Use Section 36-3 NSSP with Incentive/Disincentive Pavement Smoothness NSSPs, which includes:

For asphalt pavements: 39-2.01A(4)(i)(iii), 39-2.01C(3)(d), 39-2.01C(3)(e) and 39-2.04A(4)(c)(iii)

For concrete pavements: 40-1

Check with the Pavement Program for the latest NSSPs:

For asphalt pavements: allen.king@dot.ca.gov

For concrete pavements: dulce.rufino@dot.ca.gov

Replace section 36-3 with:
36-3 PAVEMENT SMOOTHNESS

36-3.01 GENERAL

36-3.01A Summary

Section 36-3 includes specifications for measuring the smoothness of pavement surfaces.

36-3.01B Definitions

Area of Localized Roughness (ALR): Continuous moving average of the 25-foot International Roughness Index (IRI) values for each wheel path using a 250-mm filter.

Mean Roughness Index (MRI): Average of the 0.1-mile IRI values for the left and right wheel paths for the same traffic lane using a 250-mm filter.

Wheel paths: Pair of parallel lines 3 feet left and right of the center of a traffic lane. Left and right wheel paths are based on the direction of travel.

36-3.01C Submittals

36-3.01C(1) General

Not used

36-3.01C(2) Inertial Profiler Data

At least 15 days before measuring pavement smoothness with an inertial profiler, you must register with the Department's secure file sharing system. To obtain information on the registration process, send an e-mail with your contact information to asphalt.smoothness@dot.ca.gov for asphalt and concrete.smoothness@dot.ca.gov for concrete surfaces.

Submit electronic copy of the raw profile data as a PPF file on an authorized data storage device within 12 hours or on the same day of completing smoothness measurement, with a coordinated video or images taken at intervals no greater than 52.8 feet for the existing and baseline profiles. Also, submit a printout or a PDF file listing the following:

1. Profile data collection time and date
2. Data collection software version used
3. Sensor serial number
4. Low- and high-pass filter used
5. 0.1-MRI values

Within 2 business days after each day of profiling, submit the profile information to the Engineer and to the Department's secure file sharing system. After submitting the profile information to the Department's file sharing system, send a notification of your electronic submittal to the Engineer and to the above electronic mailbox address with the names of the files submitted.

For each surface subject to inertial profile smoothness requirements, the profile data information must include:

1. Raw profile data for each lane
2. ProVAL ride quality analysis report for the MRI of each lane in a PDF file. Report the following:
   2.1. Listing of MRI values for 0.1-mile segments or portions thereof
   2.2. Input data including the specified MRI threshold and fixed segment length
   2.3. Raw profile data name selections
   2.4. Areas exempt from inertial profile smoothness requirements
3. ProVAL ride quality analysis report for the IRI of the left and right wheel paths of each lane in a PDF file. Report the following:
   3.1. Listing of ALR
   3.2. Input data including the specified area of the localized roughness threshold and continuous segment length
   3.3. Raw profile data name selections
   3.4. Areas exempt from inertial profile smoothness
4. GPS data file for each lane. Submit the data file in GPS eXchange file format.
5. Manufacturer's recommended calibration and verification test results for the inertial profiler.
6. Inertial profiler's calibration and verification test results, including results for bounce, block, and the distance measurement instrument.
7. Completed Pavement Smoothness Inertial Profiler Submittal Record.

Submit Asphalt Concrete Pavement Smoothness Corrections Information or Concrete Pavement Smoothness Corrections Information with your final profile data information submittal.

