

Method of Test for
**MEASURING THICKNESSES AND WIDTHS OF BASE AND SUBBASE COURSES
AND AGGREGATE TYPE SURFACE COURSES**

DOTD Designation: TR 602M/602-96

I. Scope

This method covers the procedure for determining the thicknesses and widths of base and subbase courses and of aggregate type surface courses for acceptance measurements and verification measurements of contractor's quality control.

II. Apparatus

- A. **Coring rig** - A powered drill rig equipped with diamond-tipped coring bit or steel auger.
- B. **Hand auger.**
- C. **Post hole digger.**
- D. **300 mm (12 in.) ruler.**
- E. **50 m (100 ft) tape measure.**
- F. **Straightedge or stringline.**
- G. **Hand tools** - Small hand tools such as a small spade, screwdriver, chisel, spoon, shovel, pick, or other apparatus as required of the type or types and design necessary to obtain the required samples and make the necessary measurements.
- H. **Field Book and Report** (Figures 5 and 6, respectively).
- I. **Phenolphthalein Solution** - The phenolphthalein solution shall consist of 2000 mL water, 2000 mL denatured alcohol, and 8 g of phenolphthalein powder.
- J. **Squirt bottle.**

Note 1: *Phenolphthalein solution is a chemical solution that turns pink when it comes in contact with an alkaline substance, such as cement, lime, or shell.*

III. Test Specimens and/or Measurements

When cores are used as specimens for thickness measurements they shall be representative of the base or subbase from which they are removed. Thickness and width measurements shall be representative of the base or subbase courses and of the aggregate type surface courses.

IV. Procedure

- A. **Aggregate, stabilized, or treated base and subbase courses and aggregate surface courses.**

1. Verification Measurements or Contractor's Quality Control.

a. Mixed in Place

- (1) Check the thickness and width of the base, subbase or surface courses at randomly selected locations.
- (2) Take a minimum of three thickness checks across the roadway and one on each shoulder and record for each location.
- (3) Take the first set of measurements immediately after the final mixing operation and prior to compaction. Make these thickness checks by digging a hole through the base to the bottom of the cut made by the in-place mixer. Take the initial measurements from a straightedge or stringline stretched between points of known elevation (other suitable reference) to the bottom of the cut.
- (4) After the compaction and tight blading operations are finished, take the second set of measurements from a straightedge or stringline stretched between the same points to the top of the finished section (at the same locations transversely).
- (5) To determine the thickness of the base, subbase or surface course subtract the second set of measurements from the first.
- (6) Take width measurements at the same location representing the actual width cut and mixed (See Figures 1 and 2).
- (7) Record all measurements as outlined in Section V.

b. Mixed Prior to Placement

- (1) Check the thickness and width of the base, subbase or surface course at randomly selected locations.
- (2) Take a minimum of three thickness checks across the roadway and one on each shoulder and record for each location.

X = Distance between Stringline and Sub-Grade

Y = Distance between Stringline and Final Grade

Depth = (X - Y)

