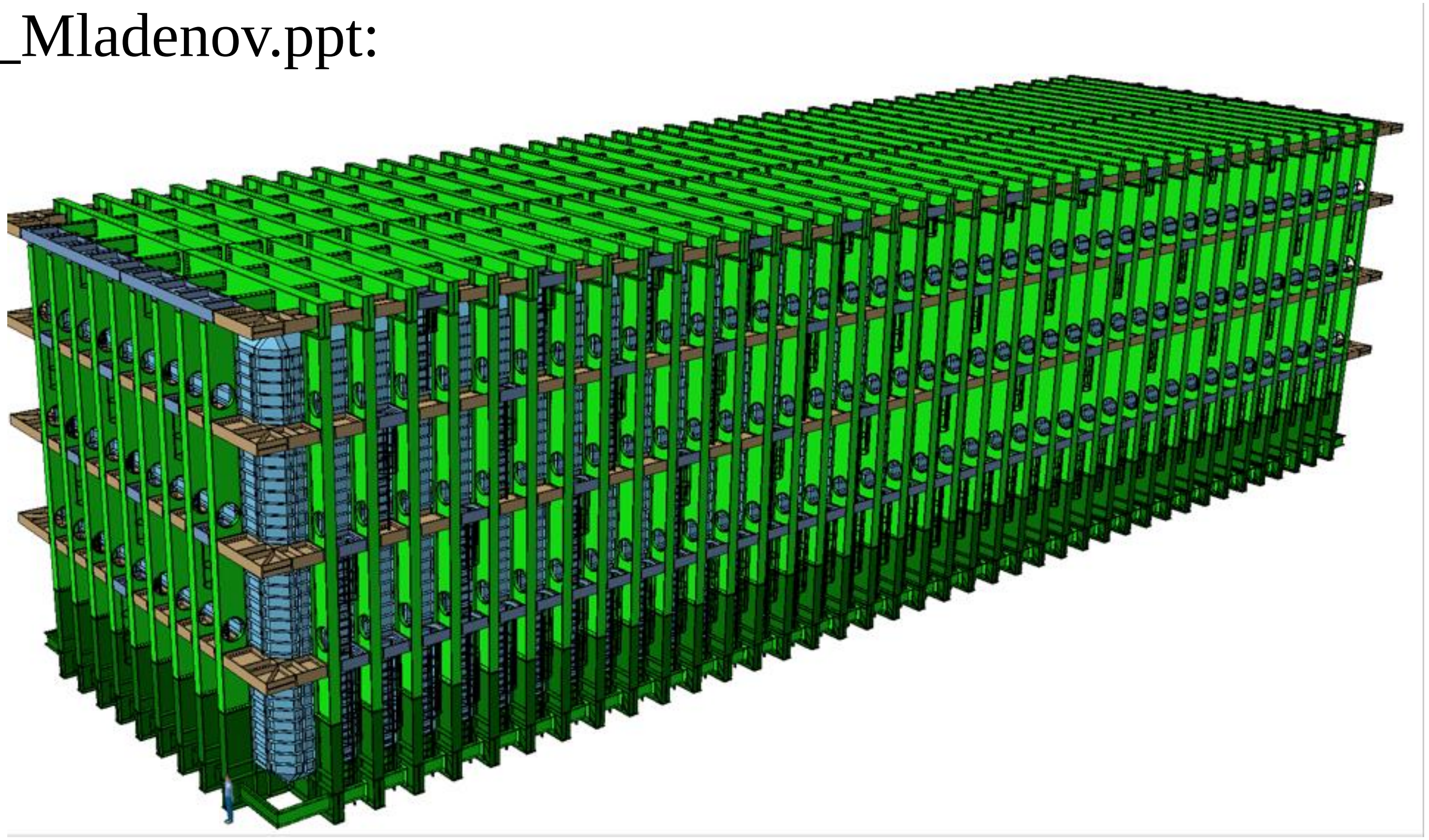
Structural Discussion

Topics for Discussion

- Point Loadings from Detector on Slabs – load spread requirements
- Non-Conductive Slabs
- Slab Flatness

Point Loadings on Slab

02-02-30-LBNF_Floor_Mladenov.ppt:



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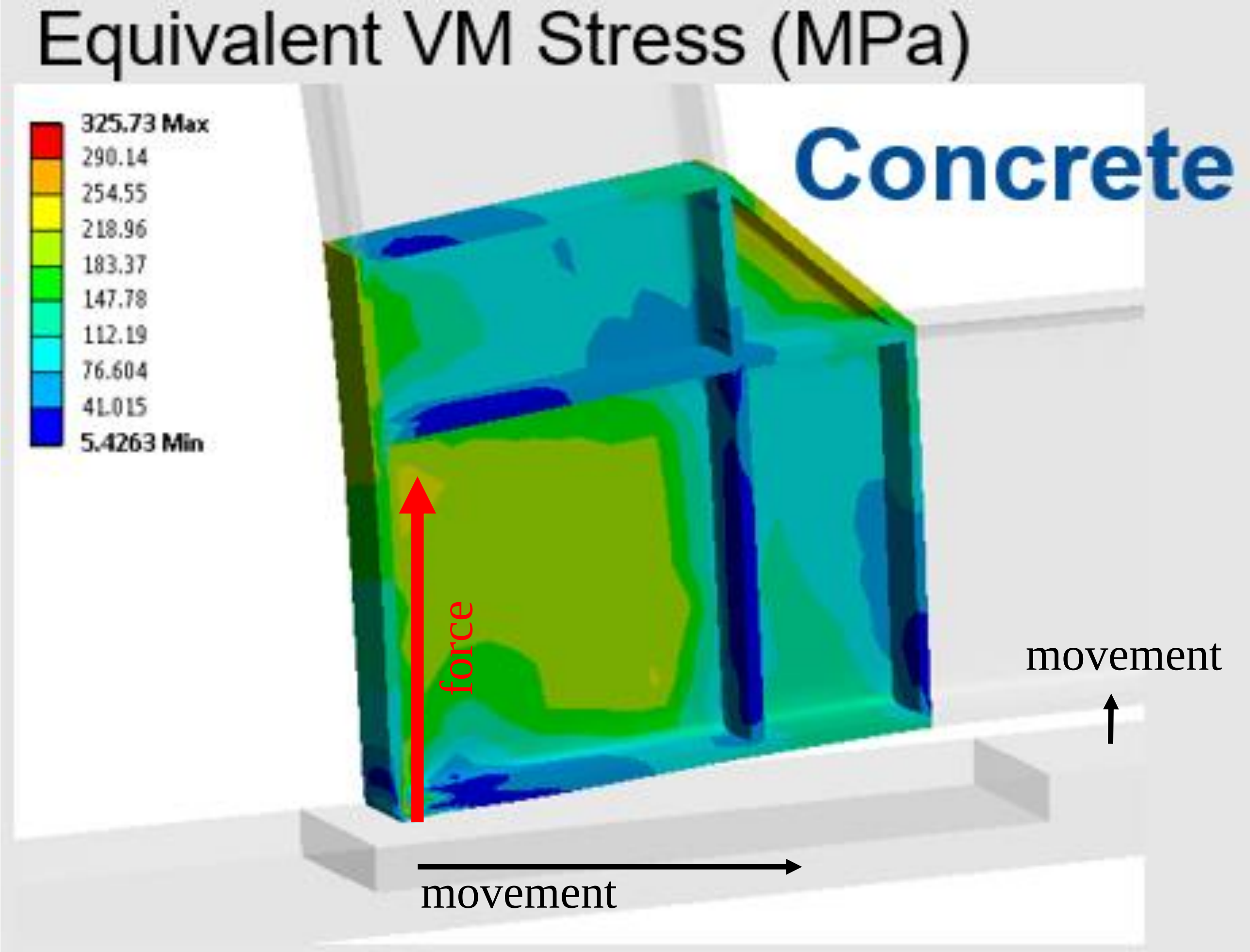
Point Loadings on Slab

Rotation of Frame:

Vertical Floor Reaction at the Corner ~1.86MN



Point Loadings on Slab

Concentration of Load on Slab:

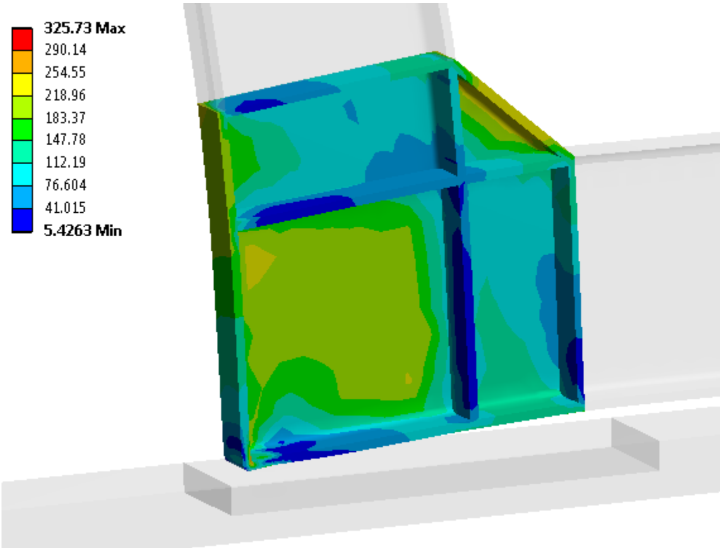
Estimated Concrete Stress

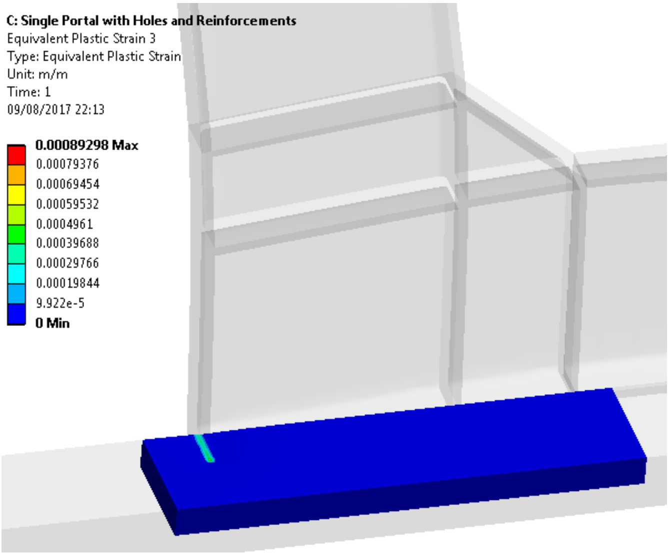
185N/mm^2 (27,000psi)

cf allowable approx. 4,000psi

We need approx. 200mm x 400mm contact area

We need some effective way to reduce concentration of stress





Assumed 402mm x 25mm contact surface

Point Loadings on Slab

Point Loading Support Details – Rocker Bearings

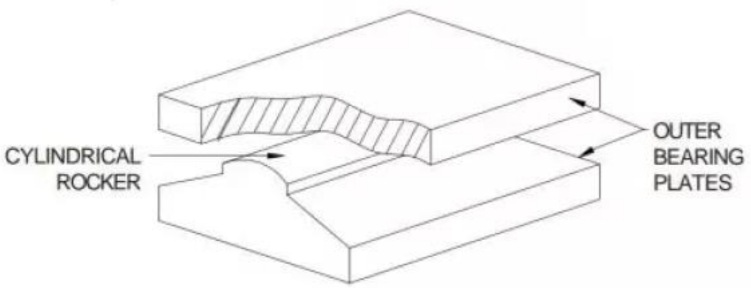


FIG. 1.7 LINEAR ROCKER BEARING

a) Linear rocker bearing

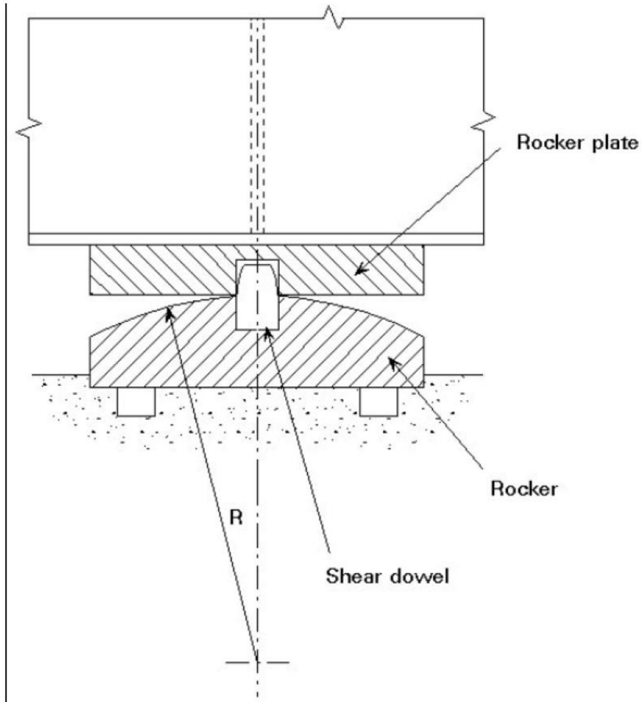
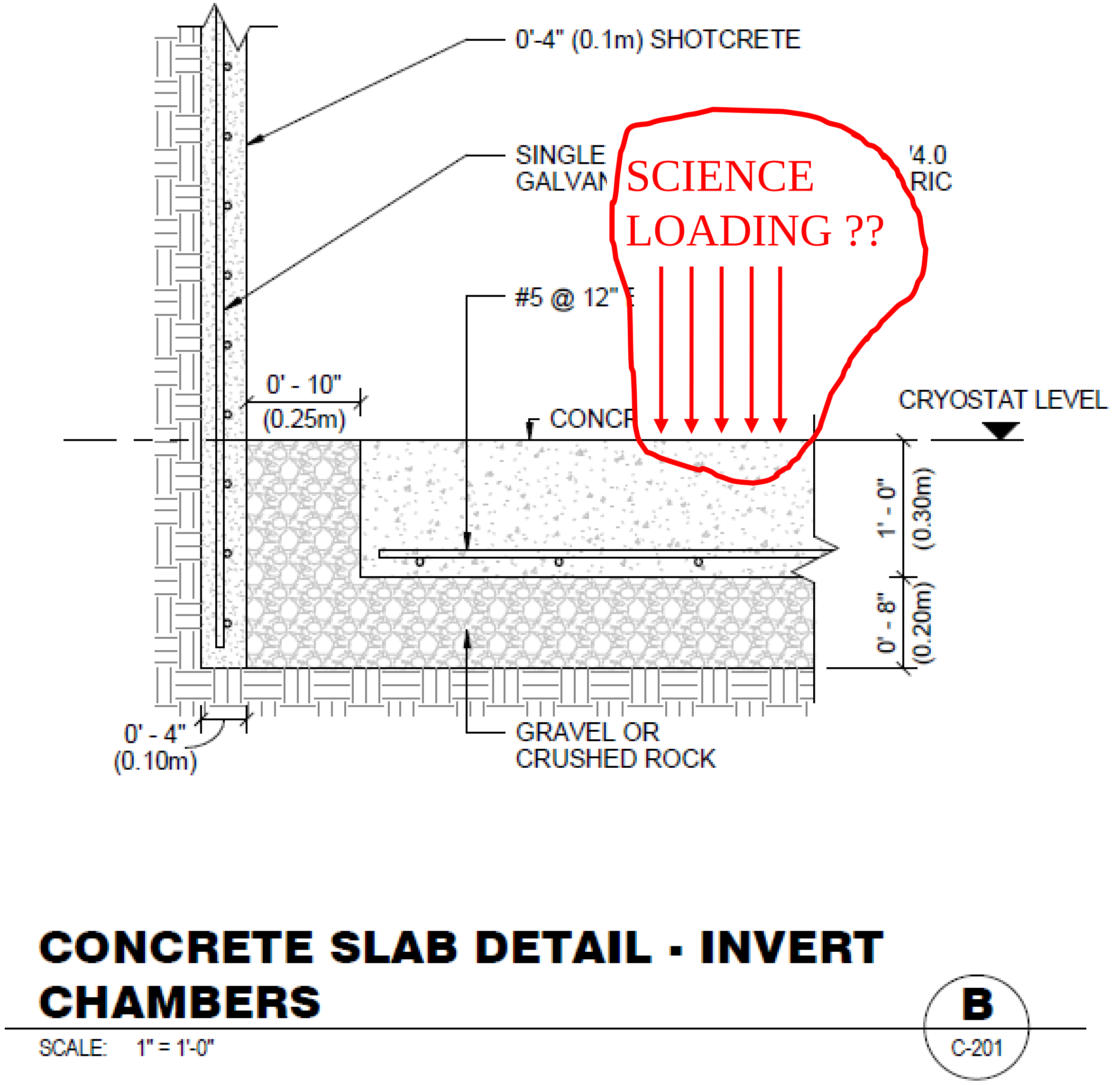


