STATE OF CALIFORNIA-CALIFORNIA STATE TRANSPORTATION AGENCY EDMUND G. BROWN Jr., Governor

DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
OFFICE ENGINEER
1727 30th Street MS-43
P.O. BOX 168041
SACRAMENTO, CA 95816-8041
FAX (916) 227-6214
www.dot.ca.gov/hq/esc/oe

Serious Drought.
Help save water!

May 1, 2014

11-SD-76-24.1/34.9
11-2M6304
Project ID 1113000094

Addendum No. 2

Dear Contractor:

This addendum is being issued to the contract for CONSTRUCTION ON STATE HIGHWAY IN SAN DIEGO COUNTY NEAR PALA AND PAUMA VALLEY FROM PALA MISSION ROAD TO 2.0 MILES WEST OF RED GATE ROAD.

Submit bids for this work with the understanding and full consideration of this addendum. The revisions declared in this addendum are an essential part of the contract.

Bids for this work will be opened on Thursday, May 15, 2014.

This addendum is being issued to revise the *Notice to Bidders and Special Provisions*.

In the Special Provisions, Section 30-4, "COLD IN-PLACE RECYCLING," is replaced as attached.

In the Special Provisions, Section 30-6, "PAVEMENT RECYCLING WITH INTELLIGENT COMPACTION," is replaced as attached.

In the Special Provisions, Section 39-1.03B, "Hot Mix Asphalt Design," is added as follows.

"Add to section 39-1.03B:

Determine the OBC for RHMA-G at 4.0 percent air voids under California Test 367. The OBC must be greater than or equal to 7.5 percent based on the total weight of mix."

To *Bid* book holders:

Inquiries or questions in regard to this addendum must be communicated as a bidder inquiry and must be made as noted in the *Notice to Bidders* section of the *Notice to Bidders and Special Provisions*.

Indicate receipt of this addendum by filling in the number of this addendum in the space provided on the signature page of the *Bid* book.

11-SD-76-24.1/34.9
11-2M6304
Project ID 1113000094

Submit bids in the *Bid* book you now possess. Holders who have already mailed their book will be contacted to arrange for the return of their book.

Inform subcontractors and suppliers as necessary.

This addendum and attachments are available for the Contractors' download on the Web site:

http://www.dot.ca.gov/hq/esc/oe/project_ads_addenda/11/11-2M6304

If you are not a *Bid* book holder, but request a book to bid on this project, you must comply with the requirements of this letter before submitting your bid.

Sincerely,

for LAURIE BERMAN
District Director

Attachments

Replace section 30-4 with:

30-4 COLD IN-PLACE RECYCLING

30-4.01 GENERAL

30-4.01A Summary

Section 30-4 includes specifications for constructing the pavement using cold in-place recycling (CIR).

CIR consists of:

1. Cold planing the existing asphalt concrete pavement to the depth shown
2. Mixing the cold-planed material with an emulsified recycling agent (ERA) and cement
3. Spreading and compacting the mixture
4. Applying asphaltic emulsion and sand cover

30-4.01B Definitions

lot: 3000 sq yd or fraction thereof of CIR pavement constructed in the same day.

break-over point: Maximum density of the CIR section achieved when nuclear density tests do not show an increase in density after additional compaction passes.

30-4.01C Submittals

30-4.01C(1) General

At least 20 days before starting CIR work, submit the following:

1. QC Plan
2. Mix Design
3. Contingency Plan

Contingency plan must include actions you will take to ensure the roadway will be open to traffic at the end of each work shift. The contingency plan must include provisions for constructing a temporary structural section and reopening the roadway to traffic.

30-4.01C(2) Quality Control Plan

The QC plan must describe the organization, responsible parties, and procedures you will use to perform the following:

1. Control quality including sampling, testing, and reporting
2. Determine action limits when corrective actions are needed
3. Implement corrective actions
4. Ensure CIR cold planing, mixing, placing, compacting and finishing activities are coordinated

The QC plan must contain copies of the forms that will be used to provide the required inspection records and sampling and testing results.

The QC plan must include the name of your authorized laboratory.

If QC procedures, personnel, tester qualifications, or lab accreditation status change, submit a QC plan supplement at least 3 business days before implementing proposed changes.

30-4.01C(3) Mix Design

Submit separate mix designs based on RAP material qualities for each location shown on the following table:

Mix Design	
Location No.	Post mile to post mile
1	24.1 to 34.9

For each CIR mix design, submit:

1. Mix design documentation on the *Contractor Cold in Place Recycling Mix Design form*, including all raw test data and calculations. The mix design submittal must be signed and sealed by an engineer who is registered as a civil engineer in the State.
2. JMF on the *Contractor Cold in Place Recycling Job Mix Formula form*
3. MSDS for:
   3.1. Emulsified recycling agent
   3.2. Cement:
   3.3. Rejuvenator (if applicable)
4. Process for incorporating cement to be used into the CIR mixture.

30-4.01C(4) Quality Control Reporting

For each lot, submit a report daily that includes the following items:

1. General Information:
   1.1. Lot number
   1.2. Location description
   1.3. Beginning and ending station
   1.4. Lane number and offset from centerline
   1.5. Temperature:
      1.5.1.Ambient air temperature before beginning daily CIR activities including time of temperature reading
      1.5.2.Road surface temperatures before beginning daily CIR activities including time of temperature reading
2. For ERA:
   2.1. Weight in tons
   2.2. Percentage by weight of dry RAP
3. For cement:
   3.1 Application rate by lb/sqyd, if you spread cement directly to the existing pavement, take surface area measurements to calculate applied spread rate and submit with the quantity of cement used, area covered, and certified weight tickets.
   3.2 Total weight in tons
   3.3. Percentage by weight of dry RAP
4. Water application rate by theoretical percent dry weight of CIR from the controller
5. For CIR processing:
   5.1. Length, width, depth of cut at each end of the milling drum at least every 300 feet along the cut length
   5.2. Average forward speed
   5.3. Calculated weight in tons of material processed
   5.4. Break-over point density used for relative compaction calculation
6. Straightedge measurement locations and the following:
   6.1 Variance measured from the lower edge of a 12-foot straightedge placed parallel with the centerline
   6.2 Variance measured from the lower edge of a 12-foot straightedge placed transverse

7. CIR quality control test results for:
   7.1. Wet field gradation for material passing the 1-inch, 3/4-inch, and No. 4 sieves
   7.2. In-place wet density
   7.3. Relative compaction
8. For asphaltic emulsion used on finished CIR surface:
   8.1. Emulsion type
   8.2. Emulsion application rate in gal/sqyd
   8.3. Emulsion dilution as the weight ratio of added water to asphaltic emulsion
9. Rate of sand cover application
10. Note on the daily report postmile or station limits of any:
    10.1 Changes to ERA application rate, including application rate change and reasons for change
    10.2 Changes to water application rate, including application rate change and reasons for change
    10.3 Unsuitable materials locations and when the Engineer was notified

Update each day's submitted report within 24 hours of obtaining test results. Consolidate all of the lots completed in a day onto one report with each lot reported separately.

