

# NDE Technology to Assess Bridge Decks

Problem 1–Concrete Bridge Deck repair is notoriously difficult to quantify on a maintenance project, particularly when the deck is under asphalt paving. Tight windows of allowable lane time make this problem even more critical.

Can GPR help?

# NDE Technology to Assess Bridge Decks

Problem 2--The bridge deck being the least durable bridge member, but also the one most important to user experience, PennDOT is developing a Bridge Deck Strategy in an attempt to balance the desires to minimize both risk and lifetime cost. But....

- Neither age nor ADT correlate well to deck performance.
- Even *condition rating* does not correlate as well as one would think.

Can GPR help?

# NDE Technology to Assess Bridge Decks

Problem 3—Some PennDOT districts are experiencing early deck spalling due to severe honeycombing below the top mat at the joints on phased decks.

Can GPR help?

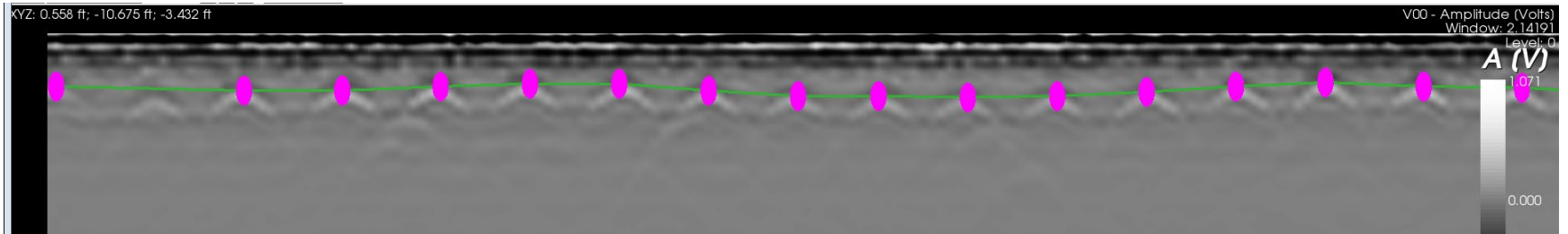
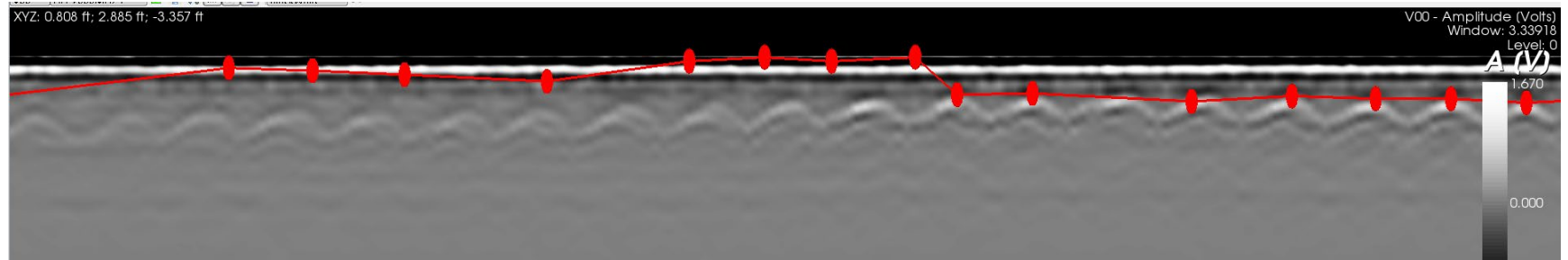
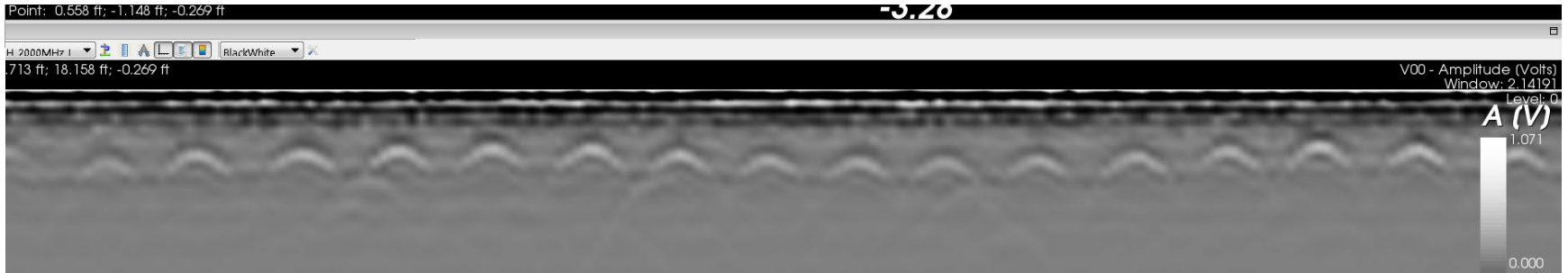
# NDE Technology to Assess Bridge Decks