Figure 3 Elevation of line rocker bearing.

Point Loadings on Slab

Slab Detail UG-PDR-C-502:



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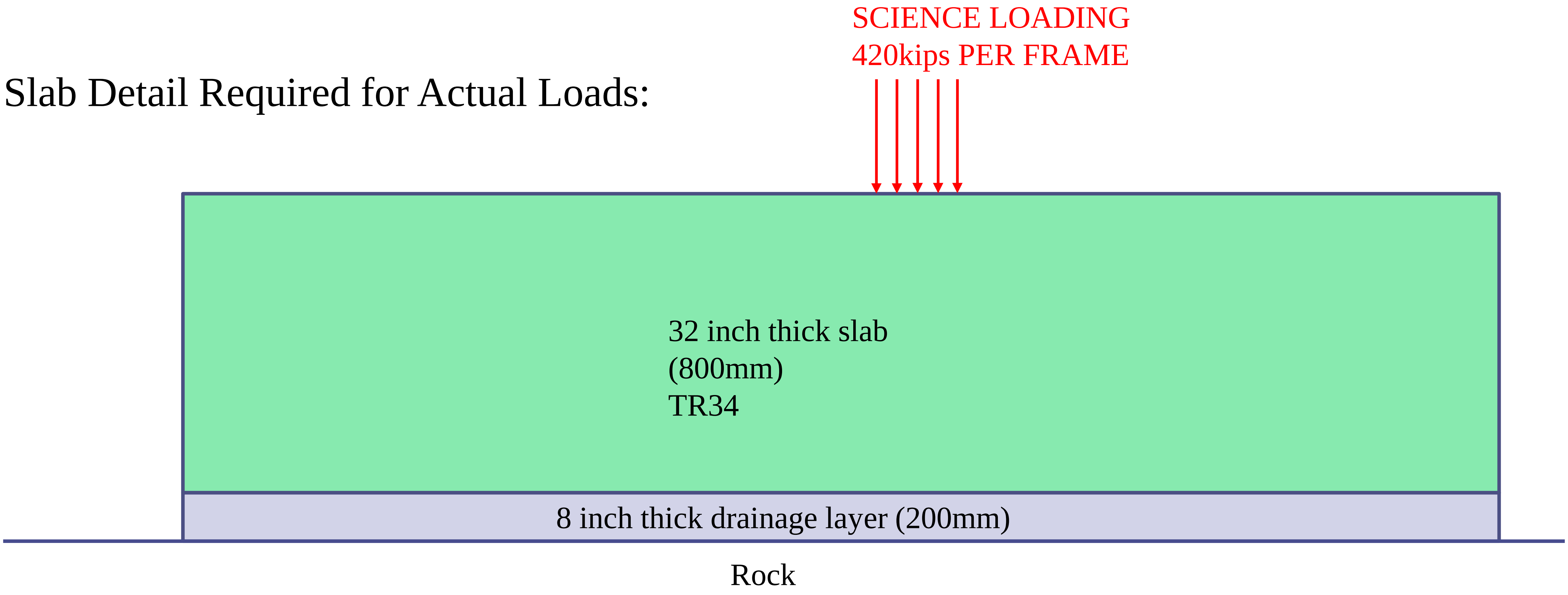
Point Loadings on Slab

