

**GEOTECHNICAL AND PAVEMENT
ENGINEERING REPORT**
Thorp Prairie Road Evaluation and Design
Kittitas County, Washington
HWA Project No. 2012-105-21
Prepared for
PacifiClean Environmental LLC
February 1, 2013



HWA GEOSCIENCES INC.

- *Geotechnical Engineering*
- *Hydrogeology*
- *Geoenvironmental Services*
- *Inspection & Testing*



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Geotechnical & Pavement Engineering • Hydrogeology • Geoenvironmental • Inspection & Testing

February 1, 2013
HWA Project No. 2012-105-21

PacificClean Environmental LLC
111 N Post Street, Suite 200
Spokane, WA 99201

Attention: Mr. Larry Condon

**SUBJECT: Geotechnical and Pavement Engineering Report
Thorp Prairie Road Evaluation and Design
Kittitas County, Washington**

Dear Mr. Condon:

As authorized, HWA GeoSciences Inc. (HWA) has completed a geotechnical and pavement engineering study along approximately 10,700 feet of Thorp Prairie Road in Kittitas County, Washington. The objective of our investigation was to evaluate the existing pavement and subgrade conditions along Thorp Prairie Road, between the intersection with Elk Heights Road and the proposed location of the new Elk Heights Organics Processing Facility at 8860 Thorp Prairie Road, in order to assess the impact of increased truck traffic and to provide pavement rehabilitation options, if necessary. Our scope of work included field reconnaissance, Falling Weight Deflectometer (FWD) testing, pavement coring, engineering analyses, and preparation of the attached report summarizing the investigation results and our recommendations.

We appreciate the opportunity to provide geotechnical services on this project.

Sincerely,

HWA GEOSCIENCES INC.

George Minassian, Ph.D., P.E.
Geotechnical Engineer

Enclosure: Geotechnical Report

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TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY	1
2.0 INTRODUCTION.....	1
2.1 GENERAL.....	1
2.2 PROJECT UNDERSTANDING.....	1
3.0 FIELD AND LABORATORY TESTING.....	2
3.1 FALLING WEIGHT DEFLECTOMETER TESTING	2
3.2 PAVEMENT CORE HOLES	3
3.3 LABORATORY TESTING	3
4.0 SITE CONDITIONS	4
4.1 SITE DESCRIPTION.....	4
4.2 GENERAL GEOLOGY	4
4.3 PAVEMENT STRUCTURAL LAYERS.....	5
4.4 FWD TESTING RESULTS.....	6
5.0 CONCLUSIONS AND RECOMMENDATIONS	7
5.1 GENERAL.....	7
5.2 DESIGN TRAFFIC.....	7
5.3 OVERLAY DESIGN	9
5.4 NEW HOT MIX ASPHALT (HMA) PAVEMENT STRUCTURE.....	11
5.4.1 Pavement Design Considerations.....	11
5.5 HOT- MIX ASPHALT (HMA)	12
5.5.1 Binder Selection	12
5.5.2 Placement of HMA.....	12
5.6 DRAINAGE.....	13
5.7 EARTHWORK	13
5.7.1 Site Preparation	13
5.7.2 Structural Fill and Compaction	13
6.0 LIMITATIONS	14
REFERENCES	16

LIST OF FIGURES (FOLLOWING TEXT)

Figure 1	Project Vicinity Map
Figures 2A and 2B	Site and Exploration Plans
Figure 3	FWD Test Results

APPENDICES

Appendix A: Field Exploration

Figure A1	Legend of Terms and Symbols Used on Exploration Logs
Figures A2 – A7	Logs of Cores Core-1 through Core-6

Appendix B: Laboratory Test Results

Figure B1	Particle-Size Analysis of Soils
Figure B2	Percent of Material Passing #200 Sieve
Figure B3	Liquid Limit, Plastic Limit and Plasticity Index of Soils

Appendix C: FWD Deflection Basins

Appendix D: Core Photographs

GEOTECHNICAL AND PAVEMENT ENGINEERING REPORT THORP PRAIRIE ROAD EVALUATION AND DESIGN KITITAS COUNTY, WASHINGTON

1.0 EXECUTIVE SUMMARY

HWA GeoSciences Inc (HWA) conducted a geotechnical and pavement engineering investigation along Thorp Prairie Road in Kittitas County, Washington. This objective of this investigation was to assess the existing pavement structure of the section of the road between the intersection with Elk Heights Road and the proposed location of the new Elk Heights Organics Processing Facility (EHOPF) at 8860 Thorp Prairie Road.

HWA used Falling Weight Deflectometer and pavement coring exploration as part of its investigation. The results show that the existing pavement structure, which consists of approximately 2 inches of Bituminous Surface Treatment (BST) over approximately 2 inches of crushed aggregate base course, will not be able to accommodate the anticipated traffic loading generated by the new facility. Based on engineering analysis, the existing pavement requires a minimum of 1.5 inches of HMA overlay to support the projected additional traffic for a 20 year design life. We understand that currently PacifiClean Environmental is considering two separate scenarios. The first scenario assumes that the proposed facility will operate at 50% of maximum capacity for 5 years (initial phase) before starting operation at full capacity (build-up phase); and the second scenario assumes that the proposed facility will operate at 50% of maximum capacity for at least 20 years. Based on our analysis, the remaining life of the existing pavement under the increased loading is approximately 6 years and 7 years for the first and second scenarios, respectively.

2.0 INTRODUCTION

2.1 GENERAL

This report summarizes the results of a geotechnical and pavement engineering investigation undertaken by HWA GeoSciences Inc. (HWA) along Thorp Prairie Road, between the intersection with Elk Heights Road and the proposed location of the new Elk Heights Organics Processing Facility (EHOPF) at 8860 Thorp Prairie Road, in Kittitas County, Washington. Project location and general alignment are shown on the Project Vicinity Map, Figure 1. Project alignment and stationing are presented in Figures 2A and 2B.

2.2 PROJECT UNDERSTANDING

Based on conversations with PacifiClean Environmental, we understand that PacifiClean Environmental is proposing to build a compost facility to process organics collected mostly from western Washington and convert it into compost, to be used as fertilizer. The location of the

proposed facility is at 8860 Thorp Prairie Road, in Kittitas County, Washington. The new facility will be using Thorp Prairie Road as its main access route for incoming organics and outgoing compost. PacifiClean Environmental is interested in evaluating the capacity of the existing pavement structure, and to determine if it can handle the projected increase in truck traffic. Thorp Prairie Road is a collector that runs almost parallel to I-90 with one lane in each direction.

Authorization to proceed was provided by Mr. Larry Condon of PafiClean Environmental, in an email on October 19, 2012. Our work was in accordance with our proposal, dated October 4, 2012, and included field reconnaissance, Falling Weight Deflectometer (FWD) testing, pavement coring, engineering analyses, and preparation of the attached report summarizing the investigation results and our recommendations.

3.0 FIELD AND LABORATORY TESTING

3.1 FALLING WEIGHT DEFLECTOMETER TESTING

Falling Weight Deflectometer (FWD) testing was conducted on November 16, 2012, in both directions, at intervals of approximately 100 feet. The FWD testing was undertaken using a Dynatest Model 8081 Heavy Falling Weight Deflectometer. This FWD allows the pavement to be tested under a wide range of loading conditions (6,500 to 54,000 pounds) to simulate a variety of traffic loads. For this investigation, the FWD was programmed to apply controlled pulse loads of approximately 6,000, 9,000 and 12,000 pounds to the pavement surface. The corresponding pavement surface deflections were measured with velocity transducers located directly under the loaded area, and at 12, 24, 36, 48, 60 and 72 inches from the center of the loaded area. The measured deflections were normalized to a 9,000-pound load for comparison purposes. The load-deflection relationships were then used along with the measured thicknesses of each pavement layer to back-calculate the resilient modulus (M_r) of the subgrade soil.

FWD stationing commenced with Station 0+00 at the center of the intersection of Elk Height Road and extended to the proposed location of EHOPF (at 8860 Thorp Prairie Road) at Station 107+00.

Figure 3 presents the results of the FWD testing along Thorp Prairie Road. **Plot a** presents the normalized maximum deflections (deflections at center of loaded area) for each test location in both the northbound and southbound lanes. In general, maximum deflections of 0 to 15 mils are representative of good pavement response. Maximum deflections ranging from about 16 to 25 mils represent fair pavement response. Maximum deflections ranging from 26 mils to 45 mils represent fair to poor pavement response. Maximum deflections greater than about 45 mils are typical of poor pavement response. **Plot b** presents the resilient modulus of the soil below the

Bituminous Surface Treatment (BST) for each test location, as back-calculated by ELMOD computer software.

The deflection basins for each of the test locations, normalized to a 9,000-pound load, are presented in Appendix C. Deflection readings closest to the applied load reflect the strength of the near-surface layers, whereas, deflection readings further from the applied load reflect deeper soil conditions.

3.2 PAVEMENT CORE HOLES

Pavement layer thickness and shallow subgrade support conditions along the project alignments were investigated in six, 6-inch diameter pavement cores (designated Core-1 through Core-6). Shallow explorations using hand digging equipment were advanced through each pavement core. The coring and limited subsurface explorations were performed by a geologist from HWA on November 26, 2012, who also obtained disturbed samples of soils at selected depths in the explorations. Upon completion, all pavement cores were patched with EZ-Street cold asphalt concrete patch.

Appendix A contains summary logs of the explorations. Figure A-1 presents a legend of the terms and symbols used on the pavement core logs. Logs of the pavement cores are presented in Figures A-2 through A-7. The approximate pavement core locations are shown on the Site and Exploration Plans, Figures 2A and 2B, and approximate station locations are given on the core logs. Photographs of the cores, along with pertinent information, are presented in Appendix D of this report.

3.3 LABORATORY TESTING

Laboratory tests were conducted on selected soil samples obtained from the pavement core investigations to characterize relevant engineering properties. The laboratory testing program was performed in general accordance with appropriate ASTM Standards, as outlined below.

Moisture Content of Soil: The moisture content of selected soil samples (percent by dry mass) was determined in accordance with ASTM D 2216. The test results are shown at the sampled intervals on the appropriate summary pavement core logs in Appendix A.

Particle Size Analysis of Soils: Selected granular samples were tested to determine the particle size distribution of material in accordance with ASTM D 422. The results are summarized on the attached Particle-Size Analysis report (Figure B-1, in Appendix B), which also provides information regarding the classification of the samples and the moisture content at the time of testing.

Amount of Material Finer Than the No. 200 Sieve: Selected samples were tested to determine the percent passing the No.200 sieve in general accordance with ASTM D1140. The results are presented in the attached Percent of Material Passing #200 Sieve Report, Figure B-2 in Appendix B.

Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits): Selected samples were tested using method ASTM D 4318, multi-point method. The results of the laboratory testing are presented in the attached Liquid Limit, Plastic Limit, and Plasticity Index of Soils report, Figure B-3 in Appendix B.

4.0 SITE CONDITIONS

4.1 SITE DESCRIPTION

Thorp Prairie Road is a north-south collector road located just south of Interstate I-90. The investigated segment of Thorp Prairie Road starts at the intersection with Elk Heights Road located at Exit 93 of I-90 and ends at the proposed location of the new EHOPF at 8860 Thorp Prairie Road. The approximate elevation at the intersection with Elk Heights Road is about 2,235 ft, then the roadway slopes down to approximately 2,175 ft at about 1,850 ft north of the intersection with Elk Heights Road, before climbing to an approximate elevation of 2,370 ft then slopes down to approximate elevation of 2,230 ft at the proposed location of EHOPF. The length of the studied segment of Thorp Prairie Road is approximately 2.03 miles. There are a few commercial and residential buildings located on this stretch of Thorp Prairie Road, which consists of one travel lane in each direction, and is surfaced with BST.

4.2 GENERAL GEOLOGY

Geologic information for the project area was obtained from the map titled *Geologic Map of the Wenatchee 1:100,000 Quadrangle, Central Washington* (Tabor, R.W. et. al., 1982). According to this map, the near-surface deposits in the project vicinity consist of early Pleistocene aged main stream deposits of the Yakima River. In the local area the deposits are terraced and generally consist of pebble to boulder gravel with interstitial silts and sands. Rock types are locally sourced and tend to consist of volcanic and dike rocks. Also mapped in the area are outcrops of the Yakima Basalt subgroup of the Columbia River Basalt group. In the project area deposits of the upper flows of normally magnetic polarity are mapped. These consist of columnar, basal and tabular basalts, with intermittent formations of pillow basalts and some areas of interstitial sand and gravel deposits. Locally sills and dikes will have intruded on the formation.

4.3 PAVEMENT STRUCTURAL LAYERS

The coring and FWD test results indicate that the subgrade soils typically consist of dense to very dense silty gravel with sand and will generally provide suitable support for the pavement, when an adequately thick Hot Mix Asphalt (HMA) and crushed gravel base course are provided.

Table 1 summarizes the results of all pavement core explorations. Appendix D presents photographs of the asphalt pavement cores. No ground water seepage was observed in any of the pavement cores, which extended to a maximum depth of 3.4 feet, at the time of exploration. Ground water seepage is not likely to be encountered in very shallow pavement explorations.

The BST wearing surface samples, obtained from the pavement cores along Thorp Prairie Road, had an approximate thickness of 2 inches and were generally in good to fair condition. Five cores were taken in the southbound lane and one pavement core (Core-5) was taken in the northbound lane. Crushed base course was encountered in pavement cores Core-1, Core-3, Core-4 and Core-6. The thickness of the crushed base layer was approximately 5 inches in Core-6, and it ranged from 1 inch to 1.5 in the other pavement cores. In the remaining pavement cores (Core-2 and Core-5), fill soils were encountered directly underneath the BST layer. The subgrade soils in all pavement cores were fill materials consisting of very dense silty gravel with sand or silty sand with gravel, and were likely placed as a subbase course during construction.

Table 1: Summary of Pavement Cores

Core Designation and Approximate Location		BST Thickness (inches)	Base Course Thickness (inches)	Fill Soil USCS Classification
Core-1	Sta 15+00, SB Lane	2	1.5	GM
Core-2	Sta 30+50 SB Lane	1.75	-	GM
Core-3	Sta 45+00 SB Lane	2	1	GM
Core-4	Sta 60+50 SB Lane	1.75	1.25	GM
Core-5	Sta 75+00 NB Lane	1.75	-	SM
Core-6	Sta 92+50 SB Lane	2	5	GC

SB = Southbound. NB = Northbound.

In Core-1 and Core-4, the explorations advanced through the silty gravel with sand layer and encountered fine grained layer of fill consisting of medium stiff silt or clay with sand and gravel. The thickness of the silty gravel with sand layer was approximately 15 inches in both pavement cores. More exploration results are presented in the pavement cores logs in Appendix A.

4.4 FWD TESTING RESULTS

The existing pavement surface is in good to fair condition and the major types of pavement distress observed are raveling and wear loss due to oxidization of the asphalt cement. Some rutting, longitudinal cracking and transverse or temperature cracking were also observed along both travel lanes.

Based on FWD results, bedrock or similarly very hard layers of soils are located within 3 feet of the existing roadway surface in few isolated areas along Thorp Prairie Road, and in particular between Sta 37+50 and Sta 45+50 in the southbound travel lane. The proximity of bedrock in these locations results in higher than normal back-calculated values of resilient modulus of subgrade soils. These outlier values have been omitted when calculating the average resilient modulus of subgrade soils.

As mentioned previously in this report, the FWD testing occurred on November 16, 2012 and coring and shallow subsurface explorations along Thorp Prairie Road occurred on November 26, 2012. The ground water conditions reported are for the specific date and locations indicated, and therefore may not necessarily be indicative of other times and/or locations. Seasonal variation in local ground water levels may affect the FWD measurements and thus the back-calculated resilient modulus results of subgrade soils.

The FWD test results reveal that the maximum deflections (normalized to a 9,000-pound load) along the northbound lane varied from 11.9 mils to 26.8 mils with an average of 20.8 mils and a standard deviation of 3.2. The average resilient modulus of the subgrade in the northbound lane is 18.3 ksi with a standard deviation of 4.7 ksi.

The maximum deflections (normalized to a 9,000-pound load) along the southbound lane varied from 9.6 mils to 26.8 mils with an average of 17.3 mils and a standard deviation of 4.0. The average resilient modulus of the subgrade in the southbound lane is 25.8 ksi with a standard deviation of 7.8 ksi.

These results indicate that the southbound travel lane typically has a stronger pavement structure.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 GENERAL

The investigation shows that the existing pavement along Thorp Prairie Road, within the project boundary, is in fair condition with most of the visible pavement distresses consisting of raveling and wear loss due to oxidization or aging of the asphalt cement. Some other distresses mainly due to long term loading and localized subgrade softening such as rutting, longitudinal cracking and transverse, or temperature cracking, were also observed along both travel lanes.

Currently, the pavement structure along Thorp Prairie Road typically consists of at least 12 inches of granular subbase overlain by 2 inches of crushed aggregate base course and 2 inches of BST. This pavement section appears to be adequate for the current traffic level. The construction of the proposed EHOPF will increase the traffic loading along Thorp Prairie Road by approximate factors of 3.5 and 4.5 times, in southbound and northbound directions, respectively. Therefore, the existing pavement structure needs to be strengthened in order to accommodate the anticipated traffic loading.

In our opinion, the pavement could be rehabilitated to support the anticipated traffic loading over a 20-year design life by overlaying the existing pavement surface with a new 1.5-inch thick HMA overlay bound to the layer below. In some isolated locations, full depth pavement reconstruction will be required given the severity of the surface distresses (mainly potholes and severe cracking) observed. The following sections provide our recommendations for overlay and reconstruction sections, for a 20-year design life, based on the traffic volumes provided, as presented below.

5.2 DESIGN TRAFFIC

Information about anticipated traffic generated by the proposed EHOPF was obtained from PacifiClean Environmental in a *Trip Generation Analysis* report prepared by William Popp Associates and an email message from Harold Rupert of O2Compost, dated January 11, 2012.

According to the traffic data obtained, two phases of operation are considered for the proposed EHOPF: an Initial Phase (operating at 50% capacity) and a Build-out Phase (operating at 100% capacity). PacifiClean Environmental asked us to evaluate two separate scenarios: The first scenario assumes that the proposed facility will operate at 50% of maximum capacity for 5 years before starting operation at full capacity; and the second scenario assumes that the proposed facility will operate at 50% of maximum capacity for at least 20 years.

The traffic during the initial phase is assumed to consist of 27 trucks per day for 350 days a year delivering organic material to the facility, and 24 trucks per day for 157 days a year hauling out

top soil from the facility. Once the construction of the facility is complete, EHOPF will be operating at full capacity. During this phase (Build-out Phase), 54 trucks per day for 350 days a year will be bringing into the facility organic material to be processed into top soil which will be hauled away by 48 trucks a day for 157 days a year. The organic material will be imported using 70,000-lbs truck and semi trailers with 5 permanent axles and two lift axles. We assumed that these trucks are equivalent to 1 ESAL per truck when loaded with the lift axles down, and 0.5 ESAL when empty. We assumed that the same type of trucks will be used to haul out the top soil and consequently we assumed same ESAL per truck values as stated above.

In addition to the traffic mentioned above, we assumed that the current Annual Average Daily Traffic (AADT) along this portion of Thorp Prairie Road consists of about 350 vehicles (in both directions). We estimated that the current heavy truck traffic on this segment of road amounts to approximately 4% of the AADT, we also assumed 1.4 ESAL per heavy truck.

We assumed that the traffic generated by the facility has no growth rate and that traffic from other sources (existing traffic) has an annual growth rate of 2 percent. We also disregarded the contribution of other vehicles (mostly passenger vehicles) as their contribution is assumed to be negligible. Based on all these assumptions and a design period of 20 years, we calculate a total of approximately 484,000 ESAL and 314,000 ESAL in the northbound travel lane for the first and the second scenarios, respectively; and 384,000 ESAL and 257,000 ESAL in the southbound travel lane for the first and the second scenarios, respectively. Tables 2 and 3 summarize the traffic calculations for each travel lane.

Table 2 – Summary of Traffic Calculation for the First Scenario

Travel Lane	Trucks/Day		ESAL/Truck	ESAL/Phase		Total ESAL
	Initial Phase	Build-out Phase		Initial Phase	Build-out Phase	
NB	27	54	1	47,250	283,500	483,349
	24	48	0.5	9,420	56,520	
	7	7.7*	1.4	18,615	68,044	
SB	27	54	0.5	23,625	141,750	383,914
	24	48	1	18,840	113,040	
	7	7.7*	1.4	18,615	68,044	

**Heavy Truck Count projected for 2018*

Table 3 – Summary of Traffic Calculation for the Second Scenario

Travel Lane	Trucks/Day		ESAL/Truck	ESAL/Phase		Total ESAL
	Initial Phase	Build-out Phase		Initial Phase	Build-out Phase	
NB	27	-	1	189,000	-	313,592
	24	-	0.5	37,680	-	
	7	-	1.4	86,912	-	
SB	27	-	0.5	94,500	-	256,772
	24	-	1	75,360	-	
	7	-	1.4	86,912	-	

The pavement recommendations presented in this report are based on these traffic estimates. If improved traffic count information is obtained that varies appreciably from these values, the recommendations given in this report should be reviewed and revised as necessary.

5.3 OVERLAY DESIGN

The existing AASHTO Structural Number (SN) along Thorp Prairie Road was estimated based on the findings of our investigation. We assumed an existing 2 inches of BST at an estimated structural coefficient of 0.25 per inch, an existing 2 inches of crushed aggregate base course layer at an estimated structural coefficient of 0.12 per inch; and an existing 12 inches of crushed granular subbase layer with an estimated structural coefficient of 0.08 per inch. Therefore, we estimate the existing AASHTO Structural Number is about 1.7. Based on this structural number, the remaining life of the existing pavement under the anticipated traffic loading is approximately 6 years and 7 years for the first and second scenarios, respectively. Hence, this section will require an overlay layer to accommodate the increased traffic loading. The thickness of the overlay needed is calculated from the required SN minus the estimated existing SN. The required SN numbers were calculated based on the design method given in the 1993 AASHTO Design Guide (AASHTO, 1993), using the following parameters:

- Reliability = 75%
- Initial Serviceability = 4.2
- Terminal Serviceability = 2.2

- Overall Standard Deviation = 0.45
- Design Subgrade Resilient Modulus in Northbound Travel Lane = 13,500 psi
- Design Subgrade Resilient Modulus in Southbound Travel Lane = 18,000 psi

When applied to the first scenario, these assumptions result in a required structural number (SN) of 2.2 for the northbound travel lane and a required SN of 1.9 for the southbound travel lane, to accommodate the anticipated traffic loading. For the second scenario, the required SN numbers are 2.1 and 1.8 for the northbound lane and southbound lane, respectively.

Therefore, for the northbound lane, the required overlay thicknesses are 1.25 inches and 1 inch for the first and second scenarios, respectively. Whereas, for the southbound lane, the required overlay thicknesses are 0.5 inches and 0.25 inches for the first and second scenarios, respectively. For practical purposes, the minimum lift thickness of Class ½-inch HMA that can be placed is 1.5 inches. Therefore, we recommend overlaying both travel lanes with a minimum of 1.5 inches of HMA for either scenario.

It is imperative that the new overlay be adequately bonded to the existing HMA below. Adequate bonding can be achieved by applying a tack coat, per the manufacturer's recommendations, to the existing BST layer. We further recommend that the entire pavement surface should be cleaned prior to placement of tack coat. The tack coat should not be applied in cold or wet weather, or when wet weather is forecasted prior to placement of the overlay. Before the application of the tack coat, all cracks greater than 1/4-inch in width should be cleaned and sealed prior to overlay construction.

We anticipate that isolated areas of the alignment will require total reconstruction prior to placement of the new overlay. Before the application of tack coat, the existing pavement surface should be assessed to delineate the areas requiring total reconstruction. Areas exhibiting potholing, or severe alligator cracking indicate poor subgrade support and should be reconstructed prior to overlaying. We recommend that in these areas, excavation extend through the pavement layers, exposing the subgrade soils below. A geotechnical engineer, or qualified earthworks inspector, should observe the excavations and assess the extent of over-excavation required. Excavations should be backfilled with Crushed Surfacing Base Course (CSBC) to an elevation below final grade that will allow for the recommended HMA thickness (given in Table 3, in the following section) to be placed. HMA should be placed to the level of the existing surface and the final overlay should be applied after all the pavement reconstruction is performed.

