



Floors:

Creating Healthy,
Learning Environments

Floors



School Flooring Products & Implications

Flooring Categories

Hard floors

Types of Applied Finish Flooring:



Wood



VCT



Cork



Bamboo

Hard Floors

Types of Inherent Finish Flooring:



Linoleum



Terrazzo
Ceramic Tile



Rubber



Sheet Vinyl

Flooring Categories

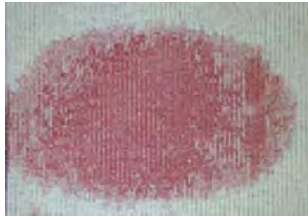
Carpet

Types of Carpet:

- Action Bac
- Unitary
- Polyurethane
- Woven
- Urethane Cushion
- Hard Plate Vinyl
- Carpet Tile



Front

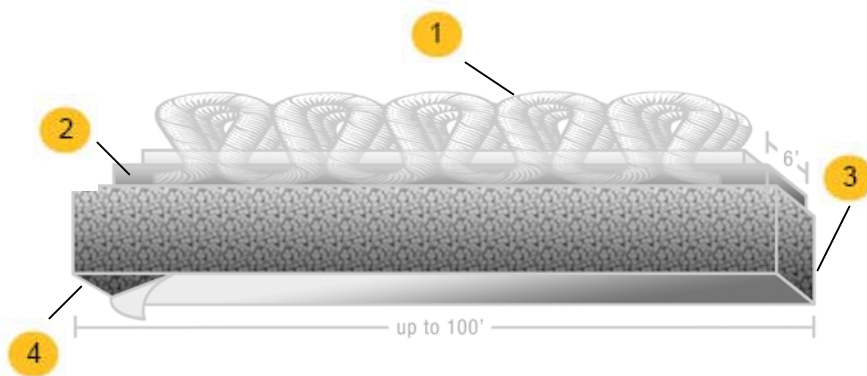


Back



Changing the Paradigm

Variable Cushion Tufted Textile (VCTT)



- 1 Super dense low-profile wear layer
- 2 Encapsulated sealant pre-coat
- 3 Closed-cell resilient cushion
- 4 Peel and stick pre-applied adhesive

- Permanent Nylon Wear Layer
- Non Flow-Through Closed Cell Cushion Backing
- Thermal Insulation
- Acoustical enhancement
- Non-Detectable VOC's
- No Antimicrobials
- 100% Recyclable
- Superior Durability
- Helps improve IAQ
- 40% Recycled Content

Changing the Application Paradigm



ELEMENTARY CLASSROOM E-AC-3

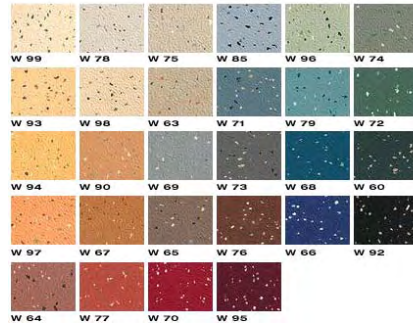
<u>FINISHES¹:</u>	Spec. Ref.#
Flooring:	
<i>Combination</i> carpet	09680
<i>with</i> vinyl composition tile	09650
Optional: All vinyl composition tile, linoleum, VET, <u>VCTT</u> , or sheet vinyl	09654

SELF-CONTAINED CLASSROOM M-SE-1

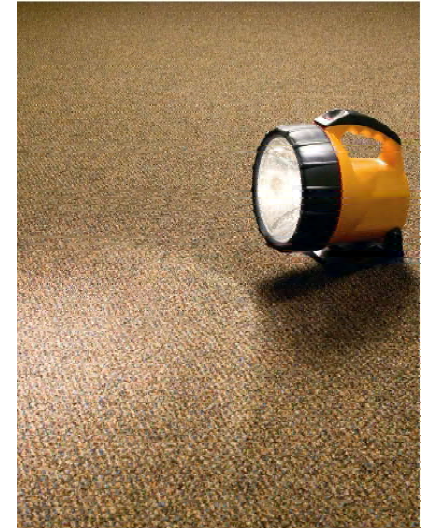
<u>FINISHES¹:</u>	Spec. Ref.#
Flooring:	
<i>Combination</i> carpet	09680
<i>with resilient options</i>	09650
Optional: All vinyl composition tile, <u>VCTT</u> , VET, sheet vinyl, or linoleum	09654

Changing the Design Paradigm

Resilient



V C T T



Discussion



Floors:

- Sustainable
- Acoustical
- Improves IAQ
- Applicable

Sustainable – why it matters



Building Operations Account for:

- 30-40% of total energy use and atmospheric emissions
- 35-40% of municipal solid waste (150 million tons)
- 25-30% of wood & raw materials use
- 25% of potable water
- 1.7 million acres developed each year
- Impact individual health
(people spend 80% to 90% of their time indoors)

Sustainable — Building Certificate Programs



the
S
collaborative
P
for high
H
performance
S
schools

Self-assessing system designed for rating new and existing school buildings.

- Credits earned for satisfying criteria

Sustainable – Building Certificate Programs



Sustainable Sites	16 Points
Water Efficiency	6 - 7 Points
Energy and Atmosphere	6 - 17 Points
Materials and Resources	9 - 13 Points
Indoor Environmental Quality	14 - 19 Points
Innovation and Design Process	<u>4 - 7 Points</u>
TOTALS	79 Points

Sustainable + Appropriate



Product Approval

Standardize on Products That are Proven

- Performance based specifications
- Proven Track Record
- Claims are 3rd Party Certified
- Data is Peer Reviewed
- Products Meet the Assigned Application

Sustainable



V C T T

- 100% Recyclable
- 40% Recycled Content
- 10% Post Consumer RC
- Available non-PVC
- > 133,000,000 Pounds

Sustainable — Approved



Product Approval

Renewable	Recycled Content	Closed-Loop Recyclable	Durable 30 Years
Bamboo	VCTT	VCTT	VCTT
Cork	Terrazzo	Terrazzo	Terrazzo
Rubber	Rubber	Rubber	Rubber*
Wood	Ceramic	Sheet Vinyl	Ceramic
Linoleum	Sheet Vinyl Linoleum Carpet Tile Roll Carpet VCT	Carpet Tile	Concrete

*Note: Thickness dependent

Discussion



Floors:

- Sustainable
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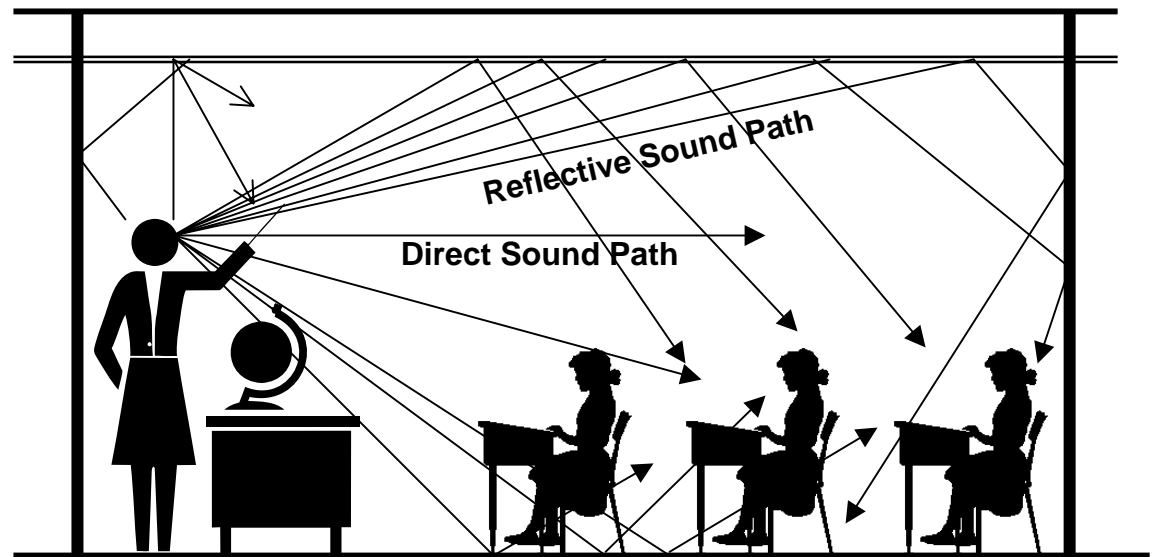


“Children lack the knowledge and maturity to fill in missed words that can be rationalized by adult listeners.”