Slab Detail Required for Actual Loads:



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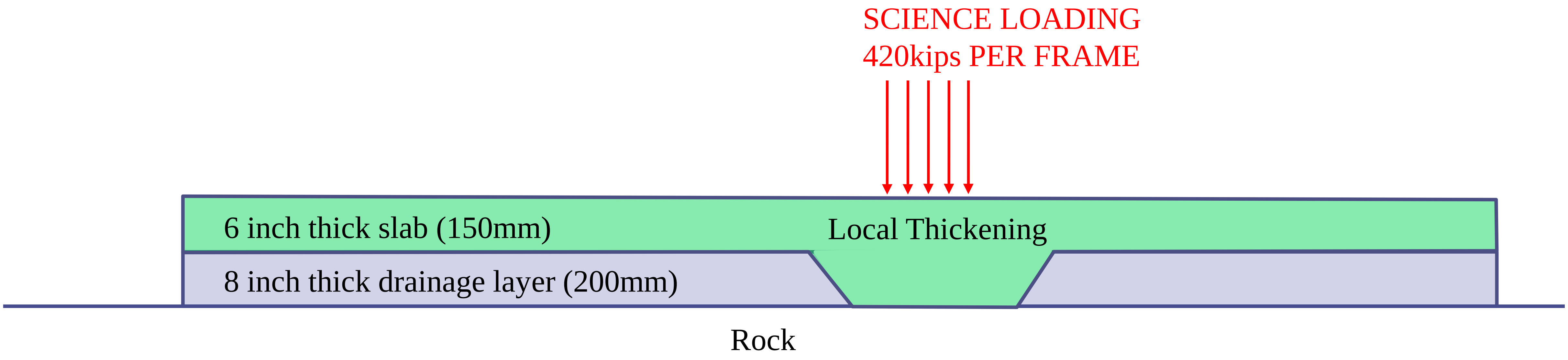
Point Loadings on Slab

Slab Detail Required for Actual Loads:



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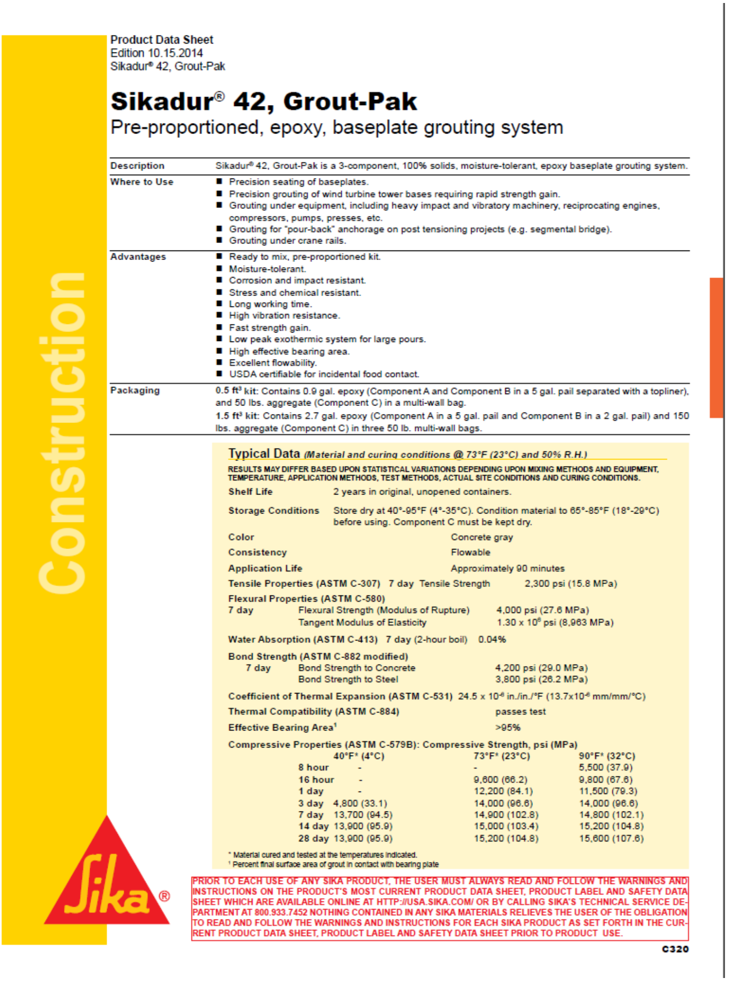
Point Loadings on Slab



