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Simplified Approach for Structural Evaluation of Flexible Pavements at the Network Level

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SIMPLIFIED APPROACH FOR STRUCTURAL EVALUATION OF FLEXIBLE PAVEMENTS AT THE NETWORK LEVEL

By

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ABSTRACT

SIMPLIFIED APPROACH FOR STRUCTURAL EVALUATION OF FLEXIBLE PAVEMENTS AT THE NETWORK LEVEL

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Currently, there is no simple procedure available to identify structurally weak pavement sections using Falling Weight Deflectometer (FWD) data at the network level (e.g., city, state or province). A simple method is needed to determine the structural condition of pavement sections that can be directly implemented and automated in the current pavement databases. The method needs to be simple enough to be used with a network level FWD database for the purpose of numerically ranking pavement sections at the network level from good to poor. Texas Department of Transportation (TxDOT), as well as many other state transportation agencies, collect FWD data at the network level in order to identify weak pavement sections that would require further analysis at the project (e.g., local street) level. Backcalculation has been utilized to obtain layer moduli and determine overlay (new added surface pavement layer) thickness at the project level. However, the use of the backcalculation technique at the network level is

complicated and time consuming, which makes it not practical for network level pavement sections assessment.

The objective of this research study is to develop a simple analysis method to determine the structural condition of pavements using currently available non-destructive testing (NDT) deflection measurement devices at the network level that can be directly implemented and automated in the database of a typical transportation agency (such as TxDOT). In addition, this proposed study aims to run an advanced 3D-Move simulation analyses to mimic the FWD deflection bowl obtained from the field in an effort, for the first time, to reduce the need to run extensive FWD testing on the network level.

The proposed deflection and area ratio parameters will serve as indicators of the pavement structure's capacity to carry heavy traffic. In addition, deflection and area ratio parameters will help with the overall evaluation of the health of the road network and the determination of the remaining life of individual road segments. This will allow transportation officials to obtain a clearer view of the state of the network. Therefore, they can have more accurate estimation of the required funds to maintain the highway network at a certain desired level. With this approach, more informed decisions about the most suitable maintenance and rehabilitation strategies can be made.

Since the deflection data that are commonly collected by the agency will be utilized in this approach, the approach will be economically feasible. The developed single and overall parameter, CA_r' was well related to the number of load repetitions to fatigue failure, N_f, with a coefficient of determination, R^2 of 0.96. The single parameter can be easily implemented in the

PMS databases and thus, CA_r' will help the South-Central state DOTs and local highway agency officials to make more informed decisions about the most suitable maintenance and rehabilitation strategies.

Chapter One

Introduction

Many state and overseas DOTs collect nondestructive (NDT) deflection testing data at the network level in order to identify weak pavement sections that would require further analysis at the project level. NDT equipment employed include Falling Weight Deflectometer (FWD), Deflectograph, Traffic Speed Deflectometer (TSD), and others. In these devices, a load is applied on the pavement surface and the surface deflections at several lateral locations from the load point are recorded. Backcalculation technique has been utilized to estimate layer moduli and determine the overlay thickness at the project level. However, the use of the backcalculation technique at the network level is complicated and time consuming. In addition, it requires the knowledge of layer thicknesses which are not commonly collected at the network level, making this technique not practical for the network level assessment. Currently, there is no simple procedure available to identify structurally weak sections using data obtained from the NDT deflection measurement devices at network level. A huge amount of NDT data collected by various transportation agencies has not been utilized because of the lack of an automated method of analysis. In fact, some state Departments of Transportation (DOT), such as TxDOT, used to collect NDT data at the network level, but stopped doing this collection due to the lack of a simple method to analyze the collected data.

An innovative method is needed to determine the structural condition of pavement sections at the network level that can be directly implemented and automated in the agency's database. The method needs to be simple enough to be used with the network level deflection data for the purpose of numerically ranking pavement sections at the network level from good to poor.

Chapter Two

Background

2.1 Deflection-Based Measurement Devices

Pavement deflection has been widely utilized as a nondestructive technique to evaluate the structural capacity of pavement structures at both network and project levels. Current devices include the Quest/Dynatest Rolling Weight Deflectometer (Quest/Dynatest RWD), Swedish Road Deflection Tester (Swedish RDT), Texas Rolling Dynamic Deflectometer (Texas RDD), Applied Research Associates, Inc. Rolling Wheel Deflectometer (ARA RWD), United Kingdom's Highway Agency Traffic Speed Deflectometer (UK TSD), and Falling Weight Deflectometer (FWD).

The FWD is the main deflection-measuring device in the U.S. (Coetzee et al.(1)). The FWD measures the impact resulting from a known load falling from a certain height to closely simulate the effect of rolling traffic loads on the pavement surface. The FWD has been widely used as a reliable tool to measure pavement surface deflection bowl. With the advent of computer technology and the development of multilayer elastic analysis software along with the development of accelerated test tracks, the measured deflection bowl was utilized to backcalculate layer moduli, and several parameters were derived to evaluate the structural condition of pavement structures. However, the backcalculation technique is not feasible to conduct at the network level due to its inability to produce a simple measure of the structural integrity of pavement and, therefore, its use is limited to project level evaluation.

When pavement surface deflects under load, the deflected shape varies depending on the pavement structural capacity, subgrade strength, load magnitude, and pulse duration. The

deflection bowl can be divided into different zones with each zone partaking its own pavement structural associations. For example, the maximum central deflection is more related to the entire pavement structure, which furthermore reflect the condition of the subgrade. High central deflection is usually associated with weak subgrade or poor drainage condition. Stubstad et al. (2) provided a summary of potentially relevant agency practices for FWD data collection and use for network-level analyses (Table 1).

Table 1 Summary of useful practices of FWD in network-level analyses (4)

Agency and Publication	Test Point Spacing	FWD Test Frequency	FWD Sensor Spacing	Limiting Factors	Basic Details of the PMS Approach
South Africa; Benchmarking the Structural Condition of Flexible Pavements with Deflection Bowl Parameters	0.2 km	N/A	300 mm typical	Flexible pavements only	Pavement is divided into three zones based on depth. Uses basin parameters to characterize base, mid-depth, and subgrade structural condition such as sound, warning or severe.
Alaska Department of Transportation (AkDOT); Modeling Flexible Pavement Response and Performance	0.1 mi	After repaving	SHRP positions	No limits	Deflections are converted to layer moduli, which are then used to obtain stress/strain values under a standard equivalent single axle load (ESAL). Transfer functions relate stress/strain to cracking in bound layers and permanent deformation in unbound layers.

Table 1 Summary of useful practices of FWD in network-level analyses (Cont) (4)

Texas Department of Transportation (TxDOT); Incorporating a Structural Strength Index into the Texas Pavement Evaluation System (FHWA/TX-88/409-3F)	0.5 mi	One recommended per year	1 ft	Flexible pavements less than 5.5 inches AC thickness	Structural strength index (SSI) varies from zero to 100 (weak to strong). Based on normalized basin parameters, such as outer deflections, surface curvature index (SCI), and center deflection under a 9,000-lb load. Can characterize subgrades and pavement structure independently in terms of relative stiffness. System based on statistical valuation of deflections statewide.

2.2 Existing Structural Parameters

Many states have investigated the possibility of implementing structural capacity indicators into their network-level pavement management systems (Zhang (3); Flora (4); Chowdhury et al. (5)). Coetzee et al. (1) analyzed the pavement deflection measuring devices that were used for the past few decades. In the late 1980s, FWD emerged as the new electronic deflection measuring tool, which could simulate a moving wheel load, measure elastic response and other critical points. The device was capable of measuring deflection bowl up to a distance of 1.8 to 2.0 m away from the point of loading.

The structural adequacy index (SAI) was an early index developed by Haas et al. (6) utilizing the Benkelman beam test. In fact, the SAI was calculated based on a single deflection value measured by the Benkelman beam test. Since the developed index depended on single deflection value, any minor error during measurement could adversely affect the parameter.

Haas et al. (7) conducted another study in which a bounded scale from 1 to 10 was allocated to the SAI and a maximum tolerable deflection (MTD) was calculated based on the pavement characteristics and the number of expected equivalent single axle loads (ESALs). Furthermore, deflection values that match the maximum calculated tolerable deflection were given 5 on the 1 to 10 scale and the maximum deflection that corresponds to a weak section in a bad condition was given 1, while a strong pavement in a good condition having a minimal deflection value was given 10 on the same scale. The limitation of this index was that the developed scale was not fixed and must be changed to meet the needs of any transportation agency implementing it.

Scullion (8) introduced a new structural strength index to the pavement evaluation system (PES) used in Texas. In this new index, pavement conditions were rated in terms of visual distresses or present serviceability index. After utilizing deflection bowl parameters and mechanistic approach in the calculation process of this index, the deflection bowl parameters approach proved more promising at the project level as a tool to estimate the remaining service life for different pavement sections. The report concluded that the network-level structural strength index may be calculated utilizing FWD testing at a load level of 9000 lbs.

Horak and Emery (9) illustrated the practice and basis for utilizing the deflection bowl parameters in the measurement of the elastic response for the entire deflection bowl. The study developed nine parameters as shown within Table 2. As demonstrated in this study, the parameters that had a good correlation with the pavement structural conditions were the maximum deflection (D0), Radius of Curvature (RoC), Base Layer Index (BLI), Middle Layer Index (MLI) and Lower Layer Index (LLI). Thus, only five out of the nine may be utilized in pavement structural condition prediction.

Table 2 Collection of parameters and their formulae (9)

Parameter	Formula	Structural indicator
Maximum deflection	D_0 as measured	Gives an indication of all structural layers with about 70 % contribution by the subgrade
Radius of Curvature (RoC)	$RoC = (L)^2 / 2\ D_0\ (1 - D_0/D_{200})$ where L=127mm in the Dehlen curvature meter and 200mm for the FWD	Gives an indication of the structural condition of the surfacing and the base condition
Base Layer Index (BLI)	$BLI=D_0-D_{300}$	Primarily gives an indication of the base layer structural condition
Middle Layer Index (MLI)	$MLI=D_{300}-D_{600}$	Primarily gives an indication of the subbase and probably selected layer structural condition
Lower Layer Index (LLI)	$LLI=D_{600}-D_{900}$	Gives an indication of the lower structural layers like the selected and the subgrade layers
Spreadability, S	$S = \{[(D_0 + D_1 + D_2 + D_3)/5] * 100\} / D_0$ where D1, D2, D3 spaced at 300 mm.	Supposed to reflect the structural response of the whole pavement structure, but with weak correlations
Area, A	$A = 6\ [1 + 2(D_1/D_0) + 2(D_2/D_0) + D_3/D_0]$	The same as above
Shape factors	$F_1=(D_0-D_2)/D_1$ $F_2=(D_1-D_3)/D_2$	The F2 shape factor seemed to give better correlations with subgrade moduli while F1 gave weak correlations
Slope of Deflection	$SD = \tan^{-1}(D_0 - D_{600})/600$	Weak correlations observed

Utilizing the five deflection bowl parameters that had good correlation with the pavement structural condition, a structural condition rating scale was developed to distinguish between structurally strong, warning, and severe damaged pavements. However, the developed parameters were calculated based on deflection values at four offset distances (200, 300, 600 and 900 mm) from the load plate.

The structural strength index (StSI) was developed by the Texas Department of Transportation (TxDOT) to supplement structural information into their pavement management information system. This index was based on the surface curvature index and the deflection at 457.2 mm (18 in.) for a 40 kN (9,000 lb) load level (3). Two methods were utilized in StSI calculation, one for thin asphalt sections and the other for intermediate and thicker asphalt pavements. Also, the calculated index was corrected for rainfall and traffic. An internal study (3) performed by TxDOT detected that the StSI was not sensitive enough to significantly distinguish pavements based on their distresses. It is worth mentioning that the developed index was based on a single deflection value at an offset of 18 inches from the load plate.

The structural strength indicator (SSI) was proposed in 2009 as a comprehensive index that utilizes deflection values from FWD. The SSI used the central deflections from FWD testing over a group of pavement sections to develop a function based on the cumulative distribution of the deflections. The basis for the SSI was developed by Flora (4). The method compared the deflection measurement of a given pavement with the overall deflection values of that particular group of pavements within the network. The index was ranked on a scale from 0 to 100, with 0 being a poor pavement section and 100 being a strong pavement section.

Kansas Department of Transportation (KDOT) and researchers from Kansas State University developed a set of regression equations to estimate the remaining service life (RSL) of a pavement section based on the central deflection under a 40-kN (9,000-lb) load (Gedafa et al. (10)). The remaining service life is the anticipated number of years left in a pavements functional or structural service life. The RSL employs sigmoidal performance models, and the central deflection was utilized to predict the remaining service life of a pavement section. The RSL equations were calibrated based on information from non-interstate routes and showed good correlation to the remaining life predictions based on serviceability.

Effective Structural Number (SN_{eff}) is considered to be a reliable parameter and many researchers have developed the SN_{eff} based on different approaches. In 2014, Gedafa et al. (11) developed a SN_{eff} based on KDOT pavement management systems (PMS) data. The study stated that the SN_{eff} based on AASHTO procedure included only the thickness of pavement layers and effective pavement modulus of all layers above subgrade. Whereas the developed SN_{eff} was based on different responses and properties of pavements such as central deflection and fatigue. Multiple regression models for SN_{eff} were developed for twelve different road categories utilized in the state of Kansas. Developed models were successfully correlated to the SN_{eff} calculated based on AASHTO procedure. It should be noted that developed SN_{eff} was most sensitive to the central deflection, which represents that a minor error during measurement can mislead the transportation officials. In addition, the models were developed based on various independent parameters such as pavement mid-depth temperature and subgrade modulus (M_R). Calculation of all required parameters included in regression models could be difficult for pavement engineers.

Table 3 Multiple regression models. (11)

RC	Multiple Regression Models	R^2	SE	n
12	$SN = 1.7646 - 0.1192d_0 + 0.0618D + 3.3807\log(EAL) - 1.2093\left(log(EAL)\right)^2$	0.71	0.29	57
13	$SN = -18.4003 - 0.2280d_0 + 0.0039d_0^2 + 17.2182l\,og(AADT) - 3.1194\left(log(AADT)\right)^2 + 0.2053EFCR - 0.0433EFCR^2 - 2.0512\text{Rut}$	0.85	0.29	134
14	$SN = 1.7135 - 0.2824d_0 + 0.0034d_0^2 - 0.1684D + 0.0093D^2 + 0.0067(d_0 \times D) + 3.2203\log(AADT) - 0.5636\left(log(AADT)\right)^2 + 0.1539ETCR - 2.7282Rut + 6.6896Rut^2$	0.85	0.36	253
15	$SN = 6.5122 - 0.6298d_0 + 0.0164d_0^2 + 0.0905D + 0.7622\log(EAL)$	0.86	0.38	70
16	$SN = 15.5117 - 0.3529d_0 + 0.0065d_0^2 - 0.0951D + 0.0095D^2 - 6.8613\log(AADT) + 1.2916\left(log(AADT)\right)^2 + 0.1596ETCR - 1.2294Rut$	0.80	0.44	651
17	$SN = 3.5042 - 0.4264d_0 + 0.0088d_0^2 - 0.0109D + 0.0063D^2 + 2.1527\log(AADT) - 0.3784\left(log(AADT)\right)^2 + 0.1916ETCR - 0.1178ETCR^2 - 0.0039EFCR + 0.0083(ETCR \times EFCR)$	0.75	0.57	3,771
18	$SN = 6.4899 - 0.2335d_0 + 0.0037d_0^2 - 0.0462D + 0.0066D^2 - 0.9754\log(AADT) + 0.1873\left(log(AADT)\right)^2 - 0.0441ETCR + 0.0298ETCR^2 - 1.7865Rut + 3.4189Rut^2$	0.77	0.31	1,918
19	$SN = 4.0496 - 0.1494d_0 + 0.0023d_0^2 - 0.1626D + 0.0169D^2 + 0.1911ETCR - 0.0827ETCR^2 - 1.4850Rut + 3.8085Rut^2$	0.61	0.32	1,362
20	$SN = 7.4849 - 0.3019d_0 + 0.0043d_0^2 - 0.1011D + 0.0074D^2 + 0.0036(d_0 \times D) - 0.5310\log(AADT) - 0.0656ETCR$	0.80	0.32	807
21	$SN = 6.4955 - 0.4262d_0 + 0.0081d_0^2 - 0.1133D + 0.0065D^2 + 0.0042(d_0 \times D) + 0.9910\log(EAL) - 0.5484\left(log(EAL)\right)^2 + 1.9962Rut - 7.2991Rut^2$	0.86	0.39	446
22	$SN = 7.0760 - 0.4130d_0 + 0.0073d_0^2 - 0.2327D + 0.0134D^2 + 0.0068(d_0 \times D) + 0.0822ETCR$	0.75	0.39	704
23	$SN = 5.1440 - 0.3253d_0 + 0.0058d_0^2 - 0.0924D + 0.0095D^2 + 1.0930\log(EAL) - 0.3153\left(log(EAL)\right)^2 + 0.1094ETCR + 0.2903Rut$	0.75	0.45	1,446
Over -all	$SN = 6.3763 - 0.3364d_0 + 0.0062d_0^2 - 0.0805D + 0.0100D^2 - 0.0008(d_0 \times D) - 0.4155\log(EAL) + 0.1438\left(log(EAL)\right)^2 + 0.0836ETCR - 0.0091EFCR + 0.0004EFCR^2 - 0.4061Rut$	0.77	0.51	11,819

Note: RC=road category; SE=standard error; R2= coefficient of determination; n=number of data points; SN= Structural Number; d0= center deflection (mils); D= pavement depth (inches); AADT=average annual daily traffic; EAL = equivalent standard daily traffic; EFCR=equivalent fatigue/transverse cracking; rut=rut depth; 1 inch = 2.54 cm; 1 mil=0.0254 mm.

Bryce et al. (12) developed a structural-based condition index along with a methodology to implement in network level pavement evaluation. The study was conducted in the state of Indiana, and the results stated that the central deflection of the FWD has a very little statistical correlation with the functional indicators such as International Roughness Index (IRI) and Pavement Condition Rating (PCR). A new structural-based condition index was developed, which was of the form:

$$SSI = 100\ (1\text{-}1.0069e^{\frac{-1071.8}{d_1^{3.9622}}}) \quad (1)$$

where d_1 is the FWD central deflection.

However, the developed parameter was effective only for project level pavement assessments.

Stubstad et al. (2) stated that the use of load deflection data obtained by the commonly used FWD is the only applicable measurement and analysis technique for assessing the overall network-level structural performance of pavements. The study (2) also recommended simplified deflection-based analytical techniques suitable for rapid automated screening of pavement structural capacity for inclusion in a network-level PMS. The report was based on data collected from the LTPP database and other highway agencies. The developed models were based on the three distresses: rutting, fatigue and roughness performances of pavements.

Based on roughness performance, the developed model was,

$$I_2 = \frac{1}{D2}$$

Where D_2 is the deflection at 8 inches (203.2 mm) from the center of the load.

Based on rutting performance, developed model was,

$$CI_3 = D_3 - D_4$$

Where D_3 and D_4 are the deflections at 12 and 18 inches, respectively.

Based on fatigue cracking performance, developed model was,

$$I_1 = \frac{1}{D1}$$

Where D_1 is the deflection at the center of the load

Though FWD is capable to measure deflections till 1,500 mm from the center of load plate, the developed variables were based on deflection measured at a distance less than 500 mm.

Horak et al. (13) augmented a benchmark parameter called the Effective Pavement Number (PN_{eff}). It was the product of equivalent layer thickness (H_e) and the Surface Modulus of the pavement structure (SM_{pav}). The deflection bowl was effectively utilized to derive the Equivalent Long Term Stiffness (ELTS) for PN calculation. The calculation of proposed parameter, $PN_{eff,}$ consisted of two methods. The first method converted the pavement layered structure above subgrade to an ideal equivalent half space and the second method was comprised of the application of Boussinesq's equation, to calculate the Surface Moduli (SM_i). Though a large database of flexible pavements were successfully validated with the approach, the PN_{eff} was not able to determine the indications of actual cause or origin of distress.

The Traffic Speed Deflection Devices (TSDD) have been continuously updated for accuracy and functionalities to overcome their shortcomings. As a result, they have been successfully implemented and were employed in testing pavement sections in the states of Kansas, Texas, Minnesota, Louisiana, as well as Australia and New Zealand. The objective of the study by Elbagalati et al. (14) was to develop a model to predict pavement structural capacity at an interval of 0.16 km (0.1 mi.) based on the Rolling Wheel Deflectometer (RWD) measurements. In most of the previous studies conducted, the factors and parameters used to

assess pavements were based on functional parameters such as surface distress and ride quality. The Structural Condition Index (SCI) was developed, which was determined by dividing the Effective Structural Number (SN_{eff}) by Required Structural Number (SN_{req}). The results showed that the SCI was very sensitive to the pavement deterioration, based on a sensitivity analysis conducted on the TxDOT PMS data. The developed model showed an acceptable accuracy with a coefficient of determination (R^2) of 0.80, and a Root Mean Square Error (RMSE) of 0.8. However, the model needed to be recalibrated prior to use by other agencies. Though samples that were predicted to be structurally-deficient suffered from asphalt stripping and material deterioration problems, few sections were in very good condition according to PCI values.

In 2000, the United Kingdom Highways Agency (HA) suspended the use of deflectograph for routine network-level assessment considering its limitations such as expensive operation, lane closures during testing which was hazardous to the road users, and time-consumption for their static tests. Consequently, it was necessary to improve Traffic Speed Deflectometer (TSD) that was first introduced in 2005. Operation of TSD and their calibration techniques was described by Ferne et al. (15). During the introduction of TSD, the device was equipped with three lasers at a distance of 100, 200, and 300 mm in front of the rear wheel assembly towards the direction of travel or front bumper. In 2008, the laser positioned at 200 mm was moved to 750 mm to monitor the response of lower pavement layers. Later, a fourth laser was introduced as reference laser at a distance of 3.6 m from the real wheel assembly towards the direction of travel. The method employed the Doppler effect to measure the deflection velocity. The deflection slope measurements were recorded in millimeters per meter. Though the device was able to capture the pavement responses close to FWD results for a 30 m section, the device requires installation of accelerometer into asphalt pavement layer to measure reliable pavement deflection bowls. The

report acknowledges that further experimentation is needed to overcome the repeatability limitations.

Saleh (16, 17, 18) simplified the approach for structural capacity evaluation of flexible pavements at the network level by introducing few parameters such as Normalized Area Ratio Parameter under Area Ratio Concept. The parameters that were utilized in the report were:

$$\text{Deflection Ratio, } D_r = D_{250} / D_0 \quad (2)$$

$$\text{Normalized Deflection Ratio, } D_r' = D_r / D_0^2 \quad (3)$$

where, D_{250} – deflection measured at 250 mm from the load plate (micrometers (μm))

D_0 – deflection below the load plate (micrometers (μm))

The Normalized Area Ratio was derived using synthetic deflection bowl data of 140 pavement sections with different layer thicknesses and moduli properties. AREA parameter was introduced to establish Area Ratio concept, which is the area of the deflection bowl between the point of load applied and a distance of 900mm.

$$\text{AREA} = (50 / D_0) * \{ ((D_0 + D_{900}) / 2) + \sum_{i=50}^{850} Di \} \quad (4)$$

where D_0 is the central deflection, D_{900} is the deflection at offset 900 mm from the load and D_i is the deflection at offset *i* (mm) from the load.

For comparing the strength of a pavement, an extremely stiff strong pavement was assumed, which will have same deflection measurement throughout the sensors. With the assumption of very rigid pavement, whose deflection is same throughout the sensors, the AREA of the deflection bowl was calculated as:

$$AREA = (50 / D_0) * \{ ((D_0 + D_{900}) / 2) + 17 \times D_0 \}$$

$$= 900 \text{ mm}^2/\text{mm}.$$

The non-open source computer program, Circly was used to develop the deflection bowl of pavements similar to FWD bowls. The area ratio and normalized area ratio values were found to be well correlated to deflection ratio and normalized deflection ratio. The Area Ratio parameter was introduced relating the AREA of deflection bowl of a pavement to the AREA of imaginary very stiff pavement (900 mm^2/mm).

$$\text{Area Ratio, } A_r = (50 / D_0 * 900) * \{ ((D_0 + D_{900}) / 2) + \sum_{i=50}^{850} Di \} \quad (5)$$

Depending on the Area Ratio, a pavement was categorized from weak to strong. If the value of A_r is equal to or less than 0.3, the pavement was considered weak. For a stiff pavement, the value would be a little lesser than 1. Also, a new parameter called the Normalized Area Ratio (A_r') was introduced by dividing the Area Ratio by the central deflection to identify the structural capacity of entire pavement structure. The entire pavement structure refers to the sub-grade below the pavement surface and base, subbase, and HMA layers above sub-grade.

$$\text{Normalized Area Ratio, } A_r' = (50 / D_0^2 * 900) * \{((D_0 + D_{900}) / 2) + \sum_{i=50}^{850} Di \} \quad (5)$$

Depending on the deflection ratio, the pavement's structural condition was classified as bound pavement, good quality unbound pavement and possibly weak unbound pavement, for $D_r>0.8$, $0.6<D_r<0.7$ and $D_r<0.6$, respectively. The area ratio was found to be less susceptible to measurement errors compared to deflection ratio because area ratio is based on several deflection readings ($\sum_{i=50}^{850} Di$) while deflection ratio was based on two points, D_0 and D_{250}. Though the

study depicts a clear information regarding pavement deflection and analysis, it was designed for network level assessment and was not suitable for project level assessment.

Based on the collected literature, it can be concluded that throughout the last several decades, researchers have developed parameters to assess the structural integrity of the pavement system from the deflection bowl measurements (1, 7, 8, 10). Developed parameters include the difference between the central deflection and the deflection at a certain distance. Another parameter is the normalized area parameter, which is the total area of the deflection bowl normalized by the central deflection which was found to be highly correlated with the pavement stiffness. Pavement curvature is another parameter that is widely used in Australia and is defined as the difference between the central deflection and the deflection measured at 200 mm from the center of the load. Pavement curvature is used to express the tensile strains and therefore the fatigue life of asphalt surface layer. Horak argued that variability has been observed in methods that rely on pavement curvature because of the closeness of this point to the edge of the loading plate (8, 20). Deflection ratio is also one of the common parameters that are used by some highway agencies to estimate the pavement structural capacity. Deflection ratio is defined as the ratio between the measured deflections at 250 mm offset from the center of the load to the central deflection (3).

Although various transportation agencies have used several methods, there is no standard acceptable method available to provide accurate estimates of the structural integrities of pavement layers and the subgrade. In addition, methods and parameters employed till date are either based on central deflection (D_0) or a single deflection point away from the load plate. No parameter includes the entire deflection bowl measured by the FWD.

Chapter Three

Deflection and Pavement Condition Data Extraction from the Long-Term Pavement Performance Data Base (LTPP)

3.1 Introduction

LTPP is one of the largest pavement performance research programs, initiated in the year 1987, as a part of Strategic Highway Research Program (SHRP). Under the sponsorship of the Federal Highway Administration (FHWA) and with cooperation of the American Association of State Highway and Transportation Officials (AASHTO), the Transportation Research Board (TRB) of the National Research Council undertook a Strategic Transportation Research Study (STRS) of the Nation's highway and bridge infrastructure systems. Based on the study, a report was published in 1984 as TRB special report 202, America's Highways, Accelerating the Search for Innovation (TRB special report (19)). LTPP program was one among the recommended six strategic research areas by the TRB report.

The database includes around 2,500 pavement sections all over the USA and Canada. The term pavement section refers to a segment of a highway or freeway or other rural roads, measuring a length of 152m. Each pavement section is unique with its properties of materials, base (treated or non-treated), sub-base and sub-grade properties. Each pavement section is given a unique SHRP ID, a unique 4-digit alpha-numeric identification code is given to represent either a single test section or a group of test sections. The SHRP ID is combined with a state code, a 2-digit unique numeric code assigned to all states within the United States and Canada. Thus, each pavement section have an easily identifiable six-digit unique code.

3.2. Data Collection

3.2.1 Locations and Layer Properties of Selected LTPP Pavement Sections

The LTPP database defines the location of every individual pavement section by its latitude and longitude. Location of all pavement sections in the state of Texas are displayed under the MAP tab in the LTPP website (LTPP (20)). The Global Positioning System (GPS) locations of 35 SHRP pavement sections are shown in Tables 4. The 35 SHRP pavement sections considered for the study were selected in such a way to cover a wide area of the state of Texas. However some areas were not covered due to the lack of enough data required to simulate the deflection bowl utilizing the computer program.

Figure 1 shows the locations of the 35 LTPP pavement sections considered for the study along with their SHRP ID. The sections were classified into two categories: active sections and out of study sections. Active sections refer to sections that are being monitored and regularly tested up to date while out of study sections were monitored and tested during the past few years. Thus, no new testing results will be available for out of study sections. The selected 35 sections included both active and out of study sections. The reason for considering the out of study sections in this study is the limited available number of active sections and the fact that the only difference between the active and out of study sections is the availability of the up to date testing results. Therefore, it was believed that both types of sections include equally valuable data that can be utilized in this study.

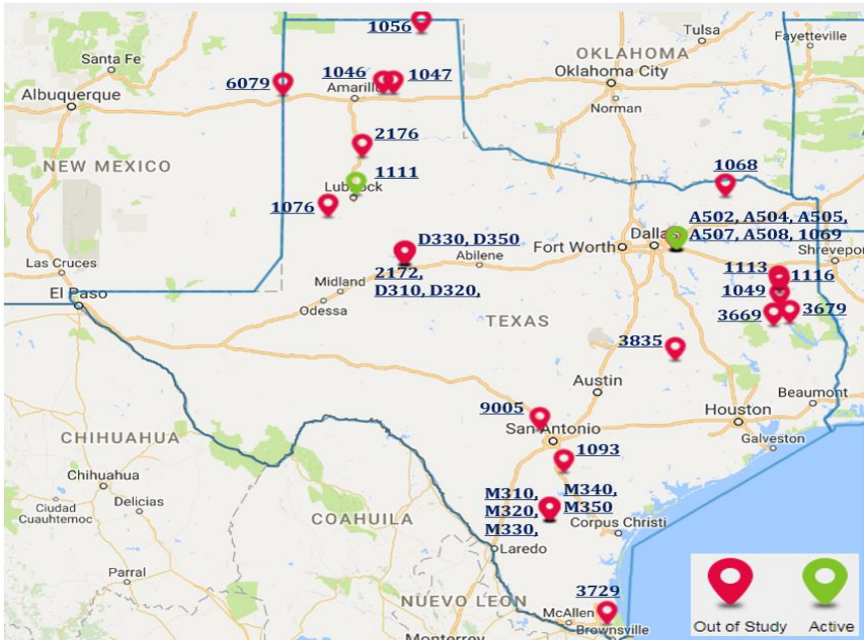


Figure 1 Location of the utilized 35 SHRP pavement sections.

Table 4 Location details of 35 SHRP pavement sections in Texas

Serial Number	SHRP ID	County	GPS location (Latitude, Longitude)
1	1046	Carson	35.2076, -101.34516
2	1047	Carson	35.20766, -101.17967
3	1049	Nacogdoches	31.65924, -94.67828
4	1056	Ochiltree	36.19438, -100.70943
5	1068	Lamar	33.50472, -95.58941
6	1069	Kaufman	32.61718, -96.42596
7	1076	Terry	33.16708, -102.28275
8	1093	Atascosa	28.77723, -98.30895
9	1111	Lubbock	33.53144, -101.80471
10	1113	Rusk	31.95767, -94.7002
11	1116	Rusk	31.89281, -94.68111
12	2172	Mitchell	32.36639, -100.99145
13	2176	Hale	34.16527, -101.70905
14	3669	Angelina	31.32793, -94.78652
15	3679	Angelina	31.37204, -94.50556
16	3729	Cameron	26.08664, -97.5844
17	3835	Brazos	30.7342, -96.43423
18	6079	Deaf Smith	35.18151, -103.03008

Table 4 Location details of 35 SHRP pavement sections in Texas (Cont)

19	9005	Bexar	29.5168, -98.721
20	A502	Kaufman	32.61423, -96.41357
21	A504	Kaufman	32.6134, -96.40476
22	A505	Kaufman	32.6134, -96.3972
23	A507	Kaufman	32.6134, -96.40186
24	A508	Kaufman	32.61364, -96.40928
25	B310	Kaufman	32.62042, -96.43343
26	B320	Kaufman	32.61927, -96.43085
27	D310	Mitchell	32.37174, -100.9831
28	D320	Mitchell	32.37023, -100.98542
29	D330	Mitchell	32.36432, -100.99456
30	D350	Mitchell	32.36296, -100.99666
31	M310	Duval	27.93181, -98.55456
32	M320	Duval	27.93369, -98.55273
33	M330	Duval	27.93513, -98.55131
34	M340	Duval	27.93657, -98.5499
35	M350	Duval	27.93839, -98.54814

Extracted layer thicknesses for the pavement sections are shown in Table 5. The Elastic moduli values that will be utilized in the deflection simulation of selected pavement sections are shown in Table 6. HMA elastic moduli values were estimated utilizing ANNACAP software package as recommended by LTPP (Kim et al. (21)). The values were then approximated to match current age of pavement sections at the time of FWD testing. Elastic moduli for the base and subbase layers were provided by LTPP in terms of soil classification type. Few pavement sections comprised of bound layers (lime or cement treated) without soil classification data. Typical elastic modulus for such layers were assigned based on recommendations given in MODULUS 6.1, a pavement design software recommended by the Texas Department of Transportation (Liu et al. (22).

Table 5 Layer thicknesses for the 35 SHRP pavement sections in Texas

Serial Number	SHRP ID	Layer thickness, inch				
		HMA Layer-1	HMA Layer-2	HMA Layer-3	Base	Subbase
1	1046	10.0	2.4		8.4	5.1
2	1047	10.0			15.3	14.4
3	1049	4.6			11.2	7.8
4	1056	1.8			14.4	
5	1068	2.1	7.8		6.0	8.0
6	1069	9.5			15.2	6.5
7	1076	5.4			8.4	
8	1093	1.9	2.4		17.2	
9	1111	9.5			8.4	
10	1113	4.2			11.5	
11	1116	4.6			10.9	
12	2172	0.9	10.0		6.8	8.8
13	2176	2.3			9.4	
14	3669	4.2			8.0	7.9
15	3679	1.6			8.4	
16	3729	11.6			10.5	5.4
17	3835	8.5			13.0	6.0
18	6079	2.6	1.6	5.2	5.0	
19	9005	1.9	1.2		9.4	
20	A502	9.3			14.6	8.0
21	A504	5.0	8.9		10.0	8.0
22	A505	2.1	9.4		15.0	10.4
23	A507	8.8			15.0	8.3
24	A508	9.5			14.0	8.0
25	B310	9.9			15.2	6.5
26	B320	9.7			15.2	6.5
27	D310	1.9	9.9		6.8	8.8
28	D320	2.2	1.9	7.3	15.0	10.4
29	D330	3.1			15.6	8.4
30	D350	0.8	10.1		6.8	8.8
31	M310	0.6	1.6		8.1	8.8
32	M320	1.7			8.1	8.8
33	M330	1.9			8.1	8.8
34	M340	1.7			8.1	8.8
35	M350	1.6			8.1	8.8

Table 6 Layers properties of considered 35 SHRP pavement sections

Serial Number	SHRP ID	Elastic Modulus (E), psi					
		HMA Layer-1	HMA Layer-2	HMA Layer-3	Base	Subbase	Sub-grade
1	1046	882,000	798,035		32,000	26,000	26,000
2	1047	756,000			32,000	32,000	24,000
3	1049	1,296,000			400,000	100,000	26,000
4	1056	12,600			28,000		13,500
5	1068	324,000	324,000		32,000	100,000	8,000
6	1069	648,000			28,000	17,000	17,000
7	1076	378,000			26,000		26,000
8	1093	648,000	504,000		26,000		17,000
9	1111	630,000			32,000		26,000
10	1113	486,000			38,000		32,000
11	1116	486,000			38,000		17,000
12	2172	1,377,000	1,071,000		26,000	32,000	17,000
13	2176	693,000			250,000		26,000
14	3669	648,000			350,000	100,000	26,000
15	3679	1,620,000			400,000		29,000
16	3729	1,458,000			32,000	8,000	8,000
17	3835	1,539,000			40,000	24,000	24,000
18	6079	1,008,000	1,296,000	1,008,000	32,000		24,000
19	9005	1,340,603	1,134,000		26,000		17,000
20	A502	1,134,000			28,000	100,000	17,000
21	A504	504,000	648,000		28,000	17,000	17,000
22	A505	756,000	972,000		28,000	17,000	17,000
23	A507	1,134,000			28,000	100,000	17,000
24	A508	1,296,000			28,000	100,000	17,000
25	B310	972,000			28,000	100,000	17,000
26	B320	648,000			28,000	100,000	17,000
27	D310	1,296,000	1,008,000		26,000	32,000	17,000
28	D320	1,260,000	1,620,000		28,000	17,000	17,000
29	D330	1,620,000			40,000	20,000	20,000
30	D350	1,053,000	819,000		26,000	32,000	17,000
31	M310	48,600	37,800		32,000	15,000	5,000
32	M320	63,000			32,000	40,000	6,000
33	M330	37,800			24,000	40,000	6,000
34	M340	63,000			32,000	20,000	8,000
35	M350	37,800			32,000	20,000	8,000

3.2.2 Falling Weight Deflectometer (FWD) Data

FWD deflection measurements were collected from the Pavement Monitoring (MON) module in the LTPP database. FWD measurements and their corresponding deflection data were stored in tables with MON_DEFL as a part of their names. The extracted data included 1) Peak drop load, 2) Drop height, 3) Sensors offset distances from the load point, and 4) Peak deflection values recorded by each sensor.

FWD machines are equipped with one of the two types of geophone offset configuration from the center of the load plate: (a) 9 sensors and (b) 7 sensors. Offsets in front of the load plate (i.e., in the travel direction) are considered positive and that behind the load plate (i.e., opposite to the direction of travel) are considered negative (Schmalzer (23)) as shown in Table 7. Deflections recorded by the geophone sensors were referred to as peak deflections (PEAK_DEFL). The extracted FWD deflection data for the LTPP section 1049 is shown in Table 9. Similarly, extracted field measured FWD deflection measurements for the rest of the LTPP pavement sections are summarized in Appendix A. Generally, deflection measured by 9th sensor (D9) is excluded since it is the replica of deflection measured by 3rd sensor, D3 (305 mm).

FWD applied load to the load plate differs for each drop height. There are four typical drop heights (load levels) defined for LTPP FWD testing. The acceptable load range for each drop height is between 90 percent and 110 percent of the targeted load value as shown in Table 8.

Table 7 Deflection sensor offsets for 9 and 7 sensor FWDs

Deflection Sensors		D1	D2	D3	D4	D5	D6	D7	D8	D9
Offset Distance (mm)	9 sensors	0	203	305	457	610	914	1,219	1,524	– 305
	7 sensors	0	203	305	457	610	914	1,524	-	-

Table 8 Targeted loads and acceptable ranges. (1kip = $1x10^3$ lb)

Drop Height	Targeted Load, kN (kips)	Acceptable Range, kN (kips)
1	26.7 (6.0)	24.0 to 29.4 (5.4 to 6.6)
2	40.0 (9.0)	36.0 to 44.0 (8.1 to 9.9)
3	53.4 (12.0)	48.1 to 58.7 (10.8 to 13.2)
4	71.2 (16.0)	64.1 to 78.3 (14.4 to 17.6)

At each drop height, four FWD deflection measurements are recorded (i.e., four replicates). The four replicates associated to each drop height were averaged to represent a single deflection measurement reading at that specific location.

Upon application of the FWD load, and at each drop height, the resulting deflection values were measured and recorded by geophone sensors installed at specified distances from the load plate. FWD tests were conducted along different point locations throughout the 152 meters long pavement sections (Figure 2). In order to have a good representation of the pavement section condition, all measured deflections values at all point locations were averaged and utilized in the analysis. The response of the pavement section varies depending on the applied drop loads. Drop loads corresponding to drop height 1 will result in a lower measured deflection values compared to measured deflection values corresponding to drop height 4.

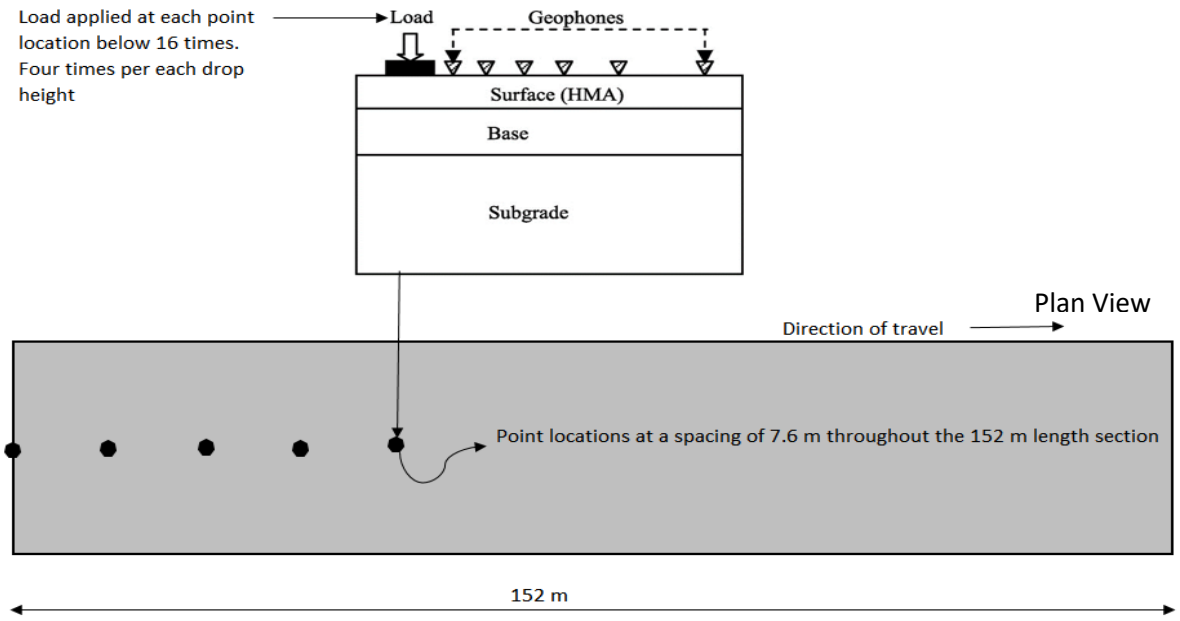


Figure 2 Illustration of the number of FWD test conducted at different point locations.

Table 9 FWD data collected on 28-Mar-1996 on pavement section with SHRP ID: 1049.

Drop Height	Drop load (kPa)	Average all point locations peak deflections (PEAK_DEFL), micrometers						
		D1	D2	D3	D4	D5	D6	D7
1	391.73	75.3	60.7	54.3	46.9	40.5	31.0	17.6
2	589.36	112.9	91.4	82.0	71.1	61.5	46.9	26.5
3	788.46	152.8	124.3	111.6	96.9	84.0	63.9	36.1
4	1,040.60	205.9	168.2	151.2	131.4	114.3	87.0	48.9

3.2.3 Distress Condition Data

Structural distresses such as fatigue cracking and rutting were measured in m^2 and mm, respectively. Functional distress such as International Roughness Index (IRI) was measured in m/km. The measurements of both structural and functional distresses were conducted based on the LTPP Distress Identification Manual (24). Distress conditions were extracted from the performance tab for each section at the corresponding FWD measured date as shown in Table 10.

Table 10 Distress data: Fatigue, Rutting, and IRI.

Serial Number	SHRP ID	Fatigue (m^2)	Rutting (mm)	IRI (m/km)
1	1046	0		
2	1047	1.3		
3	1049	13.7		
4	1056	197.4	23	1.893
5	1068	96.9	7	1.4
6	1069	50.3	14	1.834
7	1076	65.3	11	2.681
8	1093	140.8	16	1.531
9	1111	0.9		1.013
10	1113	97.2	10	1.088
11	1116	143.22		1.383
12	2172	0	5	0.754
13	2176	96.4	7	1.444
14	3669	20.6	14	1.469
15	3679	0		1.79
16	3729	10.7	10	1.42
17	3835	12.4	4	1.782
18	6079	4.7	7	
19	9005	50.8		2.25
20	A502	0	13	1.375
21	A504	0	11	1.301
22	A505	0	4	1.315
23	A507	1	10	1.463
24	A508	2.8	9	1.258
25	B310	4.2	5	
26	B320	69.9	15	1.545
27	D310	0	5	1.137
28	D320	0	6	0.834
29	D330	0	6	0.834
30	D350	0	5	1.137
31	M310	176.6		3.047
32	M320	149.7		2.497
33	M330	189.8		2.361
34	M340	171.4		2.69
35	M350	114.2		1.312

Chapter Four

Computer Simulation of FWD for the Most Common Flexible Pavement Structures

4.1. Background: 3D-Move Analysis Software Package

3D-Move Analysis Software is a powerful software package that has been utilized for the analysis of asphalt pavements. The program was released by University of Nevada, Reno (UNR), under a cooperative agreement with the Federal Highway Administration (FHWA) to analyze asphalt pavements under variety of loading conditions. The software uses a continuum-based finite-layer approach to compute pavement responses. The finite layer approach treats each pavement layer as a continuum and uses the Fourier transform technique. Therefore, the program can handle complex surface loadings such as multiple loads and non-uniform tire pavement contact stress distribution (Siddharthan et al. (25)). One of the important aspects of the program is that the tire and loading configurations are adjustable to meet user requirements. A shot of the program's main screen is shown in Figure 3. Some of the advanced applications of 3D-Move Analysis include (1) Estimation of pavement performance at intersections, which account for effect of braking on pavement response and (2) Estimation of damage under off-road farm vehicles (Siddharthan et al. (26)). There are numerous computer programs available for analyzing and modelling flexible pavement structures. The reason of utilizing 3D move software package in this study besides being an open source free software are: (Siddharthan et al. (27)) (28)

1) The software utilizes finite layer continuum approach.
2) It models moving 3D-surface stresses (dynamic, normal and shear contact stresses).
3) It accounts for visco-elastic material characterization utilizing symmetrical sigmoidal function.
4) It analyzes tire imprint of any shape (circular, rectangular or elliptical).
5) It has ability to analyze non-generic axle and tire configurations.
6) It has ability to predict responses at any locations required by the user, and actually this point is very important to replicate the FWD sensor locations, so that the new defined response points will be equivalent to the actual FWD sensor locations.
7) It accounts for the effect of braking on pavement response.
8) It has ability to analyze pavement responses due to non-standard vehicles such as off-road farm vehicles and oversize or overweight (OS/OW) vehicles.

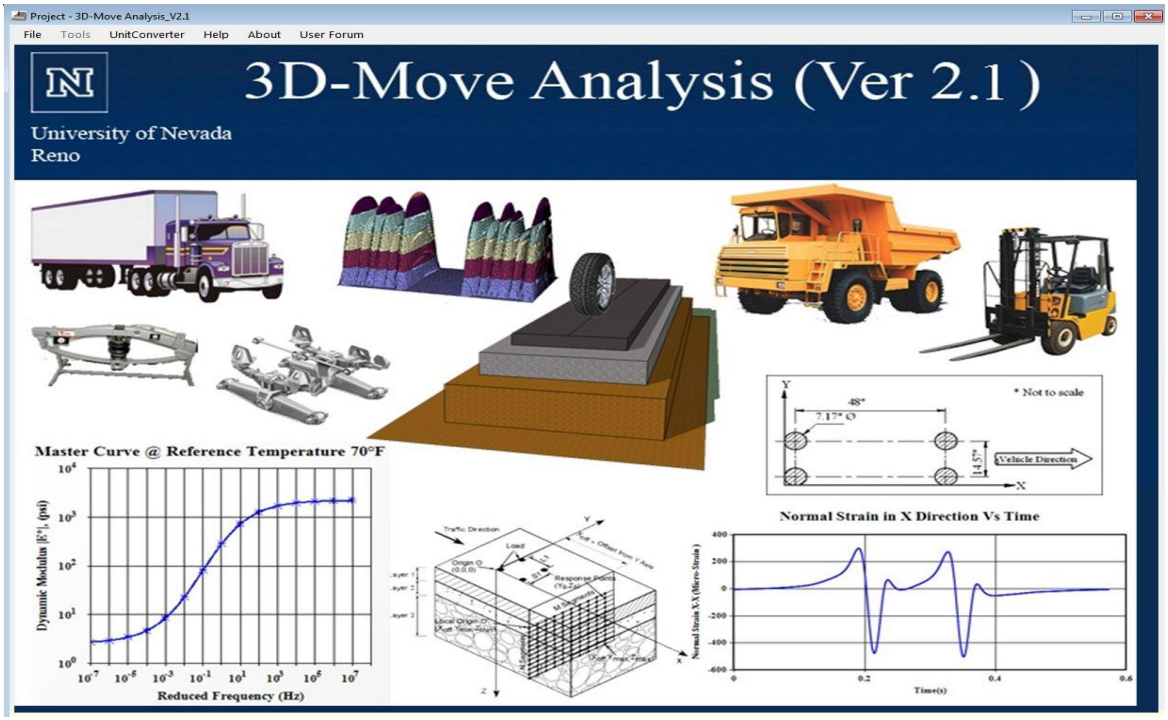


Figure 3 Screenshot of the 3D Move Analysis computer program.

4.2. Detailed Analysis Approach

For a better demonstration of the analysis approach, a detailed step by step process along with actual snaps form the software will be illustrated and discussed for one LTPP pavement section (SHRP ID: 48-1049) out of the 35 sections considered. 3D-Move Analysis program has the ability to perform both static and dynamic analyses. Since this study aims to replicate FWD measured deflection bowls, the static analysis approach was utilized. The following are the steps involved in simulation of field measured FWD deflection bowl utilizing 3D-Move analysis software package:

- Project identification
- Analysis type
- Axle configuration/contact pressure distribution
- Pavement structure
- Pavement layer properties
- Response points

4.2.1 Project Identification and Analysis Type

The first required input data by the software is the identification data of the pavement section considered for analysis. This data include project location, milepost, and traffic direction (Figure 4). Upon supplementing the pavement section identification details, static analysis type was selected.

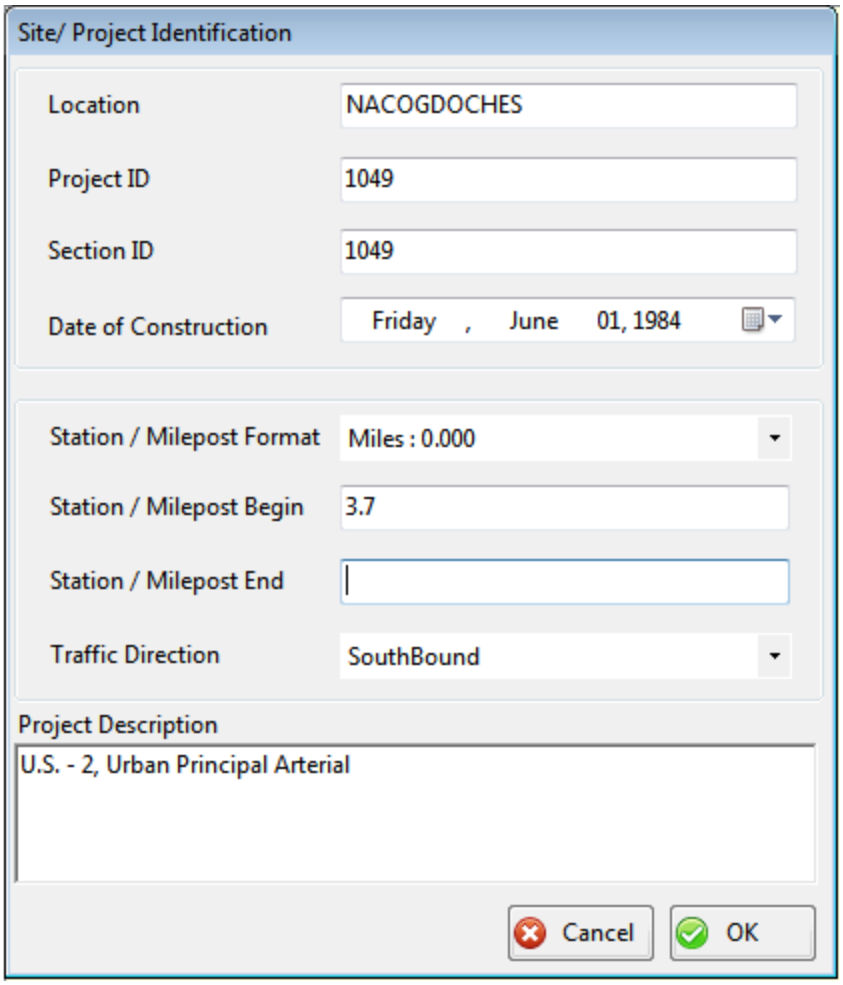


Figure 4 Location identification details for the SHRP section 1049.

4.2.2. Axle configuration/ Contact Pressure Distribution

Upon the selection of static analysis approach, the next step is to select the axle configuration/contact pressure distribution. This section can be divided into two parts, the first is the selection of the tire configuration and the second is the applied load. 3D-Move program offers six options (A through F) that can be selected as a tire configuration setting based on the user needs.

Out of the six configurations offered by the software, option B may be utilized to replicate FWD test conditions since this option offers the required flexibility to model various types of

simulation configurations. As discussed earlier, measured deflections at different locations due to the application of 4 different loads are linked to 4 drop heights. All of the 4 loads were utilized in the analysis, starting from drop height 1 that has the lowest applied load and ending with the highest applied load allocated to drop height number 4 (Table 8). The average stress at different point locations for each drop height (4 values, one for each drop height) extracted under data collection in this report were utilized to calculate the applied load. The calculation was completed by the multiplication of the FWD stress with the known area of the load plate (300 mm). Tire pressure for the analysis was considered uniform with a constant value of 120 psi. The geometry of the load area was selected to be circular to match the circular FWD plate shape. Radius was calculated internally by the software utilizing the equation shown in Figure 5.

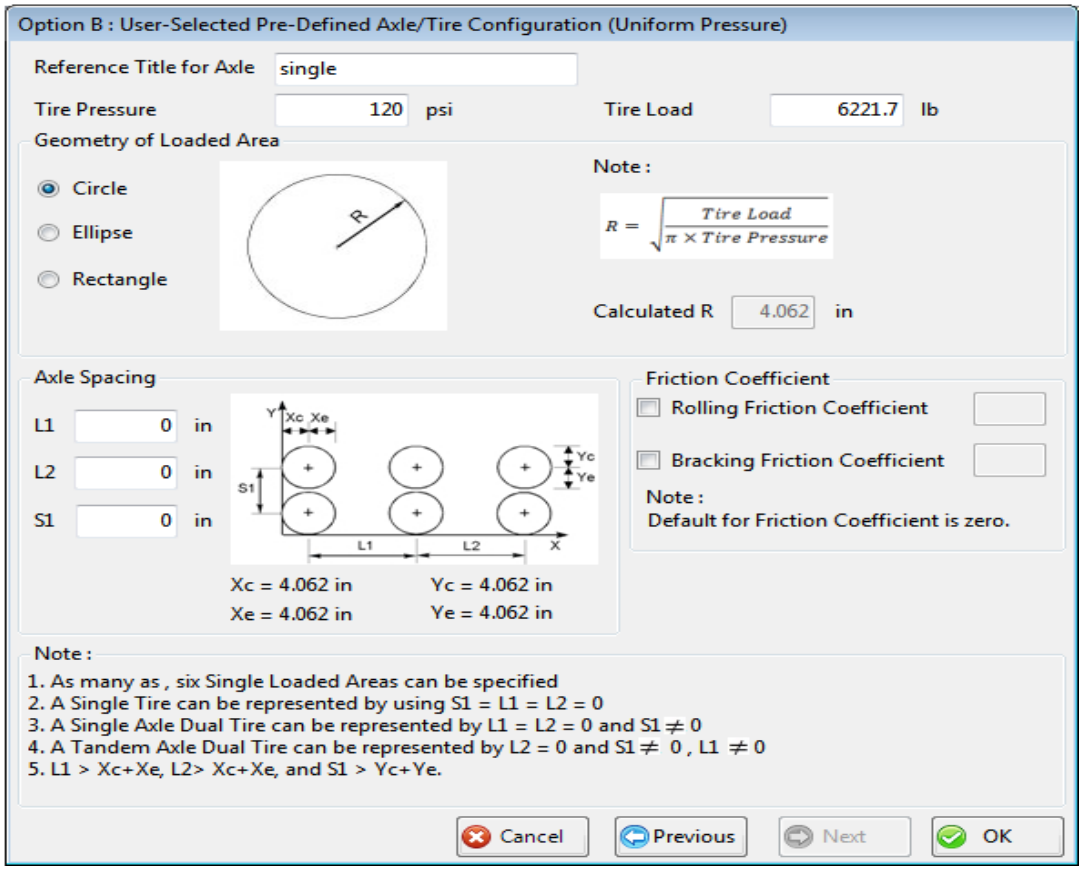


Figure 5 FWD recorded drop load is considered as tire load for analysis.

4.2.3. Pavement Structure

Each pavement section has a unique structure, layer thickness and material properties such as binder grade, base, subbase, and subgrade soil types. This section allows the user to select the number of layers and their corresponding thicknesses. Upon entering the thickness of individual layers as per the extracted pavement cross section details, the software generates a separate tab to input each layer properties. Layer properties included modulus values and Poisson's ratio for asphalt layer (Figure 6a) and unbound flayers (Figure 6b).

The extracted moduli values for the different layers were utilized as an input at this stage, constant Poisson's ratio of 0.35, 0.4 and 0.45 for the asphalt layer, base or subbase, and subgrade, respectively were considered in the analysis for all sections.

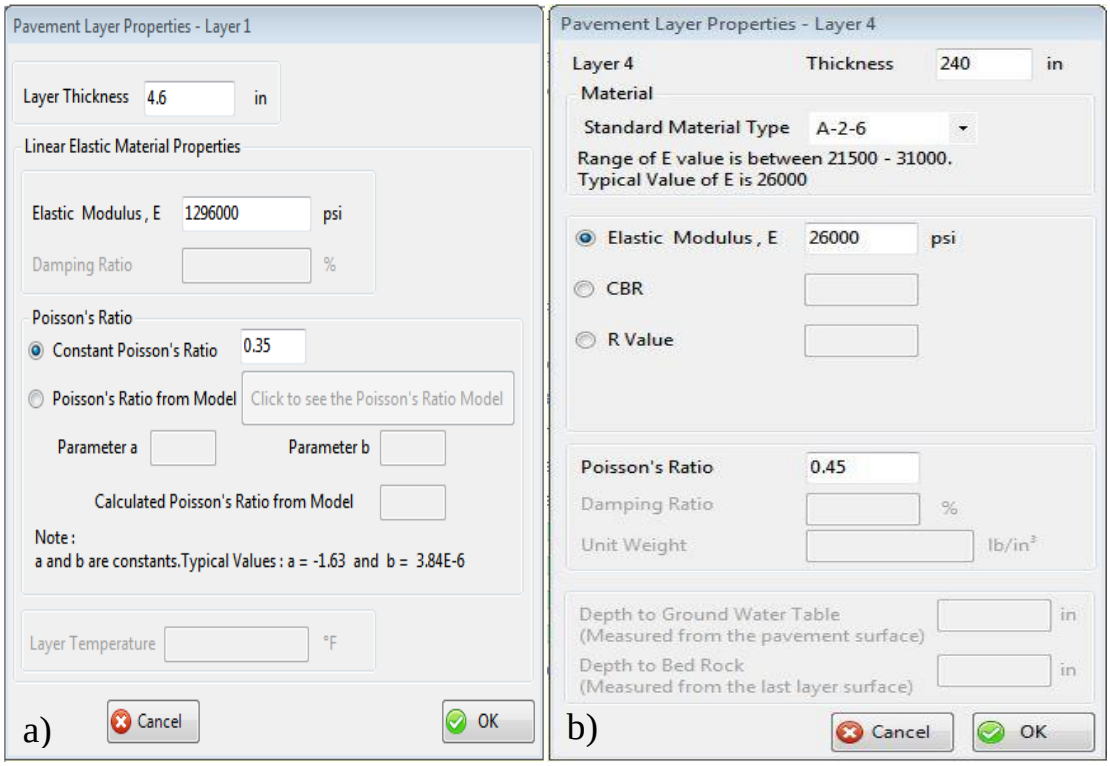


Figure 6 Pavement layer properties window of the 3D Move Analysis program. (a) Asphalt layer, and (b) Unbound layer.

4.2.4. Response Points

For a successful 3D-Move Analysis simulation, the simulated deflection bowls must be obtained at locations equivalent to the actual FWD sensor locations. To model this, a better understanding of the software coordinates is required. The graphical representation of the response points is shown in Figure 7 and the response points considered for the analysis of SHRP section 1049 is shown in Table 11. It should be noted that the Z-Coordinate was assigned a constant value of 0.001 mm to simulate deflection at the surface of the pavement.

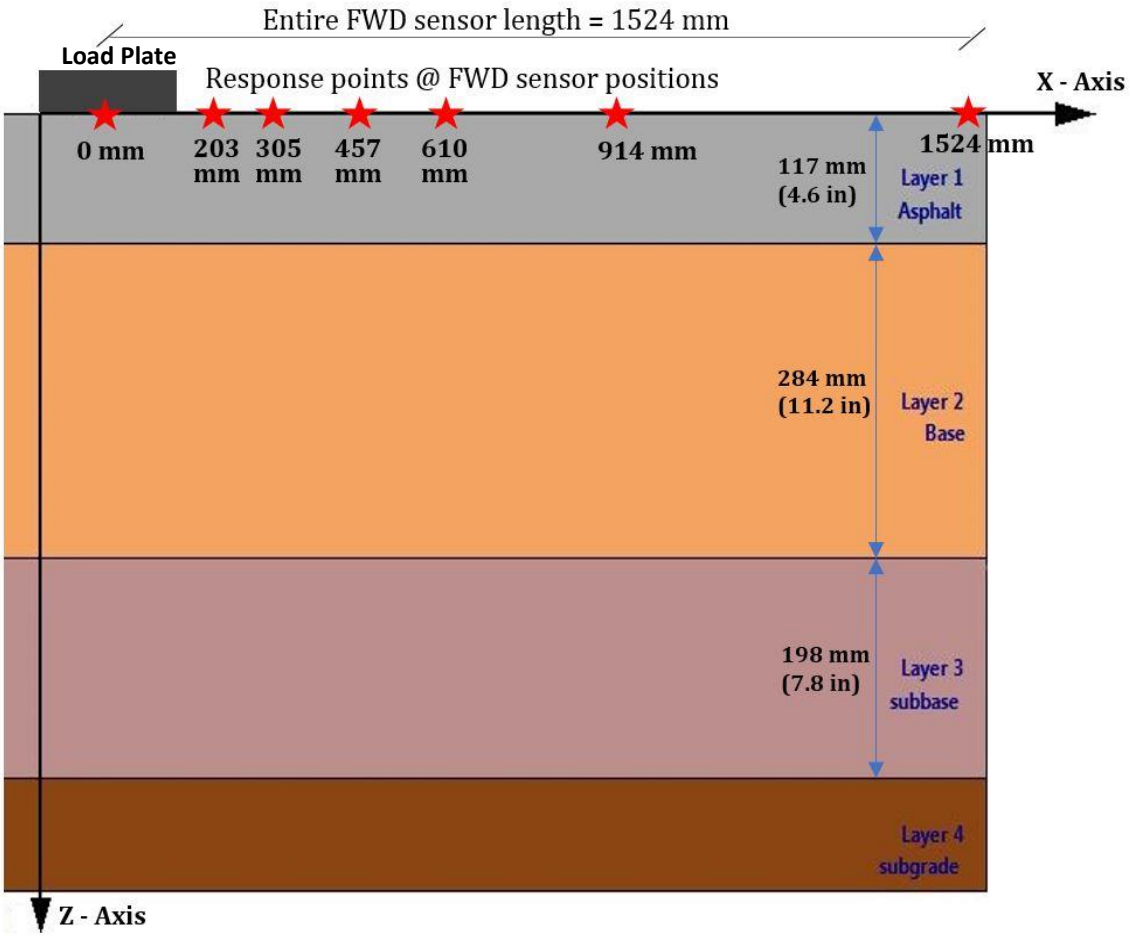


Figure 7 Graphical representation of locations of the response points for the section 1049.

