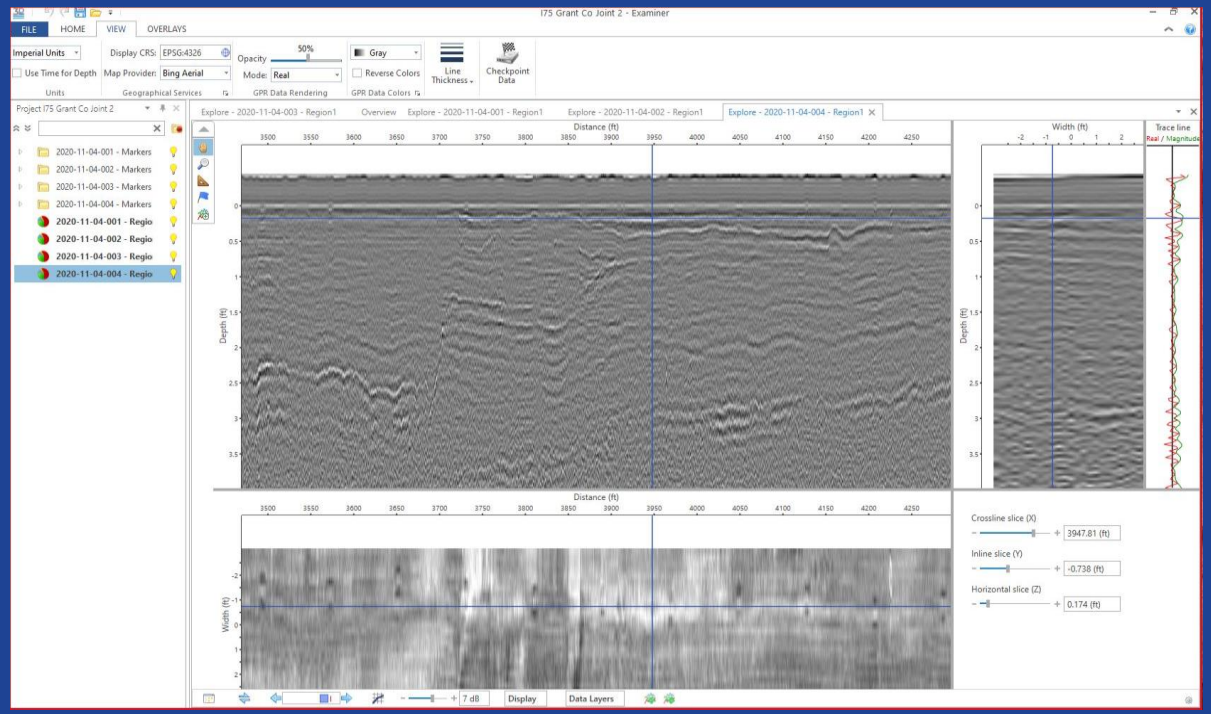
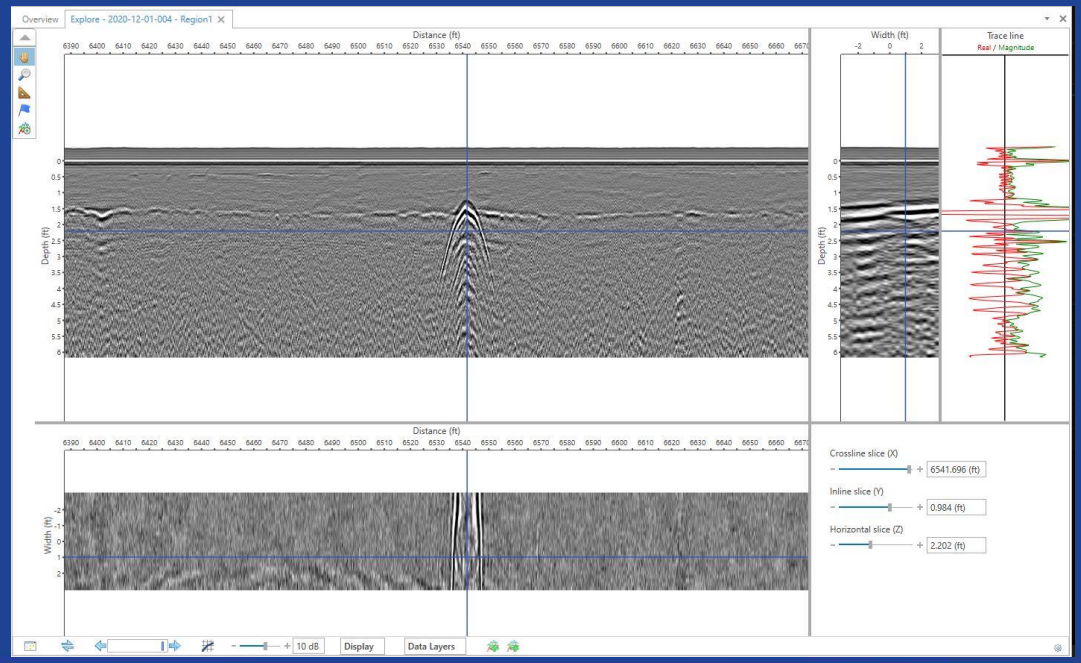
3D RADAR





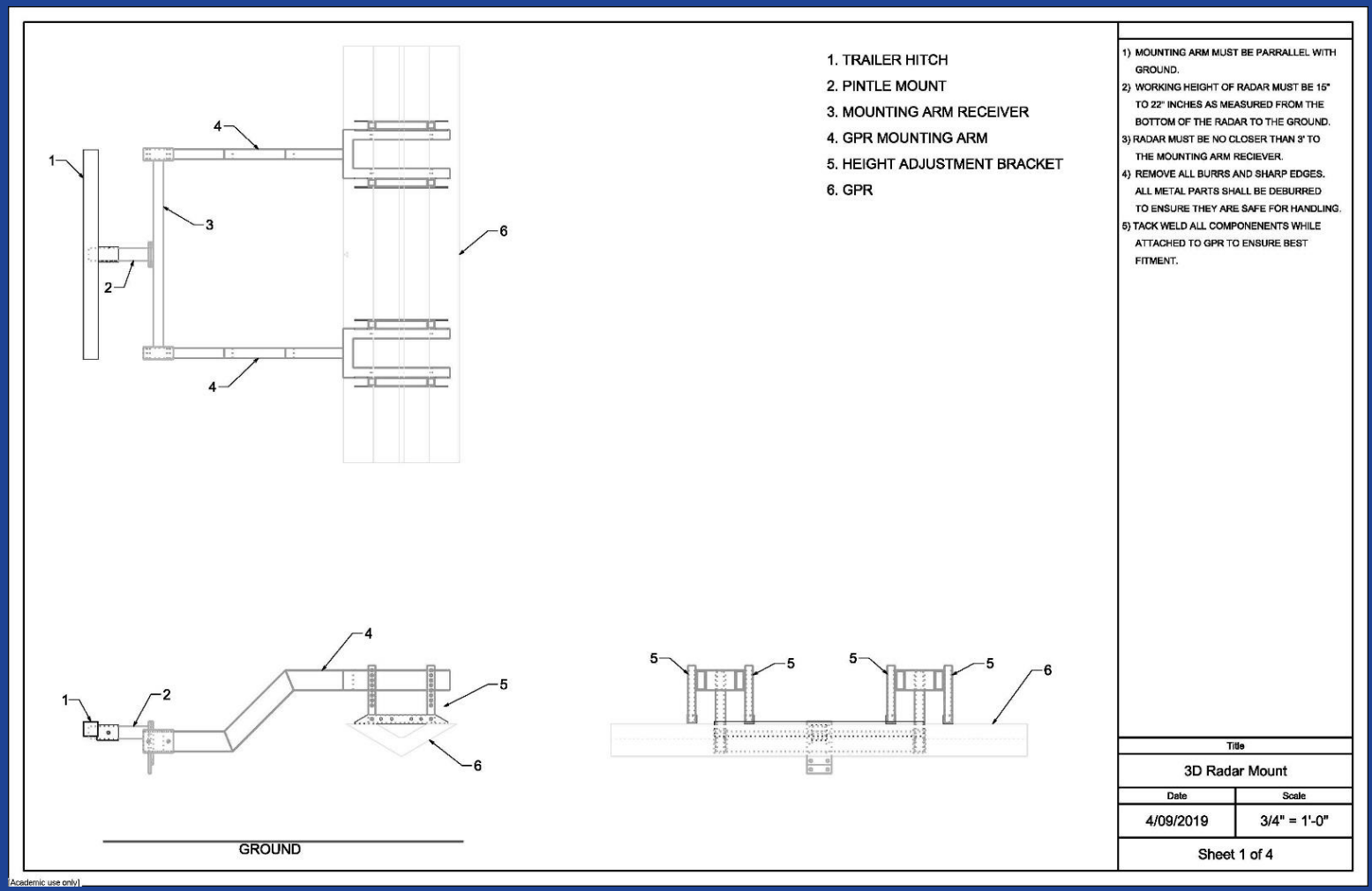
KENTUCKY TRANSPORTATION CABINET

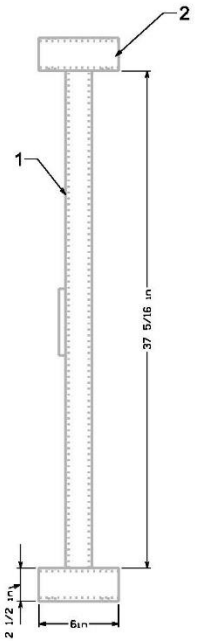
EXCELLENCE IN MOTION

PREVIOUS MULTI-ANTENNA (3D) SCAN WITH GPS

MANUFACTURER DOES NOT SUPPLY OR SELL MOUNTS FOR THEIR ANTENNAS.

