



Construction Noise Monitoring for the Dick Henderson Memorial Bridge Replacement

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Topics

- Introduction
- SP Section 699 and noise criteria
- Sound level sampling
- Site selection
- Monitoring results - baseline, construction and post-construction
- Special investigation
- Summary and conclusions

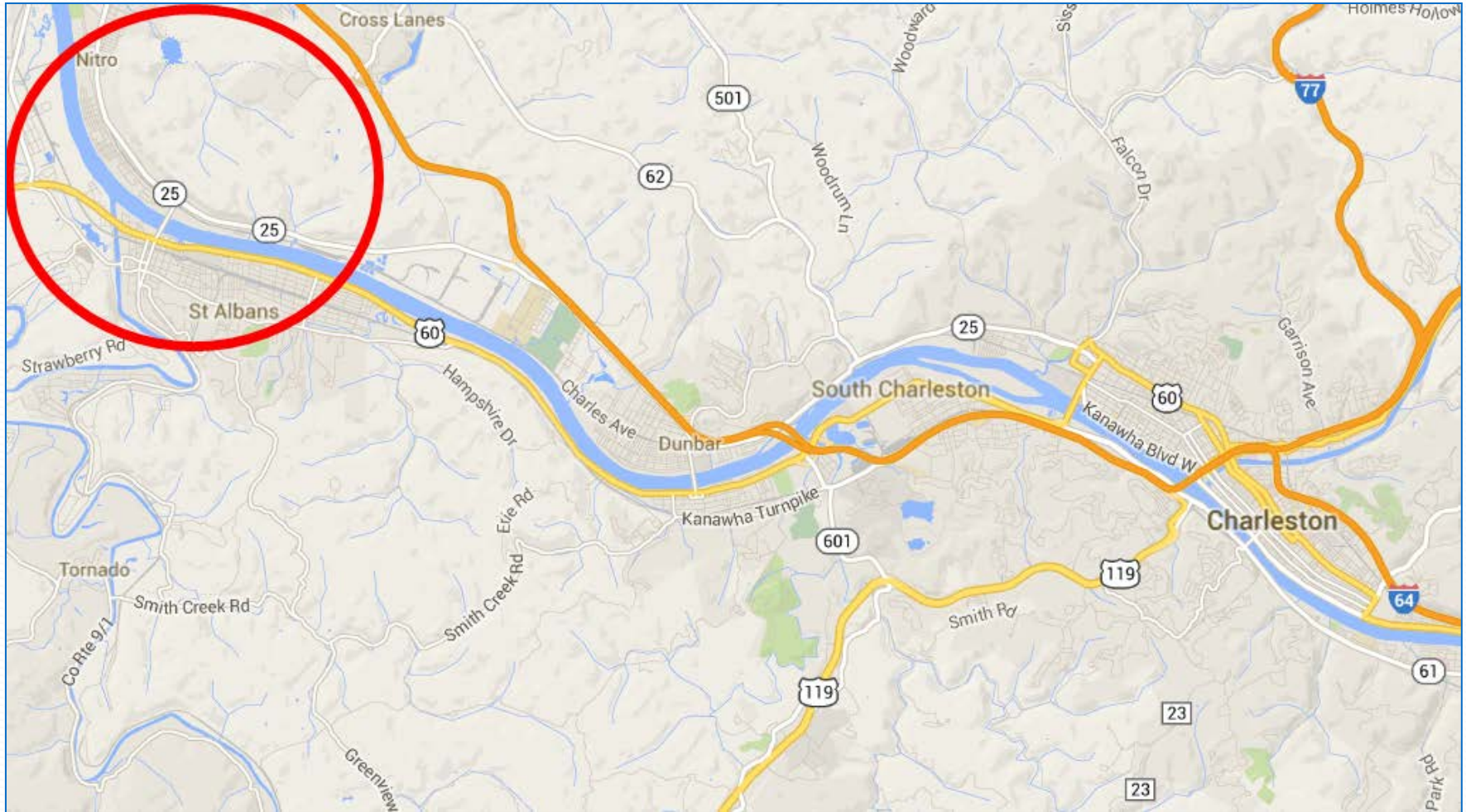


Roles

- West Virginia DOT Division of Highways (WVDOH)
 - Owner/client
- Michael Baker Jr., Inc.
 - Bridge design; task management and local support
- Bowlby
 - Review of contractor's plan, management of data collection, conduct of baseline monitoring, monthly reporting of results, and special investigations as needed
- SID
 - Installation and operation of monitors, including data transmittal, processing and storage



Nitro and St. Albans, WV



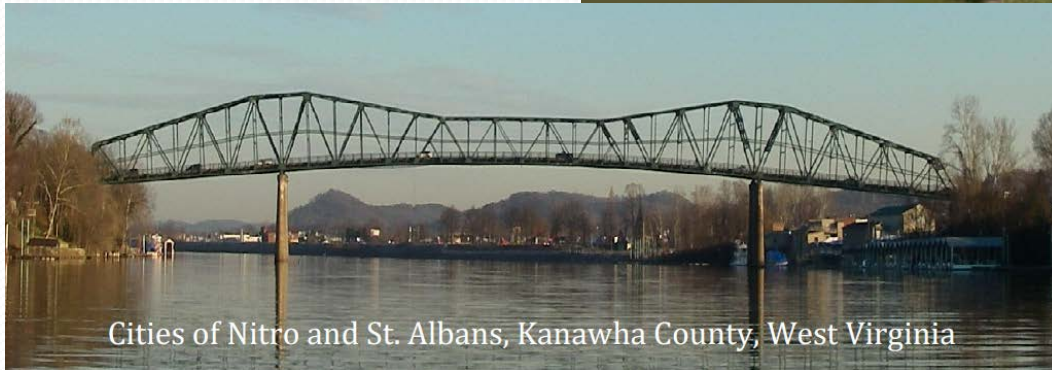
Map credit: Google Maps



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Existing Bridge



Cities of Nitro and St. Albans, Kanawha County, West Virginia

Photo credit: WVDOH FONSI

Photo credit: Bing.com



Special Provision (SP) Section 699

Construction Noise Impacts

- Specified use of construction sound level criteria in the Federal Transit Administration's (FTA) *Transit Noise and Vibration Impact Assessment* manual
- Required contractor to submit Noise Mitigation Plan and designate a Noise Mitigation Representative
- Required mitigation measures to meet FONSI commitments (micropiles or drilled caissons; mufflers; meeting EPA equipment standards)



Noise Criteria

- Chapter 12 of the FTA manual
- Longer-term impact: 30-day (monthly) energy-average of the daily Day-Night Levels (DNL) of **70 dBA**
- Shorter-term residential impact criteria
 - One-hour equivalent sound level (L_{eq}) of **90 dBA** during the day and **80 dBA** at night, and
 - Eight-hour L_{eq} of **80 dBA** (day) and **70 dBA** (night)
- Day: 7 a.m. to 10 p.m.; night: 10 p.m. to 7 a.m.



