DESIGNING PRECAST for Climate, Quality, Durability

PEPSCON 2017

CURING CONCRETE

Concrete's strength and durability is determined largely by how it is cured

YET IT IS THE MOST NEGLECTED ASPECT OF CONCRETE

WHAT IS IT

- Curing is a procedure that is adopted to promote the hardening of concrete under conditions of humidity and temperature which are conducive for the HYDRATION reaction to continue

HYDRATION REACTION

- Cement + Water ➡ CSH + $Ca(OH)_2$

  Cementitious Gel (BINDER)

In order to achieve complete HYDRATION it is **ESSENTIAL** that moisture does not evaporate from the product.

CURING

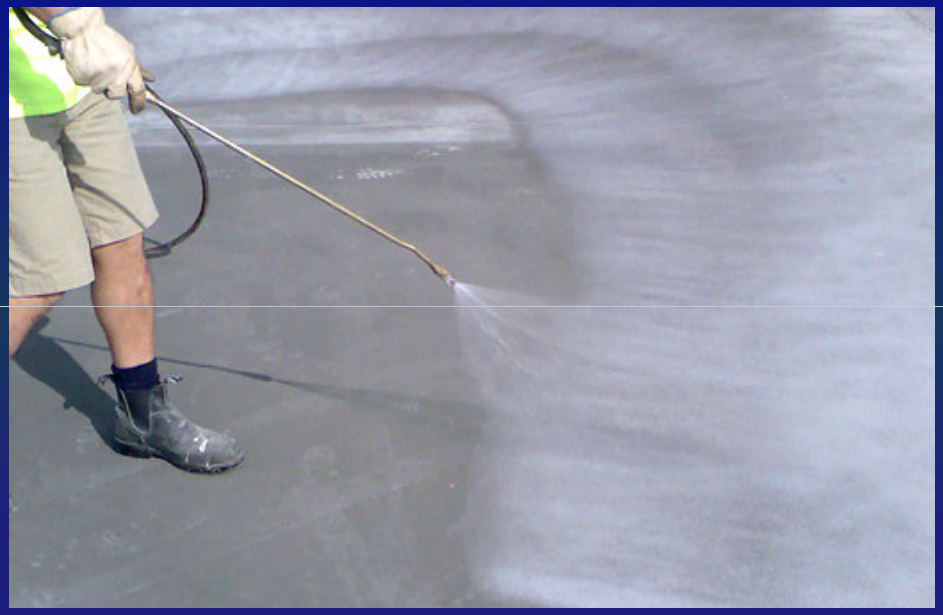
SPRAYING / FOGGING

PONDING

PLASTIC FILM

1) Maintaining / reducing loss of mixing water in concrete

- ***Saturated wet coverings***



- ***Applying membrane-forming curing compounds***

2) Accelerating strength gain using heat

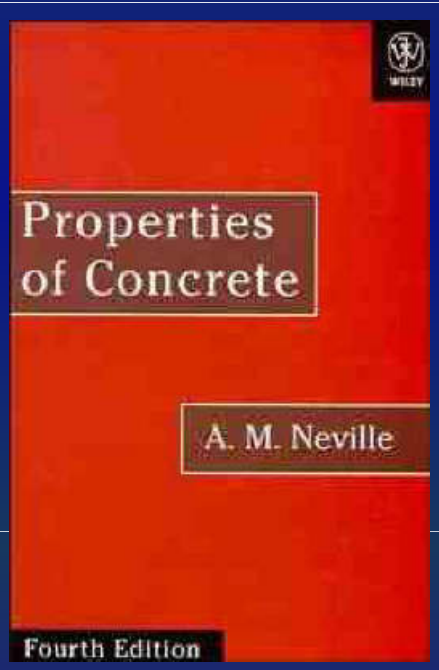
- ***Electrical heated forms or pads***
- ***Insulation blankets***
- ***Live steam***
  -- Steam at atm. pressure (Temp. should be < 60-70°C)

HOW LONG

- American Concrete Institute (ACI) Committee 301 recommends a min. curing period corresponding to concrete attaining 70% of the specified compressive strength.
- The commonly specified 7-day curing corresponds to approx. 70% of the specified compr. Strengths
- This can be reached sooner when concrete cures at higher temperatures.

