

10th Geotechnical, Geophysical, Geoenvironmental
Technology Transfer Conference - NC DOT

Design of Geosynthetic Reinforced MSEWs as Integral Bridge Abutment Walls

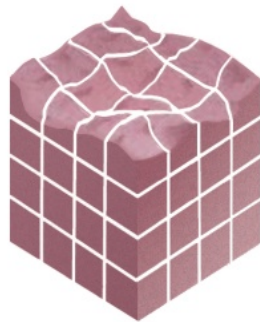
PRESENTED BY

Michael R. Simac, P.E., M. ASCE

Mike@EarthImprovement.com

and

David J. Elton, Ph.D., P.E., F. ASCE



EARTH IMPROVEMENT TECHNOLOGIES

Greenville Southern Connector

Private Developer in 1999

I-85 with I-385 / I-26

now

SC DOT Toll Road I-185

Greenville Southern Connector MSEWs

- **3 Roadway Walls > 35,000 sf**
- **2 Conventional Bridge Abutment Walls, each > 30 ft. tall**
- **4 Integral Bridge Abutment Walls, each > 22 ft. tall**
***FIRST* in North America**

Greenville Southern Connector MSEWs

- **Contractor Supplied Design**
- **Steel or Geosynthetic MSEWs**
- **1998 AASHTO (ASD) Design**
- **Silty Fine to Med. SAND R-Fill**
- **Connection FS just 1.5**
- **Design Seismic Load $A = 0.12g$**

