



THE SWITCH FROM PRI TO IRI: "AN UPDATE"

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RPUG
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OUTLINE

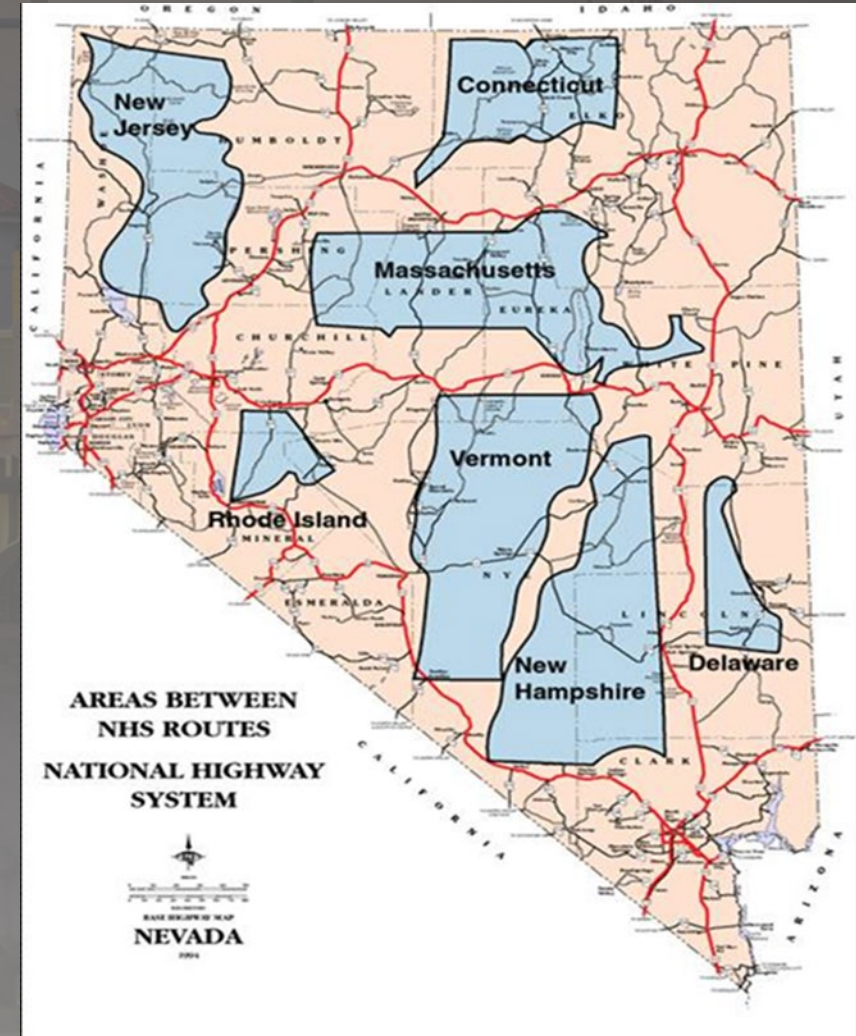
- ROADWAYS MAINTAINED BY NDOT
- INITIAL IRI SPECIFICATIONS FOR PROJECT ACCEPTANCE
- CURRENT IRI SPECIFICATIONS FOR PROJECT ACCEPTANCE
- PROFILING EQUIPMENT UTILIZED BY NDOT CONSTRUCTION
- NDOT CERTIFICATION PROGRAM
- LESSONS LEARNED
- WHAT THE FUTURE HOLDS



