STRUCTURAL OVERLAY DESIGN OF FLEXIBLE PAVEMENT BY NON-DESTRUCTIVE TEST METHODS IN LOUISIANA

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ABSTRACT

The Louisiana Department of Transportation and Development currently uses empirical "book" values in the overlay thickness design. This can lead to errors since the values do not necessarily represent actual field conditions. The objective of this study was to establish an overlay thickness design method for flexible pavement in Louisiana based on in-situ pavement conditions and non-destructive test methods. Four overlay rehabilitation projects with different soil subgrade types and traffic levels were selected for this study. On each pavement section, nondestructive deflection tests (NDT) including Falling Weight Deflectometer (FWD) and Dynaflect were performed at a 0.1-mile interval, and a detail condition survey data including cracking, rut depth, International Roughness Index (IRI), mid-depth temperature, and pavement thickness was also collected. Four NDT-based overlay design methods were investigated and used in the design of required overlay thicknesses. Results indicated that the 1993 AASHTO procedure method was generally over-estimated the effective structural number for existing pavements, which would result in an under-designed overlay thickness. On the other hand, other NDT methods, such as Asphalt Institute MS-17, Arkansas ROADHOG and ELMOD5, were found not directly applicable to the Louisiana pavement condition. Therefore, a modified NDT-base overlay thickness design method was proposed in this study. This method, before full implementation of the new Mechanistic-Empirical (M-E) pavement design method, is deemed to better reflect the Louisiana pavement structural condition and be more effective for a routine use.

Keyword: overlay design, flexible pavement, AASHTO, NDT.

INTRODUCTION

Prior to 1960, most agencies relied heavily on engineering judgment and experience in determining the thickness and type of overlay required. Since 1960, the use of nondestructive deflection testing (NDT) e.g. Benkelman Beam, Dynaflect, Falling weight deflectometer (FWD) and etc., has gained wide acceptance due to their ease of operation and their ability to assess the structural integrity. After 1980, more rational methods based on NDT deflection measurements to evaluate the in situ pavement conditions have gradually developed [*1-8*]. The benefits of using NDT-based overlay design methods can be summarized as follows [*1*]:

- Elimination of reliance on human judgment in an estimation of pavement strength.
- Elimination of the expenses and inaccuracies associated with destructive testing of pavement components.
- Direct evaluation of existing pavement and subgrade in situ structural condition without coring.
- Direct estimation of existing pavement layer moduli without laboratory testing.

There are three design methods commonly used in practice to estimate the required overlay thickness: the effective thickness approach, the deflection approach, and the mechanistic-empirical (M-E) approach [*9-11*]. In general, the NDT deflection testing can be incorporated into any of those design methods. The Louisiana Department of Transportation and Development (LADOTD) in 1980 developed a deflection based overlay thickness design method [*1*] using Dynaflect measured deflections. Due to then implementation of the AASHTO pavement design procedure, it was not fully implemented at that time. However, a Dynaflect-deflection based pavement evaluation chart developed from that study is still widely used in Louisiana for routine structural evaluation of existing pavements [*1*].

The current LADOTD overlay thickness design follows the “component analysis” method used in the 1993 AASHTO pavement design guide [*12*]. Since field or laboratory tests are not mandatory required by this method, engineers have to use their engineering judgments and a typical subgrade resilient modulus (Mr) value in the overlay design. Obviously, this can lead to errors since the values do not necessarily represent actual field conditions. By considering that full implementation of the new Mechanistic-Empirical (M-E) design method still requires several years to achieve, therefore, an overlay design method based on the actual field conditions is currently needed for Louisiana.

OBJECTIVE AND SCOPE

The objective of this study was to establish an overlay thickness design method for flexible pavement in Louisiana based on in-situ pavement conditions and non-destructive test methods.

Four overlay rehabilitation projects with different soil subgrade types and traffic levels were selected in this study. Detailed condition survey and NDT deflection tests (FWD and Dynaflect) were performed on test sections at 0.1 mile interval measurements. Four NDT-based overlay thickness design methods such as Asphalt Institute (AI) MS-17, Arkansas ROADHOG, ELMOD 5, and the 1993 AASHTO NDT procedure were investigated and used in the design of required overlay thicknesses. The new NCHRP 1-37A M-E Pavement Design Guide (MEPDG) software version 1.00 was also used in the analysis.

