

A Bassetti CA Group Production Presents....

EXPOSED CONCRETE FLOORS

bassetti /
architects





INTRODUCTION

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OBJECTIVES

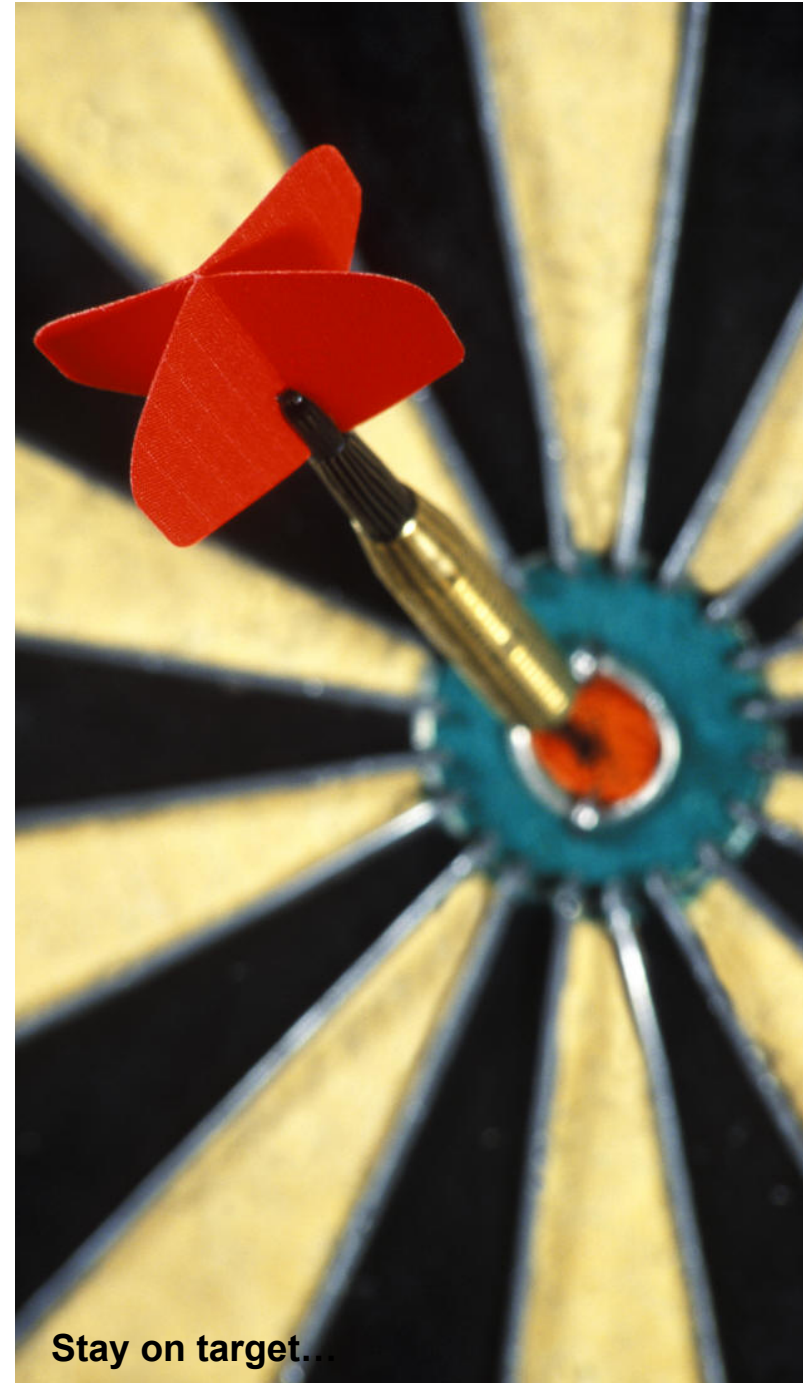
Objectives and Outline

Objectives:

- Learn the different components of concrete floor systems
- Understand objectives and concerns for floors in our buildings
- Learn the pros and cons of exposed concrete floors as opposed to other flooring systems

Outline:

- Factors in Concrete Floor Design
- Survey Results on Concrete Floors
- Bassetti Projects with Concrete Floors
- Conclusions



Stay on target...

I was walking down the street one day....

Factors in Concrete Floor Design

Benefits of Concrete Floors

- Hard
- Insta-floor!
- Inexpensive
- Durable
- Beautiful
- Low maintenance
- Healthy
- Sustainable
- Can be covered later!



Acid stained and sealed concrete floor

Challenges of Concrete Floors

- Slab curl
- FF/FL Tolerances
- Smoothness
- SOMD sag
- Rain damage
- Contractor damage
- Cracking (structural and shrinkage)
- Rock pockets and voids
- Form & floor protection stains
- Items cast into concrete (drains, electrical boxes, etc.)



Rain damaged concrete floor

Sustainability & Concrete Floors

- Acoustics
- Building Reuse
- Cleanability
- Disaster Resistance
- Durability
- Energy Performance
- Heat Island Reduction (reflects heat?)
- Indoor Air Quality
- Life Cycle Balance
- Lighting Efficiency
- Locally Produced
- Minimize Site Disruption (on-site storage)
- Recyclable Material
- Recycled Content
- Resource Efficient
- Site Remediation (Contaminant Solidification/ Stabilization)
- Stewardship of Environment
- Stormwater Management (Pervious Concrete and stormwater catchment/piping)
- Thermal Mass

Source: <http://www.concretethinker.com/> (Portland Cement Association)



Textured Green Concrete

Sustainability & Concrete Floors

Leslie Struble and Jonathan Godfrey: HOW SUSTAINABLE IS CONCRETE?

- Based on calculations using ATHENA, "... concrete has less environmental impact than steel when compared in structures designed for the same engineering function..."
 - Impact
 - Resource use (kg)
 - Warming potential
 - Water pollution index
 - Air pollution index
 - Solid waste (kg)
 - Energy (MJ)
- | | Concrete | Steel |
|-----------------------|----------|--------|
| (kg equivalent CO2) | | |
| Water pollution index | 0.34 | 0.98 |
| Air pollution index | 2.01 | 2.46 |
| Solid waste (kg) | 1.87 | 1.80 |
| Energy (MJ) | 140.18 | 229.69 |

International Workshop on Sustainable Development and Concrete Technology, Beijing, China, May 20–21, 2004



St. Patrick's Day? No – Green Concrete!

