NOISE REDUCTION PLAN FOR:

San Rafael Rock Quarry
Marin County, CA

RGDL Project# 11-025

PREPARED FOR:

San Rafael Rock Quarry
1000 Point San Pedro Road
San Rafael, CA 94901

PREPARED BY:

Harold S. Goldberg, P.E.

DATE:

29 March 2011
Revised 1 June 2012
1. Introduction

This report is prepared in response to condition of approval No. 74 of the Marin County Surface Mining and Quarrying Permit #Q-72-03, Amendment #1. The Condition of Approval requires a phased noise reduction program. In particular, Condition No. 74 (COA 74) requires the following:

74. The Permittee shall implement the following noise reduction program which shall be maintained in good operating condition:

   a. Enclose the conveyor systems at the Quarry crushing and processing plant including barge loading, primary, and secondary conveyors.

   b. Screens and secondary crushers shall have sound curtains with sound deadening materials installed between the equipment and residences.

   c. Enclosed transfer points along the conveyor system where material transfers from one belt to another by means of a hopper. The enclosures shall incorporate sound deadening materials.

   d. Permittee shall line all unenclosed hoppers and chutes on the conveyor at which aggregate materials fall onto a metal surface with a sound deadening material such as heavy neoprene, rubber or HDPE.

   e. Permittee shall implement the above noise reduction program as a phased program over 3 years from Permit approval. The noise reduction program shall include a barge loading noise reduction component to be included in the phasing plan. Proposed plans and phasing shall be prepared by a qualified acoustical engineer and then provided to the Public Works Director within 6 months of Permit issuance for review and approval. The phasing goal is to have the noisiest equipment, relative to nearby residences, retrofitted in the first 12 months following plan approval. The applicant shall have a qualified acoustical engineer inspect the site and equipment and submit a verification of compliance with these conditions after each phase.

This report provides recommendations for the design and materials of the required noise control measures based on good noise control practices and the practical constraints associated with operating and maintaining the equipment. The phasing of the noise control measures is based on the relative noise contribution of the various noise sources addressed by COA 74. Figure 1 shows the Quarry site and locations of the nearest homes.
2. Noise Reduction Measures

2.1. Materials

The materials used to implement the noise reduction measures fall into three categories: **SOUND BARRIER, SOUND ABSORPTION** and **CUSHION LINING**.

**SOUND BARRIER** materials block the transfer of sound through a wall or panel. The sound barrier material must be solid (without cracks or gaps) and have a minimum weight to block the direct sound path between a source and receiver.

**Requirement:**

Sound barrier materials shall be solid with a minimum surface density of 1 pound per square foot or provide equivalent sound transmission loss.

**Examples:**

- 20 gauge sheet metal
- Reinforced mass loaded vinyl sheet (see Attachments for example)
- ½-inch thick plywood
- Earthen berm

**SOUND ABSORPTION** materials reduce the acoustical reflections from solid surfaces by absorbing the sound. Sound absorption materials are generally porous and relatively light. They usually incorporate glass fiber, either compressed or as a batting. The sound absorption properties of a material are often quantified by an acoustical laboratory test and the results are specified as sound absorption coefficients or the Noise Reduction Coefficient (NRC).

**Requirement:**

Sound absorptive treatments on the side of the material facing the sound source shall have a minimum Noise Reduction Coefficient (NRC) of 0.65

**Examples:**

- 2-inch thick perforated metal panels with glass fiber filling
- 1 inch thick quilted blankets filled with glass fiber batting and covered with vinyl or silicone coated fabric. (see Attachments)
- Field fabricated panels with 2-inch thick glass fiber board or blanket by covered by an expanded metal (grating) as for protection.
**CUSHION LINING** is used to reduce the sound of rocks banging against a metal surface. Rubber is commonly used for this purpose. It is attached to the metal panels with adhesive and/or mechanical fasteners.

**Requirement:**

Cushion Lining shall be rubber or neoprene (or equivalent cushioning material) and have a minimum thickness of \( \frac{1}{2} \)-inch. The actual thickness should be based on the wear requirements and the type of material that will come into contact with it.

**Examples:**

- 3/4-inch-thick rubber for hoppers with 1-inch or less aggregate.
- 3-inch-thick rubber blocks for hoppers with 6-inch or greater rip-rap.

**2.2. Conveyor Enclosures**

There are generally two types of conveyor enclosures; the first is supported by the existing conveyor structure and is constructed close to the conveyor belt and rollers while the other is a free standing structure or building that is built around entire sections of the conveyor belt and support structure.

