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STATE OF TENNESSEE  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF ENGINEERING

OBION COUNTY

S.R. 22

FROM: L.M. 2.98 (S.R. 22 CONNECTOR)  
TO: L.M. 4.84 (S.R. 214)

RESURFACING

STATE HIGHWAY NO. 22 F.A.H.S. NO. N.A.

TENN.	YEAR	SHEET NO.
	2015	1
FED. AID PROJ. NO.	HSIP-22(83)	
STATE PROJ. NO.	66011-4238-04	



PROJECT SITE

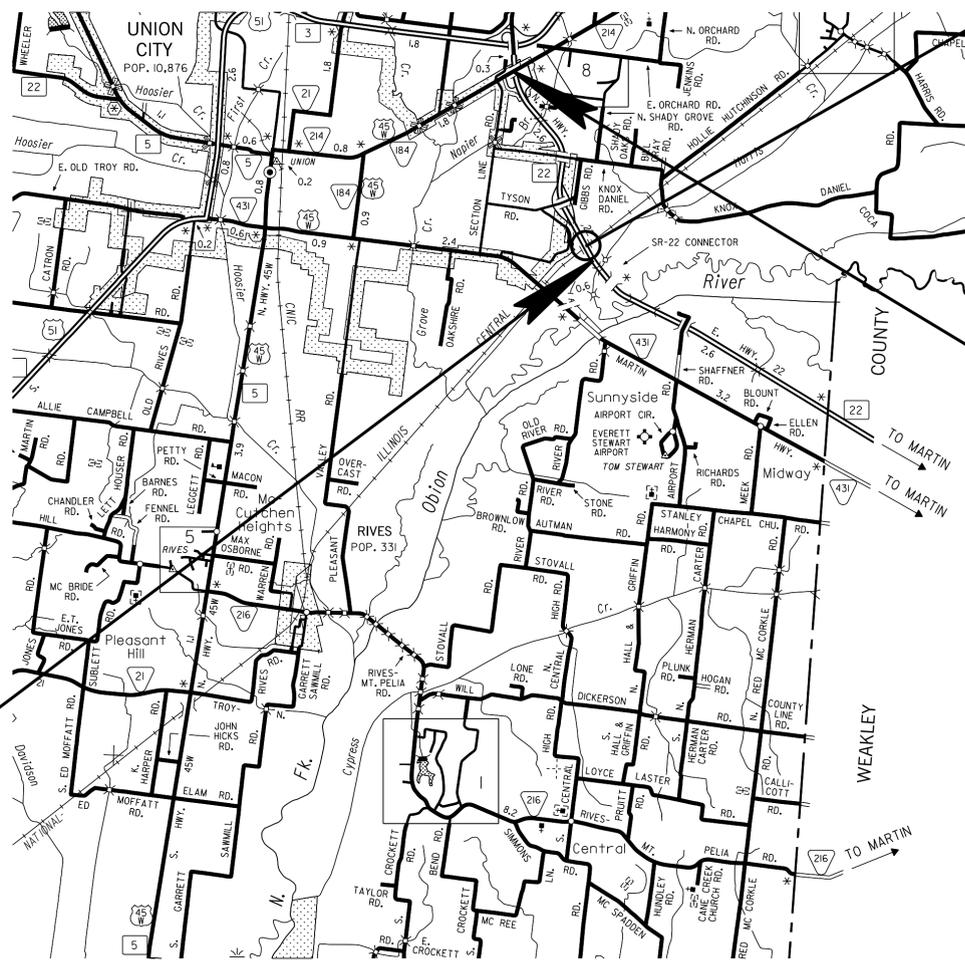
Standard Roadway Drawings

SHEET NO.	REV.	DESCRIPTION
RD-A-1	12-18-99	STANDARD ABBREVIATIONS
RD-L-1	10-26-94	STANDARD LEGEND
T-M-1	07-24-14	DETAILS OF PAVEMENT MARKINGS FOR CONVENTIONAL ROADS AND MARKING ABBREVIATIONS
T-M-5	04-23-13	MARKING DETAILS FOR EXPRESSWAYS & FREEWAYS
T-M-6	06-22-12	MARKING DETAIL FOR EXPRESSWAY & FREEWAY INTERCHANGES
T-M-7	01-12-12	GORE MARKING DETAILS FOR EXPRESSWAY AND FREEWAY INTERCHANGES
T-M-9	11-01-11	MARKING DETAILS FOR RAMP INTERSECTIONS
T-M-15		ASPHALT SHOULDER RUMBLE STRIP INSTALLATION DETAILS FOR INTERSTATE AND ACCESS CONTROLLED ROUTES
T-WZ-10	04-04-12	ADVANCE ROAD WORK SIGNING ON HIGHWAYS AND FREEWAYS
T-WZ-11	03-13-09	ONE LANE CLOSURE DETAIL ON DIVIDED HIGHWAYS
T-FAB-1	05-27-97	FLASHING YELLOW ARROW BOARD

**RAILROAD NOTE**

ILLINOIS CENTRAL CROSSING DOT# 297345S

THE CONTRACTOR SHALL RESTRIPE OVERPASS BRIDGES AT L.M. 3.12. NO OTHER RESURFACING WORK SHALL BE DONE ON THESE BRIDGES. SEE BRIDGE NOTES ON SHEET 3-3A AND RAILROAD NOTES ON SHEET 4A.



END PROJECT L.M. 4.84  
(S.R. 214)

BEGIN PROJECT L.M. 2.98  
(S.R. 22 CONNECTOR)

**UNOFFICIAL  
SET  
NOT FOR  
BIDDING**

SPECIAL NOTES

PROPOSALS MAY BE REJECTED BY THE COMMISSIONER IF ANY OF THE UNIT PRICES CONTAINED THEREIN ARE OBVIOUSLY UNBALANCED, EITHER EXCESSIVE OR BELOW THE REASONABLE COST ANALYSIS VALUE.

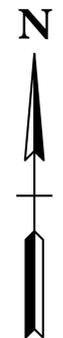
THIS PROJECT TO BE CONSTRUCTED UNDER THE STANDARD SPECIFICATIONS OF THE TENNESSEE DEPARTMENT OF TRANSPORTATION DATED MARCH 1, 2006 AND ADDITIONAL SPECIFICATIONS AND SPECIAL PROVISIONS CONTAINED IN THE PLANS AND IN THE PROPOSAL CONTRACT

TDOT C.E. MANAGER 1 TABITHA CAVANESS, P.E., REG. 4  
DESIGNER LARRY BRASHER, E.I., REG. 4 CHECKED BY DEREK LINK, REG. 4

P.E. NO. 98043-4283-04  
PIN: 101852.01

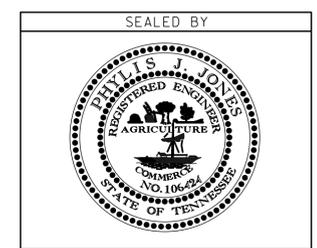
SCALE: 0 1 2 3 MILES

PROJECT LENGTH **1.86 MILES**  
TOTAL LANE MILES RESURFACED **7.44 MILES**



**NO EXCLUSIONS  
NO EQUATIONS**

**TRAFFIC DATA**  
ADT (2014) **3360**



APPROVED: Paul D. Decker  
CHIEF ENGINEER

DATE: \_\_\_\_\_

APPROVED: [Signature]  
JOHN SCHROER, COMMISSIONER

U.S. DEPARTMENT OF TRANSPORTATION  
FEDERAL HIGHWAY ADMINISTRATION

APPROVED: \_\_\_\_\_  
DIVISION ADMINISTRATOR DATE

05-DEC-2014 15:32 \\JJ04w-f01.tdot.state.tn.us\04SHARED\Design\DESIGN\RESURF REG4 PROJ\OBION\SR 22\LM2-98LM4-84\66022LM2-98 EST\_QTYS.dgn