Table 11 Typical response points co-ordinates for seven sensor FWD.

Sensor Offset (mm)	Z-Coord (mm)	Layer No
0	0.001	1
203	0.001	1
305	0.001	1
457	0.001	1
610	0.001	1
914	0.001	1
1524	0.001	1

4.2.5. Software Simulated Deflection Bowl Outputs

Out of the many outputs produced by the 3D-Move Analysis software package, displacements predicted at the surface of the pavement section were considered. The simulation results for pavement section with SHRP ID 1049 is shown in Table 12. Similarly, deflections predicted for the rest of the SHRP sections are shown in Appendix B.

Table 12 Predicted displacement at response points for the SHRP section 1049.

Sensor Offset (mm)	Displacement (μm)
0	70.716
203	51.658
305	45.266
457	38.380
610	32.898
914	24.114
1524	12.041

4.3. Comparison between Measured FWD and Simulated 3d-Move Deflection Bowls

The field measured FWD deflection bowls as extracted from the LTPP database were plotted against the deflection bowls simulated by 3D-Move Analysis software package. Figure 8 illustrates the field measured FWD deflection bowls and 3D-Move simulated deflection bowls

for SHRP sections 1049 and 1116 at 4 different drop heights. SHRP section 1049 experienced a low deflection while SHRP section 1116 experienced a high deflection for the same target loads.

The deflection values produce a good indication related to the structural condition of pavement sections. For example, the SHRP section 1049 had a maximum central deflection of 70 micrometers (μm) whereas SHRP section 1116 had a maximum central deflection of 276 μm, at drop height 1. It can be noted that section SHRP 1116 had about four times the amount of deflection experienced by section 1049. Figure 8 illustrates the prediction capability of 3D-Move Analysis to replicate the field measured FWD deflection bowls as well. 3D Move Software Package has the ability to replicate both high and low measured FWD deflections, and thus, it may be used as a useful tool for pavement structural conditions evaluation. Similarly, the results of FWD deflection simulated bowls for all LTPP pavement sections considered in this study are shown in appendix C.

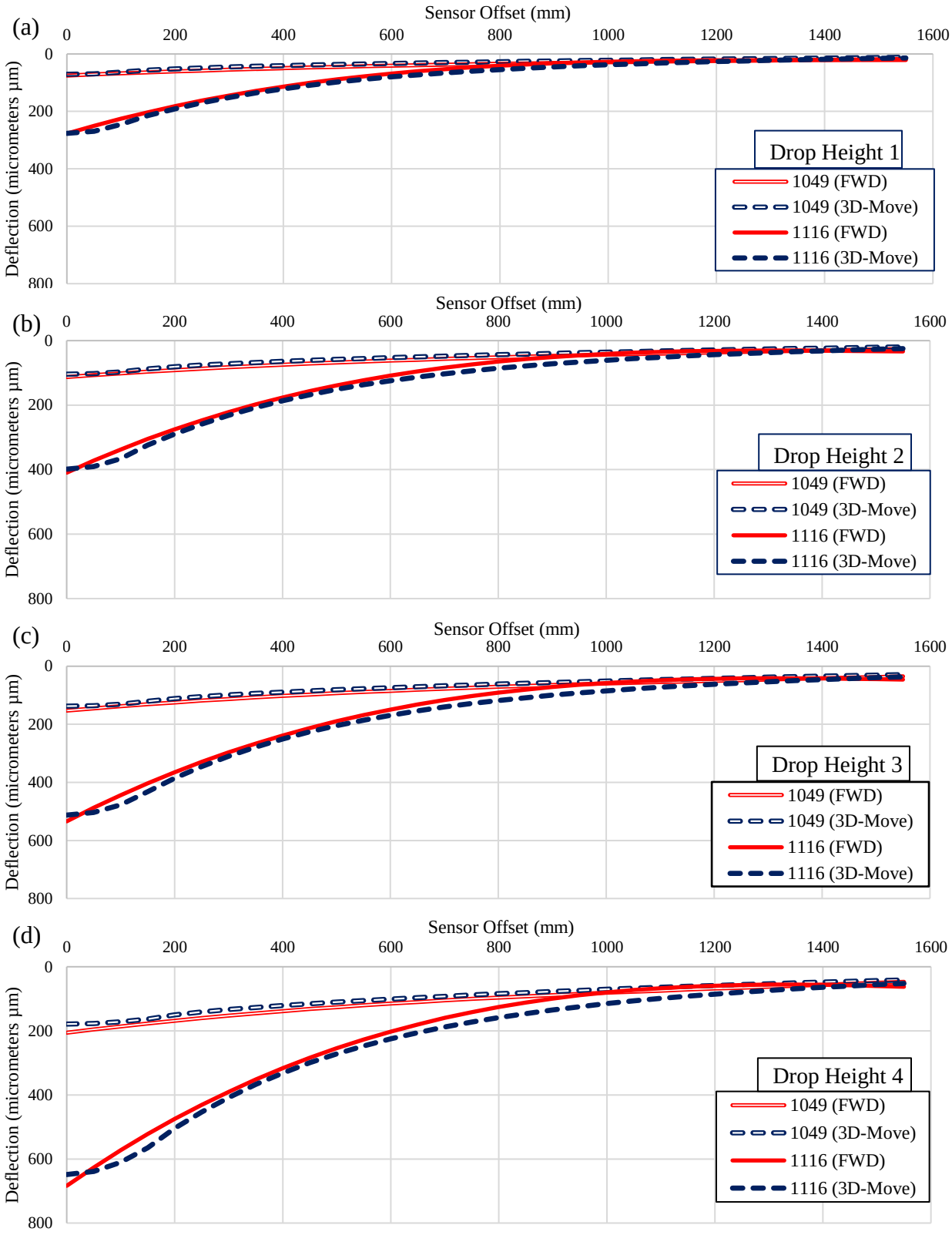


Figure 8 Measured FWD & 3D Move simulated deflection bowls for SHRP sections 1049 and 1116. (a) Drop Height 1, (b) Drop Height 2, (c) Drop Height 3, and (d) Drop Height 4.

4.4. Simulated Deflection Values

Central deflection (D_0) is the deflection measured under the center of the load plate during regular FWD field testing. As discussed in the literature, D_0 has been utilized as an indication of the overall structural status of pavement structure. D_0 values, historically, are highly correlated to the HMA pavement structural conditions. The actual measured FWD central deflections and 3D-Move simulated central deflections for all the 35 SHRP pavement sections at 4 drop heights were plotted (Figure 9). The figure clearly shows the ability of 3D Move to replicate the actual FWD measured central deflections with a high coefficient of determination (R^2). This support the proposal that the 3D-Move Analysis software can be employed to generate deflection bowls measured by the FWD. Simulated deflection bowls can be utilized to determine structural condition of a pavement without performing extensive FWD field tests on the network level. Similar to the comparison between central deflections, deflections measured by all sensors of 35 SHRP pavement sections were compared to that of the simulated deflections (Figure 10).

The relationship had a coefficient of determination (R^2) value of 0.91 for 1028 data points. High value of the coefficient of determination (R^2) indicates that 3D Move may be utilized to simulate not only the central deflection (D_0) but all the other deflection values at different locations along the deflection bowl. The outcome of 3D-Move Analysis simulated deflection bowls will be utilized to potentially develop structural condition parameters.

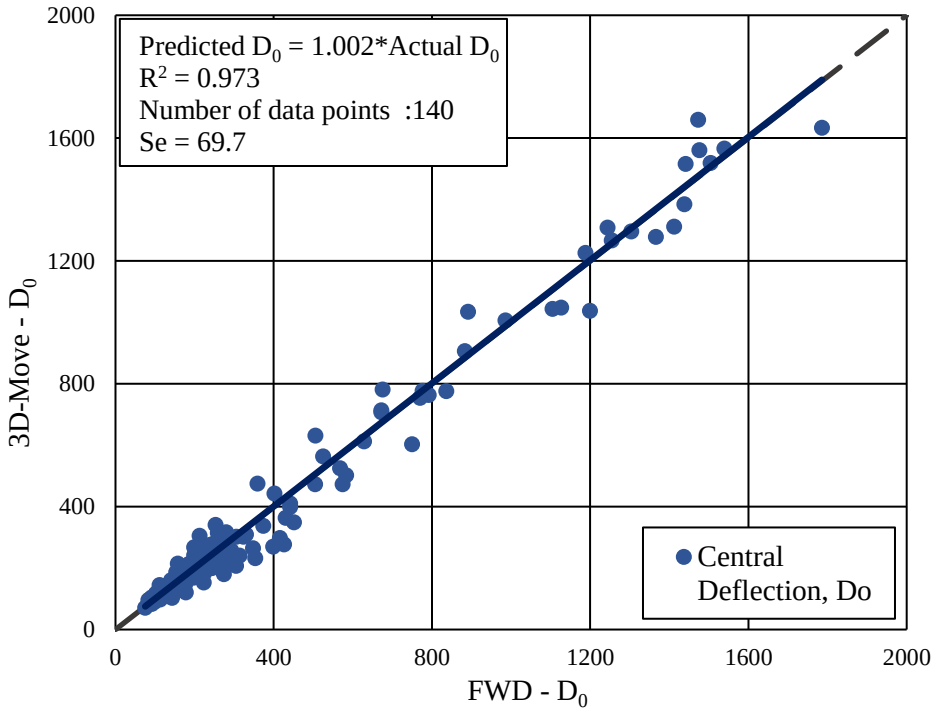


Figure 9 FWD Measured and 3D Move simulated central deflections for 35 SHRP sections.

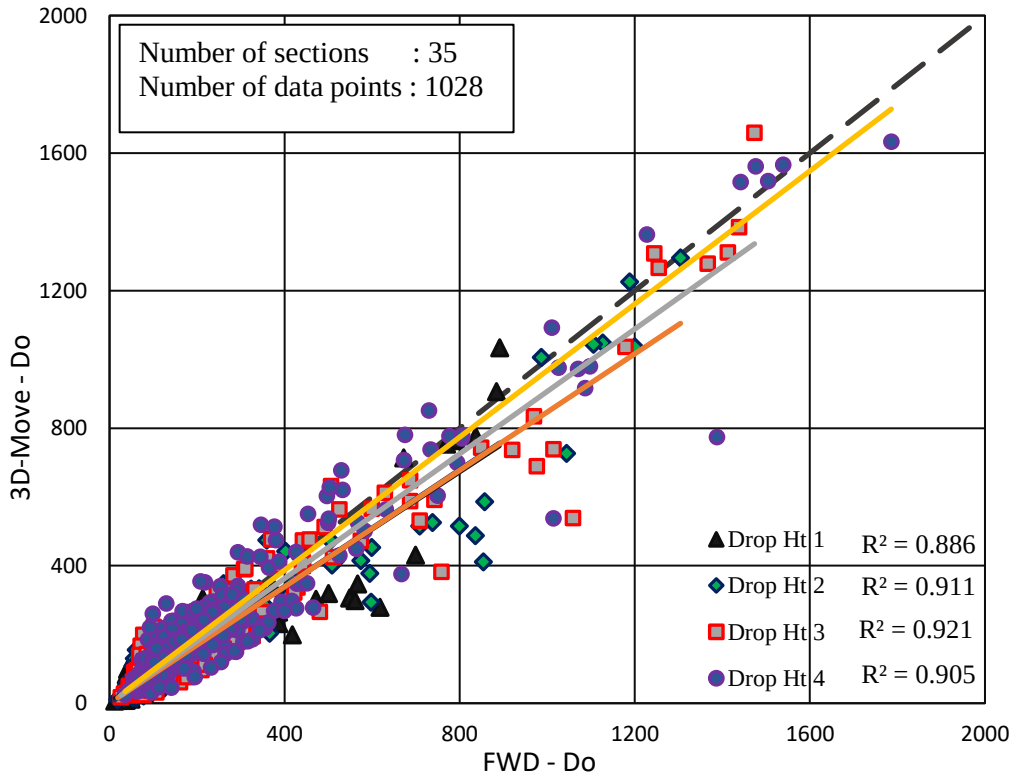


Figure 10 FWD Measured and 3D Move simulated deflections at all sensors for 35 SHRP sections.

Chapter Five

Deflection Parameters Generation and Evaluation

The simulated FWD deflection bowls were utilized to develop deflection parameters, which can be utilized to categorize pavement sections as structurally good, fair, and poor. By observing measured FWD deflection bowls of 35 pavement sections and their corresponding structural layer thicknesses and properties, it can be observed that there is a direct relationship between pavement moduli, layer thicknesses and stiffness to the shape of deflection bowls.

The pavement section with thin HMA layer or week subgrade experience higher central deflection while the section with thick HMA layer and stiff base layer experience smaller central deflection. However, central deflection alone cannot be considered as a parameter to decide the structural condition of a pavement. The deflection bowl shape can be divided into different zones with each associated to pavement structural condition of individual layers. For example, the central deflection represent the condition of asphalt layer along with other pavement layers such as base and subgrade while the subgrade condition highly impacts the overall deflection bowl shape. Deflections measured by the sensors in the middle (neither close to the load plate nor close to the farthest sensor) represent the conditions of base and subbase layers.

5.1. Comprehensive Deflection Ratio (CD_r)

Deflection ratio is considered one of the important parameters developed and employed by different agencies such as DTMR (Department of Transportation and Main Roads) in Australia. Deflection ratio (D_r) is defined as the ratio of deflection measured at 250 mm (D_{250}) from the center of the load plate to the central deflection (D_0).

$$D_r = D_{250} / D_0$$

Depending on the deflection ratio, the pavement's structural condition was classified as bound pavement, good quality unbound pavement and possibly weak unbound pavement, for $D_r>0.8$, $0.6<D_r<0.7$ and $D_r<0.6$, respectively (23). However, deflection ratio is calculated based on deflection at 250 mm, which is close to the load plate and represent similar conditions of pavement layers compared to D_0. Hence, a new parameter is introduced to include the effect of base and subbase layers on surface deflection. The new parameter is termed as Comprehensive Deflection ratio (CD_r), which is the ratio of deflection measured at 600 mm from the load plate (D_{600}) to the central deflection.

$$CD_r = D_{600} / D_0 \quad (6)$$

where CD_r is Comprehensive Deflection ratio, D_0 is the central deflection, D_{600} is deflection measured at 600 mm from center of the load plate.

D_r was found to be ineffective for few pavement sections. Though central deflections differed to great extent between pavement sections, D_r remained same, which states that both sections are structurally similar in their performance. But, the field measured fatigue cracking for the SHRP section B320 was 69.9 m^2 whereas the same for SHRP section M340 was 171 m^2. The

total area of a typical pavement section was around 550 m^2 and the measured fatigue area for the SHRP section M340 was nearly one-third of the total surface area of the pavement section, which clearly states the poor condition of that section. However, when the sections are categorized based on D_r, the sections would be concluded as structurally fair, which is not true based on field measured fatigue.

CD_r was found to be effective for sections with deflections differing in less magnitude. For example, comparison between calculated deflection ratio (D_r) and comprehensive deflection ratio (CD_r) for two pavement sections (SHRP: B320 and M340) is shown in Figure 11. The deflection bowls for both pavement sections were based on drop height 1 (target load of 27 kN).

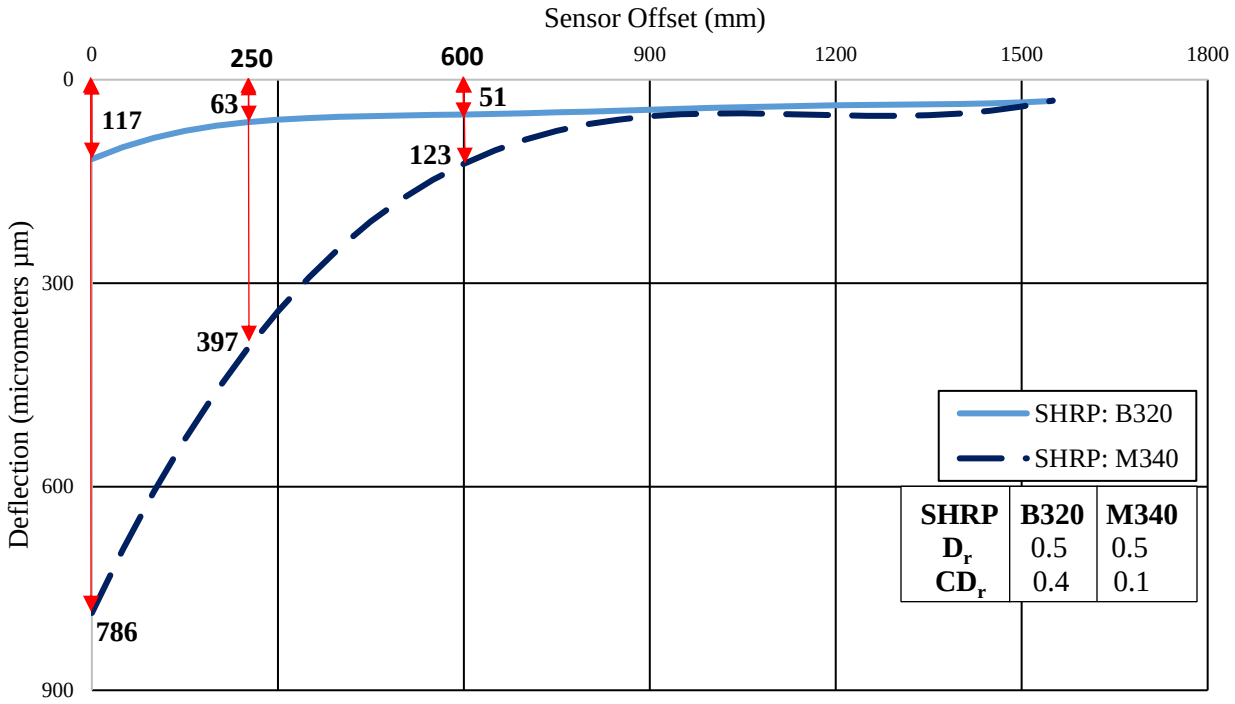


Figure 11 Deflection ratio (D_r) and comprehensive deflection ratio (CD_r) illustration with SHRP pavement sections B320 and M340.

It is obvious that stiff pavement section must possess higher deflection ratio than a weak pavement section. However, deflection ratio remains same for both pavement sections

irrespective of their central deflections. It can be noted that the comprehensive deflection ratio is greater for section with lesser deflection than the section with higher deflection. Hence, CD_r is found to be more effective for assessing pavement sections. In addition, CD_r was well related to the central deflection D_0, which can be observed in Figure 12. The co-efficient of determination proves the relationship between D_0 and CD_r.

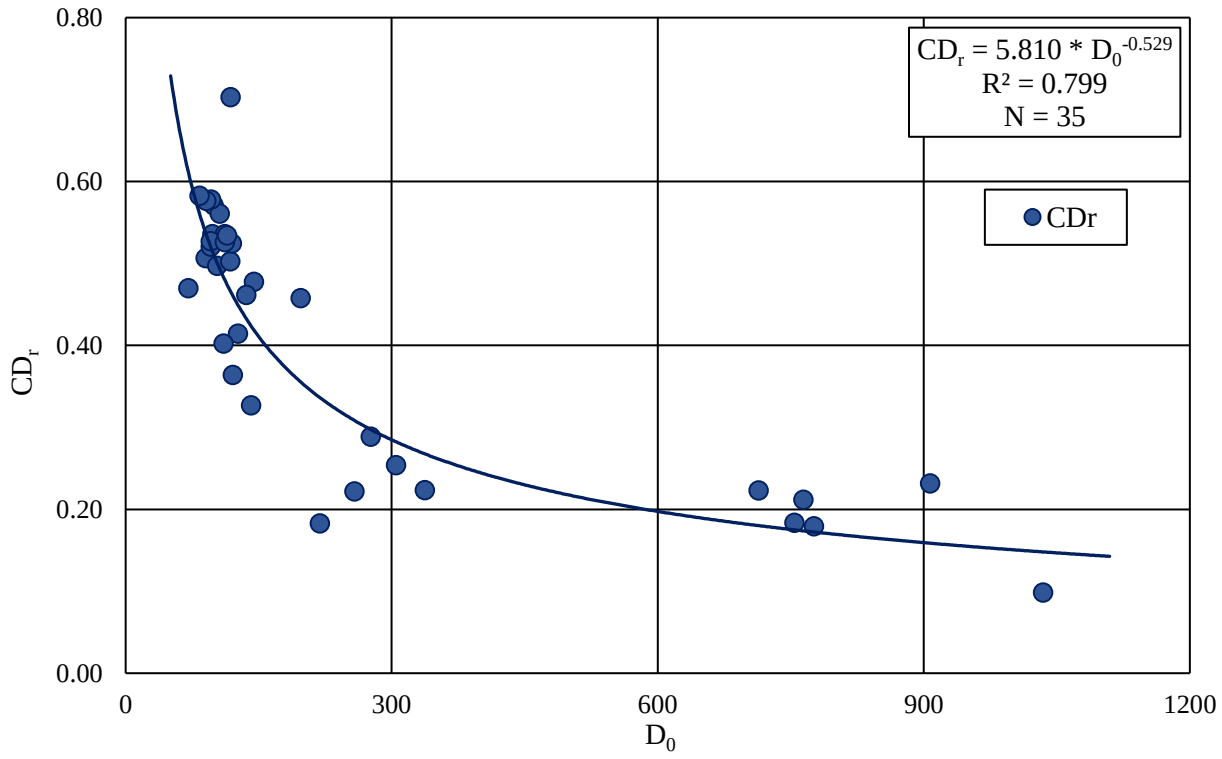


Figure 12 Relationship between deflection ratio (D_r) and central deflection (CD_r).

Utilizing the relationship between CD_r and D_0, the sections can be categorized as structurally good, fair and weak, whose CD_r values are less than 0.3, between 0.3 and 0.5, and greater than 0.5, respectively. The figure also illustrates the importance of CD_r compared to consideration of central deflection (D_0) alone. Pavement sections with maximum D_0 (around 800 micrometers) consecutively resulted in lesser CD_r, while few other pavement sections with lesser D_0 (around 200 micrometers) also resulted in lesser CD_r. When central deflection is solely

considered for the structural assessment of pavement sections, this phenomena could lead to erroneous conclusion about pavement sections.

It should be noted that the graph shown in Figure 11 corresponded to drop height 1(27 kN). The ranking system would differ for other three drop load levels as central deflections eventually differ for different load levels. This phenomena is due to the four load levels utilized during FWD testing. Different ranking system based on target load levels can be related to most probable traffic load utilizing the considered pavement section. With the increase in magnitude of target drop loads, both deflections at center of the load plate and 600 mm would increase, which would result in the same trend as seen for the drop load of 27 kN. Based on the discussion, it can be concluded that CD_r is more effective to represent structural condition of pavement sections than D_r.

5.2. Comprehensive Area under Pavement Profile (CAPP)

Though CD_r is capable of predicting the structural condition of pavement sections to great extent, the model is developed based on deflections at 2 points only (i.e., 0 mm and 600 mm). To overcome the shortcoming of utilizing only two deflections, area ratio concept was primarily introduced back in 1980s (Hoffman & Thompson (29)) and later updated to include deflections at regular intervals throughout the 900 mm length of deflection sensors (18). The area parameter was developed based on different deflections measured by different sensors from the center of the load plate. The reports claimed that the area parameter that combined deflections at different offsets and central deflection could provide useful information regarding the pavement structural capacity. In order to represent the structural condition of a pavement section, the area parameter was updated to a parameter termed as Comprehensive Area under Pavement Profile (CAPP). The

developed CAPP involves deflection throughout the entire length of deflections measured by FWD (i.e., 1500 mm from the center of the load plate).

5.3. Comprehensive Area Ratio (CA_r)

It is well known that weak section deflect more whereas deflection would be minimum for a stiff or thick pavement section. For a strong pavement section, deflections measured at different sensor offsets would differ in minimum magnitude compared to the central deflection. In order to determine the strength of a pavement, an extremely stiff pavement section was assumed, which would have same deflection measurements throughout the sensors. The concept of comprehensive area ratio is to divide the comprehensive area of the pavement profile by the comprehensive area of the imaginary rigid pavement section. To precisely calculate the area of the deflection bowl, entire deflection bowl was divided into 50 mm segments and the area of each 50 mm segment was added together.

Area of each segment can be calculated as $50*(\frac{D_0 + D_{50}}{2})$

For the imaginary perfectly rigid pavement section, whose deflection is same throughout the sensors (i.e., $D_0 = D_{50} = D_{100} = \ldots. = D_{1500}$), the CAPP of the deflection bowl was calculated as:

$$CAPP = (\frac{1}{D_0}) * \{50 * [(\frac{D_0 + D_{50}}{2}) + (\frac{D_{50} + D_{100}}{2}) + \ldots + (\frac{D_{1450} + D_{1500}}{2})]\}$$

$$= (\frac{1}{D_0}) * \{50 * [(\frac{D_0 + D_0}{2}) + 29 * D_0]\}$$

$$= 1500 \text{ mm}^2/\text{mm}.$$

When the calculated CAPP for a pavement section is divided by the CAPP of imaginary rigid pavement section, the result would be the portion of considered pavement section in the imaginary rigid section profile, which is termed as the comprehensive area ratio (CA_r). Based on the area ratio concept, the comprehensive area ratio (CA_r) is defined as:

$$CA_r = \left(\frac{1}{1500 * D_0}\right) * \{50 * [(\frac{D_0 + D_{1500}}{2}) + \sum_{i=50}^{1450} Di\ ]\} \quad (8)$$

A strong pavement section would cover more area than a weak pavement section and hence CA_r would be higher for a strong section and comparatively less for a weak section. For an extremely stiff pavement section, the CA_r value could be nearly 1.0 while a weak section could have a CA_r value of 0.1. In order to understand the area ratio concept, two pavement sections (SHRP: 1093 and 3729) with different properties were compared as shown in Figure 13. Both pavement sections were normalized with respect to the central deflection (D_0) to have a unity peak deflection. The outer dashed line represent the imaginary rigid pavement section with same deflections throughout the length of 1500 mm. By observing the figure, it can be understood that for SHRP section 3729, the area covered by the pavement profile is more than half the area of imaginary rigid pavement whereas the SHRP section 1093 covers comparatively lesser area of imaginary rigid pavement section. As expected, the CA_r for SHRP section 3729 is 0.7 whereas 0.3 for SHRP section 1093. Deflection bowls for both pavement sections considered corresponded to drop height 1 with target load of 27 kN. However, the trend remains same for the rest of the three targeted load levels.

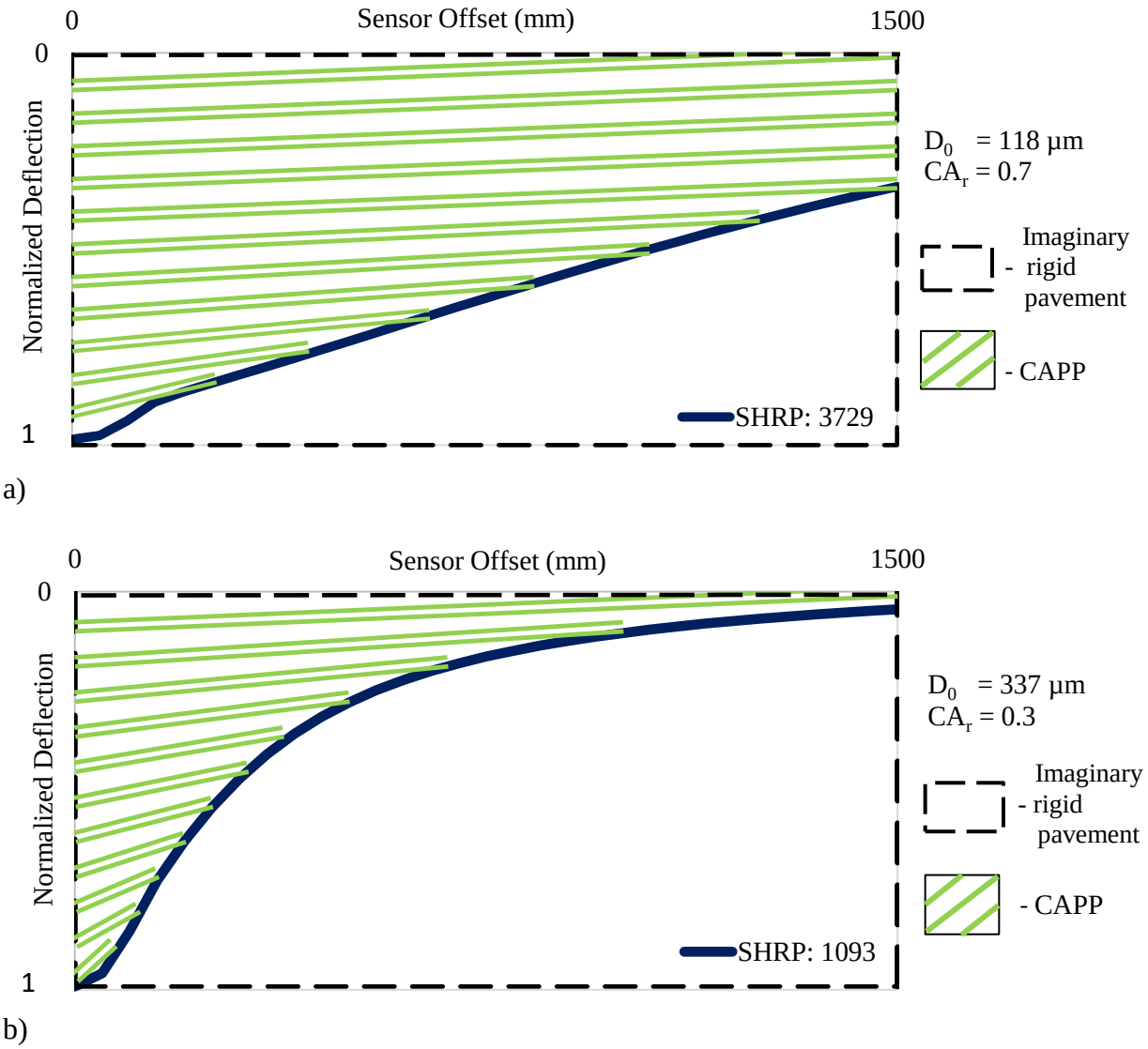


Figure 13 Normalized area of deflection profiles for SHRP sections: (a) 3729 and (b) 1093.

The central deflection has significant impact on the CA_r and it can be noticed in the figure. D_0 for the SHRP section 3729 is 118 µm (micrometers) whereas D_0 is 337 µm (micrometers) for section 1093. However, it cannot be concluded that CA_r is solely dependent on D_0 since deflections at 50 mm intervals throughout the length of 1500 mm (shape of deflection bowl) has to be considered. This criteria is proved in the Figure 14, which correlates D_0 and CA_r. Though a trend can be seen in the relationship, it is non-linear, which shows that CA_r is not solely dependent on D_0. The relationship shown for 35 SHRP pavement sections was based on FWD

target load of 27 kN and the trend was observed to be same for the remaining three targeted load levels.

In addition, CA_r was compared to CD_r as shown in Figure 15, and a strong correlation was found between the parameters CA_r and CD_r. The relationship trend was linear with coefficient of determination (R^2) being 0.99, which shows that CA_r is much dependent on CD_r and vice versa. The relationships established between D_0 and CD_r or CA_r were based on single targeted load level whereas the relationship between CA_r and CD_r was established for all four targeted load levels of 35 SHRP pavement sections. This was successful since both CD_r and CA_r vary in the same trend depending on applied load or condition of the pavement structure. Hence, CA_r can be considered a parameter to assess a pavement section but it should be noted that the area ratio parameter account only for the structural condition above the subgrade.

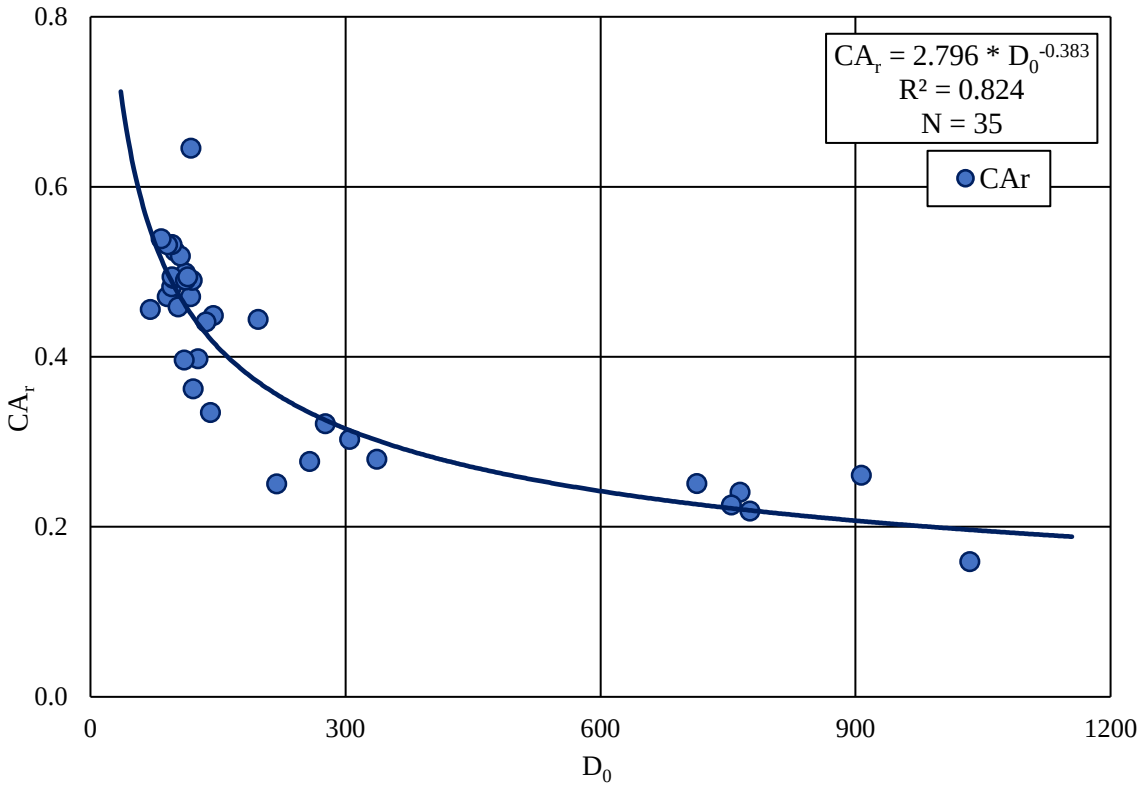


Figure 14 Relationship between comprehensive area ratio (CA_r) and central deflection (D_0)

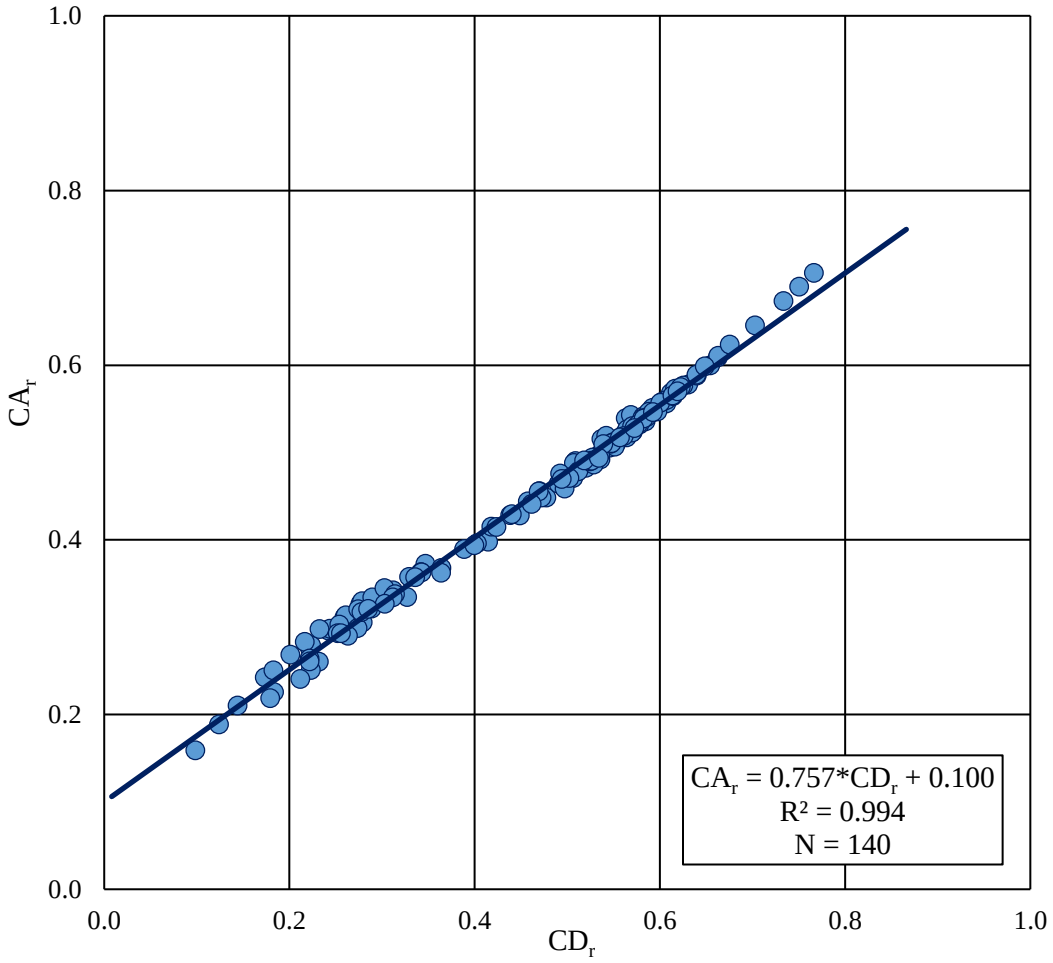


Figure 15 Relationship between comprehensive area ratio (CA_r) and comprehensive deflection ratio (CD_r)

5.4. Normalized Comprehensive Area Ratio (CA_r')

Based on the literature and discussion in previous section, it is well known that the area ratio parameter account only for the structural capacity of pavement sections above subgrade. The concept of normalized area ratio was then introduced in order to overcome the limitation associated with the area ratio parameter, CA_r. By combining the area ratio and central deflection into a single parameter could account for the structural property of the entire pavement section (both subgrade and layers on top of subgrade). The developed parameter was found to be very

effective to assess the structural capacity of pavement sections. The area parameter is normalized by dividing the CA_r by D_0, and the new parameter was termed as CA_r':

$$CA_r' = \left(\frac{1}{1500 * D_0}\right) * \left(\frac{1}{D_0}\right) * \{50 * [(\frac{D_0 + D_{1500}}{2}) + \sum_{i=50}^{1450} Di\ ]\} \quad (9)$$

Furthermore, the change in area ratio for a pavement section based on different target load levels was observed to be too minimum to differentiate the structural property of the pavement section. The resulted deflection bowls based on all four target load levels for the SHRP section 1049 was considered as shown in Figure 16. The calculated CA_r for the section was 0.5 for all four targeted load levels irrespective of the change in central deflection due to the increase in the loads. By observing the calculated parameters of the SHRP section 1049, the area ratio values categorize the pavement section as medium strong section.

It is obvious that the response by structural layers of pavement differ for different loading conditions or targeted load levels. However, the parameter CA_r was not capable of accounting the change in response by pavement section to differing target load levels. The newly developed parameter CA_r' was capable of accounting even the minimum change in response by the pavement section. It can be identified in the figure that the values of CA_r' varies from 2.6 for target load level 4 (73 kN) all the way to 6.9 for target load level 1 (27 kN) while CA_r remains the same as 0.5.

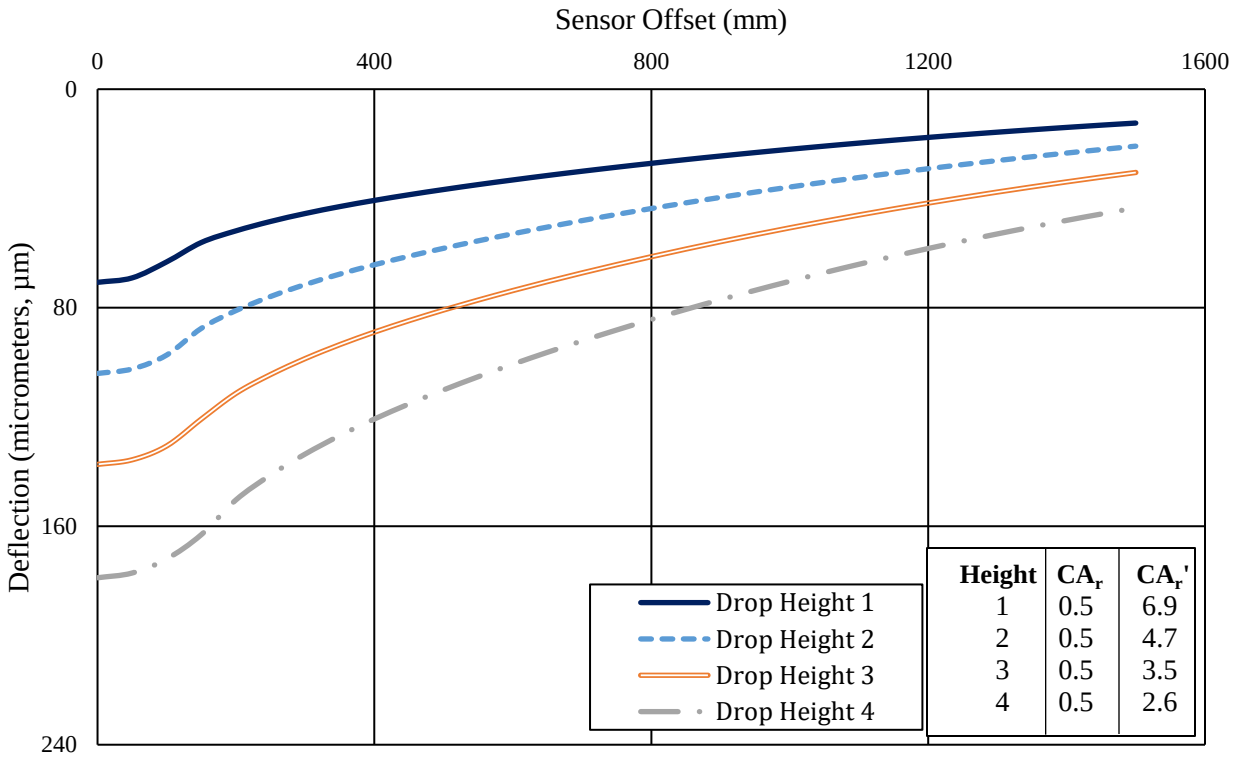


Figure 16 Illustration on importance of normalized comprehensive area (CA_r') ratio based on SHRP section 1049

5.5. Relationship between Normalized Comprehensive Area Ratio (CA_r') and Central Deflection (D_0)

A comparison was established between CA_r' and the central deflection (D_0) as shown in Figure 17. Strong correlation was observed between D_0 and CA_r', which proves that CA_r' can be utilized as a structural accessibility parameter. The normalized comprehensive area ratio is an effective parameter to assess the structural condition of a pavement section. As seen in previous section, the comprehensive area ratio parameter CA_r does not effectively account for the change in loading levels though central deflection differed. Hence, the area ratio parameter is normalized with respect to D_0, the developed CA_r' accounts for the different targeted load conditions unlike the area ratio parameter. Thus, CA_r' for all four target load levels could be plotted in a single graph for comparison.

In addition, variation in CA_r' and D_0 were compared with respect to the four targeted load levels. Since the structure of a pavement section remains same for all four target load levels, the resulted plot shows the variation of CA_r' and D_0 with respect to target loads. SHRP sections 1049 and A505 are shown in the report to clearly understand the variation in parameters based on target loads (Figure 18). CA_r' decreases with increase in load whereas D_0 increases with increase in load, which represent the effect of normalization with respect to D_0.

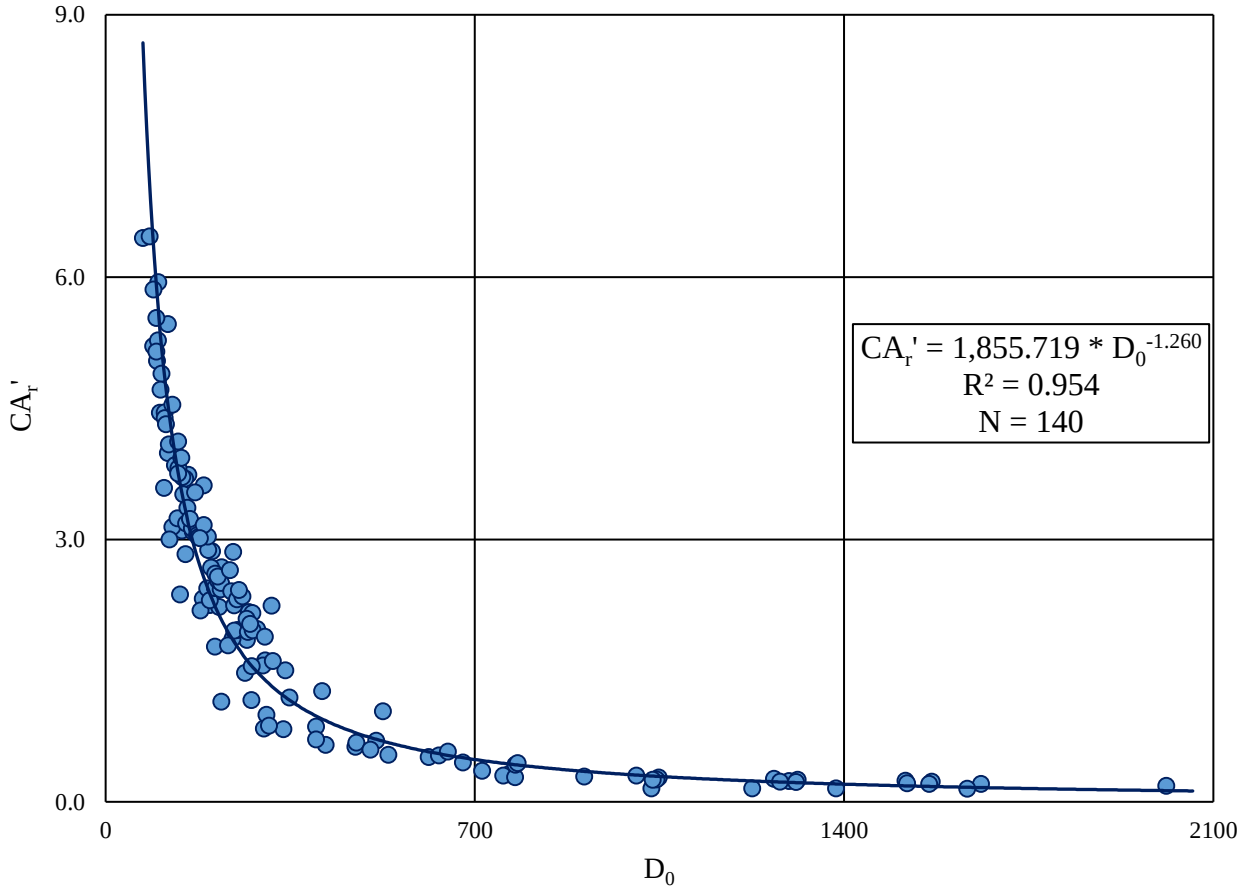


Figure 17 Relationship between normalized comprehensive area ratio (CA_r') and central deflection (D_0)

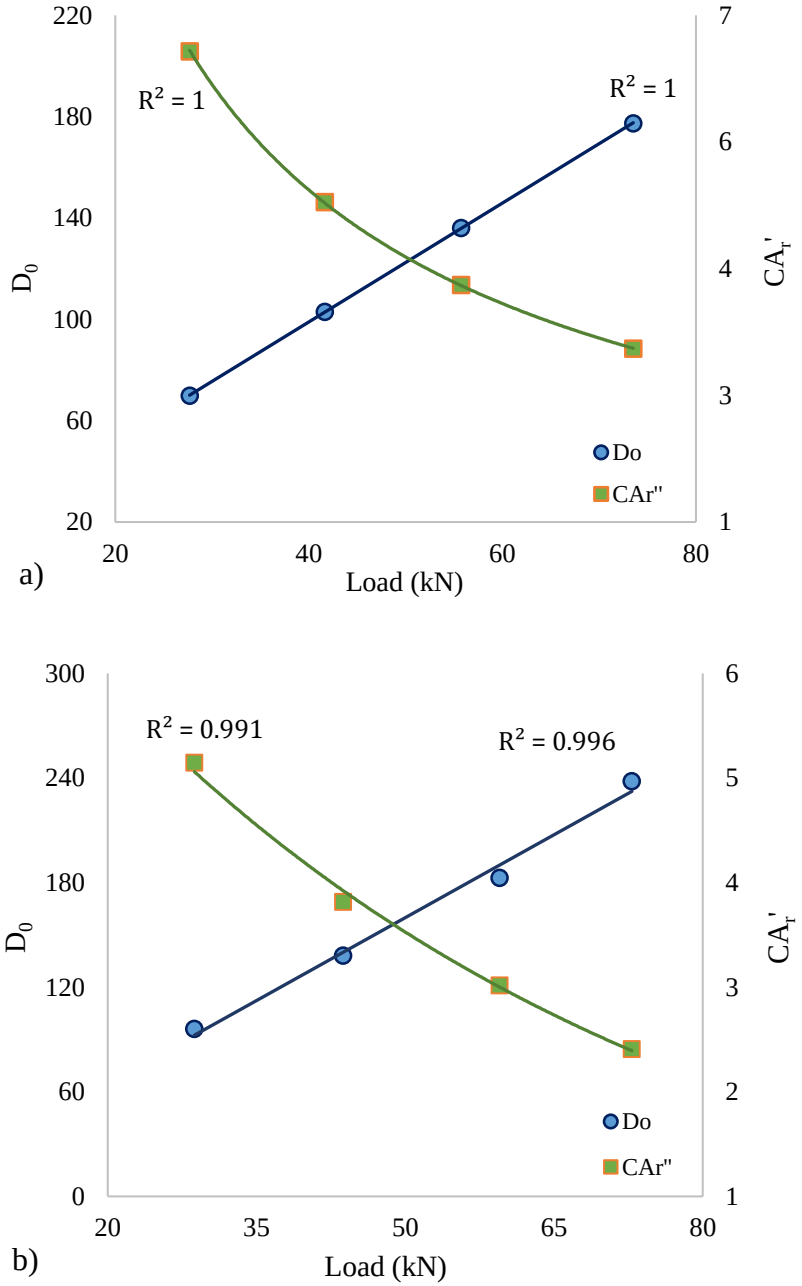


Figure 18 Sensitivity of normalized comprehensive area ratio (CA_r') and central deflection (D_0) to load variation. (a) SHRP 1049 and (b) SHRP A505

5.6. Normalized Comprehensive Deflection Ratio (CD_r')

CD_r was calculated for all 35 pavement sections for all 4 drop heights since FWD tests were conducted for four drop load levels (27 kN, 40 kN, 53 kN, and 70 kN). 3D Move Analysis

simulated deflection bowls for four drop heights for the SHRP section 1047 are shown in the Figure 19. It can be noted that the slope or rate of change in deflection is uniform from center of the load plate to 700 mm from center of the load plate (i.e., deflection bowls are nearly parallel). As a result of the uniformity in deflection bowls, the calculated CD_r values were same for all four drop heights irrespective of the load change. To include the effect of load and resulting deflection, concept of normalization is introduced similar to the area ratio parameter. In addition to the effect of load change, normalizing includes the effect of subgrade on the structural condition of pavement since D_0 is directly proportional to subgrade condition. The normalized deflection ratios for the same SHRP section 1047 corresponding to different loads are significantly different. CD_r' for deflection bowls based on lesser load was found to be maximum and that based on greater load was found to be minimum.

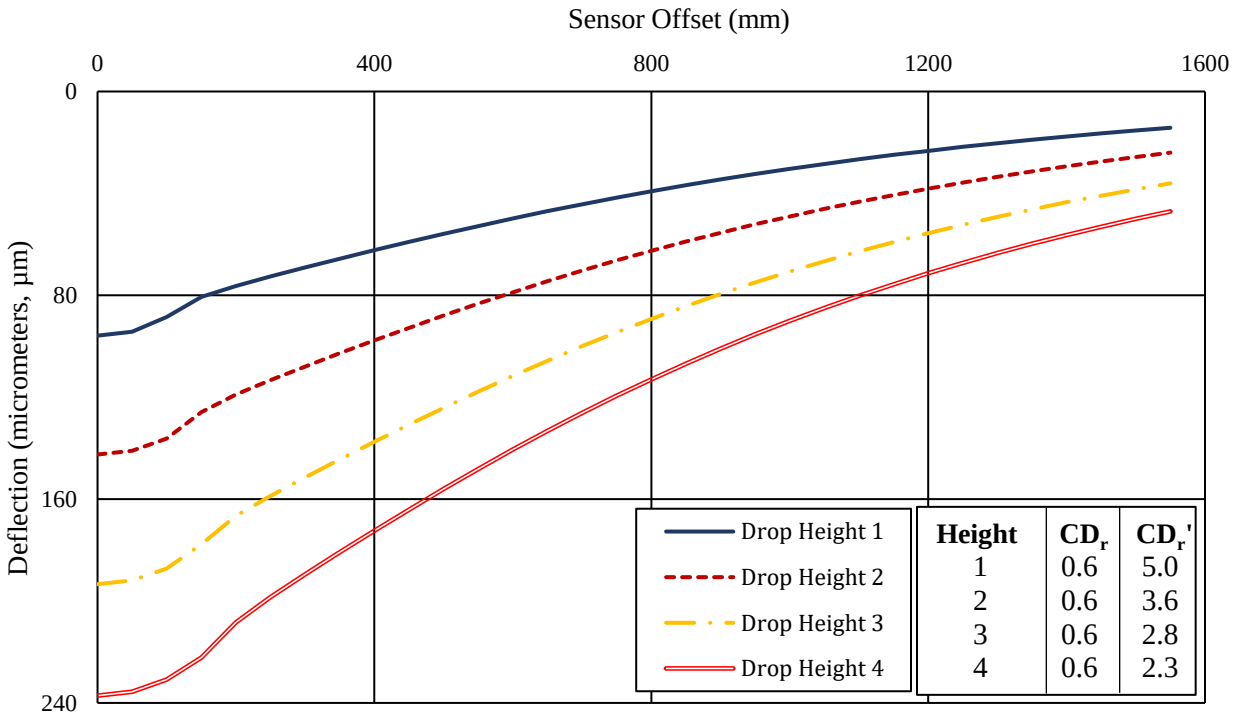


Figure 19 Illustration on importance of normalized comprehensive deflection ratio (CD_r') based on SHRP section 1047.

The parameter was effective to detect the change in target load as observed with CA_r', which is shown in Figure 20. Similar to CA_r', CD_r' had a strong correlation with the central deflection (D_0) as well, as shown in Figure 21. In addition, CD_r' was compared to CA_r' as shown in Figure 22, which illustrate that both parameters are well related. CD_r' is found to be capable of representing the developed normalized comprehensive area ratio parameter. Hence, CA_r' and CD_r' can be considered as overall parameters to assess the structural condition of any pavement section.

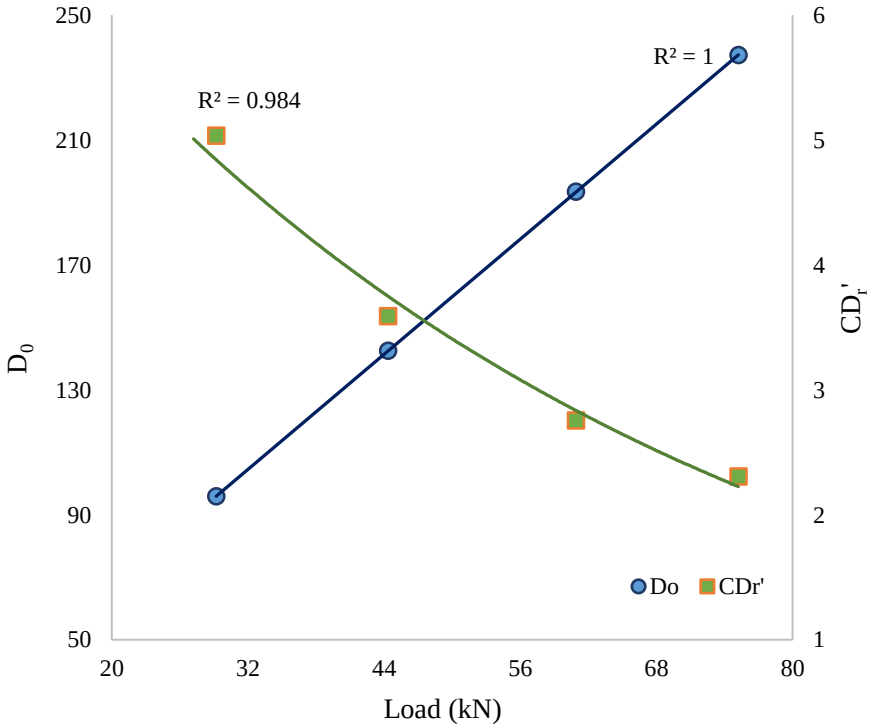


Figure 20 Sensitivity of normalized comprehensive deflection ratio (CD_r') and central deflection (D_0) to load variation.

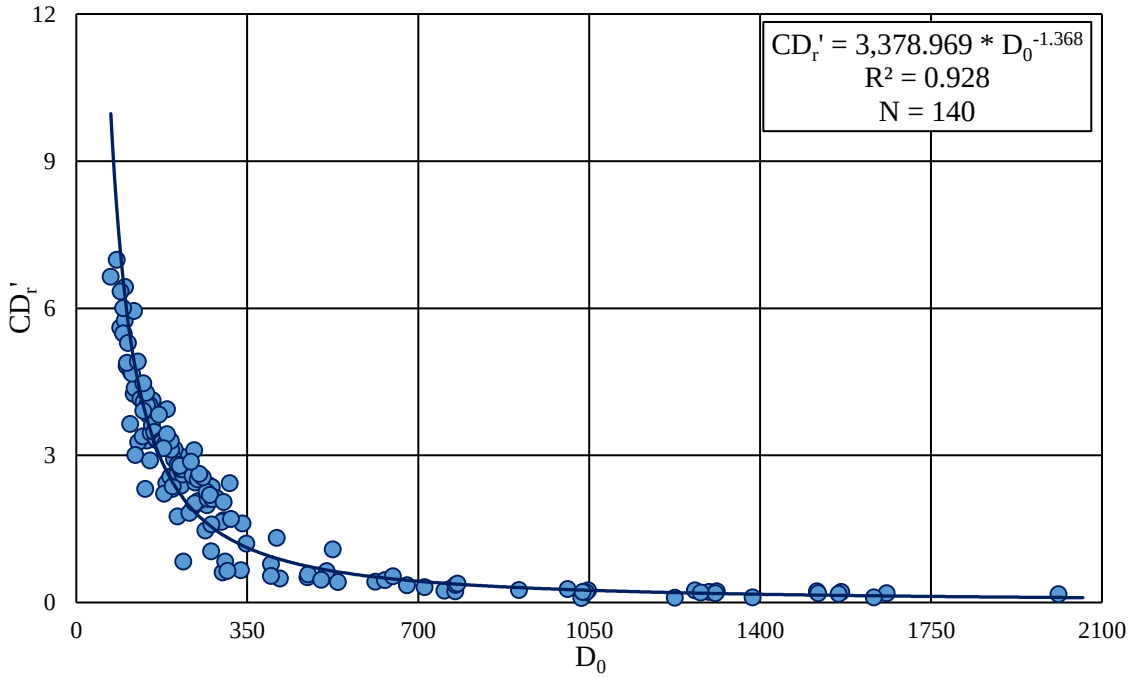


Figure 21 Relationship between normalized comprehensive deflection ratio (CD_r') and central deflection (D_0)

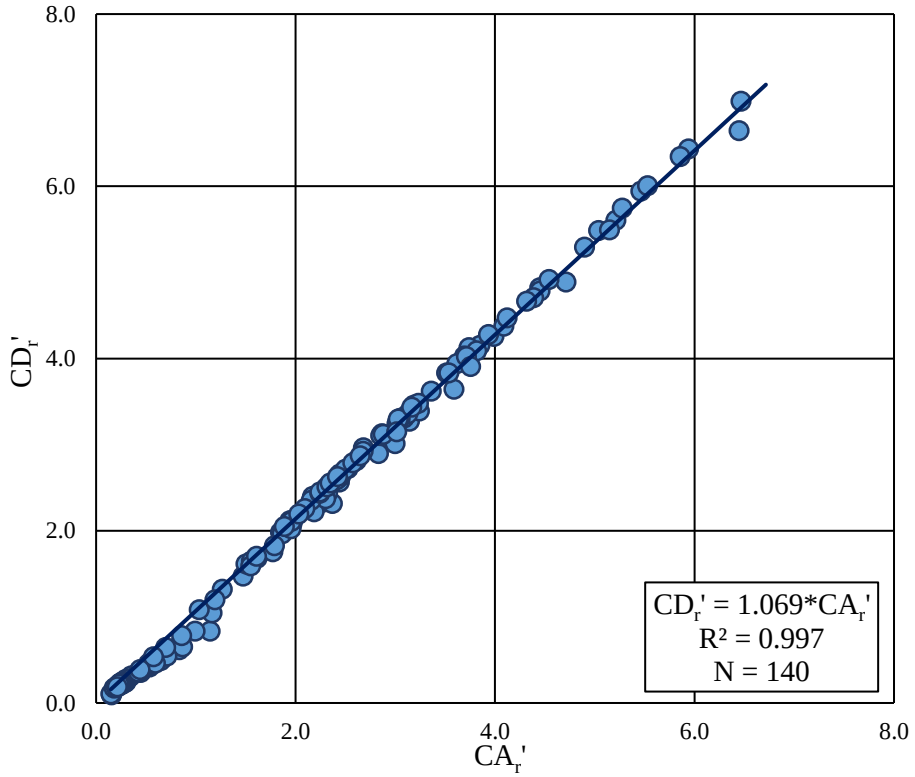
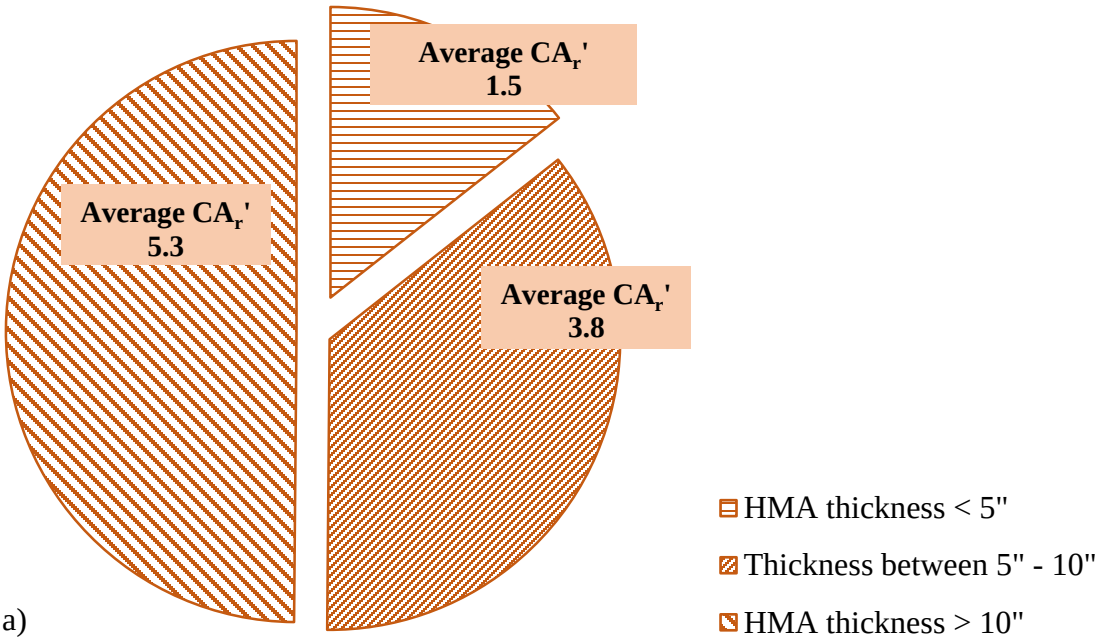


Figure 22 Relationship between normalized comprehensive area ratio (CA_r') and normalized comprehensive deflection ratio (CD_r')

5.7. Sensitivity of Normalized Comprehensive Area Ratio (CA_r') and Normalized Comprehensive Deflection Ratio (CD_r') to Asphalt Layer Thickness

The 35 SHRP pavement sections considered for the study were categorized based on their HMA layer thicknesses to identify the sensitivity of developed parameters. It was interesting to identify the trend in parameters such that greater for thicker pavements and smaller for thinner pavement sections (Figure 23). Pavement sections were categorized into three divisions as HMA thickness lesser than 5 inches, sections between 5 and 10 inches, and sections greater than 10 inches. It is obvious that thinner sections should exhibit lesser CA_r' and CD_r' and vice versa. The results were same as expected such that thinner sections resulted 1.5 as CA_r' while for thicker sections, calculated CA_r' was 5.3. This illustration proved that CA_r' can be considered as an overall parameter to assess pavement sections.



a)

b)

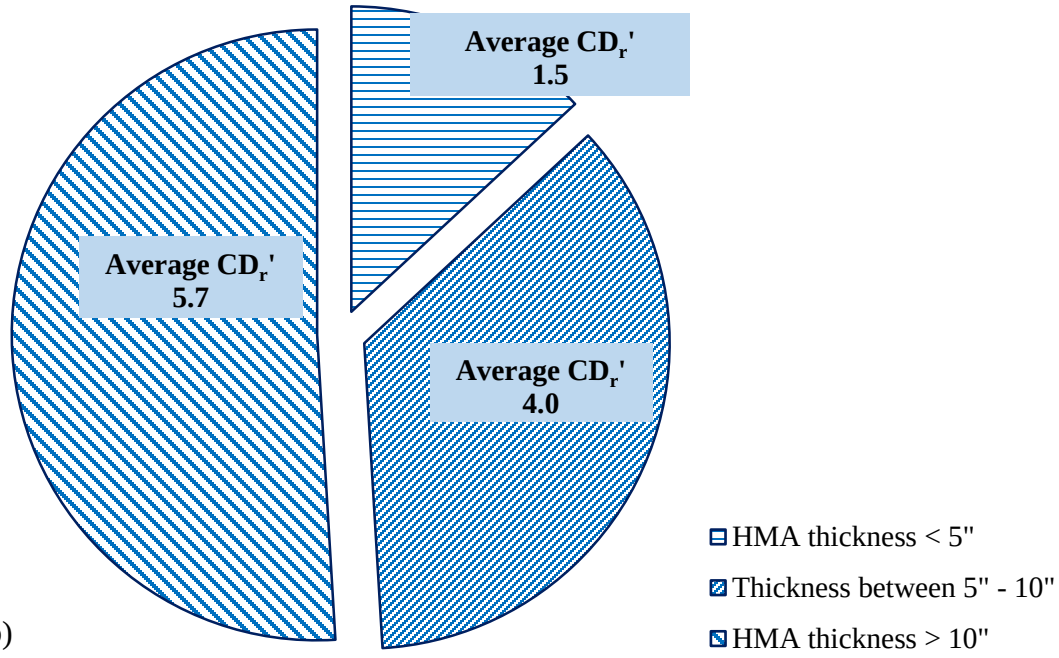


Figure 23 Average values of (a) normalized comprehensive area ratio (CA_r') and (b) normalized comprehensive deflection ratio (CD_r') based on asphalt layer thickness

It is clear from the discussion that CA_r' and CD_r' can be employed as deflection bowl parameters to assess pavement sections. However, it should be noted that all thinner sections cannot be considered weak always and hence, pavement sections are not ranked based on thicknesses. Therefore, the parameters were compared to that of physical distress data of considered pavement sections measured during the period of FWD tests. Based on their relationship with the observed distress, a scale was developed to rank pavement sections as structurally good, fair, and poor sections.

