Adhesion of Thermofusible and Self-Adhesive Membranes to Green Concrete

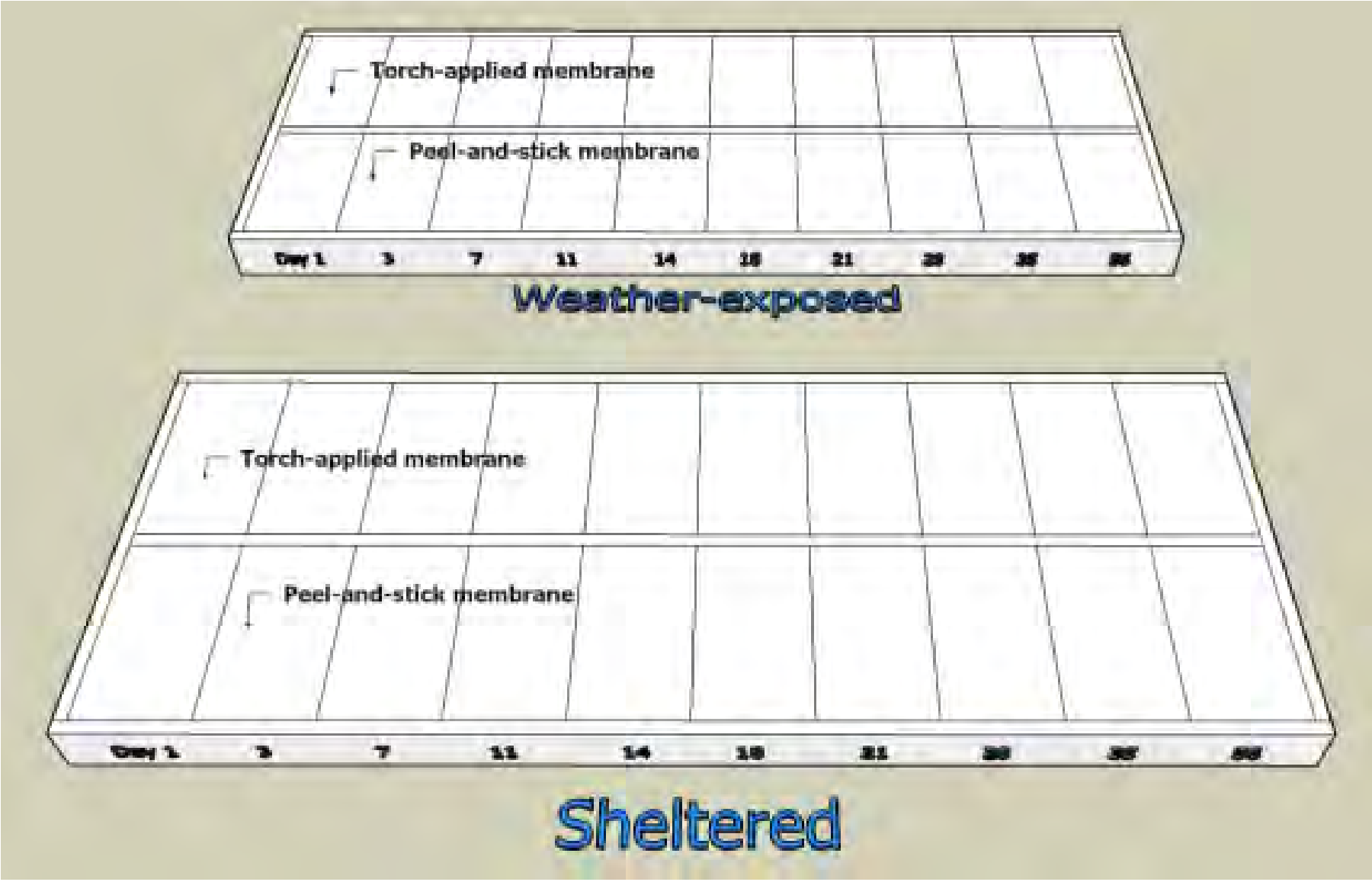
Laurence Matzek – RCABC

Leslie Peer – RJC Engineers