### ESTIMATED ROADWAY QUANTITIES

ITEM NO.	DESCRIPTION	UNIT	66011-4238-04 QUANTITY	HSIP-22(83) QUANTITY	TOTAL QUANTITY
202-03.01	REMOVAL OF ASPHALT PAVEMENT	S.Y.	50		50
203-06	WATER	M.G.	8		8
① 303-02	MINERAL AGGREGATE, TYPE B BASE, GRADING C OR D	TON	1242		1242
② 307-01.01	ASPHALT CONCRETE MIX (PG64-22) (BPMB-HM) GRADING A	TON	23		23
③ ④ 311-03.01	HOT IN PLACE RECYCLING OF ASPHALT PAVEMENT (1.25IN)	S.Y.	113002		113002
⑤ 311-03.10	ASPHALT REJUVENATING AGENT	GAL.	16951		16951
⑥ ⑦ 411-01.10	ACS MIX(PG64-22) GRADING D	TON	50		50
411-12.01	SCORING SHOULDERS (CONTINUOUS) (16IN WIDTH)	L.M.		17.48	17.48
411-12.02	SCORING SHOULDERS (NON-CONTINUOUS) (16IN WIDTH)	L.M.		17.48	17.48
⑧ 705-04.07	TAN ENERGY ABSORBING TERM (NCHRP 350, TL3)	EACH		21	21
712-01	TRAFFIC CONTROL	LS	1		1
⑨ 712-06	SIGNS (CONSTRUCTION)	S.F.	1216		1216
712-08.03	ARROW BOARD (TYPE C)	EACH	4		4
716-01.23	SNOWPLOWABLE PVMT MRKRS (BI-DIR)(2 COLOR)	EACH		474	474
716-01.30	REMOVAL OF SNOWPLOWABLE REFLECTIVE MARKER	EACH	474		474
⑩ 716-02.02	PLASTIC PVMT MARKING (8" BARRIER LINE)	L.F.		5893	5893
⑩ 716-02.04	PLASTIC PAVEMENT MARKING(CHANNELIZATION STRIPING)	S.Y.		680	680
⑩ 716-02.06	PLASTIC PAVEMENT MARKING (TURN LANE ARROW)	EACH		7	7
⑩ 716-02.11	PLASTIC PVMT MARKING (6' DOTTED LINE)	L.F.		1101	1101
⑩ 716-12.02	ENHANCED FLATLINE THERMO PVMT MRKNG (6IN LINE)	L.M.	10.7		10.7
717-01	MOBILIZATION	LS	1		1
<b>ALTERNATE AA1</b>					
⑪⑫ 403-01.01	BITUMINOUS MATERIAL FOR TACK COAT (MICRO-SURFACING)	TON	19		19
⑬ 414-03.01	EMULSIFIED ASPHALT FOR MICRO-SURFACING	TON	217		217
⑭ 414-03.02	AGGREGATE FOR MICRO SURFACING	TON	1809		1809
⑮ 716-05.20	PAINTED PAVEMENT MARKING (6" LINE)	L.M.	21.74		21.74
<b>ALTERNATE AA2</b>					
⑯ 403-01	BITUMINOUS MATERIAL FOR TACK COAT (TC)	TON	35		35
⑰ ⑱ 411-03.13	ACS MIX(PG70-22) THIN LIFT D ASPHALT	TON	4803		4803
⑲ 716-05.20	PAINTED PAVEMENT MARKING (6" LINE)	L.M.	10.87		10.87

### FOOTNOTES

- ① INCLUDES 34 TONS FOR BREAKOUT. INCLUDES 256 TONS FOR RAMPS AND ACCELERATION LANES.
- ② FOR REPLACEMENT OF QUANTITY REMOVED UNDER ITEM 202-03.01 ONLY.
- ③ SEE SPECIAL PROVISION NO. 411C FOR RIDEABILITY SPECIFICATIONS.
- ④ INCLUDES 30,713 S.Y. FOR GORE AREAS, ACCELERATION LANES, CROSS OVERS, AND ON/OFF RAMPS.
- ⑤ INCLUDES 4607 GAL. FOR GORE AREAS, ACCELERATION LANES, CROSS OVERS, AND ON/OFF RAMPS.
- ⑥ FOR SPOT LEVELING ONLY.
- ⑦ SEE SPECIAL PROVISION NO. 407G FOR MATERIAL TRANSFER DEVICE.
- ⑧ FOR UPGRADE OF EXISTING ANCHORS AT ALL STRUCTURE LOCATIONS IN PROJECT LIMITS. THE COST OF REMOVAL OF EXISTING GUARDRAIL AND ANCHORS TO BE INCLUDED IN THIS ITEM.
- ⑨ QUANTITY INCLUDES
 

4	ROAD WORK NEXT 2 MI.	(G20-1)	(48" X 24")
4	END ROAD WORK	(G20-2)	(48" X 24")
20	UNEVEN LANES	(W8-11)	(48" X 48")
4	ROAD WORK AHEAD	(W20-1)	(48" X 48")
4	ROAD WORK 1500 FT.	(W20-1)	(48" X 48")
4	ROAD WORK 1000 FT.	(W20-1)	(48" X 48")
4	ROAD WORK 500 FT.	(W20-1)	(48" X 48")
4	RIGHT LANE CLOSED 1,500 FT.	(W20-5)	(48" X 48")
4	RIGHT LANE CLOSED 1,000 FT.	(W20-5)	(48" X 48")
4	RIGHT LANE CLOSED 500 FT.	(W20-5)	(48" X 48")
4	LEFT LANE CLOSED 1,500 FT.	(W20-5)	(48" X 48")
4	LEFT LANE CLOSED 1,000 FT.	(W20-5)	(48" X 48")
4	LEFT LANE CLOSED 500 FT.	(W20-5)	(48" X 48")
4	FRESH OIL	(W21-2)	(48" X 48")
8	SHOULDER WORK	(W21-5)	(48" X 48")
- THIS CONSTRUCTION SIGNING IS TO BE AS A MINIMUM. OTHER SIGNS AS DIRECTED BY THE ENGINEER MAY BE REQUIRED DURING DIFFERENT PHASES.
- ⑩ FOR FINAL PAVEMENT MARKING ONLY.
- ⑪ TACK COAT SHALL CONSIST OF 1 PART EMULSION AND 3 PARTS WATER. THE QUANTITY FOR THE EMULSION PAYMENT, ITEM NO. 403-01.01, SHOULD BE ONE FOURTH OF THE ESTIMATED APPLICATION RATE. TACK COAT SHALL BE PLACED UNDER LEVELING AND SURFACE COURSES.
- ⑫ INCLUDES 5 TONS FOR GORE AREAS, ACCELERATION LANES, CROSS OVERS, AND ON/OFF RAMPS.
- ⑬ INCLUDES 59 TONS FOR GORE AREAS, ACCELERATION LANES, CROSS OVERS, AND ON/OFF RAMPS.
- ⑭ INCLUDES 492 TONS FOR GORE AREAS, ACCELERATION LANES, CROSS OVERS, AND ON/OFF RAMPS.
- ⑮ FOR USE AS TEMPORARY LINE MARKINGS; INCLUDES 5.0 MILES FOR BREAKOUT, SPOT LEVELING, RAMPS, ACCELERATION LANES.
- ⑯ INCLUDES 35 TONS FOR GORE AREAS, ACCELERATION LANES, CROSS OVERS, AND ON/OFF RAMPS.
- ⑰ SEE SPECIAL PROVISION NUMBER 411TLD.
- ⑱ INCLUDES 1306 TONS FOR GORE AREAS, ACCELERATION LANES, CROSS OVERS, AND ON/OFF RAMPS.
- ⑲ FOR USE AS TEMPORARY LINE MARKINGS; INCLUDES 2.50 MILES FOR BREAKOUT, SPOT LEVELING, RAMPS, ACCELERATION LANES.

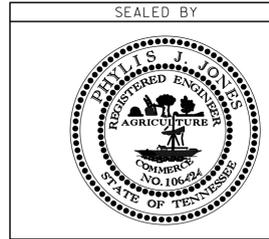
TYPE	YEAR	PROJECT NO.	SHEET NO.
RESURF.	2014	HSIP-22(83)	2