Chapter Six

Development of a Scale to Classify the Structural Capacity for Different Pavement Categories

6.1. Development of Normalized Comprehensive Area Ratio (CA_r') scale based on Fatigue

Deflection parameters were developed based on simulated deflection bowls for the 35 SHRP pavement sections. Among the developed parameters, Normalized Comprehensive Area Ratio, CA_r' and Normalized Comprehensive Deflection Ratio, CD_r' were found to be effective and reliable to assess structural adequacy of a pavement section. To develop a scale to categorize good, fair, and poor pavement sections, developed parameters were compared to that of their corresponding structural distresses such as fatigue and rutting, and functional distress such as IRI (International Roughness Index). Distresses in pavement sections were collected from the LTPP database as shown in chapter 2. Fatigue cracking, generally termed as alligator cracking, is the series of interconnected cracks caused by fatigue failure of the HMA surface under repeated traffic loading. Fatigue failure is considered one of the important failures in a pavement section, which would lead to serious issues resulting in reconstruction of a pavement structure. Fatigue cracking is crucial as it can initiate rain water infiltration and result in formation of pot holes. Fatigue cracking is measured in terms of area on surface of a pavement section. It is obvious that structurally good pavement section must possess lesser area of fatigue cracking compared to a structurally poor pavement section.

In order to categorize and develop a scoring scale to rank pavement sections, developed parameters were compared with the measured fatigue as shown in Figure 24. The relationship between fatigue and developed parameter CA_r' was found to be sensible and reliable with co-efficient of determination of greater than 0.8. As expected, pavement sections with lesser fatigue area exhibited higher CA_r' whereas sections with higher fatigue area exhibited lesser CA_r', which proves the ability of the developed parameter to assess pavement sections. Though the area of fatigue is measured in square meters, the illustration is based on the percentage of area to make it accessible by other transportation agencies. LTPP SHRP pavement sections are typically 152 meters long and 3.7 or 4.0 m wide, which may differ compared to the area of pavement section considered by agencies in other countries. In addition, CA_r' was found to be effective to include the impact of change in target loads on the pavement structure. This can be observed in the illustration that illustrates the variation of CA_r' with respect to fatigue percentage based on target loads. For example, in case of drop height 1 with target load of 27 kN (6000 lbs), CA_r' for structurally good pavement section was found to be greater than 4.0 whereas pavement sections can be considered structurally good when the CA_r' is greater than 1.8 for drop height 4 with target load of 71 kN (16,000 lbs). It can be observed as well that the percentage of fatigue in a pavement section is minimum corresponding to higher CA_r'.

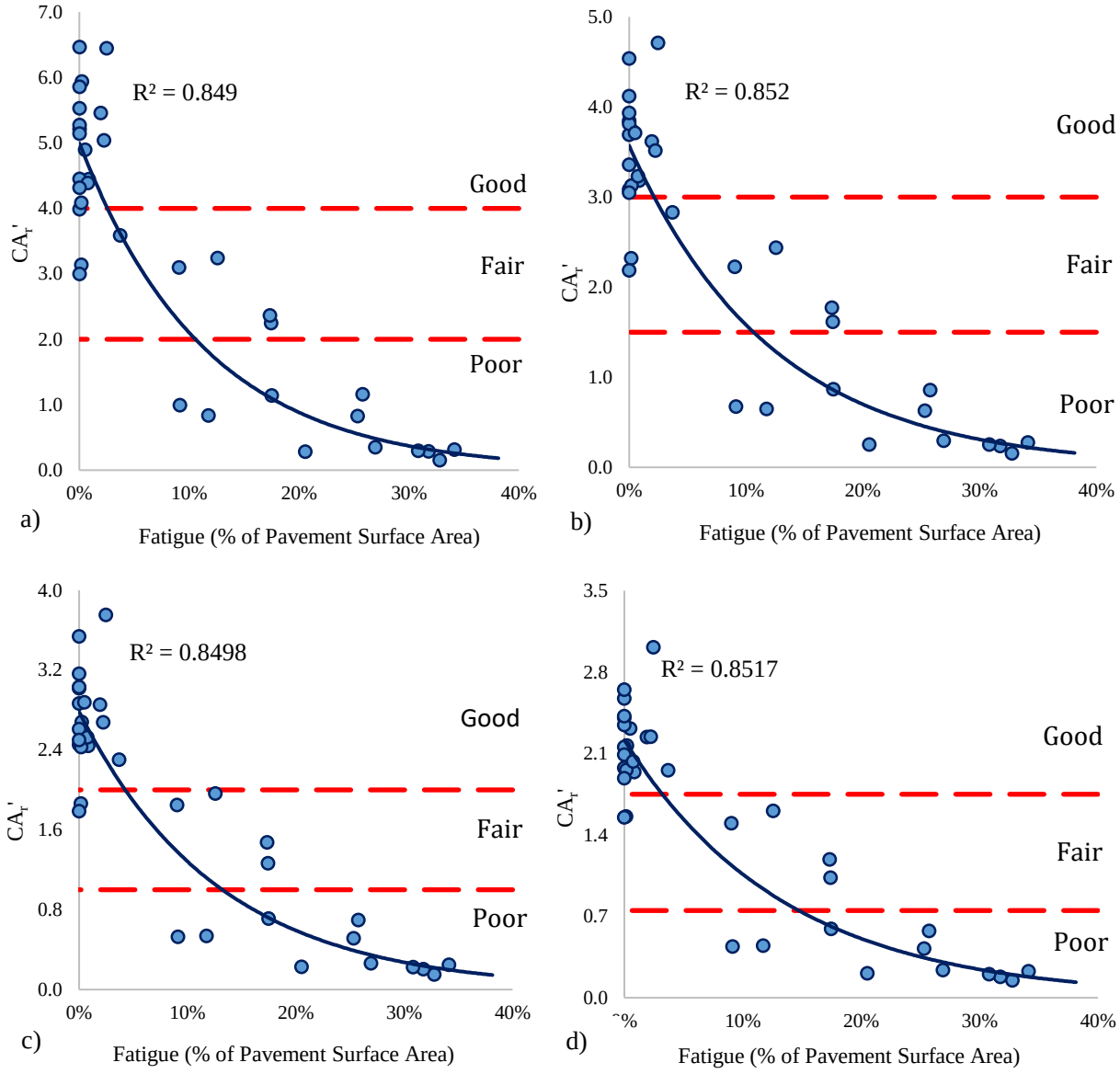


Figure 24 Development of normalized comprehensive area ratio (CA_r') scale to rank pavement sections based on Fatigue. (a) Height 1, (b) Height 2, (c) Height 3, and (d) Height 4

6.2. Classification of Pavement Sections based on Normalized Comprehensive Area Ratio (CA_r')

Based on the illustration (Figure 24), a scale was developed with ranges to categorize structurally good, fair, and poor pavement sections. The scale was developed based on individual drop load levels, which can be employed to any pavement section that has the maximum

probable traffic load matching the target load level. The developed scoring scale is shown in Table 13.

Table 13 Developed range of scale for normalized comprehensive area ratio (CA_r')

Normalized Comprehensive Area Ratio, CA_r' ranges			
Target Load	Pavement structural capacity ranking		
	Good	Fair	Poor
27 kN (6,000 lbs)	> 4.0	2.0 - 4.0	< 2.0
40 kN (9,000 lbs)	> 3.0	1.5 - 3.0	< 1.5
53 kN (12,000 lbs)	> 2.0	1.0 - 2.0	< 1.0
71 kN (16,000 lbs)	> 1.8	0.8 - 1.8	< 0.8

The table illustrates the range of CA_r' to rank any flexible pavement section based on structural condition. For pavement sections with target load of 27 kN, structurally good pavement section should exhibit CA_r' greater than 4.0, fair, and poor must exhibit CA_r' values of 2.0 – 4.0 and <2.0, respectively. Similarly, for the rest of the three target loads have their corresponding ranges of CA_r'. To validate the developed scale, pavement sections from each category was considered to compare their structural properties. SHRP sections 1049, 1069, and 1116 were considered from structurally good, fair, and poor categories, respectively. It is obvious that SHRP section 1049 must be structurally sound than other two pavement sections, which is because of lesser fatigue area than other two pavement sections. Similarly, SHRP section 1069 should be structurally sound than SHRP section 1116. Physical properties of the three pavement sections were compared as shown in Table 14. By observing the Table 13, the range of CA_r' for structurally good, fair, and poor sections can be identified.

Table 14 Comparison of pavement structural properties with respect to fatigue and normalized comprehensive area ratio (CA_r')

SHRP ID	Pavement layer properties						CA_r'	Fatigue Area (%)	Pavement Classification
	Layer thicknesses (mm)			Layer moduli (MPa)					
	HMA	Base	Subbase	HMA	Base	Subbase			
1049	117	284	198	10,053	2,758	689	6.5	2	Good
1069	241	386	165	4,468	193	117	3.1	9	Fair
1116	117	277	0	3,351	262	0	1.2	26	Poor

In order to clearly understand the comparison, each section has to be individually examined. SHRP sections were considered in such a way that all sections possess same subgrade moduli of 117 MPa (17,000 psi). Since the thickness of subgrade for all pavement sections were considered as a constant value of 6,096 mm (240 inches), the subgrade property and thickness were excluded from the comparison. Considering the SHRP section 1049 that exhibits CA_r' of 6.5 is comprised of 117 mm thick asphalt layer, 284 mm thick cement treated base layer, and 198 mm thick lime treated subbase layer, with corresponding layer moduli of 10,053 MPa, 2,758 MPa, and 689 MPa, respectively. Whereas the SHRP section 1116 does not include a subbase layer alike other two pavement sections. In addition, the modulus of asphalt layer is 3,351 MPa, which is lesser than both SHRP pavement sections 1049 and 1069. It is obvious that lesser thickness and layer moduli would result in weaker pavements and vice versa.

Considered pavement sections were compared with respect to their percentage of fatigue area as illustrated in the Table 13. Fatigue area for the SHRP section 1049 was observed to be 2% of total surface area of pavement section, which proves that the section is structurally good. Similarly, considering the rest of the three sections, SHRP section 1069 and 1116, the fatigue area was observed to be 9% and 26%, respectively. Pavement sections with 9% and 26% of

fatigue area exhibited CA_r' values of 3.1 and 1.1, respectively, which clearly states that the developed scale is effective. Hence, classification of pavement sections based on their structural condition is successful and reliable. Based on the relationship between CD_r' and CA_r' as shown in the previous section, CD_r' is also well related to the percentage of fatigue area (Figure 25). Relationship between CD_r' and fatigue is shown for one of the four drop heights since that the observed trend was same for all four targeted load levels.

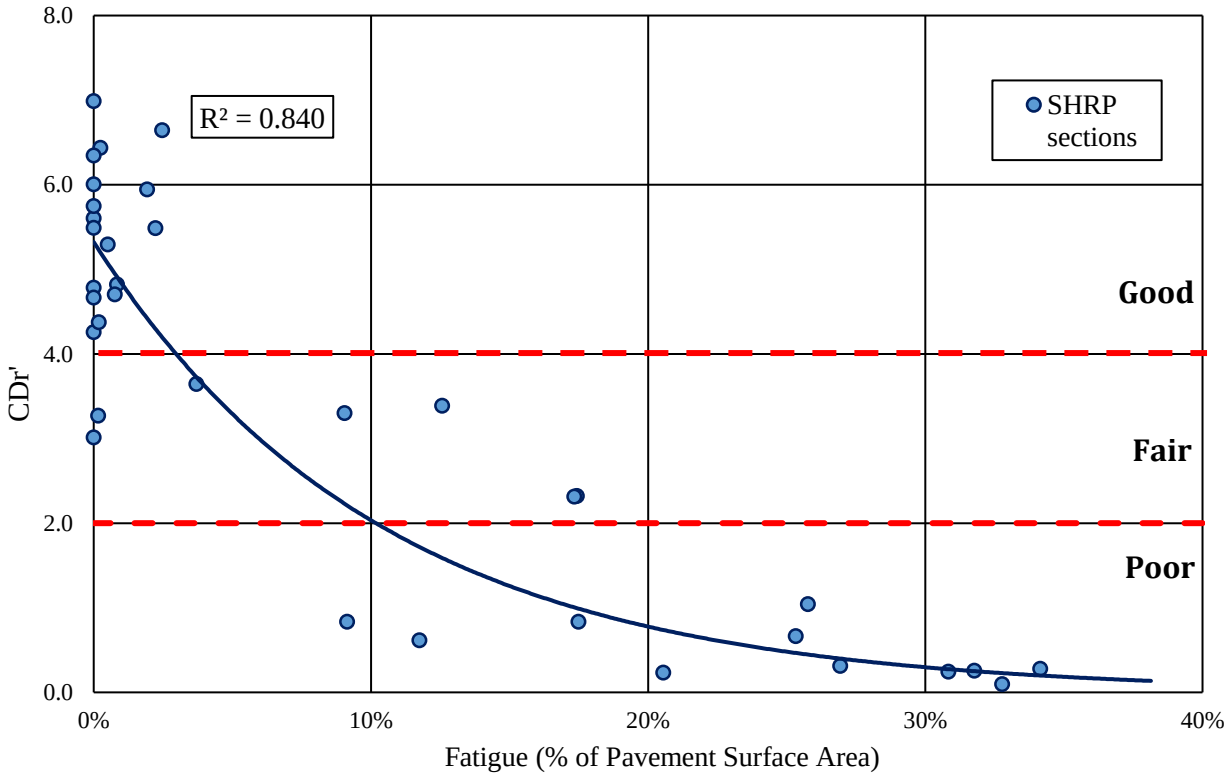


Figure 25 Relationship between normalized comprehensive deflection ratio (CD_r') and fatigue observed for 27 kN target load

The relationship between CD_r' and fatigue percentage exhibit a coefficient of determination of 0.8, which proves that CD_r' could be utilized to assess the structural condition of a pavement section as well. The scaling range for CD_r' was found to be the same as the scale observed for CA_r'. By observing Figures 24 and 25, it should be noted that there are two SHRP sections

(SHRP sections 1111 and 3679) with zero fatigue, which is an indication for structurally good pavement sections. However, the sections categorized as structurally fair pavement sections. This can be explained with their pavement layer properties. For example, considering the SHRP section 1111, the pavement structure comprised of two layers above subgrade similar to the SHRP section 1116 shown in Table 13 without a subbase layer. The SHRP section 1111 included a 241 mm thick HMA layer with a modulus of 4,344 MPa, 213 mm thick base layer with a modulus of 221 MPa, and subgrade properties for both pavement sections were same. The layer moduli of SHRP section 1111 is significantly greater than layer moduli observed for the SHRP section 1116. This indicates that developed parameters such as CA_r' and CD_r' are effective to assess the structural condition of any pavement section with respect to entire pavement structure. Pavement structural layers and their individual properties should be considered while ranking.

It can also be noted that two SHRP sections, SHRP 1069 and 9005 with same fatigue percentage (9%) have been categorized as structurally fair and poor, respectively. In addition, other two pavement sections such as SHRP B320 and 1076 with same fatigue percentage around 12% have been ranked structurally fair and poor, respectively. This phenomenon can be easily understood by comparing their respective tensile strain developed at the bottom of asphalt layer. It is obvious that a stiff pavement would experience lesser tensile strain at the bottom of HMA than experienced by a weak pavement section. Hence, pavement sections experiencing higher tensile strain can be considered weak and vice versa. 3D-Move Analysis software package is capable of predicting the tensile strain developed at the bottom of HMA along with the simulation of FWD deflection bowls.

Considering the SHRP sections (SHRP 1069 and 9005), developed tensile strain at the bottom of HMA for both sections were compared as shown in Figure 26. The variation in tensile

strain was expressed with respect to targeted load levels. The plot clearly illustrates the significant difference in strain between both pavement sections.

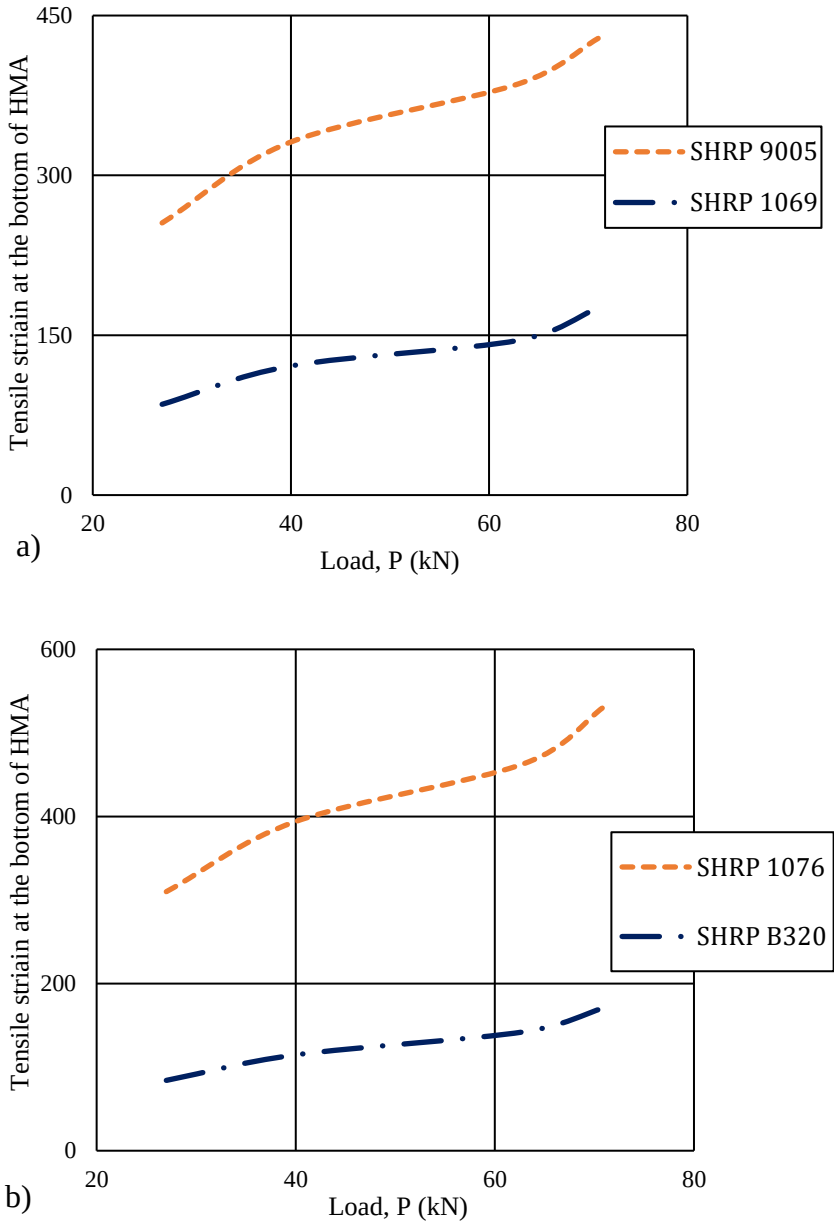


Figure 26 Variation in tensile strain based on layer thicknesses and stiffness: a) 9% fatigue sections and b) 12% fatigue sections

Maximum strain developed for targeted load level 1 was 85 μs (micro-strain) for the SHRP section 1069 whereas 255 μs for the SHRP section 9005. Similarly, in case of targeted load level

4, maximum tensile strain developed for the SHRP section 1069 was 176 μs while the same for SHRP section 9005 was observed to be 429 μs. This significant increase in the strain values of SHRP section 9005 resulted it in structurally poor category.

Similarly, SHRP pavement sections B320 and 1076 were considered for comparison with respect to their corresponding tensile strains. Tensile strains developed at the bottom of HMA for the SHRP section 1076 was found to be 310 and 532 for targeted load levels 1 and 4, respectively. Whereas the SHRP section B320 experienced lesser tensile strain such as 84 and 171 for targeted load levels 1 and 4, respectively. This comparison proves the structural capacity of all four pavement sections considered. It is well known that the tensile strain developed at the bottom of HMA is directly related to the stiffness of both asphalt layer and base layers. Hence, CA_r' and CD_r' can be considered effective parameters to assess structural condition of pavement sections provided the relationship between strain and parameters are well correlated.

6.3. Relationship between Tensile Strain and Developed Parameters

Tensile strain at the bottom of asphalt layer is a critical attribute as it causes the origin of fatigue crack at the bottom of HMA. Hence, tensile strain developed at the bottom of HMA layers for all 35 SHRP pavement sections were considered. As the developed parameters as well as tensile strain at the bottom of HMA are directly related to the targeted load, all four targeted load levels were considered in the relationship. The relationship between tensile strain and CA_r' as well as CD_r' were well related with coefficient of determination near unity ($R^2 = 0.95$), as shown in Figure 27. Developed equations prove the strong correlation between tensile strain and developed parameters. The relationship between the tensile strain and developed parameters (CA_r' and CD_r') were related as shown in the following equations:

$$\varepsilon = 310.06*CA_r'^{-1.219} \quad (10)$$

$R^2 = 0.95$

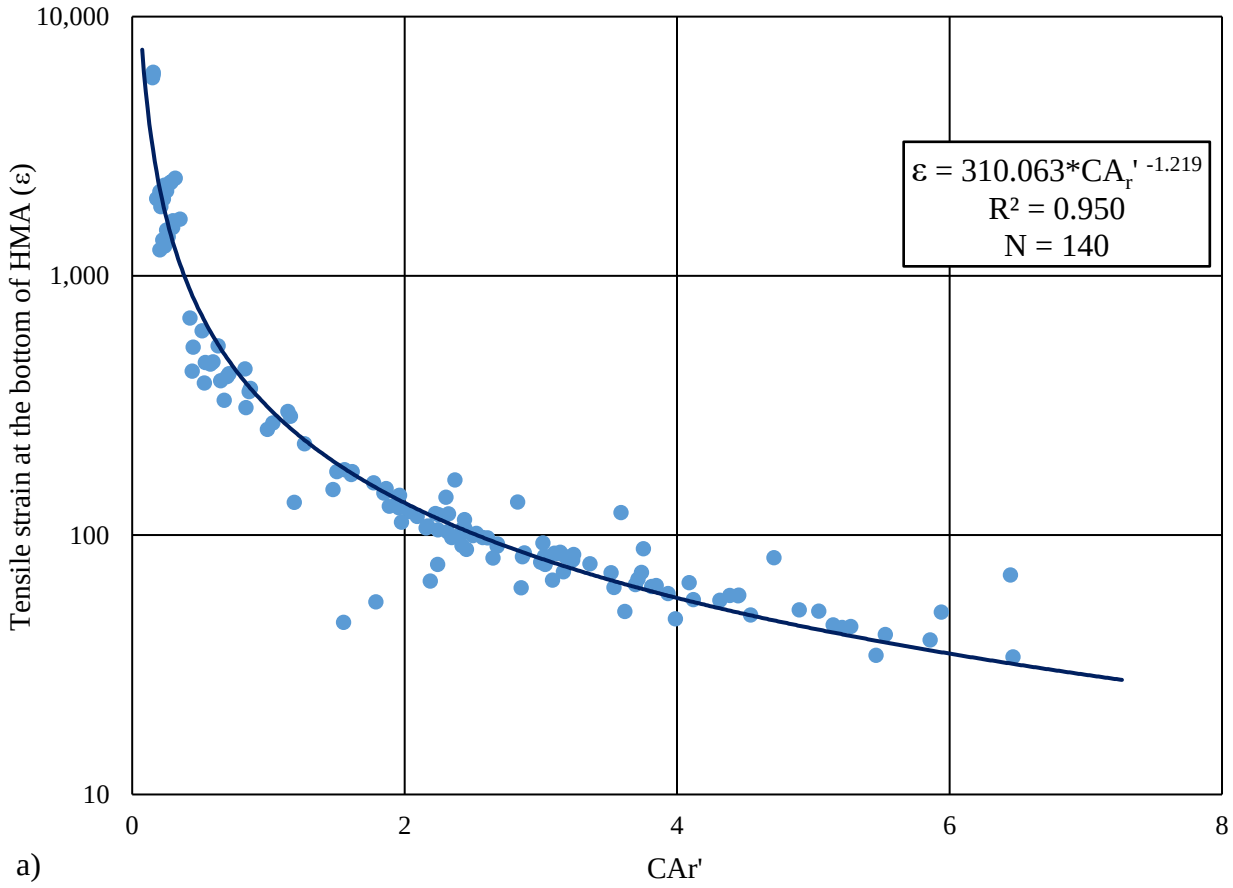
$$\varepsilon = 292.35*CD_r'^{-1.108} \quad (11)$$

$R^2 = 0.95$

where ε is the tensile strain developed at the bottom of asphalt layer

CA_r' – Normalized comprehensive area ratio

CD_r' – Normalized comprehensive deflection ratio



a)

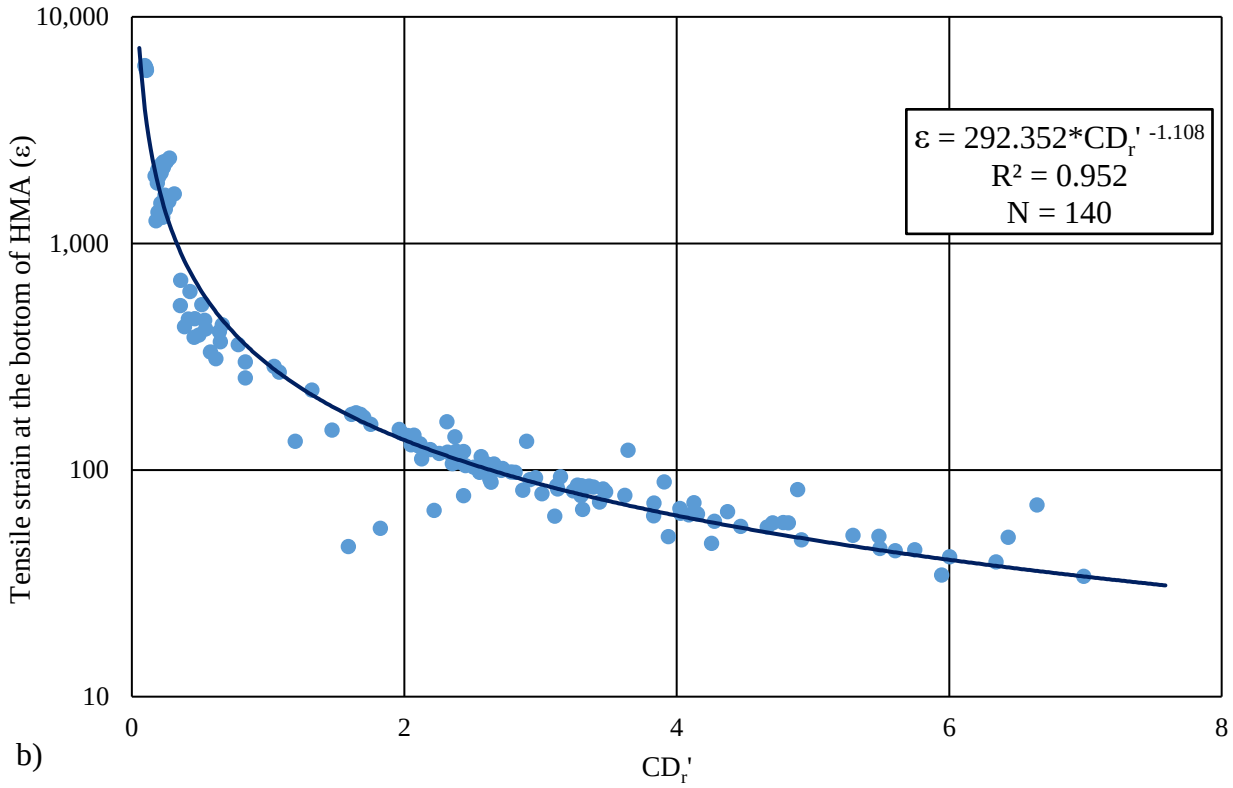


Figure 27 Relationship between tensile strain at the bottom of HMA and: (a) Normalized Comprehensive Area Ratio (CA_r') and (b) Normalized Comprehensive Deflection Ratio (CD_r')

6.4. Prediction of Remaining Service Life based on Fatigue Failure

Critical responses of pavement sections such as the maximum tensile strain at the bottom of HMA was found to be in strong correlation with the developed parameters such normalized comprehensive area and deflection ratios (CA_r' & CD_r') as shown in Figure 27. This relationship could result in prediction of the remaining service life of pavements based on the mechanistic empirical pavement design fatigue model since the tensile strain plays an important role in the fatigue model. The considered 35 SHRP pavement sections were analyzed to determine their remaining service life in terms of number of load repetitions to fatigue failure (N_f), which would result in the origin of bottom-up fatigue crack at the bottom of asphalt layer. The number of load

repetitions to failure was calculated based mechanistic empirical pavement design model utilizing the tensile strain at the bottom of HMA and the stiffness of asphalt layer. Tensile strain is inversely proportional to the number of cycles to failure that can be noticed in the equation. This represents that pavement sections experiencing lesser tensile strain would serve for higher number of load cycles until failure and pavement sections with higher tensile strain would handle significantly lesser number of load cycles before failure. Though pavement sections could be categorized based on their tensile strain, number of load cycles to failure would serve the transportation agencies in a better way to plan the maintenance activities in a timely manner.

Number of load repetitions to fatigue failure (3) is given by

$$N_f = 0.0795*(1/\varepsilon)^{3.291}*(1/E)^{0.854} \quad (12)$$

where N_f is the number of load repetitions to failure

ε is the tensile strain developed at the bottom of HMA

E is the stiffness (modulus) of the asphalt material

Based on the above equation, N_f was calculated for the 35 SHRP pavement sections. Number of cycles to fatigue failure was well related to CA_r' and CD_r' as shown in Figure 28. The relationship gives a clear indication that remaining service life of a pavement section can be estimated based on CA_r' and CD_r'.

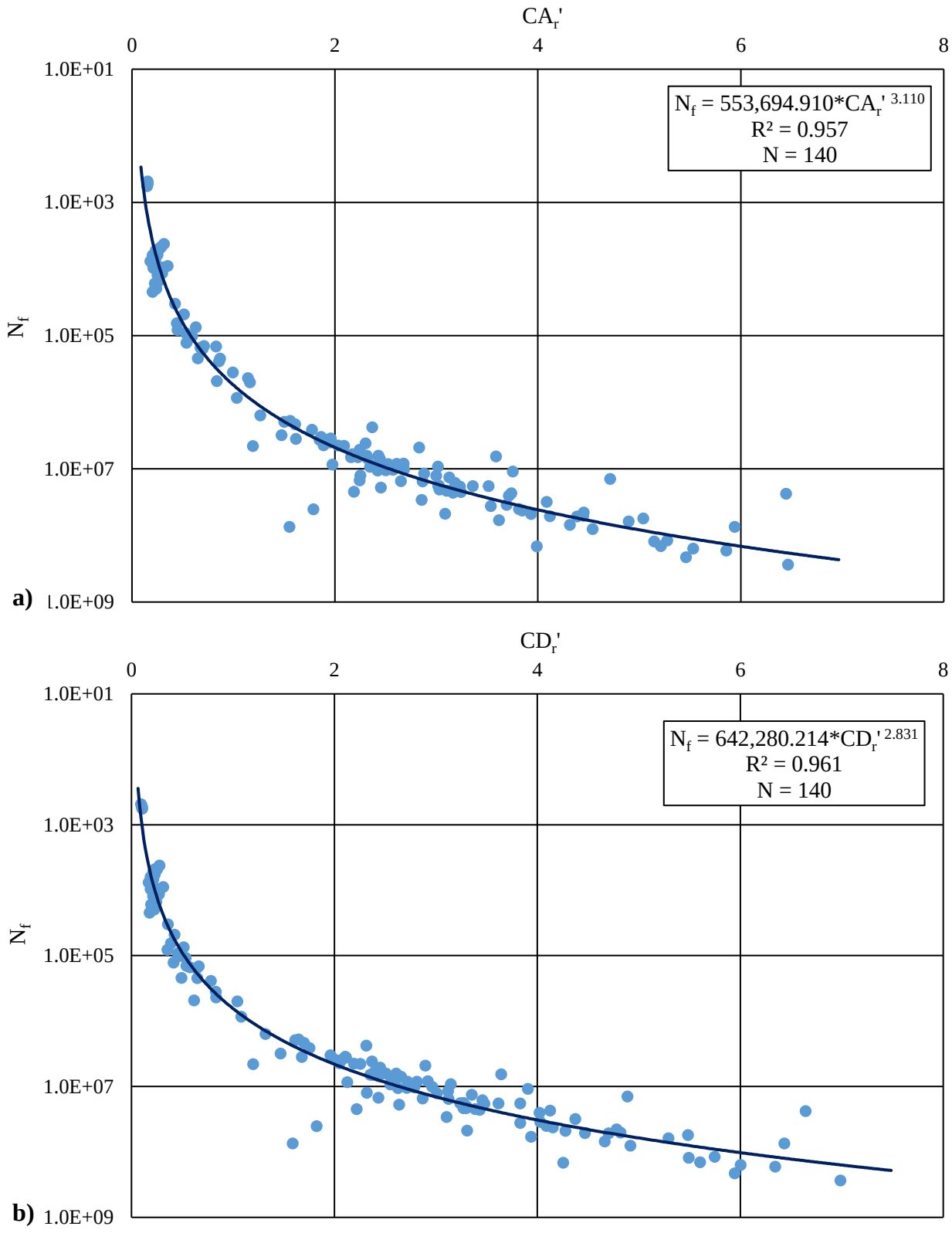


Figure 28 Relationship between N_f and: (a) Normalized Comprehensive Area Ratio (CA_r') and (b) Normalized Comprehensive Deflection Ratio (CD_r')

Based on the relationships observed in the Figure 28, number of load cycles that a pavement could handle can be calculated based on both CA_r' and CD_r' utilizing the following equations:

$$N_f = 553{,}694.910 * CA_r'^{\,3.110} \quad (12)$$

$$R^2 = 0.957$$

$$N_f = 642{,}280.214 * CD_r'^{\,2.831} \quad (13)$$

$$R^2 = 0.961$$

where N_f is the number of load repetitions to failure

CA_r' is the normalized comprehensive area ratio

CD_r' is the normalized comprehensive deflection ratio

Hence, this relationship can be utilized by transportation agencies to predict the remaining service life of a pavement section. Though CD_r' is effective to assess the structural condition of a pavement section, CA_r' is considered as a reliable parameter as it includes entire deflection bowl rather than deflection at one point.

Chapter Seven

Summary, Conclusions and Recommendations

Based on the broad literature, it is well known that there are very few simple procedures employed by agencies to identify structurally weak pavement sections based on FWD data. 3D Move Analysis software package was utilized to emulate the measured FWD deflection bowls. A simple method was developed based on pavement critical responses such as surface deflection and tensile strain determined at the bottom of the HMA layer of 35 SHRP pavement sections in Texas for four different load cases. Though deflection ratio (D_r) was used as a simple deflection parameter to assess pavements at the network level, the parameter solely depended on deflections at the center and at 250mm from the load plate. Comprehensive deflection ratio (CD_r) parameter was developed based on deflection at 600mm from the center of load plate, which would not have any impact from the load plate. Compared to D_r, CD_r was found to be in correlation with central deflection, D_0. However, both parameters were developed based on single deflection value at a certain distance from the center of load plate, which is more susceptible to errors. To evaluate the entire pavement structure, area ratio parameter was introduced. Area ratio parameter was developed based on the simulated entire 1500mm (center of load plate to 1500mm) FWD deflection bowl. Area of the deflected bowl shape was calculated and compared to an imaginary stiff pavement with uniform deflection, which was termed as comprehensive area ratio (CA_r).

Concept of normalization was introduced so that the area ratio parameter would reflect the response of pavement structure to load variations, which was achieved by dividing the CA_r by central deflection. Normalized comprehensive area ratio (CA_r') was found to have a strong relationship with pavement critical responses such as D_0 and tensile strain at the bottom of HMA, which can be identified from the equation,

$$\varepsilon = 310.06*CA_r'^{-1.219}$$

$$R^2 = 0.95$$

Since there was a strong relationship between CA_r' and ε, it was expected that CA_r' must be effective to predict the remaining service life. Remaining service life was calculated in terms of number of load repetitions to failure based on the MEPDG fatigue failure model. Calculated N_f was well related to CA_r' as well, which can be seen in the equation,

$$N_f = 553694.910*CA_r'^{3.110}$$

$$R^2 = 0.96$$

Hence, based on discussions, CA_r' can be concluded as a simple and robust parameter to evaluate structural capacity of pavement section at the network level. Developed simple and overall parameters, CA_r', would help the south-central state DOTs and local highway agency officials to make more informed decisions about the most suitable maintenance and rehabilitation strategies. However, field validation of developed parameters is recommended to be implemented into the PMS databases of transportation agencies. It should be noted that temperature effects are not included in the developed parameter, which would be considered in future studies.

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APPENDIX A: Deflection Measurements Collected for 35 SHRP Pavement Sections in Texas.

Table A-1. FWD deflection measurements extracted for LTPP pavement section 1046 for FWD test date 17-Dec-98

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
0.00	1	417.75	136.50	104.00	95.50	83.00	73.50	57.75	35.75
	2	630.75	219.25	164.25	151.75	132.50	117.50	92.75	57.75
	3	851.75	295.50	225.50	207.50	181.50	159.75	125.00	75.75
	4	1,042.25	359.25	275.75	254.00	221.75	196.00	153.75	94.25
8.20	1	419.75	99.75	87.75	81.75	74.00	67.00	54.75	35.50
	2	634.00	159.75	137.75	127.75	116.25	105.25	85.75	54.00
	3	852.25	219.75	194.75	181.50	165.00	149.75	120.75	78.25
	4	1,035.50	274.75	239.25	222.25	202.00	182.50	148.25	94.75
15.20	1	419.25	76.75	69.50	66.25	61.25	56.75	46.75	31.00
	2	632.00	121.75	107.50	102.50	94.75	87.50	73.00	48.50
	3	854.00	167.00	150.50	143.50	133.25	123.50	103.00	69.00
	4	1,041.00	204.75	184.50	176.25	163.50	152.00	126.25	85.00
22.90	1	420.00	110.75	92.00	85.00	75.75	68.50	54.75	35.00
	2	630.75	171.50	143.50	131.75	118.25	106.75	85.25	54.75
	3	850.00	240.75	201.50	185.75	166.50	150.75	120.00	76.75
	4	1,025.00	294.50	248.25	229.25	206.00	185.75	148.75	94.75
30.50	1	412.25	124.00	97.50	86.50	74.50	65.25	50.25	31.75
	2	620.75	197.00	153.00	136.75	119.00	101.75	79.50	49.00
	3	841.00	274.00	212.50	188.75	164.00	143.75	111.00	67.75
	4	1,025.75	332.25	261.00	233.00	202.25	177.00	136.50	83.50
38.10	1	390.25	151.00	134.00	98.00	71.25	64.00	48.25	40.50
	2	594.25	229.50	208.50	155.50	119.25	104.75	81.50	52.00
	3	786.00	312.50	287.75	222.00	174.00	152.50	118.25	72.50
	4	1,033.00	383.50	351.75	277.00	220.00	192.25	148.25	91.25
45.70	1	406.25	152.25	153.25	146.25	83.50	73.50	56.50	35.00
	2	617.00	241.50	238.75	227.75	133.25	117.00	89.50	55.75
	3	831.75	335.75	334.50	317.75	190.00	165.50	125.50	76.75
	4	1,024.25	413.75	409.00	388.75	235.25	204.50	155.00	95.25
53.30	1	405.50	90.50	83.25	78.50	72.00	66.75	55.00	36.25
	2	615.25	147.25	129.75	122.50	112.75	103.75	86.00	56.25
	3	843.25	204.25	185.25	174.75	160.75	148.50	123.00	81.00
	4	1,025.75	255.00	229.25	215.50	198.50	184.00	152.50	100.25
61.00	1	403.25	115.25	92.25	83.75	73.25	65.75	51.75	32.50
	2	618.75	180.25	145.00	132.00	115.25	103.75	82.00	51.25
	3	847.25	250.50	206.75	187.75	165.25	147.00	116.00	72.25
	4	1,039.75	311.25	254.75	231.75	204.00	181.50	143.50	89.25
68.60	1	410.75	89.25	80.00	76.50	70.25	65.00	53.00	34.00
	2	623.25	138.25	124.50	119.25	110.50	101.50	82.50	52.50
	3	851.75	192.50	178.00	170.75	158.00	145.25	119.00	75.00
	4	1,038.50	243.00	219.50	210.50	194.50	179.00	146.50	92.75

Table A-1. FWD deflection measurements extracted for LTPP pavement section 1046 for FWD test date 17-Dec-98 (Cont.)

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
76.20	1	406.00	84.00	76.25	72.50	66.00	60.50	49.00	33.00
	2	620.75	133.25	119.50	113.50	103.50	94.50	76.75	49.25
	3	848.00	187.50	169.75	161.25	147.25	134.25	109.00	70.00
	4	1,036.75	233.00	209.50	199.25	182.00	166.25	134.00	86.00
83.80	1	406.25	99.75	88.00	83.50	76.00	69.75	57.00	34.25
	2	617.75	157.25	139.75	131.75	120.75	110.25	90.25	53.75
	3	843.00	221.00	199.75	188.75	173.00	157.75	128.75	75.00
	4	1,029.25	278.00	248.00	234.00	215.00	196.25	160.50	92.50
91.40	1	404.25	111.75	91.25	84.75	75.00	67.75	53.25	33.50
	2	618.00	171.75	144.00	132.75	117.75	106.25	83.75	51.75
	3	842.00	238.75	204.50	188.00	167.75	150.25	119.00	73.00
	4	1,027.00	299.50	251.50	232.75	207.25	187.25	147.00	89.75
99.10	1	400.25	131.50	107.50	97.00	85.00	75.00	58.75	35.00
	2	613.75	204.25	169.00	152.75	134.00	119.25	93.00	55.00
	3	840.75	283.75	239.25	216.75	191.50	170.00	132.75	78.25
	4	1,031.75	353.50	295.75	268.75	237.75	211.75	164.50	97.25
106.70	1	401.00	87.00	75.50	72.00	66.00	60.75	49.75	32.50
	2	616.00	137.00	117.75	112.75	103.75	94.75	78.00	50.50
	3	843.50	190.75	167.00	160.00	147.00	135.00	110.25	71.25
	4	1,040.50	238.25	206.25	196.75	180.75	166.00	136.00	87.50
114.30	1	402.25	97.50	84.25	79.50	73.25	63.50	50.50	33.50
	2	617.00	153.75	133.00	126.50	116.75	101.25	81.00	53.00
	3	845.00	213.25	189.25	180.25	166.50	145.00	116.25	75.50
	4	1,025.75	268.25	234.00	223.00	206.50	179.25	144.25	93.00
121.90	1	397.75	78.00	66.50	63.75	58.50	53.75	44.00	28.75
	2	609.00	124.25	105.00	100.25	92.25	85.00	69.75	45.00
	3	834.00	176.00	148.25	141.00	130.25	120.00	98.00	63.00
	4	1,006.00	217.50	182.75	174.00	160.75	147.50	121.00	77.75
129.50	1	406.50	83.50	65.75	60.25	54.00	48.50	39.50	25.75
	2	618.00	130.25	103.50	94.75	84.75	76.50	61.75	40.00
	3	842.50	182.75	146.75	134.50	120.75	108.75	87.00	55.50
	4	1,029.75	229.25	182.75	167.75	150.75	135.50	108.75	69.25
137.20	1	403.50	67.25	58.75	55.00	50.00	45.25	37.75	25.25
	2	616.75	105.50	92.00	85.75	78.50	71.25	58.75	39.25
	3	842.75	149.00	130.00	122.00	111.25	101.25	83.25	55.75
	4	1,033.50	184.50	160.50	150.75	137.50	125.75	103.25	68.50
144.80	1	402.50	70.75	57.50	54.25	49.50	45.25	37.25	24.50
	2	616.25	111.25	89.50	84.25	76.50	70.00	57.00	37.75
	3	845.75	154.25	127.75	119.75	109.75	99.75	81.50	53.00
	4	1,039.25	193.50	158.25	148.75	136.00	124.00	101.00	66.00
152.40	1	406.00	88.25	67.50	63.25	56.25	50.50	40.25	25.75
	2	617.00	141.50	106.50	98.50	88.50	79.50	63.00	40.75
	3	842.25	196.75	152.00	140.25	126.00	113.00	90.00	57.00
	4	1,019.25	245.50	188.75	174.75	157.25	140.75	111.75	70.75

Table A-2. Average all point locations FWD deflection measurements extracted for LTPP pavement section 1046

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
All Point Locations	1	406.73	102.15	87.25	80.18	68.96	62.21	49.80	32.33
	2	618.90	160.76	136.76	125.76	108.99	98.00	78.61	49.89
	3	841.83	223.15	192.92	177.74	154.73	139.11	111.30	70.11
	4	1,030.93	276.80	237.67	219.46	191.39	172.13	137.68	86.63

Table A-3. FWD deflection measurements extracted for LTPP pavement section 1047 for FWD test date 17-Dec-98

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
0.00	1	414.75	116.25	95.00	87.75	76.50	66.50	49.00	27.50
	2	634.75	179.25	148.00	136.25	118.50	103.25	77.00	42.50
	3	873.50	250.00	208.25	191.75	167.50	146.00	108.50	60.25
	4	1,080.50	306.50	255.25	234.75	204.75	178.75	132.75	74.25
7.60	1	409.75	113.00	100.25	91.00	76.50	67.25	48.00	25.00
	2	622.75	175.25	156.75	141.75	120.75	104.00	74.25	38.25
	3	853.50	246.25	220.75	199.75	169.75	147.00	105.00	54.50
	4	1,066.50	304.50	272.00	245.25	209.00	181.00	129.25	67.25
15.20	1	413.50	138.00	114.00	104.00	88.75	76.00	54.75	29.50
	2	630.75	212.75	177.75	161.25	138.00	118.75	86.00	46.00
	3	872.50	296.75	249.00	226.25	194.75	167.25	121.50	65.25
	4	1,074.50	365.50	306.25	278.25	239.00	206.00	150.00	79.50
22.90	1	418.00	102.25	86.00	79.25	68.75	61.00	45.75	27.00
	2	635.50	160.00	135.00	124.00	108.00	95.75	72.75	42.00
	3	875.25	225.75	190.00	174.25	152.25	134.25	102.25	58.25
	4	1,077.25	277.75	233.00	214.25	187.00	165.50	125.75	72.25
30.50	1	414.50	99.00	87.75	83.00	72.50	64.00	48.00	26.50
	2	624.25	155.50	138.00	129.75	114.25	100.75	75.75	41.25
	3	858.00	219.75	196.00	183.75	162.25	143.00	107.25	58.50
	4	1,057.75	273.25	243.00	228.00	201.25	177.25	132.75	72.25
38.10	1	413.75	89.00	81.50	76.50	68.00	60.25	46.00	27.00
	2	628.25	139.25	127.00	119.25	106.00	94.00	73.00	42.00
	3	859.75	194.50	179.00	168.00	150.00	133.00	102.75	59.25
	4	1,062.25	241.00	220.50	206.75	183.75	164.00	126.25	73.00
45.70	1	415.25	93.25	83.25	78.00	69.00	61.25	47.00	28.00
	2	629.75	146.00	129.75	121.00	107.50	95.50	73.25	42.75
	3	867.75	206.50	183.25	171.00	152.00	135.00	103.75	60.75
	4	1,072.75	253.75	226.00	210.00	187.00	167.00	129.00	75.00
53.30	1	417.00	94.50	88.00	82.50	73.75	65.75	49.25	28.25
	2	630.50	148.25	137.75	128.75	115.50	102.75	78.25	45.00
	3	866.75	209.00	194.50	182.50	163.75	146.25	111.00	63.25
	4	1,067.50	258.25	238.25	224.25	200.75	179.25	137.25	78.00
61.00	1	415.50	101.00	92.00	86.25	75.75	67.00	50.00	28.50
	2	628.00	157.00	143.00	134.00	118.25	105.00	78.75	44.00
	3	867.75	221.25	201.75	188.00	167.00	147.50	111.25	62.25
	4	1,069.25	273.50	248.25	232.25	205.75	182.00	137.00	76.75
68.60	1	415.50	101.50	96.00	92.00	84.50	78.25	65.00	23.00
	2	627.00	160.50	150.00	144.00	132.75	122.75	103.50	35.00
	3	860.50	225.00	212.25	203.00	188.00	173.75	147.50	48.25
	4	1,065.25	278.50	262.25	250.75	232.25	215.50	183.50	58.50
76.20	1	416.00	96.50	87.50	81.50	73.50	64.75	50.25	30.00
	2	631.75	149.00	136.00	127.50	114.00	101.00	78.00	45.00
	3	866.75	208.75	191.00	179.00	160.50	142.75	110.00	64.00
	4	1,069.25	258.25	235.25	221.25	198.25	176.00	136.00	77.75

Table A-3. FWD deflection measurements extracted for LTPP pavement section 1047 for FWD test date 17-Dec-98 (Cont.)

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
83.80	1	413.50	102.00	90.25	84.50	73.75	65.50	49.50	30.00
	2	631.25	159.50	141.50	131.50	115.75	102.75	78.00	45.25
	3	864.50	223.00	199.25	186.00	163.50	145.00	110.00	64.50
	4	1,066.25	275.25	245.00	229.00	201.75	179.00	136.00	78.25
91.40	1	415.75	125.00	110.50	102.50	90.50	79.25	58.75	29.75
	2	625.75	192.50	170.00	157.75	139.50	122.50	90.75	46.75
	3	860.25	267.50	237.25	220.25	194.50	171.00	126.75	67.75
	4	1,064.50	328.50	291.75	270.75	239.75	210.25	156.50	84.00
99.70	1	406.25	99.50	88.25	81.25	70.25	61.75	45.50	26.25
	2	620.25	151.25	137.75	127.50	110.50	96.50	71.75	40.75
	3	839.50	209.50	193.50	178.75	155.50	135.25	101.00	56.50
	4	1,036.00	265.00	240.00	220.75	191.50	168.25	124.75	70.50
107.30	1	408.50	106.75	91.00	84.00	73.25	64.00	47.00	26.00
	2	624.25	164.50	144.00	132.50	115.75	100.25	74.75	41.00
	3	851.50	230.25	203.25	187.00	162.25	142.00	105.00	58.00
	4	1,053.25	282.75	250.50	231.00	200.75	175.00	129.00	70.00
114.30	1	411.00	87.25	80.00	75.00	66.00	57.50	42.50	23.75
	2	621.00	139.00	126.50	118.75	104.75	91.75	68.00	38.00
	3	849.50	197.00	179.00	167.50	147.75	129.25	96.00	53.25
	4	1,050.50	242.25	221.25	207.25	182.75	159.75	118.75	65.75
121.90	1	410.50	93.25	85.25	79.50	69.00	60.00	44.25	24.00
	2	622.75	150.00	134.50	125.00	109.25	95.00	70.00	38.00
	3	858.75	210.00	190.50	176.75	154.75	135.00	99.25	54.00
	4	1,059.25	260.00	235.50	218.75	191.50	166.75	122.75	67.25
129.50	1	411.75	82.50	75.50	70.25	62.00	54.50	40.25	22.75
	2	627.50	131.25	118.50	110.75	97.00	85.75	64.00	35.25
	3	868.50	184.75	167.75	156.75	138.00	121.50	90.75	49.75
	4	1,072.00	228.75	207.00	193.75	170.75	150.75	113.00	62.50
137.20	1	409.25	84.75	75.00	71.00	62.00	55.00	41.00	23.00
	2	622.75	134.00	118.00	111.25	98.00	87.00	64.75	36.00
	3	861.50	187.75	167.00	157.75	139.00	123.00	91.75	51.25
	4	1,067.00	233.00	206.75	194.75	171.75	152.25	113.75	64.25
144.80	1	414.75	85.75	78.00	72.50	63.00	55.00	41.00	22.75
	2	627.25	136.00	121.00	112.75	97.75	86.00	64.00	36.25
	3	864.75	190.25	170.50	158.50	137.75	121.25	90.00	50.75
	4	1,070.25	234.50	210.25	194.25	170.00	149.25	111.00	62.75
152.40	1	416.25	85.25	80.00	73.75	64.00	55.25	40.75	22.50
	2	632.00	140.50	125.75	115.50	100.75	87.00	63.75	35.75
	3	858.50	195.25	176.00	162.25	141.00	122.50	90.00	51.00
	4	1,056.75	240.00	216.50	199.50	174.25	150.75	110.25	62.75

Table A-4. Average all point locations FWD deflection measurements extracted for LTPP pavement section 1047

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
All Point Locations	1	413.38	99.82	88.81	82.67	72.44	63.80	47.79	26.24
	2	627.52	156.25	138.88	129.08	113.45	99.90	75.25	40.80
	3	861.87	218.99	195.70	181.85	160.08	141.02	106.25	57.68
	4	1,064.69	270.51	241.17	224.07	197.31	174.01	131.20	71.07

Table A-5. FWD deflection measurements extracted for LTPP pavement section 1049 for FWD test date 28-Mar-98

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
0.00	1	397.75	65.25	56.25	51.00	44.75	37.75	28.25	16.00
	2	595.75	100.25	85.50	77.50	68.00	58.00	42.75	24.25
	3	789.25	135.50	116.75	106.00	92.00	79.25	58.25	32.75
	4	1,035.25	184.00	158.25	143.75	125.00	107.50	79.25	43.75
7.60	1	391.50	99.25	70.00	60.50	50.75	43.50	33.00	20.50
	2	588.75	147.00	105.00	91.00	77.00	66.00	49.75	30.00
	3	784.00	198.00	143.75	125.00	105.00	90.00	67.50	40.75
	4	1,035.00	265.00	193.75	169.25	142.75	123.00	92.00	55.00
15.20	1	392.00	96.75	77.25	67.25	55.50	45.50	34.25	21.50
	2	588.75	145.25	115.25	101.00	83.25	67.75	51.00	30.75
	3	780.25	194.50	156.25	135.75	112.25	91.75	68.50	41.50
	4	1,025.50	260.00	210.25	183.00	151.50	124.50	92.75	56.00
22.90	1	391.00	83.50	67.00	60.25	52.50	45.50	36.00	22.00
	2	589.00	126.25	102.25	91.50	79.75	70.00	54.25	33.00
	3	784.25	172.25	139.75	125.50	109.25	96.00	74.00	44.25
	4	1,033.25	233.75	190.25	170.75	149.25	130.75	100.75	60.00
30.50	1	390.50	64.75	54.25	50.00	44.75	39.75	32.00	18.50
	2	591.75	98.00	82.25	76.25	68.25	61.25	49.25	27.50
	3	788.25	133.25	112.00	103.00	93.00	83.00	67.00	37.25
	4	1,043.00	179.00	150.75	139.00	125.00	112.50	90.25	49.50
38.10	1	389.50	59.75	51.75	48.00	43.25	38.25	29.50	18.00
	2	590.00	90.25	78.25	73.00	65.25	58.00	45.00	26.50
	3	791.50	124.50	108.00	100.25	90.25	79.75	61.25	35.25
	4	1,053.25	170.25	147.25	136.50	123.00	109.00	83.00	47.50
45.70	1	393.25	64.50	54.00	48.50	43.00	37.75	29.50	18.00
	2	592.25	97.00	81.25	73.75	64.75	57.00	44.00	26.50
	3	788.25	132.00	110.00	99.75	87.50	77.00	60.00	36.00
	4	1,037.00	180.00	149.00	135.50	118.25	104.50	81.25	49.00
53.30	1	393.00	63.00	54.00	49.75	44.75	39.00	30.50	16.75
	2	589.25	94.25	81.25	74.50	66.25	59.00	45.50	25.50
	3	791.00	130.25	110.75	102.00	91.00	80.75	62.00	34.75
	4	1,050.50	177.25	151.50	140.00	124.50	110.25	85.00	47.25
61.00	1	391.25	66.50	54.75	49.25	43.00	38.00	29.00	15.75
	2	588.75	99.25	81.50	74.25	65.25	57.75	45.00	23.50
	3	789.00	133.75	110.75	100.50	89.00	78.75	61.00	32.00
	4	1,044.75	180.75	149.75	136.00	120.00	106.75	82.75	43.00
68.60	1	390.25	124.25	79.25	67.75	55.75	47.00	34.00	17.00
	2	582.75	180.25	116.75	100.75	83.00	70.50	50.75	26.00
	3	779.75	236.00	157.50	136.25	113.00	96.00	69.00	35.75
	4	1,025.00	313.00	212.00	183.50	152.75	130.00	93.75	48.25
76.20	1	395.75	66.00	58.25	54.75	49.25	42.25	30.25	16.00
	2	591.25	100.00	88.00	83.00	74.50	64.00	45.25	24.00
	3	792.25	137.00	120.75	112.75	102.00	87.75	62.00	32.75
	4	1,042.75	184.50	162.75	152.00	137.75	119.75	84.00	44.25

Table A-5. FWD deflection measurements extracted for LTPP pavement section 1049 for FWD test date 28-Mar-98 (Cont.)