For each test strip, and days production submit your break over density results on the *Contractors Establishment of Break Over Density form.*

During CIR activities, submit the following items daily

1. Square yards recycled.
2. Tons ERA utilized.
3. Tons ERA to be carried over to next production day.
4. Tons cement utilized and spread rate.
5. Tons cement to be carried over to next production day.

30-4.01C(5) Certificates

Submit certificates of compliance for the cement and ERA with each delivery. Include the manufacturer's test results for the ERA with your certificate of compliance. The test results must be from material tested within 30 days prior to delivery.

Submit a certified copy of each delivery's weight for ERA, cement, asphaltic emulsion, and sand.

30-4.01C(6) Asphaltic Emulsion

Each time you dilute the asphaltic emulsion, submit:

1. Weight ratio of water to bituminous material in the original asphaltic emulsion
2. Weight of asphaltic emulsion before diluting
3. Weight of added water
4. Final dilution weight ratio of water to asphaltic emulsion

30-4.01D Quality Control and Assurance

30-4.01D(1) General

Provide a testing laboratory and personnel for quality control testing. The laboratory for testing and preparing the mix design and JMF must be qualified under AASHTO Materials Reference Laboratory program and the Department's Independent Assurance Program. Testing personnel for QC must be qualified under the Department's Independent Assurance Program.

If you adjust the application rate of CIR components, record the adjustments and document the reasons for the adjustments in your daily submittal to the Engineer.

30-4.01D(2) Quality Control Plan

The QC plan must describe the organization and procedures for:

1. Controlling CIR quality characteristics
2. Obtaining samples, including sampling locations
3. Establishing, implementing, and maintaining QC
4. Determining when corrective actions are needed
5. Implementing corrective actions
6. Taking samples, including location of sampling

The QC plan must address the elements affecting CIR quality including:

1. RAP
2. Emulsified recycling agent
3. Cement
4. Production
5. Paving
6. Compaction
7. Smoothness

The Engineer reviews the QC plan within 5 business days from the submittal. Do not start CIR production until the Engineer authorizes the plan.

If a change is needed in your QC plan, do not implement the change without authorization.

For any lot including the test strip, stop CIR activities and immediately notify the Engineer whenever any test result does not comply with the requirements shown in the table titled "Quality Control Requirements" in section 30-4.01D(4), or your quality control plan. If CIR activities are stopped for noncompliance, before resuming activities:

1. Notify the Engineer of the adjustments you will make
2. Reprocess, remedy, or replace the noncompliant lot

30-4.01D(3) Prepaving Conference

At least 10 days before starting CIR activities, Meet with the Engineer at a prepaving conference at a mutually agreed time and place. Discuss the QC plan and the methods of performing production and placement.

The following personnel must attend the prepaving conference:

1. Project manager
2. Project superintendent
3. QC manager
4. Workers and your subcontractor's workers, including:
   4.1. Foremen
   4.2. Ground supervisors
   4.3. Representative from testing lab
   4.4. Representative from the ERA supplier

30-4.01D(4) Quality Control Sampling and Testing

30-4.01D(4)(a) General

Take samples under California Test 125.

During CIR activities, take two 0.5-gal samples of ERA from each load delivered to the job site in the presence of the Engineer. Use 1 sample for QC testing and submit 1 sample to the Engineer.

Store ERA samples in clean, dry, and sealed 0.5-gal plastic containers at a temperature between 40 to 100 degrees F.

30-4.01D(4)(b) Test Strip

On the 1st day of CIR activities and within the pavement area to receive CIR, construct a test strip. The test strip must be a single lane width and at least 1,500 feet in length. The test strip must show:

1. How the equipment, materials, and processes proposed can produce and place the CIR mixture
2. How varying the forward speed and drum rotation rate of the cold-planing machine affect the consistency of the mixture
3. Optimum rates for ERA, cement, and water
4. Rolling pattern needed to reach the break-over point
5. Application rates of asphaltic emulsion and sand cover

Document the rolling pattern on *Contractors Establishment of Break Over Density form.*

The Engineer evaluates the test strip under section 30-4.01D(5). For smoothness, only the straightedge requirements apply for test strip authorization. Retest the test strip smoothness under section 30-4.01D(4)(b). Rework and recompact or remove and replace test strip if it does not comply with the specifications. Do not proceed with CIR activities until the Engineer notifies you that the test strip is authorized.

After curing is completed per Section 30-4.03G, recompact the test strip and determine what rolling pattern will establish a new break-over point. Document the supplemental rolling pattern on *Contractors Establishment of Break Over Density form.* Use this rolling pattern during supplemental compaction.

30-4.01D(4)(c) Quality Control Testing

For emulsified recycling agent, the testing laboratory must perform quality control sampling and testing at the specified frequency and location for the following quality characteristics:

Emulsified Recycling Agent Quality Control Requirements

Property	Test method	Minimum sampling and testing frequency	Requirement		Sampling Location	Maximum reporting time allowance
			Minimum	Maximum		
Test on emulsion:						
Sieve test, % of weight sample	AASHTO T 59	Each tanker load	--	0.1	Tanker	10 business days
Residue by evaporation, %	California Test 330		63	67		
Test on residue by evaporation:						
Penetration at 25 °C, 100 g/ 5 sec	AASHTO T 49	Each tanker load	40	120	Tanker	10 business days
Ductility at 25 °C and 50 mm/minute, mm	AASHTO T 51		400	--		
Creep stiffness, Test temperature, °C max S-value, MPa min M-value	AASHTO T 313		Note a			

[a]Must comply with the requirements for the PG binder specified.