ROADWAYS MAINTAINED BY NDOT



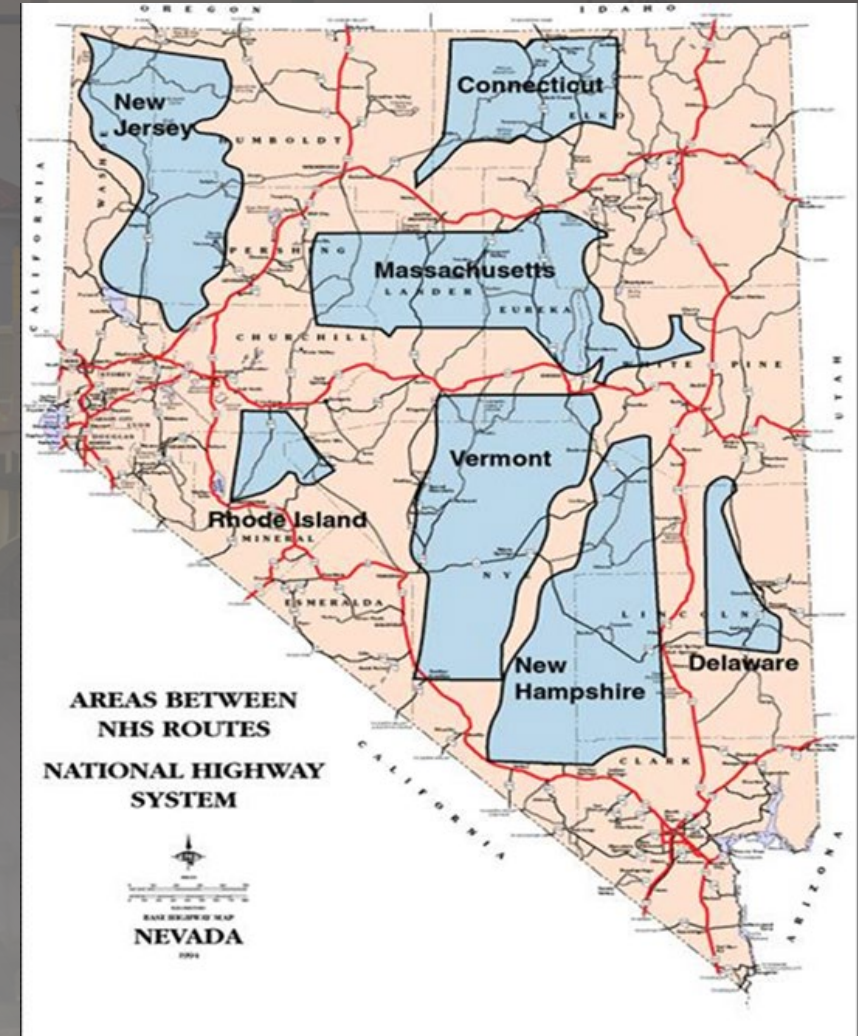
- INTERSTATE (NHS)
 - 618 CENTERLINE MILES
- NHS ROUTES (NON-INTERSTATE)
 - 1,798 CENTERLINE MILES
- US ROUTES (NON-NHS)
 - 455 CENTERLINE MILES
- STATE ROUTES (NON-NHS)
 - 2,135 CENTERLINE MILES



ROADWAYS MAINTAINED BY NDOT (CONTINUED)



- FRONTAGE ROADS (NON-NHS)
 - 305 CENTERLINE MILES
- STATE PARK ROADS
 - 50 CENTERLINE MILES
- COLLECTORS/DISTRIBUTORS
 - 34 CENTERLINE MILES



ROADWAYS MAINTAINED BY NDOT (CONTINUED)

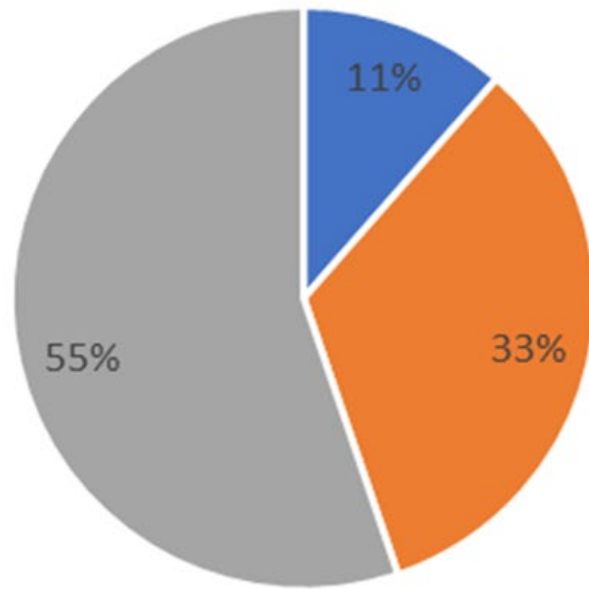


GRAND TOTAL
5,395 CENTERLINE MILES

ROADWAYS MAINTAINED BY NDOT (CONTINUED)