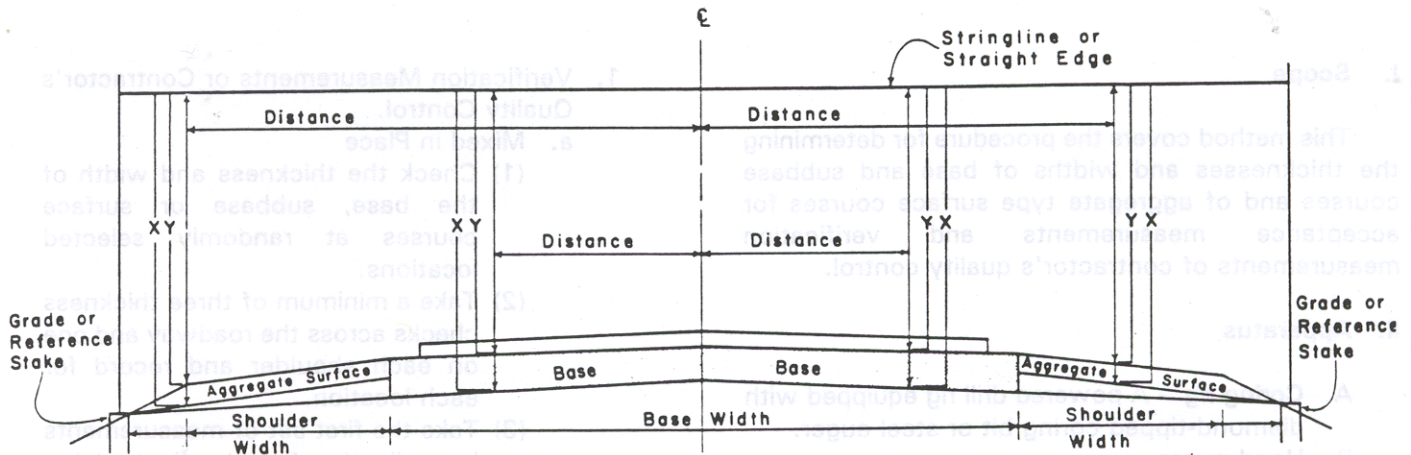


Figure 1

X = Distance between Stringline and Sub-Grade

Y = Distance between Stringline and Final Grade

Depth = (X - Y)

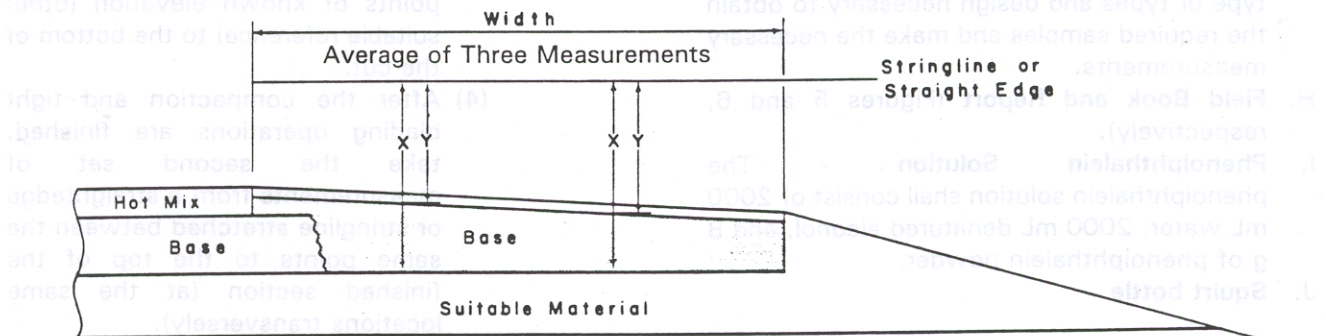


Figure 2

- (3) Take the first set of measurements prior to placement of materials. Take these measurements from a straightedge or stringline stretched between points of known elevation (or other suitable reference) to the prepared subgrade.
- (4) After the compaction and tight blading operations are finished,

take the second set of measurements from a straightedge or stringline stretched between the same points to the top of the finished section (at the same spots transversely).

- (5) To determine the thickness of the base, subbase or surface course, subtract the second set of measurements from the first. The difference is the thickness of the

completed course (See Figures 1 and 2).

(6) Take width measurements at the same locations as the thickness measurements.

(7) Record all measurements as noted in Section V.

2. Acceptance Measurements

a. Measure the thickness and width of the completed course or courses at random locations to represent each 300-m (1000-ft) section of roadway or 600-m (2000-ft) section of shoulder or widening constructed separately. Determine the transverse and longitudinal locations of thickness and width measurements by using Random Number Tables, DOTD S 605. Follow the instructions shown in Figures 3 and 4.

b. To obtain the thickness of a raw base, subbase, or surface course, use a power or hand auger, a pick and shovel, post hole digger or other tool to dig a hole approximately 100 mm (4 in.) in diameter through the course being checked into the subbase or embankment. Remove the disturbed material around the edge of the hole with the straightedge. Lay the straightedge horizontally across the hole and take thickness measurements from the bottom of the straightedge to the top of the subbase or embankment. Take three measurements to the nearest 5 mm (0.25 in.) equally spaced around the circumference of the hole. Average the three measurements and record as noted in Section V.

c. To determine the thickness of lime or cement stabilized or treated materials, dig an approximately 100 mm (4 in.) hole with a power or hand auger, pick and shovel, post hole digger or other tools through the course being checked into the subbase or embankment below. Remove the disturbed material around the edge of the hole with the straightedge. Using a squirt bottle, squirt a stream of phenolphthalein solution from the bottom of the hole until the material turns pink. Lay the

straightedge across the hole and measure from the bottom of the straightedge to the point where the pink color begins. Take three thickness measurements to the nearest 5 mm (0.25 in.) equally spaced around the circumference of the hole or core. Average the three measurements and record as noted in Section V.

