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## Appendix C

### Breadth Studies Supplemental Information

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**Acoustical Breadth – Reverberation Time Calculations**

Surface Properties:

<u>Surface</u>	<u>Sound Absorption Coefficient (<math>\alpha</math>) at Frequency</u>						<u>Surface Area</u>	<u>Assumption</u>	<u>Average <math>\alpha</math></u>
	<u>125</u>	<u>250</u>	<u>500</u>	<u>1000</u>	<u>2000</u>	<u>4000</u>			
Carpet	0.05	0.06	0.14	0.37	0.6	0.65	1302.10	Carpet, heavy, over concrete	0.31
Sintered Aluminum Panels	0.4	0.3	0.15	0.1	0.04	0.12	560.13	Metal Roof Deck, plain	0.19
Drywall	0.16	0.07	0.04	0.04	0.03	0.03	1150.37	1/2 GB, 3.625 St, Fiber	0.06
Glass	0.35	0.25	0.18	0.12	0.07	0.04	172.80	Glass window	0.17
Chalkboard	0.01	0.01	0.02	0.02	0.02	0.03	307.40	Clay Brick (Painted)	0.02
Ceiling	0.07	0.21	0.81	0.85	0.93	0.88	1921.80	Perf metal ceiling	0.63
Drywall Ceiling	0.16	0.07	0.04	0.04	0.03	0.03	834.20	1/2 GB, 3.625 St, Fiber	0.06
Desks	0.58	1.18	0.07	0.04	0.03	0.07	456.74	Plywood. 1/4" air	0.33
Wood	0.35	0.22	0.07	0.04	0.03	0.07	416.53	Plywood. 1/4" air	0.13
Door	0.58	0.22	0.07	0.04	0.03	0.07	48.00	Plywood. 1/4" air	0.17
People In Chairs	0.68	0.75	0.82	0.85	0.86	0.86	456.74	Audience, medium uphol	0.80



Approximate Volume of Lecture Hall:

<b>Area of Room</b>	<b>FA</b>	<b>Avg Hgt</b>	<b>Volume</b>
Front Exit	303	12	3636
Front Desks	781	11.302	8826.862
Middle Desks	590	9.65	5693.5
Back Desks	309	8.167	2523.603
Back Exit	532	10.583	5630.156

<b>Total Volume</b>	26310.121
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Reverberation Time Calculation:

<b>Calculation</b>	<b>Sound Absorption Coefficient (<math>\alpha</math>) at Frequency</b>					
	<b>125</b>	<b>250</b>	<b>500</b>	<b>1000</b>	<b>2000</b>	<b>4000</b>
$\Sigma A$	1243.30	1476.08	2004.09	2314.44	2696.36	2745
RT (Solid)	1.06	0.89	0.66	0.57	0.51	0.50
RT (Porous)	1.31	1.11	0.82	0.71	0.61	0.60

Access to Calculation File:

P:/Thesis Spreadsheets/Acoustics.xls



**Acoustical Breadth – New Lecture Hall Ceiling Material Cutsheet**



**Acoustical Surfaces, Inc.**

**SOUNDPROOFING, ACOUSTICS, NOISE & VIBRATION CONTROL SPECIALISTS**  
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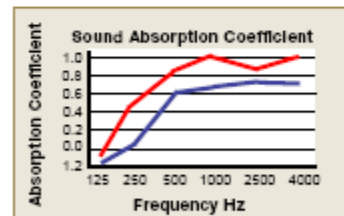
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Introducing Acoustimetal™, the latest advancement in noise control and acoustic treatment. Acoustimetal™ combines the durability of a perforated metal shell and the superior noise control, properties of our exclusive nonflammable acoustical material. Acoustimetal™ is ideal for demanding environments where noise control applications are exposed to physical impact. Indoor or outdoor use.

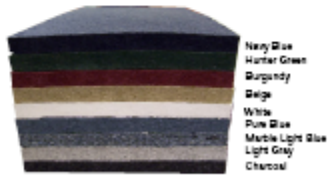
The Acoustimetal™ shell is available in electrostatically finished, anodized aluminum or optional painted white. The Acoustimetal™ shell is designed to withstand the harshest industrial installations or visually appealing interior design. The unique 50% perforation pattern gives maximum sound control with the use of our Class 1, Fiberglass Free (LEED ELIGIBLE) Echo Eliminator or Sound Silencer material inside. Custom panel sizes available.



**Sound Absorption Coefficients Within Speech Frequency Range**  
 Red = Echo Eliminator  
 Blue = Sound Silencer

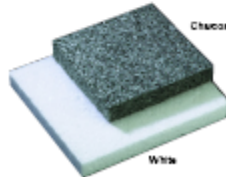


(LEED ELIGIBLE) ECHO ELIMINATOR™ FILL



Nom. Size	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	NRC
1" x 2" x 4"	.26	.31	.79	1.01	1.00	.89	.80
2" x 2" x 4"	.35	.44	1.02	1.22	1.00	1.03	1.15

SOUND SILENCER™ FILL



Nom. Size	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	NRC/NTC
1" x 2" x 4"	.05/8	.06/5	.21/7	.80/8	.65/10	.75/14	.45/9
2" x 2" x 4"	.07/9	.21/8	.81/10	.85/10	.93/17	.88/20	.70/18

	250	500Hz	1KHz	NRC
Acoustimetal	0.60	1.13	1.00	0.95

with 2" Echo Eliminator and 1/8" Round Perf X 3/4" staggered centers.

