

Comparison of Estimated Driving Parameters to Dynamic Test Results

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Project Information

- Western Wake Freeway
- Dual Bridges over:
 - Jack Branch (#18); 3 Spans
 - White Oak Creek (#19); 7 Spans
 - Panther Creek (#23); 2 Spans
 - Nancy Branch (#26); 3 Spans

- Bridge 26
- Bridge 23
- Bridge 19
- Bridge 18

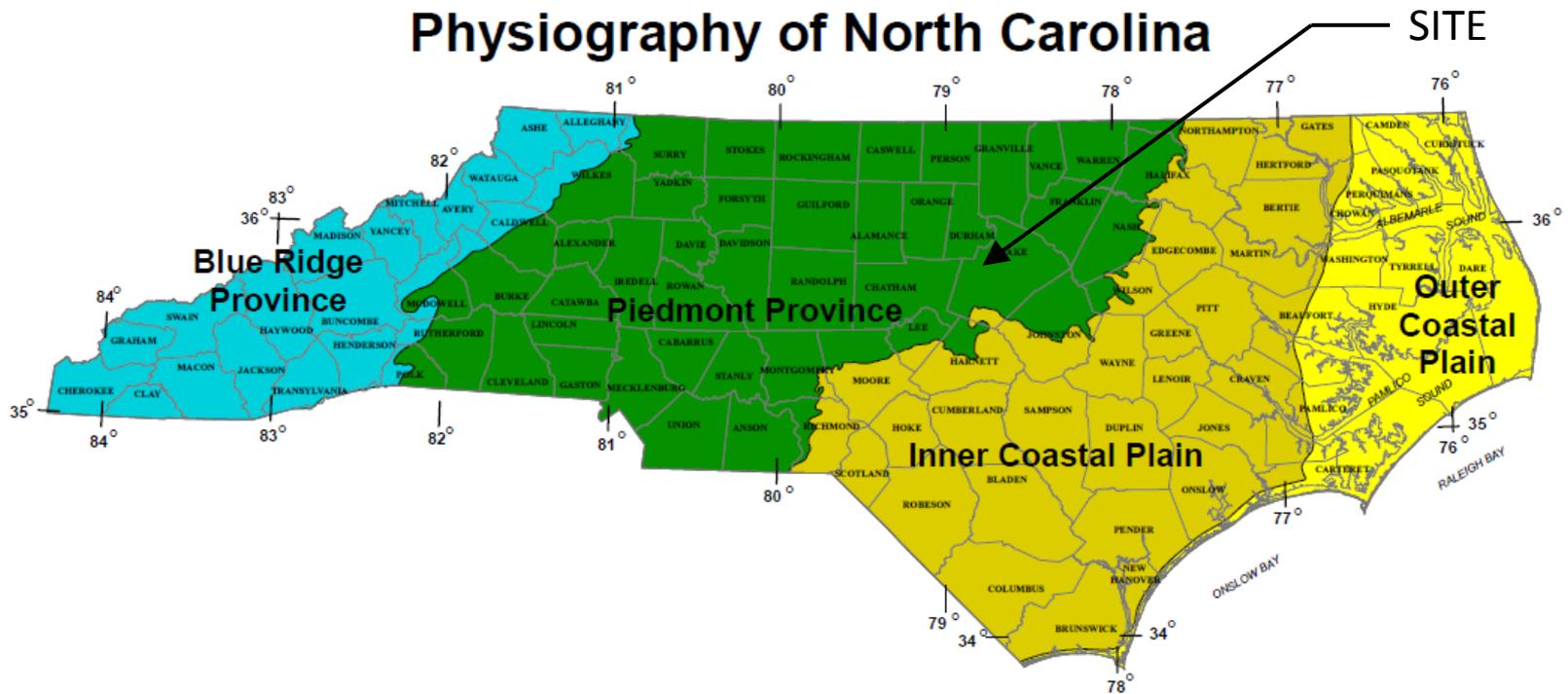


— Candidate Turnpike Alternative
 Interstate Under Construction
NCDOT TIP No. R-2000

