



“First we shape our schools, then they shape us.”



## Daylighting



**The study found that exposure to full-spectrum lighting was associated with:**

- better school attendance,**
- greater concentration,**
- more positive moods, and**
- better scholastic performance.**

*McClintock, 1996, pp.12-13*



## Daylighting



**“ Students with the most daylighting in their classrooms progressed 20% faster on math tests and 26% on reading tests in one year than those with the least. ”**

*Daylighting in Schools, August 20, 1999; [www.pge.com](http://www.pge.com)*



# Daylighting

## Lighting for Schools

*James R. Benya, PE*

*[www.edfacilities.org](http://www.edfacilities.org)*

- **Balanced, diffused, glare-free daylight from two or more directions;**
- **Sufficient light levels for the tasks in the space;**
- **Operable shading devices to reduce light intensity for audio-visual programs;**
- **Windows for interest, relaxation, and communication with outdoors; and**
- **Exterior shading devices as needed to minimize solar heat gains during summer.**

# The Total Learning Environment

## Daylighting

- How do your flooring specifications impact SIGHT learning?

“In VCT classrooms, blinds have to be shut more than ½ of day. With Hybrid Resilient (non-glare flooring), blinds stay open all day”

*Teacher planning review. Pasco County Florida, 12/21/01*

## Acoustics



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

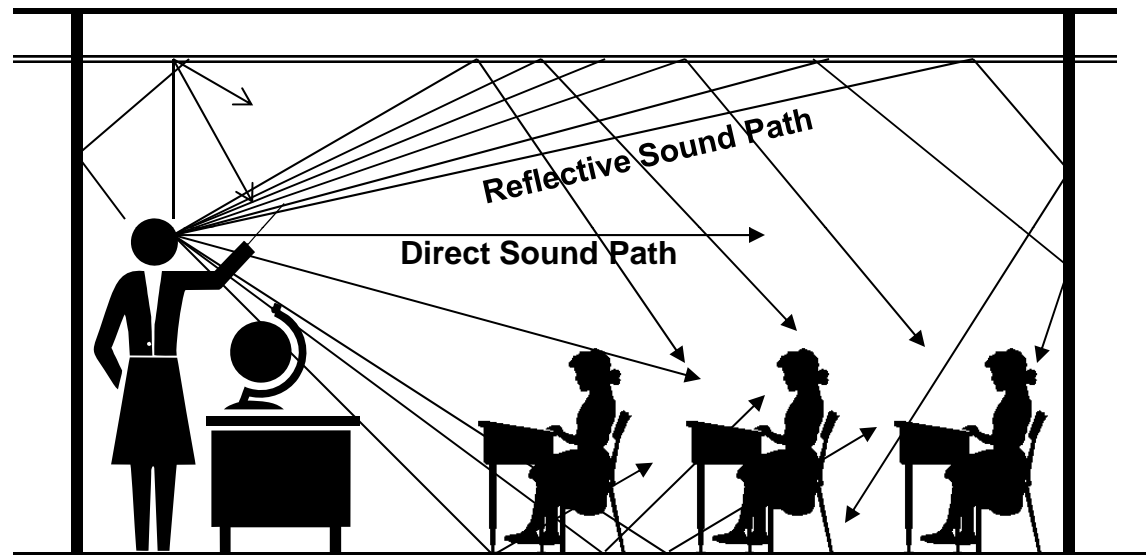
*Mike Nixon, ANSI classroom Acoustics Standards Working Group.*

- As many as one-third of all students are missing up to 33% of verbal communication in class.<sup>1</sup>

- Reflected sound tends to “buildup” to a level higher than direct sound.

- Reflective sounds MASK direct sound.

# Reverberation



<sup>1</sup>Source: *Acoustical Standards Begin to Reverberate*, Mike Nixon, School Construction News, March/April 2002



## Access Board of the ADA

### Standards:

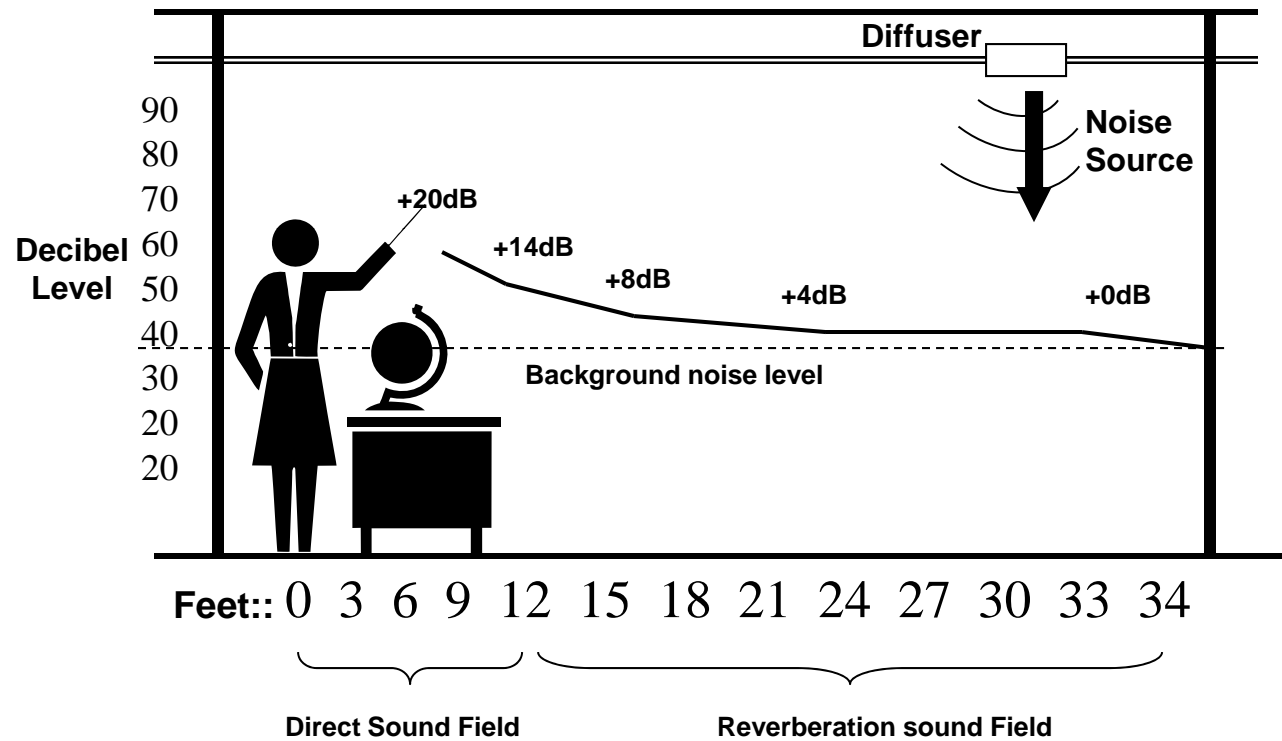
Background noise not to exceed 35 decibels in unoccupied classroom.