Costs of Concrete Floors - SOMD

Slab on Metal Deck (SOMD)	High cost system	Unit Cost	Units	Low cost system	Unit Cost	Units
Girder Size:	W21x62 @ 29' o.c.	\$ 3,000.00	ton	W16x31 w/ 1" camber @ 30' o.c.	\$3,000.00	ton
Beam Size/Spacing/camber:	W16x26 w/ 1" camber @ 9'-8" o.c.	\$ 3,000.00	ton	W14x22 w/ 1" camber @ 10' o.c.	\$3,000.00	ton
Metal Deck thickness/gauge:	3" x 18 GA	\$ 3.85	SF	2" x ? GA	\$ 3.00	SF
Concrete thickness/strength:	6" total thk @ 4000 PSI	\$ 3.25	SF	4" total thk @ 3000 PSI	\$ 2.75	SF
Reinforcing:	Fiber Mesh @ 1.5 lbs/CY + 6x6 W1.4xW1.4 mesh	\$ 0.75	SF	6x6 W1.4xW1.4 mesh	\$ 0.45	SF
Coloring:	Integral Color (Liquid)	\$ 1.25	SF	No color	\$ -	SF
	Lamp Black	\$ 1.25	SF			
	Acid Stain	\$ 1.50	SF			
	Water Based Stain	\$ 1.00	SF			
Finish	Steel Troweled	\$ 0.75	SF	Broom Finish	\$ 0.20	SF
	Stamped-no color	\$ 1.75	SF			
	Retroplate-no color	\$ 2.50	SF			
SOMD TOTAL COST (including structural steel)	High cost	\$ 24.00	SF	Low Cost	\$ 18.00	SF

Costs of Concrete Floors - SOG

Slab on Grade (SOG)	High cost system	Unit Cost	Units	Low cost system	Unit Cost	Units
Subgrade:	4" gravel over compacted subgrade	\$ 16.00	CY	4" gravel over compacted subgrade	\$ 16.00	CY
Slab thickness:	4: thk	\$ 255.00	CY	4: thk	\$ 255.00	CY
Configuration (thickened edge or flat slab)	Thickened slab edge	\$ 150.00	LF	Thickened slab edge	\$ 150.00	LF
Control Joint/Expansion Joint spacing:	15' o.c. max	\$ 0.60	LF	15' o.c. max	\$ 0.60	LF
Reinforcing:	Fiber Mesh @ 1.5 lbs/CY + 6x6 W1.4xW1.4 mesh	\$ 0.85	sf	6x6 W1.4xW1.4 mesh	\$ 0.45	sf
Coloring:	Integral Color (Liquid)	\$ 1.25	SF	No color	\$ -	SF
	Lamp Black	\$ 1.25	SF			
	Acid Stain	\$ 1.50	SF			
	Water Based Stain	\$ 1.00	SF			
Finish:	Steel Troweled	\$ 0.75	SF	Broom Finish	\$ 0.20	SF
	Stamped-no color	\$ 1.75	SF			
	Retroplate-no color	\$ 2.50	SF			
4" SOG TOTAL COST	High cost	\$ 5.00	SF	Low Cost	\$ 4.50	SF

Alternatives to Concrete Floors

- Quarry/ceramic/porcelain tile (\$4.75 to \$6/sf)
- Stone (varies widely)
- Slate flooring (\$7/sf – material)
- Epoxy (thin) terrazzo (\$13/sf)
- Fritztile (\$7 to \$9/sf)
- Linoleum (\$4.75/sf)
- Rat slab/finish slab (\$6 to \$7/sf)
- Rubber (recycled/tile/sheet) (\$6 to \$8/sf)
- Cork (\$6.75/sf)
- Hardwood (\$6.75/sf for maple)
- Carpet (\$3 to \$3.50/sf)
- VCT (\$1.25/sf)
- Vinyl sheet (\$3.75/sf)
- Epoxy (\$10 to \$12/sf)
- Cementitious Overlay (Ardex) (\$11 to \$14/sf)
- Deco pour



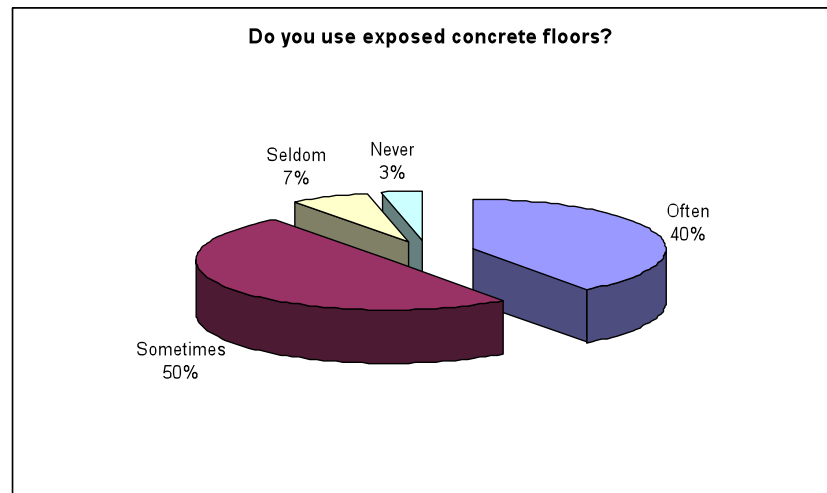
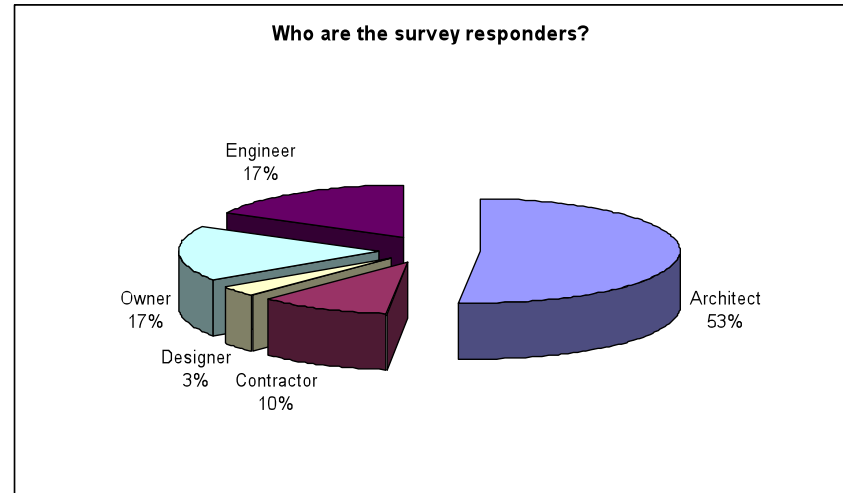
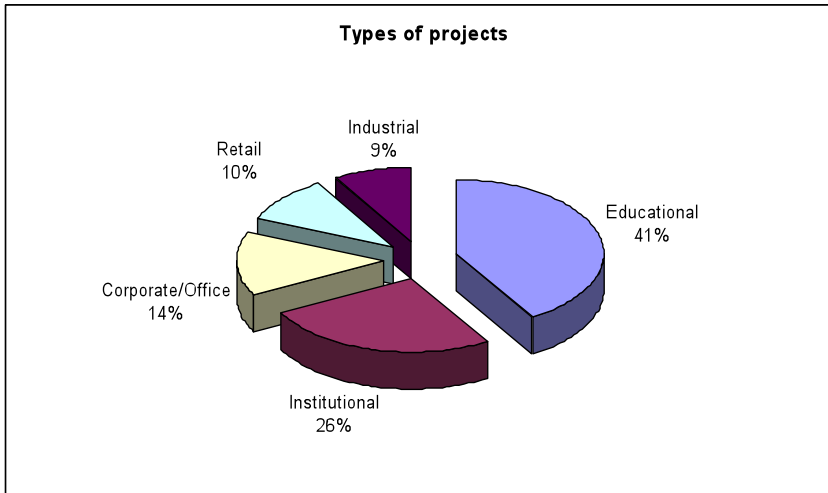
Confetti terrazzo