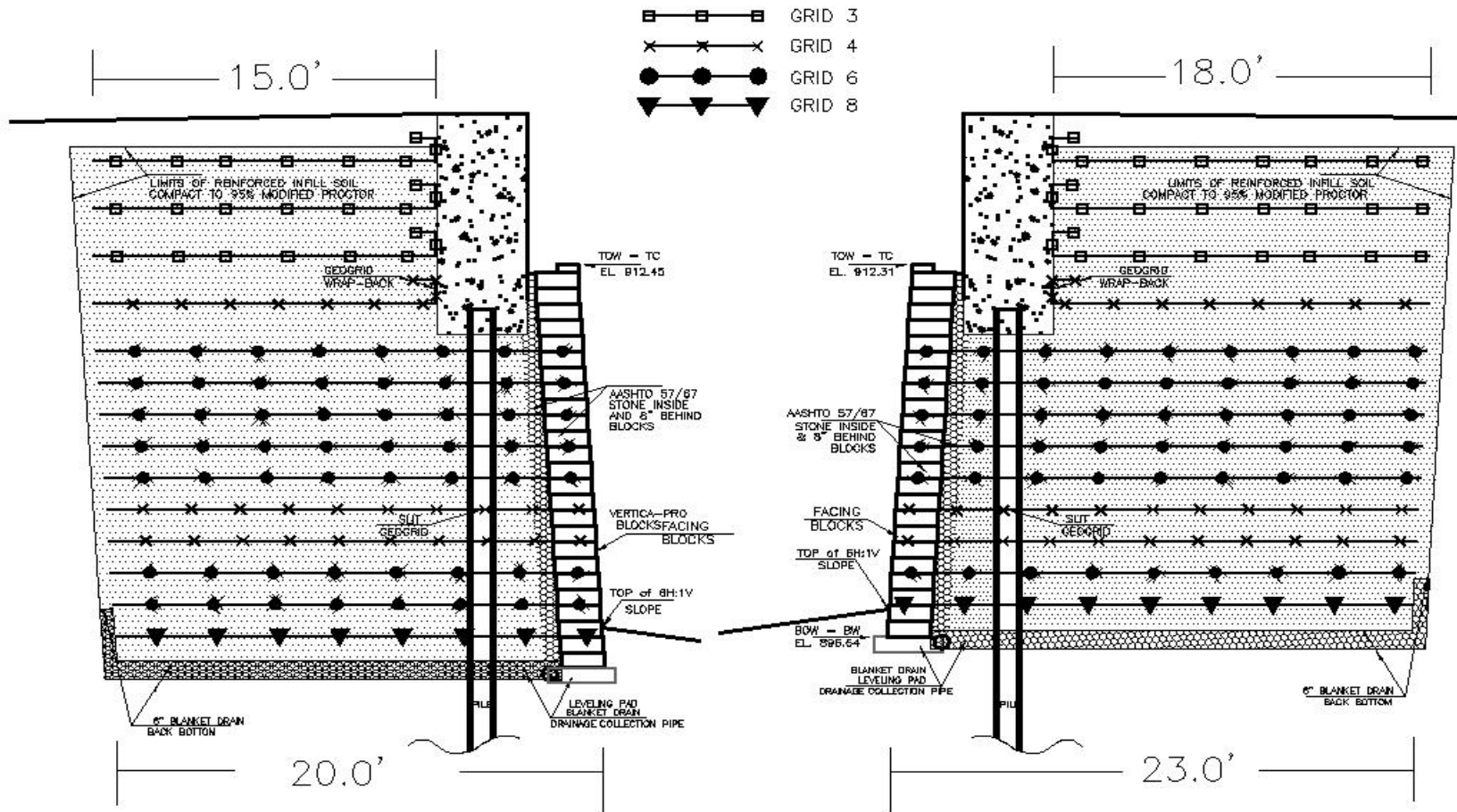
Integral Bridge Abutment, B19



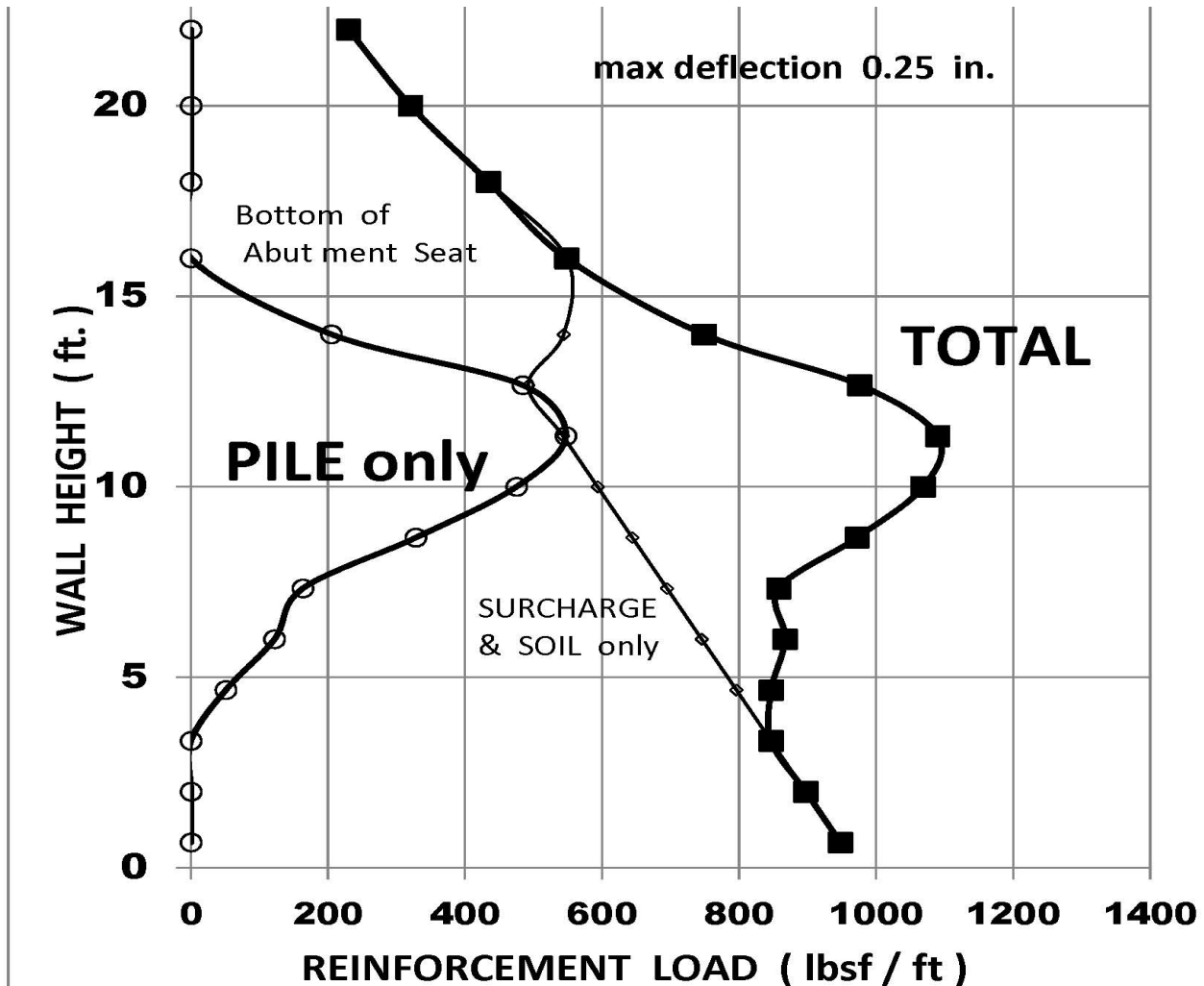
Integral Bridge Abutment, B19



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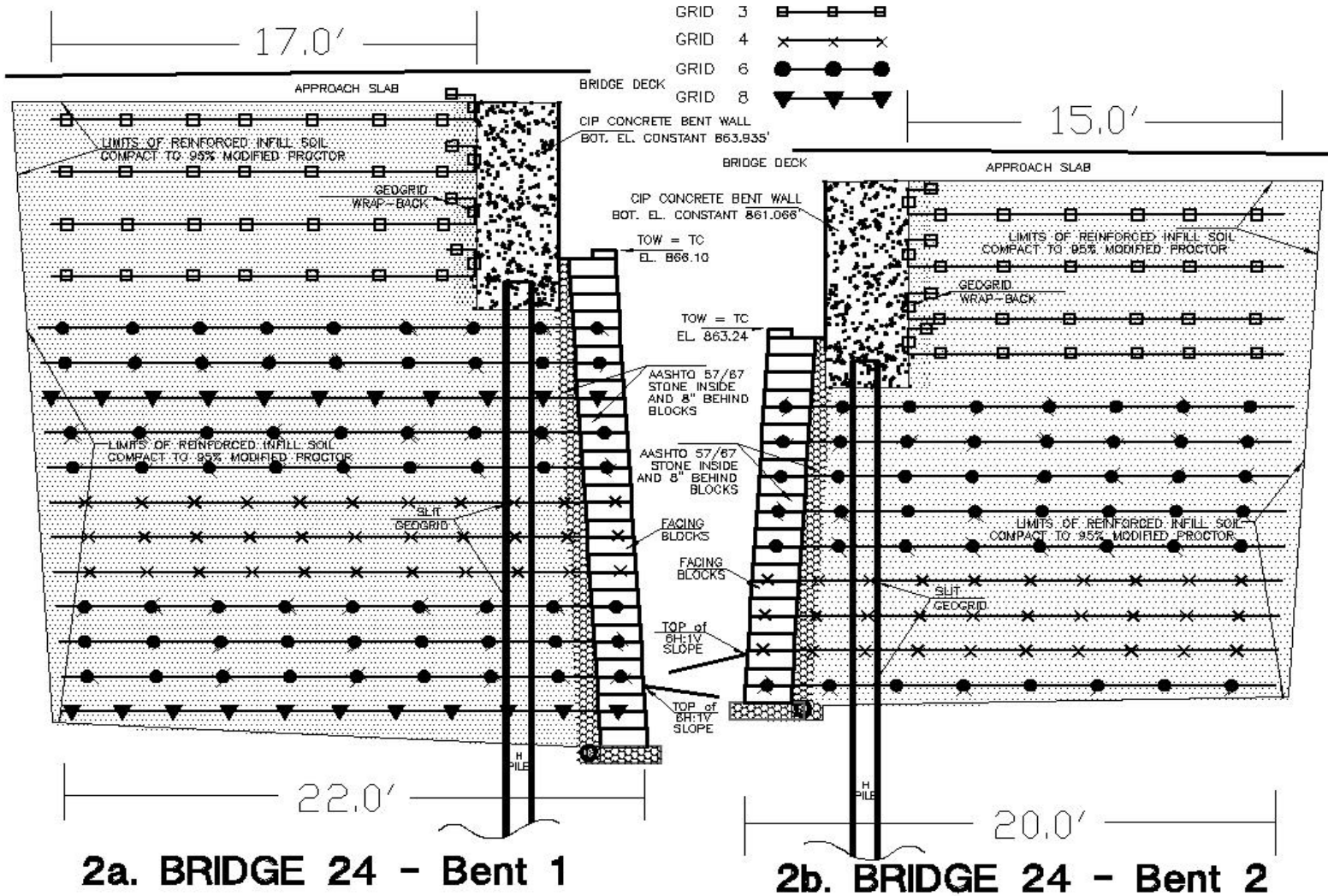
Integral Bridge Abutment, B24