Sound Level Sampling

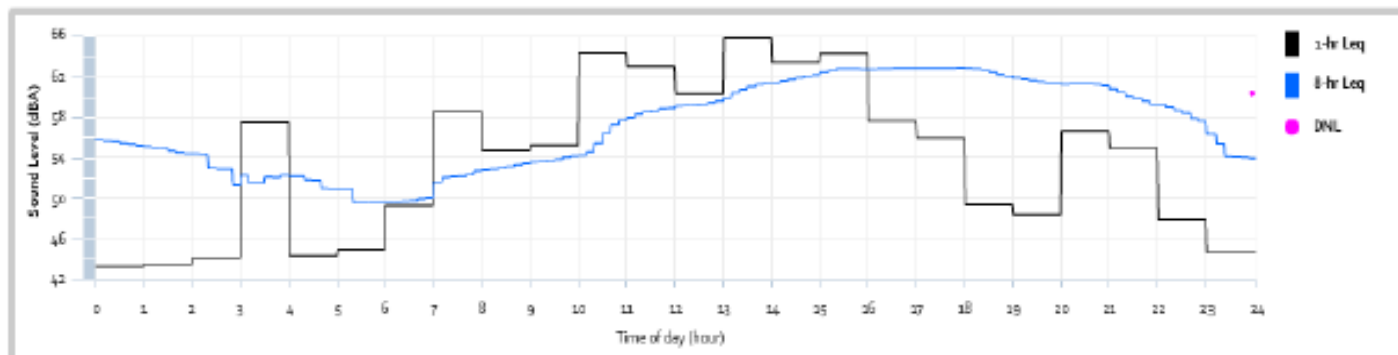
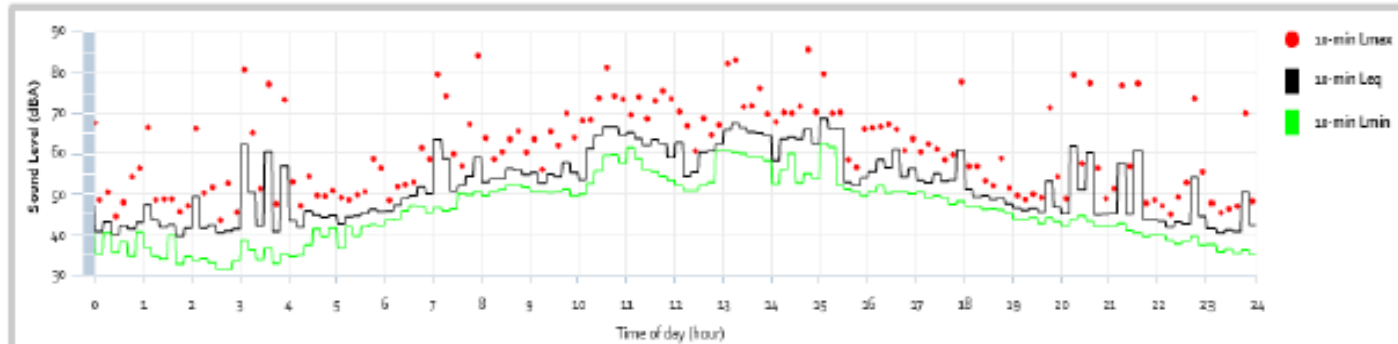
- Larson-Davis LD-820 Noise Monitor with EcoEARS data logger at each site
- Wind speed and direction data collected at one site with Gill WindObserver II ultrasonic sensor
- One-second A-weighted sound level data collected using “slow” response
- Data transmitted to SID’s server via cellular modem, processed, and made available for daily download by Bowlby

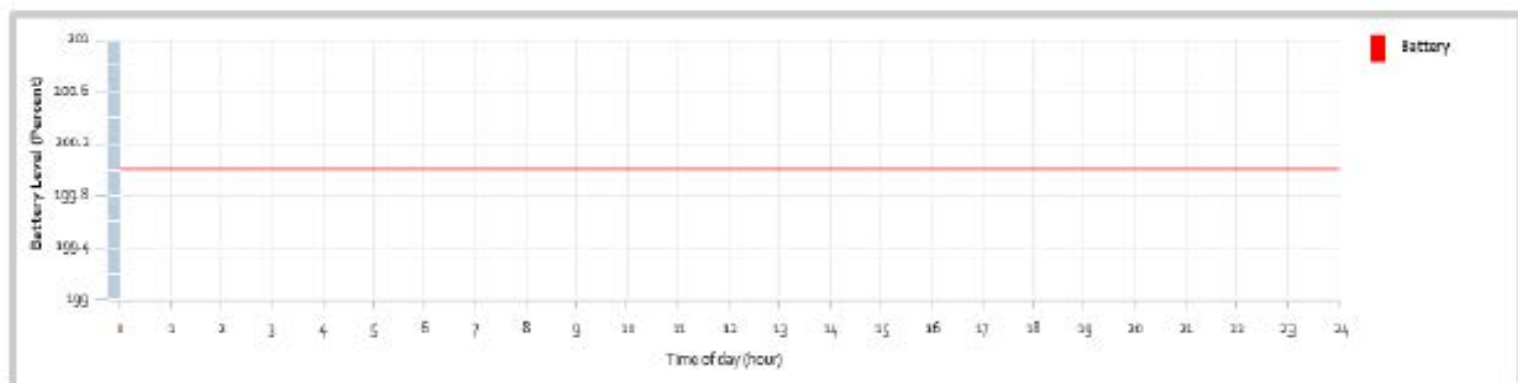
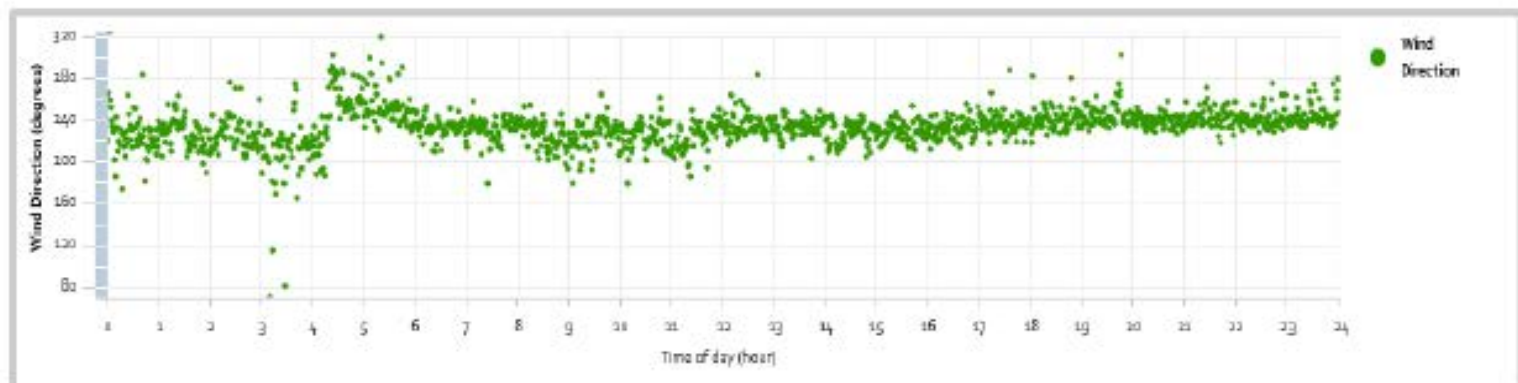
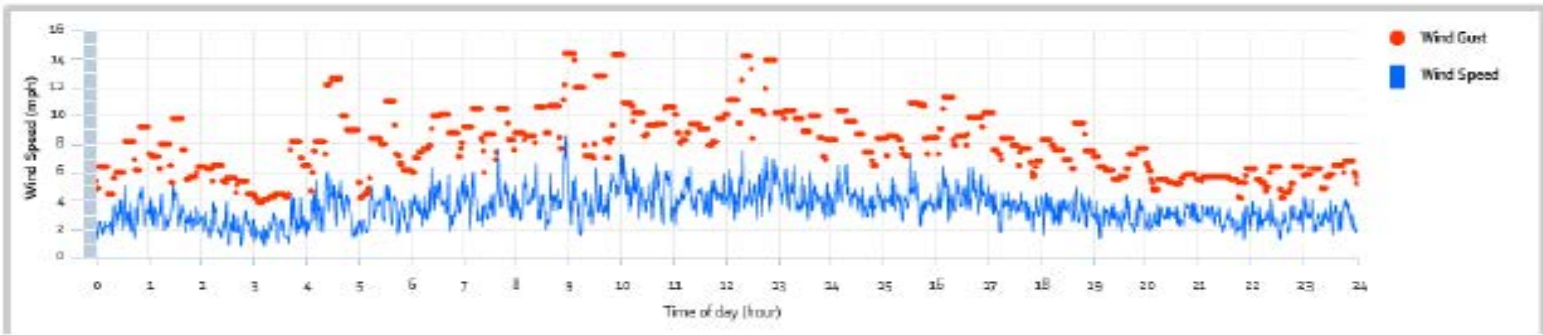