Perform sampling and testing as at the specified frequency and location for the following quality characteristics:

Quality Control Requirements

Quality Characteristic	Test method	Minimum sampling and testing frequency	Requirement	Sampling location	Maximum reporting time allowance
Water sulfates[a] (ppm, max)	California Test 417	1 per source	1,300	Source	Before work starts
Water chlorides[a] (ppm, max)	California Test 422	1 per source	650	Source	
Wet gradation (% passing) Sieve Size 1 inch	California Test 202	Test strip and 1 per lot	100	Loose RAP before adding ERA	24 hours
Wet field gradation (% passing) Sieve size 1-inch 3/4-inch No. 4	California Test 202	Test strip and every 3rd lot	Report only		5 business days
Dry gradation (% passing) Sieve size 1-inch 3/4-inch No. 4 No. 30 No. 200	California Test 202	Test strip and 1 per day	Report only		
Air voids %[d]	California Test 308	Test strip and 2 per day	Report only		
Theoretical maximum density[d]	California Test 309	Test strip and 2 per day	Report only		
Relative compaction[b,c] (%, min)	California Test 375	Test strip and 2 per lot	95	Compacted mix	24 hours

[a]Only required for non-potable water sources.
[b]The relative compaction is based on the break-over point.
[c]Verify break over density once per day of production
[d]Take and split a sample of the loose RAP and CIR mixture daily at a location determined by the Engineer. Split the RAP and CIR samples into 2 parts and label the containers with location and station. Submit 1 split part and use 1 part for your testing. Determine maximum theoretical density of the CIR sample under California Test 309. Use the maximum theoretical density and calculate air voids under California Test 308 for each compaction test site and the average of the lot. Report air voids ratio on daily quality control inspection records. The Department does not use your California Test 309 test results and air voids to determine specification compliance.

30-4.01D(4)(d) Smoothness

Straightedge and record surface smoothness at least once every 1000 feet along the cut length.

Stop milling activities and immediately inform the Engineer whenever:

1. Variance of more than 0.03 foot measured from the lower edge of a 12-foot straightedge placed parallel with the centerline
2. Transverse slope variance of more than 0.02 foot measured from the lower edge of a 12-foot straightedge
3. Visual inspection shows evidence of
   3.1. Raveling
   3.2 Loose material
   3.3. Non-uniform surface texture

After completing CIR activities, determine surface smoothness under section 39-1.12.

Correct MRI greater than 75 in/mi for a 0.1-mile section and areas of localized roughness greater than 140 in/mi.

The final HMA surface MRI must be 60 in/mi or less for each 0.1-mile section.

30-4.01D(5) Acceptance Criteria

The Engineer samples materials for testing under California Test 125 and tests under the applicable test method.

CIR acceptance is based on:

1. Visual inspection for the following:
   1.1. Segregation, raveling, rutting, humps, depressions, roller marks, and loose material.
   1.2. Uniform surface texture throughout the work limits.
2. Compliance with smoothness requirements under 30-4.01D(4)(b).
3. For ERA acceptance is based on the Department's sampling and testing for compliance with the requirements for the quality characteristics shown in table in 30-4.02E.
4. Compliance with quality characteristics of the following table:

Quality Characteristic	Test method	Requirement	Sampling location
Wet gradation (% passing) Sieve Size 1 inch	California Test 202	100	Loose RAP before adding ERA
Dry gradation (% passing) Sieve size 1-inch 3/4-inch No. 4 No. 30 No. 200	California Test 202	Report only	
Relative compaction (%, min)	California Test 375[a]	95	Compacted mix

Notes:

[a] In-place density and relative compaction under California Test 375 except the break-over point is used instead of maximum density under California Test 216. Relative compaction of each individual location must be greater than or equal to 95 percent and less than or equal to 105 percent of the break-over point obtained in the test strip. The average relative compaction must be greater than or equal to 97 percent or less than or equal to 103 percent of the break-over point in the test strip.

If the Engineer orders you to stop CIR activities for noncompliance, before resuming activities:

1. Notify the Engineer of the adjustments you will make
2. Reprocess, remedy, or replace the noncompliant lot
4. Obtain the Engineer's authorization

30-4.01D(6) Dispute Resolution

You and the Engineer must work together to avoid potential conflicts and to resolve disputes regarding test result and visual inspection discrepancies. Notify the Engineer within 5 business days of receiving a test result if you dispute the test result.

If you or the Engineer dispute each other's test results, submit quality control test results and copies of paperwork including worksheets used to determine the disputed test results. An independent third party (ITP) performs referee testing. Before the ITP participates in a dispute resolution, the ITP must be qualified under AASHTO Materials Reference Laboratory program (AMRL), and the Department's Independent Assurance Program. The ITP must be independent of the project. By mutual agreement, the ITP for referee testing is chosen from:

1. A Department laboratory
2. A Department laboratory in a district or region not in the district or region the project is located
3. The Transportation Laboratory
4. A laboratory not currently employed by you or your CIR producer

If split QC or acceptance samples are not available, the ITP uses any available material representing the disputed CIR for evaluation.

If you or the Engineer dispute each other's visual inspection findings, submit copies of your visual inspection findings. An independent third party (ITP) consisting of a Department expert and a CIR industry or Academia expert will perform a joint visual inspection. The ITP must be independent of the project. The ITP is chosen by mutual agreement.

30-4.02 MATERIALS

30-4.02A General

A summary of existing material investigations is available in the *Information Handout* as supplemental project information.

30-4.02B Water

If a water source other than potable water is used, test water for chlorides and sulfates.

30-4.02C Cement

Cement must comply with section 90-1.02B(2).

30-4.02D Reclaimed Asphalt Pavement

Cold plane existing asphalt pavement and process to produce RAP. RAP must be processed by mechanical means to pass the 1-inch sieve.

Separate RAP larger than 1 inch by screenings or other means and dispose of or reprocess RAP larger than 1-inch.

30-4.02E Emulsified Recycling Agent

Use PG 64-16 as the asphalt binder in the ERA.

The ERA must comply with the values shown in the following table:

Emulsified Recycling Agent Requirements

Property	Test method	Requirement	
		Minimum	Maximum
Test on emulsion:			
Sieve test, % of weight sample	AASHTO T 59	--	0.1
Residue by evaporation, %	California Test 330	63	67
Test on residue by evaporation:			
Penetration at 25 °C, 100 g/ 5 sec	AASHTO T 49	40	120
Ductility at 25 °C and 50 mm/minute, mm	AASHTO T 51	400	--
Creep stiffness, Test temperature, °C max S-value, MPa min M-value	AASHTO T 313	Note a	

[a]Comply the requirements for the PG binder specified.

30-4.02F CIR Mix Design

The mix design must include RAP from the job site, ERA, cement, and water.

The mix design must comply with Lab Procedure LP-8 and the requirements shown in the following table:

Mix Design Requirements

Quality Characteristic	Test Method	Requirement
RAP asphalt content, %	ASTM D 2172, Method B	Report only
Bulk specific gravity of compacted samples[a, b]	AASHTO T 275	Report only
Maximum theoretical specific gravity[b]	AASHTO T 209	Report only
Air voids of compacted and cured specimens[b], %	AASHTO T 269	Report only
Marshall Stability, cured specimen[b] at 104 °F, lbs min	AASHTO T 245	1250
Marshall retained stability[b, c] at 104 °F based on moisture conditioning on cured specimen, % min	AASHTO T 245	70
Ratio of emulsion residue to cement	--	3.0
Raveling test at 50 °F, % max	Lab Procedure LP-8, Section 9	7
RAP coating Test, %	AASHTO T 59	95

[a]-inch diameter mold compaction based on gyratory compactor at 30 gyrations.
[b]Test specimens after 140 °F curing to constant weight between 16 hours and 48 hours.
[c]Vacuum saturation from 55 percent to 75 percent. Water bath at 77 °F for 23 hours, with the last 30 minutes to 40 minutes in 104 °F water bath.
[d]If the saturated Marshall Stability is at least 1500 lbs, the Marshall Retained Stability ratio may be reduced to 60 percent.