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**BIDDING**



STATE OF TENNESSEE  
DEPARTMENT OF TRANSPORTATION

**ESTIMATED**

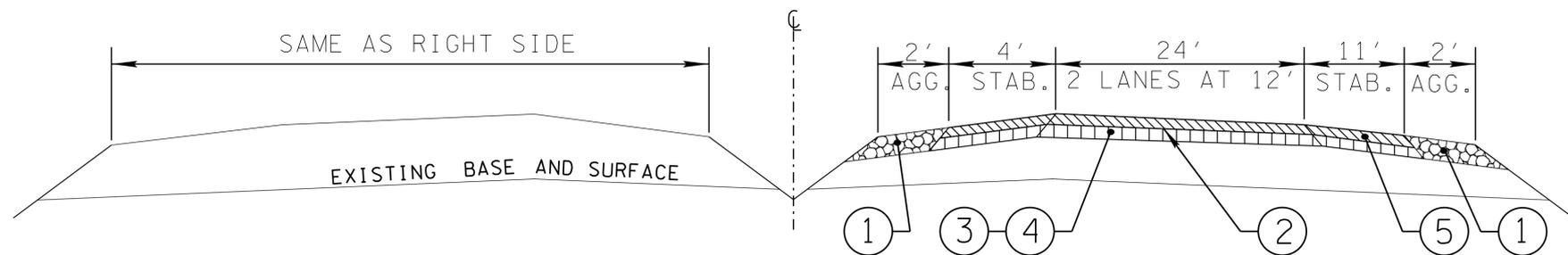
**ROADWAY**

**QUANTITIES**

# TYPICAL SECTION

ALTERNATE  
AA1

TYPE	YEAR	PROJECT NO.	SHEET NO.
RESURF.	2014	HS1P-22(83)	3



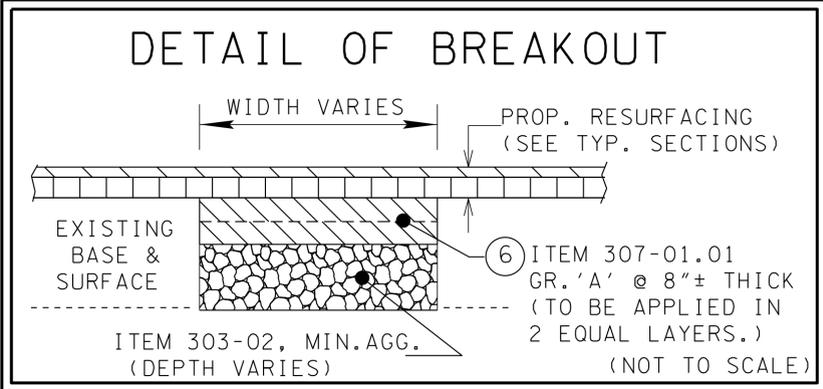
FROM: L.M. 2.98 TO L.M. 4.84

**BRIDGE NOTE**

THE CONTRACTOR SHALL:

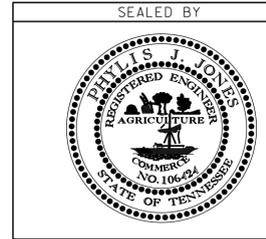
RESTRIPE OVERPASS BRIDGES (RT/LT LANES) AT L.M. 3.12.  
NO OTHER RESURFACING WORK SHALL BE DONE ON THESE BRIDGES.

PAVE ACROSS EXISTING STRUCTURE WITH  
PLANS QUANTITIES ONLY @ L.M. 4.62 (36')



PROPOSED PAVEMENT SCHEDULE	
①	MINERAL AGGREGATE BASE @ 2"± THICK FOR SHOULDERS ITEM 303-02 MINERAL AGGREGATE, TYPE "B" BASE, GRADING "C OR D"
②	TACK COAT (TC) FOR MICRO-SURFACING ITEM 403-01.01 BITUMINOUS MATERIAL FOR TACK COAT (TC) (AT 0.15 GAL./S.Y.)
③	RECYCLE-IN-PLACE @ 1.25" THICK ITEM 311-03.01 HOT IN PLACE RECYCLING OF ASPHALT PAVEMENT
④	REJUVENATING AGENT FOR RECYCLE IN PLACE ITEM 311-03.10 ASPHALT REJUVENATING AGENT (AT 0.10 - 0.15 GAL./S.Y.)
⑤	MICRO-SURFACING @ 0.375" THICK (APPROX. 32 LBS./S.Y.) ITEM 414-03.01 EMULSIFIED ASPHALT FOR MICRO-SURFACING ITEM 414-03.02 AGGREGATE FOR MICRO-SURFACING LEVELING COURSE - 14 LBS./S.Y. SURFACE COURSE - 18 LBS./S.Y.
⑥	BITUMINOUS BASE COURSE (BLACK BASE) @ 8"± THICK (APPROX. 920.0 LBS./S.Y.) ITEM 307-01.01 ASPHALT CONCRETE MIX (PG64-22)(BPMB-HM) GRADING "A" (THIS ITEM IS TO BE USED FOR BREAKOUT ONLY)
	ASPHALTIC CONCRETE SURFACE (ACS) @ 1.25"± THICK (APPROX. 132.50 LBS./S.Y.) ITEM 411-01.10 ACS MIX (PG64-22) GRADING "D" (THIS ITEM IS TO BE USED FOR SPOT LEVELING ONLY)

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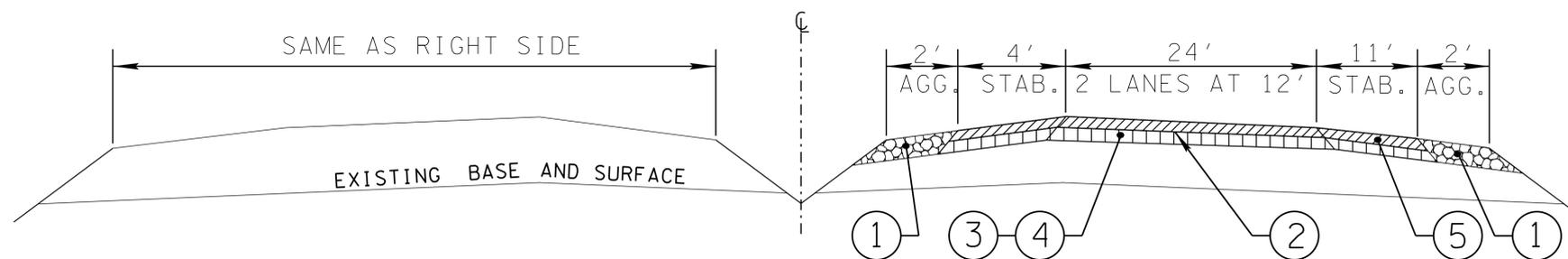
STATE OF TENNESSEE  
DEPARTMENT OF TRANSPORTATION

**TYPICAL  
SECTIONS**  
(NOT TO SCALE)

TYPE	YEAR	PROJECT NO.	SHEET NO.
RESURF.	2014	HS1P-22(83)	3A

# TYPICAL SECTION

ALTERNATE  
AA2



FROM: L.M. 2.98 TO L.M. 4.84

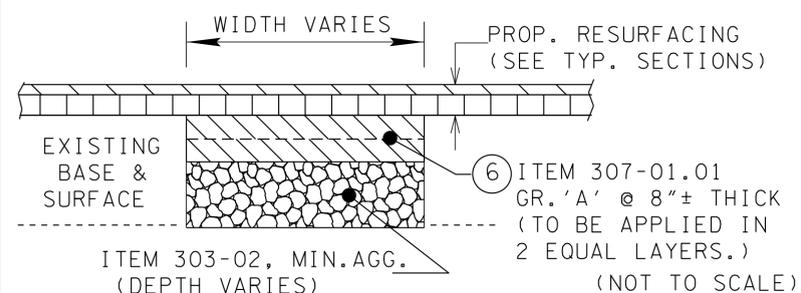
## BRIDGE NOTE

THE CONTRACTOR SHALL:

RESTRIPE OVERPASS BRIDGES (RT/LT LANES) AT L.M. 3.12.  
NO OTHER RESURFACING WORK SHALL BE DONE ON THESE BRIDGES.