Data Presentation

WV DOT NOISE MONITORING Dick Henderson Memorial Bridge Replacement

WV DOT
Site Name: FEN
Site Location: FENTON CIRCLE, NITRO, WV
Date: Thu Feb 28 2013





Monitoring Site Selection

- Four monitors installed in community locations in both Nitro (SAT and FEN) and St. Albans (HIG and MAR)
- Two residential sites, one near school athletic field, one at marina

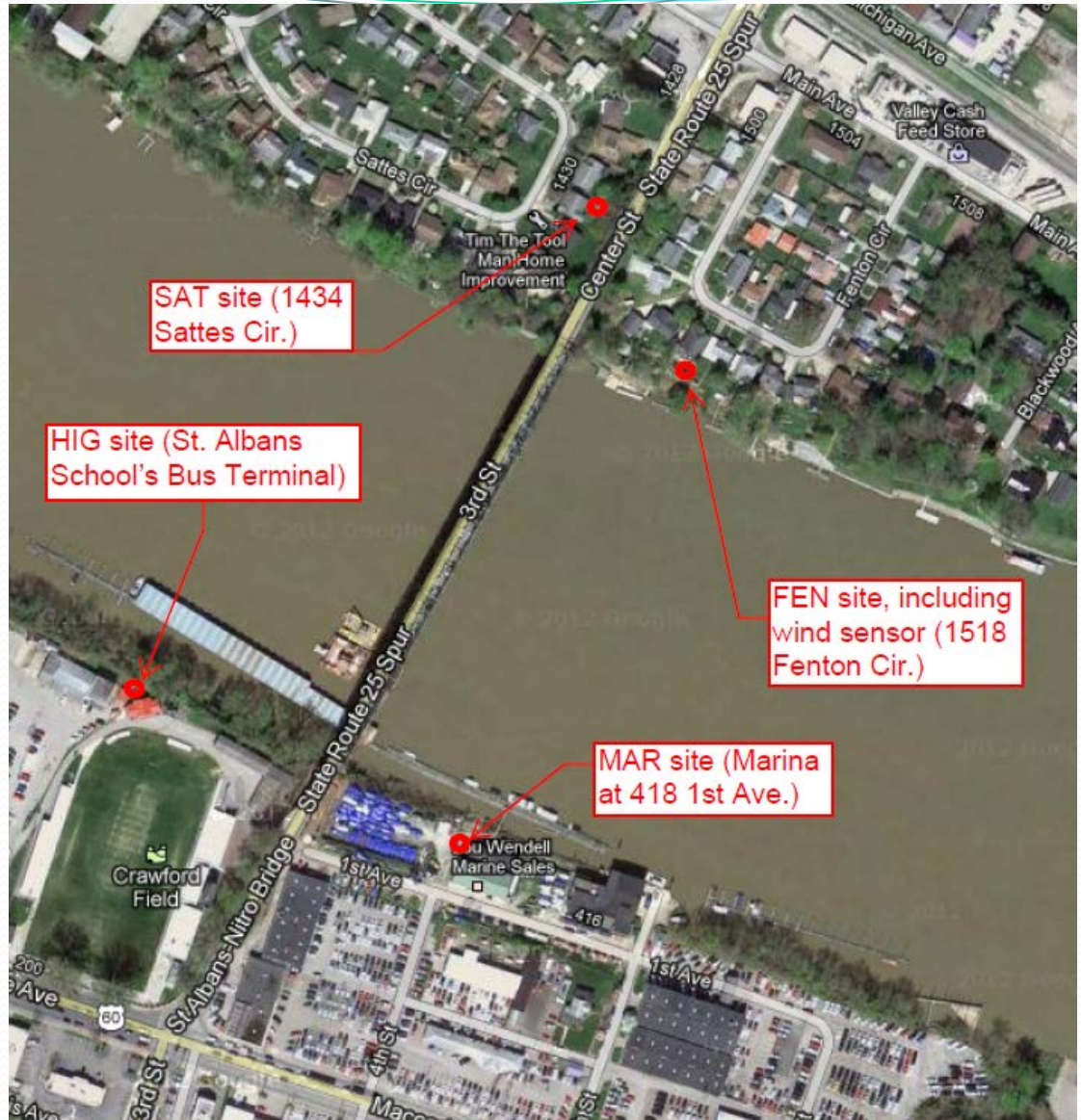


Photo credit: Google Maps



Site SAT: Residence at 1434 Sattes Circle, Nitro

- Located in backyard along Nitro bridge approach
- Microphone moved in April 2013 due to construction activities taking place in the backyard
- Noise sources: traffic on the bridge, construction activities, and A/C equipment