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
83.80	1	394.50	60.25	51.25	47.00	42.00	34.25	26.00	13.50
	2	592.25	90.75	76.75	71.50	62.75	53.00	38.75	20.50
	3	794.75	125.00	106.25	98.50	86.50	73.00	53.00	27.75
	4	1,045.50	171.25	145.00	134.25	118.50	100.25	73.25	38.00
91.40	1	390.75	63.50	51.50	45.25	39.00	33.75	25.75	14.75
	2	588.50	95.00	77.50	68.00	59.00	51.00	38.00	22.00
	3	792.00	129.50	105.00	93.00	80.00	69.00	52.00	29.75
	4	1,048.25	175.00	141.50	125.25	107.50	93.00	69.75	39.75
99.10	1	392.75	53.25	45.00	41.50	37.25	33.50	26.25	16.00
	2	589.75	79.75	67.75	62.25	56.25	49.50	39.25	24.00
	3	791.50	109.25	92.00	85.00	76.75	68.00	53.75	33.00
	4	1,049.25	146.50	124.00	115.00	103.00	92.50	73.00	44.00
106.70	1	393.00	49.25	42.25	39.00	35.25	31.75	25.25	16.75
	2	592.00	75.50	64.75	59.50	53.75	48.00	38.75	25.25
	3	793.00	102.75	88.00	81.00	73.00	66.00	52.25	34.50
	4	1,046.25	139.75	119.00	110.00	99.00	89.25	71.00	47.00
114.30	1	393.00	71.75	62.75	58.25	52.25	47.00	37.00	20.75
	2	589.75	108.25	95.50	88.75	80.00	71.75	56.00	31.50
	3	788.75	148.50	130.75	121.50	110.00	98.25	77.25	43.25
	4	1,037.00	201.75	177.00	165.00	149.50	134.25	105.50	59.50
121.90	1	390.50	94.00	77.50	68.75	59.00	52.00	41.00	21.50
	2	587.00	140.50	117.00	104.50	91.25	80.25	63.50	33.50
	3	787.75	189.00	158.75	142.00	124.00	110.00	87.75	46.00
	4	1,038.50	253.25	214.00	192.75	169.00	150.75	119.50	63.00
129.50	1	389.00	70.00	59.00	52.50	42.75	34.75	26.50	14.50
	2	587.75	106.00	89.50	79.75	65.25	53.00	40.50	22.25
	3	790.75	144.75	122.00	109.00	90.00	73.50	56.00	31.00
	4	1,043.25	196.00	165.25	148.00	122.00	100.00	76.75	42.00
137.20	1	390.50	54.25	45.00	40.00	34.00	30.75	25.00	15.00
	2	589.50	82.50	68.50	59.75	52.00	47.00	37.75	23.25
	3	790.50	113.00	92.75	81.50	71.00	64.00	51.75	31.75
	4	1,043.75	151.75	125.25	110.25	97.00	87.00	70.50	43.50
144.80	1	387.50	113.25	79.75	69.50	59.00	50.50	36.75	19.25
	2	586.00	167.50	119.75	105.00	89.00	76.00	55.75	29.50
	3	783.00	222.50	161.00	141.00	119.75	103.00	75.25	40.75
	4	1,032.50	297.25	219.50	190.50	162.75	139.50	102.50	55.50
152.40	1	389.00	98.25	83.75	71.25	58.00	48.25	35.00	18.25
	2	585.75	147.00	125.00	107.00	88.00	73.25	54.00	27.00
	3	788.00	198.00	168.25	144.75	119.00	100.00	73.25	37.00
	4	1,043.00	264.75	225.50	194.00	160.75	136.00	100.00	50.00

Table A-6. Average all point locations FWD deflection measurements extracted for LTPP pavement section 1049

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
All Point Locations	1	391.73	75.30	60.69	54.29	46.94	40.51	30.99	17.63
	2	589.36	112.88	91.39	82.02	71.07	61.52	46.89	26.49
	3	788.46	152.82	124.33	111.62	96.87	84.04	63.94	36.08
	4	1,040.60	205.94	168.17	151.15	131.37	114.33	86.98	48.85

Table A-7. FWD deflection measurements extracted for LTPP pavement section 1056 for FWD test date 21-Nov-02

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
0.00	1	404.75	929.25	633.75	404.50	240.50	160.25	88.25	59.75	46.50
	2	570.50	1,217.75	854.00	569.75	351.50	238.00	130.00	88.75	55.75
	3	730.25	1,466.50	1,054.50	723.75	461.75	319.00	175.50	118.75	77.25
	4	1,014.00	1,854.00	1,370.00	966.25	639.25	452.25	252.00	170.75	110.50
7.60	1	402.50	868.00	595.25	385.50	219.25	140.50	74.25	52.00	40.50
	2	580.50	1,119.00	815.00	549.00	327.50	213.00	111.75	77.00	61.75
	3	737.75	1,348.50	1,004.50	695.75	432.25	285.00	150.50	103.00	81.50
	4	1,027.25	1,787.75	1,322.25	930.75	604.50	407.75	219.25	150.25	114.50
15.20	1	406.00	819.50	567.25	388.25	230.75	153.50	80.75	51.75	40.00
	2	585.75	1,089.25	779.50	552.25	343.50	231.50	121.00	78.00	60.25
	3	743.50	1,311.00	959.50	695.50	448.75	308.50	165.50	105.00	81.25
	4	1,030.50	1,665.00	1,266.00	931.25	624.75	440.25	238.50	150.75	114.00
22.90	1	401.00	848.25	589.00	391.00	232.75	148.25	77.25	53.25	45.50
	2	577.25	1,131.50	814.25	560.25	347.75	225.50	121.25	82.50	68.50
	3	739.00	1,368.25	1,011.00	712.25	456.00	302.50	162.50	111.25	90.75
	4	1,028.00	1,718.50	1,327.50	972.50	635.75	432.50	236.25	160.00	128.25
30.50	1	400.00	853.75	573.75	390.25	218.00	141.75	79.50	60.25	46.75
	2	576.50	1,144.75	796.50	561.50	327.75	214.25	120.25	85.25	67.25
	3	739.00	1,377.50	987.75	713.25	431.00	286.00	161.75	113.75	88.75
	4	1,020.75	1,722.00	1,329.75	959.75	605.25	411.50	232.50	164.50	128.75
38.10	1	400.25	945.75	683.50	472.25	277.00	180.75	101.25	70.75	52.00
	2	575.25	1,265.75	944.50	674.00	412.50	274.75	153.50	107.75	78.00
	3	738.50	1,535.00	1,171.25	856.00	542.25	368.50	207.50	142.50	105.00
	4	1,016.00	1,951.00	1,519.25	1,138.25	751.00	524.50	299.50	201.50	150.00
45.70	1	398.00	817.25	562.00	377.00	221.75	144.00	81.75	59.25	46.25
	2	573.25	1,086.50	777.25	539.50	332.25	220.25	125.25	90.00	70.00
	3	733.25	1,315.00	960.25	683.50	436.50	295.75	168.75	119.75	93.50
	4	1,016.00	1,683.25	1,249.75	913.00	607.50	423.75	243.75	170.25	133.25
53.30	1	404.50	927.50	657.50	470.50	287.50	193.75	107.75	72.25	58.50
	2	581.50	1,232.00	907.25	659.00	424.25	288.00	160.50	108.25	83.25
	3	736.25	1,490.00	1,118.00	834.50	554.50	385.25	216.25	145.50	110.25
	4	1,015.00	1,888.75	1,454.50	1,107.00	763.50	544.50	310.25	211.50	157.50
61.00	1	394.25	882.75	613.75	419.50	248.50	165.25	94.00	70.25	52.50
	2	571.25	1,174.50	847.00	598.00	371.50	252.75	144.25	104.75	78.25
	3	732.25	1,420.75	1,047.75	757.50	486.75	338.25	194.25	136.75	103.50
	4	1,014.25	1,783.25	1,363.00	1,007.50	672.25	479.00	278.00	196.50	147.50
68.60	1	399.75	879.75	602.75	417.00	258.00	179.75	98.00	70.00	50.00
	2	575.00	1,172.25	828.75	598.00	380.75	261.50	150.25	108.50	77.50
	3	733.75	1,422.00	1,030.25	755.75	495.25	349.00	202.25	141.25	101.50
	4	1,018.75	1,780.75	1,327.00	993.50	670.50	488.25	288.25	200.75	142.75
76.20	1	404.75	706.75	470.25	315.00	183.75	123.75	76.50	57.25	45.25
	2	584.50	947.50	650.75	451.25	274.25	185.50	115.25	85.75	69.00
	3	748.25	1,142.25	807.50	571.25	358.25	244.75	152.75	113.50	90.75
	4	1,034.00	1,443.50	1,048.00	758.50	493.50	343.75	216.00	160.75	125.50

Table A-7. FWD deflection measurements extracted for LTPP pavement section 1056 for FWD test date 21-Nov-02 (Cont.)

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
83.80	1	399.00	812.25	585.00	369.50	207.00	141.25	84.50	60.50	48.25
	2	576.75	1,080.50	797.25	527.25	313.25	213.50	128.50	91.00	71.00
	3	739.25	1,309.00	982.50	670.50	410.50	288.50	173.25	122.75	96.25
	4	1,026.75	1,665.00	1,278.25	895.00	572.50	404.75	247.50	175.50	131.25
91.40	1	393.50	865.50	585.00	405.25	238.00	160.50	88.50	61.00	47.75
	2	568.75	1,154.75	816.50	583.75	358.25	246.25	134.25	91.50	71.75
	3	732.00	1,400.50	1,016.00	741.75	469.00	330.75	180.75	124.50	93.00
	4	1,010.75	1,784.50	1,352.00	996.50	656.50	470.25	258.00	175.50	129.25
99.10	1	393.75	1,057.50	743.50	510.25	299.25	194.00	107.50	75.50	55.00
	2	568.25	1,404.50	1,024.75	726.75	446.00	296.50	165.00	114.00	82.00
	3	732.50	1,696.25	1,265.00	918.50	584.75	396.00	221.50	152.50	109.00
	4	1,003.25		1,666.25	1,220.75	807.00	561.50	318.25	217.25	152.00
106.70	1	391.75	943.00	658.75	462.25	276.50	183.25	101.75	71.25	50.00
	2	563.00	1,261.00	913.25	658.75	412.50	280.75	155.00	103.50	75.50
	3	721.50	1,530.50	1,135.50	831.00	542.25	375.75	209.00	139.75	101.50
	4	1,002.00	1,950.75	1,495.25	1,109.00	751.25	534.75	300.00	200.25	137.25
114.30	1	390.00	929.75	665.25	449.25	262.00	172.00	95.25	63.00	47.75
	2	564.00	1,243.50	918.00	640.75	392.75	261.75	143.75	95.50	69.50
	3	724.50	1,510.00	1,138.25	815.25	514.75	351.25	194.25	128.25	90.75
	4	1,005.00	1,906.75	1,484.25	1,085.00	711.50	497.75	278.00	183.25	131.00
121.90	1	394.00	994.50	702.75	456.75	252.75	167.50	96.75	67.00	52.75
	2	569.00	1,324.75	965.50	654.50	384.00	259.25	148.75	102.00	81.00
	3	732.50	1,606.25	1,194.25	832.25	509.00	350.00	201.00	137.50	109.25
	4	1,000.25	2,030.00	1,559.50	1,110.25	712.50	502.50	292.00	199.00	148.25
129.50	1	396.50	922.00	625.75	421.75	248.25	158.00	83.50	57.25	42.75
	2	571.25	1,227.00	864.75	605.00	370.50	240.75	127.50	86.50	66.50
	3	736.25	1,479.75	1,069.00	767.75	486.25	322.25	172.00	116.25	89.50
	4	1,003.75	1,861.00	1,396.50	1,029.00	679.25	462.00	250.50	168.25	122.00
137.20	1	392.25	799.00	523.25	347.25	200.75	130.75	73.00	50.00	42.25
	2	565.25	1,082.50	738.75	506.00	300.50	197.75	108.75	73.25	62.25
	3	728.00	1,310.75	927.00	651.75	399.75	266.75	148.25	98.25	83.75
	4	1,000.75	1,647.25	1,229.00	885.50	565.50	387.00	219.00	143.00	137.00
144.80	1	391.00	966.00	651.00	440.50	255.25	162.25	85.25	58.00	43.50
	2	567.25	1,306.50	920.50	643.75	389.25	252.75	132.00	88.75	65.50
	3	730.75	1,591.00	1,152.50	827.50	514.50	340.00	179.00	119.75	85.00
	4	991.75		1,522.25	1,121.50	722.00	489.00	261.50	175.00	112.50
152.40	1	395.25	953.25	692.75	477.50	281.00	173.00	86.25	58.00	46.50
	2	572.50	1,283.50	967.00	685.75	419.50	263.50	131.25	87.50	68.50
	3	734.25	1,569.50	1,203.00	870.25	548.25	355.25	177.25	117.25	90.50
	4	999.00	1,993.25	1,580.25	1,164.75	759.00	506.50	257.00	171.50	130.00

Table A-8. Average all point locations FWD deflection measurements extracted for LTPP pavement section 1056

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
All Point Locations	1	397.75	891.49	618.18	417.67	244.69	160.67	88.64	61.82	47.63
	2	573.20	1,188.06	854.33	597.37	365.71	243.70	134.67	92.86	70.62
	3	734.44	1,438.11	1,058.82	758.36	480.11	326.62	181.61	124.18	93.93
	4	1,013.23	1,785.96	1,387.64	1,014.07	666.89	464.95	261.71	178.38	132.52

Table A-9. FWD deflection measurements extracted for LTPP pavement section 1068 for FWD test date 3-Jul-97

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
-9.10	1	355.50	166.25	136.75	121.75	98.25	79.25	51.00	24.00
	2	563.75	267.25	217.25	193.25	157.25	127.25	82.00	40.00
	3	782.00	370.00	300.00	267.00	217.00	176.75	114.75	56.00
	4	1,017.75	483.00	389.75	346.75	282.50	230.25	150.00	73.75
0.00	1	351.00	267.25	217.25	193.25	157.25	127.25	82.00	40.00
	2	560.00	370.00	300.00	267.00	217.00	176.75	114.75	56.00
	3	781.00	483.00	389.75	346.75	282.50	230.25	150.00	73.75
	4	1,021.50	171.00	121.25	107.25	87.00	71.00	47.00	23.25
7.60	1	351.00	171.75	137.00	118.00	95.00	77.25	50.00	23.25
	2	560.00	275.50	219.25	190.00	153.75	125.75	82.00	39.00
	3	779.50	379.00	302.75	262.75	213.00	175.00	115.00	54.50
	4	1,015.00	495.25	395.00	341.75	277.75	228.75	150.75	71.00
15.20	1	354.00	178.25	141.75	123.25	100.75	82.00	53.25	23.75
	2	562.75	286.75	228.50	197.75	164.00	134.00	89.00	40.00
	3	780.75	398.00	316.25	275.00	227.75	186.75	124.75	56.75
	4	1,011.50	517.75	411.00	356.50	297.25	243.75	164.00	75.00
22.90	1	350.00	191.50	146.25	127.00	101.75	82.50	52.25	23.25
	2	559.50	304.50	234.50	203.50	164.50	133.75	86.50	39.75
	3	777.75	420.75	325.00	282.50	228.25	187.50	121.50	56.00
	4	1,010.00	546.00	423.00	367.75	298.00	244.25	160.00	74.00
30.80	1	346.50	194.75	151.00	127.00	100.75	80.75	51.50	23.25
	2	558.00	313.00	243.25	205.75	165.00	132.50	85.25	40.25
	3	776.00	432.25	337.00	285.25	229.75	185.50	120.25	56.50
	4	1,010.00	564.25	440.00	373.00	301.25	243.50	158.75	75.75
38.10	1	350.50	203.25	153.25	130.00	105.00	83.00	51.00	22.75
	2	557.25	321.50	245.75	209.75	169.75	135.00	85.00	39.00
	3	775.25	439.00	339.75	290.50	236.25	188.25	120.00	55.25
	4	1,007.75	569.25	442.00	379.00	308.50	246.25	158.25	73.50
45.70	1	350.50	186.75	135.75	113.50	89.00	70.00	45.00	22.25
	2	559.00	296.50	217.75	183.00	144.75	115.75	74.75	36.00
	3	776.50	407.75	301.00	253.25	201.75	162.00	106.00	51.75
	4	1,006.75	529.50	391.00	329.25	263.75	212.75	140.75	70.00
53.30	1	350.00	164.25	126.75	110.00	90.00	74.75	50.75	24.75
	2	560.25	263.00	204.75	178.25	147.75	122.50	83.50	41.00
	3	778.50	363.25	284.25	247.25	205.75	171.75	117.75	57.75
	4	1,016.50	470.25	369.00	321.25	268.00	224.50	155.75	77.75
61.00	1	348.75	172.00	133.00	115.00	91.00	73.75	48.00	23.25
	2	556.75	274.00	214.25	185.25	148.50	120.25	79.00	39.00
	3	778.25	378.25	297.00	256.75	207.00	169.00	111.00	55.25
	4	1,018.75	492.50	387.50	334.25	270.75	221.50	146.25	73.25

Table A-10. Average all point locations FWD deflection measurements extracted for LTPP pavement section 1068

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
All Point Locations	1	362.59	208.60	154.09	130.58	103.44	82.05	51.71	24.47
	2	566.81	323.41	241.21	205.59	164.37	131.18	83.53	40.16
	3	780.36	441.80	331.08	283.03	227.13	182.28	116.94	56.54
	4	1,002.90	567.73	426.03	364.44	293.19	235.93	152.18	74.02

Table A-11. FWD deflection measurements extracted for LTPP pavement section 1069 for FWD test date 2-Apr-02

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
0.00	1	395.00	118.25	59.75	41.25	37.50	36.00	33.75	30.00	24.75
	2	600.50	169.00	86.75	62.75	55.50	56.00	52.75	44.50	37.25
	3	748.50	211.50	108.75	78.00	69.50	69.00	64.00	54.50	46.75
	4	976.25	268.25	139.50	100.50	89.75	88.75	81.75	69.75	59.75
7.60	1	388.50	169.00	86.75	62.75	55.50	56.00	52.75	44.50	37.25
	2	592.00	211.50	108.75	78.00	69.50	69.00	64.00	54.50	46.75
	3	737.00	268.25	139.50	100.50	89.75	88.75	81.75	69.75	59.75
	4	970.00	134.00	53.25	44.50	42.75	40.50	34.50	29.25	24.25
15.20	1	388.50	134.75	62.50	46.50	44.25	42.75	38.00	32.25	27.00
	2	591.00	191.25	91.00	68.75	64.75	63.00	56.50	47.50	38.75
	3	743.50	242.25	117.25	87.50	83.25	79.00	69.75	60.50	50.50
	4	965.50	306.00	151.25	114.00	108.00	103.25	90.75	78.75	65.75
22.90	1	393.00	75.75	51.25	44.50	42.25	39.25	34.25	28.75	25.75
	2	592.50	108.75	78.75	67.25	60.75	56.25	50.00	43.50	37.50
	3	739.50	141.00	101.25	86.00	77.50	72.25	63.25	55.75	46.75
	4	976.25	180.75	132.00	111.00	100.50	93.75	81.75	70.75	60.00
30.50	1	393.25	112.50	55.75	40.25	37.00	34.75	31.00	26.50	23.50
	2	597.25	155.25	78.00	59.25	54.00	51.50	45.50	39.75	34.75
	3	755.00	194.50	98.00	75.25	69.75	66.00	58.25	50.50	43.75
	4	963.75	244.50	124.00	96.00	89.00	84.00	74.75	64.50	56.00
38.10	1	393.00	89.75	52.00	40.50	35.25	34.00	30.50	27.75	24.00
	2	594.25	122.50	75.75	58.75	52.25	50.00	45.75	40.00	35.00
	3	748.25	161.50	97.00	75.00	67.25	64.00	58.00	51.00	43.75
	4	967.50	207.50	124.50	96.00	87.25	82.50	75.25	65.50	56.50
45.70	1	389.00	126.50	55.75	39.25	37.25	36.75	33.50	30.75	25.50
	2	591.25	178.50	79.75	59.25	55.00	54.75	49.75	45.25	37.75
	3	740.75	216.00	100.50	73.50	70.50	67.75	63.50	54.75	48.00
	4	980.00	277.75	126.00	95.00	89.75	88.50	80.75	72.00	60.50
53.30	1	388.00	99.25	51.50	39.75	36.00	34.75	31.75	27.00	23.75
	2	590.75	142.00	76.00	59.00	54.00	52.50	47.50	41.50	35.50
	3	744.25	181.50	97.25	75.50	68.75	66.75	60.00	52.00	45.00
	4	956.50	231.50	125.25	97.25	88.25	85.50	76.75	66.50	56.75
61.00	1	388.00	69.25	50.25	42.75	36.75	36.25	32.75	29.50	24.75
	2	591.00	103.75	75.00	64.25	56.25	54.50	48.75	44.25	36.75
	3	733.50	133.50	95.75	81.25	71.50	68.50	62.25	55.25	46.75
	4	970.25	169.25	122.50	103.75	91.50	87.00	79.50	68.75	58.75
68.60	1	383.50	82.75	53.75	42.00	38.25	33.25	32.00	28.25	24.00
	2	584.50	122.25	76.75	63.25	55.75	51.00	46.25	38.00	35.75
	3	736.00	163.25	99.00	81.25	72.00	67.25	61.25	53.75	46.00
	4	955.00	211.50	128.25	105.25	93.75	88.25	79.50	69.75	61.00
76.20	1	382.25	105.25	62.25	43.50	36.75	33.50	30.75	27.25	23.75
	2	585.00	153.25	88.25	63.75	53.25	50.00	45.50	40.50	35.50
	3	736.25	196.25	111.25	81.00	68.50	64.00	58.00	51.50	45.00
	4	960.75	249.50	141.25	103.75	88.25	83.50	75.50	66.25	57.25

Table A-11. FWD deflection measurements extracted for LTPP pavement section 1069 for FWD test date 2-Apr-02 (Cont.)

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
83.80	1	383.25	117.00	50.50	38.75	36.00	31.50	30.25	27.00	25.25
	2	588.50	161.50	74.50	55.25	52.00	48.25	45.00	40.50	35.25
	3	745.25	205.25	93.50	69.00	64.75	61.75	56.75	51.25	44.50
	4	944.00	259.75	120.75	88.25	83.75	79.00	72.75	64.25	57.00
91.40	1	381.75	124.25	59.75	37.25	39.50	37.25	34.75	27.75	23.75
	2	585.25	173.00	81.50	58.50	55.75	52.75	48.75	42.00	37.00
	3	738.75	218.25	100.75	73.25	69.25	65.50	60.50	51.50	44.75
	4	940.75	279.50	129.00	94.50	89.25	84.75	77.00	66.25	57.25
99.10	1	382.50	115.50	44.75	34.00	33.25	34.00	30.50	27.75	22.75
	2	585.00	163.00	66.50	49.75	49.00	48.50	44.50	39.00	34.00
	3	736.75	206.50	85.00	63.50	62.50	62.00	56.00	50.00	43.25
	4	938.25	261.00	111.00	82.75	81.25	80.00	72.50	64.00	55.00
106.70	1	382.50	128.50	55.25	39.50	38.00	36.75	33.50	29.50	25.50
	2	586.00	173.75	79.00	57.25	55.00	52.75	47.75	41.25	35.50
	3	738.75	217.50	100.25	72.50	69.25	66.25	59.75	52.25	45.00
	4	938.25	273.50	128.50	94.25	89.75	85.50	76.50	66.00	56.25
114.30	1	381.75	144.75	53.00	34.50	33.50	32.25	30.50	27.00	23.25
	2	583.50	201.25	79.25	52.75	51.50	50.25	47.00	42.00	36.75
	3	737.75	245.25	96.25	65.50	63.00	60.50	57.75	49.75	43.25
	4	936.50	306.25	120.75	85.75	83.00	77.50	75.25	64.00	55.25
121.90	1	375.25	105.75	46.00	35.50	33.00	32.50	31.50	27.50	23.25
	2	581.50	154.50	68.25	52.00	49.50	48.25	45.75	40.00	34.75
	3	744.75	193.50	87.00	65.75	63.75	61.00	57.00	50.25	44.00
	4	963.25	246.00	112.75	84.75	81.50	78.50	72.75	63.50	56.00
129.50	1	378.75	108.25	51.00	41.25	39.00	38.00	34.25	29.00	25.00
	2	584.00	157.50	75.25	60.00	56.75	55.25	49.00	42.25	36.00
	3	736.50	201.00	97.75	77.50	73.75	71.50	64.00	55.00	47.75
	4	934.00	257.00	125.50	98.50	94.25	91.00	81.25	69.00	59.75
137.20	1	379.00	107.50	54.75	40.00	39.50	37.50	32.25	28.00	24.50
	2	583.00	147.75	79.00	58.50	58.00	55.00	47.75	41.25	36.25
	3	736.50	187.00	98.75	74.00	73.00	69.00	59.75	52.00	45.00
	4	935.75	236.00	127.50	95.75	96.00	90.25	76.25	66.50	56.75
144.80	1	375.50	130.25	63.75	43.75	40.50	36.75	32.25	27.50	23.50
	2	582.75	185.75	95.75	68.50	62.50	58.00	51.50	44.00	38.00
	3	746.25	234.50	122.00	87.50	80.50	74.25	65.25	55.75	48.25
	4	961.00	295.25	153.00	109.50	101.50	93.50	82.75	69.50	60.00
152.40	1	378.25	111.50	60.75	47.50	41.25	39.00	33.50	29.50	24.75
	2	584.25	159.00	88.00	69.00	61.25	57.00	49.75	43.00	37.25
	3	742.50	195.50	108.50	85.25	75.50	70.50	61.50	53.25	45.50
	4	949.00	246.75	138.25	108.75	97.50	91.25	79.75	69.25	59.50

Table A-12. Average all point locations FWD deflection measurements extracted for LTPP pavement section 1069

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
All Point Locations	1	384.79	111.49	54.64	40.80	37.98	36.06	32.67	28.46	24.40
	2	588.27	157.90	79.76	60.80	56.15	53.71	48.51	42.15	36.39
	3	741.25	199.46	101.02	76.96	71.37	67.93	61.19	53.20	45.79
	4	956.31	253.14	129.49	99.04	92.11	87.60	78.67	68.01	58.42

Table A-13. FWD deflection measurements extracted for LTPP pavement section 1076 for FWD test date 14-Feb-13

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
0.00	1	385.50	434.25	268.75	192.75	121.00	73.00	36.00	21.75	20.50
	2	576.00	631.75	400.50	291.00	186.50	113.25	57.50	37.00	30.75
	3	785.50	828.25	535.25	393.75	255.75	159.25	80.75	52.75	44.75
	4	1,059.00	1,045.75	688.75	510.00	332.50	214.75	108.25	73.00	61.75
7.60	1	403.75	631.75	400.50	291.00	186.50	113.25	57.50	37.00	30.75
	2	597.50	828.25	535.25	393.75	255.75	159.25	80.75	52.75	44.75
	3	808.25	1,045.75	688.75	510.00	332.50	214.75	108.25	73.00	61.75
	4	1,076.25	274.00	193.75	146.25	99.50	68.75	40.00	28.00	21.75
15.20	1	407.75	189.25	156.75	128.25	95.00	69.25	41.75	28.75	21.50
	2	607.25	295.25	239.25	196.50	145.50	107.25	64.75	43.75	33.25
	3	820.75	404.25	328.50	270.25	200.50	149.50	90.00	61.75	47.25
	4	1,086.00	537.75	436.25	359.00	268.25	200.75	122.50	84.00	63.75
22.90	1	409.50	192.00	149.00	120.00	88.00	63.25	38.75	26.25	20.50
	2	605.00	298.25	232.25	187.25	136.00	100.25	59.00	41.00	31.50
	3	815.50	410.75	320.75	258.75	189.75	138.25	83.75	56.25	42.50
	4	1,072.75	551.50	429.50	347.00	255.25	187.25	113.00	77.00	58.75
30.50	1	402.00	326.75	248.25	190.50	131.25	91.75	49.00	31.75	23.50
	2	592.00	487.25	369.25	285.25	199.00	140.00	75.75	47.50	35.75
	3	803.25	655.00	500.00	388.50	273.50	195.50	106.75	67.75	52.00
	4	1,063.75	857.00	653.25	509.00	362.75	262.25	145.50	92.75	69.00
38.10	1	405.00	220.00	190.75	159.50	120.50	87.50	44.75	29.75	21.75
	2	597.75	336.00	287.25	240.75	185.00	134.75	71.00	44.75	32.25
	3	808.25	456.50	392.50	329.75	253.25	186.50	98.00	62.50	45.75
	4	1,069.75	610.00	522.00	437.50	338.50	250.75	132.75	85.50	61.75
45.70	1	407.75	169.00	133.00	111.50	87.25	67.75	44.00	30.25	22.75
	2	606.50	257.25	203.25	170.25	133.25	104.25	67.00	45.75	34.75
	3	822.00	354.50	280.75	235.75	184.50	145.00	93.50	64.50	47.75
	4	1,093.50	478.50	378.25	317.00	249.00	196.00	127.25	88.00	66.00
53.30	1	398.50	165.75	131.00	114.25	90.00	71.75	44.75	28.00	20.75
	2	593.00	249.50	207.50	175.00	139.75	110.50	70.25	43.50	32.00
	3	794.25	344.25	283.25	241.25	193.75	153.00	98.25	61.25	44.25
	4	1,061.00	461.75	383.50	328.00	259.50	209.00	131.75	83.25	61.25
61.00	1	410.00	187.00	147.00	120.00	91.75	69.25	42.75	29.00	22.00
	2	603.25	281.50	223.50	182.75	139.25	105.75	65.25	44.25	33.75
	3	812.00	385.50	308.00	253.25	193.25	147.00	90.75	62.25	46.75
	4	1,077.50	521.00	412.50	339.50	260.00	198.75	123.25	84.25	63.00
68.60	1	396.50	226.75	170.75	134.75	98.00	72.00	42.00	28.00	21.00
	2	594.25	337.25	261.25	206.75	150.50	111.50	65.00	43.50	33.00
	3	800.50	461.25	355.50	282.25	206.75	153.75	90.25	60.50	46.00
	4	1,065.25	614.50	473.50	376.00	277.00	206.50	122.25	82.25	62.75
76.20	1	403.75	168.50	132.25	107.50	81.25	61.00	39.50	27.00	21.00
	2	602.50	259.50	203.75	165.50	124.50	95.50	60.25	41.25	31.75
	3	814.75	355.75	280.25	227.50	171.75	132.00	83.50	58.00	44.00
	4	1,082.50	476.50	375.00	304.50	230.25	177.75	113.00	79.00	60.25

Table A-13. FWD deflection measurements extracted for LTPP pavement section 1076 for FWD test date 14-Feb-13 (Cont.)

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
83.80	1	407.75	180.75	146.50	118.25	88.25	65.75	40.50	28.00	20.75
	2	604.50	278.75	222.00	179.75	134.00	101.00	62.50	42.75	32.25
	3	811.25	380.25	304.00	245.75	183.50	138.75	86.00	59.00	44.75
	4	1,066.75	507.50	405.00	328.00	245.50	186.00	115.50	79.75	60.00
91.40	1	394.75	331.50	293.25	136.75	95.75	68.25	39.25	26.75	20.50
	2	588.00	488.75	428.50	215.75	150.25	107.25	61.00	41.00	31.25
	3	797.50	657.25	573.25	300.75	209.25	149.75	85.75	57.75	44.00
	4	1,060.00	866.50	746.75	404.25	283.50	203.00	115.75	78.50	59.50
99.10	1	392.00	307.50	218.50	163.75	110.00	75.50	42.50	28.50	22.25
	2	581.00	454.00	332.75	250.75	170.00	117.75	66.00	44.75	33.50
	3	785.75	616.25	456.50	343.25	237.00	164.75	92.75	62.75	48.00
	4	1,051.75	824.00	611.25	460.25	322.75	226.75	128.00	86.75	65.75
106.70	1	378.50	419.75	296.25	218.25	143.25	85.25	47.00	31.00	22.75
	2	565.25	606.50	437.50	325.00	216.00	132.75	74.75	47.75	36.00
	3	764.75	797.75	582.00	436.00	294.25	185.00	104.00	67.75	50.75
	4	1,031.00	1,039.50	757.50	572.25	392.00	251.75	142.00	92.75	69.25
114.30	1	381.25	440.00	288.25	214.25	142.00	92.50	46.00	29.50	21.75
	2	569.50	638.00	433.25	322.50	214.50	144.50	72.00	46.50	34.75
	3	770.50	845.50	583.75	439.25	296.75	201.50	102.50	66.75	49.75
	4	1,031.75	1,099.50	768.50	580.00	396.25	273.50	140.25	91.75	68.75
121.90	1	405.00	173.75	130.50	106.25	81.25	61.50	41.50	28.50	22.00
	2	604.25	264.75	201.25	164.25	124.50	94.75	63.75	44.00	34.25
	3	816.00	365.00	279.00	227.00	172.75	131.75	88.25	61.75	48.25
	4	1,076.25	490.25	376.00	305.50	233.00	178.75	119.75	83.75	65.50
129.50	1	383.25	590.25	414.00	265.50	146.75	97.75	48.75	31.75	24.00
	2	566.50	821.75	584.50	389.50	222.25	151.00	76.50	49.50	37.25
	3	772.75	1,045.50	757.00	515.25	300.00	208.00	107.50	70.75	53.00
	4	1,035.00	1,293.50	951.75	657.25	391.75	273.75	144.75	97.00	72.25
137.20	1	384.75	480.25	280.50	198.50	124.25	79.25	41.00	26.50	20.50
	2	569.00	666.00	410.50	294.25	185.25	120.75	63.00	41.00	31.50
	3	773.25	857.75	546.00	393.50	250.50	165.25	87.75	57.75	44.75
	4	1,033.25	1,082.50	705.00	510.00	328.50	218.25	117.75	77.75	60.50
144.80	1	402.00	214.00	161.25	130.00	96.25	71.00	43.00	30.00	23.00
	2	593.50	319.75	245.25	198.00	146.25	109.50	66.00	46.25	35.25
	3	800.50	436.25	336.75	271.75	200.75	150.75	91.50	64.25	48.75
	4	1,054.25	582.75	447.25	361.25	268.25	201.75	123.75	87.00	66.75
152.40	1	388.75	454.75	326.00	235.75	148.50	97.75	46.00	31.25	23.00
	2	575.75	647.25	474.50	347.00	222.75	148.25	71.50	48.25	36.00
	3	783.50	847.75	627.50	459.75	302.25	203.00	102.25	67.25	52.50
	4	1,041.00	1,081.25	801.25	591.75	394.50	268.50	137.25	95.50	71.25

Table A-14. Average all point locations FWD deflection measurements extracted for LTPP pavement section 1076

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
All Point Locations	1	397.52	292.65	213.15	157.74	108.56	75.70	42.80	28.58	21.79
	2	590.11	430.05	318.38	238.49	165.57	117.01	66.45	44.13	33.52
	3	798.13	574.14	429.42	324.37	227.51	162.18	92.94	62.05	47.23
	4	1,061.35	749.77	563.45	428.13	303.06	218.20	125.80	84.79	64.32

Table A-15. FWD deflection measurements extracted for LTPP pavement section 1093 for FWD test date 5-Feb-04

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
0.00	1	382.00	399.25	318.25	258.75	186.00	132.25	64.00	38.25	27.75
	2	564.50	546.00	439.00	360.00	263.00	189.00	95.50	57.25	42.75
	3	752.75	682.00	551.00	454.50	334.50	243.50	125.75	77.25	58.00
	4	990.50	845.25	683.75	565.75	420.00	308.50	163.00	101.75	76.00
7.60	1	387.75	546.00	439.00	360.00	263.00	189.00	95.50	57.25	42.75
	2	569.00	682.00	551.00	454.50	334.50	243.50	125.75	77.25	58.00
	3	762.00	845.25	683.75	565.75	420.00	308.50	163.00	101.75	76.00
	4	1,002.50	404.50	327.00	270.75	197.75	140.75	74.25	45.00	33.00
15.20	1	386.50	438.50	359.25	299.00	220.50	160.50	83.75	49.25	35.25
	2	564.25	592.25	488.50	410.50	306.50	227.25	121.75	74.00	55.00
	3	755.25	741.75	612.25	518.50	389.75	292.50	159.50	98.75	73.25
	4	991.25	918.75	758.50	644.25	488.75	371.00	205.75	127.75	96.50
22.90	1	385.00	420.75	336.50	277.50	206.00	149.25	76.25	47.50	31.00
	2	564.50	566.75	457.25	382.50	284.25	207.25	114.25	67.75	49.50
	3	756.50	707.50	574.25	482.75	363.00	268.75	149.25	90.50	66.75
	4	993.00	876.00	713.50	604.50	457.75	344.25	194.25	119.75	88.00
30.50	1	382.75	367.25	300.00	241.50	173.00	124.25	62.50	37.00	27.00
	2	564.25	498.50	408.00	332.00	241.25	175.75	91.50	55.50	42.00
	3	755.50	622.00	508.25	417.00	306.25	223.75	120.25	73.50	56.75
	4	990.75	767.00	627.50	517.50	383.50	285.00	154.75	96.75	75.25
38.10	1	384.50	361.50	302.75	249.75	183.75	132.50	69.25	42.75	30.00
	2	564.75	494.75	415.00	347.00	257.75	189.50	101.25	63.75	45.25
	3	753.50	617.75	521.25	438.25	328.50	244.50	134.00	84.25	62.00
	4	987.25	764.25	648.75	548.00	414.00	311.75	174.25	110.75	82.00
45.70	1	385.75	367.25	291.50	231.75	165.75	114.25	55.00	35.50	26.25
	2	564.75	490.50	390.75	314.00	229.25	160.75	80.50	53.25	40.25
	3	761.25	606.00	483.50	392.00	289.00	204.00	106.00	70.50	53.75
	4	1,003.50	745.50	598.50	489.75	362.75	260.25	139.75	91.25	72.00
53.30	1	374.00	319.75	257.50	208.75	149.50	106.50	55.25	34.25	25.50
	2	549.75	427.25	342.50	281.75	205.00	148.75	81.25	51.00	40.25
	3	742.00	530.75	421.00	349.75	256.25	189.50	108.25	67.50	54.25
	4	989.00	646.25	514.25	427.75	317.75	236.25	135.25	88.50	70.25
61.00	1	382.75	346.00	278.00	224.25	163.00	115.25	60.25	38.50	29.25
	2	562.50	456.00	372.00	302.50	224.00	161.25	87.75	56.50	44.00
	3	756.75	562.75	460.00	377.00	281.50	206.75	115.25	76.00	58.25
	4	994.75	689.75	563.25	466.25	350.75	260.50	148.50	99.25	76.50
68.60	1	383.75	362.25	297.75	242.25	175.75	126.25	64.75	41.00	30.25
	2	561.25	482.75	400.00	328.25	241.75	177.75	94.25	60.75	46.00
	3	758.75	597.25	496.00	411.00	305.75	227.50	123.75	80.75	61.50
	4	1,003.75	734.25	609.75	509.50	382.00	287.75	159.75	105.50	81.00
76.20	1	380.25	338.50	275.50	224.50	164.75	118.75	60.50	36.25	27.50
	2	559.25	456.00	376.25	310.00	229.25	168.00	88.00	55.25	42.25
	3	756.50	569.00	468.00	388.00	289.75	214.25	117.00	73.25	56.25
	4	1,005.00	702.75	578.25	482.00	362.50	270.25	151.25	96.00	73.25

Table A-15. FWD deflection measurements extracted for LTPP pavement section 1093 for FWD test date 5-Feb-04 (Cont.)

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
83.80	1	383.25	361.00	288.75	231.50	165.50	117.25	57.00	34.25	26.75
	2	561.00	485.25	393.25	319.00	230.25	167.25	83.75	51.25	41.25
	3	758.25	605.00	491.25	402.50	293.75	214.25	111.75	70.00	54.50
	4	1,008.00	750.00	611.25	504.25	371.75	274.25	147.25	94.00	72.75
91.40	1	376.75	366.50	301.50	249.00	183.00	132.50	71.25	43.00	31.25
	2	559.50	511.25	421.75	352.75	262.25	194.00	107.50	66.75	50.75
	3	751.50	643.00	532.00	447.50	336.50	251.50	142.00	89.75	67.50
	4	986.00	800.25	663.50	560.50	425.00	321.75	185.75	118.75	89.50
99.10	1	379.50	356.50	283.75	230.00	166.00	118.00	61.25	38.50	28.75
	2	559.00	485.50	387.75	317.50	232.25	168.25	90.00	57.75	43.75
	3	748.25	608.50	484.75	399.75	295.50	216.50	119.00	77.50	59.00
	4	982.25	753.00	600.50	497.25	371.25	275.50	155.25	102.50	78.00
106.70	1	382.25	375.75	310.00	251.00	182.75	129.50	67.00	39.75	28.75
	2	564.50	511.50	423.75	347.75	256.25	185.25	97.75	59.00	43.75
	3	757.25	639.50	529.50	439.00	326.25	239.25	128.75	80.25	60.25
	4	994.25	796.25	660.00	549.50	412.25	305.75	167.75	107.00	80.50
114.30	1	381.50	407.00	322.00	257.25	184.00	129.50	66.50	41.50	31.00
	2	559.75	546.50	435.00	351.00	255.25	183.75	98.00	63.00	47.25
	3	756.00	680.50	542.50	441.50	324.00	237.25	129.75	84.75	64.25
	4	998.25	844.50	674.50	551.75	409.50	301.25	170.50	112.75	86.75
121.90	1	374.50	404.00	319.50	249.75	174.75	120.25	63.50	41.75	31.00
	2	554.75	544.25	434.00	343.50	243.75	171.75	93.50	62.00	47.25
	3	751.00	677.75	540.00	431.00	309.25	221.75	123.75	83.75	64.00
	4	1,000.00	832.75	663.50	532.25	386.25	280.25	160.50	110.00	85.25
129.50	1	378.00	362.75	282.50	226.25	157.50	108.50	55.00	34.75	26.25
	2	556.25	483.25	378.50	306.75	217.00	151.00	78.75	51.50	39.50
	3	753.50	596.50	466.75	379.50	271.50	193.75	104.75	68.25	53.50
	4	999.25	731.25	572.50	467.75	338.00	245.00	136.75	90.00	71.00
137.20	1	374.75	388.75	297.00	237.25	168.75	118.00	59.00	36.50	28.00
	2	554.00	522.50	402.75	325.00	234.50	166.25	85.75	54.25	41.00
	3	751.25	648.25	501.00	407.25	297.00	213.50	114.75	74.00	57.00
	4	1,004.00	798.25	618.25	505.75	372.50	271.25	149.75	99.75	77.25
144.80	1	377.25	351.25	283.00	230.50	168.25	119.75	64.00	40.50	29.75
	2	555.50	476.00	384.25	317.00	234.00	170.00	93.75	61.25	47.25
	3	751.25	591.75	477.75	396.50	295.75	218.00	123.25	81.75	63.00
	4	992.25	730.75	589.00	492.00	369.75	276.25	159.25	106.75	83.50
152.40	1	375.75	342.50	282.75	238.75	184.00	140.25	84.75	53.00	38.25
	2	552.75	472.25	394.75	336.25	261.75	201.25	122.25	78.50	57.00
	3	717.75	596.50	498.25	426.50	334.50	260.50	160.75	104.75	77.75
	4	962.75	741.50	621.25	534.50	422.25	331.50	208.00	137.50	102.75

Table A-16. Average all point locations FWD deflection measurements extracted for LTPP pavement section 1093

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
All Point Locations	1	380.88	373.40	300.70	244.29	177.15	126.38	65.48	40.42	29.64
	2	560.27	504.51	408.95	336.00	246.82	179.15	95.94	60.36	45.51
	3	752.70	628.65	510.07	422.12	313.08	230.20	126.56	80.73	61.30
	4	994.20	776.32	630.94	524.98	392.82	292.15	164.07	106.27	81.15

Table A-19. FWD deflection measurements extracted for LTPP pavement section 1113 for FWD test date 13-May-04

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
0.00	1	361.00	223.00	193.50	129.50	77.50	51.00	25.25	17.00	13.00
	2	543.25	333.00	286.00	200.25	122.75	80.25	39.75	26.00	21.00
	3	729.75	451.25	381.75	272.00	170.75	113.75	57.00	35.00	29.00
	4	958.25	605.75	498.50	362.50	232.75	158.00	79.75	47.00	38.50
7.60	1	374.75	333.00	286.00	200.25	122.75	80.25	39.75	26.00	21.00
	2	554.75	451.25	381.75	272.00	170.75	113.75	57.00	35.00	29.00
	3	739.00	605.75	498.50	362.50	232.75	158.00	79.75	47.00	38.50
	4	973.00	243.25	176.50	113.00	70.50	44.00	24.50	15.25	13.50
15.20	1	367.75	245.25	175.75	116.25	70.50	50.75	26.00	19.75	10.25
	2	549.75	351.25	269.75	183.00	113.00	72.50	36.50	25.00	18.75
	3	736.25	475.00	360.00	250.00	157.75	103.50	51.75	35.25	25.50
	4	969.25	624.00	475.75	335.75	216.25	141.50	71.25	47.25	36.25
22.90	1	366.25	229.00	158.75	101.25	64.25	39.75	21.25	15.00	12.50
	2	547.50	323.50	239.25	161.00	100.00	63.50	33.75	22.75	18.50
	3	733.25	428.75	319.25	221.25	139.50	91.00	48.25	32.00	25.75
	4	962.75	550.50	419.00	296.75	190.25	127.25	68.50	45.25	35.75
30.50	1	365.75	268.25	198.75	134.25	80.50	51.50	25.00	16.25	12.25
	2	547.25	384.75	298.50	207.50	127.50	82.00	38.75	25.00	19.50
	3	733.75	524.00	397.25	281.50	176.75	115.75	55.75	35.75	27.50
	4	967.50	679.25	521.50	375.50	241.25	161.25	78.00	49.75	38.00
38.10	1	369.00	261.00	199.00	133.00	79.75	49.75	26.50	16.25	13.50
	2	548.25	372.25	294.75	204.75	125.00	79.50	38.75	26.00	20.25
	3	735.50	508.75	389.00	276.25	172.75	112.00	55.00	36.25	28.25
	4	967.50	660.50	509.00	365.75	234.75	155.00	75.50	50.75	39.00
45.70	1	363.50	281.50	199.50	132.25	79.00	49.00	25.25	17.25	13.75
	2	543.50	413.00	296.50	203.00	124.00	79.25	39.75	26.50	21.25
	3	731.75	534.00	390.25	273.50	172.00	111.00	56.75	38.00	30.00
	4	967.75	692.75	508.00	362.00	233.00	152.75	78.75	52.75	41.00
53.30	1	364.00	261.00	203.50	137.50	81.00	50.00	25.00	17.50	13.25
	2	544.50	370.75	300.75	210.25	126.50	79.75	39.00	27.00	20.25
	3	734.50	507.00	395.50	282.75	174.75	112.00	55.00	38.00	28.50
	4	969.50	675.75	515.00	373.50	236.00	154.75	77.00	53.00	40.25
61.00	1	367.00	238.50	165.50	106.50	65.75	42.75	24.00	17.00	14.00
	2	548.25	336.00	246.25	164.25	103.00	68.00	37.25	26.00	21.00
	3	737.00	461.00	326.00	223.00	143.00	95.75	52.00	36.00	29.00
	4	966.50	599.25	423.50	295.00	193.00	131.00	72.00	49.00	38.75
68.60	1	365.75	238.75	159.00	103.25	63.25	41.00	22.00	15.00	12.25
	2	548.00	322.50	238.00	159.50	99.75	65.00	34.25	23.00	18.25
	3	735.00	437.00	314.75	216.00	137.75	91.00	48.00	32.25	25.00
	4	967.75	576.75	409.50	287.00	186.50	125.00	66.00	44.00	34.50
76.20	1	364.75	225.00	151.00	94.75	57.00	36.25	20.25	14.00	10.75
	2	546.50	312.00	225.75	146.75	89.00	57.25	31.00	22.00	17.00
	3	733.25	415.00	298.50	198.25	122.75	79.50	43.00	30.00	23.00
	4	968.50	545.50	390.25	263.50	166.75	109.75	58.25	40.25	31.00

Table A-19. FWD deflection measurements extracted for LTPP pavement section 1113 for FWD test date 13-May-04 (Cont.)

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
83.80	1	364.00	218.75	156.75	98.75	59.50	38.00	20.50	14.00	11.00
	2	544.50	294.25	233.75	153.00	92.50	59.00	31.50	22.00	17.00
	3	734.00	412.25	309.75	207.75	127.75	82.00	43.00	30.00	24.00
	4	965.50	558.25	402.75	275.75	173.75	113.00	59.75	40.25	32.00
91.40	1	363.75	202.25	155.25	100.75	56.50	37.25	20.25	14.00	11.00
	2	542.25	290.50	230.75	154.00	88.75	59.00	32.00	22.00	17.75
	3	733.25	415.00	307.25	210.00	123.75	83.00	44.25	30.00	24.00
	4	963.75	551.25	402.25	279.75	169.00	115.00	61.00	41.00	33.00
99.10	1	360.25	216.50	164.50	110.25	64.25	41.25	21.75	15.00	12.25
	2	540.75	306.00	247.25	170.25	101.50	64.75	33.00	23.00	19.50
	3	730.75	414.00	330.00	232.00	141.00	91.00	46.50	32.00	25.00
	4	961.00	565.75	432.75	308.75	192.75	127.00	65.00	44.00	35.00
106.70	1	358.00	244.75	181.75	120.50	71.00	42.75	23.00	15.00	12.00
	2	539.75	351.50	271.50	185.75	111.00	67.75	36.25	23.75	19.00
	3	732.75	468.25	360.00	252.25	154.00	95.75	51.00	33.00	26.00
	4	964.00	620.50	468.00	335.50	209.75	132.75	69.25	46.25	36.50
114.30	1	361.00	213.25	152.00	96.50	59.25	37.50	21.00	14.75	11.25
	2	540.75	306.75	228.50	149.25	93.25	58.75	32.00	22.50	18.00
	3	735.25	402.00	306.00	204.50	129.75	83.00	44.50	31.00	24.00
	4	968.75	540.50	400.75	275.00	176.75	115.00	61.00	42.50	33.00
121.90	1	371.25	216.25	150.75	94.75	55.25	35.50	19.00	14.25	11.25
	2	548.75	314.00	223.25	144.50	86.00	54.00	29.75	21.00	17.25
	3	739.25	390.25	294.50	194.25	117.00	75.00	40.00	28.75	23.25
	4	968.00	528.50	383.75	256.75	158.50	102.75	54.25	39.00	32.00
129.50	1	368.75	237.50	168.75	110.25	65.50	40.50	21.00	15.00	11.50
	2	546.00	330.75	243.00	163.75	99.75	62.50	31.00	22.00	16.75
	3	740.00	416.25	318.50	217.75	134.25	84.75	43.00	30.25	24.50
	4	971.50	535.75	411.75	286.00	179.75	115.50	58.00	41.00	33.00
137.20	1	367.25	193.75	141.25	94.00	57.75	37.00	20.00	14.75	11.25
	2	549.00	271.50	207.75	142.50	88.50	57.00	31.00	22.00	18.25
	3	742.00	349.25	272.25	190.75	120.25	78.50	42.25	30.00	24.75
	4	971.00	468.75	353.50	252.00	161.75	106.50	57.25	41.00	34.00
144.80	1	368.75	210.00	144.50	95.50	58.25	38.50	21.25	15.25	12.00
	2	546.25	290.50	212.75	145.00	89.75	59.50	31.75	22.50	18.25
	3	738.75	378.00	281.25	195.75	122.50	82.00	42.50	30.00	25.25
	4	970.00	508.75	365.50	259.00	164.75	112.00	58.75	41.50	34.00
152.40	1	361.00	219.00	164.75	109.00	66.50	40.00	20.00	13.25	10.25
	2	540.75	318.75	243.00	165.50	102.00	63.00	30.75	20.50	16.00
	3	732.00	431.00	322.25	223.25	140.50	88.00	42.50	28.75	23.00
	4	962.25	560.75	419.75	296.25	189.25	121.75	59.00	39.00	31.25

Table A-20. Average all point locations FWD deflection measurements extracted for LTPP pavement section 1113

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
All Point Locations	1	365.40	232.69	169.57	111.04	66.80	42.57	22.51	15.50	12.04
	2	545.73	330.04	252.26	170.90	104.40	66.76	34.50	23.60	18.74
	3	735.10	441.36	334.24	231.44	144.27	93.64	48.26	32.73	25.86
	4	966.86	582.95	436.42	307.54	195.93	129.29	66.68	44.87	35.48

Table A-21. FWD deflection measurements extracted for LTPP pavement section 1116 for FWD test date 28-Apr-98

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
0.00	1	396.25	288.00	201.25	149.75	98.00	67.75	38.75	21.00
	2	596.75	428.00	306.00	231.50	155.00	107.00	61.50	33.00
	3	783.75	555.75	401.75	308.75	209.75	147.75	84.50	45.25
	4	1,026.25	710.00	518.75	404.25	279.75	198.75	114.50	62.00
7.60	1	403.75	428.00	306.00	231.50	155.00	107.00	61.50	33.00
	2	600.25	555.75	401.75	308.75	209.75	147.75	84.50	45.25
	3	789.25	710.00	518.75	404.25	279.75	198.75	114.50	62.00
	4	1,030.50	236.25	169.50	128.50	85.25	58.25	35.25	18.25
15.20	1	398.25	279.50	195.50	144.00	92.50	62.00	36.50	20.00
	2	593.00	410.75	293.50	221.50	144.50	99.00	54.75	32.00
	3	782.00	536.50	389.00	298.00	198.75	137.75	76.75	43.25
	4	1,020.75	688.50	505.00	393.50	268.00	188.50	105.75	59.50
22.90	1	396.50	256.25	185.50	136.50	89.50	61.25	35.75	20.25
	2	592.50	381.50	279.75	210.50	140.75	96.75	56.00	32.00
	3	780.50	499.50	370.50	283.00	192.25	133.75	77.75	43.25
	4	1,019.50	644.00	482.25	373.75	258.50	183.00	106.25	59.00
30.50	1	399.50	237.25	168.50	123.50	84.00	56.25	38.50	20.50
	2	595.00	353.00	256.75	191.50	131.75	90.50	58.75	32.25
	3	783.00	465.00	341.75	258.75	180.75	127.00	81.00	44.00
	4	1,017.75	602.25	447.00	344.25	245.00	173.25	110.00	59.50
45.70	1	396.50	269.75	187.00	139.50	90.75	62.00	37.00	21.75
	2	589.00	398.50	283.50	214.75	142.00	97.75	58.50	34.50
	3	777.00	519.00	375.00	288.50	194.00	134.75	80.00	46.50
	4	1,015.50	667.00	490.00	380.25	260.00	183.25	109.75	63.25
53.30	1	395.00	275.25	206.25	155.00	96.00	65.75	34.75	21.25
	2	595.00	411.50	311.75	236.75	151.75	104.75	55.25	33.00
	3	778.75	529.25	402.25	309.00	203.25	141.00	75.50	44.25
	4	1,013.75	678.25	518.25	403.50	271.00	189.75	103.25	58.25
61.00	1	392.75	269.75	185.50	136.75	87.25	59.75	36.00	21.25
	2	587.25	395.50	279.00	209.50	136.50	93.50	55.75	32.50
	3	775.25	514.50	370.50	281.25	185.75	128.75	77.25	44.75
	4	1,011.75	659.00	479.25	369.75	250.75	176.75	105.75	60.75
68.60	1	393.50	253.75	180.50	130.75	84.50	58.00	35.00	19.00
	2	587.50	374.50	270.75	201.00	131.75	92.25	54.75	30.50
	3	774.75	487.00	357.75	269.50	180.75	126.50	76.25	41.50
	4	1,009.75	626.75	466.75	357.75	244.50	173.75	104.75	57.25
76.20	1	394.25	243.00	163.00	121.75	79.25	56.00	34.00	19.75
	2	588.75	363.00	250.25	189.00	124.50	88.25	52.25	30.50
	3	777.75	477.75	334.75	255.75	171.50	122.50	73.25	42.25
	4	1,006.00	614.75	438.00	340.00	232.50	168.75	101.00	57.75
83.80	1	391.75	235.25	172.50	128.00	84.50	56.00	32.75	20.00
	2	585.50	348.50	261.25	197.75	132.75	89.00	51.00	29.75
	3	776.00	457.00	345.75	266.00	182.00	124.25	71.25	41.00
	4	1,010.00	590.25	451.75	352.75	246.25	170.00	98.25	55.75

Table A-21. FWD deflection measurements extracted for LTPP pavement section 1116 for FWD test date 28-Apr-98 (Cont.)

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
91.40	1	390.00	293.00	204.75	147.75	94.50	64.00	37.75	21.25
	2	582.50	425.50	305.25	226.25	148.75	102.00	59.25	33.25
	3	773.50	551.75	401.75	302.25	203.50	141.00	83.75	47.75
	4	1,009.75	703.25	519.50	397.50	274.50	193.25	115.50	64.25
99.10	1	387.00	317.25	221.75	161.00	102.00	68.00	38.00	21.50
	2	579.50	464.25	334.50	249.00	161.75	109.50	60.25	33.00
	3	769.25	602.75	440.75	334.50	222.75	152.50	84.75	47.00
	4	1,003.00	768.25	570.00	440.00	300.25	208.00	118.00	63.75
106.70	1	383.25	346.00	251.00	181.50	113.00	75.00	41.00	22.50
	2	575.25	492.00	365.25	272.00	176.00	119.25	64.75	35.75
	3	765.25	629.75	474.75	359.50	238.75	164.25	91.75	49.75
	4	995.50	784.00	599.00	462.25	315.25	222.25	125.00	69.50
114.30	1	385.00	303.50	220.75	164.75	103.00	69.75	40.50	23.00
	2	580.00	445.25	329.50	252.00	161.50	110.00	60.75	33.50
	3	771.00	577.50	431.25	334.25	219.50	152.00	84.25	46.50
	4	1,003.50	731.50	552.25	433.25	290.50	204.50	114.25	63.00
121.90	1	386.50	290.75	209.50	151.75	95.25	61.25	34.75	20.25
	2	579.00	431.50	316.00	234.25	150.50	97.75	54.75	30.75
	3	770.00	563.00	416.25	313.75	206.50	136.50	75.75	42.75
	4	1,001.75	718.00	535.75	410.75	277.00	186.50	104.00	57.50
129.50	1	387.25	263.75	180.75	131.50	84.25	58.00	33.75	20.00
	2	582.25	390.25	274.50	204.00	134.25	91.00	53.00	30.50
	3	772.50	510.75	365.25	274.75	183.25	127.00	72.50	41.00
	4	1,002.25	653.50	474.75	363.50	245.75	173.25	99.00	55.75
137.20	1	385.75	270.00	192.50	144.00	90.25	61.75	35.00	21.00
	2	578.50	401.00	292.25	223.25	142.75	97.50	55.00	32.50
	3	768.00	527.00	388.00	300.75	196.50	135.75	76.25	44.25
	4	994.50	677.50	505.25	398.00	266.00	187.00	105.50	60.75
144.80	1	385.75	258.25	178.50	133.75	85.75	60.00	34.75	20.25
	2	580.75	387.00	275.25	208.50	135.75	94.25	55.75	31.50
	3	770.75	510.25	367.00	282.50	186.75	131.00	77.00	43.50
	4	997.25	656.75	478.00	373.00	252.25	180.25	104.00	58.75
152.40	1	386.50	259.25	186.25	139.00	89.75	59.00	36.50	19.75
	2	579.75	392.25	286.00	218.50	143.25	95.75	55.25	30.00
	3	770.75	520.75	384.50	296.50	197.75	132.75	77.50	41.50
	4	998.00	674.25	500.50	392.75	267.25	184.00	104.75	56.00

Table A-22. Average all point locations FWD deflection measurements extracted for LTPP pavement section 1116

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
All Point Locations	1	391.75	272.29	193.04	142.45	91.46	61.99	36.31	20.63
	2	586.40	402.39	291.49	219.54	143.98	98.41	56.59	31.96
	3	775.45	525.10	385.14	294.25	196.84	136.29	78.51	43.95
	4	1,009.35	672.66	499.18	387.31	264.56	186.01	107.55	59.80

Table A-23. FWD deflection measurements extracted for LTPP pavement section 2172 for FWD test date 20-Aug-91

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
0.00	1	388.00	92.75	73.00	65.75	57.75	49.75	39.50	26.75
	2	594.75	147.50	115.00	104.00	90.50	78.50	62.00	41.50
	3	797.25	201.25	158.00	141.25	123.50	106.75	85.00	55.25
	4	1,097.00	261.00	202.75	182.75	159.50	139.50	109.50	72.50
30.50	1	390.75	147.50	115.00	104.00	90.50	78.50	62.00	41.50
	2	594.75	201.25	158.00	141.25	123.50	106.75	85.00	55.25
	3	797.75	261.00	202.75	182.75	159.50	139.50	109.50	72.50
	4	1,104.50	78.50	58.50	51.50	43.75	37.00	29.50	20.25
61.00	1	386.75	89.25	72.75	67.00	60.25	53.50	42.50	27.75
	2	592.00	145.50	115.75	106.00	93.75	82.25	66.00	44.25
	3	797.25	199.50	158.75	144.50	128.25	113.25	90.00	60.25
	4	1,093.75	255.25	204.25	187.00	165.00	145.00	115.25	76.75
91.40	1	388.75	91.75	72.75	64.25	59.50	50.25	41.50	28.00
	2	593.50	145.50	114.00	102.75	91.75	80.00	64.25	43.00
	3	795.00	200.50	155.50	140.00	125.25	109.25	88.00	57.50
	4	1,104.00	260.50	201.75	181.50	160.75	142.00	113.00	73.00
121.90	1	388.50	93.75	76.00	68.50	60.00	51.75	40.50	26.25
	2	595.25	150.25	117.75	106.75	93.25	80.75	63.25	39.75
	3	799.75	207.25	162.50	146.50	128.50	112.50	86.50	54.75
	4	1,104.00	261.00	209.25	189.50	164.75	143.75	111.75	70.00
152.40	1	389.00	81.50	62.50	55.00	47.75	41.50	32.75	21.25
	2	594.50	124.25	96.00	85.00	74.00	63.50	50.00	33.50
	3	798.50	171.75	131.50	115.00	100.00	86.25	68.25	45.25
	4	1,109.00	220.75	168.25	147.75	128.25	111.50	87.75	58.00

Table A-24. Average all point locations FWD deflection measurements extracted for LTPP pavement section 2172

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
All Point Locations	1	388.63	87.92	69.25	62.00	54.83	47.29	37.71	25.04
	2	594.13	139.04	108.17	97.46	85.21	73.88	58.50	39.04
	3	797.58	191.46	148.46	132.92	116.54	101.42	80.04	52.63
	4	1,102.04	245.58	191.17	171.83	150.00	130.96	102.92	67.42

Table A-25. FWD deflection measurements extracted for LTPP pavement section 2176 for FWD test date 23-Jul-97

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
0.00	1	400.75	113.75	103.00	99.25	88.75	78.75	65.25	37.50
	2	586.25	185.75	161.75	155.75	141.50	125.75	102.50	59.00
	3	748.75	257.25	219.25	212.75	194.00	173.00	139.75	80.00
	4	1,065.75	333.50	285.25	276.50	254.00	227.75	180.75	102.00
7.60	1	385.50	185.75	161.75	155.75	141.50	125.75	102.50	59.00
	2	588.00	257.25	219.25	212.75	194.00	173.00	139.75	80.00
	3	749.00	333.50	285.25	276.50	254.00	227.75	180.75	102.00
	4	1,061.25	101.75	96.50	91.25	83.25	75.00	59.25	35.25
15.20	1	386.25	121.50	107.00	100.00	90.00	79.00	61.00	34.00
	2	592.50	202.25	175.25	163.25	147.25	130.00	101.00	56.00
	3	749.75	275.75	238.75	223.00	201.00	178.75	138.50	77.00
	4	1,048.25	360.50	310.75	290.50	262.00	232.75	181.00	100.00
22.90	1	370.00	197.75	160.00	143.00	118.75	94.75	58.75	30.00
	2	567.00	310.00	258.25	232.25	194.25	156.75	97.75	50.25
	3	737.25	419.25	348.25	314.25	265.25	215.00	135.50	70.75
	4	1,029.25	542.50	450.00	407.50	343.25	278.25	176.50	91.00
30.50	1	368.00	176.75	129.75	121.25	110.00	98.50	76.00	39.25
	2	570.25	275.50	214.75	200.25	182.25	163.25	126.75	66.75
	3	742.25	375.50	294.75	276.25	251.75	224.75	174.25	91.25
	4	1,036.25	487.50	385.25	362.00	329.75	294.00	227.00	118.75
38.10	1	362.00	194.75	135.50	123.50	108.00	93.75	69.75	35.00
	2	562.25	298.75	223.50	204.50	179.00	156.00	118.00	61.75
	3	738.00	402.25	304.50	279.75	245.25	214.75	162.00	84.75
	4	1,030.75	513.75	392.25	361.75	317.75	277.75	209.75	108.75
45.70	1	359.25	193.75	157.25	144.25	125.50	107.75	73.00	36.25
	2	556.50	309.50	253.50	233.75	204.50	176.75	121.50	60.75
	3	743.75	419.00	344.75	318.75	280.75	244.00	170.75	85.25
	4	1,029.50	539.25	450.25	416.00	367.25	320.25	225.50	112.25
53.30	1	355.00	195.75	132.75	121.75	104.25	87.00	58.25	28.25
	2	553.25	304.00	219.00	201.25	172.25	144.75	97.75	47.00
	3	741.25	413.00	302.50	278.25	238.00	200.25	136.25	66.00
	4	1,018.00	538.75	401.25	369.50	316.25	266.25	182.50	87.75
61.00	1	355.75	133.00	104.50	96.00	83.00	71.00	50.00	26.00
	2	556.25	213.00	170.25	157.00	135.50	117.00	83.50	43.25
	3	737.50	293.75	234.00	215.75	186.00	161.00	116.00	61.00
	4	1,023.00	383.75	305.00	281.50	243.75	210.50	152.00	79.50
68.60	1	364.25	103.50	82.00	78.75	72.00	65.75	51.75	30.25
	2	562.00	163.50	136.00	131.00	119.75	108.75	85.75	50.00
	3	745.25	224.50	187.50	182.75	166.75	150.50	119.50	69.00
	4	1,032.00	296.75	247.75	238.00	218.75	198.00	156.50	90.25
76.20	1	357.00	128.50	107.75	102.50	91.25	81.00	63.25	34.75
	2	556.50	207.00	175.75	167.00	149.50	134.00	102.00	57.00
	3	743.25	283.00	241.75	230.00	206.00	185.00	141.25	79.00
	4	1,027.50	368.50	317.25	302.00	270.50	243.00	186.00	102.00

Table A-25. FWD deflection measurements extracted for LTPP pavement section 2176 for FWD test date 23-Jul-97 (Cont.)

