

MO SPS-7



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July 2, 1996

Mr. Richard E. Ingberg, P.E.
Regional Engineer, North Central FHWA - LTPP
c/o Braun Intertec Inc.
6875 Washington Avenue South
P.O. Box 39108
Minneapolis, MN 55439-0108

Re: Missouri SPS-7 Construction Report
FHWA - LTPP
SME Project No. PP18400



Dear Mr. Ingberg:

Enclosed please find three copies of the construction report for the Missouri SPS-7 project.

Should you have any questions concerning this report, please contact our office.

Very truly yours,

SOIL AND MATERIALS ENGINEERS, INC.

Cary T. Keller, P.E.
Senior Engineer

Enclosure: Construction Report: Missouri SPS-7 (3 copies)

pc: Tom Wilson, ERES
Monte Symons, FHWA LTPP
William Trimm, Missouri Highway & Transportation Dept.

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FEDERAL HIGHWAY ADMINISTRATION
Long Term Pavement Performance
Specific Pavement Studies

CONSTRUCTION REPORT FOR SPS-7
290700

Missouri Highway and Transportation Department
Federal Project Number
Missouri Job Number: F-67-3 (53)

Route 67 Northbound, Jefferson County
Missouri

Report Prepared by:
Soil and Materials Engineers, Inc.
FHWA-LTPP North Central Region
December 1995



TABLE OF CONTENTS

1.0 INTRODUCTION	1
1.1 Project Description	1
1.2 Traffic Characteristics	4
1.3 Geometry	4
1.4 Traffic Monitoring.....	5
1.5 Weather Station	5
1.6 Deviation.....	5
1.7 Key Personnel.....	7
2.0 PROJECT DETAILS	7
2.1 Layout.....	7
2.2 Mix Design	9
2.3 Materials Sampling and Testing	10
3.0 CONSTRUCTION	13
3.1 Test Section Construction	14
4.0 INITIAL PERFORMANCE	15

APPENDIX A	SPS PROJECT DEVIATION REPORT
APPENDIX B	CONSTRUCTION PLAN AND PROFILE

LIST OF FIGURES

Figure 1	Missori SPS-7 Location
Figure 2	Project Map
Figure 3	Layout of Test Sections

LIST OF TABLES

Table 1	SPS-7 Experiment
Table 2	Traffic Volumes
Table 3	Project Geometrics
Table 4	28 Day Strength of Beams
Table 5	Missouri SPS-7 Layout
Table 6	Pre-Construction Testing Quantities
Table 7	Existing Pavement Structure
Table 8	Post-Construction Testing



1.0 INTRODUCTION

The SPS-7 experiment was developed to investigate the performance of bonded Portland Cement Concrete (PCC) overlays. Bonded concrete overlays are used to improve the serviceability and extend the service life on concrete pavements that are in need of structural improvements. The objective of the SPS-7 experiment is to measure the additional pavement life that results from the use of bonded concrete overlays, and evaluate the effectiveness of surface preparation techniques. The Missouri SPS-7 project lies in the Wet-Freeze environmental area and consists of nine (9) SHRP-LTPP sections with surface preparation of cold milling, shot blasting, both with and without grout to facilitate bonding, and a control section which receives only routine type of maintenance and no overlay. Also, part of the experiment was to study the effects of overlay thickness for each type of surface preparation. Table 1 summarizes the experiment variables. In addition to the main experiment, the Missouri Department of Highways and Transportation (MHTD) added two supplemental sections that included a four (4) inch concrete overlay typical of the project and a three (3) inch asphalt concrete overlay.

The work plan for the project (report MR91-2) produced by the MHTD Research Section provides more information concerning the project and was referenced for this report.

Table 1-SPS-7 Experiment

Section	Thickness (in.)	Surface Preparation	Grouted (Yes/No)
290701	0"	Control - No Work	Control - No Work
290702	3"	Cold Milled	Yes
290703	3"	Cold Milled	No
290704	3"	Shot Blasted	No
290705	3"	Shot Blasted	Yes
290706	5"	Shot Blasted	Yes
290707	5"	Shot Blasted	No
290708	5"	Cold Milled	Yes
290709	5"	Cold Milled	No

1.1 Project Description

The project is located in the northbound lane of the four-lane roadway of U.S. 67 beginning at the Jefferson-St. Francois County line and proceeding north 4.83 miles. The project location is shown in Figures 1 and 2. The terrain is very hilly with numerous rock cuts and deep fills. The 24 feet wide nonreinforced roadway consists of eight (8) inches of PCC with 20 feet non-doweled joints over a 4 inches of compacted granular limestone base. The pavement was assessed to be in fair condition with the predominant distress being joint faulting with some longitudinal and transverse cracking.

The roadway was built on a subgrade which was variable and consisted of fine-grained residual clay soils, rock fills (mixed residual clay soil and excavated rock), or rock. The roadway has 9.5 feet wide asphalt concrete shoulders and does not have subsurface drainage. Over the years



