COLD IN-PLACE RECYCLING
CONSTRUCTION INSPECTION GUIDELINES

May 2003
Cold In-Place Recycling Construction Inspection Guidelines

Introduction

Cold in-place recycling (CIPR) is a continuous multi-step process in which the existing asphalt pavement is recycled using specialized equipment identified in the Department’s Approved List. This equipment cold mills the asphaltic pavement and blends asphalt emulsion and aggregate (if necessary) with the reclaimed material. Adding emulsion and aggregate improves the strength and durability of the reclaimed material. The recycled asphalt mix is then placed onto the existing milled roadway using conventional paving equipment and compacted using vibratory and pneumatic tire rollers. Once cured, all CIPR projects are overlaid.

CIPR is used as a pavement rehabilitation treatment and should only be used on roads with good pavement structure and no drainage problems. This treatment will rehabilitate surface distresses such as minor rutting, cracking, and raveling. CIPR can make corrections to the cross-slope. This treatment should not be used if the existing pavement has fatigue cracks or severe rutting.

A recycling depth of 75 or 100 mm is used depending on the depth of the existing pavement. A minimum of 25 mm of existing asphalt should remain above the underlying subbase or portland cement concrete (PCC) pavement for both the mainline and shoulders. Milling the existing underlying subbase material or PCC could significantly change the emulsion content and decrease pavement performance. Asphalt shoulders should be recycled at the same time as the mainline if they meet the pavement condition and minimum thickness requirements.

CIPR takes a minimum of 7 days to cure. At intersections with heavy truck traffic, CIPR should be stopped at least 150 meters before the intersection to prevent shoving. Additional information can be found in Chapter 5 of the Comprehensive Pavement Design Manual.

NOTE: CIPR relies on field quality control (QC) and quality assurance (QA) inspection. These guidelines outline some typical communication, construction and inspection practices for CIPR. Since some inspection items are not easily quantified, immediate and effective communication between the CIPR Contractor and Engineer can be critical to the perceived success or failure of a project. Contact the Regional Materials Engineer for assistance whenever concerns are not readily resolved.

Preconstruction Meeting

Attendance - It is required that all recycling projects begin with a meeting. This meeting should be held at least one week in advance of paving operations. The following people should attend:

- Engineer and Inspectors
- Contractor including CIPR Crew Supervisor/Foreman
- Regional Materials Engineer or designee
- Pavement Marking Subcontractor (if applicable)
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The Engineer should arrange for written minutes to be taken for the record and then distribute these minutes appropriately. Individuals attending the Preconstruction meeting should be at the project site the first day of production, before paving operations begin. Meeting attendees are responsible for relaying the information covered and agreed to at the Preconstruction meeting with the paving Crew and Inspectors.

Topics for Discussion

1. Maintenance and Protection of Traffic (M&PT) - M&PT is not always the responsibility of the Contractor. On OGS Maintenance Contracts, M&PT will sometimes be done by the Residencies. Refer to the contract to determine who is responsible for M&PT.
   - Contractor submits M&PT plan for approval, if responsible for M&PT.
   - Identify what equipment is needed - channelizing devices, radios, traffic cones, etc.
   - Verify Flagger locations in the M&PT plan. Additional cones and a flag tree are required at each Flagger station.
   - Temporary rumble strips are required at the beginning of the project in each direction of travel.

2. Traffic Flow:
   - Determine how traffic control procedures will be handled at specific locations (such as major intersections).
   - Discuss local business, resident and public facility considerations or conflicts that might affect traffic (e.g., a school closing, maintaining access to businesses).
   - Discuss considerations for non-motorized users such as cyclists and pedestrians.
   - Determine how supply trucks will enter and exit.
   - Determine a procedure for giving emergency vehicles the right-of-way.

3. Signs:
   - Discuss permanent and temporary signs required at the project site.
   - Discuss “Do Not Pass” sign installations.

4. Variable Message Signs (if applicable):
   - Discuss schedule and availability in Residency and Region.
   - Discuss who will arrange for their placement.

5. Lane closure time restrictions as detailed in the contract documents.
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- Pilot Vehicle and Driver (optional) - Determine if a pilot vehicle is required in the contract documents and who is responsible for providing a vehicle, the Engineer or Contractor. A sign stating “Pilot Vehicle” is required on the back of the vehicle. Any vehicle used as a pilot vehicle will have all hazard lights working including a beacon light.

- Temporary Pavement Markings - Discuss what type of material will be used for temporary pavement markings. Maintaining proper pavement delineators/markings is part of the M&PT responsibilities and includes correcting displaced markings when using material such as preformed temporary tape.