- PennDOT D12 owns a HI-BRIGHT 2 GHz GPR Unit
- 8 sets of antennas at 10 cm (~4") spacing oriented in direction of travel, plus additional 8 sets mounted the other way.
- Very good at "seeing" top mat of rebar on bare and overlaid decks.
- Very good at finding rebar cover and spacing.
- Very good at finding asphalt overlay thickness.
- Can also find deteriorated rebar, (but requires a lot of work back in the office.)
- Can not see delamination at all unless it's so bad that there is an actual gap.

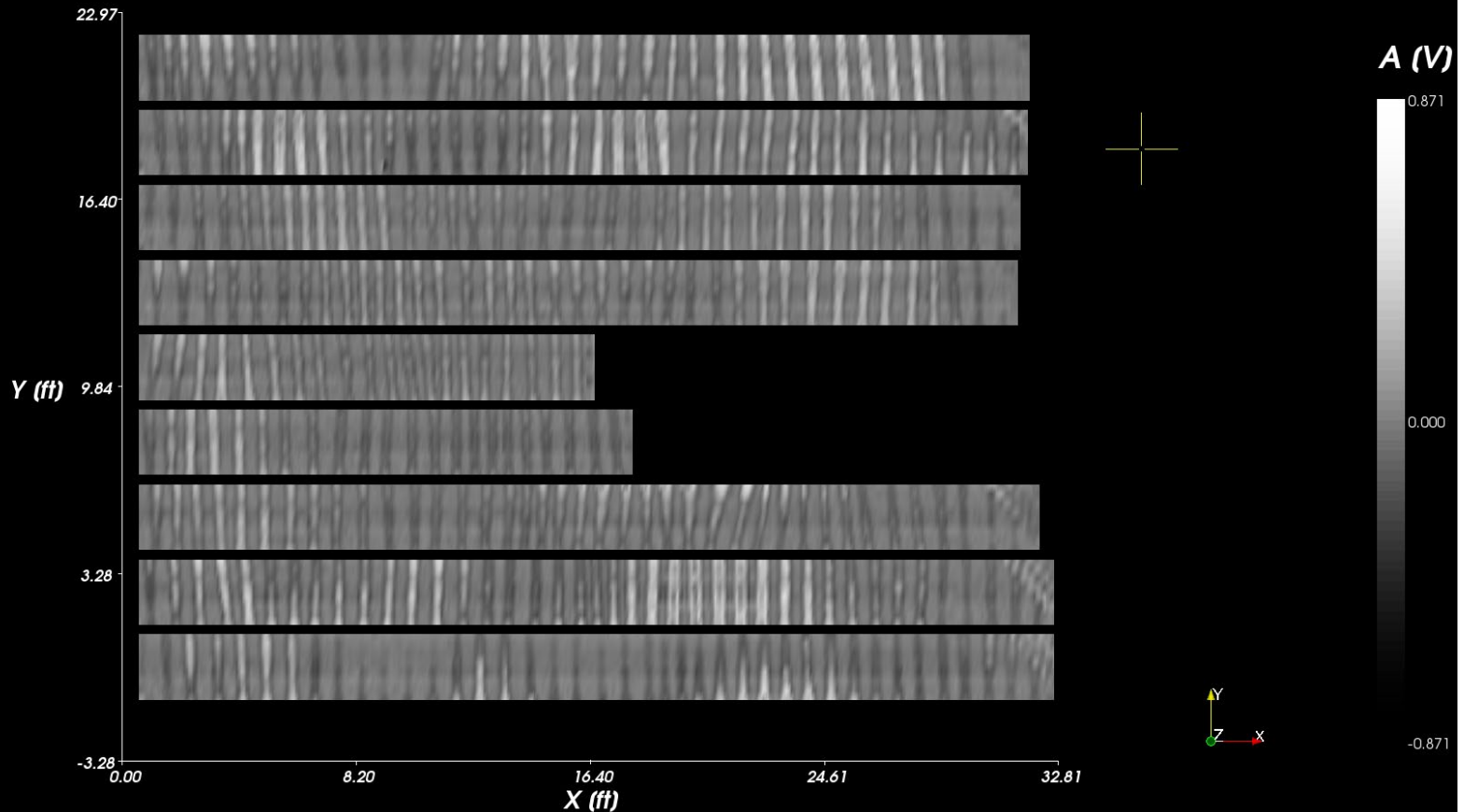
# NDE for Decks—GPR in Action at Night



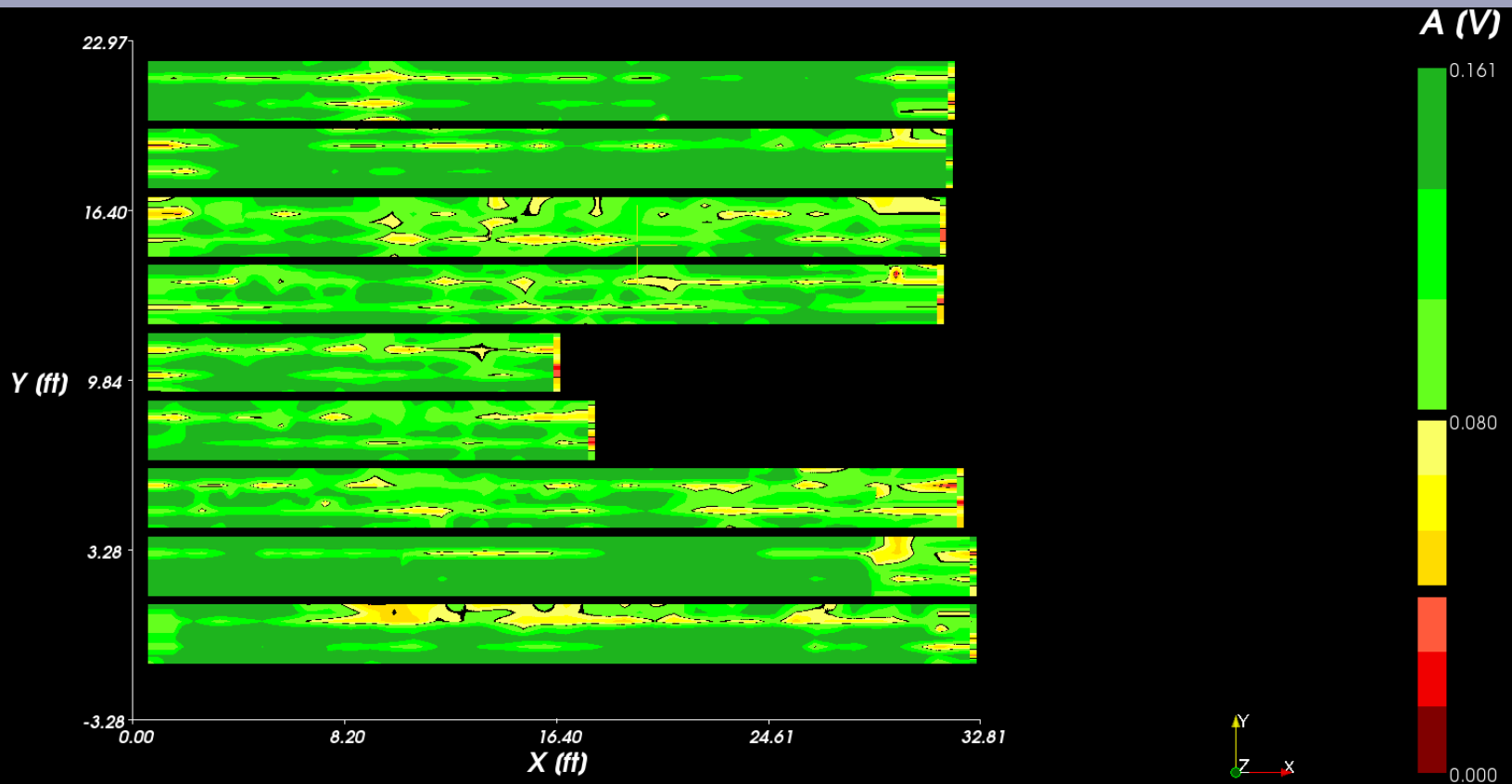