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
83.80	1	358.00	155.75	137.50	126.50	110.75	94.25	67.50	35.00
	2	551.50	261.75	229.50	211.75	185.50	159.25	115.75	58.75
	3	735.25	361.25	317.00	294.00	258.50	222.25	162.00	83.25
	4	1,022.00	479.00	421.25	389.75	342.25	294.25	214.75	110.75
91.40	1	353.25	151.50	135.50	125.25	109.25	95.50	68.00	32.00
	2	556.25	245.00	225.25	208.00	182.50	159.00	114.00	54.00
	3	743.75	336.75	311.25	288.50	253.50	221.50	159.25	76.00
	4	1,021.25	448.00	413.00	383.00	337.00	294.50	212.25	100.75
99.10	1	339.50	218.50	161.50	146.25	122.25	103.00	69.50	31.75
	2	543.75	338.50	261.75	237.75	200.75	170.00	117.00	53.25
	3	736.50	448.75	353.25	322.25	274.25	234.25	163.50	77.50
	4	1,009.00	574.25	455.25	416.25	355.25	305.75	214.75	102.50
106.70	1	341.00	160.00	132.50	123.75	110.75	97.25	72.25	35.75
	2	551.75	262.75	220.00	206.50	185.00	163.50	121.75	58.75
	3	741.00	354.50	302.00	284.00	253.75	225.75	169.25	84.50
	4	1,012.75	457.50	391.25	369.00	331.50	294.50	221.50	103.75
114.30	1	346.25	190.75	137.75	127.75	111.75	95.50	67.75	34.25
	2	553.50	302.50	227.75	211.00	185.25	158.50	113.75	56.75
	3	743.00	412.00	313.75	291.00	256.00	220.00	158.25	79.25
	4	1,009.50	534.00	410.00	381.50	335.25	288.00	208.50	103.75
121.90	1	342.25	162.75	136.75	125.00	107.25	92.50	66.00	32.00
	2	552.75	263.75	224.50	206.25	177.75	153.75	110.50	53.75
	3	741.75	359.75	308.25	284.00	246.50	214.00	154.00	75.50
	4	1,006.75	466.00	401.25	370.00	322.75	279.75	201.75	98.50
129.50	1	351.00	150.25	132.50	123.25	105.25	89.00	60.00	29.00
	2	556.25	244.25	217.50	202.00	172.75	147.00	101.00	48.50
	3	745.75	331.50	297.75	277.75	239.25	204.50	142.00	68.50
	4	1,016.00	434.00	391.25	365.00	315.75	269.50	186.50	91.00
137.20	1	346.25	152.50	114.50	105.00	88.00	77.75	57.00	26.00
	2	556.50	244.25	187.25	171.75	146.00	129.00	96.00	44.00
	3	745.25	329.75	256.25	235.75	202.75	179.00	133.00	63.00
	4	1,006.75	425.75	334.25	308.00	266.25	235.25	175.00	82.75
144.80	1	349.75	183.50	158.00	141.25	117.50	97.50	63.00	26.00
	2	551.00	292.00	250.50	225.00	189.75	158.00	104.75	44.00
	3	740.25	388.75	334.00	302.00	257.50	216.50	146.00	63.25
	4	1,005.50	493.75	424.75	385.75	331.00	279.25	191.50	85.00
152.40	1	345.25	181.25	150.75	136.75	109.00	86.00	54.25	25.75
	2	549.00	289.50	243.25	222.25	180.00	141.25	91.00	43.00
	3	742.50	390.25	328.25	301.00	245.50	195.00	127.25	61.25
	4	1,005.25	494.00	418.50	384.75	315.50	251.50	166.75	81.75

Table A-26. Average all point locations FWD deflection measurements extracted for LTPP pavement section 2176

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
All Point Locations	1	358.87	160.36	129.20	119.15	103.17	88.60	63.40	32.10
	2	560.62	256.21	211.05	195.17	169.93	146.50	105.67	53.46
	3	742.43	347.92	288.23	267.55	233.89	202.44	146.71	74.93
	4	1,024.58	451.08	375.67	349.00	305.86	264.93	192.62	97.81

Table A-27. FWD deflection measurements extracted for LTPP pavement section 3669 for FWD test date 9-Mar-00

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
0.00	1	438.00	125.75	111.75	105.00	93.00	83.00	65.75	52.75	44.75
	2	611.75	183.25	162.25	152.00	135.25	120.75	97.50	78.75	63.25
	3	813.00	247.00	217.25	203.00	182.50	162.75	132.25	106.75	86.00
	4	1,007.25	305.50	269.00	252.00	225.75	202.00	164.25	132.50	107.50
7.60	1	428.25	183.25	162.25	152.00	135.25	120.75	97.50	78.75	63.25
	2	607.25	247.00	217.25	203.00	182.50	162.75	132.25	106.75	86.00
	3	813.50	305.50	269.00	252.00	225.75	202.00	164.25	132.50	107.50
	4	1,024.75	134.25	114.00	103.75	90.50	81.00	61.25	46.75	35.75
15.20	1	422.25	140.25	114.00	105.75	90.25	77.75	61.00	48.25	38.00
	2	597.00	195.00	165.75	152.75	133.50	115.50	89.00	68.75	58.00
	3	799.75	264.75	220.25	204.75	179.75	156.75	121.50	95.50	77.50
	4	997.50	328.00	276.75	255.50	221.25	194.50	152.75	120.00	94.50
22.90	1	413.50	196.50	121.00	101.75	85.25	73.75	56.00	42.50	32.00
	2	594.50	278.75	176.50	151.25	126.75	109.75	84.75	62.75	48.00
	3	798.75	363.25	235.00	208.25	171.00	149.75	115.50	87.75	65.25
	4	1,002.50	443.25	290.75	257.25	214.00	186.75	143.50	108.75	81.25
30.50	1	417.50	106.25	62.50	54.00	49.50	46.00	38.00	30.00	24.75
	2	596.25	152.50	92.75	80.75	74.75	68.75	57.25	46.75	36.25
	3	803.50	202.25	126.75	111.25	102.75	95.00	79.25	64.00	50.00
	4	1,010.00	251.50	159.50	140.75	131.00	121.00	100.00	80.50	65.00
38.10	1	416.50	119.25	92.00	74.75	56.75	46.00	32.50	23.00	17.00
	2	595.75	169.00	132.75	108.00	84.75	68.75	49.00	35.25	25.50
	3	801.25	227.25	179.00	146.50	114.00	94.75	68.25	49.00	35.00
	4	1,002.00	286.75	222.00	183.75	147.50	120.75	85.25	62.25	46.00
45.70	1	416.75	97.75	71.50	63.00	54.00	47.00	36.25	28.00	21.50
	2	595.25	137.00	105.50	93.75	80.75	70.25	54.75	41.75	32.50
	3	802.00	184.00	142.75	127.75	110.75	97.00	75.25	58.25	44.25
	4	1,009.50	233.75	179.75	161.25	140.25	122.75	95.50	73.00	56.25
53.30	1	416.75	87.25	67.00	60.00	51.50	46.00	35.00	27.00	19.25
	2	595.25	129.25	99.50	88.75	77.75	69.25	53.75	40.50	29.75
	3	806.50	175.75	135.50	122.25	105.75	95.50	74.00	56.00	41.50
	4	1,018.25	222.25	172.50	154.00	135.50	121.50	94.00	71.25	52.25
61.00	1	413.00	96.25	70.75	65.00	58.00	52.00	41.25	32.75	25.25
	2	594.00	139.75	105.00	96.50	87.25	77.50	61.75	48.25	37.75
	3	800.50	191.50	144.50	132.75	120.00	107.25	85.75	67.00	52.00
	4	1,013.25	241.75	182.50	168.00	151.75	135.75	108.00	84.00	65.25
68.60	1	407.75	147.75	100.50	84.50	68.00	57.25	43.00	32.00	24.75
	2	587.75	213.50	148.25	125.00	101.50	86.25	64.75	48.50	36.25
	3	795.50	285.25	199.00	170.50	140.25	120.50	88.00	66.00	50.75
	4	1,005.00	357.25	251.75	215.00	177.00	151.50	113.25	85.00	62.50
76.20	1	411.00	108.75	80.25	72.50	63.00	56.00	43.00	33.75	27.00
	2	591.50	160.50	119.25	107.50	93.75	83.25	65.25	50.25	38.75
	3	800.75	219.75	165.00	148.75	130.25	116.00	91.25	70.00	53.50
	4	1,013.50	277.00	209.75	189.50	165.75	147.75	115.50	88.75	69.25

Table A-27. FWD deflection measurements extracted for LTPP pavement section 3669 for FWD test date 9-Mar-00 (Cont.)

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
83.80	1	407.50	132.50	101.50	96.25	83.50	73.75	61.00	46.75	34.00
	2	588.50	191.75	149.75	139.50	124.50	112.50	90.50	69.25	51.50
	3	798.00	258.50	203.25	190.00	170.50	154.00	123.75	94.00	70.25
	4	1,009.25	322.50	255.75	238.50	213.50	193.00	154.25	117.25	88.50
91.40	1	411.50	105.50	83.75	76.50	65.25	60.00	49.00	38.50	30.25
	2	588.25	154.75	124.50	113.25	99.25	90.75	74.00	57.75	46.75
	3	798.75	213.50	170.25	154.75	138.50	127.00	103.25	82.50	63.50
	4	1,008.75	268.25	216.25	198.00	174.25	160.25	132.25	105.25	80.00
99.10	1	408.25	116.00	76.00	68.75	59.25	52.25	41.25	31.25	24.00
	2	588.50	170.25	115.00	104.25	91.50	80.75	63.50	48.75	36.75
	3	797.50	231.25	161.00	146.75	128.75	113.75	90.00	68.75	52.75
	4	1,010.75	291.50	205.00	186.50	165.25	146.25	115.50	89.00	68.00
106.70	1	412.75	97.00	62.75	56.25	49.00	44.00	35.00	27.25	20.50
	2	587.00	140.25	95.50	84.75	75.50	68.00	53.75	42.00	31.75
	3	795.75	194.75	132.75	119.00	106.00	95.50	76.00	59.25	45.50
	4	1,001.00	248.75	171.50	153.75	136.75	122.75	97.50	77.00	58.25
114.30	1	409.75	87.75	68.75	62.75	54.00	47.50	37.50	29.25	22.00
	2	588.50	131.25	102.75	94.50	81.50	72.00	57.00	44.00	33.75
	3	796.75	182.25	144.50	132.75	115.50	101.00	80.75	63.00	48.00
	4	1,015.50	232.75	185.50	170.50	149.00	132.25	104.75	81.00	62.25
121.90	1	410.50	100.00	84.25	76.75	67.00	59.00	44.50	33.50	25.50
	2	586.50	152.00	127.50	116.25	101.75	89.75	68.50	51.75	39.00
	3	796.50	210.50	177.25	161.25	142.25	125.75	95.75	72.75	54.00
	4	1,008.50	270.25	226.25	206.25	182.00	160.75	122.75	92.75	69.50
129.50	1	403.75	127.75	88.25	78.25	66.75	58.00	44.00	33.75	25.00
	2	586.50	186.25	132.25	116.50	100.50	87.25	66.50	49.25	37.00
	3	794.00	252.25	181.50	160.75	139.25	121.25	92.75	69.00	51.25
	4	1,009.50	318.50	230.25	205.00	176.50	154.50	117.50	88.25	64.00
137.20	1	404.75	144.50	103.25	92.25	78.75	68.50	51.25	37.25	27.75
	2	581.75	211.25	153.25	137.50	118.50	103.00	76.75	56.50	41.00
	3	792.50	284.25	209.75	188.50	162.50	141.75	105.75	77.75	57.25
	4	1,003.75	355.75	263.00	236.25	203.75	177.50	132.75	97.50	72.00
144.80	1	404.50	124.50	88.00	77.00	63.00	54.00	40.00	30.00	23.00
	2	583.50	178.00	128.00	112.50	94.25	80.50	59.75	44.75	34.75
	3	795.75	242.00	174.75	155.25	130.75	112.75	84.50	63.00	48.75
	4	1,010.75	304.50	222.00	198.25	167.75	144.25	108.50	81.00	63.25
152.40	1	404.75	118.00	81.25	70.50	59.75	52.50	40.25	31.00	25.00
	2	582.50	171.75	120.00	105.00	90.00	79.75	60.75	46.75	36.75
	3	795.00	234.50	166.50	146.75	125.75	111.50	85.00	64.75	51.75
	4	1,007.25	294.25	211.50	186.75	160.75	141.75	108.75	83.00	65.75

Table A-28. Average all point locations FWD deflection measurements extracted for LTPP pavement section 3669

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
All Point Locations	1	413.30	119.69	87.76	78.35	66.95	58.82	45.56	35.01	27.00
	2	591.80	173.32	129.56	115.80	100.17	88.30	68.46	52.46	40.32
	3	799.79	234.55	176.61	158.83	137.96	121.94	94.86	72.75	55.74
	4	1,008.98	294.14	222.70	200.52	174.46	154.23	120.00	92.08	70.46

Table A-29. FWD deflection measurements extracted for LTPP pavement section 3679 for FWD test date 27-Mar-90

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
0.00	1	401.75	207.00	212.25	213.25	214.50	217.00	221.50	33.00
	2	619.75	311.00	320.50	321.00	322.50	326.50	332.50	51.75
	3	814.00	391.75	397.75	397.75	397.25	401.00	406.25	66.75
	4	969.25	459.00	462.00	461.50	459.25	461.25	465.50	80.25
7.60	1	396.75	311.00	320.50	321.00	322.50	326.50	332.50	51.75
	2	610.50	391.75	397.75	397.75	397.25	401.00	406.25	66.75
	3	805.00	459.00	462.00	461.50	459.25	461.25	465.50	80.25
	4	962.00	120.75	109.75	102.00	92.00	80.75	62.00	36.50
16.80	1	393.25	175.00	149.25	137.25	119.00	102.75	77.00	40.00
	2	607.00	273.00	230.00	212.50	185.25	159.50	117.50	62.50
	3	795.50	346.50	294.25	270.75	236.50	203.50	150.50	78.25
	4	956.00	415.00	354.75	326.00	285.00	245.75	180.50	93.75
23.80	1	399.25	175.00	149.00	135.50	115.25	98.50	69.75	36.25
	2	619.25	273.00	233.75	213.25	183.50	155.25	111.00	57.00
	3	807.00	350.50	299.25	273.00	234.50	199.00	142.00	72.25
	4	999.75	424.25	362.75	330.75	284.25	242.00	172.50	88.00
32.00	1	390.25	157.25	135.75	120.50	107.50	94.25	71.00	37.75
	2	605.75	247.75	213.50	192.75	171.25	149.75	112.75	61.75
	3	801.00	323.25	276.75	250.50	222.00	193.50	145.50	78.75
	4	958.00	391.00	338.25	309.50	273.25	237.50	174.50	95.25
40.20	1	386.25	134.75	119.50	109.50	98.00	87.50	67.25	38.00
	2	597.50	207.50	186.00	170.75	154.75	136.25	105.50	60.75
	3	795.75	271.00	241.00	221.75	199.25	176.75	136.50	78.00
	4	948.75	326.75	291.25	268.25	241.25	213.50	164.75	94.00
45.70	1	373.75	194.25	156.25	140.00	119.50	100.75	70.00	35.75
	2	590.00	274.75	224.00	202.00	173.75	147.50	104.50	54.25
	3	781.75	340.50	278.00	251.75	216.50	185.50	132.00	68.00
	4	952.75	399.50	327.75	298.50	256.75	219.50	158.25	82.50
53.30	1	378.75	103.75	93.25	86.25	78.00	69.25	55.00	33.25
	2	589.75	163.00	145.00	135.50	122.50	109.00	85.00	52.50
	3	788.50	212.75	189.25	176.75	158.75	141.75	111.00	67.50
	4	944.25	262.25	231.25	216.25	194.25	172.00	135.25	83.25
63.10	1	369.50	345.25	271.25	239.50	198.00	163.25	110.00	52.00
	2	580.75	525.25	415.50	368.75	306.25	253.75	172.25	83.00
	3	766.50	665.25	526.75	468.75	391.00	324.00	222.50	108.25
	4	948.75	776.50	618.00	551.75	460.50	383.50	264.75	130.25
69.50	1	371.25	173.25	149.25	139.25	121.25	109.25	84.00	43.00
	2	583.25	273.75	237.50	221.75	193.75	174.00	135.00	68.25
	3	780.50	360.25	311.50	290.50	254.25	228.50	176.50	90.00
	4	945.25	436.50	385.75	359.50	319.50	281.00	214.25	114.50
76.20	1	370.50	128.75	117.50	108.50	97.50	85.00	67.25	35.50
	2	584.00	210.50	191.75	176.50	159.75	138.75	110.25	60.25
	3	777.00	279.00	254.75	235.25	212.00	185.25	146.50	80.75
	4	953.50	347.75	315.75	293.00	264.25	231.75	177.50	101.25

Table A-29. FWD deflection measurements extracted for LTPP pavement section 3679 for FWD test date 27-Mar-90 (Cont.)

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
83.80	1	369.50	123.50	105.50	98.00	85.25	80.00	65.00	36.75
	2	581.75	192.75	167.75	158.00	139.75	126.75	100.75	56.25
	3	778.25	255.25	222.50	208.00	186.00	166.50	128.25	71.75
	4	953.50	311.50	273.25	256.00	227.50	204.25	158.25	87.50
91.40	1	366.00	339.25	99.25	89.25	80.25	70.00	54.25	33.50
	2	578.00	508.75	192.00	165.00	145.75	125.25	93.75	54.50
	3	764.75	635.75	282.75	242.75	210.25	179.50	130.25	73.75
	4	944.50	752.50	373.00	321.00	275.50	234.25	167.25	90.00
99.10	1	368.50	147.50	124.00	115.00	105.50	97.25	81.50	35.25
	2	582.00	231.25	197.25	184.25	169.25	156.00	132.50	56.25
	3	774.00	301.50	258.75	242.75	222.75	204.25	174.25	72.75
	4	955.50	369.25	318.00	299.00	273.50	252.75	215.25	87.25
106.70	1	371.50	153.00	131.00	120.75	108.75	96.75	75.25	41.25
	2	583.50	239.25	207.75	192.25	173.25	154.50	119.00	66.50
	3	778.00	316.50	272.75	251.75	226.25	201.50	156.75	84.50
	4	954.00	385.00	334.00	309.25	277.75	246.75	190.75	102.00
114.60	1	366.75	155.50	129.00	117.25	105.25	91.50	69.25	37.00
	2	580.50	242.25	205.00	188.75	167.75	146.75	111.75	61.25
	3	772.75	319.50	269.00	247.50	219.50	192.25	146.25	78.50
	4	954.75	391.25	329.75	304.25	270.00	236.50	178.75	95.00
121.90	1	365.25	218.00	173.50	154.25	130.25	109.25	75.75	37.75
	2	576.00	335.25	273.25	244.75	207.50	175.00	122.75	61.75
	3	766.50	429.25	350.00	314.25	267.75	225.25	157.75	79.00
	4	946.75	517.50	426.00	384.50	328.50	277.00	194.75	96.75
130.50	1	367.25	209.00	161.00	143.75	122.25	101.75	72.50	38.50
	2	576.50	327.50	256.00	226.50	192.75	161.75	115.25	62.00
	3	769.75	428.50	334.25	297.00	253.00	211.00	150.75	79.50
	4	946.00	521.50	409.00	362.00	309.00	257.50	184.25	96.00
137.20	1	364.25	214.25	174.25	159.50	137.25	118.75	82.75	46.00
	2	573.50	325.00	267.50	246.50	212.25	185.50	130.50	69.50
	3	766.75	414.50	346.00	318.25	275.00	241.00	171.75	90.25
	4	944.75	498.75	422.50	387.75	336.50	291.50	210.00	107.25
144.80	1	365.50	134.75	115.75	107.00	94.75	82.50	61.75	32.00
	2	576.75	211.75	182.50	169.25	150.25	131.50	99.75	52.50
	3	771.75	278.25	240.00	222.00	196.25	171.50	129.25	67.50
	4	954.25	341.75	293.50	272.25	240.25	211.00	159.25	83.50
149.70	1	368.75	129.50	119.25	110.75	105.75	98.25	65.25	36.00
	2	578.00	204.25	190.25	174.50	166.75	156.75	103.25	57.25
	3	777.75	268.00	247.50	229.75	218.25	204.50	133.00	73.25
	4	954.75	329.50	305.00	284.50	268.75	251.75	161.75	89.25

Table A-30. Average all point locations FWD deflection measurements extracted for LTPP pavement section 3679

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
All Point Locations	1	376.40	178.06	142.64	130.81	115.99	102.58	78.95	37.86
	2	589.24	274.51	224.15	205.90	182.98	161.75	124.55	60.44
	3	782.51	353.95	291.17	267.49	237.33	209.63	160.81	77.93
	4	954.62	426.46	354.37	326.07	289.19	254.89	194.60	94.92

Table A-31. FWD deflection measurements extracted for LTPP pavement section 3729 for FWD test date 16-Feb-02

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
0.00	1	427.00	107.25	102.75	98.50	91.25	83.75	69.25	57.25	45.00
	2	641.50	164.25	154.25	147.50	135.25	124.75	103.00	83.75	69.50
	3	798.00	209.50	198.50	189.75	173.75	161.00	133.00	107.50	89.00
	4	1,017.25	272.00	256.25	245.00	224.00	207.75	171.00	138.75	114.00
7.60	1	420.00	164.25	154.25	147.50	135.25	124.75	103.00	83.75	69.50
	2	634.00	209.50	198.50	189.75	173.75	161.00	133.00	107.50	89.00
	3	794.50	272.00	256.25	245.00	224.00	207.75	171.00	138.75	114.00
	4	1,013.25	105.75	90.25	85.75	78.00	70.75	58.25	47.00	38.50
15.20	1	412.25	121.25	108.50	102.75	93.50	84.25	67.75	54.25	43.00
	2	626.25	182.25	162.75	154.75	140.00	126.25	101.50	80.75	65.50
	3	789.75	234.75	209.75	199.75	180.00	162.25	129.75	102.75	81.75
	4	1,008.25	306.00	273.00	259.25	234.25	211.00	168.25	133.00	106.00
22.90	1	411.00	106.00	94.00	88.25	82.50	75.25	62.25	51.00	41.25
	2	624.00	158.75	138.75	132.50	123.00	111.25	92.50	76.00	62.75
	3	788.50	203.75	179.25	171.00	157.75	143.50	119.00	97.00	79.00
	4	1,005.50	264.00	233.00	221.25	205.00	186.25	154.25	125.25	102.00
30.50	1	407.50	91.50	81.00	77.75	71.00	64.75	53.75	44.75	37.25
	2	620.75	137.75	121.50	116.00	106.00	97.00	81.00	67.00	55.50
	3	784.75	178.00	156.75	150.00	136.00	124.75	104.00	85.00	71.75
	4	998.00	232.25	203.75	195.00	177.75	162.50	135.00	111.00	91.75
38.10	1	405.75	96.50	82.00	78.25	71.00	64.50	54.75	45.75	37.75
	2	619.50	142.75	122.25	116.75	105.75	96.25	81.00	67.75	57.00
	3	787.00	185.00	159.00	151.50	137.50	125.25	104.75	87.00	72.50
	4	1,004.75	240.50	207.00	197.25	178.75	162.75	136.75	113.25	94.25
45.70	1	404.25	87.00	73.50	71.00	64.75	59.25	51.00	42.50	36.25
	2	619.00	129.25	111.50	106.50	97.00	89.25	75.50	62.75	54.50
	3	787.75	166.75	144.00	137.00	125.00	114.25	96.25	80.00	68.00
	4	1,004.50	217.00	186.75	178.50	162.50	149.00	125.00	103.75	88.25
53.30	1	399.50	87.00	78.00	73.75	67.00	61.00	51.25	42.00	35.25
	2	614.50	129.75	116.75	110.75	100.25	91.00	76.00	62.50	54.00
	3	784.75	168.25	151.50	143.50	129.50	118.00	97.00	80.00	66.50
	4	1,003.00	219.00	197.00	186.50	167.75	153.00	126.50	102.75	86.75
61.00	1	396.75	93.75	83.75	79.75	72.75	66.25	54.00	43.75	37.00
	2	612.50	139.75	124.50	119.00	109.25	99.00	81.25	65.25	54.75
	3	780.25	180.25	160.25	154.00	140.75	127.50	104.00	83.00	70.00
	4	1,000.50	235.25	209.75	200.75	183.50	166.50	136.00	108.25	89.75
68.60	1	395.25	110.25	94.00	88.25	80.25	72.00	58.00	47.00	37.00
	2	607.50	164.50	140.25	134.25	120.50	108.25	86.25	69.50	56.50
	3	774.25	214.00	183.00	174.00	156.75	140.50	112.25	89.25	71.75
	4	989.50	279.50	239.75	227.25	204.50	183.50	146.75	116.00	93.75
76.20	1	395.00	86.75	83.25	79.00	71.50	65.00	54.00	44.25	36.75
	2	602.25	131.00	124.00	118.00	106.50	96.75	80.00	65.25	54.75
	3	766.00	171.50	161.25	154.00	139.75	126.50	103.75	85.00	70.25
	4	969.75	223.25	210.25	200.75	182.00	165.00	135.00	110.00	91.00

Table A-31. FWD deflection measurements extracted for LTPP pavement section 3729 for FWD test date 16-Feb-02 (Cont.)

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
83.80	1	394.75	97.00	83.00	79.25	71.50	64.75	53.00	43.00	36.25
	2	609.00	146.00	124.50	119.25	107.50	97.75	80.00	65.25	54.25
	3	778.25	187.75	161.25	154.50	139.00	125.50	102.75	83.50	69.50
	4	995.75	244.75	210.75	201.00	181.50	164.00	133.00	108.25	89.00
91.40	1	393.00	97.75	84.00	79.25	71.50	63.75	53.00	41.25	33.75
	2	608.50	147.50	125.75	119.50	107.50	97.00	79.00	63.25	52.00
	3	776.00	189.75	162.50	154.50	138.00	124.50	99.75	80.25	66.00
	4	989.75	247.25	212.50	201.75	181.00	162.75	130.50	104.75	85.50
99.10	1	393.00	112.75	97.50	93.00	83.00	74.00	59.00	47.25	39.50
	2	604.75	168.00	146.00	139.75	125.00	111.75	89.50	71.00	58.50
	3	772.50	218.00	189.75	180.50	161.75	144.25	114.50	90.75	73.75
	4	989.00	285.00	249.50	236.00	212.75	189.75	149.25	117.50	94.50
106.70	1	395.50	110.50	97.00	89.50	80.50	71.50	58.25	46.25	38.00
	2	606.00	165.75	143.75	134.25	120.25	108.00	86.50	70.00	58.00
	3	773.75	213.75	185.25	173.50	155.50	138.75	110.75	89.00	73.75
	4	987.50	279.00	242.75	226.75	202.75	181.75	144.25	116.00	95.00
114.30	1	392.75	96.00	80.25	77.25	68.50	62.25	51.00	41.00	34.00
	2	604.50	143.00	120.75	115.00	103.25	93.00	75.75	61.00	52.00
	3	773.25	185.50	157.00	149.50	134.00	120.50	96.75	78.25	65.50
	4	989.25	242.25	205.50	195.25	175.50	158.25	126.25	102.25	85.00
121.90	1	391.25	107.00	93.25	89.50	79.25	71.25	57.75	47.00	38.00
	2	600.50	158.00	139.50	132.50	118.00	105.00	84.50	68.75	56.25
	3	770.00	206.50	181.00	172.75	153.00	137.25	109.75	88.75	72.75
	4	988.25	270.00	237.25	225.25	200.75	179.50	143.50	115.25	94.75
129.50	1	392.50	109.25	94.25	90.75	82.25	74.00	59.75	49.00	37.75
	2	600.25	161.25	139.75	134.00	121.00	109.75	89.25	70.25	60.00
	3	771.75	209.00	180.75	174.50	157.50	142.00	114.50	92.00	74.50
	4	983.00	272.25	237.50	226.75	204.50	185.50	149.75	119.25	97.25
137.20	1	389.50	117.50	107.25	102.75	92.50	83.00	66.25	52.50	42.50
	2	598.50	176.75	162.00	153.25	139.25	125.00	99.75	79.00	65.50
	3	765.50	230.00	209.25	199.25	180.25	162.00	128.25	101.50	82.75
	4	978.00	302.75	274.00	260.75	235.50	211.75	167.25	131.75	105.75
144.80	1	388.50	102.75	92.25	90.00	82.50	76.25	64.75	53.75	43.50
	2	600.75	155.75	138.00	133.25	123.25	114.75	96.75	80.75	67.00
	3	769.75	198.50	177.25	171.50	158.25	146.50	123.50	102.25	84.00
	4	985.75	259.75	232.25	224.00	207.00	191.25	160.75	132.75	109.00
152.40	1	387.75	112.75	106.00	103.00	96.00	90.00	76.50	64.75	52.50
	2	599.50	174.00	160.75	155.75	145.50	135.50	116.25	97.25	82.00
	3	769.75	221.75	206.25	199.50	186.25	173.75	149.00	124.25	100.50
	4	988.00	289.75	269.75	261.50	244.00	227.50	194.00	162.00	132.25

Table A-32. Average all point locations FWD deflection measurements extracted for LTPP pavement section 3729

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
All Point Locations	1	399.65	102.68	90.75	86.54	78.62	71.31	58.74	47.87	39.08
	2	612.10	153.92	135.76	129.51	117.61	106.76	87.63	71.24	59.42
	3	778.86	198.71	175.55	167.56	151.87	137.75	112.45	91.14	74.99
	4	994.69	259.01	229.13	218.23	197.98	179.67	146.32	118.29	97.07

Table A-33. FWD deflection measurements extracted for LTPP pavement section 3835 for FWD test date 19-Feb-99

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
0.00	1	434.25	107.75	99.75	94.25	85.00	76.25	61.00	39.50
	2	644.00	167.25	154.50	146.75	132.50	120.00	96.50	61.00
	3	865.25	233.75	218.50	207.00	187.50	169.75	136.00	85.75
	4	1,062.75	288.75	267.25	253.75	229.75	208.50	167.75	105.00
7.60	1	429.75	167.25	154.50	146.75	132.50	120.00	96.50	61.00
	2	640.25	233.75	218.50	207.00	187.50	169.75	136.00	85.75
	3	862.75	288.75	267.25	253.75	229.75	208.50	167.75	105.00
	4	1,054.25	82.50	75.00	70.50	63.00	56.75	46.00	32.75
15.20	1	424.25	128.25	114.00	107.00	95.00	85.00	67.50	45.00
	2	637.00	196.00	175.00	164.25	147.00	131.50	104.50	69.25
	3	864.50	270.25	243.25	228.75	204.25	183.25	145.75	96.50
	4	1,054.50	330.50	295.75	277.75	248.25	223.00	178.00	117.00
22.90	1	420.75	119.25	109.50	103.75	92.75	83.50	66.75	44.25
	2	634.50	188.25	172.25	162.75	145.75	132.00	105.75	70.00
	3	860.00	262.50	243.00	230.50	207.00	187.75	150.00	98.75
	4	1,053.00	324.75	297.25	282.25	253.25	230.25	183.75	120.25
30.50	1	417.25	114.75	108.75	105.25	100.00	96.00	51.00	38.00
	2	632.25	180.50	171.25	166.00	158.00	151.50	80.00	59.75
	3	860.25	248.50	240.50	233.00	221.75	213.00	114.25	84.50
	4	1,054.00	305.25	291.75	283.25	270.25	260.50	142.75	103.75
38.10	1	416.75	98.25	91.50	87.75	78.75	72.75	60.25	44.75
	2	631.00	156.75	144.25	137.25	124.25	114.75	95.50	69.50
	3	860.75	216.75	202.50	193.00	174.75	161.00	134.75	98.50
	4	1,058.25	266.75	247.00	236.25	214.00	197.25	165.00	121.75
45.70	1	409.50	94.75	86.00	81.25	73.00	66.25	54.00	37.00
	2	625.75	152.00	137.25	129.25	117.25	106.00	86.25	58.50
	3	860.00	211.00	195.00	184.50	167.00	152.25	124.00	83.00
	4	1,054.25	261.00	238.25	226.25	205.00	188.00	153.00	102.25
53.30	1	411.25	80.75	72.00	68.25	60.75	55.25	45.25	32.00
	2	628.25	127.50	114.50	108.00	97.00	88.25	71.75	50.50
	3	858.75	179.50	163.00	153.75	138.00	125.00	102.00	71.00
	4	1,052.00	221.75	199.75	188.75	169.75	154.00	125.25	86.50
61.00	1	411.00	77.25	69.00	65.50	57.75	52.00	41.75	29.75
	2	625.75	125.00	111.00	104.50	93.25	83.50	68.00	47.00
	3	858.00	176.25	159.25	150.50	134.50	120.75	97.75	66.75
	4	1,047.75	218.75	196.50	186.00	166.50	149.75	121.50	83.00
68.60	1	408.25	87.25	80.50	76.25	69.00	62.75	51.00	35.75
	2	625.75	140.00	128.75	122.00	110.00	100.00	82.00	56.25
	3	855.75	197.75	183.75	174.00	157.25	143.00	116.75	80.25
	4	1,041.75	244.75	226.00	213.75	194.00	176.00	143.75	98.25
76.20	1	408.75	188.75	177.50	170.25	157.25	144.50	118.25	76.25
	2	624.75	268.50	254.00	243.75	225.75	207.75	170.75	110.25
	3	857.00	347.00	327.25	314.25	290.25	268.00	220.50	143.25
	4	1,042.75	406.75	381.75	366.00	337.75	311.75	257.25	168.50

Table A-33. FWD deflection measurements extracted for LTPP pavement section 3835 for FWD test date 19-Feb-99 (Cont.)

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
83.80	1	408.25	104.50	96.00	91.00	81.75	74.00	59.00	39.25
	2	621.25	166.50	153.25	144.75	130.25	117.25	94.25	62.00
	3	851.00	234.50	217.75	205.75	185.75	167.75	135.00	88.00
	4	1,039.50	289.50	266.75	252.50	227.75	206.00	166.00	108.75
91.40	1	405.75	98.25	91.75	86.75	77.75	70.75	57.25	39.00
	2	622.25	159.25	144.50	136.75	123.00	111.75	90.75	61.00
	3	858.50	221.25	203.25	192.50	173.75	157.75	128.00	86.75
	4	1,048.25	273.50	248.25	235.50	212.50	193.25	158.00	106.00
99.10	1	406.00	115.25	106.75	101.50	92.50	84.50	70.00	48.00
	2	622.25	181.75	168.75	160.25	146.00	133.25	110.00	75.75
	3	854.25	256.75	237.25	226.00	206.25	188.50	155.75	107.00
	4	1,042.50	311.75	289.25	275.00	251.75	230.25	190.50	131.50
106.70	1	407.25	120.75	111.25	105.00	94.75	85.75	70.00	47.75
	2	621.00	190.75	174.75	165.75	149.25	135.00	109.75	74.25
	3	850.25	262.50	244.00	231.50	209.25	189.50	154.75	105.25
	4	1,038.50	319.75	296.00	280.50	254.75	231.25	189.75	129.50
114.30	1	404.50	164.50	152.75	143.75	128.75	111.75	84.00	48.25
	2	615.00	240.25	223.25	210.75	189.75	166.50	127.50	75.25
	3	837.75	319.50	296.75	281.25	253.00	224.50	173.75	104.50
	4	1,024.00	379.50	352.75	334.50	301.75	267.75	209.25	126.75
121.90	1	404.25	119.25	106.75	100.75	90.75	81.75	66.00	44.00
	2	620.00	185.25	168.00	158.50	143.25	129.25	104.00	69.25
	3	848.50	258.75	235.75	222.75	201.50	182.50	147.00	97.25
	4	1,038.00	316.00	288.00	272.75	246.75	223.75	180.50	119.75
129.50	1	404.00	125.00	111.25	104.50	93.00	83.50	66.75	44.25
	2	620.75	192.25	174.50	164.25	147.00	132.00	105.50	69.75
	3	852.75	271.00	244.50	230.25	206.50	185.75	148.50	97.25
	4	1,040.25	329.25	298.25	281.00	252.25	228.25	181.25	119.00
137.20	1	404.50	122.50	111.25	106.00	95.00	86.25	68.75	44.75
	2	620.50	191.75	176.00	167.00	150.50	136.00	109.25	71.25
	3	851.50	269.00	247.50	235.25	212.25	192.50	154.50	100.50
	4	1,043.00	328.00	301.50	287.25	259.00	235.75	189.50	123.75
144.80	1	406.50	118.50	110.00	102.25	90.00	80.00	62.75	40.50
	2	617.50	185.25	173.00	160.75	141.75	126.75	99.50	64.75
	3	845.50	259.00	242.50	225.50	199.75	178.50	140.25	91.00
	4	1,036.25	314.50	295.00	274.50	242.75	217.50	171.00	111.00
152.40	1	399.50	115.00	103.75	97.75	87.25	78.00	62.25	41.25
	2	615.75	178.50	162.00	153.25	137.25	124.00	98.50	64.50
	3	847.00	247.25	225.50	212.75	191.00	171.50	136.50	89.00
	4	1,044.00	300.50	273.00	258.50	231.75	210.75	167.50	107.75

Table A-34. Average all point locations FWD deflection measurements extracted for LTPP pavement section 3835

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
All Point Locations	1	411.54	113.48	104.05	98.54	88.75	80.35	63.31	42.48
	2	625.98	176.38	161.86	153.21	138.49	125.54	99.14	66.18
	3	855.24	244.11	225.64	213.81	193.45	175.69	138.96	92.62
	4	1,046.17	298.06	274.07	260.00	235.36	214.31	169.88	113.14

Table A-35. FWD deflection measurements extracted for LTPP pavement section 6079 for FWD test date 6-Nov-91

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
0.00	1	407.00	165.25	148.00	138.75	126.75	112.25	86.25	50.75
	2	608.25	256.25	230.00	215.25	196.50	173.25	134.75	81.25
	3	820.25	349.25	312.50	293.00	267.75	236.25	183.00	109.25
	4	1,058.50	455.50	409.00	382.00	350.50	308.75	240.75	143.25
8.20	1	400.75	256.25	230.00	215.25	196.50	173.25	134.75	81.25
	2	601.75	349.25	312.50	293.00	267.75	236.25	183.00	109.25
	3	815.50	455.50	409.00	382.00	350.50	308.75	240.75	143.25
	4	1,057.50	102.75	96.50	91.00	85.00	77.00	61.00	39.00
15.20	1	399.00	88.00	81.25	74.75	74.00	62.75	53.75	35.50
	2	598.50	134.50	125.75	116.00	112.50	97.75	82.50	55.25
	3	815.75	188.00	174.25	162.25	156.00	137.25	115.00	77.25
	4	1,057.75	248.25	230.00	212.75	206.75	178.00	151.50	102.25
22.90	1	394.25	101.00	94.75	89.75	84.25	78.25	65.50	42.75
	2	591.25	156.25	146.75	140.25	131.75	121.75	102.50	68.00
	3	806.00	216.75	202.75	194.75	183.50	168.25	142.75	95.25
	4	1,047.50	286.25	268.50	256.75	242.25	223.75	189.00	127.00
30.50	1	384.25	114.00	108.50	106.25	100.50	96.75	88.00	39.25
	2	583.25	180.50	172.00	168.50	162.00	155.00	143.00	64.00
	3	795.00	252.00	242.50	237.50	228.75	220.75	204.50	89.00
	4	1,035.00	336.00	324.75	319.25	308.25	297.75	279.75	117.50
38.10	1	378.50	236.25	204.75	189.00	170.75	149.25	114.25	65.25
	2	573.25	359.75	315.00	291.50	264.25	232.00	180.00	102.50
	3	788.00	463.75	408.50	378.50	344.25	304.00	238.25	136.75
	4	1,034.75	580.50	513.00	479.00	436.75	387.50	307.00	177.25
45.70	1	383.50	171.00	162.00	154.50	145.25	131.50	107.00	68.00
	2	580.50	264.50	248.00	238.50	224.00	202.75	166.25	105.50
	3	794.75	355.00	336.50	322.75	302.25	275.75	227.00	145.00
	4	1,031.75	456.50	433.00	415.25	390.50	355.75	294.00	188.75
54.60	1	376.75	229.25	197.25	182.25	163.25	143.50	112.50	66.00
	2	574.50	357.75	306.50	283.50	254.75	224.50	176.50	103.25
	3	790.50	479.25	412.75	383.25	345.75	305.25	239.75	143.75
	4	1,025.75	614.75	529.00	491.75	443.25	393.50	308.75	187.00
61.60	1	380.75	228.25	199.00	184.75	166.50	147.50	116.25	59.25
	2	574.50	346.25	298.50	276.50	248.75	219.00	171.00	85.25
	3	787.25	468.25	404.25	374.00	335.25	295.25	232.00	115.25
	4	1,022.25	601.50	517.00	474.50	429.75	377.25	296.00	149.25
69.20	1	376.25	179.00	154.25	138.75	126.50	110.75	87.50	53.50
	2	566.75	279.75	242.50	220.25	198.75	174.50	137.50	84.75
	3	784.00	390.75	339.50	308.25	278.75	245.50	193.00	117.25
	4	1,024.50	520.25	450.75	414.75	370.00	328.50	259.50	158.25
76.20	1	375.00	219.00	199.25	188.50	170.50	152.00	115.50	67.00
	2	567.00	346.00	313.00	296.00	268.00	238.00	181.75	106.50
	3	781.75	472.50	428.75	405.50	366.00	326.75	250.00	146.75
	4	1,028.00	607.75	550.25	519.00	470.00	418.50	322.00	189.75

Table A-35. FWD deflection measurements extracted for LTPP pavement section 6079 for FWD test date 6-Nov-91 (Cont.)

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
83.80	1	375.00	114.50	104.75	100.25	92.50	83.00	67.75	43.75
	2	570.00	180.75	165.50	157.25	145.25	131.50	108.25	70.00
	3	787.25	250.75	231.00	219.50	202.75	184.25	150.25	97.25
	4	1,047.75	335.50	310.00	294.50	272.50	247.50	203.00	132.25
91.40	1	377.25	108.75	101.50	98.75	90.00	82.50	69.50	44.75
	2	569.50	170.25	160.25	154.50	142.00	130.00	109.50	71.00
	3	786.50	236.75	222.25	214.75	199.00	180.75	151.75	98.75
	4	1,038.00	314.25	296.00	284.00	264.75	242.50	201.00	131.75
99.10	1	374.00	114.00	107.25	103.00	95.50	86.50	71.00	45.75
	2	566.50	183.00	170.25	163.50	152.75	138.75	113.75	72.25
	3	784.00	255.75	239.00	229.00	214.00	195.25	160.00	102.25
	4	1,039.00	344.25	321.00	307.25	286.75	262.25	216.00	137.75
106.70	1	372.75	127.00	117.75	111.50	107.00	97.25	79.25	50.50
	2	566.75	198.50	185.00	176.75	167.50	153.75	127.00	81.25
	3	783.25	274.75	257.00	245.25	232.50	213.50	177.00	112.25
	4	1,041.25	365.00	342.00	325.75	310.75	285.25	236.25	149.25
114.30	1	373.25	230.50	202.75	189.75	170.50	151.25	117.25	69.25
	2	566.25	370.00	324.75	303.00	273.00	241.75	189.75	114.00
	3	781.75	503.75	444.00	413.75	374.25	331.00	258.75	152.50
	4	1,027.00	654.00	579.25	540.75	488.50	433.75	340.25	200.50
122.50	1	379.00	109.50	101.50	96.00	89.25	80.75	66.00	42.75
	2	571.25	172.50	159.75	153.00	141.00	128.75	105.75	69.50
	3	788.00	239.50	222.75	212.25	196.25	179.25	147.75	97.00
	4	1,042.50	318.00	296.25	281.75	262.50	238.00	197.00	128.50
129.50	1	380.75	101.25	96.25	89.25	82.75	77.25	60.75	39.25
	2	571.25	159.50	149.75	141.25	131.50	120.75	99.25	64.75
	3	786.75	218.00	206.25	194.00	180.50	166.00	135.50	87.00
	4	1,042.75	291.75	275.00	261.75	244.50	223.25	184.75	119.00
137.20	1	383.75	91.25	85.50	81.25	76.00	69.00	57.00	37.50
	2	575.00	145.50	134.00	127.50	118.50	108.00	90.00	60.75
	3	790.00	198.00	184.25	174.50	162.50	149.50	124.25	82.75
	4	1,040.25	262.75	244.50	232.25	216.50	197.75	164.75	110.00
145.40	1	379.75	90.00	85.25	78.25	72.75	67.50	55.50	36.25
	2	569.25	139.50	131.00	123.00	113.00	104.50	87.00	58.00
	3	784.75	193.75	181.00	169.75	157.75	144.75	120.75	80.00
	4	1,039.25	256.75	240.00	226.75	210.75	192.75	160.25	104.75
152.40	1	375.00	85.25	79.25	75.75	69.25	62.50	52.00	33.50
	2	568.25	133.00	123.25	117.25	109.00	98.25	81.00	53.25
	3	783.00	183.50	170.00	162.25	149.50	137.00	112.25	73.00
	4	1,042.25	243.00	225.75	214.25	199.50	180.25	148.50	97.25

Table A-36. Average all point locations FWD deflection measurements extracted for LTPP pavement section 6079

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
All Point Locations	1	382.21	143.13	129.87	122.00	112.32	100.90	81.12	49.02
	2	576.83	223.54	202.36	190.68	175.50	157.73	127.76	77.76
	3	792.10	305.11	277.25	261.32	240.80	217.08	175.98	106.80
	4	1,039.20	398.94	362.90	342.20	316.30	285.01	232.05	141.14

Table A-37. FWD deflection measurements extracted for LTPP pavement section 9005 for FWD test date 13-Aug-09

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
0.00	1	377.00	151.25	109.75	81.00	59.50	47.25	28.75	18.00	11.75
	2	605.25	258.75	191.00	140.75	104.25	80.75	47.50	29.00	18.25
	3	812.25	368.50	272.00	202.00	151.00	116.75	68.25	41.00	24.75
	4	1,028.50	498.75	368.50	275.25	205.75	160.50	93.00	55.00	33.75
7.60	1	375.50	258.75	191.00	140.75	104.25	80.75	47.50	29.00	18.25
	2	597.75	368.50	272.00	202.00	151.00	116.75	68.25	41.00	24.75
	3	813.25	498.75	368.50	275.25	205.75	160.50	93.00	55.00	33.75
	4	1,027.75	137.00	93.50	66.25	46.50	38.00	21.25	15.00	10.75
15.20	1	373.75	136.50	92.00	63.25	43.75	34.00	19.75	12.75	8.00
	2	593.25	226.75	154.00	105.75	72.00	53.50	30.00	18.00	11.50
	3	810.25	325.00	221.00	151.50	103.00	76.00	42.00	24.25	15.00
	4	1,025.00	441.25	303.25	210.50	144.50	103.25	55.00	30.50	18.75
22.90	1	372.50	136.50	88.75	62.50	46.00	35.00	20.50	12.25	7.75
	2	595.75	228.00	150.50	105.50	77.25	56.25	33.00	20.50	13.00
	3	808.50	322.25	215.00	153.00	109.00	80.00	46.00	27.00	17.25
	4	1,026.00	434.00	294.75	212.25	153.25	111.00	61.00	35.00	22.25
30.50	1	367.50	154.75	104.25	68.75	49.75	35.75	21.00	12.25	10.00
	2	591.25	259.25	175.00	115.25	81.00	59.25	34.00	20.75	13.75
	3	804.50	362.25	246.50	166.00	115.00	84.00	47.00	28.00	18.00
	4	1,023.00	485.75	335.50	231.75	160.75	114.25	62.00	35.00	22.75
38.10	1	368.25	141.00	96.50	67.25	51.50	39.75	25.25	16.25	10.75
	2	595.25	246.00	167.25	119.75	88.50	67.00	42.00	26.75	16.75
	3	805.25	349.50	242.50	175.00	130.00	98.25	60.00	37.00	23.00
	4	1,020.00	472.75	331.25	241.75	180.50	137.50	81.75	49.75	30.25
45.70	1	368.50	131.00	87.25	58.50	42.00	32.25	19.00	10.00	8.75
	2	591.00	221.25	147.75	101.25	71.50	53.75	30.50	17.50	12.25
	3	811.50	316.25	212.25	146.75	103.50	77.00	43.25	23.75	15.50
	4	1,026.25	425.75	290.00	203.25	145.75	108.00	57.75	31.75	19.50
53.30	1	369.75	152.00	98.50	63.50	45.50	38.00	24.00	15.00	9.50
	2	592.75	259.50	168.75	113.50	80.50	63.25	39.00	24.00	14.50
	3	806.75	370.00	242.75	164.25	118.50	87.50	52.75	32.00	20.00
	4	1,020.25	496.50	330.75	227.50	164.50	123.50	72.75	44.00	27.00
61.00	1	370.25	158.00	111.75	75.25	55.50	40.25	27.00	21.50	12.75
	2	593.00	270.50	189.00	133.00	98.25	79.00	49.25	31.50	21.25
	3	807.25	385.75	272.00	192.75	142.75	112.75	71.25	46.50	31.00
	4	1,018.00	519.25	367.50	263.00	194.00	153.25	98.00	63.00	43.25
68.60	1	365.00	228.00	155.00	122.00	90.00	79.25	54.75	41.75	31.75
	2	584.75	381.25	269.00	198.00	156.75	130.00	94.50	68.25	52.50
	3	800.50	534.75	369.25	287.50	212.00	182.50	124.00	94.75	70.00
	4	1,013.75	706.00	497.00	377.50	284.75	238.75	167.25	124.50	95.25
76.20	1	370.25	181.50	140.25	115.00	95.75	80.75	59.00	43.00	31.75
	2	592.00	307.25	238.25	193.75	160.00	134.50	97.00	69.75	50.75
	3	793.75	440.25	340.00	275.75	225.50	188.75	135.50	97.50	71.50
	4	1,001.25	591.00	456.50	367.75	298.25	247.75	177.00	127.00	93.25

Table A-37. FWD deflection measurements extracted for LTPP pavement section 9005 for FWD test date 13-Aug-09 (Cont.)

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
83.80	1	366.25	215.50	167.00	141.00	117.25	98.00	68.75	48.50	34.25
	2	588.25	366.50	285.25	242.00	200.25	166.00	115.50	80.00	57.00
	3	801.50	518.75	406.50	345.75	285.00	236.00	163.25	113.25	80.00
	4	1,005.50	697.25	548.75	464.75	381.50	315.25	216.50	149.50	105.25
91.40	1	364.00	211.00	152.75	122.50	98.50	78.00	51.50	34.25	24.00
	2	586.50	360.00	259.75	209.75	167.75	132.75	86.25	58.00	40.00
	3	796.75	504.25	369.25	298.75	238.00	189.00	122.00	81.00	57.00
	4	1,002.50	673.50	495.25	401.25	318.50	252.50	162.25	107.00	75.00
99.10	1	364.50	220.00	163.75	133.75	108.25	97.00	63.50	42.50	34.75
	2	586.00	372.75	280.75	227.50	181.75	150.25	102.25	72.25	52.75
	3	799.75	530.00	399.50	323.50	257.50	210.25	143.75	101.00	74.25
	4	1,008.00	707.00	536.00	432.75	342.25	278.25	187.75	131.75	96.25
106.70	1	362.00	196.75	144.75	116.00	89.25	73.75	53.00	39.00	29.00
	2	583.75	331.00	244.50	194.00	151.25	123.75	87.25	64.00	48.25
	3	798.00	470.50	349.25	273.25	214.75	175.25	124.75	90.50	67.00
	4	1,006.25	632.50	470.75	367.25	287.75	233.25	164.00	118.50	88.50
114.30	1	362.25	241.75	174.50	139.25	101.00	91.50	61.75	44.00	35.25
	2	581.00	403.00	294.00	236.75	167.00	155.00	98.25	68.75	60.25
	3	795.00	564.00	416.25	329.50	243.75	212.75	141.25	101.75	79.25
	4	1,005.00	751.50	556.50	435.25	334.25	276.25	189.75	136.75	103.00
121.90	1	358.00	274.50	195.75	141.75	109.50	89.50	64.00	47.00	36.00
	2	574.50	458.25	325.25	239.00	182.00	147.75	104.25	76.00	57.50
	3	791.25	636.25	460.75	341.50	257.50	207.75	145.00	106.00	80.25
	4	1,003.75	843.00	616.00	458.00	343.00	274.50	189.25	136.25	104.75
129.50	1	349.75	304.75	214.50	153.50	110.25	93.50	62.25	49.00	38.50
	2	566.00	510.00	360.75	261.50	187.25	153.50	103.25	80.00	61.75
	3	779.75	714.00	508.50	369.75	268.25	213.50	148.00	110.75	85.25
	4	990.00	948.00	680.00	496.50	359.00	282.00	194.50	144.00	111.50
137.20	1	347.25	481.50	355.25	264.25	201.25	164.25	113.00	76.50	54.75
	2	559.25	786.50	583.50	444.50	339.00	274.25	185.75	126.00	91.50
	3	773.50	1,084.00	812.75	621.50	477.25	384.00	257.75	176.25	128.75
	4	980.50	1,407.00	1,066.50	817.00	629.75	504.50	335.00	230.00	168.25
144.80	1	361.00	269.00	222.00	181.25	147.75	118.75	77.50	51.25	37.25
	2	580.75	455.50	374.75	310.75	252.00	205.25	130.25	85.00	58.50
	3	800.50	650.75	536.00	445.25	359.75	293.50	185.00	120.50	82.00
	4	1,019.75	875.25	715.50	592.50	474.50	393.00	245.00	157.25	108.25
152.40	1	353.00	354.00	264.00	210.00	166.25	130.50	84.50	56.75	41.25
	2	572.25	603.00	449.25	360.50	283.75	222.25	139.75	93.25	66.75
	3	781.25	843.75	632.75	511.00	400.50	315.50	196.75	131.75	94.00
	4	984.75	1,122.00	846.75	685.25	535.75	422.25	260.00	172.25	123.75

Table A-38. Average all point locations FWD deflection measurements extracted for LTPP pavement section 9005

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
All Point Locations	1	365.06	213.15	153.89	116.50	89.29	73.10	48.57	33.64	24.69
	2	586.20	358.93	260.19	198.51	151.36	122.32	80.15	54.73	39.55
	3	799.57	505.82	369.19	282.79	215.54	172.64	112.67	76.76	54.85
	4	1,011.23	675.20	496.25	380.51	290.36	230.87	149.32	100.65	72.04

Table A-39. FWD deflection measurements extracted for LTPP pavement section A502 for FWD test date 29-Apr-91

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
0.00	1	426.50	71.75	45.75	40.75	38.75	37.00	33.00	27.00
	2	595.00	101.00	65.25	59.25	57.50	54.75	48.25	38.50
	3	801.50	134.00	86.75	78.50	76.00	72.50	64.25	51.00
	4	1,035.50	169.50	109.75	99.75	95.75	91.25	80.00	63.75
15.20	1	427.25	101.00	65.25	59.25	57.50	54.75	48.25	38.50
	2	596.00	134.00	86.75	78.50	76.00	72.50	64.25	51.00
	3	796.75	169.50	109.75	99.75	95.75	91.25	80.00	63.75
	4	1,022.25	87.00	50.00	45.25	44.25	43.25	37.25	29.00
30.50	1	423.75	116.25	50.75	42.00	40.50	38.00	35.25	28.00
	2	591.25	154.00	71.00	60.00	57.75	55.00	49.50	39.00
	3	788.25	200.25	95.00	79.75	76.00	73.50	66.00	51.25
	4	1,008.50	253.25	119.25	101.25	96.25	92.00	81.50	63.50
45.70	1	426.00	104.25	64.50	54.75	50.75	45.75	39.25	29.75
	2	595.75	144.75	92.50	79.25	74.50	67.50	57.00	43.75
	3	791.75	194.00	121.75	105.00	98.25	89.25	75.25	55.75
	4	1,005.75	252.25	153.50	134.75	126.75	114.50	95.00	71.00
61.00	1	426.50	74.25	56.50	47.50	46.25	44.00	38.00	29.75
	2	594.50	106.75	80.00	67.00	66.00	63.50	55.00	42.50
	3	796.25	143.75	106.50	90.00	89.00	84.25	72.50	56.00
	4	1,029.75	185.75	134.25	114.00	112.50	107.00	92.00	69.75
76.20	1	417.50	102.75	67.75	58.75	53.25	50.50	40.50	30.25
	2	585.25	144.50	97.25	84.50	77.25	70.25	58.50	42.75
	3	790.25	192.50	129.25	112.25	102.25	94.00	78.00	56.00
	4	1,026.00	250.75	165.50	144.25	131.25	121.75	99.75	71.00
91.40	1	424.00	73.25	55.50	48.50	45.25	43.00	38.00	30.25
	2	592.25	108.00	78.50	68.00	64.00	61.25	54.75	43.00
	3	795.25	139.00	102.75	90.25	84.25	79.75	71.25	55.25
	4	1,036.00	178.25	131.50	115.25	108.00	102.25	91.00	70.25
121.90	1	406.00	161.25	75.75	56.00	50.25	48.25	42.75	32.25
	2	569.50	213.50	105.25	79.00	71.75	67.50	60.50	46.00
	3	784.25	278.75	138.00	104.75	95.00	89.75	80.25	60.00
	4	1,035.75	350.50	175.25	133.00	121.25	115.00	102.25	76.25
137.20	1	419.00	126.75	70.50	53.50	47.50	45.75	41.75	32.50
	2	587.25	174.25	99.00	76.25	68.00	65.75	59.25	46.50
	3	789.50	228.00	129.00	100.75	90.75	86.75	78.25	60.25
	4	1,017.25	290.50	161.75	126.00	114.25	111.00	99.75	78.50
152.40	1	412.75	163.00	77.50	62.25	60.25	57.25	47.75	34.75
	2	582.25	224.75	111.00	90.50	86.25	81.25	69.00	51.50
	3	785.75	296.00	147.00	120.50	114.25	107.50	91.00	66.50
	4	1,007.75	378.75	188.75	155.00	146.50	138.75	115.50	84.25

Table A-40. Average all point locations FWD deflection measurements extracted for LTPP pavement section A502

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
All Point Locations	1	420.93	108.05	61.45	50.93	47.70	45.28	39.35	30.35
	2	588.90	149.18	86.85	72.60	68.48	64.73	56.33	43.33
	3	791.95	196.43	114.98	96.55	90.68	85.60	74.53	56.48
	4	1,022.45	251.18	145.73	123.00	115.68	109.48	94.40	71.53

Table A-41. FWD deflection measurements extracted for LTPP pavement section A504 for FWD test date 25-Apr-02

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
0.00	1	395.75	101.75	57.00	47.25	42.25	39.00	34.25	29.75	26.25
	2	578.00	144.75	82.50	68.50	61.25	56.75	50.00	43.00	37.50
	3	793.75	189.50	107.50	89.25	79.75	73.50	64.75	56.00	48.25
	4	1,056.75	239.50	136.00	113.00	100.50	93.00	81.75	70.75	60.75
15.20	1	405.00	144.75	82.50	68.50	61.25	56.75	50.00	43.00	37.50
	2	588.25	189.50	107.50	89.25	79.75	73.50	64.75	56.00	48.25
	3	798.50	239.50	136.00	113.00	100.50	93.00	81.75	70.75	60.75
	4	1,056.00	93.00	64.50	55.75	49.50	44.00	37.75	32.75	28.00
30.50	1	397.25	144.00	94.50	75.25	59.00	49.25	39.75	33.25	28.50
	2	581.00	207.00	137.50	110.50	86.25	72.50	58.25	49.25	41.75
	3	796.75	273.00	182.25	146.75	114.75	96.50	77.75	65.00	54.75
	4	1,053.50	349.50	232.25	187.50	146.75	124.00	98.75	82.75	69.50
45.70	1	399.50	161.50	127.25	109.25	85.50	68.25	49.25	38.50	31.25
	2	584.25	235.75	186.00	159.50	124.75	100.50	73.00	56.75	46.00
	3	795.75	312.25	245.75	211.00	165.75	133.50	97.00	76.00	61.25
	4	1,038.50	398.25	311.25	266.75	210.00	169.25	123.00	96.25	77.00
61.00	1	401.25	129.75	87.50	68.75	56.75	48.00	39.75	33.75	28.75
	2	583.00	185.75	124.25	99.00	81.50	69.75	57.00	49.00	41.25
	3	796.50	243.00	163.50	130.50	107.50	92.50	76.25	64.50	54.25
	4	1,055.50	309.00	206.50	165.50	136.50	117.75	96.75	81.75	68.25
76.20	1	403.00	97.50	62.75	52.75	47.75	43.25	36.75	31.25	27.25
	2	586.25	140.75	90.50	76.75	69.00	63.00	53.25	45.50	38.75
	3	797.25	186.25	118.75	101.50	91.00	82.75	70.00	60.00	50.75
	4	1,055.50	237.25	149.75	128.00	115.00	104.75	88.25	74.75	62.75
91.40	1	394.75	114.00	65.50	56.00	50.75	45.75	39.25	33.25	28.75
	2	575.50	158.25	94.50	81.00	73.25	66.50	56.75	48.25	41.25
	3	791.25	210.00	124.75	107.75	97.75	88.00	74.50	63.75	53.75
	4	1,059.25	260.00	158.75	137.25	123.75	111.75	94.75	80.00	67.75
106.70	1	397.75	98.00	65.75	56.25	51.00	46.50	39.75	34.50	29.75
	2	579.25	142.75	94.75	81.75	73.75	67.75	57.75	50.00	42.75
	3	795.50	189.00	126.00	108.00	97.25	89.25	77.00	66.25	56.25
	4	1,057.50	242.50	159.50	135.75	122.75	112.75	96.50	82.75	69.75
121.90	1	397.25	113.50	68.00	58.00	52.50	48.00	41.00	35.75	31.00
	2	579.00	160.50	97.00	84.00	76.00	69.00	59.50	51.50	44.00
	3	793.75	210.50	129.00	113.00	101.00	92.50	79.75	68.75	58.75
	4	1,057.50	263.50	162.50	142.00	127.00	116.00	99.50	85.00	72.50
137.20	1	394.75	90.25	62.25	56.00	51.00	46.00	40.25	35.00	30.25
	2	573.75	128.75	89.00	80.50	72.75	66.25	57.75	49.50	42.50
	3	791.25	173.25	117.75	106.25	95.75	88.00	76.25	65.50	57.00
	4	1,059.50	217.75	149.50	134.25	120.75	110.75	96.00	82.25	71.25
152.40	1	392.50	92.25	57.50	50.25	45.50	41.25	36.25	32.00	28.25
	2	571.25	133.00	83.75	72.50	65.50	60.00	52.50	46.25	40.50
	3	790.00	175.50	110.50	95.25	86.00	78.75	68.50	60.00	52.00
	4	1,061.00	225.00	140.75	121.50	109.00	99.75	86.75	75.75	65.75

Table A-42. Average all point locations FWD deflection measurements extracted for LTPP pavement section A504

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
All Point Locations	1	398.07	112.32	73.86	62.32	53.77	47.20	39.45	33.61	28.91
	2	579.95	161.02	106.61	90.45	77.73	68.73	57.32	48.75	41.55
	3	794.57	212.91	140.73	119.61	102.68	90.84	75.80	64.34	54.55
	4	1,055.50	270.07	178.30	151.48	129.98	115.11	95.75	80.93	68.36

Table A-43. FWD deflection measurements extracted for LTPP pavement section A505 for FWD test date 15-Jul-93

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
0.00	1	402.75	89.50	64.75	57.00	49.75	44.75	36.25	24.50
	2	591.00	127.00	94.75	83.50	73.00	65.25	53.25	36.00
	3	790.00	167.50	123.25	109.75	95.75	85.75	68.75	46.25
	4	1,036.25	213.00	157.75	139.50	122.75	109.75	89.75	58.75
15.20	1	399.75	127.00	94.75	83.50	73.00	65.25	53.25	36.00
	2	590.75	167.50	123.25	109.75	95.75	85.75	68.75	46.25
	3	788.75	213.00	157.75	139.50	122.75	109.75	89.75	58.75
	4	1,043.50	75.25	51.75	43.75	38.75	36.00	30.75	23.50
30.50	1	399.00	71.50	47.00	41.50	37.00	34.50	29.25	21.75
	2	589.75	102.75	70.00	62.75	55.50	51.50	44.25	33.25
	3	789.25	134.75	90.50	80.25	72.25	66.50	56.75	41.75
	4	1,043.00	171.25	116.25	103.50	92.25	84.75	73.25	53.50
45.70	1	399.00	126.75	69.25	50.75	39.50	36.00	31.00	24.00
	2	592.00	184.75	100.50	74.50	58.75	53.50	46.75	35.00
	3	793.75	238.50	130.50	95.75	75.75	68.50	61.50	44.75
	4	1,045.75	303.00	165.75	121.50	96.75	88.00	77.00	56.00
61.00	1	402.75	74.25	55.00	47.75	40.75	37.75	33.50	24.75
	2	593.50	110.00	81.75	69.75	61.50	56.25	49.25	37.00
	3	795.50	147.00	106.75	92.00	81.00	74.75	65.50	48.75
	4	1,042.00	189.00	136.75	118.50	103.00	95.50	83.75	62.00
76.20	1	403.00	161.50	97.50	75.00	59.00	52.25	45.00	32.00
	2	594.50	229.25	144.00	110.50	89.25	79.75	68.00	45.25
	3	794.75	294.75	183.50	142.75	114.75	102.50	87.50	58.25
	4	1,041.00	373.50	234.50	182.75	148.75	132.50	113.00	74.75
91.40	1	403.25	86.25	68.00	61.00	54.50	52.50	45.25	33.50
	2	593.50	124.75	98.50	89.00	80.50	75.50	65.50	47.75
	3	795.25	164.00	128.75	116.25	105.75	99.00	85.75	62.25
	4	1,043.25	209.75	163.50	148.00	134.50	126.75	110.00	79.00
106.70	1	404.75	76.50	62.00	57.50	52.75	49.75	44.25	33.25
	2	597.25	111.50	91.75	84.50	78.00	73.75	65.00	48.50
	3	799.25	145.75	118.00	109.75	100.75	94.75	83.75	62.75
	4	1,051.50	185.25	149.00	138.50	129.50	121.00	106.00	79.25
121.90	1	401.00	76.50	62.00	57.00	53.00	49.00	44.00	33.00
	2	591.00	111.75	90.75	83.75	77.75	73.25	65.00	48.25
	3	794.50	146.25	117.75	108.00	100.00	93.75	83.75	61.00
	4	1,043.25	185.50	149.00	137.50	126.75	119.75	105.75	77.75
137.20	1	401.75	80.00	61.00	57.00	53.00	50.00	45.75	36.00
	2	595.50	118.25	90.25	83.75	78.25	75.00	67.25	52.25
	3	796.50	154.75	117.25	109.00	102.00	97.00	86.75	67.50
	4	1,045.00	199.75	149.25	139.25	131.00	124.25	111.50	86.75
152.40	1	403.75	85.25	68.00	64.00	59.25	56.00	49.00	38.00
	2	593.25	127.00	100.25	94.00	88.00	83.00	73.25	56.00
	3	794.25	165.25	130.00	121.25	113.00	107.50	94.00	72.25
	4	1,041.75	212.75	164.25	154.00	144.50	136.50	120.00	90.50