Jason Teetaert – SMT Research

Geometry of the experimental slabs

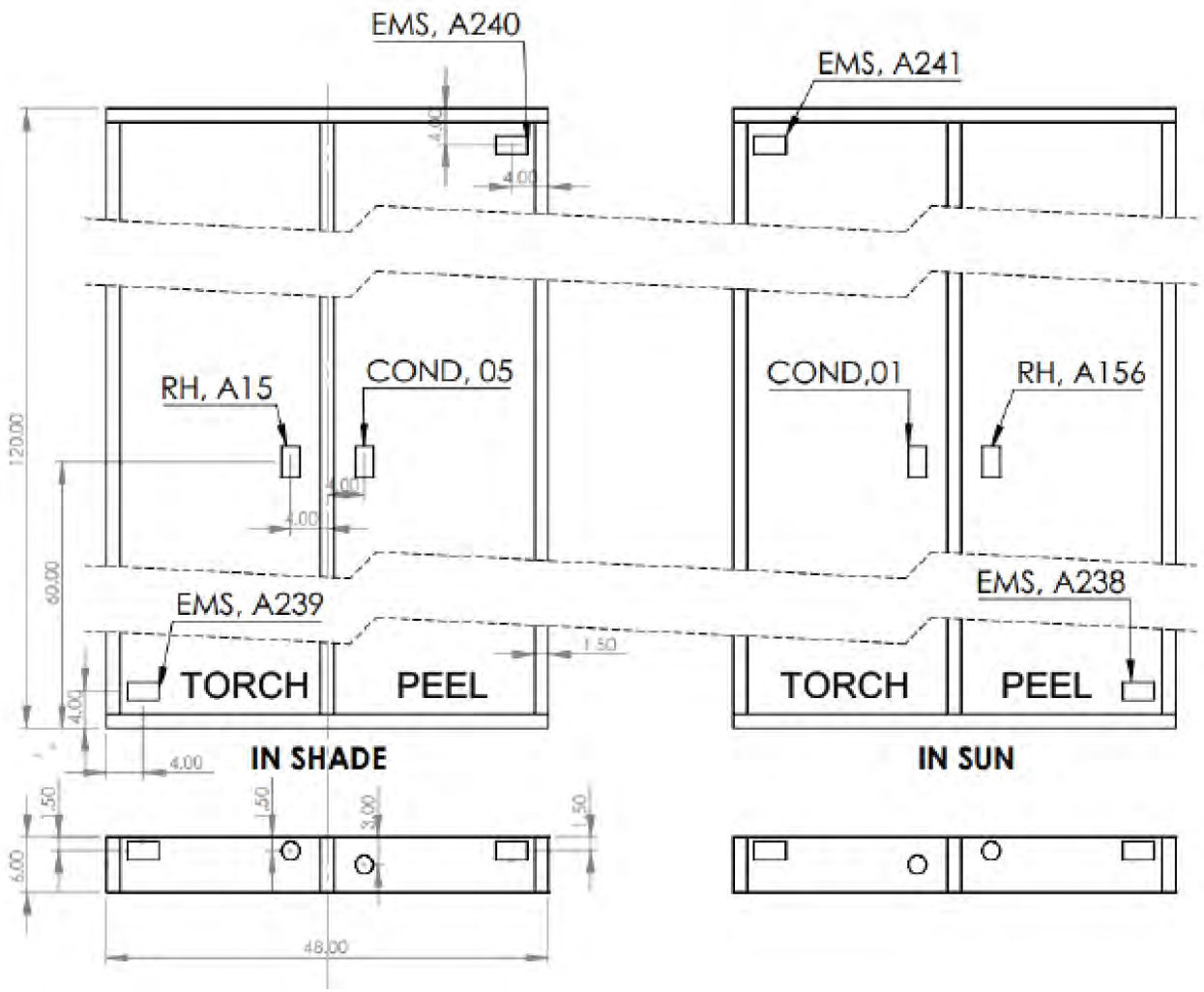
Membrane installed in increments up to 56 days after casting