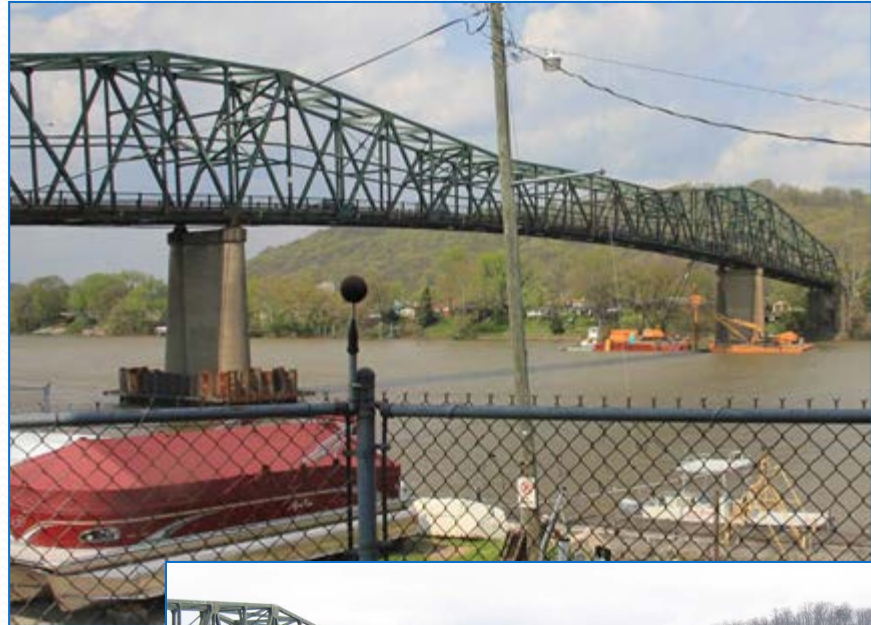
Site FEN: Residence at 1518 Fenton Circle, Nitro

- Microphone and wind sensor mounted on roof deck of a boat house located next to the river
- Noise sources: traffic on the bridge, boat traffic, construction activities, wind



Site MAR: Marina at 418 1st Ave, St. Albans

- Microphone was located behind marina shop facing the river and the bridge
- Noise sources: traffic on the bridge, boat traffic, construction activities, marina activities

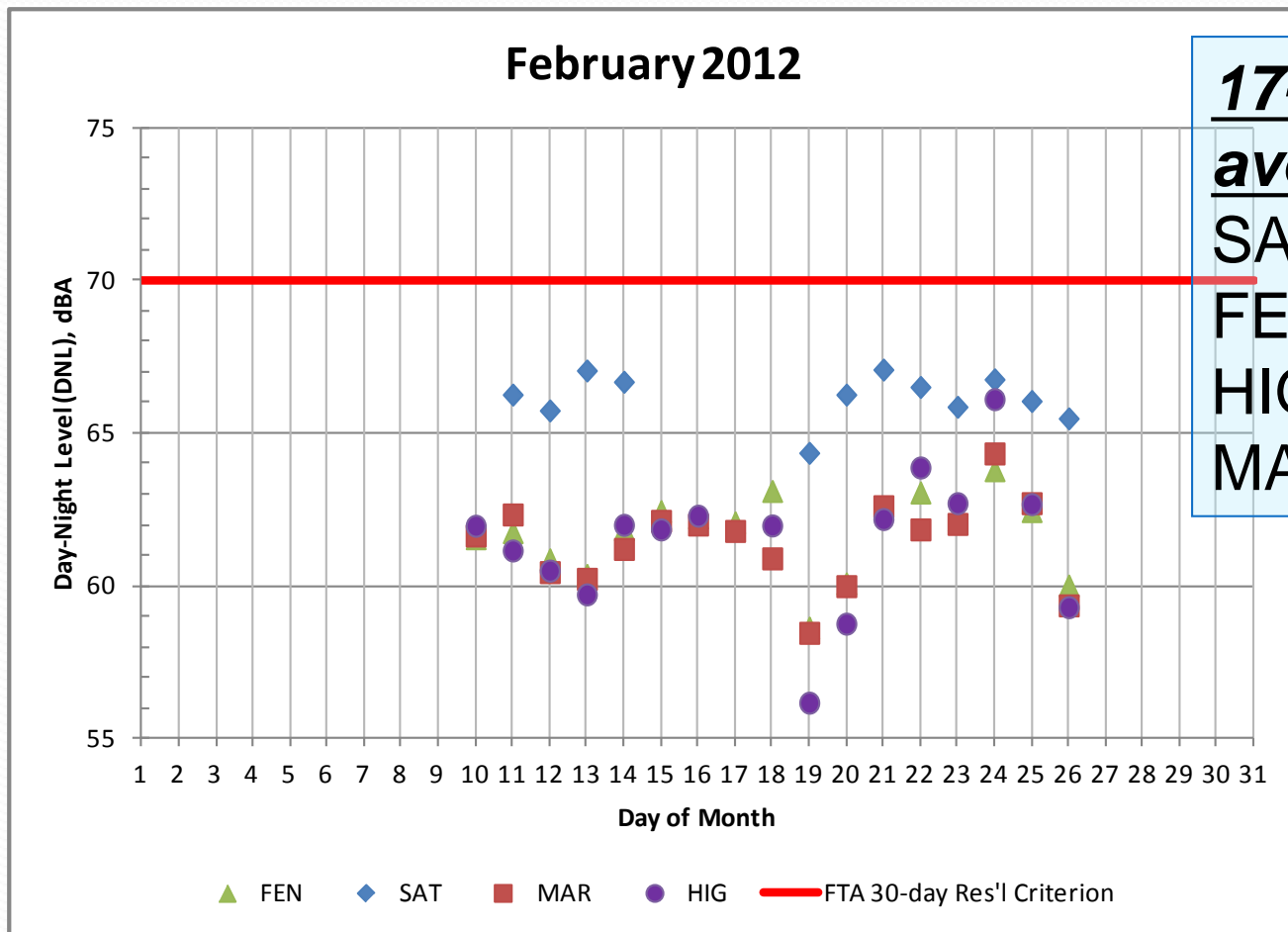


Site HIG: St. Albans School Bus Terminal, St. Albans

- Microphone located next to St. Albans School Bus Garage
- Adjacent to school athletic field
- Noise sources: traffic on the bridge, boat traffic, construction activities, bus garage activities, athletic activities