DESIGNING A MOUNTING SYSTEM





ABOVE SCALE 3/4" = 6"

1. 2" x 4" x 0.25" A500 STEEL TUBE 37-5/16 IN. LNG. (QTY - 1)
2. 2.5" x 4.5" x 0.25" A500 STEEL TUBE 6 IN. LNG (QTY - 2)
3. 5" x 8-21/32" x 0.50" HRS (QTY - 1)

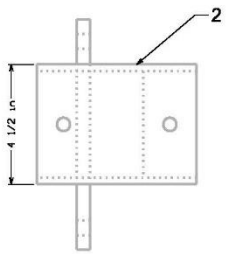
SECURING MOUNTING ARM TO RECEIVER

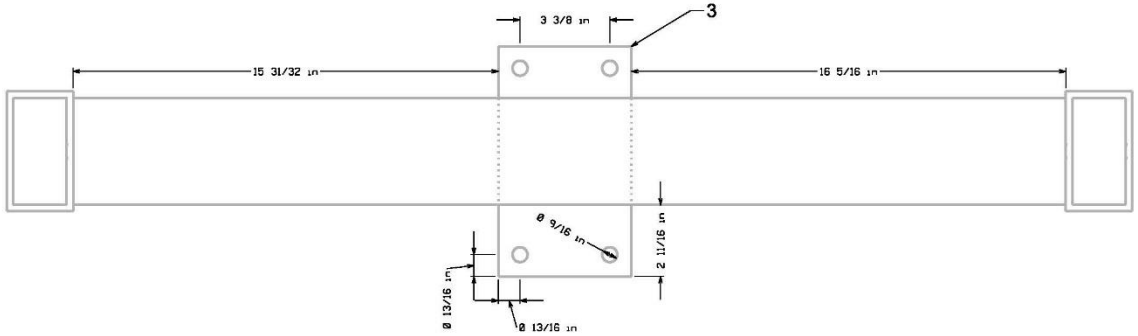
- 0.5" DIA. x 2.5" USABLE LENGTH 18-8 SS CLEVIS PINS (QTY - 4)
- HAIRPIN COTTER PINS (QTY - 4)

SECURING MOUNTING ARM TO PINTLE MOUNT

- 0.5"-13 X 2" LONG GRADE 8 HEX BOLTS (QTY - 4)
- 0.5"-13 GRADE 8 HEX NUTS (QTY - 4)
- 0.5" DIAMETER GRADE 8 LOCK WASHERS (QTY - 4)

1) MOUNTING ARM MUST BE PARRALLEL WITH GROUND.
2) WORKING HEIGHT OF RADAR MUST BE 15" TO 22" INCHES AS MEASURED FROM THE BOTTOM OF THE RADAR TO THE GROUND.
3) RADAR MUST BE NO CLOSER THAN 3' TO THE MOUNTING ARM RECIEVER.
4) REMOVE ALL BURRS AND SHARP EDGES. ALL METAL PARTS SHALL BE DEBURRED TO ENSURE THEY ARE SAFE FOR HANDLING
5) TACK WELD ALL COMPONENENTS WHILE ATTACHED TO GPR TO ENSURE BEST FITMENT.

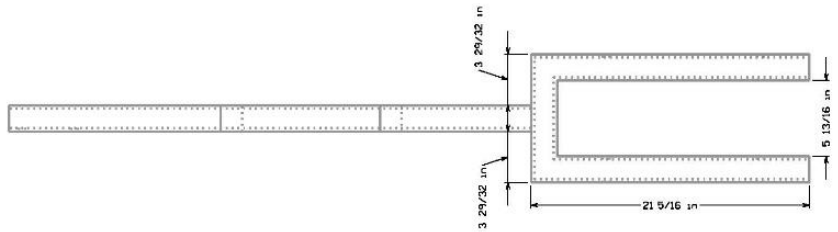


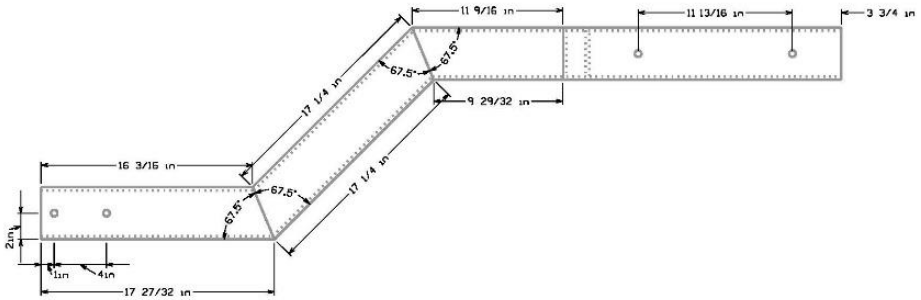


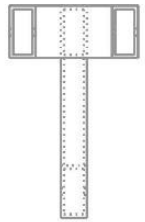
Title	
MOUNTING ARM RECEIVER	
Date	Scale
4/09/2019	3/4" = 3"
Sheet 2 of 4	

1. 2" x 4" x 0.25" 6061 T6 ALUMINUM TUBE TOTAL LENGTH FOR SINGLE ARM IS 99 - 3/32 IN. (QTY - 2)
2. ANGLED JOINTS TO BE WELDED AND PLATED
3. ALL HOLES ON THIS SHEET ARE 1/2" IN DIAMETER

SECURING SUPPORT BRACKET TO MOUNTING ARM
-0.5" DIA. x 3.75" USABLE LENGTH 18-8 SS CLEVIS PINS (QTY - 4)
-HAIRPIN COTTER PINS (QTY - 4)



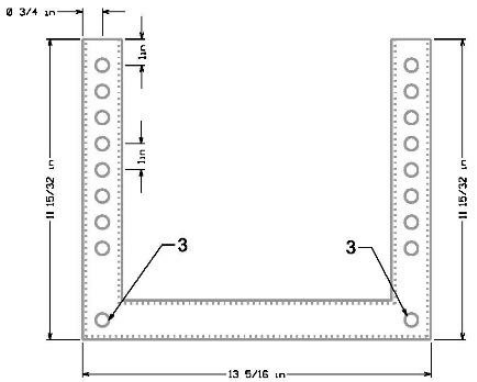




1) MOUNTING ARM MUST BE PARRALLEL WITH GROUND.
2) WORKING HEIGHT OF RADAR MUST BE 15" TO 22" INCHES AS MEASURED FROM THE BOTTOM OF THE RADAR TO THE GROUND.
3) RADAR MUST BE NO CLOSER THAN 3' TO THE MOUNTING ARM RECIEVER.
4) REMOVE ALL BURRS AND SHARP EDGES. ALL METAL PARTS SHALL BE DEBURRED TO ENSURE THEY ARE SAFE FOR HANDLING
5) TACK WELD ALL COMPONENENTS WHILE ATTACHED TO GPR TO ENSURE BEST FITMENT.

Title	
MOUNTING ARM	
Date	Scale
4/09/2019	3/4" = 6"
Sheet 3 of 4	

1. 1.5" x 1.5" x 0.125" 6061 T6 ALUMINUM TUBE TOTAL LENGTH FOR EACH SUPPORT IS 36 - 7/8 IN. (QTY - 4)
2. ALL HOLES ON THIS SHEET ARE 1/2" IN DIAMETER
3. HOLES FOR EACH BRACKET TO BE LINED UP WITH HOLES ON C-CHANNEL LOCATED ON GPR. PLACEMENT MAY BE DIFFERENT FOR EACH SUPPORT.



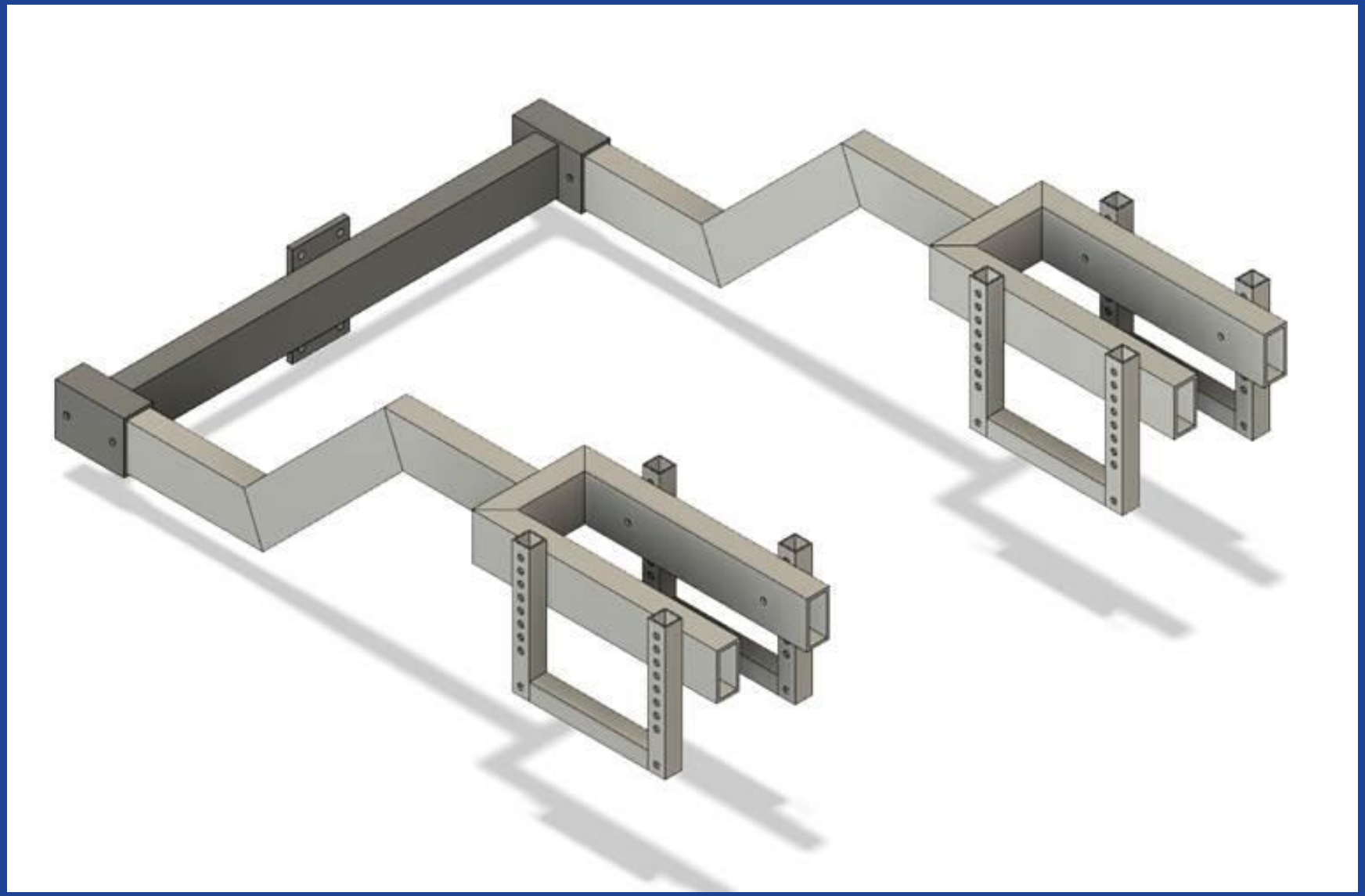
SECURING GPR TO SUPPORT BRACKET

-0.5" DIA. x 2.0" USABLE LENGTH 18-8 SS CLEVIS PINS (QTY - 4)