PROJECT INFORMATION AND FIELD TESTING

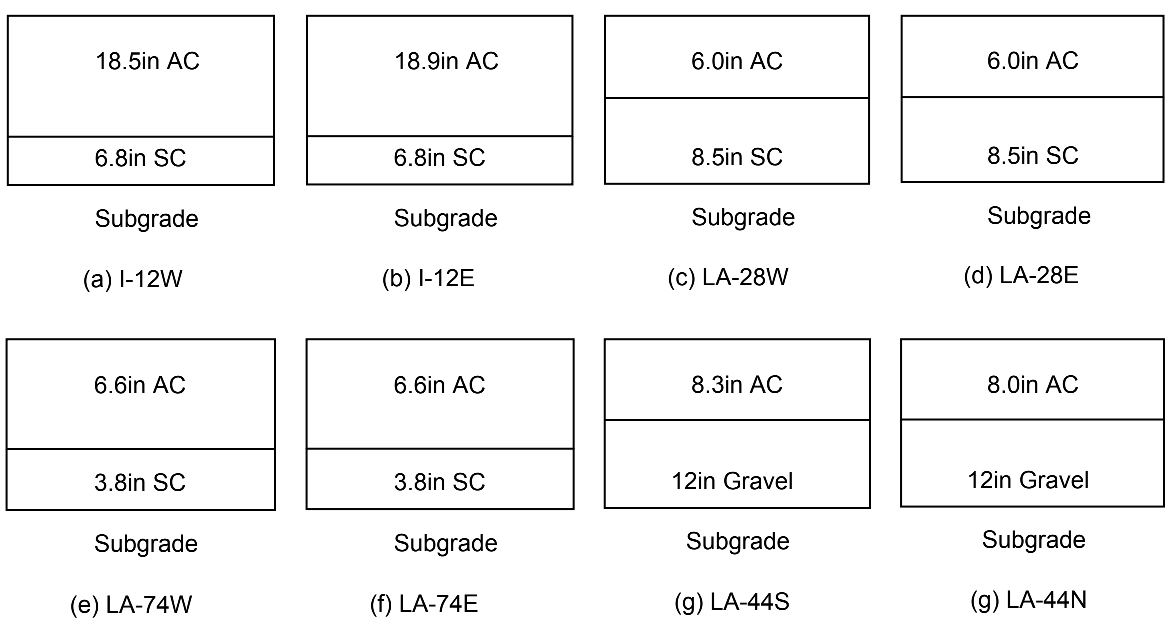
The selection of four overlay rehabilitation projects was coordinated with the LADOTD pavement design and research personnel. These projects were strategically chosen to have different soil subgrade types and traffic levels. Table 1 presents general information of each project.

TABLE 1 General Project Information

Route name	Road Classification	Parish	Design Mr* (psi)	ADT	Annual Growth (%)	Design life (year)
I-12	Rural Principal Arterial Interstate	St Tammany	9,200	45,100	2.7	15
LA28	Rural Principal Arterial Other	Rapides	8,797	5,500	1	20
LA74	Rural Major Collector	Ascension	8,400	7,500	3	10
LA44	Rural Major Collector	ST James	8,023	3,300	1.1	10

Note: * the design subgrade resilient values (Mr) are from Louisiana parish Mr map, 1 psi= 6.89kPa.

Based upon the structural and conditional difference existed on each travel direction of pavements, eight overlay design sections were resulted for this study, i.e. I-12W, I-12E, LA-28W, LA-28E, LA-74W, LA-74E, LA 44S and LA-44N. The existing pavement structures of these pavements are presented in Figure 1.

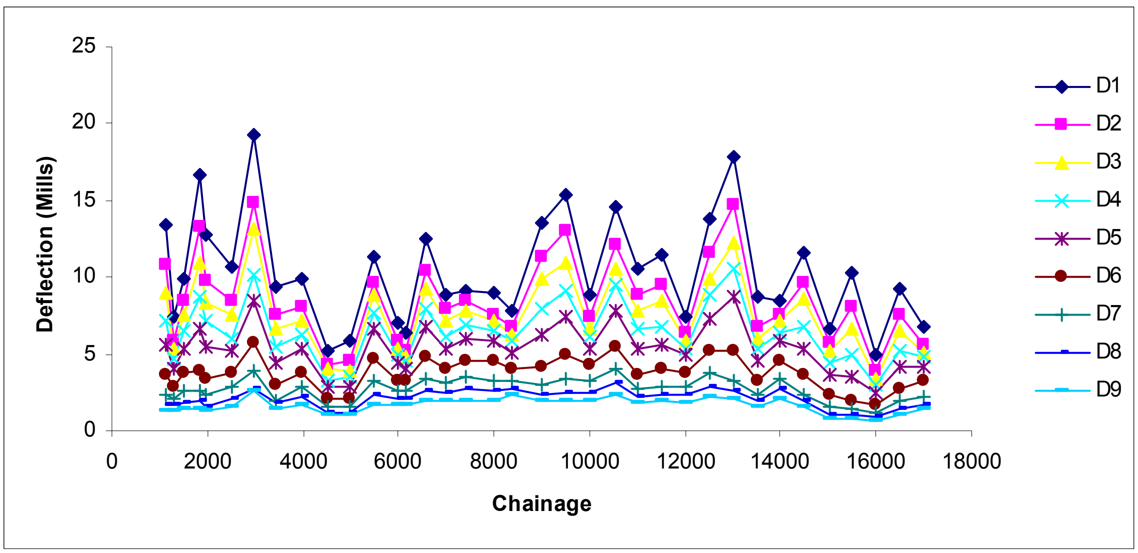


Note: 1 in= 25.4mm.

FIGURE 1 Existing Pavement Structures (AC-Asphalt Concrete, SC-Soil Cement).

NDT tests, including FWD and Dynaflect, were performed at each selected pavement section at a 0.1 mile (160m) interval. NDT tests were conducted on the right wheel path of a selected lane or the outside lane of a two-lane two-direction highway. Pavement mid-depth temperatures and in situ pavement thickness were measured during the NDT tests.