STRENGTH ? ONLY ?

Criteria for GOOD CONCRETE



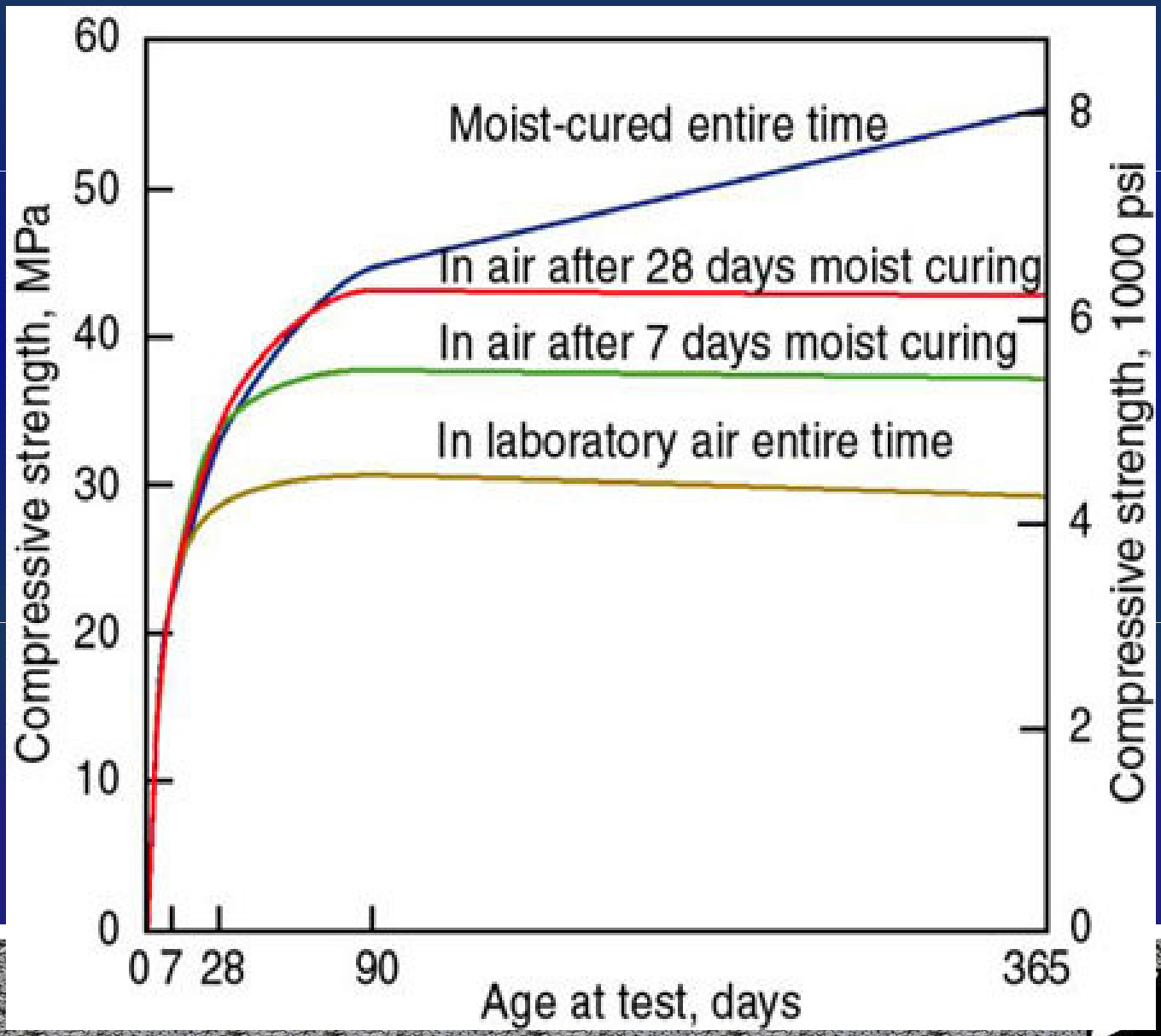
DURABILITY

Reasons for CURING

1. Beside achieving STRENGTH
2. DURABILITY :
   i. better surface hardness
   ii. better surface wear and abrasion resistance
   iii. Water tightness to prevent ingress of moisture & other deleterious compounds which cause corrosion
3. SERVICEABILITY :
   – Prevent CRAZING, DUSTING & SCALING