5.4 NEW HOT MIX ASPHALT (HMA) PAVEMENT STRUCTURE

Areas of pavement currently exhibiting moderate to severe distresses such as alligator cracking and/or rutting will likely deteriorate quickly under more frequent application of heavy truck traffic. Therefore, we recommend these areas be reconstructed prior to overlay construction.

This section provides our HMA design recommendations for reconstruction areas along Thorp Prairie Road. All HMA pavement designs are based on the design method given in the 1993 AASHTO Design Guide (AASHTO, 1993).

The pavement design of the areas requiring total reconstruction is presented in Table 4 based on the parameters stated in section 5.3.

To accommodate the anticipated traffic loading, the assumptions given in section 5.3 result in the following required structural numbers (SN):

- For the northbound travel lane, required SN of 2.2 and 2.1 for the first and the second scenarios respectively; and,
- For the southbound lane, required SN numbers of 1.9 and 1.8 for first and the second scenarios respectively.

Table 4. Structure Requirements for New HMA Pavement

Material Description	Minimum Layer Thickness (inches)		WSDOT Standard Specification
	NB	SB	
HMA	3.5	3	5-04 & 9-02.1
CSBC	6	6	9-03.9(3)
Prepared Subgrade	Compact/Proof-roll		2-06.3(2)

HMA: Hot Mix Asphalt

CSBC: Crushed Surfacing Base Course, compacted as specified.

5.4.1 Pavement Design Considerations

The following should be noted:

- The pavement will likely require a functional overlay after about 10 to 12 years because of non-structural associated distress caused by environmental factors such as degradation of the asphalt surface and rutting.
- HMA pavements are susceptible to shoving and rutting from heavy vehicles, such as buses and heavy delivery trucks, particularly at intersections and on steep slopes. In

these areas, more frequent maintenance and even premature reconstruction of the pavement may be required.

- The upper 2 to 3 inches of CSBC can be substituted by Crushed Surfacing Top Course (CSTC) as specified in Section 9-03.9(3) of WSDOT *Standard Specifications* (WSDOT 2012).

5.5 HOT- MIX ASPHALT (HMA)

5.5.1 Binder Selection

The selection of the optimum asphalt binder type for the climate is critical to ensure long-term pavement performance. Use of the wrong binder can result in low temperature cracking or permanent deformation at high temperatures.

Based on the climate in Kittitas County, Washington and WSDOT recommendations (WSDOT, 2003), SuperPave Performance Grade binder PG 64-28, or better, should be used.

5.5.2 Placement of HMA

Placement of HMA should be in accordance with Section 5-04 of the WSDOT *Standard Specifications* (WSDOT, 2012). Particular attention should be paid to the following:

- HMA should not be placed until the engineer has accepted the previously constructed pavement layers.
- HMA should not be placed on any frozen or wet surface.
- HMA should not be placed when precipitation is anticipated before the pavement can be compacted, or before any other weather conditions which could prevent proper handling and compacting of HMA.
- HMA should not be placed when the average surface temperatures are less than 45° F.
- HMA temperature behind the paver should be in excess of 240° F. Compaction should be completed before the mix temperature drops below 180° F. Comprehensive temperature records should be kept during the HMA placement.
- For cold joints, tack coat should be applied to the edge to be joined and the paver screed should be set to overlap the first mat by 1 to 2 inches.

5.6 DRAINAGE

It is essential to the satisfactory performance of the roadway that good drainage is provided to prevent water ponding alongside or under the pavement. Water ponding can cause saturation of the pavement and subgrade layers and premature failure. The base layers should be graded to prevent water being trapped within the layer. The surface of the pavement should be sloped to convey water from the pavement to appropriate drainage facilities.

5.7 EARTHWORK

5.7.1 Site Preparation

Site preparation for pavement reconstruction should begin with the excavation of all existing materials down to a depth sufficient to accommodate the new pavement structure. The excavation should be inspected by a geotechnical engineer, or qualified earthworks inspector, and the exposed subgrade thoroughly evaluated by probing and/or proof-rolling. Any areas exhibiting pumping, rutting or heaving should be over-excavated to a depth determined by the geotechnical engineer and backfilled with Crushed Surfacing Base Course (CSBC), placed and compacted as described in the following section.

The on-site native subgrade soils will not be suitable for re-use as structural fill given the high fines content and high moisture susceptibility. The existing crushed base and subbase courses may be used as structural fill provided that the material is within 2% of optimum moisture content as determined by ASTM D 1557, at the time of construction.

5.7.2 Structural Fill and Compaction

For the purposes of this report, material used to raise site grades, or placed directly under pavement structure, is classified as structural fill. Imported structural fill should consist of Crushed Surfacing Base Course (CSBC) as described in Section 9-03.9(3) of the WSDOT *Standard Specifications* (WSDOT, 2012).

Structural fill should be placed in loose, horizontal, lifts of not more than 8 inches in thickness and compacted to at least 95 % of the maximum dry density, as determined using test method ASTM D 1557 (Modified Proctor). At the time of placement, the moisture content of structural fill should be at or near optimum. The procedure required to achieve the specified minimum relative compaction depends on the size and type of compaction equipment, the number of passes, thickness of the layer being compacted, and the soil moisture-density properties.

When the first fill is placed in a given area, and/or anytime the fill material changes, the area should be considered a test section. The test section should be used to establish fill placement and compaction procedures required to achieve proper compaction. The geotechnical consultant,

or qualified earthworks inspector, should observe placement and compaction of the test section to assist in establishing an appropriate compaction procedure. Once a placement and compaction procedure is established, the contractor's procedure should be monitored and periodic density tests performed to verify that proper compaction is being achieved.

Generally, loosely compacted soils are a result of poor construction technique or improper moisture content. Soils with a high percentage of silt or clay are particularly susceptible to becoming too wet and coarse-grained materials easily become too dry, for proper compaction. Silty or clayey soils with a moisture content too high for adequate compaction should be dried as necessary, or moisture conditioned by mixing with drier materials, or other methods. For coarse-grained structural fill soils, moisture conditioning by sprinkling before and during compaction is sometimes required to achieve the required relative compaction.

6.0 LIMITATIONS

We have prepared this report for the PacifiClean Environmental for use in design of this project. This report should be provided in its entirety to prospective contractors for bidding and estimating purposes; however, the conclusions and interpretations presented herein should not be construed as a warranty of the subsurface conditions. Experience shows that soil and ground water conditions can vary significantly over small distances. Seasonal variation in local ground water levels may affect the results obtained by non-destructive pavement evaluation method, such as those used for this project. Inconsistent conditions may occur between explorations that may not be detected by a geotechnical study. If, during future site operations, subsurface conditions are encountered which vary appreciably from those described herein, HWA should be notified to review the recommendations made in this report, and revise, if necessary. If there is a substantial lapse of time between submission of this report and the start of construction, or if conditions change due to construction operations, it is recommended that this report be reviewed to determine the applicability of the conclusions and recommendations considering the changed conditions and time lapse.

This report is issued with the understanding that it is the responsibility of the owner, or the owners' representative, to ensure that the information and recommendations are brought to the attention of the appropriate design team personnel and incorporated into the project plans and specifications, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

We recommend HWA be retained to monitor construction, evaluate soil and ground water conditions as they are exposed, and verify that subgrade preparation, backfilling, and compaction are accomplished in accordance with the specifications.

February 1, 2013
HWA Project No. 2012-105-21

Within the limitations of scope, schedule and budget, HWA attempted to execute these services in accordance with generally accepted professional principles and practices in the fields of geotechnical engineering and engineering geology at the time the report was prepared. No warranty, express or implied, is made. The scope of our work did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous or toxic substances in the soil, surface water, or ground water at this site.

This firm does not practice or consult in the field of safety engineering. We do not direct the contractor's operations, and cannot be responsible for the safety of personnel other than our own on the site. As such, the safety of others is the responsibility of the contractor. The contractor should notify the owner if any of the recommended actions presented herein are considered unsafe.



We appreciate this opportunity to be of service.

Sincerely,

HWA GEOSCIENCES INC.



George Minassian, Ph.D., P.E.
Geotechnical Engineer

A handwritten signature in blue ink, appearing to read "Bryan K. Hawkins".

Bryan K. Hawkins, P.E.
Senior Geotechnical Engineer

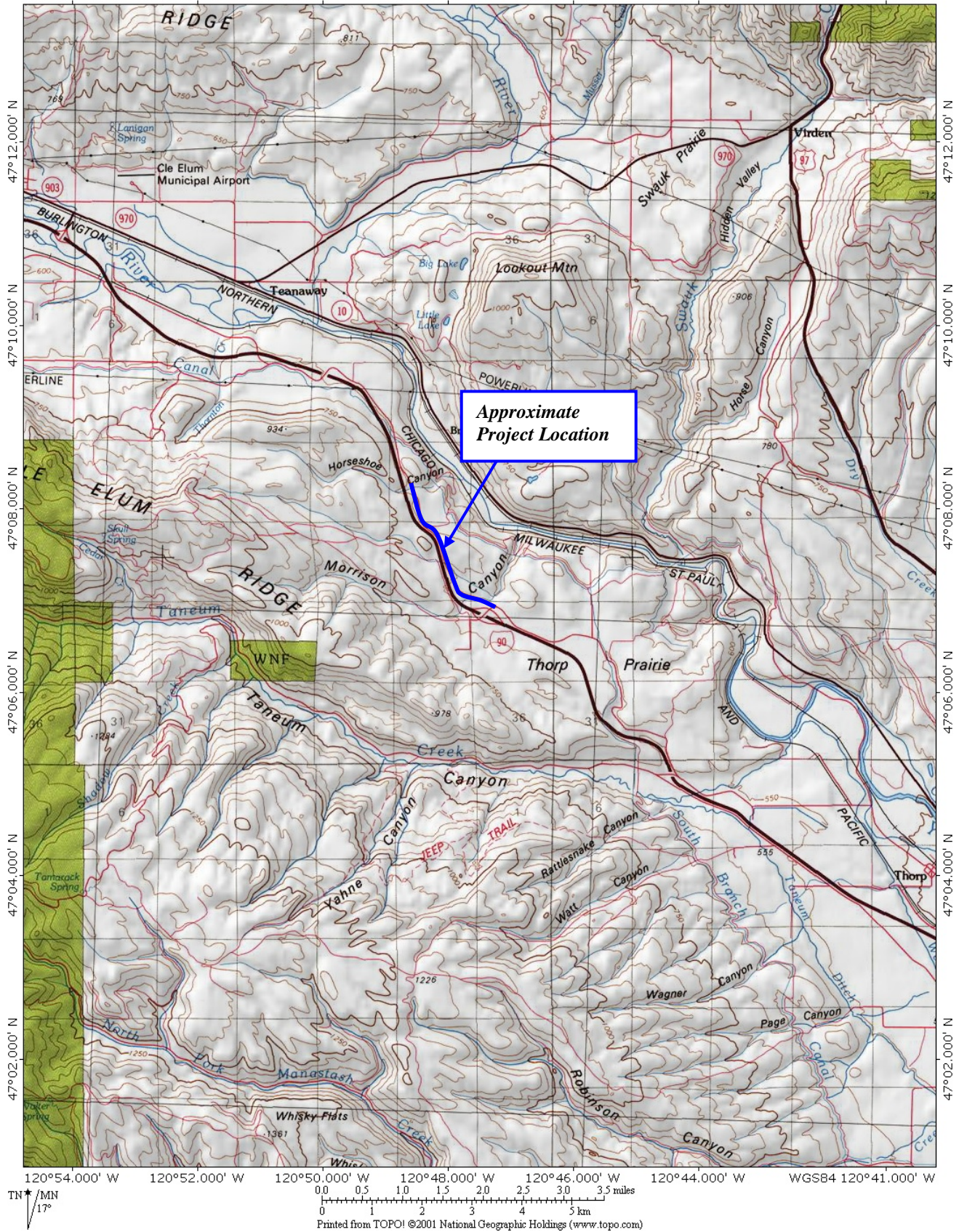
REFERENCES

American Association of State Highway and Transportation Officials, 1993, *AASHTO Guide for Design of Pavement Structures*, American Association of State Highway and Transportation Officials.

Tabor, R.W., Waitt, Jr., R.B., Frizzell, Jr., V.A., Swanson, D.A., Byerly, G.R., Bentley, R.D.; 1982, *Geologic Map of the Wenatchee 1:100,000 Quadrangle, Central Washington*: Department of the Interior, U.S. Geological Survey, Miscellaneous Investigations Series Map I-1311, 3 pl.

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PROJECT VICINITY MAP

**GEOTECHNICAL & PAVEMENT ENGINEERING REPORT
 THORP PRAIRIE ROAD EVALUATION AND DESIGN
 KITTITAS COUNTY, WASHINGTON**

FIGURE NO.

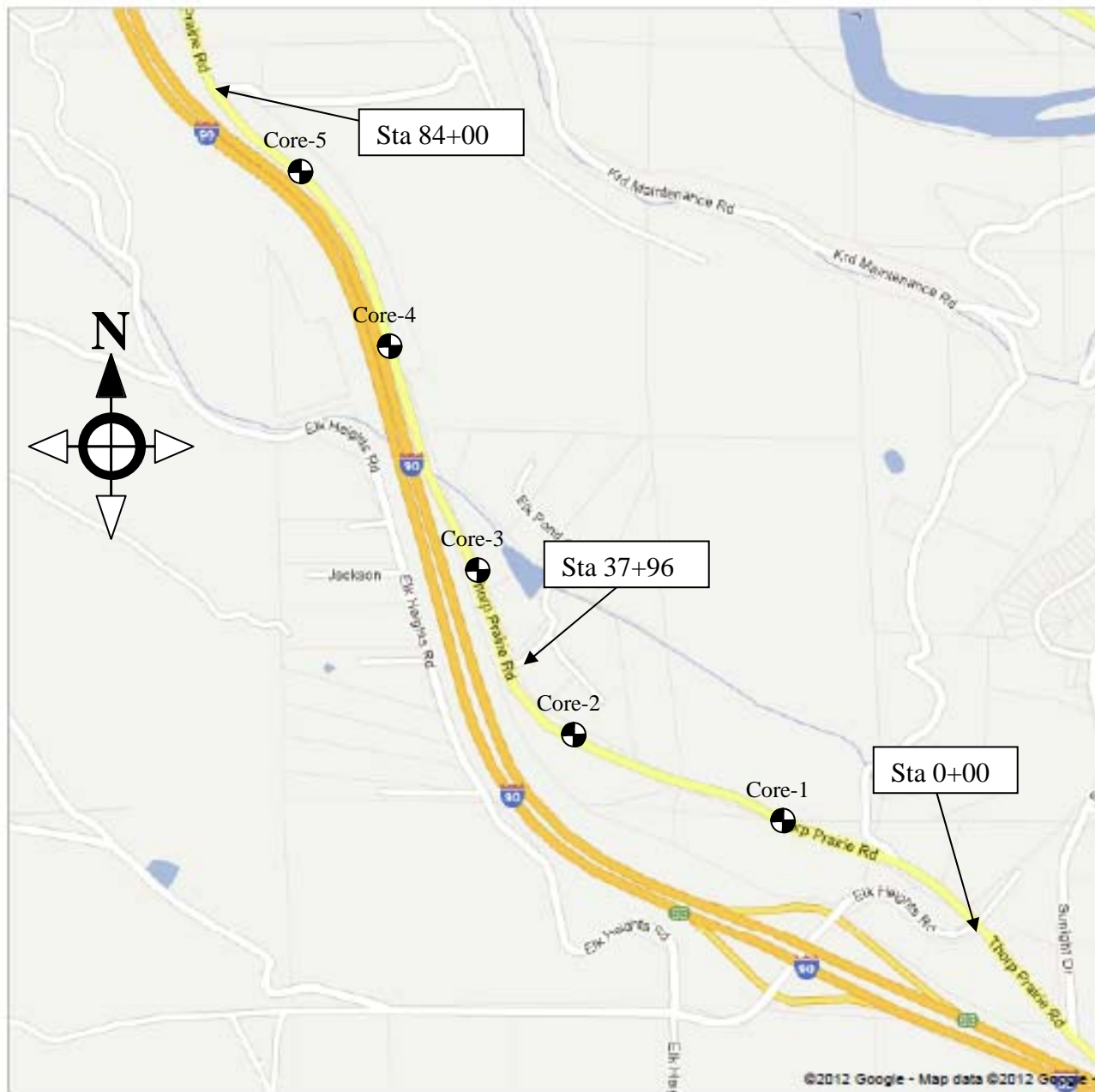
1

PROJECT NO.

2012-105



HWA GEOSCIENCES INC.



Core-1
 Approximate Pavement Core Location and Designation



HWA GEOSCIENCES INC.

PROJECT ALIGNMENT AND EXPLORATION MAP
 GEOTECHNICAL & PAVEMENT ENGINEERING REPORT
 THORP PRAIRIE ROAD EVALUATION AND DESIGN
 KITTITAS COUNTY, WASHINGTON

FIGURE NO.

2A

PROJECT NO.

2012-105



Core-1
 Approximate Pavement Core Location and Designation

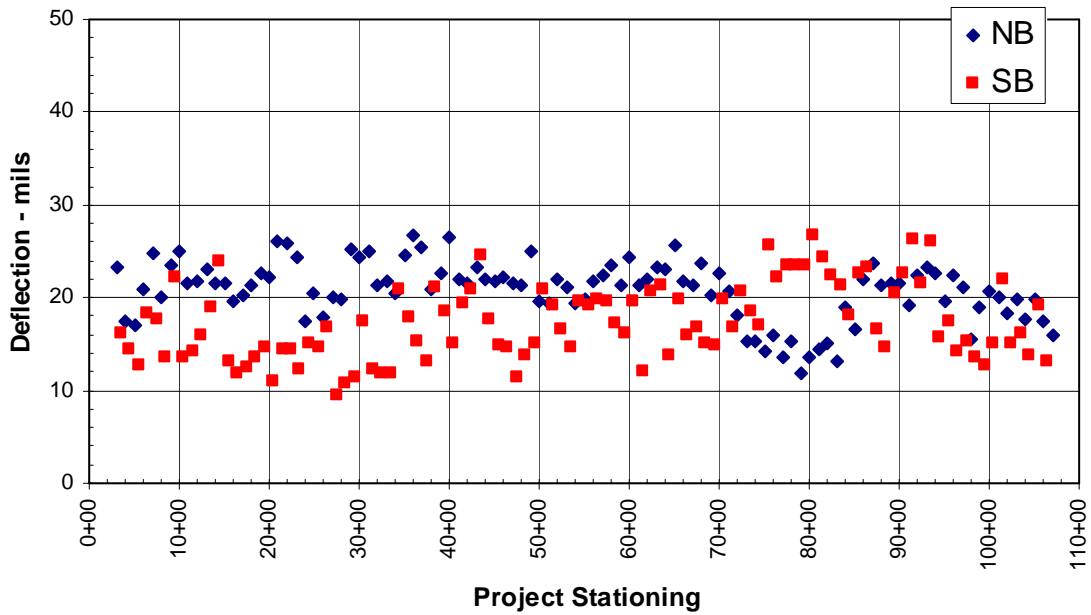


HWA GEOSCIENCES INC.

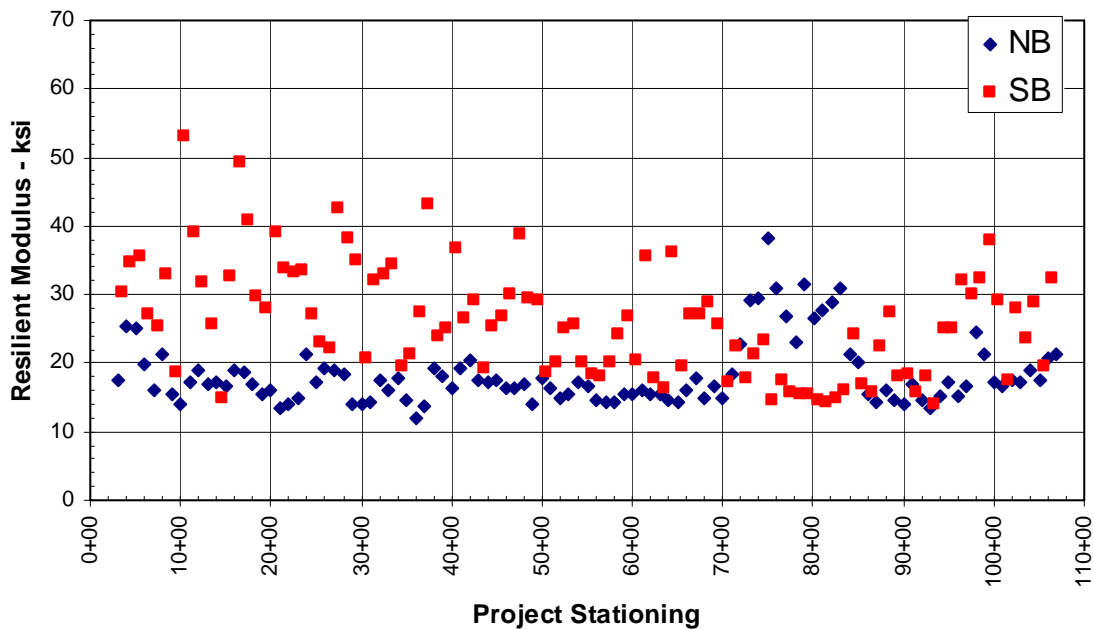
PROJECT ALIGNMENT AND EXPLORATION MAP
 GEOTECHNICAL & PAVEMENT ENGINEERING REPORT
 THORP PRAIRIE ROAD EVALUATION AND DESIGN
 KITTITAS COUNTY, WASHINGTON

FIGURE NO.
2B
 PROJECT NO.
 2012-105

a. Maximum Deflection Normalized for 9,000 lb Load



b. Resilient Modulus of Subgrade



FWD TEST RESULTS

GEOTECHNICAL & PAVEMENT ENGINEERING REPORT
 THORP PRAIRIE ROAD EVALUATION AND DESIGN
 KITTITAS COUNTY, WASHINGTON

FIGURE NO.

3

PROJECT NO.

2012-105



HWA GEOSCIENCES INC.