The conveyor enclosures shall be constructed with SOUND BARRIER materials covering the top and sides of the conveyor belt. Figure 2 shows an example of a conveyor enclosure that is supported by the existing conveyor structure. The SOUND BARRIER at the sides of the conveyor shall have SOUND ABSORPTIVE material facing the conveyor rollers, while the cover over the top of the belt need not have SOUND ABSORPTIVE material. In this example the conveyor hood could be comprised of a hinged sheet metal cover for convenient access.

Most of the conveyors have a walkway on at least one side. To allow visual access to the rollers, the barrier panel may be located on the outside of the walkway railing. The cover and sides should block at least two-thirds of the angular distance and the open area under the conveyor should be no greater than one-third, or 120 degrees (see Figure 2).

If the conveyor enclosure is constructed as a free-standing building then the roof and sides shall be constructed of SOUND BARRIER material and 50 percent of the available interior surfaces should be lined with SOUND ABSORPTIVE material. The sides of the structure should extend at least 3 feet below the bottom of the conveyor structure.

Figures 3 and 4 show the locations of the conveyors at the barge loading area, the primary crushing plant and the secondary crushing plant.
The conveyor systems at the Primary and Secondary Crushing Plants are complex. The proposed conveyor enclosures will impede the access to the conveyors needed to detect and correct operational problems. Furthermore, the conveyors are a relatively minor noise source at the Quarry. There may be alternative measures that can be implemented with equivalent acoustical effectiveness that will have significantly less impact on operations and maintenance. Additional studies to assess the alternative measures to conveyor enclosures are currently under way.

2.3. Screen and Crusher Sound Curtains

Sound curtains are required for the screens and secondary crushers. The sound curtains shall be constructed of SOUND BARRIER material with SOUND ABSORPTIVE material facing the noise source. Figures 5 and 6 show the locations of the screens and crushers at the primary and secondary crushing plants to be treated. The crusher at the primary crushing plant is located within a structure/hillside and this treatment is not required. The sound curtain treatment is to be located between the screen or crusher and the homes. Figures 5 through 7 show the direction of the homes from the various crushing plants and should be used to guide the location of the curtains.

The structural design of this treatment will depend on the specific location and arrangement of the screen or crusher. For example, the sound curtains at the primary plant screen will either be attached to the existing structure or supported by a new structure offset from the screen. Figure 8 shows the extents of the recommended sound curtains to effectively reduce the noise from the screen. This general arrangement will apply to the crushers and screens at the secondary crushing plant. The sound curtains should extend as close as possible to the ground while allowing for sufficient access and circulation during operation and maintenance of the equipment. The sound curtains at the secondary plant screens and crushers would be similar.

Since the Portable Crushing Plant is much more compact than the older fixed location plants, the measure can be achieved by a single structure even though the portable plant includes three crushers and two screens. An earthen berm may be located between the plant and the homes to serve the same purpose as the sound curtains. Figure 7 shows the location of the berm at the southeast side of the quarry property where the portable plant is currently located. The berm is setback from the equipment by approximately 100 feet to allow vehicle access to the equipment and stockpiles. The height of the berm in this arrangement is 35 feet. The berm would be an extension of an existing berm comprised of overburden.

The portable crushing plant may also be located at the base of the pit which is approximately 200 feet below the rim of the pit. This will create a natural earthen berm that is equivalent to the required sound curtains.
2.4. Conveyor Transfer Point Enclosures

The conveyor transfer point enclosures shall be constructed with SOUND BARRIER material with SOUND ABSORPTIVE material in the interior surfaces. The enclosures may be constructed by attaching these materials to existing structures or by constructing a free standing structure. The arrangement will depend on the type of conveyor and material that it services. For example, the secondary plant already has steel enclosures around some transfer points. These enclosures are connected to a ventilated dust control system. In these instances the enclosures may satisfy the requirement with only the addition of SOUND ABSORPTIVE material to inside surfaces. Figures 2 and 3 shows the locations of the conveyor transfer points.

2.5. Hopper Lining

Unenclosed hoppers shall be treated with a CUSHION LINING. The locations of hoppers are shown in Figures 2 and 3. This treatment is appropriate at locations where rocks impact metal surfaces. It is not effective at surfaces where fine materials normally buildup so that the aggregate does not impact the metal surfaces. The specific thickness of the material, placement and attachment will depend on the arrangement of the hopper and the type of material it receives.