Dynaflect is a trailer mounted device which induces a dynamic load of 1000 lbs (4.45kN) on the pavement to measure the resulting deflections by five geophones, spaced under the trailer at 1 foot (0.305m) intervals from the application of the load. A Dynatest 8002 model FWD device was used with nine sensors spaced at 0, 8, 12, 18, 24, 36, 48, 60 and 72 inches (0, 203.2, 304.8, 457.2, 619.2, 914.4, 1219.2, 1524, and 1828.8mm), respectively. FWD deflection data obtained from a target load of 9000 pounds (40.05kN) was used in the analysis of this study. Figure 2 presents the typical deflections measured by FWD. As expected, a large variation of deflections can be observed along the chainage of a project, which indicates different pavement structural strengths within the project.



Note: 1 mills=0.0254mm.

FIGURE 2 Typical Deflections of FWD Test.

A detail condition survey was performed, and the collected data included cracking, rut depth, and International Roughness Index (IRI) were collected for each selected section. Figure 3 shows typical severe field cracking patterns on each section. In general, the cracks observed on I-12 project were not as severe as those on other projects.

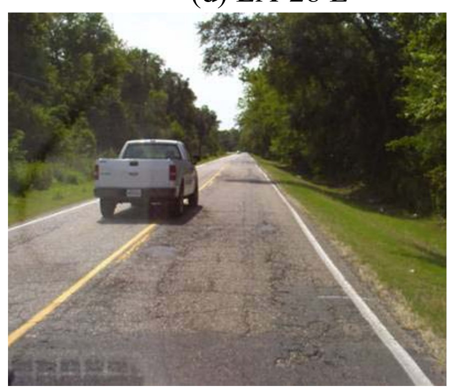
(a) I-12W

(b) I-12E

(c) LA-28 W

(d) LA-28 E

(e) LA-74 W



(f) LA-74 E

(g) LA-44 S

(h) LA-44 N

FIGURE 3 Project Cracking Information Survey.

The measured rut depth and IRI values are presented in Table 2. In general, the average rut depths for projects were found similar, which ranged from 0.18 to 0.27 in (4.6 to 6.9 mm). However, the standard deviations for LA-74W, LA-74E and LA-44N were found higher than that of other projects. From Table 2, the average IRI values of I-12W and I-12E were only about 70 in./mile (1.11m/km), followed by LA28 two sections of about 110 in./mile (1.75m/km). The average IRI values for the other four pavement sections were more than 150 in/mile (2.38m/km), indicating a very rough riding surface.

TABLE 2 Summary of Condition Survey on Rutting and Surface Roughness

Project	Rut (in.)		IRI (in./Mile)	
	Average	Std.	Average	Std.
I-12 W	0.262	0.029	70.9	13.7
I-12 E	0.267	0.039	76.1	43.5
LA-28 W	0.196	0.056	113.9	26.7
LA-28 E	0.175	0.068	114.7	21.4
LA-74 W	0.208	0.132	216.1	85.7
LA-74 E	0.233	0.150	167.2	56.9
LA-44 S	0.227	0.071	224.1	68.2
LA-44 N	0.242	0.143	198.1	53.8

Note: 1 in.= 25.4mm, 1 in./mile= 0.0159 m/km.

OVERLAY THICKNESS DESIGN METHODS

Current LADOTD Method

The current LADOTD overlay design method follows the 1993 AASHTO pavement design guide. The 1993 AASHTO overlay thickness design method utilizes the effective thickness approach. The required thickness of the asphalt concrete (AC) overlay is a function of the structural capacity required to meet future traffic demands and the structural capacity of the existing pavement, as determined by the following basic design equation [*12*]:

$$h_{OL} = \frac{SN_{OL}}{a_{OL}} = \frac{SN_f - SN_{eff}}{a_{OL}} \qquad (1)$$

where h_{OL}= required thickness of asphalt overlay; SN_{OL} = required structural number of asphalt overlay; a_{OL}= structural layer coefficient of asphalt overlay; SN_f = structural number required to carry future traffic; and SN_{eff} = total effective structural number of the existing pavement prior to overlay.

The AASHTO provides three methods from which the design subgrade resilient modulus (M_R value) may be obtained: (a) Laboratory Testing; (b) Backcalculation from NDT measurements; and (c) Approximate estimate using available soil information and relationships developed from resilient modulus study. Similarly, the AASHTO proposes three methods to determine the effective structural number (SN_{eff}): (a) NDT method; (b) Component analysis method; and (c) Remaining life method [*12*].

The current LADOTD overlay design method uses empirical "book" values. Each parish in the state is pre-assigned one representative design M_R value, so-called "parish-map modulus". The SN_{eff} value, on the other hand, is determined based on the component analysis method, where the layer coefficients for existing pavement layers are chosen from a pre-defined layer coefficient table.

The 1993 AASHTO NDT-Based Procedure

As descried above, the 1993 AASHTO NDT-based overlay design procedure requires both the design M_R and the effective structural number (SN_{eff}) are backcalculated from NDT measurements.