-HAIRPIN COTTER PINS (QTY - 4)

1) MOUNTING ARM MUST BE PARRALLEL WITH GROUND.
2) WORKING HEIGHT OF RADAR MUST BE 15" TO 22" INCHES AS MEASURED FROM THE BOTTOM OF THE RADAR TO THE GROUND.
3) RADAR MUST BE NO CLOSER THAN 3' TO THE MOUNTING ARM RECIEVER.
4) REMOVE ALL BURRS AND SHARP EDGES. ALL METAL PARTS SHALL BE DEBURRED TO ENSURE THEY ARE SAFE FOR HANDLING.
5) TACK WELD ALL COMPONENENTS WHILE ATTACHED TO GPR TO ENSURE BEST FITMENT.

Title	
SUPPORT BRACKET	
Date	Scale
4/09/2019	3/4" = 3"
Sheet 4 of 4	



KENTUCKY TRANSPORTATION CABINET

KTC
EXCELLENCE IN MOTION


4X4
Ford

METHOD OF TRANSPORTING THE MOUNT AND ANTENNA LONG DISTANCE FOR USE.

WHAT CAN 3D RADAR DO?

- Water Bleeding through pavements
- Keeneland Scan
- Dowel Bars
- Bridges
- Forensics

US 25 E KNOX/LAUREL CO

WATER BLEEDING – PAVEMENT INVESTIGATION

PRELIMINARY FINDINGS

8/24/20

US 25 E KNOX/LAUREL CO

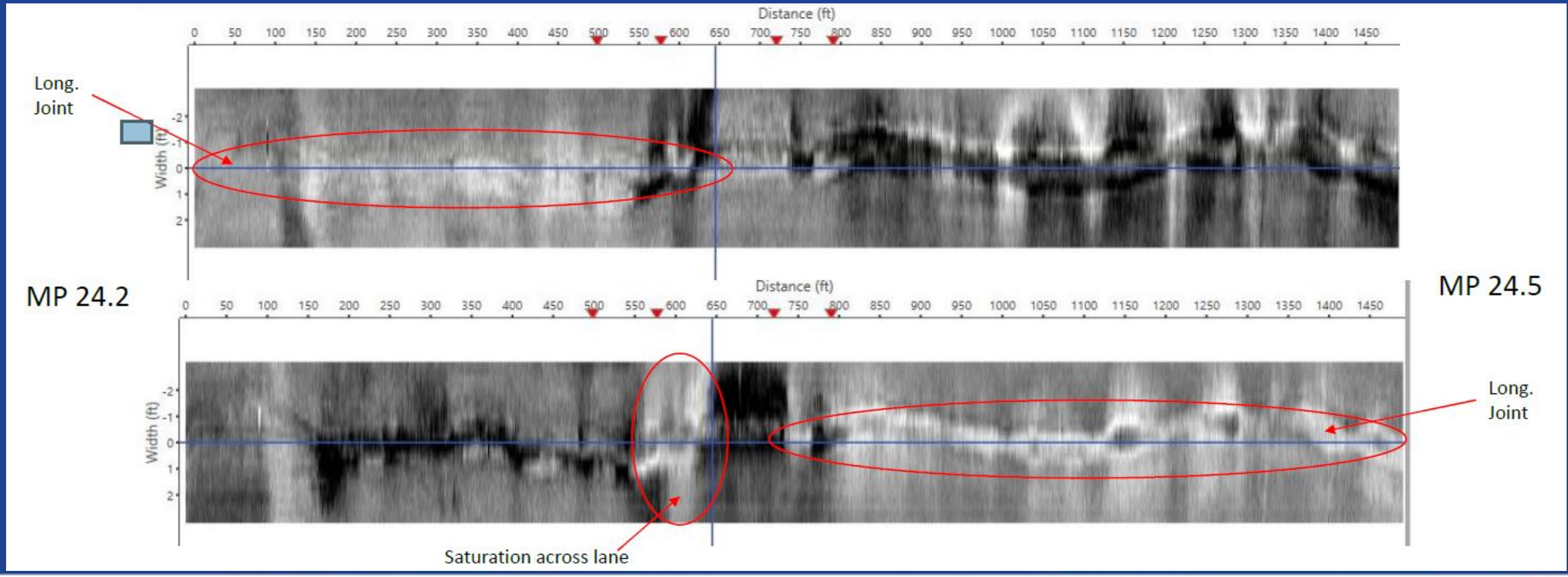
- Knox Co. MP 24.2 to Laurel Co. MP 0.35
- Preliminary site visit showed water coming up through longitudinal joint
- 3 sites chosen
  - Site 1 - NB MP 24.4
  - Site 2 - NB MP 25.25
  - Site 3 - SB MP 24.35
- 3D GPR to see where water is located
  - Longitudinal joint scan - 7 foot scan width
- AIP for surface permeability along joint and adjacent to joint
- Cores to confirm pavement structure and to perform density and permeability of internal layers

NB SITE 1 – MP 24.4

- Water bleeding up through longitudinal joint
- Slight super, high side left shoulder
- 9 Perms
  - 4 on joint
  - 3 six inches left of joint
  - 2 six inches right of joint
- 3 cores
  - Left of joint
  - Right of joint
  - On joint

NB SITE 1 - 3D GPR SCAN OF LONGITUDINAL JOINT MP 24.2 TO MP 24.5

- Top down slice of 3D scan
- First Image shows moisture at 5.5” and second image shows moisture at 5”
- Joint appears saturated, some saturation across the lane



KENTUCKY TRANSPORTATION CABINET

KTC EXCELLENCE IN MOTION

NB SITE 1 – SURFACE PERMEABILITY

Perm #	Direction	Milepoint	Location	Perm Value (mmhg)	Core #
10	NB	25.25	Right Lane, 6" off CLJ	224	
11	NB	25.25	Left Lane, 6" off CLJ	375	
12	NB	25.25	CLJ	290	
13	NB	25.25	Right Lane, 6" off CLJ	182	4
14	NB	25.25	Center of Lane	500+	
15	NB	25.25	Right Lane, Left Wheel Path	500+	

- Perms typically less than 300 are considered to be permeable.

NB SITE 1 – CORE 1 (ON JOINT)

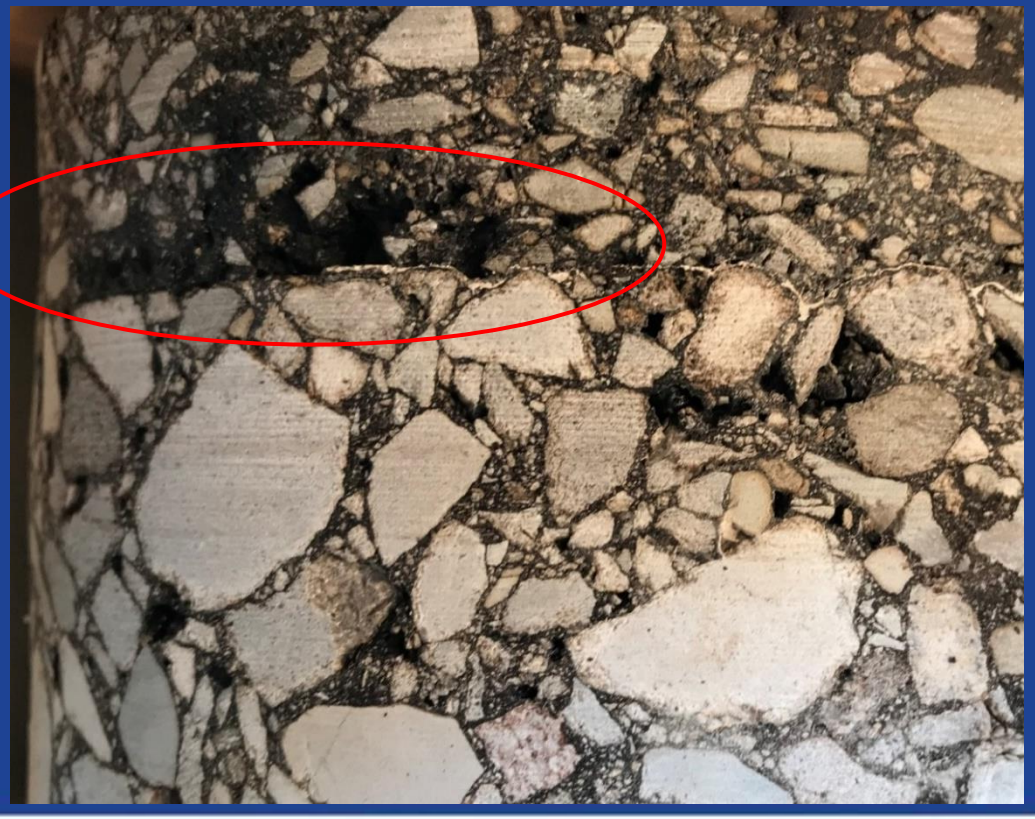
- Cored to top of DGA
- Dried out core hole
- After a few minutes there was an inch of water in the core hole
- Debonding at old and new pavement at ~ 3.5”
- Water appears to be coming in through Old/New interface as can be seen from the pictures