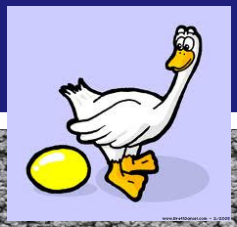
EFFECT OF CURING DURATION

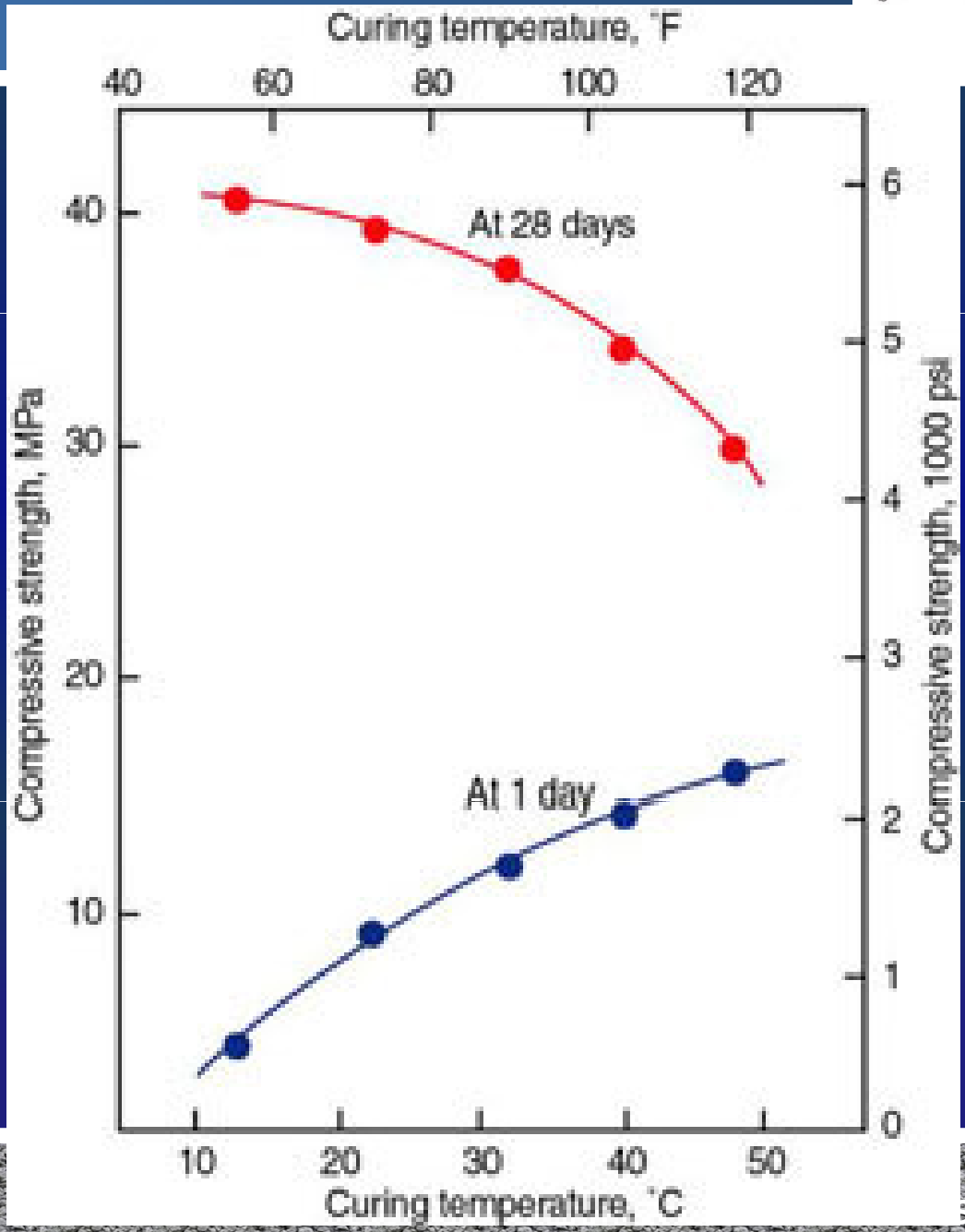
on COMPRESSIVE STRENGTH DEVELOPMENT



EFFECT OF CURING TEMPERATURE on COMPRESSIVE STRENGTH DEVELOPMENT

- Higher curing temperatures promote an early strength gain in concrete but may decrease its 28-day strength