Cement must be at least 0.25 but not more than 1.0 percent of the dry weight of RAP.

You may add water to facilitate mixing ERA and RAP uniformly. The added water must not exceed 4.0 percent by weight of the dry RAP. Do not reduce the amount of ERA due to the added water.

If additional mix designs are required, their design and submittal are change order work.

30-4.02G Temporary Structural Section

Use HMA Type A to construct a temporary structural section.

The HMA Type A for the temporary structural section must include:

1. 1/2-inch aggregate grading as specified in section 39-1.02E
2. Asphalt binder grade PG 64-10, PG 64-16, or the binder grade specified for the HMA layer on the CIR surface
3. Method construction process as specified in section 39-3

The bituminous material for the temporary structural section must:

1. Contain aggregate using 1/2-inch HMA grading as specified in section 39-1.02E
2. Use liquid asphalt, Grade SC-800

30-4.02H Asphaltic Emulsion

Asphaltic emulsion must be Grade SS1h or Grade CSS1h. If ERA meets the specification requirements for Grade SS1h or Grade CSS1h emulsion, it may be used as the asphaltic emulsion.

Notify the Engineer if you dilute the asphaltic emulsion with water. The ratio by weight of added water to asphaltic emulsion must not exceed 1 to 1.

Measure added water weight.

30-4.02I Sand Cover

Sand used for sand cover must comply with the material specifications for fine aggregate in section 90-1.02C. Sand must not contain more than 2 percent moisture by dry weight of sand.

30-4.03 CONSTRUCTION

30-4.03A General

Do not disturb or damage the underlying materials during cold-planing activities. Do not use a heating device to soften the pavement.

Before starting CIR activities, provide 200 tons of commercial quality bituminous surfacing material onsite for maintenance and protection of the completed CIR surface. Use liquid asphalt SC-800 in compliance with section 93 for the commercial quality bituminous surfacing material.

Use the same equipment, materials, rolling pattern and construction methods that were used for the authorized test strip for the remainder of the CIR work. Any adjustments must be authorized.

If the equipment or process fail to meet the specifications, stop CIR activities and notify the Engineer.

30-4.03B Surface Preparation

Before starting CIR activities, prepare the existing roadway by:

1. Removing loose material from the roadway width including:
   1.1. Dirt.
   1.2. Vegetation.
   1.3. Standing water.
   1.4. Combustible materials.
   1.5. Oils.
   1.6. Pavement markers and underlying adhesive.
2. Accurately referencing the existing pavement's profile and cross slope. Use the profile and cross slope to establish the CIR finished surface.
3. Accurately marking the proposed longitudinal cut lines on the existing roadway surface.

30-4.03C Cold In-place Recycling Equipment

30-4.03C(1) General

The equipment for CIR must consist of recycling train for:

1. Cold planing
2. Pulverizing, crushing, or sizing
3. Mixing and proportioning
4. Water storage and supply
5. Cement storage and supply
6. Cement mixing and spreading
7. CIR mixture spreading
8. Compacting
9. Applying asphaltic emulsion to the surface
10. Spreading sand cover

Use equipment that:

1. Cold planes, crushes, and sizes the existing asphalt pavement
2. Mixes the RAP with the ERA and cement into a homogeneous and uniformly coated mixture
3. Places the CIR mixture to the lines, grades, and specifications

Pulverizing, crushing, or sizing equipment must produce uniform material to the specified size before mixing RAP with ERA.

30-4.03C(2) Cold-Planing Equipment

The cold-planing machine must:

1. Be self-propelled
2. Have a 12-foot minimum wide cutter that can remove the existing pavement to the specified depths
3. Be equipped with automatic depth and cross slope controls capable of maintaining the cutting depth to within 0.25 inch of the specified depth

A cold-planing machine with a cutter narrower than 12 feet wide may be used for shoulders and miscellaneous areas.

30-4.03C(3) Mixing Chamber or Pugmill

Provide a continuous mixing chamber or pugmill mixing machine as part of the recycle train with either a belt scale or an integrated microprocessor control system to control:

1. RAP delivered to the mixing chamber or pugmill
2. Amount of ERA being delivered

Equip the mixing chamber or pugmill with paddles or other suitable mixing device arranged to mix the RAP, ERA, and cement to produce the specified CIR mixture. Feed RAP from the pulverizing, crushing, or sizing equipment to the mixer at a uniform and controlled rate.

The paver's loading equipment must pick up the CIR mixture and deposit it in the paving machine without waste. If the paving screed is directly attached to the CIR equipment, feed the CIR mixture directly to the paving screed.

30-4.03C(4) Mixing and Proportioning Equipment

30-4.03C(4)(a) General

Use a mass flow, Coriolis effect type meter with a visible readout display and printing capabilities.

The weighing and measuring devices for the ERA and cement must comply with the requirements of the MPQP. You may use equipment that has successfully passed the calibration requirements of MPQP within the past 6 months.

30-4.03C(4)(b) Cement Continuous Mixing Equipment

For continuous mixing of cement slurry, the proportioning device must be capable of determining the exact ratio of water to dry cement at each production rate.

Rate-of-flow indicators and totalizers for similar materials must be accurate within 0.5 percent of each other.

The cement continuous mixing equipment must include:

1. Belt scale for weighing cement. The belt scale must operate between 30 to 100 percent of production capacity. The average difference between the indicated and actual material weight must not exceed 0.5 percent of the actual material weight for 3 individual runs. For each run, the indicated weight must not vary from the actual material weight by more than 1 percent of the actual weight. Test for belt scale accuracy must be for at least 0.5 tons of cement. Actual material weight must be verified on a certified scale.
2. Water meter for measuring water used in cement slurry. The meter must operate between 50 to 100 percent of production capacity. The average difference between the indicated and actual water weight must not exceed 1 percent of the actual weight for 3 individual runs. Test for water meter accuracy must be for at least 300 gallons of water.

Meters and scales must be equipped with:

1. Rate-of-flow indicators that show the delivery rates of cement and water
2. Resettable totalizers that indicate the total amount of cement and water introduced into the slurry storage tank

Feeds for water and cement must be equipped with no-flow devices that stop slurry production when the individual ingredients are not being delivered to the cement slurry storage tank.