PAVE ACROSS EXISTING STRUCTURE WITH  
PLANS QUANTITIES ONLY @ L.M. 4.62 (36')

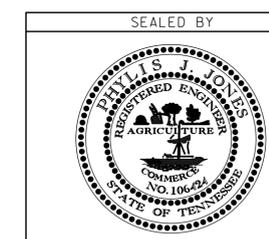
## DETAIL OF BREAKOUT



## PROPOSED PAVEMENT SCHEDULE

①	MINERAL AGGREGATE BASE @ 2"± THICK FOR SHOULDERS ITEM 303-02 MINERAL AGGREGATE, TYPE "B" BASE, GRADING "C OR D"
②	TACK COAT (TC) ITEM 403-01 BITUMINOUS MATERIAL FOR TACK COAT (TC) (AT 0.07 GAL./S.Y.)
③	RECYCLE-IN-PLACE @ 1.25" THICK ITEM 311-03.01 HOT IN PLACE RECYCLING OF ASPHALT PAVEMENT
④	REJUVENATING AGENT FOR RECYCLE IN PLACE ITEM 311-03.10 ASPHALT REJUVENATING AGENT (AT 0.10 - 0.15 GAL./S.Y.)
⑤	ASPHALTIC CONCRETE SURFACE (ACS) @ 0.80"± THICK (APPROX. 85.00 LBS./S.Y.) ITEM 411-03.13 ACS MIX (PG70-22) THIN LIFT D ASPHALT
⑥	BITUMINOUS BASE COURSE (BLACK BASE) @ 8"± THICK (APPROX. 920.0 LBS./S.Y.) ITEM 307-01.01 ASPHALT CONCRETE MIX (PG64-22) (BPMB-HM) GRADING "A" (THIS ITEM IS TO BE USED FOR BREAKOUT ONLY)
	ASPHALTIC CONCRETE SURFACE (ACS) @ 1.25"± THICK (APPROX. 132.50 LBS./S.Y.) ITEM 411-01.10 ACS MIX (PG64-22) GRADING "D" (THIS ITEM IS TO BE USED FOR SPOT LEVELING ONLY)

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STATE OF TENNESSEE  
DEPARTMENT OF TRANSPORTATION

**TYPICAL  
SECTIONS**  
(NOT TO SCALE)

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# GENERAL NOTES

## GRADING

ANY AREA THAT IS DISTURBED OUTSIDE LIMITS OF CONSTRUCTION DURING THE LIFE OF THIS PROJECT SHALL BE REPAIRED BY THE CONTRACTOR AT HIS EXPENSE.

## GUARDRAIL

THE CONTRACTOR SHALL NOT REMOVE ANY SECTIONS OF EXISTING GUARDRAIL TO REWORK SHOULDERS OR FLATTEN SLOPE UNTIL THE ENGINEER CONCURS IN THE NECESSITY OF REMOVAL DUE TO CONSTRUCTION REQUIREMENTS AND THE APPROPRIATE WARNING DEVICES ARE INSTALLED. THE PROPOSED GUARDRAIL, INCLUDING ANY ANCHOR SYSTEM, SHALL BE INSTALLED QUICKLY TO MINIMIZE TRAFFIC EXPOSURE TO ANY HAZARD. NO PAYMENT WILL BE MADE FOR A SECTION OF PROPOSED GUARDRAIL, INCLUDING ANCHORS, UNTIL IT IS COMPLETE IN PLACE.

IF ANY APPROACH END OF A SECTION OF GUARDRAIL OR BRIDGE RAIL MUST TEMPORARILY BE LEFT INCOMPLETE AND EXPOSED TO TRAFFIC, THE CONTRACTOR SHALL USE TWO (2) TEMPORARY BARRICADES OR DRUMS WITH TYPE A LIGHTS AND ROUNDED END ELEMENTS AS MINIMUM MEASURES TO PROTECT TRAFFIC FROM THE HAZARD OF AN EXPOSED END. ALL COST OF FURNISHING AND INSTALLING A TEMPORARY ROUNDED END ELEMENT SHALL BE INCLUDED IN THE COST OF THE PROPOSED GUARDRAIL.

## UTILITIES

THE LOCATIONS OF UTILITIES SHOWN WITHIN THESE PLANS ARE APPROXIMATE ONLY. EXACT LOCATIONS SHALL BE DETERMINED IN THE FIELD BY CONTACTING THE UTILITY COMPANIES INVOLVED. NOTIFICATION BY CALLING THE TENNESSEE ONE CALL SYSTEM, INC., AT 1-800-351-1111 AS REQUIRED BY TCA 65-31-106 WILL BE REQUIRED.

THE CONTRACTOR SHALL NOTIFY EACH INDIVIDUAL UTILITY OWNER OF HIS PLAN OF OPERATION IN THE AREA OF THE UTILITIES. PRIOR TO COMMENCING WORK, THE CONTRACTOR SHALL CONTACT THE UTILITY OWNERS AND REQUEST THEM TO PROPERLY LOCATE THEIR RESPECTIVE UTILITY ON THE GROUND. THIS NOTIFICATION SHALL BE GIVEN AT LEAST THREE (3) BUSINESS DAYS PRIOR TO COMMENCEMENT OF OPERATIONS AROUND THE UTILITY IN ACCORDANCE WITH TCA 65-31-106.

## MISCELLANEOUS

NOTHING IN THE GENERAL NOTES OR SPECIAL PROVISIONS SHALL RELIEVE THE CONTRACTOR FROM HIS RESPONSIBILITIES TOWARD THE SAFETY AND CONVENIENCE OF THE GENERAL PUBLIC AND THE RESIDENTS ALONG THE PROPOSED CONSTRUCTION AREA.

## PAVEMENT MARKINGS

TEMPORARY PAVEMENT LINE MARKINGS ON INTERMEDIATE LAYERS OF PAVEMENT SHALL BE REFLECTIVE TAPE OR REFLECTORIZED PAINT INSTALLED TO PERMANENT STANDARDS AT THE END OF EACH DAY'S WORK. SHORT, UNMARKED SECTIONS SHALL NOT BE ALLOWED. THESE MARKINGS WILL BE MEASURED AND PAID FOR UNDER ITEM NO. 716-05.20 PAINTED PAVEMENT MARKINGS (6" LINE), L.M.

PERMANENT PAVEMENT LINE MARKINGS SHALL BE 6" SPRAY THERMOPLASTIC (60 mil) INSTALLED TO PERMANENT STANDARDS AT THE END OF EACH DAY'S WORK. SHORT UNMARKED SECTIONS SHALL NOT BE ALLOWED. PAVEMENT MARKINGS WILL BE MEASURED AND PAID FOR UNDER ITEM NO. 716-13.02, SPRAY THERMO PVMT MRKNG (60 mil) (6IN LINE), L.M. THE CONTRACTOR SHALL HAVE THE OPTION OF USING REFLECTORIZED PAINT INSTALLED TO PERMANENT STANDARDS AT THE END OF EACH DAY'S WORK AND THEN INSTALLING THE PERMANENT MARKINGS AFTER THE PAVING OPERATIONS IS COMPLETED. THE TEMPORARY MARKINGS FOR THE FINAL SURFACE WILL NOT BE MEASURED AND PAID FOR DIRECTLY, BUT THE COSTS ARE TO BE INCLUDED IN THE PRICE BID FOR THE PERMANENT MARKINGS.

## PAVING

THE CONTRACTOR SHALL BE REQUIRED TO PAVE IN THE DIRECTION OF TRAFFIC.

## RESURFACING

IN ALL CASES, THE LENGTH OF THE PAVEMENT TRANSITION, THE THICKNESS AND WIDTH OF THE RESURFACING AND ANY ADDITIONAL PAVEMENT MATERIALS SHALL BE AS DIRECTED BY THE TDOT ENGINEER.

## CONSTRUCTION WORK ZONE & TRAFFIC CONTROL NOTES

ADVANCED WARNING SIGNS SHALL NOT BE DISPLAYED MORE THAN FORTY-EIGHT (48) HOURS BEFORE PHYSICAL CONSTRUCTION BEGINS. SIGNS MAY BE ERECTED UP TO ONE WEEK BEFORE NEEDED, IF THE SIGN FACE IS FULLY COVERED.

IF THE CONTRACTOR MOVES OFF THE PROJECT, HE SHALL COVER OR REMOVE ALL UNNEEDED SIGNS AS DIRECTED BY THE ENGINEER. COSTS OF REMOVAL, COVERING, AND REINSTALLING SIGNS SHALL NOT BE MEASURED AND PAID FOR SEPARATELY, BUT ALL COSTS SHALL BE INCLUDED IN THE ORIGINAL UNIT PRICE BID FOR ITEM NO. 712-06, SIGNS (CONSTRUCTION) PER SQUARE FOOT.

A LONG TERM BUT SPORADIC USE WARNING SIGN, SUCH AS A FLAGGER SIGN, MAY REMAIN IN PLACE WHEN NOT REQUIRED PROVIDED THE SIGN FACE IS FULLY COVERED.

TRAFFIC CONTROL DEVICES SHALL NOT BE DISPLAYED OR ERECTED UNLESS RELATED CONDITIONS ARE PRESENT NECESSITATING WARNING.