PLANT 1


EK501


Electro Fab


15XW-F
ACE

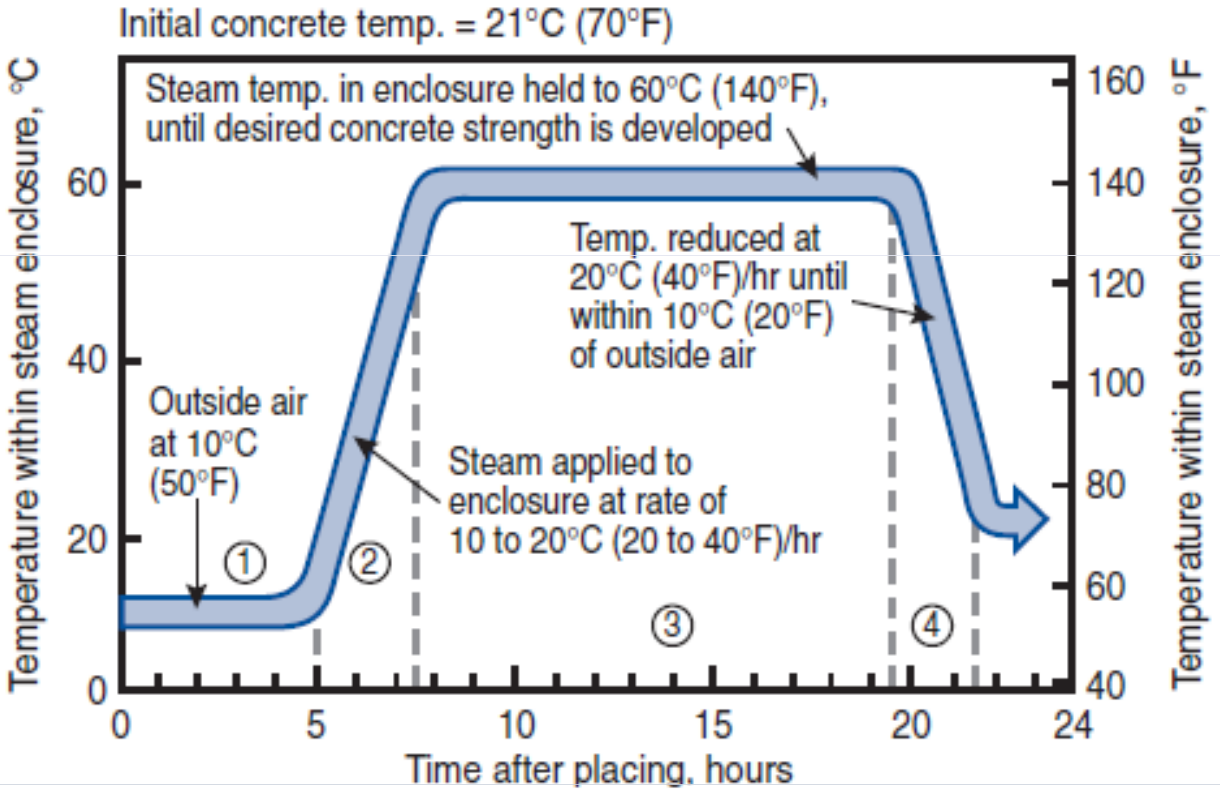

=B26


3D VIEWS OF PRECAST BEAMS
FB 2
12·8·14
FB 2
12·8·14
FB 2
12·8·14
AMW


PLASTIC SHRINKAGE
Evaporation rate ~ 1 kg/m²/hr


1 m³ Concrete : 180 kg water
1 cm layer /m2 : 1.8 kg

PLANT 2

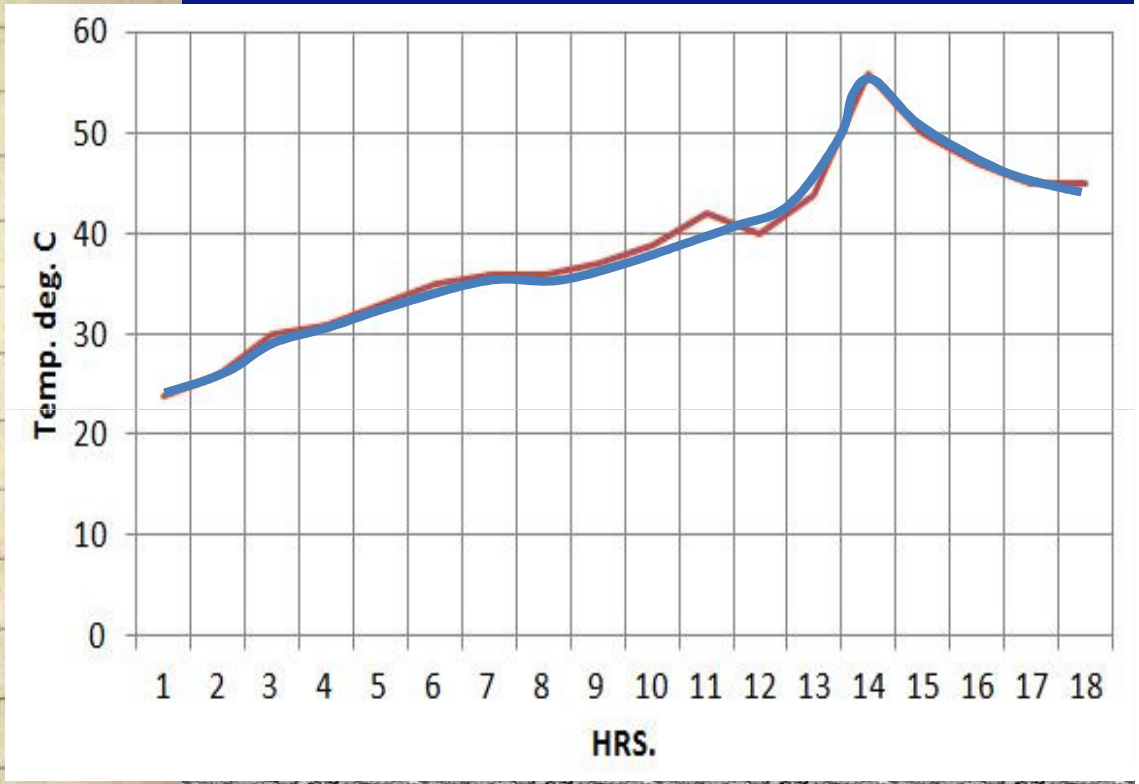


①	Initial delay prior to steaming	3 to 5 hours
②	Temperature increase period	2½ hours
③	Constant temperature period	6 to 12 hours*
④	Temperature decrease period	2 hours

*Type III or high-early-strength cement, longer for other types

18/04/014

Time	Tempreture	Humidity
7:30 PM	24	52%
8:30 PM	26	54%
9:30 PM	30	56%
10:30 PM	31	62%
11:30 PM	33	63%
12:30 AM	35	66%
1:30 AM	36	65%
2:30 AM	36	67%
3:30 AM	37	68%
4:30 AM	39	69%
5:30 AM	42	70%
6:30 AM	40	70%
7:30 AM	44	70%
8:30 AM	56	65%
9:30 AM	50	47%
10:30 AM	47	39%
11:30 AM	45	36%
12:30 AM	45	34%