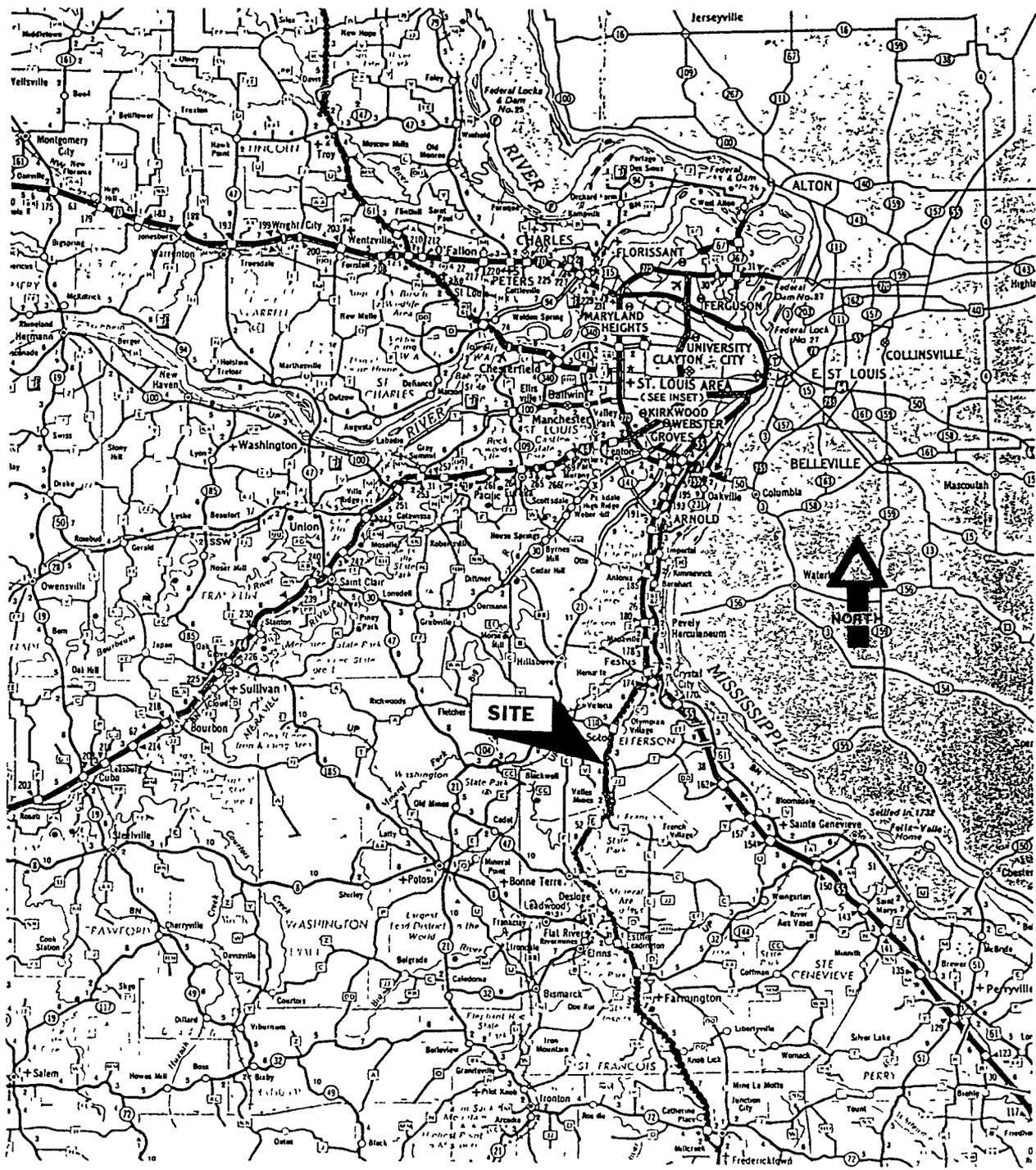


Figure 1

Missouri SPS-7 Location



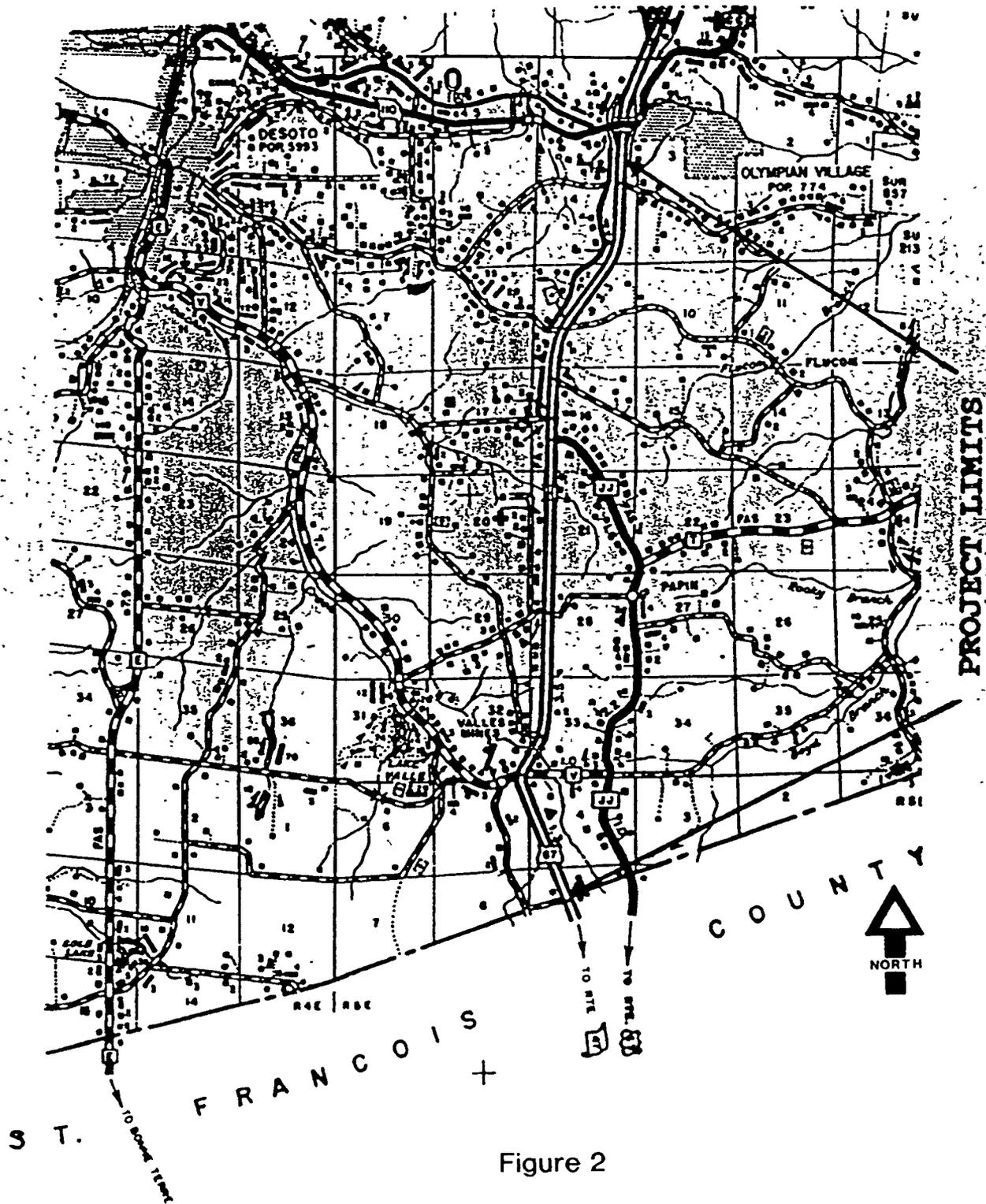


Figure 2
Project Map



routine maintenance has consisted of sealing of the joints with rubberized asphalt and undersealing with asphalt material.

The state route was built in 1955 as a two lane road handling northbound and southbound traffic. In 1971 southbound lanes were constructed and the old pavement carried northbound traffic only.

Appendix B contains the plan and profile sheets within the SPS-7 project limits.

1.2 Traffic Characteristics

Traffic volumes reported in the construction documents and plan profile sheets (see Appendix B) are provided in Table 2.

Table 2 - Traffic Volumes

Location	ADDT	% Trucks	KESALS/YR
Route 110 to Route JJ	7,715	11	276
Route JJ to Route V	6,528	11	253
Route V to County Line	6,299	11	213

1.3 Geometry

Table 3 provides the highway geometry and grades for the test sections.

Table 3 Project Geometrics

Test Section	Begin Station	Cut/Fill & Depth	End Station	Cut/Fill & Depth	Horizontal Alignment	Vertical Alignment	Comment
290701	4+26	At Grade	1860+69	At Grade	Tangent	-0.76%	Station EQ. at County Line
290759	1857+28	Fill 1'	1852+28	Fill 2'	Tangent	-0.76%	Intermediate Cut Section
290703	1850+17	AT Grade	1845+17	Cut 3'	Tangent	-0.76%	
290760	1812+73	At Grade	1807+13	Cut 24'	Tangent	-4.28%	
	1794+00						Intersection with RT. V
290704	1728+51	Fill 30'	1723+51	Fill 7'	Tangent	1.40%	Pipe at 0+50, 25' Cover
290705	1687+07	Cut 10'	1682+07	Cut 12'	Tangent	-3.00%	
290702	1673+50	Fill 5'	1668+50	Fill 20'	Tangent	-3.00%	
290708	1638+75	Fill 13'	1633+75	Fill 4'	Tangent	2.78%	
290709	1632+25	Cut 2'	1627+25	Cut 4'	Tangent	2.78%	
290707	1624+83	Cut 1'	1619+83	Cut 4'	Tangent	2.78%	
290708	1615+50	Fill 21'	1610+50	Fill 10'	Tangent	4.14%	
	1608+00						Intersection with RT. JJ



1.4 Traffic Monitoring

Traffic monitoring equipment was installed at the North end of the project at Route JJ. The equipment consists of an IRD bending plate WIM and piezoelectric classifiers and counters.

1.5 Weather Station

The closest weather station to the project is located in Jefferson County two miles northwest of Festus, Missouri (Long. 90.42° and Lat. 38.25°).

1.6 Deviations

The SPS-7 Project Deviation Report is contained in Appendix A.

Deviations from Construction Guidelines

The following lists reports on deviations from the construction guidelines. During construction there were also some deviations from the project specifications which may impact the performance of the pavement and these are discussed under Section 3.0, Construction.

Project Level:

The Portland cement intended to be used in the experiment was either Type I or II. However, Type III was used. The MHTD had originally planned to use the site as a demonstration project for "fast-track" concrete and volunteered it for use as a SHRP SPS-7 project. Since there were very few candidate projects for the experiment, this deviation was approved by SHRP.

The design compressive strength for the concrete required a minimum of 3,500 psi in 12 hours. This criteria was not met as determined by testing of 6" cylinders which had strengths ranging from about 2,650 to 3,450 psi. Flexural strength testing at 14 days was only conducted on a few occasions. The 14 and 28 day test data indicates that, in general, the strengths were within the range of 500 to 700 psi which was required by SHRP.

Table 4 - 28 Day Flexural Strength of Beams.

Section	Flexural Strength
290703	745 psi (average)
290760	865 psi (average)
290704	675 psi (average)
290705	670 psi (average)
290702	660 psi (average)
290708	680 psi (average)
290709	655 psi (average)
290707	720 psi (average)
290706	670 psi (average)



Transverse and longitudinal joints were sealed with hot-poured rubberized asphalt (ASTM D3405) while the December, 1990, construction guidelines required that they be sealed with silicone. There were no construction guidelines available at the time the project was being designed, nor was this subject addressed in the Experimental Design and Research Plan dated February, 1990. In the absence of any guidelines, Missouri's standard joint sealing practice was used.

290708:

From observation of the area and the lack of sand residue before paving, it appeared that sandblasting was not performed after coldmilling on the section.

290702, 290704, 290706, and 290707:

Fresh concrete temperatures exceeded 90°F and were near 100°F.

290702, 290704, 290705, and 290711:

Fresh concrete had air contents of about 3% which is well below the recommended range of 6.5% ± 1.5%.

Deviations from Site Location Guidelines

There is an intersecting roadway with projects length, County Route V, located between test sections 290760 and 290704. Based on the 1988 traffic counts (see Table 2) the test sections located south of Route V received less traffic than those to the North. Minor deviations from the layout guidelines also included the following:

- An underground pipe was located within test section 290704 at Station 0+50 and has about 25 feet of cover.
- Test sections 290760 and 290708 are located on grades in excess of 4% at -4.28% and 4.14% respectively.

Deviation from Data Collection and Material Sampling and Testing Guidelines

The final documentation of materials sampling and testing requirements for the SPS-7 was not published until January, 1991. Input from SHRP and existing samples and testing documents were utilized to develop sampling and testing plans. The pre-construction sampling was performed in general accordance with the SPS-6 guidelines, which are similar to the SPS-7 guidelines. During construction, sampling on delivered concrete was performed in general accordance with the SPS-7 guidelines, however 365 day test specimens were not made. The major deviation from the published guidelines occurred during the post-construction phase testing of the overlay. The following are deviations from the developed plan for sampling and testing of the overlay with comments.