KENTUCKY TRANSPORTATION CABINET

KTC EXCELLENCE IN MOTION

NB SITE 1 – STRIPPING

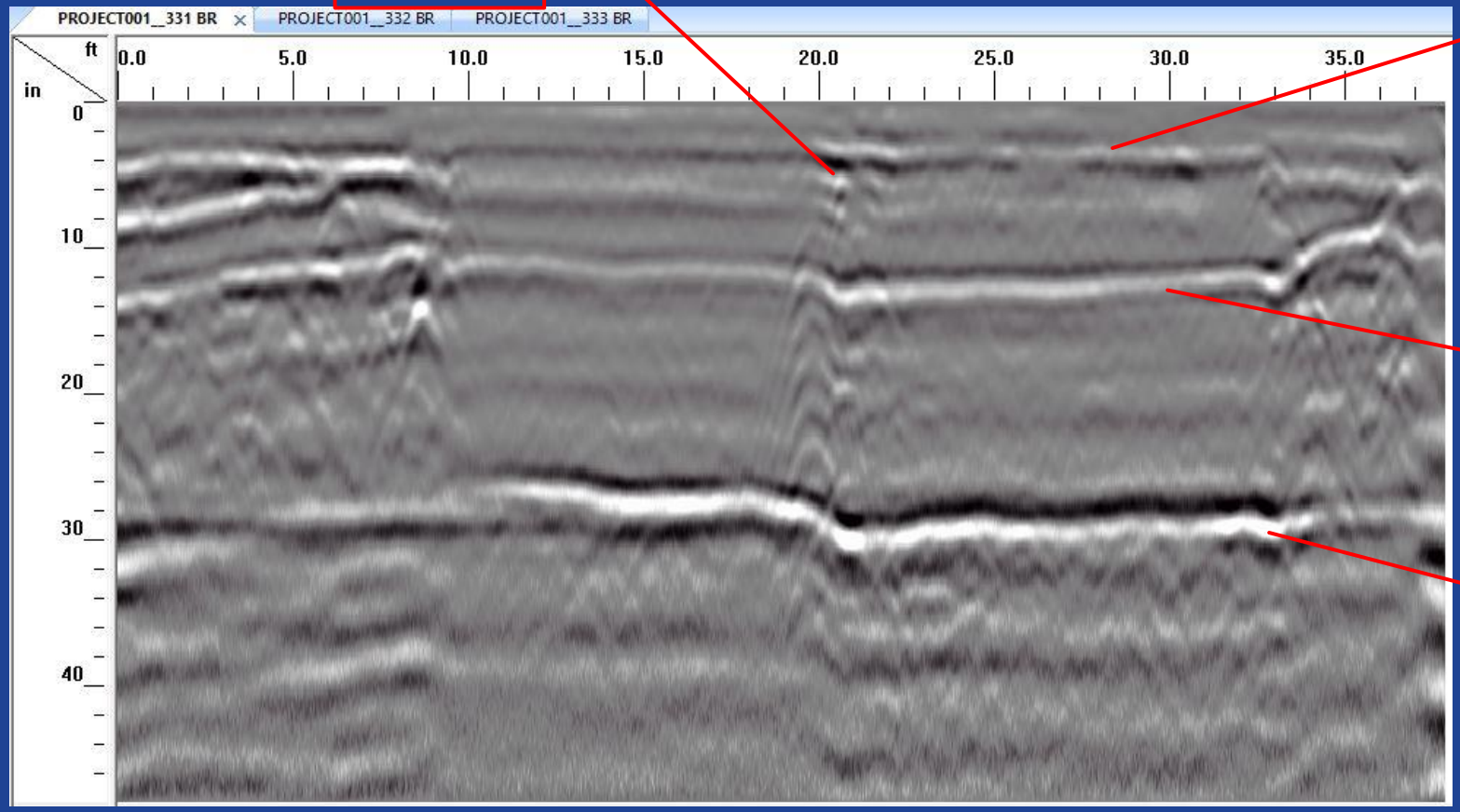
- Dark brown staining on surface possible indication of stripping
- Potential stripping at interface between new surface and new base



NB SITE 1 – CORE 2 (RIGHT OF JOINT) AND CORE 3 (LEFT OF JOINT)

- Cores taken 6-inches either side of the joint
- Water entering core hole at interface between new and old pavement
- Both debonded between interface between new and old pavement
  - Core 2 – 3.5”
  - Core 3 – 4.0”

NB SITE 1 – GPR TRANSVERSE SCAN



Outside Shoulder | Right Lane | Left Lane | Inside Shoulder

KENTUCKY TRANSPORTATION CABINET

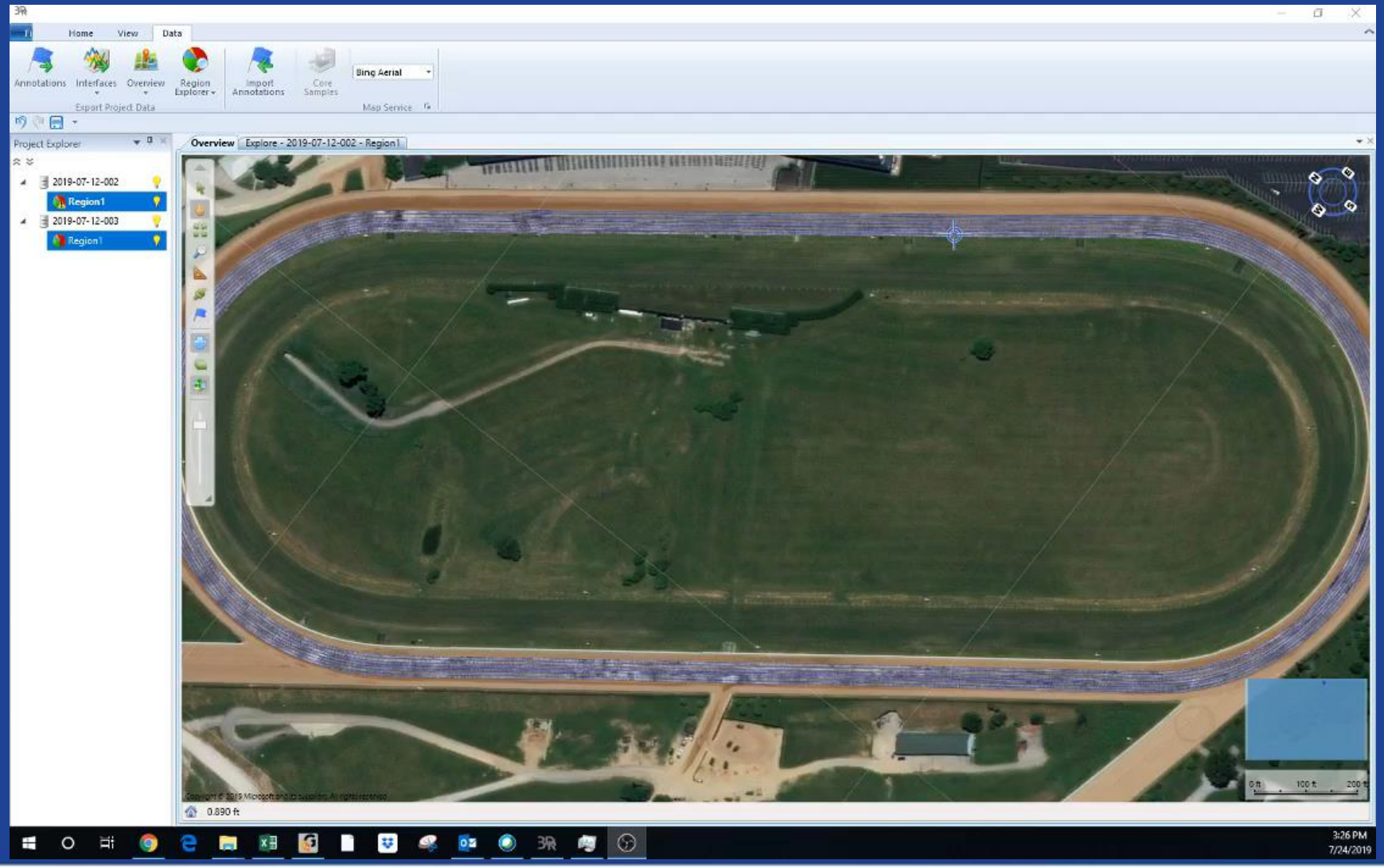
KTC EXCELLENCE IN MOTION

KEENELAND SCAN

KENTUCKY TRANSPORTATION CABINET

KTC
EXCELLENCE IN MOTION

SLIDING THROUGH DEPTH PLANE



KENTUCKY TRANSPORTATION CABINET

EXCELLENCE IN MOTION

DOWEL BARS

SPECIAL NOTE FOR DOWEL BAR AND TIE BAR PLACEMENT IN JPC PAVEMENT

This Special Note will apply where indicated on the plans or in the proposal. Section references herein are to the Department's current Standard Specifications for Road and Bridge Construction.

1.0 DESCRIPTION. This Special Note applies when new JPC pavement is placed on a project. Allowable tolerances are outlined for both dowel bar and tie bar placement in driving lanes and shoulders. Concrete patches will not be tested under this special note unless they are required as corrective work under subsection 3.1. Testing applies to all joints except that transverse joints in the shoulders will not be tested. *Working with concrete requires at least seven days or more of curing time. The concrete should be dry for at least 24 hrs prior to testing.*

This Special Note specifies the allowable tolerances for placement of dowel bars and tie bars in JPC pavement.

2.0 MATERIALS. Conform to Subsection 501 or 502 of the current Standard Specifications. Consistent with Standard Drawing RPS-020-13, dowel baskets will be manufactured with the mid-point of the dowel bar at T/2.

3.0 CONSTRUCTION.

3.1 Dowel Bars. Transverse dowel bars, which are generally in baskets, should be located in the center of the slab vertically. They should not be skewed or rotated. Contrary to Section 501 of the Standard Specification and Standard Drawing RPS-020-13, place dowel bars to the tolerances shown in the table below.