### 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.



## Access Board of the ADA

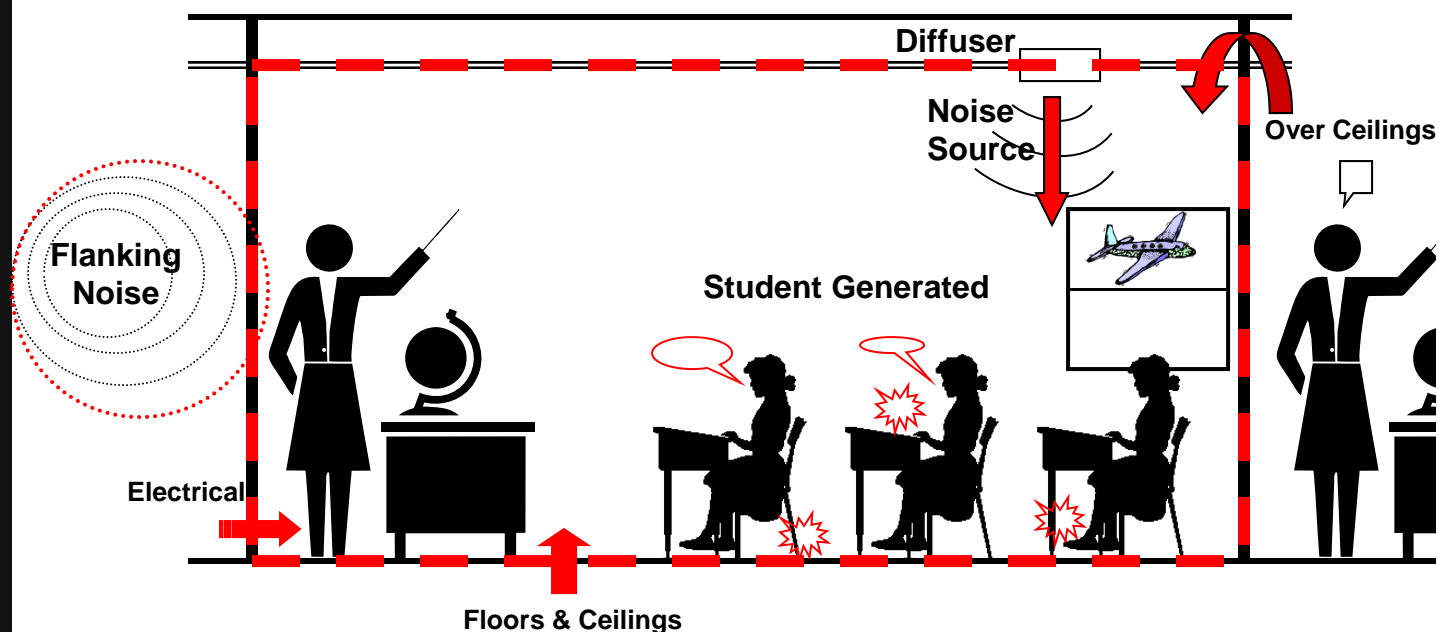
### Standards:

Reverberation Times  
@ 250,500 & 1000 Hertz

**Classroom:**  
10,000 ft<sup>3</sup>  
≤ 0.6 seconds

**Classroom:**  
20,000 ft<sup>3</sup>  
≤ 0.7 seconds

# Ambient & Background Noise



Source: *Acoustical Standards Begin to Reverberate*, Mike Nixon,  
School Construction News, March/April 2002

## Acoustics



“Since the *principles of acoustical design* for good speech intelligibility *are well established*, it is possible *to specify criteria for classroom acoustical environments* in the same manner as specifying illumination, temperature, or any other environmental parameter.”

*Dr. John Erdreich, FASA*

# The Total Learning Environment

## Daylighting

- How do your flooring specifications impact SIGHT learning?

## Acoustics

- Have you considered ACOUSTICS in your flooring specifications?

**“All classrooms exceeded 35 dBA, the American National Standards Institute (ANSI 2002) Acoustical Standard and World Health Organization (WHO,1999) guideline for unoccupied classroom acoustics.”**

*California Portable Classrooms Study Project Executive Summary, Volume III, May 2003*

**“The average dBA sound pressure with the acoustical flooring was in the order of approximately 5 dBA lower than without.**

**A 5 dBA reduction therefore is approximately a 25% reduction in loudness. This is deemed a significant reduction.”**

*Acoustical Measurements Woodin Elementary, Bothell, WA, Towne, Richards & Chaudiere, Inc. 10/10/90*

## Thermal Quality



**“In almost all of these studies, the importance of a controlled thermal environment was stressed as necessary for satisfactory student performance.”**

*McGuffey (1982), Mayo (1955), Nolan (1960), Peccolo (1962), Stuart and Curtis (1964), McCardle (1966), Harner (1997) Chan (1980).*

*Harner, David P. 1974. “Effects of Thermal Environmental on Learning Skills.”*



## Thermal Quality

# Effects of Thermal Environment on Learning Skills.

*Harner, David P. 1974*

[www.ucla-idea.org](http://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.

## Thermal Quality

# The Physical Environment - Revisited

*Day, William C.*

*The Education Facility Planner (18)2*



**“Students experience approximately a 2% reduction in learning ability for every degree a room temperature fluctuates from optimum.**

**On the other hand, in a proper thermal environment, educators believe that the amount of learning by the average student increases from a range of 15 to 16 percent.”**

# The Total Learning Environment

## Daylighting

- How do your flooring specifications impact **SIGHT** learning?

## Acoustics

- Have you considered **ACOUSTICS** in your flooring specifications?

## Thermal

- Can your flooring improve **THERMAL** comfort & **ENERGY** savings?

<u>PRODUCT</u>	<u>R-VALUE</u> <u>(Hr-ft<sup>2</sup> – F/Btu)</u>
Hybrid Resilient (closed cell cushion)	0.84
Performance Carpet tile	0.49
VCT Tile (CH41-TH059-10)	0.19

*Sparrel Engineering Research Corporation, June 4, 1998*

## Maintenance



- Students in school buildings in poor condition had achievement that was 6% below schools in fair condition and 11% below schools in excellent condition.

*Edwards (1991)*

## Maintenance



- Achievement also appeared to be more directly related to cosmetic factors than to structural ones.

*Cash (1993)*



## Maintenance



## “Pride of place”

*Attractive facilities* characterized by features with which the students readily can identify are more likely to *inspire good conduct* and *reduce vandalism* than ordinary, uninspiring, and poorly maintained facilities.

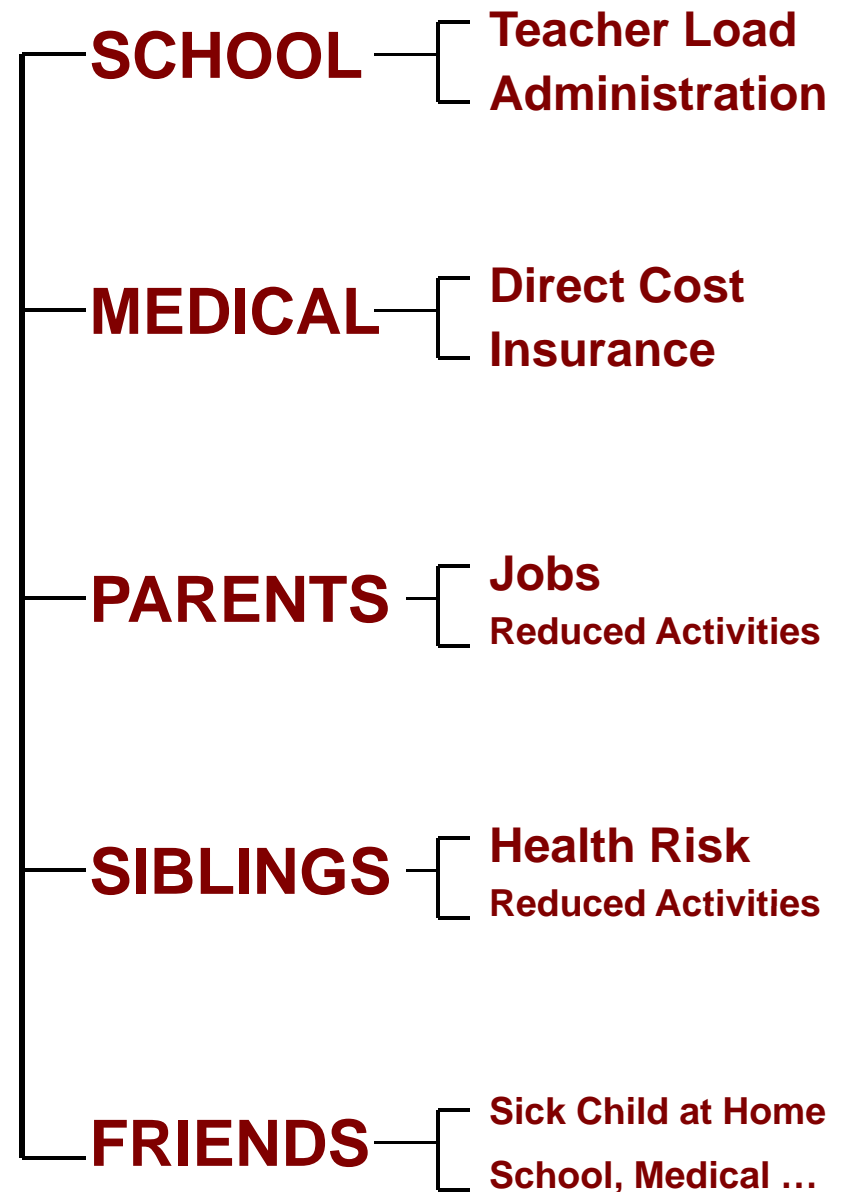
(Crowe, 1991)

Maintenance



Sickness Impact

## Sick Child at Home



# Maintenance

Mats capture 80% +





## Maintenance



**Do we want pesticides  
in our school flooring?**

**Anti-microbials are registered EPA  
PESTICIDES.**

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

*Maryland State Dept. of Education*

---

No antimicrobial can substitute for  
proper care and cleaning.