THE CONTRACTOR SHALL NOT BE PERMITTED TO PARK ANY VEHICLES OR CONSTRUCTION EQUIPMENT DURING PERIODS OF INACTIVITY, WITHIN THIRTY (30) FEET OF THE EDGE OF PAVEMENT WHEN THE LANE IS OPEN TO TRAFFIC UNLESS PROTECTED BY GUARDRAIL, BRIDGE RAIL, AND/OR BARRIERS INSTALLED FOR OTHER PURPOSES FOR ROADWAYS WITH CURRENT ADT'S LESS THAN 1500 AND DESIGN SPEED OF LESS THAN 60 MPH. THIS DISTANCE SHALL BE INCREASED TO FORTY-FIVE (45) FEET FOR ROADWAYS WITH CURRENT ADT'S OF 1500 OR GREATER AND DESIGN SPEED OF 60 MPH OR GREATER OR ON THE OUTSIDE OF A HORIZONTAL CURVE. PRIVATELY OWNED VEHICLES SHALL NOT BE ALLOWED TO BE PARKED WITHIN THIRTY (30) FEET OF AN OPEN TRAFFIC LANE AT ANY TIME UNLESS PROTECTED AS DESCRIBED ABOVE FOR ROADWAYS WITH CURRENT ADT'S LESS THAN 1500 AND DESIGN SPEED OF LESS THAN 60 MPH. THIS DISTANCE SHALL BE INCREASED TO FORTY-FIVE (45) FEET FOR ROADWAYS WITH CURRENT ADT'S OF 1500 OR GREATER AND DESIGN SPEED OF 60 MPH OR GREATER OR ON THE OUTSIDE OF A HORIZONTAL CURVE.. WHERE THERE IS INSUFFICIENT RIGHT-OF-WAY TO PROVIDE FOR THIS REQUIRED SETBACK, THE CONTRACTOR SHALL DETERMINE THE ALTERNATE LOCATIONS AND REQUEST THE ENGINEER'S APPROVAL TO USE THEM.

TYPE	YEAR	PROJECT NO.	SHEET NO.
RESURF.	2014	HS1P-22(83)	4

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STATE OF TENNESSEE  
DEPARTMENT OF TRANSPORTATION

**GENERAL  
NOTES**

# SPECIAL NOTES

SURFACE IS TO BE CROWNED AS DIRECTED BY THE ENGINEER.

ALL SIGNS WHICH INTERFERE WITH CONSTRUCTION WILL BE RELOCATED OUTSIDE LIMITS OF CONSTRUCTION BY THE CONTRACTOR. UPON COMPLETION OF CONSTRUCTION, THE CONTRACTOR WILL RESTORE THE SIGNS TO ORIGINAL LOCATION. COST TO BE INCLUDED IN ITEM NO. 712-06.

IF THE CONTRACTOR ELECTS TO UTILIZE SIGN POST ANCHORS (STUBS) FOR SIGN ERECTION, THESE SHALL BE REMOVED WHEN THE SIGNS ARE REMOVED TO AVOID FUTURE DAMAGE TO MOWERS OR OTHER MACHINERY.

UNDER THE DIRECTION OF THE ENGINEER, THE CONTRACTOR MAY BE REQUIRED TO APPLY PLASTIC MARKINGS IN THE PAVEMENT AREAS NOT SPECIFICALLY DETAILED IN THE PLANS. PAYMENT WILL BE MADE AT THE UNIT PRICE BID FOR ITEM NO. 716-05.20.

UNDER THE DIRECTION OF THE ENGINEER, THE CONTRACTOR MAY BE REQUIRED TO APPLY PAINTED MARKINGS IN THE PAVEMENT AREAS NOT SPECIFICALLY DETAILED IN THE PLANS. PAYMENT WILL BE MADE AT THE UNIT PRICE BID FOR ITEM NO. 716-05.20.

ITEM 303-02 TO BE PLACED BEFORE PLACING SURFACING MATERIAL.

THE CONTRACTOR WILL BE REQUIRED TO CLEAN AND BLADE GRASS FROM SHOULDERS BEFORE PLACING ITEM 303-02. MATERIAL BLADED FROM SHOULDERS TO BE PICKED UP AND DISPOSED OF AS DIRECTED BY THE ENGINEER. COST TO BE INCLUDED IN ITEM 303-02.

MATERIAL TRANSFER DEVICE SHALL BE USED FOR ALL D MIXES.

THE INSIDE SHOULDERS WILL BE PAVED CONCURRENTLY WITH THE INSIDE TRAFFIC LANE.

FEATHER "D"-MIX TO ENDS OF BRIDGES THAT ARE NOT TO BE PAVED.

THE CONTRACTOR SHALL COMPLY WITH SECTION 712 OF THE STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION REGARDING TEMPORARY TRAFFIC CONTROL AND THE CURRENT EDITION OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.

ONLY 4 ARROW BOARDS WILL BE PAID FOR DURING THE LIFE OF THIS PROJECT. IF THE CONTRACTOR'S WORK PHASES REQUIRED ADDITIONAL ARROW BOARDS, THEIR COST WILL BE INCLUDED IN THE COST OF OTHER ITEMS.

THE RAISED REFLECTOR SHALL BE REMOVED BEFORE HOT RECYCLE IN PLACE.

ONLY 4 ARROW BOARDS WILL BE PAID FOR DURING THE LIFE OF THIS PROJECT. IF THE CONTRACTOR'S WORK PHASES REQUIRED ADDITIONAL ARROW BOARDS, THEIR COST WILL BE INCLUDED IN THE COST OF OTHER ITEMS.

THE CONTRACTOR IS TO CONDUCT HIS WORK SO AS TO PROTECT THE ILLINOIS CENTRAL RAILROAD COMPANY TRACT FACILITIES AND PROPERTIES FROM ANY DAMAGE. THE WORK SHALL BE DONE IN ACCORDANCE WITH REGULATIONS STIPULATED BY ILLINOIS CENTRAL SO AS TO MAINTAIN CLEARANCE AND NOT TO INTERRUPT TRAIN TRAFFIC IN ANY MANNER. THE CONTRACTOR SHALL NOT STORE ANY OF HIS CONSTRUCTION EQUIPMENT ON THE RAILROAD'S RIGHT-OF-WAY.

SEE STATE CONTRACT RAILROAD SPECIAL PROVISION 105C FOR THE RAILROAD'S RULES REGARDING RAILROAD AUTHORITY, CONSTRUCTION CLEARANCES, FLAGGING SERVICES, INSURANCE, AND DETAILS FOR THE REQUIRED, SEPARATE RIGHT-OF-ENTRY AGREEMENT THAT IS REQUIRED TO BE EXECUTED BETWEEN THE CONTRACTOR AND THE RAILROAD PRIOR TO THE CONTRACTOR BEGINNING WORK ON THIS PROJECT.

THE CONTRACTOR SHALL NOTIFY AND COORDINATE HIS WORK AT THE RAILROAD CROSSING WITH THE FOLLOWING REPRESENTATIVES OF THE RAILROAD.

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## *SPECIAL EROSION PREVENTION AND SEDIMENT CONTROL*

THE CONTRACTOR SHALL TAKE APPROPRIATE STEPS, BEFORE CLEANING OUT OR REMOVAL/REPLACEMENT OF DITCHES, SIDE DRAINS, AND CROSS DRAINS, TO ENSURE THAT THE DRAINAGE FEATURES/ WATERCOURSES ARE NOT STREAMS OR WETLANDS. IF THE CONTRACTOR/ TDOT INSPECTOR IS UNSURE WHETHER THE DRAINAGE FEATURES ARE STREAMS OR WETLANDS, THE INSPECTOR SHALL CONTACT THE TDOT ENVIRONMENTAL DIVISION, PERMITS SECTION TO OBTAIN THE APPROPRIATE PERMITS.

THE CONTRACTOR SHALL TAKE APPROPRIATE STEPS BEFORE CONSTRUCTING EARTH PADS FOR THE TYPE 38 TERMINALS TO ENSURE THAT THE ENVIRONMENTAL FEATURES (STREAMS, WETLANDS, OR SPRINGS) ARE NOT IMPACTED DURING CONSTRUCTION. IF THE CONTRACTOR/TDOT INSPECTOR IS UNSURE WHETHER THE ENVIRONMENTAL FEATURES ARE STREAMS, SPRINGS OR WETLANDS, THE INSPECTOR SHALL CONTACT THE TDOT ENVIRONMENTAL DIVISION ECOLOGY OR PERMITS SECTION SO AN ACCURATE DETERMINATION CAN BE ASSESSED. AND DURING CONSTRUCTION OF THE EARTH PADS FOR THE TYPE 38 GUARDRAIL TERMINALS, EXISTING VEGETATION WILL BE REQUIRED TO BE REMOVED FOR THE PROPOSED PAD AND SLOPES. IF DURING THE VEGETATION REMOVAL, ANY TREES GREATER THAN 3 INCHES IN DIAMETER ARE REQUIRED TO BE REMOVED, CONTACT THE TDOT ENVIRONMENTAL DIVISION ECOLOGY SECTION IMMEDIATELY. DUE TO RECENT MODIFICATION OF THE USFWS STANCE REGARDING THE INDIANA BAT NO TREES >3" DBH SHOULD BE CUT WITHOUT CLEARANCE FROM THE TDOT ENVIRONMENTAL DIVISION ECOLOGY SECTION.

