia County
19MAR2014
Other Conditions: Pavement= Asphalt

Year Rehabilitated	Lane Miles Rehabilitated	Average Rehabilitation Age	Standard Deviation
2006	165.9	12.8	6.2
2007	83.5	14.0	5.2
2008	65.0	13.7	5.6
2009	37.7	16.7	8.3
2010	73.1	17.5	4.5
2011	164.2	16.7	4.8
2012	26.8	14.7	2.4
2013	17.0	11.4	2.4

Rehabilitation Age by Year

For Seminole County
27FEB2014
Other Conditions: Pavement= Asphalt

Year Rehabilitated	Lane Miles Rehabilitated	Average Rehabilitation Age	Standard Deviation
2006	17.1	20.0	5.3
2007	29.5	12.8	3.2
2008	42.3	20.1	9.2
2009	15.1	13.9	6.6
2010	43.6	16.0	1.9
2011	33.2	22.1	11.3
2012	6.5	15.0	0.0
2013	39.9	14.7	5.3

13JUN2012

Deficient Rehabilitation age by Year

For Hillsborough County

Other Conditions: Pavement= Concrete

Surface Type in (CONC)

Year Rehabilitated	Lane Miles Rehabilitated	Average Rehabilitation Age	Standard Deviation
2006	10.8	20	0
2007	26.7	25	0
2008	9.3	22	0

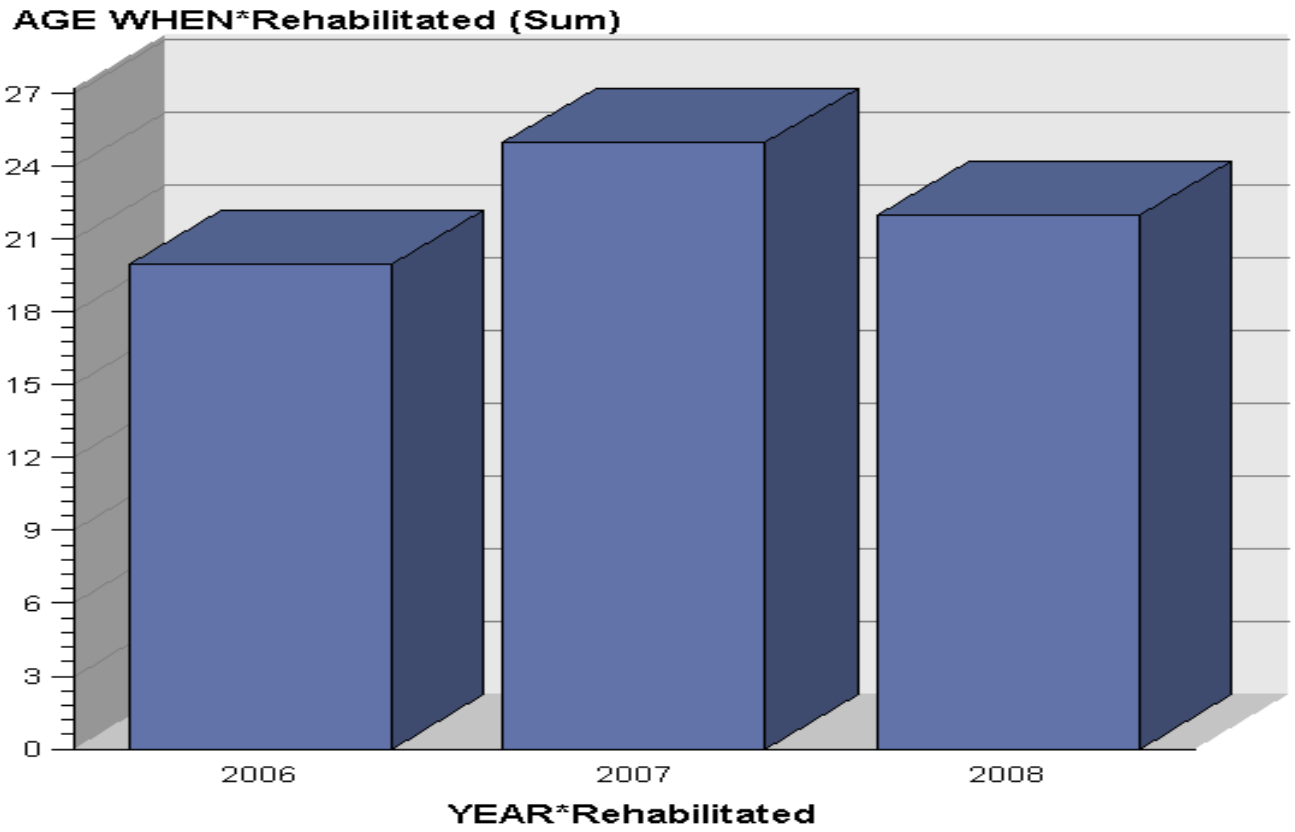
13JUN2012

Deficient Rehabilitation age by Year

For Hillsborough County

Other Conditions: Pavement= Concrete

Surface Type in (CONC)



APPENDIX G

QUALITY CONTROL CHECKLIST

PAVEMENT TYPE SELECTION

QUALITY CONTROL CHECKLIST

	Satisfactory Yes / No
Project Description	yes
Financial Project ID / Annual Report	yes
State Road No	yes
County	yes
Project Length	yes
Transportation System	yes
Flexible Pavement Design	
ESAL	yes
Level of Reliability	yes
Initial Design Period	yes
Structural Number	yes
Friction Course	yes
Structural Thickness	yes
Base Thickness	yes
Number of Through Lanes	yes
Lane Width	yes
Shoulder Width	yes
Rigid Pavement Design	
ESAL	yes
Level of Reliability	yes
Initial Design Period	yes
Thickness	yes

Base Thickness	yes
Base Type	yes
Number of Through Lanes	yes
Lane Width	yes
Shoulder Width	yes
Design Method (AASHTO 1993 or MEPDG)	yes

PROJECT MILE ESTIMATES

Initial

Mainline Quantities	yes
Shoulder Quantities	yes
Unit Prices Reasonable	yes

Rehabilitation

Mainline Quantities	yes
Shoulder Quantities	yes
Unit Prices Reasonable	yes

Reviewer Signature

4/7/14
Date