Asphalt Institute MS-17 Method

The Asphalt Institute (AI) MS-17 [*13*] provided two separate flexible pavement overlay design methods: one is the effective thickness method and the other is a deflection-based procedure. The effective thickness method estimates the overlay thickness as the difference between the thickness required for a new full-depth asphalt pavement and the effective thickness of the existing pavement. The determination of the effective thickness requires the conversion factors associated with each of existing layers. Since this method does not require any field NDT measurements and based solely on the "conversion factor" concept, it was not included in the overlay design of this study.

The second method in the AI MS-17 manual [*13*] is based on the representative rebound deflection measured from the Benkelman beam test. With the projected overlay traffic, temperature adjustment factor, and critical period adjustment factor, the design overlay thickness is obtained from a design chart, in which a unique relationship is pre-constructed among the design rebound deflection, the allowable ESALs and overlay thickness. In this study, this method was used in the overlay design based on a relationship between deflections measured from the Benkelman Beam and FWD.

ROADHOG Program

The ROADHOG is an Excel spreadsheet based overlay design computer program. It was developed based on the results of research conducted for the Arkansas State Highway and Transportation Development [*14*]. The ROADHOG procedure is generally similar to the 1993 AASHTO NDT-based procedure except that the *SNeff* value in ROADHOG is determined based on a relationship between *SNeff* and *Delta-D.* The *Delta-D* value represents the difference between the FWD surface deflection measured directly under the load (the maximum deflection) and the deflection measured at a distance from the applied load equal to the thickness of the pavement structure [*14*].

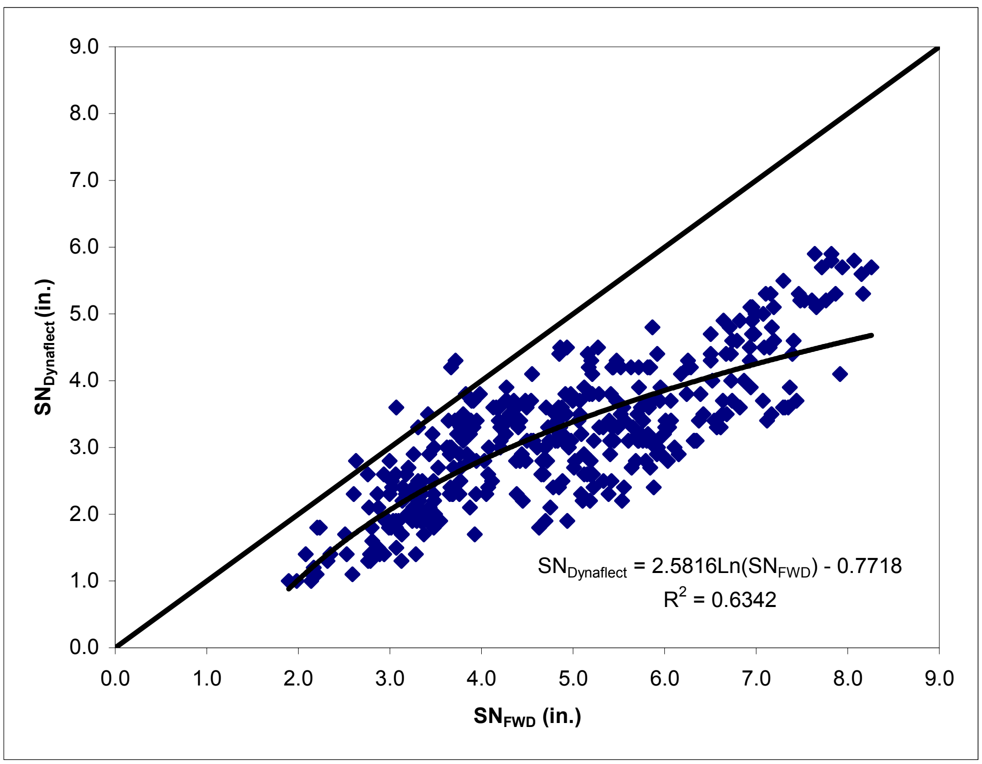
ELMOD 5 Method

ELMOD is an acronym for Evaluation of Layer Moduli and Overlay Design [*15*]. The ELMOD 5 program is a mechanistic-empirical based approach for overlay thickness design. It includes a FWD backcalculation module based on the Odemark-Boussinesq method. In an overlay design using ELMOD 5, the required inputs include the predicted future traffic, backcalculated layer moduli, seasonal variation parameters, and the design criteria for both fatigue cracking and permanent deformation. Due to lack of data, the ELMOD default values were selected for both seasonal variation parameters and the design criteria. Basically, the default design criteria in ELMOD 5 are the fatigue cracking and rutting equations used in Asphalt Institute MS-1 design manual [*15*].

Proposed NDT-Based Overlay Design Method

Background

Kinchen and Temple [*1*] in 1980 developed a Dynaflect-deflection based approach for structural evaluation of flexible pavements in Louisiana. In that approach, based on a temperature-corrected Dynaflect center deflection and a percent spread value, an effective structural number, SN_{eff}, and a design subgrade modulus of existing pavements can be determined using a Pavement Evaluation Chart. This chart is currently being implemented into a computer program. The percent spread value is defined as the average of five Dynaflect-measured deflections in percentage of its central deflection. Louisiana experience indicates that, when a good engineering judgment is involved, the SN_{eff} -values determined from the current component analysis method matches reasonably well to the Dynaflect determined ones, indicating that the Dynaflect SN_{eff} -value can reflect Louisiana pavement conditions. On the other hand, as shown in Figure 4, the SN_{eff} -values determined from the 1993 AASHTO procedure based on FWD measurements are generally much higher than the Dynaflect determined SN_{eff} -values. The correlation equation showed in Figure 4 was developed based on 370 data points on 17 in-situ asphalt pavements. It is noted that more pavement data are currently being collected and the developed Pavement Evaluation Chart will be modified if necessary.