30-4.03C(4)(c) Cement Batch Mixing Equipment

For batch-type mixing of cement slurry, the proportioning equipment must include:

1. Certified weight scale.
2. Water meter equipped with a resettable totalizer. Test for water meter accuracy must be for at least 300 gallons of water.

If an automatic controller is used to batch the cement, the controller must also control the water proportioning.

If an automatic controller is used to proportion the water, the indicated draft of the water must be within 1 percent of its total draft weight.

The meter must operate between 50 to 100 percent of production capacity. The average difference between the indicated and actual water weight must not exceed 1 percent of the actual weight for 3 individual runs.

30-4.03C(5) Water Storage and Supply Equipment

As part of the recycle train, provide an independent supplemental water source separate from the water added to the mill to cool the teeth. Interlock the supplemental water with the RAP weighing device or microprocessor to properly disperse the ERA.

The water source for the ERA must be independent of the cement slurry and be capable of maintaining a consistent water supply of 0.5 to 4.0 percent by weight of the RAP.

30-4.03C(6) Cement Storage and Supply Equipment

Provide cement slurry storage and supply equipment with agitators or similar equipment to keep the cement slurry in suspension while held in the slurry feed tank.

If cement is spread dry to the existing pavement, use a spreader capable of spreading the cement at the required weight per unit area. The spreader must have working scales and distance measuring devices to control the spread rate.

30-4.02C(7) Spreading Equipment

Spreading equipment must comply with section 39-1.10.

30-4.03C(8) Compacting Equipment

Compacting equipment must comply with sections 39-1.10 and 39-3.03. Provide a minimum of 1 pneumatic-tired roller weighing at least 25 tons and 1 double drum vibratory steel-wheeled roller weighing at least 10 tons. Rollers must be at least 5.5 foot wide. Each roller must have a working water spray system.

30-4.03D Cold In-Place Recycling

30-4.03D(1) General

Do not perform CIR activities under the following conditions:

1. Pavement surface is wet.
2. Rain is forecasted within 24 hour.
3. Pavement temperature is less than 60 degrees F.
4. Ambient temperature is less than 50 degrees F.
5. 30 minutes before sunset.

Do not leave gaps of unrecycled material between successive cuts along the same longitudinal cut line. Do not leave untreated wedges created by the entry of the milling drum into the existing pavement. Longitudinal joints between successive cuts must overlap by 4 inches minimum.

30-4.03D(2) Unsuitable Conditions

If you encounter unsuitable subgrade material you will:

1. Notify and meet with the Engineer immediately.
2. Clearly define the unsuitable material areas and depth.
3. Excavate and dispose of any unsuitable subgrade material encountered.
4. Unless otherwise ordered, backfill the excavated area with Class 2 AB as specified in section 26.
5. Submit within 24 hours of defining unsuitable material the following:
   - 5.1 Unsuitable areas including station or postmile, length, width, depth and centerline offset
   - 5.2 Remediation taken, including quantities of materials used.

Top the Class 2 AB with HMA Type A or a premixed bituminous material equivalent in thickness to the existing asphalt concrete layer adjacent to the excavation. If premixed bituminous material is used, remove and replace it with HMA Type A prior to placing final surfacing. Place HMA in layers and compact until the level of the CIR surface is reached.

Excavating and disposing of unsuitable material and replacing with AB and surfacing material is change order work.

30-4.03D(3) Cement

Add the cement into the recycling process by one of the following methods:

1. Add at the mill head as a slurry
2. Add directly in the pugmill as a slurry
3. Spread on the existing pavement surface ahead of the recycling train in a dry form

If you spread the cement directly to the existing pavement, do not spread more than 50 feet ahead of the recycling train. Do not spread under windy conditions and employ dust control measures to minimize fugitive dust.

Do not allow spread cement to remain exposed at the end of the work shift. Do not allow traffic other than the recycling equipment to pass over the spread cement.

30-4.03D(4) Proportioning

Using the mass flow, Coriolis effect type meter, measure the cement slurry and ERA before adding them into the RAP. The amount of cement slurry and ERA must match the amount reported in the JMF or the amount as adjusted and authorized.

Keep cement slurry in suspension during transport using agitator equipment. Keep dry cement in dry cement spreader trucks, pneumatic trailers, or silos.

30-4.03D(5) Spreading and Initial Compacting

Remove any visible oversized crack treatment material larger than 1 inch measured at any dimension in the RAP or in the CIR mixture before placement and compaction.

Do not allow segregation, tearing, or scarring of the compacted surface.

Determine the time interval between spreading and compacting CIR mixture. Establish the time interval based on ambient temperatures, weather, and type of ERA. Record the time intervals in the daily quality control records. Avoid starting or stopping rolling on uncompacted material.

Compact the CIR mixture by implementing the same compaction rolling pattern established in the authorized test strip.

Establish a new rolling pattern and a new maximum density if any of the following occurs:

1. Relative compaction of any of the 10 individual locations is less than 95 percent of the break-over point density
2. Average relative compaction of the lot is less than 95 percent of the break-over point density
3. Changes in RAP or proportions
4. Changes in equipment or procedures
5. Change in temperature or weather conditions affecting mixing and compaction temperatures of the placed mixture
6. Visible displacement or cracking occurs

Perform final rolling with a double-drum vibratory steel-wheel roller operating in static or vibratory mode.

The compacted CIR surface must be free from raveling, segregation, rutting, humps, depressions, roller marks, or irregularities. Rework, recompact, or remove and replace CIR that shows raveling, segregation, rutting, humps, depressions, roller marks, or irregularities.

30-4.03E Asphaltic Emulsion and Sand Cover

After initial compaction and before opening the CIR surface to traffic, apply a coat of asphaltic emulsion followed by sand cover to the CIR surface. Apply asphaltic emulsion and sand cover under section 37-2.03F(5).

Remove excess sand from the pavement surface by sweeping before opening to traffic.

30-4.03F Temporary Structural Section

Place a temporary structural section to the level of the CIR surface if:

1. You are unable to complete the CIR before opening to roadway to traffic
2. CIR fails during the maintaining period by raveling or rutting

If a bituminous material is used, remove and replace it with HMA Type A. Place HMA in layers and compact until the level of the CIR surface is reached.

30-4.03G Maintain, Cure and Protect Surface

Do not recompact the CIR or place the HMA layer until the CIR surface is in place for at least one of the following conditions:

1. 3 days and until less than 2.0 percent moisture is measured at mid-depth of the CIR pavement
2. 10 days without rainfall

Immediately repair any damage or defects by:

1. Reworking and recompacting the CIR surface
2. Replacing any damaged area with the same depth of cold bituminous surfacing material or HMA

30-4.03H Supplemental Compaction

Recompact the CIR surface:

1. After curing is completed per Section 30-4.03G
2. Before smoothness testing
3. Before placing the HMA surfacing

Use the same equipment and rolling pattern used for recompacting the authorized test strip. Adjustments must be authorized.