3. Phasing Plan

According to COA 74, the phasing goal is to have the noisiest equipment, relative to nearby residences, retrofitted in the first 12 months following plan approval. Based on noise measurements and observations, the noisiest equipment relative to the nearby residences is the Primary Crushing Plant. This is because the plant is closer to the residences than the other processing equipment and it handles the larger rip-rap material. At the plant, the noisiest sources addressed by COA 74 are the screen and the transfer points and these sources would be addressed by the treatments during Phase 1.

As of the date of the preparation of this Noise Reduction Plan, the Secondary Crushing Plant is not being used and is not anticipated to be used within the next 12 months or possibly longer. Instead, the Portable Crushing Plant, which can function as both a primary and secondary plant, is used. Because the Secondary Crushing Plant is not operating, its noise reduction treatments are deferred to Phase 3 and would only be required if the plant is to be operated.

The conveyor enclosures are included in Phase 3 because the conveyors are a minor noise source at the Quarry. It may be appropriate to conduct additional acoustical studies should be performed after Phase 1 is complete to assess the effectiveness of the conveyor enclosure measure in reducing overall operational noise. These additional studies might conclude that other measures, which are less intrusive to
operations (e.g. replacing older rollers with newer rubber coated rollers with quieter bearings), may be as effective in reducing noise as the enclosures.

**NOISE REDUCTION MEASURE PHASING PLAN**

**Phase 1**

A. Sound Curtains at Primary Crushing Plant Screen (this screen, also known as the Diester has been identified as the noisiest piece of equipment and will be treated first.)

B. Rubber lining for hoppers and transfer points at Primary Crushing Plant (implemented since 2004 and worn linings will be replaced).

C. Rubber lining for hoppers at Barge Loading Conveyor (implemented since 2004 and worn linings will be replaced).

**Phase 2**

A. Construct earthen berm at Portable Crushing Plant or relocate plant to base of pit to function as sound curtains

B. Rubber lining for hoppers at Portable Crushing Plant

**Phase 3**

A. Enclose conveyor transfer points at Primary Crushing Plant

B. Enclose conveyors at Primary Crushing Plant and Barge Loading

C. Sound curtains at Secondary Crushing Plant (if plant is to be used)

D. Enclose conveyors at Secondary Crushing Plant (if plant is to be used)

**Barge Loading Component**

The flat deck barge fleet associated with quarry operations shall be fully converted to concrete deck barges within three years. At least two steel deck barges shall be converted per 500,000 tons of annual (calendar) quarry production. Within three years of Permit approval, only non metallic flat deck barges, i.e. concrete deck barges, shall be permitted to be loaded at the Quarry site.
4. Figures

Figure 1:
Aerial Photo of Site with Residences and Current Equipment Locations
Figure 2:
Example of Conveyor Enclosure
Figure 3:
Primary Crushing Plant and Barge Loading Conveyors, Transfer Points and Hopper Locations
### Table 1: Primary Crushing Plant and Barge Conveyor List

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Swoop Conveyor</td>
</tr>
<tr>
<td>2</td>
<td>Swoop Feed Hopper TP</td>
</tr>
<tr>
<td>3</td>
<td>Jaw Feeder</td>
</tr>
<tr>
<td>4</td>
<td>P1 - Conveyor and TP</td>
</tr>
<tr>
<td>5</td>
<td>P2 - Conveyor and TP</td>
</tr>
<tr>
<td>6</td>
<td>P3 - Conveyor and TP</td>
</tr>
<tr>
<td>7</td>
<td>P4 - Conveyor and TP</td>
</tr>
<tr>
<td>8</td>
<td>P5 - Conveyor and TP</td>
</tr>
<tr>
<td>9</td>
<td>C2 - Conveyor</td>
</tr>
<tr>
<td>10</td>
<td>Waste Belt</td>
</tr>
<tr>
<td>11</td>
<td>Barge Belt</td>
</tr>
<tr>
<td>12</td>
<td>Barge Belt Feeder TP</td>
</tr>
<tr>
<td>13</td>
<td>Texas Feeder TP</td>
</tr>
<tr>
<td>14</td>
<td>Texas Feeder Conveyor</td>
</tr>
</tbody>
</table>
Figure 4:
Secondary Crushing Plant Conveyors, Transfer Points and Hopper Locations
### Table 2: Secondary Plant Conveyor List