Mike Nixon, ANSI classroom Acoustics Standards Working Group.

Acoustics - Reverberation

- As many as one-third of all students are missing up to 33% of verbal communication in class.¹
- Reflected sound tends to “buildup” to a level higher than direct sound.
- Reflective sounds MASK direct sound.



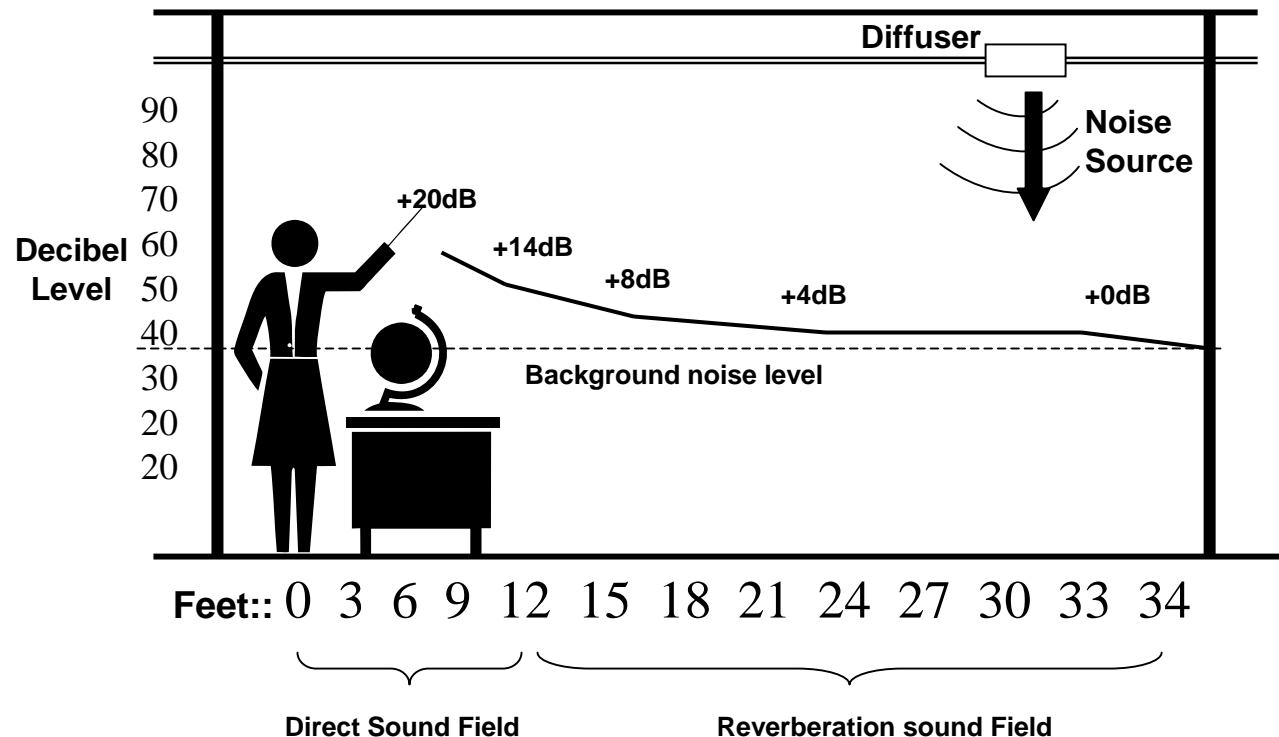
Access Board
of the ADA

Standards:
Background noise not
to exceed 35 decibels
in unoccupied
classroom.

NOTE:
Average student
requires a S/NR of at
least +15 decibels.

Signal -To-Noise Ratio (S/NR)

The sound level at the listener's ear, above the background noise level.



Ambient & Background Noise

Access Board
of the ADA

Standards:

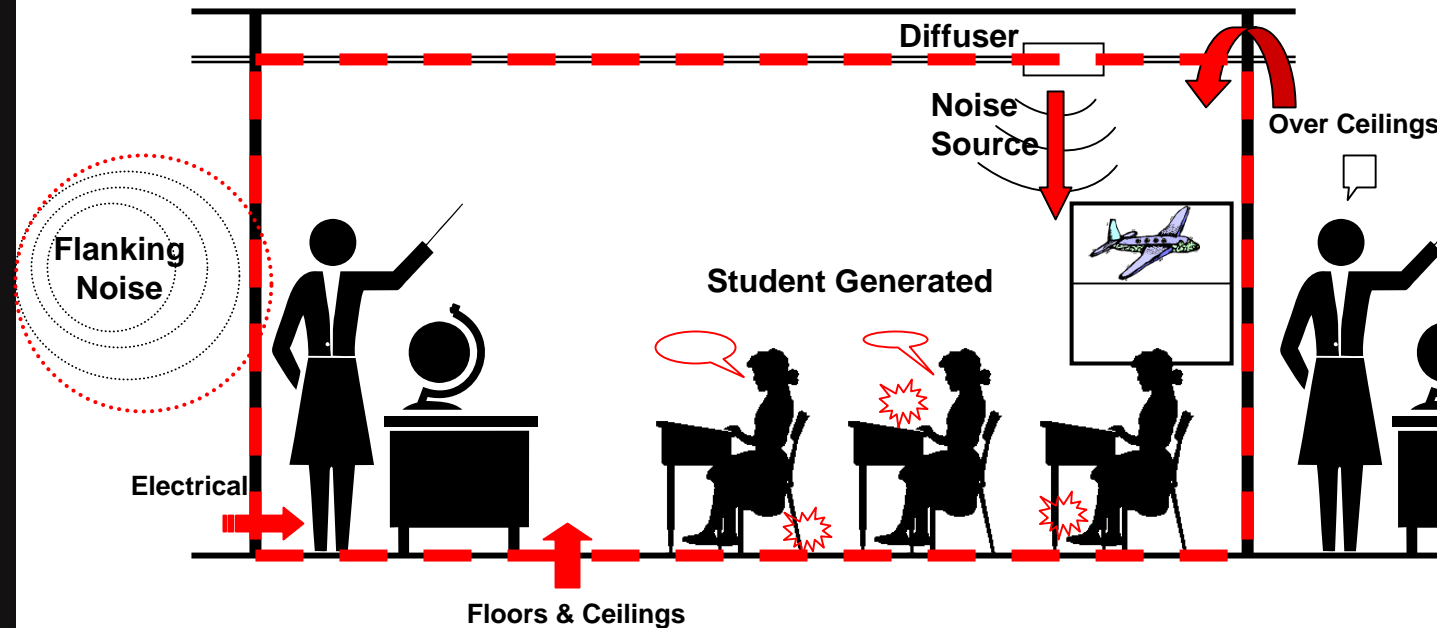
Reverberation Times
@ 250,500 & 1000 Hertz

