Acoustiblok Bridge Joint Isolation Material

Acoustical Testing at Waters Avenue Bridge, Hillsborough County, FL

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Testing

Summary

Project Name:
Acoustiblok Bridge Joint Noise Application Testing

System Name:
Acoustiblok Bridge Joint Isolation Material™

Purpose:
Determine if Acoustiblok sound mitigating material is an effective treatment for bridge joint noise under bridge decks.

Test Owner:
RJ Watson - Bridge & Structural Engineered Systems
11035 Walden Ave., Alden, NY 14004 USA , (P) 716.901.7020

Testing Company:
Acoustiblok Inc. - Soundproofing materials manufacturer
6900 Interbay Blvd., Tampa, Florida 33616 USA

Tested Material:
Acoustiblok sound mitigating material manufactured by Acoustiblok Inc.

Test Date:
November, 6, 2013

Test Participants:
Representatives from Acoustiblok Inc. and R.J. Watson

Testing Environment
This test was performed at the West Waters Avenue Bridge (County Road 584) located in Hillsborough County, Florida. The testing area focused on a noise source located under the bridge deck in the joint at the concrete bridge abutment.

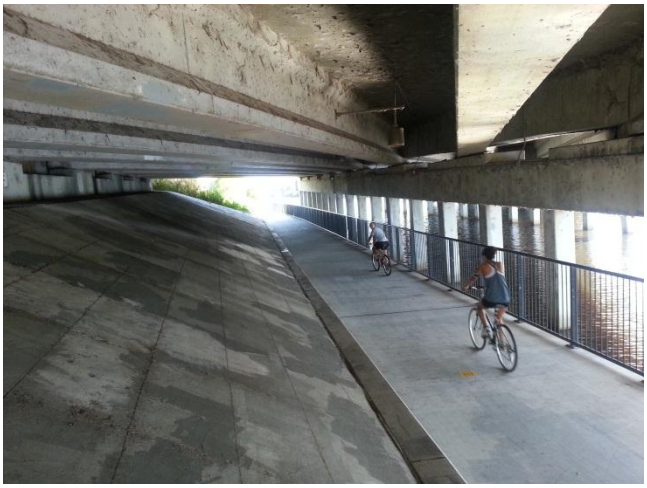
Test Results
Results showed that Acoustiblok is effective at reducing bridge joint noise problems when they occur at bridge deck joints. Without Acoustiblok, bridge joint noise reached as high as 105 dBA during a vehicular impact with the bridge joint. With Acoustiblok, that noise was reduced to 83 dBA, which is a 99% reduction in pressure and a 73% perceived reduction in sound.

Acoustiblok was easy to install and proved to be effective for the control of bridge joint noise in these types of areas.

General Background

Project Background and Intent

R.J Watson, Inc. is developing a new acoustical system to mitigate bridge joint noise that is common on bridges around the world. The company sought an effective acoustical sound mitigating material to use as the principle noise barrier for this system. Acoustiblok's patented sound mitigating material was selected and a trial testing of the material was performed at the West Waters Avenue CR 584) Bridge in Hillsborough County, Florida. The county receives complaints from pedestrians who use the nearby biking path that is within approximately 25 feet of the noise source. The cause of the loud noise is a bridge joint located directly above the bike path.



Biking and walking pedestrians pass nearby the loud bridge joint noise source each day at the West Waters Avenue Bridge.

Overview of Bridge Joint Noise Issue

Expansion and contraction caused by temperature changes, shortening and creep caused by pre-stressing, deflections caused by live loads, and longitudinal forces caused by vehicular traffic all combine to produce nearly continuous motion in highway bridges. Bridge expansion joints are designed to permit the longitudinal movement and small rotations presented on bridge decks due to changes in environmental condition, live loads, and physical changes on the structural materials such as creep and shrinkage. While there are many types of bridge joint systems, they can be classified as either open or closed joint systems.

Travelling over a bridge expansion joint with a vehicle creates a short noise impulse that can range from 70-105 decibels (dBA) on a sound meter. How loud is that? To put that in context:

Noise	Decibel Level
Normal conversation	60
Garbage disposal or dishwasher	80
Gasoline powered lawnmower	90
Bulldozer without a cab	100-105

Cause of General Bridge Joint Noise

Noise events due to vehicles passing over bridge expansion joints occur when vehicle tires strike the rectangular face of the expansion joint units and traverse the discontinuous surface profile. It can also be induced by the unevenness of the surface of the expansion joint itself and of the road surface before and after the joint. In the case of the West Waters Avenue Bridge, steel armor on the joint has come loose exacerbating the problem.