Product Data Sheet
Edition 10.15.2014
Sikadur® 42, Grout-Pak

Sikadur® 42, Grout-Pak

Pre-proportioned, epoxy, baseplate grouting system

Construction

Description	Sikadur® 42, Grout-Pak is a 3-component, 100% solids, moisture-tolerant, epoxy baseplate grouting system.
Where to Use	■ Precision seating of baseplates. ■ Precision grouting of wind turbine tower bases requiring rapid strength gain. ■ Grouting under equipment, including heavy impact and vibratory machinery, reciprocating engines, compressors, pumps, presses, etc. ■ Grouting for "pour-back" anchorage on post tensioning projects (e.g. segmental bridge). ■ Grouting under crane rails.
Advantages	■ Ready to mix, pre-proportioned kit. ■ Moisture-tolerant. ■ Corrosion and impact resistant. ■ Stress and chemical resistant. ■ Long working time. ■ High vibration resistance. ■ Fast strength gain. ■ Low peak exothermic system for large pours. ■ High effective bearing area. ■ Excellent flowability. ■ USDA certifiable for incidental food contact.
Packaging	**0.5 ft^3 kit**: Contains 0.9 gal. epoxy (Component A and Component B in a 5 gal. pail separated with a topliner), and 50 lbs. aggregate (Component C) in a multi-wall bag. **1.5 ft^3 kit**: Contains 2.7 gal. epoxy (Component A in a 5 gal. pail and Component B in a 2 gal. pail) and 150 lbs. aggregate (Component C) in three 50 lb. multi-wall bags.

Typical Data *(Material and curing conditions @ 73°F (23°C) and 50% R.H.)*

RESULTS MAY DIFFER BASED UPON STATISTICAL VARIATIONS DEPENDING UPON MIXING METHODS AND EQUIPMENT, TEMPERATURE, APPLICATION METHODS, TEST METHODS, ACTUAL SITE CONDITIONS AND CURING CONDITIONS.

Shelf Life 2 years in original, unopened containers.

Storage Conditions Store dry at 40°-95°F (4°-35°C). Condition material to 65°-85°F (18°-29°C) before using. Component C must be kept dry.

Color Concrete gray

Consistency Flowable

Application Life Approximately 90 minutes

Tensile Properties (ASTM C-307) 7 day Tensile Strength 2,300 psi (15.8 MPa)

Flexural Properties (ASTM C-580)
7 day Flexural Strength (Modulus of Rupture) 4,000 psi (27.6 MPa)
Tangent Modulus of Elasticity 1.30×10^6 psi (8,963 MPa)

Water Absorption (ASTM C-413) 7 day (2-hour boil) 0.04%

Bond Strength (ASTM C-882 modified)
7 day Bond Strength to Concrete 4,200 psi (29.0 MPa)
Bond Strength to Steel 3,800 psi (26.2 MPa)

Coefficient of Thermal Expansion (ASTM C-531) 24.5×10^{-6} in./in./°F (13.7×10^{-6} mm/mm/°C)

Thermal Compatibility (ASTM C-884) passes test

Effective Bearing Area[1] >95%

Compressive Properties (ASTM C-579B): Compressive Strength, psi (MPa)