<table>
<thead>
<tr>
<th>Item</th>
<th>Matl</th>
<th>Width</th>
<th>Est. Length</th>
<th>Description</th>
<th>HP</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-5</td>
<td>3x0</td>
<td>42</td>
<td>187'</td>
<td>24&quot; truss inclined</td>
<td>120</td>
</tr>
<tr>
<td>C-6</td>
<td>3&quot;x3/4&quot;</td>
<td>36</td>
<td>130' 8&quot;</td>
<td>24&quot; truss w/ incline &amp; vert. curve</td>
<td>50</td>
</tr>
<tr>
<td>C-7</td>
<td>1 1/2&quot; x 0</td>
<td>36</td>
<td>185'</td>
<td>24&quot; truss &amp; channel w/ vert. curve</td>
<td>50</td>
</tr>
<tr>
<td>C-8</td>
<td>3/4&quot; x 0</td>
<td>36</td>
<td>39' 6&quot;</td>
<td>24&quot; truss horizontal, reversible</td>
<td>10</td>
</tr>
<tr>
<td>C-9</td>
<td>3/4&quot; x 0</td>
<td>36</td>
<td>223' 2&quot;</td>
<td>24&quot; truss inclined</td>
<td>60</td>
</tr>
<tr>
<td>C-10</td>
<td>BASE</td>
<td>36</td>
<td>45' 2&quot;</td>
<td>24&quot; truss inclined</td>
<td>20</td>
</tr>
<tr>
<td>C-11</td>
<td>BASE</td>
<td>36</td>
<td>347&quot;</td>
<td>24&quot; truss inclined</td>
<td>50</td>
</tr>
<tr>
<td>C-13</td>
<td>1 1/2&quot; x 1&quot;</td>
<td>30</td>
<td>22' 8&quot;</td>
<td>24&quot; truss inclined</td>
<td>10</td>
</tr>
<tr>
<td>C-14</td>
<td>1 1/2&quot; x 1&quot;</td>
<td>30</td>
<td>159' 10&quot;</td>
<td>24&quot; truss inclined</td>
<td>20</td>
</tr>
<tr>
<td>C-15</td>
<td>1 1/2&quot; x 3/4&quot;</td>
<td>30</td>
<td>27' 10&quot;</td>
<td>24&quot; truss inclined</td>
<td>7.5</td>
</tr>
<tr>
<td>C-16</td>
<td>1 1/2&quot; x 3/4&quot;</td>
<td>30</td>
<td>126' 4&quot;</td>
<td>24&quot; truss inclined</td>
<td>15</td>
</tr>
<tr>
<td>C-17</td>
<td>3/16&quot; minus</td>
<td>30</td>
<td>34'</td>
<td>24&quot; truss under screen</td>
<td>10</td>
</tr>
<tr>
<td>C-18</td>
<td>3/16&quot; minus</td>
<td>30</td>
<td>34'</td>
<td>24&quot; truss under screen</td>
<td>10</td>
</tr>
<tr>
<td>C-19</td>
<td>3/16&quot; minus</td>
<td>30</td>
<td>83'</td>
<td>24&quot; truss inclined</td>
<td>10</td>
</tr>
<tr>
<td>C-21</td>
<td>1/2&quot; x 3/8&quot;</td>
<td>30</td>
<td>28'</td>
<td>24&quot; deep truss horizontal</td>
<td>7.5</td>
</tr>
<tr>
<td>C-22</td>
<td>3/8&quot; x 3/16&quot;</td>
<td>30</td>
<td>23'</td>
<td>24&quot; deep truss horizontal</td>
<td>7.5</td>
</tr>
<tr>
<td>C-23</td>
<td>3/4&quot; x 1/2&quot;</td>
<td>30</td>
<td>121'</td>
<td>24&quot; truss inclined</td>
<td>20</td>
</tr>
<tr>
<td>C-24</td>
<td>1/2&quot; x 3/8&quot;</td>
<td>30</td>
<td>126'</td>
<td>24&quot; truss inclined</td>
<td>15</td>
</tr>
<tr>
<td>C-25</td>
<td>3/8&quot;x 3/16&quot;</td>
<td>30</td>
<td>178' 4&quot;</td>
<td>24&quot; truss inclined</td>
<td>30</td>
</tr>
<tr>
<td>C-26</td>
<td>12&quot; x 3&quot;</td>
<td>48</td>
<td>130'</td>
<td>24&quot; truss inclined</td>
<td>40</td>
</tr>
<tr>
<td>C-27</td>
<td>12&quot; x 6&quot;</td>
<td>48</td>
<td>50'</td>
<td>24&quot; truss inclined</td>
<td>15</td>
</tr>
<tr>
<td>C-28</td>
<td>6&quot; x 3&quot;</td>
<td>48</td>
<td>50'</td>
<td>24&quot; truss inclined</td>
<td>15</td>
</tr>
<tr>
<td>C-29</td>
<td>12&quot; x 3&quot;</td>
<td>48</td>
<td>165'</td>
<td>24&quot; truss inclined</td>
<td>30</td>
</tr>
</tbody>
</table>