What did the fish say when he hit a concrete wall?

"Dam".

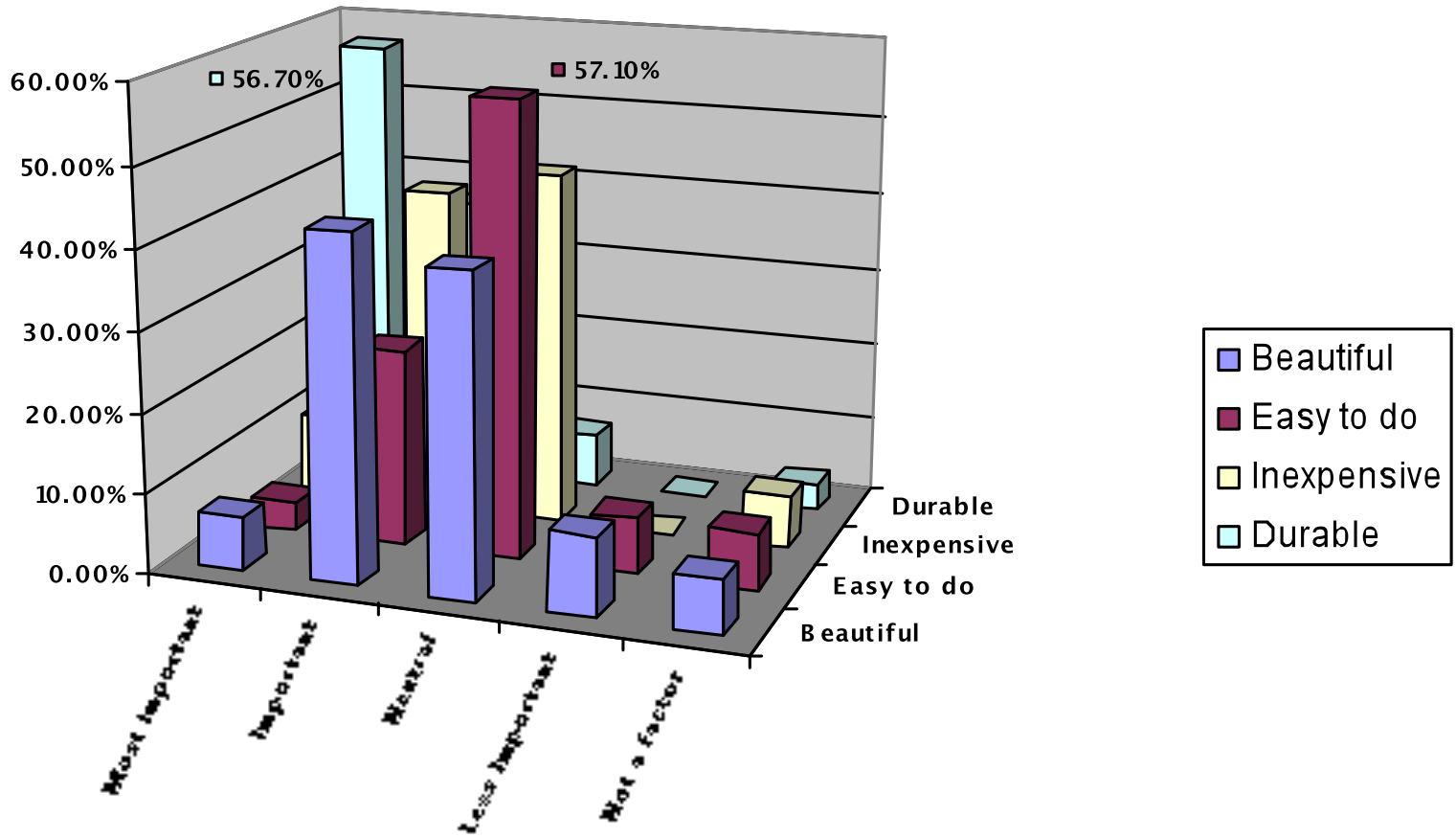
Concrete Survey – What do you think?

Survey Says!