APPENDIX A

FIELD EXPLORATION

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N-VALUE

COHESIONLESS SOILS			COHESIVE SOILS		
Density	N (blows/ft)	Approximate Relative Density(%)	Consistency	N (blows/ft)	Approximate Undrained Shear Strength (psf)
Very Loose	0 to 4	0 - 15	Very Soft	0 to 2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250 - 500
Medium Dense	10 to 30	35 - 65	Medium Stiff	4 to 8	500 - 1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000 - 2000
Very Dense	over 50	85 - 100	Very Stiff	15 to 30	2000 - 4000
			Hard	over 30	>4000

TEST SYMBOLS

%F	Percent Fines
AL	Atterberg Limits: PL = Plastic Limit LL = Liquid Limit
CBR	California Bearing Ratio
CN	Consolidation
DD	Dry Density (pcf)
DS	Direct Shear
GS	Grain Size Distribution
K	Permeability
MD	Moisture/Density Relationship (Proctor)
MR	Resilient Modulus
PID	Photoionization Device Reading
PP	Pocket Penetrometer Approx. Compressive Strength (tsf)
SG	Specific Gravity
TC	Triaxial Compression
TV	Torvane Approx. Shear Strength (tsf)
UC	Unconfined Compression

USCS SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP DESCRIPTIONS		
Coarse Grained Soils	Gravel and Gravelly Soils	Clean Gravel (little or no fines)		GW Well-graded GRAVEL	
		Gravel with Fines (appreciable amount of fines)		GP Poorly-graded GRAVEL	
	Sand and Sandy Soils	More than 50% of Coarse Fraction Retained on No. 4 Sieve	Clean Sand (little or no fines)		GM Silty GRAVEL
			Sand with Fines (appreciable amount of fines)		GC Clayey GRAVEL
More than 50% Retained on No. 200 Sieve Size	Sand and Sandy Soils	Clean Sand (little or no fines)		SW Well-graded SAND	
		Sand with Fines (appreciable amount of fines)		SP Poorly-graded SAND	
	50% or More of Coarse Fraction Passing No. 4 Sieve	Silt and Clay	Liquid Limit Less than 50%		SM Silty SAND
			Liquid Limit 50% or More		SC Clayey SAND
Fine Grained Soils	Silt and Clay	Liquid Limit Less than 50%		ML SILT	
		Liquid Limit 50% or More		CL Lean CLAY	
	50% or More Passing No. 200 Sieve Size	Silt and Clay	Liquid Limit Less than 50%		OL Organic SILT/Organic CLAY
			Liquid Limit 50% or More		MH Elastic SILT
Highly Organic Soils				CH Fat CLAY	
				OH Organic SILT/Organic CLAY	
				PT PEAT	

SAMPLE TYPE SYMBOLS

	2.0" OD Split Spoon (SPT) (140 lb. hammer with 30 in. drop)
	Shelby Tube
	3-1/4" OD Split Spoon with Brass Rings
	Small Bag Sample
	Large Bag (Bulk) Sample
	Core Run
	Non-standard Penetration Test (3.0" OD split spoon)

GROUNDWATER SYMBOLS

	Groundwater Level (measured at time of drilling)
	Groundwater Level (measured in well or open hole after water level stabilized)

COMPONENT DEFINITIONS

COMPONENT	SIZE RANGE
Boulders	Larger than 12 in
Cobbles	3 in to 12 in
Gravel	3 in to No 4 (4.5mm)
Coarse gravel	3 in to 3/4 in
Fine gravel	3/4 in to No 4 (4.5mm)
Sand	No. 4 (4.5 mm) to No. 200 (0.074 mm)
Coarse sand	No. 4 (4.5 mm) to No. 10 (2.0 mm)
Medium sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Smaller than No. 200 (0.074mm)

COMPONENT PROPORTIONS

PROPORTION RANGE	DESCRIPTIVE TERMS
< 5%	Clean
5 - 12%	Slightly (Clayey, Silty, Sandy)
12 - 30%	Clayey, Silty, Sandy, Gravelly
30 - 50%	Very (Clayey, Silty, Sandy, Gravelly)
Components are arranged in order of increasing quantities.	

NOTES: Soil classifications presented on exploration logs are based on visual and laboratory observation. Soil descriptions are presented in the following general order:

Density/consistency, color, modifier (if any) GROUP NAME, additions to group name (if any), moisture content. Proportion, gradation, and angularity of constituents, additional comments.
(GEOLOGIC INTERPRETATION)

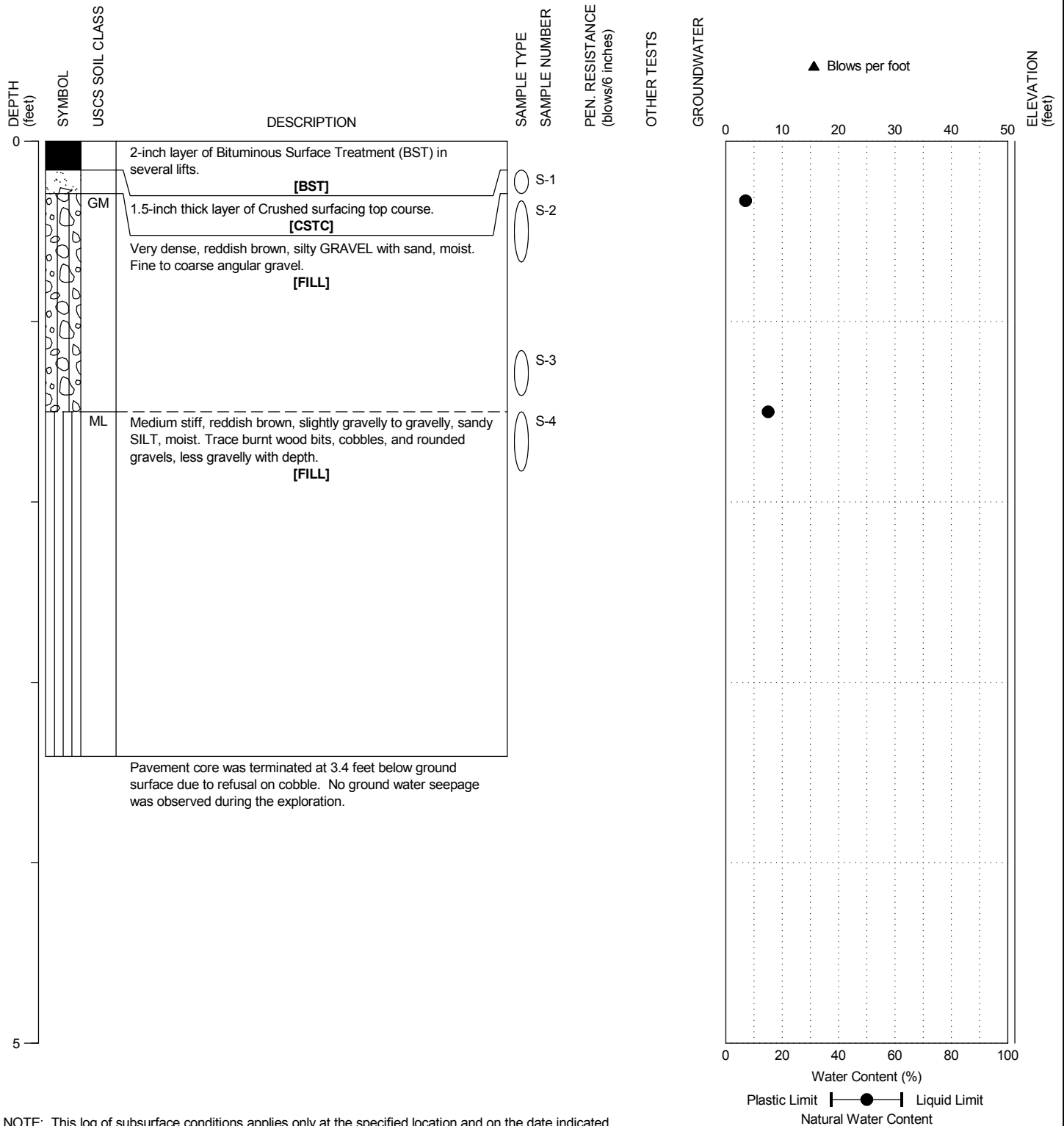
Please refer to the discussion in the report text as well as the exploration logs for a more complete description of subsurface conditions.

MOISTURE CONTENT

DRY	Absence of moisture, dusty, dry to the touch.
MOIST	Damp but no visible water.
WET	Visible free water, usually soil is below water table.

DRILLING COMPANY: HWA Geosciences Inc.
 DRILLING METHOD: Hand portable core drill and bucket auger
 SAMPLING METHOD: GRAB
 LOCATION: Station 15+00 Center of Southbound travel lane

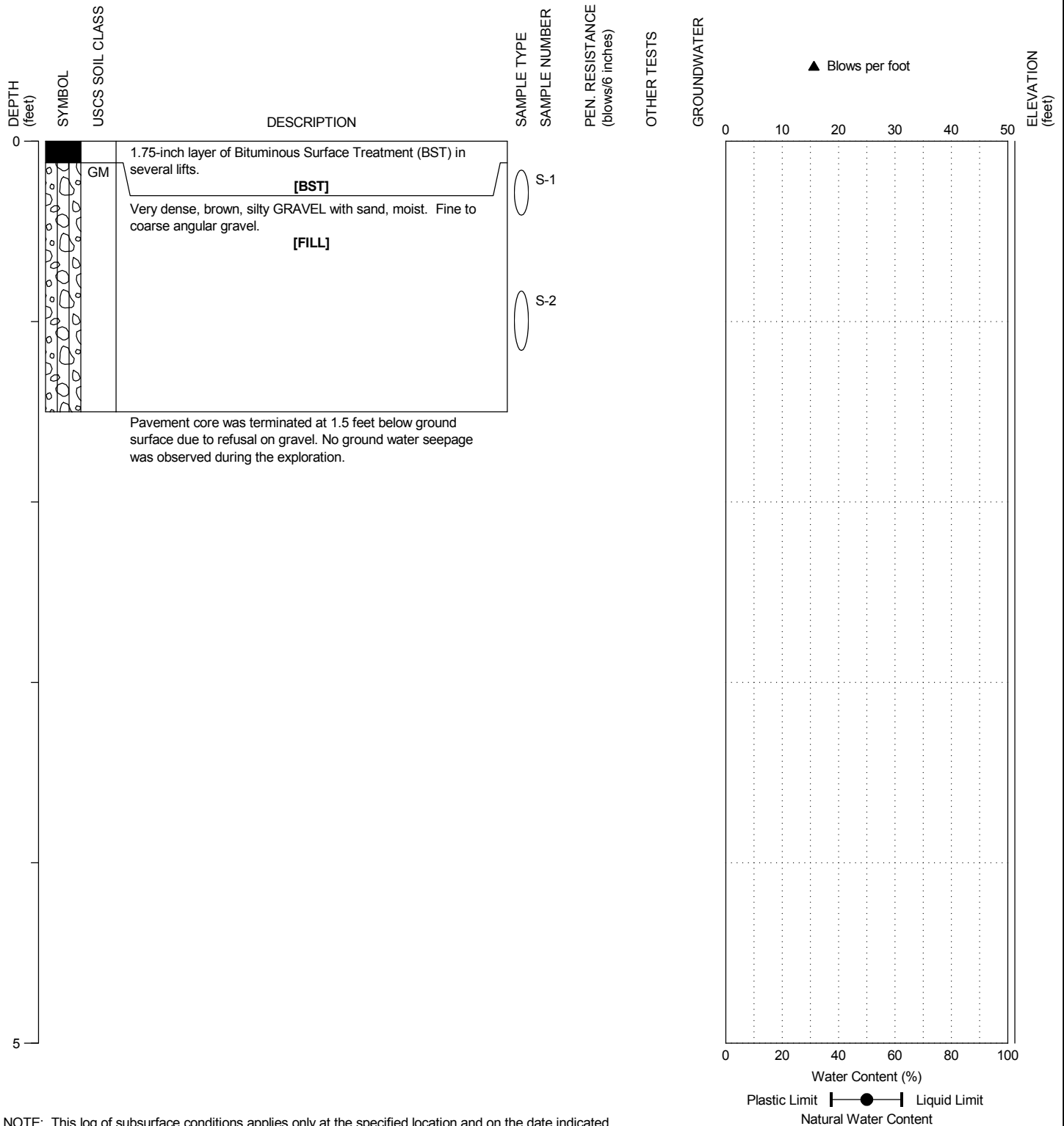
DATE STARTED: 11/26/2012
 DATE COMPLETED: 11/26/2012
 LOGGED BY: D. Coltrane



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

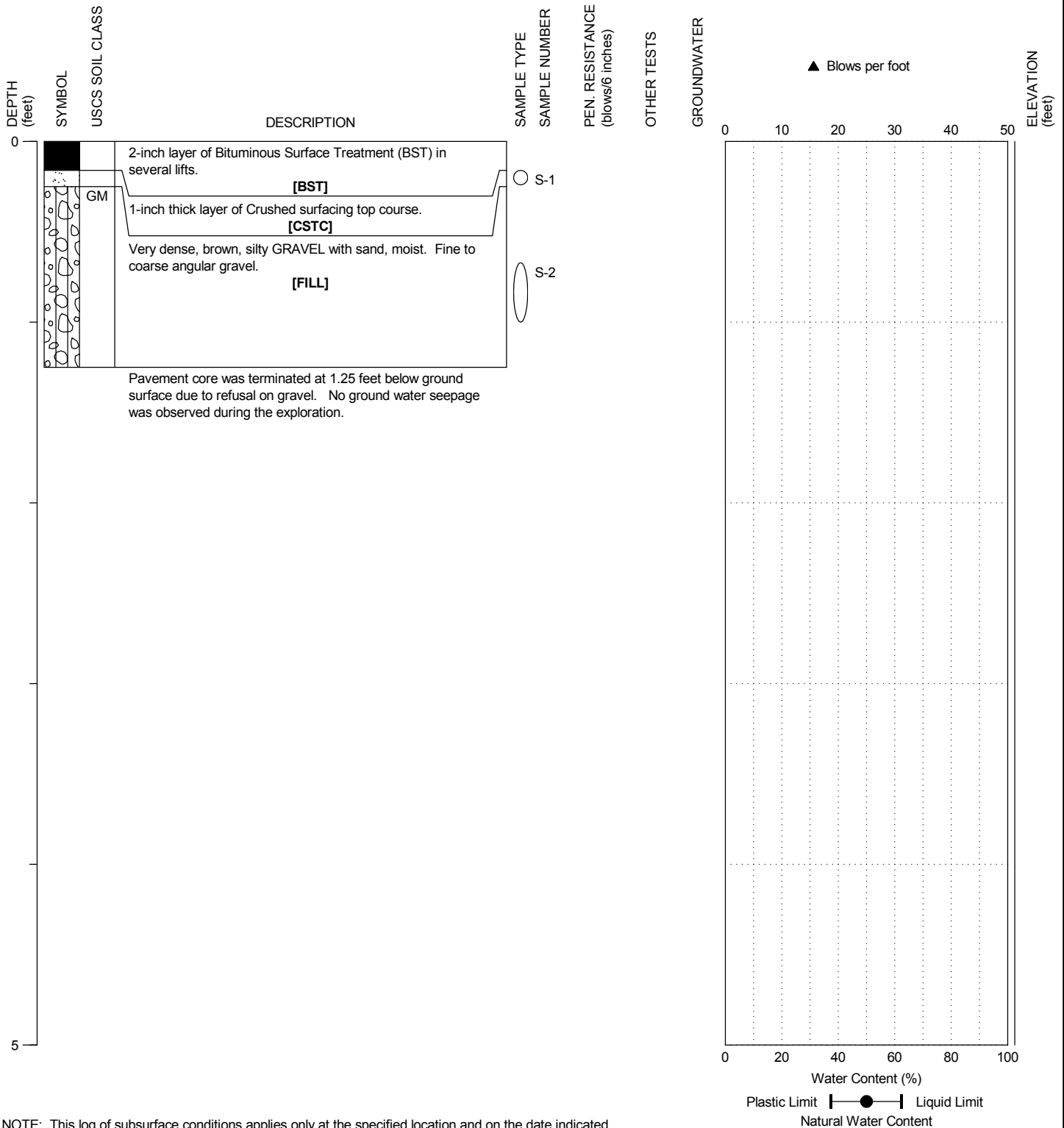
DRILLING COMPANY: HWA Geosciences Inc.
 DRILLING METHOD: Hand portable core drill and bucket auger
 SAMPLING METHOD: GRAB
 LOCATION: Station 30+50 Outside wheel path of Southbound travel lane

DATE STARTED: 11/26/2012
 DATE COMPLETED: 11/26/2012
 LOGGED BY: D. Coltrane



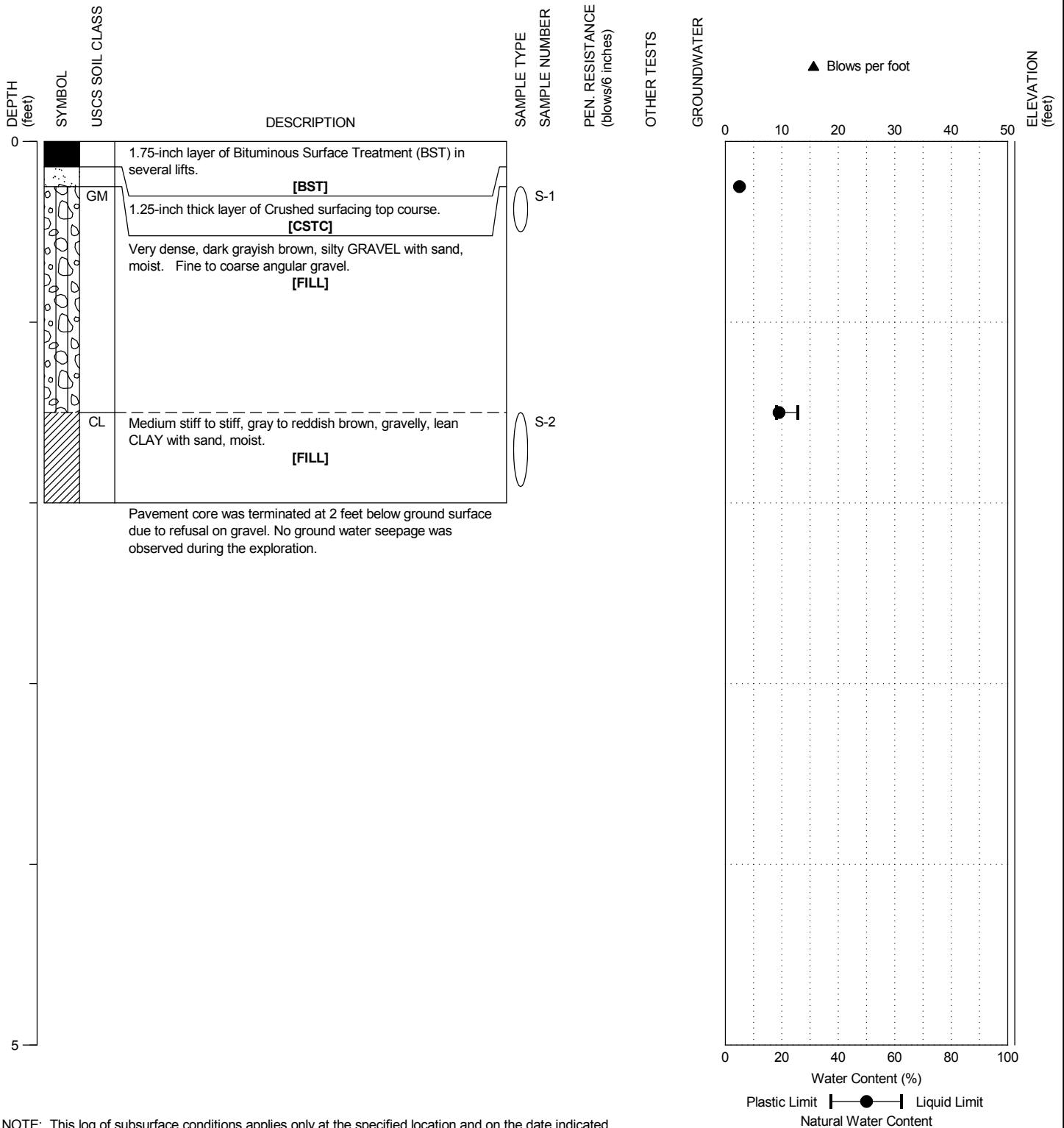
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 SAMPLING METHOD: GRAB
 LOCATION: Station 45+00 Center of Southbound travel lane

DATE STARTED: 11/26/2012
 DATE COMPLETED: 11/26/2012
 LOGGED BY: D. Coltrane



DRILLING COMPANY: HWA Geosciences Inc.
 DRILLING METHOD: Hand portable core drill and bucket auger
 SAMPLING METHOD: GRAB
 LOCATION: Station 60+50 Outside wheel path of Southbound travel lane

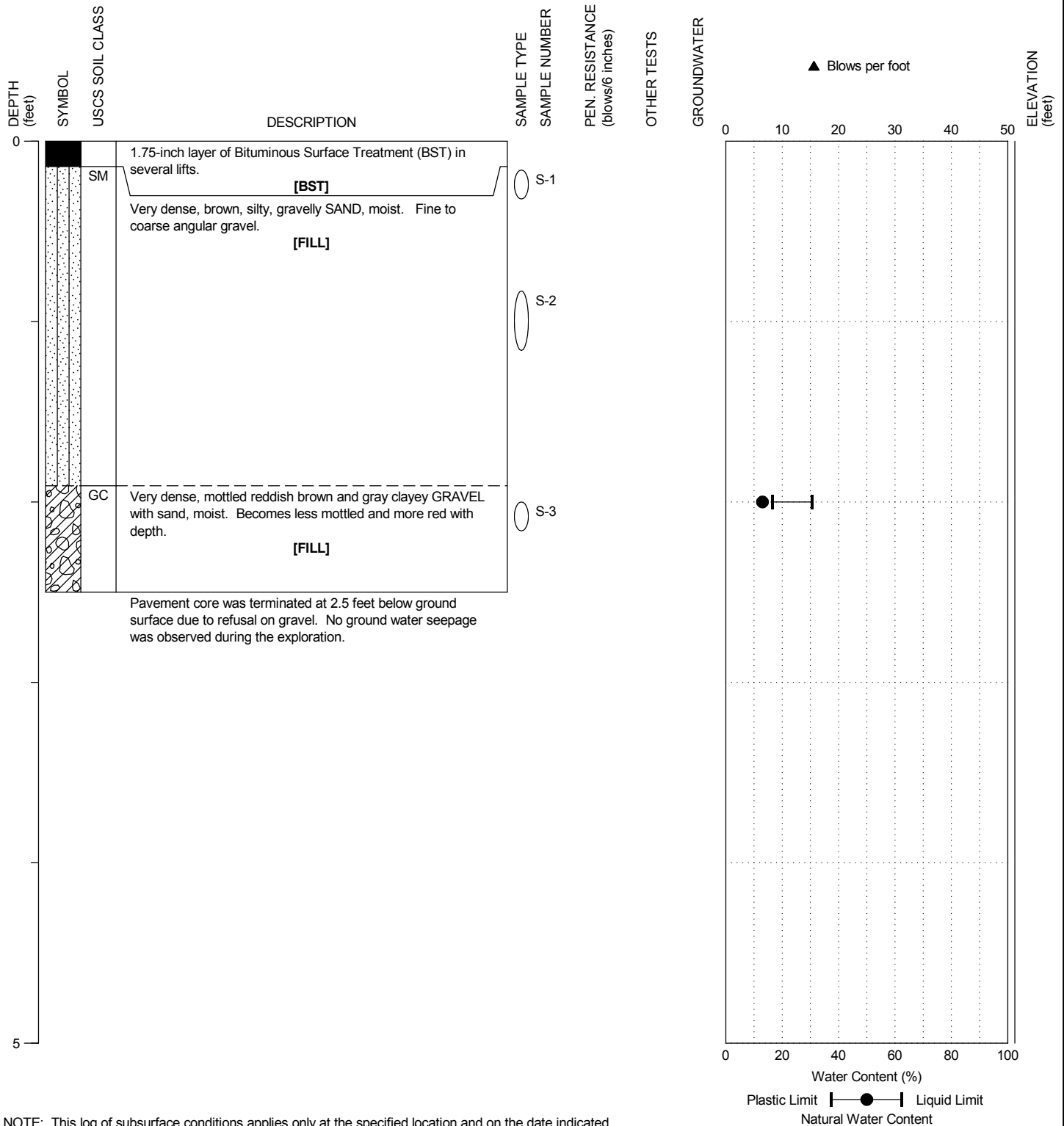
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 DATE COMPLETED: 11/26/2012
 LOGGED BY: D. Coltrane



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

DRILLING COMPANY: HWA Geosciences Inc.
 DRILLING METHOD: Hand portable core drill and bucket auger
 SAMPLING METHOD: GRAB
 LOCATION: Station 75+00 Outside wheel path of Northbound travel lane