Percentage of Roadways Maintained by NDOT



■ Interstate ■ NHS (Non-Interstate) ■ Other Routes



INITIAL IRI SPECIFICATIONS

- IRI SPECIFICATIONS FOR PROJECT ACCEPTANCE WAS IMPLEMENTED ON ALL NDOT PROJECTS AS OF JANUARY 2016.
- CONTRACTOR'S RESULTS WERE USED IN THE PROJECT ACCEPTANCE PROCESS
- OPERATOR AND EQUIPMENT REQUIRED CERTIFICATION
 - ACCEPTED OTHER STATE DOT'S CERTIFICATION

INITIAL IRI SPECIFICATIONS (CONTINUED)



- VERIFICATION TESTING PERFORMED BY NDOT QA (QUALITY ASSURANCE) PERSONNEL
 - THREE HIGH SPEED INERTIAL PROFILING SYSTEMS (ONE FOR EACH DISTRICT)
 - PERFORMED VERIFICATION TESTING AT 10% (MIN.) OF THE CONTRACTOR'S ACCEPTANCE TESTING
- NDOT USED MRI FOR TENTH MILE SPECIFICATION AND IRI FOR LOCALIZED ROUGHNESS SPECIFICATION

INITIAL IRI SPECIFICATIONS (CONTINUED)



- NDOT SPECIFIED FOUR DIFFERENT SMOOTHNESS TYPES FOR HMA

	MRI	IRI
▪ TYPE A	(50 IN./MI)	(150 IN./MI)
▪ TYPE B	(60 IN./MI)	(160 IN./MI)
▪ TYPE C	(80 IN./MI)	(175 IN./MI)
▪ TYPE D	(100 IN./MI)	(175 IN./MI)

- FOR PCCP, THE SPECIFIED MRI VALUE WAS 60 IN./MI, AND THE IRI (LOCALIZED ROUGHNESS) VALUE WAS 175 IN./MI

INITIAL IRI SPECIFICATIONS (CONTINUED)



- FINAL HMA SURFACE
 - CONTRACTOR WAS RESPONSIBLE FOR CORRECTING DEFECTS TO MEET SPECIFICATION REQUIREMENTS
 - ❖ OPTION TO LEAVE DEFECTS IN PLACE AT \$1,000.00 PER DEFECT

INITIAL IRI SPECIFICATIONS (CONTINUED)



- NDOT SPECIFIED A RIDE INCENTIVE/DISINCENTIVE ON THE FINAL SURFACE OF INTERSTATE ROUTES
- FINAL SURFACE OF HMA
 - MAXIMUM INCENTIVE WAS \$600.00 PER TENTH OF A MILE
 - ❖ INCENTIVE WAS BASED UPON THE INITIAL MEASURED MRI
 - ❖ TENTH OF A MILE SECTION HAD AN MRI ≤ 44.999 IN./MI
 - ❖ NO AREAS OF LOCALIZED ROUGHNESS > 150.000 IN./MI
 - ❖ NO DEFECTS IN EXCESS OF 0.25 IN. AS MEASURED WITH A STRAIGHTEDGE

INITIAL IRI SPECIFICATIONS (CONTINUED)



- FINAL SURFACE OF HMA
 - MAXIMUM DISINCENTIVE WAS \$600.00 PER TENTH OF A MILE
 - ❖ GRINDING OF AREAS WITH AN MRI FROM 55.000 TO 74.000 IN./MI WAS NOT ALLOWED EXCEPT FOR THE FOLLOWING:
 - IF ANY TENTH OF A MILE SECTIONS HAD AREAS OF LOCALIZED ROUGHNESS > 150.000 IN./MI
 - IF ANY TENTH OF A MILE SECTIONS HAD DEFECTS IN EXCESS OF 0.25 IN. AS MEASURED WITH A STRAIGHTEDGE