Table A-44. Average all point locations FWD deflection measurements extracted for LTPP pavement section A505

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
All Point Locations	1	401.89	91.20	64.20	55.66	48.84	45.32	39.45	29.48
	2	592.91	132.34	94.39	81.95	72.52	67.25	58.48	43.05
	3	793.80	172.64	122.18	106.30	94.07	87.07	75.70	55.41
	4	1,043.30	220.16	155.52	135.52	120.41	111.41	96.86	70.43

Table A-45. FWD deflection measurements extracted for LTPP pavement section A507 for FWD test date 1-May-91

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
0.00	1	452.50	63.00	51.50	49.25	46.00	43.00	35.00	27.50
	2	616.25	85.00	71.75	68.00	64.00	62.25	48.75	38.00
	3	824.00	114.75	97.00	91.00	85.00	81.00	65.50	50.50
	4	1,049.75	144.75	123.75	115.50	108.00	101.00	84.00	64.50
15.20	1	440.25	85.00	71.75	68.00	64.00	62.25	48.75	38.00
	2	602.75	114.75	97.00	91.00	85.00	81.00	65.50	50.50
	3	805.75	144.75	123.75	115.50	108.00	101.00	84.00	64.50
	4	1,039.75	55.25	45.50	41.25	38.00	36.25	33.25	26.75
30.50	1	441.75	78.00	55.00	48.25	43.50	41.50	37.00	28.75
	2	602.25	106.00	75.75	63.50	61.25	57.25	50.50	39.00
	3	800.00	142.75	99.75	86.25	80.75	76.50	68.75	52.75
	4	1,040.00	180.25	126.75	109.50	103.75	98.25	87.00	66.50
45.70	1	437.75	64.00	54.75	50.25	46.25	43.25	36.25	28.75
	2	601.75	86.75	76.75	70.50	63.75	60.00	50.75	39.00
	3	803.50	118.50	102.00	93.50	85.50	80.00	68.00	52.00
	4	1,028.25	150.50	129.25	119.00	108.75	103.75	85.25	71.25
61.00	1	430.25	75.25	64.50	60.00	57.00	51.00	42.00	29.75
	2	593.25	102.00	87.50	82.50	78.50	69.50	56.50	40.25
	3	795.00	135.75	119.00	111.00	105.50	93.00	76.25	53.50
	4	1,018.25	175.25	151.25	141.75	135.00	120.00	95.75	67.75
76.20	1	429.00	103.00	81.00	72.00	64.50	59.50	47.75	33.25
	2	593.25	137.75	111.50	99.00	89.50	81.75	66.00	45.75
	3	790.00	186.50	148.75	132.00	120.50	110.75	88.75	62.00
	4	1,005.00	239.00	191.00	169.00	153.50	142.50	113.00	78.25
91.40	1	426.25	89.25	58.75	54.75	51.00	48.00	39.25	30.75
	2	587.50	116.75	80.50	74.50	68.75	64.25	55.50	39.00
	3	792.25	157.25	108.50	100.50	93.00	87.00	73.25	54.00
	4	1,017.00	198.75	137.00	128.00	118.00	110.75	93.00	71.00
106.70	1	427.00	151.50	121.50	100.75	83.75	71.75	51.00	36.25
	2	587.25	206.75	166.50	139.25	116.00	98.50	71.75	49.00
	3	792.50	277.75	224.25	187.75	156.25	131.75	96.75	66.25
	4	1,007.75	353.25	285.75	239.25	200.75	170.50	125.75	86.75
121.90	1	422.75	187.75	126.25	95.25	76.00	64.75	47.75	36.75
	2	586.50	253.25	173.25	132.50	105.75	87.50	68.25	47.75
	3	786.75	337.75	228.50	175.75	140.25	119.00	91.50	64.25
	4	998.50	428.50	290.50	224.00	178.50	157.00	115.50	90.00
137.20	1	412.00	257.50	166.50	130.75	107.50	90.50	68.50	39.75
	2	570.50	343.50	226.25	177.75	146.75	125.50	93.50	56.00
	3	784.00	447.50	298.25	236.25	195.75	167.75	125.75	76.00
	4	1,017.25	556.25	374.50	298.00	248.50	212.50	158.75	95.75
152.40	1	422.50	151.25	92.75	73.25	62.25	54.00	43.00	30.25
	2	579.25	197.00	125.25	100.25	83.00	73.00	58.00	39.75
	3	791.25	255.50	164.50	131.25	111.50	97.50	78.00	54.25
	4	1,023.75	320.50	207.75	166.00	141.75	123.75	98.25	67.25

Table A-46. Average all point locations FWD deflection measurements extracted for LTPP pavement section A507

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
All Point Locations	1	431.09	115.98	83.45	70.52	61.43	54.86	43.70	31.68
	2	592.77	155.45	114.32	96.82	84.57	75.48	60.48	42.70
	3	796.82	206.84	152.14	129.27	113.23	101.05	81.25	57.68
	4	1,022.30	261.61	193.05	164.30	144.32	129.64	103.14	74.66

Table A-47. FWD deflection measurements extracted for LTPP pavement section A508 for FWD test date 30-Apr-91

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
0.00	1	441.75	90.25	83.25	75.00	67.75	57.75	47.75	33.25
	2	603.00	127.25	113.75	103.50	92.75	80.00	65.00	46.50
	3	792.00	170.25	150.00	136.50	122.75	106.00	84.75	60.75
	4	1,060.00	210.50	191.25	172.75	156.50	134.50	109.00	76.00
15.80	1	439.75	127.25	113.75	103.50	92.75	80.00	65.00	46.50
	2	607.00	170.25	150.00	136.50	122.75	106.00	84.75	60.75
	3	804.25	210.50	191.25	172.75	156.50	134.50	109.00	76.00
	4	1,019.00	121.25	101.00	86.00	76.00	66.75	55.50	37.50
30.50	1	441.00	98.00	80.25	73.25	65.25	58.00	49.50	35.75
	2	604.00	133.50	111.50	101.00	91.50	79.50	69.75	50.25
	3	799.50	176.00	146.50	132.75	120.00	105.25	91.50	65.00
	4	1,023.00	224.50	184.75	167.75	152.75	133.00	118.75	83.50
46.30	1	430.50	71.25	60.25	53.25	48.50	45.25	37.25	28.00
	2	595.75	100.25	83.00	76.50	68.75	63.75	54.75	40.50
	3	801.50	132.00	110.75	100.50	92.25	85.50	72.00	53.50
	4	1,023.75	167.50	138.25	127.00	116.00	107.50	90.00	65.50
61.00	1	428.50	97.25	75.50	66.50	59.50	53.25	43.75	30.75
	2	593.25	133.50	104.50	93.25	82.00	73.25	60.00	42.00
	3	796.75	177.25	139.75	124.25	110.00	99.25	81.50	57.50
	4	1,014.50	224.50	178.00	159.50	141.25	126.50	104.50	74.00
76.20	1	426.00	93.75	86.25	79.75	71.75	64.50	54.25	37.00
	2	592.75	131.75	120.00	111.50	100.25	90.00	75.50	52.50
	3	796.25	176.75	161.00	148.00	135.50	121.00	100.25	70.00
	4	1,014.25	222.50	206.00	190.25	172.25	154.75	127.75	88.00
91.40	1	427.75	83.75	75.75	67.75	62.00	56.25	47.00	33.75
	2	592.25	118.50	106.00	96.00	87.50	79.00	66.25	47.25
	3	796.50	159.50	144.75	131.25	118.25	107.75	89.50	63.50
	4	1,016.75	203.25	184.75	168.00	151.00	136.25	113.25	78.75
106.70	1	417.50	151.25	115.25	95.00	75.50	63.75	49.25	32.50
	2	581.00	207.00	157.75	132.00	105.50	89.25	69.00	46.50
	3	784.75	277.50	211.25	178.00	143.25	121.75	94.25	63.00
	4	994.50	353.75	258.75	220.75	179.00	154.50	118.75	80.25
121.90	1	427.50	114.25	98.25	89.25	80.00	72.00	58.00	39.00
	2	588.00	157.50	136.00	125.00	112.00	100.50	80.75	53.75
	3	790.50	210.00	183.25	166.75	151.00	134.75	108.00	72.00
	4	1,004.00	266.25	232.50	213.75	191.25	171.25	138.50	89.00
137.20	1	419.00	137.25	120.00	110.25	97.25	86.00	69.25	45.50
	2	579.75	188.75	167.25	151.75	134.50	117.50	96.75	64.50
	3	789.75	256.50	225.25	204.50	181.00	158.75	129.25	84.50
	4	1,015.25	325.25	286.00	261.00	231.00	202.25	164.50	107.50
152.40	1	423.25	104.25	89.00	79.00	72.00	64.50	53.50	36.25
	2	587.25	146.75	125.50	111.50	100.75	90.75	75.50	52.75
	3	791.00	197.50	166.75	148.75	136.25	122.25	100.75	69.00
	4	1,009.50	253.50	213.50	190.25	174.75	155.75	127.00	86.25

Table A-48. Average all point locations FWD deflection measurements extracted for LTPP pavement section A508

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
All Point Locations	1	429.32	105.68	89.52	79.55	70.50	62.55	51.36	35.39
	2	593.09	146.52	124.02	110.93	98.18	86.93	71.82	49.95
	3	794.80	195.98	165.64	148.02	131.66	116.89	95.68	66.18
	4	1,017.68	248.55	209.66	188.25	167.41	148.48	121.91	83.34

Table A-49. FWD deflection measurements extracted for LTPP pavement section B310 for FWD test date 24-Apr-02

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
0.00	1	408.25	123.75	67.75	57.50	51.00	46.25	40.00	34.75
	2	589.50	174.25	97.75	82.75	73.00	67.50	58.50	50.25
	3	799.00	229.25	128.50	109.75	96.25	88.50	76.75	65.00
	4	1,033.75	290.25	162.75	138.75	121.75	111.00	96.50	82.25
30.50	1	410.75	174.25	97.75	82.75	73.00	67.50	58.50	50.25
	2	597.25	229.25	128.50	109.75	96.25	88.50	76.75	65.00
	3	794.00	290.25	162.75	138.75	121.75	111.00	96.50	82.25
	4	1,016.75	105.75	64.50	50.50	42.75	38.00	32.25	28.50
61.00	1	408.00	109.50	67.50	54.00	48.00	44.25	37.50	32.75
	2	595.50	154.75	97.50	78.50	69.25	65.25	54.25	46.75
	3	793.75	205.00	127.25	103.25	91.00	85.75	71.25	61.00
	4	1,016.75	260.00	163.25	131.75	116.25	109.50	90.50	77.25
91.40	1	407.50	122.25	69.00	60.50	54.25	50.00	43.00	36.25
	2	592.50	167.75	98.25	86.50	77.50	71.00	61.00	51.50
	3	798.50	221.75	130.00	114.75	102.50	94.25	81.00	67.75
	4	1,030.75	279.00	165.00	145.75	130.50	119.50	102.50	86.00
121.90	1	410.50	58.50	44.25	40.75	37.00	34.00	29.75	24.75
	2	596.25	82.50	63.75	58.25	53.00	48.75	42.50	36.75
	3	802.25	110.50	84.25	77.50	71.00	65.25	56.25	48.75
	4	1,041.50	142.00	107.75	98.75	90.00	82.75	71.25	61.75
152.40	1	407.00	81.75	51.50	41.25	36.75	33.75	29.75	26.25
	2	593.00	116.75	74.75	60.25	53.00	49.50	43.50	38.00
	3	799.75	155.25	99.50	80.25	70.00	65.75	58.25	50.50
	4	1,042.50	199.75	127.75	101.75	89.00	84.00	74.00	64.00

Table A-50. Average all point locations FWD deflection measurements extracted for LTPP pavement section B310

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
All Point Locations	1	408.67	100.25	60.75	50.75	44.96	41.04	35.38	30.54
	2	594.00	140.79	87.33	73.13	64.54	59.54	51.17	44.13
	3	797.88	185.92	114.88	96.67	85.21	78.54	67.50	57.67
	4	1,030.33	236.54	146.42	122.75	108.08	99.63	85.46	73.00

Table A-51. FWD deflection measurements extracted for LTPP pavement section B320 for FWD test date 24-Apr-02

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
0.00	1	408.75	111.75	54.00	47.25	45.25	42.50	37.50	32.25	27.75
	2	594.50	157.00	78.50	67.25	64.50	60.50	53.25	45.50	39.25
	3	796.75	211.00	105.00	89.50	85.75	80.25	71.00	60.75	51.75
	4	1,025.50	268.75	134.00	114.75	108.75	102.75	90.25	77.50	65.50
30.50	1	414.50	157.00	78.50	67.25	64.50	60.50	53.25	45.50	39.25
	2	601.25	211.00	105.00	89.50	85.75	80.25	71.00	60.75	51.75
	3	786.00	268.75	134.00	114.75	108.75	102.75	90.25	77.50	65.50
	4	1,007.75	118.00	71.75	57.00	51.50	47.00	41.50	36.25	31.00
61.00	1	408.25	124.00	80.75	67.50	63.00	58.25	48.50	39.50	34.00
	2	594.25	173.75	117.25	97.75	92.75	83.00	70.25	58.25	48.50
	3	790.00	230.75	156.25	131.00	123.75	110.50	93.00	77.25	64.25
	4	1,006.00	292.00	200.00	168.00	158.00	141.25	118.50	97.75	81.00
91.40	1	412.75	102.00	66.25	57.00	55.75	53.00	46.50	41.25	35.50
	2	599.50	151.50	95.50	84.00	80.25	75.25	68.00	58.75	50.50
	3	778.00	196.00	127.75	110.25	105.75	100.75	88.50	77.50	65.75
	4	1,015.00	251.00	163.50	141.25	134.75	128.25	113.00	97.25	82.25
121.90	1	407.00	141.50	73.75	62.50	56.25	55.25	46.75	40.50	36.25
	2	591.50	194.00	107.00	88.75	83.25	77.00	69.50	59.75	50.50
	3	788.50	258.25	141.25	118.50	109.00	103.25	90.50	77.25	65.75
	4	1,006.00	329.75	179.75	152.50	137.75	132.50	114.25	97.25	82.75
152.40	1	408.00	105.00	63.00	55.75	52.75	49.00	42.75	36.00	31.25
	2	598.00	152.50	91.25	80.75	76.00	70.75	62.00	52.25	45.25
	3	787.00	193.25	119.50	103.50	99.00	91.50	79.25	67.00	57.75
	4	1,008.75	251.25	150.50	132.25	124.00	116.75	101.00	85.50	73.25

Table A-52. Average all point locations FWD deflection measurements extracted for LTPP pavement section B320

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**							
			D1	D2	D3	D4	D5	D6	D7	D8
All Point Locations	1	409.88	117.04	68.25	57.83	54.08	50.83	43.92	37.63	32.63
	2	596.50	166.75	98.83	83.58	78.54	72.46	64.00	54.58	46.42
	3	787.71	218.63	131.00	110.38	103.71	96.21	83.71	71.29	60.92
	4	1,011.50	279.58	167.04	141.54	131.58	122.79	106.50	90.58	76.04

Table A-53. FWD deflection measurements extracted for LTPP pavement section D310 for FWD test date 20-Aug-91

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
0.00	1	407.00	80.75	54.75	48.00	41.00	35.00	26.75	18.75
	2	605.25	124.50	84.75	73.75	62.75	53.50	41.75	27.75
	3	822.25	170.75	116.75	101.00	86.00	73.00	56.00	37.00
	4	1,097.50	216.50	148.75	129.25	110.00	93.75	70.75	47.50
30.50	1	402.75	124.50	84.75	73.75	62.75	53.50	41.75	27.75
	2	606.00	170.75	116.75	101.00	86.00	73.00	56.00	37.00
	3	820.25	216.50	148.75	129.25	110.00	93.75	70.75	47.50
	4	1,099.50	80.25	59.75	51.75	45.00	38.50	31.25	21.00
61.00	1	403.75	81.00	58.25	51.50	44.50	38.50	30.75	20.75
	2	603.50	126.00	89.75	79.25	68.25	60.00	47.00	33.00
	3	817.75	170.50	122.75	108.00	93.75	81.25	64.50	45.00
	4	1,093.00	217.00	158.50	138.50	119.50	104.25	81.25	57.00
91.40	1	400.00	92.50	66.75	58.50	50.50	43.75	33.50	21.75
	2	601.00	144.25	104.00	91.25	78.75	68.00	53.00	34.50
	3	816.00	198.50	143.75	126.00	108.00	93.25	71.25	47.00
	4	1,094.25	249.75	184.25	160.75	139.25	119.00	91.25	59.75
121.90	1	399.25	77.75	60.00	53.25	46.00	38.75	32.75	23.00
	2	603.25	122.00	94.00	83.00	72.00	62.00	48.50	32.75
	3	817.00	168.25	128.25	113.25	98.25	84.75	67.00	45.25
	4	1,094.75	215.75	164.00	144.75	125.50	107.75	85.00	56.50
152.40	1	397.25	89.50	64.00	54.00	47.75	39.25	32.00	20.75
	2	603.25	139.75	97.75	84.75	74.00	63.00	49.00	32.75
	3	815.00	190.75	133.75	115.50	100.00	85.25	67.00	45.00
	4	1,102.50	243.00	171.25	148.25	128.25	110.25	86.25	56.75

Table A-54. Average all point locations FWD deflection measurements extracted for LTPP pavement section D310

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
All Point Locations	1	401.67	83.63	60.58	52.83	45.79	38.96	31.17	21.00
	2	603.71	130.54	93.79	82.00	70.79	61.08	47.83	32.17
	3	818.04	178.63	128.54	112.13	96.83	83.25	65.13	43.88
	4	1,096.92	226.58	164.46	143.29	123.92	106.46	82.67	55.42

Table A-55. FWD deflection measurements extracted for LTPP pavement section D320 for FWD test date 20-Aug-91

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
0.00	1	389.75	93.50	66.25	56.75	48.50	40.50	31.50	20.75
	2	591.75	139.00	104.00	89.00	76.00	63.25	49.00	33.00
	3	809.75	197.75	141.75	122.50	104.25	88.25	67.00	45.50
	4	1,087.75	250.00	181.50	159.25	134.00	114.75	86.50	59.00
30.50	1	394.00	139.00	104.00	89.00	76.00	63.25	49.00	33.00
	2	596.50	197.75	141.75	122.50	104.25	88.25	67.00	45.50
	3	813.00	250.00	181.50	159.25	134.00	114.75	86.50	59.00
	4	1,100.75	81.50	63.00	54.75	46.50	39.00	31.00	20.00
61.60	1	392.75	103.00	83.25	74.25	64.75	56.25	44.50	29.75
	2	595.75	160.75	131.50	116.75	101.75	88.50	69.50	46.00
	3	809.75	225.00	179.75	160.75	140.75	121.50	95.50	62.75
	4	1,098.00	286.00	232.50	207.75	180.50	156.25	123.00	80.25
91.40	1	395.00	88.50	74.75	65.25	56.50	48.00	36.50	24.00
	2	601.25	145.75	118.25	104.50	89.00	76.50	57.75	38.00
	3	812.75	199.50	161.25	143.00	123.50	104.25	79.75	51.50
	4	1,103.00	262.50	210.00	186.75	159.50	136.00	103.00	66.50
121.90	1	393.00	82.00	69.25	61.50	52.75	45.75	35.75	23.50
	2	599.75	132.75	110.50	98.50	84.00	72.50	56.50	37.00
	3	813.00	186.00	151.00	134.50	115.75	100.50	78.00	51.25
	4	1,108.25	240.25	196.25	174.25	150.00	129.50	100.25	66.00
152.40	1	394.50	83.25	68.75	60.75	52.00	44.75	34.00	22.00
	2	602.50	129.50	108.75	95.50	82.00	70.00	54.00	35.00
	3	811.75	186.00	148.75	131.75	112.75	95.75	74.00	47.25
	4	1,109.00	235.50	191.25	168.50	145.00	123.00	94.00	61.00

Table A-56. Average all point locations FWD deflection measurements extracted for LTPP pavement section D320

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
All Point Locations	1	393.17	88.63	70.88	62.21	53.50	45.71	35.54	23.33
	2	597.92	139.33	111.96	98.29	84.38	72.04	55.67	36.67
	3	811.67	195.38	152.92	134.88	116.13	99.13	76.54	50.21
	4	1,101.13	250.25	197.79	174.79	149.63	128.08	98.21	64.42

Table A-57. FWD deflection measurements extracted for LTPP pavement section D330 for FWD test date 20-Aug-91

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
0.00	1	391.25	86.00	64.50	57.00	51.00	45.50	38.00	28.00
	2	597.25	134.00	99.25	88.75	79.00	70.75	59.00	43.25
	3	798.00	181.25	134.50	119.50	107.00	95.25	80.00	57.00
	4	1,108.00	233.25	171.75	154.75	137.25	124.50	102.25	73.50
30.50	1	389.25	134.00	99.25	88.75	79.00	70.75	59.00	43.25
	2	593.75	181.25	134.50	119.50	107.00	95.25	80.00	57.00
	3	793.75	233.25	171.75	154.75	137.25	124.50	102.25	73.50
	4	1,106.00	86.25	63.00	55.25	48.25	43.25	35.25	26.00
61.00	1	386.00	97.25	77.25	69.00	60.00	52.50	42.00	29.00
	2	591.50	151.75	118.25	106.00	92.00	80.50	64.00	43.00
	3	794.00	211.25	161.75	144.00	124.75	109.25	87.00	57.50
	4	1,102.25	269.00	209.25	186.00	160.50	140.50	110.75	73.00
91.40	1	385.50	99.75	76.25	66.25	58.25	49.50	39.50	27.00
	2	590.50	154.00	117.50	102.75	88.75	75.75	58.75	39.25
	3	792.75	213.50	160.50	140.25	121.00	103.50	80.00	53.00
	4	1,099.50	272.00	209.25	181.00	155.25	131.75	101.75	67.75
121.90	1	388.50	99.25	74.00	64.25	56.25	48.00	37.00	26.00
	2	594.00	156.75	113.75	100.25	85.75	73.75	57.75	38.75
	3	792.50	210.50	153.75	135.00	115.75	98.75	77.00	51.50
	4	1,103.00	269.50	198.50	173.00	150.00	127.50	98.75	66.50
152.40	1	390.25	85.25	65.75	59.75	51.75	45.50	36.00	23.75
	2	596.25	132.50	101.75	91.00	80.75	70.25	56.00	37.75
	3	793.50	185.75	138.50	125.00	110.00	95.00	75.50	50.50
	4	1,105.50	232.50	179.00	160.50	142.25	124.00	97.00	65.25

Table A-58. Average all point locations FWD deflection measurements extracted for LTPP pavement section D330

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
All Point Locations	1	388.46	92.29	70.13	61.92	54.25	47.38	37.96	26.63
	2	593.88	143.83	108.04	95.63	83.50	72.96	58.38	40.04
	3	794.08	197.79	146.92	129.88	113.33	98.67	78.92	53.50
	4	1,104.04	251.71	189.58	167.38	145.88	127.38	100.83	68.54

Table A-59. FWD deflection measurements extracted for LTPP pavement section D350 for FWD test date 20-Aug-91

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
0.00	1	405.75	101.75	81.75	74.75	64.25	56.75	44.75	30.75
	2	611.75	159.75	124.00	112.75	97.75	86.00	68.00	45.75
	3	776.00	212.75	169.25	153.00	133.00	117.00	91.50	62.00
	4	1,076.50	283.75	214.00	196.25	169.00	150.00	116.50	78.00
31.10	1	391.00	159.75	124.00	112.75	97.75	86.00	68.00	45.75
	2	605.00	212.75	169.25	153.00	133.00	117.00	91.50	62.00
	3	768.50	283.75	214.00	196.25	169.00	150.00	116.50	78.00
	4	1,073.75	111.00	87.75	80.25	69.25	60.50	46.00	30.25
61.00	1	390.75	120.00	102.75	97.00	85.25	74.75	59.50	37.50
	2	605.50	191.50	161.00	150.00	133.50	116.25	93.00	57.50
	3	768.25	261.00	219.25	206.00	183.25	161.50	126.00	76.50
	4	1,076.25	346.00	282.00	265.50	235.50	208.50	162.25	98.00
92.00	1	392.50	114.50	86.50	78.75	68.25	58.50	44.50	28.50
	2	603.50	181.50	134.25	121.00	105.75	90.00	68.50	43.75
	3	766.50	240.75	183.50	164.75	143.00	122.50	93.00	59.00
	4	1,070.25	323.25	236.75	210.75	183.75	157.00	121.00	76.75
121.90	1	390.00	105.25	85.50	78.00	68.75	59.25	46.25	30.00
	2	608.75	163.25	131.75	120.75	106.75	93.00	72.00	46.75
	3	772.50	226.75	180.50	164.00	145.50	126.25	98.25	63.25
	4	1,081.75	287.75	229.50	211.25	185.25	163.00	125.25	81.25
152.40	1	393.75	109.75	79.25	71.00	63.00	54.00	42.75	28.25
	2	608.25	166.75	120.75	109.50	95.75	84.00	65.75	42.25
	3	775.50	227.50	165.75	148.25	131.50	115.00	89.50	56.25
	4	1,080.75	295.25	211.50	190.75	168.50	146.00	114.25	72.25

Table A-60. Average all point locations FWD deflection measurements extracted for LTPP pavement section D350

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
All Point Locations	1	393.96	110.38	87.25	79.96	69.79	60.63	47.29	30.88
	2	607.13	171.58	134.58	123.04	107.88	93.71	73.13	47.04
	3	771.21	233.29	183.75	167.33	146.92	128.08	99.25	63.21
	4	1,076.54	305.71	235.08	215.00	188.17	164.38	127.42	81.04

Table A-61. FWD deflection measurements extracted for LTPP pavement section M310 for FWD test date 29-Mar-97

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
0.00	1	331.75	1,246.25	1,010.25	836.50	581.00	401.00	181.25	47.00
	2	544.50	1,809.75	1,486.00	1,244.25	884.25	625.00	301.50	87.75
	3								
	4								
30.50	1	338.25	1,809.75	1,486.00	1,244.25	884.25	625.00	301.50	87.75
	2	551.75							
	3	767.50							
	4	981.25	526.00	399.75	315.25	210.25	146.50	76.25	28.75
61.00	1	334.75	501.00	385.50	304.75	206.00	140.00	73.00	31.00
	2	545.50	798.50	619.25	493.50	339.25	233.00	121.75	54.00
	3	762.50	1,071.50	835.00	671.75	467.25	325.50	173.75	78.75
	4	981.75	1,318.50	1,028.25	829.50	580.75	406.75	220.75	101.25
91.40	1	330.75	1,021.25	810.00	655.75	442.00	295.25	138.00	53.00
	2	543.50	1,471.00	1,171.75	961.50	664.75	459.25	227.50	92.75
	3	756.00	1,828.00	1,466.75	1,213.50	851.50	602.75	312.25	131.25
	4								
121.90	1	335.25	825.00	667.50	550.00	399.00	286.50	149.00	52.00
	2	547.25	1,226.25	1,005.50	838.75	621.25	455.75	247.50	90.25
	3	759.50	1,555.75	1,284.25	1,079.50	810.50	603.00	338.25	128.50
	4	976.50	1,860.00	1,537.00	1,296.00	977.50	732.25	415.75	160.75
152.40	1	329.25	1,183.25	920.75	737.25	477.25	317.75	147.00	62.00
	2	539.00	1,660.00	1,319.25	1,075.75	722.00	498.50	244.00	107.25
	3	749.00	2,028.50	1,631.50	1,343.00	921.00	652.00	332.50	149.00
	4								

Table A-62. Average all point locations FWD deflection measurements extracted for LTPP pavement section M310

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
All Point Locations	1	333.33	883.79	698.96	566.58	385.92	264.50	127.42	45.63
	2	545.25	1,304.42	1,044.17	857.08	598.54	420.29	212.38	80.54
	3	760.00	1,473.44	1,178.33	969.28	686.89	491.50	262.33	108.39
	4	979.83	1,539.58	1,227.75	1,010.42	729.75	529.50	293.33	120.08

Table A-63. FWD deflection measurements extracted for LTPP pavement section M320 for FWD test date 28-Mar-97

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
0.00	1	327.75	980.25	715.25	515.50	298.25	195.00	102.50	48.00
	2	530.25	1,387.50	1,028.75	754.75	457.50	305.00	166.00	80.00
	3	750.50	1,732.00	1,311.00	977.00	610.50	416.75	230.50	112.25
	4	950.50	2,022.50	1,551.00	1,168.00	749.50	521.00	296.50	143.00
30.50	1	318.75	1,387.50	1,028.75	754.75	457.50	305.00	166.00	80.00
	2	525.75	1,732.00	1,311.00	977.00	610.50	416.75	230.50	112.25
	3	733.50	2,022.50	1,551.00	1,168.00	749.50	521.00	296.50	143.00
	4	947.00	678.00	481.50	355.50	232.50	156.75	82.75	36.50
61.00	1	327.25	807.75	622.00	445.00	267.50	179.75	93.00	37.25
	2	524.25	1,179.25	914.75	665.50	413.00	283.75	150.00	62.25
	3	744.50	1,514.75	1,195.50	899.25	567.00	391.75	209.75	91.25
	4	951.25	1,793.75	1,449.00	1,077.25	703.00	494.25	271.50	120.00
91.40	1	330.50	605.75	404.50	278.50	160.50	106.00	60.25	30.00
	2	543.75	881.25	610.00	440.25	270.75	183.25	105.00	50.50
	3	742.75	1,112.50	785.75	583.25	376.00	262.00	152.25	74.75
	4	959.75	1,323.50	942.75	711.00	472.50	336.00	197.50	97.25
121.90	1	336.50	478.50	295.50	196.25	114.50	77.75	47.00	25.00
	2	556.75	714.00	455.75	315.75	194.75	135.25	82.50	43.00
	3	752.50	897.75	584.50	418.25	268.00	190.25	117.75	62.00
	4	970.00	1,067.50	708.75	513.75	338.00	244.25	151.25	80.25
152.40	1	332.25	482.00	312.75	217.00	125.50	85.25	52.00	23.75
	2	547.75	726.75	491.00	351.75	216.00	150.75	92.25	42.00
	3	748.25	927.25	641.00	472.25	300.75	213.50	130.75	60.75
	4	964.50	1,112.50	774.25	578.50	377.75	272.50	168.75	81.25

Table A-64. Average all point locations FWD deflection measurements extracted for LTPP pavement section M320

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
All Point Locations	1	328.83	672.04	471.92	334.63	199.79	133.42	72.92	33.42
	2	538.08	986.38	708.88	516.58	322.96	220.25	123.13	57.08
	3	745.33	1,254.71	919.46	686.46	441.96	307.04	174.13	82.58
	4	957.77	1,441.41	1,070.27	805.00	532.68	376.73	218.14	104.05

Table A-65. FWD deflection measurements extracted for LTPP pavement section M330 for FWD test date 28-Mar-97

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
0.00	1	333.50	589.75	383.00	258.75	148.00	98.50	56.50	29.50
	2	544.25	851.00	575.75	406.00	247.25	165.50	97.25	49.75
	3	742.00	1,071.50	735.25	534.25	339.75	234.25	140.00	71.25
	4	962.25	1,266.25	881.50	648.75	423.50	298.25	182.00	94.00
30.50	1	327.25	851.00	575.75	406.00	247.25	165.50	97.25	49.75
	2	525.75	1,071.50	735.25	534.25	339.75	234.25	140.00	71.25
	3	739.00	1,266.25	881.50	648.75	423.50	298.25	182.00	94.00
	4	949.00	790.75	544.00	375.50	209.25	137.25	78.50	39.50
61.00	1	326.25	754.00	510.50	360.25	206.50	129.00	69.00	34.75
	2	525.25	1,074.00	733.25	530.75	318.25	205.25	112.50	58.00
	3	740.75	1,408.75	939.75	688.00	423.00	280.50	159.50	86.25
	4	950.00	1,694.00	1,124.50	836.00	529.25	358.25	207.75	114.25
91.40	1	324.75	1,131.00	828.75	602.50	360.25	234.25	114.00	51.50
	2	535.25	1,606.50	1,200.75	895.75	560.00	375.25	188.25	87.25
	3	749.75	1,971.25	1,497.75	1,132.25	726.00	498.50	258.25	121.75
	4								
121.90	1	323.75	813.50	564.50	396.25	212.25	131.00	74.25	33.25
	2	520.50	1,135.00	806.25	584.00	334.25	216.00	120.50	56.50
	3	740.50	1,419.50	1,027.75	752.50	447.75	296.50	166.25	80.00
	4	958.00	1,658.00	1,224.75	908.50	553.25	369.75	211.50	101.00
152.40	1	345.50	671.75	461.50	297.75	148.00	91.50	59.00	30.75
	2	552.50	948.25	673.25	456.00	250.00	163.50	102.75	51.00
	3	742.75	1,151.25	848.25	591.75	344.25	234.25	149.50	74.25
	4	972.50	1,358.00	1,021.00	722.00	434.00	303.25	194.75	98.00

Table A-66. Average all point locations FWD deflection measurements extracted for LTPP pavement section M330

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
All Point Locations	1	330.17	791.79	548.71	381.83	214.04	136.92	75.21	36.54
	2	533.92	1,126.83	798.88	574.17	341.21	225.33	125.21	61.79
	3	742.46	1,412.17	1,014.04	742.33	457.33	310.13	176.63	88.42
	4	958.35	1,539.15	1,097.40	805.75	503.25	346.10	207.40	106.70

Table A-67. FWD deflection measurements extracted for LTPP pavement section M340 for FWD test date 28-Mar-97

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
0.00	1	362.50	617.00	406.00	253.00	134.50	91.00	60.75	32.25
	2	576.25	871.00	593.25	390.00	227.25	160.50	107.00	56.25
	3	769.00	1,059.50	743.25	508.25	314.00	228.00	152.75	82.50
	4	977.75	1,232.25	878.25	611.00	391.75	291.50	197.25	108.25
30.50	1	347.25	871.00	593.25	390.00	227.25	160.50	107.00	56.25
	2	552.75	1,059.50	743.25	508.25	314.00	228.00	152.75	82.50
	3	758.00	1,232.25	878.25	611.00	391.75	291.50	197.25	108.25
	4	951.75	718.25	470.75	302.25	152.75	96.75	61.75	29.75
61.00	1	336.50	1,211.50	776.75	522.00	271.75	163.50	93.25	48.75
	2	541.00	1,707.25	1,135.75	792.50	439.00	274.75	157.00	84.25
	3								
	4								
91.40	1	332.75	631.75	401.75	269.50	146.75	96.25	57.25	29.75
	2	532.75	959.25	616.75	424.25	242.25	161.00	96.25	49.00
	3	740.50	1,243.25	817.00	577.75	346.00	236.00	140.50	71.50
	4	961.75	1,530.00	1,004.25	720.75	444.25	309.75	186.00	94.25
121.90	1	336.25	538.25	351.75	248.75	144.50	90.00	53.75	29.00
	2	538.25	818.75	543.75	394.00	239.25	156.75	89.75	49.25
	3	738.25	1,062.50	720.75	534.50	336.25	225.00	131.75	72.00
	4	959.75	1,280.75	885.25	663.25	426.50	290.50	174.75	95.00
152.40	1	329.00	902.75	595.25	395.00	213.00	131.25	72.00	34.25
	2	525.25	1,275.50	866.50	596.25	338.50	216.50	116.75	57.50
	3	750.75	1,611.50	1,106.50	779.00	457.50	299.75	163.00	81.50
	4	973.25	1,883.00	1,340.25	949.00	568.75	378.00	206.25	104.50

Table A-68. Average all point locations FWD deflection measurements extracted for LTPP pavement section M340

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
All Point Locations	1	340.71	769.92	500.38	331.75	177.21	111.46	66.46	33.96
	2	544.38	1,105.38	738.00	508.08	288.96	188.79	110.92	57.58
	3	751.30	1,244.50	848.65	598.55	359.80	244.80	146.05	75.45
	4	964.85	1,476.45	1,025.90	733.10	453.55	314.70	190.40	98.25

Table A-69. FWD deflection measurements extracted for LTPP pavement section M350 for FWD test date 28-Mar-97

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
0.00	1	363.50	659.00	423.50	289.25	153.25	95.75	59.50	32.50
	2	568.75	913.75	616.75	433.75	247.00	159.50	96.00	54.00
	3	771.50	1,158.25	801.50	577.25	346.00	230.25	139.00	76.25
	4	985.50	1,387.50	970.75	711.25	440.25	299.00	181.50	98.00
30.50	1	370.50	913.75	616.75	433.75	247.00	159.50	96.00	54.00
	2	578.50	1,158.25	801.50	577.25	346.00	230.25	139.00	76.25
	3	750.75	1,387.50	970.75	711.25	440.25	299.00	181.50	98.00
	4	984.25	433.00	263.25	169.75	97.25	66.75	43.00	23.00
61.00	1	338.75	994.00	673.00	474.00	273.25	167.50	86.50	44.25
	2	536.75	1,438.25	1,007.25	731.50	444.50	283.00	145.75	74.50
	3	759.50	1,846.75	1,313.75	967.50	609.25	399.50	209.50	106.00
	4								
91.40	1	343.25	770.50	546.25	383.25	214.00	139.00	79.25	38.75
	2	539.00	1,117.00	812.50	587.00	347.75	233.00	132.25	64.75
	3	750.50	1,429.50	1,072.50	788.75	487.00	333.75	189.50	92.75
	4	979.00	1,714.00	1,312.00	976.00	616.75	431.50	242.00	120.25
121.90	1	351.75	866.50	611.25	420.00	239.75	150.00	82.50	40.00
	2	553.75	1,248.75	904.75	644.00	388.50	252.00	136.75	68.25
	3	763.75	1,594.25	1,167.50	845.00	526.25	349.75	190.25	95.00
	4	982.25	1,941.00	1,417.75	1,030.75	651.75	439.00	239.50	116.75
152.40	1	330.25	1,295.00	849.50	583.00	314.00	183.75	95.75	40.25
	2	533.00	1,847.75	1,270.75	902.75	519.00	317.75	162.75	69.75
	3								
	4								

Table A-70. Average all point locations FWD deflection measurements extracted for LTPP pavement section M350

Point location	Drop height	Drop load (kPa)*	Average all point locations peak deflections (peak_defl), microns**						
			D1	D2	D3	D4	D5	D6	D7
All Point Locations	1	349.67	836.33	561.13	386.54	215.25	133.79	74.42	36.46
	2	548.96	1,292.43	897.86	638.82	375.68	239.68	129.86	63.04
	3	759.20	1,366.20	976.05	708.75	439.45	295.30	166.40	85.55
	4	982.75	1,504.63	1,086.75	794.13	501.00	344.81	199.00	102.44

APPENDIX B: Simulated Deflections by 3d-Move Analysis for 35 SHRP Pavement Sections in Texas based on FWD Data.

Table B – 1. Simulated deflections for SHRP section 1046 based on FWD test conducted on 17-Dec-1998.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)						
	D1	D2	D3	D4	D5	D6	D7
Drop Height 1	90.33	68.11	61.68	53.16	45.24	31.76	13.80
Drop Height 2	131.47	105.45	95.69	82.93	71.03	50.71	23.27
Drop Height 3	175.50	146.71	133.23	115.93	99.79	72.13	34.57
Drop Height 4	212.49	182.18	165.39	144.27	124.56	90.71	44.63

Table B – 2. Simulated deflections for SHRP section 1047 based on FWD test conducted on 17-Dec-1998.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)						
	D1	D2	D3	D4	D5	D6	D7
Drop Height 1	95.84	76.09	68.77	58.63	49.29	33.95	14.80
Drop Height 2	142.49	118.56	107.44	92.10	77.93	54.53	24.88
Drop Height 3	193.39	166.11	150.77	129.83	110.43	78.27	37.26
Drop Height 4	237.14	207.76	188.68	162.96	139.07	99.38	48.59

Table B – 3. Simulated deflections for SHRP section 1049 based on FWD test conducted on 28-Mar-1996.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)						
	D1	D2	D3	D4	D5	D6	D7
Drop Height 1	70.72	51.66	45.27	38.38	32.90	24.11	12.04
Drop Height 2	104.07	80.74	71.15	60.75	52.45	39.07	20.29
Drop Height 3	137.37	110.94	98.12	84.19	73.06	55.11	29.71
Drop Height 4	178.87	149.82	132.90	114.51	99.83	76.11	42.42

Table B – 4. Simulated deflections for SHRP section 1056 based on FWD test conducted on 29-Sep-2010.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)							
	D1	D2	D3	D4	D5	D6	D7	D8
Drop Height 1	1034.54	279.08	199.57	137.68	99.56	55.10	31.51	18.06
Drop Height 2	1225.98	411.83	294.09	204.12	149.01	84.64	50.24	30.33
Drop Height 3	1384.68	538.53	382.64	266.46	195.70	113.04	68.74	42.97
Drop Height 4	1633.30	774.18	538.41	375.90	277.96	163.64	102.23	66.38

Table B – 5. Simulated deflections for SHRP section 1068 based on FWD test conducted on 17-Sep-1997.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)						
	D1	D2	D3	D4	D5	D6	D7
Drop Height 1	202.55	143.67	127.80	108.48	92.30	67.09	34.35
Drop Height 2	304.90	234.12	209.13	178.91	153.44	113.35	59.63
Drop Height 3	411.99	332.68	297.98	256.48	221.40	165.94	90.84
Drop Height 4	522.73	437.70	392.39	339.29	294.26	222.92	125.83

Table B – 6. Simulated deflections for SHRP section 1069 based on FWD test conducted on 02-Apr-2002.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)							
	D1	D2	D3	D4	D5	D6	D7	D8
Drop Height 1	144.64	110.88	98.88	82.65	68.20	45.37	29.32	18.42
Drop Height 2	215.07	173.90	155.55	130.84	108.76	73.68	48.80	31.63
Drop Height 3	267.64	222.13	199.01	168.00	140.22	95.99	64.52	42.70
Drop Height 4	340.89	290.69	260.70	220.96	185.23	128.20	87.50	59.19

Table B – 7. Simulated deflections for SHRP section 1076 based on FWD test conducted on 14-Feb-2013.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)							
	D1	D2	D3	D4	D5	D6	D7	D8
Drop Height 1	257.86	165.84	125.97	83.22	55.78	27.65	15.27	8.77
Drop Height 2	363.83	248.27	189.97	126.88	86.11	44.12	25.47	15.52
Drop Height 3	472.80	337.39	259.77	175.02	119.89	62.86	37.44	23.81
Drop Height 4	603.73	449.83	348.41	236.72	163.46	87.31	53.30	35.03

Table B – 8. Simulated deflections for SHRP section 1093 based on FWD test conducted on 05-Feb-2004.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)							
	D1	D2	D3	D4	D5	D6	D7	D8
Drop Height 1	337.21	211.40	157.69	105.24	73.82	41.02	24.32	14.46
Drop Height 2	473.51	314.29	236.37	159.38	112.99	64.39	39.46	24.51
Drop Height 3	612.22	425.13	322.04	218.95	156.46	90.84	57.12	36.77
Drop Height 4	777.11	564.10	430.51	294.99	212.22	125.14	80.38	53.31

Table B – 9. Simulated deflections for SHRP section 1111 based on FWD test conducted on 14-Mar-2012.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)							
	D1	D2	D3	D4	D5	D6	D7	D8
Drop Height 1	126.68	92.29	80.48	65.00	51.71	31.85	18.99	10.94
Drop Height 2	184.33	142.81	124.93	101.62	81.52	51.36	31.65	19.16
Drop Height 3	240.61	193.82	169.84	138.84	112.03	71.66	45.20	28.33
Drop Height 4	297.92	247.16	216.71	177.83	144.12	93.22	59.77	38.39

Table B – 10. Simulated deflections for SHRP section 1113 based on FWD test conducted on 13-May-2004.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)							
	D1	D2	D3	D4	D5	D6	D7	D8
Drop Height 1	219.09	130.11	93.51	58.83	39.07	20.05	11.35	6.53
Drop Height 2	309.58	196.05	142.17	90.49	60.84	32.20	19.00	11.55
Drop Height 3	399.01	265.42	194.00	124.59	84.51	45.72	27.80	17.62
Drop Height 4	502.01	350.19	257.99	167.06	114.15	62.83	39.12	25.62

Table B – 11. Simulated deflections for SHRP section 1116 based on FWD test conducted on 28-Apr-1998.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)						
	D1	D2	D3	D4	D5	D6	D7
Drop Height 1	310.95	198.17	152.92	107.27	77.75	43.65	14.62
Drop Height 2	442.42	300.65	233.78	165.60	121.31	69.97	25.71
Drop Height 3	564.08	400.82	313.47	223.55	164.91	96.82	37.85
Drop Height 4	707.72	524.85	412.77	296.24	219.80	130.96	53.85

Table B –12. Simulated deflections for SHRP section 2172 based on FWD test conducted on 20-Aug-1991.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)						
	D1	D2	D3	D4	D5	D6	D7
Drop Height 1	99.36	80.44	73.98	64.89	56.18	40.92	19.39
Drop Height 2	150.63	127.73	117.79	103.91	90.57	67.03	33.21
Drop Height 3	201.70	175.90	162.47	143.90	126.02	94.36	48.57
Drop Height 4	277.95	249.29	230.37	204.88	180.28	136.58	73.05

Table B –13. Simulated deflections for SHRP section 2176 based on FWD test conducted on 23-Jul-1997.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)						
	D1	D2	D3	D4	D5	D6	D7
Drop Height 1	141.28	89.04	74.20	58.15	45.46	27.48	9.19
Drop Height 2	207.43	142.71	119.26	94.18	74.35	46.13	16.97
Drop Height 3	264.29	192.01	160.64	127.43	101.22	63.81	24.94
Drop Height 4	348.69	269.44	225.49	179.70	143.64	92.03	38.16

Table B –14. Simulated deflections for SHRP section 3669 based on FWD test conducted on 09-Mar-2000.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)							
	D1	D2	D3	D4	D5	D6	D7	D8
Drop Height 1	110.42	74.41	64.12	52.94	43.89	29.91	19.84	12.70
Drop Height 2	151.34	109.42	94.60	78.57	65.59	45.47	30.88	20.39
Drop Height 3	197.77	151.11	130.91	109.23	91.70	64.47	44.65	30.33
Drop Height 4	243.28	193.66	167.87	140.51	118.43	84.09	59.03	40.88

Table B –15. Simulated deflections for SHRP section 3679 based on FWD test conducted on 27-Mar-1990.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)						
	D1	D2	D3	D4	D5	D6	D7
Drop Height 1	120.82	82.20	69.68	55.10	43.28	26.29	8.81
Drop Height 2	180.16	131.98	112.19	89.43	70.94	44.24	16.35
Drop Height 3	232.00	177.97	151.43	121.30	96.80	61.32	24.07
Drop Height 4	276.86	219.26	186.61	149.96	120.14	76.87	31.31

Table B –16. Simulated deflections for SHRP section 3729 based on FWD test conducted on 16-Feb-2002.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)							
	D1	D2	D3	D4	D5	D6	D7	D8
Drop Height 1	118.23	103.69	98.47	90.64	82.56	66.79	52.40	40.06
Drop Height 2	186.18	168.52	160.43	148.32	135.73	110.91	87.81	67.44
Drop Height 3	241.66	222.13	211.74	196.33	180.27	148.49	118.74	92.31
Drop Height 4	314.63	293.26	279.83	260.18	239.68	198.98	160.76	126.66

Table B –17. Simulated deflections for SHRP section 3835 based on FWD test conducted on 19-Feb-1999.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)						
	D1	D2	D3	D4	D5	D6	D7
Drop Height 1	97.66	80.54	72.84	61.84	51.69	35.02	14.40
Drop Height 2	147.20	125.82	114.17	97.53	82.09	56.64	24.72
Drop Height 3	200.06	175.10	159.24	136.66	115.64	80.87	37.00
Drop Height 4	243.78	216.46	197.08	169.64	144.01	101.52	47.74

Table B –18. Simulated deflections for SHRP section 6079 based on FWD test conducted on 06-Nov-1991.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)						
	D1	D2	D3	D4	D5	D6	D7
Drop Height 1	103.13	81.68	73.27	61.44	50.61	33.07	12.20
Drop Height 2	152.80	126.51	113.86	96.08	79.75	53.18	21.14
Drop Height 3	207.42	176.92	159.59	135.35	112.98	76.49	32.22
Drop Height 4	269.42	235.29	212.50	180.94	151.73	103.93	45.69

Table B –19. Simulated deflections for SHRP section 9005 based on FWD test conducted on 13-Aug-2009.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)							
	D1	D2	D3	D4	D5	D6	D7	D8
Drop Height 1	304.98	214.50	164.73	110.64	75.69	38.80	21.54	12.22
Drop Height 2	475.11	348.07	269.90	183.65	127.44	67.78	39.59	24.03
Drop Height 3	631.90	476.81	372.60	255.82	179.14	97.44	58.71	37.20
Drop Height 4	781.02	603.54	474.84	328.30	231.35	127.70	78.50	51.12

Table B –20. Simulated deflections for SHRP section A502 based on FWD test conducted on 29-Apr-1991.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)						
	D1	D2	D3	D4	D5	D6	D7
Drop Height 1	111.98	90.77	82.19	70.21	59.30	41.57	19.48
Drop Height 2	155.13	130.12	118.13	101.43	86.13	61.17	29.57
Drop Height 3	207.60	178.96	162.84	140.50	119.97	86.32	43.37
Drop Height 4	267.08	235.31	214.42	185.78	159.36	115.93	60.21

Table B –21. Simulated deflections for SHRP section A504 based on FWD test conducted on 25-Apr-2002.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)							
	D1	D2	D3	D4	D5	D6	D7	D8
Drop Height 1	118.03	84.33	77.01	67.62	58.72	43.04	30.37	20.64
Drop Height 2	165.28	127.14	116.24	102.54	89.55	66.53	47.75	33.12
Drop Height 3	220.72	179.26	163.89	145.14	127.36	95.76	69.87	49.57
Drop Height 4	287.53	244.16	222.81	197.93	174.38	132.43	97.96	70.83

Table B –22. Simulated deflections for SHRP section A505 based on FWD test conducted on 15-Jul-1993.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)						
	D1	D2	D3	D4	D5	D6	D7
Drop Height 1	104.78	82.55	75.92	66.59	57.65	41.96	20.00
Drop Height 2	145.17	119.62	110.23	97.08	84.43	62.15	30.45
Drop Height 3	204.21	175.07	161.60	142.96	125.00	93.22	47.61
Drop Height 4	261.24	229.73	212.11	188.24	165.19	124.31	65.38

Table B –23. Simulated deflections for SHRP section A507 based on FWD test conducted on 01-May-1991.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)						
	D1	D2	D3	D4	D5	D6	D7
Drop Height 1	119.90	97.37	87.69	74.24	62.14	42.91	19.79
Drop Height 2	163.33	136.84	123.58	105.14	88.49	61.90	29.46
Drop Height 3	218.36	187.84	170.06	145.43	123.08	87.27	43.21
Drop Height 4	278.99	245.04	222.21	190.83	162.27	116.34	59.53

Table B –24. Simulated deflections for SHRP section A508 based on FWD test conducted on 30-Apr-1991.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)						
	D1	D2	D3	D4	D5	D6	D7
Drop Height 1	105.94	87.30	79.66	68.85	58.79	42.02	20.19
Drop Height 2	145.53	123.69	113.15	98.25	84.33	61.01	30.19
Drop Height 3	194.71	169.75	155.61	135.74	117.12	85.79	44.04
Drop Height 4	249.11	221.51	203.33	178.05	154.28	114.17	60.46

Table B –25. Simulated deflections for SHRP section B310 based on FWD test conducted on 24-Apr-2002.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)							
	D1	D2	D3	D4	D5	D6	D7	D8
Drop Height 1	111.81	88.84	80.40	68.77	58.16	40.83	28.10	19.04
Drop Height 2	160.07	132.76	120.48	103.62	88.17	62.80	43.97	30.32
Drop Height 3	213.39	182.42	165.88	143.35	122.63	88.49	63.01	44.42
Drop Height 4	273.99	239.98	218.47	189.55	162.89	118.81	85.82	61.64

Table B –26. Simulated deflections for SHRP section B320 based on FWD test conducted on 24-Apr-2002.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)							
	D1	D2	D3	D4	D5	D6	D7	D8
Drop Height 1	136.14	102.40	90.69	75.32	62.01	41.71	27.88	18.53
Drop Height 2	192.64	152.71	135.66	113.37	93.99	64.26	43.80	29.72
Drop Height 3	250.19	205.47	182.90	153.61	128.07	88.75	61.55	42.71
Drop Height 4	316.89	268.12	238.92	201.55	168.87	118.38	83.34	58.99

Table B –27. Simulated deflections for SHRP section D310 based on FWD test conducted on 20-Aug-1991.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)						
	D1	D2	D3	D4	D5	D6	D7
Drop Height 1	96.24	77.51	71.44	63.10	55.11	40.89	20.20
Drop Height 2	143.55	121.20	111.98	99.44	87.38	65.82	33.84
Drop Height 3	194.05	168.99	156.34	139.40	123.08	93.79	50.07
Drop Height 4	259.61	232.33	215.01	192.41	170.60	131.35	72.48

Table B –28. Simulated deflections for SHRP section D320 based on FWD test conducted on 20-Aug-1991.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)						
	D1	D2	D3	D4	D5	D6	D7
Drop Height 1	90.82	73.21	67.40	59.41	51.84	38.53	19.23
Drop Height 2	137.27	116.09	107.20	95.05	83.49	63.02	32.73
Drop Height 3	186.19	162.34	150.15	133.71	118.03	90.18	48.65
Drop Height 4	252.38	226.21	209.35	187.16	165.96	128.19	71.60

Table B –29. Simulated deflections for SHRP section D330 based on FWD test conducted on 20-Aug-1991.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)						
	D1	D2	D3	D4	D5	D6	D7
Drop Height 1	83.37	66.64	61.59	54.71	48.15	36.41	18.88
Drop Height 2	126.63	106.64	98.82	88.29	78.19	60.00	32.19
Drop Height 3	169.30	147.07	136.49	122.44	108.93	84.52	46.93
Drop Height 4	235.43	211.12	195.99	176.54	157.82	123.89	71.33

Table B –30. Simulated deflections for SHRP section D350 based on FWD test conducted on 20-Aug-1991.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)						
	D1	D2	D3	D4	D5	D6	D7
Drop Height 1	114.49	89.96	81.89	70.84	60.51	42.97	19.42
Drop Height 2	173.22	143.59	131.08	114.08	98.15	70.91	33.75
Drop Height 3	218.42	185.88	169.90	148.37	128.15	93.52	46.02
Drop Height 4	302.01	265.86	243.10	213.24	185.16	136.85	70.25

Table B –31. Simulated deflections for SHRP section M310 based on FWD test conducted on 28-Mar-1997.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)						
	D1	D2	D3	D4	D5	D6	D7
Drop Height 1	906.96	431.28	347.09	265.82	206.73	126.51	33.35
Drop Height 2	1295.78	727.40	586.26	452.91	356.00	223.84	62.12
Drop Height 3	1659.43	1037.27	834.80	648.48	513.36	328.78	95.94
Drop Height 4	2010.94	1363.55	1092.51	851.65	677.55	439.43	135.53

Table B –32. Simulated deflections for SHRP section M320 based on FWD test conducted on 28-Mar-1997.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)						
	D1	D2	D3	D4	D5	D6	D7
Drop Height 1	713.66	302.71	243.19	193.76	157.03	102.22	39.41
Drop Height 2	1006.22	516.08	413.88	331.97	271.60	181.16	75.21
Drop Height 3	1267.23	737.28	588.41	473.61	389.88	264.40	116.31
Drop Height 4	1516.48	972.67	770.57	621.17	513.53	352.26	161.28

Table B –33. Simulated deflections for SHRP section M330 based on FWD test conducted on 28-Mar-1997.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)						
	D1	D2	D3	D4	D5	D6	D7
Drop Height 1	764.31	306.51	247.17	197.03	159.60	103.55	39.42
Drop Height 2	1048.41	515.39	415.08	333.05	272.28	180.93	74.16
Drop Height 3	1311.66	738.89	592.37	477.02	392.41	265.17	115.36
Drop Height 4	1566.09	980.03	779.14	628.54	519.26	355.00	160.93

Table B –34. Simulated deflections for SHRP section M340 based on FWD test conducted on 28-Mar-1997.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)						
	D1	D2	D3	D4	D5	D6	D7
Drop Height 1	753.97	319.49	244.40	179.54	135.88	80.24	27.54
Drop Height 2	1044.32	526.10	402.13	297.86	227.88	138.36	51.96
Drop Height 3	1308.84	743.78	566.40	421.66	324.92	201.08	80.77
Drop Height 4	1561.36	976.01	738.53	551.34	426.99	267.76	112.62

Table B –35. Simulated deflections for SHRP section M350 based on FWD test conducted on 28-Mar-1997.

Sensor Offset (mm)	Predicted Deflections (micrometers, µm)						
	D1	D2	D3	D4	D5	D6	D7
Drop Height 1	775.97	299.27	232.30	175.96	136.76	83.49	29.40
Drop Height 2	1037.31	487.89	378.09	288.42	226.38	141.81	54.42
Drop Height 3	1278.59	689.97	531.86	407.36	321.87	205.28	84.02
Drop Height 4	1519.07	917.19	700.18	537.41	426.65	275.63	118.07

APPENDIX C: Computer Simulation for FWD for the 35 SHRP Pavement Sections.

Note: Y-axis range is considered constant to distinguish the difference in deflection between four drop heights.

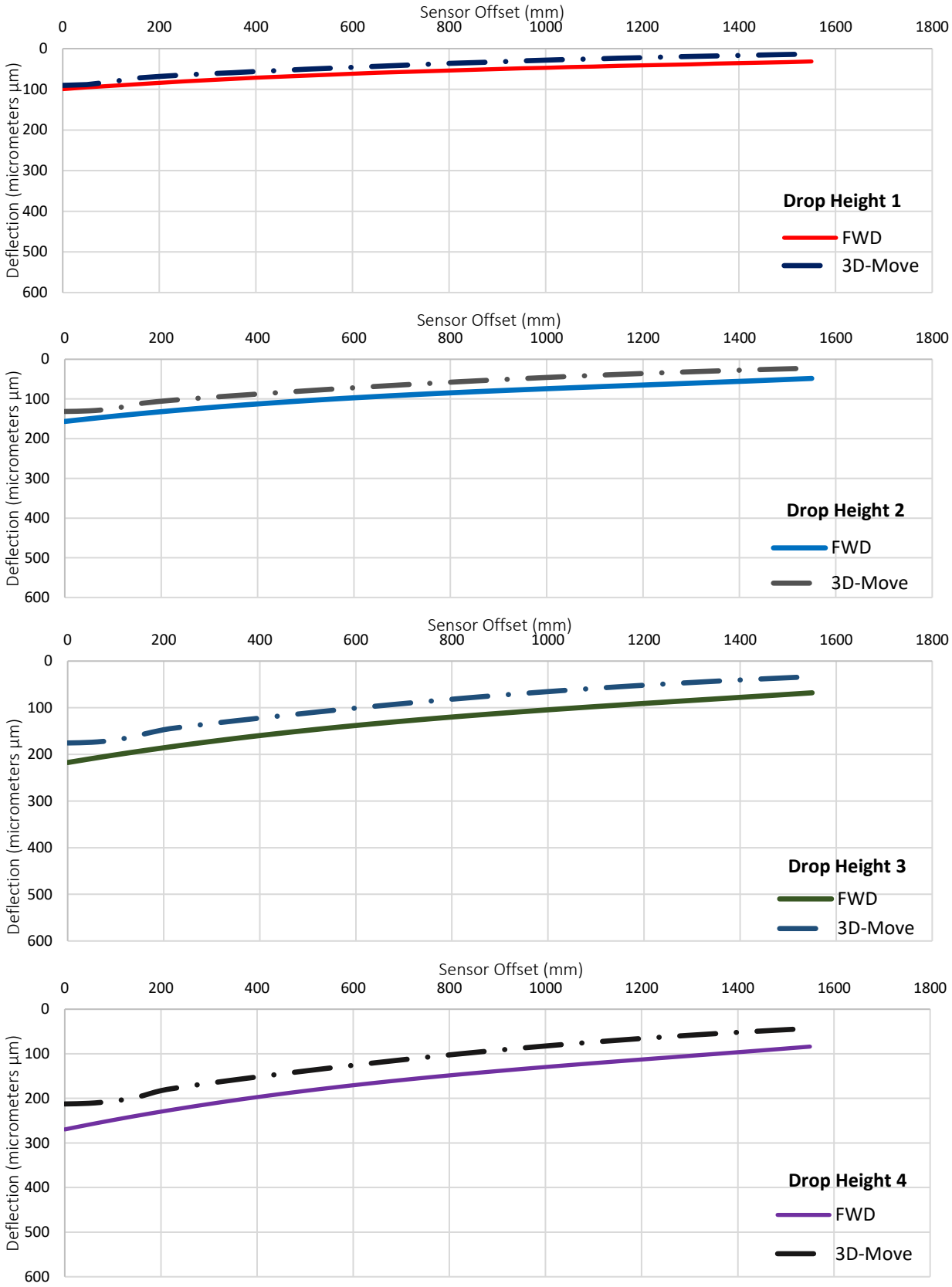

Figure C – 1. Simulated Deflection Bowl for the SHRP section 1046.