Dimension	Tolerance
Horizontal offset	± 1 inch
Longitudinal translation	± 3 inches
Horizontal skew	½ inch, max
Vertical skew	½ inch, max
Vertical depth	The minimum distance below the concrete pavement surface must be: DB=T/3 + ½ inch Where: DB = vertical distance in inches, measured from the concrete pavement surface to any point along the top of dowel bar; and T = actual concrete pavement thickness at joint location, in inches. The maximum distance below the surface to any point along the dowel bar should be 2T/3.

Dowel bars determined to be out of tolerance are to be marked in the field with marking paint. Corrective work will be required for the following circumstances:

- if 3 or more bars are higher than T/3 + ½ inch from the top of the slab or lower than 2T/3 (as measured from the top) for the bottom of the slab
- if 3 or more bars are translated longitudinally 3 inches or more
- if more than two consecutive joints have any bars that are skewed vertically or horizontally

Any corrective work shall be completed in accordance with the current special note 11J – Special Note for Full Depth Concrete Pavement Repair. Contrary to Special Note 11J, all joint repairs completed due to corrective work shall be sealed with silicone rubber unless approved by the Engineer.

3.2 Tie Bars. Install tire bars at a depth equal to ½ of the slab thickness. Tie bars shall be perpendicular to the longitudinal joint and parallel with the concrete pavement surface. Installation shall be to the tolerances outlined below.

- Not less than ½ inch below the saw cut depth of the joints
- 2" clearance from the tie bar and bottom of pavement

Corrective action will be required for the following circumstances:

- 2 consecutive tie bars are missing or outside of the tolerance listed above
- 4 or more bars in a slab are missing or outside of the tolerances listed (does not have to be consecutive)

The correction shall be made by cross stitching to place the new tie bars accordingly.

4.0 MEASUREMENT

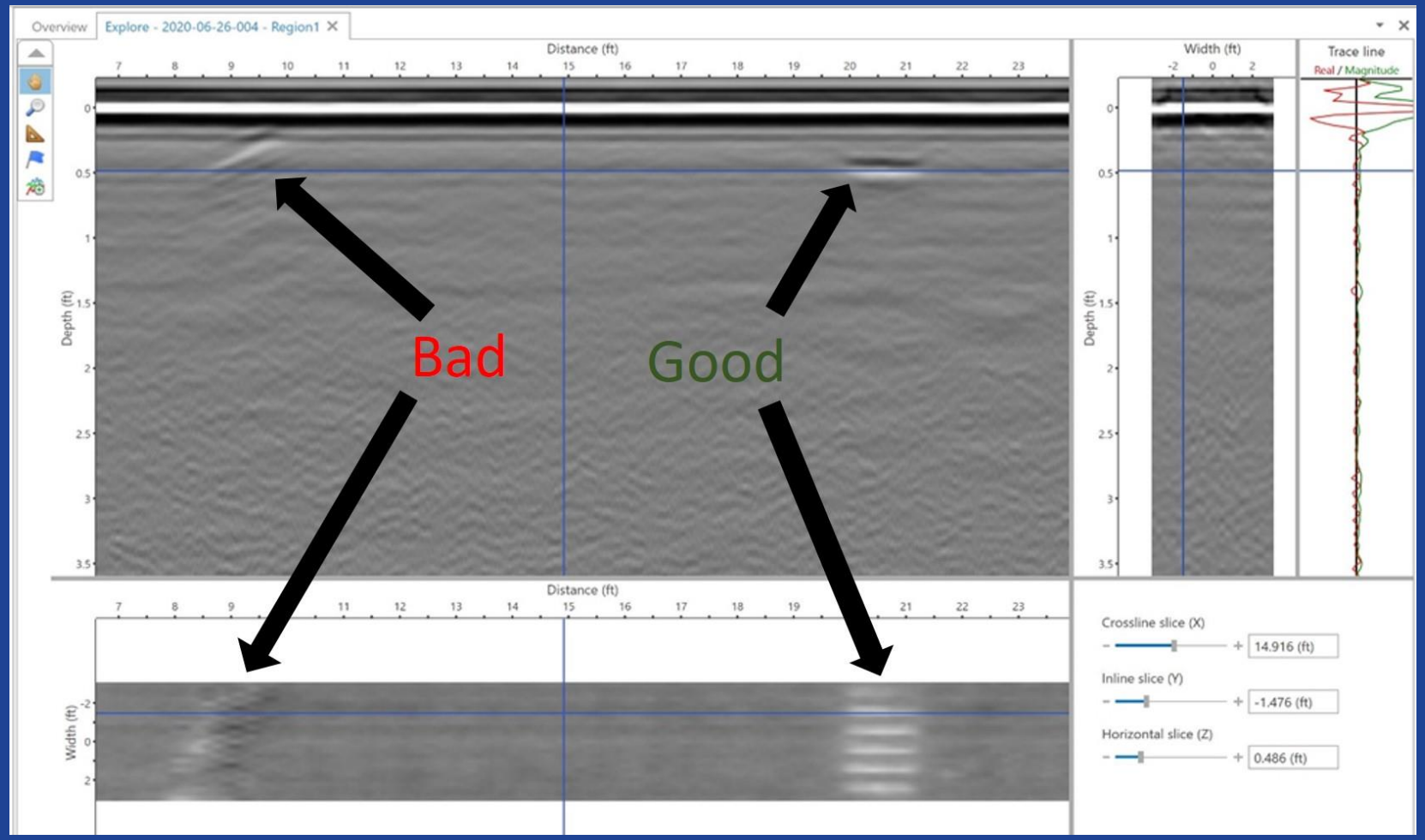
4.1 Testing Limits. All driving lanes requiring load transfer assemblies will be tested with Ground Penetrating Radar (GPR) equipment. All longitudinal joints will be tested. The Kentucky Transportation Center (KTC) will perform all testing.

4.2 Validation. A minimum of one location per lane mile will be cored to verify GPR testing. Two 4 inch cores shall be obtained at each location. One core will be taken on each dowel bar end to expose both ends and allow physical measurements. KTC will conduct coring while the contractor shall patch all core holes.