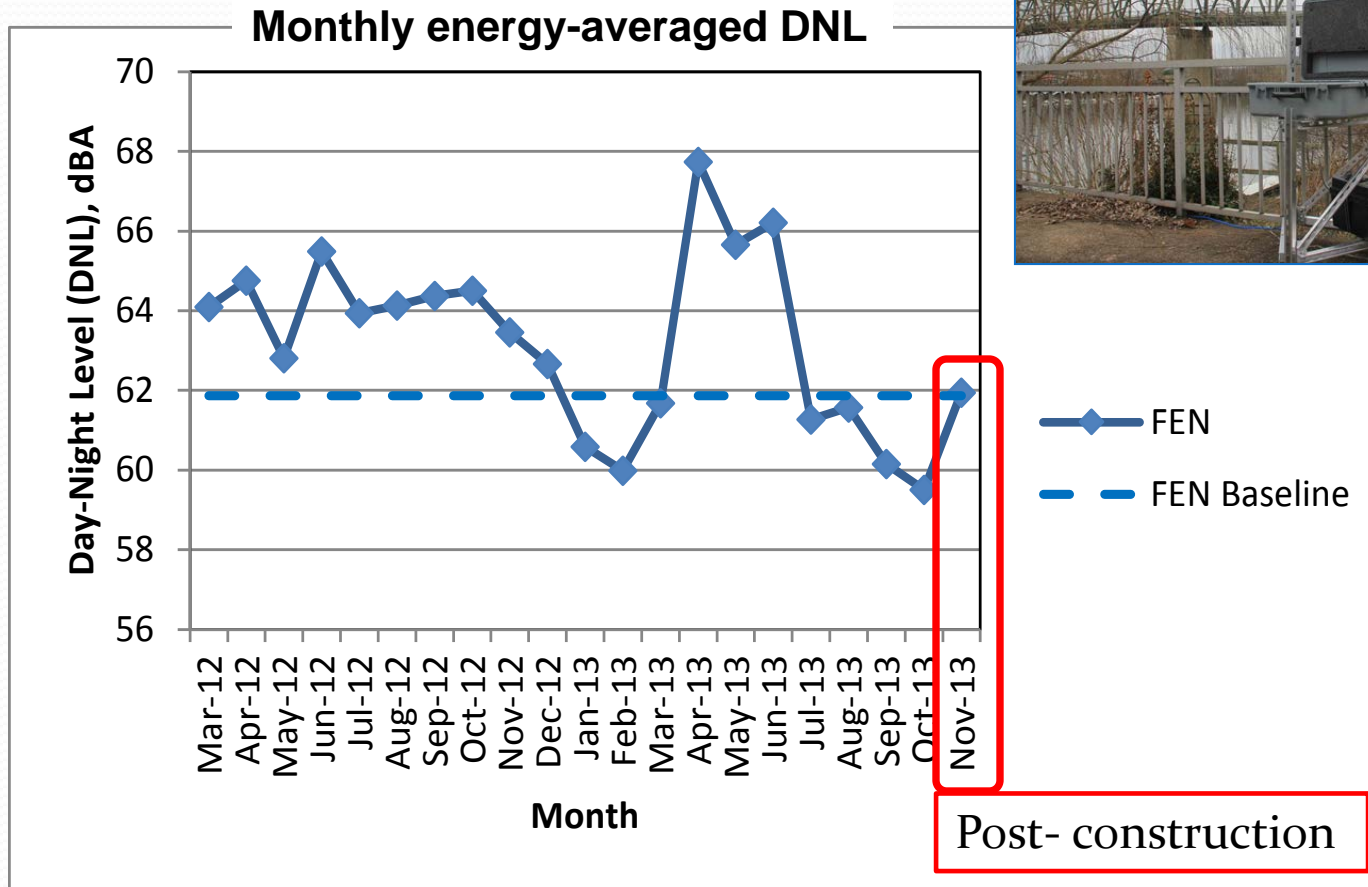
Baseline Noise Monitoring (DNL)