30-4.04 PAYMENT

Test strips are paid for as CIR.

The Department does not adjust the unit price for an increase or decrease in the quantity for:

1. Cement (cold in-place recycling)
2. Emulsified recycling agent (cold in-place recycling)
3. Asphaltic emulsion (cold in-place recycling)
4. Sand cover (cold in-place recycling)

Replace section 30-6 with:

30-6.01 PAVEMENT RECYCLING WITH INTELLIGENT COMPACTION

30-6.01A GENERAL

30-6.01A(1) Summary

This is a pilot project for evaluating intelligent compaction and the Department will not consider a VECP that substitutes the processes or equipment specified in this section 30-6.

Section 30-6 includes specifications for compaction of cold in-place recycling (CIR) utilizing intelligent compaction. Intelligent compaction uses vibratory steel drum rollers or static pneumatic tire roller equipped with intelligent compaction measurement devices that produce data for standardized software Veda. For Veda, go to Use Veda to analyze the data for coverage uniformity and intelligent compaction measurement values.

Intelligent compaction does not waive any specifications for CIR.

Create project layout files for the intelligent compaction system from project plans.

30-6.01A(2) Definitions

All passes data: intelligent compaction data that contain measurements from all passes

California Coordinate System of 1983 (CCS83): A set of 6 geographic zones or coordinate systems designed for specific regions of the State of California, the boundaries of which follow county lines. CCS83 is based on NAD83. When a project crosses state plane zone boundaries, a single zone will be used for the entire project.

Coordinated Universal Time (UTC): A time measurement system commonly referred to as Greenwich Mean Time (GMT) based on a 24-hour time scale from the mean solar time at the Earth's prime meridian (zero degrees longitude) located near Greenwich, England

Coverage: Roller single pass over a given area

Final Coverage: Intelligent compaction data that contain the last pass measurements for a given area

Foot: Unit of measurement equal to U.S. survey foot.

Geodetic Coordinates: A coordinate system to describe a position in longitude, latitude, and altitude above the imaginary ellipsoid surface based on a specific geodetic datum. The NAD83 datum is required for use with CCS83 State Plane Coordinates.

Global Positioning System (GPS): A space-based satellite navigation system that provides location and time information in all weather, anywhere on or near the Earth to determine the location in geodetic coordinates. GPS refers to all GPS-related signals including US GPS, and other Global Navigation Satellite Systems (GNSS). GPS satellite signals are subject to interference from canyons, buildings, trees or even fencing. Not all locations are suitable for GPS techniques, and it is your responsibility to determine if the site conditions are practical for GPS, and to notify the Engineer if they are not.

GPS Base Station: A single ground-based system consisting of a GPS receiver, GPS antenna, and telemetry equipment (typically radio and radio antenna or cellular phone) to provide L1/L2 differential GPS correction signals to other GPS receivers.

GPS Rover: A portable L1/L2 GPS antenna, mount, and receiver with telemetry equipment for Real Time in-situ point measurements.

GPS Correction Service Subscription: A service that can be subscribed to receive differential GPS correction signals for higher accuracy GPS positioning without the need of a GPS Base Station. Signals are normally received via cellular wireless data services. Examples of GPS correction service subscriptions are: Trimble VRS™, Leica Smart RTK™, Topcon TopNet™ or OmniSTAR™.

GPS Site Calibration or Localization: A process to establish a relationship between the observed GPS coordinates and the known grid coordinates.

Grid: A Cartesian system of XY (or North-East) coordinates utilizing the California State Plane Coordinates, known as the California Coordinate System of 1983 (CCS 83).

Intelligent Compaction Data: data collected by intelligent compaction equipment

Intelligent Compaction Measurement Value: A generic term for all intelligent compaction measurements in units specific to the roller manufacturer.

Intelligent Compaction Equipment: Measurement devices installed by the roller manufacturer or a reseller including accelerometer, GPS, temperature sensor, and displays.

Network Real Time Kinematic (Network RTK): A system of multiple bases in real-time to provide high-accuracy GPS positioning within the coverage area that is generally larger than that covered by a single GPS base station.

Real Time Kinematic Global Positioning System (RTK-GPS): A system based on the use of carrier phase measurements of the available GPS signals where a single GPS base station or RTK network provides the corrections in order to achieve centimeter-level accuracy in real time.

30-6.01A(3) Submittals

30-6.01A(3)(a) General

Not Used

30-6.01A(3)(b) Mapping Existing Pavement

At least 10 days before sampling for mix designs for CIR, submit color layouts of intelligent compaction measurement value for the existing pavement determined by mapping the existing pavement under section 30-6.01C(3). Use an interval length of 100 feet.

30-6.01A(3)(c) Just In Time Training

Submit a list of names participating in the JITT training at the time of the mix design submittal. Identify each participant's name, employer, title, and role in intelligent compaction.

30-6.01A(3)(d) GPS Site Calibration or Localization Report and Check Testing

Submit GPS site calibration or localization report and check testing results for intelligent compaction rollers within 1 business day of calibration, localization or check testing.

30-6.01A(3)(e) Data and Software Analysis Results

30-6.01A(3)(e)(i) General

Within 1 business day of compaction work, submit:

1. Intelligent compaction data from rollers in file format readable by Veda
2. Hardcopy and Adobe .pdf file of the compaction quality control report from data analysis performed using Veda software.
3. Post processed Veda data file *.icp used for creating the CIR compaction quality control report

For each test strip submit:

1. Test strip data including:
    1.1. Nuclear gage density per location
    1.2. GPS measured coordinates per location
2. All passes compaction curves from Veda
3. All passes correlation analysis report from Veda

30-6.01A(3)(e)(ii) Data

Submit intelligent compaction information and data elements using Veda. You may combine roller data for multiple rollers operating in echelon into a section file.