### Table 3: Secondary Plant Equipment List

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>HP</th>
</tr>
</thead>
<tbody>
<tr>
<td>E5</td>
<td>7 x 20 Triple Deck Inclined Screen</td>
<td>40</td>
</tr>
<tr>
<td>E6</td>
<td>7 ft Symons Heavy Duty Standard Cone Crusher - Coarse Liners</td>
<td>250</td>
</tr>
<tr>
<td>E7</td>
<td>8 x 20 Cedar Rapids Triple Deck Inclined Screen</td>
<td>40</td>
</tr>
<tr>
<td>E8</td>
<td>8 x 20 Cedar Rapids Triple Deck Inclined Screen</td>
<td>40</td>
</tr>
<tr>
<td>E9</td>
<td>20 ton approx. crusher surge bin</td>
<td></td>
</tr>
<tr>
<td>E10</td>
<td>5.5 ft Symons Standard Head Cone Crusher - Med Liners</td>
<td>200</td>
</tr>
<tr>
<td>E11</td>
<td>5.5 ft Symons Standard Head Cone Crusher - Med Liners</td>
<td>200</td>
</tr>
<tr>
<td>E12</td>
<td>8 x 20 Cedar Rapids Triple Deck Inclined Screen</td>
<td>40</td>
</tr>
<tr>
<td>E13</td>
<td>8 x 20 Cedar Rapids Triple Deck Inclined Screen</td>
<td>40</td>
</tr>
<tr>
<td>HP</td>
<td>200 Cone Crusher</td>
<td>150</td>
</tr>
<tr>
<td>E14</td>
<td>Symons 5100 Crusher with Stand</td>
<td></td>
</tr>
<tr>
<td>E15</td>
<td>Control Shack</td>
<td></td>
</tr>
<tr>
<td>E16</td>
<td>3 Baghouses</td>
<td></td>
</tr>
</tbody>
</table>
Figure 5:
Direction of Homes from Primary Crushing Plant
Figure 6: Direction of Homes from Secondary Crushing Plant

Direction of Marin Bay Park Homes

Direction of Heritage Drive and San Marino Drive Homes

Secondary Crushing Plant Screens

Secondary Crushing Plant Crushers

N
Figure 7:
Direction of Homes from Portable Crushing Plant
Figure 8:
Extent of Sound Curtains for Primary Crushing Plant Screens
APPENDIX A: NOISE MEASUREMENT RESULTS

Noise Measurements Methodology and Standards

The primary purpose of the noise measurements made for this noise reduction plan and contained in Appendix A is to compare the relative noisiness of individual noise sources at the Quarry. This was used to help determine the order in which the various required treatments are to be implemented. To ensure that the proper measurement equipment, quantities and procedures are used in the analysis, the measurement methodology generally follows ASTM E 1014 – 84 *Standard Guide for Measurement of Outdoor A-Weighted Sound Levels* and ANSI S1.4-1983 (R 1997), *American National Standard Specification for Sound Level Meters*.

The noise measurements can also be used to help document the acoustical effectiveness of the noise reduction treatments by representing the BEFORE condition. After the treatments are implemented, the measured sound level in the AFTER condition can be subtracted from that of the BEFORE condition to calculate the NOISE REDUCTION of the treatment. In order to achieve a reasonably accurate and representative NOISE REDUCTION values the principles of ANSI S12.8-1998, *American National Standard Methods for Determining the Insertion Loss of Outdoor Noise Barriers* should be generally followed. These principles include measuring the average sound level (L_{eq}) and measuring in the same position and operating mode in both the BEFORE and AFTER conditions.

Figure A-1: Noise Measurement Locations - Primary Plant and Barge Loading
Figure A-2: Noise Measurement Locations - Secondary Plant

Figure A-3: Noise Measurement Locations - Portable Plant
### Table A-1: Noise Measurement Results