Concrete slab after casting

Instrumentation installed in concrete slabs

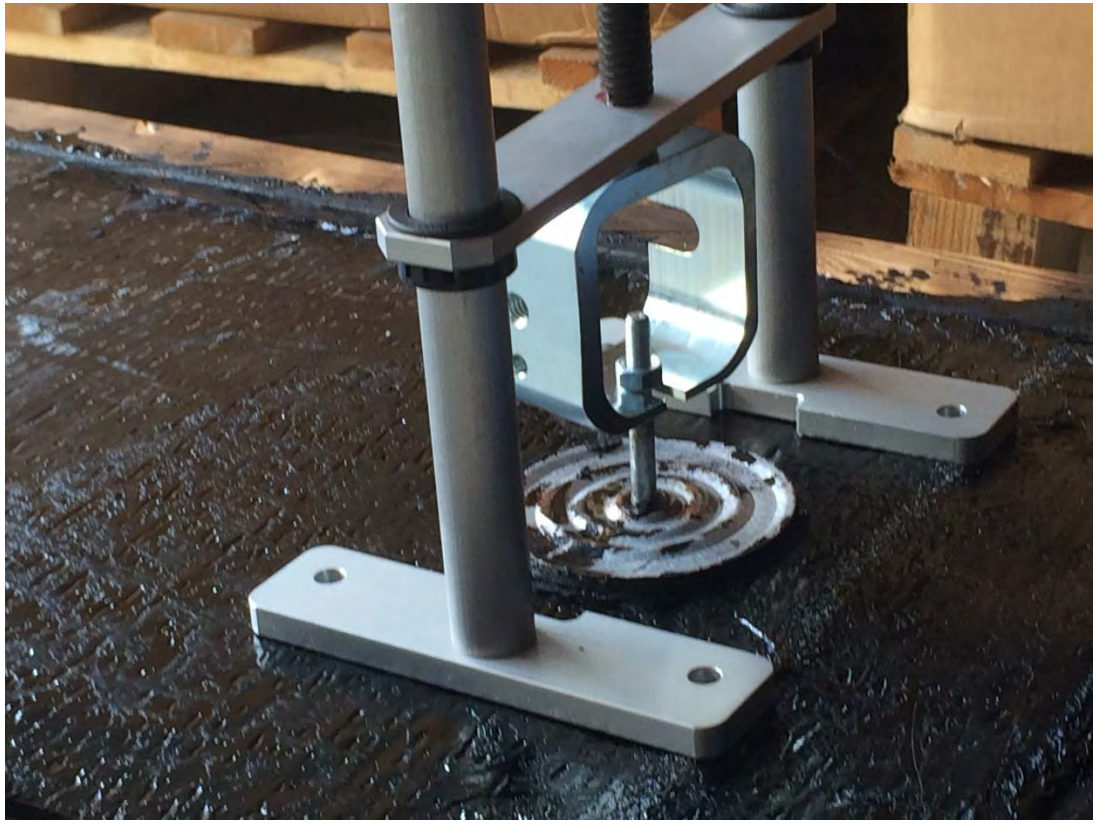
- Moisture Meters at both ends
- Relative Humidity Meters at centre
- Condensation meters at centre
- Connected to Data Logger
- Also recorded Air Temperature and Rainfall