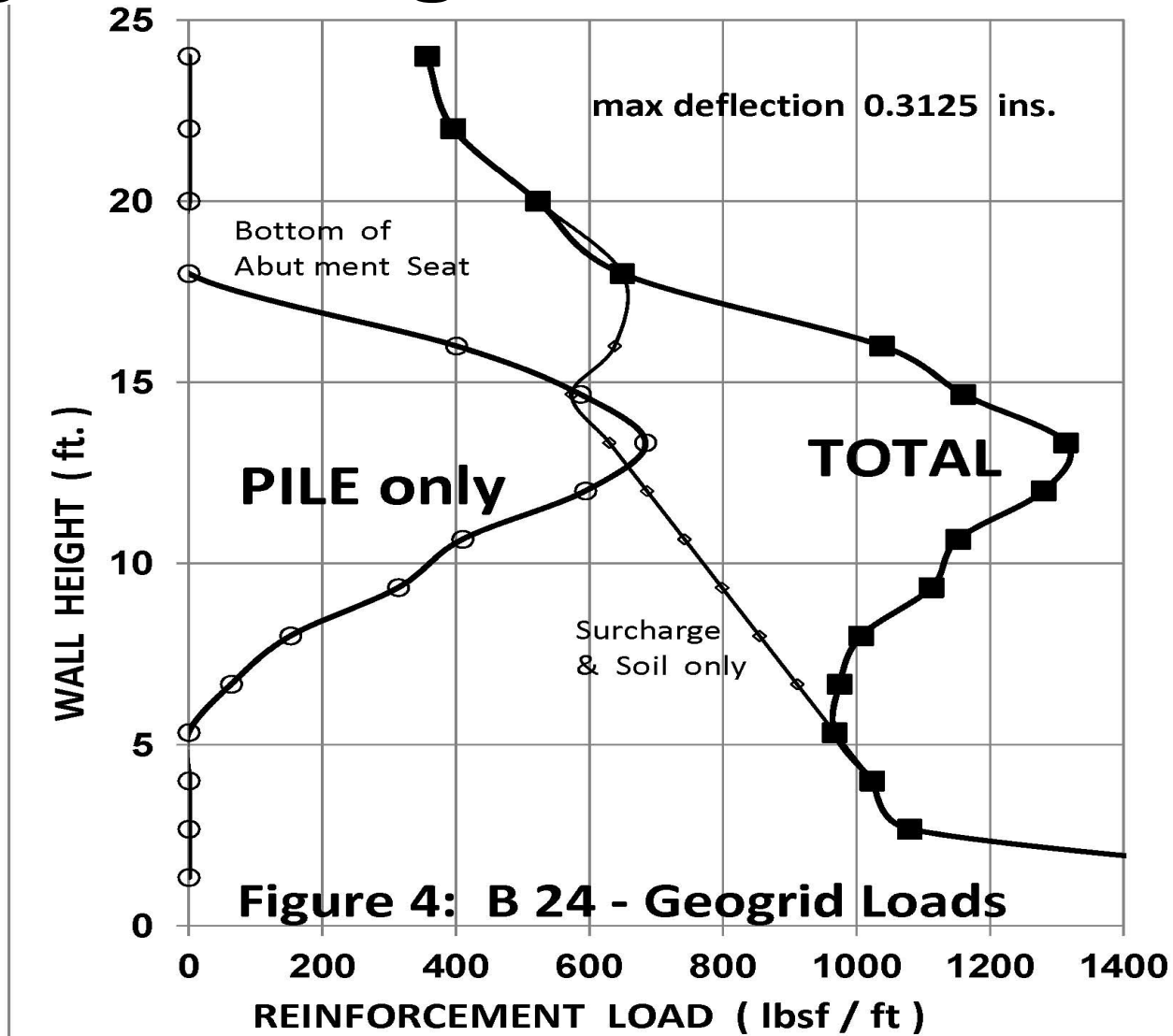
Integral Bridge Abutment, B24



Integral Bridge Abutment, B24



Integral Bridge Abutment, B24





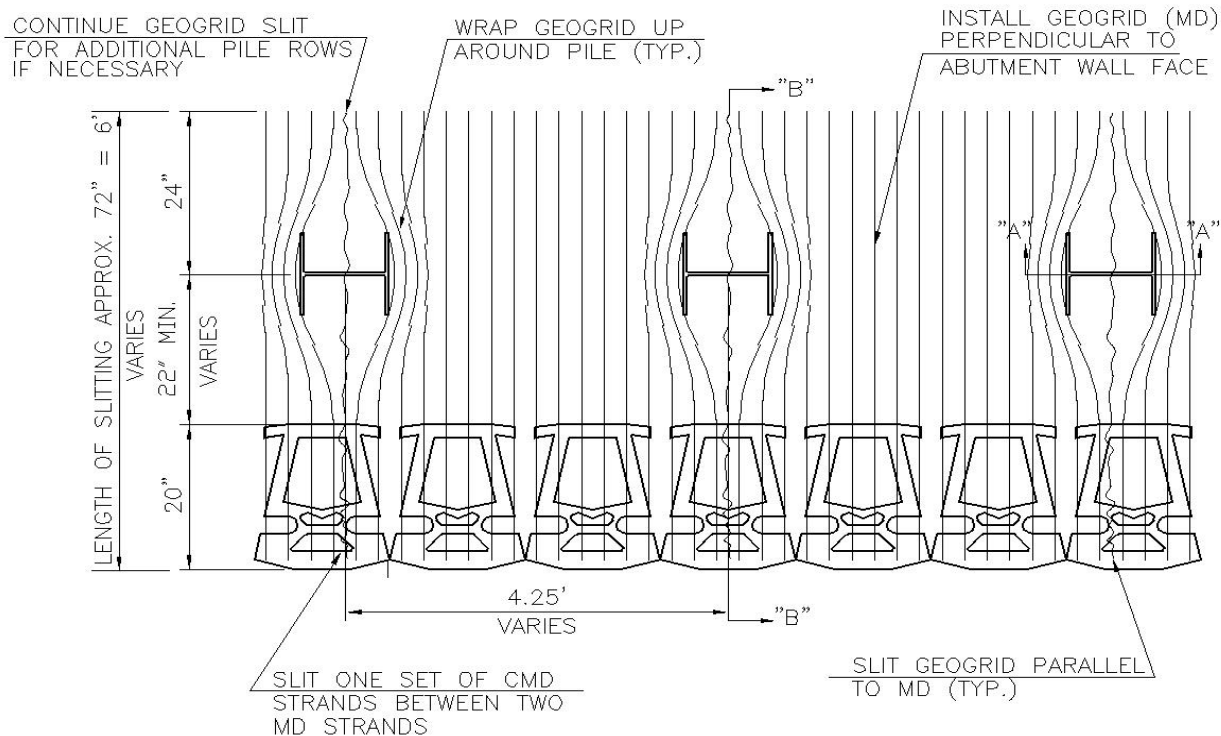
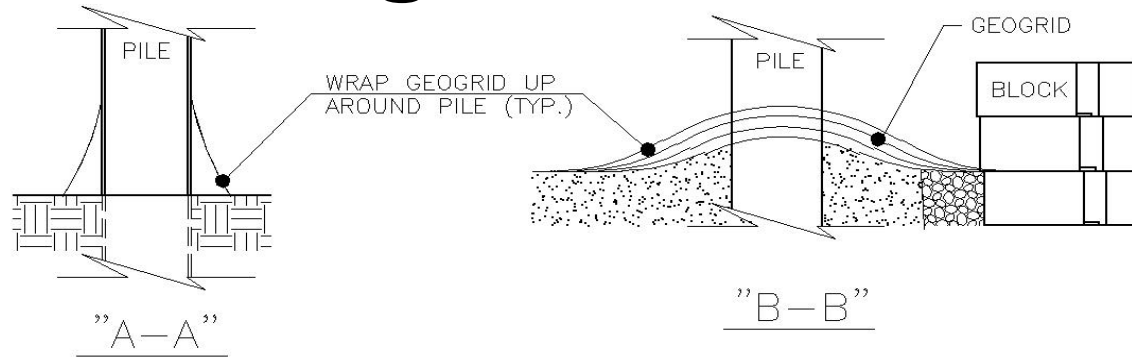








Integral Bridge Abutment, B24



ABUTMENT FACE PLAN











Integral Bridge Abutment, B24



Greenville Southern Connector

- **B19, built 1999**
- **B24, built 2000**
- **NO As-Built Survey of Face**
- **Can't differentiate construction vs. post – construction movement**