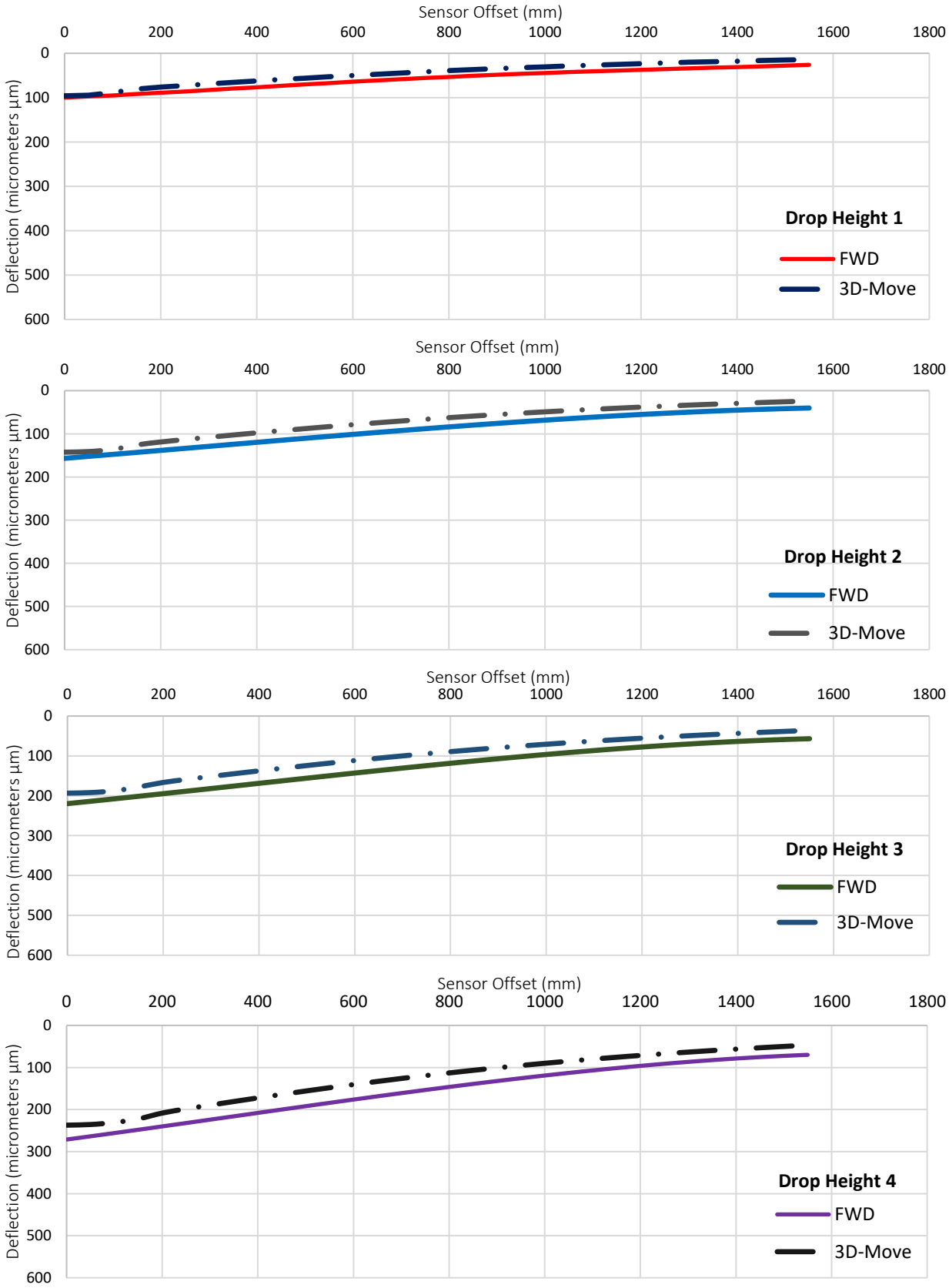

Figure C – 2. Simulated Deflection Bowl for the SHRP section 1047.

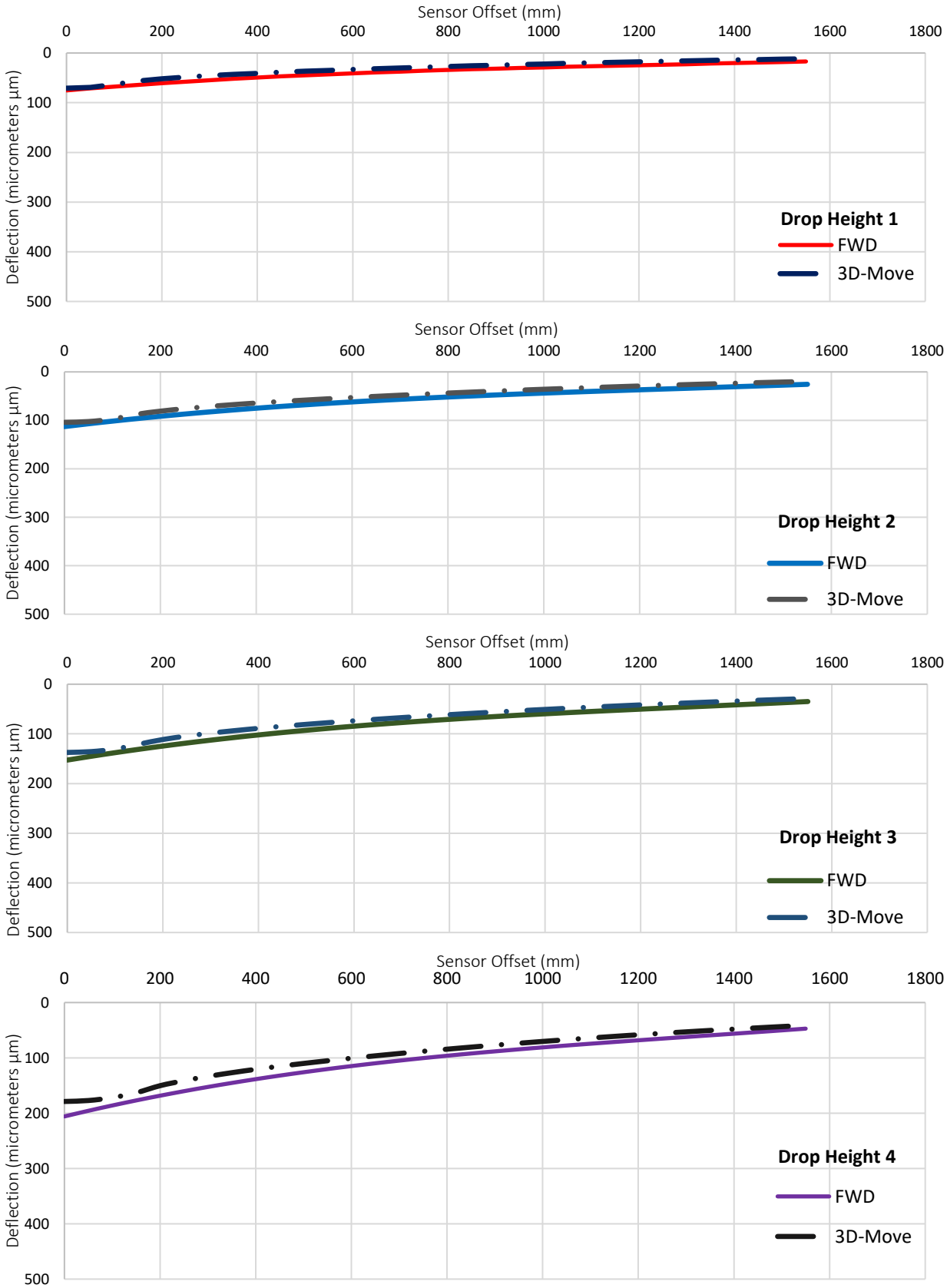

Figure C – 3. Simulated Deflection Bowl for the SHRP section 1049.

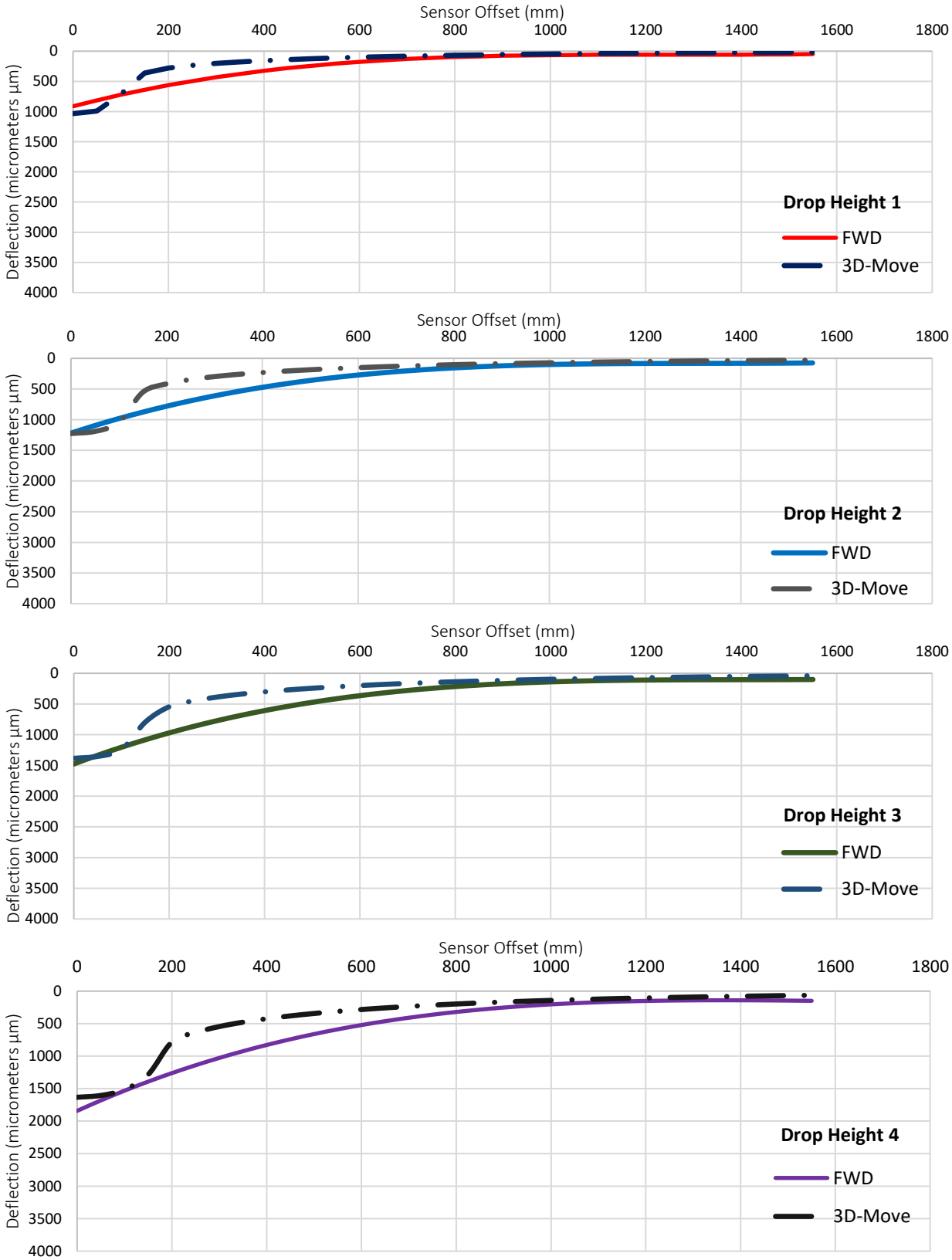

Figure C – 4. Simulated Deflection Bowl for the SHRP section 1056.

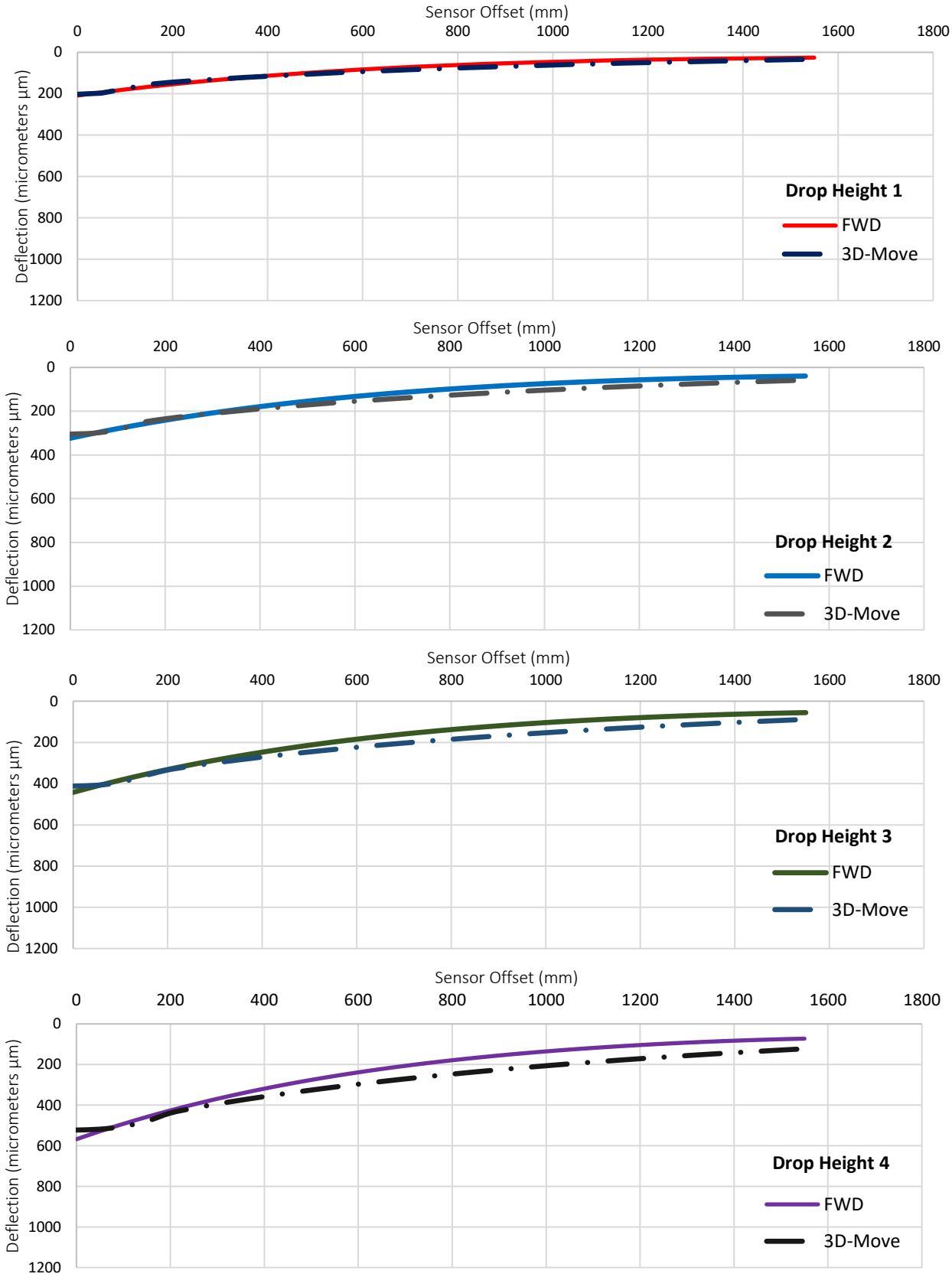

Figure C – 5. Simulated Deflection Bowl for the SHRP section 1068.

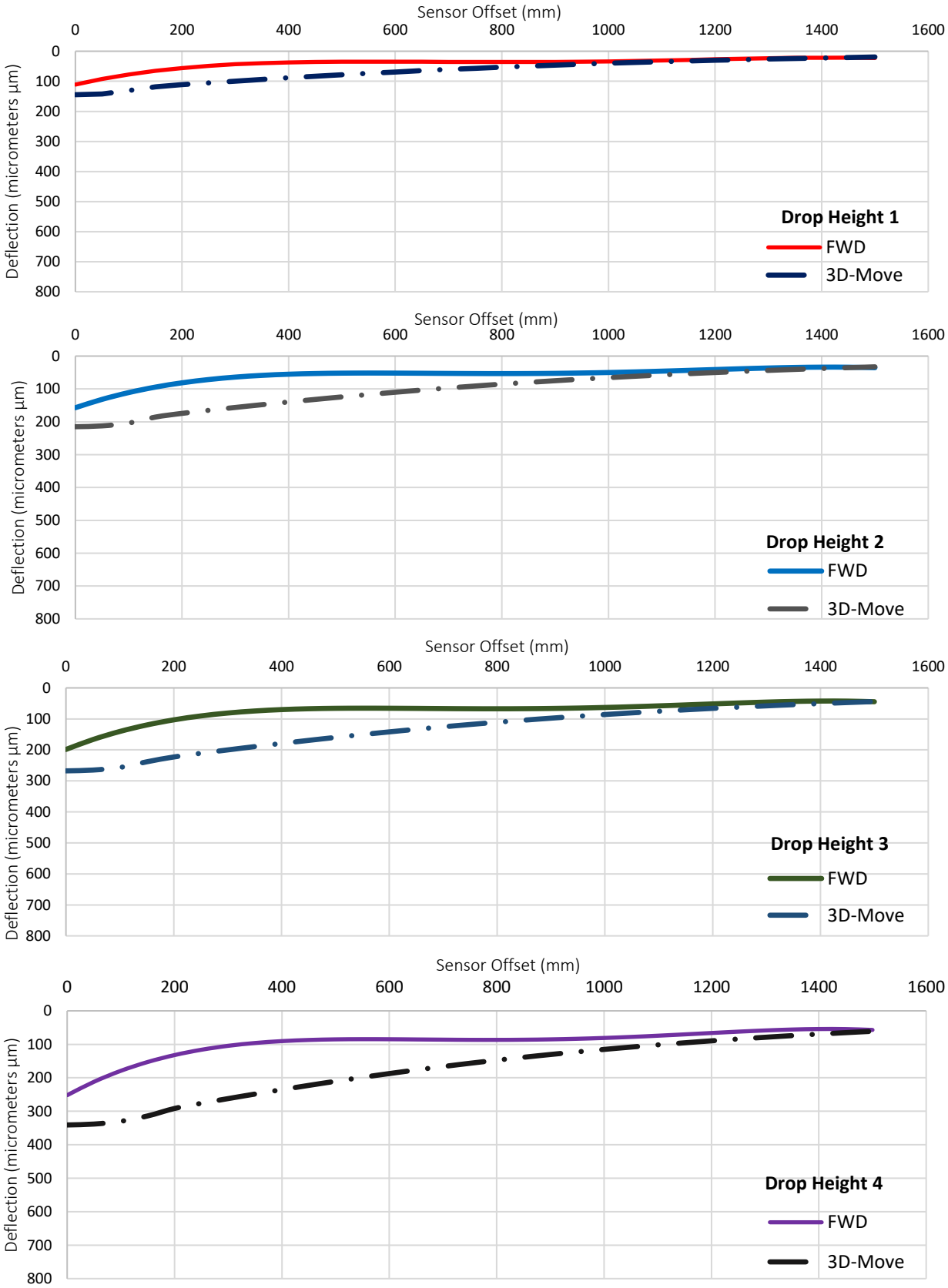

Figure C – 6. Simulated Deflection Bowl for the SHRP section 1069.

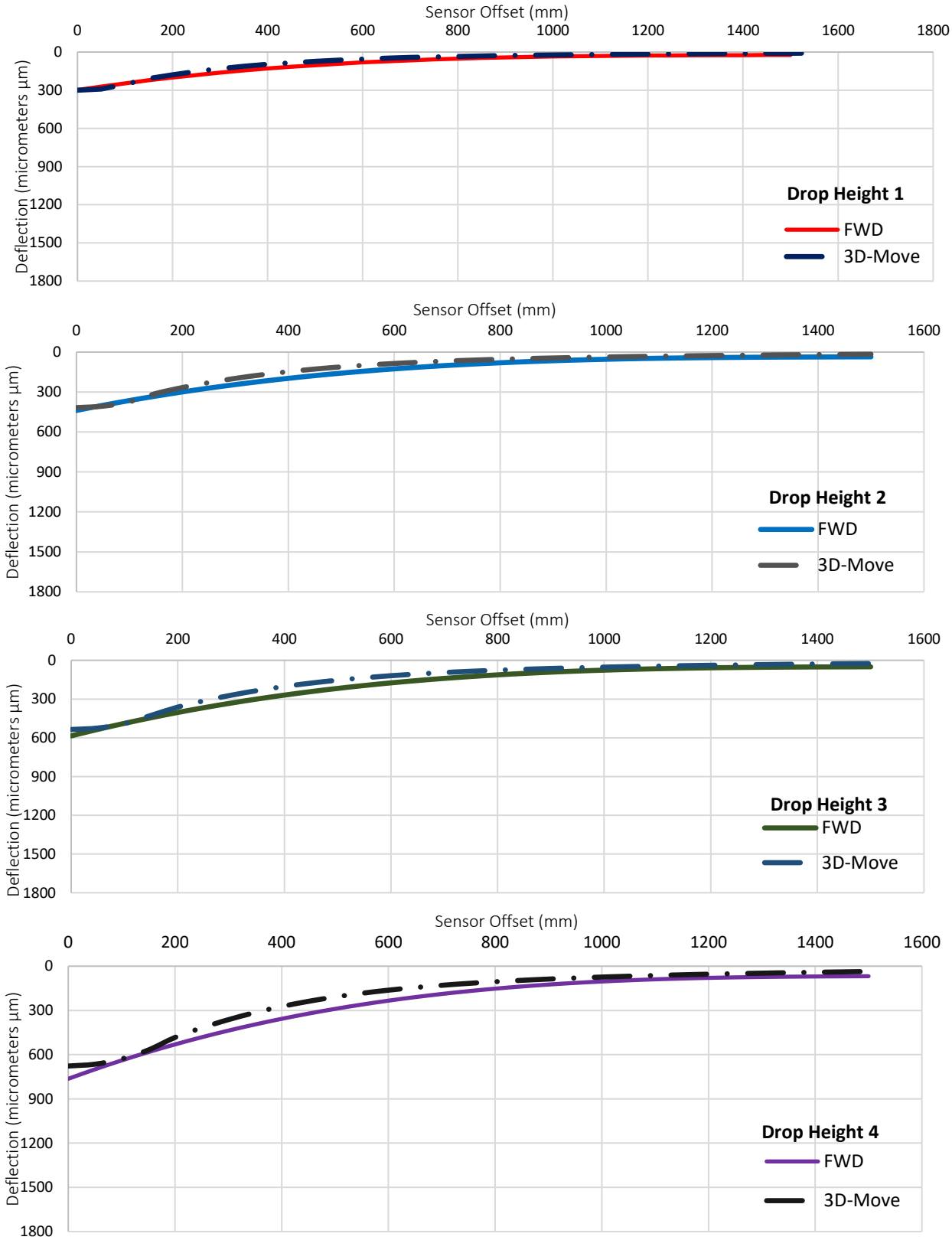

Figure C – 7. Simulated Deflection Bowl for the SHRP section 1076.

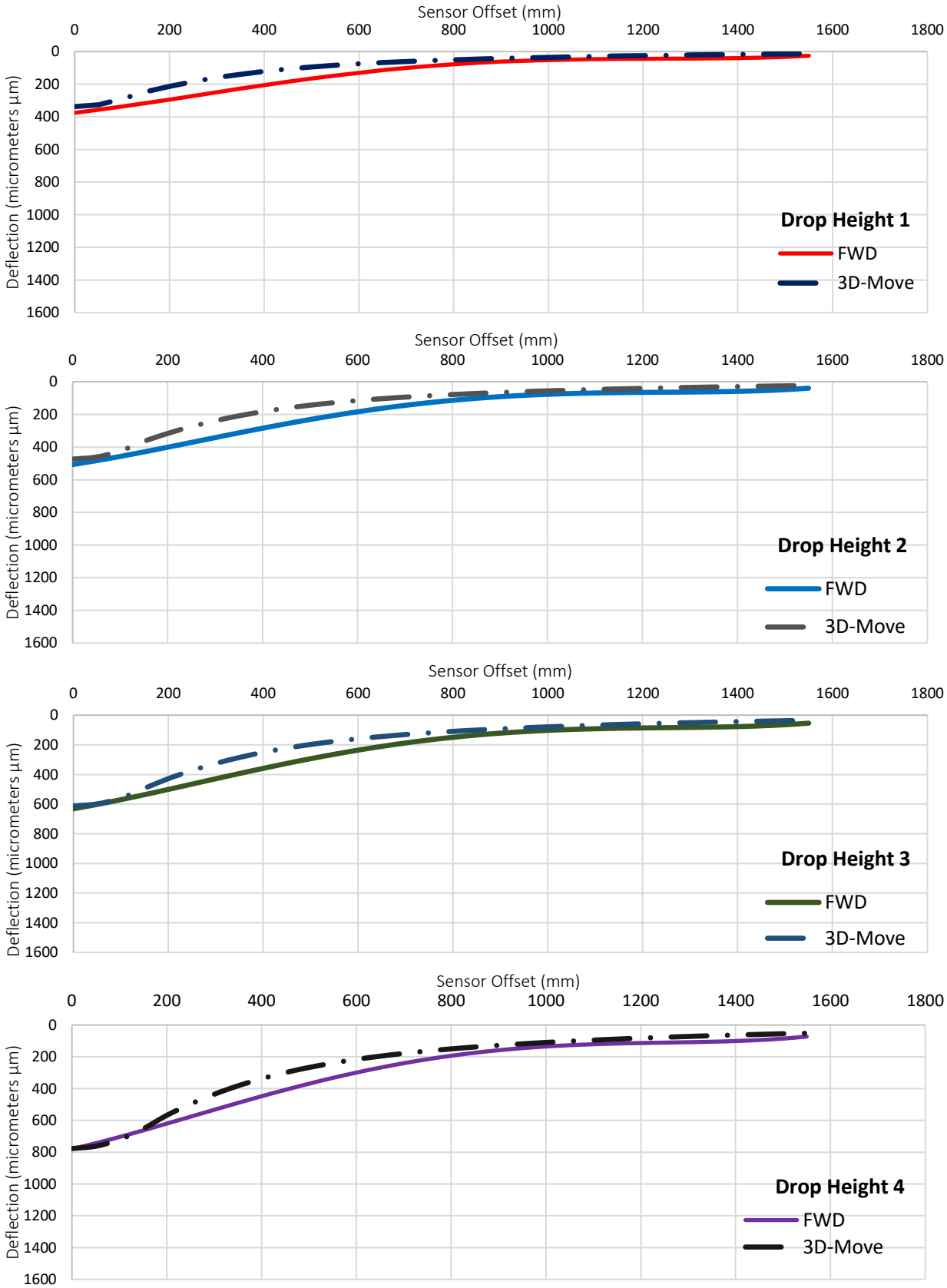

Figure C – 8. Simulated Deflection Bowl for the SHRP section 1093.

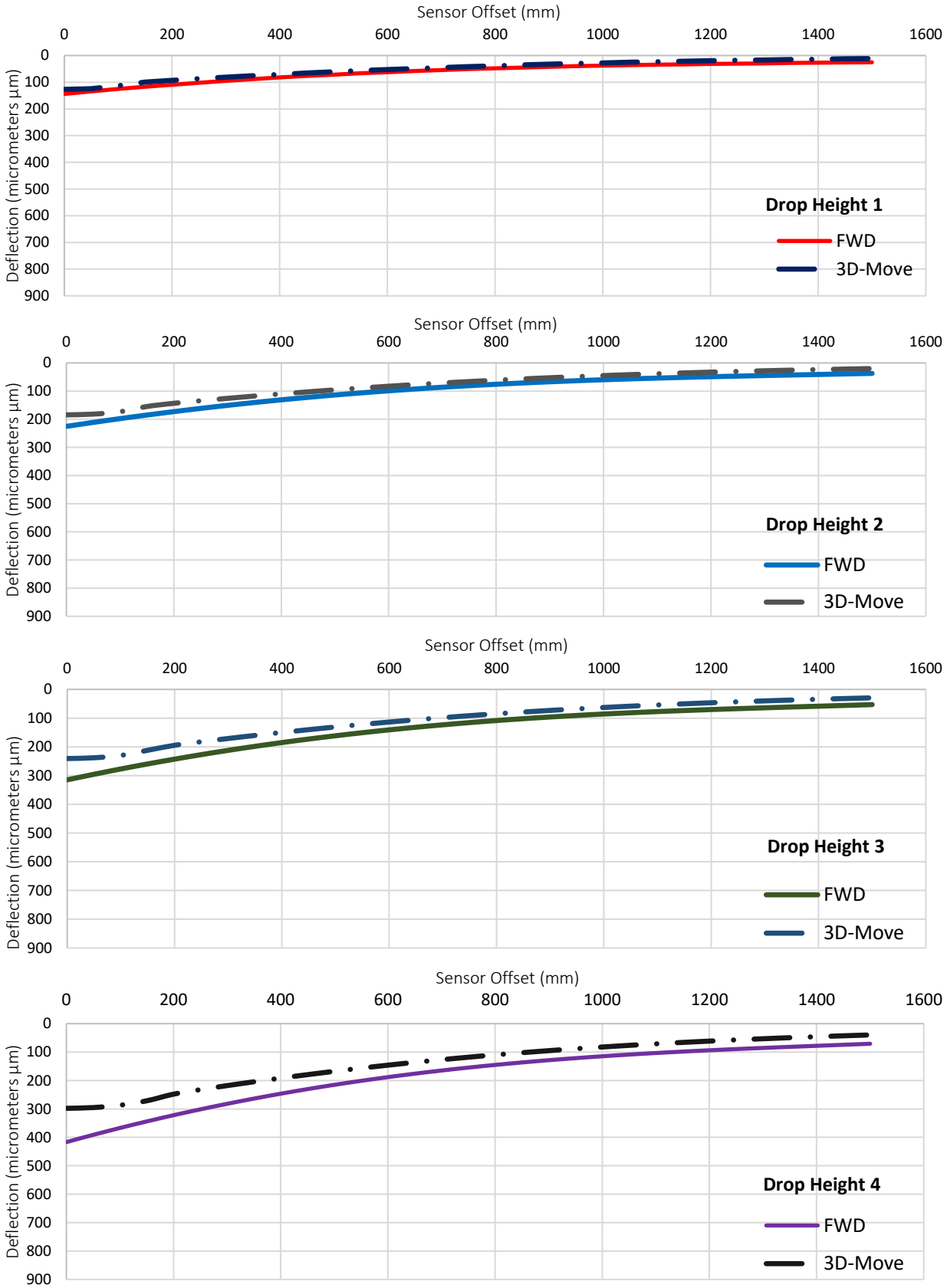

Figure C – 9. Simulated Deflection Bowl for the SHRP section 1111.

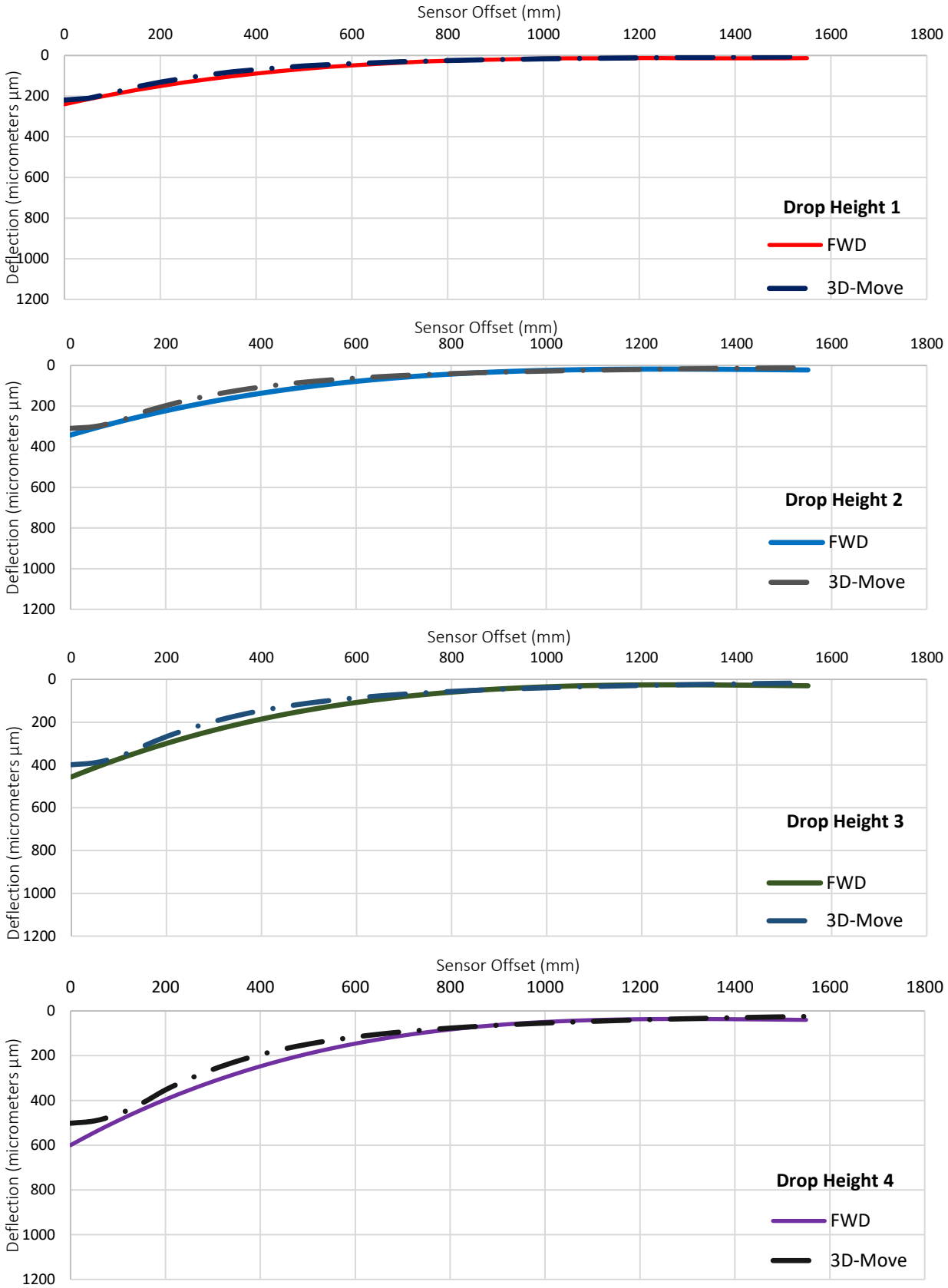

Figure C – 10. Simulated Deflection Bowl for the SHRP section 1113.

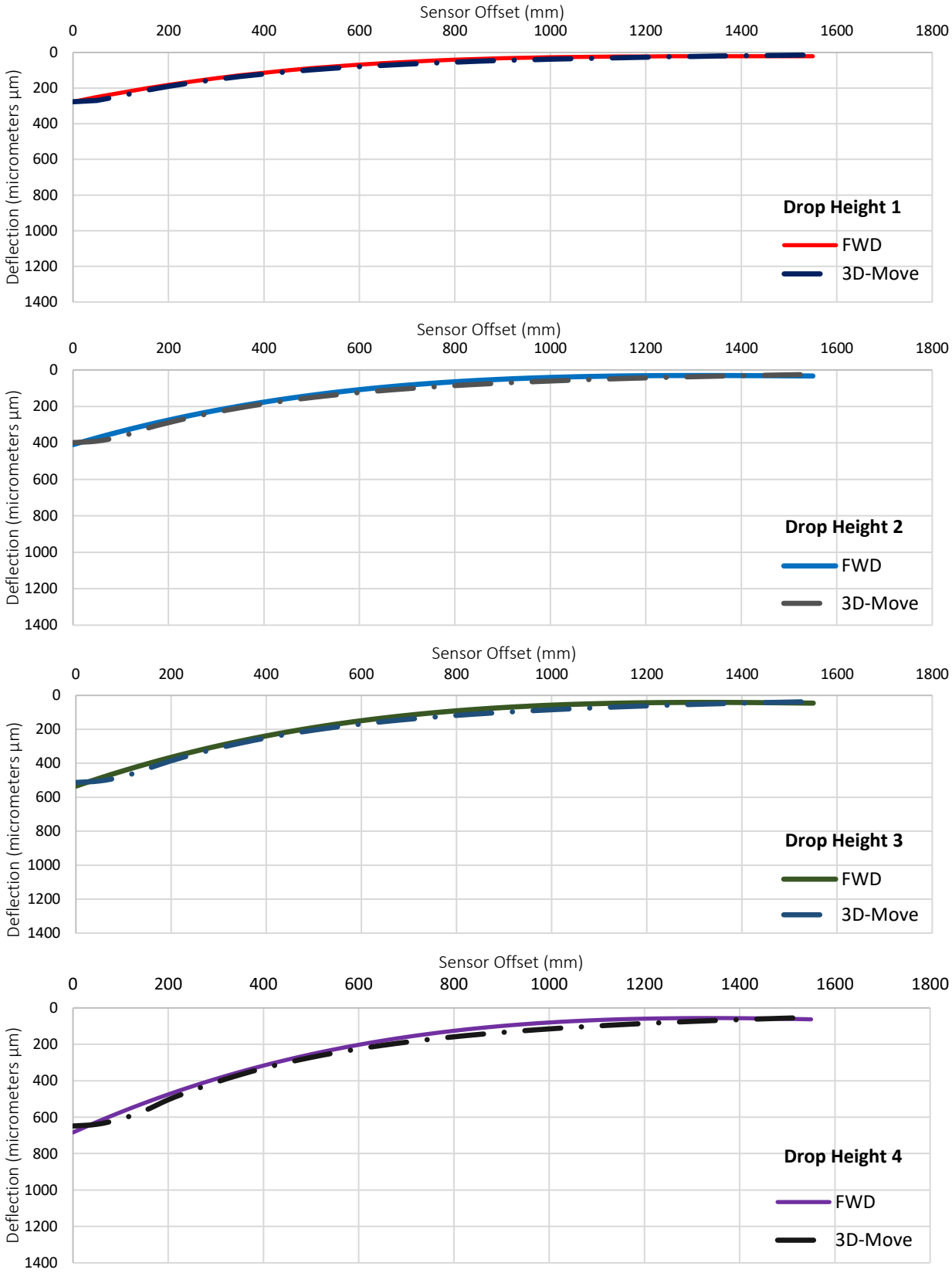

Figure C – 11. Simulated Deflection Bowl for the SHRP section 1116.

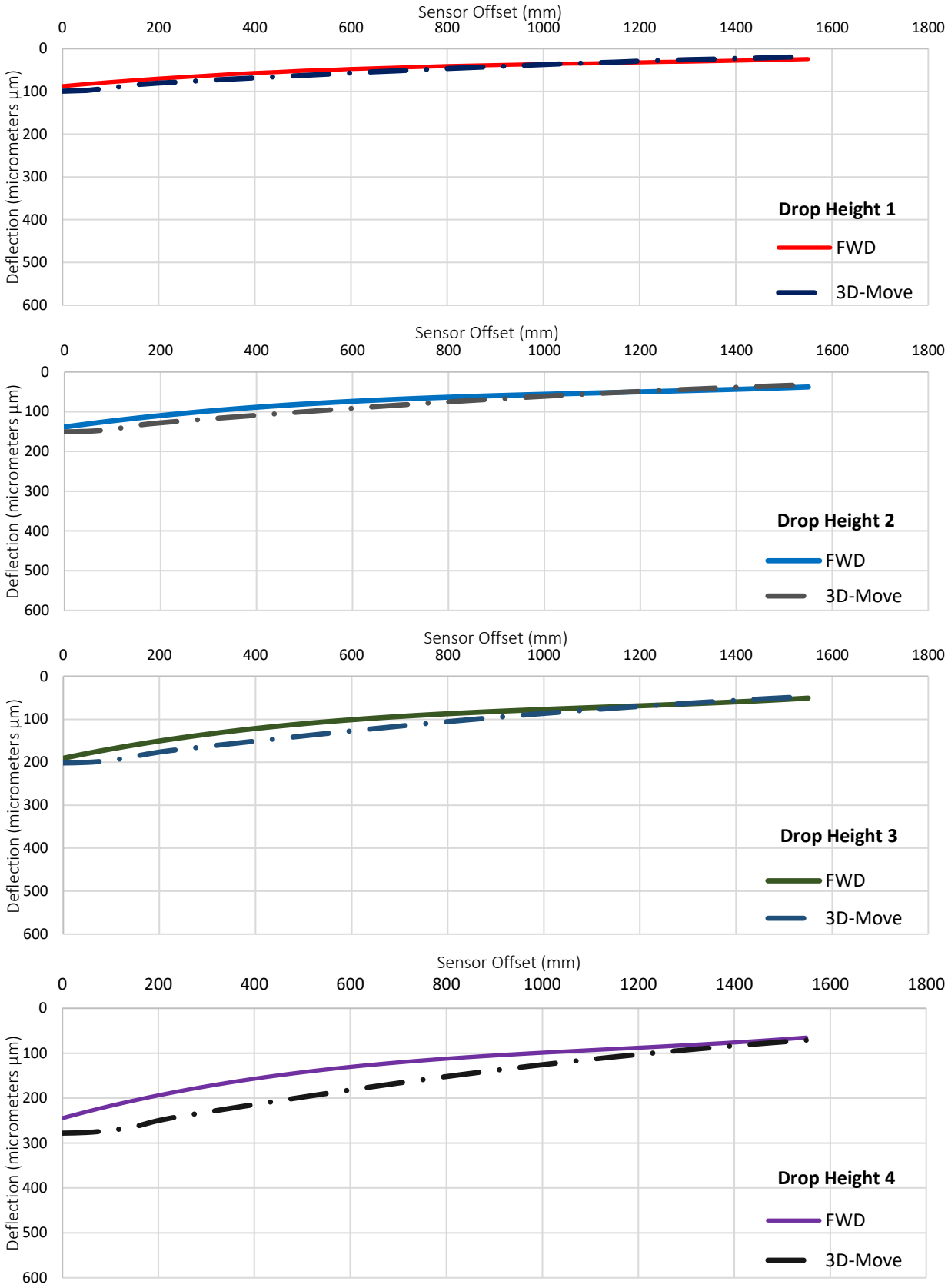

Figure C – 12. Simulated Deflection Bowl for the SHRP section 2172.

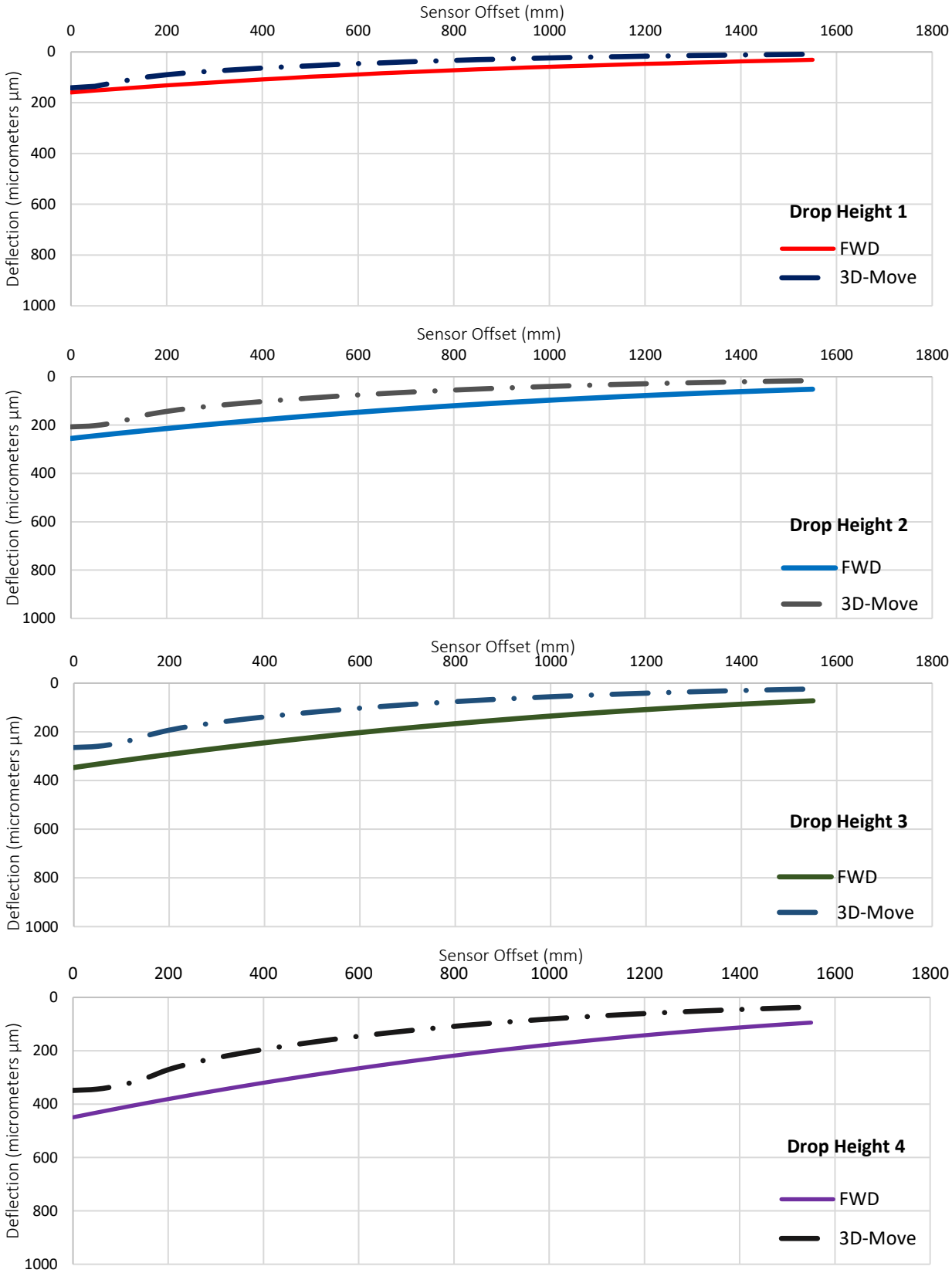

Figure C – 13. Simulated Deflection Bowl for the SHRP section 2176.

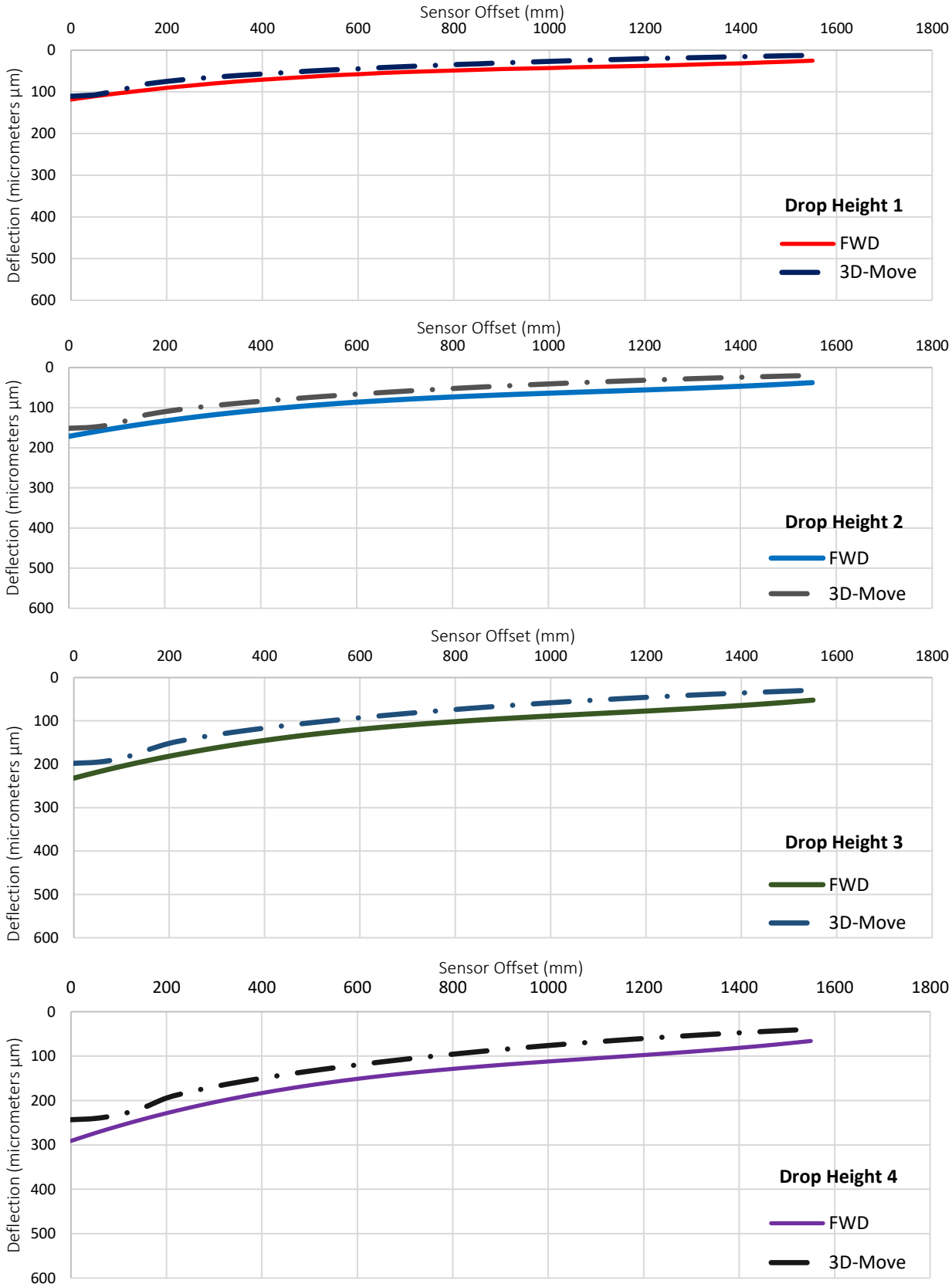

Figure C – 14. Simulated Deflection Bowl for the SHRP section 3669.

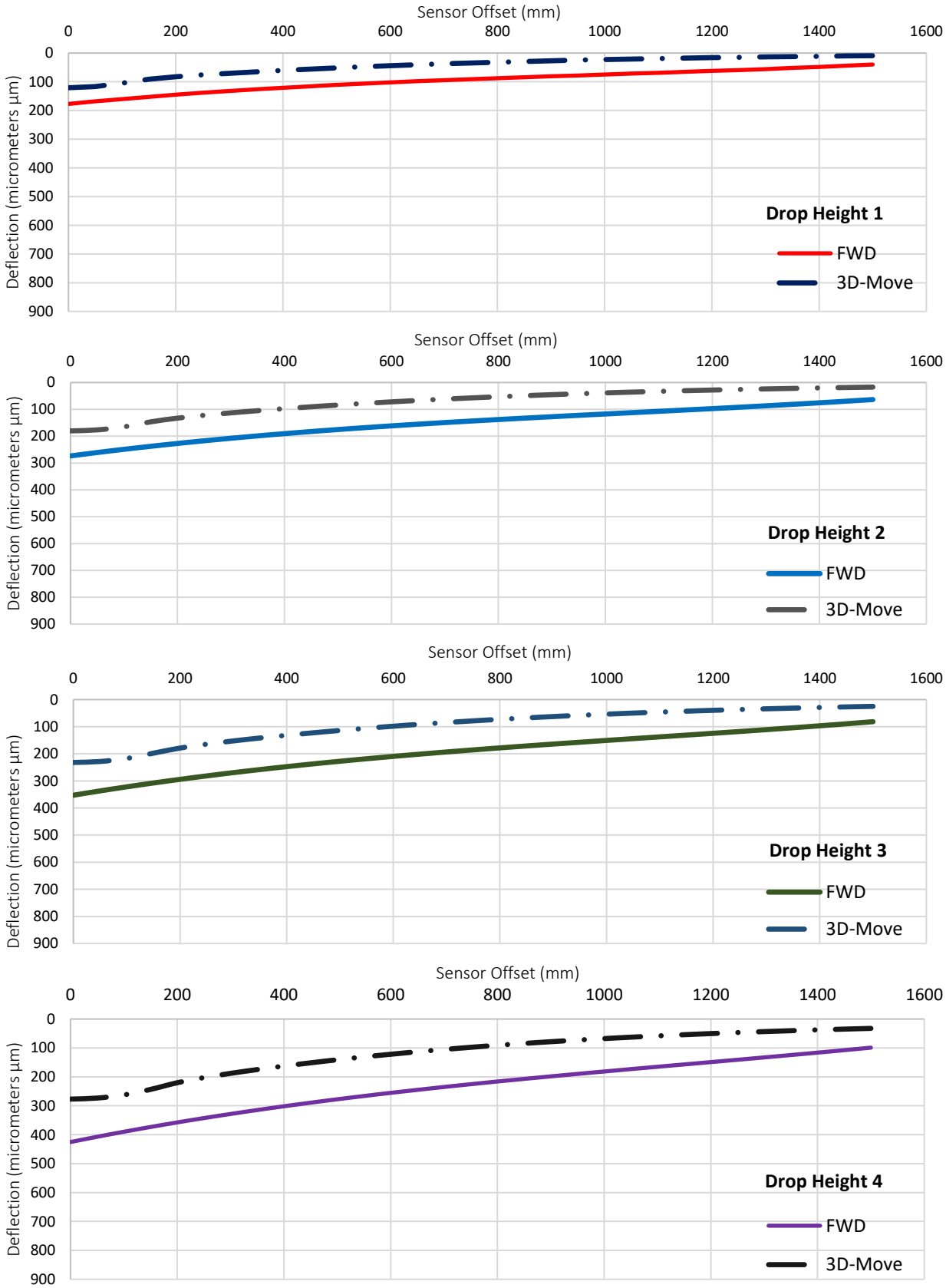

Figure C – 15. Simulated Deflection Bowl for the SHRP section 3679.

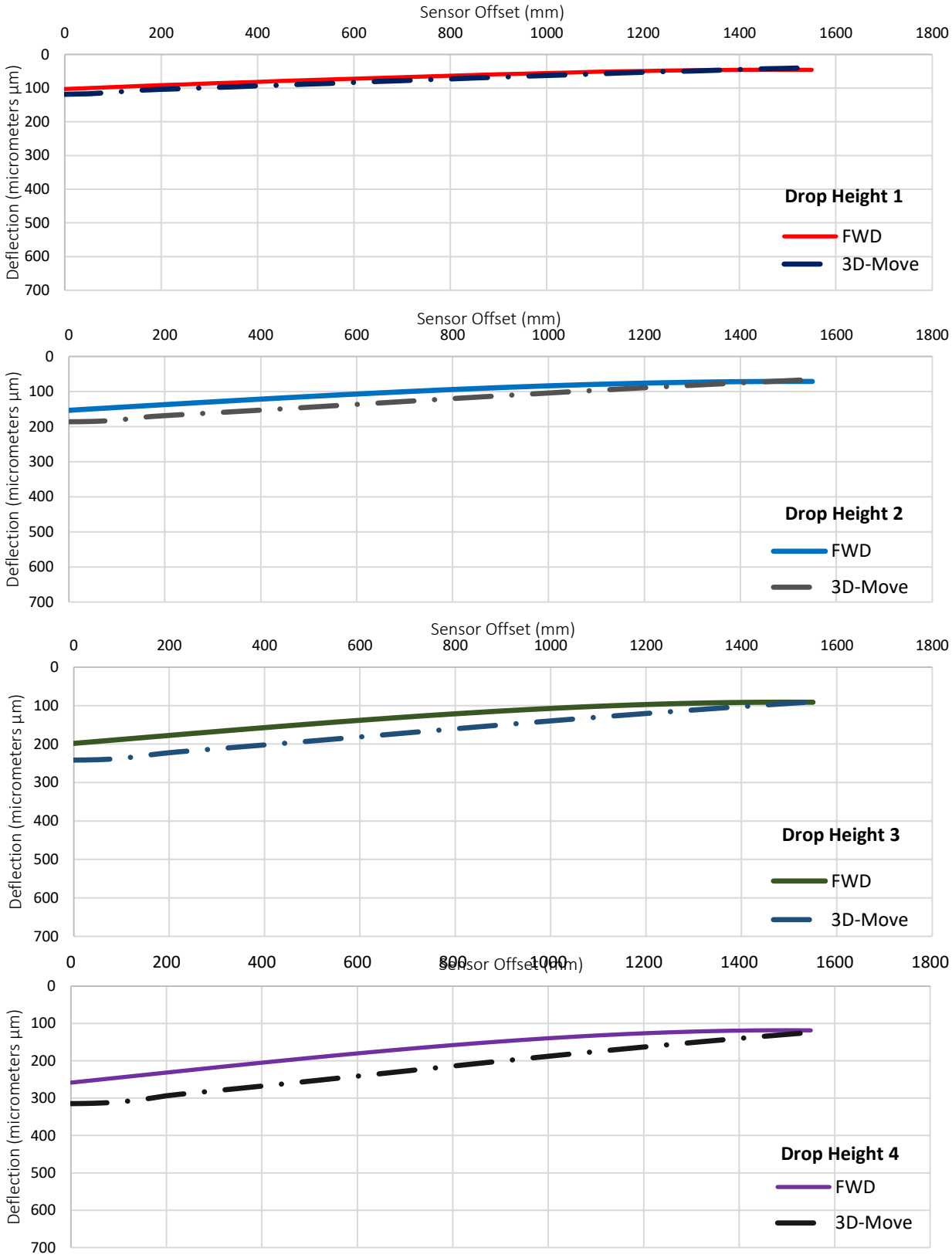

Figure C – 16. Simulated Deflection Bowl for the SHRP section 3729.

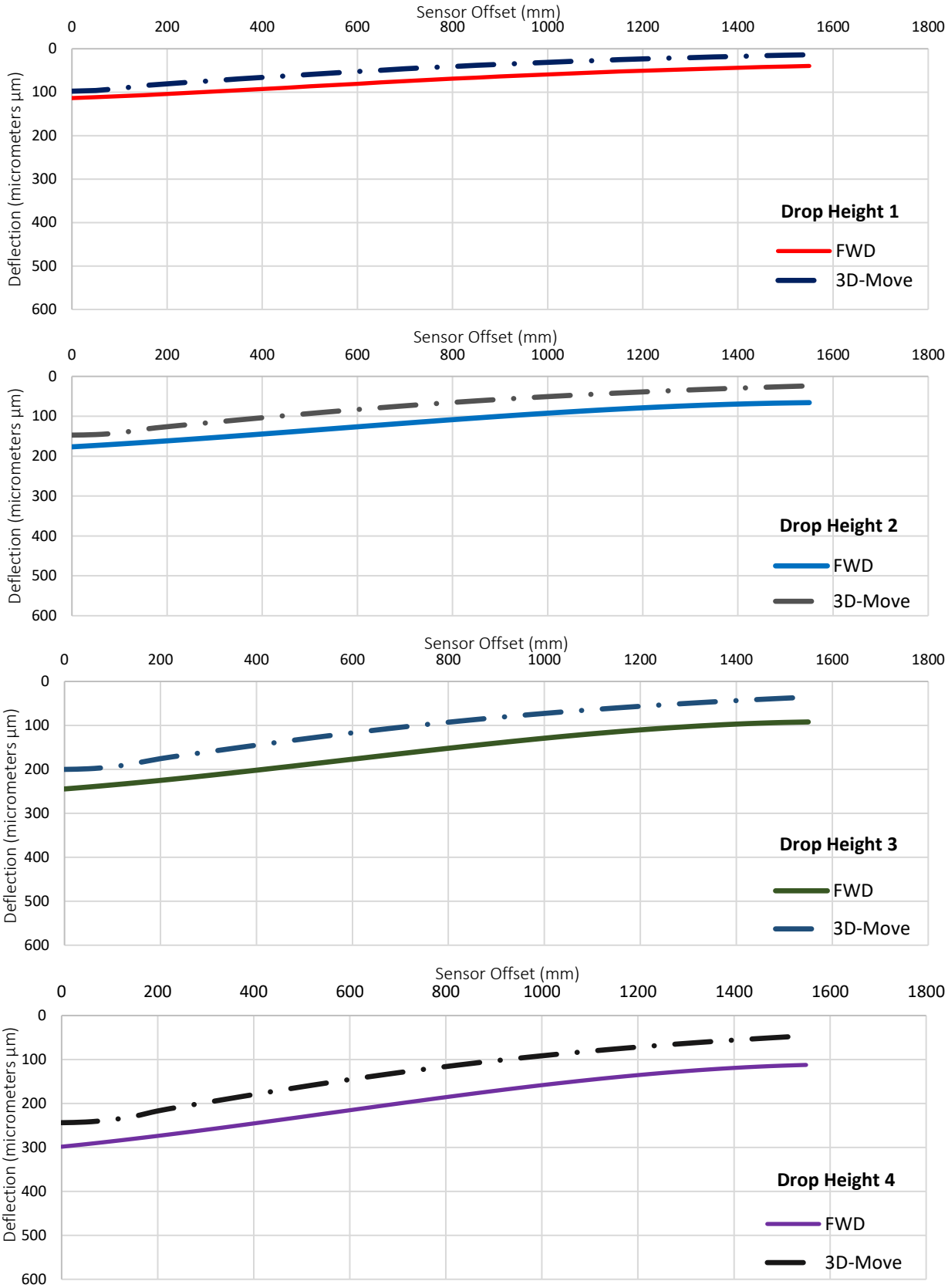

Figure C – 17. Simulated Deflection Bowl for the SHRP section 3835.

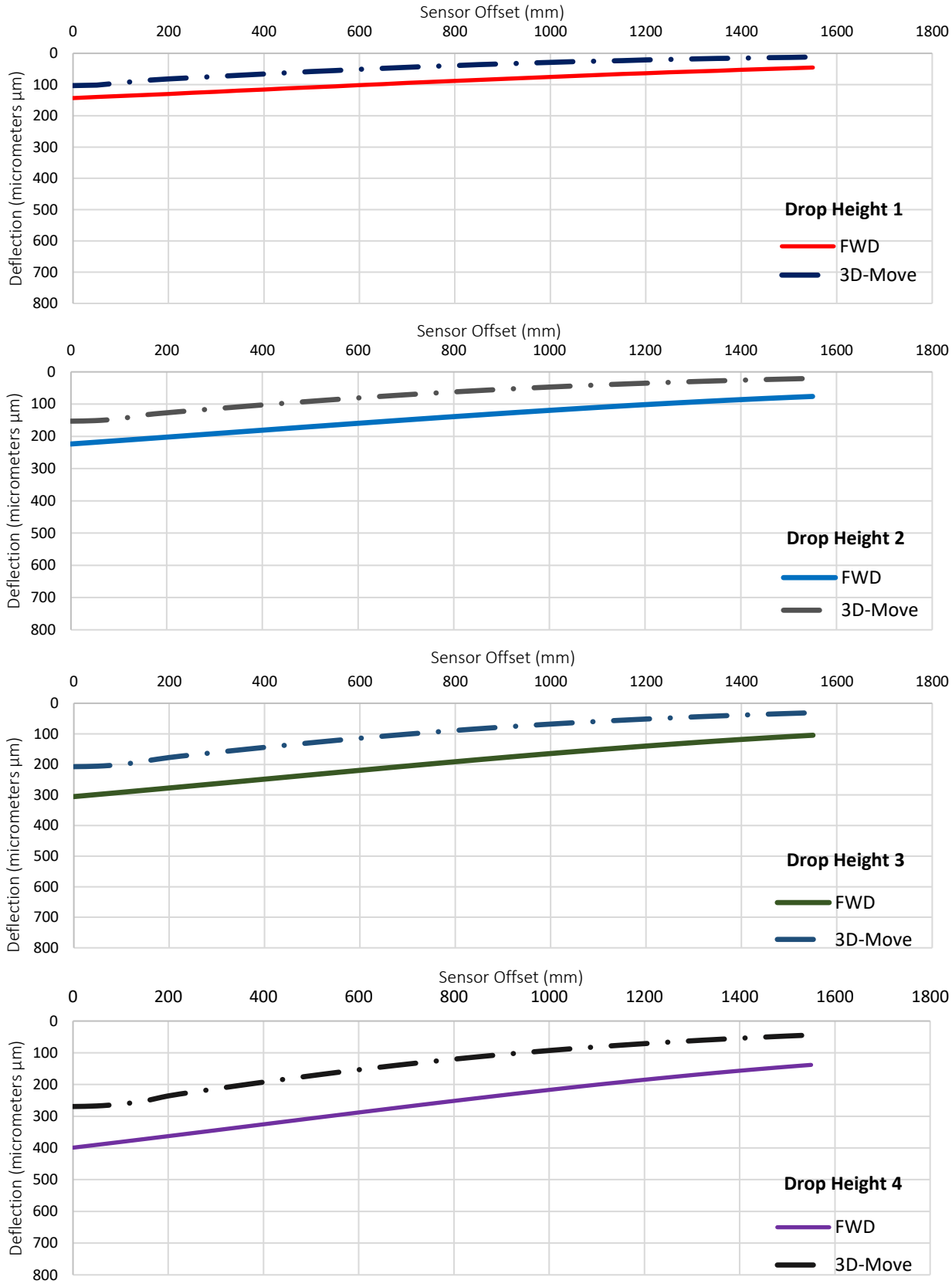

Figure C – 18. Simulated Deflection Bowl for the SHRP section 6079.