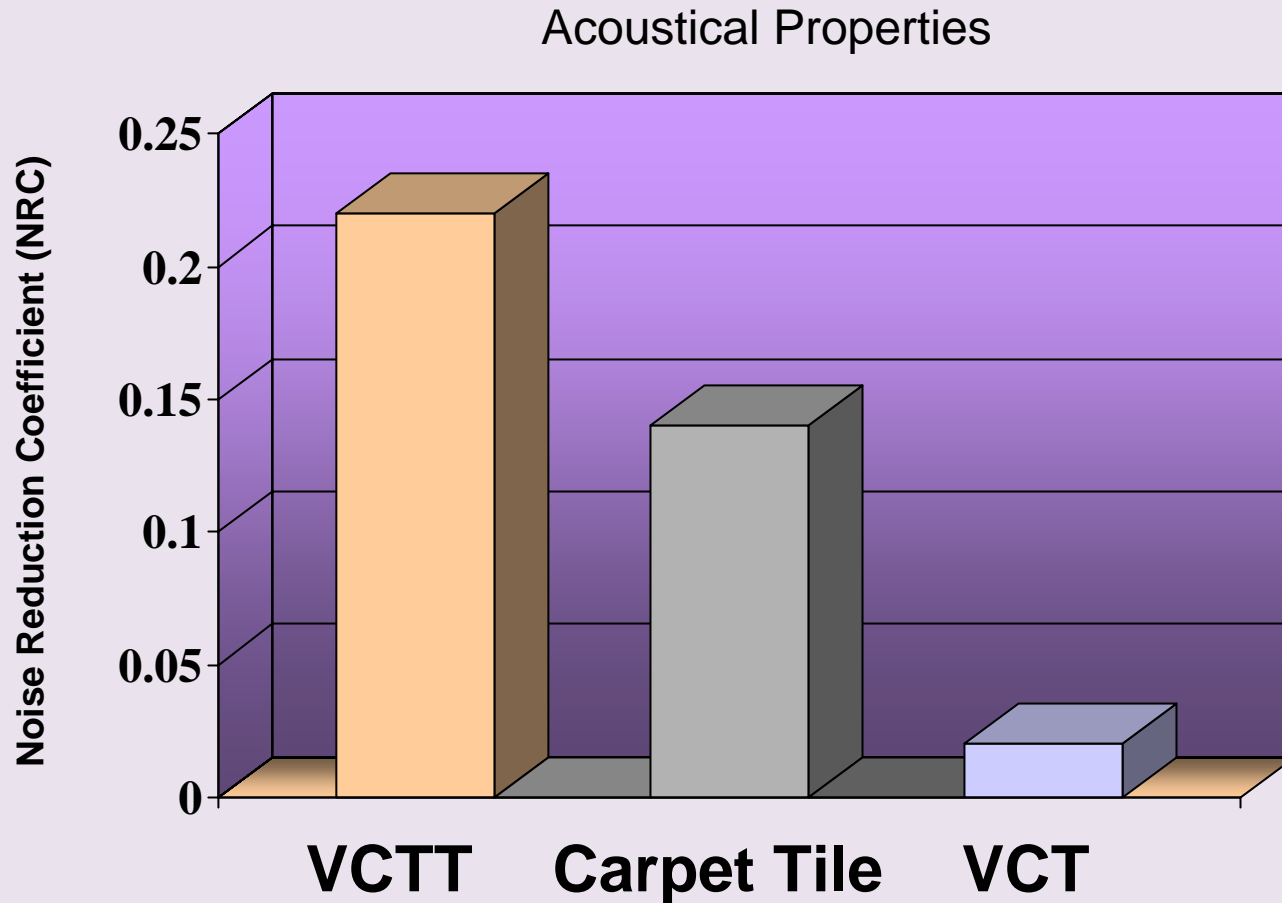
Classroom:

10,000 ft³
≤ 0.6 seconds

Classroom:

20,000 ft³
≤ 0.7 seconds







Product Approval

Low Impact Noise	Impedes Sound Transmission	NRC \geq 20 Sound Absorbent
VCTT	VCTT	VCTT
Rubber	Rubber	Roll Carpet+
Linoleum	Linoleum	
Wood	Wood	
Cork	Cork	
Roll Carpet	Roll Carpet	
Carpet Tile	Carpet Tile	
Sheet Vinyl		

+Note: With dense cushion backing

Discussion



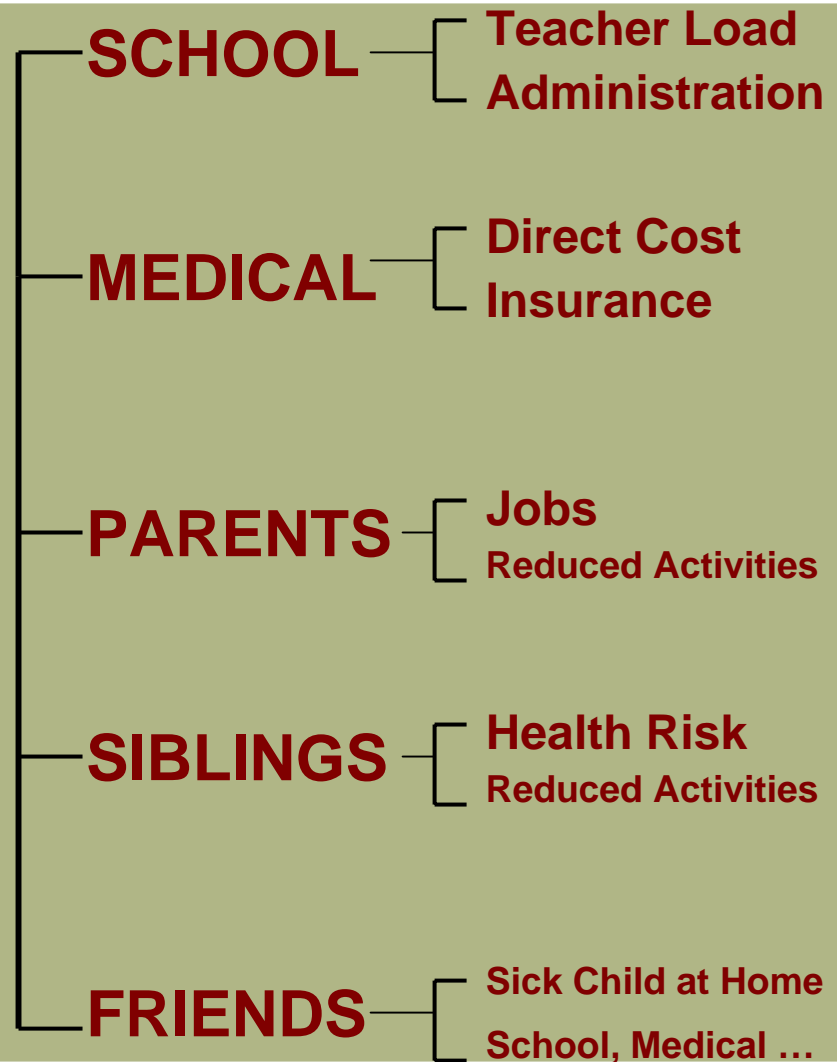
Floors:

- Sustainable
- Acoustical
- Improves IAQ
- Applicable

Poor IAQ Impact



Sick Child at Home



Indoor Air Quality - Discussion



- Thermal Comfort
- VOC's
- Moisture Management
- Respirable Factors



Effects of Thermal Environment on Learning Skills.

Harner, David P. 1974

www.ucla-idea.org

- According to Harner's (1974) analysis, the ideal temperature range for effective learning in reading and mathematics is between 68° and 74° F.
- The New York Commission on Ventilation reported that classrooms maintained at 67° – 73° and 50% rH, had less reported cases of student illness than students outside this thermal environment.



Conclusion

For optimum learning environment maintain temperature in classrooms:

68° to 74° F

and

50% Relative Humidity (rH)

Thermal Benefits

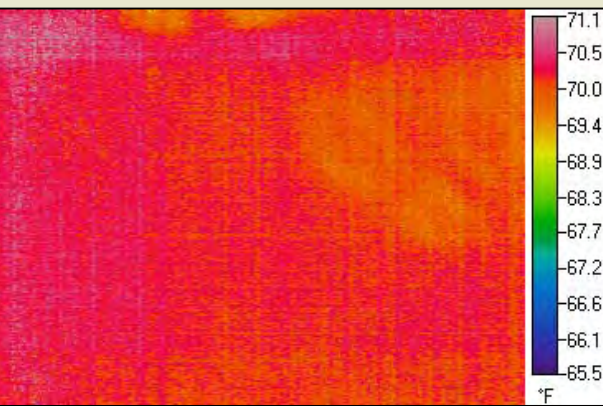
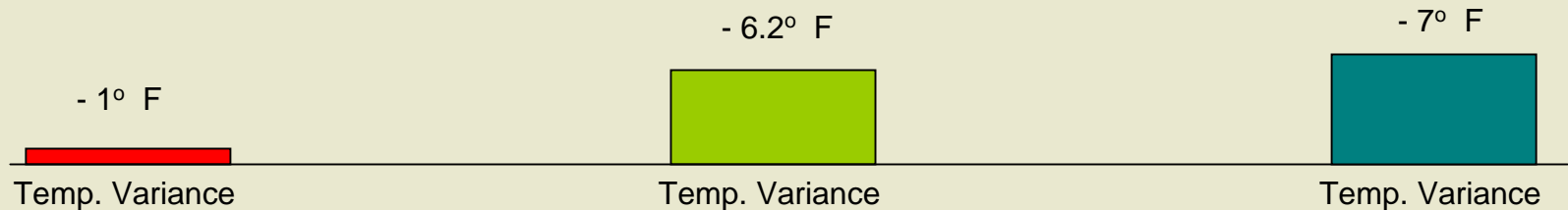