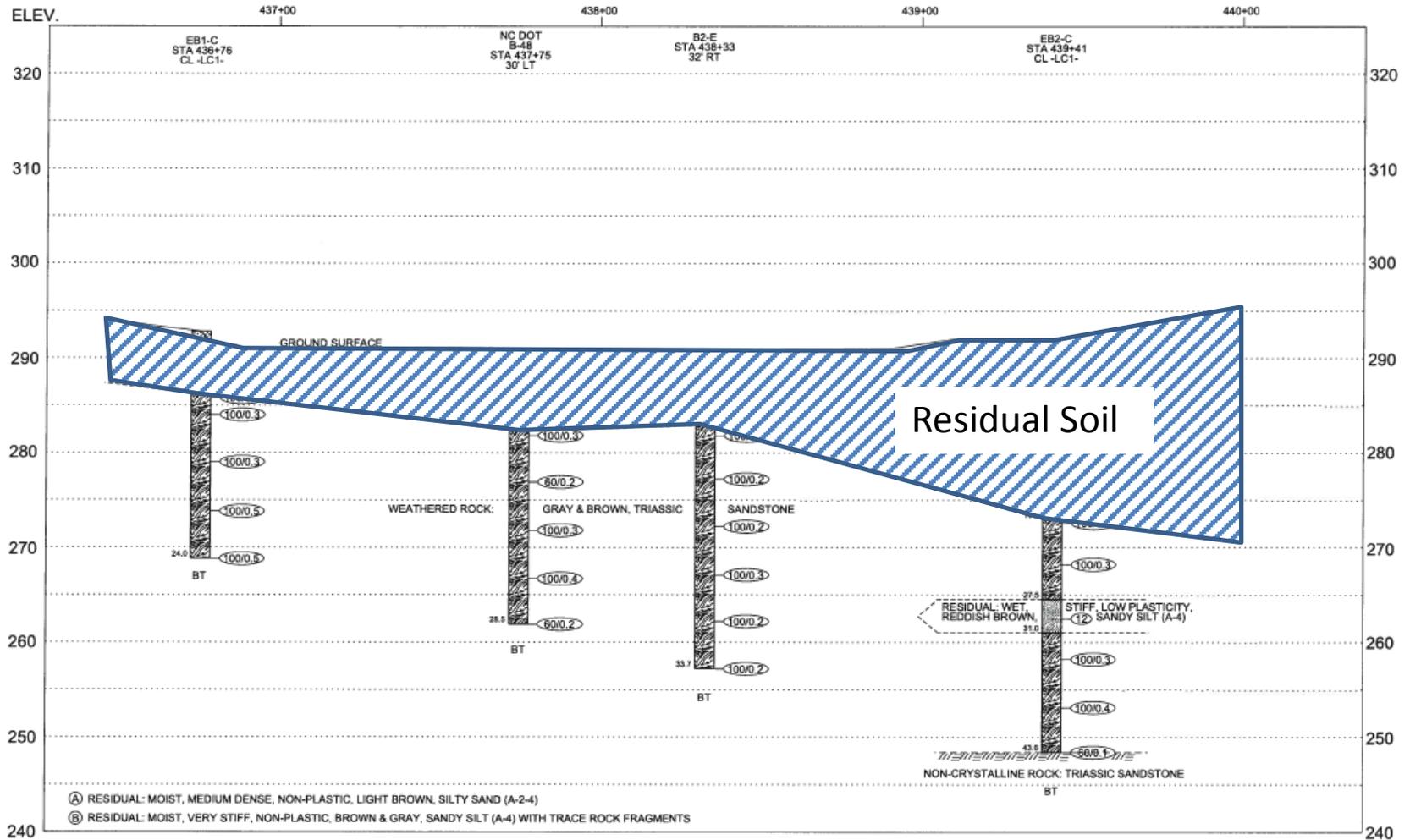
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Geologic Setting