November 5, 2014

SCANNING A KNOWN “BAD” DOWEL BASKET

BAD AND GOOD DOWEL BASKET

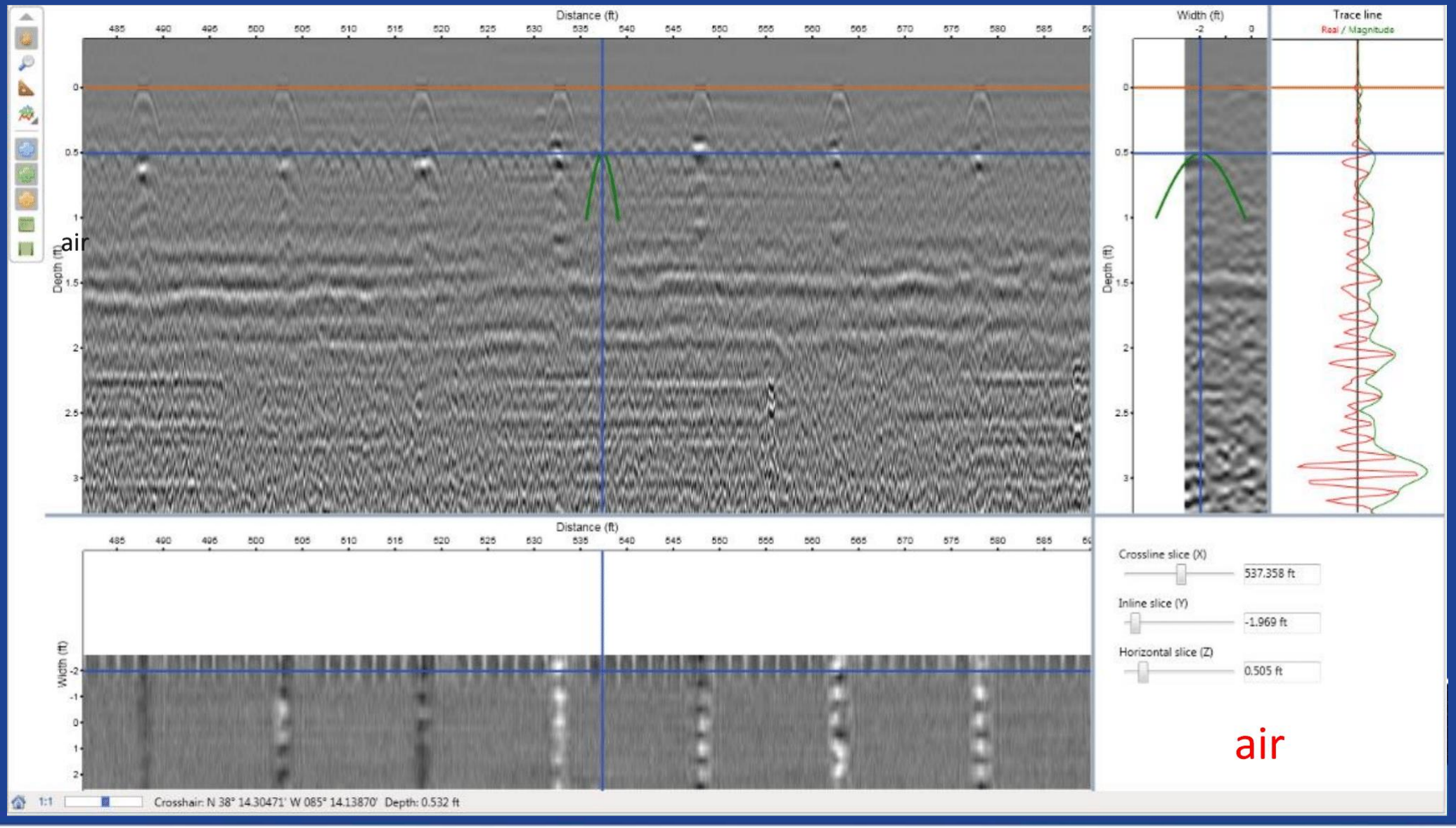


KENTUCKY TRANSPORTATION CABINET

KTC
EXCELLENCE IN MOTION

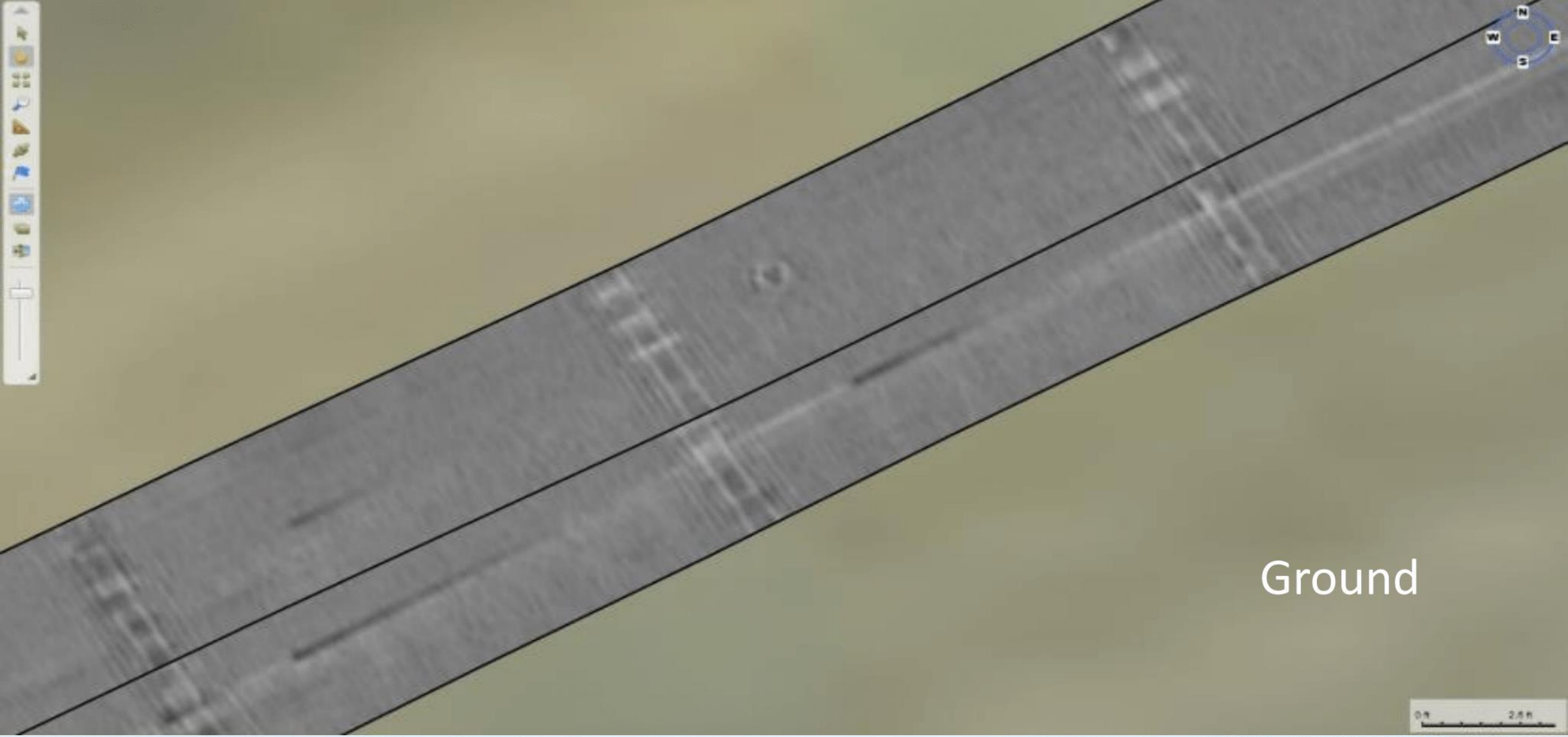
KENTUCKY TRANSPORTATION CABINET

KTC
EXCELLENCE IN MOTION



KENTUCKY TRANSPORTATION CABINET

EXCELLENCE IN MOTION



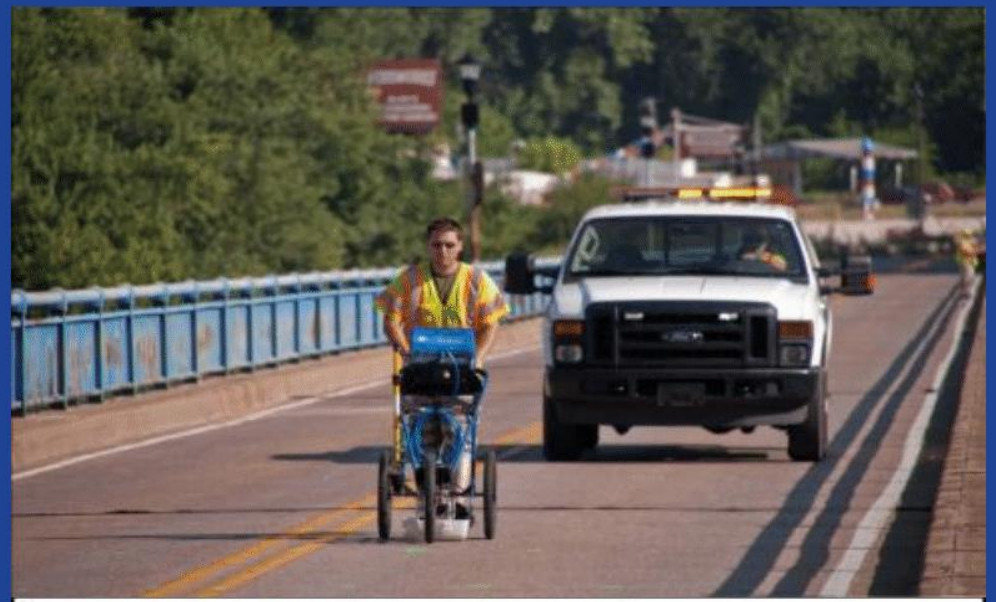
KENTUCKY TRANSPORTATION CABINET

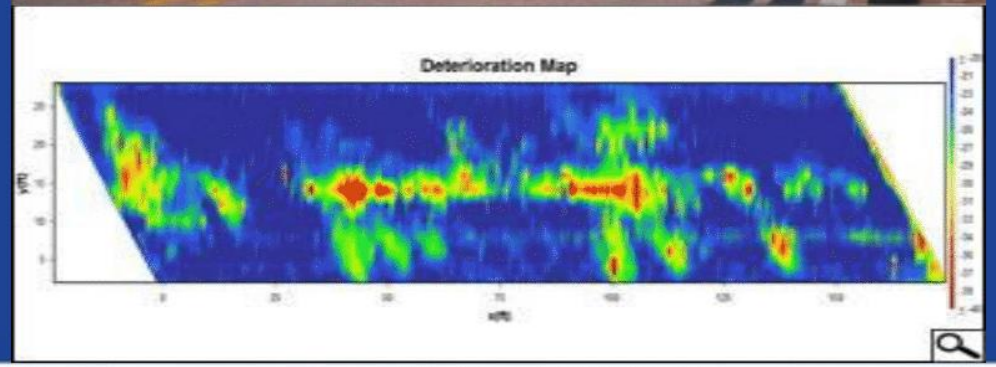
KTC
EXCELLENCE IN MOTION

BRIDGES

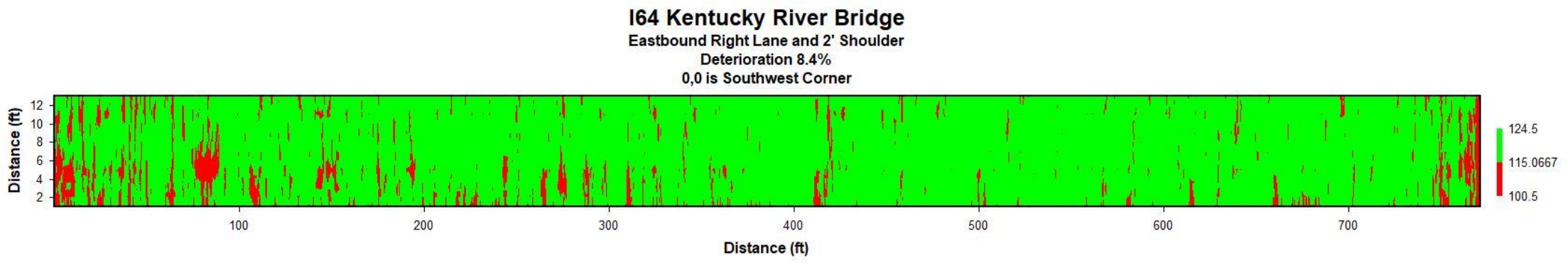
I64 Kentucky River Bridges
Franklin County