Solution: A cleanable floor.

# The Total Learning Environment

Daylighting

Acoustics

Thermal

Maintenance

**“Even after seven years of neglect, many, including the school health official, thought that the flooring was beyond repair and would need to be removed. The decision to restore it, and not replace with VCT, saved the school \$55,000. The savings from that decision alone reallocated the district’s resources and allowed the school to fix and repair the real source of items that impacted on school health.”**

*Indoor Environment Connections, Volume 4, Issue 10, August 2003*

- **Is your flooring protecting the overall HEALTH of the occupants?**



## Indoor Air Quality

*“Good indoor air quality contributes to a favorable learning environment for students, productivity for teachers and staff, and a sense of comfort, health, and well-being for school occupants. These combine to assist a school in its core mission – educating children.”*

**Indoor Air Quality Basics for Schools, United States EPA.**



## Product Selection

Floorcoverings are only one of several components in the interior product selection process that affects IAQ.

# Flooring Options



Wood



Linoleum,  
Sheet Vinyl,  
Rubber



Terrazzo



VCT



Carpet

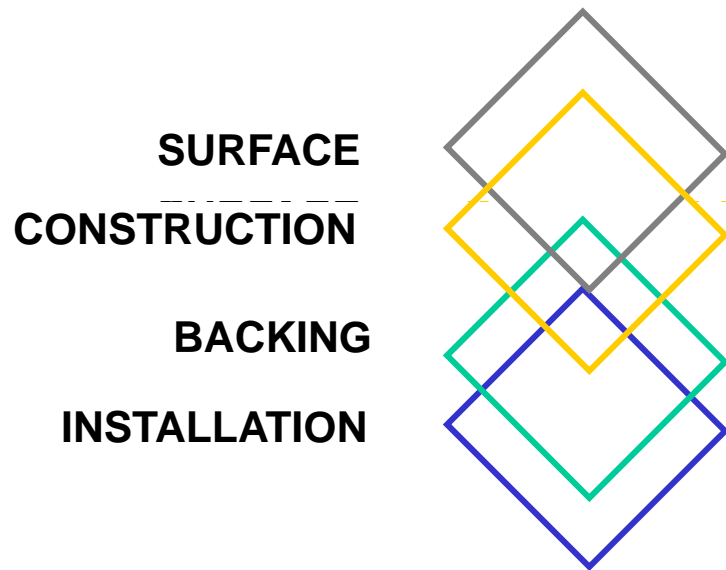
- Action Bac
- Latex Unitary Bac
- Hot Melt
- Woven
- Polyurethane
- Polypropylene
- Urethane
- Cushion Vinyl
- Hard Plate Vinyl

# Indoor Air Quality Consortium

November 2000

Dalton, GA/Chattanooga, TN

- Scientist, Indoor Air Pollution Research
- IAQ Consultant - Maintenance
- IAQ Consultant - Mechanical Engineering
- Healthcare Consultant
- Registered Nurse
- President (independent floor covering testing lab)
- School Facilities Planning Specialist
- Executive Director (international school association)
- Director of Interior Design (national school architectural firm)
- State Environmental Specialist
- Product Engineer (national maintenance equipment company)
- Vice President (school architectural firm)
- Director of Physical Plants, New School Construction
- Education Manager (national maintenance equipment mfr.)
- Director of Maintenance (school district)
- V. President (school construction Singapore)



- Quality compliance
- Meets the application
- Meaningful warranty

- Resilient
- Not topically applied

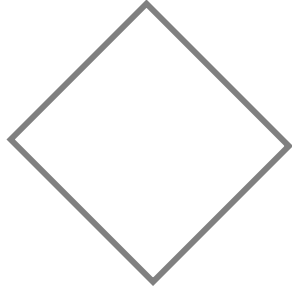
- Impermeable to moisture
- Impermeable to microbial penetration
- Water proof seams

- No “off-gassing” or curing time
- No seams or seam degradation



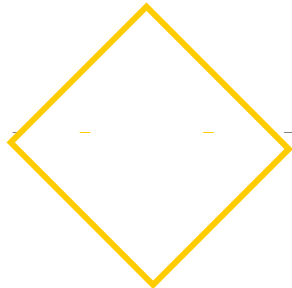
# Link Engineering ??