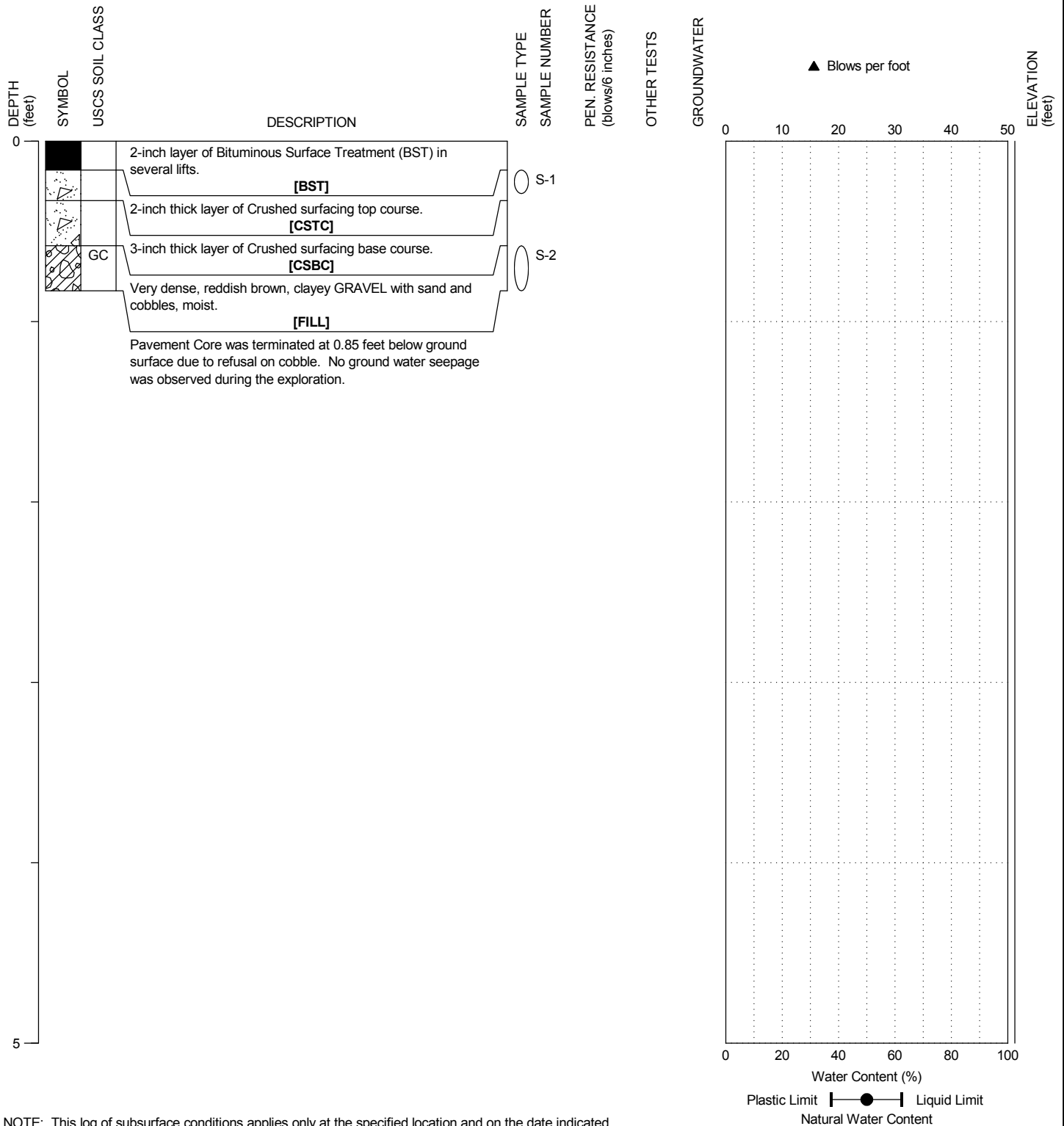
DATE STARTED: 11/26/2012
 DATE COMPLETED: 11/26/2012
 LOGGED BY: D. Coltrane



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

DRILLING COMPANY: HWA Geosciences Inc.
 DRILLING METHOD: Hand portable core drill and bucket auger
 SAMPLING METHOD: GRAB
 LOCATION: Station 92+50 Outside wheel path of Southbound travel lane

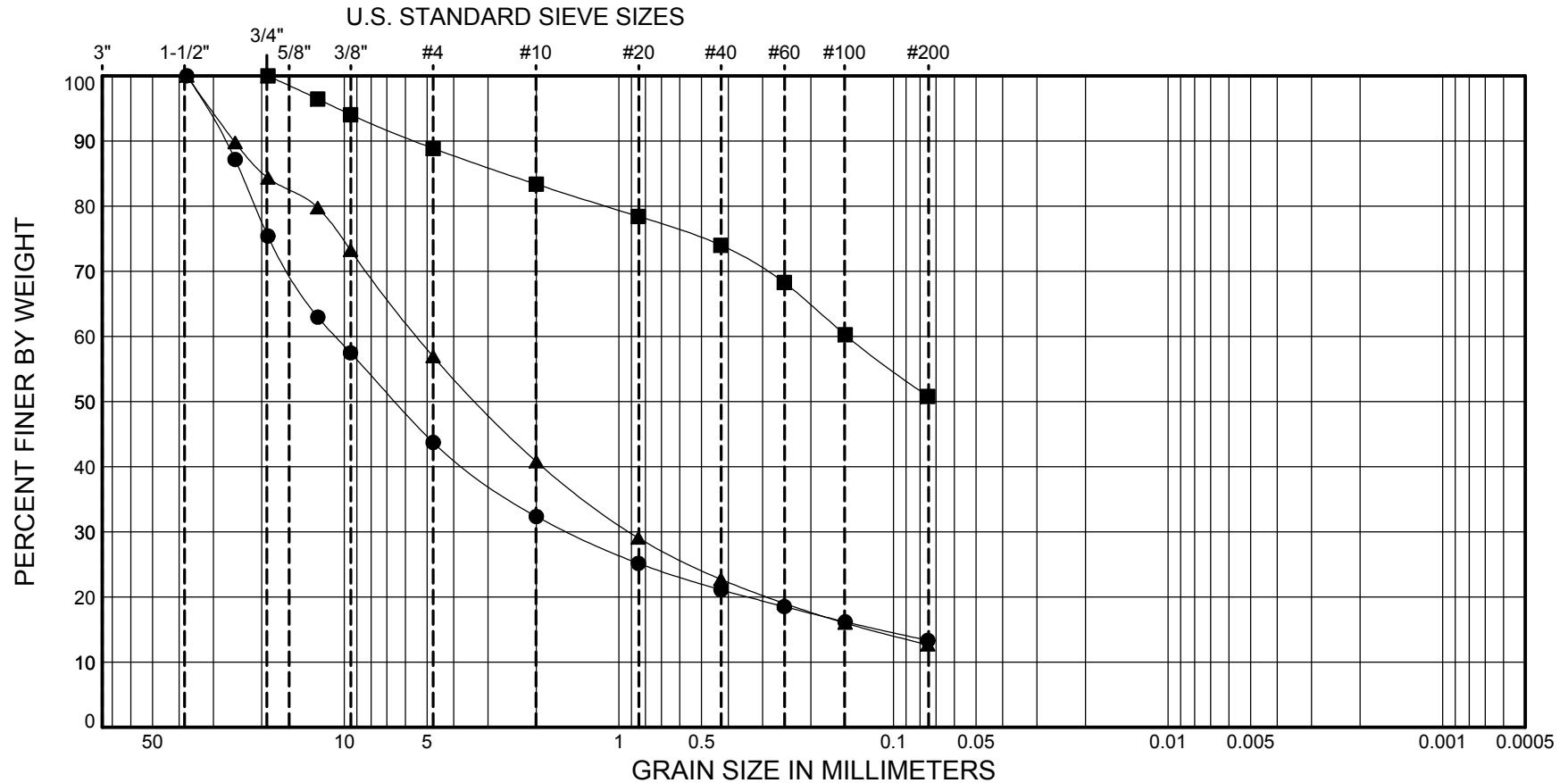
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APPENDIX B

LABORATORY TEST RESULTS

GRAVEL		SAND			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		



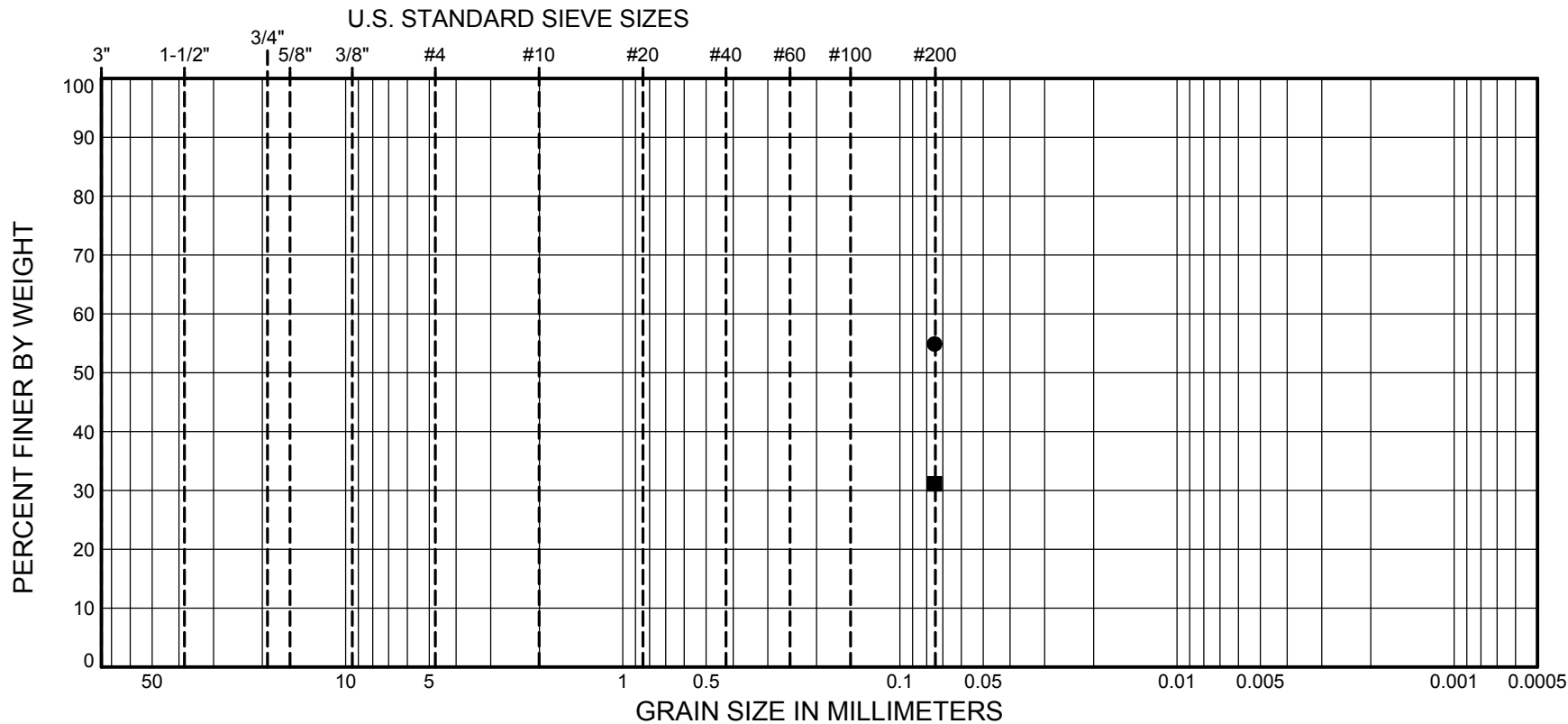
SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	Core-1	S-2	0.3 - 0.7	(GM) Very dark brown, silty GRAVEL with sand	7				56.3	30.4	13.3
■	Core-1	S-4	1.5 - 1.8	(ML) Dark brown, sandy SILT	15				11.1	38.1	50.8
▲	Core-4	S-1	0.3 - 0.5	(GM) Black, silty GRAVEL with sand	5				43.1	44.3	12.7



GEOTECHNICAL & PAVEMENT ENGINEERING REPORT
 THORP PRAIRIE ROAD EVALUATION AND DESIGN
 KITTITAS COUNTY, WASHINGTON

PARTICLE-SIZE ANALYSIS
 OF SOILS
 METHOD ASTM D422

GRAVEL		SAND			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

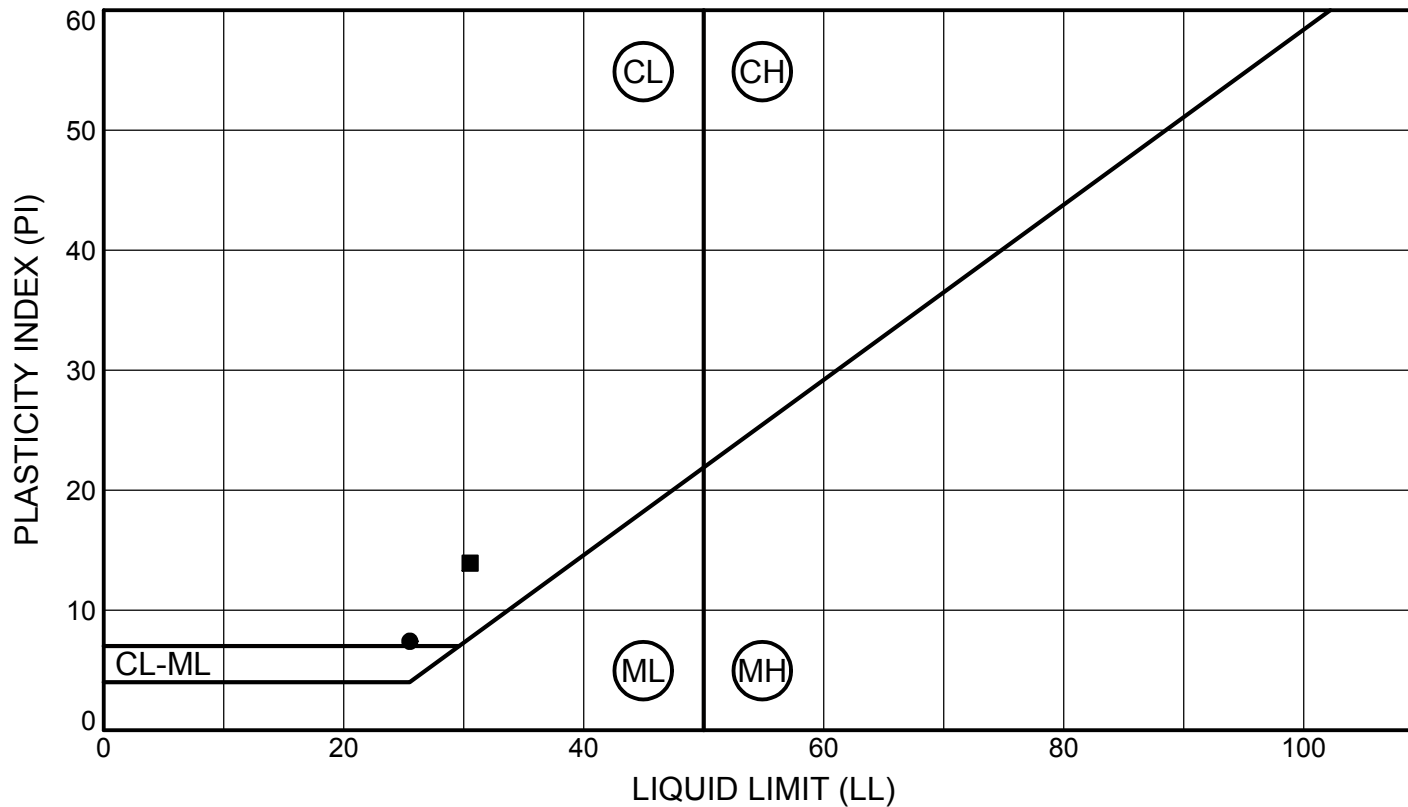


SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	Core-4	S-2	1.5 - 1.9	(CL) Very dark brown, sandy lean CLAY	19	26	18	8			54.9
■	Core-5	S-3	2.0 - 2.2	(GC) Dark yellowish brown, clayey GRAVEL	13	31	17	14			31.1



GEOTECHNICAL & PAVEMENT ENGINEERING REPORT
 THORP PRAIRIE ROAD EVALUATION AND DESIGN
 KITTITAS COUNTY, WASHINGTON

PERCENT OF MATERIAL PASSING
 #200 SIEVE
 METHOD ASTM D1140

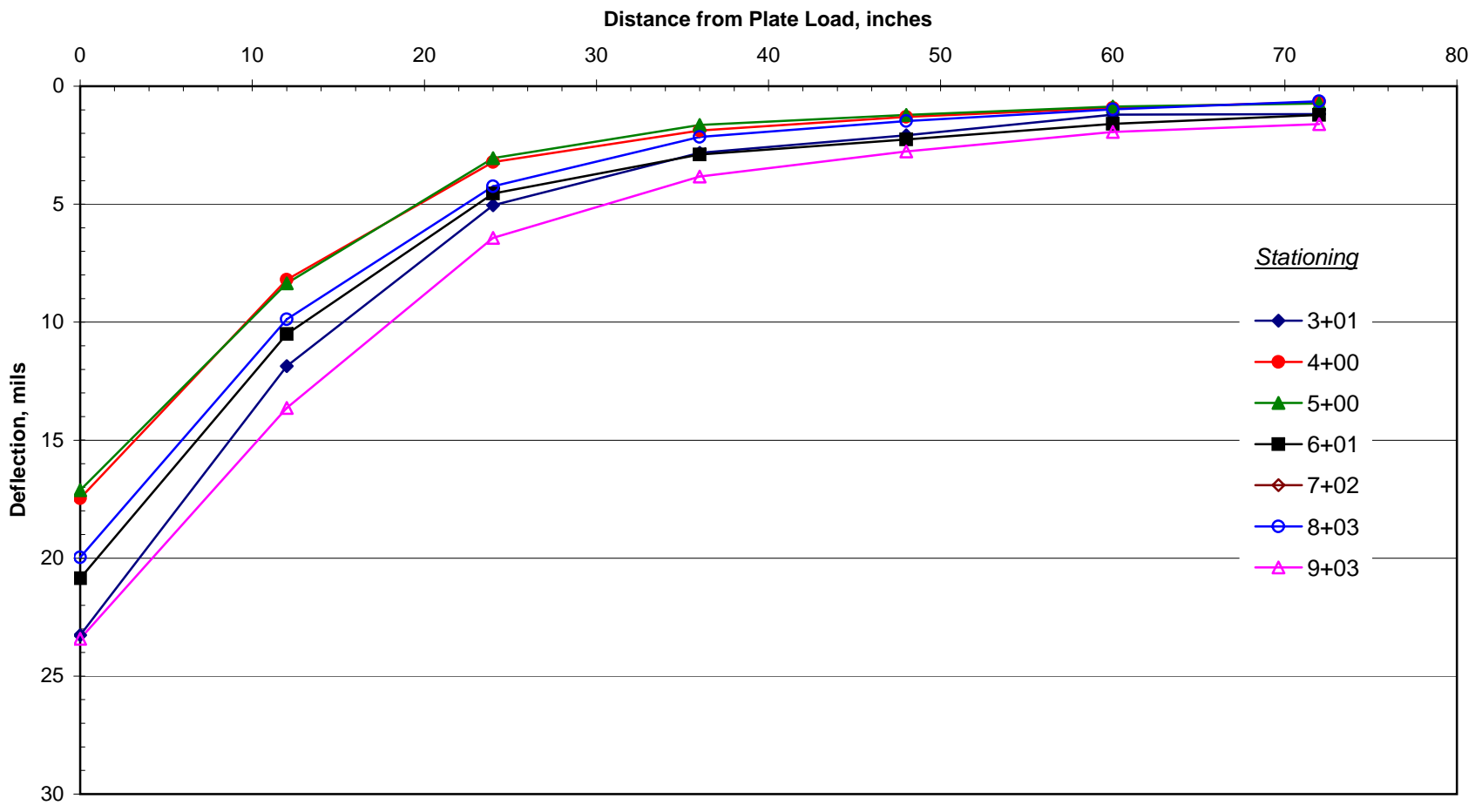


SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION	% MC	LL	PL	PI	% Fines
●	Core-4	S-2	1.5 - 1.9	(CL) Very dark brown, sandy lean CLAY	19	26	18	8	54.9
■	Core-5	S-3	2.0 - 2.2	(GC) Dark yellowish brown, clayey GRAVEL	13	31	17	14	31.1

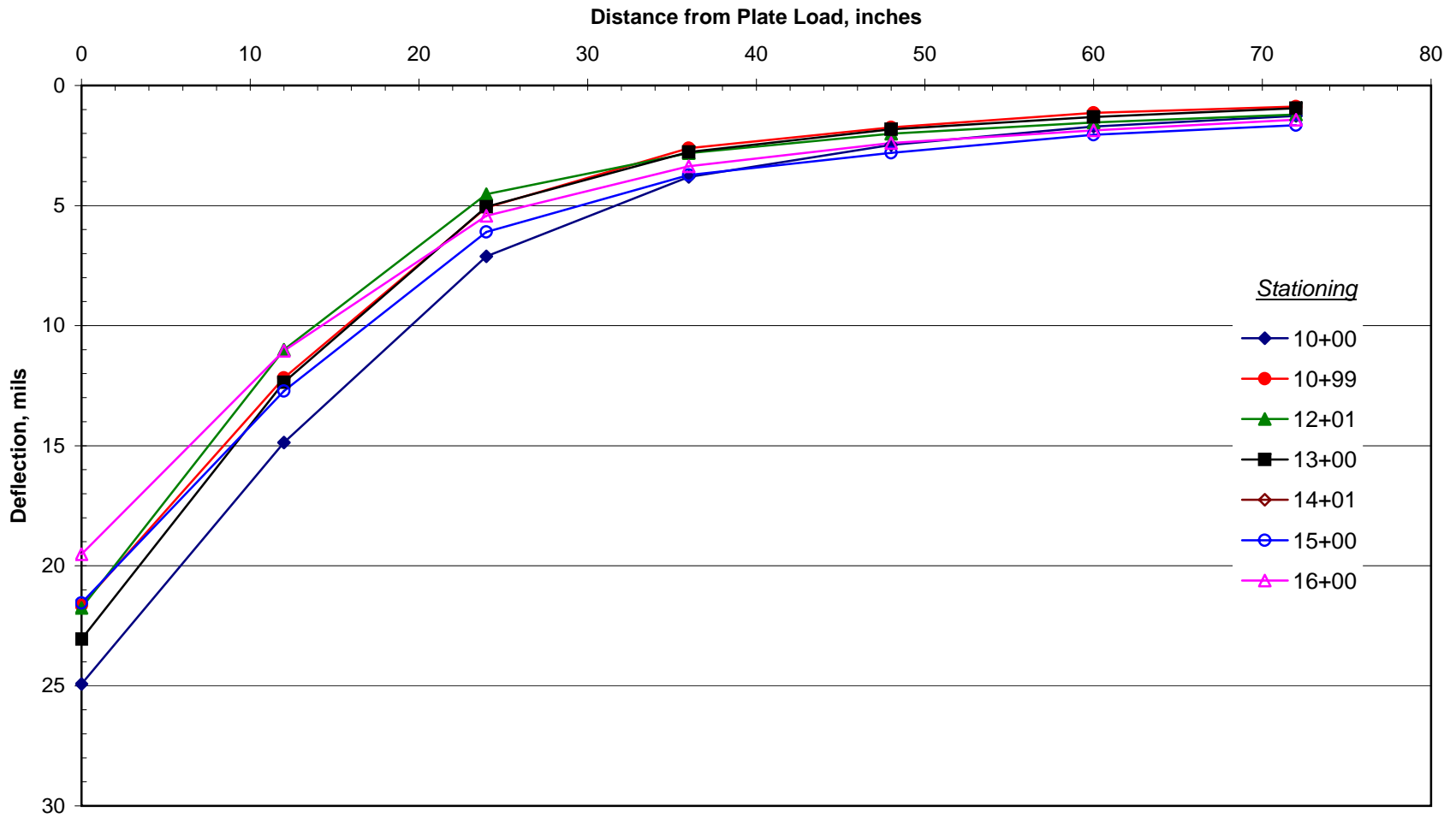
APPENDIX C

FWD DEFLECTION BASINS

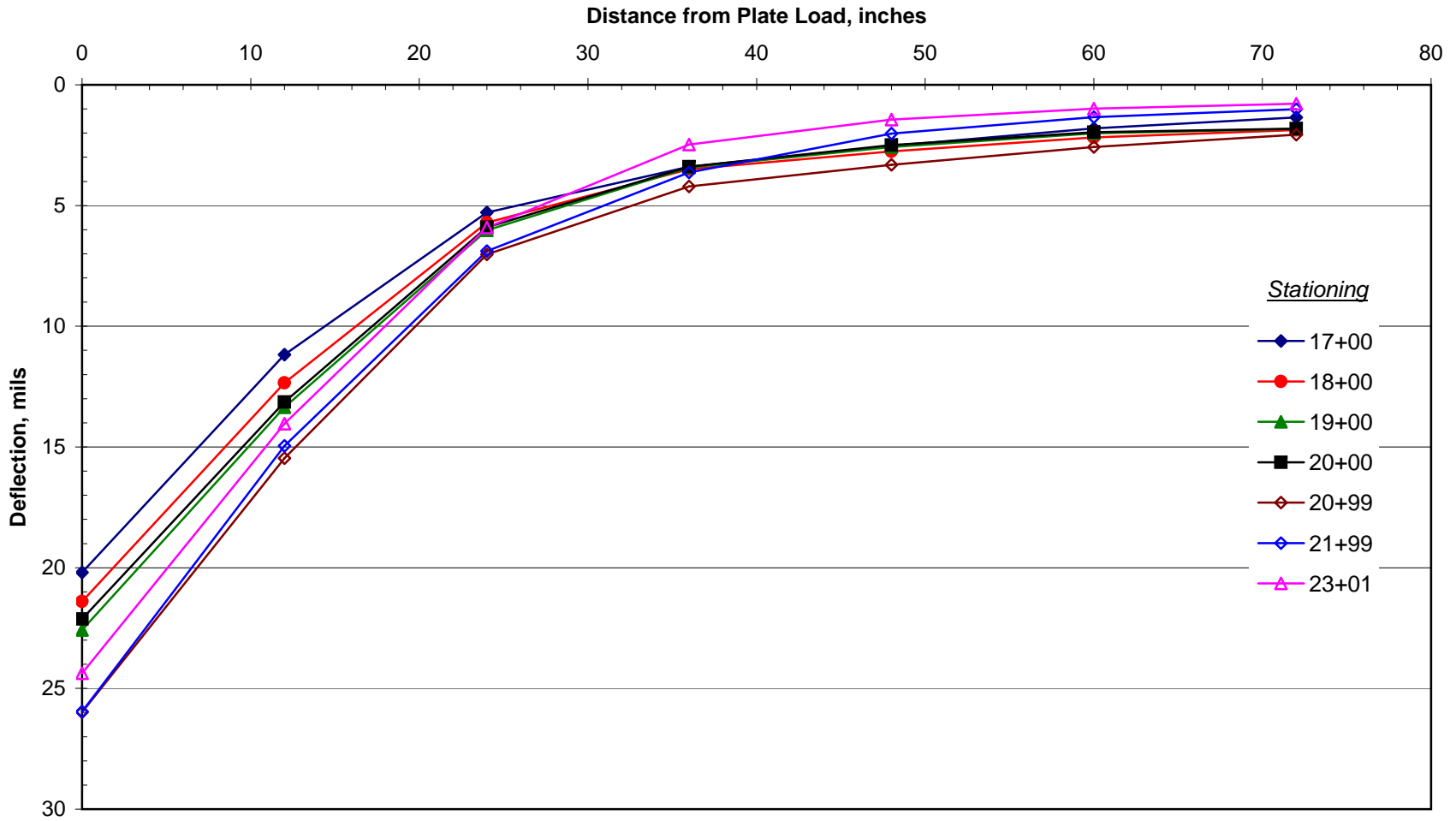
Thorp Prairie Road
From Exit 93 to EHIOCP Facility
NB Deflection Basins (1 of 14)