NOTE 2: *When the existing material contains lime or cement, the newly cement stabilized or treated material will turn a darker pink than the existing material, and there may be a color or density change between layers.*

NOTE 3: *Approved survey methods may be used to determine the thickness of the base course.*

d. To determine the width of the completed base or subbase, or aggregate surface course, remove material from each edge of roadway for the total thickness of the course being checked. Use phenolphthalein solution to locate the point at which the stabilized or treated materials stop and the course reaches plan thickness in the same manner as in step c. For raw aggregate material, use a shovel, screwdriver, spoon, etc. to find the point where the raw aggregate course reaches plan thickness. Repeat this procedure for both edges of the roadway. Measure the width from edge to edge transverse to the centerline to the nearest 0.01 m (1 in.) and record as noted in Section V.

e. If any individual thickness or width measurement exceeds allowable tolerances, take two additional measurements within 1.5 m (5 ft) of the failing measurement location and use the average of the three measurements as the value for that location.

f. If the average measurement exceeds allowable tolerances, isolate the failing area for the purpose of correction. Isolate the failing area by moving longitudinally up and down the course 7.5 m (25 ft) in each direction and taking thickness or width measurements. If those measurements fail, move up and down the course 15 m

(50 ft) in each direction and take measurements. Keep doubling the distance moved and take measurements until a passing measurement within tolerance is reached. When a passing measurement is recorded, move back half the distance between the passing location and the last failing location. Repeat this procedure until the failing area is isolated within 7.5 m (25 ft) longitudinally. Document the failing area for the purpose of correction in the field book.

B. Asphaltic Concrete Base and Subbase Courses

1. Verification Measurements or Contractor's Quality Control

- a. Check thickness of this material by using all cores obtained for density acceptance.
- b. Take three thickness measurements equally spaced around the circumference of each core. Take each measurement to the nearest 5 mm (0.25 in.). Average the three measurements to the nearest 5 mm (0.25 in.) and record as thickness for that location.
- c. Record all thickness measurements as noted in Section V.

2. Acceptance Measurements

- a. Measure the thickness and width of the completed course or courses at random locations to represent each section. The transverse and longitudinal locations of thickness and width measurements shall be determined by using Random Number Tables, DOTD S 605, and as shown in Figures 3 and 4.
- b. To determine the thickness of asphaltic concrete base or subbase, use a coring rig to drill through the asphaltic concrete course to the subbase or embankment. Remove the core and measure thickness. If a core cannot be obtained in one piece, lay a straight-edge across the hole and take thickness measurements from the bottom of the straightedge to the bottom of the asphaltic concrete. Take three measurements

to the nearest 5 mm (0.25 in.) equally spaced around the circumference of the core or around the hole. Average the measurements and record as noted in Section V.

- c. Measure the width of the asphaltic concrete base or subbase from edge to edge transverse to the centerline to the nearest 0.01 m (1 in.) and record as noted in Section V.
- d. If any individual thickness or width measurement exceeds allowable tolerances, take two additional measurements within 1.5 m (5 ft) of the failing measurements' locations and use the average of the three measurements as the value for that location.
- e. If the average measurement exceeds allowable tolerances, isolate the failing areas as noted in step IV.A.2.f.

V. Report

Record average thickness measurements to the nearest 5 mm (0.25 in.). Record width measurements to the nearest 0.01 m (1 in.). Each measurement shall be as outlined below:

A. Records

1. Verification Measurements - Document all measurements during construction of the base, subbase or surface course as outlined in Figure 5.
2. Acceptance Measurements - Document all measurements as outlined in Figure 6.