**SURFACE**

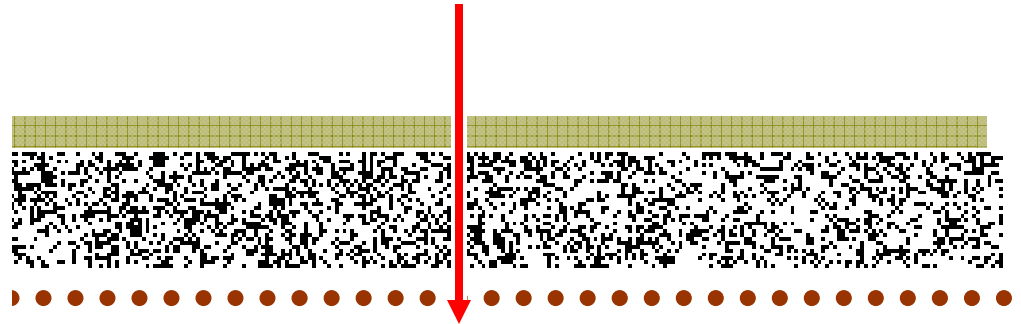


Hard Surface

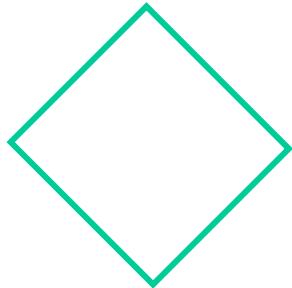
**CONSTRUCTION**



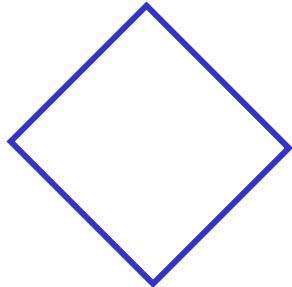
VCT



**BACKING**



**INSTALLATION**



## VCT

⊗ *Applied finish*

⊗ *Open Seams*

⊗ *Porous*



appropriate finish



# VCT Maintenance Equipment





# Link Engineering

## Preferred Hard Surface

Terrazzo

Linoleum

Sheet Vinyl

Ceramic Tile

Rubber

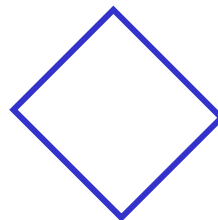


► ***Resilient Surface***  
*(not topically applied)*

► ***Waterproof***

► ***Waterproof Seams***

► ***Non Porous***  
*(impermeable)*

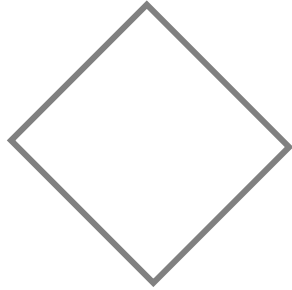


► ***Low VOCs***

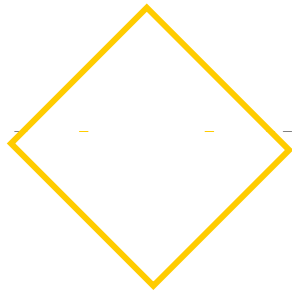
INSTALLATION

# Link Engineering ??

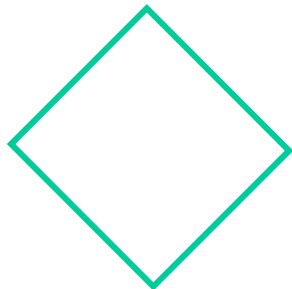
**SURFACE**



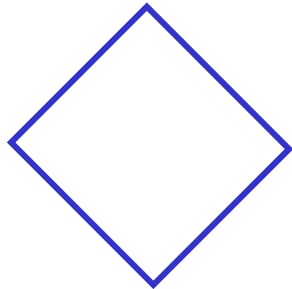
**CONSTRUCTION**



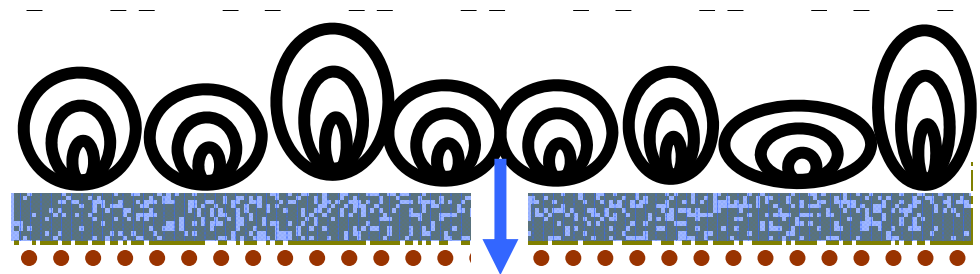
**BACKING**



**INSTALLATION**

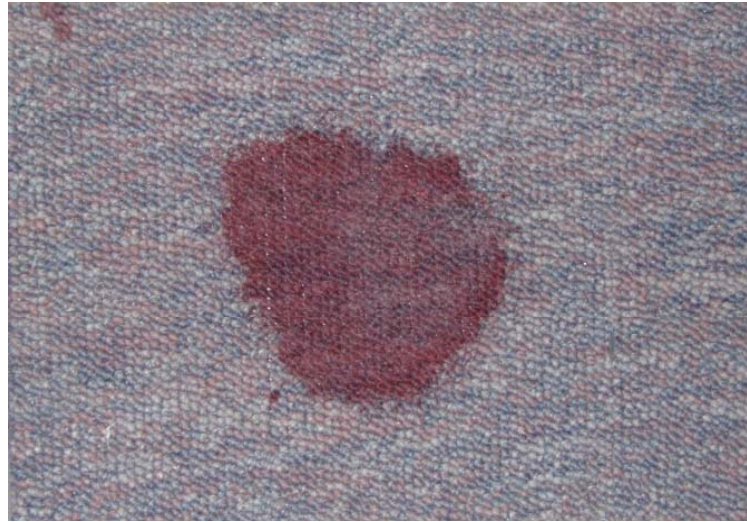


Flow Through Broadloom



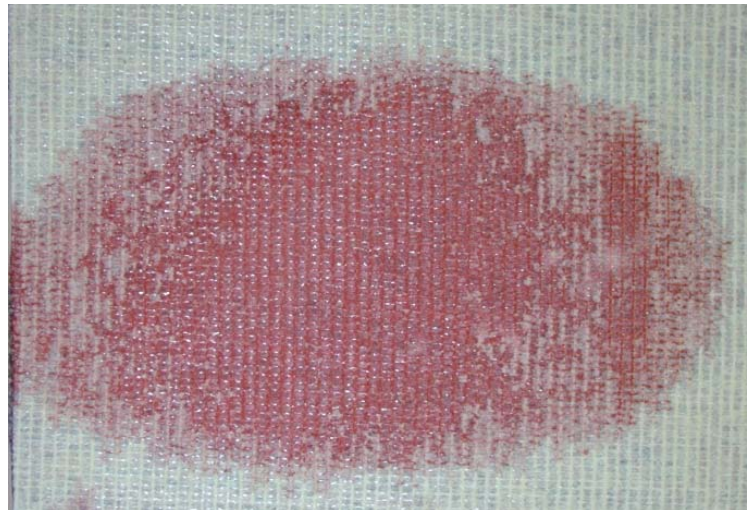


# Flow Through Backing



10"

**Front**



10"

**Back**



Flow Through

Latex "Flow Through" 6 Years

← transitions strip (cannot bond the seams)

Non-Flow Through

Closed cell vinyl cushion 26 Years





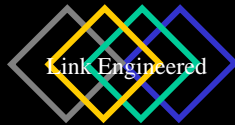
**Closed cell vinyl cushion  
3 Years After Flooding**

## **IMPERMEABLE:**

- **Waterproof**
  - **Waterproof seams**
- 
- **NO open seams**  
(6' vinyl cushion broadloom)
  - **NO Modular Tiles**
  - **Improved Maintenance**
  - **.....Improved IAQ**

# Closed Cell Vinyl Cushion

Is  
Impermeable



# Moisture

## Control

“To solve IAQ and mold issues, designers must design buildings with materials that can sustain moisture breaches without catastrophic results.

Prevention, rather than repair, is the key to successful building health.”

*Mold-Resistive Construction, Christopher Huckabee, AIA,  
School Planning & Management, Aug. 2003*

- British Spill Test (E)  
("No penetration after 24 hours.")  
**DOES NOT ACCOUNT FOR IMPACT or SPILLS at SEAMS**
- Moisture Penetration by Impact  
("No penetration after 10,000 impacts.")
- Moisture Penetration at Seam Test  
("No penetration after 10,000 impacts.")
- Phillips Chair Caster Test at Seam  
("No seam degradation after 50,000 cycles.")

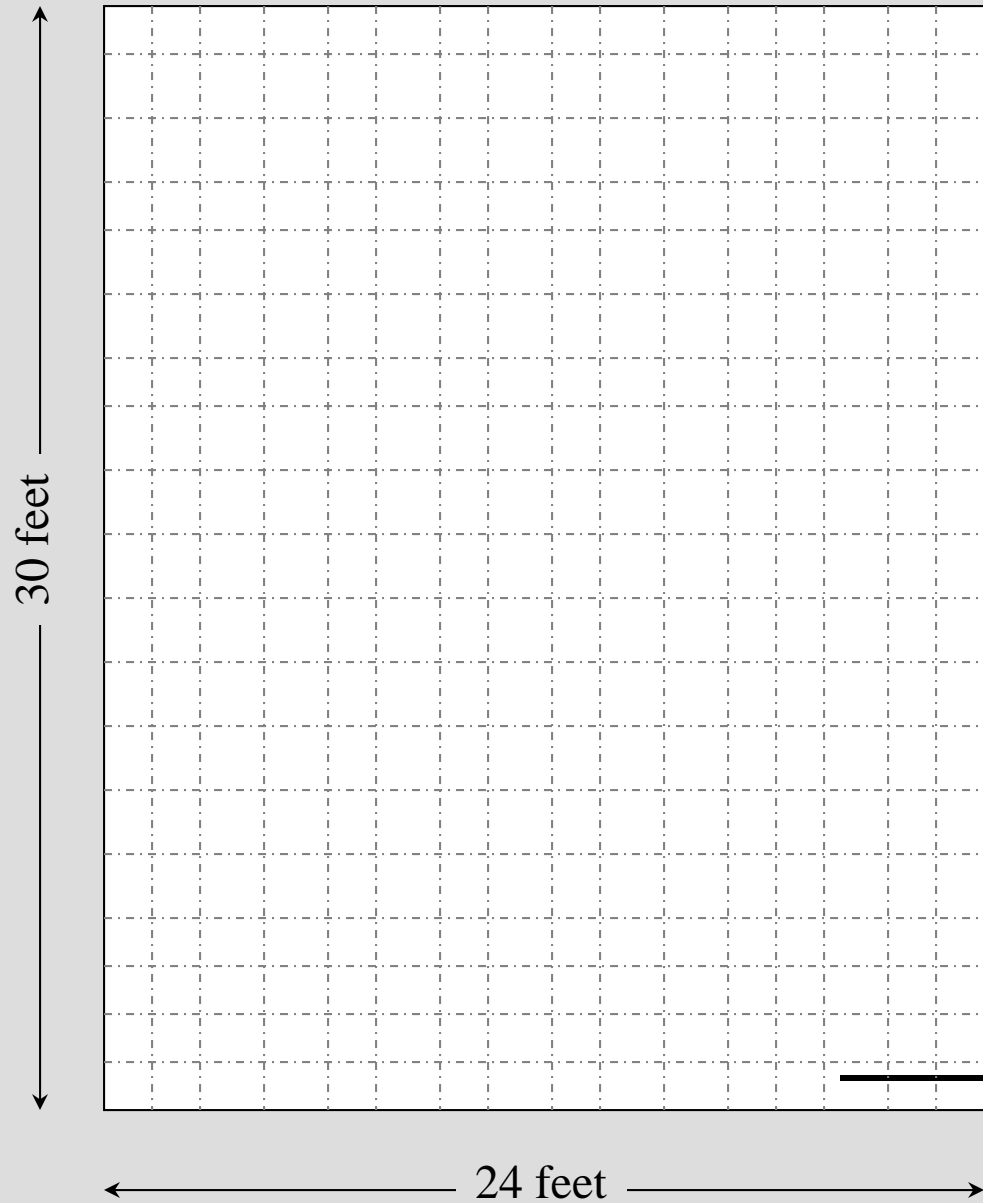
**When Good  
Modular Tiles  
...Go Bad**