<table>
<thead>
<tr>
<th>Location</th>
<th>Date/Time</th>
<th>Duration</th>
<th>$L_{eq}$ (dBA)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Plant</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>200 feet northwest of Diester, 24 ft above ground</td>
<td>5/16/2012 9:20</td>
<td>5 min</td>
</tr>
<tr>
<td>1</td>
<td>200 feet northwest of Diester, 24 ft above ground (Conveyors only)</td>
<td>3/16/2011 14:38</td>
<td>1 min</td>
</tr>
<tr>
<td>2</td>
<td>75 feet northwest of Diester, 24 ft above ground</td>
<td>5/16/2012 8:35</td>
<td>8 min</td>
</tr>
<tr>
<td>2A</td>
<td>50 feet northwest of Diester, 24 ft above ground</td>
<td>5/16/2012 8:47</td>
<td>5 min</td>
</tr>
<tr>
<td>3</td>
<td>25 ft west of rip rap chute, 5 ft above ground</td>
<td>5/16/2012 9:11</td>
<td>6 min</td>
</tr>
<tr>
<td><strong>Secondary Plant</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>First Crusher/Screen - 25 ft north of frame, 8 ft below catwalk</td>
<td>5/15/2012 12:25</td>
<td>3 min</td>
</tr>
<tr>
<td>8</td>
<td>First Crusher – 25 ft west of cone edge, 24 ft above ground,</td>
<td>5/15/2012 12:34</td>
<td>2 min</td>
</tr>
<tr>
<td>9</td>
<td>Baghouse fan - 15 ft northwest of fan housing, 7 ft above ground</td>
<td>5/15/2012 12:44</td>
<td>1 min</td>
</tr>
<tr>
<td>10</td>
<td>Baghouse fan - 8 ft northwest of outlet, 18 ft above ground</td>
<td>5/15/2012 12:46</td>
<td>2 min</td>
</tr>
<tr>
<td>11</td>
<td>Second (Loop) Crusher - 25 ft northwest of crusher 24 ft above ground</td>
<td>5/15/2012 12:56</td>
<td>2 min</td>
</tr>
<tr>
<td>12</td>
<td>Loop screens - 25 ft northeast of screens, 25 ft above ground (top of baghouse)</td>
<td>5/15/2012 13:03</td>
<td>1 min</td>
</tr>
<tr>
<td>13</td>
<td>Edge of pit - 260 ft to First crusher/screen, First and loop crushers and screens operating</td>
<td>5/15/2012 12:00</td>
<td>30 min</td>
</tr>
<tr>
<td>13</td>
<td>Edge of pit - Baghouse fan on All other equipment off</td>
<td>5/15/2012 13:27</td>
<td>1 min</td>
</tr>
<tr>
<td>13</td>
<td>Edge of pit – Conveyors on All other equipment off</td>
<td>5/15/2012 13:46</td>
<td>7 min</td>
</tr>
<tr>
<td><strong>Conveyors (without material)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>3 ft to side of conveyor from crusher to Diester – includes motor, spatial average along length of conveyor</td>
<td>3/16/2011 14:00</td>
<td>3 min</td>
</tr>
<tr>
<td>5</td>
<td>3 ft to side of Barge Belt conveyor – includes motor, spatial average along length of conveyor</td>
<td>6/17/2011 11:38</td>
<td>2 min</td>
</tr>
<tr>
<td>14</td>
<td>25 ft to side of Secondary Plant conveyor – 5 ft above ground</td>
<td>5/15/2012 13:46</td>
<td>7 min</td>
</tr>
<tr>
<td><strong>Portable Plant</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Top of overburden stockpile, 180 feet from first cone crusher</td>
<td>3/14/11 14:32</td>
<td>1 hr</td>
</tr>
</tbody>
</table>
**Description**

Kinetics KBC Barrier Composites are thin, rugged, high-performing, flexible acoustical composites designed to solve difficult noise control applications where sound absorption must be increased and sound transmission must be reduced. Kinetics Model KBC Barrier Composites are available with 1/2, 1 or 2 psf (2.5, 4.9 or 9.8 kg/m²) loaded vinyl barriers with a quilted aluminum cloth faced fiberglass absorber on one or both sides of the barrier.

Kinetics Models KBC-50RBQ and 100RBQ are used when a noise source is located on one side of the acoustical material. Sound originating from the source is initially absorbed by the fiberglass and then blocked by the sound barrier. The reflected sound waves are further dissipated by the fiberglass absorber.

Model KBC-50BQQ, 100BQQ, and 200BQQ perform in the same manner except that they are designed to absorb sound on both sides of the composite, with one side acting as a decoupling layer.

Model KBC Barrier Composites can be installed free hanging or attached directly to a noise-radiating surface. Models KBC-50BQQ, 100BQQ, and 200BQQ are ideal as an internal lining on any rigid structure that requires significant transmission loss improvement. In this manner, the limp mass vinyl barrier is decoupled from the structure by the fiberglass absorber which allows the barrier to vibrate freely thus increasing sound transmission loss performance.