## *PAVEMENT EDGE DROP-OFF TRAFFIC CONTROL*

- A. DIFFERENCE IN ELEVATION BETWEEN ADJACENT TRAFFIC LANES OR TRAFFIC LANE AND SHOULDER WHERE THE TRAFFIC LANE IS BEING USED BY TRAFFIC. CAUSED BY BASE, PAVING OR RESURFACING:
  1. DIFFERENCE IN ELEVATION BETWEEN ADJACENT ROADWAY ELEMENTS GREATER THAN 0.75 INCH AND NOT EXCEEDING 2 INCHES.
    - a. WARNING SIGNS, UNEVEN PAVEMENT (W8-11) AND/OR SHOULDER DROP-OFF (W8-9A), SHALL BE PLACED IN ADVANCE OF AND THROUGHOUT THE EXPOSED AREA. MAXIMUM SPACING BETWEEN SIGNS SHALL BE 2,000 FEET WITH A MINIMUM OF 2 SIGNS PER EXPOSED AREA. WHERE UNEVEN PAVEMENT IS ENCOUNTERED, SIGNS SHALL BE PLACED ON EACH SIDE OF THE ROADWAY.
    - b. DIFFERENCES IN ELEVATION BETWEEN ADJACENT TRAFFIC LANES BEING UTILIZED BY TRAFFIC CAUSED BY ADDED PAVEMENT SHALL BE ELIMINATED WITHIN THREE WORKDAYS.
    - c. DIFFERENCES IN ELEVATION BETWEEN ADJACENT TRAFFIC LANES BEING UTILIZED BY TRAFFIC CAUSED BY COLD PLANING SHALL BE ELIMINATED WITHIN THREE WORKDAYS.
    - d. WHEN THE DIFFERENCE IN ELEVATION IS BETWEEN THE TRAFFIC LANE BEING UTILIZED BY TRAFFIC AND SHOULDER, THE DIFFERENCE IN ELEVATION SHALL BE ELIMINATED WITHIN SEVEN WORKDAYS AFTER THE CONDITION IS CREATED.

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**SPECIAL  
NOTES**

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**SPECIAL NOTES REGARDING**

**HOT IN PLACE RECYCLED ASPHALT- REMIX PROCESS**

**DESCRIPTION:**

This work shall consist of Hot In Place Recycling of the existing bituminous pavement in a continuous multi-step process of heating, scarifying or milling, remixing, blending of the dislodged material with an asphalt rejuvenating agent, spreading, reshaping, leveling, and compacting the asphalt pavement. All work shall be performed in accordance with the Standard and Supplemental Specifications, 407 except as modified herein and in reasonably close conformity to the lines and grades shown on the plans or as directed by the engineer.

**MATERIALS:**

An asphalt rejuvenating agent with 3% polymer (ARA-3P) shall be uniformly dispersed and blended into the hot recycled material at a rate between 0.10 to 0.30 gallons per square yard. The exact rate shall be determined by TDOT based on the in situ volumetrics and/or stiffness of the asphalt pavement. The Contractor shall provide and deliver samples of the proposed ARA-3P to the Regional Lab at least 21 days prior to beginning the work in order for tests to be performed and completed. Submitted samples will also be used to perform verification test on the properties of the material.

The ARA-3P shall be capable of increasing the ductility and lowering the viscosity of the asphalt binder in the existing pavement to be recycled. The ARA-3P shall be composed of a polymer modified asphalt emulsion containing a minimum of 3.0% SBS polymer blended to an asphalt base stock. The polymer modified base stock shall be further blended with process oils and other additives before emulsification to achieve the desired finished product properties.

The Producer/Supplier shall manufacture the ARA-3P in compliance with TDOT Standard Operating Procedure (SOP) 3-2, Certified Supplier Requirements. The manufacture shall issue with each load a manufactures certification and certified weight using TDOT form DT-0293 Emulsion. A unit weight (pounds per gallon) shall be included with each certification.

Material unused in storage tanks shall be transferred into tankers for re-weighing. Certificated weights less reweights shall be comparable to the accumulated gallons used that are provided by the Contractor.

The ARA-3P material shall meet the following requirements;

PROPERTY	METHOD	Min.	Max.
Viscosity @ 25°C, Sec	AASHTO T-59	15	100
Sieve Test, %	AASHTO T-59		0.10
24-Hour Storage Stability, % (Note 1)	AASHTO T-59		1.0
Residue by Distillation, % (Note 2)	AASHTO T-59	60	
Oil Distillate, % by Volume	AASHTO T-59		2.0
Particle Charge	AASHTO T-59		Positive
Pump Stability Test @ 140°F (Note 3)	TM 101	3 Passes	

**TEST ON EMULSION FROM PUMP STABILITY TEST**

Sieve Test, %	ASTM D244	0.10
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**TEST ON RESIDUE FROM DISTILLATION: (Note 2)**

Solubility in TCE, % (Note 4)	ASTM D2042	97.5	
Elastic Recovery @ 4°C, % (Note 5)	AASHTO T-301	58	
Penetration @ 4°C, 100 g, 5 sec, dmm	ASTM D5	60	150
Asphaltenes, % (Note 6)	KT-MR20	25	

Note 1: After standing undisturbed for 24 hours, the surface shall show no white, milky colored substance, but shall be a smooth homogeneous color throughout.  
 Note 2: 1 Use distillation temperature of 350°F with a 20 minute hold.  
 Note 3: TM 101 is identified within these specifications or plan notes.  
 Note 4: ASTM D5546, "Test Method for Solubility of Polymer-Modified Asphalt Materials in 1,1,1-Trichloroethane" may be substituted where polymers block the filter in Method D2042.  
 Note 5: The elongation is 20 cm, the test temperature is 4°C and the relaxation time is 5 minutes.  
 Note 6: KT-MR20 is identified within these specifications or plan notes.

Other ARAs may be submitted for consideration of use in lieu of the above. The request must be in writing and approved by the Engineer. All tests must be completed for certification of material by supplier and test results must accompany delivered material.

**CONSTRUCTION REQUIREMENTS:**

**A. EQUIPMENT**

All equipment necessary for the satisfactory performance of this work shall be on hand and approved prior to the beginning of construction. Processing equipment shall be capable of uniformly heating the existing pavement, homogenously mixing ARA-3P to the scarified or milled recycle material, distributing the mixture uniformly over the width and depth being processed, and finishing and compacting the recycled pavement so as to produce a uniform cross section and surface of the required evenness and texture without tearing, shoving or gouging.

Heating units shall be self-propelled rigid sections of indirect radiant or infrared heaters that will uniformly heat the existing pavement to a temperature sufficient to allow milling, scarifying, or dislodging the material to the specified depth without fracturing the aggregate, burning petroleum distillates in the asphalt binder, subjecting the existing surface to an open flame, or producing undesirable pollutants. An adequate number of self-propelled pre-heating units of sufficient length shall be utilized to comply with these requirements. Pavement sections shall be heated approximately 4 inches beyond the width of scarifying or milling. The heating units shall have enclosed or shielded hoods.

The Contractor may utilize individual multiple pass heating-milling units employing the windrowing process. Tunnel heaters shall be utilized that are capable of heating the underlying pavement while shielding the previously milled material from direct flame.

Milling/Scarifying units shall be capable of uniformly dislodging and removing the heated pavement to the desired depth for a full lane width of 12 feet without fracturing the aggregate. Automatic grade and slope control shall be utilized in this process. The units shall be height adjustable to clear obstructions in the existing pavement. Acceptable means of measurement shall be provided to verify that the desired recycling depth is obtained.

Distribution and blending units shall be a controlled system that is capable of uniformly adding, dispersing, blending, and mixing the ARA-3P at the established rate with the dislodged material either prior to or during remixing. The unit shall be so equipped to enable the contractor to provide documentation of the application rate of the added material(s). The system shall be calibrated and synchronized to the speed of the operation. The quantity of ARA-3P shall be controlled within -0.02 to +0.05 gallons per square yard of surface treated within the given application rate. The blending and mixing system shall consist of a twin shaft pugmill or an on board heated mixing drum capable of providing a uniform mix free of temperature and/or aggregate segregation whose binder content does not vary by more than 0.2% by total weight of the mix transversely across the recycled lane at any

given section. The equipment shall include a devise that will measure and record the accumulated gallons of rejuvenating agent within an accuracy of 2%.