INITIAL IRI SPECIFICATIONS (CONTINUED)



- FINAL SURFACE OF HMA
 - MAXIMUM DISINCENTIVE WAS \$600.00 PER TENTH OF A MILE
 - ❖ LIQUIDATED DAMAGES OF \$1,000.00 WAS ASSESSED FOR EACH SUCH AREA AND/OR DEFECT NOT CORRECTED
 - CONTRACTOR HAD TO CORRECT IF MRI WAS ≥ 75 IN./MI

INITIAL IRI SPECIFICATIONS (CONTINUED)



- FINAL SURFACE OF PCCP
 - MAXIMUM INCENTIVE WAS \$1,600.00 PER TENTH OF A MILE
 - ❖ INCENTIVE WAS BASED UPON THE INITIAL MEASURED MRI
 - ❖ TENTH OF A MILE SECTION HAD AN MRI ≤ 59.999 IN./MI
 - ❖ NO AREAS OF LOCALIZED ROUGHNESS > 175.000 IN./MI
 - ❖ NO DEFECTS IN EXCESS OF 0.25 IN. AS MEASURED WITH A STRAIGHTEDGE

INITIAL IRI SPECIFICATIONS (CONTINUED)



- FINAL SURFACE OF PCCP
 - MAXIMUM DISINCENTIVE WAS \$1,600.00 PER TENTH OF A MILE
 - ❖ TENTH MILE SECTIONS WITH AN MRI OF 76.000 TO 95.999 IN./MI HAD TO BE CORRECTED TO REDUCE AND/OR ELIMINATE DISINCENTIVE
 - ❖ TENTH MILE SECTIONS WITH AN MRI \geq 96.000 IN./MI HAD TO BE CORRECTED BY THE CONTRACTOR
 - ❖ TENTH MILE SECTIONS CONTAINING AREAS OF LOCALIZED ROUGHNESS $>$ 175.000 IN./MI OR DEFECTS IN EXCESS OF 0.25 IN./MI AS MEASURED WITH A STRAIGHTEDGE MUST BE CORRECTED BY THE CONTRACTOR

CURRENT IRI SPECIFICATIONS



- IRI SPECIFICATIONS FOR ACCEPTANCE WAS IMPLEMENTED ON ALL NDOT PROJECTS AS OF JANUARY 2016.
- CONTRACTOR'S RESULTS WERE USED IN THE PROJECT ACCEPTANCE PROCESS
- OPERATOR AND EQUIPMENT REQUIRED CERTIFICATION
 - **NDOT CERTIFIED OR APPROVED EQUAL**

CURRENT IRI SPECIFICATIONS (CONTINUED)



- NDOT SPECIFIES FOUR DIFFERENT SMOOTHNESS TYPES FOR HMA

	MRI	IRI
▪ TYPE A	(50 IN./MI)	(150 IN./MI)
▪ TYPE B	(60 IN./MI)	(160 IN./MI)
▪ TYPE C	(80 IN./MI)	(180 IN./MI)
▪ TYPE D	(100 IN./MI)	(200 IN./MI)

CURRENT IRI SPECIFICATIONS (CONTINUED)



- FINAL HMA SURFACE

- CONTRACTOR NOT ALLOWED TO GRIND FINAL SURFACE

- ❖ LIQUIDATED DAMAGES OF \$2,500.00 WILL BE ASSESSED FOR EACH DEFECT (MRI, IRI, AND STRAIGHTEDGE) WITHIN EACH ONE-TENTH MILE SECTION EXCEEDING THE PAVEMENT SMOOTHNESS TYPE AND STRAIGHTEDGE REQUIREMENTS. THE CUMULATIVE AMOUNT OF LIQUIDATED DAMAGES FOR EACH TRAVEL LANE WITHIN EACH ONE-TENTH MILE SECTION SHALL NOT EXCEED \$20,000.00

CURRENT IRI SPECIFICATIONS (CONTINUED)