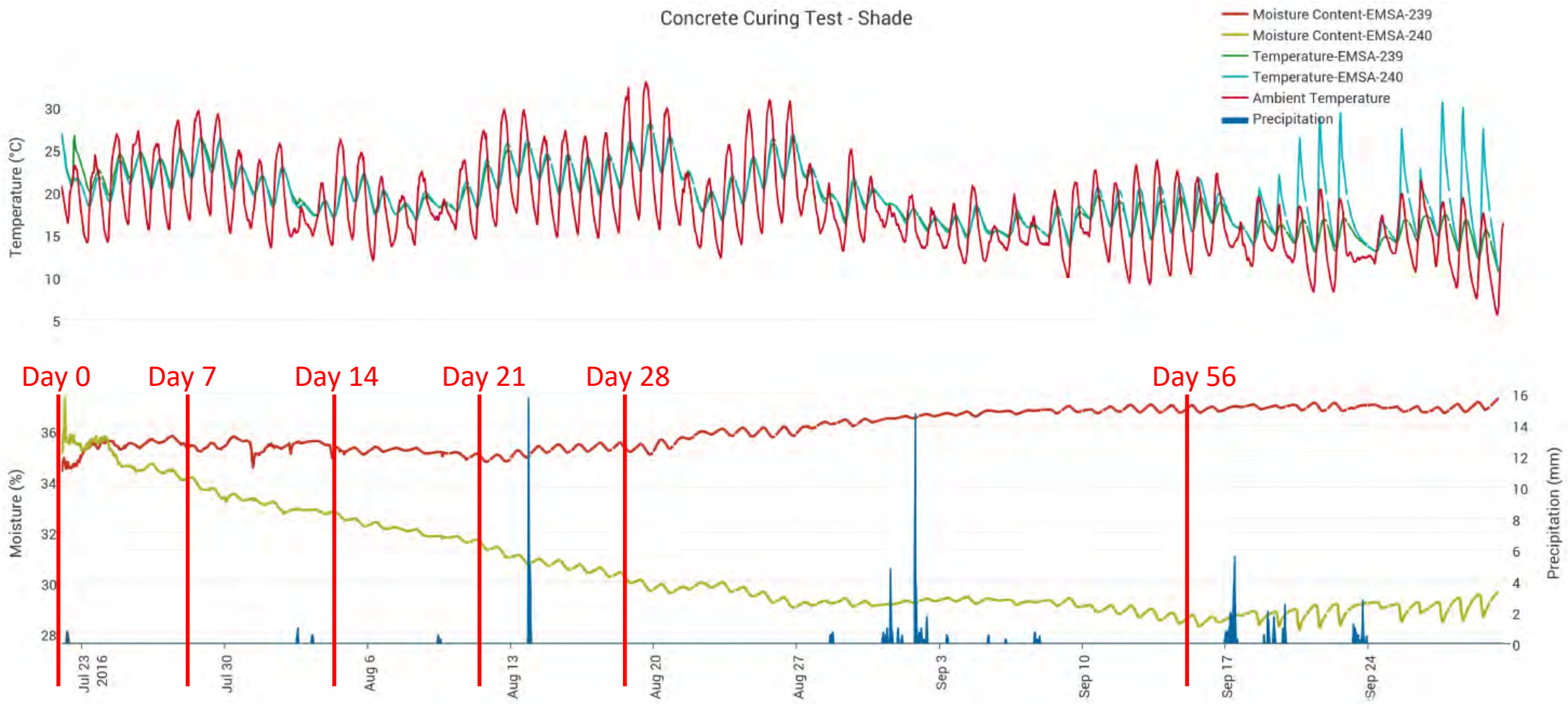
Day 1

- Concrete is primed and membrane is applied