Name the intelligent compaction data file using:

YYYYMMDD_TTCCCRRR_D_L_B_E_RT_TC_T_Data

where:
YYYY = year
MM = Month, leading zero
DD = Day of month, leading zero
TT = District, leading zero
CCC = County, 2 or 3 letter abbreviation as shown in section 1-1.08
RRR = Route number, no leading zeros
D = Traffic direction as NB, SB, WB, or EB
L = Lane number from left to right in direction of travel
B = Beginning station to the nearest foot (i.e., 10+20) or beginning post mile to the nearest hundredth (i.e., 25.06) with no leading zero
E = Ending station to the nearest foot (i.e., 14+20) or ending post mile to the nearest hundredth (i.e., 28.06) with no leading zero
RT = CIR
TC= Type of compaction "I" for initial compaction, "S" for supplemental compaction
T= Type of roller "R" for rubber tire, "S" for steel drum

Use the following header information for each intelligent compaction data file or section:

Item No.	Description
1	Section Title
2	Machine Manufacture
3	Machine Type
4	Machine Model
5	Drum Width (inch)
6	Drum Diameter (inch)
7	Machine Weight (ton)
8	Name index of intelligent compaction measurement values
9	Unit index for intelligent compaction measurement values
10	Reporting resolution for independent intelligent compaction measurement values – 90 degrees to the roller moving direction (inch)
11	Reporting resolution for independent intelligent compaction measurement values – in the roller moving direction (inch)
12	CCS83 Zone
13	Offset to UTC (hrs)
14	Number of intelligent compaction data points

Use the following data field names for each intelligent compaction data point:

Item No.	Data Field Name	Example of Data
1	Date Stamp (YYYYMMDD)	20080701
2	Time Stamp (HHMMSS.SS -military format)	090504.00 (9 hr 5 min. 4.00 s.)
3	Longitude (decimal degrees or degrees-minutes-	94.85920403
4	Latitude (decimal degrees or degrees-minutes-	45.22777335
5	Easting (foot)	6,096,666.000
6	Northing (foot)	1,524,166.650
7	Elevation (foot)	339.9450
8	Roller pass number	2
9	Direction index	1 forward, 2 reverse
10	Roller speed (mph)	2.0
11	Vibration on	1 for yes, 2 for no
12	Frequency (vpm)	3500.0
13	Amplitude (inch)	0.0236
14	Intelligent compaction measurement values	20.0

Note: Provide either items 3 and 4 or items 5 and 6

The GPS coordinate for each intelligent compaction data point recorded in data files must be at the center of the drum.

The size of the data mesh after post processing must be less than 1.5 feet by 1.5 feet in the X and Y directions.

30-6.01A(3)(d)(iii) Software Analysis Results

Analyze the intelligent compaction data daily using Veda and include nuclear gage data points, target values for passes and intelligent compaction measurement values. For a fixed interval report use an interval length of 100 feet.

For each day of production at the end of initial compaction, prepare an intelligent compaction quality control report that includes:

1. Each roller final coverage histogram of number of passes and when steel drum roller with vibratory on is used, include histogram of intelligent compaction measurement value
2. Each roller final coverage histogram of number of passes for a fixed interval, and when steel drum roller with vibratory on is used, include histogram of intelligent compaction measurement value for a fixed interval.
3. All passes histogram for each roller
4. Color layout plots of roller passes for each roller
5. Color layout plots of intelligent compaction measurement value for steel drum roller with vibratory on

For supplemental compaction, prepare an intelligent compaction report that includes:

1. Each roller final coverage histogram of number of passes and when steel drum roller with vibratory on is used, include histogram of intelligent compaction measurement value
2. Each roller final coverage histogram of number of passes for a fixed interval, and when steel drum roller with vibratory on is used, include histogram of intelligent compaction measurement value for a fixed interval.
3. All passes histogram for each roller
4. Color layout plots of roller passes for each roller
5. Color layout plots of intelligent compaction measurement value for steel drum roller with vibratory on

Plots must be scaled to be legible and must be 11 by 17 inches. Plots must include quality control density testing locations and results.

Name the post processed Veda data file using:

YYYYMMDD_TTCCCRRR_D_L_B_E_RT_TC_T_Veda

where:
YYYY = year
MM = Month, leading zero
DD = Day of month, leading zero
TT = District, leading zero
CCC = County, 2 or 3 letter abbreviation as shown in section 1-1.08
RRR = Route number, no leading zeros
D = Traffic direction as NB, SB, WB, or EB
L = Lane number from left to right in direction of travel
B = Beginning station to the nearest foot (i.e., 10+20) or beginning post mile to the nearest hundredth (i.e., 25.06) no leading zero
E = Ending station to the nearest foot (i.e., 14+20) or ending post mile to the nearest hundredth (i.e., 28.06) with no leading zero
RT = CIR
TC= Type of compaction "I" for initial compaction, "S" for supplemental compaction
T= Type of roller "R" for rubber tire, "S" for steel drum

30-6.01A(4) Quality Assurance

30-6.01A(4)(a) General

Not Used

30-6.01A(4)(b) Technical Representative

A technical representative from the intelligent compaction equipments manufacturer or reseller must be on site during the initial setup and verification testing of the intelligent compaction rollers and the first 2 days of CIR production. If requested, the technical representative must assist the Engineer with data management using Veda including intelligent compaction data input and processing.

30-6.01A(4)(c) Just In Time Training

Provide just-in-time training onsite or near the project site for your personnel and Department project personnel. Schedule the just-in-time training with the Engineer at a mutually agreed time and place. Provide training materials for 4 Department personnel. Provide an enclosed facility with electrical power for visual presentations.

Just-in-time training must be at least 4 hours in duration and include the following topics:

1. Background information for the specific intelligent compaction systems to be used
2. Setup and checks for intelligent compaction systems including:
    - 2.1. GPS receiver
    - 2.2. GPS base station
    - 2.3. GPS rovers
    - 2.4. Rollers
3. Operation of the intelligent compaction system on the rollers including:
    - 3.1. Setup data collection
    - 3.2. Start/stop of data recording
    - 3.3. On-board display options
4. Transferring raw intelligent compaction data from the rollers using USB connections
5. Operation of vendor's software to open and view raw intelligent compaction data files and to export all-passes and proofing data files in Veda-compatible format

6. Operation of Veda software to:
    6.1. Import the exported all-passes and proofing data files
    6.2. Inspect the intelligent compaction maps
    6.3. Input point test data
    6.4. Perform statistical analysis
    6.5. Produce reports for project requirements
7. Coverage and uniformity requirements
8. Method for establishing target intelligent compaction measurement values for stiffness

The following personnel must attend just in time training:

1. Project manager
2. Superintendent
3. Technical representative for intelligent compaction rollers
4. Intelligent compaction quality control technicians
5. Roller operators

30-6.01A(4)(d) Quality Control

30-6.01A(4)(d)(i) General

Quality control for intelligent compaction must document that the number of roller passes comply with the test strip determinations.

The number of roller passes and intelligent compaction measurement values are report only and not used for compaction acceptance.