- NDOT SPECIFIES A RIDE INCENTIVE/DISINCENTIVE ON THE FINAL SURFACE OF INTERSTATE ROUTES
- FINAL SURFACE OF HMA
 - MAXIMUM INCENTIVE IS **\$1,000.00** PER TENTH OF A MILE
 - ❖ INCENTIVE IS BASED UPON THE INITIAL MEASURED MRI
 - ❖ TENTH OF A MILE SECTION HAS AN MRI ≤ 39.999 IN./MI
 - ❖ NO AREAS OF LOCALIZED ROUGHNESS > 150.000 IN./MI
 - ❖ NO DEFECTS IN EXCESS OF 0.25 IN. AS MEASURED WITH A STRAIGHTEDGE

CURRENT IRI SPECIFICATIONS (CONTINUED)



- MAXIMUM DISINCENTIVE IS **\$1,000.00** PER TENTH OF A MILE
 - ❖ IF ANY 0.100 MILE LOT SECTIONS HAVE AREAS OF LOCALIZED ROUGHNESS OF **> 150.000** INCHES PER MILE OR DEFECTS IN EXCESS OF 0.25 INCH AS MEASURED WITH THE STRAIGHTEDGE, LIQUIDATED DAMAGES OF **\$2,500.00** WILL BE ASSESSED FOR EACH SUCH DEFECT. THE CUMULATIVE AMOUNT OF LIQUIDATED DAMAGES AND THE NEGATIVE RIDE PAY ADJUSTMENT FOR EACH LOT SHALL NOT EXCEED **\$20,000.00**.

CURRENT IRI SPECIFICATIONS (CONTINUED)



- MAXIMUM DISINCENTIVE IS **\$1,000.00** PER TENTH OF A MILE
 - ❖ REMOVING AND REPLACING THE OPEN-GRADED PAVING OR WEARING COURSE SURFACE MAY BE REQUIRED IF THE CALCULATED AMOUNT EXCEEDS THE MAXIMUM CUMULATIVE AMOUNT OF **\$20,000.00** IN LIQUIDATED DAMAGES AND THE NEGATIVE RIDE PAY ADJUSTMENT FOR EACH RIDE QUALITY LOT.

CURRENT IRI SPECIFICATIONS (CONTINUED)



NO CHANGES TO PCCP SPECIFICATIONS

SMOOTHNESS SPECIFICATION FOR BRIDGE DECKS



SMOOTHNESS SPECIFICATION FOR BRIDGE DECKS



- 502.03.16 FINISH OF HORIZONTAL SURFACES
 - TEST THE FINISHED CONCRETE SURFACES AS WELL AS PAVEMENT WITHIN 50 FEET OF THE LEADING EDGE AND WITHIN 50 FEET OF THE TRAILING EDGE OF THE BRIDGE DECK (INCLUDING APPROACH SLABS) BY MEANS OF AN INERTIAL PROFILER OR MULTIPURPOSE SURFACE PROFILER ACCORDING TO TEST METHOD NO. NEV. T448 SECTION II. THE MAXIMUM ALLOWABLE INTERNATIONAL ROUGHNESS INDEX (IRI) FOR LOCALIZED ROUGHNESS IS 175.000 INCHES/MILE. LOCATE AND CORRECT AREAS EXCEEDING PROFILE REQUIREMENTS BY GRINDING.

SMOOTHNESS SPECIFICATION FOR BRIDGE DECKS (CONTINUED)



- 502.03.16 FINISH OF HORIZONTAL SURFACES.
 - OBTAIN A MINIMUM OF TWO PROFILES PER TRAFFIC LANE AND ONE PROFILE FOR EACH SHOULDER. OBTAIN THE PROFILE RUNS PARALLEL TO AND IN THE DIRECTION OF TRAFFIC. MEASURE THE PROFILES WITHIN EACH TRAFFIC LANE 3 FEET FROM THE RESPECTIVE LEFT OR RIGHT TRAFFIC LANE LINES. MEASURE THE PROFILES WITHIN EACH SHOULDER APPROXIMATELY 3 FEET FROM THE CURB OR RAIL FACE. WHERE THE COMBINED WIDTH OF THE BRIDGE DECK AND/OR APPROACH SLAB SHOULDER AND ADJACENT TRAFFIC LANE IS 16 FEET OR LESS, THE PROFILE MEASUREMENT FOR THAT SHOULDER IS NOT REQUIRED.