Greenville Southern Connector

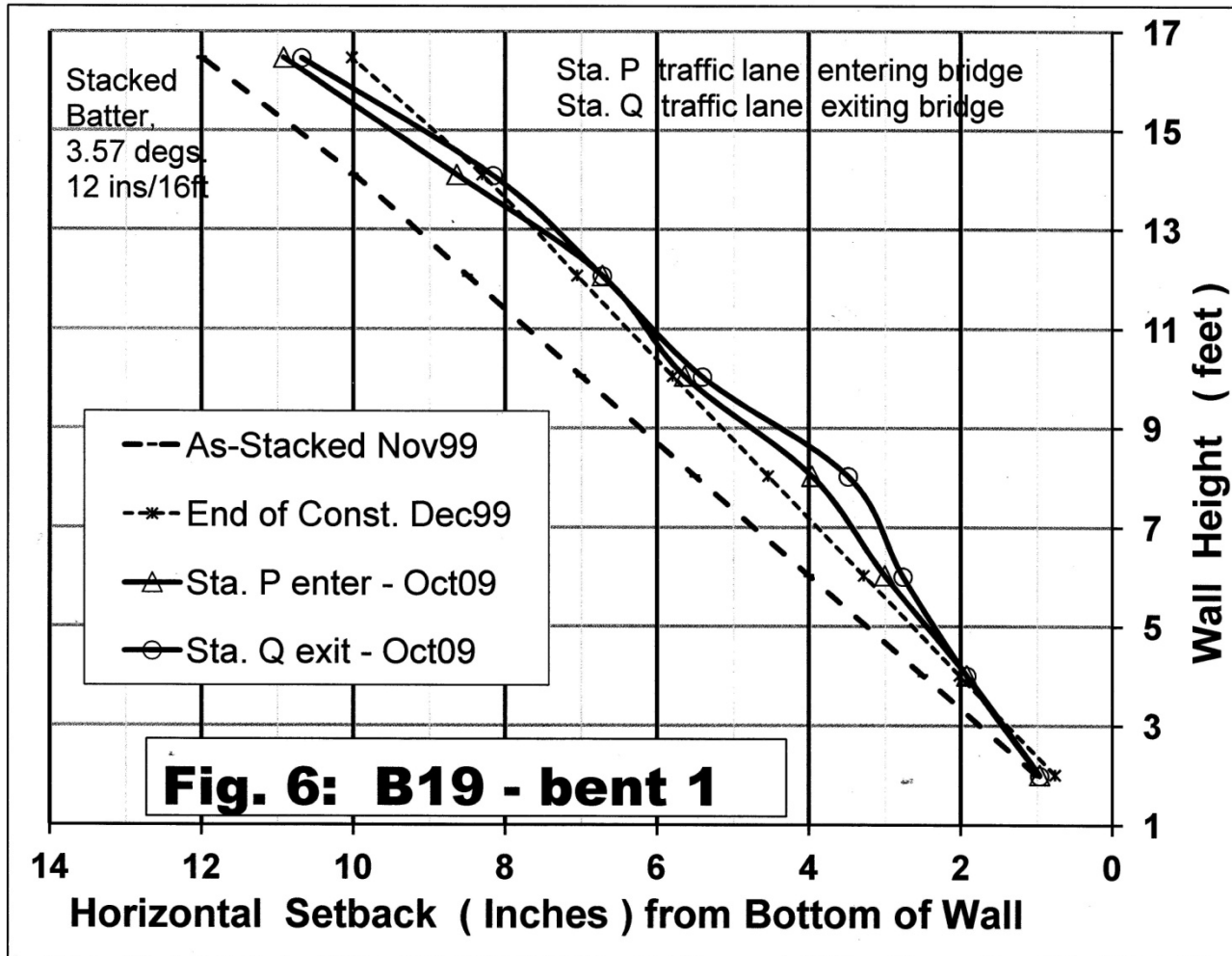
MONITORING PROGRAM

- **only Total Station Survey measure**
- **Twice: Oct. 2009 & June 2016**
- **Measure to nearest 0.01' = 3 mm**
- **Repeatability / Accuracy about
~ 0.02' = 0.25" = 6 mm**