Submit the raw profile data in an unfiltered pavement profile standard (PPF) file format. Use the following file naming convention:

> *YYYYMMDD_TTCCCRRR_EA_D_L_W_B_E_X_PT.EXT*
> where:
> *YYYY* = year
> *MM* = month, leading zero
> *DD* = day of the month, leading zero
> *TT* = district, leading zero
> *CCC* = county, 2- or 3-letter abbreviation as shown in section 1-1.08
> *RRR* = route number with no leading zeros
> *EA* = Contract number, excluding the district identification number, expressed as 6 characters
> *D* = traffic direction, *NB*, *SB*, *WB*, or *EB*
> *L* = lane number from left to right in the direction of travel
> *W* = wheel path, *L* for left, *R* for right, or *B* for both
> *B* = beginning station to the nearest foot, such as 10+20, or beginning postmile to the nearest hundredth, such as 25.06 with no leading zero.
> *E* = ending station to the nearest foot, such as 14+20, or ending postmile to the nearest hundredth, such as 28.06 with no leading zero.
> *X* = profile operation, *EXIST* for existing pavement, *BASELINE* for existing pavement after performing repairs, *PAVE* for after paving, and FINAL for completed pavement documentation of compliance.
> *PT* = type of pavement surface profiled, such as Type A HMA, RHMA-G, OGFC, JPCP, or CRCP
> *EXT* = "PPF" for raw profile data file extension.

If you are submitting multiple inertial profiler data files, compress the files into a .ZIP file format and submit them using the file-naming convention TT_EA_X_YYYYMMDD.zip.

36-3.01C(3) Smoothness Corrective Grinding Plan

At least 2 business days before performing corrective grinding for areas that do not meet the smoothness requirements, submit a corrective grinding plan as an informational submittal.

The corrective grinding plan must include:

1. Grinder make and model

2. Grinder wheelbase in feet, measured from the front centerline to the back centerline of the single wheel or tandem wheel spread
3. Grinder head position in feet, measured relative to the centerline of the front single wheel or the front tandem wheel spread
4. Tandem wheel spreads in feet
5. Tabular listing of the planned corrective grinding, including:
    5.1. Begin and End locations in stationing to the nearest foot
    5.2. Width of grind, such as left half lane, right half lane, or full-width lane
    5.3. Corresponding grinder head depths to the nearest 0.01 inch
    5.4. Direction of grind such as forward, reverse, forward-forward, reverse-reverse, forward-reverse, reverse-forward
6. Forecasted improvement in terms of the MRI and ALR values

36-3.01C(4) Straightedge Measurements

Within 2 business days of measuring smoothness with a straightedge, submit a list of the areas requiring smoothness correction or a report stating there are no areas requiring smoothness correction. Identify the areas requiring smoothness correction by:

1. Location number
2. District-County-Route
3. Beginning station or postmile to the nearest 0.01 mile
4. For correction areas within a traffic lane:
    4.1. Lane direction, *NB, SB, EB*, or *WB*
    4.2. Lane number from left to right in the direction of travel
    4.3. Wheel path, *L* for left, *R* for right, or *B* for both
5. For correction areas not within a traffic lane:
    5.1. Identify the pavement area, such as shoulder, weigh station, or turnout
    5.2. Direction and distance from the centerline, *L* for left or *R* for right
6. Estimated size of correction area

36-3.01C(5) Smoothness Quality Control Plan

Submit a written Smoothness Quality Control Plan to the Engineer at or before Preconstruction Meeting. The plan must include:

1. Organization: Contact names, organizational chart, telephone numbers, current certifications and titles, and roles and responsibilities of personnel for monitoring smoothness, collecting profile data, submitting data, pay adjustment requests and reports, and implementing corrective actions.
2. Inertial profiler certification:
    2.1. Inertial profiler certification issued by the Department
    2.2. Operator certification for the inertial profiler issued by the Department
    2.3. Manufacturer's instructions and test procedures for calibration and verification of the inertial profiler
3. Schedule: The methods and timing used for monitoring and/or testing ride quality throughout the placement operation process. Indicate the approximate timing of acceptance testing for the profile operations defined in section 36-3.01C(6)(b) in relation to placement operations.
4. Layout plan:
    4.1 Establish semipermanent reference points at the beginning and end of the project based on the plans. For each profile run, define additional semipermanent reference points for the starting and end position of each run. Show the position and name of each semipermanent reference point. These reference points must be located outside of the traveled way perpendicular to the starting position of each lane. Where starting positions are adjacent to each other but staggered, use separate starting positions. Semipermanent reference points used to establish the beginning position of a profile run must be labeled in the field and in the pavement profiles using the following naming convention:

    XXX-D-L-STA-VAL

    where:

XXX = "Beg" for the beginning of each profile run, "End" for the end of each profile run, "ExB" for the beginning point of the areas excluded from inertial profiler testing and "ExE" for the end point of the areas excluded from inertial profiler testing.

D = traffic direction, *NB*, *SB*, *WB*, or *EB*.

L = lane number from left to right in the direction of travel, such as "1", "2", or "3."

STA = station to the nearest foot, such as 10+20. Do not use postmiles.

VAL = use "INC" where the value of stationing in the pavement profile data file (*.PPF) will increase in the direction of travel. Use "DEC" where the absolute value of the stationing in the pavement profile data file (*.PPF) will decrease in the direction of travel.

Use the same label name regardless of the stage of the profile.

4.2 For each semipermanent reference point, include a KMZ file with:
4.2.1 Color photographs clearly displaying the physical label used to define the semipermanent reference points.
4.2.2 Listing of GPS coordinates.

Semipermanent reference points, wherever possible, must be recorded by inertial profilers using electronic eye readings of reflectors.

36-3.01C(6) Smoothness Payment Adjustment Request
36-3.01C(6)(a) General

Smoothness payment adjustment data includes a ProVAL project file and a payment adjustment spreadsheet for each lane.

36-3.01C(6)(b) ProVAL Project File

After completing final corrections, submit an electronic ProVAL project (PVP) file for each lane using the same naming convention listed in section 36-3.01C(2), except:

1. B = use the common beginning station found in all profiles included in the PVP file followed by the postmile to the nearest tenth of a mile, such as 528 +00(10.0).
2. E = use the ending station found in the FINAL profile followed by the postmile to the nearest tenth of a mile such as 681+12(12.9).
3. X = PAYADJ.
4. EXT = "PVP" for ProVAL project file extension.

Use a single PVP file for each lane. Each PVP file must contain the PPF files from the profile operation shown in the Profiles Needed by Smoothness Table.

Profiles Needed by Smoothness Table

Profile	Asphalt Target 60/75 Percent Improvement	Concrete Target 60/67.5/75	Grind Existing Concrete Percent Improvement
EXIST	X		X
BASELINE	X		X
PAVE	X	X	
FINAL	X	X	X

Establish and maintain stationing to allow for direct comparison of smoothness data between you and the Engineer in subsequent tests. The profiles must:

1. Align with each other in ProVAL.
2. Use the same beginning station position in all profiles files and in a single PVP project file.

3. Use the same semipermanent reference points for the beginning and ending positions of each profile and semipermanent reference points required by section 36-3.01C(3)(a).

4. For alignment purposes, the end station determined from the profiles distance measuring instrumentation of each sequentially numbered 0.1-mile segment or portion thereof in the BASELINE, PAVE and FINAL profiles must be no greater than 20 feet in the first mile when compared to the same sequentially numbered segment end station in the EXIST profile. For locations more than 1 mile but less than 2.5 miles, the difference must be prorated from 20 feet to 50 feet. For locations more than 2.5 miles from the beginning position of the profile, the difference must be no greater than 50 feet. Where these differences create an additional sequentially numbered segment and when needed to bring the sequentially numbered segments back into alignment, the event defining the ending position of the partial segment in the PPF file of the BASELINE, PAVE and FINAL profiles may be adjusted no more than 20 feet within the first 2.5 miles, and no more than 50 feet at all other locations. Include the same leave-out sections referenced to the same semipermanent reference points.