SMOOTHNESS SPECIFICATION FOR BRIDGE DECKS (CONTINUED)



- 502.03.16 FINISH OF HORIZONTAL SURFACES.
 - WHEN A STRAIGHTEDGE 12 FEET LONG IS LAID ON THE FINISHED SURFACE BOTH PERPENDICULAR AND PARALLEL WITH THE CENTERLINE OF THE BRIDGE DECK AND APPROACH SLABS, THE SURFACE SHALL NOT VARY BY MORE THAN 0.25 INCH FROM THE LOWER EDGE OF THE STRAIGHTEDGE.
 - WHEN THE BRIDGE DECK AND APPROACH SLAB CONCRETE ARE INDICATED TO BE COVERED BY PLANTMIX BITUMINOUS SURFACING, MEASURE AND CORRECT THE PAVEMENT SURFACE ACCORDING TO SUBSECTIONS 402.03.05 AND 403.03.04.
 - PERFORM GRINDING IN ACCORDANCE WITH SUBSECTION 402.03.05.

NDOT CONSTRUCTION PROFILING EQUIPMENT



NDOT CERTIFICATION PROGRAM



- PROGRAM IS ADMINISTERED BY THE QUALITY ASSURANCE SECTION OF THE CONSTRUCTION DIVISION
- CERTIFICATION CONSISTS OF A WRITTEN EXAM AND A PERFORMANCE VERIFICATION OF THE PROPOSED OPERATOR AND EQUIPMENT
- CERTIFICATION OF BOTH OPERATOR AND CORRESPONDING EQUIPMENT IS VALID FOR ONE YEAR

NDOT CERTIFICATION PROGRAM (CONTINUED)



- TWO CERTIFICATION SITES (NORTH AND SOUTH)
 - FRONTAGE ROAD ALONG US 395 BETWEEN CARSON CITY AND RENO
 - FRONTAGE ROAD ALONG US 93 NORTH OF LAS VEGAS
 - EITHER A SURPRO 4000 (ICC) OR A CS8800 (SSI) WALKING PROFILER IS USED TO ESTABLISH A BASELINE PROFILE ALONG THE CERTIFICATION TRACK

NDOT CERTIFICATION PROGRAM (CONTINUED)



North Track



NDOT CERTIFICATION PROGRAM (CONTINUED)