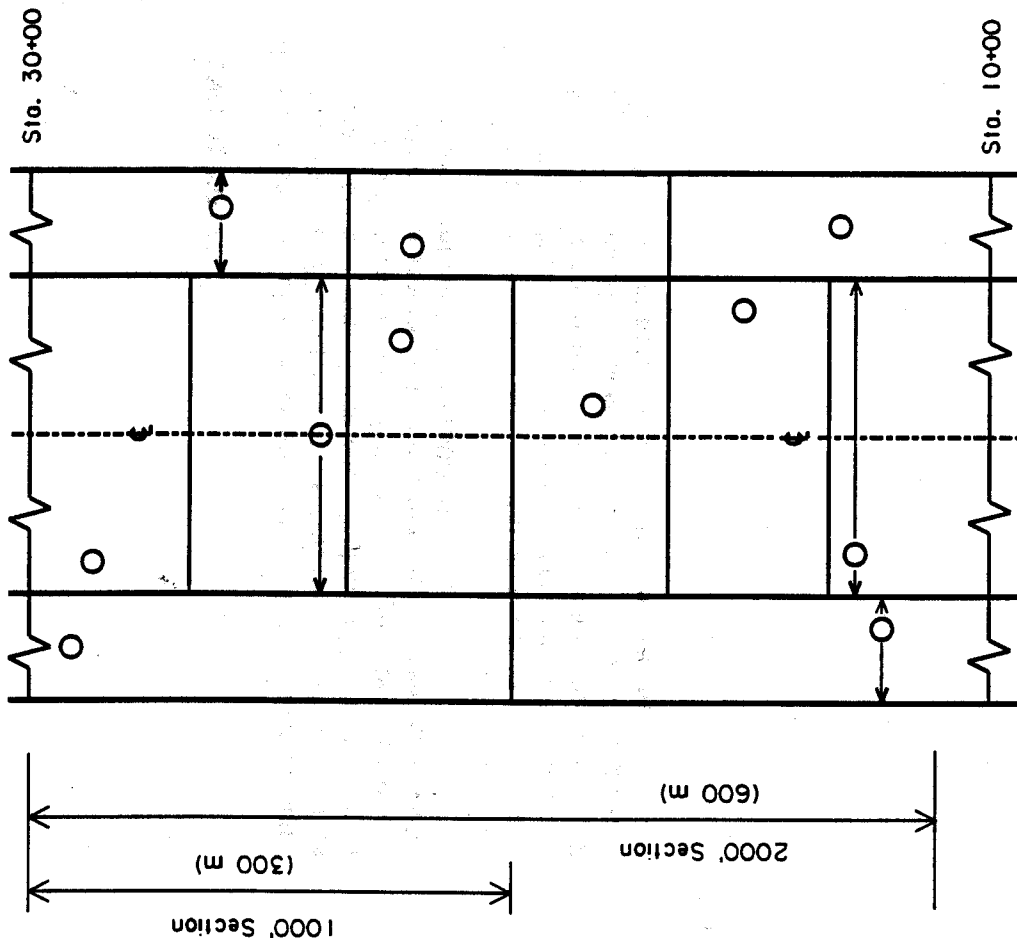
B. Report

1. Acceptance Measurements - The report shall consist of a Matt System computer generated document (Figure 7) including nonconforming sections and corrective measures taken. Computer data entry shall be made directly from a properly formatted field book (Figure 6).

VI. Normal Test Reporting Time

The normal test reporting time is 1 day.

ACCEPTANCE MEASUREMENTS



GENERAL NOTES:

1. Divide each 300-m (1000-ft) section of two-lane roadway into three equal segments; take one thickness measurement per segment. Take one width measurement per 300-m (1000-ft) section.
2. For shoulders or widening 2.5 m (8 ft) or greater in width, divide into three equal segments for each 600-m (2000-ft) section; take one thickness measurement per segment. Take one width measurement per 600 m (2000 ft) section.
3. For shoulders or widening less than 2.5 m (8 ft) in width, divide into two equal segments for each 600-m (2000-ft) section. Take one thickness measurement per segment. Take one width measurement per 600-m (2000-ft) section.