Note: 1 in.=25.4mm.

FIGURE 4 Correlation of Effective Structural Number between FWD and Dynaflect.

Proposed Overlay Design Method

The proposed overlay design method generally follows the design steps described in the 1993 AASHTO NDT-based overlay design procedure. If Dynaflect measured deflections are available, the SN_{eff} value and a design subgrade Mr can be determined based on the Pavement Evaluation Chart (or computer-program) as described above. When FWD tests are used, the determined SN_{eff} value needs to be scaled down based on the equation showed in Figure 4. The FWD-based design Mr value is computed using the following equation:

$$Design \quad M_R = 0.33(\frac{0.24P}{d_r r}) \tag{2}$$

Where P = applied FWD load of approximately 9,000 pounds (40 kN); d_r= deflection at a distance of 36 inches (900 mm) from the center of the load; and r = 36 inches (900 mm).

It is noted, all other design inputs, e.g. the reliability level, design PSI loss and overall standard deviation, are selected based on the current LADOTD overlay design method.

OVERLAY THICKNESS DESIGN RESULTS

Effective Thickness Overlay Design Method

Three overlay design methods evaluated in this study are belonged to the effective thickness method. They are the current LADOTD method, ROADHOG, and the 1993 AASHTO NDT procedure. Table 3 presents the overlay thickness design results from these methods. It is noted that the reliability level in the overlay design is based on Louisiana roadway classification, suggested by the current DOTD overlay design method. As shown in Table 3, the overlay thicknesses determined by both the AASHTO NDT procedure and ROADHOG program were generally lower than those values obtained from the current DOTD method with a few exceptions in projects LA-74E and LA 44. The lower required overlay thicknesses by the AASHTO NDT procedure are expected since it usually predicts a higher SN_{eff} value for pavements in Louisiana, as a result, a lower required overlay thickness. On the other hand, the overlay thicknesses determined from the ROADHOG program were similar to that from the AASHTO procedure. Since the empirical relationships used in the ROADHOG program has not been verified by Louisiana pavement conditions, a direct use of this program is not recommended based on the results obtained in this study.

TABLE 3 Overlay Design Results Using the Effective Thickness Methods

Project	Classification	Reliability (%)	S_0	Design ESALs	ΔPSI	Overlay thickness (in)		
						LADOTD	AASHTO	ROADHOG
I-12 W	Rural Principal Arterial Interstate	97	0.47	24,399,600	1.5	3.4	0.0	0.0
I-12 E						3.4	0.0	0.0
LA-28 W	Rural Principal Arterial Other	95		1,512,993	1.8	3.3	0.5	0.9
LA-28 E						3.3	2.0	2.2
LA-74 W	Rural Major Collector	85		819,101	2	2.4	1.3	0.2
LA-74 E						2.4	2.7	0.7
LA-44 S	Rural Major Collector	85		353,256	2	0.0	0.0	0.6
LA-44 N						0.0	0.0	0.8

Note: 1 in.=25.4mm.

AI MS-17 Deflection Method

Table 4 presents the overlay design results using AI MS-17 deflection based method. In general, the overlay thicknesses determined by the AI MS-17 deflection method were all smaller than those thickness values obtained from the current LADOTD method. As shown in Table 4, to use the AI MS-17 method, the FWD measured deflections had to be translated into the Benkelman Beam deflections. Since the correlation between FWD and Benkelman Beam deflections is not planned to be further modified based on Louisiana conditions, directly using the AI MS-17 method is considered not valid based on this study. Interestingly, although the fundamental methodology using in the AI MS-17 deflection method is completely different from the effective thickness method, the required overlay thicknesses were found quite similar to the values determined from the 1993AASHTO NDT procedure.

TABLE 4 Overlay Design Results Using AI Deflection Method

Project	Average D_1 (Mills)	Std. D_1 (Mills)	Temperature Correction	RRD (Mills)	Overlay Thickness (in.)
I-12 W	3.071	0.349	0.85	5.159	0.0
I-12 E	2.646	0.385	0.9	4.951	0.0
LA-28 W	10.444	3.607	0.85	24.164	0.0
LA-28 E	14.752	9.802	0.82	45.356	2.5
LA-74 W	13.141	6.495	0.9	37.865	1.0
LA-74 E	19.453	9.54	0.82	31.591	2.2
LA-44 S	12.708	2.985	0.83	24.961	0.0
LA-44 N	13.171	3.077	0.8	24.891	0.0

Note: D1= Center deflection of FWD; RRD=Representative rebound deflection converted from FWD to Bankelman Beam; 1 Mills = 0.0254mm, 1in.= 25.4mm.