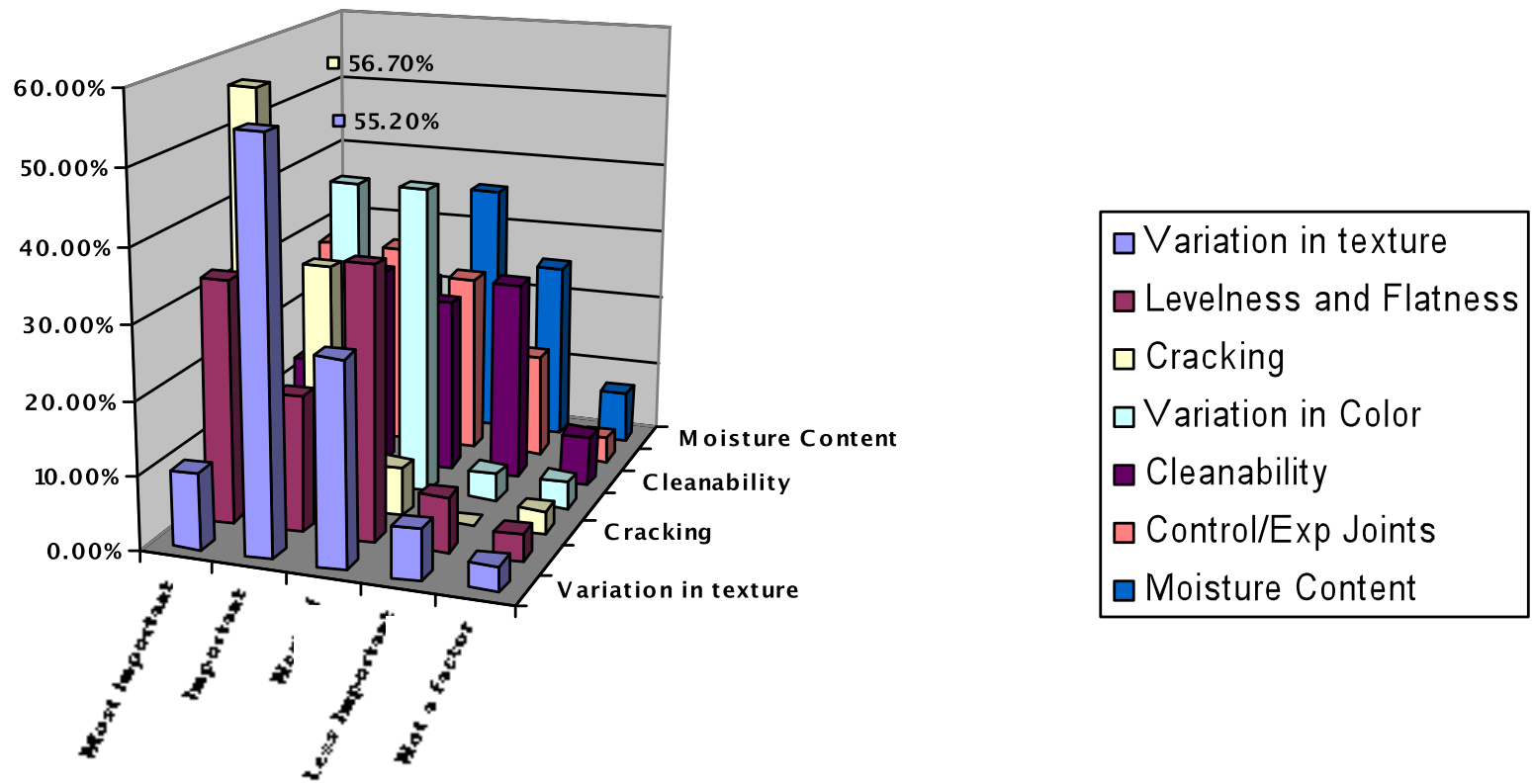
Survey Says!

Top benefits of exposed concrete floors

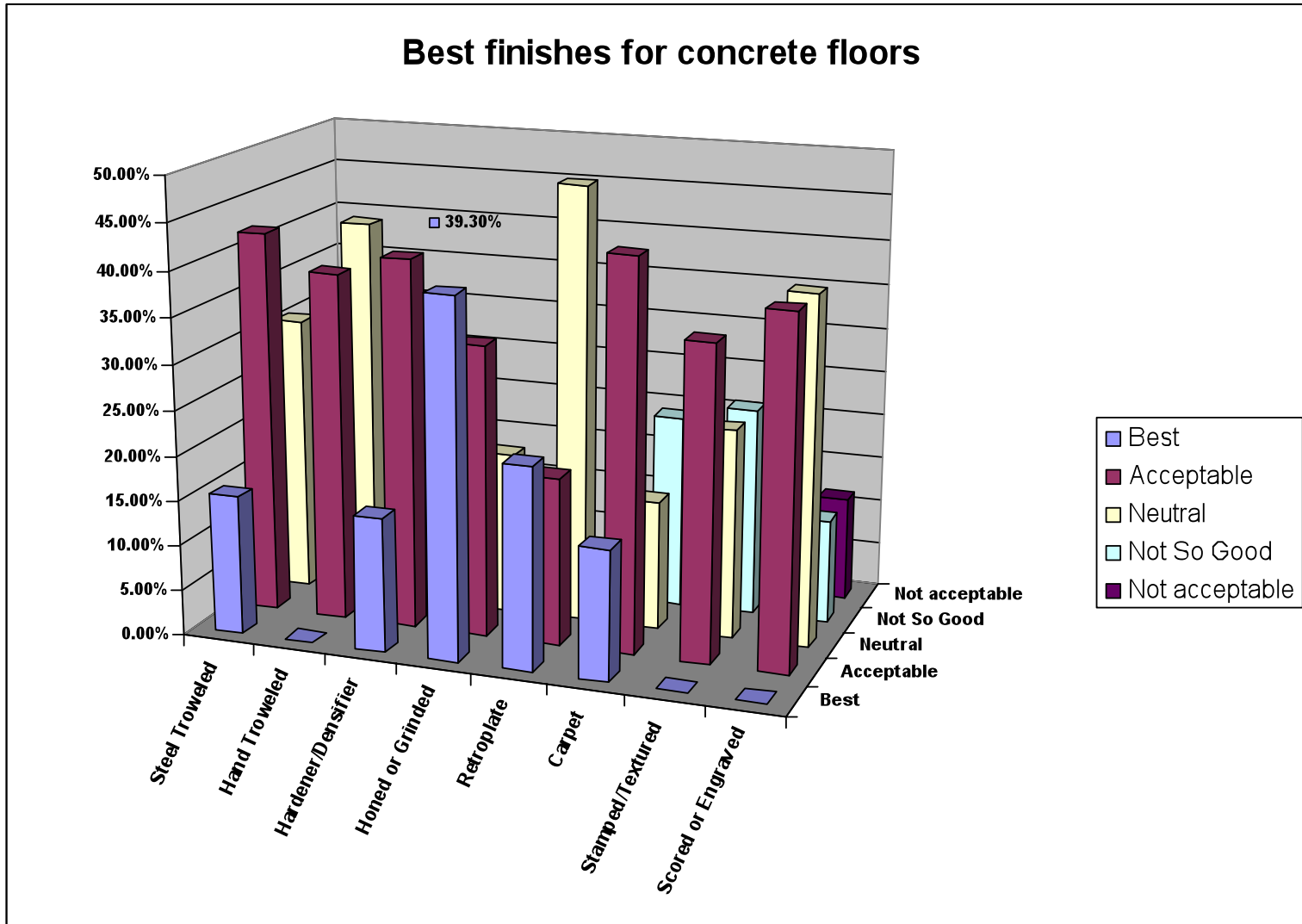


Survey Says!