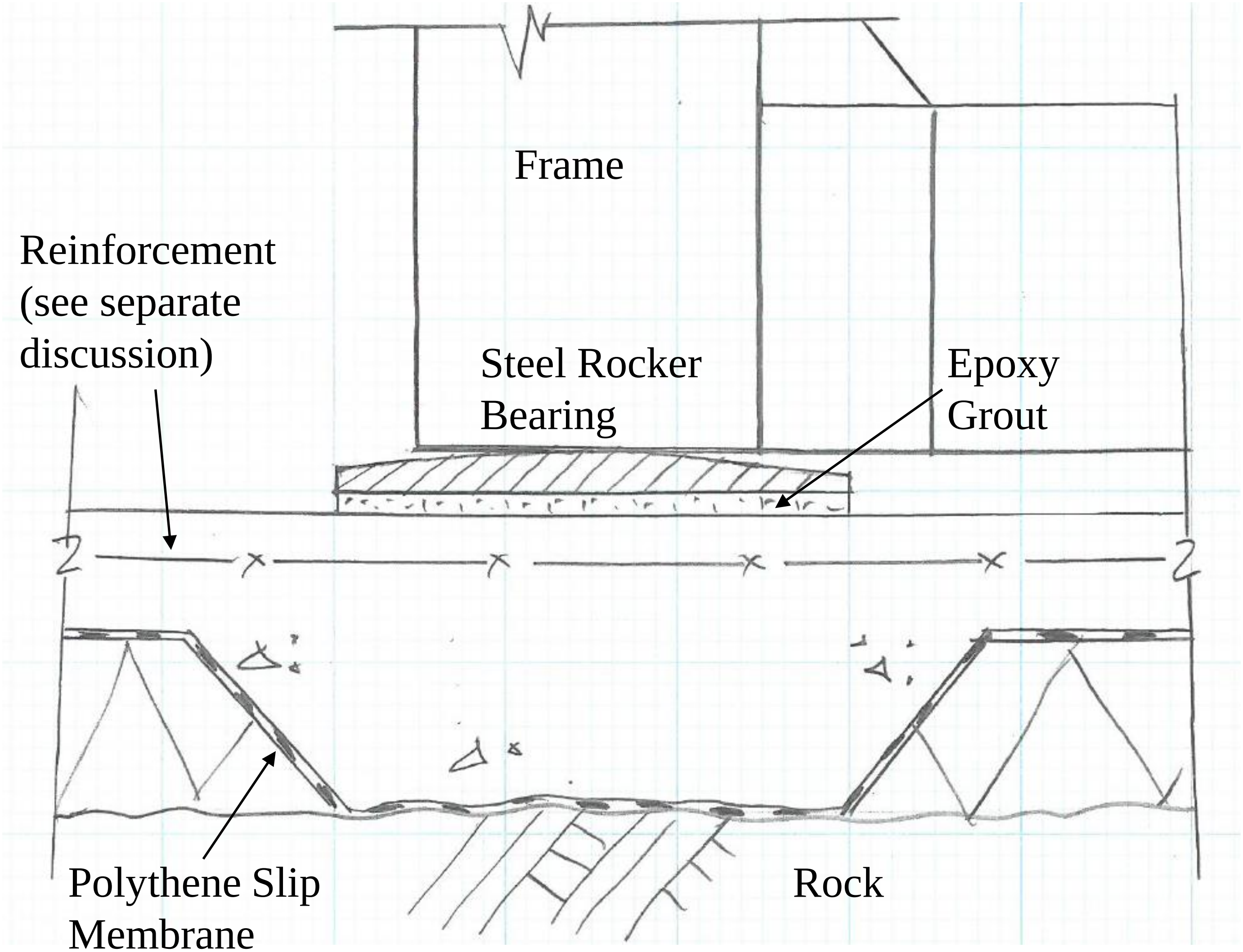
	40°F* (4°C)	73°F* (23°C)	90°F* (32°C)
8 hour	-	-	5,500 (37.9)
16 hour	-	9,600 (66.2)	9,800 (67.6)
1 day	-	12,200 (84.1)	11,500 (79.3)
3 day	4,800 (33.1)	14,000 (96.6)	14,000 (96.6)
7 day	13,700 (94.5)	14,900 (102.8)	14,800 (102.1)
14 day	13,900 (95.9)	15,000 (103.4)	15,200 (104.8)
28 day	13,900 (95.9)	15,200 (104.8)	15,600 (107.6)

* Material cured and tested at the temperatures indicated.
[1] Percent final surface area of grout in contact with bearing plate

PRIOR TO EACH USE OF ANY SIKA PRODUCT, THE USER MUST ALWAYS READ AND FOLLOW THE WARNINGS AND INSTRUCTIONS ON THE PRODUCT'S MOST CURRENT PRODUCT DATA SHEET, PRODUCT LABEL AND SAFETY DATA SHEET WHICH ARE AVAILABLE ONLINE AT HTTP://USA.SIKA.COM/ OR BY CALLING SIKA'S TECHNICAL SERVICE DEPARTMENT AT 800.933.7452 NOTHING CONTAINED IN ANY SIKA MATERIALS RELIEVES THE USER OF THE OBLIGATION TO READ AND FOLLOW THE WARNINGS AND INSTRUCTIONS FOR EACH SIKA PRODUCT AS SET FORTH IN THE CURRENT PRODUCT DATA SHEET, PRODUCT LABEL AND SAFETY DATA SHEET PRIOR TO PRODUCT USE.

C320

Epoxy Grout



Non-Conductive Slabs

Issues impacting Conductivity:

$$\rho_e = k_e \frac{U_x}{I_x} = \frac{1}{\sigma} \text{ (Eq. 1)}$$

Where,

ρ_e is the electrolytic resistivity of concrete in [Ωm]

k_e is a geometrical "cell" constant, which for two flat electrodes on either side of a rectangular specimen can be obtained by dividing the conducting concrete cross-section [m^2] by the distance between the electrodes in [m]

U_x is the potential difference between the electrodes in [V],

I_x is the current flowing between the electrodes in [A]

σ is the conductivity in [Ω-1·m-1].