- Pucks are installed

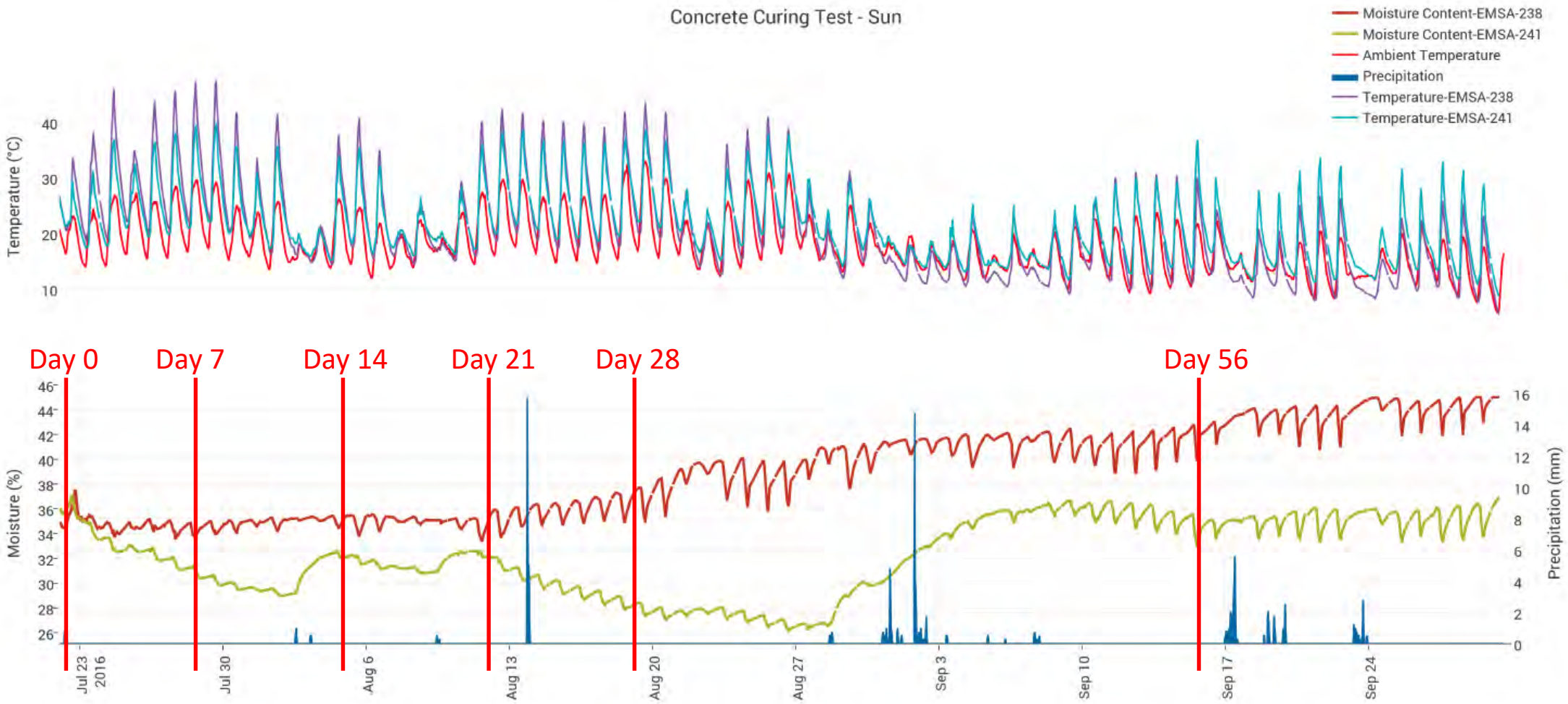
Adhesion Testing using Tensiometer and Pucks