- Compressive Strength of Cores was not performed. However, cylinders were made and cured with the overlay concrete and were tested at 12 and 24 hours (this was a high early strength concrete).
- Splitting tensile strength, static modulus of elasticity, and PCC unit weight testing was not performed.

1.7 Key Personnel

The MHTD Division Engineer and SHRP-LTPP contact was Mr. William Trimm who coordinated the project tasks. The SPS-7 material field laboratory testing was coordinated by Mr. Bruce Loesch, who was with Materials and Research, but has since moved to another department.

Missouri Highway and Transportation Department-SHRP Contacts

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Jefferson City, MO 65102
(314) 751-2551
(314) 751-6551 FAX

The resident engineer for the MHTD was:

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6205 Highway 61-67
Imperial, Missouri 63052

The project was awarded to:

Fred Weber, Inc.
P.O. Box 2501
Maryland Heights, Missouri 63043-8501
Imperial, Missouri

2.0 PROJECT DETAILS

2.1 Layout

The site layout for the Missouri SPS-7 experiment is shown graphically in Figure 3 and below in Table 5. Sections with five (5) inch overlay with and without grout are located to the north end of the site while sections with three (3) inch overlay are located to the south. The Missouri three (3) inch asphalt concrete overlay and four (4) inch project typical concrete



**SPS-7 LAYOUT
US-67
NORTHBOUND LANE
MISSOURI**

FEBRUARY 1991

N



COUNTY ROUTE V

JEFFERSON CO.

ST. FRANCOIS CO.

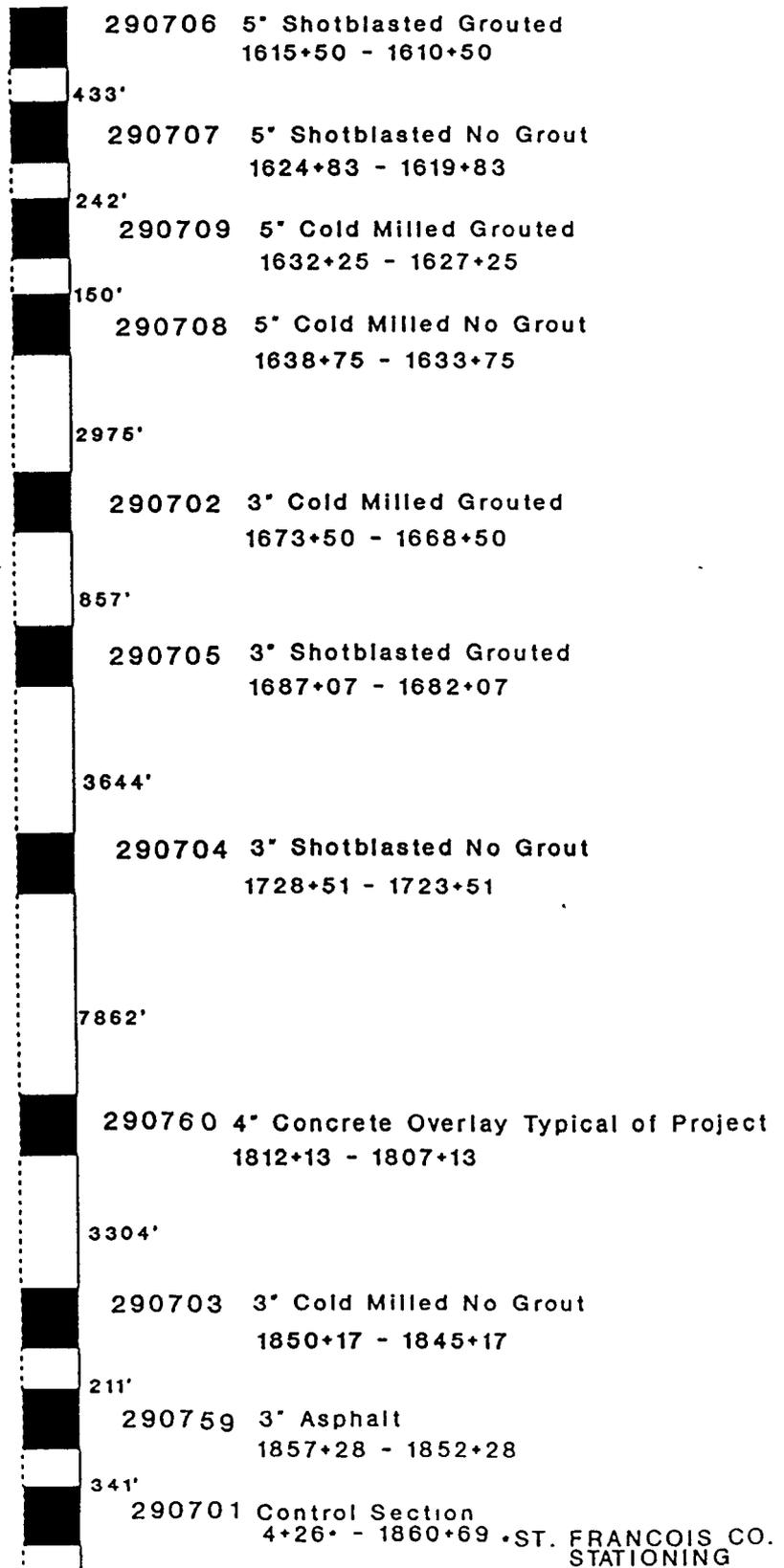


FIGURE 3

overlay are also located to the south of the site along with the control section. Test sections 290703 and 290704 were switched in location -from original contract specified locations to accommodate the ongoing surface preparation.

Table 5 - Missouri SPS-7 Layout

Section	Section Type	Study Section
290701	Control Section	1860+69 to 4+26
290702	3" Milled-Sandblasted -Grouted	1673+50 to 1668+50
290703	3" Milled-Sandblasted-No Grout	1850+17 to 1845+17
290704	3" Shot blasted-No Grout	1728+51 to 1723+51
290705	3" Shot blasted-Grout	1687+07 to 1682+07
290706	5" Shot blasted-Grout	1615+50 to 1610+50
290707	5" Shot blasted-No Grout	1624+83 to 1619+83
290708	5" Milled-Sandblasted-No Grout	1638+75 to 1633+75
290709	5" Milled-Sandblasted-No Grout	1632+25 to 1627+25
290759	3" Asphalt Section	1857+28 to 1852+28
290760	4" Milled-Shot blasted-Grouted	1812+13 to 1807+13

2.2 Mix Design

A concrete mixture which could obtain 3,500 psi compressive strength in 12 hours was required. The approved concrete mix design is provided below.

Coarse Aggregate:

Coarse (3/4 to 3/8) fraction, Plattin Limestone, Weber Festus Quarry, Festus, MO
 865 pound per cubic yard
 Fine (-3/8) Fraction, Plattin Limestone; Weber Festus Quarry, Festus, MO
 865 pounds per cubic yard.

Fine Aggregate:

Mississippi River Sand, Class A; Crystal City Sand Company, Crystal City, MO
 1,150 pounds per cubic yard

Cement

Type III; River Cement Company, St. Louis, MO
 655 pounds per cubic yard



Fly Ash:

Class C; Iatan Ash
70 pounds per cubic yard

Air Entraining Agent:

Daravair R; W.R. Grace
10 ounces per cubic yard

Water Reducer:

WRDA Hycol; W.R. Grace
3 ounces per 100 pounds cement

Water:

32 gallons per cubic yard

2.3 Materials Sampling and Testing

Existing Material Sampling and Testing guidelines were used to develop the MST plan. Figure 4 shows the pre/post construction plans that were used. It does not show the locations for tests on the delivered concrete, which were made for each section with a concrete overlay. The sampling and some of the laboratory testing was performed by the MHTD, with assistance from the North Central Region of SHRP.

Pre-Construction Material Sampling and Testing

The following field tests and samples of the existing pavement structure were collected by Missouri and SHRP engineers and shipped to SHRP laboratories for testing. Table 6 provides sample quantities.

