

PART 336 – PAVEMENT AND BRIDGE DECK SMOOTHNESS – Revised 04.25.2024

These Special Provisions amend and where in conflict, supersede applicable sections of ODT's 2019 Standard Specifications for Highway Construction, English and Metric. Units of measurement are provided in the subsections in both English and Metric equivalents. the units for this provision will be those English equivalents.

These Special Provisions apply to all types of Portland cement and asphalt concrete pavements as well as bridge decks constructed as part of this contract or as specified on the plans.

336.1 DESCRIPTION

This section establishes procedures for determining acceptability as it relates to smoothness requirements of pavements and bridge decks. The equipment and testing applicable to this Section shall be provided and/or operated by the party of parties designated by the City.

336.2 MATERIALS - VACANT

336.3 EQUIPMENT

Smoothness measurement equipment to be used for control and for acceptance testing shall include either The California Profilograph or The Lightweight Profilometer as described below. Such equipment shall be certified by the Department.

A. Profilograph

A California type profilograph produces a smoothness profilogram (or profile trace) of the surface tested. The equipment used shall be supported on multiple wheels having no common axle. The wheels shall be arranged in a staggered pattern such that no two wheels cross the same bump simultaneously. The profile is recorded from the vertical movement of a sensing wheel attached to the frame at the midpoint and is in reference to the mean elevation of the twelve points of contact with the road surface established by the support wheels.

The strip chart recorder shall be mounted on a lightweight frame 25 feet long. The relative smoothness/roughness of the pavement or bridge deck shall be measured by recording the vertical movement of a 6-inch or a larger diameter-sensing wheel attached to the midpoint of the frame.

The recorded graphical traces of the profile (termed the "profilogram") shall be on a scale of 1-inch equals 1 inch for the vertical motion of the sensing wheel. The profilogram shall be driven by the chart drive on a scale of 1 inch of chart paper equal to 25 feet longitudinal movement of the profilograph.

B. Lightweight Profilometer

The profilometer equipment shall be mounted on a lightweight, motorized vehicle Such as an All-Terrain Vehicle (ATV), Golf Cart, or other approved vehicle. The vehicle profilometer equipment, and operator shall be capable of running on “green” concrete without causing damage. The profilometer equipment shall include an onboard, precision accelerometer which measures movement of the light weight and a non-contact vertical distance sensor mounted on the vehicle. The vertical distance sensor may be either infrared or laser type. The profilometer shall be capable of making all of the measurements and providing the information required in 430.04(b) of this special provision. Additionally, the profilometer shall measure the road profile in accordance with ASTM E950-98, Class I.

C. Calibration

The profilograph or profilometer shall be calibrated within the following limits. Horizontal measurements shall be within ± 5 feet per 1,000 feet of distance tested. Vertical measurements shall be the same as those of the calibration blocks measured. a profilograph and profilometer Calibration Report shall be submitted to the Engineer each time the calibration is performed. The calibration shall be performed no more than one week prior to collection of smoothness data and repeated at the Engineer’s direction at any time during the project.

D. Profilograph or profilometer Operator

The City shall provide a profilograph or profilometer operator, certified by the Oklahoma Highway Construction Materials Technical Certification Board to perform All produced profilograms at no cost to the Contractor.

336.4

CONSTRUCTION

A. Surface Testing

The Contractor shall provide traffic control as necessary for all smoothness Measurements regardless of who provides and/or operates the equipment. The surface will be tested as soon as possible after completion of the work. For overlay projects when milling is not required, the surface will be tested immediately before construction and as soon as possible after completion of work in order to determine the percent reduction in the profile index. Profilometer readings or profilograph traces are to be collected from 25 feet prior to the beginning point of a project, including any exception areas, and run continuously through all bridges and changes in the pavement types to a point 25 feet beyond the ending point of a project, including any exceptions areas.

Testing shall include all mainline paving and bridge decks. Smoothness deviations occurring at construction and expansion joints will be considered in calculations of profile index and in identification of bumps.