Concrete Curing – Shade Slab

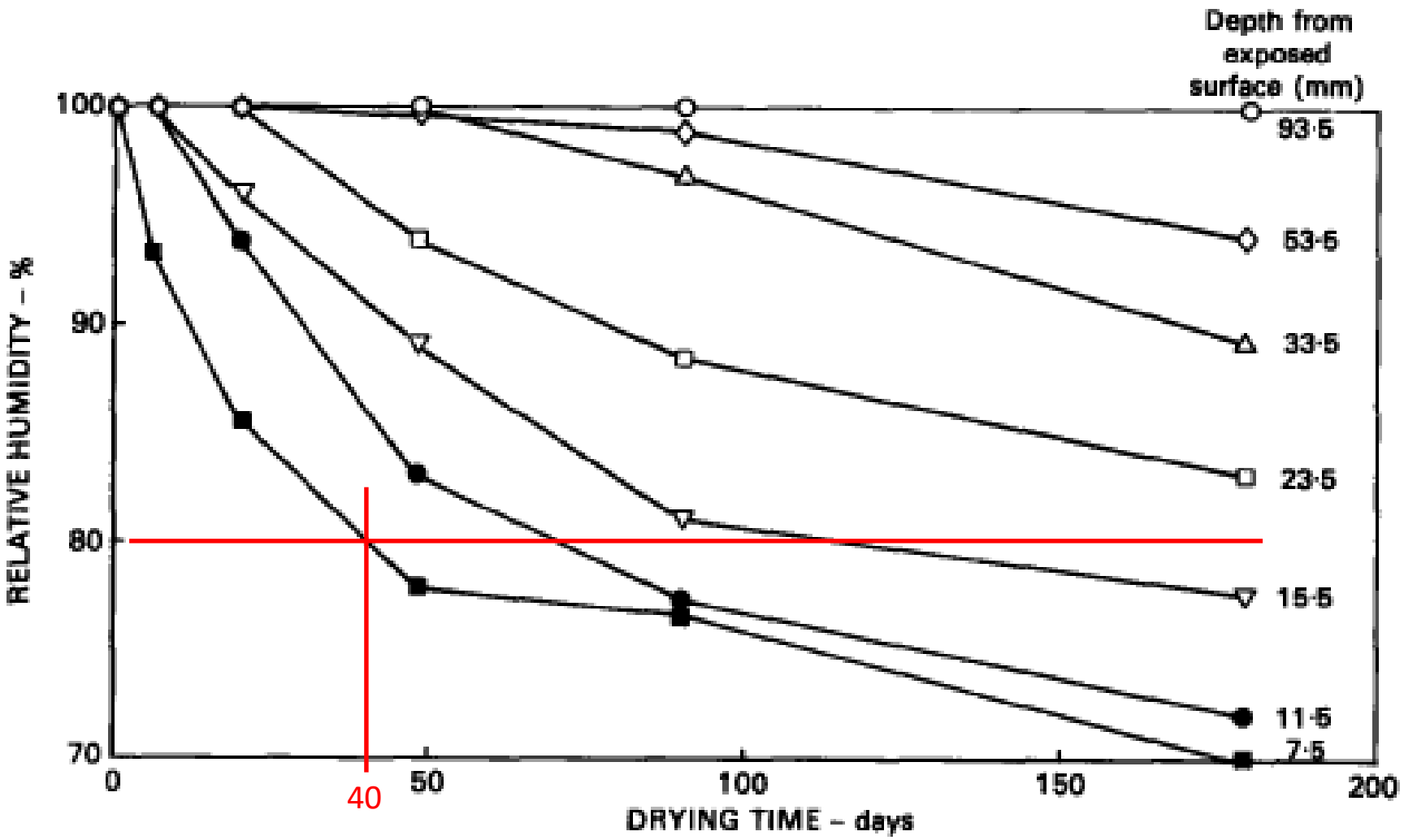


Concrete Curing – Sun Slab



In other industries, adhesion to concrete is delayed until RH in the slab is <80%

- Flooring and Coating Industry standards
- Used to use chloride salt absorption test
- Now use ASTM F2170 test
- Other industries that dry to 80%rh are typically indoor slabs