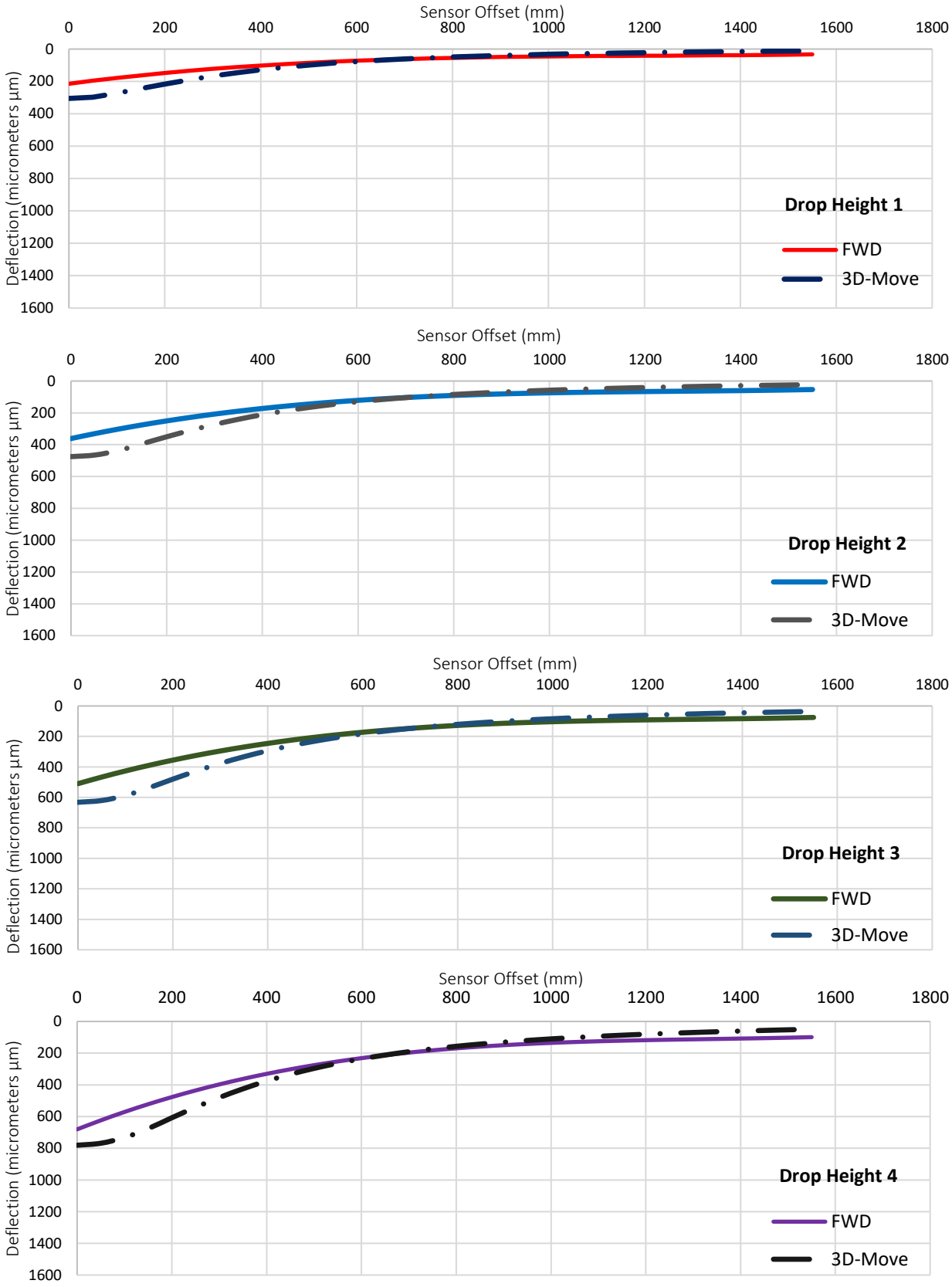

Figure C – 19. Simulated Deflection Bowl for the SHRP section 9005.

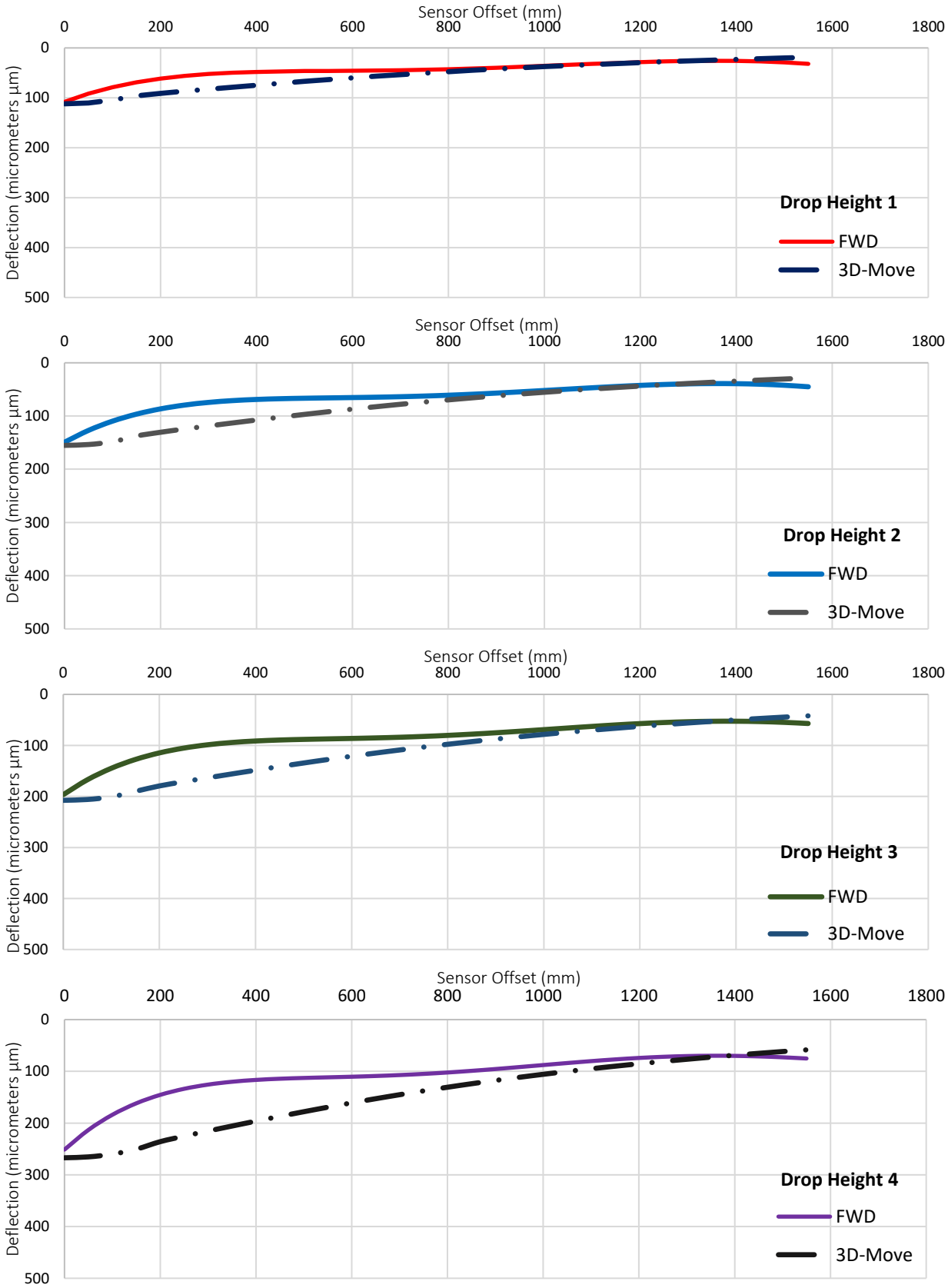

Figure C – 20. Simulated Deflection Bowl for the SHRP section A502.

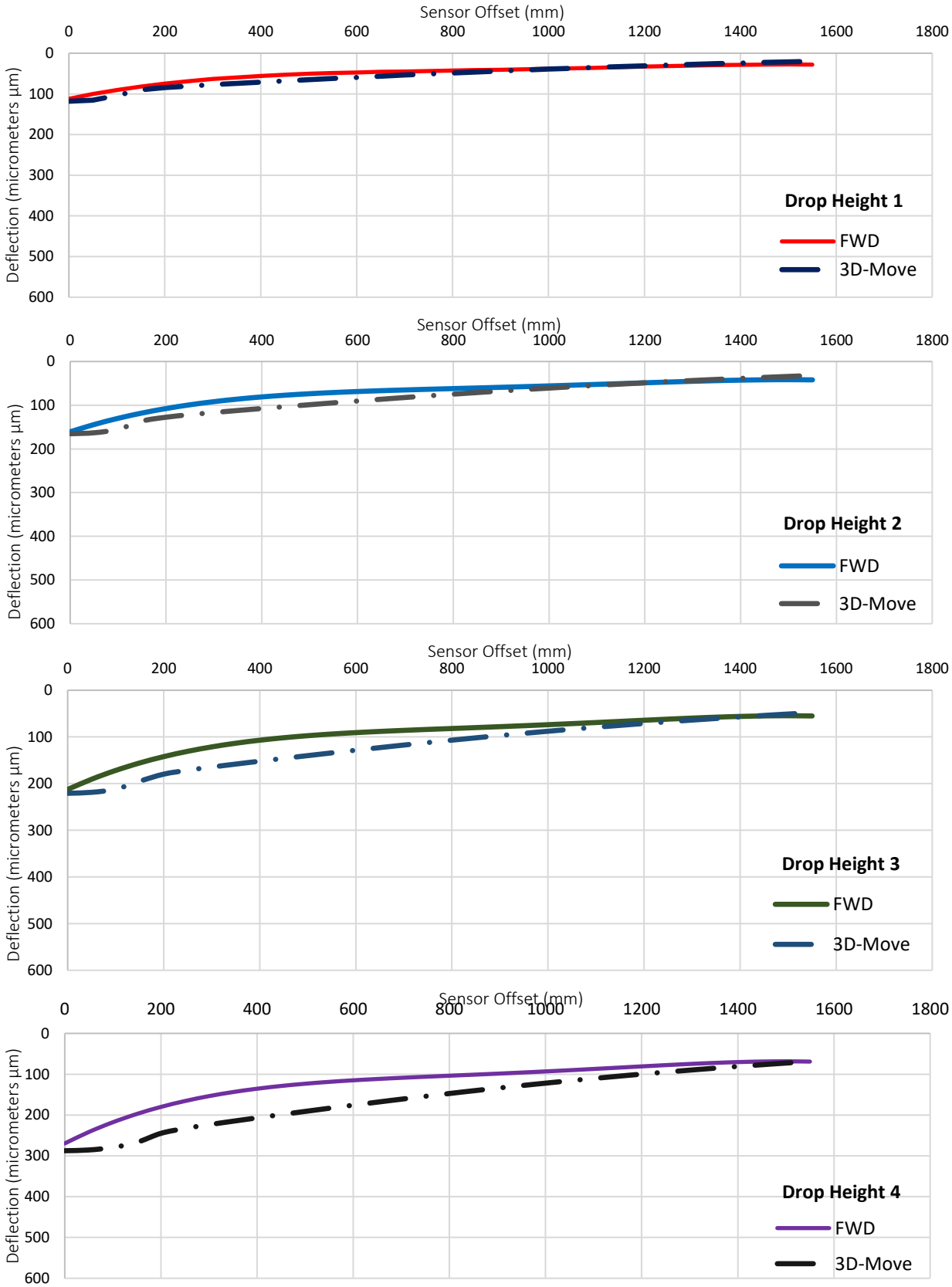

Figure C – 21. Simulated Deflection Bowl for the SHRP section A504.

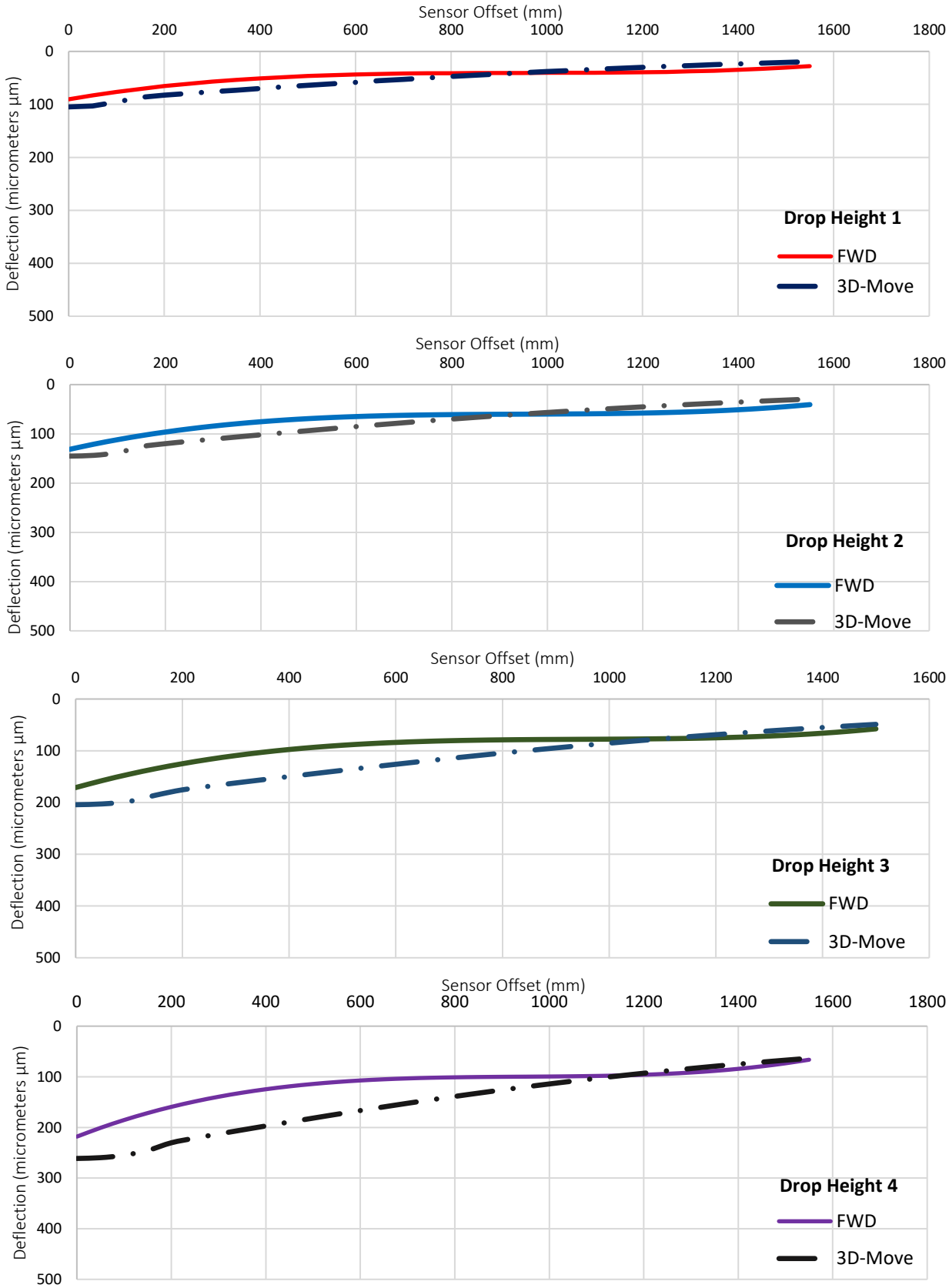

Figure C – 22. Simulated Deflection Bowl for the SHRP section A505.

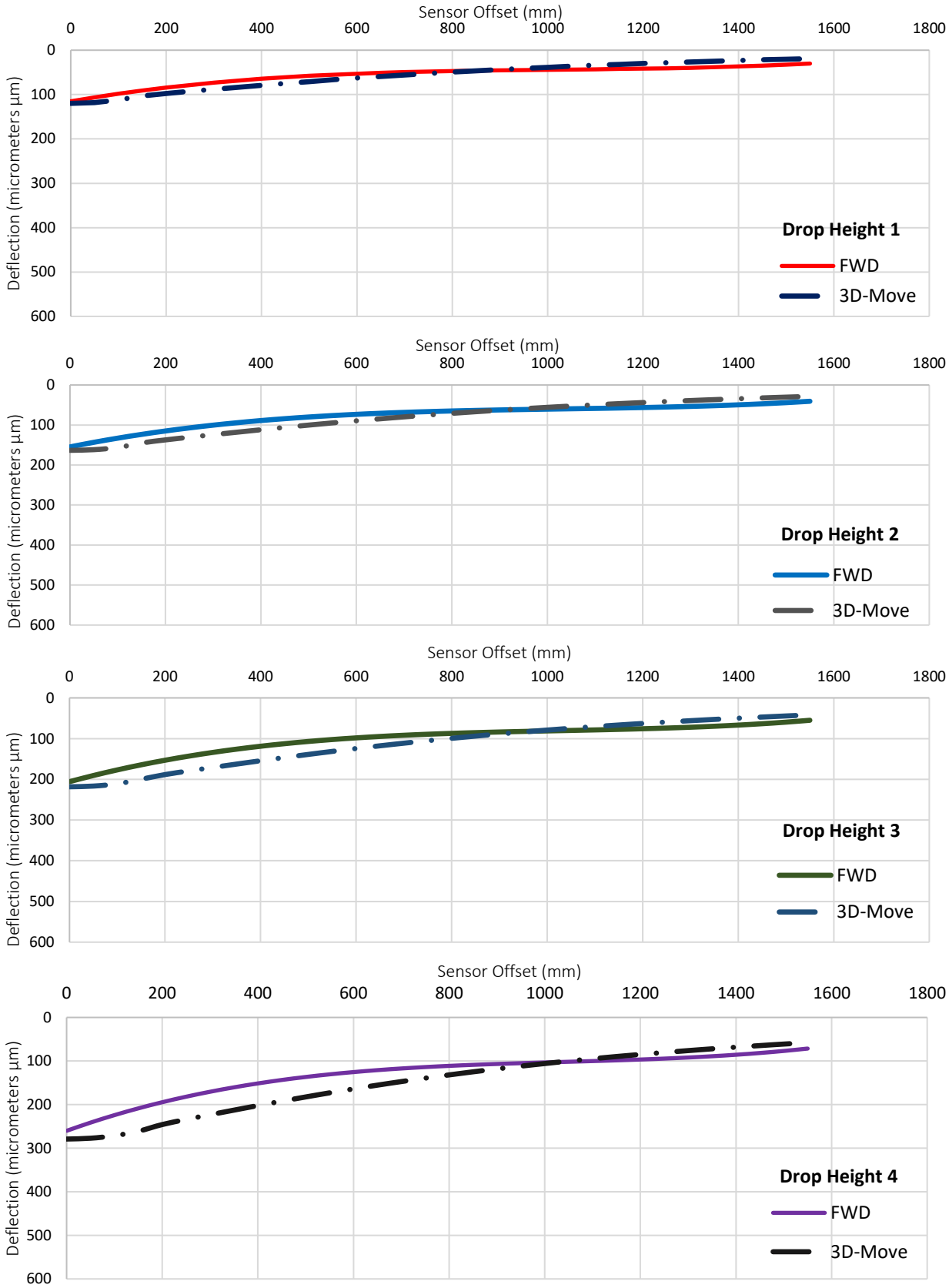

Figure C – 23. Simulated Deflection Bowl for the SHRP section A507.

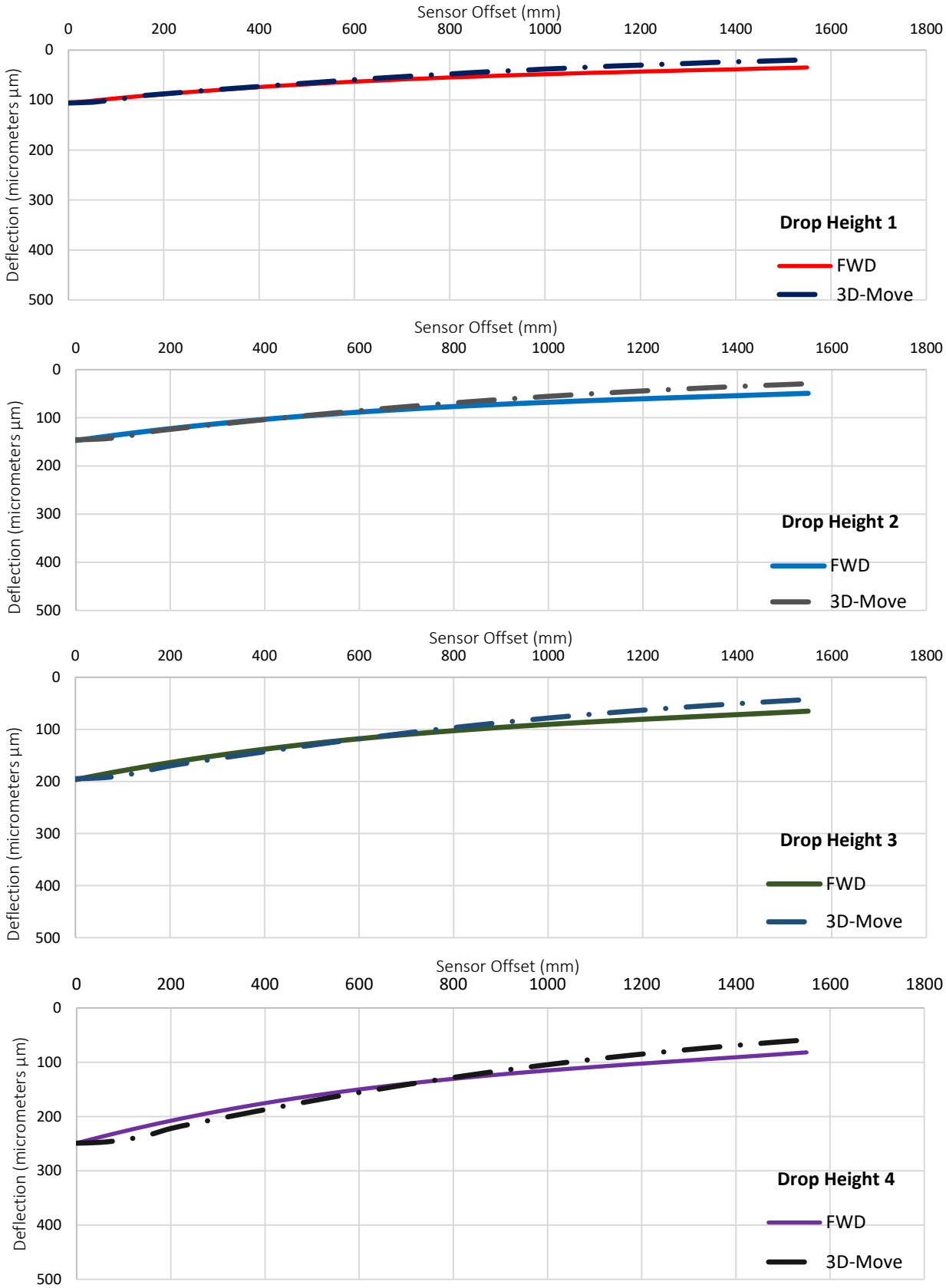

Figure C – 24. Simulated Deflection Bowl for the SHRP section A508.

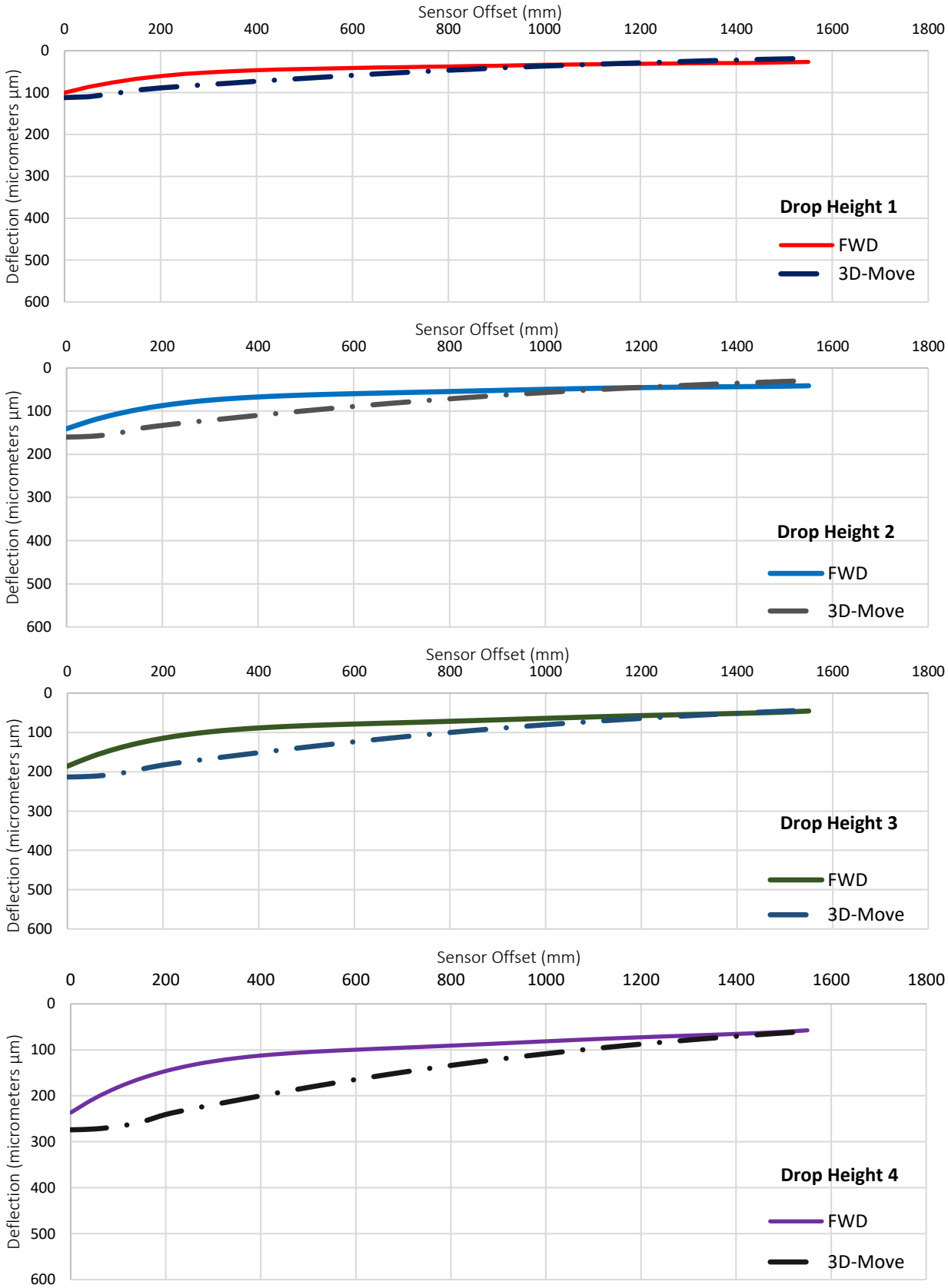

Figure C – 25. Simulated Deflection Bowl for the SHRP section B310.

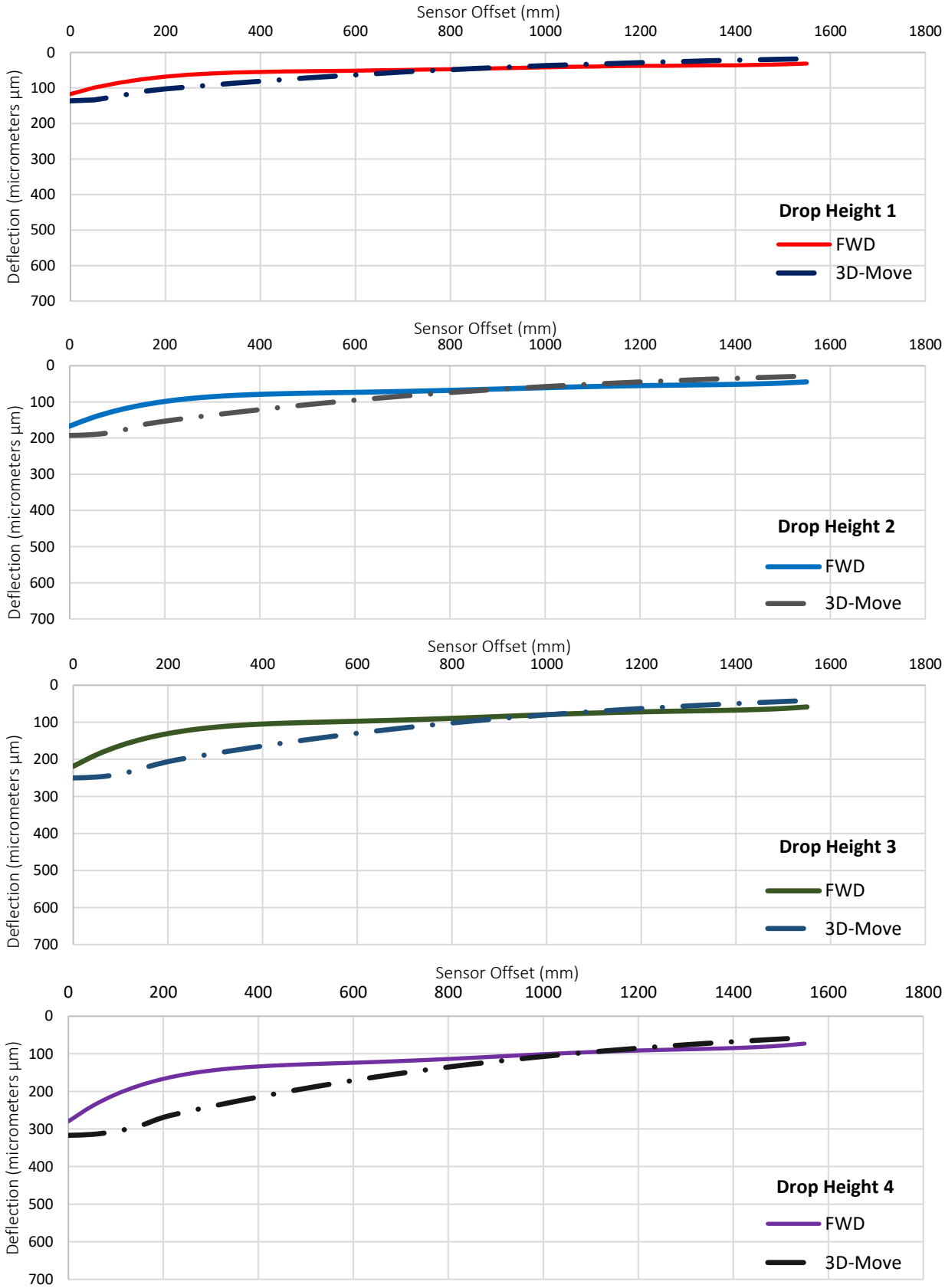

Figure C – 26. Simulated Deflection Bowl for the SHRP section B320.

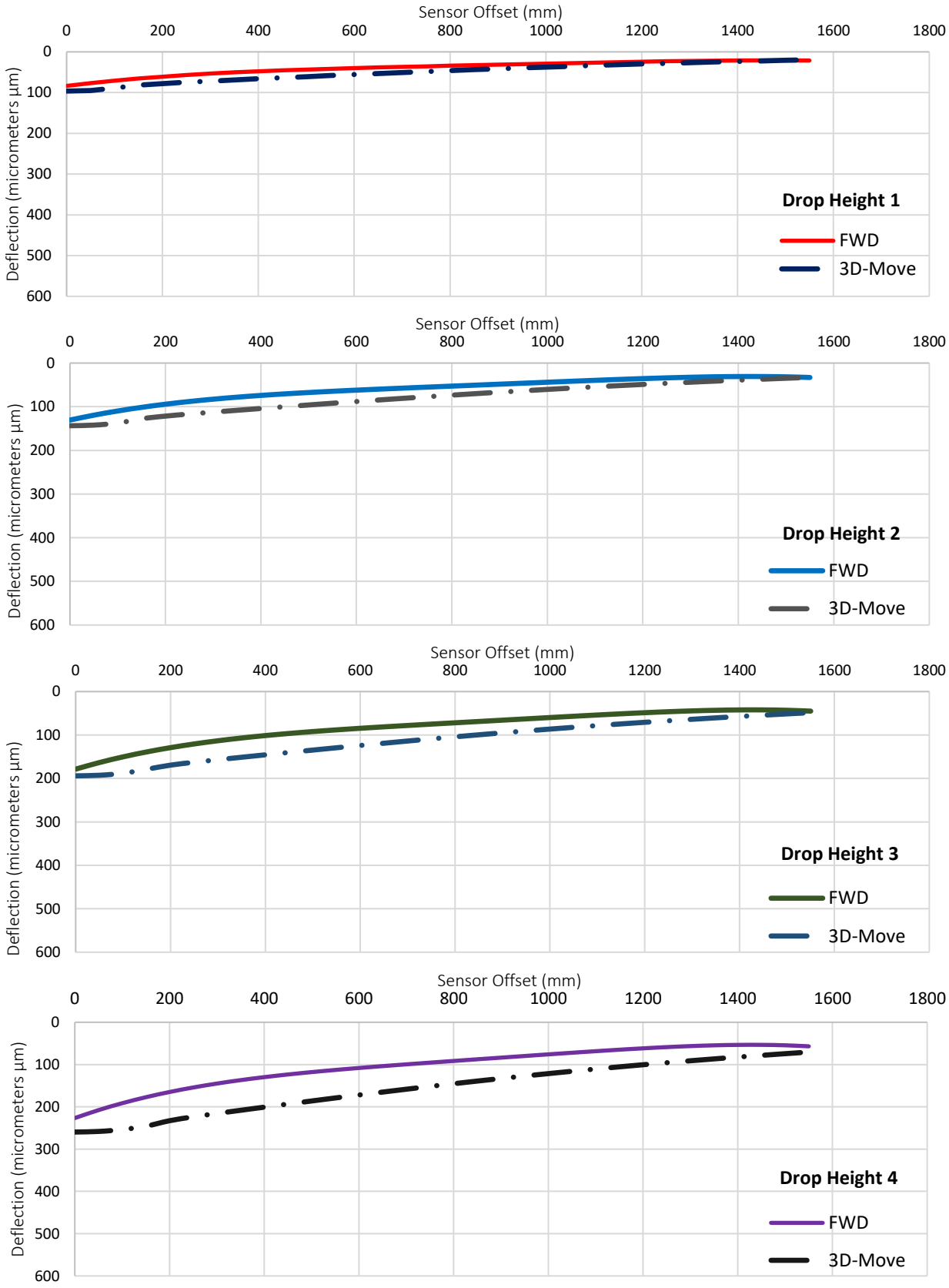

Figure C – 27. Simulated Deflection Bowl for the SHRP section D310.

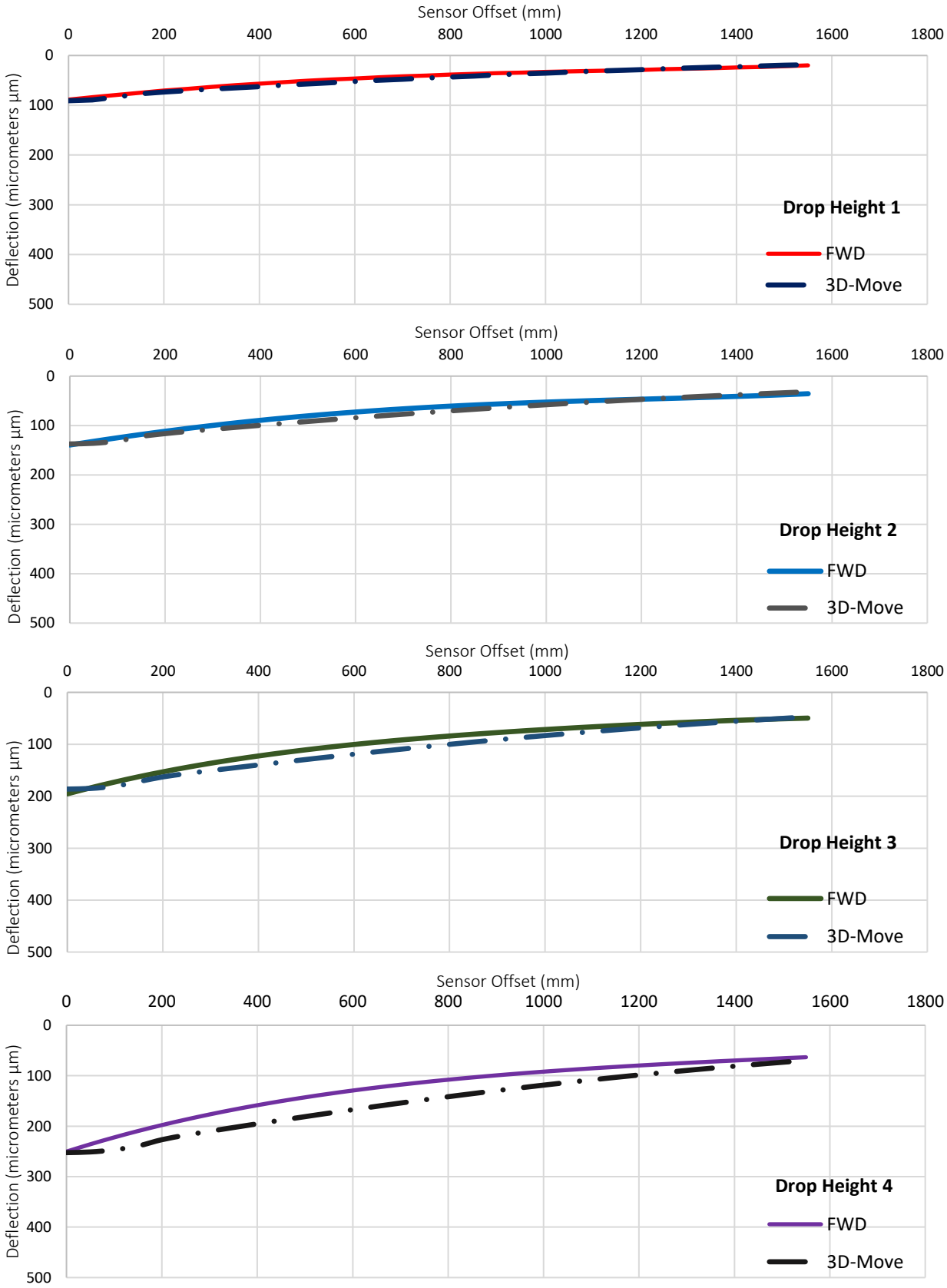

Figure C – 28. Simulated Deflection Bowl for the SHRP section D320.

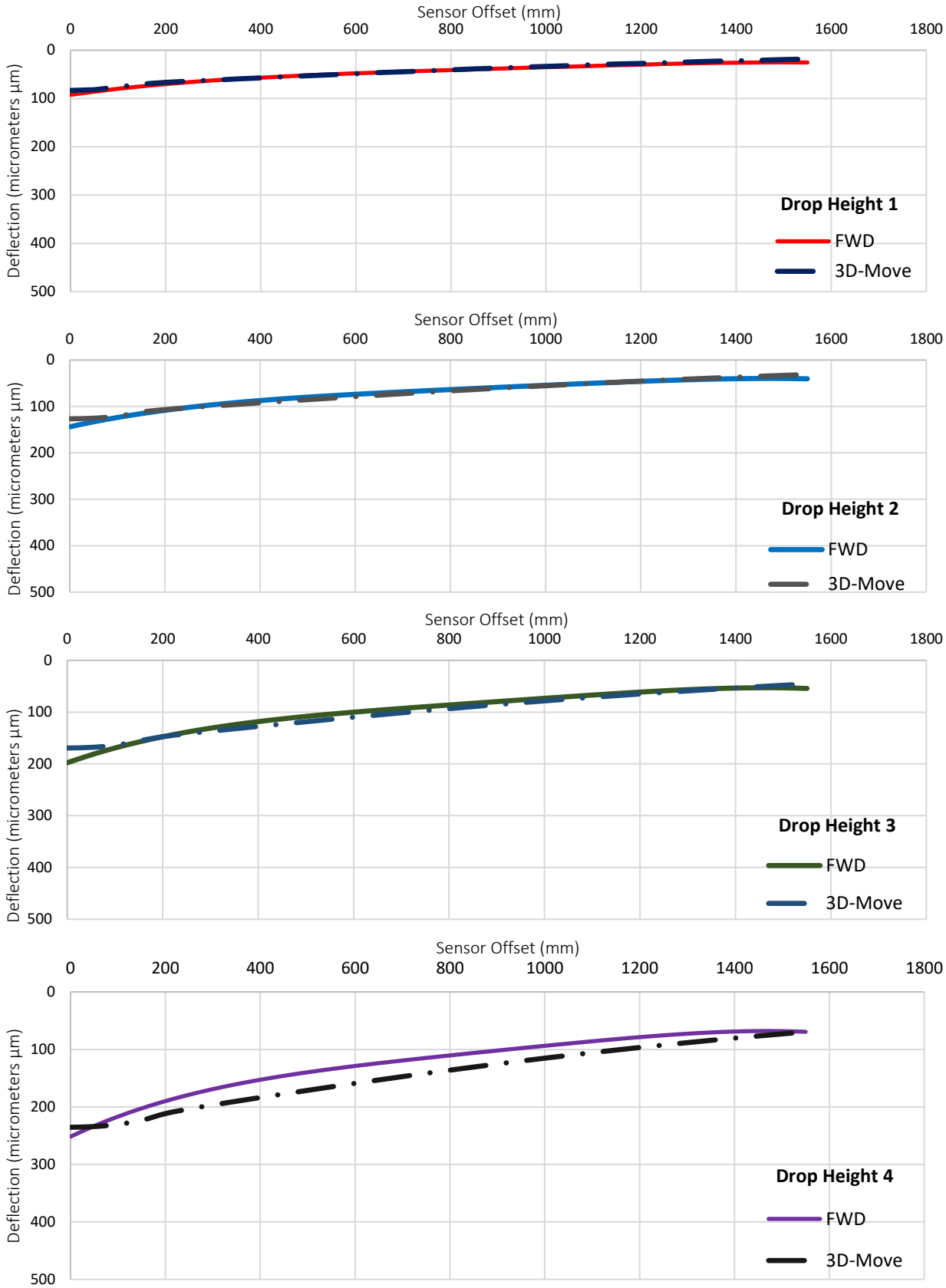

Figure C – 29. Simulated Deflection Bowl for the SHRP section D330.

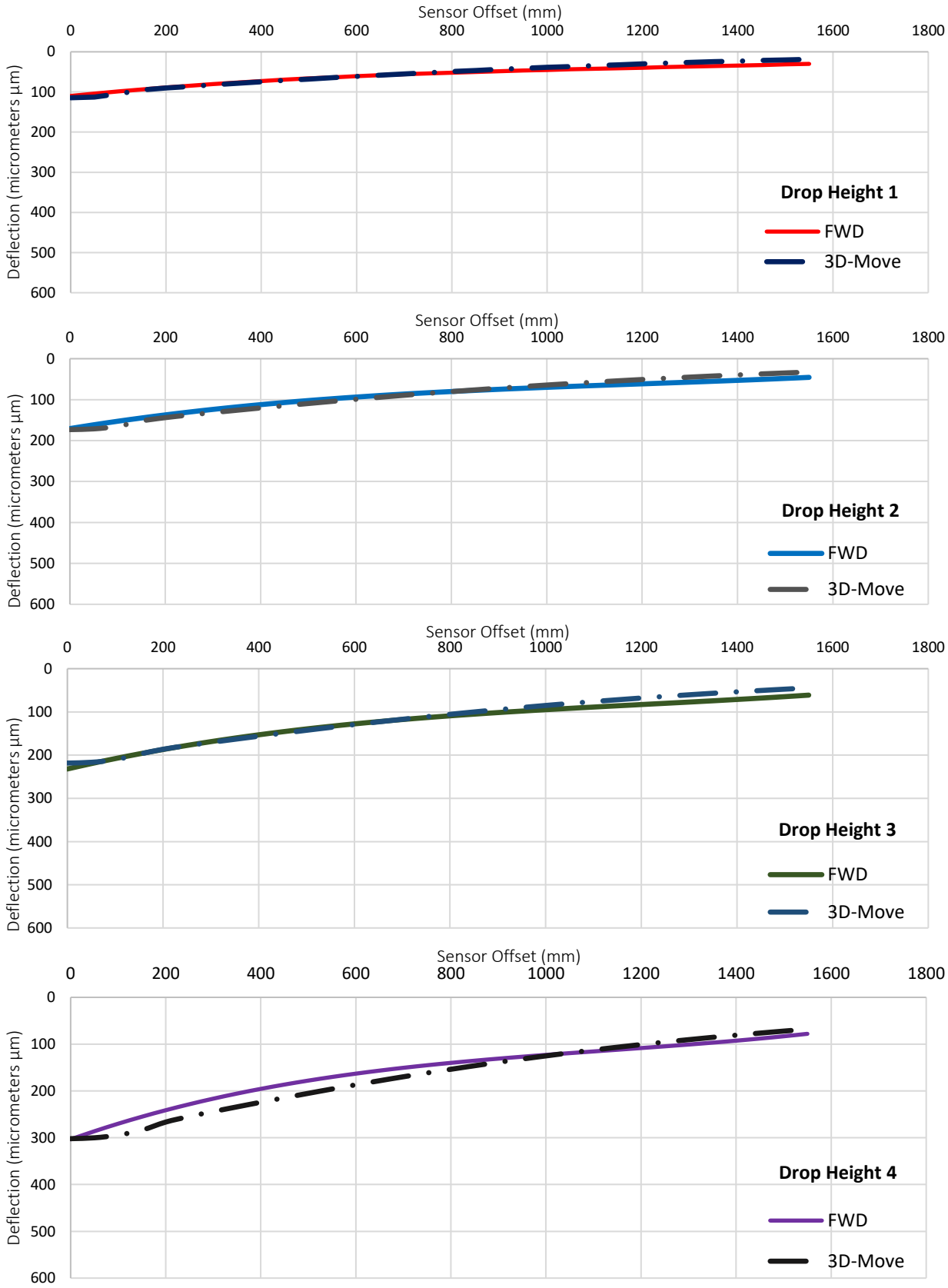

Figure C –30. Simulated Deflection Bowl for the SHRP section D350.

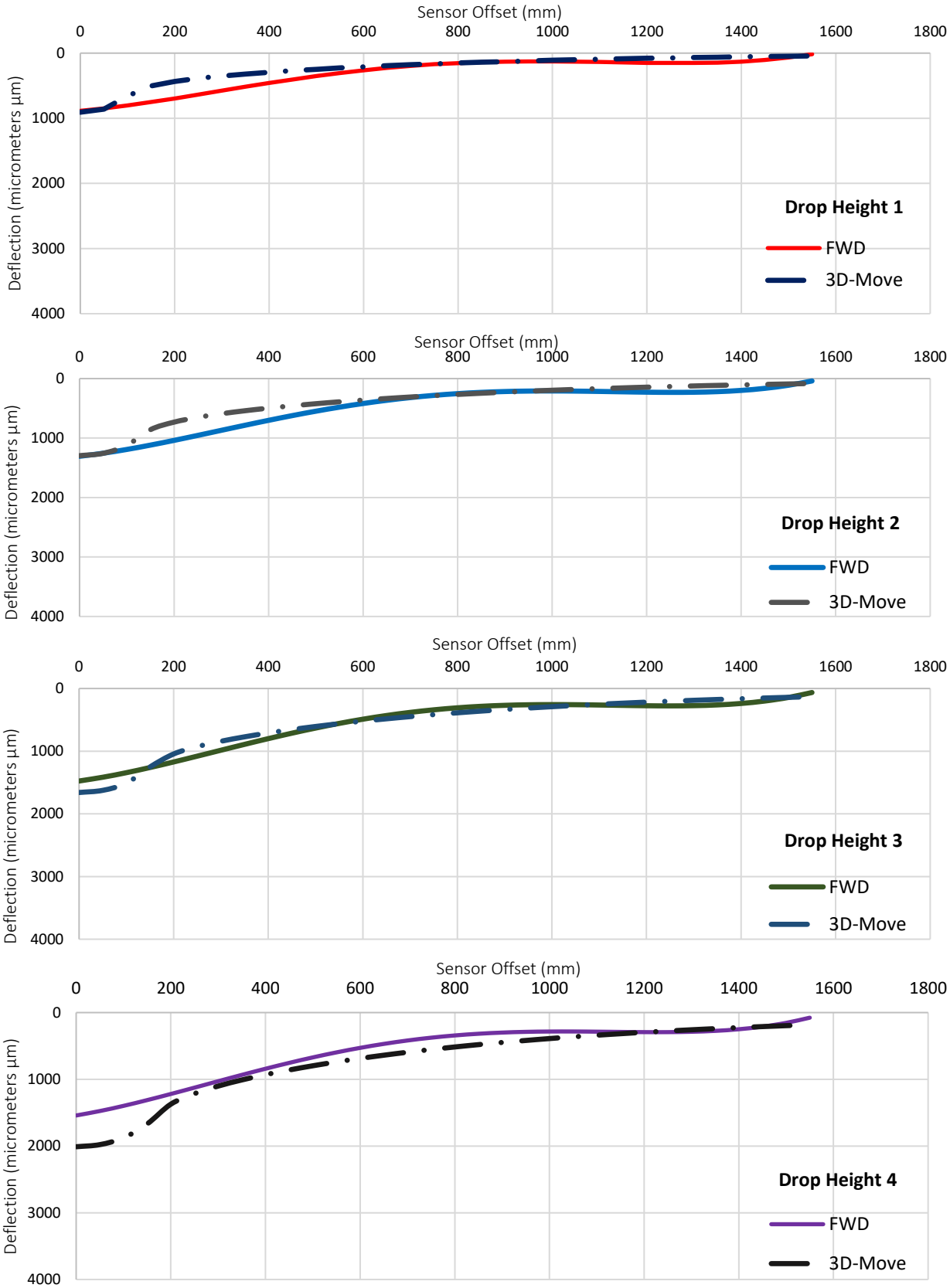

Figure C –31. Simulated Deflection Bowl for the SHRP section M310.

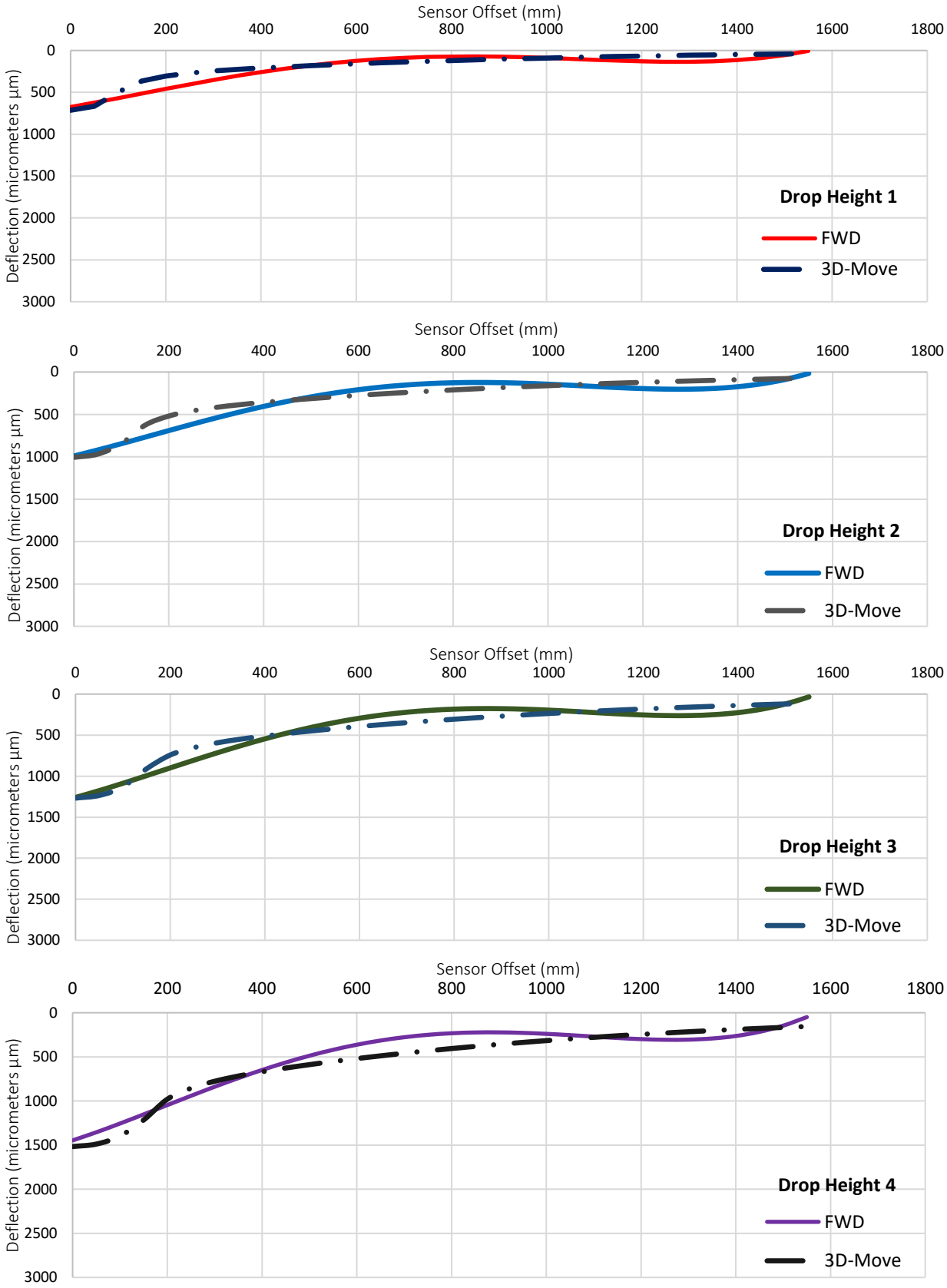

Figure C –32. Simulated Deflection Bowl for the SHRP section M320.

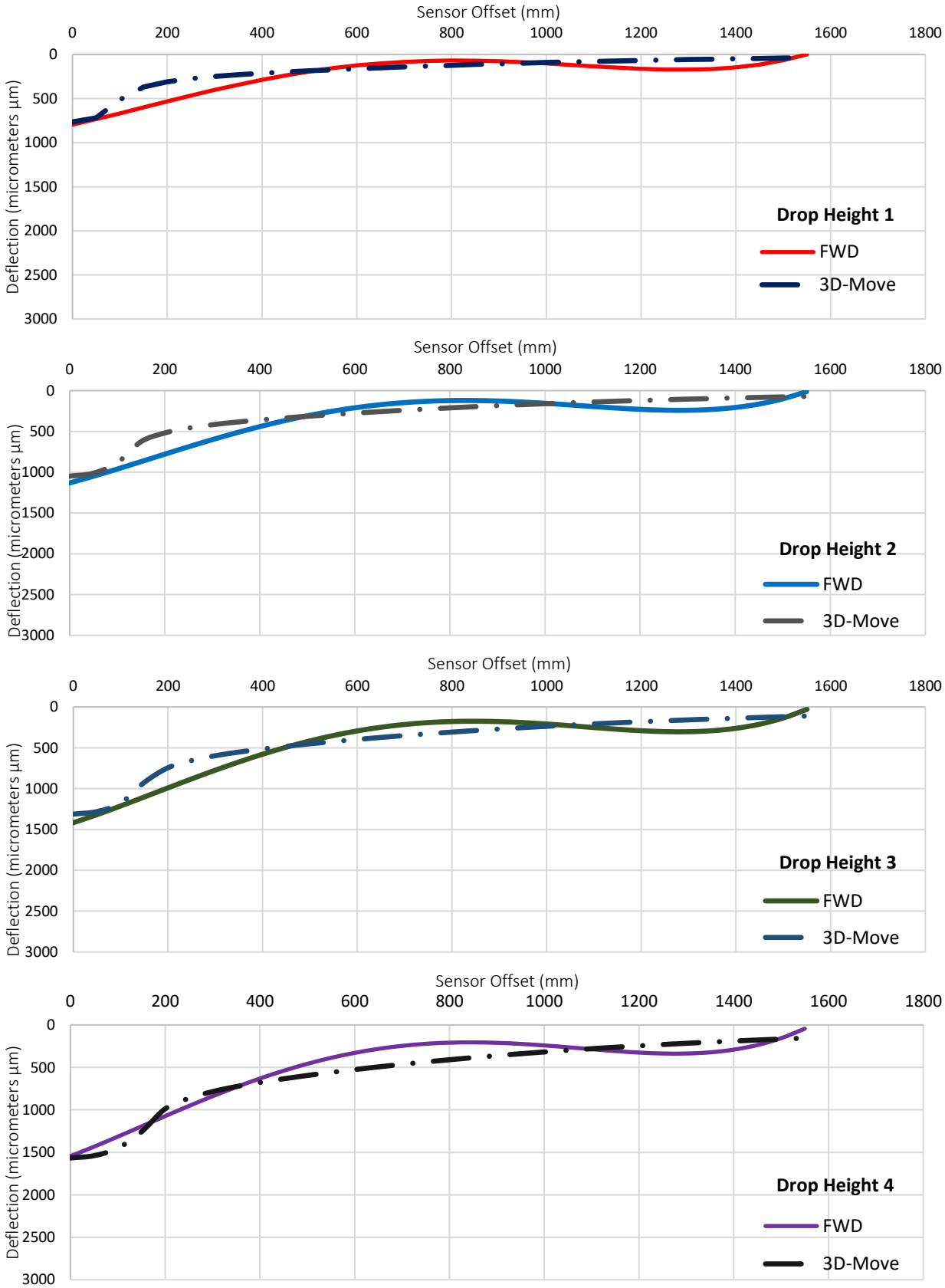

Figure C –33. Simulated Deflection Bowl for the SHRP section M330.

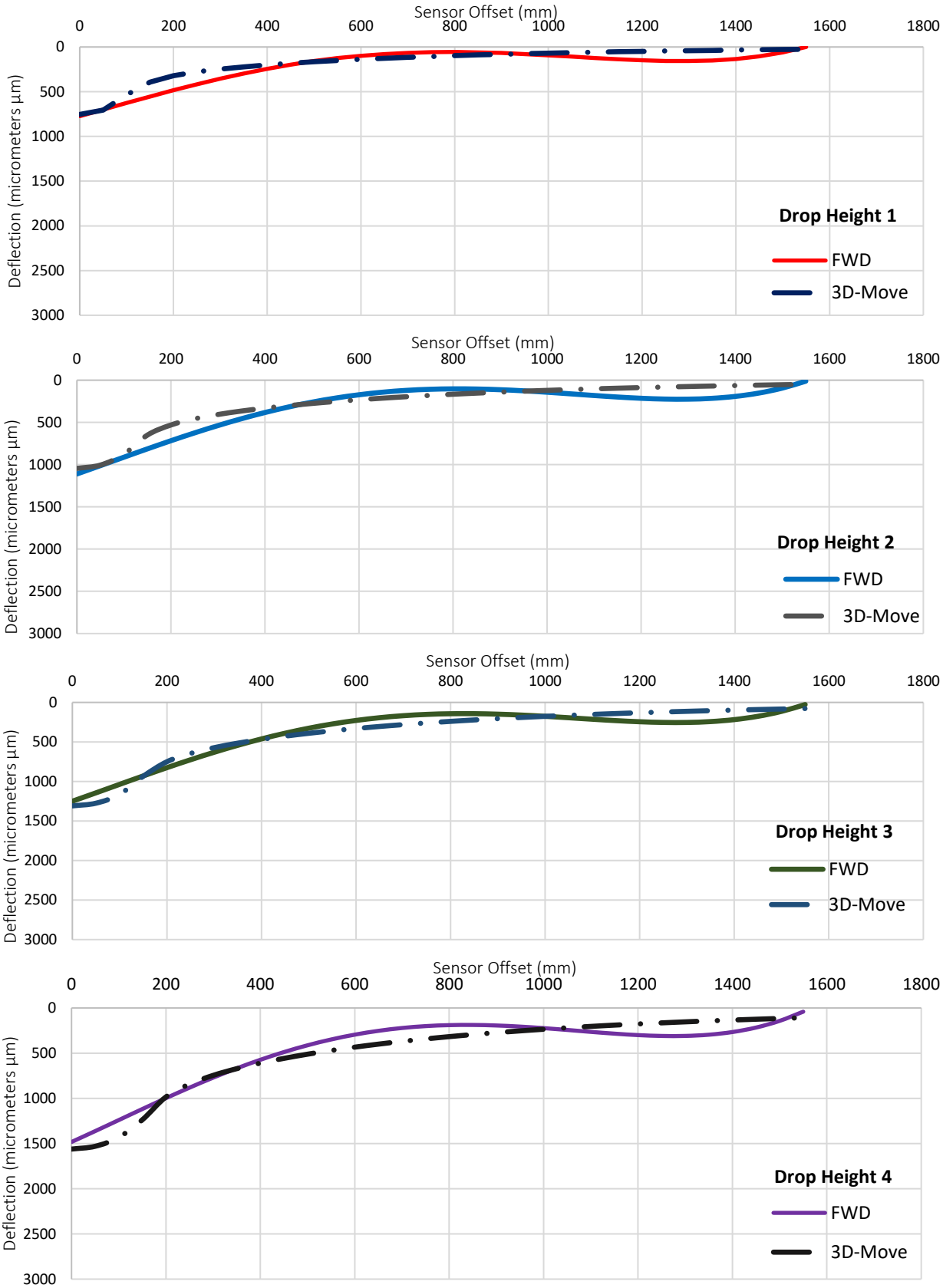

Figure C –34. Simulated Deflection Bowl for the SHRP section M340.

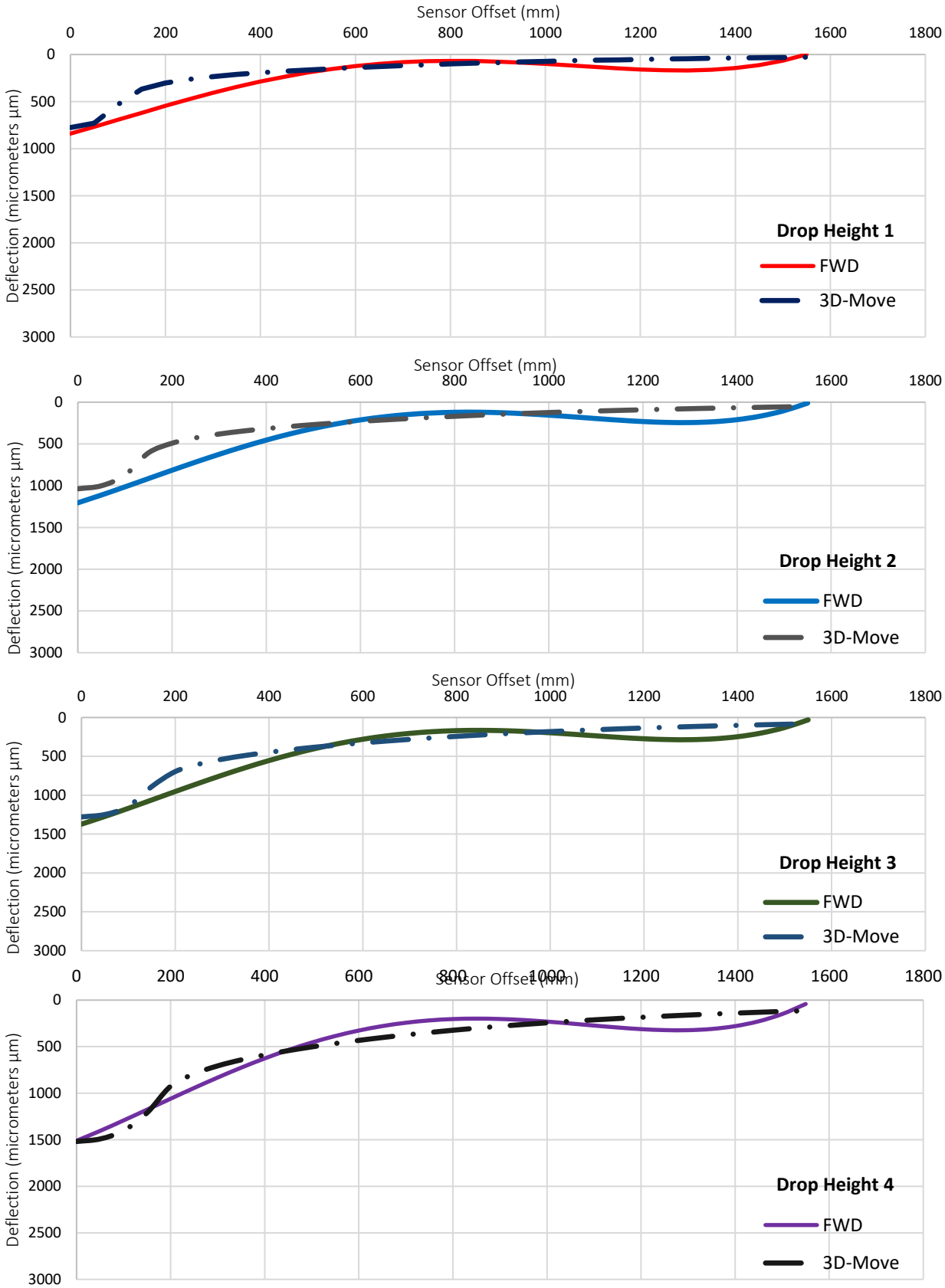

Figure C –35. Simulated Deflection Bowl for the SHRP section M350.