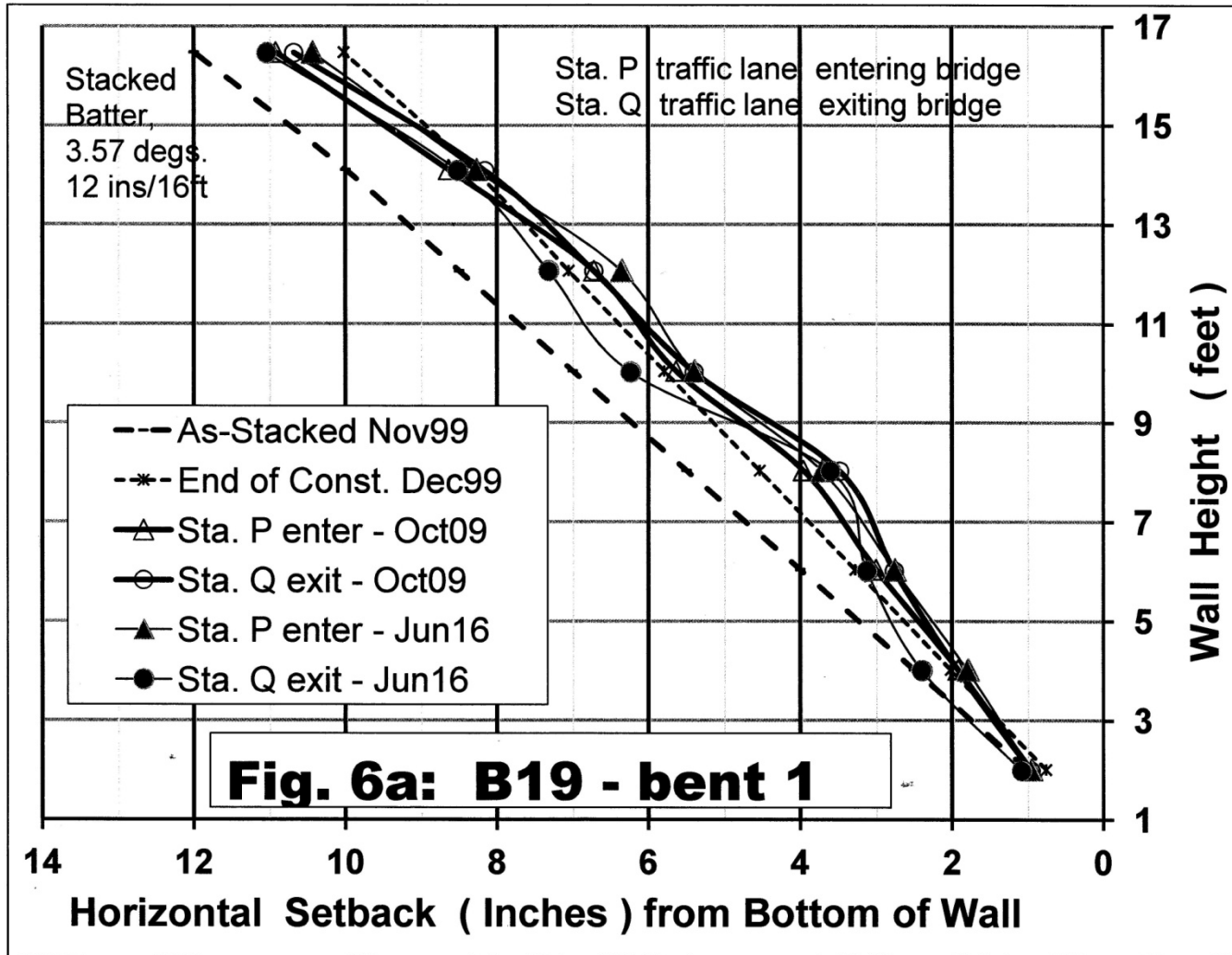
Integral Bridge Abutment, B19



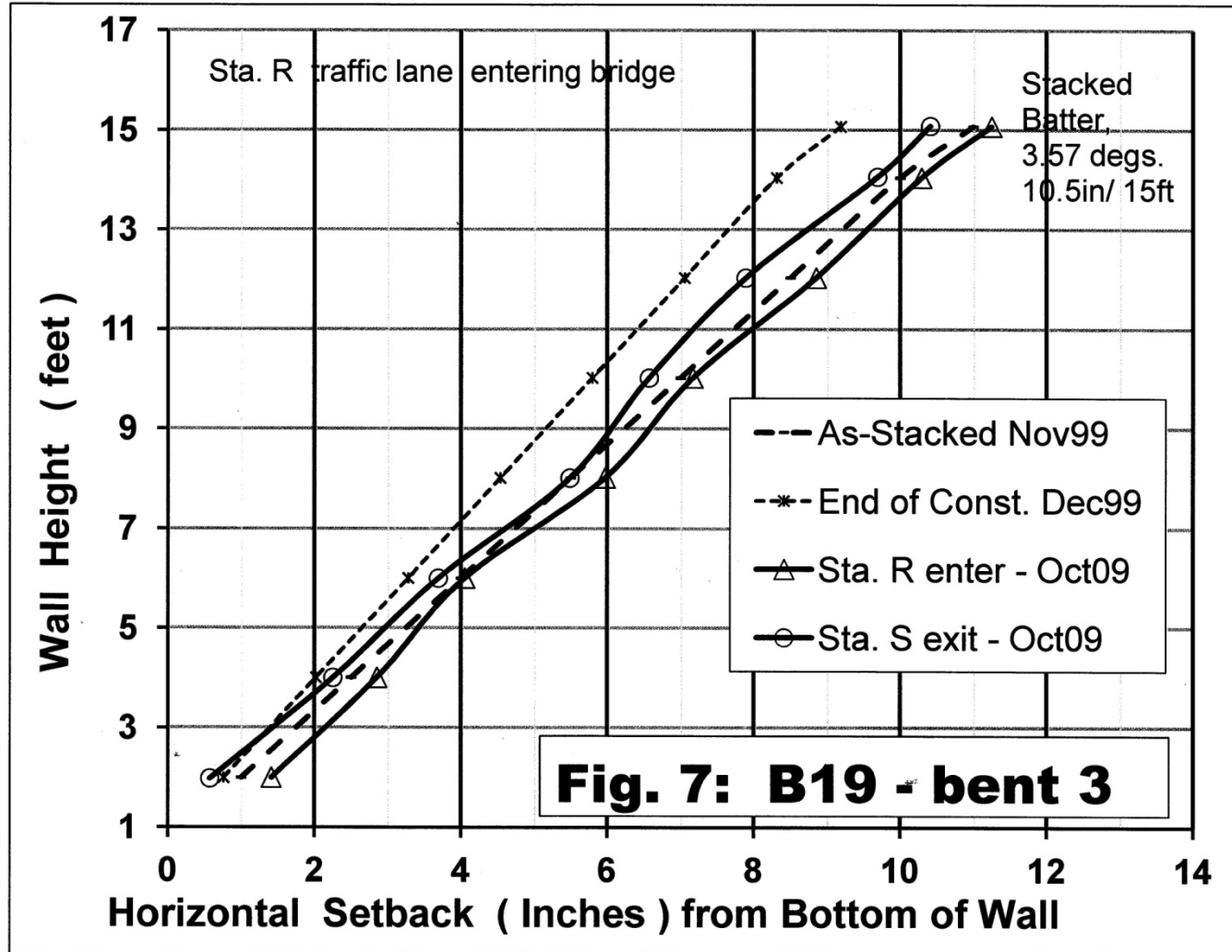
Integral Bridge Abutment, B19-b1



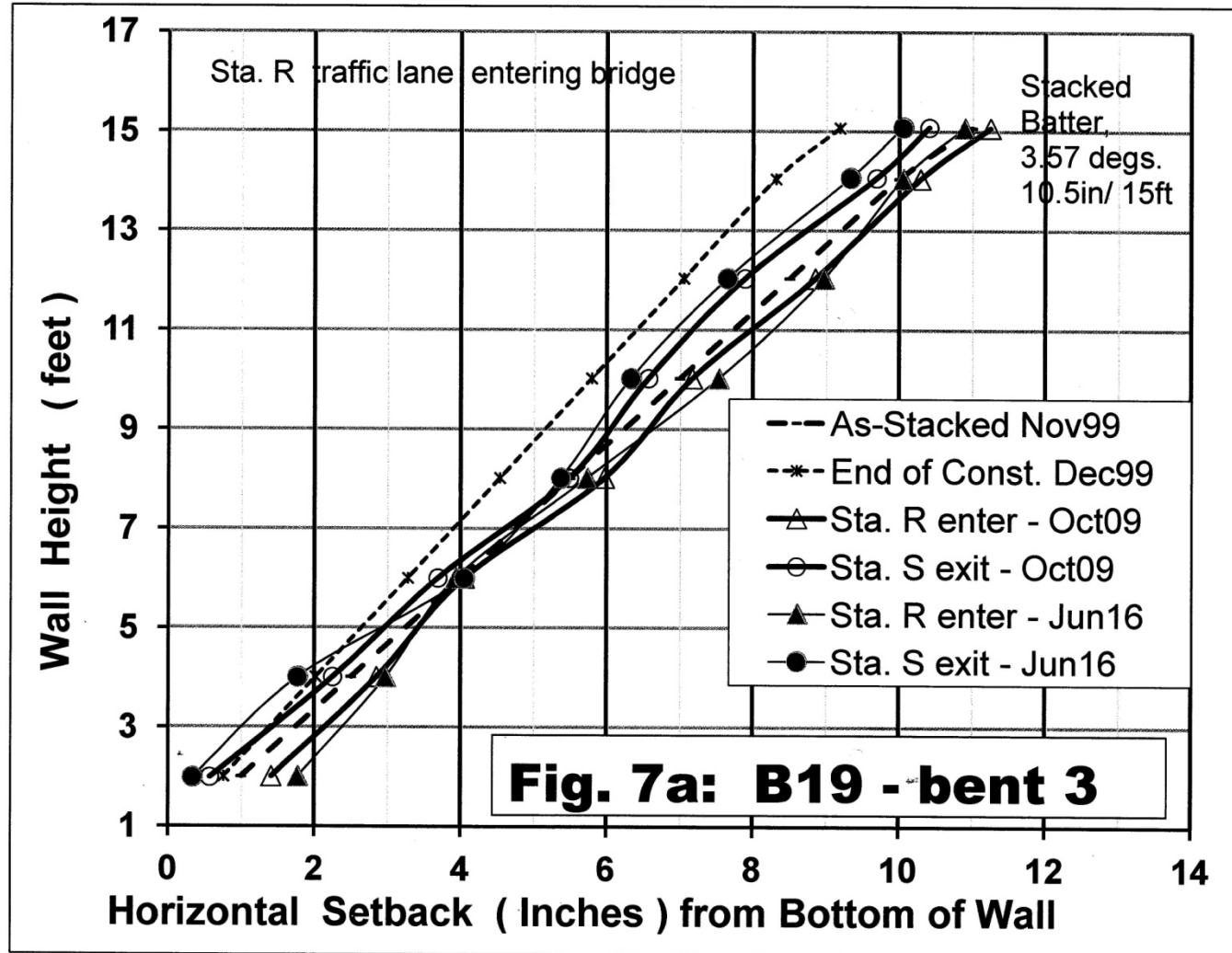
Integral Bridge Abutment, B19-b1



Integral Bridge Abutment, B19-b3



Integral Bridge Abutment, B19-b3



Integral Bridge Abutment, B19

Change in ELEVATION