**Application**

KBC Barrier Composites are ideal for many diverse industrial & OEM applications where both reverberation control and sound transmission loss are required. Industrial applications include enclosures, machinery cover linings, and additions to existing walls or barriers. Architectural applications include crosstalk barriers, room dividers, ceiling barriers, and pipe and duct wrap.

KBC-50BQQ, 100BQQ, and 200BQQ material can be used where Class 1 fire and smoke performance is required.
Product Description

KBC-50RBQ 1/2 psf (2.5 kg/m²) Kinetics Limp Barrier Material, reinforced with a fiberglass screen, loaded with barium sulphate, with a quilted faced fiberglass absorber on one side. The barrier and absorber are silver in color. Available in 54" x 25' (1.37 x 7.62 m) rolls. Nominal thickness 1" (25 mm).

KBC-100RBQ 1 psf (4.9 kg/m²) Kinetics Limp Barrier Material, reinforced with a fiberglass screen, loaded with barium sulphate, with a quilted faced fiberglass absorber on one side. The barrier and absorber are silver in color. Available in 54" x 25' (1.37 x 7.62 m) rolls. Nominal thickness 1" (25 mm).

KBC-50BQQ 1/2 psf (2.5 kg/m²) Kinetics Limp Barrier Material, loaded with barium sulphate with a quilted faced fiberglass absorber on both sides. The absorber is silver in color. Available in 48" x 25' (1.22 x 7.62 m) rolls. 2" (51 mm).

KBC-100BQQ 1 psf (4.9 kg/m²) Kinetics Limp Barrier Material loaded with barium sulphate, with a quilted faced fiberglass absorber on both sides. The absorber is silver in color. Available in 48" x 25' (1.22 x 7.62 m) rolls. 2" (51 mm).

KBC-200BQQ 2 psf (9.8 kg/m²) Kinetics Limp Barrier Material loaded with barium sulphate, with a quilted faced fiberglass absorber on both sides. The absorber is silver in color. Available in 48" x 25' (1.22 x 7.62 m) rolls. 2" (51 mm).

Vinyls and fiberglass facings are available in other colors. Consult Kinetics Noise Control for availability.

Specifications

Barrier Absorber Composite shall be of the description and acoustical data listed in this brochure. Barrier and absorber composites shall be Model KBC by Kinetics Noise Control.
Description
Kinetics Model KFA Fiberglass Absorbers are fire safe, high performance, acoustical attenuating fiberglass blankets that are used to reduce reverberant (reflected) airborne noise. The absorbers are an excellent alternative to urethane foams since they are fire safe, exhibit low smoke emissions, and possess high mechanical strength. Additionally, they have a wide temperature range, can be cleaned, and are unaffected by moisture, humidity, dust, dirt, oils and most chemicals. Flexible quilted absorbers are easily installed, will not degrade, and have extremely long service lives.

The product’s fundamental component is a low binder, fine fiber, acoustically absorptive, fiberglass batting. Two different reinforced, nonporous, fiberglass cloth facing materials are available and are quilted directly to the fiberglass batting using high strength thread and locking stitches. The quilting forms a matrix of 4” (102 mm) diamond stitch patterns which encapsulate the glass fibers. When the facing material on these stable encasements is subjected to airborne sound waves, the individual membrane faces respond diaphragmatically, like a drum head, and transmit sound energy through the nonporous facing into the fiberglass batting core material, where it is dissipated as thermal energy.

Kinetics Model KFA Fiberglass Absorbers can be produced in single or double layer, nominal thickness 1” (25 mm) or 2” (51 mm). Double layer thickness increases low frequency absorption and provides significant transmission loss characteristics.

Depending on the application requirements, the quilted absorbers can be faced on one or both sides. Available facings include the standard aluminum-vinyl coated fiberglass cloth (A), impervious high-temperature silicone-coated fiberglass cloth (S) which is quilted using a Nomex stitching thread, or nonmaintenance, nonwoven, porous, scrim fabric (N). The three facing materials can be used individually or in combination on the same absorber so that special properties or economies can be achieved.