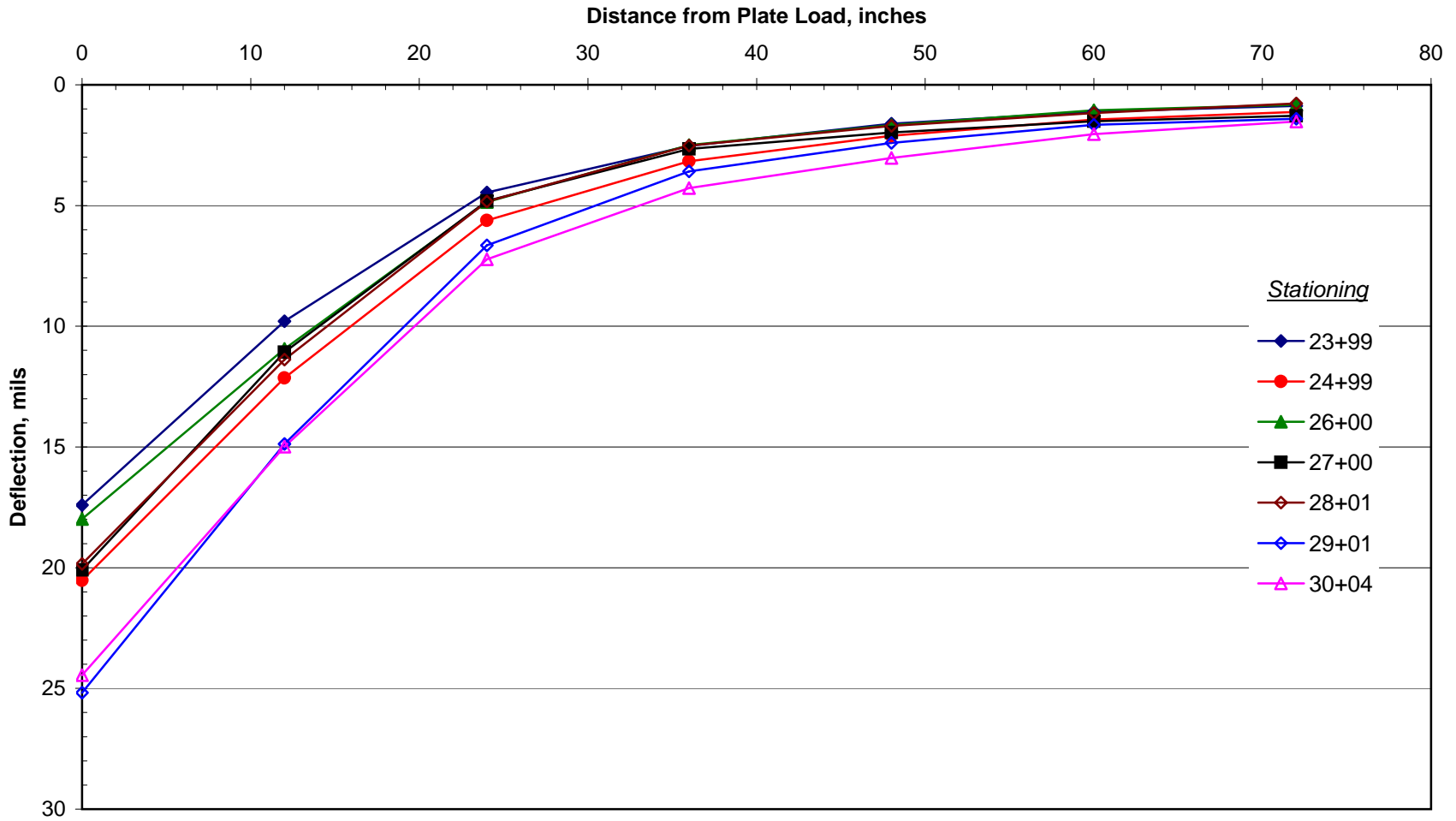
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NB Deflection Basins (2 of 14)



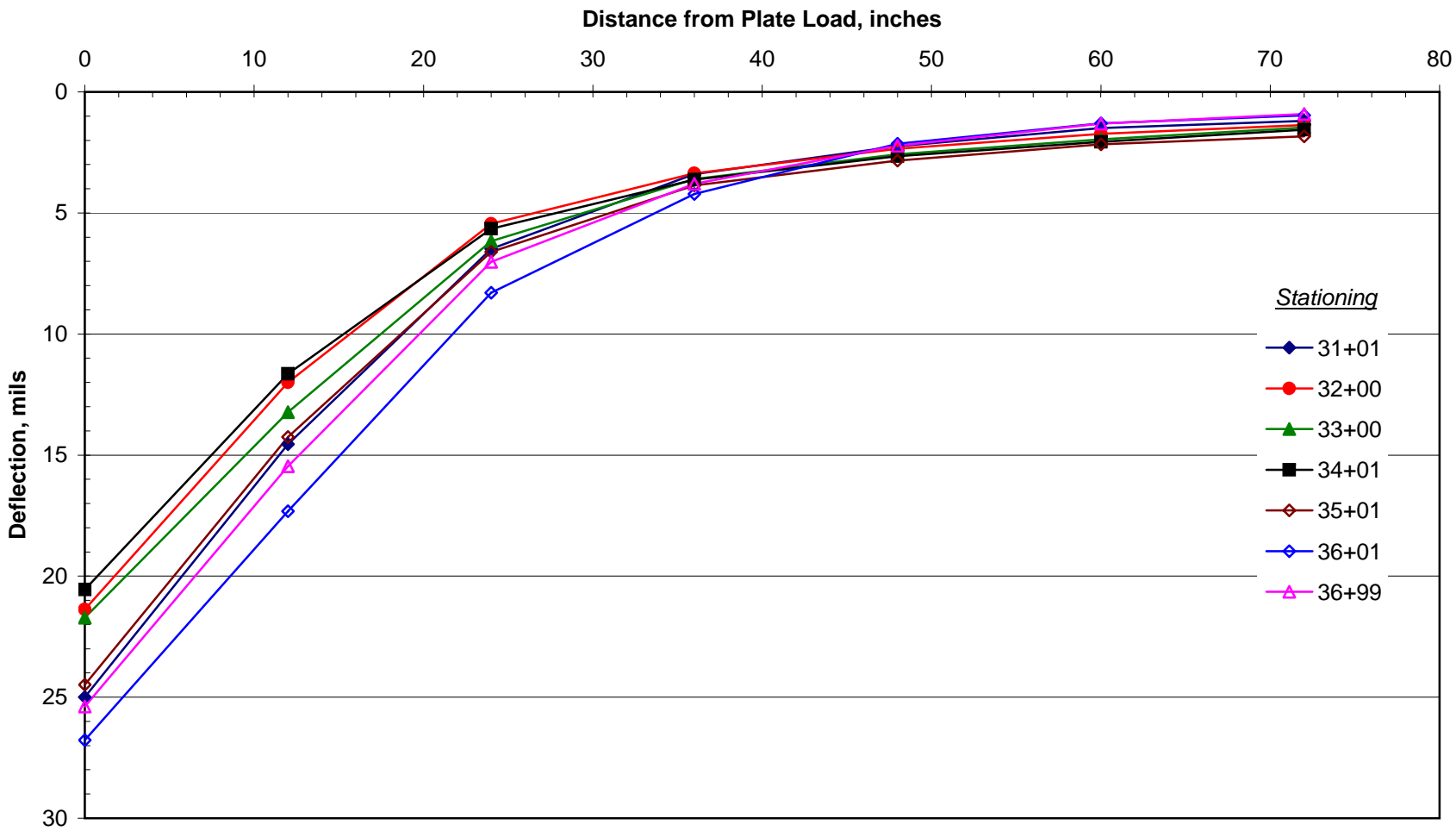
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NB Deflection Basins (3 of 14)



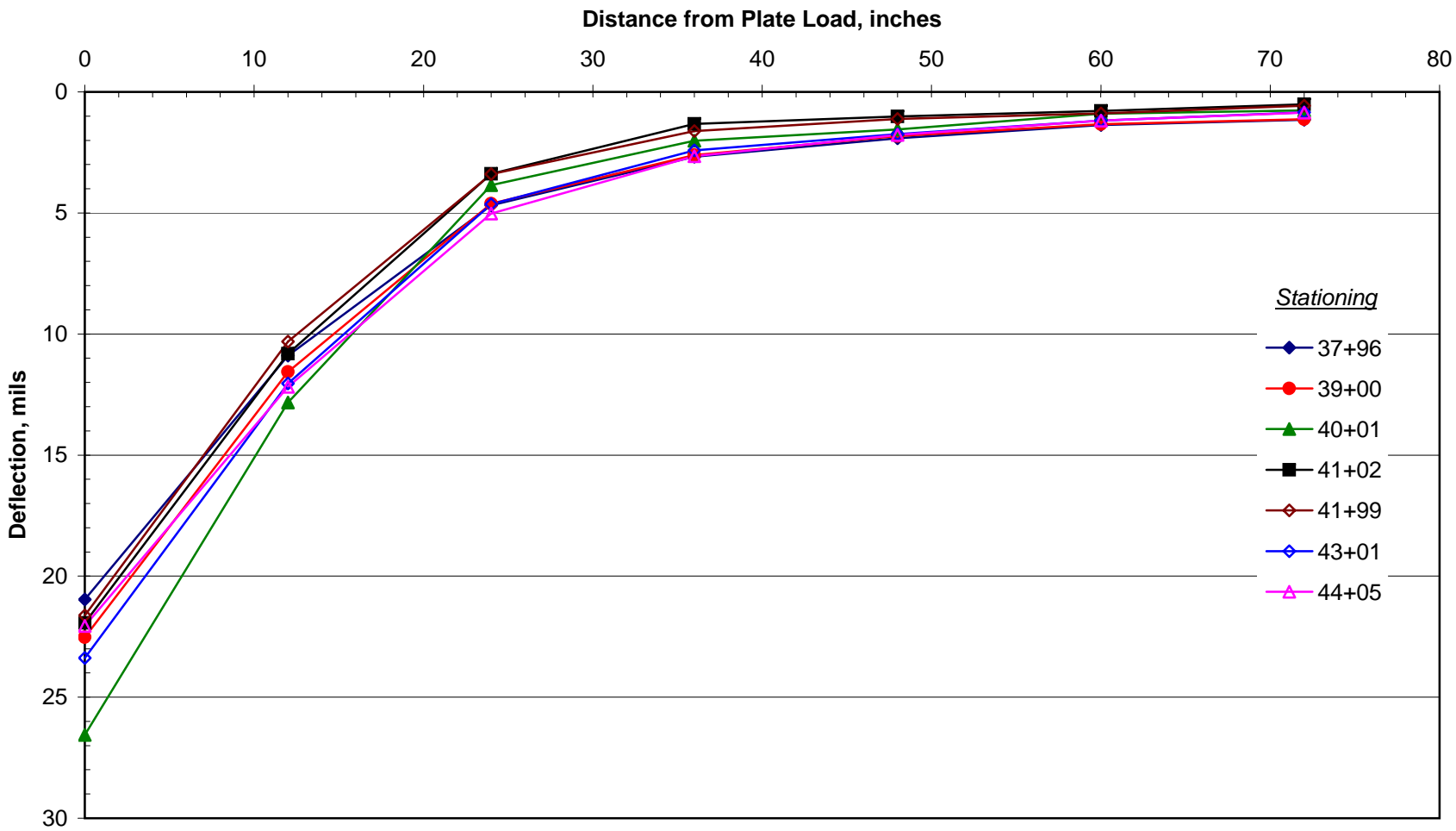
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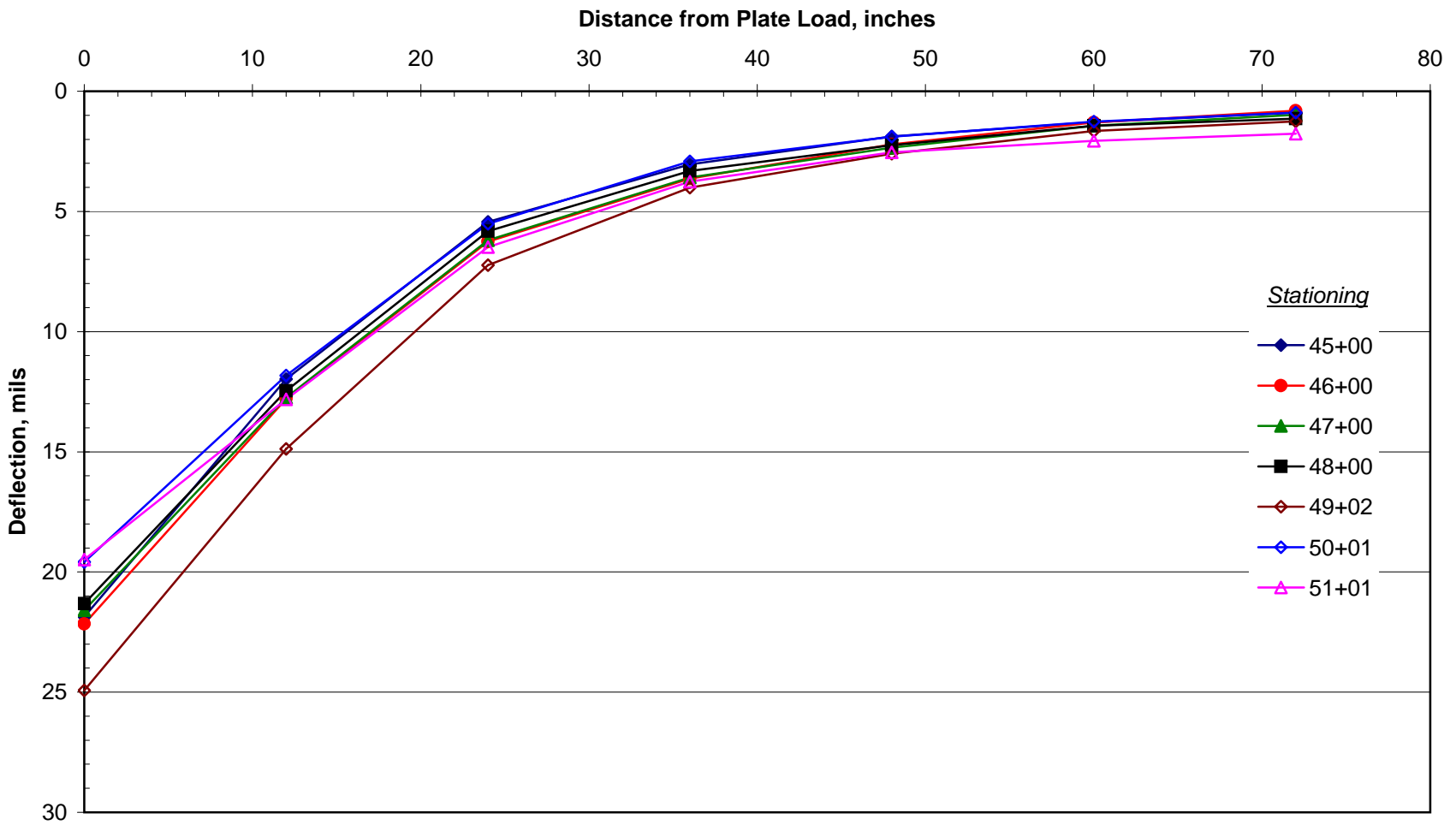
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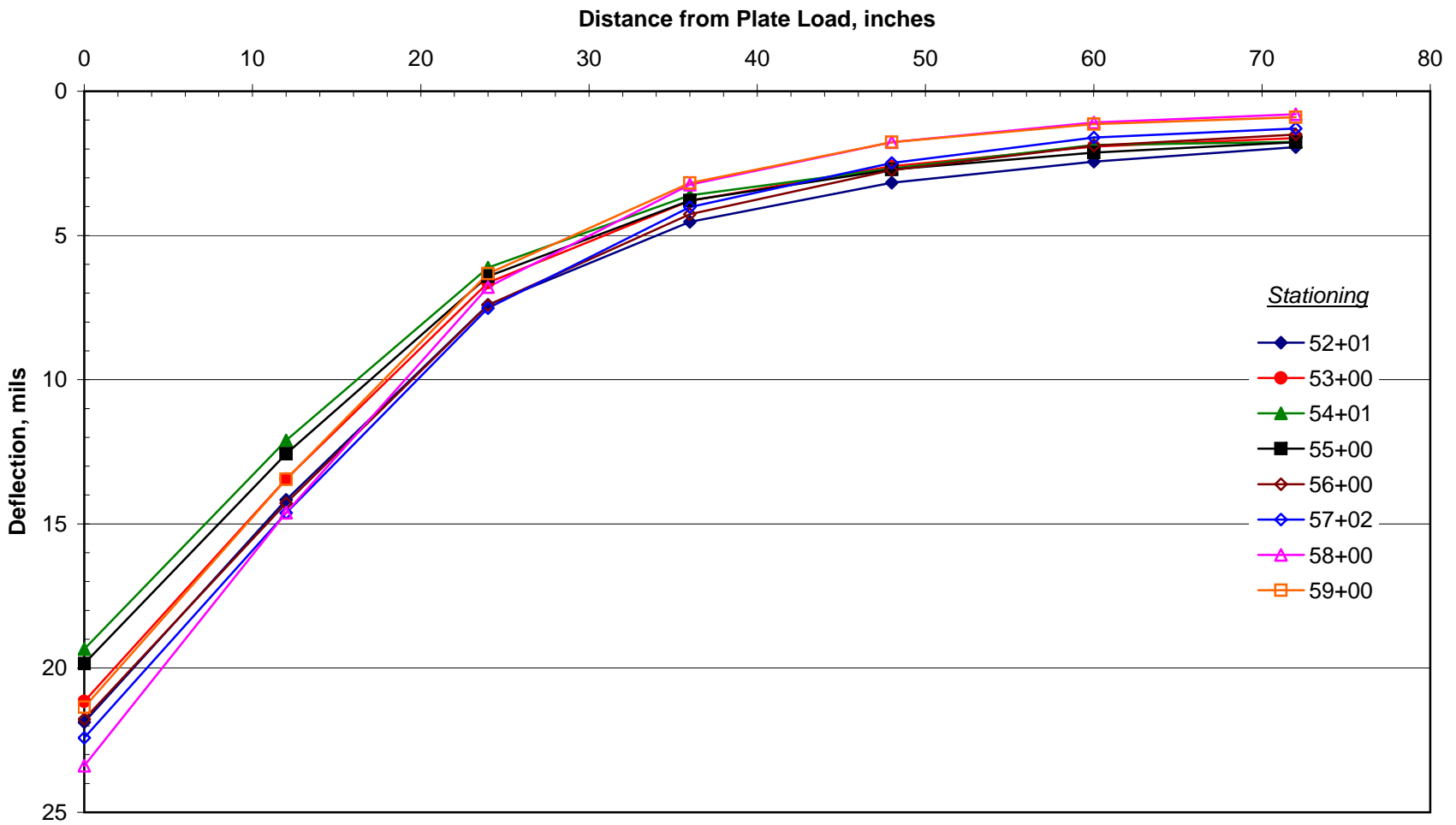
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NB Deflection Basins (6 of 14)