Non-Conductive Slabs

Issues impacting Conductivity:

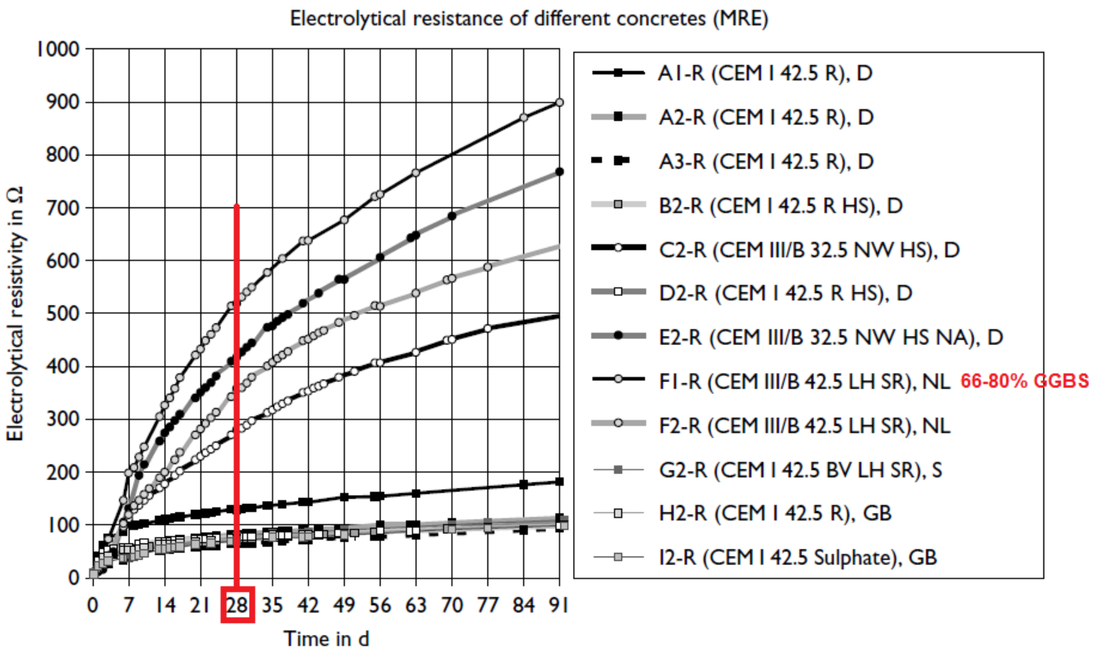
- the moisture content (higher resistivity for lower relative humidity)
- the water-to-cement ratio of the concrete (for higher w/c, resistivity value decreases)
- type of cement (plain portland cement vs slag-cements (>70% cement replacement using ground granulated blast furnace slag)
- curing time (due to the hydration process and densification of the pore solution, the resistivity value increases with time e.g. plain portland cement reach ultimate resistivity value at circa 1000 days, whereas the development continues with slag-cements)

Non-Conductive Slabs

Issues impacting Conductivity:

- Space Relative Humidity has largest impact – which we are controlling to 50%RH
- We should aim to use replacement cements - Fly Ash Type F commonly available
- We should keep water cement ratios low (less than 0.45)
- Silica Fume will accelerate time to reach required conductivity (but beware impacts)
- Slab Reinforcement will contribute partially - several options available (see later)

Non-Conductive Slabs



Potential Range of Conductivity:

<u>Specify and test at 28 days</u>

Type of cement	w/c-ratio	Relative Humidity, RH(%)	Resistivity [Ωm] measured at 10 mm depth	Resistivity [Ωm] measured at 50 mm depth
Portland Cement	0.45	50	1235	554
		65	573	356
		80	313	220
		Saturated	153	148
Slag-cement	0.45	50	3841	1756
		65	2430	1282
		80	1296	739
		Saturated	436	576

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Non-Conductive Slabs

Non-ferrous slab reinforcement options:

Reinforcement Type	Positives	Negatives
Polypropylene Fibers	Cheap, readily available	Low strength impact, performance reduces >35deg C
Basalt Fibers	Strength, heat resistance	Not yet codified
Carbon Fiber Rebar	Strength	Slower placement or adaptability
GFRP Bars	Strength	Slower placement or adaptability
Basalt Rebar	Strength, heat resistance	Slow placement or adaptability, some limited codes only
Unreinforced	Cheap	Increased number of joints in slab

Slab Flatness

- F_F=25 – but locally F_F =17
- F_L=20 – but locally F_L = 15

This is equivalent to a typical office or industrial floor. Not very stringent.

Relaxation to lower numbers locally unlikely to add value or save money??

For quick reference:
http://www.iceline.com/estref/popular_conversion_files/concrete/slab_flat.html

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