**OPEN SEAMS**

**= 906 Linear Feet  
(18" Tile)**

**PER  
CLASSROOM**

**Typical Classroom**



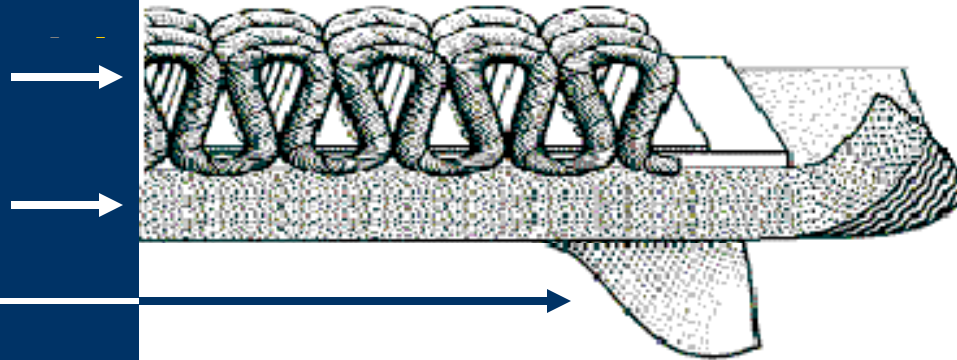
Meets the Application

Link Engineering



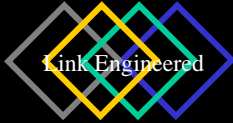
## Hybrid Resilient

- ✓ Resilient  
(low dense profile)
- ✓ Non-Flow Through  
(water proof seams)
- ✓ No Odors  
(Peel & Stick Adhesive)

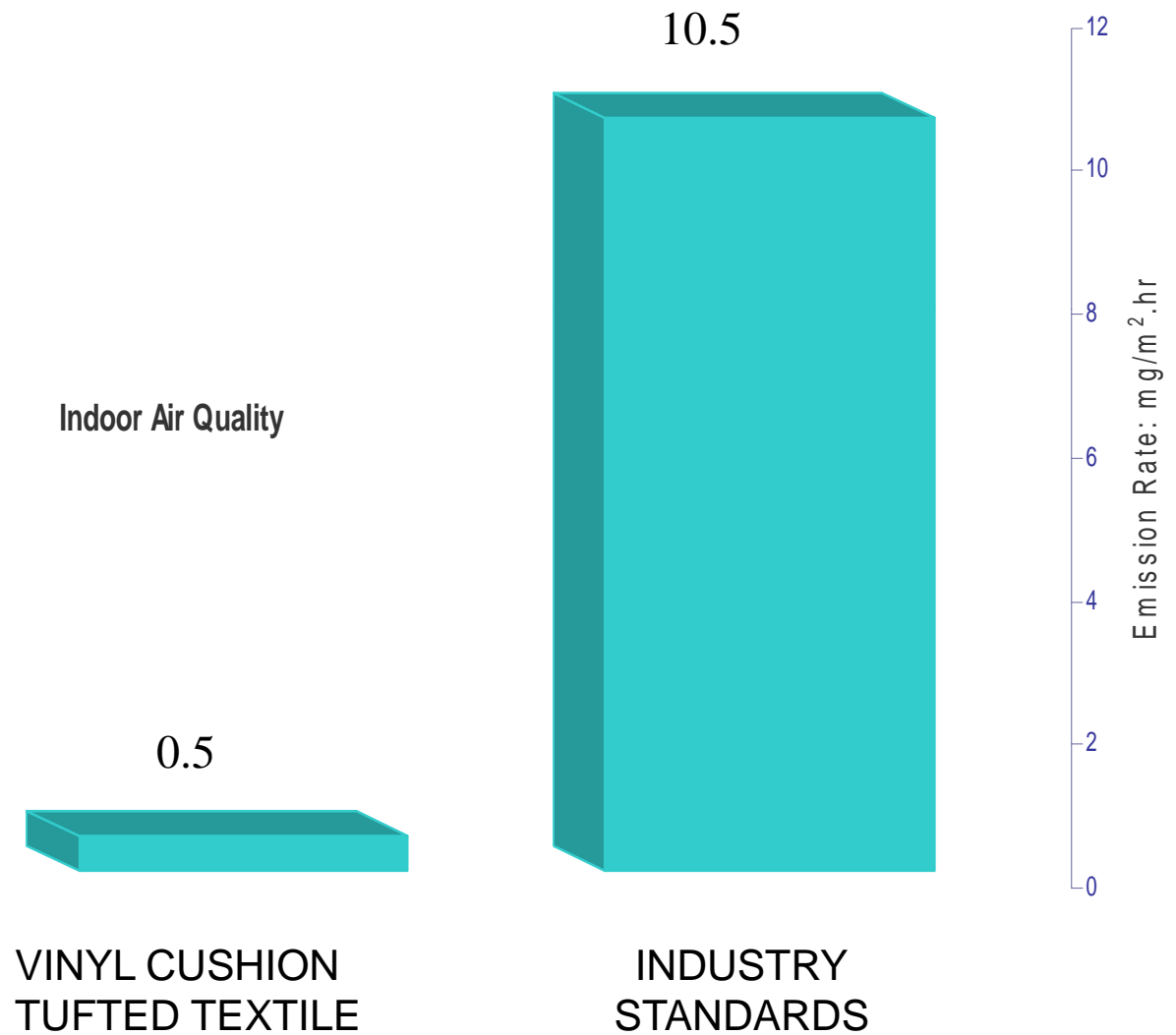




# Indoor Air Quality



## LINK ENGINEERED VOC EMISSIONS COMPARED TO INDUSTRY STANDARD





“When you can’t breathe, nothing else matters.™”

# NEWS

From the American Lung Association

CONTACT: Nancy Whitlock at (727) 347-6133 or 1-800-771-5863.

November 2, 2002

For Immediate Release

## American Lung Association Celebrates Opening Of Breathe Easy Office® - Clean Air Building Prototype

Grand Opening Ceremonies for the American Lung Association's Breathe Easy Office® will be held Saturday, November 2, beginning with a ribbon-cutting at 12:30 p.m. This innovative healthy office building prototype is the new corporate headquarters of the ALA's Gulfcoast affiliate.

The Grand Opening is sponsored by Carrier Corporation, C&A Floorcoverings, GlaxoSmithKline and Icyne Inc., with hospitality provided by Panera Bread.

The Breathe Easy Office is a landmark facility with the latest technology and safest energy systems especially designed to ensure clean indoor air. With most Americans spending 90 percent of their time indoors, buildings made with allergenic materials and poor air ventilation can cause serious health risks, especially for those with lung disease.