# NDE for Decks—B Scan



# NDE for Decks—6 dozen B-Scans Turned into a Plan View.

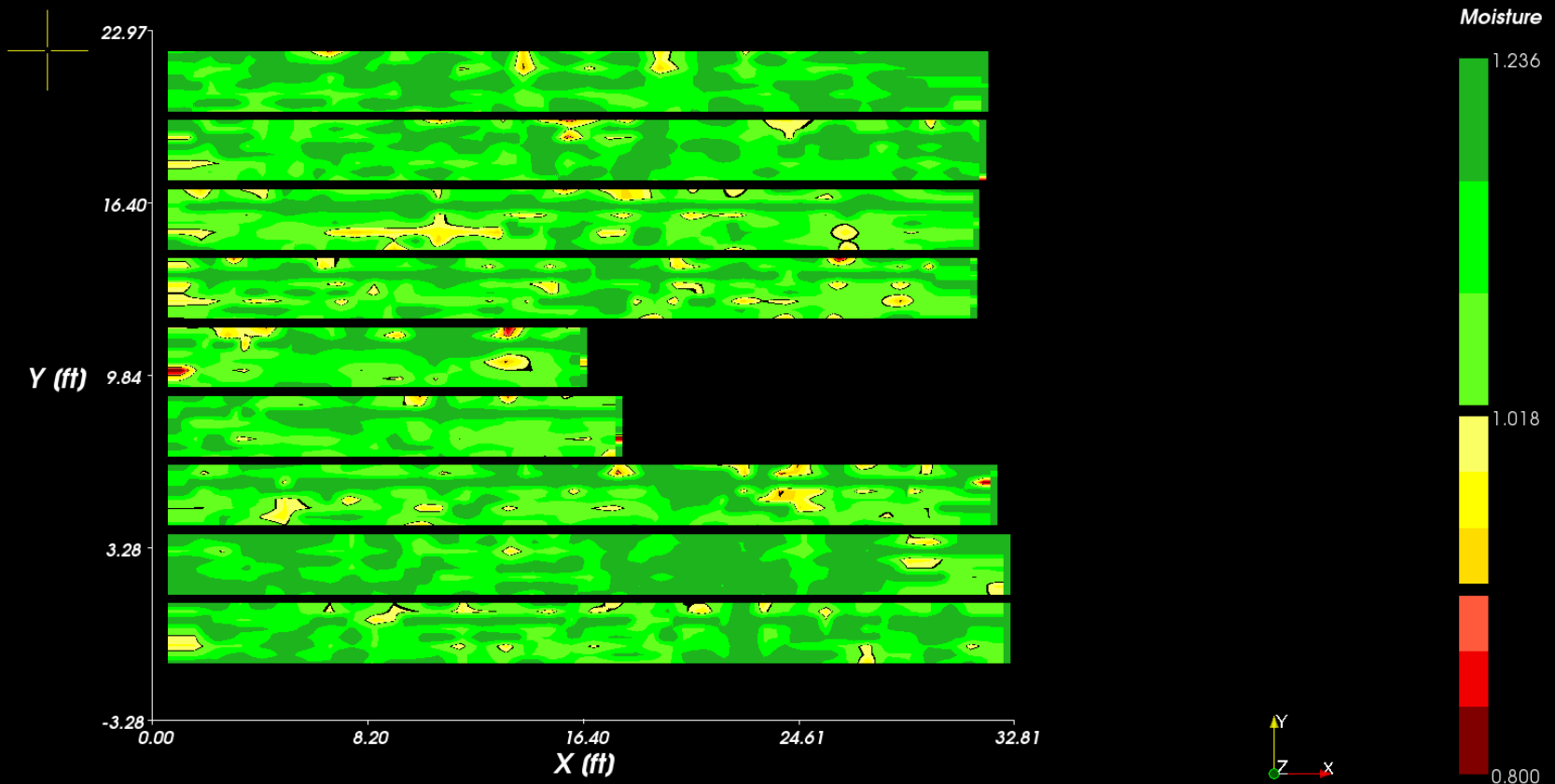


# NDE for Decks—Rebar Amplitude

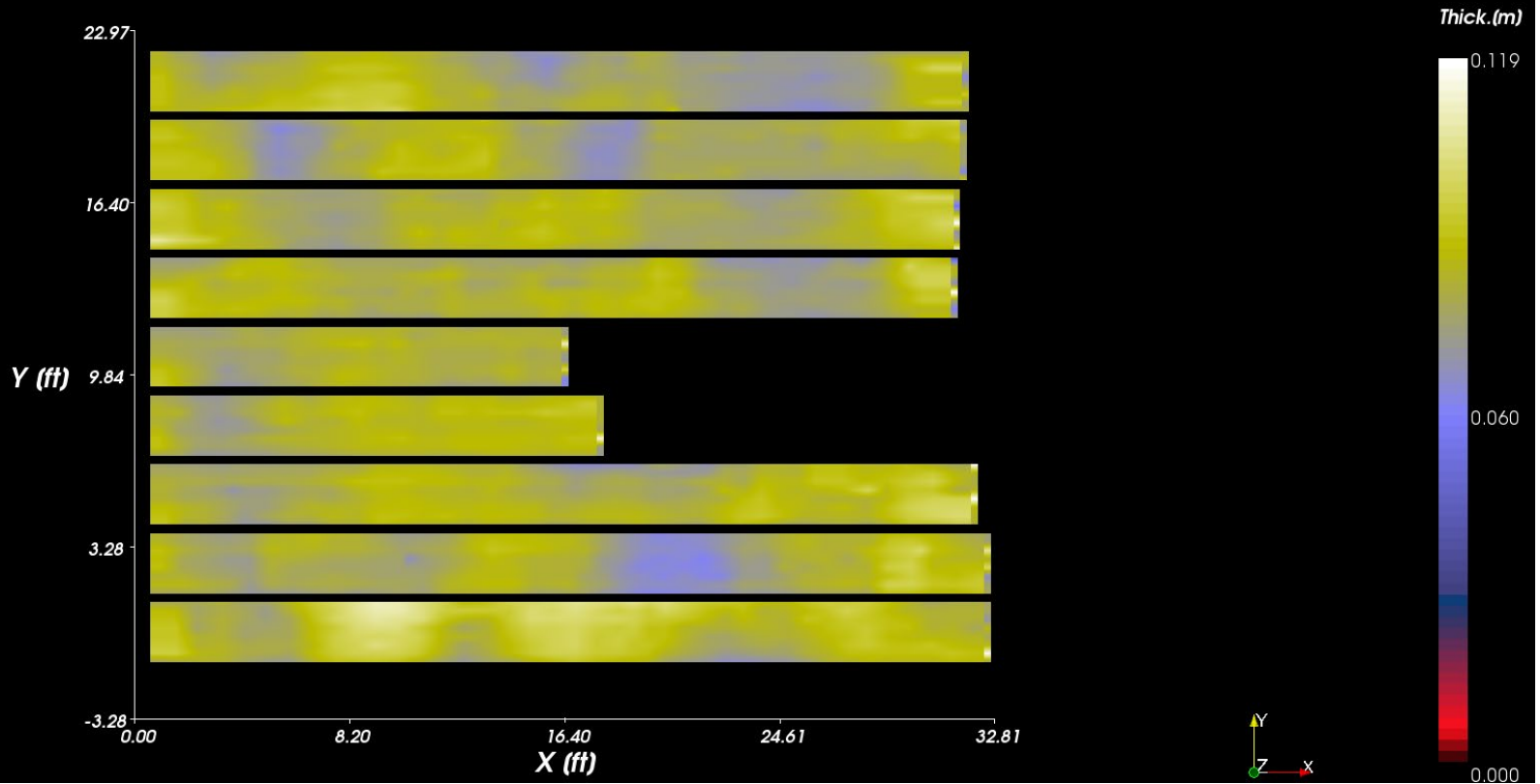




# NDE for Decks—Moisture Map



# NDE for Decks—Bar Cover



# NDE for Decks—Bar Cover Data

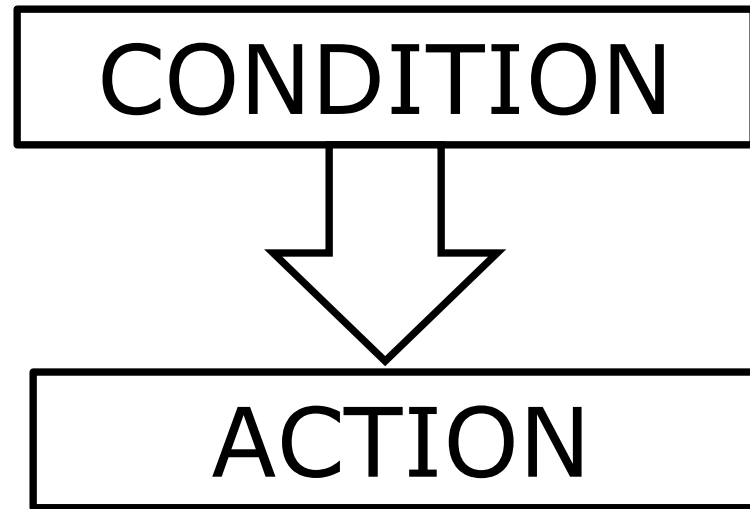
	A	B	C	D	E	F	G	H	I	J	K
1	Sample New Deck (SR 1051)										
2		Min cover:		2.379							
3				4.376			2.5 " minimum allowable cover				
4	Count of out of spec			90	99.63% Good						
5	total samples			24096							
6	X	Y	Z		V13- Zor	UTM: 0-	hemisphe	UTM: 0			
7	9.61	6.75	-0.136	2.994	2492	0.07605	2.99405	0			