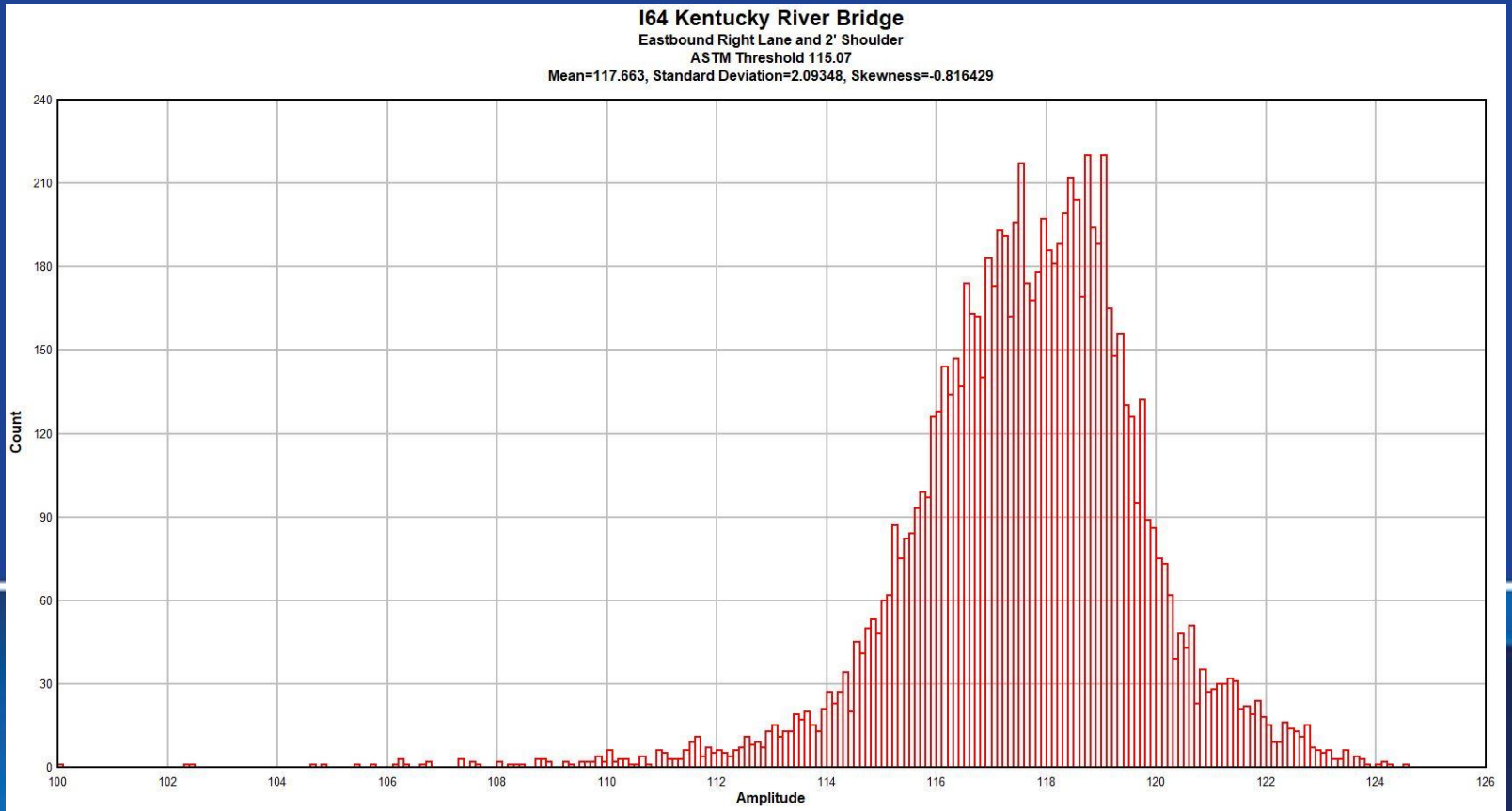
Similar to Bridge Deck Deterioration
Use amplitudes of return signals at interface to determine if voided or not