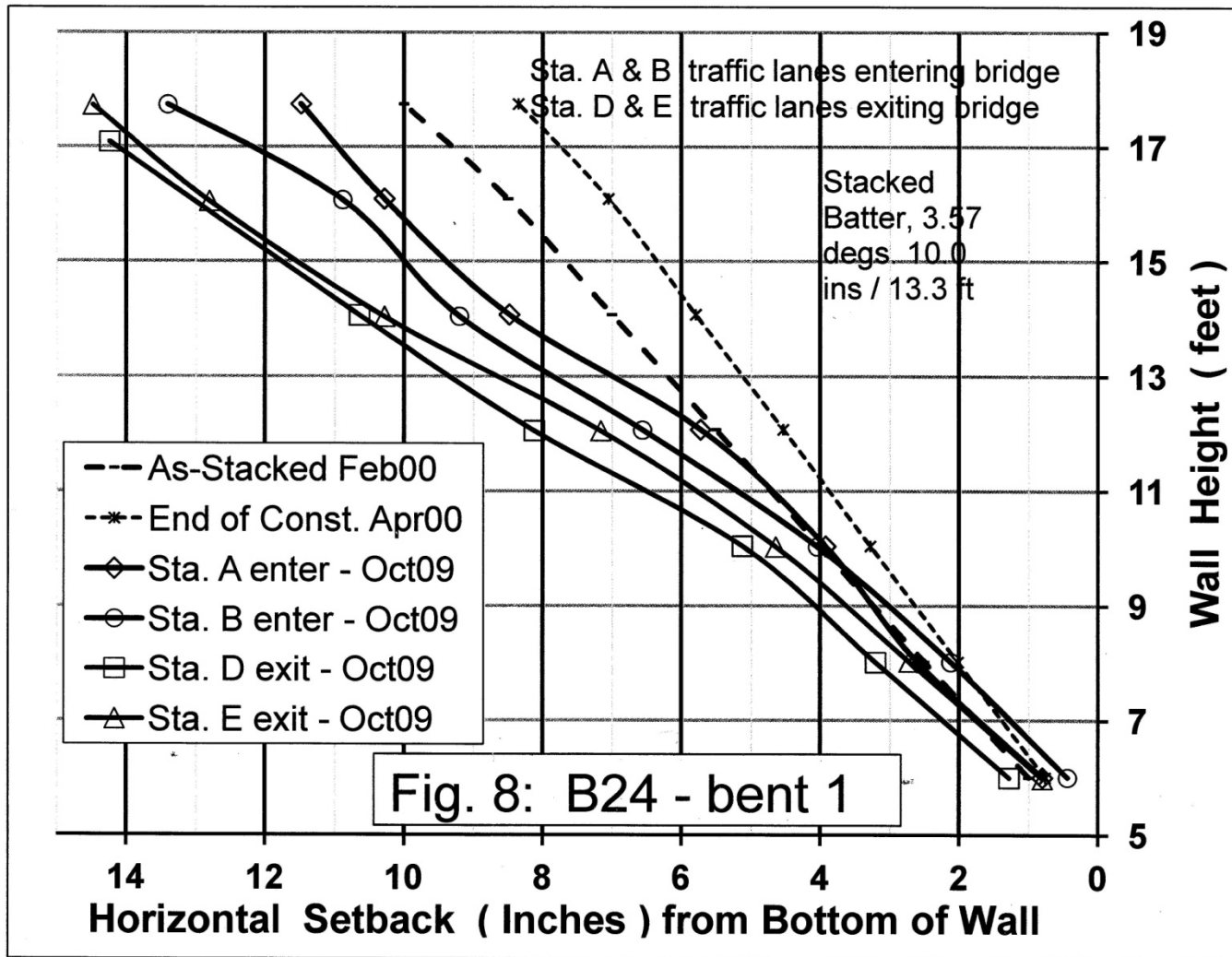
Not Much in last 6.6 years

Table 2: Number of Monitoring Points with Change in Elev .		LIST ED							
Settlement (-) or Heave (+)		Down -	Down -	Down -	None	Up +	Up +	Up +	Up +
Abutment Wall		$\geq 0.03'$	0.02'	0.01'	0.00'	0.01'	0.02'	0.03'	$\geq 0.04'$
Bridge 19, b1	P-Q			2	10	3			
Bridge 19, b3	R-S			4	8	2			