17-day energy-averaged DNL:
 SAT: 66 dBA
 FEN: 62 dBA
 HIG: 62 dBA
 MAR: 61 dBA

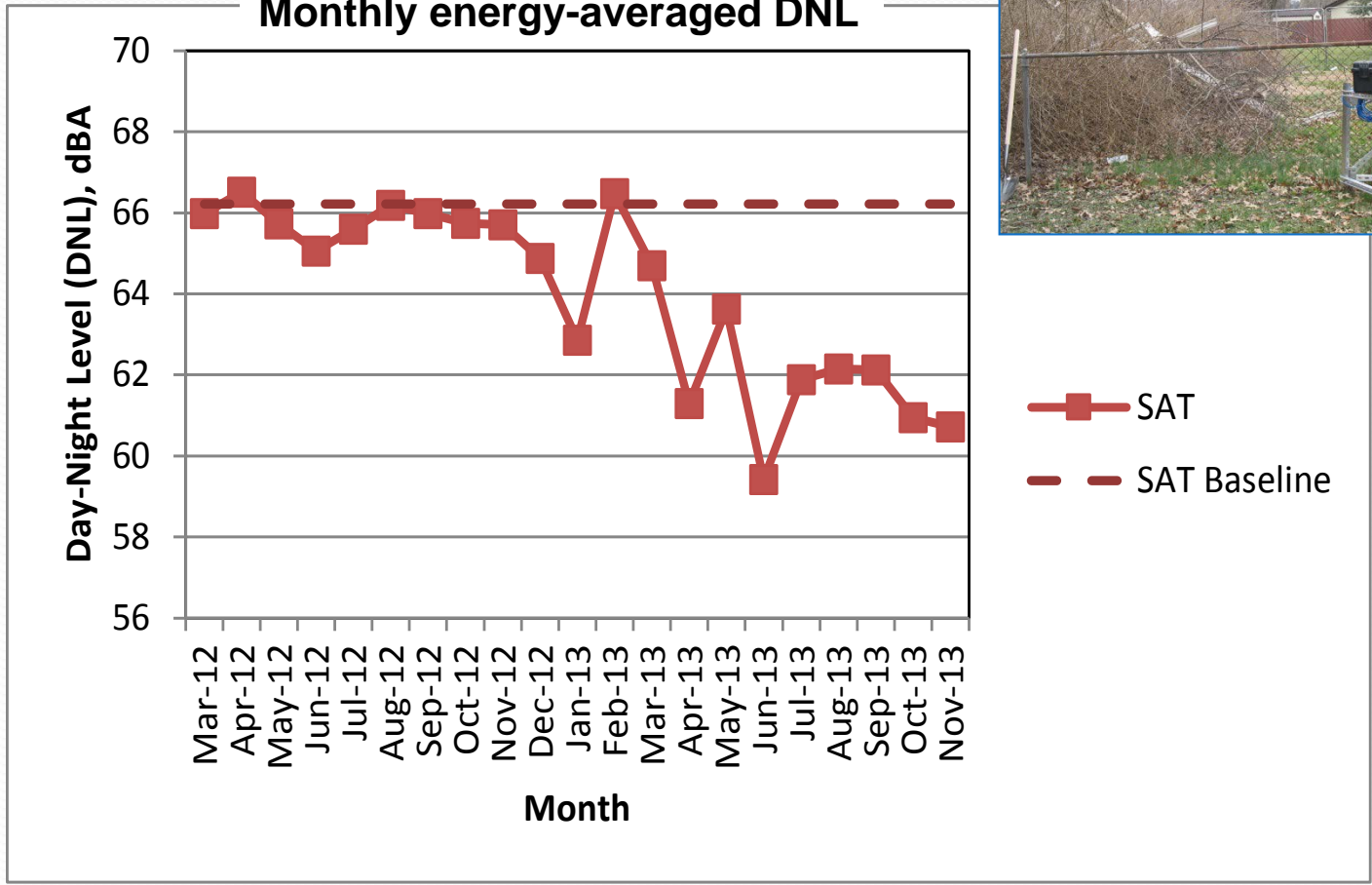


Construction Noise Monitoring Results – Site FEN



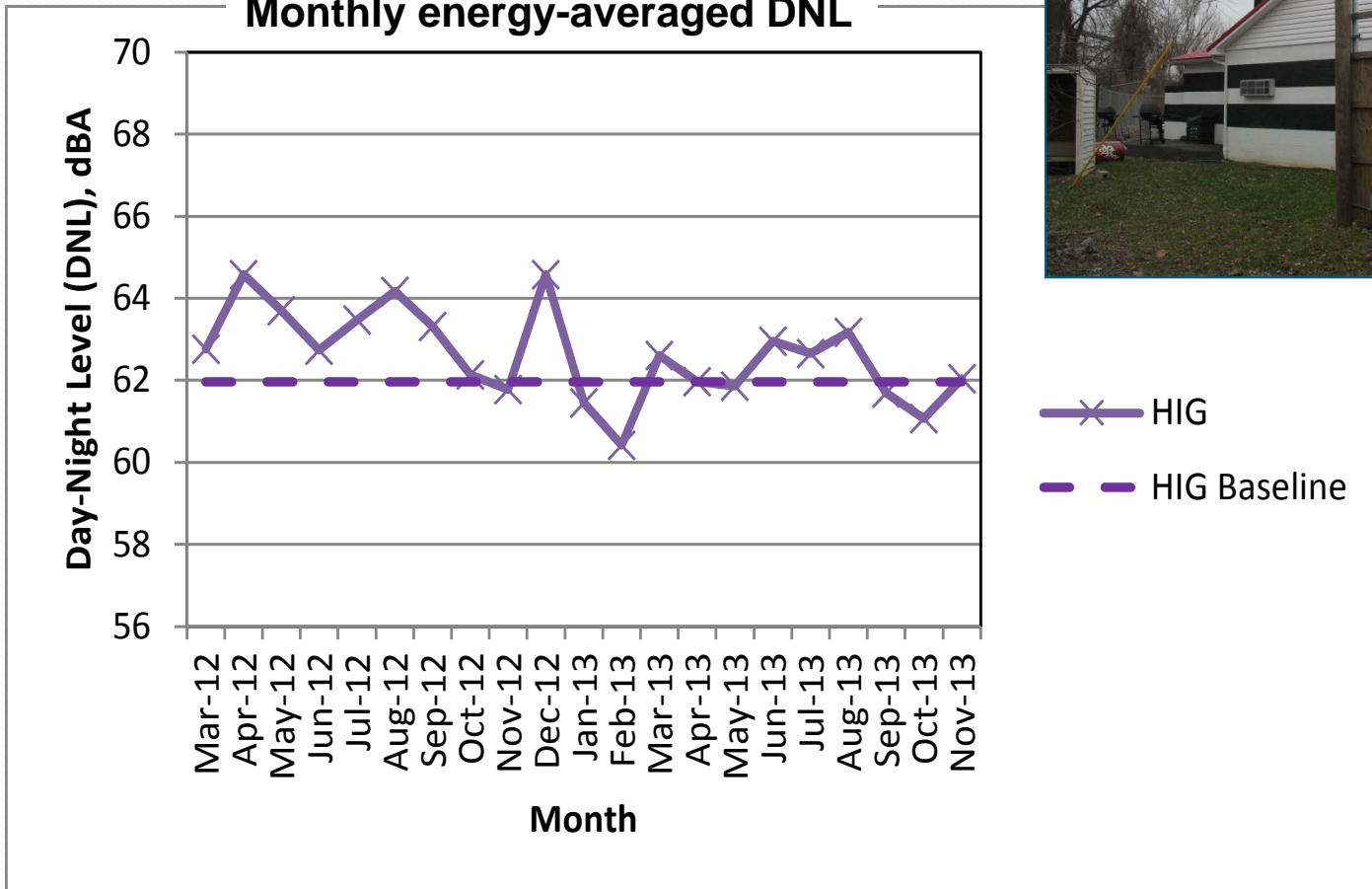
Construction Noise Monitoring Results – Site SAT