The spreading, leveling and paving unit shall meet the provisions of Standard Specification Subsection 407.06

Compaction of the recycled mat shall be accomplished with rollers that conform to Standard Specification Subsection 407.07.

**B. PREPARATION**

Prior to heating, identified break-out repair shall be completed and the existing surface cleaned of all loose and objectionable material including thermoplastic and markers by blading, brooming, or other methods approved by the Engineer. Extraneous material shall be removed from all potholes and cracks in the existing surface. Any and all unsuitable, unwanted, or clean-out material shall be properly disposed of.

**C. WEATHER LIMITATIONS**

The minimum surface temperature of the pavement prior to heating shall be 45°F and the minimum ambient air temperature shall be 50°F. Work is not permitted during foggy or raining conditions. Unless otherwise permitted in writing, hot in place recycling shall be limited to the period from April 1 to November 30. If a surface treatment is to be applied, the period limitations for the treatment as identified in the Standard Specifications shall apply.

**D. HEATING AND TEMPERATURE REQUIREMENTS**

The entire lane width of the pavement surface being processed shall be uniformly heated with a series of heating units meeting the equipment requirements herein. The heating process shall be conducted utilizing indirect heat in such a manner that the mix is not subject to damage by temperature exposure of excessive intensity or prolonged heat durations. The maximum mix temperature shall not exceed 330°F. The minimum temperature directly behind the screed shall not be less than 190°F and/or at a temperature that will assure that the time available for compaction is achievable. Deductions for failure to meet densities will be applied. An adequate number of self-propelled pre-heating units of sufficient length shall be utilized to comply with these requirements. Pavement sections shall be heated approximately 4 inches beyond the width of scarifying or milling. Traverse temperature differentials behind the screed shall not exceed 25°F.

If requested by the Contractor, the Department may consider the use of Warm Mix Technology and reestablish the mixing and compaction temperatures. The WMA additive shall be compatible with the ARA-3P and shall be on the Departments Qualified Products List.

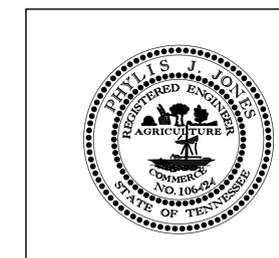
Roadside vegetation protection utilizing a water spray system attached to the heating units shall be provided if deemed necessary by the Engineer.

**E. BLENDING AND REMIXING**

The ARA-3P shall be applied uniformly to the dislodged, milled or scarified existing pavement at a rate of 0.10 to 0.30 gallons per square yard prior to remixing in a pugmill or mixing drum. The exact rate shall be determined by TDOT based on the in situ volumetrics and/or stiffness of the asphalt pavement. The Contractor shall provide and deliver samples of the proposed ARA-3P to the Regional Lab at least 21 days prior to beginning the work in order for tests to be performed and completed. The milled, scarified, or uniformly dislodged existing pavement treated with ARA-3P shall be conveyed into a mixing unit and thoroughly mixed to produce a consistent recycled mix. The ARA-3P shall be added with equipment meeting the requirements identified herein and shall be controlled through metering devices capable of adjusting for the variation of material fed into the mixing unit, the variation time of the mixing cycle, and/or the variation speed of the operation. The Contractor shall provide to the Engineer the accumulated gallons and application rates in gallons per square yard of the applied ARA-3P daily and at any time requested. The metering device(s) shall be calibrated in the presence of a TDOT representative. The Contractor shall provide written certification of the amounts used prior to payment.

Material unused in storage tanks shall be transferred into tankers for re-weighing. Certificated weights less reweights shall be comparable to the accumulated gallons used that are provided by the Contractor.

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**F. SPREADING AND FINISHING**

Unless otherwise specified or permitted, the process shall be limited to daylight hours. The mixture shall be spread and struck off to the established line, grade and elevation by means of approved asphalt paving machine(s). The Contractor shall be required to pave in the direction of traffic. The hot side of any constructed longitudinal joint shall overlap the previously paved lane 4 inches.

Unevenness of texture, segregation, tearing or shoving of the bituminous mixture that occurs during the paving operation, shall be reason to stop the paving until the condition is corrected. Unacceptable mix shall be immediately removed and replaced at the Contractor's expense. Automatic screed controls utilizing either the ski type grade reference system or a non-contact averaging system will be required on all work. Where the ski type system is used, the ski shall have the maximum practical length and in no case shall it be less than 40 ft. (12 m) in length.

**G. COMPACTION AND DENSITY REQUIREMENTS**

Compaction, rollers, density requirements, and test strips shall comply with Standard Specification Subsection 407.15. A minimum of 3 rollers will be required. Density shall be measured with a calibrated nuclear gauge.

The Contractor shall obtain 4 inch diameter cores at locations determined by the Engineer to calibrate the nuclear gauge and determine if the density of the test strip is acceptable. TDOT shall take possession of the samples and deliver them to the Regional Laboratory for testing. Holes formed by extracting samples shall be filled with an approved material and properly compacted. Cutting samples and repairing sample holes shall be at the Contractor's expense.

**H. SURFACE REQUIREMENTS**

The surface shall be tested with a 12 foot straightedge applied parallel to the centerline of the pavement. The deviation of the surface from the testing edge of the straightedge shall not exceed 1/4 inch. The crown in crowned pavements shall be tested with a string-line applied at right angles to the centerline of the pavement and the crown shall not deviate more than 1/2 in. (13 mm) from that specified on the Plans. Deviations greater than the specified tolerances shall be corrected by methods best suited for the purpose. Pavement that cannot be corrected to comply with the specified tolerances shall be removed and replaced at the Contractor's expense.

The plans will indicate if the surface of the recycled pavement is subject to a Smoothness Special Provision.

**I. SURFACE TREATMENTS**

The rejuvenated pavement surface shall be maintained if and until the surface treatment shown in the Plans is completed. The recycled pavement shall be allowed to cure at least 1 week or until the moisture content of the pavement is less than 2.0% before applying the treatment unless otherwise directed by the Engineer. The surface treatment shall be applied within 21 days of completion of the Hot in Place Recycled Asphalt.

**METHOD OF MEASUREMENT:**

Hot in Place Recycled Asphalt will be measured by the square yard complete in place. The length used in computing the area will be measured along the centerline of the work. The width will be that shown on the plans or as designated by the Engineer.

Asphalt Rejuvenating Agent will be measured by the gallon based on the amount of material applied.

**BASIS OF PAYMENT:**

The accepted quantities of Asphalt Rejuvenating Agent complete and applied in place shall be paid for at the contract unit price per gallon for the rate and control specified. Following selection of a rejuvenator application rate by the department, the pay quantity for Asphalt Rejuvenating Agent shall be adjusted by the following:

$$PA = SY \times (APP - 0.15) \times RBP$$

Where:  
PA = Price Adjustment, \$  
SY = Square Yards of project or area to be adjusted

APP = Rejuvenating Agent Application Rate Selected by Department, Gal/yd<sup>2</sup>  
RBP = Bid Price for Rejuvenating Agent, \$/Gal

The accepted quantities of Hot in Place Recycled Asphalt complete in place shall be paid for at the contract unit price per square yard for the depth specified. Such payment shall be full compensation for any additional materials, labor, equipment and incidentals necessary for the proper performance of the work and to meet the provisions of this specification.

A deduction in payment, not as a penalty but as liquidated damages, shall be made for failure to meet the density requirements. As soon as practical after the final rolling is completed on each lot, 5 density tests shall be performed by the Department at locations determined by the Engineer, and an average of all such tests shall be computed. Any deduction for failure to meet density requirements shall be computed to the nearest 0.1% as a percentage of the total payment otherwise due for each lot. The percent of total payment to be deducted shall be 5 times the percent the average in-place density for each lot that fails to meet the requirements of Standard Specification Subsection 407.15. Any deduction in monies due the Contractor for failure to meet the Density Requirements shall be made under the item for Density Deduction.

**Resistance of Emulsions to Shear Induced Degradation**  
**TM 101**

**Scope:**

This test procedure measures the propensity for an asphalt emulsion to incur shear induced degradation as a result of being pumped or circulated by means of a positive displacement gear pump. A representative sample of emulsion, after being pre-sieved [#20 mesh, according to ASTM D-244] and conditioned to 60° C, is subjected to three pumping cycles. Afterward, the emulsion is tested according to ASTM D-244 for Sieve. Any emulsion which, after being subjected to the required number of pumping cycles, exhibits degradation in the form of sieve exceeding 0.050%, shall be considered suspect and will be rejected.