- Improve comfort
- Lower energy consumption
- Lower CO2 Emmissions

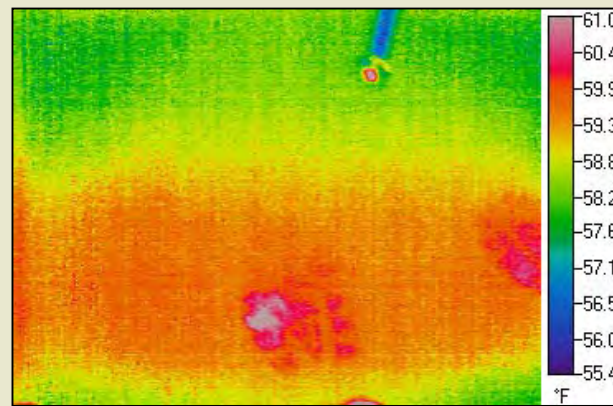
Thermal Comfort

Less temperature variance at floor surface:

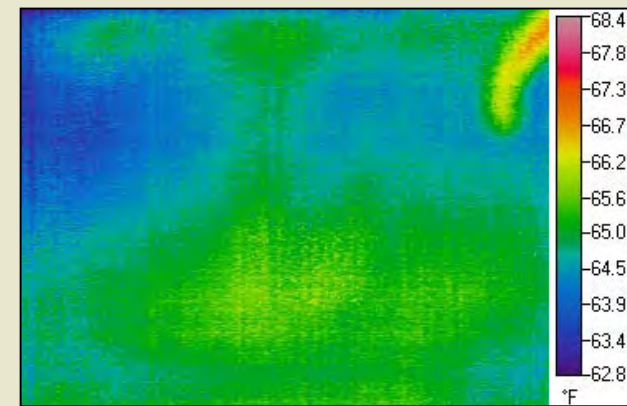
- Saves Energy
- Reduce hot/cold spots
- Manage ambient temperatures
- More productive environment



VCTT



Flow Through Carpet

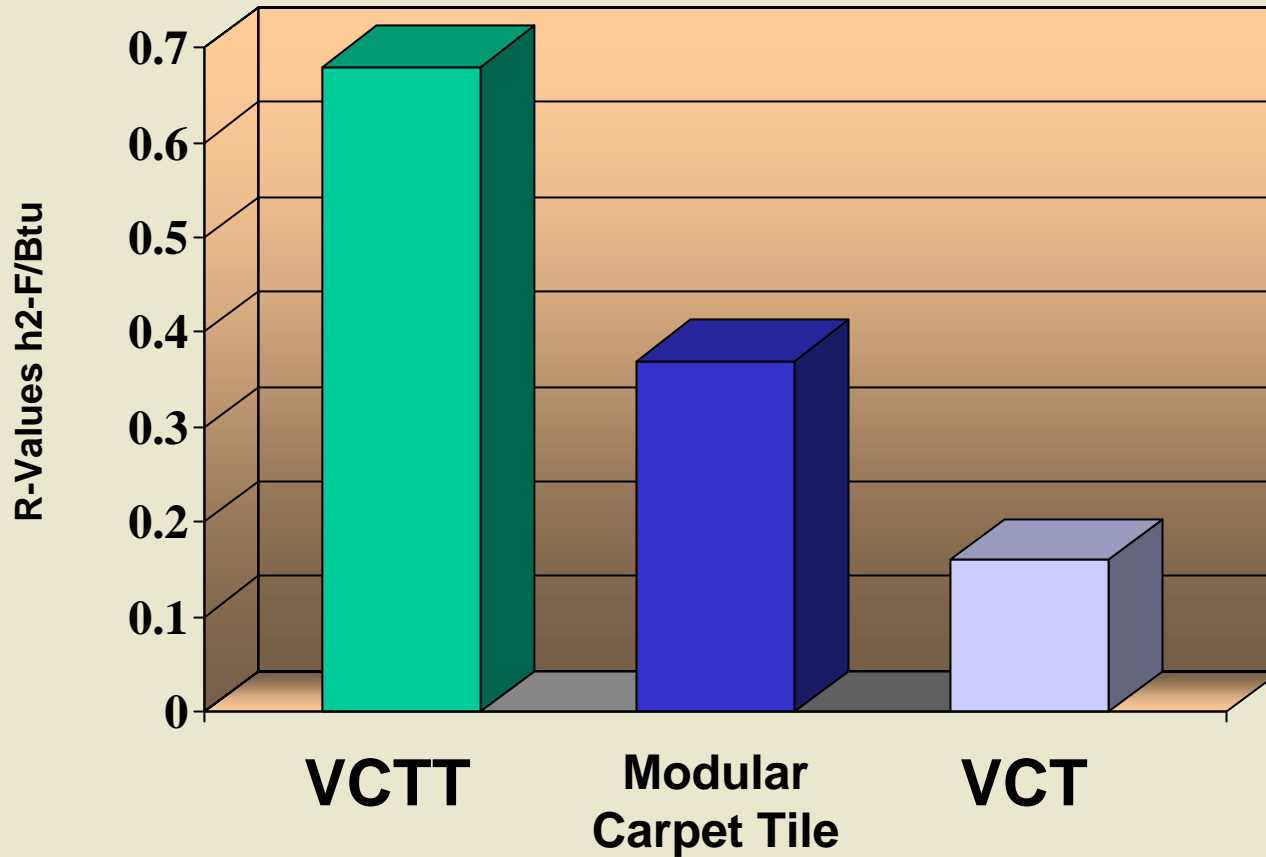


VCT

Ambient Temperature Set at 72° F

R-Values

Comfort & Energy Saving Increase with R-Values



Thermal Savings: Heating*

Single Story Savings

- \$1,100 -\$2,400/yr
- 345 – 608 gls/yr

Two Story Savings

- \$1,100 -\$2,000/yr
- 265 – 381 gls/yr

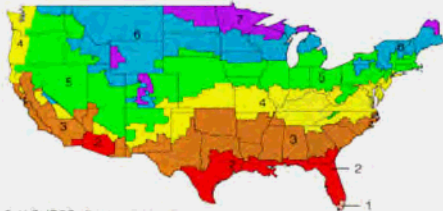


Figure 2: U.S. IECC climate zones map

	IECC Climate Zone ₇	Perimeter Foundation Insulation	Building Heating					
			Heating Energy (Annual MBTU)			% reduction in space heating	Reduction in Fuel Use (Annual gal. oil) ₃	Savings based on current energy prices (\$) ₅
			VCT Flooring ₂	VCTT ₁	Reduction			
Typical 1 Story School (50,000 sqft)	4	No underslab insulation	820.8	788.4	34.35	4.19%	344.36	\$1,377
		4' width of R-5 insulation	771.8	762.2	9.65	1.25%	96.74	\$387
	5	No underslab insulation	1013.5	973.8	39.71	3.92%	306.10	\$1,592
		4' width of R-5 insulation	955.1	944.7	10.41	1.09%	104.36	\$417
6	no perimeter insulation	1327.9	1286.1	41.80	3.15%	419.05	\$1,676	
	4' width @R-5	1250.6	1247.5	3.10	0.25%	31.08	\$124	
7	No underslab insulation	1647.0	1586.4	60.60	3.68%	607.52	\$2,430	
	4' width of R-5 insulation	1542.8	1535.0	7.80	0.51%	78.20	\$313	
Typical 2 Story School (50,000 sqft)	4	No underslab insulation	892.6	866.1	26.48	2.97%	265.46	\$1,062
		4' width of R-5 insulation	856.8	847.8	9.02	1.05%	90.43	\$362
	5	No underslab insulation	1101.8	1071.0	30.80	2.60%	306.77	\$1,235
		4' width of R-5 insulation	1054.3	1046.7	7.60	0.72%	76.19	\$305
6	no perimeter insulation	1440.9	1406.8	34.10	2.37%	341.85	\$1,367	
	4' width @R-5	1382.5	1376.9	5.60	0.41%	56.14	\$225	
7	No underslab insulation	1764.0	1716.0	48.00	2.72%	481.20	\$1,925	
	4' width of R-5 insulation	1684.5	1677.0	7.50	0.45%	75.19	\$301	