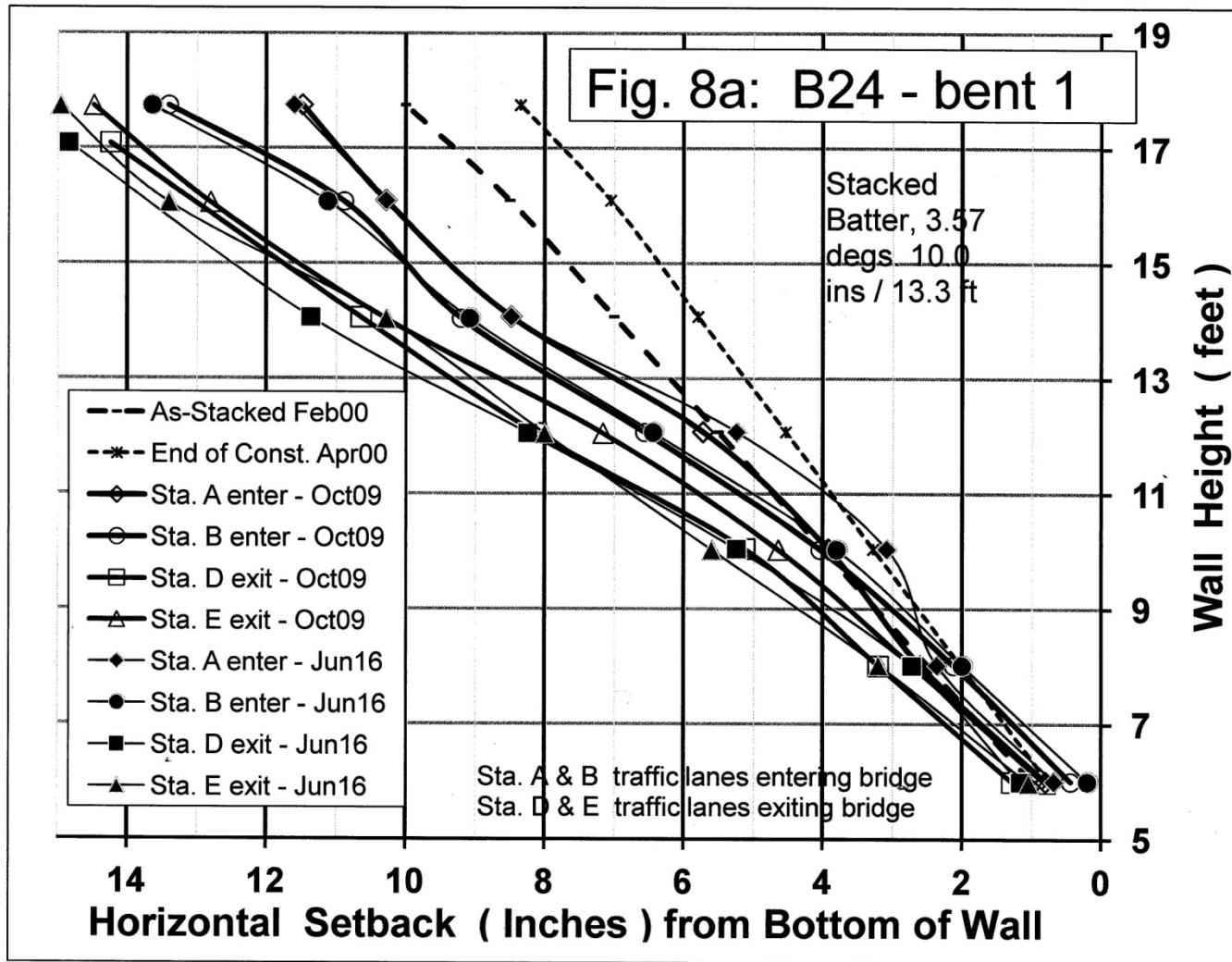
Integral Bridge Abutment, B24



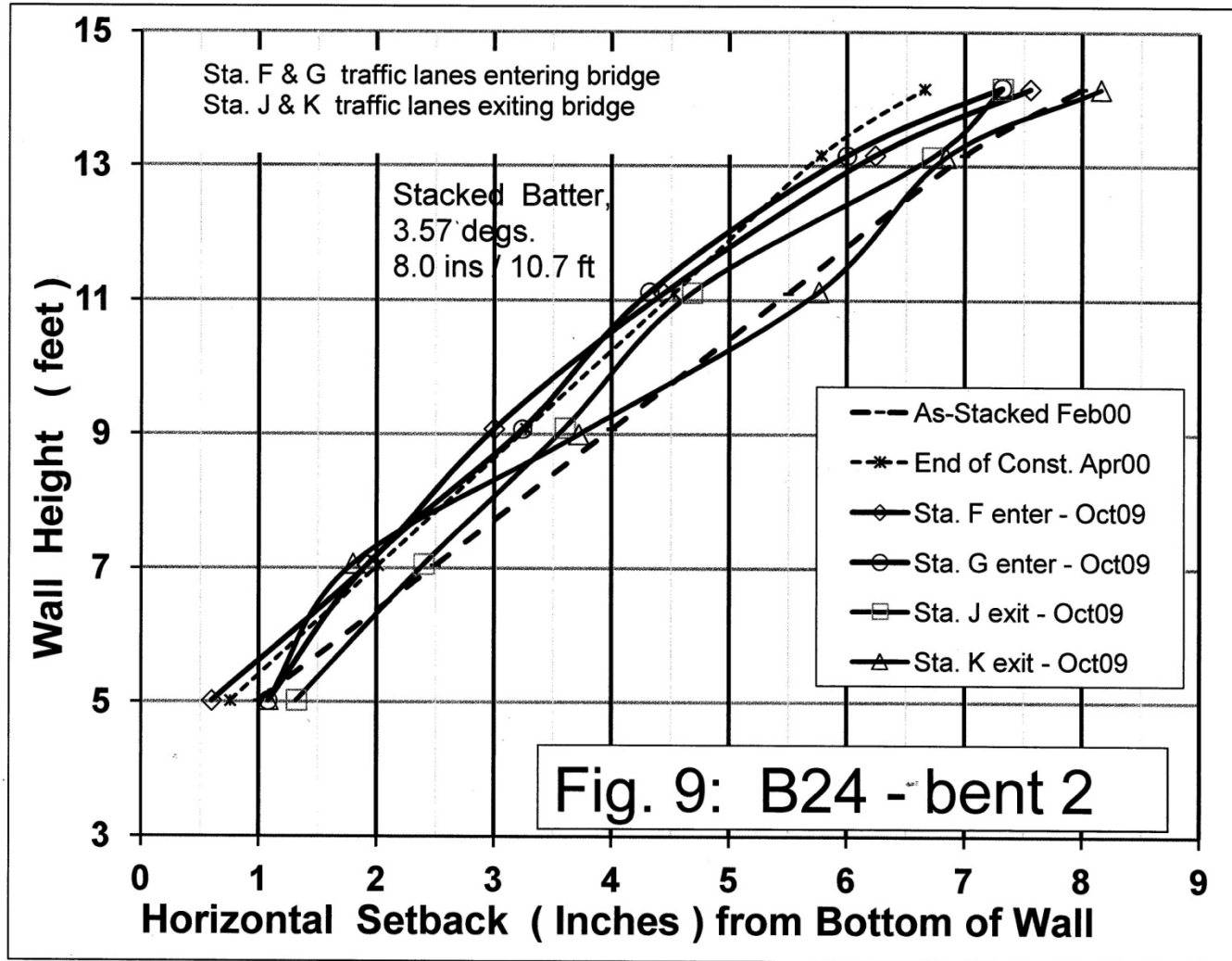
Integral Bridge Abutment, B24-b1



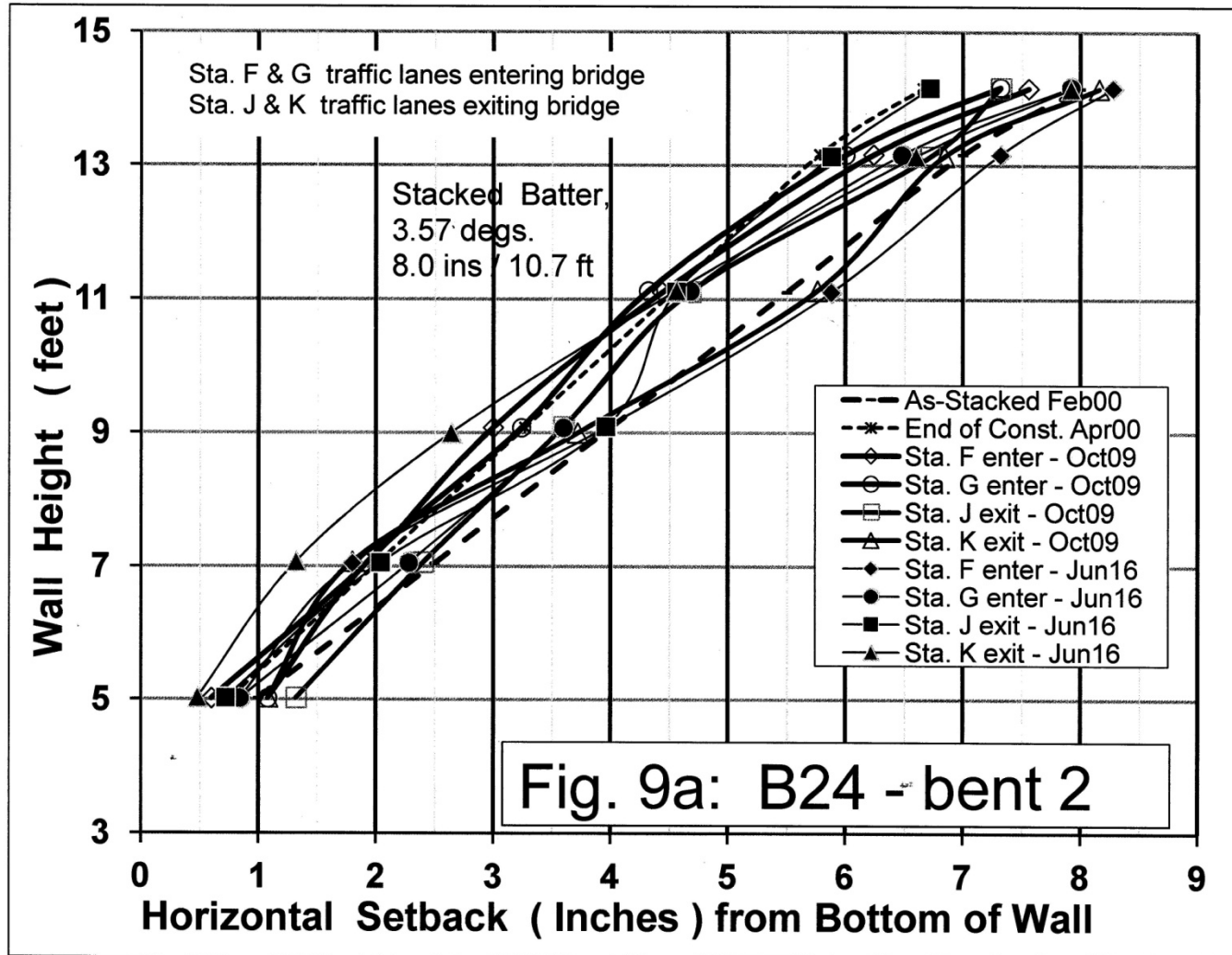
Integral Bridge Abutment, B24-b1



Integral Bridge Abutment, B24-b2



Integral Bridge Abutment, B24-b2

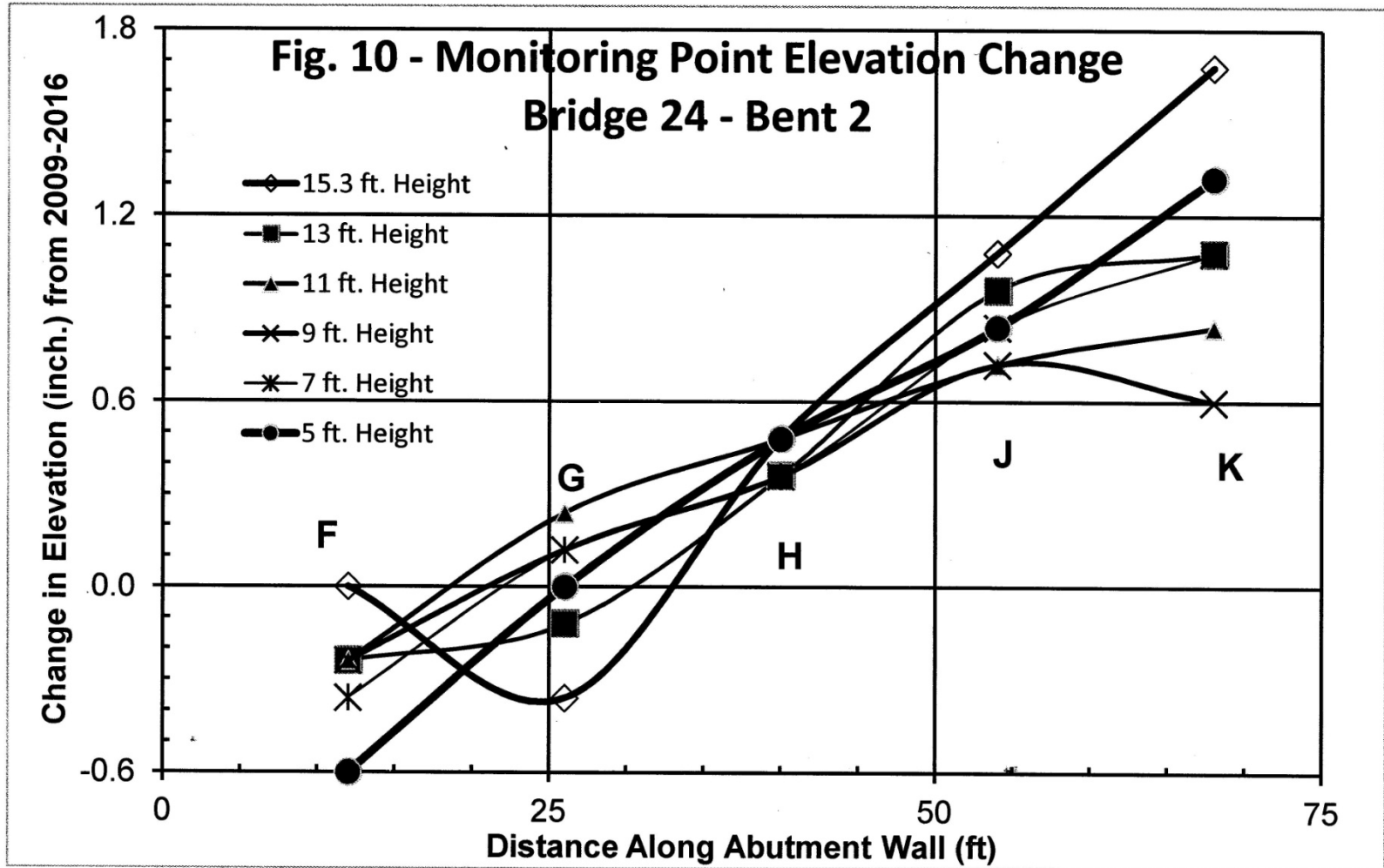


Integral Bridge Abutment, B24

Change in ELEVATION

Table 2:		Number of Monitoring Points with Change in Elev .				LIST ED			
Settlement (-) or Heave (+)	Abutment Wall	Down - ≥0.03'	Down - 0.02'	Down - 0.01'	None 0.00'	Up + 0.01'	Up + 0.02'	Up + 0.03'	Up + ≥0.04'
	Bridge 19, b1 P-Q			2	10	3			
	Bridge 19, b3 R-S			4	8	2			
	Bridge 24, b1 A-E			1	3	8	10	6	
	B-24, b2 (see Fig.10) F-K	3	3	2	4	2	1	3	8

Integral Bridge Abutment, B24-b2



Greenville Southern Connector MSEW Integral Bridge Abutments Summary & Conclusions

- **AASHTO 1998 ASD for MSEWs performing fine w/ Nominal FScs**
- **Movements small after 16 years w/i ± 2° of stacked batter (NCMA)**
- **Aesthetics good, corner maintenance**

Integral Bridge Abutment, B19



Integral Bridge Abutment, B24



Greenville Southern Connector MSEW Integral Bridge Abutments Summary & Conclusions