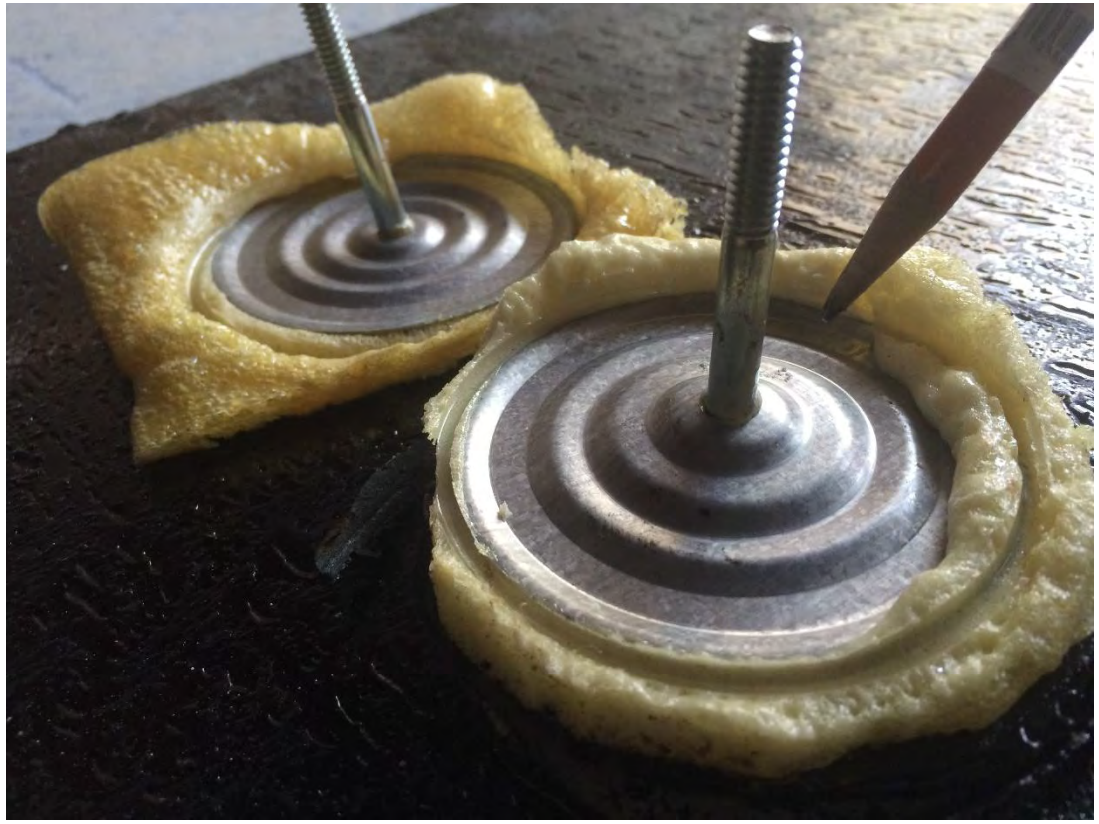
Adhesion Test Results

days after concrete pour	Membrane Installation Date	Time after memb install	DATE OF PULL TEST		Sun Slab				Shade Slab			
					Torch Applied Membrane		Self Adhesive Membrane (plus 1 day)		Torch Applied Membrane		Self Adhesive Membrane (plus 1 day)	
					kPa	Failure	kPa	Failure	kPa	Failure	kPa	Failure
1	22-Jul	0		3" Ø metal plate	24	A	0	A	49	A	0	A
		11	01-Aug						159	D		
		28	18-Aug		185	A	0	A	400	A	0	A
3	24-Jul	0		7.065	0	A	0	A	78	B	0	A C
		8	01-Aug						98	A	98	A
		25	18-Aug		210	A C	132	A	224	A C	107	A
7	28-Jul	0			63	B	0	A	98	B	49	A
		5							171	D	83	D
		4	01-Aug		44	D						
		21	18-Aug		137	A C	117	A	278	A C	219	A
		50	16-Sep				34	A	215	C A	102	A
11	01-Aug	0		3" Ø metal plate w/ duotack	137	A B	93	D	258	A B	195	D
		1	02-Aug						273	C		
		17	18-Aug		380	A C	180	A C	293	A C D	215	A C
		46	16-Sep		98	A C	127	A	137	A C		
14	04-Aug	0		3" Ø plywood	156	B			156	D	137	D
		14	18-Aug		190	A	195	A	229	C	254	A
		43	16-Sep		98	A C	98	A C	293	A C	234	A
18	08-Aug	0		3"x3" maple block	332	B D	439	B D	390	C	176	C
		10	18-Aug		585	D	312	A	332	C	190	A
		39	16-Sep		117	A C	137	A C	317	A C	161	A
21	11-Aug	0		9	195	D	400	D B	410	B D	507	A B
		1	12-Aug		527	D						
		7	18-Aug		595	A C	244	A	312	C	190	A
		36	16-Sep		293	A C	215	A C	254	C A	146	C
28	18-Aug	0			302	B	171	A B	234	A C	302	B
		29	16-Sep		332	B A	215	B A	254	A C	132	A
35	25-Aug	0			215	D	176	B	483	A	254	D
		22	16-Sep		293	A C	122	A C	297	A C	210	A
56	15-Sep	0										
		1	16-Sep		293	D	195	D A	429	A C	283	A C