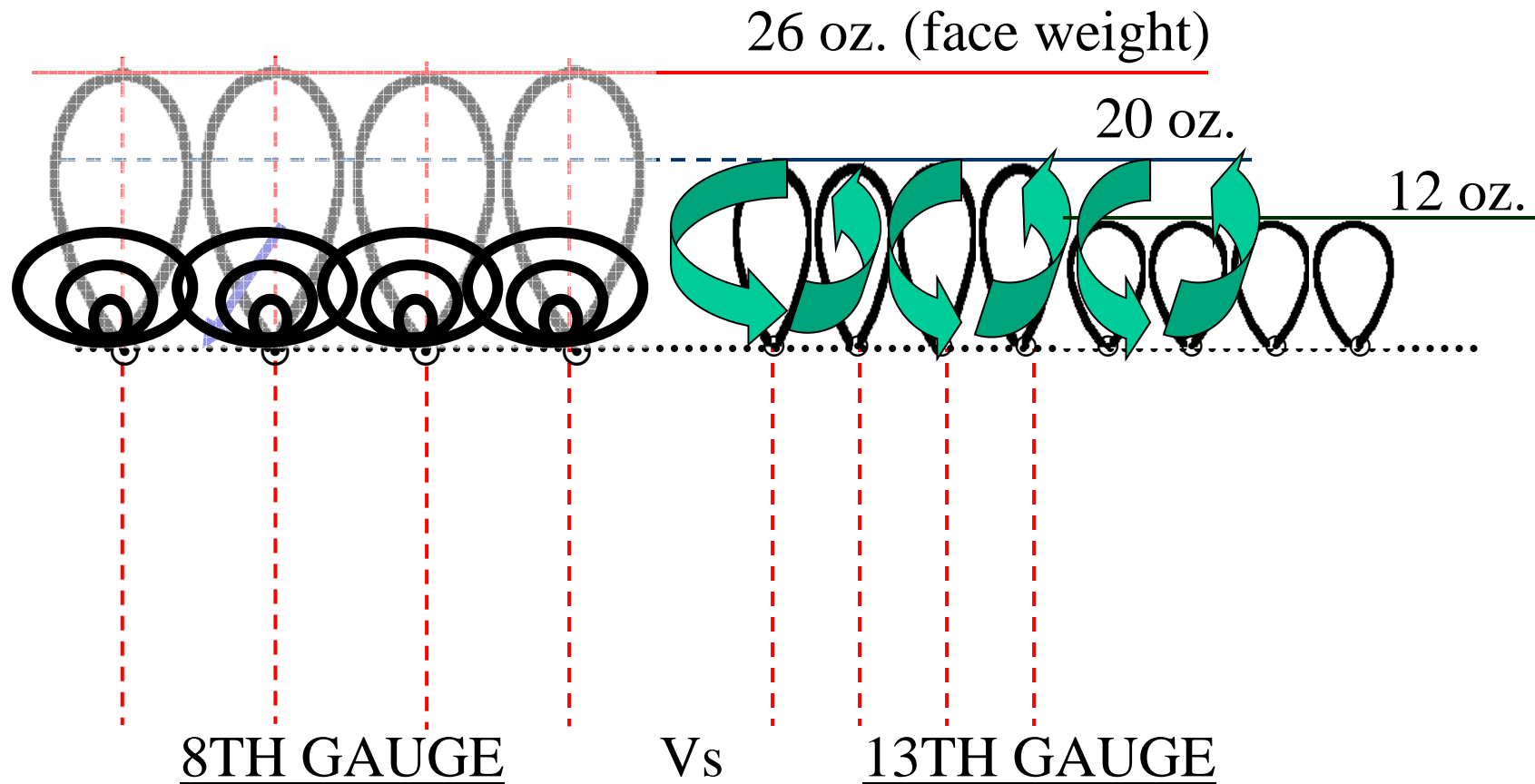
This building was designed and constructed as an active prototype for the business community. All products used in its construction have been carefully selected to create an allergen-free, chemical-free environment that provides the cleanest air possible and protects the health of all who visit it.

A prime building feature is the five-stage air filtration system, which provides heating or cooling; dehumidification to eliminate dust mites, a common allergen; ultraviolet irradiation for bacterial and viral control; and large and small particle filtration to ensure the cleanest air.

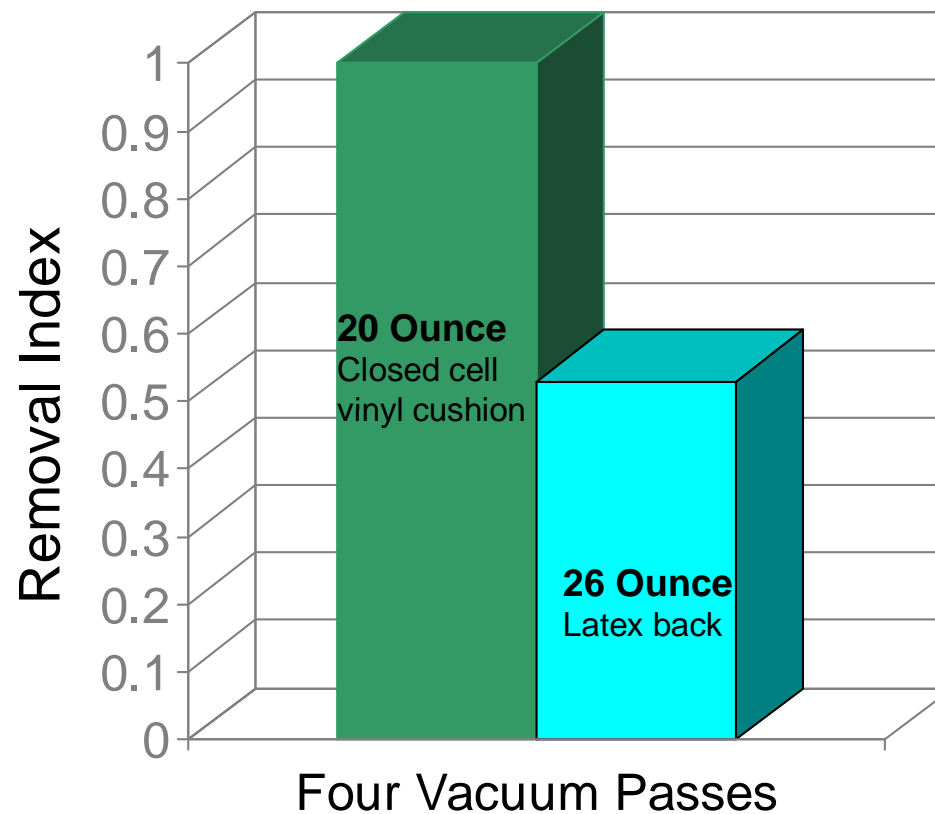
This building was designed and constructed as an active prototype for the business community. All products used in its construction have been carefully selected to create an allergen-free, chemical-free environment that provides the cleanest air possible and protects the health of all who visit it.



**Low Pile Height  
+ Low Face Weight  
= High Performance**



# Contaminant Removal Through Vacuuming



**47% better soil removal with 20 oz. Closed cell vinyl backing**

**Higher contaminant removal translates to lower biological levels and improved maintenance performance.**

## Indoor Air Quality

ONLY USE:

✓ Non-Resoiling Cleaners



No Detergent Residue



Detergent Residue

# The Total Learning Environment

Daylighting

Acoustics

Thermal

Maintenance

IAQ

## “Lessons Learned

**Product construction should be free of any seams that allow moisture and contaminants into the backing or sub-floor. Carpet tiles should never be used in schools because of the thousands of open seams, allowing for the potential of mold and mildew. Conventional flow-through broadloom carpet allows moisture and contaminants to create potential for growth of contaminants on the sub-floor.”**

*Indoor Environment Connection, Volume 4, Issue 10, August 2003*

- Is LINK ENGINEERING part of your overall evaluation of flooring?

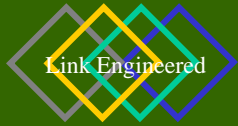
## Sustainable Design



**“The earth belongs to the living... No generation can contract debts than may be paid during the course of its own existence.”**