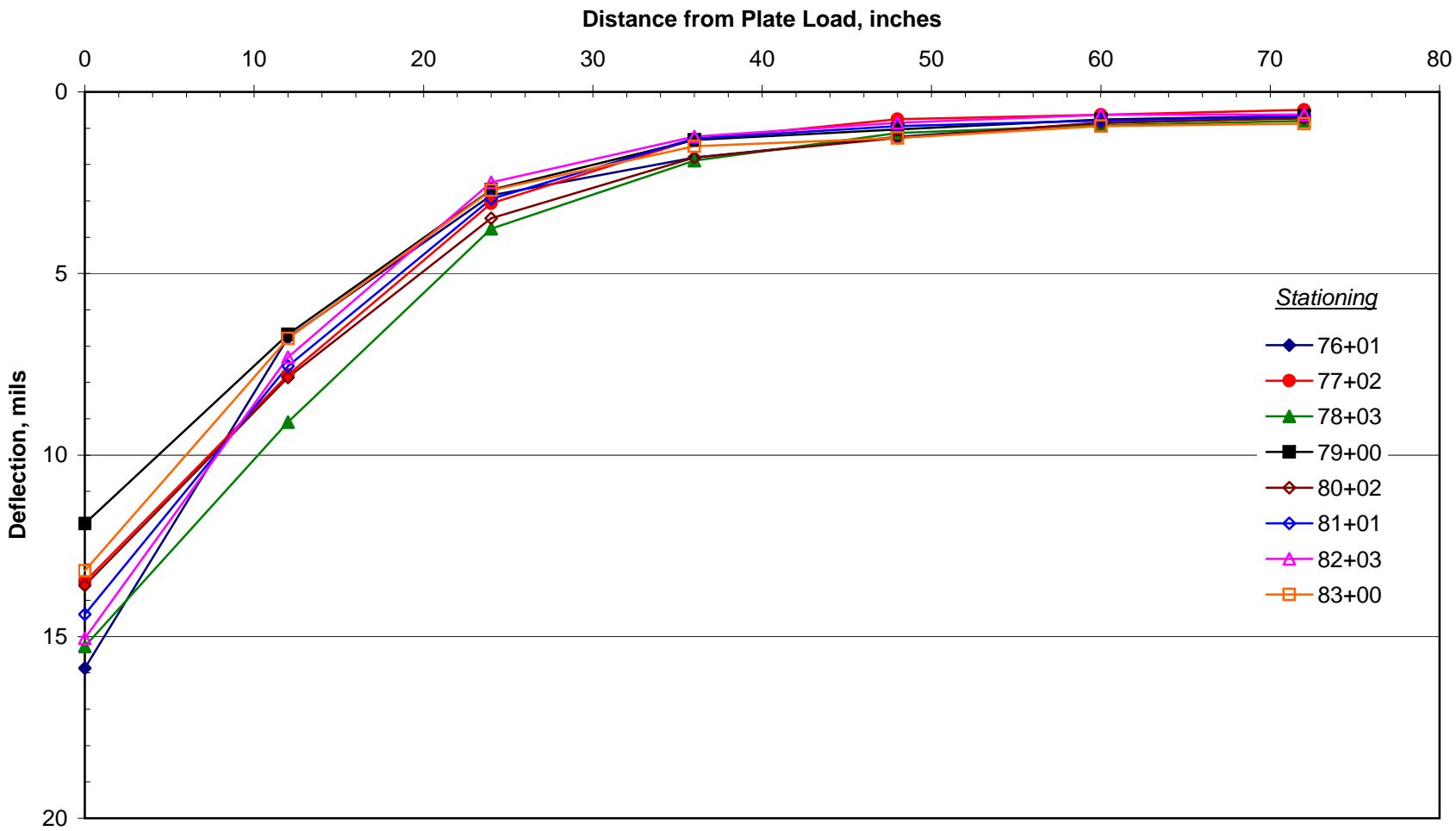
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NB Deflection Basins (7 of 14)



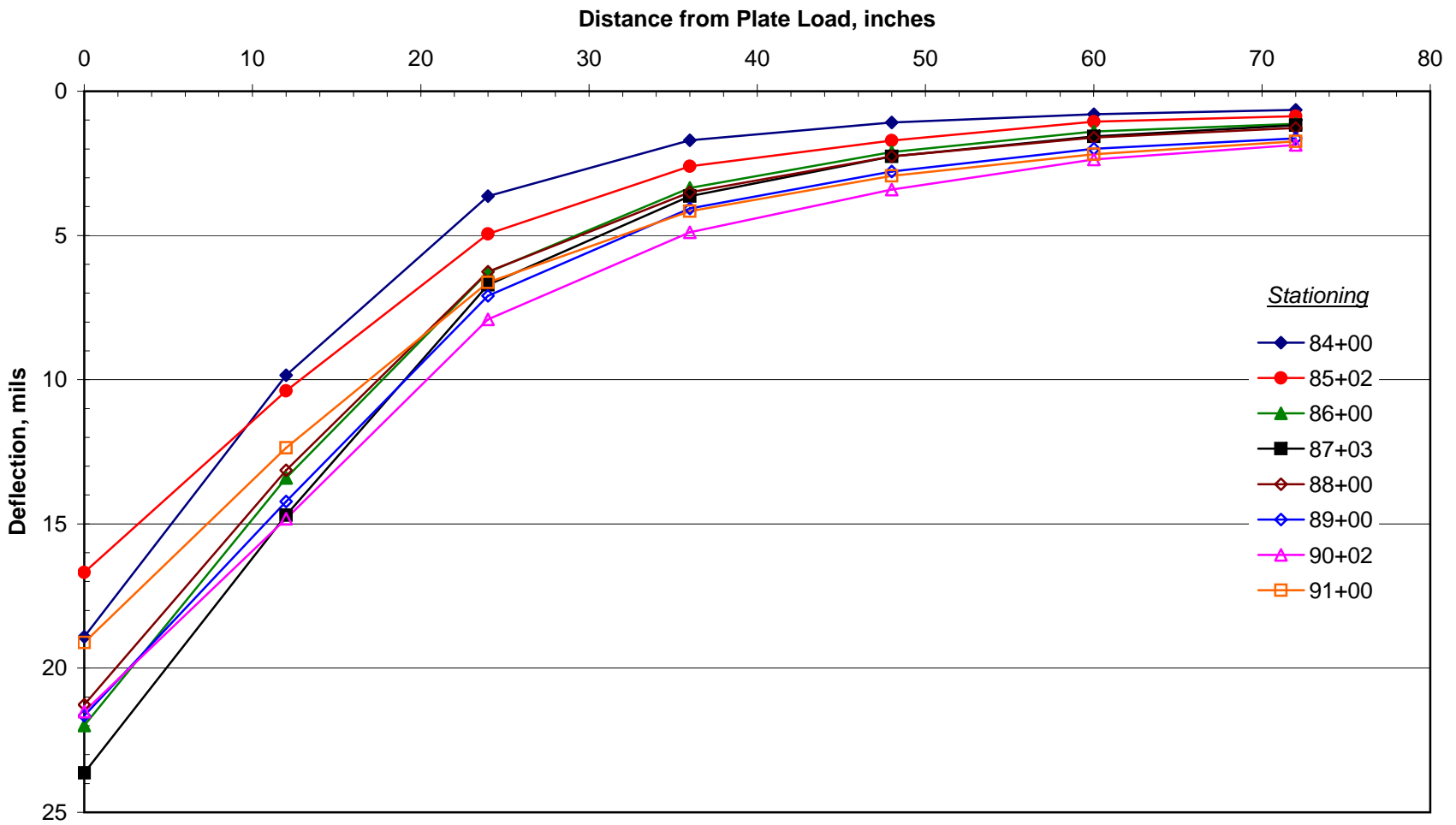
Thorp Prairie Road
From Exit 93 to EHIOCP Facility
NB Deflection Basins (8 of 14)



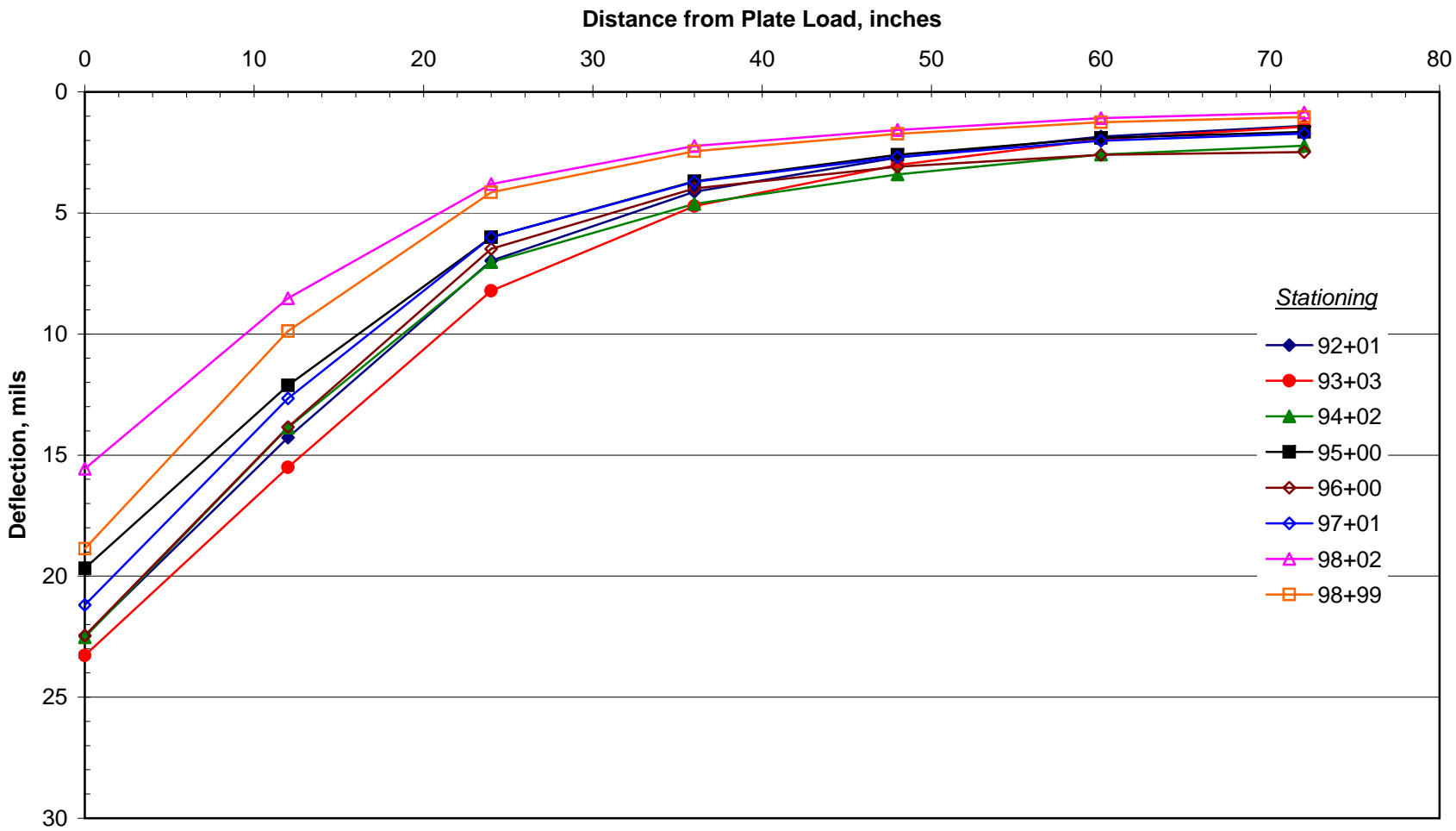
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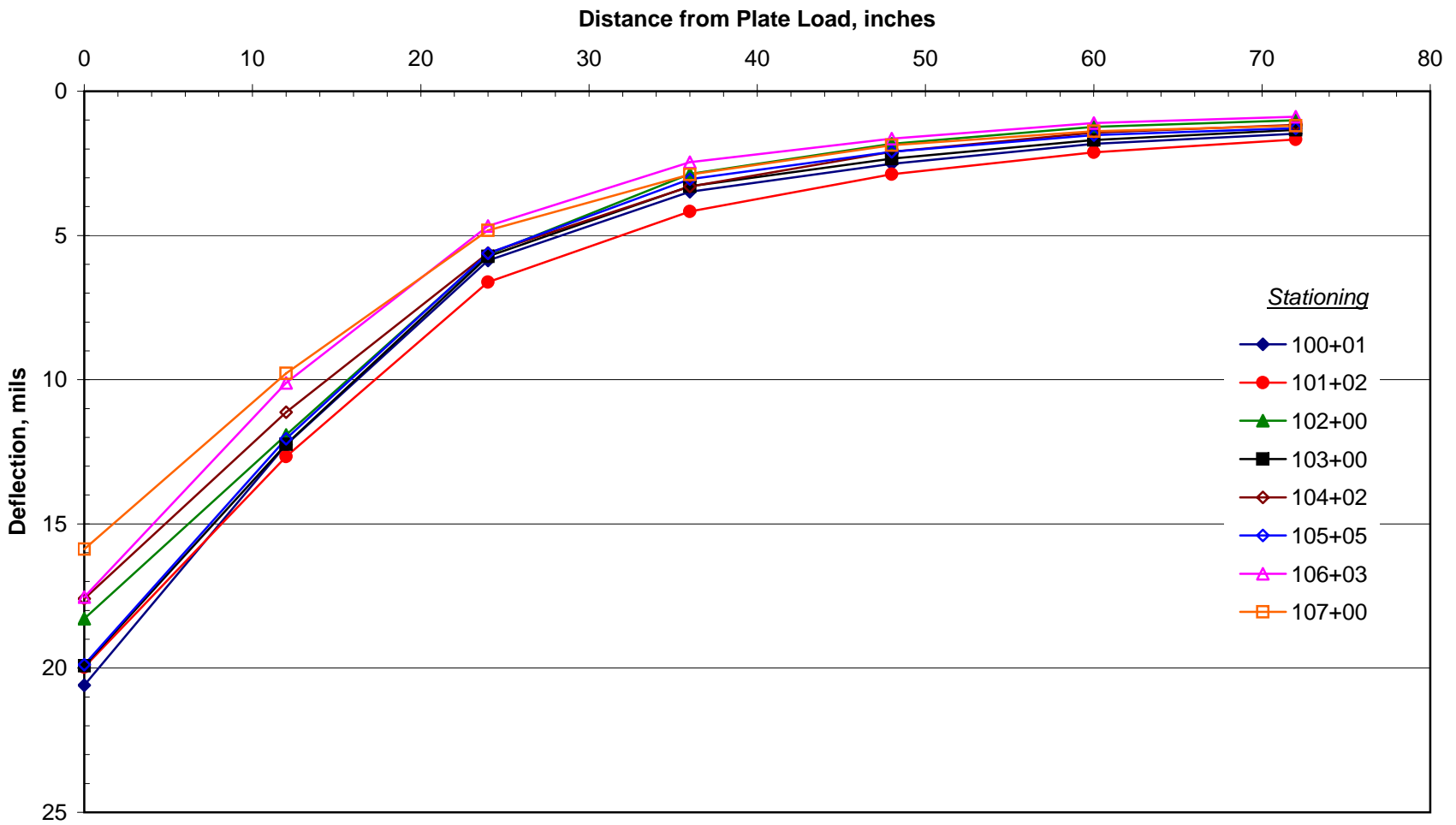
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From Exit 93 to EHIOCP Facility
NB Deflection Basins (12 of 14)



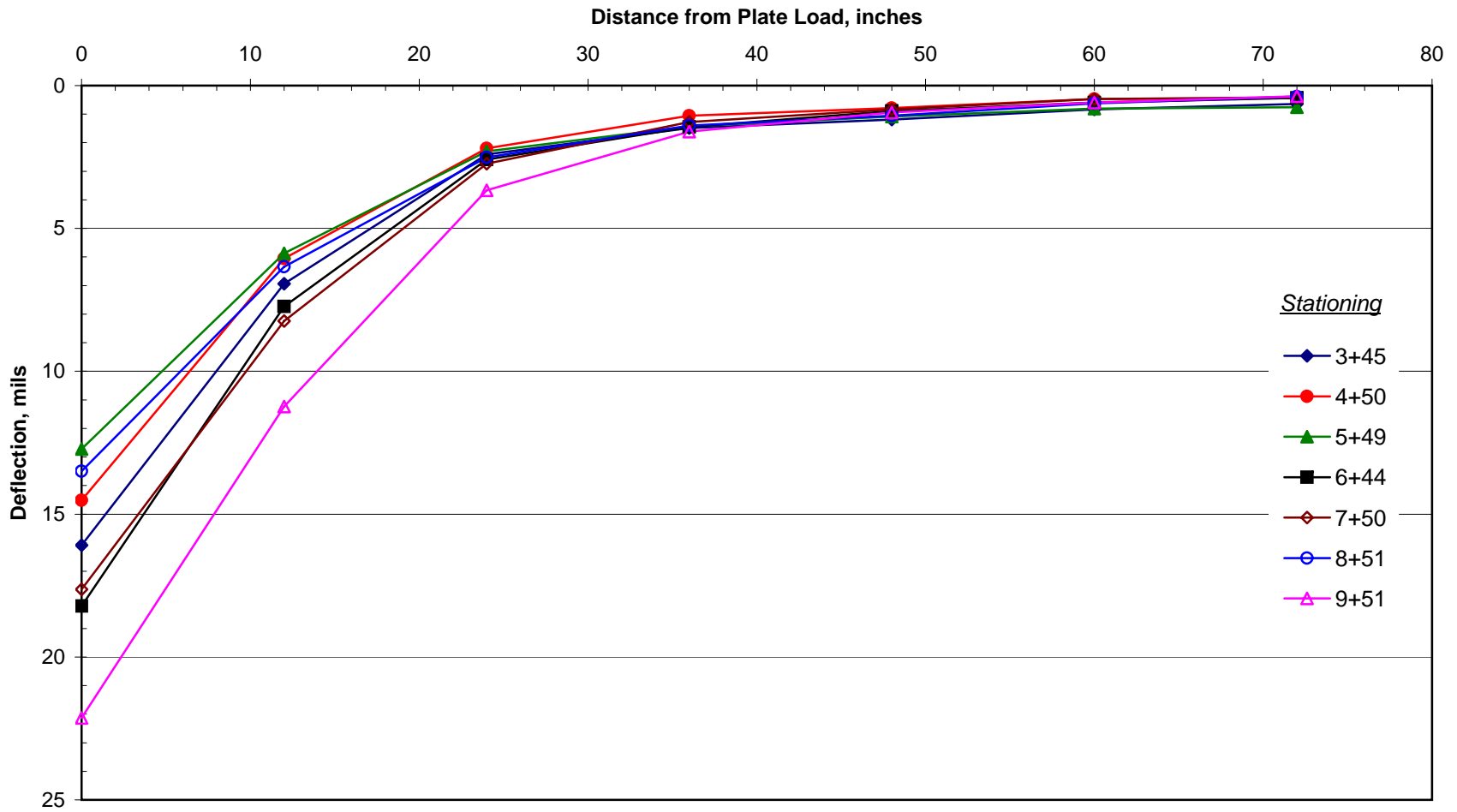
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NB Deflection Basins (13 of 14)



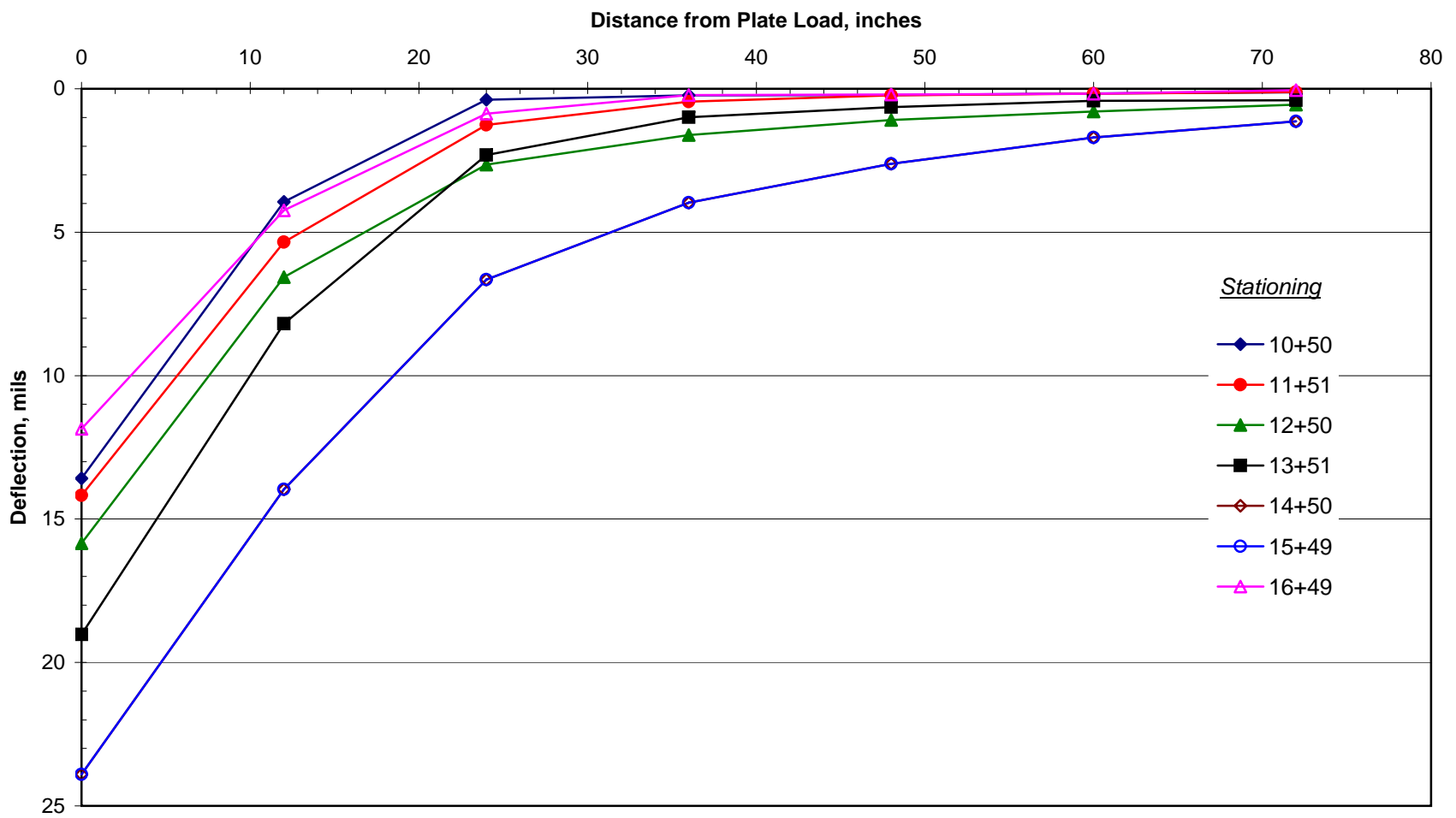
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NB Deflection Basins (14 of 14)



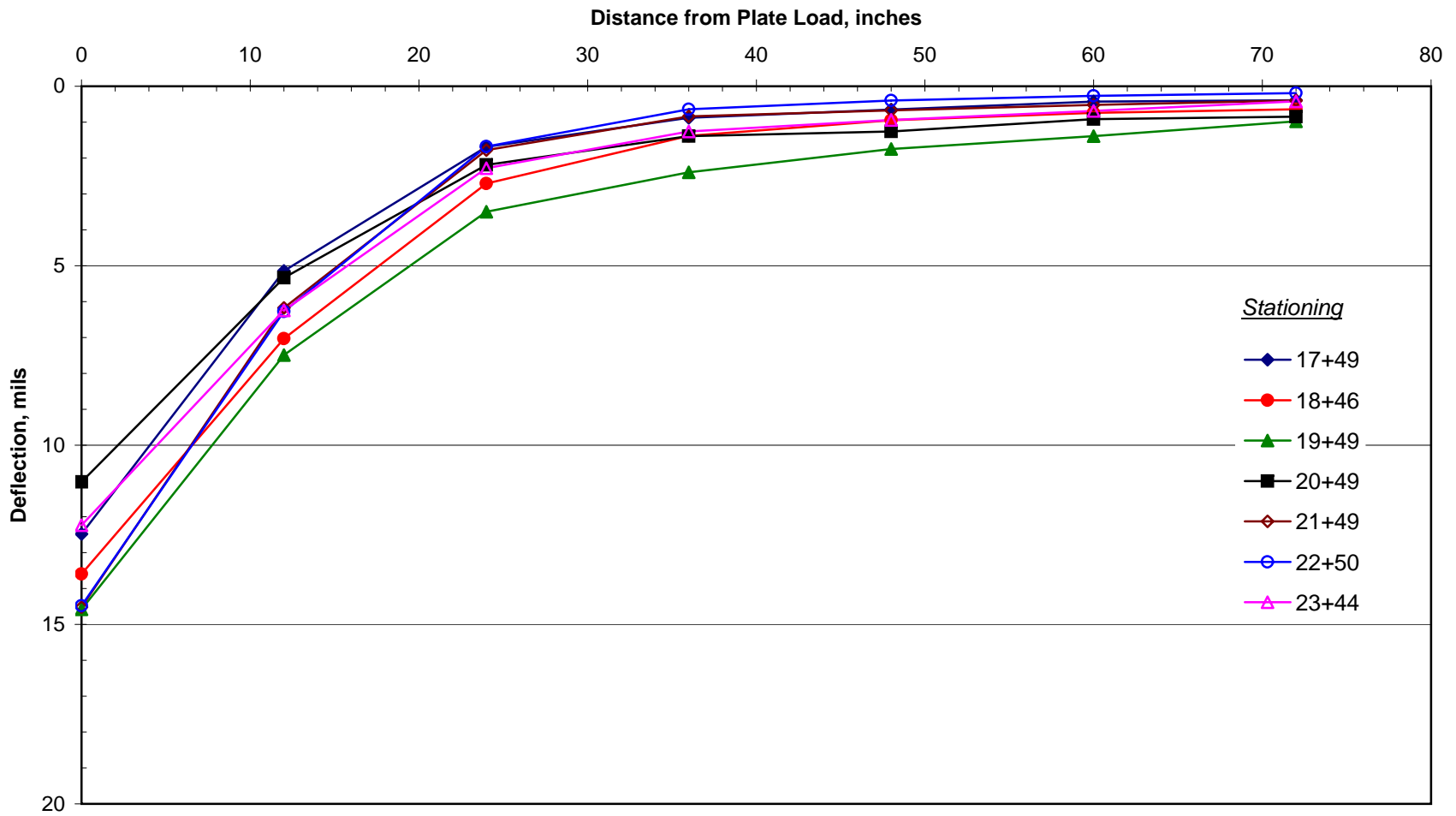
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From Exit 93 to EHIOCP Facility
SB Deflection Basins (1 of 14)