**Apparatus:**

Viking Model F-432 Gear Pump, driven at 500 +/- 10 rpm by Dayton 1/3 h.p. electric motor; metal inlet and outlet lines to and from the pump; numerous plastic containers [either 1/2 gal. or 1 gal.] for transfer/collection of material being pumped.

**Procedure:**

- [1] Condition approximately 1500g of previously sieved [per ASTM D-244] asphalt emulsion to 60 ±1° C. in a sealed container inside a laboratory oven or water bath [held at less than 100° C].
- [2] Flush the pump assembly with approximately 2 liters of heated [50-60° C] water or, preferably, compatible emulsifier solution.

[3] Place the inlet line of the pump assembly into the 60° C emulsion. The first 400 ml. [approximately] of material out of the outlet line of the pump shall be discarded [on the first cycle only], with the remaining emulsion caught in a clean plastic container. The container of pumped emulsion shall be immediately transferred to the pump inlet line and the procedure repeated using clean 'catch containers' until the requisite number of cycles has been completed.

[4] The emulsified asphalt sample shall then be tested for sieve in accordance with ASTM D-244. If conditions warrant, Saybolt Furol viscosity can also be evaluated before and after pumping.  
**KTMR-20 CHEMICAL ANALYSIS OF ASPHALT REJUVENATING AGENTS (Kansas Central Lab Test KT-MR-20)**

**a. SCOPE**

This method is used to determine the composition of petroleum oils and asphalts in terms of: Asphaltenes Content, Polar Compounds Content, First Acidaffins Content, and Saturated Compounds Content. In addition, Second Acidaffins Content and the Maltene Ratio are calculated.

**b. DEFINITIONS**

**b.1. Asphaltenes Content:** That portion of the material not soluble in pentane.

- b.2. Polar Compounds Content:** That portion of the material soluble in pentane and that reacts with cold 85% (of concentrated) sulfuric acid.
- b.3. First Acidiffins Content:** That portion of the material that is soluble in pentane and that reacts with cold concentrated sulfuric acid.
- b.4. Second Acidiffins Content:** That portion of the material that is soluble in pentane and reacts with cold fuming sulfuric acid. (This is a calculated quantity)
- b.5. Saturated Compounds Content:** That portion of the material that is soluble in pentane and does not react with cold fuming sulfuric acid.
- b.6. Maltene Ratio:** Strictly a calculated quantity.

**c. REFERENCED DOCUMENTS**

**c.1. AASHTO M 231:** Weighing Devices Used in the Testing of Materials

**PROCEDURE 1: ASPHALTENE CONTENT**

**a. APPARATUS**

- a.1.** (2) 125 Erlenmeyer flask with ground glass stopper fitting and stopper
- a.2.** Pentane, technical grade
- a.3.** Toluene, analytical reagent grade
- a.4.** 50 mL graduated cylinder
- a.5.** (2) 15 mL Gooch crucible with filter
- a.6.** (2) Walter crucible holder
- a.7.** (2) 250 mL side arm vacuum flask
- a.8.** Regulated vacuum source with gauge and hoses
- a.9.** (2) Wash bottles for solvents
- a.10.** (2) Crystallizing dish
- a.11.** 60 mL separatory funnel
- a.12.** Lab stand with ring
- a.13.** Hot plate with adjustable temperature control
- a.14.** Laboratory vent hood
- a.15.** Weighing device in accordance with AASHTO M 231 Class A
- a.16.** Oven capable of maintaining 221 +/- 9 °F.

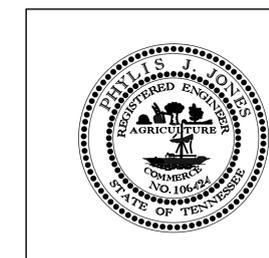
**b. SAMPLE PREPARATION**

**b.1.** This determination is made on as received material from the asphalt subsection, where the material is reduced.

**c. PROCEDURE**

- c.1.** Duplicate determinations of this procedure are required.
- c.2.** Place a clean and dry 125 mL Erlenmeyer flask with ground glass stopper fitting onto a tared analytical balance. Record the mass of the flask to the nearest 0.1 mg. Dispense into the flask 1.0 +/- 0.1 g of the as received ARA material. Record the mass of the flask plus sample to the nearest 0.1 mg.
- c.2.a.** Calculate the mass of the sample by subtracting the mass of the flask from the mass of the flask plus sample.
- c.3.** Using a 50 mL graduated cylinder add 50 +/- 5 mL of tech grade pentane. Stopper the flask and swirl until the sample appears to be completely dissolved.
- c.3.a.** Allow the flask to stand undisturbed for a minimum of 15 hours.
- c.4.** Place a 21 mm fiber glass filter into the bottom of a 15 mL Gooch crucible.
- c.4.a.** Take a 30 mm fiberglass filter and evenly tuck it into the same crucible to form a bowl shaped reservoir in the bottom of the crucible.
- c.4.b.** Place the crucible into a Walter crucible holder that is set into a 250 mL vacuum flask connected to a regulated vacuum source with a gauge. Turn the vacuum on, and run 20 +/- 5 mL of pentane through the crucible filter.
- c.4.c.** Turn off the vacuum and place crucible into a drying oven set at 105 +/- 5°C for 30 +/- 5 minutes. Remove crucible from oven and allow to cool to room temperature in a dessicator. When cooled weigh and record the mass of the crucible to the nearest 0.1 mg.
- c.5** Transfer the contents of one of the flasks into a 60 mL separatory funnel. Rinse the sample flask into the funnel using pentane dispensed from a wash bottle.
- c.5.a.** Save the sample flask for use in step **c.12** of this procedure.

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**c.6.** Set up the apparatus as shown in Figure 1. Adjust the vacuum source so it will deliver a maximum vacuum of 10 inches of mercury.  
**c.7.** Place the Gooch crucible in the holder , turn on the vacuum and slightly open the valve on the separatory funnel allowing the solution to drip onto the filter in the crucible. Adjust the flow rate so that the solution level does not exceed the top edge of the filter in the crucible. Adjust flow as needed as asphaltene builds up on the filter.  
**c.8.** Once the separatory funnel is empty, rinse it into the crucible twice using 10 +/- 2 mL of pentane. Rinse the inside of the crucible with 15 +/- 2 mL of pentane, being sure not to disturb the asphaltene residue held up on the filter.a + b

**NOTE a:** Save the separatory funnel to be used later in section **c.12.** of the method.  
**NOTE b:** Save the filtrate in the vacuum flask for use in another section of KTMR-20. One of the duplicates will be used in Polar Compounds Content and the other in Saturates Content.

**c.9** Shut the vacuum off and remove the crucible from the holder and place it in a 105°C drying oven for 15 +/- 2 minutes. Remove the crucible from the oven and allow it to cool to room temperature in a dessicator.  
**c.10** When the crucible has cooled to room temperature, weigh back and record the mass of the crucible and its contents to 0.1 mg.  
**c.11** Tare, weigh and record the mass of a clean, dry 60 mL crystallizing dish to 0.1 mg.  
**c.12** Retrieve the separatory funnel, the sample flask, and any other items such as stir rods, that may have come into contact with the sample solution before filtering. Rinse each item twice using 10 +/- 2 mL of toluene capturing the rinse solvent in the crystallizing dish.  
**c.13** Place the dish on a hot plate inside a vent hood and allow the solvent to evaporate without ever coming to a boil. When it is apparent that the solvent has been driven off, place the dish into a drying oven at 105°C for 15+/- 2 minutes. Remove and allow to cool in a dessicator.  
**c.14** Once cooled to room temperature, weigh back and record the mass of the dish and its contained residue to 0.1 mg.

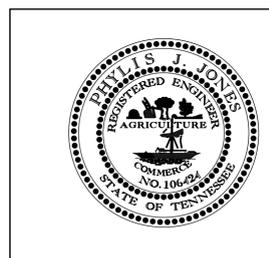
**a. CALCULATIONS**

**d.1** Asphaltene Content,  $wt/wt\% = ((C+D)/M)100\%$

Where: C = (crucible + residue) - (tare mass of crucible), in grams  
D = (dish + residue) - (tare mass of dish), in grams  
M = sample mass, in gram

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**SPECIAL NOTES  
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