All objects and foreign material on the surface shall be removed by the Contractor prior to testing. Protective covers, if used, shall be removed prior to testing and will be properly replaced by the Contractor after testing. Testing for smoothness shall produce a final trace; a second trace shall be made on segments on which allowable surface correction have been made.

The profilograph shall be propelled at a speed not to exceed 3 miles per hour. Data shall be gathered at lower speeds if the pavement or bridge deck is rough or Profilograms are not being produced clearly.

The profilometer shall be operated at a constant speed as recommended by the manufacturer. The sequence of position of the pavement or bridge deck to be tested will be one pass per driving lane in the wheel path farthest from the edge of a pavement or bridge deck.

Additional profiles will be taken only to define the limits of an out-of-tolerance surface variation. The evaluations shall include graphical traces of the profiles and the disks from which they were derived. The testing and evaluation will be done by a trained and certified operator and the evaluation will be so certified. the City reserves the right to verify the testing and/or evaluation. In case of differences the City 's results shall be considered final. If the Contractor's results are found to be significantly in error, the City may assess the cost of the of the verification efforts.

B. Evaluation

(1) Profile Index

Unless otherwise specified in Special Provision 431-3QA, a profile index shall be calculated from the profilogram for a pavement or bridge deck on 528 feet extents or entire lengths of bridges (including approach slabs) whichever is less. The index shall be calculated using a computerized profilogram reduction system. It is understood that stations reflected by automatic profilogram interpretation systems are approximate and a further survey in the field may be required to establish bump locations. The index is calculated by summing the vertical deviations outside a 0.2- inch blanking band as indicated on the profile trace. The units of this measure (inches) will be converted into inches per mile. An extent is defined as the amount of pavement or bridge deck in a 528 feet or the entire bridge deck plus both approaches in length, whichever is less. When the quantity represented is less than a full extent in length, it will be Combined with an adjacent extent or treated as a separate extent, at the option of the Contractor.

(2) Bumps

Bumps will appear as high points on the profile trace and correspond to high points on the pavement or bridges deck surfaces. Unacceptable bumps are defined as those with vertical deviations in excess of 0.60 inch (without using a blanking band) in a 25-foot span.

(3) The following will not be excluded from the smoothness requirements:

- (a)** Shoulders
- (b)** Ramps
- (c)** Turn Lanes
- (d)** Acceleration, deceleration and climbing lanes less than 528 feet full width.
- (e)** Pavement with horizontal centerline curves with radii of less than 1000 feet and the super elevation transitions of such curves.
- (f)** In overlays only, areas in roadway within a 10 foot radius of existing Inlets and utility covers. (This exception does not apply to full depth pavements.)
- (g)** Short isolated pavement areas, which by normal industry practice would require handwork.

Examples include driveway blockouts, phased intersection work with variable cross slope, etc.

For the above exceptions, the profile index and adjustments calculations corrections specified in this Special Provision, will not apply. However, the requirements for mandatory correction of bumps as defined in this Special Provision and tolerances defined in subsection 401.04 of the standard Specification for Highway construction will remain in effect.

1. Special Evacuation Requirements

Bridge approach slabs will be evaluated in accordance with bridge deck smoothness requirements. New pavements and overlays within 50 feet of bridges or their approach slabs, 50 feet of beginning and ending stations of the Project, or 50 feet of changes from Portland index calculation. However, the requirements for mandatory correction of bumps as defined in this Special Provision and tolerances defined in subsection 401.04 of the Standard Specification for Highway Construction will remain in effect.

C. Surface Correction

Unless otherwise permitted by the Engineer, in writing, all new pavements (with or without prior cold milling) and bridge deck surfaces having profile indices in excess of the acceptable limits of 13.0 in/mile for all streets and 27.0 in/mile for all bridges or having individual bumps with deviations in excess of 0.60 inch in a 25 foot span shall be corrected by the Contractor at no additional cost to the City. Such corrective action shall NOT include any grinding of metal expansion joints, themselves, but may include grinding of concrete in the vicinity of the joints.