2. Safety - Review safety requirements.

3. Responsibilities and Authority - The Engineer and Contractor should discuss the responsibilities and authority of all individuals involved with the project. Identifying the “chains of command” and who has the authority to make or approve particular changes will reduce delays when questions, changes, or other issues arise during construction.

4. Scheduling - The Contractor will submit a schedule for the Engineer’s approval. Discuss how delays caused by weather conditions, equipment breakdowns, etc. will be handled to maintain the project schedule. Also, discuss the anticipated daily production rate. Determine how residents, local businesses, and emergency services will be notified of the paving schedule. The Contractor may elect to assist the Engineer in notifying the public of project schedule.

5. Materials:

- Aggregate - All aggregate used in CIPR will be supplied by an aggregate quarry identified in the Department’s Approved List, Sources of Fine and Coarse Aggregate.

- Emulsion - The emulsion used must be from a source identified in the Approved List under Bituminous Materials Primary Sources for Asphalt Emulsion (Anionic and Cationic). Remind the Contractor that an original BR 162c, Bituminous Material Certified Shipment Notice must be given to the inspector for each delivery of emulsion and that samples of emulsion will be taken and tested for specification compliance.

- Water - The Contractor must provide the name of the water source to be used in the CIPR. Municipal water supplies are acceptable sources. Other sources may be sampled and tested for acceptance according to Construction, Material Delivery Inspection 4. Water, in these guidelines and specification 712-01, Water.

- Additive - The Contractor must receive written approval from the Director, Materials Bureau prior to using any additives.
6. Mix Design

- Approval - Every CIPR project requires an approved mix design. No CIPR will be performed until the Engineer has received a copy of the approved mix design and anticipated production emulsion rate. The Contractor is responsible for submitting the anticipated production emulsion rate to the Engineer. The production emulsion rate may be lower than the design emulsion rate. If the mix design is not part of the contract documents, the Contractor is responsible for submitting the mix design to the Region Materials Engineer for approval. Once the mix design is approved, the Contractor is responsible for submitting the approved mix design to the Engineer.

- Quality Control (QC) Sample Submission - Discuss the Contractor’s ability to meet the specified time requirement for submitting QC sample test results. The CIPR specification requires the Contractor to take samples from their recycled mix to be tested for gradation and asphalt content. These test results are used to verify that the mix conforms to the approved mix design.

For the samples taken on the first day of production, the Contractor is to submit their test results before the end of the next workday. However, due to the remote location of some of these projects, the Contractor may not be able to provide these test results in the time required. The Engineer may agree to an alternate time schedule if the Contractor cannot provide test results within this time allowance. As part of this agreement the Engineer may also require additional QC samples be taken and tested.

7. Equipment - The Contractor will provide:

- A list of equipment, including serial numbers, to be used in production. Check the Department’s Approved List to verify that the CIPR equipment is identified. If the Contractor wants to use equipment not identified on the Approved List, they need to submit a written request for approval to the Director, Materials Bureau, at least 30 days before the start of work.

- Current calibration approvals for the bituminous meters. If the calibration date exceeds 90 days, the bituminous meters will need to be re-calibrated. These meters may be a separate unit or attached to either the Profiler/Miller or Pugmill/Paver units.

-Profiler/Miller units for the Type II Trains are identified in the Department’s Approved List. Profiler/miller equipment is not listed for Type I Trains. These units will be evaluated at the project, by the Engineer, for conformance to Section 490, Cold Milling, 2.01, Equipment of the Standard Specification.

-Crusher/Screen Deck units for Type I Trains are identified in the Department’s Approved List.
- **Pugmill/Paver units**, if used, are identified in the Department’s Approved List. These units contain bituminous meters and must be calibrated prior to production. Standard paver units are not listed. These units will be evaluated by the Engineer for conformance to Section 402, Hot Mix Asphalt (HMA) Pavements, 3.02, HMA Pavers of the Standard Specification.

- **Vibratory and Pneumatic Tire Roller units**. All vibratory rollers are identified in the Department’s Approved List. The pneumatic tire roller must have a minimum weight or ground contact pressure as detailed in the specification.

- **Steel Wheel Tandem Roller**, must have a minimum weight as detailed in the specification. A vibratory roller operating in the static mode may be used in its place.

8. **Shoulder Millings and Excess Material** - Determine who is responsible for removing and hauling unsuitable shoulder material and any excess material resulting from the recycling operation. The Engineer will determine if unsuitable material in the shoulders needs to be milled out. This material will be removed from the shoulder, a minimum of 0.6 meters in width by 75 or 100 mm deep, using a milling machine.

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**Construction**

On the first day of production, the Engineer will arrange an informal meeting with the paving Crew and Inspectors to discuss what was covered and agreed to at the Preconstruction meeting. Individuals that attended the Preconstruction meeting should be present.

**Mix Design** - Review the approved mix design, to ensure only the component materials listed are being used and to verify the proper quantities of material are used during production. Any material not listed on the approved mix design will require the approval of the Director, Materials Bureau.

**Material Delivery Inspection**

1. **Aggregate** - The Contractor must submit delivery tickets from the aggregate supplier identifying the supplier’s source number, location, and quantity delivered.

   - **Aggregate Gradation** - Two QC gradation test results from the aggregate stockpile will be supplied by the Contractor. Each test result must be from separate samples taken from the stockpile. Verify these gradation results meet the type identified on the approved mix design by using the Standard Specifications, Table 501-2 for Type CA2 or Table 703-4 for the No. 2 size designation.

   - Notify the Regional Materials office if aggregate Quality Assurance (QA) samples are needed.
2. Emulsion - Review the BR162c forms for each emulsion delivery to the project. Check to ensure the primary source and type of emulsion are the same as listed on the approved mix design. Sample and submit at least one emulsion sample per Contract in accordance to Materials Method (MM) 8.2, Asphalt Emulsion - Quality Assurance. Contact the Regional Materials Engineer for assistance, if needed.

3. Additive (optional) - The proportion and amount of additive, if any, used in production must be identified in the mix design.

4. Water - Check the water source for acceptability. Municipal water supplies are acceptable sources. Obtain a three-liter sample of water from questionable sources, as determined by the Regional Director or designated representative. Submit the sample with a BR 240, Sample and Acceptance Transmittal form to the Materials Bureau to be tested for compliance to specification 712-01 for its chemical properties.

Equipment

1. Check equipment for cleanliness, and that all parts are working properly.

2. Verify serial numbers on CIPR equipment are on the Approved List.

3. The Contractor must provide the number of rollers agreed to at the Preconstruction meeting. Verify the Manufacturer and Model number on the vibratory compaction equipment are on the Approved List. If the Contract or uses a pneumatic tire roller less than the specified minimum weight then verify the ground contact pressure (GCP) meets the minimum GCP requirement in the specification. Contact the Regional Materials Engineer for assistance if needed.

Daily Inspection

1. Weather Limitations - The Weather and Seasonal Limitations are detailed in the specification for CIPR. CIPR cannot be applied if there is a possibility of the temperature falling below freezing within 24 hours. If there is concern regarding weather conditions, the Contractor and Engineer should discuss the possibility of rescheduling.

2. Application of Product - Notify the Contractor immediately if problems with the CIPR application are observed. The Contractor is responsible for correcting problems.
   - Aggregate - Check aggregate delivery tickets, to verify the aggregate supplied is from the approved source and meets stone size designation listed on the mix design.
   - Add Stone Rate - Calculate the add stone rate, kg/m² and compare to the mix design. Discuss significant differences from the mix design with the Contractor.
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- Emulsion Rate - Calculate the emulsion rate, L/m² and compare to the mix design. Discuss significant differences from the mix design with the Contractor.

- Placement - The CIPR mix will be placed into a windrow or discharged into a bituminous paver. Bituminous pavers will be equipped with a minimum 9.1 meter moving reference. This material will be spread in a uniform layer to produce the specified thickness, cross-slope, and surface tolerance once compacted. Except for unavoidable delay or breakdown, milling and placement of the recycled mix will be done at a rate sufficient to provide continuous operation of the paving machine. If recycling operations results in excessive stops, as determined by the Engineer, suspend paving operations until the Contractor can correct the problem.

- CIPR Mixture - Visually check that the mixture is homogeneous, with no segregation. If a problem with the mixture is observed, inform the paving crew supervisor and, if adjustments are not made that correct the problem, paving operations will be stopped. Notify the Engineer immediately of action taken.

  Often the aggregate is not completely covered with emulsion. This is not a problem provided the asphalt mix does not ravel. The Contractor may fog seal areas that begin to ravel. Any reclaimed material unable to pass through a 50 mm sieve will be removed from the mat by the paving crew before compaction.

- Compaction - At no time are solvents to be used on the roller wheels/drums to prevent bituminous material from sticking or for cleaning. To prevent adhesion of the CIPR pavement course to the rollers, water will be sprayed onto the wheels/drums. Small quantities of detergent may be used with the water.

  All rolling will be done at a slow and uniform speed. When the rollers need to go in the reverse direction, care should be exercised by the operator so that displacement does not occur. If minor displacement is evident, the Contractor will repair the pavement by raking additional asphalt mix into the damaged area and then re-compacting this section with the roller. All damage done by improper rolling to the pavement or adjacent property will be repaired at the Contractor’s expense.

  Sometimes the Contractor is not able to use a full sized roller because of forms, curbs, headers, walls or other obstructions. In these situations, the Contractor will propose, for the Engineer’s approval, what type of equipment to use. Equipment should never be parked on the CIPR mat.

  1. Initial and Intermediate Rolling. The Contractor must use a vibratory and pneumatic tire roller. These rollers must operate at a speed that does not exceed 4 km per hour (67 m per minute). Rolling will begin once the CIPR mix has set enough so that the roller does not cause displacement, cracking or shoving. The initial compaction will be done with the roller traveling parallel to the centerline of pavement beginning at
each edge and working toward the center. Banked curves will be compacted with the roller starting at the edge of the low side of the pavement heading toward the super-elevated edge. To prevent tearing, gouging or distortion of the pavement, it is important that a minimum of one roller pass be completed before the operator does any turning.

2. Finish Rolling. A steel wheel tandem roller or a dual vibrating drum roller operating in static mode may be used. If additional rolling is needed to get proper compaction or sections of the pavement need to be removed and replaced it will be done at the Contractor’s expense.

- Surface Tolerances - Throughout the day, periodically check the compacted recycled surface for compliance to the specification tolerances. The CIPR surface will be constructed to a 10 mm tolerance and the longitudinal joint will have a 5 mm tolerance. The following two ways will be used by the Inspector to check surface tolerances:

  1. Place a 5 m straightedge or string line along the pavement parallel to the centerline.

  2. Place a 3 m straightedge or string line along the pavement perpendicular to the centerline.

Also, verify that the required cross-slopes are achieved.

- Quality Control/Quality Assurance (QC/QA) Testing - Once production begins, the Contractor will take four random samples of the recycled mix. These samples will be tested by the Contractors’s laboratory for aggregate gradation and percent asphalt content. Test results will be submitted to the Engineer, Regional Materials Engineer, and Materials Bureau before the end of the next workday or other schedule as agreed to by the Engineer during the preconstruction meeting. The Engineer will verify these test results comply with the approved mix design. Significant differences from the mix design shall be discussed with the Contractor and Regional Materials Engineer.

For each subsequent day of production a minimum of one sample of the recycled mix will be taken from each kilometer of production, or fraction thereof. These samples will be tested as noted for the first day of production. The Engineer will receive these test results within two workdays to be verified for compliance to the approved mix design.

If a second CIPR train is introduced at the project site, QC/QA sampling will follow the requirements needed for the first day of production.

- Excess Material - This material will be disposed of as determined at the preconstruction meeting.
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- Longitudinal Joints - All longitudinal joints will correspond with the edges of the proposed traffic lanes unless other joint arrangements are approved by the Engineer. At the end of a work day, any exposed longitudinal joint must be constructed in the form of a wedge. The wedge must have a minimum 1 on 8 slope and “Uneven Lane” signs must be posted as detailed in the contract. None of the recycled mix will be overlapped onto the existing pavement.

- Brooming - The pavement and shoulders will be broomed by the Contractor as necessary to remove loose stone or reclaimed material.

- Curing - The CIPR asphalt course will be cured for a minimum of 7 days prior to the application of the surface course.

3. Pavement Markings - If responsible for M&PT, the Contractor is required to place temporary pavement markings at the end of each paving day. Until permanent pavement markings are placed, appropriate temporary pavement markings must be maintained by the Contractor for 30 days or until the mix is overlaid, whichever is less.

4. Ride Quality - Each day, drive over the CIPR to evaluate the ride quality. Although there is not a specification requirement for ride quality, discuss any concerns about the ride quality with the Contractor as soon as possible. Once aware of any concerns, the Contractor will generally try to improve the ride quality of future paving, if possible. Notify the Regional Materials Engineer if not satisfied with the Contractor’s effort to improve the ride quality.

5. Fog Sealing - The Contractor may fog seal to correct overly dry or improperly cured areas. M&PT will be done at the Contractor’s expense and is subject to approval by the Engineer.

6. Repairs - Damaged areas, determined by the Engineer, will be repaired with the recycled mix or hot mix asphalt. The cross-slopes of the CIPR pavement must be maintained for 30 days or until the mix is overlaid, whichever is less. During this time period the Contractor is required to repair these areas prior to the placement of the overlay course. Repairs must be compacted to conform to the surrounding area. Ruts, 10 mm or greater that occur in the CIPR pavement course will be repaired by a method approved by the Engineer. All repairs will be done at the Contractor’s expense.

Final Approval

1. Check CIPR mat for defects, cross-slopes, and surface tolerances.
2. Make sure Contractor has removed any excess material.
3. Verify that all utilities, etc. are accessible.
4. Check quantities of component materials used in production before payment. Emulsion used for fog sealing may be included in the total emulsion quantity for payment. Payment will not be made for emulsion quantities greater than 110% of the bid quantity.
Other References

2. Comprehensive Pavement Design Manual, Chapter 5, Rehabilitation
3. CIPR Specification