*Note: 50,000 sft Facility

Thermal Savings: Cooling*

Single Story Savings

- \$1,200 - \$2,300/yr
- 7,300 – 9,200 lbs/yr

CO2 Emissions

Two Story Savings

- \$910 - \$1,800/yr
- 6,800 – 11,000 lbs/yr

CO2 Emissions

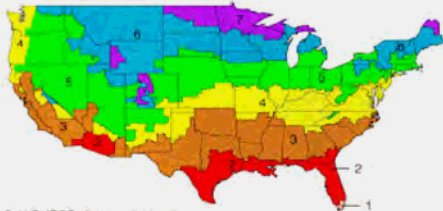


Figure 2: U.S. IECC climate zones map

	IECC Climate Zone ₇	Perimeter Foundation Insulation	Building Cooling				Net Impact		
			Cooling Energy (Annual KWH) ₄			% increase in space cooling	Costs based on current energy prices (\$) ₅	Net Savings based on current energy prices (\$)	CO2 Emission Reduction (lbs) ₆
			VCT Flooring ₂	VCTT ₁	Increase				
Typical 1 Story School (50,000 sqft)	4	No underslab insulation	48960	50300	1340	2.74%	\$201	\$1,176	7314
		4' width of R-5 insulation	50520	51060	540	1.07%	\$81	\$306	2064
	5	No underslab insulation	42120	43450	1330	3.16%	\$200	\$1,393	8760
		4' width of R-5 insulation	43440	44100	660	1.52%	\$99	\$318	2204
6	no perimeter insulation	29780	31130	1350	4.53%	\$203	\$1,474	9236	
	4' width @R-5	31040	31800	760	2.45%	\$114	\$10	488	
7	No underslab insulation	18480	19460	980	5.30%	\$147	\$2,283	13682	
	4' width of R-5 insulation	19120	19810	690	3.61%	\$104	\$209	1593	
Typical 2 Story School (50,000 sqft)	4	No underslab insulation	51910	52920	1010	1.95%	\$152	\$910	5805
		4' width of R-5 insulation	53200	53570	370	0.70%	\$58	\$306	1970
	5	No underslab insulation	44600	45550	950	2.13%	\$143	\$1,093	6819
		4' width of R-5 insulation	45710	46120	410	0.90%	\$82	\$243	1630
6	no perimeter insulation	32160	33130	970	3.02%	\$146	\$1,222	7574	
	4' width @R-5	33290	33710	420	1.26%	\$83	\$162	1166	
7	No underslab insulation	19690	20310	620	3.15%	\$93	\$1,832	10884	
	4' width of R-5 insulation	20340	20680	340	1.67%	\$51	\$250	1628	

*Note: 50,000 sft Facility



Thermal Comfort



Conclusion

Utilize flooring materials with a minimum:

$$R \text{ Value} \geq 0.68$$

Antimicrobial Additives



- Registered as Pesticides (U.S. EPA)
- Registered as Preservatives
- No Documented Healthcare Benefits
- No Healthcare Claims
- Not Substitutes for Proper Cleaning/Maintenance
- Synthetic Carpets – No Nutrient Source
- Adds Unnecessary Chemicals to the Environment

Antimicrobial Additives

“It is our considered opinion that due to the unproven benefits of anti-microbial health care finishes and fabrics such as paint, carpet, ceiling tile, privacy curtains and patient gowns, coupled with their increased cost and potential environmental concerns, these products do not recommend themselves for use in health care facilities for the purpose of greater infection prevention and control.”

Antimicrobial Position Paper
Kaiser Foundation Health Plan, Inc.

Antimicrobial Additives



“Antimicrobial treatment introduced in the manufacturing process (of carpet) is not recommended for Maryland schools. Antimicrobial treatments are pesticides”

Technical Bulletin, Carpet and IAQ in Schools, Maryland Dept. of Education

“Avoid the antimicrobial (pesticide) treatments often applied to carpeting during the manufacturing process”

Healthy School Handbook, NEA Publications, Page 185

Antimicrobial Additives



MYTH: Antimicrobials are not pesticides.

Some carpet companies add antimicrobial agents to their products, presuming this will improve product performance or human health by killing germs. Simply put, science has proven these claims wrong. Not only does the EPA recognize antimicrobial agents as pesticides – in some cases, very toxic pesticides – but no human health benefit has ever been demonstrated. Because our carpets are constructed so they don't support microbial growth, we don't add antimicrobial agents to any product – ever. It doesn't make sense to add unnecessary ingredients with no added benefits.

Over **11 Tons** of pesticides would be kept out of schools, hospitals, office buildings and the environment by NOT adding pesticides to carpet .

- from each manufacturer

Applied Wear Layer

VCT / Cork

Bamboo / Wood:

- Labor intensive
- Not just mopping
- High H₂O consumption
- High chemical exposure
- Respirable exposure



Burnishing Finish

(#1) a state-of-the-art, battery-powered 2500-rpm device,

(#2) a new plug-in 1500-rpm unit, and

(#3) an older plug-in 1,000-rpm device. New pads were used for each test.

All burnishing devices were utilized with a manufacturer-supplied dust collector bag.

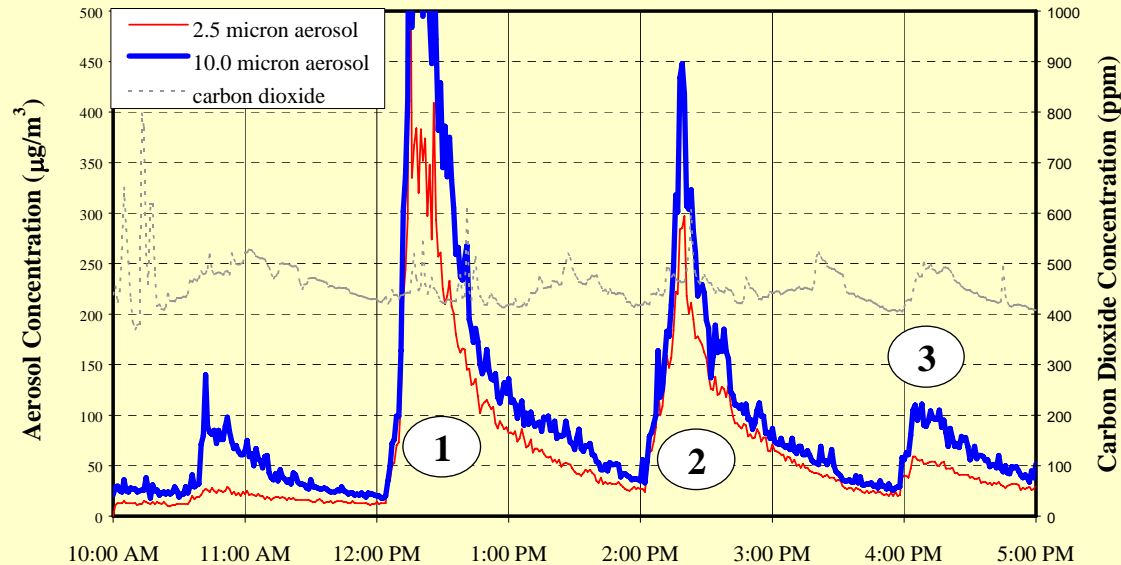


Figure 2. Experiment #1 - Test “B”: hallway with VCT during sweeping/ vacuuming/burnishing operations on December 28, 2000.