All corrective action, including the identification and correction of bumps, shall be in accordance with the requirements of the Engineer. The surfaces of ground asphalt pavements shall be fog sealed. The surfaces of corrected areas shall be retextured to be similar to that of the adjacent sections of pavement or bridge deck and shall exhibit good workmanship and be neat in appearance. Cores for thickness determinations and measurement of cover of reinforcement steel will be taken subsequently to all corrective work.

- A) General: Provide quality of all construction covered in the project.
- B) Quality Control Personnel Qualifications: All personnel directly involved in sampling and/or testing materials for either control or acceptance purposes shall be certified in the appropriate area(s) by the Oklahoma Highway Construction Materials Technician Certification Board. Manager certification for material sampling and testing is not required unless he or she is directly involved in sampling and/or testing materials.
- C) Contractor's Quality Control Plan: Submit a written Quality Control Plan at least one week prior to the pre-work conference. Include the following in the plan:
- 1) Sources of principal materials including names of suppliers and locations.
 - 2) Names and resumes of key Quality Control personnel.
 - 3) Duties, responsibilities, and authorities (to suspend production, alter mixtures, etc.) granted to key Quality Control personnel.
 - 4) Description of testing laboratories, including qualifications, key equipment, and locations.
 - 5) Description of start-up operations, including but not limited to:
 - a) Review of submittal requirements and all other Contract requirements with the performance of the work.
 - b) Examine the work area to ascertain that all preliminary work has been completed.
 - c) Verify all field dimensions and advise the Engineer of any discrepancies.
 - 6) Detailed testing schedule based on production.
 - 7) Control, verification, and acceptance testing procedures for each specific test to include the test name, specification requiring the test, feature of work to be tested, and person responsible for each test.
 - 8) Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.
 - a) Sampling and Testing: Perform sampling and testing according to the accepted Quality Control plan using personnel certified in appropriate areas

and laboratories approved by the Engineer. Keep laboratory facilities clean and maintain all equipment in proper working condition.

- b) Inspection: Provide inspection necessary to ensure compliance with applicable standards and specifications.
- c) Records: Maintain complete testing and inspection records and make them accessible to the Engineer.
 - 1. Test Results: Maintain control charts that identify the project number, contract item, test number, each test parameter, the upper and/or lower specification limit applicable to each test parameter, and the test results. Use the control charts as part of the Quality Control system to document process variability, to identify production and equipment problems, to make necessary corrections, and to identify potential pay factor adjustments.
 - i. Post control charts in an accessible location, keep them up to date, and make them available to the Engineer upon request. Make corrections to the process when problems are evident, including ceasing production if necessary.
 - 2. Inspection Results: For each day of work, prepare an "Inspector's Daily Record of Construction Operations" on an approved form. Include the following certification signed by the person with overall responsibility for the inspection system:
 - i. "It is hereby certified that the information contained in this record is accurate, and that all work documented herein complies with the requirements of the contract. Any exceptions to this certification are documented as a part of this record."
 - 3. Submit the record and certification to the Engineer within two working days of the work being performed. If the record is incomplete, in error, or otherwise misleading, a copy of the record will be returned with corrections noted. When chronic errors or omissions occur, correct the procedures by which the records are produced.
- D) Use of Contractor Test Results for Acceptance Purposes: Abbreviated test procedures are allowed for Contractor use. The Quality Control Plan shall list all abbreviated test procedures, describe all deviations from standard procedures for each, and note their intended purpose. Test results from abbreviated procedures will not be used for any purpose by the City of Tulsa. It is the Engineer's discretion to use or not use any of the Contractor's test results for acceptance purposes.
- E) Changes: Submit, in writing, all proposed changes in key Quality Control personnel, equipment or procedures from those previously approved by the Engineer. Submit written changes at least one week prior to the proposed action.