ELMOD5 M-E Method

Table 5 presents the overlay design results using the ELMOD5 computer program.

TABLE 5 Overlay Design Results Using ELMOD 5 Method

Project	Average (in)	Std.(in)	Reliability (%)	Overlay Design Thickness (in.)
I-12 W	0.00	0.00	97	0.0
I-12 E	0.00	0.00		0.0
LA-28 W	1.12	1.61	95	2.8
LA-28 E	2.40	3.60		4.0
LA-74 W	5.53	4.09	85	9.8
LA-74 E	3.98	3.50		7.6
LA-44 S	0.09	0.33	85	0.4
LA-44 N	0.04	0.22		0.3

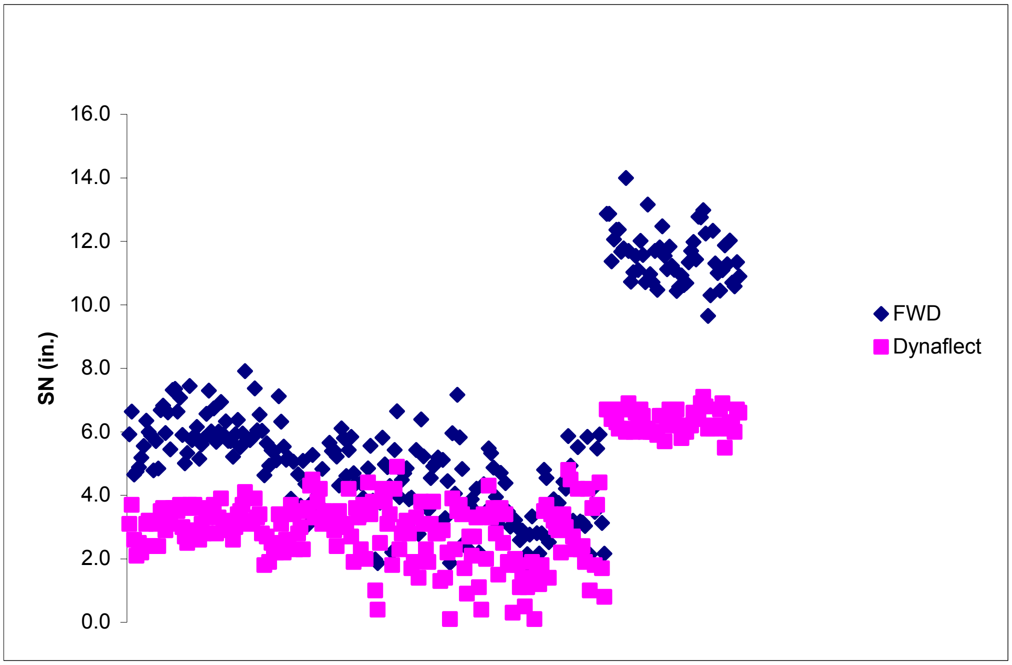
Note: 1 in. =25.4mm.

As shown in Table 5, a mix-bag of overlay thicknesses was obtained. In three projects I-12W, I-12E and LA-28W, the predicted overlay thicknesses by ELMOD5 were smaller than that from the current LADOTD method. For other five projects, the ELMOD5 determined thicknesses were higher. Especially in projects LA-74W and LA-74E, the ELMOD5 determined overlay thicknesses were 9.8 in (248.9mm) and 7.6 in (193mm), respectively. These thicknesses obviously are too high to be believed and thus not considered as valid values.

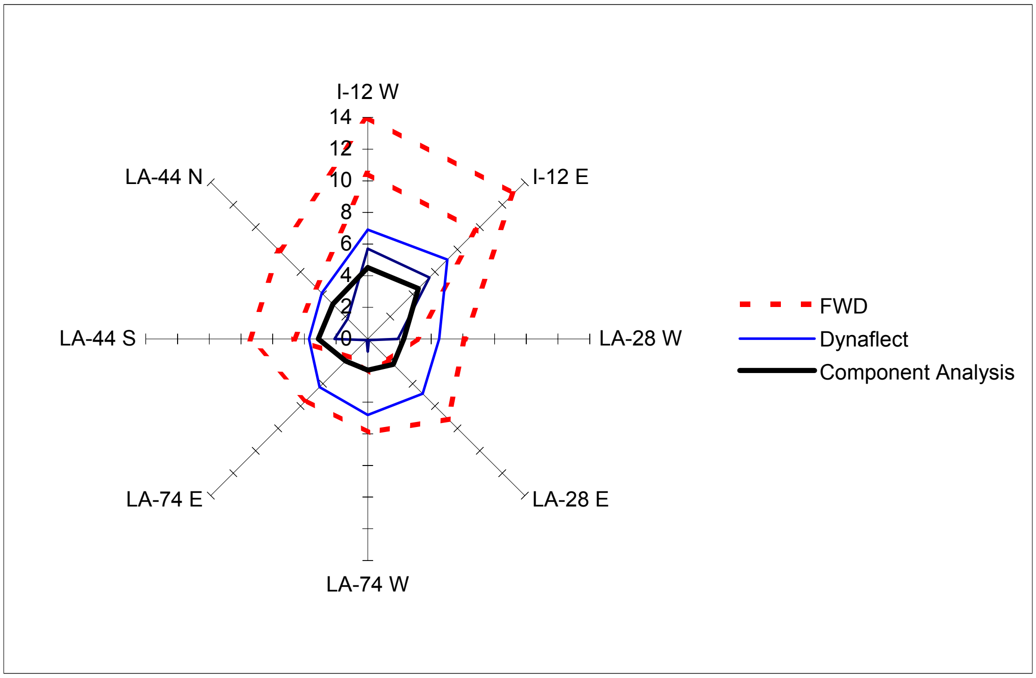
Since the ELMOD 5 program is an M-E based overlay thickness design procedure. Many inputs including the fatigue and rutting criteria are not directly available from in-situ NDT tests. Similarly, a direct implementation of this procedure is not recommended in this study.