Biggest Problems with exposed concrete floors

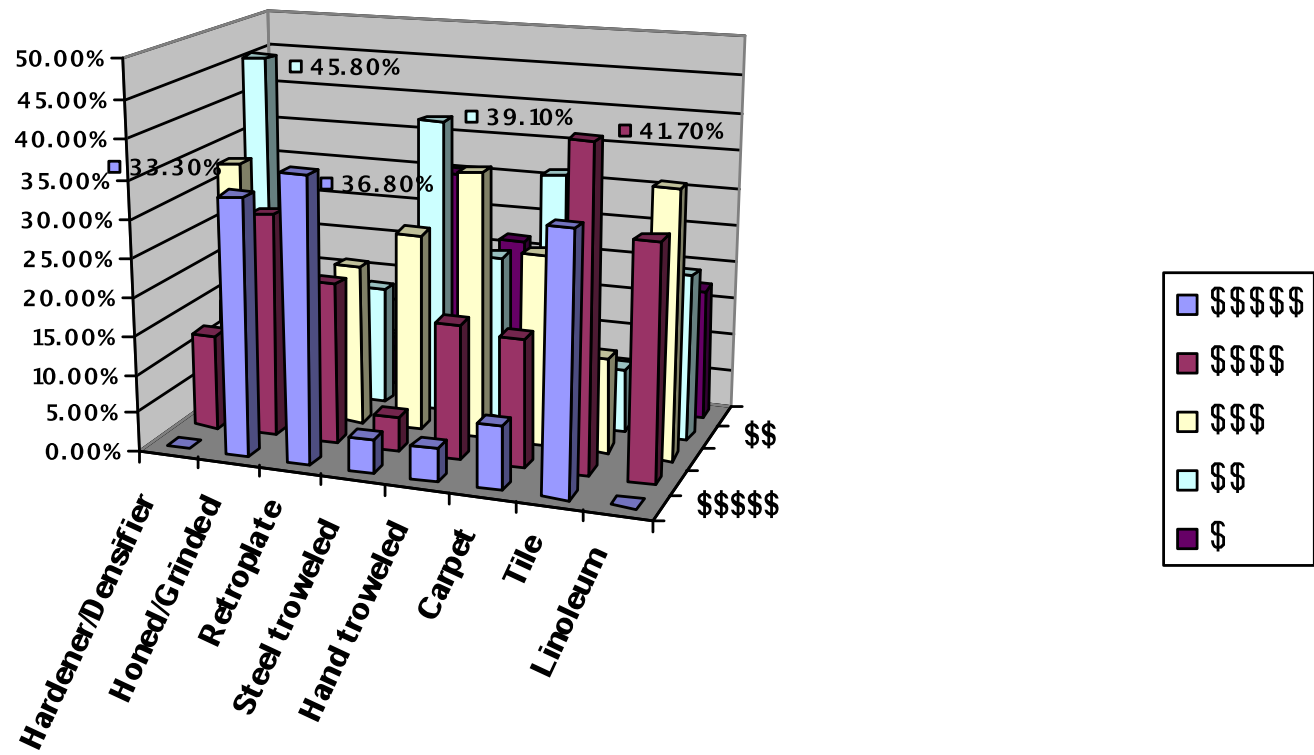


Survey Says!