30-6.01A(4)(d)(ii) Quality Control Technician

During compaction, provide a quality control technician responsible full time for:

1. GPS site calibration or localization and upload to GPS receivers
2. GPS check testing for the intelligent compaction rollers and rovers
3. During test strip construction, determining the target number for intelligent compaction roller passes and target values for intelligent compaction measurement values
4. Construction operation monitoring of the intelligent compaction rollers
5. Quality control testing for compaction
6. Backing up intelligent compaction data twice per day
7. Downloading data from rollers at the end of the work shift
8. On a daily basis, analyzing the data from the intelligent compaction rollers using Veda and producing a daily compaction quality control report
9. Monitoring the final evaluation
10. Daily set-up, take-down, and secure storage of GPS and intelligent compaction roller components

30-6.01A(4)(d)(iii) IC Test Strips

On the first day of CIR production and within a 500 foot portion of the test strip specified in section 30-4.01D(4)(b), generate data correlating intelligent compaction measurement values to measured density as follows:

1. After each coverage by each roller, use a nuclear gauge to measure the density at 10 randomly selected locations and uniformly spaced throughout the 500 foot section. Record the density readings, number of roller passes, and the GPS coordinates for each test location
2. Establish the break over point for the test strip by averaging the density of the 10 locations for each coverage.
3. After reaching break over point density, use an intelligent compaction vibratory steel drum roller to make a final coverage with vibration on set at a low amplitude. Use a nuclear gage to measure the density at 10 randomly selected locations and uniformly spaced throughout the 500 foot section. Record the density and the intelligent compaction measurement values. Either of the following may apply based on the density test results:

3.1 If the final coverage produces an increase in density above the break point density, continue rolling with steel drum roller with vibration on until a new break over point density is determined. Use this new break over point density for production. Use pneumatic tire rollers to repair any damage caused by the intelligent compaction vibratory steel drum roller.

3.2 If the final coverage produces a reduction in the compaction below the break point density:

3.2.1 The requirement of maximum density will be waived on the 500 foot portion of the test strip.

3.2.2. Use pneumatic tire rollers to repair any damage caused by the final single pass of the intelligent compaction vibratory steel drum roller.

4. Use Veda to create a compaction curve that relates the final coverage of intelligent compaction roller passes to the intelligent compaction measurement values.

On all other test strips, correlating intelligent compaction measurement values to measure nuclear gage density is not required.

30-6.01B MATERIALS

Not Used

30-6.01C CONSTRUCTION

30-6.01C(1) General

Before CIR production, upload the project plan file into the intelligent compaction data analysis software and depending on the roller manufacturer, the on-board intelligent compaction computer.

30-6.01C(2) Equipment

30-6.01C(2)(a) General

Use intelligent compaction rollers for initial and supplemental compaction.

30-6.01C(2)(b) Intelligent Compaction Rollers

In addition to the requirements in section 30, intelligent compaction rollers must be self-propelled double-drum vibratory steel rollers or self-propelled pneumatic tire rollers.

Self-propelled double-drum vibratory steel rollers must meet the following:

1. Be equipped with intelligent compaction equipment including accelerometers mounted in or about the drum to measure the interaction between the rollers and compacted materials in order to evaluate the applied compactive effort.
2. With vibratory on, produce output that represents the stiffness of the material based on the vibration of the roller drums and the measured response from the underlying materials.
3. Have GPS radio and receiver units mounted on each intelligent compaction roller to monitor the steel drum roller locations and track the number of passes of the rollers
4. Include an integrated on-board documentation system that is capable of displaying real-time color-coded maps, including the stiffness response values, vibration frequencies, roller drum amplitude, roller location, number of roller passes, and roller speeds.
5. Have a display unit capable of transferring data from a USB port.

Self-propelled pneumatic tire rollers must meet the following:

1. Be equipped with intelligent compaction equipment excluding accelerometers.
2. Have GPS radio and receiver units mounted on each intelligent compaction roller to monitor the roller locations and track the number of passes of the rollers.
3. Include an integrated on-board documentation system that is capable of displaying real-time color-coded maps of roller location, number of roller passes, and roller speeds,
4. Have a display unit capable of transferring data from a USB port.

30-6.01C(2)(c) Global Positioning System

GPS must be real time kinematic using one of the following:

1. GPS base station
2. Network real time kinematic (RTK)
3. Satellite-based augmentation station system capable of providing position accuracy within 2 centimeters

GPS devices for this project must be set to the same consistent datum, coordinate system, CCS83 zone, and site calibration or localization. The CCS83 zone must be set to zone no. 6.

30-6.01C(2)(d) Correction Signal Source

Provide either a GPS base station correction signal or a GPS correction service subscription. The GPS correction signal must be received by the GPS receivers on the intelligent compaction roller and the rovers during operations with a survey tolerance of not greater than 0.15 foot in both X and Y horizontal directions.

30-6.01C(2)(e) GPS Site Calibration or Localization and Check Testing

At least 2 days before the start of production, perform a GPS site calibration or localization to the survey control points indicated on the Project Control Map in the project plans. Perform a GPS site calibration or localization whenever the GPS base station is moved to a new location.

Before the start of daily production and using the same datum, conduct testing for the proper setup of the GPS, intelligent compaction rollers and the GPS rover:

1. On a location nearby or within the project limits, the GPS base station, if required by the GPS, must be established and the intelligent compaction roller and the GPS rover tied into the same base station
2. Verify that the roller and rover are working properly and that there is a connection with the base station
3. Verify the intelligent compaction roller GPS coordinates by:
    - 3.1. Stopping the intelligent compaction roller at a location
    - 3.2. Marking the location of both ends of the roller drum on the surface with a tee
    - 3.3. Recording the GPS measurements from the IC roller ensuring the distance offsets are applied so that the GPS coordinate is at the center of the front drum
    - 3.4. Moving the intelligent compaction roller from the marked location
    - 3.5. Finding the mid-point of the 2 marked ends of the roller and mark this location on the surface. This marked location is the theoretical center of the front drum.
    - 3.6. Using the GPS rover to measure GPS coordinates of the marked location and record the GPS measurements
    - 3.7. Computing the difference between recorded intelligent compaction roller GPS coordinates and GPS rover recorded GPS measured coordinates. The differences of the coordinates in grid must be within 0.50 foot in both the horizontal axes X and Y

30-6.01C(3) Mapping Existing Pavement

Before CIR, map the existing pavement with a vibratory steel drum roller with intelligent compaction equipment. Use low vibration amplitude and the same settings, including speed and frequency, throughout the section.

30-6.01C(4) Compacting

During compaction, monitor each roller's intelligent compaction graphical user interface display for roller passes and intelligent compaction measurement values.

Use GPS rover to measure coordinates of each quality control nuclear gage reading.

30-6.01C(5) Roller Coverage

For a lot, at least 90 percent of the area must meet or exceed the number of passes for each roller type determined from the test strip for that area. When the daily compaction quality control report shows the specified roller passes are not met, take corrective action and notify the Engineer of action taken.

30-6.01D PAYMENT

Not Used