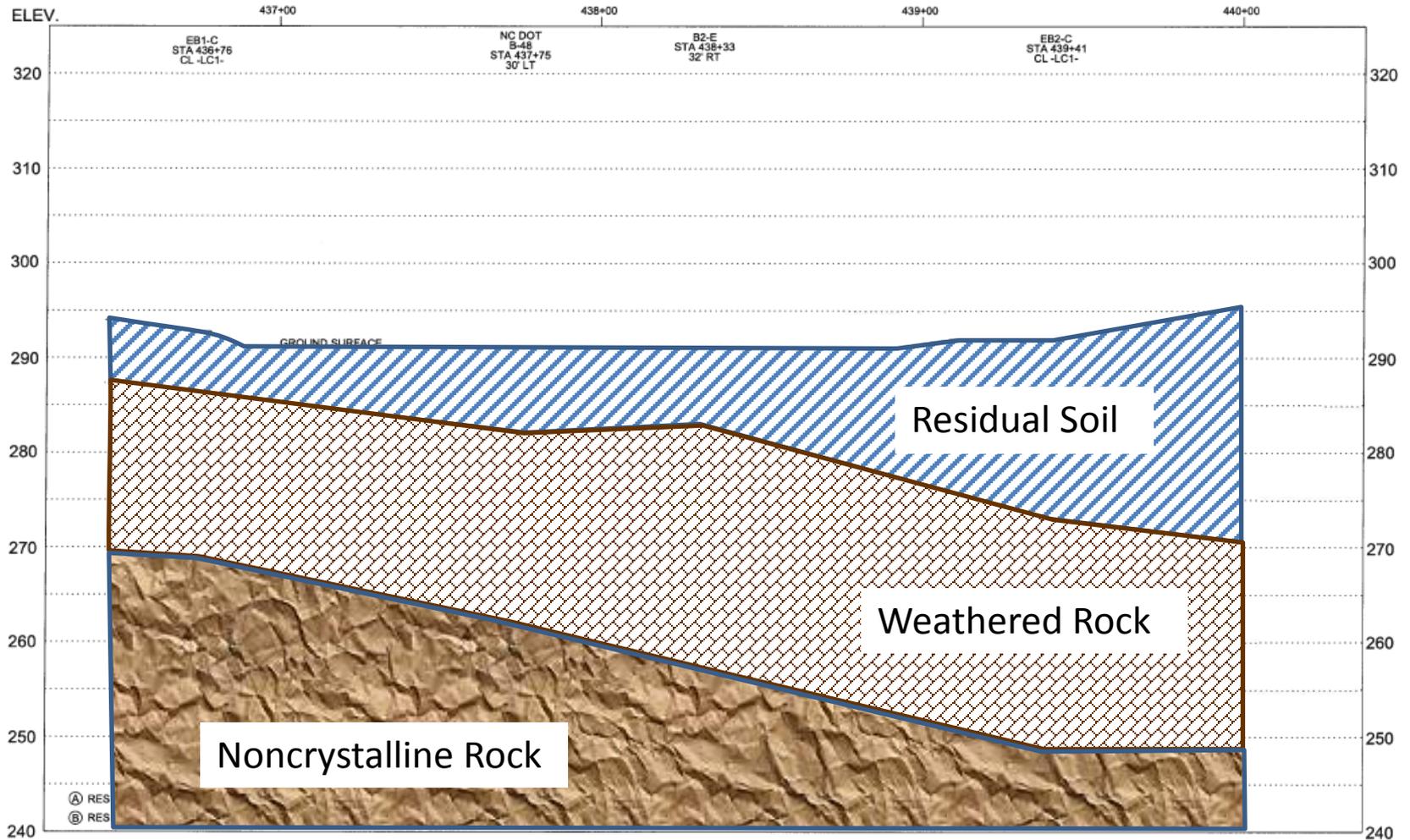
- Inner Piedmont Physiographic Province
- Metamorphic Noncrystalline Bedrock