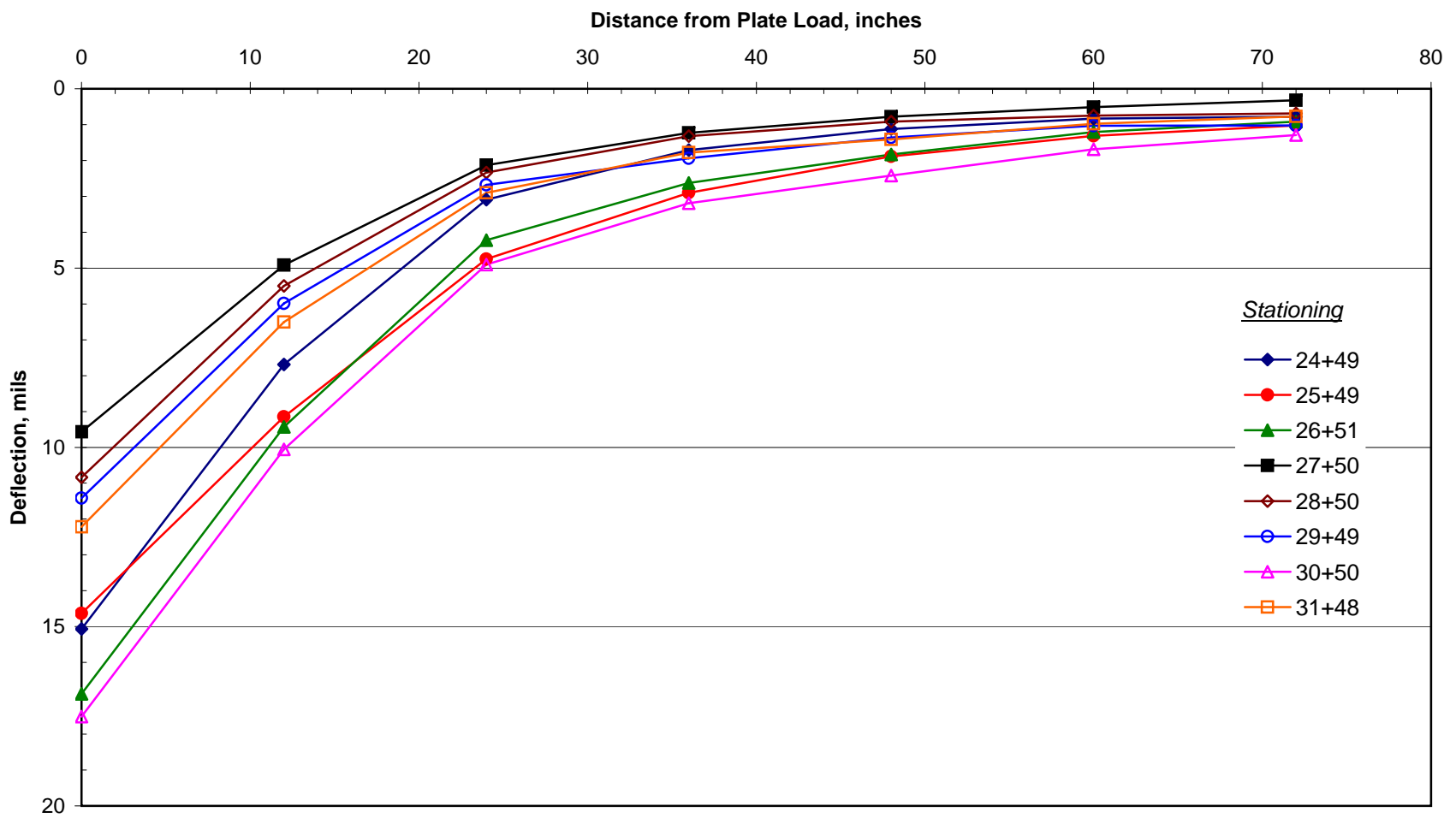
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From Exit 93 to EHIOCP Facility
SB Deflection Basins (2 of 14)



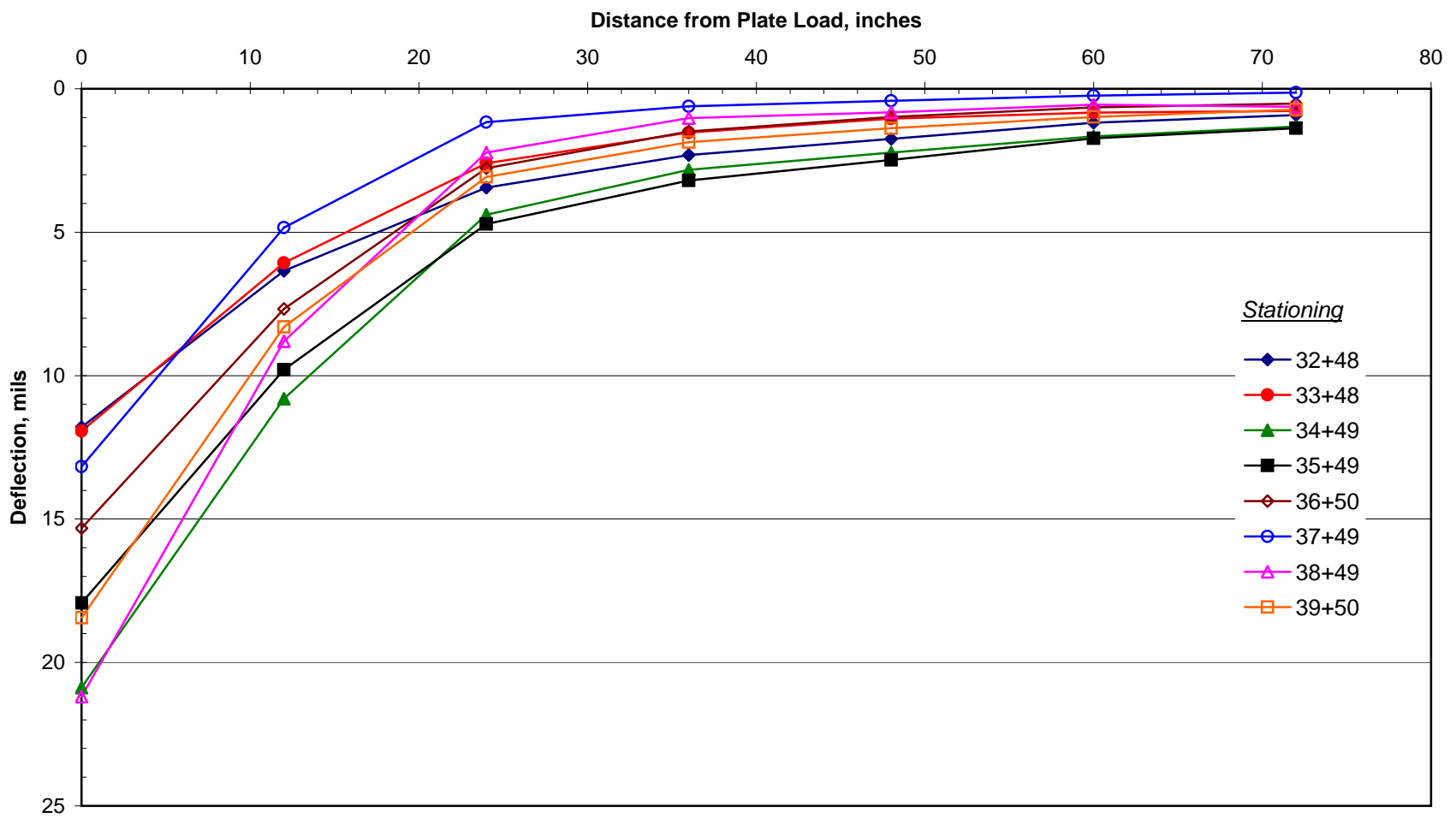
Thorp Prairie Road
From Exit 93 to EHIOCP Facility
SB Deflection Basins (3 of 14)



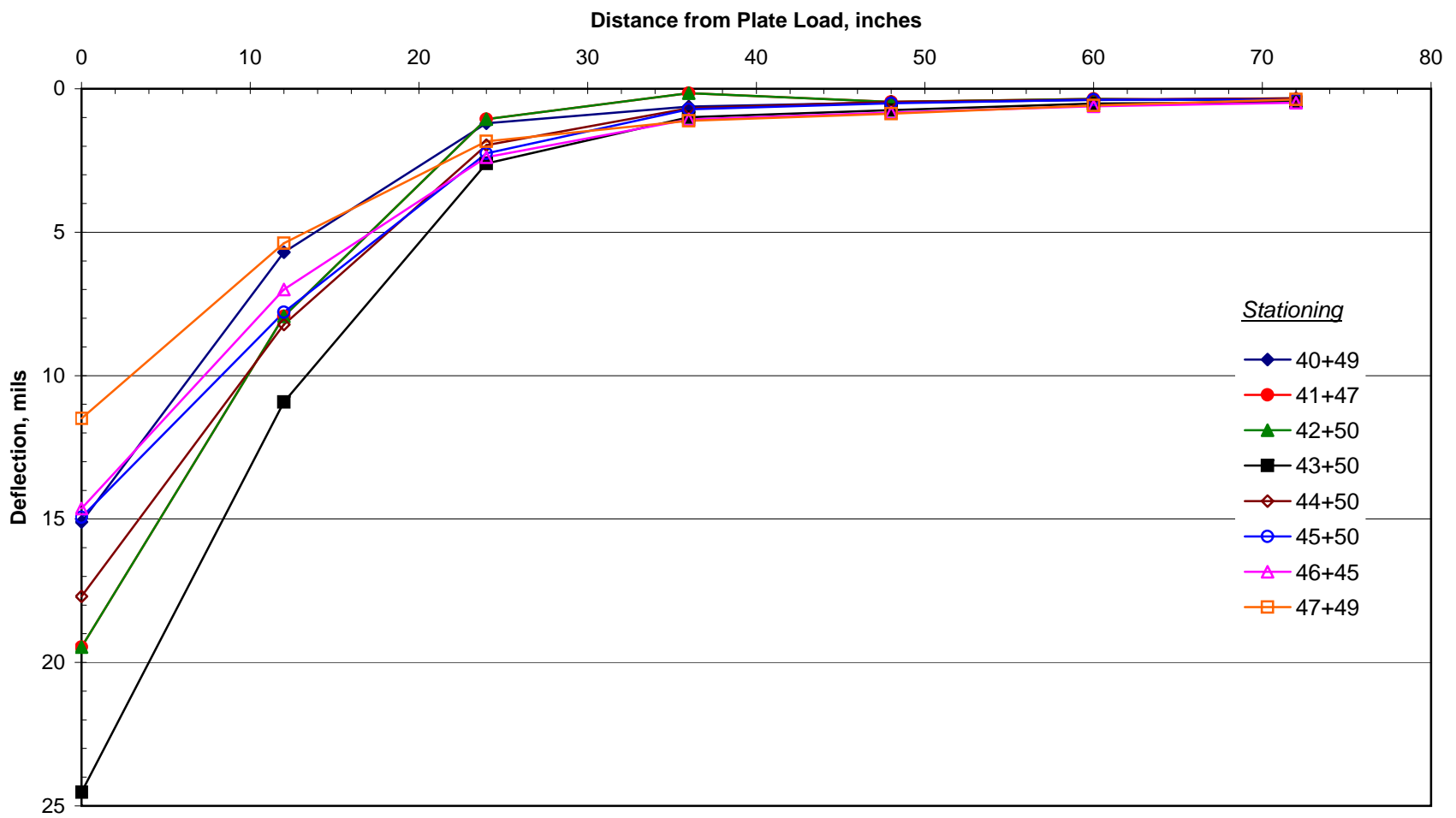
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From Exit 93 to EHIOCP Facility
SB Deflection Basins (4 of 14)**



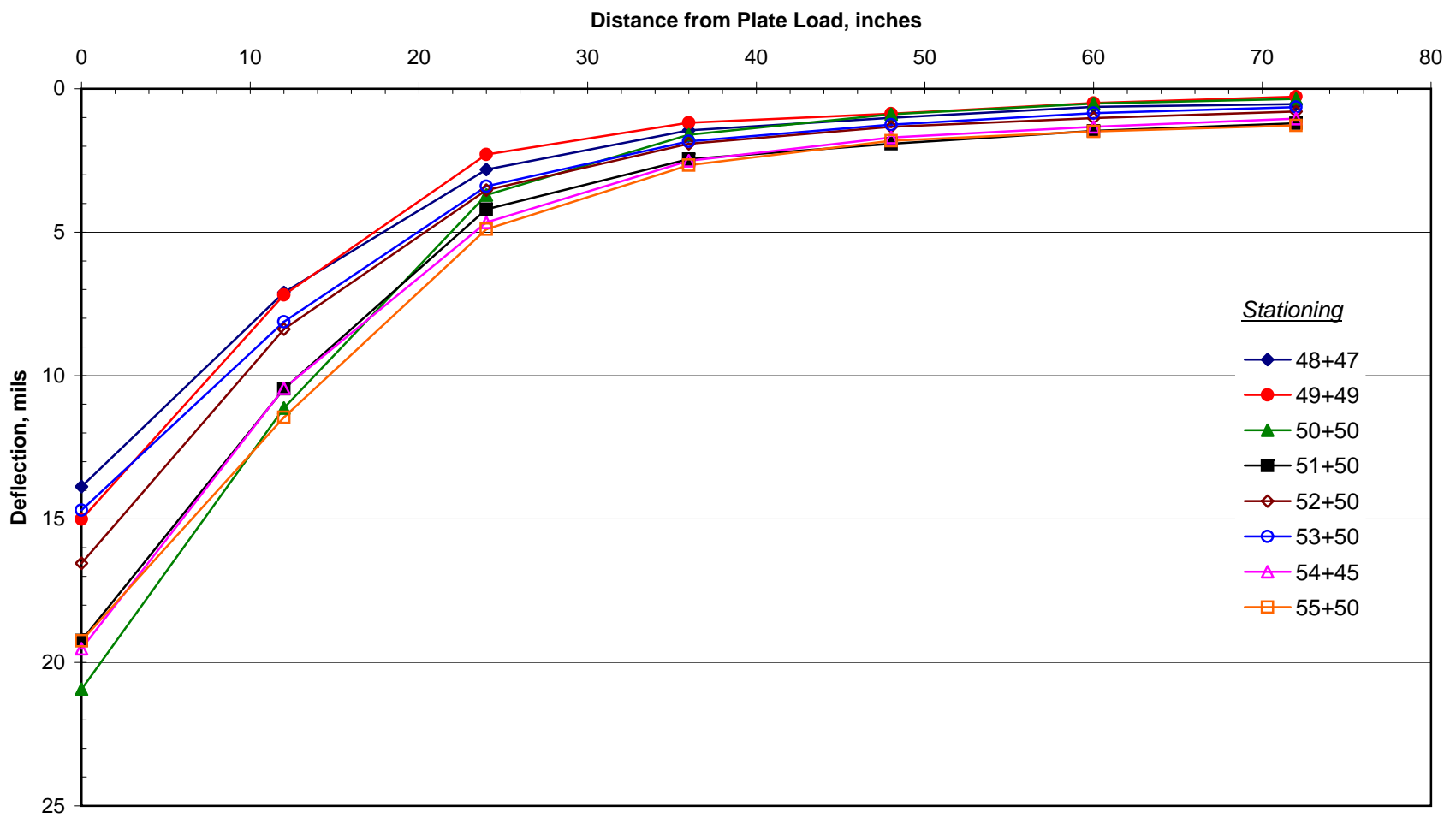
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From Exit 93 to EHIOCP Facility
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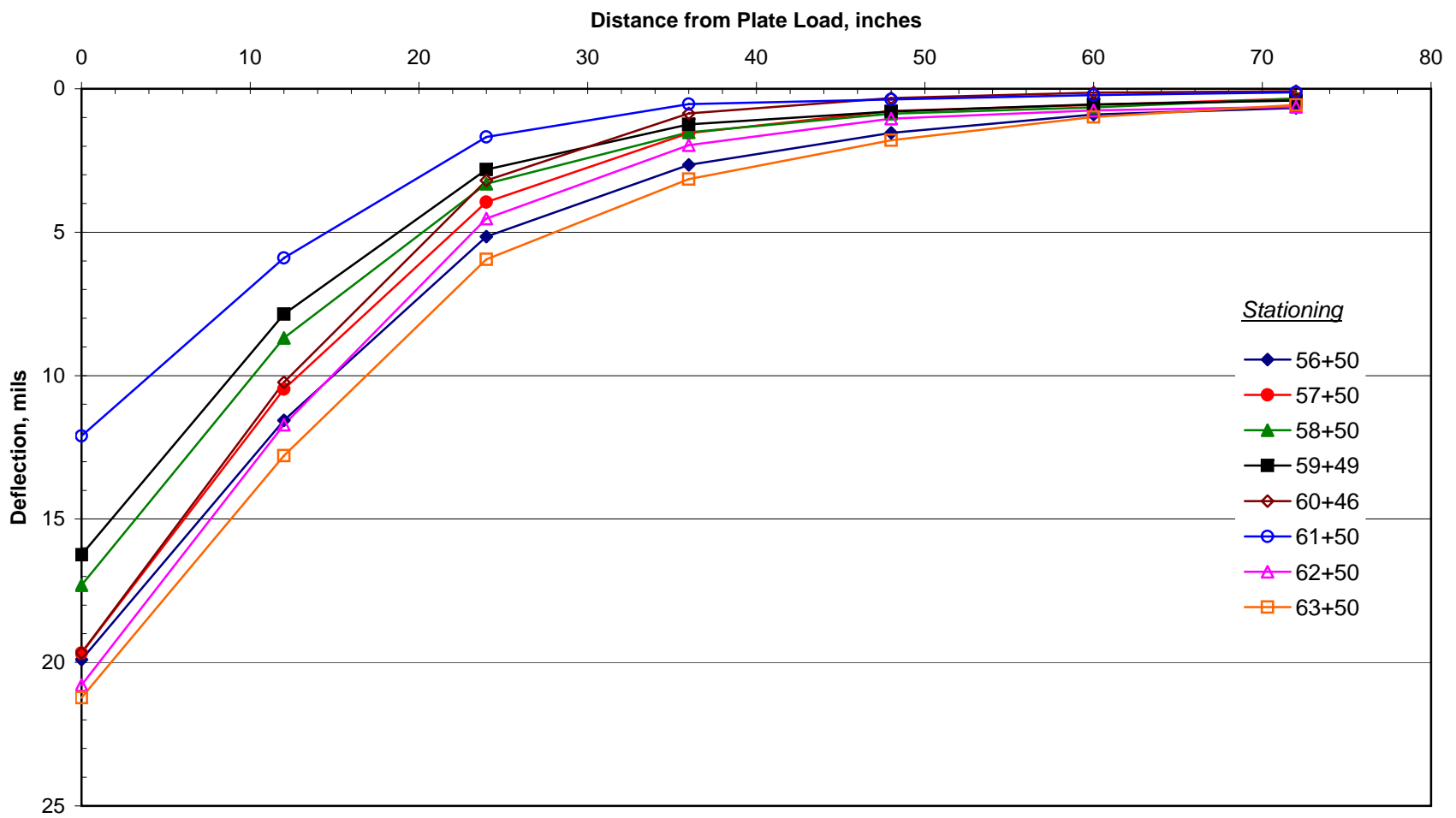
Thorp Prairie Road
From Exit 93 to EHIOCP Facility
SB Deflection Basins (6 of 14)



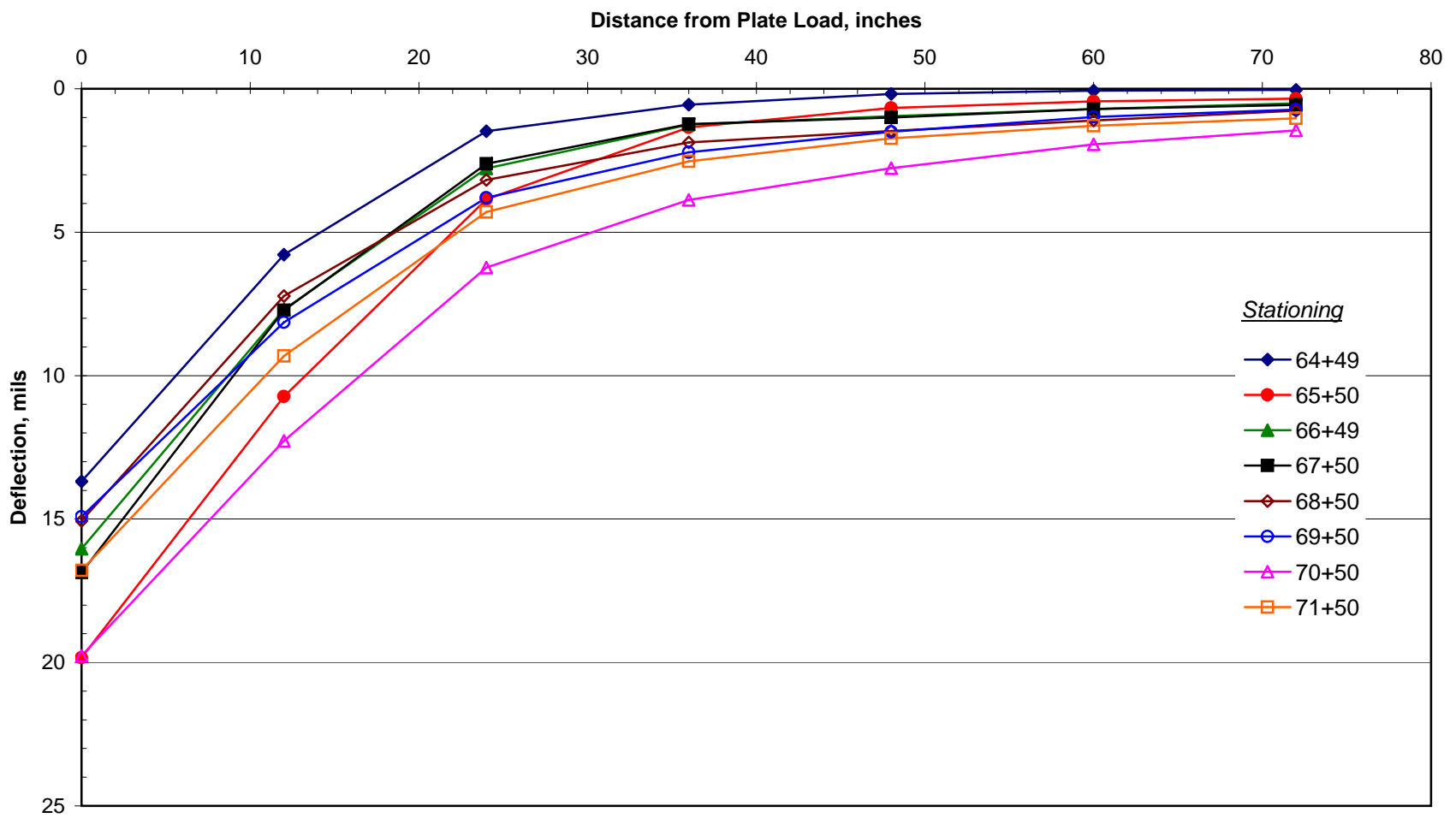
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From Exit 93 to EHIOCP Facility
SB Deflection Basins (7 of 14)