36-3.01C(6)(c) Payment Adjustment Spreadsheet

For each lane, submit payment adjustment spreadsheet using the Department-furnished worksheet. Data must be exported directly from the ProVAL project file Ride Quality module into the corresponding worksheet using the following settings:

1. Analysis Type set to "Fixed Interval"
2. Ride Quality Index set to "MRI"
3. Threshold (not applicable)
4. Segment Length (ft) set to "528.00"

Obtain the worksheet from the following site:

https://dot.ca.gov/programs/construction/pavement-smoothness

When sequentially numbered segments are misaligned and adjustments are required as described in section 36-3.01C(6)(b), make the adjustments within the ProVAL project file before exporting data to a worksheet and notify the Engineer when this occurs.

36-3.01C(7) Inertial Profiler Verification Test

Within 2 business days after the annual cross-correlation testing, submit a ProVAL profiler certification analysis report for the test results to the Engineer and to the electronic mailbox address:

smoothness@dot.ca.gov

36-3.01D Quality Assurance
36-3.01D(1) General
Not Used

36-3.01D(2) Certifications
The inertial profiler must display a current certification decal showing the expiration date.

The operator must be certified for each model of inertial profiler operated.

The certifications issued by the Department for the inertial profiler and operator must not be expired.

36-3.01D(3) Quality Control
36-3.01D(3)(a) General
Not Used

36-3.01D(3)(b) Smoothness Measurement
36-3.01D(3)(b)(i) General
Measure pavement smoothness using an inertial profiler.

The following areas are excluded from MRI smoothness requirements but are subject to ALR:

1. Continuous pavement less than 1000 feet in length
2. Ramps
3. Turn lanes
4. Acceleration and deceleration lanes

The following areas are excluded from smoothness measurement with an inertial profiler but are subject to the 12-foot straightedge measurement:

1. Areas within 15 feet of manholes, weigh-in-motion, railroad crossing, cattle guards, bus pad, and transverse gutter pans
2. Sections of traffic lane immediately adjacent to ETW where the distance between ETW and the longitudinal gutter pan is less than or equal to 8 feet
3. Areas within 25 feet each side from the intersection radius
4. Areas within 25 feet each side from the roundabout radius
5. Shoulders
6. Miscellaneous areas such as medians, gore areas, turnouts, and maintenance pullouts
7. Areas within 15 feet of the beginning of an approach slab or bridge, and 40 feet beyond the end of a departure slab or bridge
8. Horizontal curves with a centerline radius less than the following and within the superelevation transition of such curves:
    8.1. 150 feet for asphalt pavements
    8.2. 300 feet for concrete pavements
9. Pavement length less than 25 feet
10. Areas of hot mix asphalt with a single opportunity within 20 feet of locations where localized roughness exceeds 160 inches per mile on the BASELINE profile after filtering the profile with the ProVAL Moving Average Low Pass (MALP) filter with a 30-foot short cutoff wavelength

Where measurement with inertial profiler is required:

1. Determine the pavement smoothness by obtaining the IRI for the left and right wheel paths on each traffic lane.
2. Determine the MRI and ALR using FHWA's engineering software ProVAL.

Where OGFC is required, test the pavement smoothness of the final asphalt or concrete pavement surface before placing OGFC and after placing OGFC.

36-3.01D(3)(b)(ii) Inertial Profiler Calibration and Verification Tests
Notify the Engineer at least 2 business days before performing calibration and verification testing of the inertial profiler.

Conduct the following calibration and verification tests in the Engineer's presence each day before profiling:

1. Block test to verify the accuracy of the height sensor under California Test 387
2. Bounce test to verify the combined accuracy of the height sensor and accelerometer under California Test 387
3. Distance measurement instrument test to verify the accuracy of the distance measuring instrument under California Test 387
4. Manufacturer's recommended tests

Conduct a cross-correlation verification test of the inertial profiler in the Engineer's presence before performing the initial profiling. A verification test must be performed at least annually. Conduct 5 repeat runs of the inertial profiler on an authorized 0.1-mile test section. Calculate a cross-correlation to determine the repeatability of your device under California Test 387 using a ProVAL profiler certification analysis with a 3-foot maximum offset. The cross-correlation must be a minimum of 0.92.