Monthly energy-averaged DNL

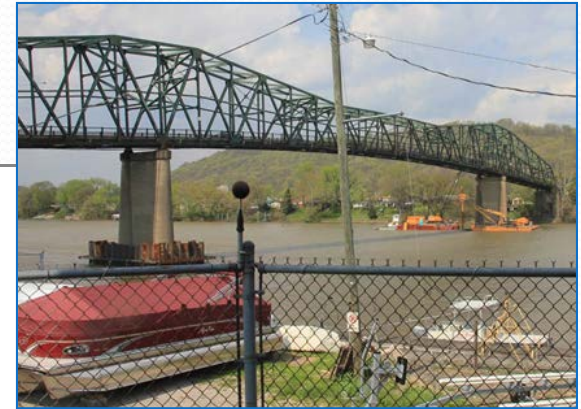


Construction Noise Monitoring Results – Site HIG

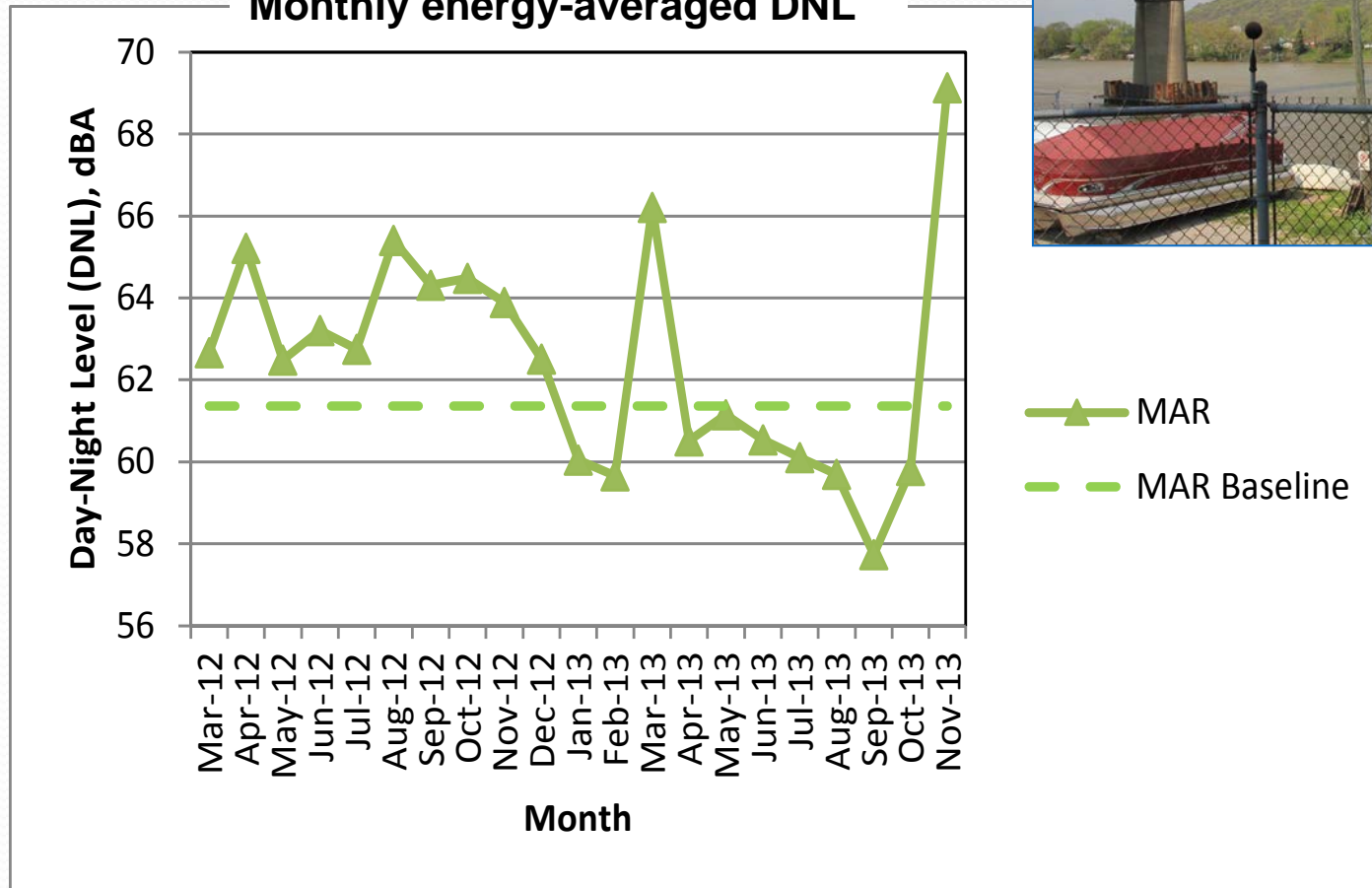
Monthly energy-averaged DNL



Construction Noise Monitoring Results – Site MAR



Monthly energy-averaged DNL



Bridge opened Nov. 1, 2013



Photo credit: WVDOH



Nitro Sites – Post-Construction



Site SAT – Final Measurement Location - Dec 2013



Site FEN – Final Measurement Location - Dec 2013



St. Albans Sites – Post-Construction



Site MAR – Final Measurement Location - Dec 2013



Site HIG – Final Measurement Location - Dec



Post-Construction Monitoring

30-day DNL:

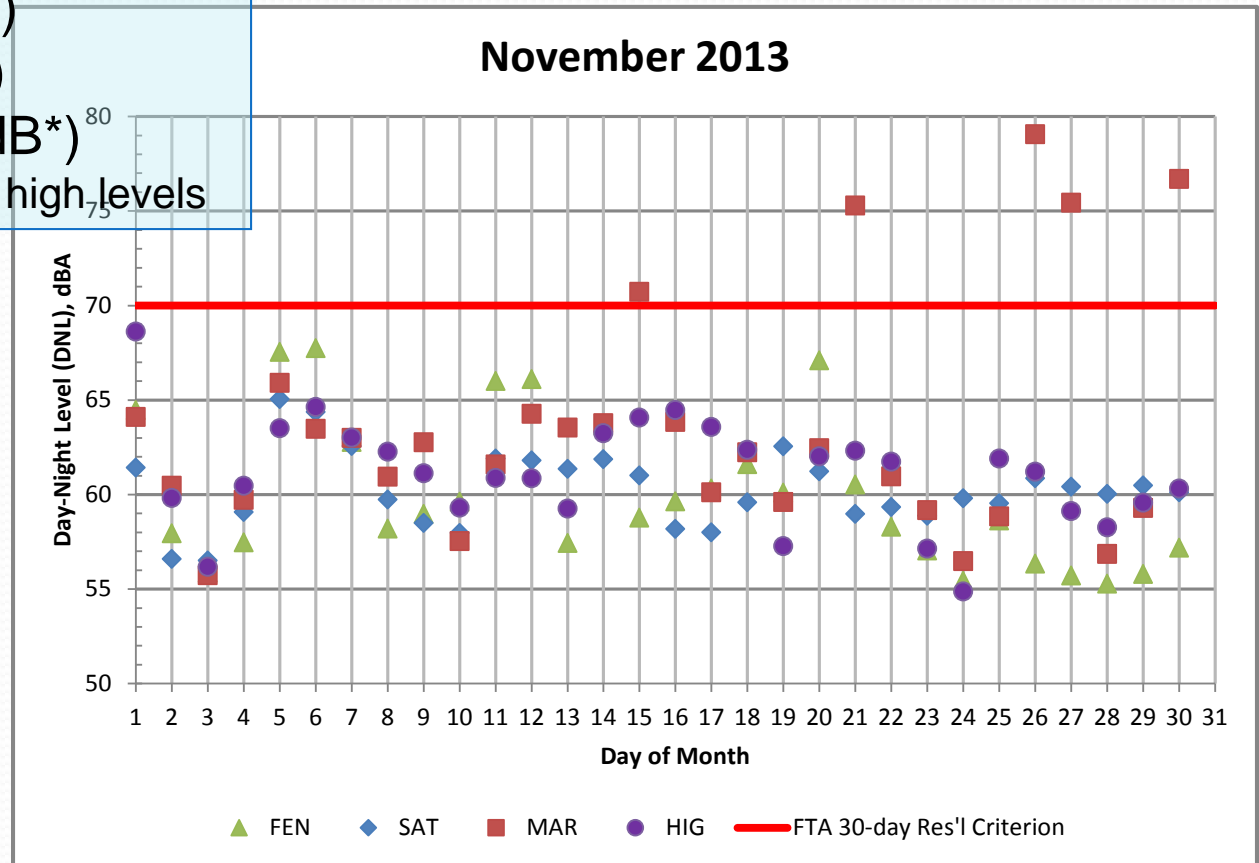
SAT: 61 dBA (-5 dB)