Concrete cores, 6" and 4" diameter

20' Shoulder Probes

Shelby Tubes

Test pits:

Base:

Bulk samples

Nuclear determination of moisture and density

Moisture content samples

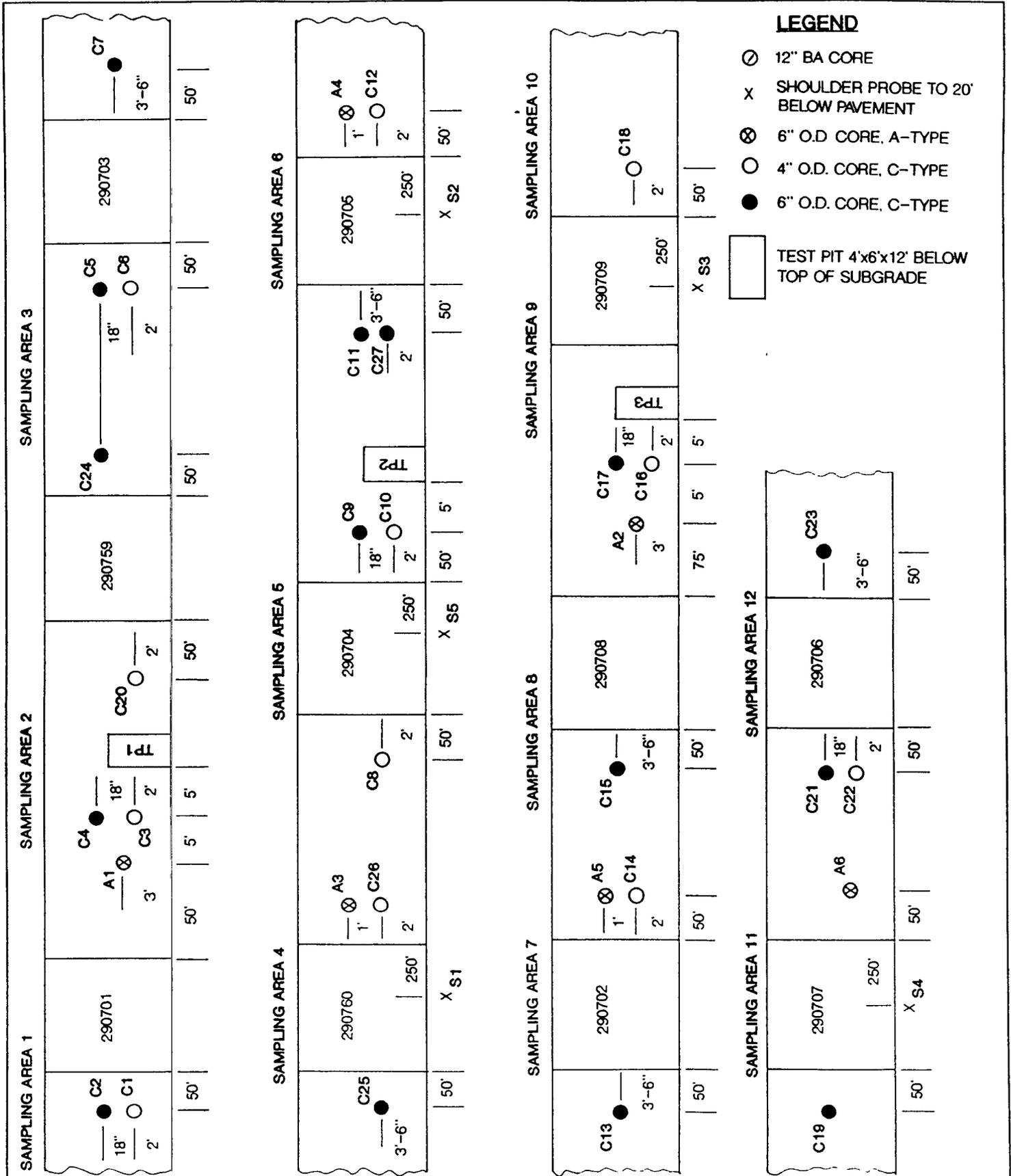
Subgrade:

Bulk samples

Nuclear determination of moisture and density

Moisture content samples





Date 6-26-96
 Drawn By ARR
 Scale NTS
 Job PP 18400

BAY CITY
 KALAMAZOO
 LANSING
 PLYMOUTH
 TOLEDO



FIGURE NO. 4
MISSOURI SPS-7
PRECONSTRUCTION SAMPLING LAYOUT
JEFFERSON COUNTY, MISSOURI

Table 6 - Pre-Construction Testing Quantities

Type of Testing	Quantity
Shoulder Probe to 20' below pavement	4
6" O.D. Core, A-Type	6
4" O.D. Core, C-Type	12
6" O.D. Core, C-Type	15
4'x6'x12" Test Pit	4

Based on the pre-construction material sampling and testing and site verification sampling, the existing pavement structure of each section is shown in Table 7.

Table 7 - Existing Pavement Structure

Section	Station	Concrete Thickness	Base	Subgrade
290701	1860+18	8"	4" Crushed Limestone	Brown silty clay over red clay
290759	1852+19	8-1/2"	4" Crushed Limestone	Gray silty clay red and gray clay
290703	1844+67	8-1/2"	4" Crushed Limestone	Gray silty clay over red silty clay
290760	1806+63	7-7/8"	6" Crushed Limestone	Crushed limestone to 2'-0" then hit rock ledge
290704	1723+01	8-1/8"	2'-0" Crushed limestone and soil	2'-4" hit rock ledge or boulder
290705	1681+57	8"	4" Crushed limestone	Brown clay layer to 2'-0" then hit rock ledge
290702	1668+01	8-1/4"	5" Crushed limestone	Reddish-gray silty clay
290708	1633+00	8-1/8"	4" Crushed limestone	Gray silty clay over red clay over red clay with gravel/
290709	1619+33	7-7/8"	4" Crushed limestone	1'-5" Hit rock ledge
290707	1619+33	7-7/8"	4" Crushed limestone	Mixture of brown silty clay with sand and gravel to 3'-4" then hit rock ledge
290706	1610+00	8-3/8"	1'-5" Crushed limestone	1'-5" hit a boulder or rock ledge



Concrete

The contractor opted to use the overlay concrete for the pavement repairs to acquaint himself with the mixtures workability. It was noted in some of the repairs which were made with this mix that some transverse shrinkage cracking occurred before the overlay. Shrinkage cracking of the overlay was observed on all of the test sections which received a PCC overlay.

Curing

It was stipulated in the specifications that the overlay was to be blanketed within 4 hours of being placed. This was not done consistently during the duration of the project. It was not until the fifth day of paving that this was done as specified.

3.1 Test Section Construction

This section summarized the construction practices at each test section.

Section 290703:

The as-built thickness of this section was 3-9/16 inches with air and concrete temperatures of 73°F and 83°F respectively. The primary surface preparation was cold milling, secondary surface preparation was shot blasting, and final surface preparation was air blasting. The concrete was not blanketed until 7-3/4 hours after placement.

Section 290760:

The as-built thickness of this section was not available. Surface preparation was performed by milling and shot blasting. Air and concrete temperatures were 77°F and 86°F respectively. The pavement was blanketed about 4 hours after the placement.

Section 290704:

The as-built thickness of this section was 3-3/8 inches. During the paving operations the air temperature was 91°F while the concrete temperature was 86°F. The primary surface preparation was shot blasting and final surface preparation was air blasting. Bonding grout was a mixture of Type I Portland cement and water that was prepared and applied in accordance with the requirements of the specifications. The concrete was blanketed soon after being placed.

Section 290702:

The as-built thickness of the concrete overlay was 4-1/4 inches. The primary surface preparation was cold milling and secondary surface preparation was air blasting. The temperature of the air and concrete were 99°F and 100°F respectively. The concrete was blanketed soon after being placed.



Section 290708:

The as-built thickness of this section was 5-3/8 inch of concrete overlay. The primary surface preparation was cold milling, secondary surface preparation was shot blasting, and the final surface preparation was air blasting. The concrete was blanketed within 4 hours of placement.

Section 290709:

The as-built thickness of this section was 5-5/16 inches. The air and concrete temperatures were 88° and 96°F respectively. The primary surface preparation was cold milling and secondary surface preparation was air blasting. Bonding grout was a mixture of Type I Portland cement and water prepared and applied in accordance with the requirements of the specification. The concrete was blanketed soon after placement.

Section 290707:

The as-built thickness of this section was 5-1/4 inches. The primary surface preparation was shot blasting with a secondary surface preparation of air blasting. The air and concrete had temperatures of 94° and 100°F respectively. The concrete was blanketed soon after placement.

Section 290706:

The as-built thickness of the section was 5-5/16 inches. The primary surface preparation was shot blasting with air blasting being used as the final surface preparation. The concrete was blanketed within 4 hours of placement.

Section 290659:

The asphalt concrete section was paved using standard paving practices. The material for the leveling course was IB mix placed at a thickness of 1-3/4 inches while an IC mix was used for the surface at a thickness of 1-1/4 inches.

4.0 INITIAL PERFORMANCE

The Missouri Highway and Transportation Department prepared an extensive Construction Report on the project's initial performance at 30, 60 and 90 days after construction. All test sections had a total of five (5) slabs tested for debonding and cracking at 24 hours after placement of the overlay and not one showed any distress.

The first noted debonding occurred within 2 days after placement of the overlay in section 290708. Also, within this time frame sections 290707 and 290709 both had transverse shrinkage cracks starting to appear. At 60 days, 290706 and 290707 had completely debonded with pumping being observed on the shoulder at the joints. Sections 290704 and 290705 both



were observed to have debonded within this period with 27.9% and 16.0% debonding respectively through 60 days. Almost every slab in each test section had some shrinkage cracking, with the 3 inch sections experiencing the most. Severely distressed slabs, which resemble shattered slabs, were limited to the 5 inch sections.

Nearly all of the cracks in the underlying pavement reflected through the overlay and have started to spall.

The asphalt concrete test sections (290759) experienced reflective cracking over the concrete joints which started about 1 year after construction with a few cracks at low severity. As of 1994, all joints have reflected through the overlay.