Vacuum Finish

#1: VCT, vacuum sweeper (battery-powered) with no brush

#2: VCT, vacuum sweeper with brush

#3: VCTT, backpack vacuum with HEPA

#4: VCTT, vacuum sweeper with no brush on

#5: VCTT, vacuum sweeper with side brush on

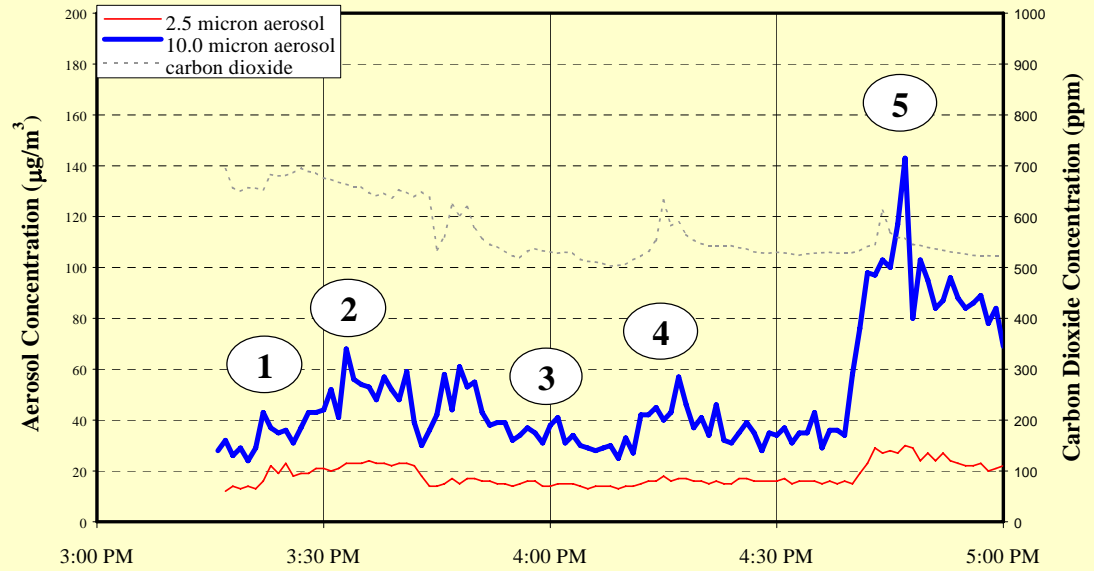
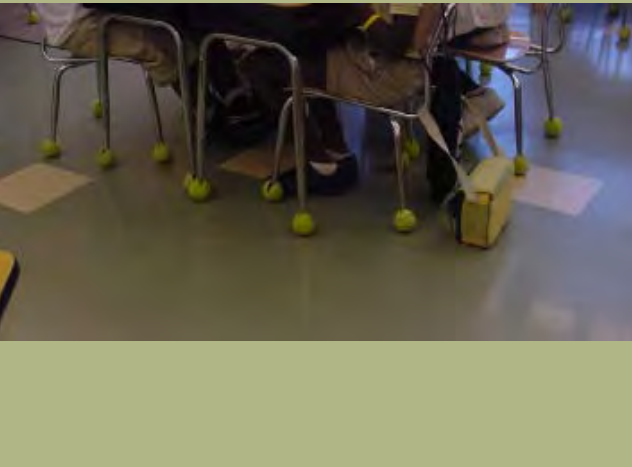
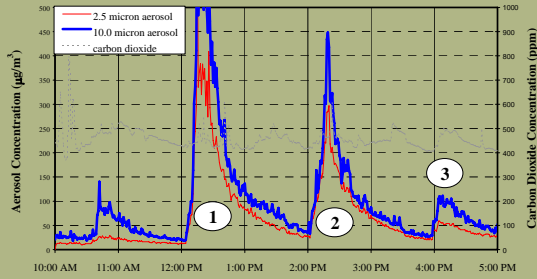


Figure 3. Experiment #1, Test “C” - School hallway with VCT (1,2) and VCTT (3-5) during sweeping/vacuumping operations on January 26, 2001

Applied Wear Layer



Shiny is NOT Clean!



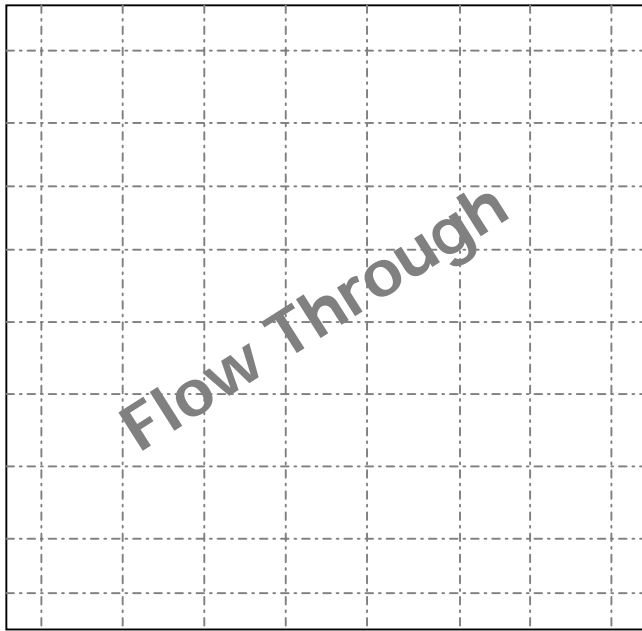
Moisture Management



Conclusion

Utilize flooring materials that manage moisture:

- Non-Flow Through
- Impermeable seams
- No applied wear layer
(Do not rely on wear layer to manage moisture)



- 1,000's Linear Ft Open Seams

Antimicrobials are EPA Registered Pesticides.

Easy:

- Easy to maintain?
- Easy to Remove (throw away)



Flooring Aspects: Dust factors



University Of Tulsa
Research
'Dust Factors'



Conclusion 1:

Textile floors are not all the same:

Cleaning:

- Contaminant removal from VCTT is predictable and consistent
- Contaminant removal from flow through carpet is not consistent

University of Tulsa Study - Recovery



Textile flooring is not a homogeneous medium

TEXTILE FLOORING

VCTT

Backing is impermeable

Installation is wall-to-wall
moisture barrier

Nylon wear layer is low
and dense

Consistent cleaning results

Low airborne release

CARPET

Backing may not be impermeable

Installation is flow through

Nylon face yarn is high
and loose

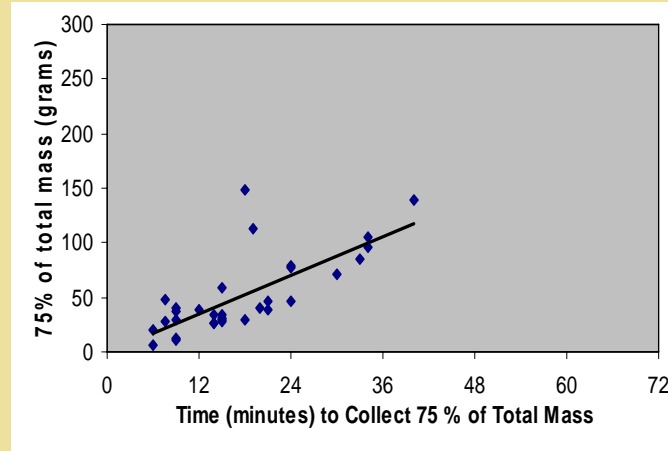
Inconsistent cleaning results

2-5 times airborne contaminants

University of Tulsa Study - Recovery

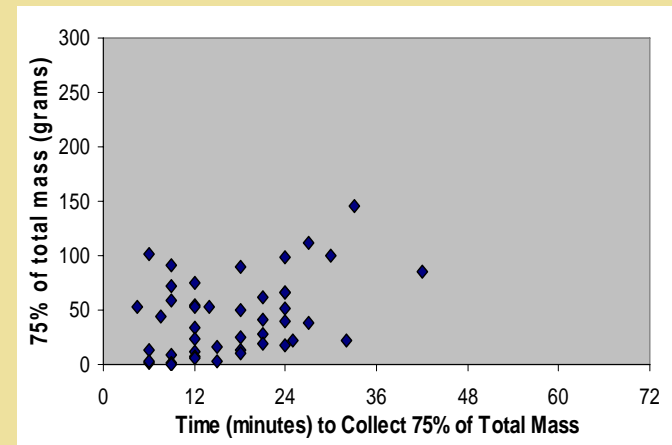
Cleaning Recovery In Schools

- **VCTT**
Consistent/Predictable
- **Flow Through Carpet**
Inconsistent/Unpredictable



VCTT

Carpet



Tulsa Study – Airborne Resuspension

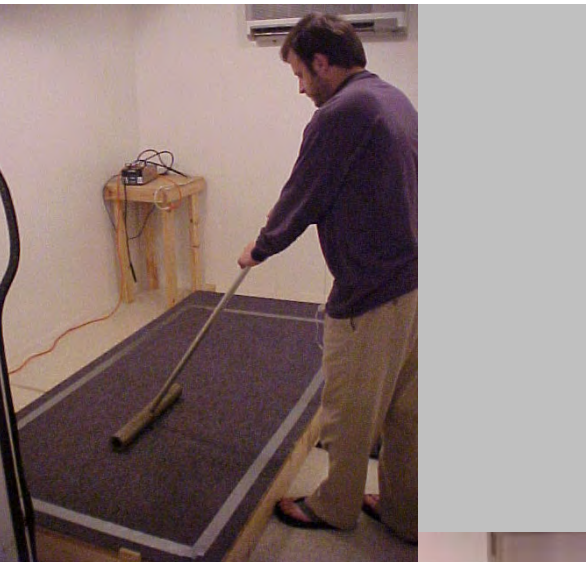


Conclusion 2:

Airborne Contaminants:

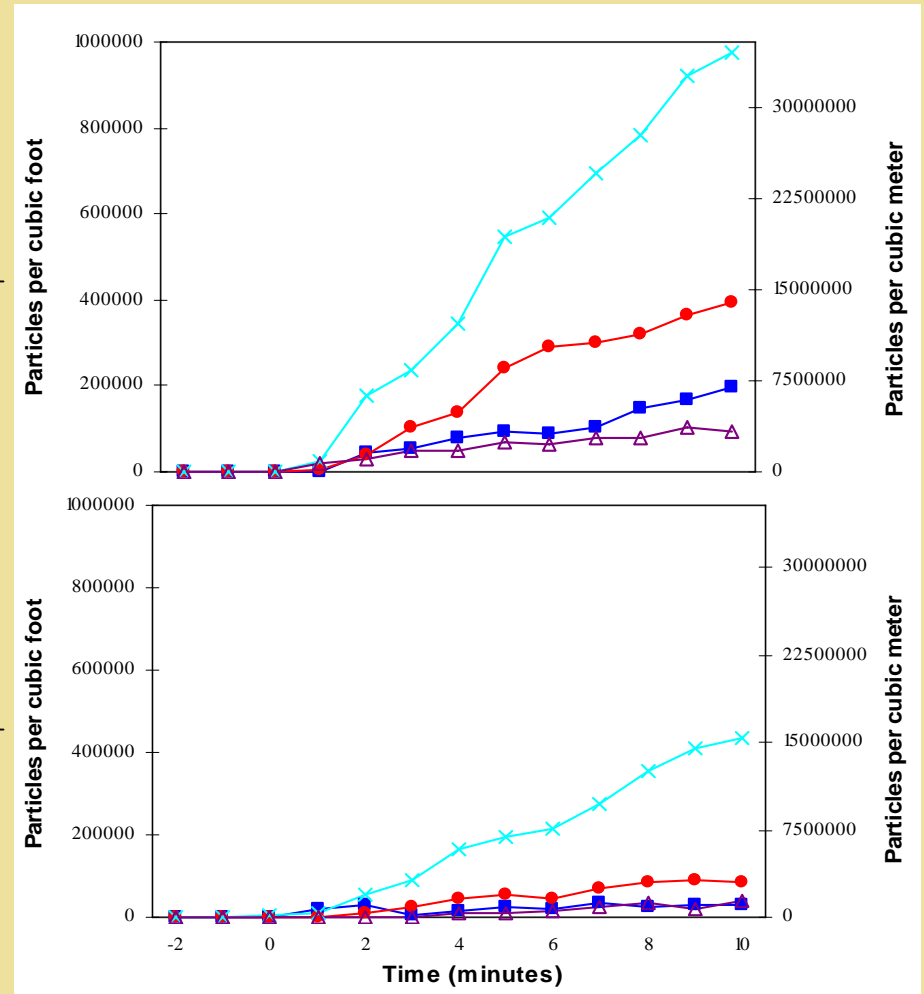
- Flow through carpet releases airborne particles 2 to 5 times greater compared to VCTT (this is significant)

Tulsa Study – Lab Resuspension



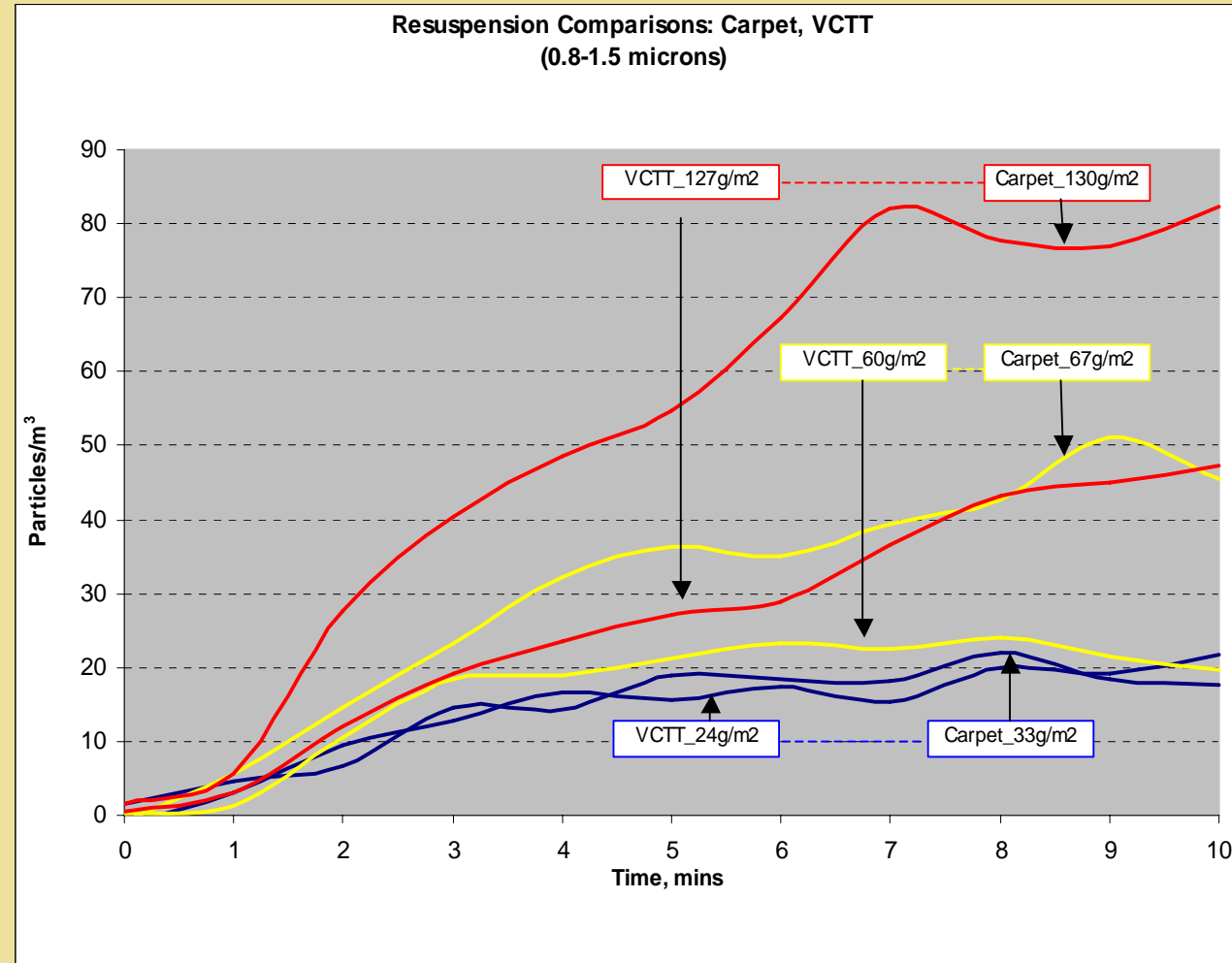
Carpet

VCTT



Loads: ● 50 g/m² ● 100 g/m² ● 150 g/m²

Tulsa Study – School Resuspension



Tulsa Study – Settled Dust



Conclusion 3:

Settled Dust:

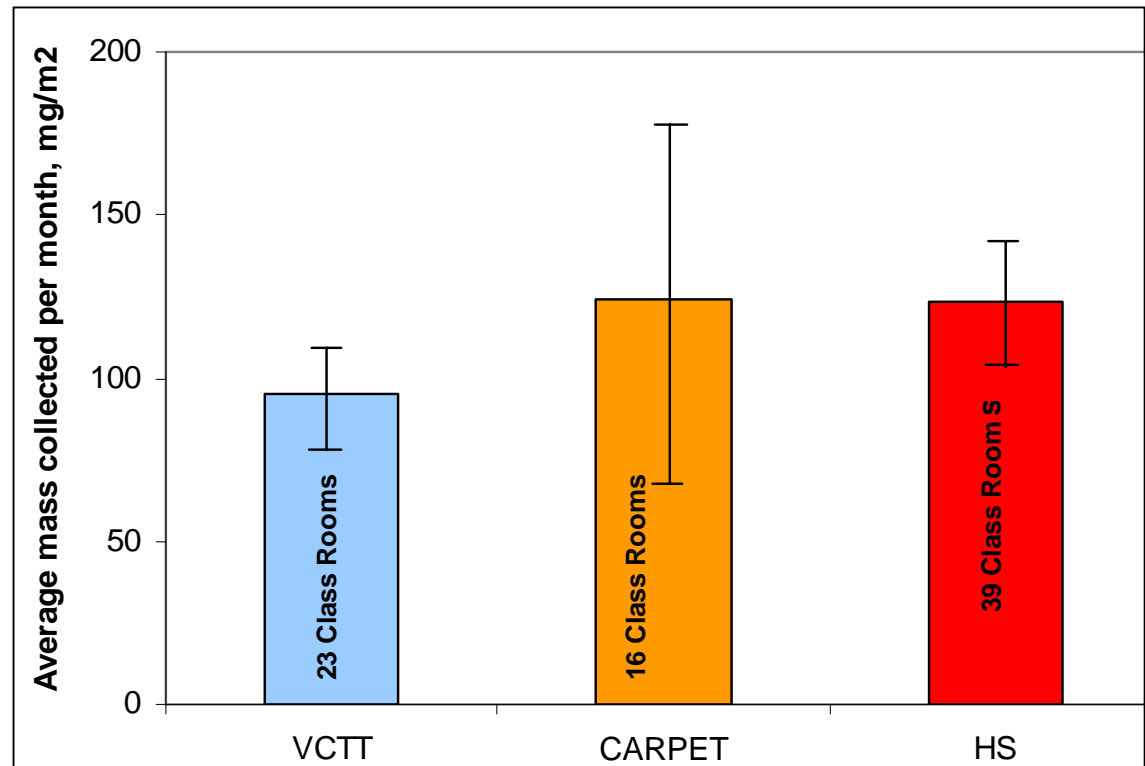
- Settled dust amounts are greater on Hard Surface (HS) and Carpet than VCTT
- Significant difference between VCTT and HS (25% lower for VCTT) $p < 0.07$
- Settled dust may be important parameter for rooms, esp. hard surface

Tulsa Study – Settled Dust

Findings

Settled Dust:

- Settled dust amounts are greater on Hard Surface (HS) and Carpet than VCTT

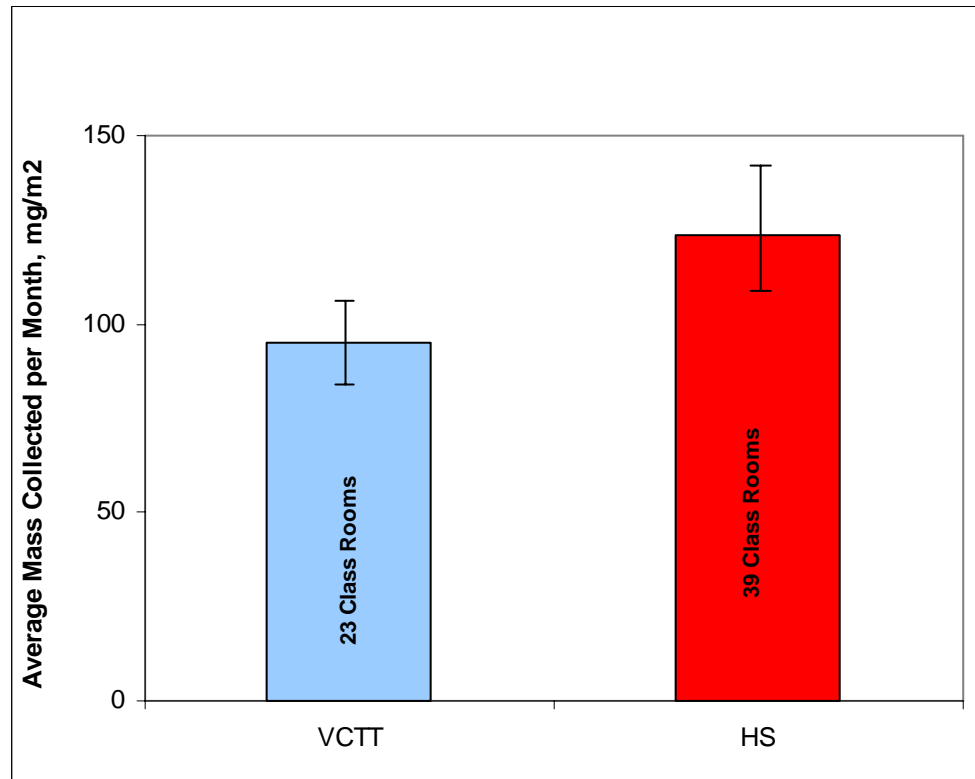


Tulsa Study – Settled Dust

Findings

Settled Dust:

- Significant difference between VCTT and HS (25% lower for VCTT)
 $p < 0.07$
- Settled dust may be important parameter for rooms, esp. hard surface



Product Approval



Thermal Value	No Pesticides	Moisture Impermeable	No Applied Finish	Low Airborne Dust	Low Settled Dust
VCTT	VCTT	VCTT	VCTT	VCTT	VCTT
Cork	Terrazzo	Terrazzo	Terrazzo		
Rubber	Ceramic	Rubber	Rubber		
Wood	Bamboo	Ceramic	Ceramic		
Roll Carpet*	Wood	Sheet Vinyl	Sheet Vinyl		
	Rubber	Linoleum	Linoleum		
	Sheet Vinyl		Carpet Tile		
			Roll Carpet		

*Note: With dense cushion



Product Applications

Corridors = Non-Flow Through



(Hard Surface / VCTT)

Photos courtesy: **BLR+B Architects**

Commons = Non-Flow Through



(Resilient (no applied finish) / VCTT)

Photos courtesy: BLR+B Architects

Art & Science = Hard Surface



(Hard Surface / Resilient)

Photos courtesy: BLR+B Architects

Multi-Purpose Classrooms = Non-Flow Through



(Hard Surface (no applied finish) + VCTT)

Photos courtesy: BLR+B Architects

Admin. / Media / Music = Carpet / Non-Flow Through



(Carpet / VCTT)

Classrooms = Non-Flow Through



(VCTT)

Floorcovering Application Chart

AREA	SPACE	HARD SURFACE		VCTT	CARPET
		INHERENT WEAR LAYER	APPLIED WEAR LAYER		
Administration					
	Reception	◆◆	◆	◆◆◆	◆◆*
	Offices	◆	◆	◆◆◆	◆◆◆
	Conference	◆	◆	◆◆◆	◆◆◆
	Lounge	◆◆	◆	◆◆◆	◆◆◆*
	Mail/Work	◆◆◆	◆	◆◆	◆
	Health Clinic	◆◆◆	◆	◆	◆
Academic					
	Classroom	◆	◆	◆◆◆	◆
	Media	◆	◆	◆◆◆	◆◆◆*
	Multi-Purpose	◆◆◆	◆	◆◆◆	◆◆*
	Art	◆◆◆	◆◆	◆◆	◆
	Music	◆◆◆	◆	◆◆	◆
	Vocal	◆◆◆	◆	◆◆◆	◆◆
	Computer	◆◆	◆	◆◆◆	◆◆◆*
	Science	◆◆	◆◆◆	◆	◆
Other					
	Entryways	◆	◆	◆	◆
	Commons	◆◆	◆	◆◆◆	◆
	Corridors	◆◆	◆◆	◆◆◆	◆
	Theaters	◆◆	◆	◆◆◆	◆◆◆
	Cafeteriums	◆◆◆	◆	◆◆	◆
	Cafeteria	◆◆◆	◆◆	◆	◆
	Athletics	◆◆◆	◆◆	◆	◆

Inherent Wear Layer Examples:
Rubber, Linoleum, Sheet Vinyl, Terrazzo, etc.

Applied Wear Layer Examples:
VCT, Sealed Concrete, Cork, Bamboo, etc.

- ◆◆◆ = Excellent
- ◆◆ = Fair
- ◆ = Poor
- ◆ = Entry System

*Modular Carpet Only
+VCT, Concrete Preferred