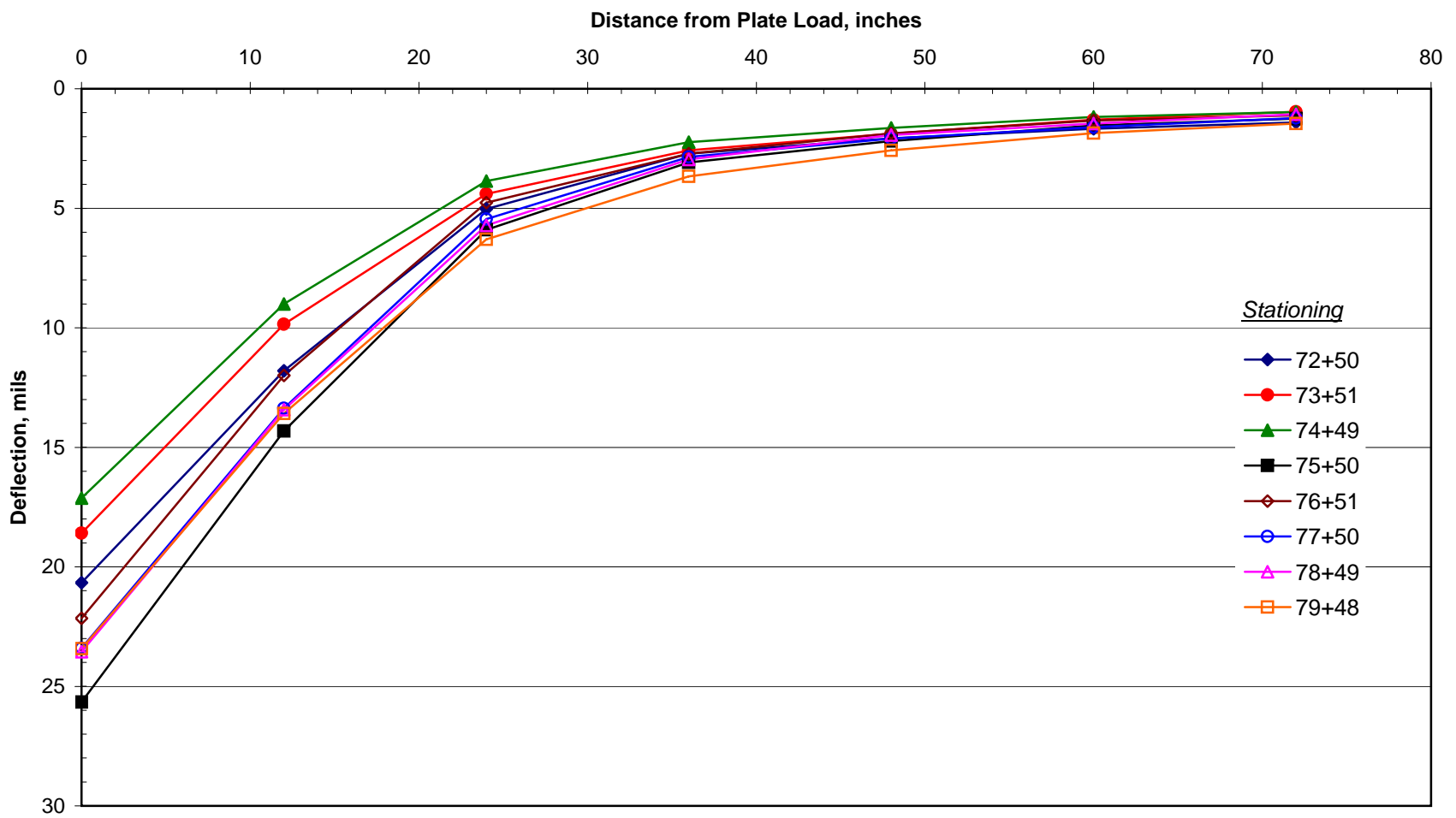
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From Exit 93 to EHIOCP Facility
SB Deflection Basins (8 of 14)



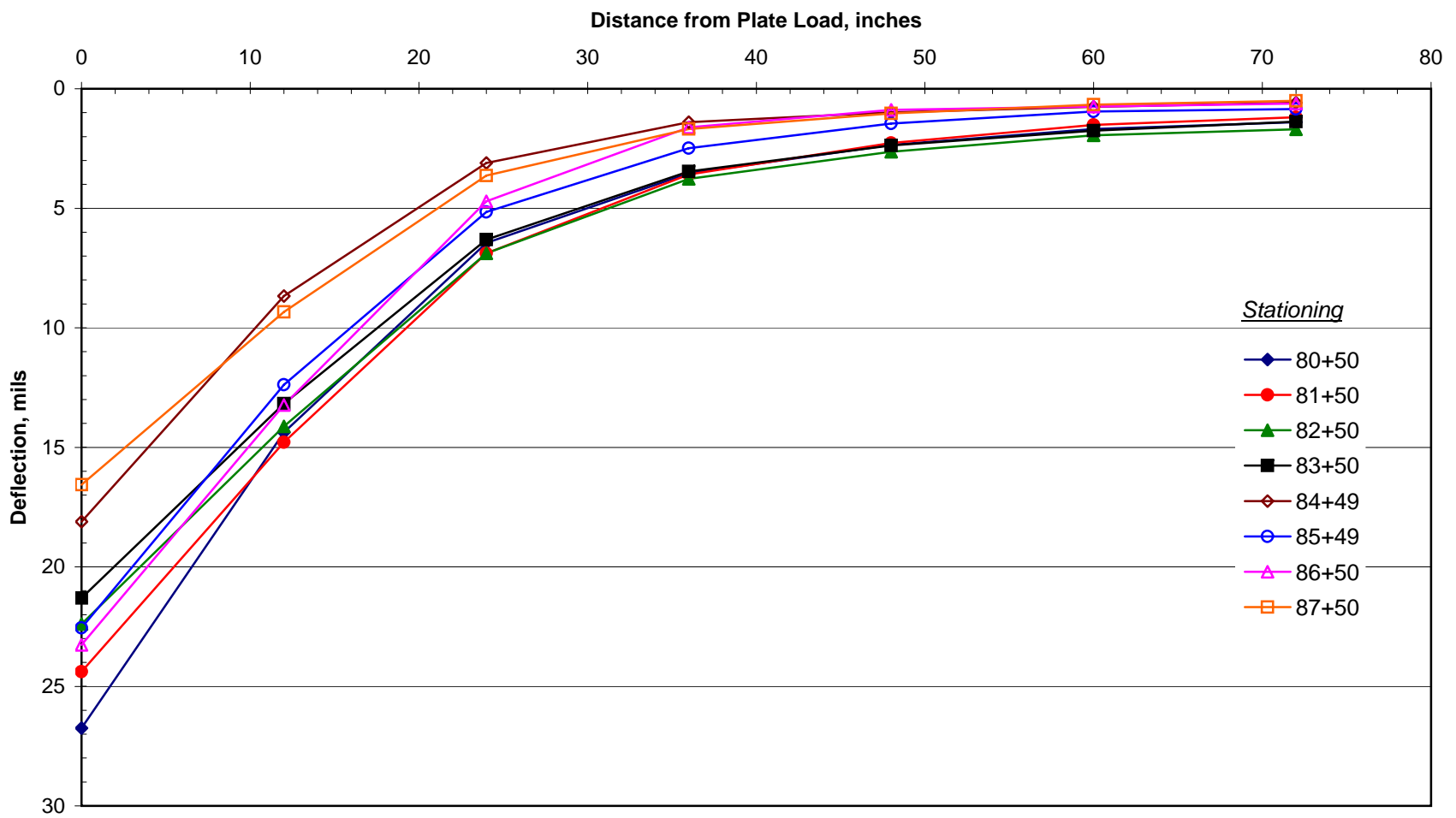
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SB Deflection Basins (9 of 14)



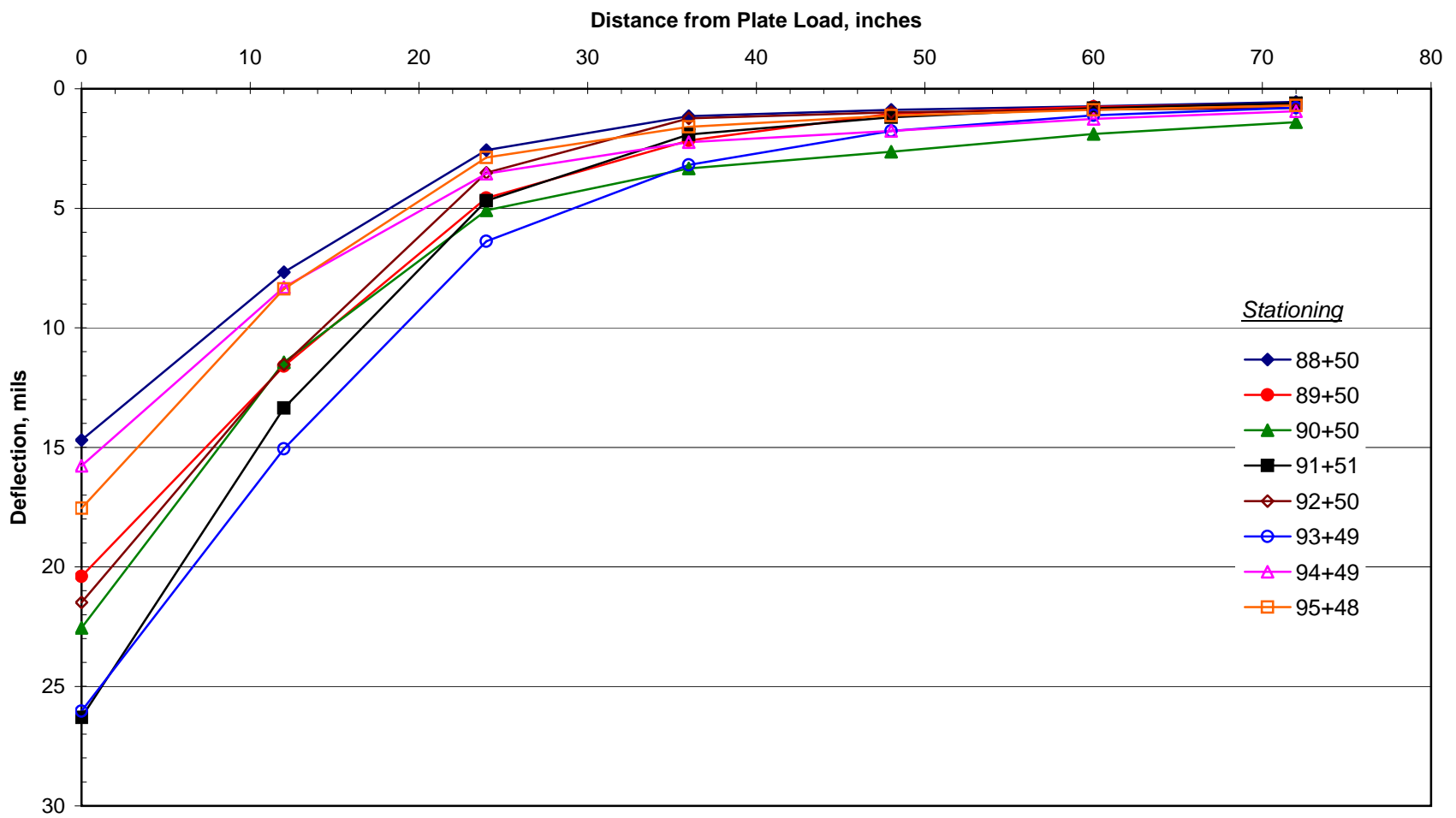
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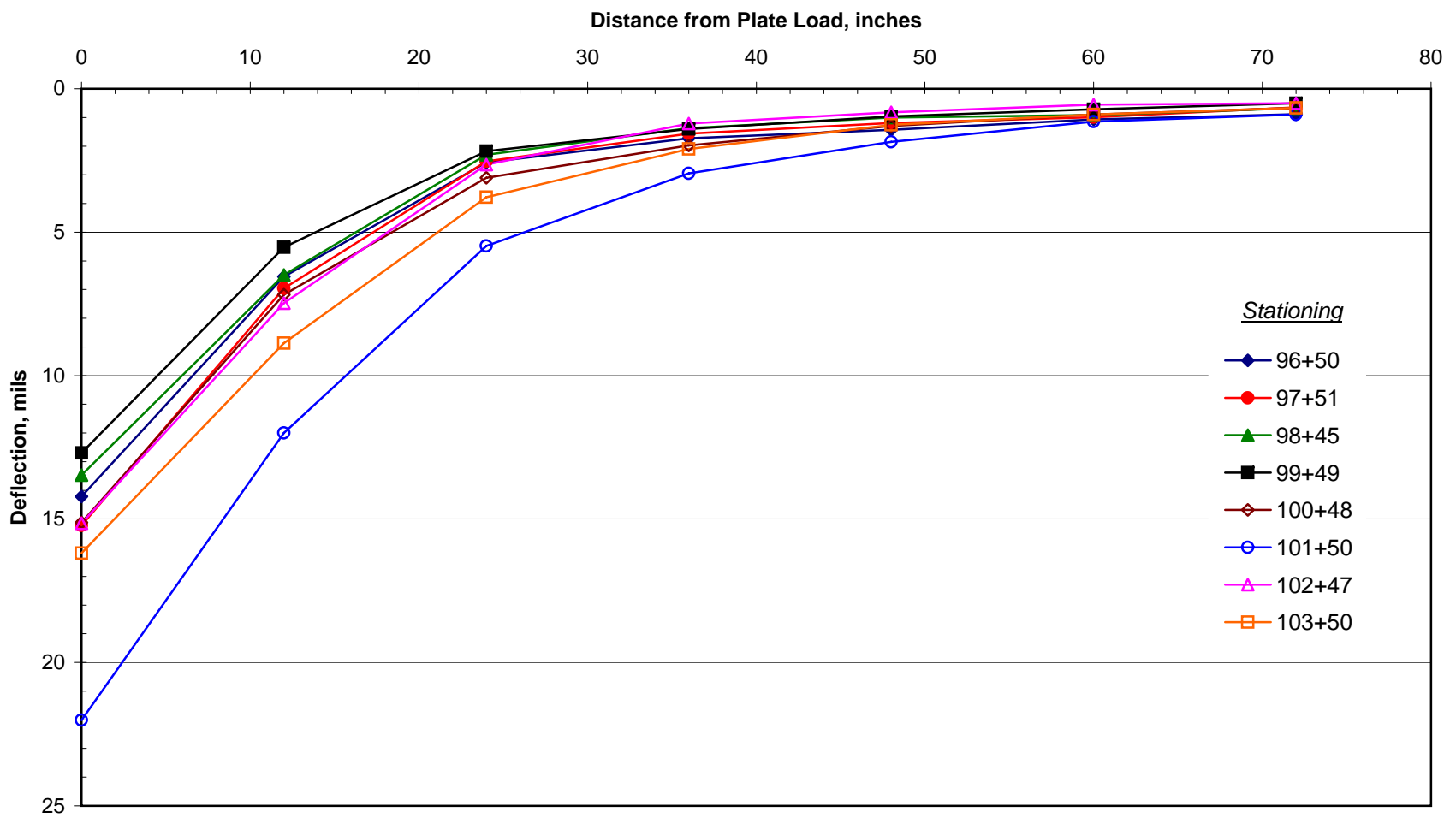
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From Exit 93 to EHIOCP Facility
SB Deflection Basins (11 of 14)



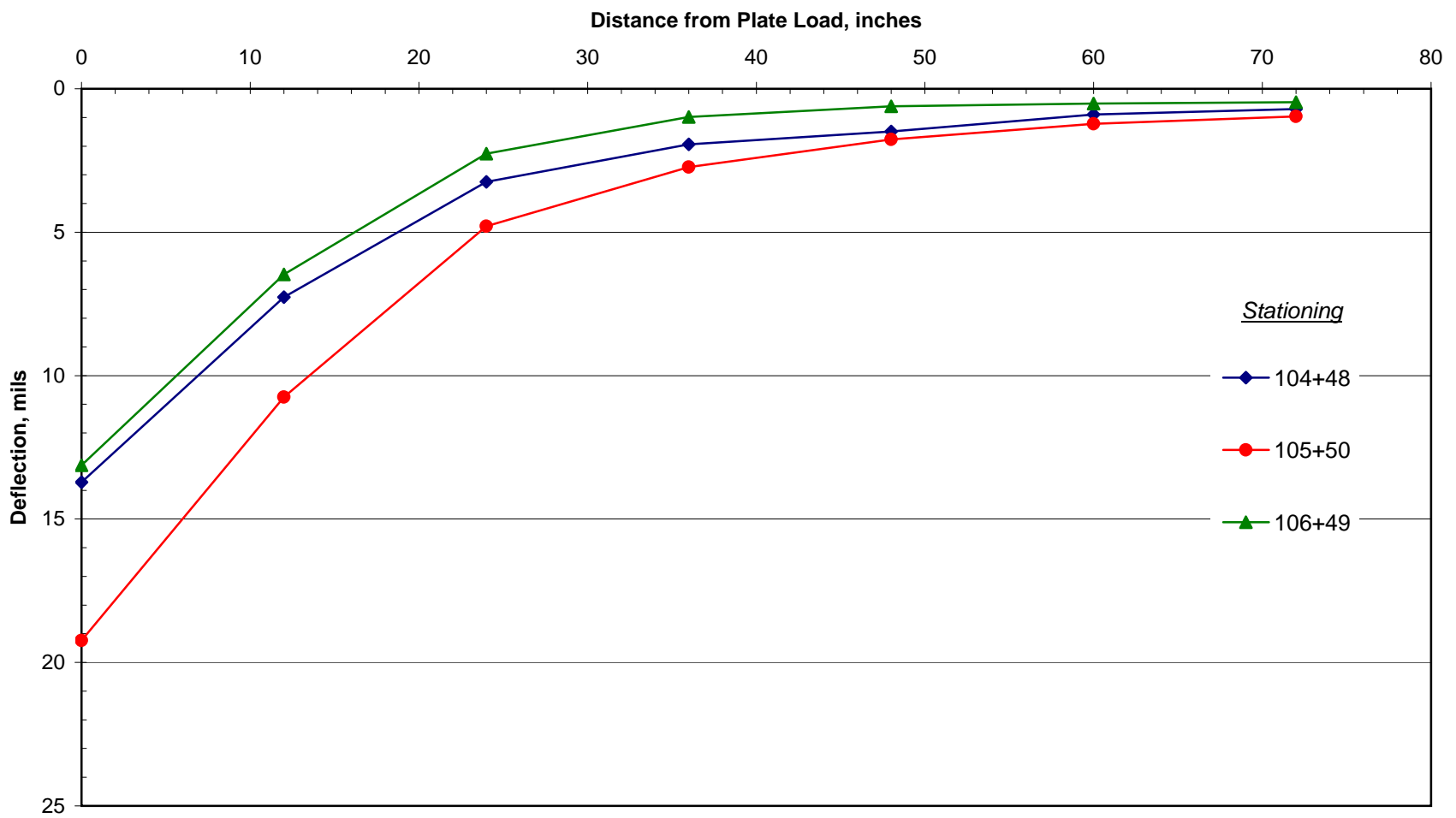
**Thorp Prairie Road
From Exit 93 to EHIOCP Facility
SB Deflection Basins (12 of 14)**



Thorp Prairie Road
From Exit 93 to EHIOCP Facility
SB Deflection Basins (13 of 14)



Thorp Prairie Road
From Exit 93 to EHIOCP Facility
SB Deflection Basins (14 of 14)



APPENDIX D

CORE PHOTOGRAPHS



HWA GEOSCIENCES INC.

Client: PacifiClean Environmental LLC

Project: Thorp Prairie Road Evaluation and Design

Project No.: 2012-105

Task No: 100

Date Sampled: November 26, 2012

Sampled by: DRC

Core Bit Used: 6-inch diameter

Sample Location: Thorp Prairie Road Station 15+00 Southbound Lane

Core Designation: Core-1



Total Wearing Surface Depth: 2 inches

Thickness (inches)	Description of Material	Lifts (inches)	Condition
2	Bituminous Surface Treatment (BST)	1,1	Fair
1.5	Crushed Surfacing Top Course	-	Dense
14.5	Reddish brown silty GRAVEL with sand	-	Very dense

Remarks: Medium stiff sandy SILT with gravel was encountered at a depth of 18 inches
BGS



HWAGEOSCIENCES INC.

Client: PacifiClean Environmental LLC

Project: Thorp Prairie Road Evaluation and Design

Project No.: 2012-105

Task No: 100

Date Sampled: November 26, 2012

Sampled by: DRC

Core Bit Used: 6-inch diameter

Sample Location: Thorp Prairie Road Station 30+50 Southbound Lane

Core Designation: Core-2



Total Wearing Surface Depth: 1.75 inches

Thickness (inches)	Description of Material	Lifts (inches)	Condition
1.75	BST	1, 0.75	Fair
-	Brown, silty GRAVEL with sand	-	Very dense

Remarks: No Crushed Rock Base Course was encountered.



HWA GEOSCIENCES INC.

Client: PacifiClean Environmental LLC

Project: Thorp Prairie Road Evaluation and Design

Project No.: 2012-105

Task No: 100

Date Sampled: November 26, 2012

Sampled by: DRC

Core Bit Used: 6-inch diameter

Sample Location: Thorp Prairie Road Station 45+00 Southbound Lane

Core Designation: Core-3



Total Wearing Surface Depth: 2 inches

Thickness (inches)	Description of Material	Lifts (inches)	Condition
2	BST	0.5, 1.5	Fair
1	Crushed Surfacing Top Course	-	Dense
-	Brown, silty GRAVEL with sand	-	Very dense

Remarks:



HWA GEOSCIENCES INC.

Client: PacifiClean Environmental LLC

Project: Thorp Prairie Road Evaluation and Design

Project No.: 2012-105

Task No: 100

Date Sampled: November 26, 2012

Sampled by: DRC

Core Bit Used: 6-inch diameter

Sample Location: Thorp Prairie Road Station 60+50 Southbound Lane

Core Designation: Core-4



Total Wearing Surface Depth: 1.75 inches

Thickness (inches)	Description of Material	Lifts (inches)	Condition
1.75	BST	0.75, 1	Fair
1.25	Crushed Surfacing Top Course	-	Dense
-	Dark grayish brown silty Gravel with sand	-	Very dense

Remarks:



HWA GEOSCIENCES INC.

Client: PacifiClean Environmental LLC

Project: Thorp Prairie Road Evaluation and Design

Project No.: 2012-105

Task No: 100

Date Sampled: November 26, 2012

Sampled by: DRC

Core Bit Used: 6-inch diameter

Sample Location: Thorp Prairie Road Station 75+00 Northbound Lane

Core Designation: Core-5



Total Wearing Surface Depth: 1.75 inches

Thickness (inches)	Description of Material	Lifts (inches)	Condition
1.75	BST	1, 0.75	Fair
21	Silty SAND with gravel	-	Very dense

Remarks: No Base Course was encountered
Very dense clayey Gravel with sand was encountered at a depth of 23 inches.



HWA GEOSCIENCES INC.

Client: PacifiClean Environmental LLC

Project: Thorp Prairie Road Evaluation and Design

Project No.: 2012-105

Task No: 100

Date Sampled: November 26, 2012

Sampled by: DRC

Core Bit Used: 6-inch diameter

Sample Location: Thorp Prairie Road Station 92+50 Southbound Lane

Core Designation: Core-6



Total Wearing Surface Depth: 2 inches

Thickness (inches)	Description of Material	Lifts (inches)	Condition
2	BST	1, 1	Fair
5	Crushed Rock Base Course	-	Dense
-	Reddish brown clayey GRAVEL with sand	-	Very dense

Remarks: