

SECTION 413

PLANTMIX BITUMINOUS GAP-GRADED SURFACE

DESCRIPTION

413.01.01 GENERAL

- A. This work shall consist of placing a gap-graded wearing course, bonded to the surface, in accordance with these specifications and in conformity with the lines, grades, thickness, and the typical cross sections shown on the plans or established by the Engineer.
- B. The bonded wearing course shall consist of an application of a warm polymer modified asphalt emulsion to create a polymer modified membrane (PMM) followed immediately with a hot gap-graded ultra-thin asphalt concrete surface course (UTACS).
- C. This work shall not be started until the Contractor has completed all heavy equipment work or any other work that could scar or mar the finished gap-graded surface.
- D. The requirements of **Section 401, "Plantmix Bituminous Pavements – General,"** shall be applicable to this work, except as hereinafter specified.

413.01.02 REFERENCE CODES AND STANDARDS

- A. Related Interagency Quality Assurance Committee (IQAC) procedures at:
http://www.clarkcountynv.gov/Depts/public_works/construction_mgmt/Pages/Materials.aspx

413.01.03 REQUIREMENTS

- A. Persons involved with the placement of UTACS shall be trained by the manufacturer and/or the Nevada T2 Program.

MATERIALS

413.02.01 GENERAL MATERIALS

- A. The materials shall conform to **Subsection 401.02.01, "Composition of Mixtures,"** with the following exceptions:
 - 1. Prior to starting work, the Contractor shall submit a proposed job-mix formula in writing for review and approval by the Engineer.
 - 2. The proposed job-mix formula shall be determined by an AASHTO certified testing laboratory, using Nevada Alliance for Quality Transportation Construction (NAQTC) certified technicians, based on the tests required to determine the gradation and surface capacity for coarse aggregate.
 - 3. The gradation shall be Type S1, S2, or S3 in accordance with **Subsection 705.03.08, "Plantmix and Roadmix Asphalt Concrete Surface Course UTACS Type S1 through S3,"** and the contract Special Provisions.
 - 4. The bituminous materials shall be PG76-22CC in accordance with **Section 703.03.02, "Asphalt Cements."**
- B. Prior to the production of the UTACS gap-graded mix material, all of the contract aggregate quantity shall be stockpiled and shall be tested by the Contractor. The tests

are to be submitted to the Engineer no earlier than two weeks prior to placement and may be used only after the Engineer has taken no exception to the results.

413.02.02 COMPOSITION OF GAP-GRADED (UTACS) MIXTURE

- A. The plantmix gap-graded Ultra-Thin Asphalt Concrete Surface (UTACS) mixture shall be composed of aggregates and bituminous materials as described in these specifications. The criteria for the design is based on **Subsection [413.02.01](#), "General Materials,"** above and the following:
1. Film Thickness (μm):
 - a. Gradation surface area factor using the film thickness calculation based on effective asphalt content and aggregate surface area according to Asphalt Institute MS-2 Table 6.1.
 - b. The minimum film thickness shall be 10 μm .
 2. Specimens for AASHTO T283 testing shall be compacted using the Superpave gyratory compactor applying 100 gyrations or using the Marshall compactor applying 50 blows on each side of the 4-inch diameter sample.
 - a. Use mix quantity necessary to obtain compacted samples 2.5 inches ± 0.05 inch in height.
 - b. Further test compacted samples regardless of air void levels achieved after 100 gyrations or 50 blows on each side.
 - c. Apply vacuum to samples to be conditioned for 20 seconds and proceed without calculating percent saturation.
 - d. Mixing and compaction temperatures are to be recommended by the binder supplier.
 - e. The minimum moisture susceptibility shall be 80 percent retained strength.
 3. The minimum air voids shall be 4 percent and the maximum aggregate surface shall be 26 square feet per pound.
 4. Marshall stabilities are not required.
 5. Gradation shall be in accordance with **Subsection [705.03.08](#), "Plantmix and Roadmix Asphalt Concrete Surface Course UTACS Type S1 through S3" of Section [705](#), "Aggregates for Bituminous Courses."**
 6. The binder type shall be PG76-22CC as described in **Section [703](#), "Bituminous Materials."**

413.02.03 POLYMER MODIFIED MEMBRANE

- A. The UTACS pavement shall consist of an application of a warm polymer modified membrane (PMM) asphalt emulsion, as specified under **Section [703](#), "Bituminous Materials,"** followed immediately with an ultra-thin surface course of quality hot mix asphalt concrete.
- B. The PMM emulsion shall be sprayed immediately prior to the application of the surface course so that no wheel or other part of the paving machine comes in contact with the PMM before the surface course is applied.

- C. The process of applying the PMM, placement of the surface course, and screed compacting shall be performed in under 5 seconds during normal paving speeds, resulting in a homogeneous surface that can be opened to traffic immediately upon sufficient cooling to 160 degrees F or below.
- D. The PMM target design application rate shall be in accordance with Table 1. The PMM application rates shall be adjusted in the field to account for the texture of the existing pavement, traffic, and project uniqueness.

TABLE 1 – PMM APPLICATION RATES

Gradation Type	Application Rate
S1	0.13 gal/sq yd
S2	0.15 gal/sq yd
S3	0.17 gal/sq yd

CONSTRUCTION

413.03.01 GENERAL CONSTRUCTION

- A. The construction shall conform to **Subsection [401.03.01](#), "Bituminous Mixing Plant,"** through **Subsection [401.03.16](#), "Surfacing Miscellaneous Areas,"** with the exceptions below.

413.03.02 GAP-GRADED UTACS PAVING EQUIPMENT

- A. The Contractor shall use a self-priming paver, designed and built for the purpose of applying the PMM bond and the UTACS pavement.
1. All other equipment and tools shall be approved by the Engineer.
 2. All equipment and tools shall be maintained in satisfactory working condition at all times.
- B. The self-priming machine shall meet the following requirements:
1. Be capable of spraying the PMM emulsion, applying the surface course overlay, and providing a smooth surface to the mat in 1 pass at the rate of 35.5 to 92 feet/minute.
 2. Shall incorporate a receiving hopper, feed conveyor, insulated storage tank for PMM emulsion, electronic device to determine rate of emulsion application, metered PMM emulsion system, spray bar, and variable width.
 3. The integrated distributor-paver shall be equipped with a full-width, heated vibratory screed that can spread and finish the bonded wearing course to the required cross section and grade that produces a uniformly finished surface free from tearing or other blemishes.
- C. At all times during paving, the sump pump for excess spray bar emulsion shall be operating as indicated by the required warning light to prevent overflow of the tray. The screed shall have the ability to be crowned at the center, both positively and negatively, and have vertically adjustable extensions to accommodate the desired pavement profile.
- D. The PMM shall be applied in accordance with the following:
1. With a mechanical pressure spray bar.
 2. Within a tolerance of 0.018 gallon per square yard of the application rate.
 3. At a uniform rate for the full paving width.

E. Rollers:

1. Rolling of the wearing course shall consist of a minimum of 2 passes with a steel double drum asphalt roller of minimum weight of 10 tons, before the material temperature has fallen below 185 degrees F.
2. At no time shall the roller or rollers be allowed to remain stationary on the freshly placed asphalt concrete.
3. Rolling shall immediately follow the placement of the UTACS with approved asphalt rollers.
4. Rollers shall be monitored to ensure the rollers are not picking up material and that the setting process is completed while the mat is above 185 degrees F.
5. Rollers shall be well maintained in reliable operating condition and be equipped with functioning water system and scrapers to prevent adhesion of the fresh mix onto the roller drums.
6. Adequate roller units shall be supplied so the rolling will be accomplished promptly following the placement of the material.
7. A release agent (added to the water system) may be required to prevent adhesion of the fresh mix to the roller drum and wheels.
8. Rolling shall normally be done in the static mode.

F. Sweepers: The Contractor shall have a minimum of 1 approved sweeper available at all times during the construction of the surface course to pick up loose material.

G. Material Transfer Vehicle (MTV): An MTV shall be used when placing UTACS, and shall meet the following requirements:

1. Able to remix the UTACS mixture to eliminate truck end segregation, minimize material temperature loss, and deliver a uniform mixture to the paver.
2. Self-propelled machine totally independent of the paver.
3. High-capacity truck unloading system to receive UTACS mix from the haul units.
4. Minimum 25-ton surge capacity to minimize paver start/stops and maximize trucking efficiency.
5. Equipped with a pivoting paver loading conveyor able to swing 55 degrees to either side to allow off-lane paving.

413.03.03 APPLICATION OF GAP-GRADED UTACS SURFACE

A. The UTACS pavement shall not be placed on wet pavement. The pavement surface temperature shall not be less than 50 degrees F and the ambient temperature shall not be less than 50 degrees F and rising.

B. The PMM shall be sprayed by a metered mechanical pressure spray bar at a temperature of 140 degrees F –180 degrees F.

1. The sprayer shall accurately and continuously monitor the rate of spray and provide a uniform application across the entire width to be overlaid.
2. The machine will be equipped with an electronic device by which the rate of emulsion application can be determined while the paver is in operation.
3. The PMM shall be applied manually where the screed extension or handwork is required outside the range of the machine mounted spray bar.

4. Over-application or double application of emulsion on the existing base shall not be permitted.
 5. The mix design target PMM shot rate shall be adjusted based upon the existing pavement surface conditions, traffic, and project uniqueness, with the approval of the Engineer.
 6. The PMM field-adjusted shot rate shall be reduced by 0.03 gallon/square yard within 150 feet of the intersection, to minimize the risk of flushing under the action of standing and slow moving traffic, unless a full-width mill transition has been specified in the plans.
 7. The Contractor and Engineer shall establish an acceptable range for the spray rate.
 8. The PMM shall have a minimum of 2 daily yield verifications to be reported to the Engineer, 1 at midway production and 1 at the end of production.
 9. These reports shall be the sum of the rates documented each 100 linear foot by the Contractor QC Inspector.
- C. The PMM application rate may be adjusted as directed by the Engineer based on the texture depth of the existing pavement measured according to ASTM E965, "Measuring Pavement Macrottexture Depth Using a Volumetric Technique." Suggestions to adjust the PMM application rate as a function of texture depth of the existing pavement are shown in Table 2.
- D. No wheel or other part of the paving machine shall come in contact with the PMM before the surface course is applied. Contractor shall use placement operations and equipment that:
1. Keep surfaces clean and free of contamination and debris prior to placement of the polymer modified asphalt emulsion membrane.
 2. Prevent tracking through the polymer modified asphalt emulsion membrane prior to placement of the gap-graded polymer modified asphalt concrete.
- E. The surface course shall be applied at a temperature of 302 degrees F – 330 degrees F and shall be spread over the PMM less than 5 seconds after the application of the PMM during normal paving speeds.

TABLE 2 – PMM RATE ADJUSTMENTS DUE TO PAVEMENT TEXTURE

Pavement Type - Texture Description	Texture Depth Range (mm)	PMM Rate Correction	
		l/m2	gal/yd2
Flushed asphalt	<0.5	-0.04 to -0.27	-0.01 to -0.06
Black asphalt	0.5 to 1.0	0	0
Smooth asphalt, non-porous	1.0 to 1.2	0	0
Absorbent asphalt, slightly porous, oxidized	1.2 to 1.7	0.09	0.02
Slightly pocked asphalt, porous, oxidized	1.7 to 2.0	0.18	0.04
Badly pocked asphalt, porous, oxidized	>2.0	0.27	0.06
Asphalt milled surface	N/A	0	0
Asphalt within 150 ft of intersection without mill	N/A	-0.13	-0.03
Asphalt within 150 ft of intersection with mill	N/A	0	0

- F. When filling the emulsion tank, no emulsion shall overflow into the paver hopper.

1. Should emulsion be spilled into the paver hopper, paving shall stop and all contaminated material shall be removed from the paver hopper.
 2. Under no circumstances shall the contaminated material be placed on the roadway.
- G. Overlapping or hot lapping of the bonded wearing course shall not be permitted when paving miscellaneous areas in order to achieve project layout requirements.
- H. Material that has been placed through the paving screed or over the polymer modified asphalt emulsion membrane shall not be reintroduced into the paving process.
- I. UTACS shall be applied at a thickness such that no aggregate is fractured.
1. The S3 mix shall be applied at a minimum 3/4-inch thickness.
 2. The S2 mix shall be applied at a minimum 5/8-inch thickness.
 3. The S1 mix shall be applied at a minimum of 9/16-inch thickness.

413.03.04 SURFACE PREPARATION FOR UTACS

- A. The following items shall be performed prior to the commencement of paving operations and paid for under the appropriate bid item numbers:
1. Manhole covers, drains, grates, catch basins, and similar utility structures shall be protected and covered with building felt prior to paving, and shall also be clearly referenced for location and adjustment after paving.
 2. Thermoplastic traffic markings shall be removed.
 3. Pavement cracks and joints greater than 0.25 inches wide shall be cleaned and filled using an approved material and method.
 - a. There shall be no over-banding of cracks which will be covered by UTACS.
 - b. Crack sealing shall be completed at least 7 days prior to paving.
 4. Surface irregularities greater than 1 inch deep shall be milled and/or filled with a material approved by the Engineer. All repairs shall be completed 1 week prior to paving or as recommended by the sealant manufacturer or the Engineer.
 5. The entire pavement surface to be overlaid shall be thoroughly cleaned, giving special attention to accumulated mud and debris. Pressurized water and/or vacuum systems may be required to ensure a clean surface.
 6. Cold planing shall be completed as specified herein.

413.03.05 JOINTS

- A. Longitudinal joints shall be constructed only on the shoulders or at the edge of the travel lanes.

413.03.06 QUALITY CONTROL ASPECTS

- A. PMM application rate shall be checked twice per day using random sample location techniques.
- B. Determination of the application rate of the PMM shall be as follows:
1. At the location to be sampled, immediately adjacent to the paving area, use 2 pads approximately 15-inches wide by 20 inches long, placed side by side, to determine the PMM application rate based on the average of 2 application rate measurements.

2. Capture the tare weight of each pad to be used prior to capturing the PMM sample.
 3. Place the first pad 5 feet in front of spray bar on the spray paver.
 4. Place the second pad in front of the first pad farther away in the travel direction.
 5. Set the machine in automatic mode; do not use manual mode when calibrating emulsion application rate.
 6. Circulate the emulsion through the spray bars for approximately 5 minutes before spray calibration in order to purge the system.
 7. Select the machine ground speed/production rate to be no less than 30 feet per minute.
 8. Select the desired emulsion application rate and take a sample at this setting.
 9. Weigh each pad that has been sprayed with the PMM.
 10. Calculate the net weight of emulsion and convert it into gallons using the PMM weight-per-gallon information provided by the emulsion manufacturer.
 11. Divide the gallons of PMM by the pad area and compare with the target application rate in gallon per square yard.
- C. A minimum of 3 daily samples of the bituminous wearing course shall be tested for asphalt content and gradation.
1. If the average of the daily test results vary from the job-mix formula by more than the tolerance indicated in **Subsection 705.03.08, "Plantmix and Roadmix Asphalt Concrete Surface Course UTACS Type S1 through Type S3,"** production shall stop.
 2. The Contractor shall identify the cause and document what corrective action will be taken.
 3. The job-mix formula may be adjusted only as approved by the Engineer.
- D. A minimum of 2 daily UTACS mixture yield checks shall be completed, 1 at midday during production and 1 at the end of the day's production, to ensure that mixture application rate requirements defined in **Subsection 413.03.03, "Application of Gap-Graded UTACS Surface,"** are met.
- E. Placement Limitations: The UTACS and/or PMM shall not be placed on pavement that has visible surface moisture.
- F. The Contractor shall immediately cease operations if any precipitation occurs. If any material is placed during the precipitation event, such material shall be removed and replaced, as directed by the Engineer, at no additional cost to the Contracting Agency.
- G. Place UTACS and/or PMM only when the pavement surface temperature is 50° F and rising and the ambient temperature is 50 degrees F and rising.
- H. The UTACS shall not be placed if the forecast low from the National Weather Service is 32 degrees F or lower for the night following any single day's paving operation.
- I. Because of the minimal depth of the surface course being placed, the course may be damaged if opened to traffic too quickly. Therefore, the new UTACS pavement shall not be opened to traffic until the rolling operation is complete and the material has cooled sufficiently to resist damage (approximately 160 degrees F).

- J. No more than 15 minutes shall be allowed to elapse between the delivery trucks carrying the UTACS mix to the paver or 3 cold joints per 1/2 mile. Cold joints are defined as when the last delivery truck leaves the paver, the paver has stopped more than 15 minutes before the next delivery truck is brought to the paver.

413.03.07 SURFACE TOLERANCES FOR UTACS

- A. The completed surfacing shall be thoroughly compacted, smooth, and free from ruts, humps, depressions, or irregularities.
1. Any ridges, indentations, or other objectionable marks left in the surface of the bituminous mixture by blading or other equipment shall be removed by rolling or other means.
 2. The use of equipment that leaves ridges, indentations, or other objectionable marks in the bituminous mixture shall be discontinued, and other acceptable equipment shall be furnished by the Contractor.
- B. The Contractor shall produce completed surfacing which meets the requirements of **Subsection [402.03.03.D](#), "Profilograph Measurement,"** when required by the Contracting Agency, with the following additions and exceptions to the profilograph measurement:
1. The Contractor shall furnish and operate a profilograph as specified in the subsection noted above at the time and date ordered by the Engineer.
 2. Any requirement for grinding shall have a depth selected so that at least 80 percent of the original UTACS thickness is preserved in order to minimize the risk of localized bleeding.
 3. Liquidated damages may be assessed, as required by the Contracting Agency, for each such high point that is allowed to remain in place.
 4. The profile index requirements herein shall not apply to the pavement within 30 feet of either end of a concrete bridge deck (including approach slabs). The finished surface of such pavement shall, however, meet all other requirements of this section.

413.03.08 UTACS PAVEMENT REPAIRS

- A. The Contractor shall pay all costs of UTACS pavement repair activities and implementation, except as otherwise provided herein.
- B. The Contractor shall have the right to use such pavement repairs deemed necessary to bring the UTACS pavement up to the performance criteria established in **Subsection [413.03.07](#), "Surface Tolerances for UTACS."**

METHOD OF MEASUREMENT

413.04.01 MEASUREMENT

- A. UTACS Pavement will be measured as specified in **Subsection [401.04.01](#), "Measurement,"** or if the Contract Documents specify payment by area, the quantity of Plantmix Bituminous Surface to be measured for payment shall be the number of square yards, including the asphalt cement, used in the accepted work.

BASIS OF PAYMENT

413.05.01 PAYMENT

- A. The Ultra-Thin Asphalt Concrete Surface (UTACS) bonded with a polymer modified membrane (PMM) will be paid at the Contract price bid per square yard, which shall include all material, mixing, loading, hauling, placing, compacting, incidentals, and for all labor, tools, and equipment necessary to complete the work as shown on the plans, as specified herein, and as directed by the Engineer.
- B. All payments will be made in accordance with **Subsection [109.02](#), "Scope of Payment."**
- C. Partial payments for UTACS may be made as set forth under **Subsection [109.06](#), "Partial Payment."**
- D. Payment will be made under:

Pay Item	Pay Unit
UTACS Bonded with a PMM, S1 Gradation	Square Yard
UTACS Bonded with a PMM, S2 Gradation	Square Yard
UTACS Bonded with a PMM, S3 Gradation	Square Yard