General Subsurface Profile



General Subsurface Profile



Initial Design Analysis Inputs

- Model Subsurface Profile (c , ϕ , γ) from Boring Results, Previously Published Data
- Perform Static Analysis (Driven, APile)
- Determine Length, etc. for Required Nominal Static Geotechnical Resistance

Initial Dynamic Analysis Inputs

- Subsurface Load Distribution from Static Analysis
- Hammer/Cushion Combination
- Soil Dynamic Properties

Soil Dynamic Properties - Quake

- Usually, the Smith Model Works Well
- Definition: Rate of Mobilization of the Soil Resistance
- Models the Elastic Displacement Limit
- Effect: Models the Soil Response Time
- Default Values in WEAP:
 - 0.10 inch for skin
 - 0.15 inch for toe

Soil Dynamic Properties - Damping

- Usually, the Smith Model Works Well
- Definition: Product of Pile Segment Velocity and Static Soil resistance
- Models the Remolding of Soil Adjacent to the Pile
- Effect: Major Effect is on the Pile Tip
- Default Values in WEAP:
 - 0.05 sec/ft for skin
 - 0.15 sec/ft for toe

Preliminary WEAP Results – Bridge 19

- Nominal Geotechnical Resistance:
 - 500 kips
- Factored Geotechnical Resistance ($\phi = 0.6$):
 - 300 kips
- Pile Section: HP 12X53, 50 ksi yield
- Pile Hammer: Delmag D30 OED (60,000 ft-lbs)
- Required Blow Count at Final Driving:
 - 124 blows/foot

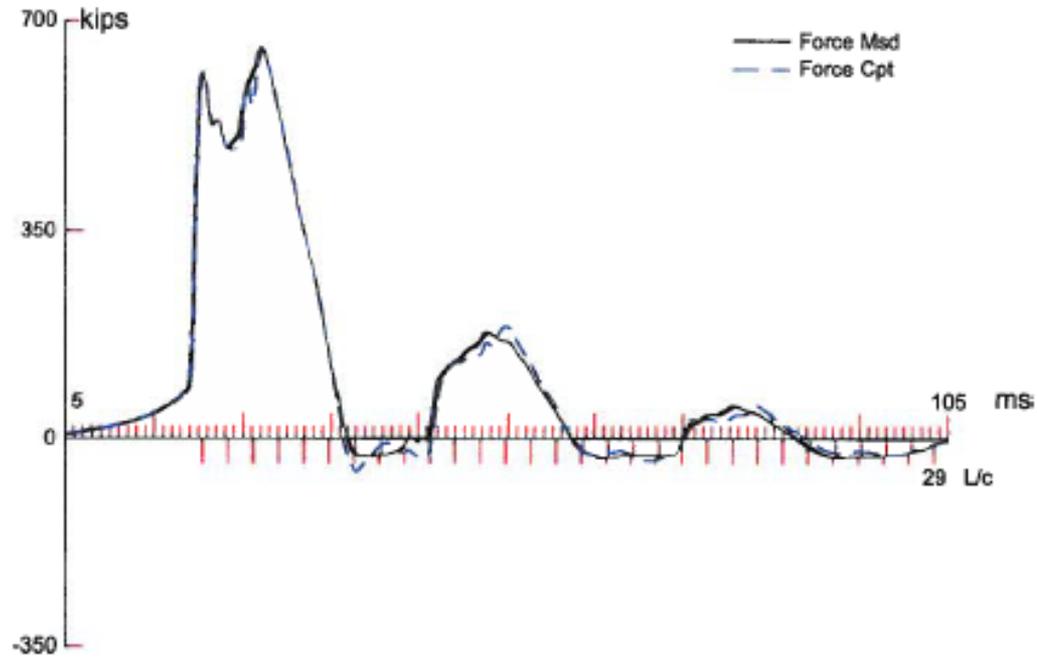
PDA Results – Bridge 19

- Dynamic Nominal Geotechnical Resistance:
 - 000 kips to 000 kips in Weathered Rock
- Factored Geotechnical Resistance ($\phi = 0.6$):
 - 300 kips
- Blow Counts at EOD: 124 blows/foot
- Total Dynamic Resistance at EOD: 755 kips