APPENDIX A
LTPP SPS Project Deviation Report

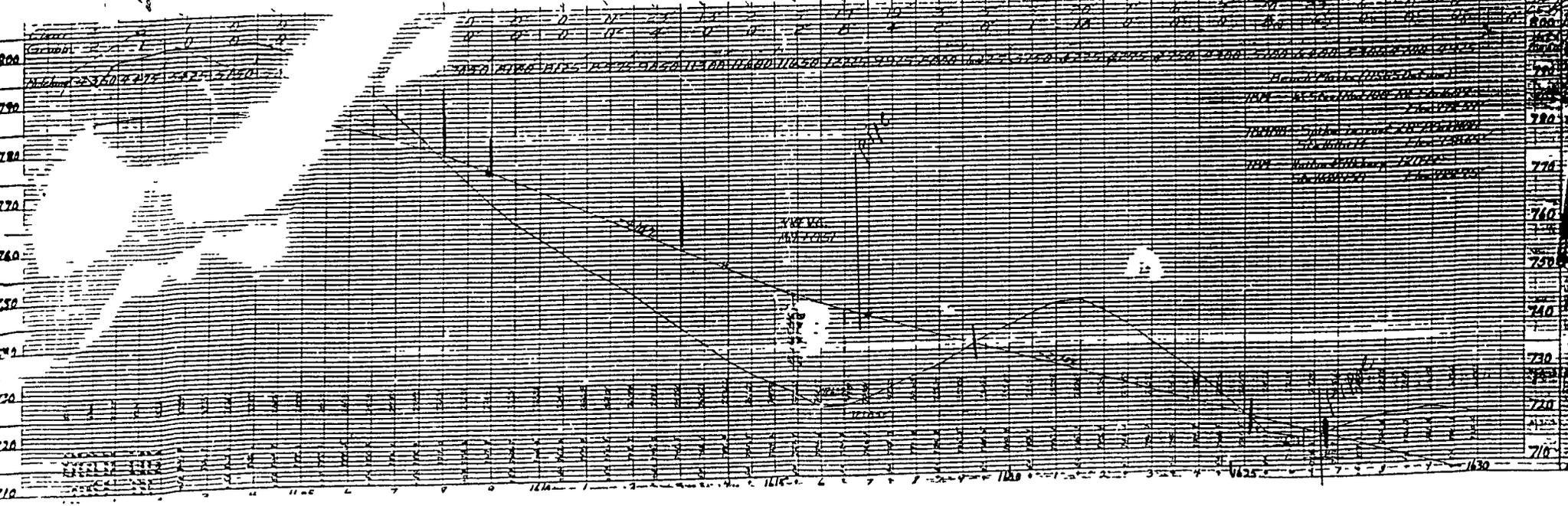
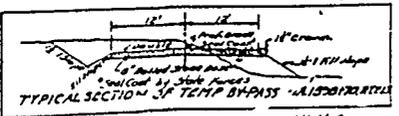
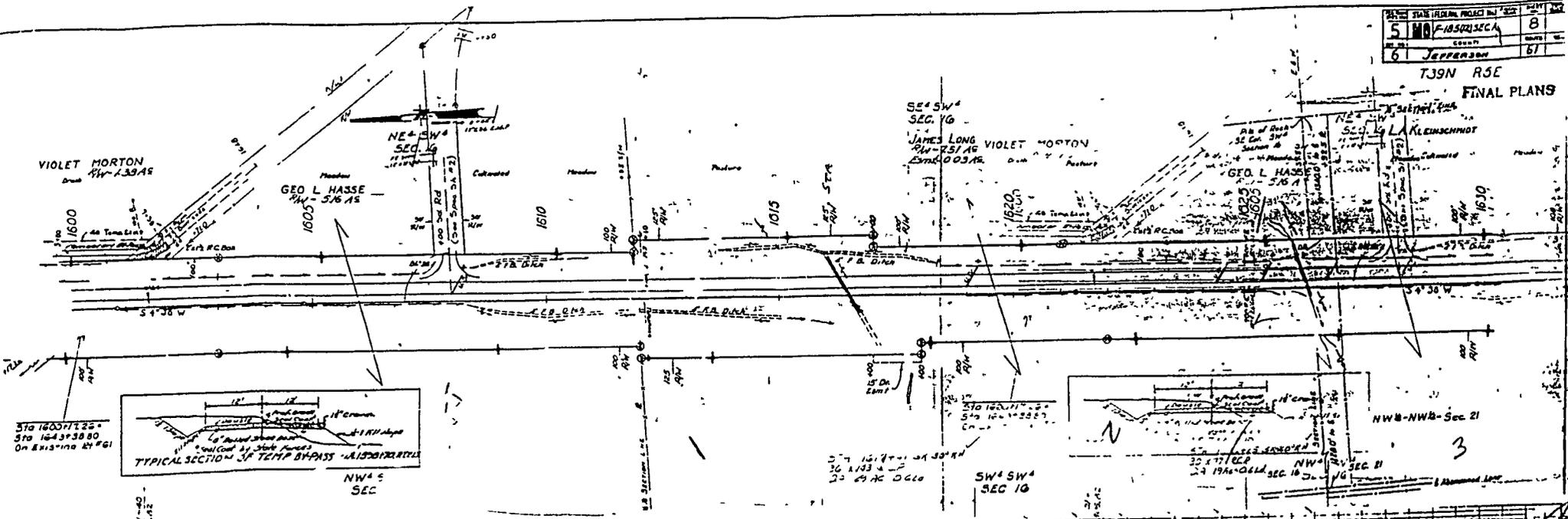
LTPP SPS Project Deviation Report Project Summary Sheet	State Code <u>29</u> Project Code <u>0700</u>
Project Classification Information	
SPS Experiment Number: <u>7</u>	State or Province: <u>MISSOURI</u>
LTPP Region:	<input type="checkbox"/> North Atlantic <input checked="" type="checkbox"/> North Central <input type="checkbox"/> Southern <input type="checkbox"/> Western
Climate Zone:	<input type="checkbox"/> Dry-Freeze <input type="checkbox"/> Dry-No Freeze <input checked="" type="checkbox"/> Wet-Freeze <input type="checkbox"/> Wet-No Freeze
Subgrade Classification:	<input checked="" type="checkbox"/> Fine Grain <input type="checkbox"/> Coarse Grain <input type="checkbox"/> Active (SPS-8 Only)
Project Experiment Classification Designation (SPS 1, 2 and 8):	
Construction Start Date: <u>JUNE, 1990</u>	Construction End Date: <u>JULY, 1990</u>
FHWA Incentive Funds Provided to Agency for this Project: <input type="checkbox"/> Yes <input type="checkbox"/> No	
Deviation Summary	
Site Location Deviations:	<input type="checkbox"/> No Deviations <input checked="" type="checkbox"/> Minor Deviations <input type="checkbox"/> Significant Deviations
Construction Deviations:	<input type="checkbox"/> No Deviations <input type="checkbox"/> Minor Deviations <input checked="" type="checkbox"/> Significant Deviations
Data Collection and Processing Status Summary	
Inventory Data (SPS 5,6,7,9):	<input checked="" type="checkbox"/> Complete Submission <input type="checkbox"/> Incomplete <input type="checkbox"/> Data Not Available
Materials Data:	<input checked="" type="checkbox"/> All Scheduled Samples Obtained and Tested <input type="checkbox"/> Incomplete/No Test Data
Construction Data:	<input checked="" type="checkbox"/> All Required Data Obtained <input type="checkbox"/> Incomplete/Missing Data Elements
Historical Traffic Data:	<input checked="" type="checkbox"/> All Required Historical Estimates Submitted (SPS 5,6,7,9) <input type="checkbox"/> Required Estimates Not Submitted
Traffic Monitoring Equipment:	<input checked="" type="checkbox"/> WIM Installed On-Site <input checked="" type="checkbox"/> AVC Installed On-Site <input type="checkbox"/> ATR Installed On-Site <input type="checkbox"/> No Equipment Installed
Traffic Monitoring:	<input checked="" type="checkbox"/> Preferred <input type="checkbox"/> Continuous <input type="checkbox"/> Minimum <input type="checkbox"/> Below Minimum <input type="checkbox"/> Site Related
Traffic Monitoring Data:	<input checked="" type="checkbox"/> Monitoring Data Submitted <input type="checkbox"/> No Monitoring Data Submitted
FWD Measurements:	<input checked="" type="checkbox"/> Preconstruction Tests Performed <input checked="" type="checkbox"/> Construction Tests Performed <input checked="" type="checkbox"/> Post-construction Tests Performed
Profile Measurements:	<input checked="" type="checkbox"/> Preconstruction Tests Performed <input checked="" type="checkbox"/> Post-construction Tests Performed
Distress Measurements:	<input checked="" type="checkbox"/> Preconstruction Tests Performed <input checked="" type="checkbox"/> Post-construction Tests Performed
Maint. & Rehab. Data:	<input checked="" type="checkbox"/> Complete Submission <input type="checkbox"/> Incomplete <input type="checkbox"/> Data Not Available
Friction Data:	<input checked="" type="checkbox"/> Complete Submission <input type="checkbox"/> Incomplete <input type="checkbox"/> Data Not Available
Report Status	
Materials Sampling and Test Plan:	<input checked="" type="checkbox"/> Document Prepared <input type="checkbox"/> Final Submitted to FHWA
Construction Report:	<input checked="" type="checkbox"/> Document Prepared <input type="checkbox"/> Final Submitted to FHWA
AWS: (SPS 1, 2, & 8)	<input type="checkbox"/> AWS Installed <input type="checkbox"/> AWS Installation Report Submitted to FHWA