Application
Model KFA Quilted Fiberglass Absorbers can be used in many diverse industrial or OEM applications including absorptive linings for machinery housings, building walls, curtain or fixed enclosures, compartments, hoods, operator cabs, piping and duct work or wherever reduction of reverberant noise is required.
Specifications and Physical Properties

Fiberglass Batting
Form: Fiber diameter 4-6 microns
Resin Binder: Thermosetting phenolic, 3-5\% content by weight
Density: 2 lb. pcf (9.8 kg/m\textsuperscript{2}) (nominal)
Thermal Conductivity: \( K = 0.25 \) (BTU in./\(^{\circ}\)F x sq. ft. x hr.)
@ \( 75^\circ\)F mean. (44.3 cal/ln. \( \times \) C x sq. cm x hr. @ 24\(^\circ\)C mean)

Facings
Aluminum-Vinyl Coated Fiberglass Cloth (A)
Breaking Strength (warp and fill):
75 lbs./ln. (13 N/mm) and 70 lbs./ln. (12 N/mm)
Tear Strength (warp and fill):
2.6 lbs. (12 N) and 2 lbs. (9 N), respectively
Continuous Service Temperature Limits:
-20\(^\circ\)F to 250\(^\circ\)F (-29\(^\circ\)C to 121\(^\circ\)C)
Moisture Permeability: 1 to 2 Perms
Color: Gray-Aluminum
Other: Passes UL-181 Heat Aging Test

Silicone Coated Fiberglass Cloth (S)
Breaking Strength (warp and fill):
100 lbs./ln. (18 N/mm) and 80 lbs./ln. (14 N/mm)
Tear Strength (warp and fill):
27 lbs. (120 N) and 22 lbs. (98 N), respectively
Continuous Service Temperature Limits:
-40\(^\circ\)F to 500\(^\circ\)F (-40\(^\circ\)C to 260\(^\circ\)C)
Color: Silver

Nonwoven Porous Scrim Fabric (N)
Composition: 100\% spun-bonded polyester
Fabric Weight: 0.4 oz. per square yard (13.6 g/m\textsuperscript{2})
Tear Strength (warp and fill):
6 lbs. (27 N) and 5 lbs. (22 N), respectively
Temperature Limit:
Continuous exposure to 400\(^\circ\)F (204\(^\circ\)C)

Quilting Thread
(N) (A)
Polyester - per Fed. Spec.
V-T-2850
(S) - Nomex per Fed.
Spec. V-T-295D

Composite
Flammability:
Class 1 flame spread and smoke developed rating
per ASTM
Designation E-84 (70); Surface Burning Characteristics
of Building Materials
Flame Spread -5
Fuel Contributed -20
Smoke Developed -5
Quilted Fiberglass Absorbers have been approved
for underground use on mining equipment.

Quilted Thickness:
1\(^{\prime}\) (25 mm), single layer fiberglass batting (nominal)
2\(^{\prime}\) (51 mm), double layer fiberglass batting (nominal)

Material Width:
48-in. (1219 mm)

Weight:
0.20 lb./sq. ft. (0.98 kg/m\textsuperscript{2}) single layer fiberglass
batting (nominal)

Quilting Pattern:
Diamond Size - 4 in. x 4 in. (102 mm x 102 mm)
(standard)

Quilted Pattern Stitch: Full Locking

Edge Binding:
As specified with (A) or (S) fabric tape on roll goods, individual
panels or components; sewn or stapled (optional)

Mildew and Rot: Full Resistance
Abrasion Resistance: Excellent

Temperature Limits:
-40\(^\circ\)F to 500\(^\circ\)F (-40\(^\circ\)C to 260\(^\circ\)C)
(see facing temperature limits)

Chemical Resistance
Resists oils, grease, moisture, mild acids, alkalies, dirt,
dust, and salt atmospheres.

Cleanability:
Maintenance facings can be steam cleaned, or
washed with standard industrial cleaners

Availability:
Roll goods, individually sized panels or die cut components

Quilted Fiberglass Absorbers shall be Model KFA by
Kinetics Noise Control, Inc.

Absorption Characteristics, Octave Band Frequency (Hz)

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Nominal Thickness</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>NRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>KFA-10Q-NA</td>
<td>1(^{\prime}) (25 mm)</td>
<td>0.12</td>
<td>0.47</td>
<td>0.85</td>
<td>0.84</td>
<td>0.64</td>
<td>0.62</td>
<td>0.70</td>
</tr>
<tr>
<td>KFA-10Q-NS</td>
<td>1(^{\prime}) (25 mm)</td>
<td>0.04</td>
<td>0.46</td>
<td>0.86</td>
<td>0.81</td>
<td>0.59</td>
<td>0.31</td>
<td>0.70</td>
</tr>
<tr>
<td>KFA-20Q-NA</td>
<td>2(^{\prime}) (51 mm)</td>
<td>0.08</td>
<td>0.33</td>
<td>0.79</td>
<td>1.02</td>
<td>1.04</td>
<td>1.02</td>
<td>0.80</td>
</tr>
</tbody>
</table>

Kinetics Noise Control, Inc. is continually upgrading
the quality of our products. We reserve the right
to make changes to this and all products without notice.