- **Temperature Induced movement appears to affect both Bridges**
- **More Movement in 137' span Steel vs. 87.5' span PC concrete beams**
- **Future Surveys in Oct., min. Temp.**
- **More research on long-term performance**

Questions are welcome.

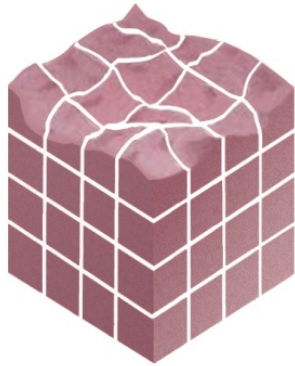
Thank you for your interest.

PRESENTED BY

Michael R. Simac, P.E.

Mike@EarthImprovement.com

803-548-8690



EARTH IMPROVEMENT TECHNOLOGIES

REFERENCES for Presentation

- **Simac, M. R. and Elton, D.J. “Geosynthetic Reinforced Soil Walls as Integral Bridge Abutment Walls,” Proceedings of the 2010 Earth Retention Conference, Bellevue, WA, Geo-Institute of ASCE, Reston VA – August 2010, pp 604-661.**
- **Simac, M. R. and Elton, D.J. “Geosynthetic Reinforced Soil Walls as Integral Bridge Abutment Walls,” Geosynthetics Magazine, IFAI, St. Paul MN, April/May 2011, pp 34-41.**
- **Simac, M. R. and Elton, D.J. “16 year Performance Update – Geosynthetic Reinforce Soil Walls as Integral Bridge Abutment Walls” GSP 278 Walls and Slopes – Geotechnical Frontiers 2017, Orlando, FL, Geo-Institute of ASCE, Reston VA – March 2017, pp 102-111.**
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