Page _____ of _____ Preparer Cary J. Keller Date 1/19/96

APPENDIX B
Plan and Profile Sheets

STATE	PROJECT DIST.	SECTION
5 MO	F-18502	8
COUNTY		
61	JEFFERSON	61

T39N R5E
FINAL PLANS



T39N R5E
 Sec 21

FINAL PLANS

L.A. KLEINSCHMIDT
 HENRY E. SPEIDEL
 & FRANK SPEIDEL

NE 1/4 SW 1/4
 SEC 21

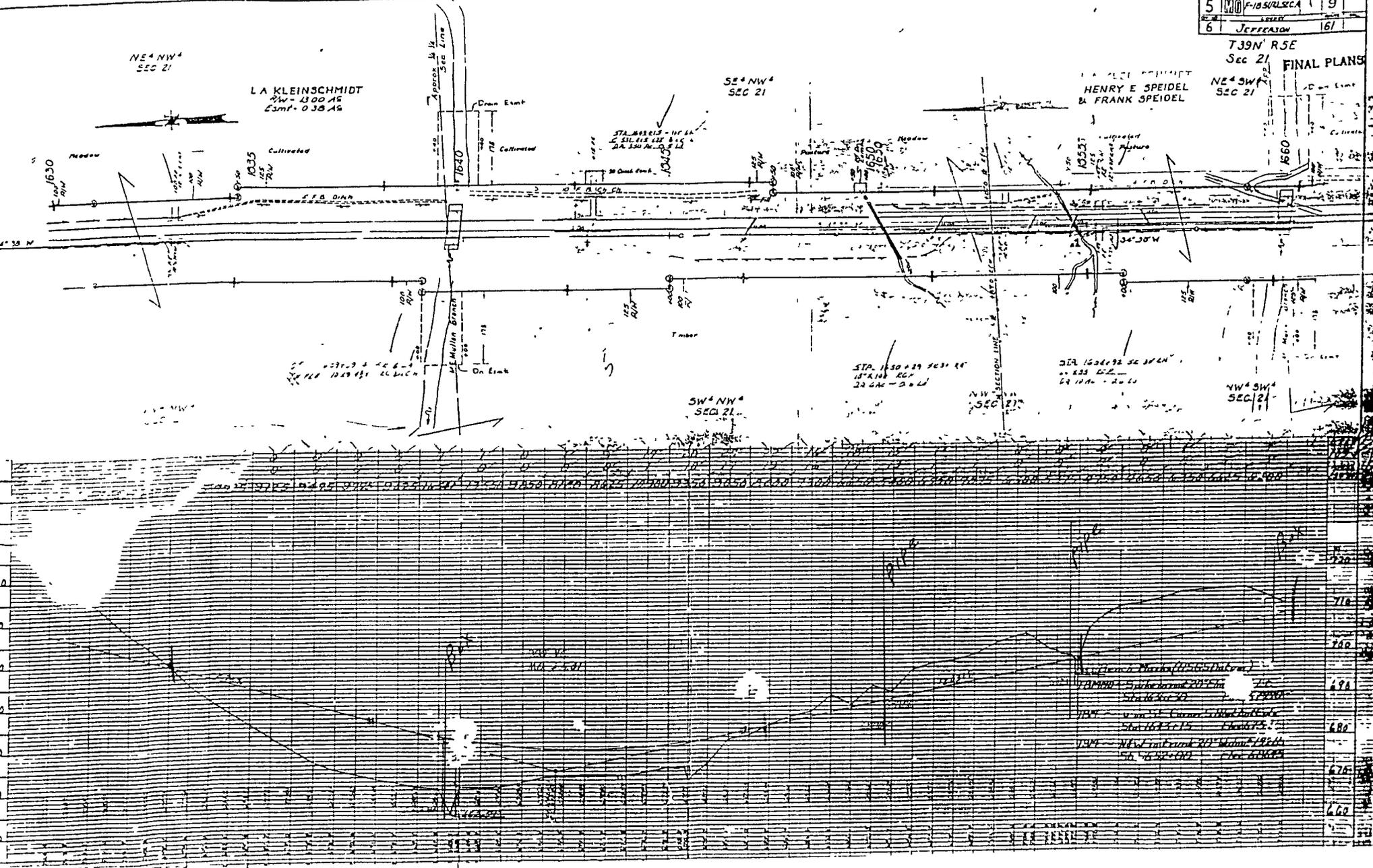
NE 1/4 NW 1/4
 SEC 21

L.A. KLEINSCHMIDT
 RW - 1300 AS
 Esmf - 0.38 AS

SE 1/4 NW 1/4
 SEC 21

SW 1/4 NW 1/4
 SEC 21

NW 1/4 SW 1/4
 SEC 21



Point	Bearing	Distance	Notes
1630	N 10° 30' W	1630	Corner of Sec 21
1650	N 10° 30' W	1650	Corner of Sec 21
1660	N 10° 30' W	1660	Corner of Sec 21
1670	N 10° 30' W	1670	Corner of Sec 21
1680	N 10° 30' W	1680	Corner of Sec 21
1690	N 10° 30' W	1690	Corner of Sec 21
1700	N 10° 30' W	1700	Corner of Sec 21
1710	N 10° 30' W	1710	Corner of Sec 21
1720	N 10° 30' W	1720	Corner of Sec 21
1730	N 10° 30' W	1730	Corner of Sec 21
1740	N 10° 30' W	1740	Corner of Sec 21
1750	N 10° 30' W	1750	Corner of Sec 21
1760	N 10° 30' W	1760	Corner of Sec 21
1770	N 10° 30' W	1770	Corner of Sec 21
1780	N 10° 30' W	1780	Corner of Sec 21
1790	N 10° 30' W	1790	Corner of Sec 21
1800	N 10° 30' W	1800	Corner of Sec 21

5	10	10
JEFFERSON		
6	61	

T39N R5E

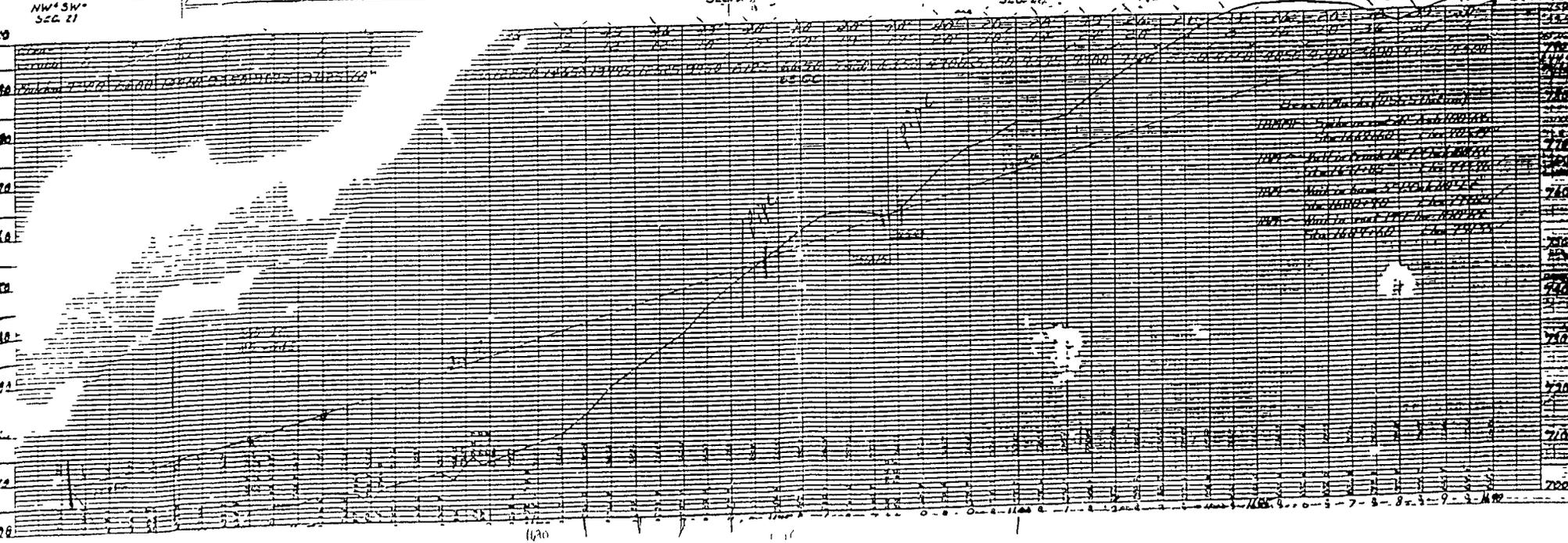
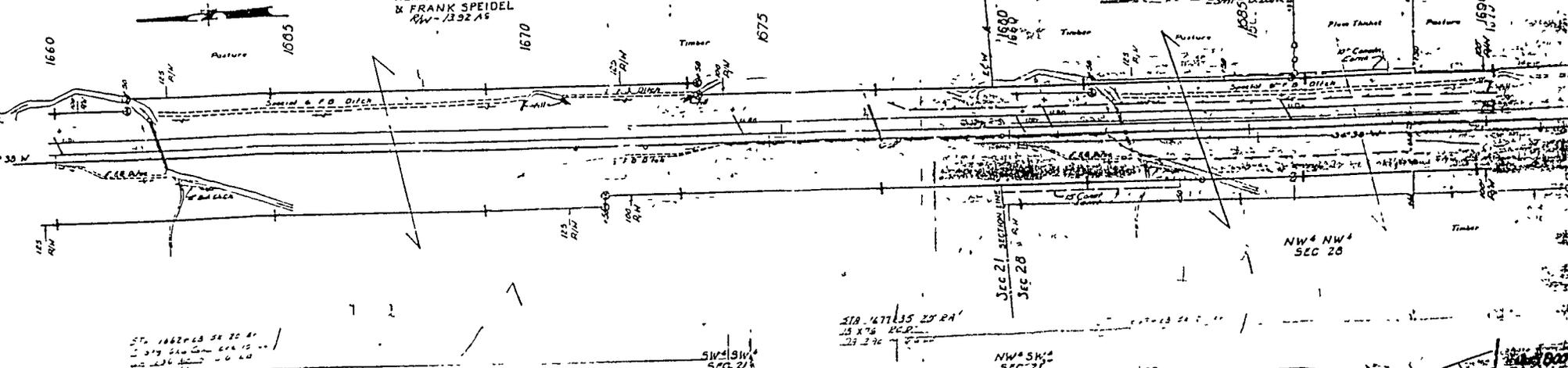
FINAL PLANS