FEN: 62 dBA (0 dB)

HIG: 62 dBA (0 dB)

MAR: 68 dBA (+7 dB*)

* 5 days of unexplained high levels



Special Investigation: Bridge Demolition, March 2013



Photo credit: WVDOH

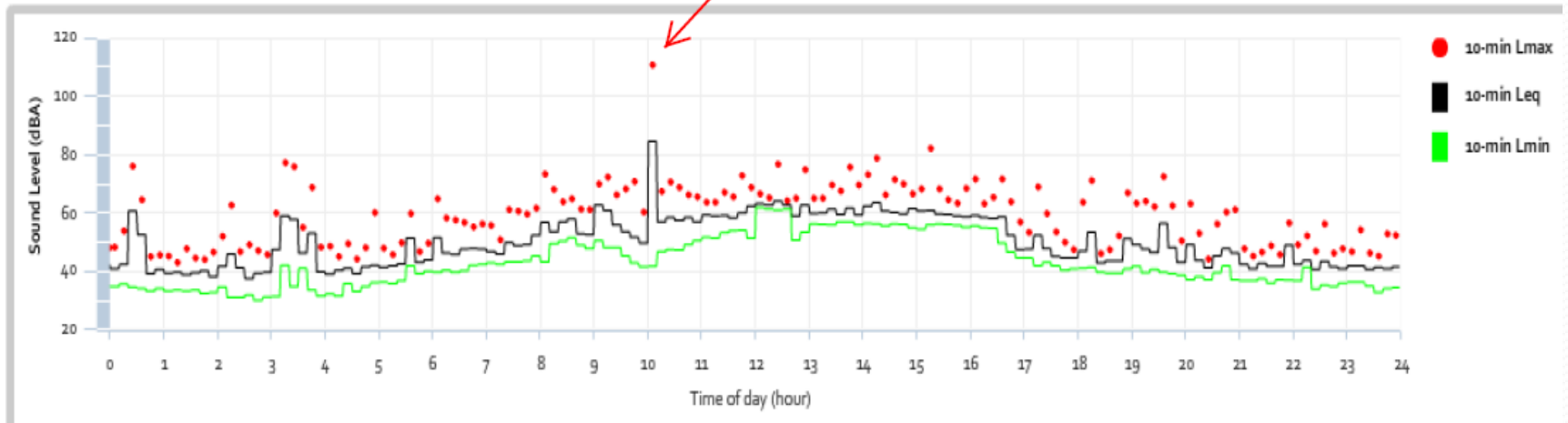




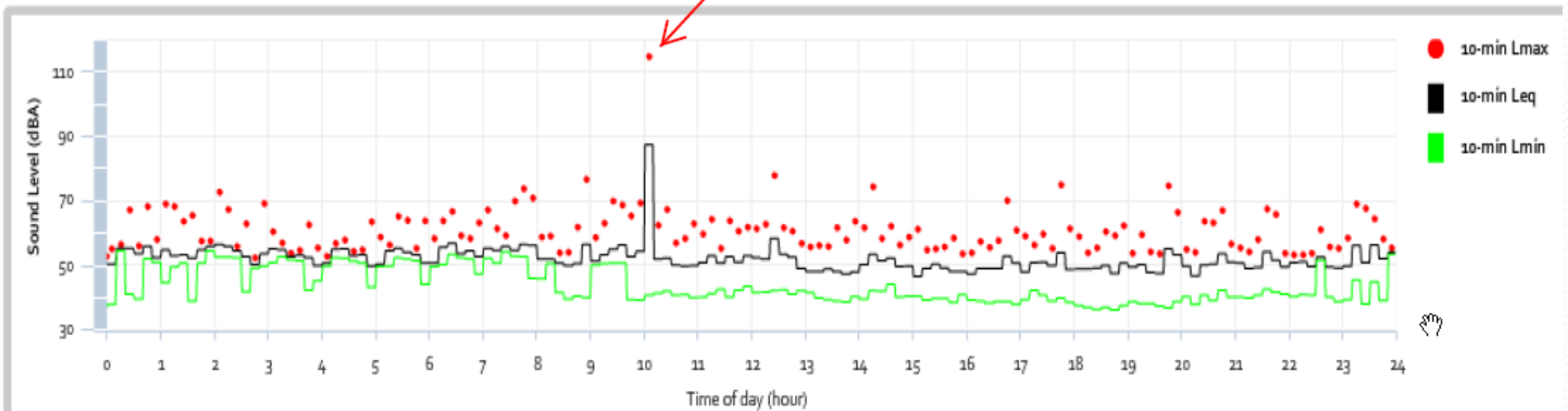
Photo credits: WVDOT



Site Name: FEN
Site Location: FENTON CIRCLE, NITRO, WV
Date: Fri Mar 1 2013



Site Name: SAT
Site Location: SATTES CIRCLE, NITRO, WV
Date: Fri Mar 8 2013



Summary

- Continuous sound level monitoring at four sites:
 - Seventeen days of pre-construction baseline monitoring
 - Twenty months of construction monitoring
 - One month of post-construction monitoring
- Monthly-average construction DNLs varied above and below pre-construction levels
- Compared to the FTA criteria:
 - No exceedance of the 70 dBA monthly-average DNL
 - Very few exceedances of the 1-hr and 8-hr daytime and nighttime L_{eq} criteria
- Post-construction traffic noise levels were reduced at the Sattes Circle site



Conclusions

- Monitoring was a success , meeting WVDOH's objectives
- Site selection and installation went smoothly, with excellent cooperation from property owners
- Data transmission, processing, daily downloading and subsequent data analysis all went well
- Available features such as web cameras and triggered audio recordings would allow more diagnostic work if needed
- Access to the data web site could be given to the public



Acknowledgements

- WVDOT Division of Highways
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- Bowlby & Associates, Inc.
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 - Rennie Williamson, Project Engineer





Questions?

Photo credit: WVDOH



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