Continued on next page..

- Soundproofing Products • Sonex™ Ceiling & Wall Panels • Sound Control Curtains • Equipment Enclosures • Acoustical Barriers & Banners • Solid Wood & Veneer Acoustical Ceiling & Wall Systems
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Acoustical Breadth – New 2<sup>nd</sup> Floor Lab Flooring Material Cutsheet

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**Item** **Installation**

**PRODUCT DETAILS**

Country

Species: Cork  
Product ID: 21206-ure  
Construction: Solid  
Finish: Urethane  
Color: Natural  
Grade: Premium  
Thickness: 4mm (5/32")  
Width: 300mm (12")  
Length: 300mm (12")  
Carlot Quantity: 65.00 sqft/m  
Price / SF: \$3.95 SF  
Installation Type: Cork Tile Glue Down  
Manufacturer: JCP Cork Products

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Description

**The Cork Forest**

- Cork Oaks grow very slowly.
- A cork Oak can grow to be 200-250 years old.
- The first Cork is peeled at age 20-30 yrs and subsequently every 9-10 yrs.
- Cork Forests cover worldwide an area of 2.5 million ha, of which 1 million is located in Portugal (1/3 of the country). Other countries cork grows include: Algeria, Spain, Morocco, France, Italy and Tunisia.

**The Cork Tree (quercus suber)**

- Harvest from the beginning of June to the end of August, possible only every 9 years, 20 times all together.
- The first peeling is called the maiden peeling.
- Peeling requires a lot of experience, only specialists are employed.
- Cork is peeled only from the trunk and from branches of a specified circumference down to the thin reddish parent layer, below which new cork is growing (approx. 1.5-4mm per year)
- 20 % of the bark is left intact to protect the tree from drying up.
- After peeling, the cork bark is stored in collecting areas to dry and stabilize for 6 months.

**The Advantages of Cork Floors**

Environmentally Friendly- Cork Flooring is produced using all natural



**Mechanical Breadth – New Linear Diffuser Cutsheet**

F8

**Diffusers • Linear Slot • Description**

**Linear Slot  
 Ceiling Diffusers**

**Modulinear  
 • Aluminum**



F

ML(PL)-37, -38, -39

**ML-37, -38, -39 Slotted • Supply**

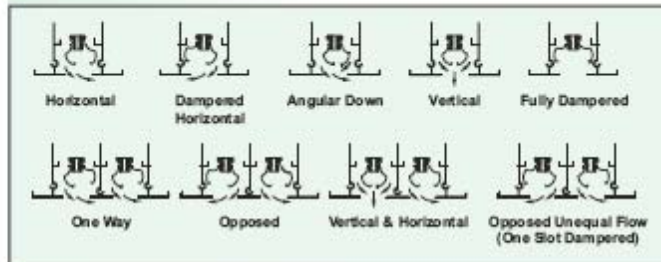
**MLR-37, -38, -39 Slotted • Return**

- Supply Models:
- ML-37 • ½" Slot
  - ML-38 • ¾" Slot
  - ML-39 • 1" Slot
- Return Models:
- MLR-37 • ½" Slot
  - MLR-38 • ¾" Slot
  - MLR-39 • 1" Slot

- These Products Include:
- Standard Finish:  
 #26 White border.  
 Black pattern controllers.
  - Optional Finishes:  
 Anodized finishes available.

- TITUS modulinear diffusers are designed for variable air volume systems. They project a uniform blanket of air that adheres to the ceiling even at low flow rates.
- Both the direction and volume of the discharge air can be adjusted gradually by moving the pattern controllers (see diagrams below).
- Full 180° pattern controller adjustment means there are no "lefts" or "rights." Specifying, ordering, and installing are simplified.

- Model MLR returns are the same as the Model ML supply diffusers except that the pattern controllers are omitted.
- Choice of borders and mounting frames for various types of installations (diagrams below and on next page).
- Available with one to eight slots.
- Ideal for continuous length applications. Multiple sections are shipped with required alignment strips or pins for field installation.
- Maximum one piece section is 6 feet. Lengths greater than 6 feet are furnished in multiple sections.
- Optional Model MLF and MLRF diffusers are designed for field cutting to length and are furnished in 6-foot sections.
- Maximum pattern controller length is 3 feet. Pattern controllers are furnished in multiple sections for a diffuser longer than 3 feet.



- Mounting frames are cut to length and assembled in the field.
- Material is extruded aluminum with steel pattern controllers.
- Optional curving to a 6-foot minimum radius available for architectural enhancement (fixed blades only).

**Frame and Border Types**

Note: See page F10 for Duct Dimensions.

All dimensions are in inches.