Proposed NDT Overlay Design Method

Figure 5(a) presents the predicted SN_{eff} values obtained from FWD and Dynaflect for all projects evaluated in this study. The FWD SN_{eff} values were backcalculated using the 1993 AASHTO NDT procedure, whereas, the Dynaflect SN_{eff} values were determined from the Louisiana Pavement Evaluation Chart method. SN_{eff} values were also estimated based on the "Component Analysis" method used in current LADOTD method. As expected, the SN_{eff} values obtained from FWD were significantly higher than that from Dynaflect, especially for I-12 projects. On the other hand, as shown in Figure 5(b), the Dynaflect SN_{eff} values were observed very similar (but not exactly the same) to that determined from the component analysis method.



(a) SN_{eff} Obtained from FWD and Dynaflect



(b) SN_{eff} Range form FWD, Dynaflect and Condition Survey
Note: 1 in.=25.4mm.

FIGURE 5 Effective Structural Number Obtained from FWD and Dynaflect.

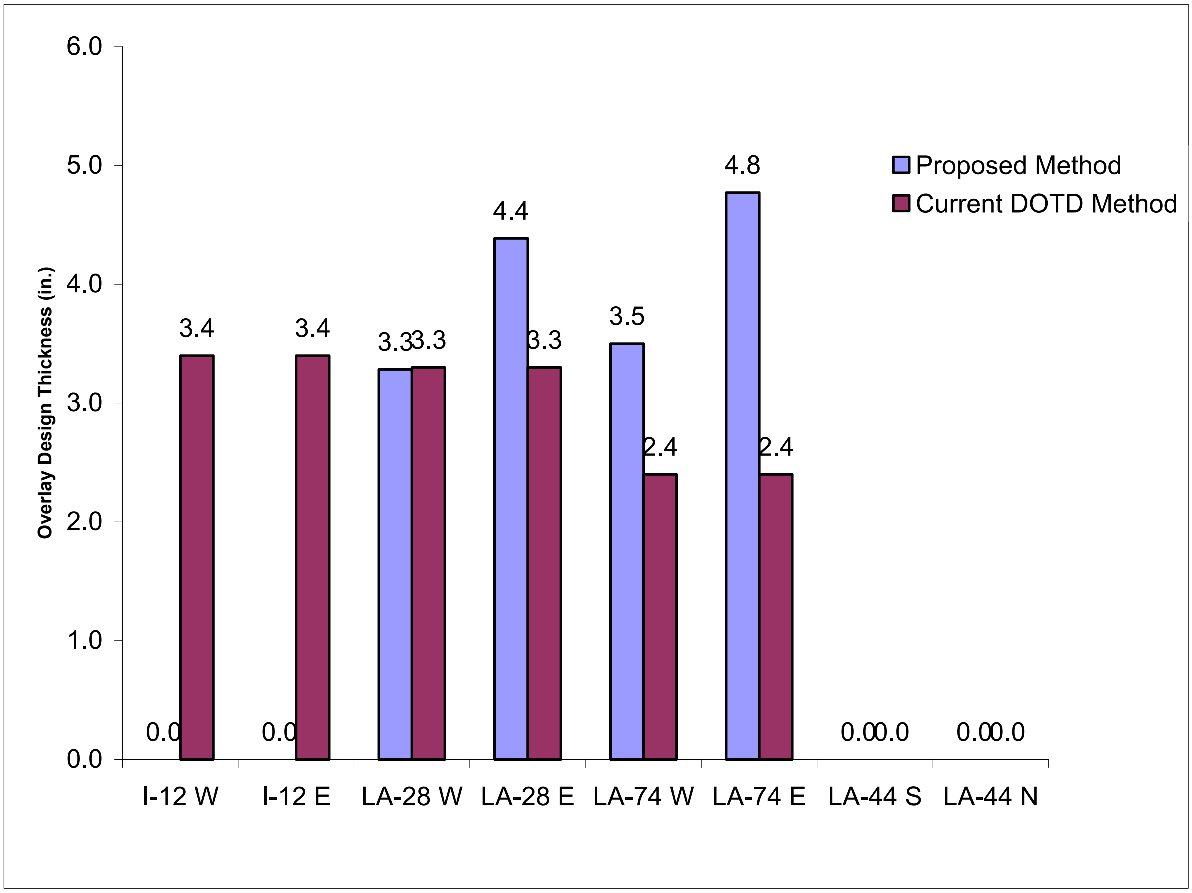
Table 6 presents the overlay design results from the proposed overlay design method as compared to those obtained from the 1993 AASHTO procedure. As shown in Table 6, both methods indicate that no overlay thickness was required by projects I-12 and LA 44. On the other hand, for projects when the structural overlay is required, the thicknesses determined from the proposed method were higher than those from the 1993 AASHTO procedure.