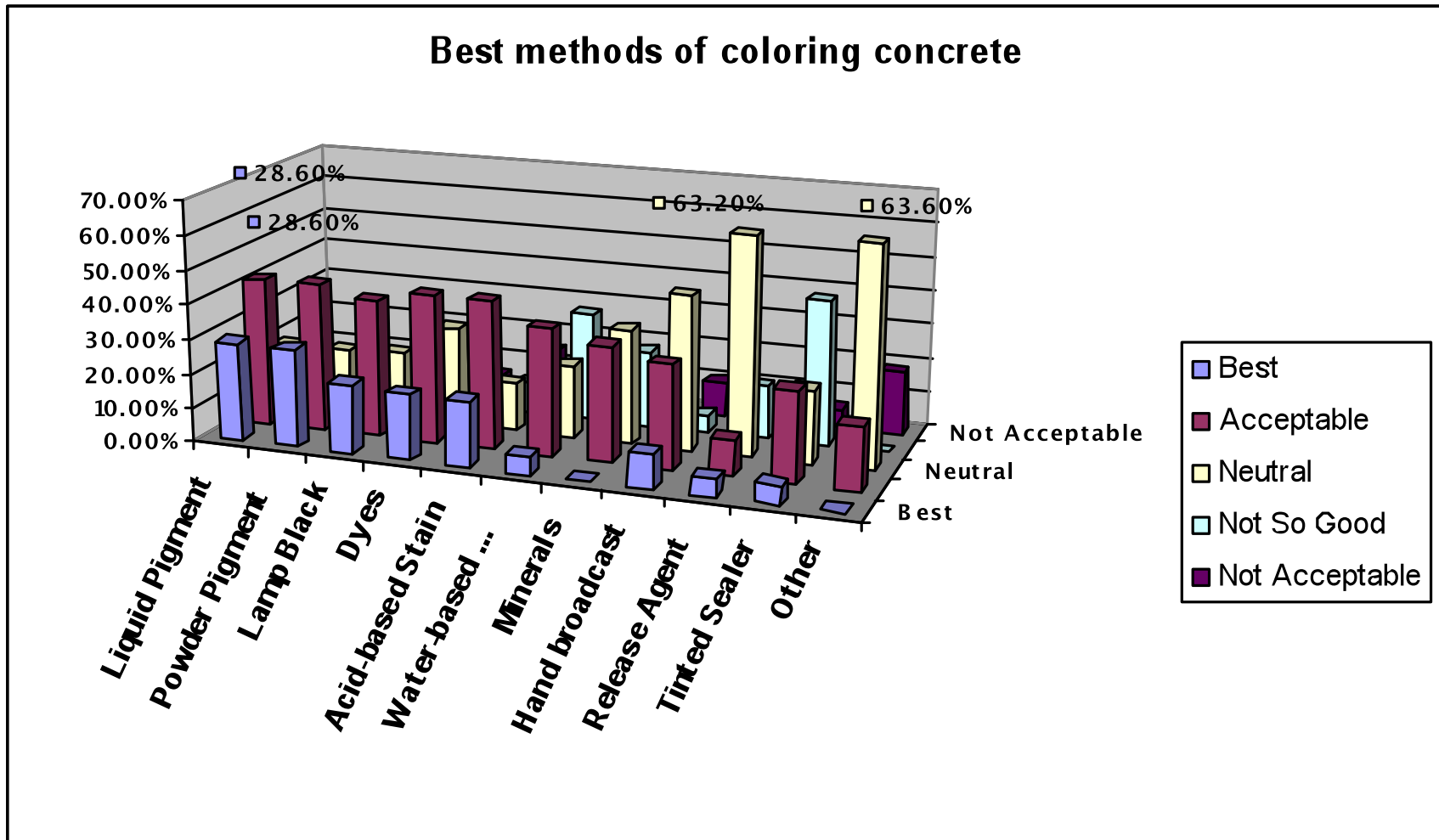


Survey Says!

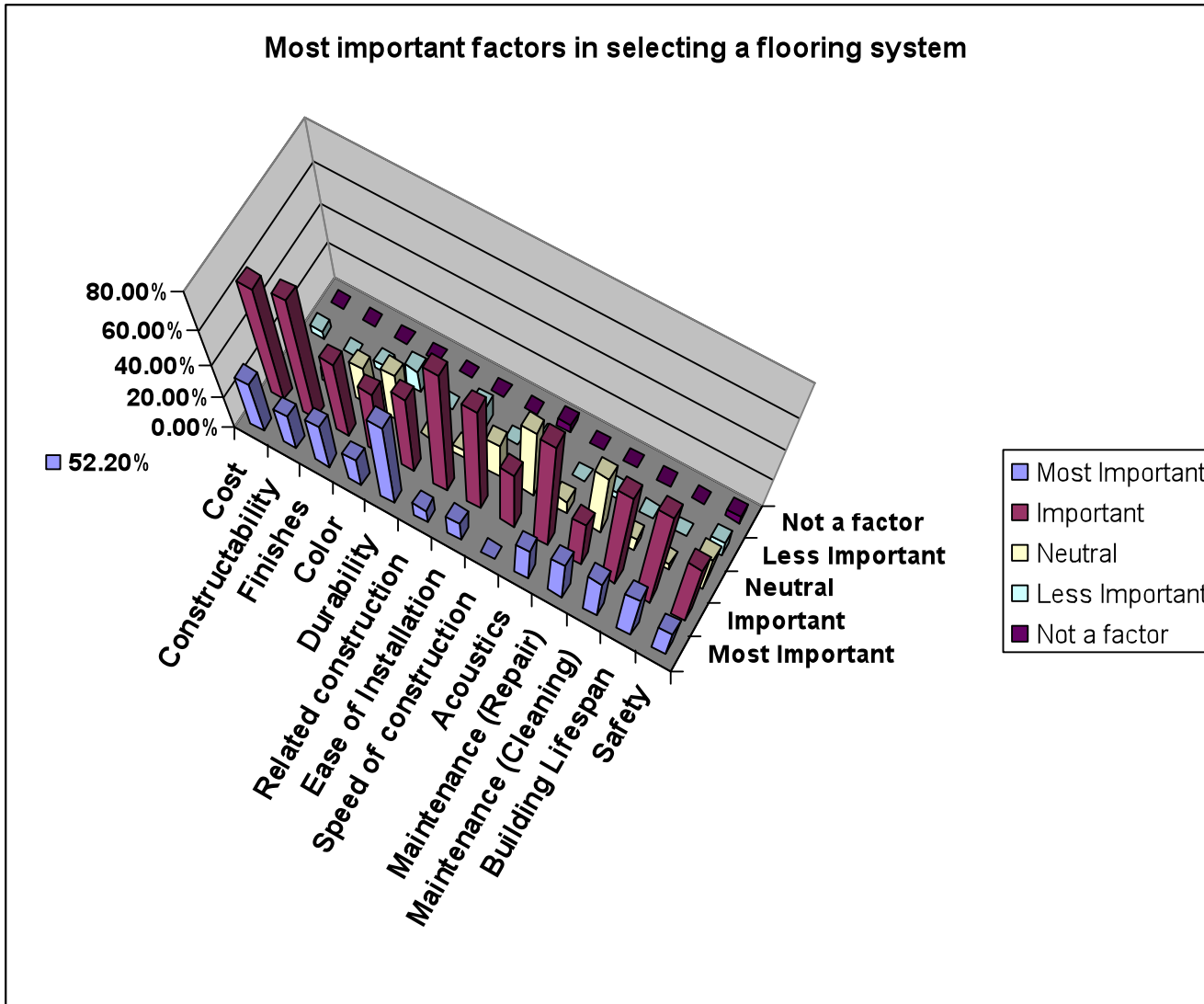
Relative costs of concrete finishes



Survey Says!



Survey Says!