HENRY E SPEIDEL
& FRANK SPEIDEL
RW-1392 AS

WALTER E MOORE

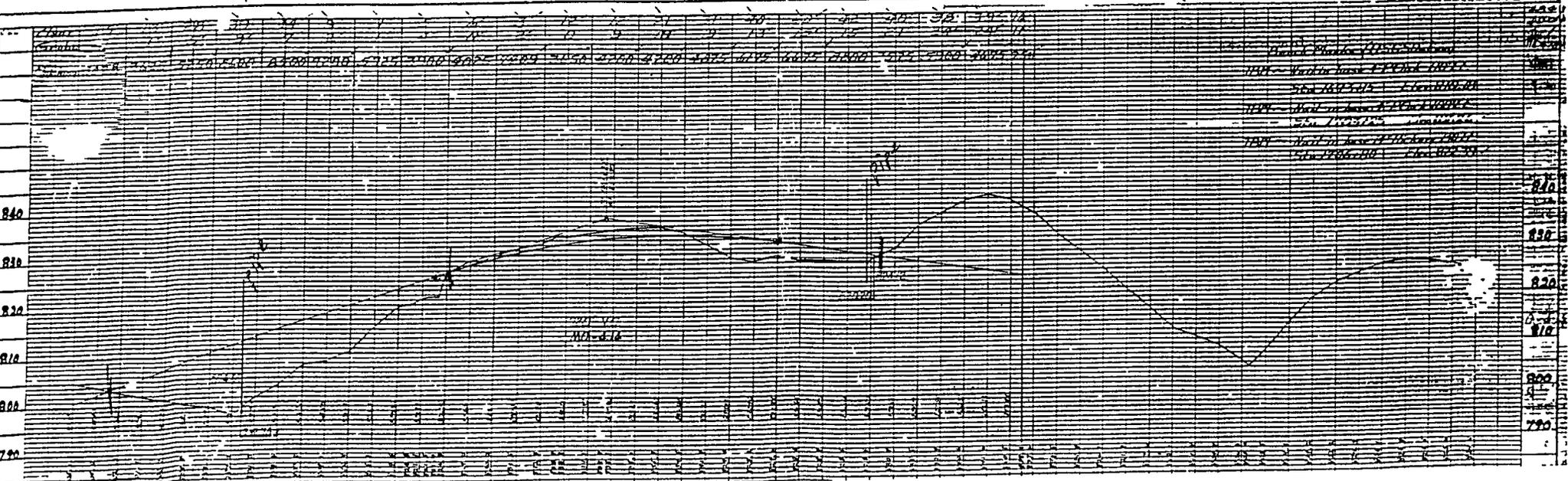
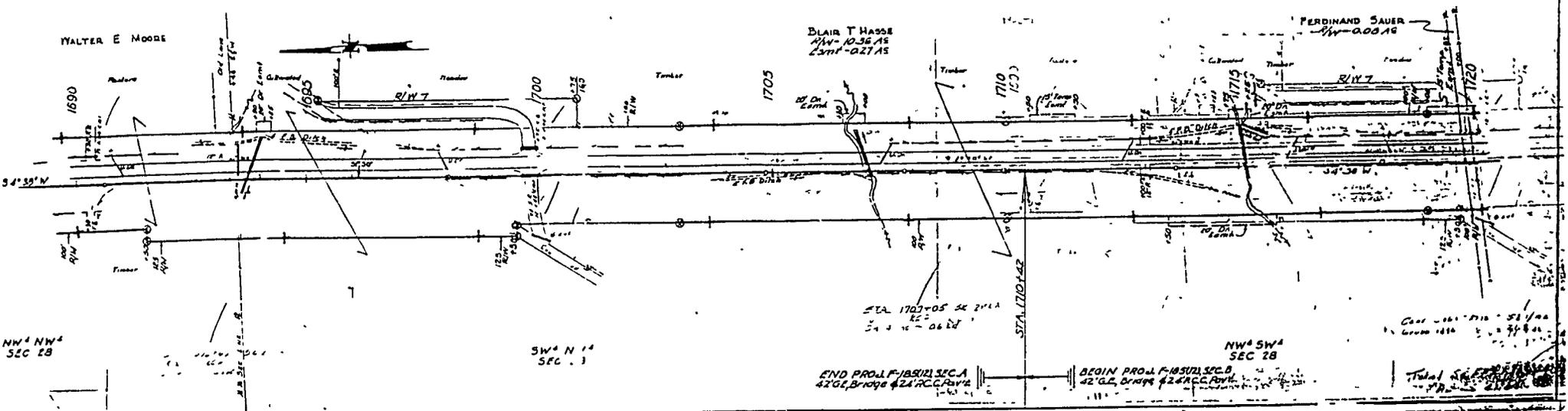
HENRY E SPEIDEL

VE SW 1/4
SEC 21

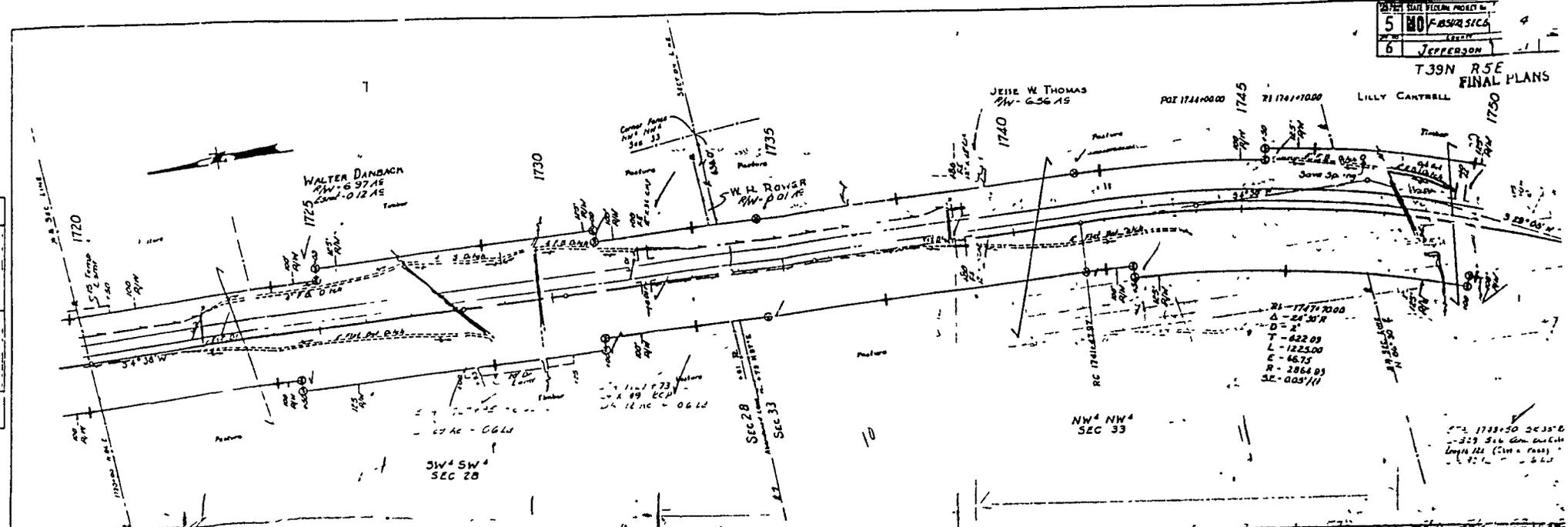


STATE FEDERAL PROJECT NO.	SEC 1	SEC 2	SEC 3	SEC 4	SEC 5	SEC 6	SEC 7	SEC 8	SEC 9	SEC 10	SEC 11	SEC 12	SEC 13	SEC 14	SEC 15	SEC 16	SEC 17	SEC 18	SEC 19	SEC 20	
5	MO	185421	SEC 9								11										
6	JEFFERSON										61										