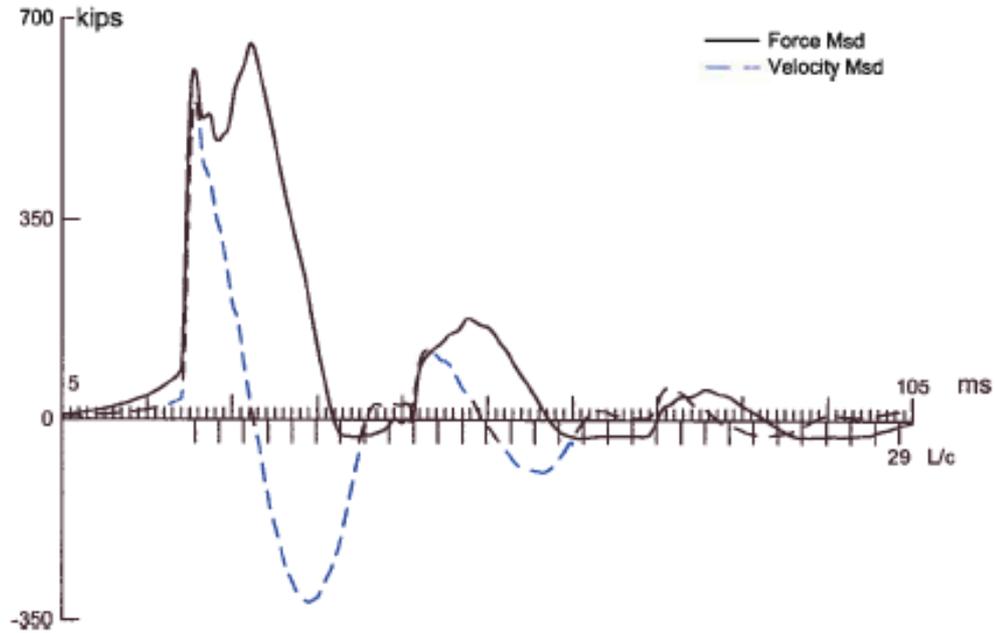
CAPWAP Results – Bridge 19

- Dynamic Toe Resistance: 377 KIPS
- Dynamic Skin Resistance: 378 kips
- Total Dynamic Resistance: 755 kips
- Required EOD blow count: 80
- Signal Match Quality: 3.25

CAPWAP Force Plot – Bridge 19



CAPWAP Velocity Plot – Bridge 19



CAPWAP Results - Bridge 19

- Signal Matched Parameters - Quake
 - Skin Quake: 0.10 inch
 - Toe Quake: 0.15 inch
- Signal Matched Parameters – Damping
 - Skin Damping: 0.03 sec/ft
 - Toe Damping: 0.15 sec/ft

EOD QUAKE COMPARISONS

Bridge No.	WEAP Q _s	WEAP Q _t	CAPWAP Q _s	CAPWAP Q _t	Match Quality
18	0.050	0.150	0.080	0.400	2.11
19	0.050	0.150	0.100	0.150	3.25
23	0.050	0.150	0.100	0.300	2.18
26	0.050	0.150	0.100	0.400	2.82

EOD DAMPING COMPARISONS

Bridge No.	WEAP Ss	WEAP St	CAPWAP Ss	CAPWAP St	Match Quality
18	0.100	0.150	0.190	0.030	2.11
19	0.100	0.150	0.030	0.030	3.25
23	0.100	0.150	0.070	0.040	2.18
26	0.100	0.150	0.150	0.040	2.82

CONCLUSIONS

- CAPWAP Q_s = Up to 90% Higher than Default
- CAPWAP Q_t = Up to 100% Higher than Default
- CAPWAP S_s = Up to 10% Higher than Default
- CAPWAP S_t = As Low as 20% of Default

QUESTIONS?