Q. How can you drop a raw egg onto a concrete floor without cracking it?

A. Concrete floors are very hard to crack!

Bassetti Projects

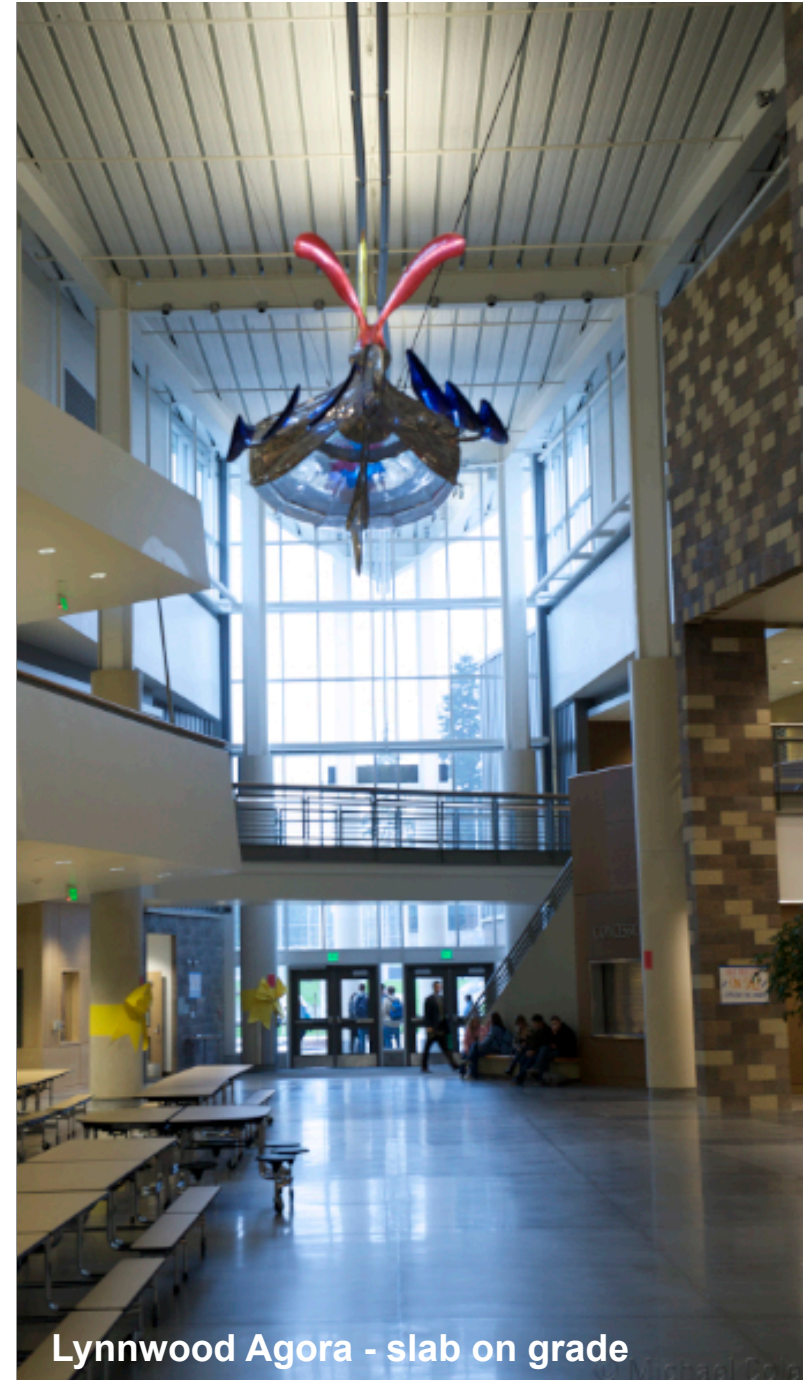
Lynnwood High School (Tom)

Slab on Grade (SOG) for polished concrete

- Subgrade: compacted on site soils or imported soil
- Slab thickness: 5"
- Configuration: varies – grade beams, flat slab and thickened edge
- Control/Expansion Jts: approx. 12 feet by 12 feet
- Reinforcing: Some 12 x 12 number 4 rebar, mostly fiber mesh
- Coloring: natural and shades of lamp black
- Finish: polished concrete

Slab on Grade (SOG) for exposed concrete

- Subgrade: compacted on site soils or imported soil
- Slab thickness: 4 inches
- Configuration: varies – grade beams, flat slab and thickened edge
- Control/Exp Jts: CJ varies 8 to 12 feet
- Reinforcing: fiber mesh
- Coloring: natural
- Finish: steel trowel



Lynnwood Agora - slab on grade

Lynnwood High School (Tom)

SOMD for polished concrete

- Structural Bay: varies from 6 to 10 feet
- Girder Size: varies
- Beam Size/Spacing/camber: beam sizes vary; camber varies from 0 to 1-1/4 inch
- Metal Deck thickness/gauge: 3" @ 20 ga
- Concrete thickness/strength: 6" @ 4,000 psi
- Topping Slab: not applicable
- Reinforcing: WWF 6x6 W4XW4 plus fiber mesh
- Control/Exp Jts: none
- Coloring: none
- Finish: polished concrete

SOMD for exposed concrete

- Structural Bay: 10 feet x ?
- Girder Size: W24 x 62 with c=1-1/4"
- Beam Size/Spacing/camber: W12x22 with c=5/8"
- Metal Deck thickness/gauge: 3" @ 20 ga
- Concrete thickness/strength: 6" total @ 4,000 psi
- Topping Slab: not applicable
- Reinforcing: WWF 6x6 W4XW4 plus fiber mesh
- Control/Exp Jts: none
- Coloring: none
- Finish steel troweled