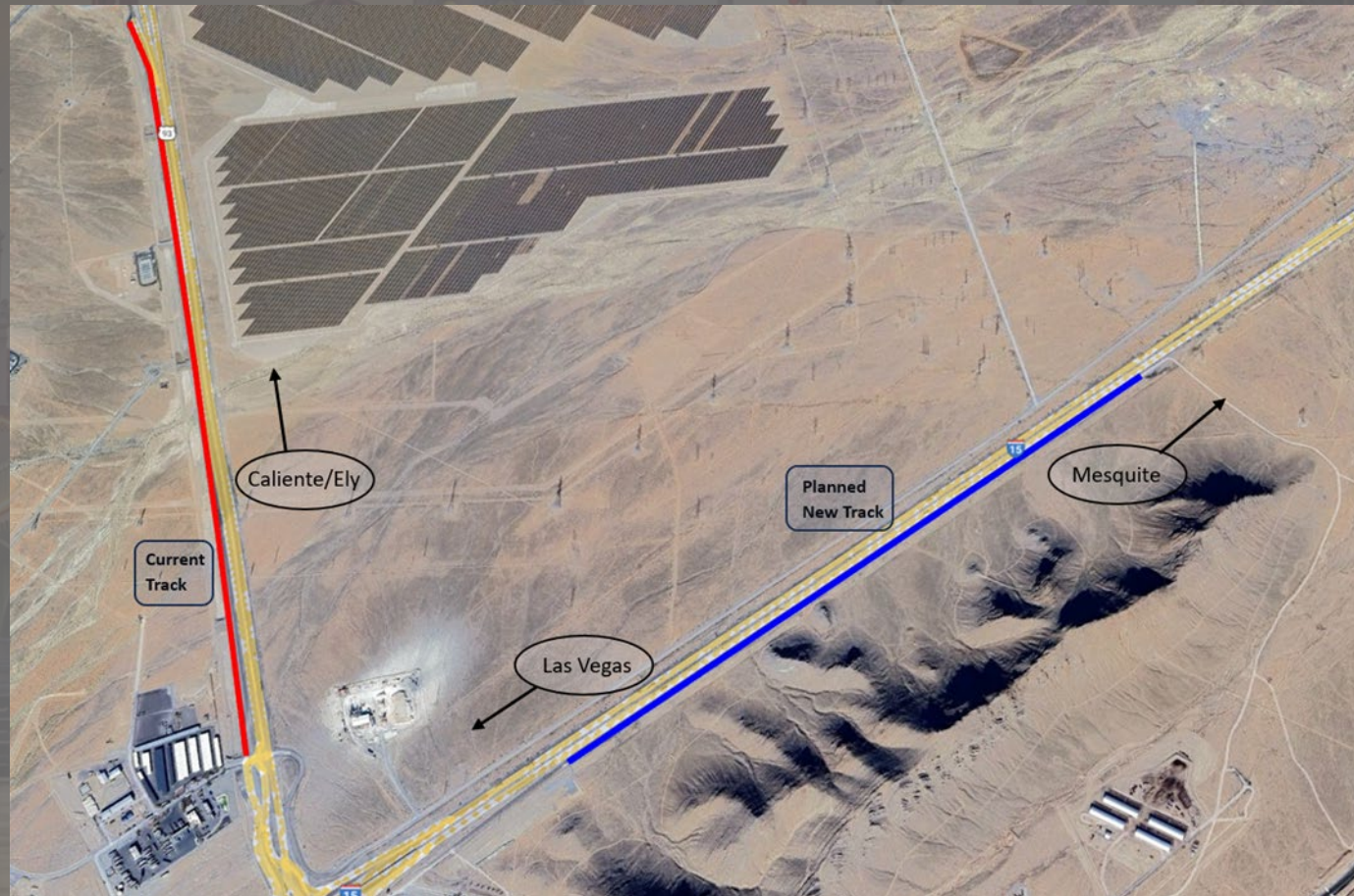
North Track



NDOT CERTIFICATION PROGRAM (CONTINUED)



South Track



NDOT CERTIFICATION PROGRAM (CONTINUED)

South Track





LESSONS LEARNED

- WHEN DEVELOPING SPECIFICATIONS, EARLY INVOLVEMENT BY INDUSTRY IS KEY
- WHEN DEVELOPING SPECIFICATIONS, MAKE A CONCERTED EFFORT TO WIN OVER VERY SEASONED INTERNAL STAFF WHO ARE SET IN THEIR WAYS
- BE FLEXIBLE WITH THE RIDE SPECIFICATIONS
 - PROJECT SPECIFIC
- CONTINUALLY REVIEW SPECIFICATIONS AND UPDATE ACCORDINGLY



LESSONS LEARNED (CONTINUED)

- DO NOT BE AFRAID TO REACH OUT TO OTHER STATES FOR ASSISTANCE WITH SPECIFICATIONS/TEST METHODS/CERTIFICATION PROGRAM
- DO NOT MAKE CERTIFICATION TRACKS TO SMOOTH
 - MUCH MORE DIFFICULT TO PASS THE 90% ACCURACY REQUIREMENT



WHAT THE FUTURE HOLDS

- PURCHASE A 2ND ZERO SPEED SYSTEM
- UPDATING THE TEST METHOD/SPECIFICATIONS TO INCLUDE ZERO-SPEED ENDORSEMENT
- CONTINUE TO PARTICIPATE IN TPF-5(354) IMPROVING THE QUALITY OF HIGHWAY PROFILE MEASUREMENT
- PARTICIPATE IN FUTURE POOLED FUND STUDY IMPROVING THE QUALITY OF HIGHWAY PROFILE MEASUREMENT LED BY ILLINOIS DOT