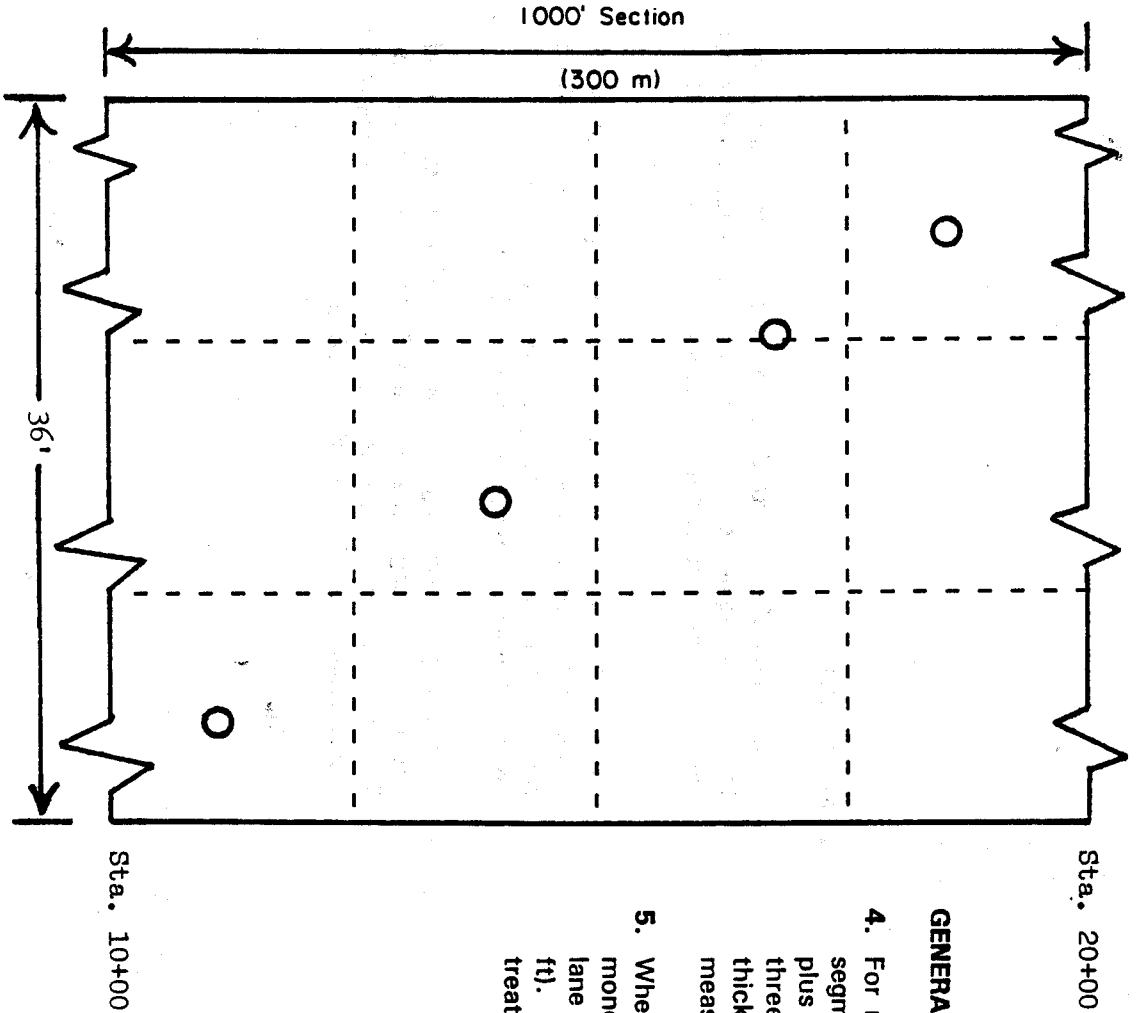
3 1 2

EXAMPLE

TWO-LANE ROADWAY

Figure 3

ACCEPTANCE MEASUREMENTS



GENERAL NOTES:

4. For roadways of three or more lanes, the number of equal segments per 300-m (1000-ft) section are the number of lanes plus one. Example, divide each 300-m (1000-ft) section of three-lane roadway into four equal segments. Take one thickness measurement per segment. Take one width measurement per 300-m (1000-ft) section.
5. When a course for roadway and shoulder is constructed monolithically, consider the shoulder portions as an additional lane provided combined shoulder width is less than 3.6 m (12 ft). If combined shoulder width is 3.6 m (12 ft) or greater, treat the shoulder portions as two additional lanes.