8	9.585	6.75	-0.136	2.994	2492	0.07605	2.99405	0			
9	9.559	6.75	-0.136	2.994	2492	0.07605	2.99405	0			
10	9.534	6.75	-0.136	2.994	2492	0.07605	2.99405	0			
11	9.508	6.75	-0.136	2.994	2492	0.07605	2.99405	0			
12	9.483	6.75	-0.136	2.994	2492	0.07605	2.99405	0			
13	9.457	6.75	-0.136	2.994	2492	0.07605	2.99405	0			
14	9.432	6.75	-0.136	2.994	2492	0.07605	2.99405	0			
15	9.407	6.75	-0.136	2.994	2492	0.07605	2.99405	0			
16	9.381	6.75	-0.136	2.994	2492	0.07605	2.99405	0			
17	9.356	6.75	-0.136	2.994	2492	0.07605	2.99405	0			

This is not the number of times the machine crossed a rebar.

24096

99.63% Good

# NDE for Decks—Programming Decisions



# NDE for Decks—Programming Decisions

CONDITION

VERY BAD

NEW

REPLACE

ASPHALT  
OVERLAY  
TO DELAY  
PROJECT

HYDRO &  
LATEX  
OVERLAY

??

THIN  
OVERLAY

NOTHING

GPR MIGHT  
HELP HERE

# NDE for Decks— Takeaways

- GPR can be useful, but only in certain ways.
  - Getting an idea of how much deterioration is under asphalt.
  - Checking asphalt thickness on decks where it varies.
  - Checking rebar cover.
- Only a narrow band of the bridge deck population can benefit from GPR.
- Getting deterioration takes a lot of office work.
- Deck needs to be clean with dry surface.
- Any metal on the deck (steel dust from bar and pan cutting, blast grit, slag fill, etc.) obliterates the data.
- Finding a severely honeycombed deck joint should be fairly easy with GPR. (Although D12 has not found one yet.)

# NDE for Decks— Future Needs

- Published “Method of Solution” for software.
- Ability to do easily do more manual adjustment of filters and processes without having to write a new process from scratch.
- Implementation of more accurate rebar picking.
- More cooperation between academia and manufacturers.
- More guidance on when a GPR investigation (or any NDE) will be of benefit to an owner.