36-3.01D(3)(b)(iii) Collecting and Analyzing Data

Operate the inertial profiler under the manufacturer's instructions. Collect profiling data under AASHTO R 57 at 1-inch recording intervals using a minimum 4-inch line laser sensor and analyze IRI using a 250-mm filter.

Establish semipermanent reference points for aligning inertial profiler runs and locating potential corrective grinding. Maintain semipermanent reference points until Department acceptance testing is completed.

While collecting the profile data to determine the IRI values, record semipermanent reference points at the beginning and end of the profile run and the beginning and end of the following locations in the raw profile data:

1. Bridge approach slabs
2. Bridges
3. Culverts visible on the roadway surface
4. Railroad crossings
5. At-grade intersections
6. Project limits
7. Change in pavement type

Profile the left and right wheel paths of each lane. Determine the MRI for 0.1-mile fixed segments using the ProVAL ride quality analysis with a 250-mm filter. Calculate the MRI of each lane. Segments less than 0.05 mile will not be evaluated for MRI but must comply with ALR requirement. Segments greater than or equal to 0.05 mile and less than or equal to 0.10 mile must comply with the MRI specifications for a 0.1-mile segment. Pay adjustments for segments greater than or equal to 0.05 mile and less than or equal to 0.10 mile will be calculated based on a prorated length. Determine the ALR using ProVAL with the average IRI values for each wheel path using a 25-foot continuous interval and a 250-mm filter.

36-3.01D(4) Department Acceptance

36-3.01D(4)(a) General

The Department accepts pavement surfaces for smoothness based on compliance with the smoothness specifications for the type of pavement surface specified.

For areas that require pavement smoothness determined using a 12-foot straightedge, the pavement surface must not vary from the lower edge of the straightedge by more than:

1. 0.01 foot when the straightedge is laid parallel with the traffic lane centerline
2. 0.02 foot when the straightedge is laid perpendicular to the centerline and extends from edge to edge of a traffic lane
3. 0.02 foot when the straightedge is laid within 24 feet of a pavement conform

36-3.01D(4)(b) Profile Verification

The Engineer may perform verification testing using the Department's inertial profiler. The Engineer notifies you of the Department's intention to perform verification testing. Your acceptance test results are considered acceptable and will be used for incentive and disincentive payments if your mean MRI is within 10 percent of the Department's mean MRI obtained over the same selected project length. When your test results are not considered acceptable, the Department's MRI values will be used in the calculation for incentive and disincentive payments for that evaluated length and the Department will have 15 days to complete an evaluation of both profiler certifications.

You and the Engineer must work together to avoid potential conflicts and to resolve disputes regarding test result discrepancies. Notify the Engineer within 5 business days of receiving the verification test result if you will dispute it. An independent third party will perform referee testing over the same selected project length. Before the third party participates in a dispute resolution, their profiler and operator must be certified under the Department's Profiler Certification Program. The independent third party must have no prior direct involvement with this Contract or no current direct involvement with you. The mean MRI value used in the calculation for incentive and disincentive payments will be from the party whose mean

MRI value is closer to the independent third party and the other party pays for the independent third party's testing.

36-3.02 MATERIALS
Not Used

36-3.03 CONSTRUCTION
Notify the Engineer of the start location by station and start time at least 2 business days before each day of profiling.

Before profiling, remove foreign objects from the pavement surface and mark the beginning and ending station on the pavement shoulder. The stationing must be the same when profiling more than 1 surface.

36-3.04 PAYMENT
Not Used