PLANT 3


EMAG 10 t


P.NO - 10000R
E.LE.NO - BEAM-90
DATE - 12-5-16
W - 3.5 TON
LOCAT - BIZ2-02F
BE-25
DATE - 12-5-16


KRUPP
PNO -100002
ENO -260 (UB)
DATE -13-5-16

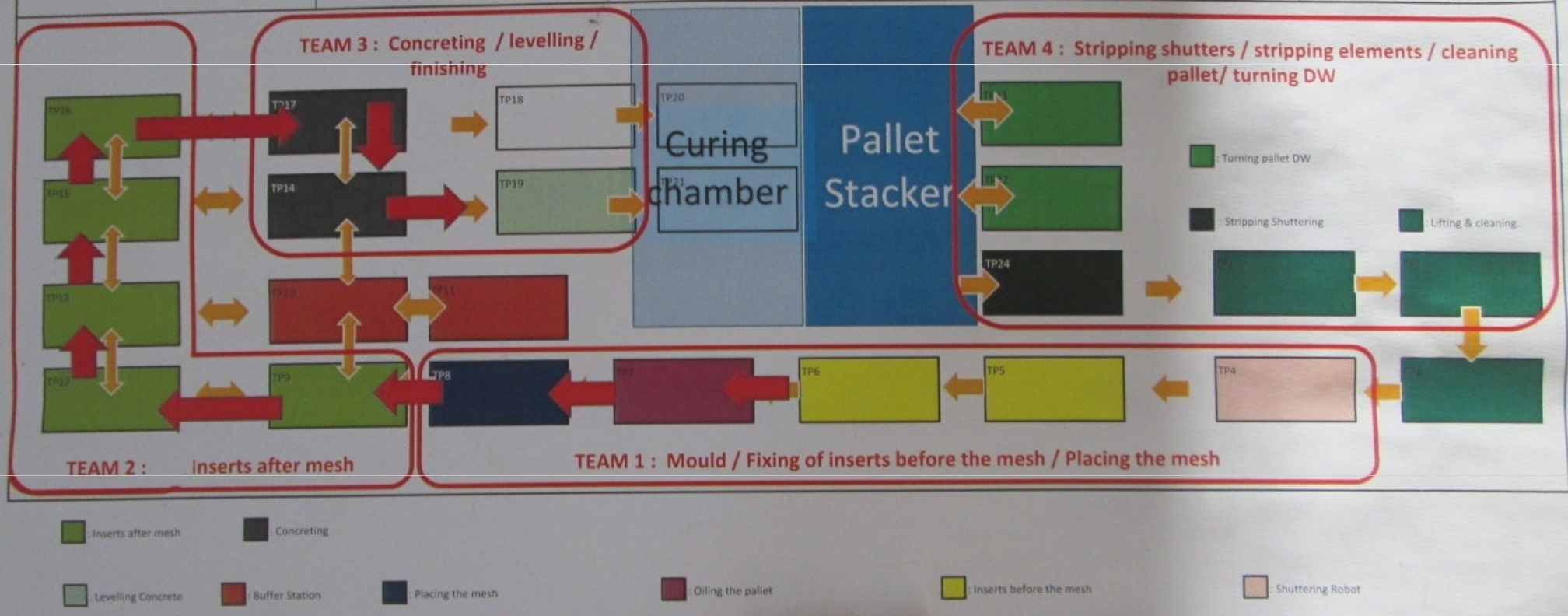
PROCEDURES MANUAL

PRECAST

PRECAST ELEMENTS

PROCESS MAPPING BAY 3

DOC. NO.	: KPRP4-01PM-01
REV. NO.	: 0
ISSUED BY:	:
ISSUED DATE:	: 2015



: Inserts after mesh

: Concreting

: Levelling Concrete

: Buffer Station

: Placing the mesh

: Oiling the pallet

: Inserts before the mesh

: Shuttering Robot

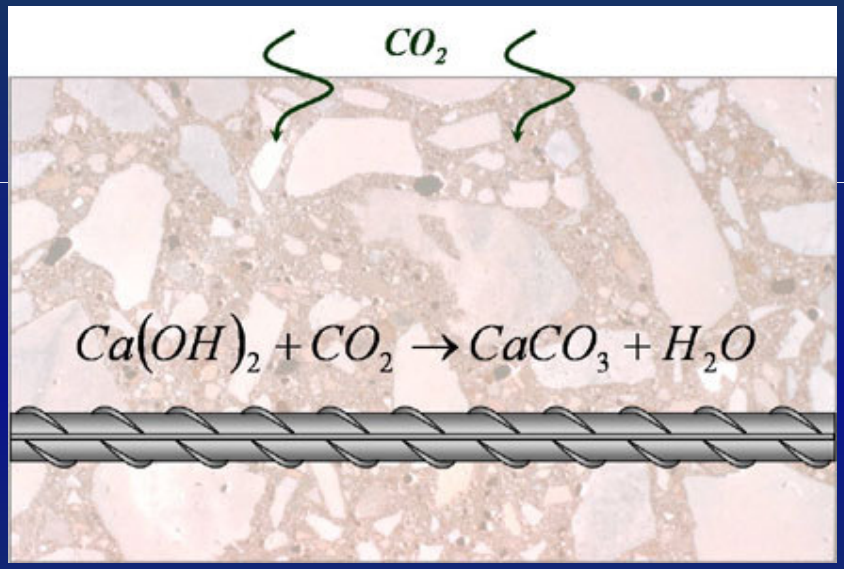
STAIRS - 5


SB
SHOP

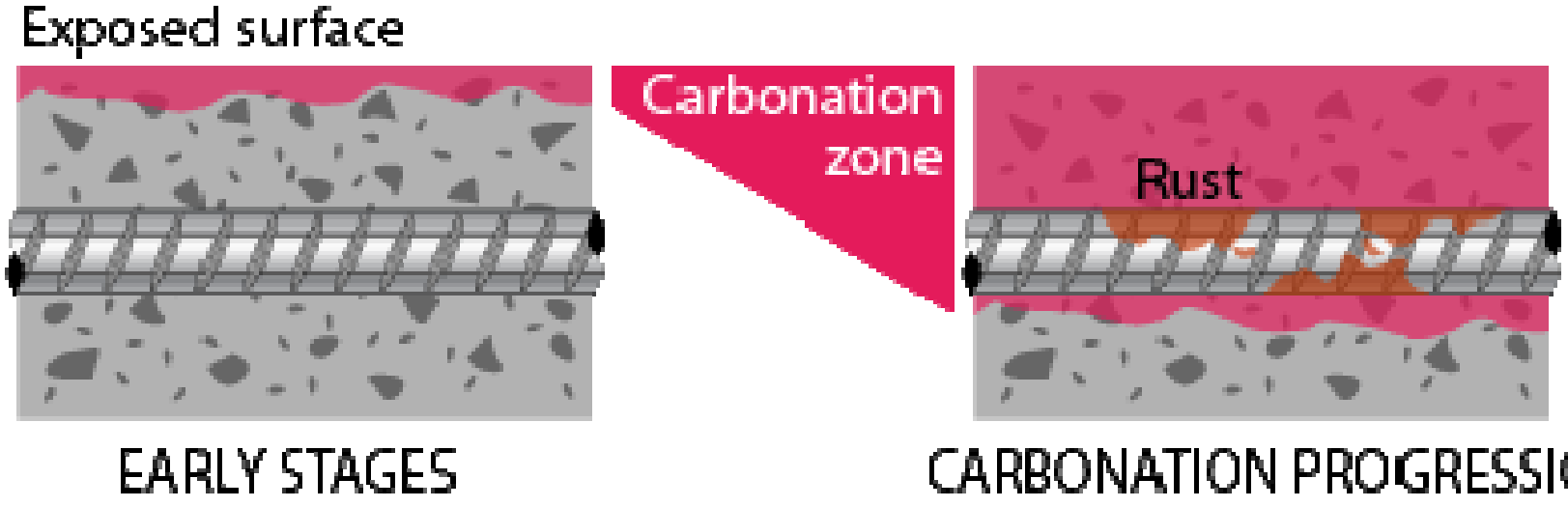
Missing elements of Durability :

- Lack of good curing practice
- No FLY ASH (ABDUN NUR)
- V. High contents of Cement – High Heat of Hydration, Internal microcracking from temp.stresses & Drying shrinkage

CARBONATION



Spalling



DESIGN for INDIAN Climate

Material	Thermal resistance R $m^2.K/W$	Thermal Conductance 1/R
Brick 10"	0.3	3.3
Poured Concrete 6"	0.084	11.9
Expanded Polystyrene 2"	0.65	1.5
Extruded Polystyrene 2"	0.9	1.1


Fig-12

INSULATION

SANDWICH PANELS

Material	Thermal resistance R $m^2.K/W$	Thermal Conductance 1/R
Brick 10"	0.3	3.3
Poured Concrete 6"	0.084	11.9
Sandwich panel 2"RCC + 1"XPS + 4"RCC	0.984	1.02
Sandwich panel 2"RCC + 2"XPS + 4"RCC	1.984	0.50

IS THAT THE KIND OF HOUSING FOR ALL WE `RE TALKING ABOUT ?

BUT