TABLE 6 Overlay Design Result of 1993 AASHTO and Proposed Methods

Project	SN_{eff} (in.)		SN_f (in)	Overlay Design Thickness (in.)	
	FWD	Proposed		AASHTO	Proposed
I-12 W	11.65	5.56	4.77	0.0	0.0
I-12 E	11.31	5.49	4.84	0.0	0.0
LA-28 W	4.14	2.89	4.34	0.5	3.3
LA-28 E	3.5	2.46	4.39	2.0	4.4
LA-74 W	3.24	2.26	3.8	1.3	3.5
LA-74 E	2.84	1.92	4.02	2.7	4.8
LA-44 S	5.74	3.74	3.59	0.0	0.0
LA-44 N	5.8	3.77	3.5	0.0	0.0

Note: 1in.=25.4mm.

Figure 6 presents the overlay thickness design results from both the proposed and the current LADOTD overlay design methods. By compared to the proposed method, the current DOTD method generally over-estimated the overlay thickness for project I-12, and under-estimated the thicknesses for projects LA-28E, LA-74W and LA74E.



Note: 1 in.=25.4mm.

FIGURE 6 Overlay Design Results of Proposed Method and Current DOTD Method.

It is noted that all above determined overlay thicknesses are structural overlay thicknesses, based on the structural deficiency of the existing pavement for the future traffic. Functional overlay is not included in the design. Based on the in site condition survey results (Figure 3 and Table 2), no structural overlay required for both I-12 projects is deemed valid based on the current roadway condition. But the routine maintenance repair is still needed for localized distresses such as cracking and rutting. However, for project LA-44, a functional overlay appears to be needed urgently due to the high IRI values and severe cracking. On the other hand, for under-estimated sections, such as LA-74E, less overlay thickness will result in an early pavement failure. Because the current LADOTD method could not reflect the in-situ pavement condition, it is thought to have under-estimated the structural overlay thickness for projects LA-28E, LA-74W and LA-74-E.

Overlay Design Using MEPDG Version 1.00

The NCHRP 1-37A MEPDG software version 1.00 was used to analyze the overlay design results determined by the proposed and current LADOTD methods, as shown in Figure 6. The MEPDG software needs sophisticate inputs, and most of them are still not available in Louisiana. In this study, the default Level 3 input values suggested by the MEPDG software version 1.00 were selected in the analysis, except the traffic, climate, pavement thickness and modulus values for the base and subgrade materials (the modulus values were backcalculated from FWD deflections). Table 7 presents the analysis results obtained from the MEPDG version 1.00. For projects I-12W and I-12E, the overlay thicknesses determined by both the proposed and current LADOTD methods were failed due to not meeting the asphalt concrete (AC) permanent deformation criteria. In these two sections, even an overlay thickness was assigned as 10 inches (254mm), such AC permanent deformation criteria was still not met. This indicates that an overlay design can not be performed by the MEPDG software version 1.00 with default values. The reason why this happens is unknown. Although some results shown in Table 7 also indicate that the overlay thicknesses determined by the current LADOTD method were met the design criteria, the default values used in the analysis plus some unknown AC permanent deformation criteria made this analysis invalid.

TABLE 7 Results of Overlay Thickness Verification using MEPDG Software

Project	Overlay thickness (in.)		MEPDG verified results	
	DOTD	Proposed	DOTD	Proposed
I-12W	3.4	1*	AC Permanent Deformation Fail	AC Permanent Deformation Fail
I-12E	3.4	1*	AC Permanent Deformation Fail	AC Permanent Deformation Fail
LA-28W	3.3	3.3	AC Permanent Deformation Fail	AC Permanent Deformation Fail
LA-28E	3.3	4.4	AC Permanent Deformation Fail	pass
LA-74W	2.4	3.5	pass	pass
LA-74E	2.4	4.8	pass	pass
LA-44S	1*	1*	pass	pass
LA-44N	1*	1*	pass	pass

Note: * The design thickness was zero, however 1 inch was used since it's the minimum overlay thickness in MEPDG software. 1in.=25.4mm.

SUMMARY AND CONCLUSION

Four overlay rehabilitation projects with different traffic levels and design requirements were selected in this study. Four NDT-based overlay design methods were investigated and used in the design of required overlay thicknesses. Results indicated that the 1993 AASHTO procedure method was generally over-estimated the effective structural number for existing pavements, which would result in an under-designed overlay thickness. On the other hand, other NDT methods, such as Asphalt Institute MS-17, Arkansas ROADHOG and ELMOD5, were found not directly applicable to the Louisiana pavement condition. Therefore, a modified NDT-base overlay thickness design method was proposed in this study. This method, before full implementation of the new M-E pavement design method, is deemed to better reflect the Louisiana pavement structural condition and be more effective for a routine use.

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DISCLAIMER

The information presented in this paper only reflects the views from the authors. No official endorsement should be associated with the information provided.

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