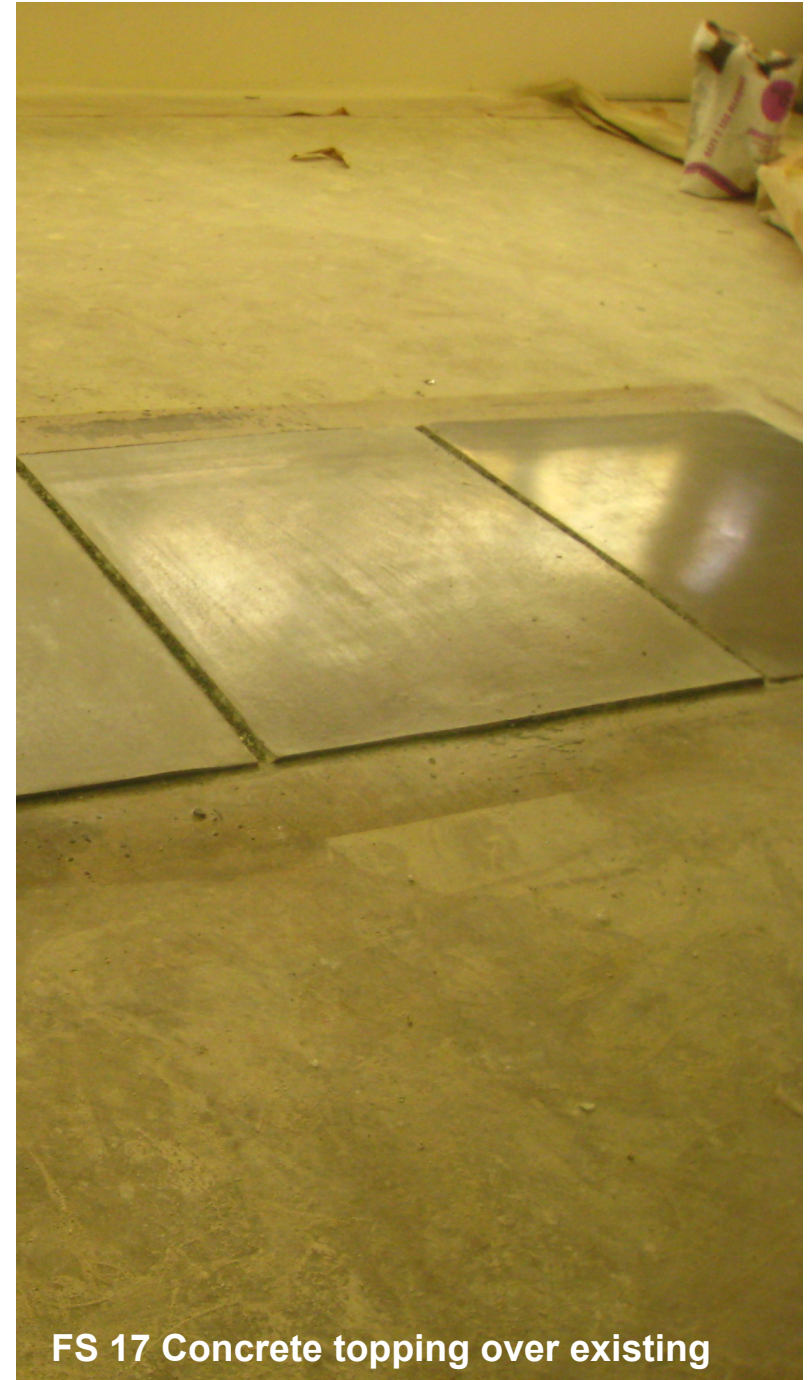


Lynnwood SOMD pour in progress!

Fire Station 17 (Don)

Concrete topping over existing slabs

Polish, hone, and ???



FS 17 Concrete topping over existing

St. Thomas (Kristian)

Slab on Grade (SOG)

- Subgrade: crushed rock
- Thickness: 4" @ 4000 psi
- Configuration: flat slab doveled @ edges
- Control/Exp Jts: approx 12'-0" o.c. each way
- Reinforcing: Fiber mesh
- Coloring: Water based dye
- Finish: Polished

Slab On Metal Deck SOMD

- Structural Bay: varies - approx. 35'-0" x 35'-0"
- Girders: W18x40 @ 33'-5" max
- Beam: W16x31 w/ 3/4" camber @ 7'-0" typ.
- Metal Deck: 2" @ 20 ga
- Thickness/strength: 4 1/2" or 5 1/2" total @ 4000 psi
- Topping Slab: none
- Reinforcing: 6x6 W1.4xW1.4 mesh
- Control/Exp Jts: none
- Coloring: Water based dye
- Finish: Polished



Polished Concrete at Donor Wall

First United (Lindsay)

Slab on Grade (SOG)

- Subgrade: 6" crushed rock
- Thickness: 4" @ 4000 psi
- Configuration: Flat slab
- Control/Exp Jts:
- Reinforcing: 6x6 W1.4xW1.4 mesh
- Coloring:
- Finish: Topping slab

Slab On Metal Deck SOMD

- Structural Bay: 24'-7" x 30'-4" max
- Girders: W21x50 w/ 0" camber @ 27'-4"
- Beam: W14x30 w/ 1/2" camber @ 8'3" o.c. max
- Metal Deck: 2" x 20 ga
- Thickness/strength: 4 1/2" total @ 4000 psi
- Topping Slab:
- Reinforcing: 6x6 W1.4xW1.4 mesh
- Control/Exp Jts:
- Coloring:
- Finish: Polished/Retroplate



FUMC SOMD at Narthex

Lakota Middle School (Brian)

Slab on Grade (SOG)

- Subgrade: 4" crushed rock
- Thickness: 4"
- Configuration: Thickened Slab Edge
- Control/Exp Jts: 15' o.c. max
- Reinforcing: Fiber Mesh @ 1.5 lbs/CY + 6x6 W1.4xW1.4 mesh
- Coloring: Integral Liquid Pigment (BASF)
- Finish: Steel troweled/exposed

Slab On Metal Deck SOMD

- Structural Bay: 29'x29'
- Girders: W21x62 @ 29' o.c.
- Beam: W16x26 w/ 1" camber @ 9'-8" o.c.
- Metal Deck: 3" x 18 ga
- Thickness/strength: 6" total @ 4000 PSI
- Topping Slab: None
- Reinforcing: Fiber Mesh @ 1.5 lbs/CY + 6x6 W1.4xW1.4 mesh + comp. slab rebar
- Control/Exp Jts: None allowed
- Coloring: Integral Liquid Pigment (BASF)
- Finish: Steel troweled/exposed



Lakota - concrete slab prior to pour

Renton Park Elementary (Brian)

Slab on Grade (SOG)

- Subgrade: 4" crushed rock
- Thickness: 4"
- Configuration: Thickened slab edge
- Control/Exp Jts: 400 SF max
- Reinforcing: 6x6 W1.4xW1.4
- Coloring: None
- Finish: Steel troweled (carpet)

Slab On Metal Deck SOMD

- Structural Bay: 30'x30'
- Girders: W16x31 w/ 1" camber @ 30' o.c.
- Beam: W14x22 w/ 1" camber @ 10' o.c.
- Metal Deck: 2" x ?? ga
- Thickness/strength: 4" total @ 3000 psi
- Topping Slab: None
- Reinforcing: 6x6 W1.4xW1.4
- Control/Exp Jts: ?
- Coloring: None
- Finish: Steel troweled (carpet)



SOG pour in action

Q: What do have when a lawyer is buried up to his neck in wet cement?

A: Not enough cement.

For Further Reading

For Further Reading

- Bob Harris' Guide to Concrete Overlays and Toppings
- ACI Manual (See David)
- Master Spec Coordination Documents

- <http://concreteconstruction.net/>
- <http://www.concretenetwork.com>
- <http://www.cement.org/>
- <http://www.aci-int.org/>
- <http://www.pci.org>
- <http://www.archprecast.org>
- <http://www.ntma.com>
- <http://www.csinet.org>

- Bassetti Master Specifications

Photo Caption Text

Q: What do you get if you cross a chicken with a cement mixer?

A: A brick layer!

Thank you!