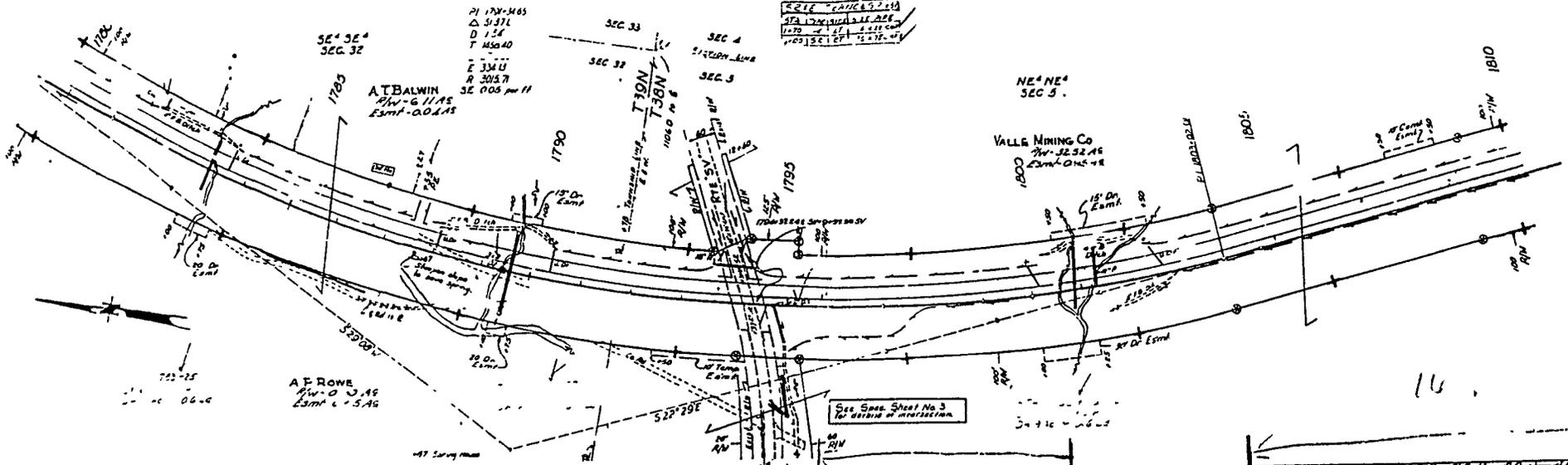
T39N R5E
Sec 20
FINAL PLANS



T39N R5E FINAL PLANS



Class	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100																																																								
1720	1725	1730	1735	1740	1745	1750	1755	1760	1765	1770	1775	1780	1785	1790	1795	1800	1805	1810	1815	1820	1825	1830	1835	1840	1845	1850	1855	1860	1865	1870	1875	1880	1885	1890	1895	1900	1905	1910	1915	1920	1925	1930	1935	1940	1945	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075	2080	2085	2090	2095	2100	2105	2110	2115	2120	2125	2130	2135	2140	2145	2150	2155	2160	2165	2170	2175	2180	2185	2190	2195	2200	2205	2210	2215	2220	2225	2230	2235	2240	2245	2250	2255	2260	2265	2270	2275	2280	2285	2290	2295	2300	2305	2310	2315	2320	2325	2330	2335	2340	2345	2350	2355	2360	2365	2370	2375	2380	2385	2390	2395	2400	2405	2410	2415	2420	2425	2430	2435	2440	2445	2450	2455	2460	2465	2470	2475	2480	2485	2490	2495	2500



Station	1780	1785	1790	1795	1800	1805	1810
790							
780							
770							
760							
750							
740							
730							
720							
710							
700							

16

See Same Sheet No 3
 For details of intersection.

NE 1/4 NE 1/4 SEC 5.

VALLE MINING CO
 1/4 SEC 32 46
 2 1/2 ACRES

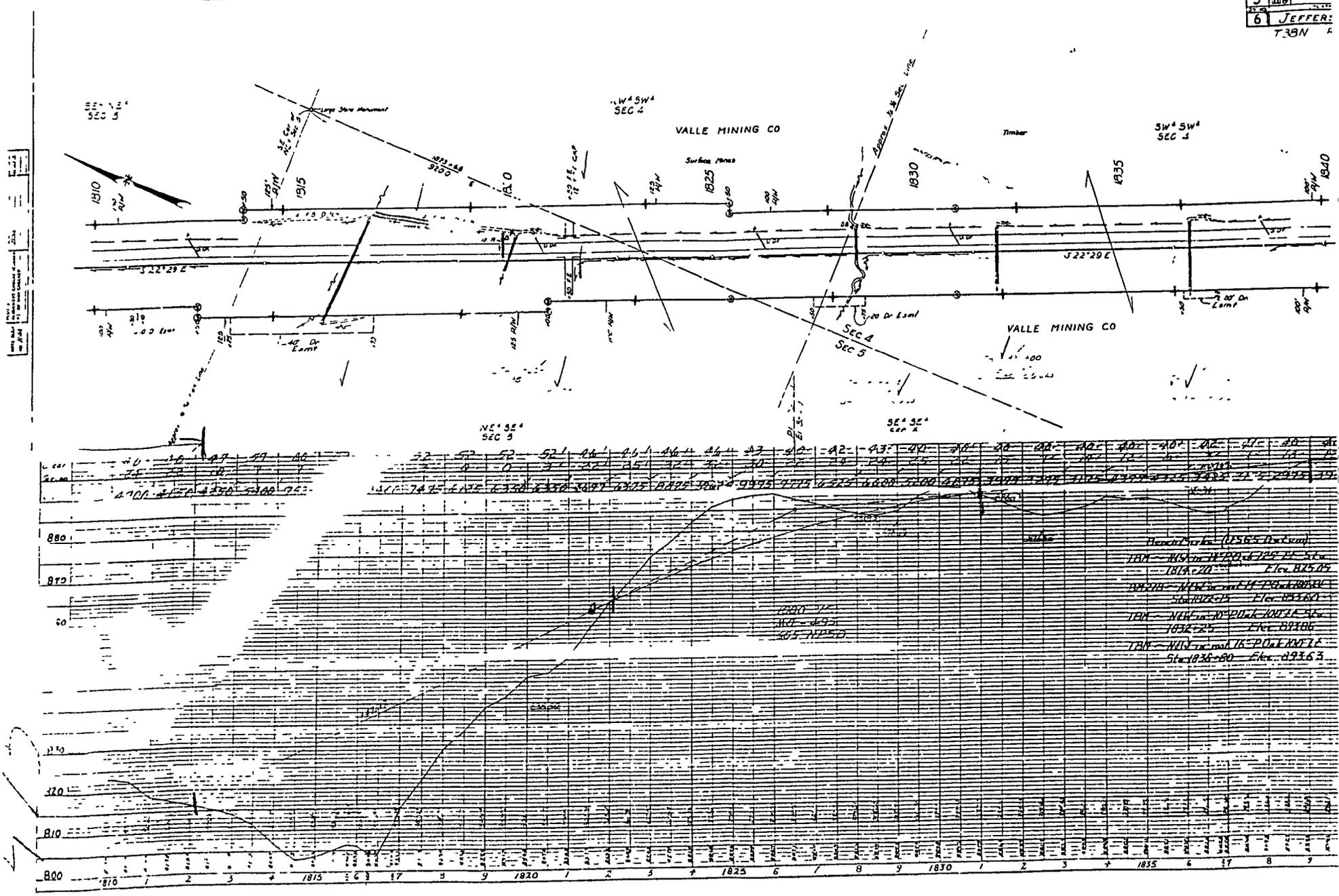
AT BALWIN
 1/4 SEC 32 46
 2 1/2 ACRES

A F ROWE
 1/4 SEC 32 46
 2 1/2 ACRES

1780 1785 1790 1795 1800 1805 1810

790 780 770 760 750 740 730 720 710 700

1780 1 2 3 4 5 6 7 8 9 1000 1 2 3 1905 6 7 8 9 1810



Survey made by J. H. ...
 in 1910
 by J. H. ...
 in 1910

1910	1915	1920	1925	1930	1935	1940
1910	1915	1920	1925	1930	1935	1940
1910	1915	1920	1925	1930	1935	1940

French Park (1856's Boundary)
 181N - 181W on 16" P.O. & 16" S.E. 56
 181A - 20" Elev. 825.05
 181B - 181W on 16" P.O. & 16" S.E. 56
 56" 1822.75 Elev. 825.60
 181N - 181W on 16" P.O. & 16" S.E. 56
 1822.25 Elev. 825.06
 181N - 181W on 16" P.O. & 16" S.E. 56
 56" 1835.80 Elev. 825.63