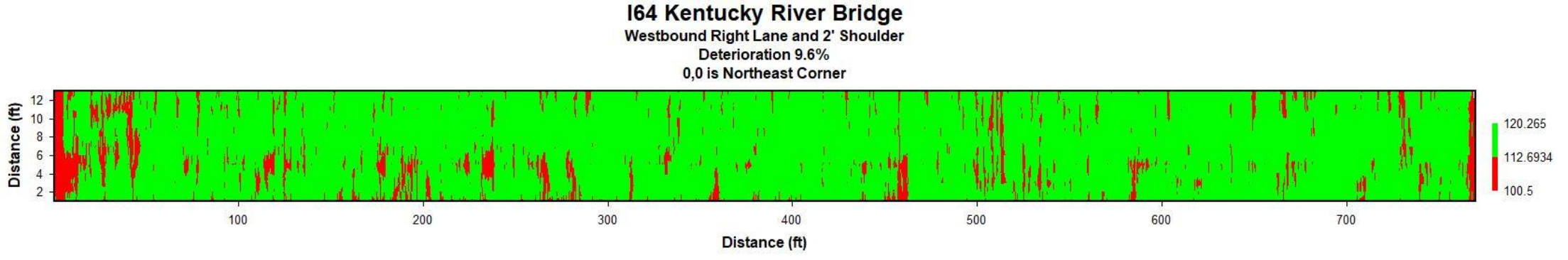
EASTBOUND

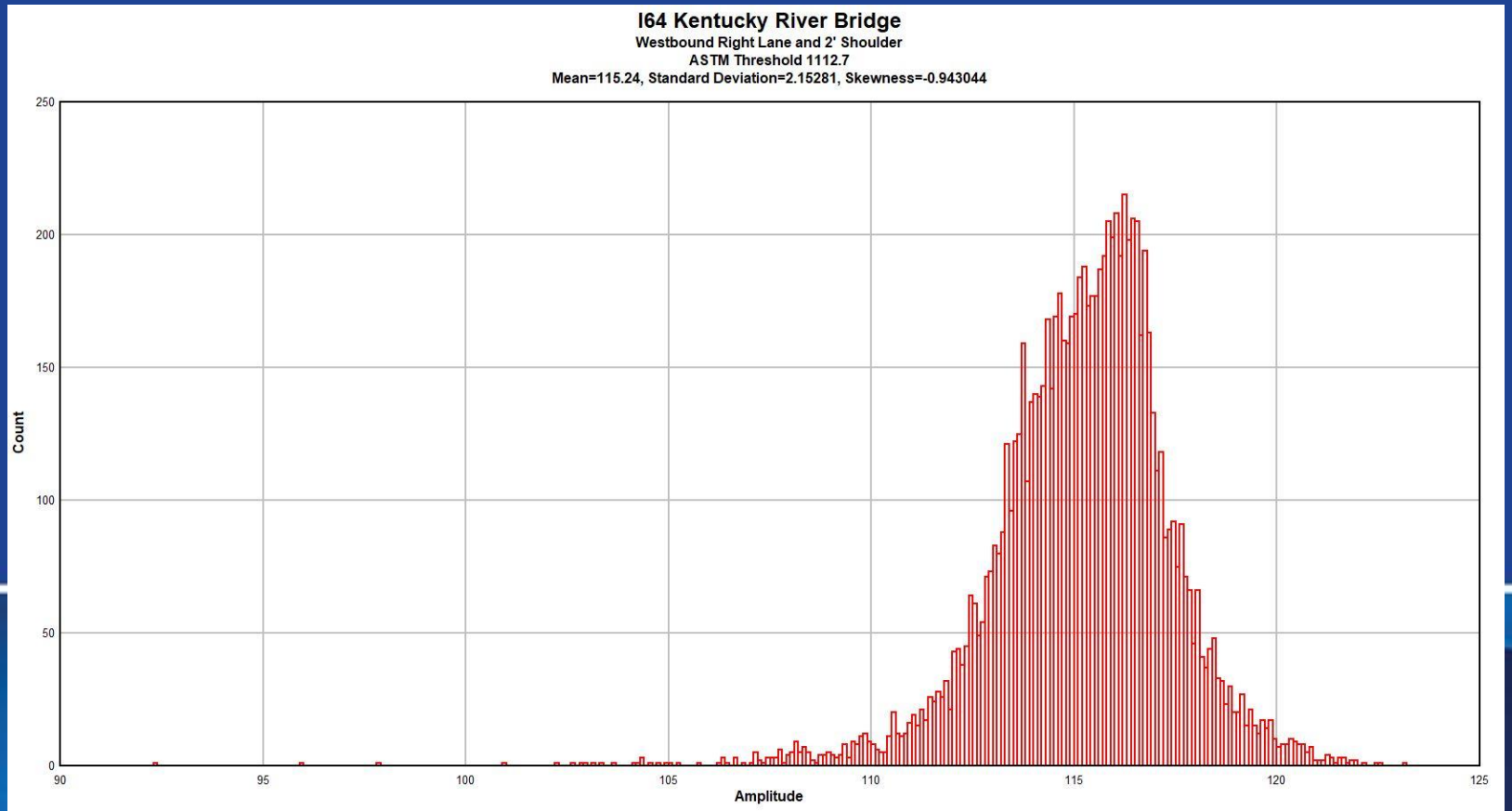




EXCELLENCE IN MOTION

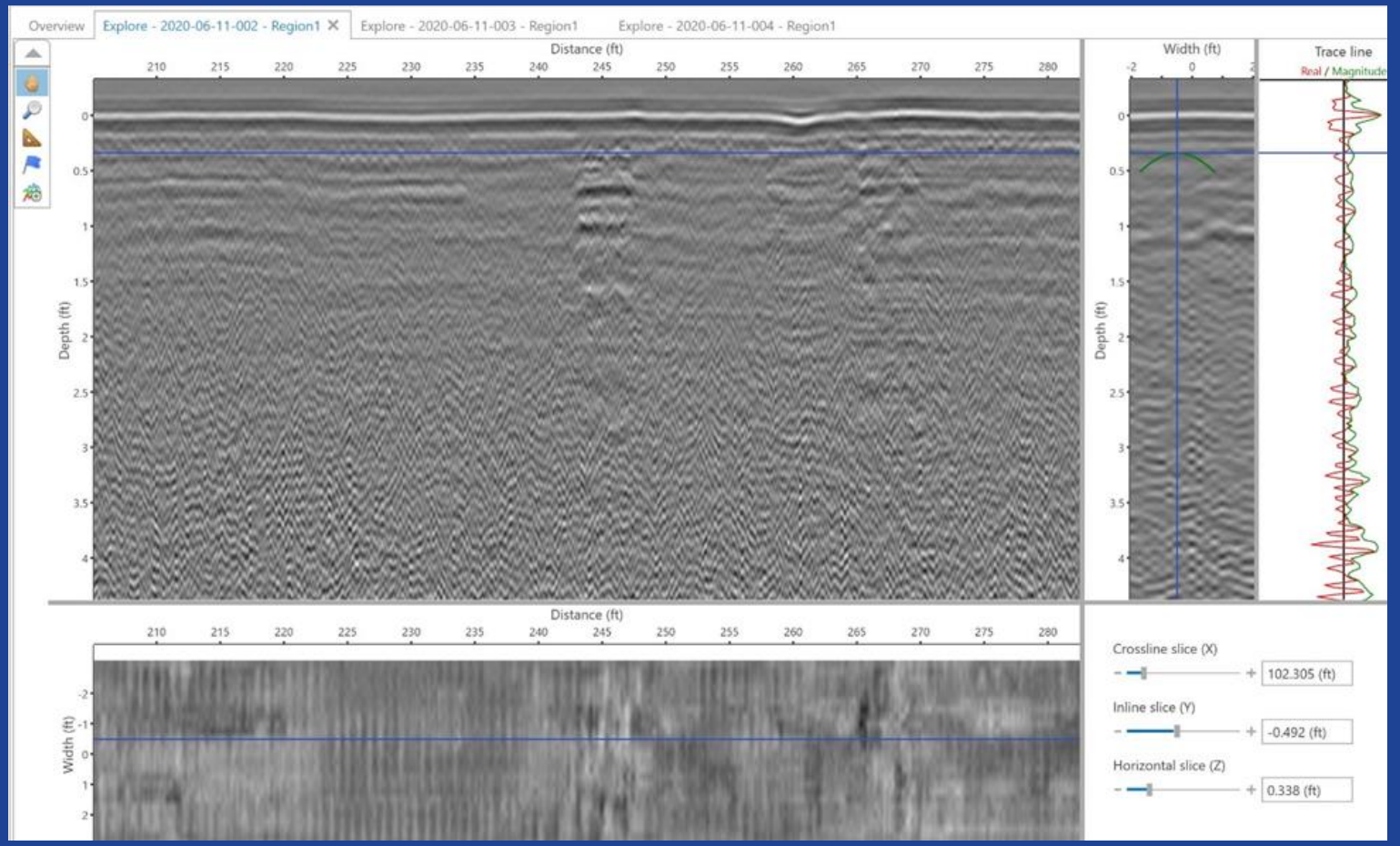
WESTBOUND





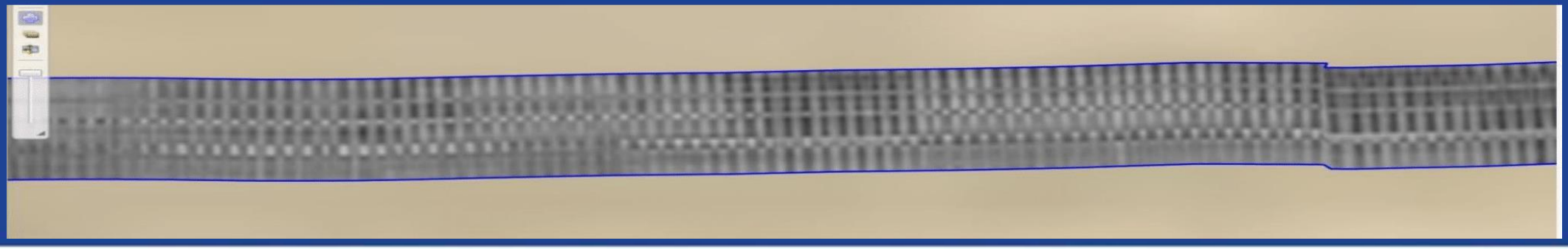
EXCELLENCE IN MOTION

BRIDGE APPEARED TO BE DRY.



KENTUCKY TRANSPORTATION CABINET

KTC
EXCELLENCE IN MOTION



KENTUCKY TRANSPORTATION CABINET

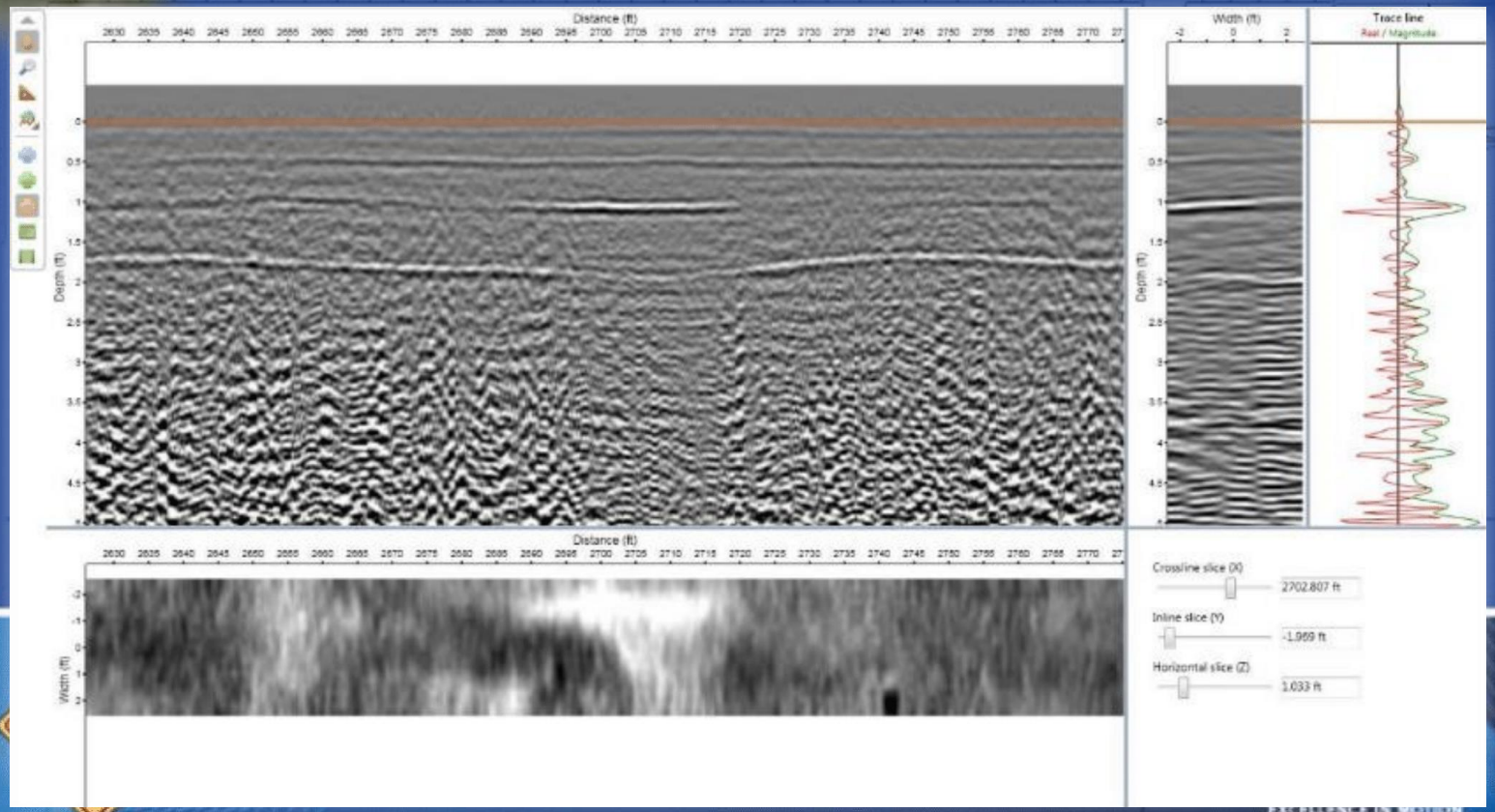
EXCELLENCE IN MOTION

FORENSICS

Pavement surface distress

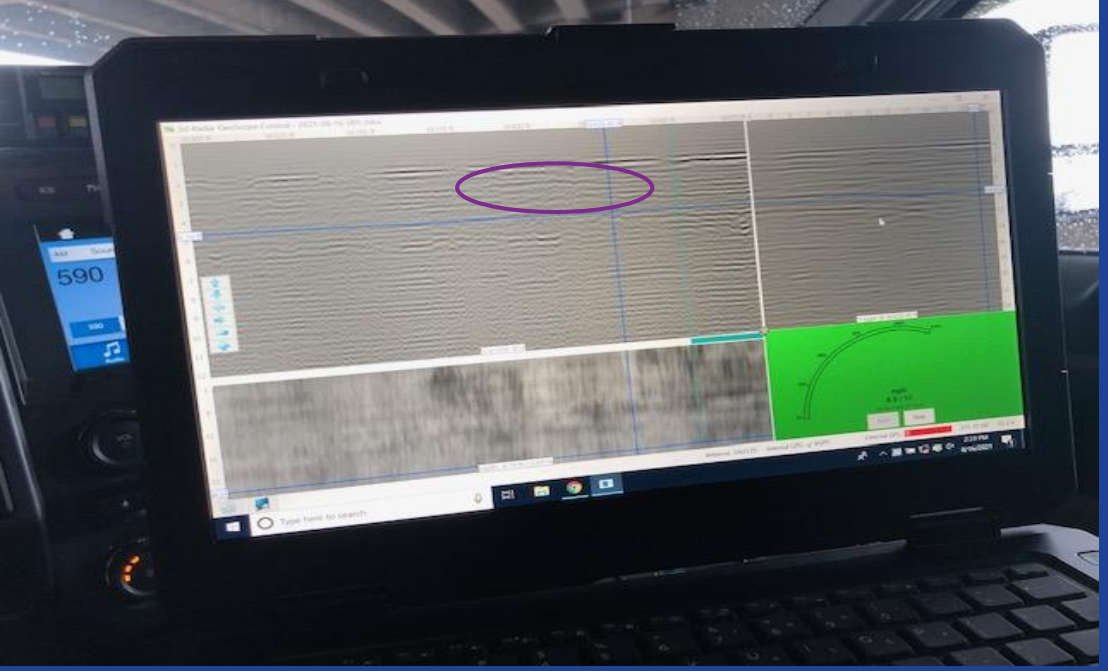
KENTUCKY TRANSPORTATION CABINET

KTC
EXCELLENCE IN MOTION


Distance (ft)
Depth (ft)
Width (ft)
Trace line
Real / Magnitude
Crossline slice (X)
2702.807 ft
Inline slice (Y)
-1.969 ft
Horizontal slice (Z)
1.033 ft

KENTUCKY TRANSPORTATION CABINET

EXCELLENCE IN MOTION


590

KENTUCKY TRANSPORTATION CABINET