Bridge Joint Noise is an Environmental Noise Nuisance

Although it is generally known that an environmental noise nuisance occurs as motor vehicle wheels pass over the joint, another environmental noise nuisance results from the interaction of vibration of the bridge expansion joint with acoustic resonances produced inside the abutment void space below the joint.

Bridge Joint Noise Draws Complaints to Bridge Owner

This constant noise can become an annoyance for people living near the bridge or for pedestrians who walk or ride under the bridge. This often results in the county or bridge owner receiving serious noise complaints.

Testing

Specifics

Background on Waters Avenue Bridge

The West Waters Avenue bridge is a four span concrete girder bridge with five armored bridge joints. The bridge is built over the Rocky Creek inlet near the Town and Country YMCA. The bridge enables Waters Avenue to connect with Sheldon Road. The Tampa Bay Bike Trail goes underneath the Waters Avenue Bridge close to the noise source beneath it. Pedestrian walkers and bicycle riders who use the trail have complained to the county about the loud abrupt noise that occurs when vehicles drive over the bridge joint located just above the pathway. The bridge can be found in Google Earth by using: 8950 West Waters Avenue, Tampa, FL.

Goals of Testing

- Determine if Acoustiblok can mitigate bridge joint noise substantially enough to the ear.
- Determine if Acoustiblok can be reasonably used for bridge environments.
- Determine if Acoustiblok can be affixed to concrete or metal areas under the bridge area.
- Determine if the Acoustiblok material can be installed by a small team of laborers in a reasonable amount of time.

Noise Issue at Test Site

Based on discussions with a Hillsborough County Transportation engineer, sound comparisons from above and below the joint, feedback from local pedestrian complaints, and the best professional judgment of the project team, it was determined that the noise appeared to be traveling from a direct path from the top of the roadway joint and is reflected down the open gaps at the concrete abutment area below. It's likely that general structural noise and vibrations were also contributing to noise heard by the pedestrians at the base of the bridge joint. The photo to the right shows the area being tested. Expansion joints span the open space between the decks and the abutments on viaducts and bridges.

Testing Methodology

Sound Testing

A. Acoustical sound testing was performed using a Sencor SP295 Sound Meter directly under (less than one foot) the bridge joint at the abutment.
B. Several sound meter readings were taken prior to applying Acoustiblok at the abutment walls.
C. Several sound meter readings were taken immediately after applying the Acoustiblok material and approximately 1.5 hours later.

Application of Acoustiblok Material

A. Acoustiblok was positioned on the concrete to form an acoustic barrier at the joint. For this test, it was fastened directly to the concrete at the top and bottom using Silicoflex locking adhesive.
B. All joint gaps were sealed at the noise source to create the acoustical barrier.
C. Total testing time was approximately 4 hours with the majority of that determining the best positioning of the Acoustiblok material.
D. The material was applied with the goal of reducing as much noise as possible, creating the most aesthetically looking noise barrier possible.
E. It took approximately 1.5 hour to apply the Acoustiblok material once a design was determined.

Project testing team members from Acoustiblok and R.J. Watson discuss the source of noise and treatment options.

Testing

Testing Results

The following readings were taken prior to Acoustiblok sound mitigating material being applied.

Test Date: Nov. 6, 2013

Test Location: West Waters Avenue Bridge (County Road 584) , Hillsborough County, Florida

Exact Positioning / Distance from noise: Less than 1 foot (12 inches).

Equipment Used: Sencor SP295 Sound Meter

WITHOUT Acoustiblok				WITH Acoustiblok	
Ambient Noise Level	After Joint Impact			Ambient Noise Level	After Joint Impact
72.4 dBA	105.0 dBA			69.8 dBA	81.4 dBA
73.2 dBA	100.8 dBA			71.8 dBA	82.3 dBA
77.3 dBA	95.4 dBA			72.2 dBA	81.4 dBA
79.9 dBA	94.0 dBA			72.6 dBA	83.5 dBA
82 dBA	93.2 dBA				
Median 76.96 dBA	Median 97.68 dBA			Median 71.6 dBA	Median 82.15 dBA

Range “without Acoustiblok: 72.4 -105 dBA

Range “with” Acoustiblok: 69.8 – 83.5 dBA

Pressure Reduction: 99% with Acoustiblok material

Perceived Reduction: 73% in bridge joint noise with Acoustiblok material

Photos