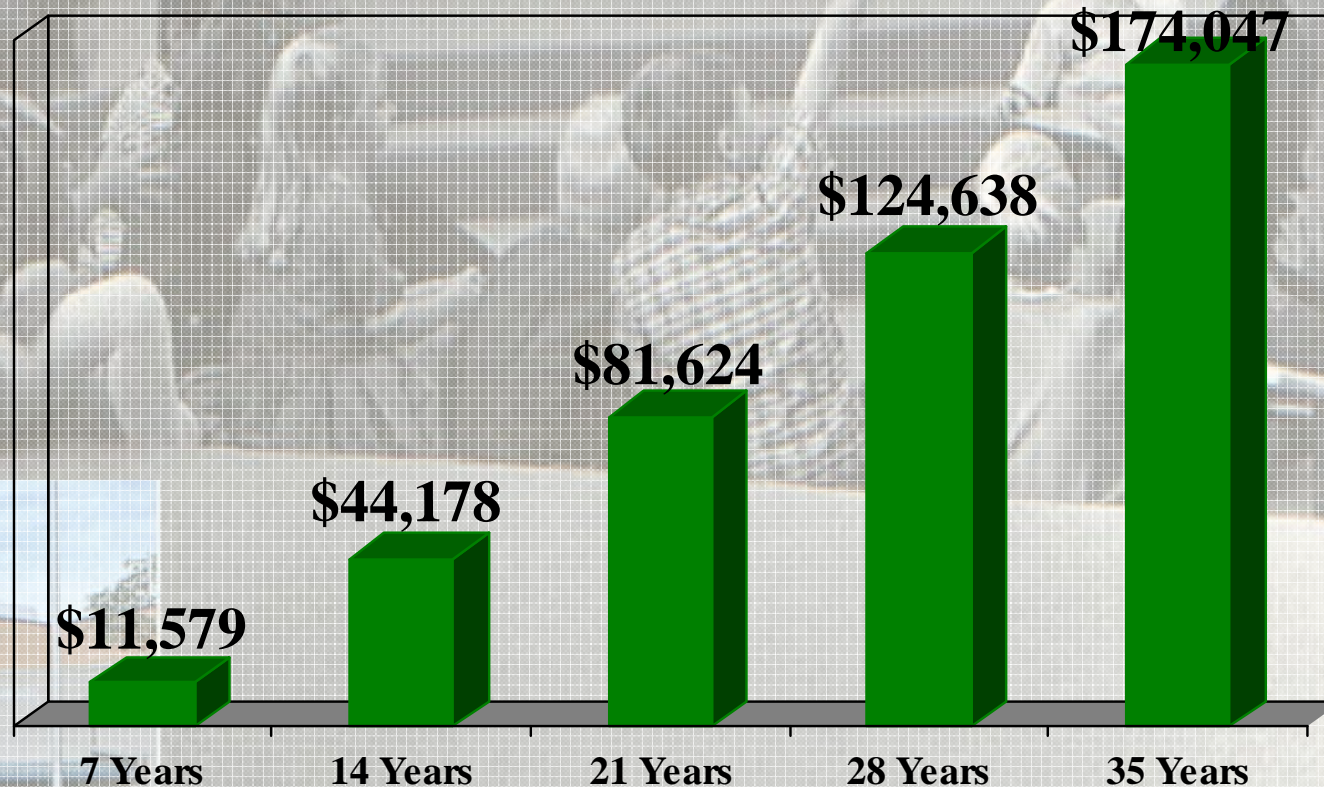
*Thomas Jefferson  
in a letter to James Madison, 1789*





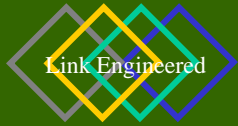
# Prospect Valley Elementary School Jefferson County School District Installed Hybrid Resilient in 1967

## Cumulated Savings



(Source: The Denver Post)

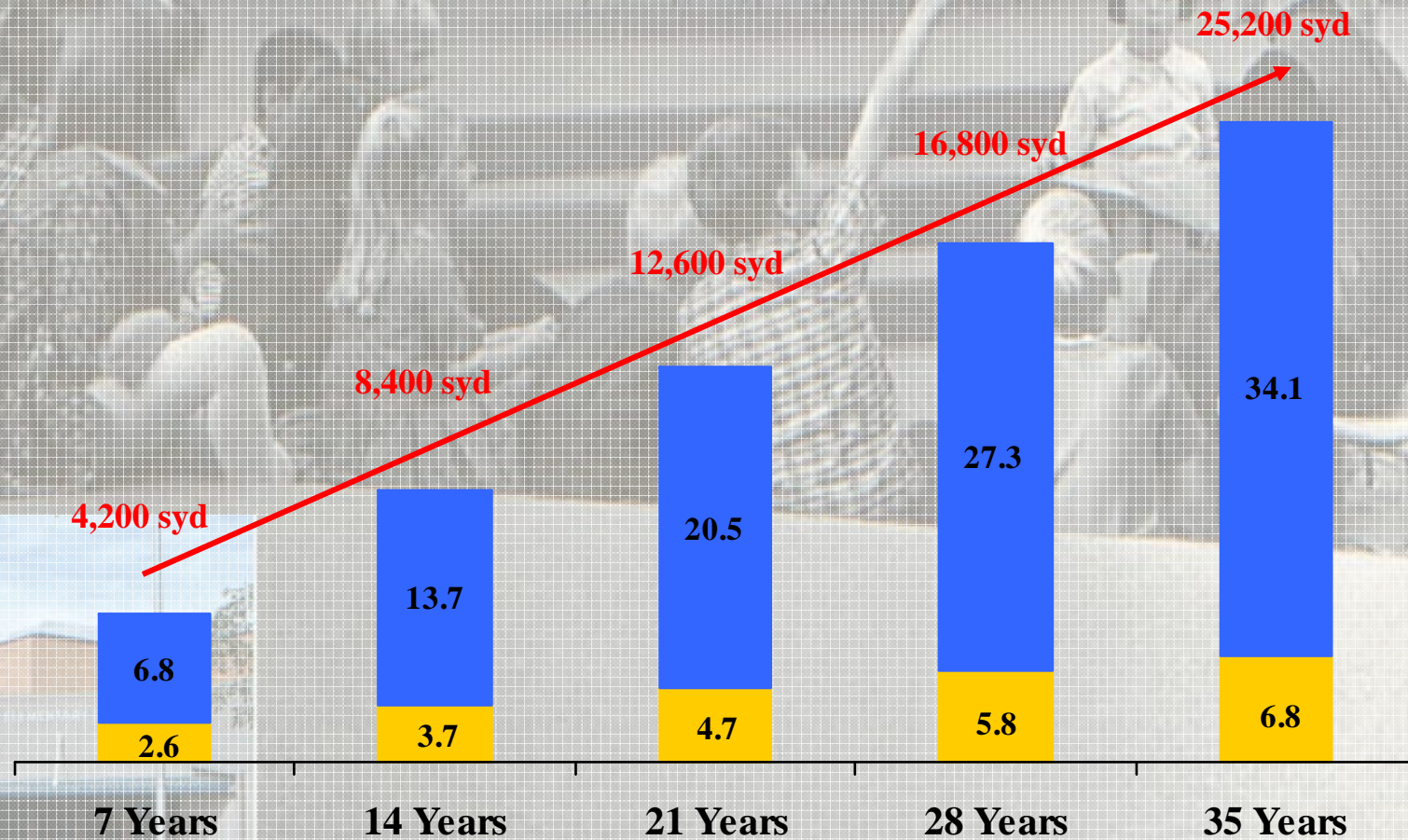




# Prospect Valley Elementary School Jefferson County School District 35 years ago ... and counting

## Material Saved From Landfills

Material in Tons



(Source: The Denver Post)



# ENVIRONMENTAL RESPONSIBILITY



## Roy Lee Walker Elementary



- Saved 3,150 lbs Nylon
- Save \$37,961/Yr Maintenance
- Save 25,200 lbs flooring
- Saved 8,400 lbs disposal
- Saved \$25,200 flooding

Mining buildings for

# RESOURCES

Instead of the Earth™

Mining buildings  
for resources  
instead of the earth



COLLINS&AIKMAN  
*floorcoverings*



# RECLAMATION



Theiss Elementary, TX  
(Installed 1981)



San Diego City S.D., CA  
(Installed 1976)



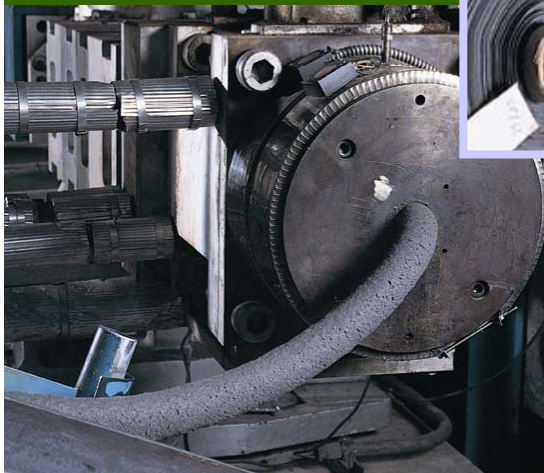
Tampa Bay Schools, FL  
(Installed 1978)







## 100% Recycled Content Backing



### CERTIFIED

#### MINIMUM 45% RECYCLED CONTENT

This Powerbond® ER3® Modular Tile product contains a minimum of 7% post-consumer recycled carpet, with the balance from post-industrial carpet and plastic.

SCIENTIFIC CERTIFICATION SYSTEMS 1-800-ECO-FACTS



# ENVIRONMENTAL IMPACT

San Diego City S.D., CA	36,000 sft / 32,000 lbs.
Maryland Public Schools, MD	69,000 sft / 52,000 lbs.
Theiss Elementary School, TX	135,000 sft / 120,00 lbs.
Tampa Bay Schools, FL	270,000 sft / 240,000 lbs.
Houston Community College, TX	360,000 sft / 320,00 lbs.