Example
Three Lanes or Roadway and Shoulders
Constructed Monolithically

Figure 4

PROJECT NO. 111-11-1111						ITEM NO. 301(01)				DATE: 12-03-95	
(MIXED-IN-PLACE)						(8 1/2" SOIL CEMENT BASE - CLASS I)					
		THEORETICAL MEASUREMENTS		FIELD MEASUREMENTS							
STATION	LOCATION	X	Y	X	Y	FIELD THICKNESS	PLAN WIDTH	FIELD WIDTH	% CEMENT SPREAD	REMARKS	
13+00	8' RT.	20 3/4	12 1/4	20 1/2	12	8 1/2	22'-00"	22'-01"	8	OK	
13+00	℄	20 1/2	12	20 1/2	12	8 1/2				OK	
13+00	8' LT.	20 3/4	12 1/4	20 1/2	12 1/4	8 1/4				OK	
27+00	4' RT.	20 1/2	12	21 3/4	11 1/2	10 1/4	22'-00"	22'-01"	8	OK - CONTRACTOR	
27+00	℄	20 1/2	12	21 1/2	11 1/2	10				ADDED EXTRA 1%	
27+00	6' LT.	20 1/2	12	21 1/2	11 1/2	10				CEMENT, RE-CUT	
27+00	5' RT.	20 1/2	12	22	11 1/2	10 1/2	22'-00"	22'-02"	9	AND COMPLETED	
27+00	℄	20 1/2	12	21 3/4	11 1/2	10 1/4				WITHIN 3 HRS.	
27+00	6' LT.	20 1/2	12	21 3/4	11 1/2	10 1/4				STA. 26+00 TO	
										STA. 28+00	

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Verifications Measurements
Figure 5

PROJECT NO. 111-11-1111				MAT. CODE 1421		SPEC. CODE 11		DIST. 10.21		UNIT OF PAY 11	
ITEM NO. 301(01)										DATE: 12-04-95	
SECTION	FROM STATION	TO STATION	SECTION LENGTH	STATION	LOCATION	THICKNESS	AVERAGE THICKNESS	PLAN THICKNESS	WIDTH	PLAN WIDTH	PASS/FAIL
001	0+00	10+00	1000'	2+54	5.8' RT.	8.50		8.50			P
				5+85	℄	8.00					P
				8+60	8.2' LT.	8.25			22'-03"	22'-00"	P
002	10+00	20+00	1000'	11+25	9.1' RT.	8.25		8.50			P
				14+80	1.2' RT.	8.50			22'-01"	22'-00"	P
				19+10	7.6' LT.	7.50					*F
				19+05	7.6' LT.	7.75	7.50*				
				19+15	7.6' LT.	7.50					
003	20+00	30+00	1000'	21+55	4.7' LT.	7.75		8.50	22'-07"	22'-00"	**F
				24+86	1.3' RT.	8.25					P
				28+30	6.8' RT.	8.50					P

* SEE SECTION 003A FOR LIMITS.
UNDERTHICKNESS AREA OVERLAID
WITH 1 1/4 INCH ASPHALTIC CONCRETE
FOR FULL WIDTH OF BASE COURSE.

** SEE SECTION 003A FOR LIMITS.
OVERTHICKNESS WAIVED IN
ACCORDANCE WITH SPECIFICATIONS.

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Acceptance Measurements
Figure 6

01/26/96

STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
ACCEPTANCE MEASUREMENTS OF BASE, SUBBASE & AGGREGATE SURFACE COURSES
SOIL CEMENT BASE (CLASS I) (421)

PROJECT NO: 111-11-1111
ITEM NO : 301(01)

SPEC CODE : 1
UNIT OF PAY: 1

DISTRICT: 07

SEC.	FROM STATION	TO STATION	SEC. LENGTH	STATION	THICK. INCHES	PLAN THICK. INCHES	WIDTH FT-IN	PLAN WIDTH FT-IN	PASS/ FAIL
001	0+00	10+00	1000	2+54	8.50	8.50			P
				5+85	8.00				P
				8+60	8.25		22-03	22-00	P
002	10+00	20+00	1000	11+25	8.25	8.50			P
				14+80	8.50		22-01	22-00	P
				19+10	7.50				F
003	20+00	30+00	1000	21+55	7.75	8.50	22-07	22-00	F
				24+86	8.25				P
				28+30	8.50				P

REMARKS: FIELD BOOK NO. 07-323. SEE SECTIONS 002A AND 003A FOR LIMITS.

THE FOLLOWING SECTIONS DO NOT CONFORM TO SPECIFICATIONS: 002 003

E. L. Jones

DISTRICT LABORATORY ENGINEER