## Sustainable Design



- Life cycle cost
- Source reduction
- Appropriate Application
- Recyclable
- Recycled content
  - Meets *FTC Guidelines*
  - *Third Party Certification*



# The Total Learning Environment

Daylighting

Acoustics

Thermal

Maintenance

IAQ

Sustainable

Prospect Valley Elementary School  
Installed Hybrid Resilient

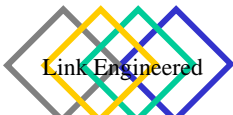
35 years ago ... and counting.



- What **SUSTAINABLE** criteria meets the needs of the application?



# Floorcovering Application Chart

			
	<b>H A R D S U R F A C E</b>	<b>V C T T</b>	<b>C A R P E T *</b>
ENTRANCES	◆	◆	◆
CORRIDORS	◆ ◆	◆ ◆ ◆	◆
CLASSROOMS	◆	◆ ◆ ◆	◆
LIBRARY	◆	◆ ◆ ◆	◆ ◆
ADMINISTRATIVE AREAS	◆	◆ ◆ ◆	◆ ◆
COMPUTER ROOMS	◆	◆ ◆ ◆	◆ ◆
SPECIAL NEEDS CLASSROOMS	◆	◆ ◆ ◆	◆
MULTI-PURPOSE ROOMS	◆ ◆	◆ ◆	◆
ART ROOMS	◆ ◆ ◆	◆ ◆	◆
SCIENCE ROOMS	◆ ◆ ◆	◆	◆
CAFETERIA	◆ ◆ ◆	◆	◆
RESTROOMS	◆ ◆ ◆	◆	◆

◆ = Poor:  
 ◆ ◆ = Good:  
 ◆ ◆ ◆ = Excellent  
 ◆ = Mat System

\*Flow through carpet



# HARD SURFACE FLOORING



## *Art and Science Classrooms*





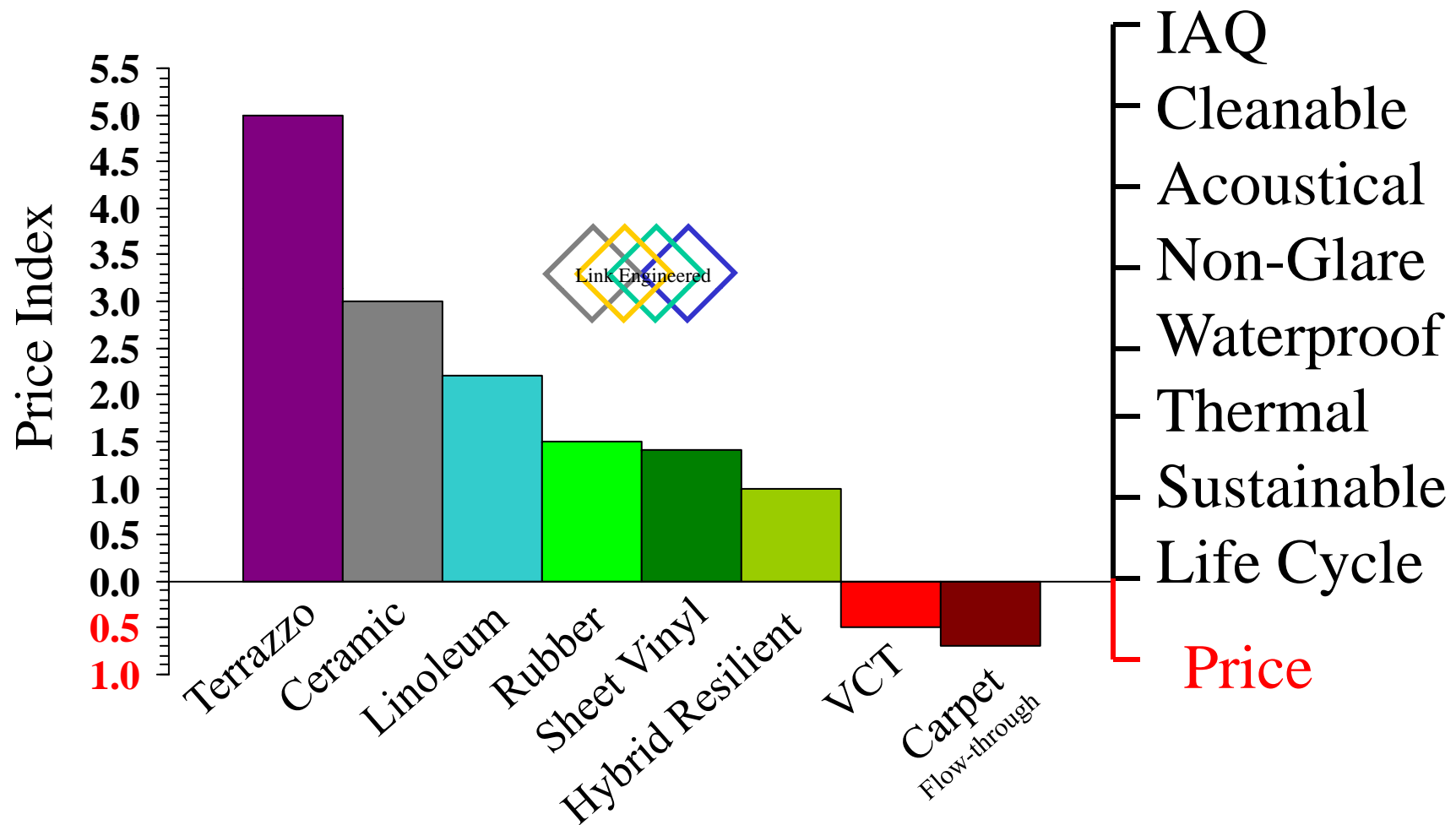


# Hybrid Resilient FLOORING



# “We are too poor to buy cheap.”

California School Superintendent



# “We are too poor to buy cheap.”

California School Superintendent

DISTRICT / CITY, STATE	Sq feet	APPROX S/Y	YEARS
Weld Co. #6/Greeley CO / Greeley, CO	7,200,000	800,000	46
Prospect Valley / Wheatridge, CO	18,000,000	2,000,000	45
Poudre Valley / Fort Collins, CO	9,000,000	1,000,000	40
Adams 50 / Westminster, CO	6,300,000	700,000	35
Pasco County Schools / New Port Richey, FL	4,320,000	480,000	32
Cy-Fair ISD / Houston, TX	4,500,000	500,000	30

# “We are too poor to buy cheap.”

California School Superintendent

DISTRICT / CITY, STATE	Sq feet	APPROX S/Y	YEARS
Hernando County Schools / Spring Hill, FL	2,700,000	300,000	30
Tacoma SD / Tacoma, WA	1,800,000	200,000	29
Tomball ISD / Tomball, TX	1,170,000	130,000	26
Citrus County Schools / Inverness, FL	1,800,000	200,000	24
Alief ISD / Houston, TX	1,800,000	200,000	22
Clear Creek ISD / Houston, TX	3,150,000	350,000	21



# “We are too poor to buy cheap.”

California School Superintendent

DISTRICT / CITY, STATE	Sq feet	APPROX S/Y	YEARS
Monroe County Schools / Forsyth, GA	225,000	25,000	20
Burlington Edison SD / Burlington, WA	450,000	50,000	20
Fort Bend ISD / Houston, TX	2,700,000	300,000	19
Lamar Consolidated ISD / Rosenberg, TX	1,800,000	200,000	19
Dickinson ISD / Dickinson, TX	1,080,000	120,000	18
Burke County Schools / Waynesboro, GA	297,000	33,000	17
Clark County School District / Las Vegas, NV	22,500,000	2,500,000	17

# “We are too poor to buy cheap.”

California School Superintendent

DISTRICT / CITY, STATE	Sq feet	APPROX S/Y	YEARS
Humble ISD / Humble, TX	1,800,000	200,000	16
Galena Park ISD / Houston, TX	1,080,000	120,000	16
Clarke County School District / Athens, GA	720,000	80,000	15
Katy ISD / Houston, TX	3,150,000	350,000	14
LaPorte ISD / LaPorte, TX	1,080,000	120,000	14
Barrow County / Winder, GA	576,000	64,000	10

Have we been trying to solve the wrong problems?

“We cannot lose sight of our clients needs,  
and we can never forget that our clients are our  
children.”

School Architect, AIA Conference