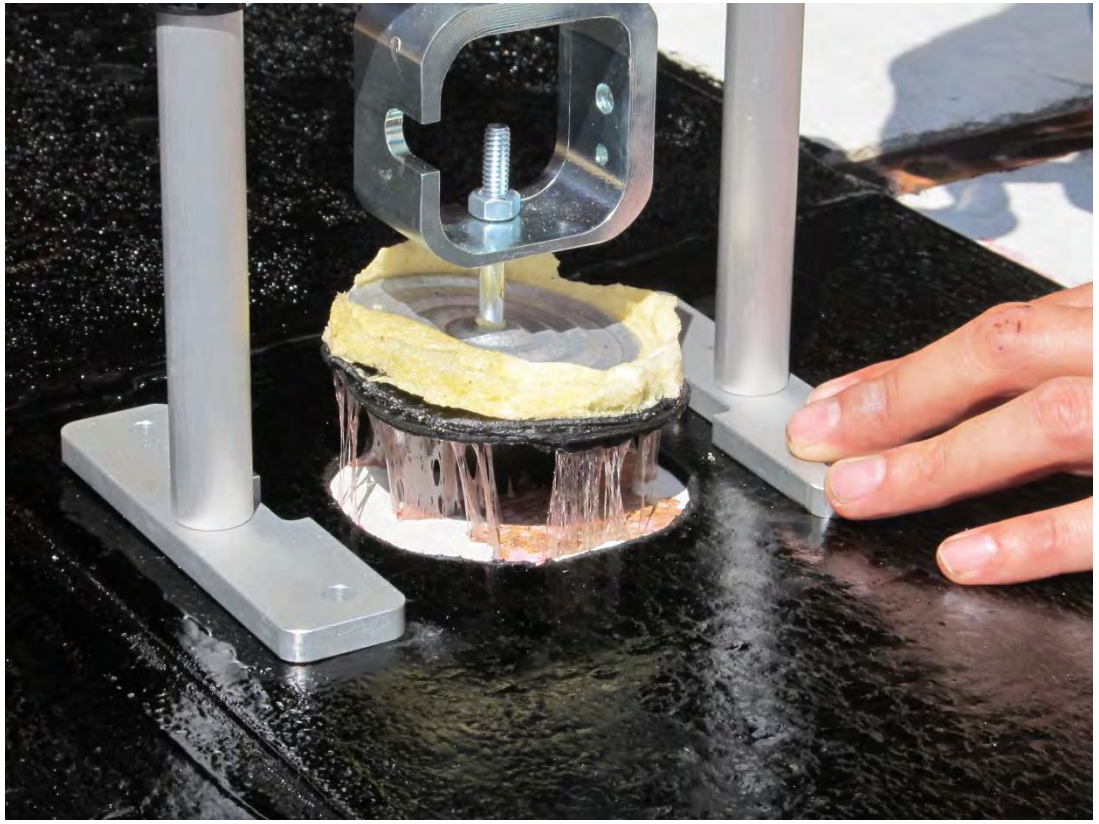
Typical primer to concrete failures at early age

Day 11 – Puck failures

Adhesion of membrane to concrete greater than pucks to membrane



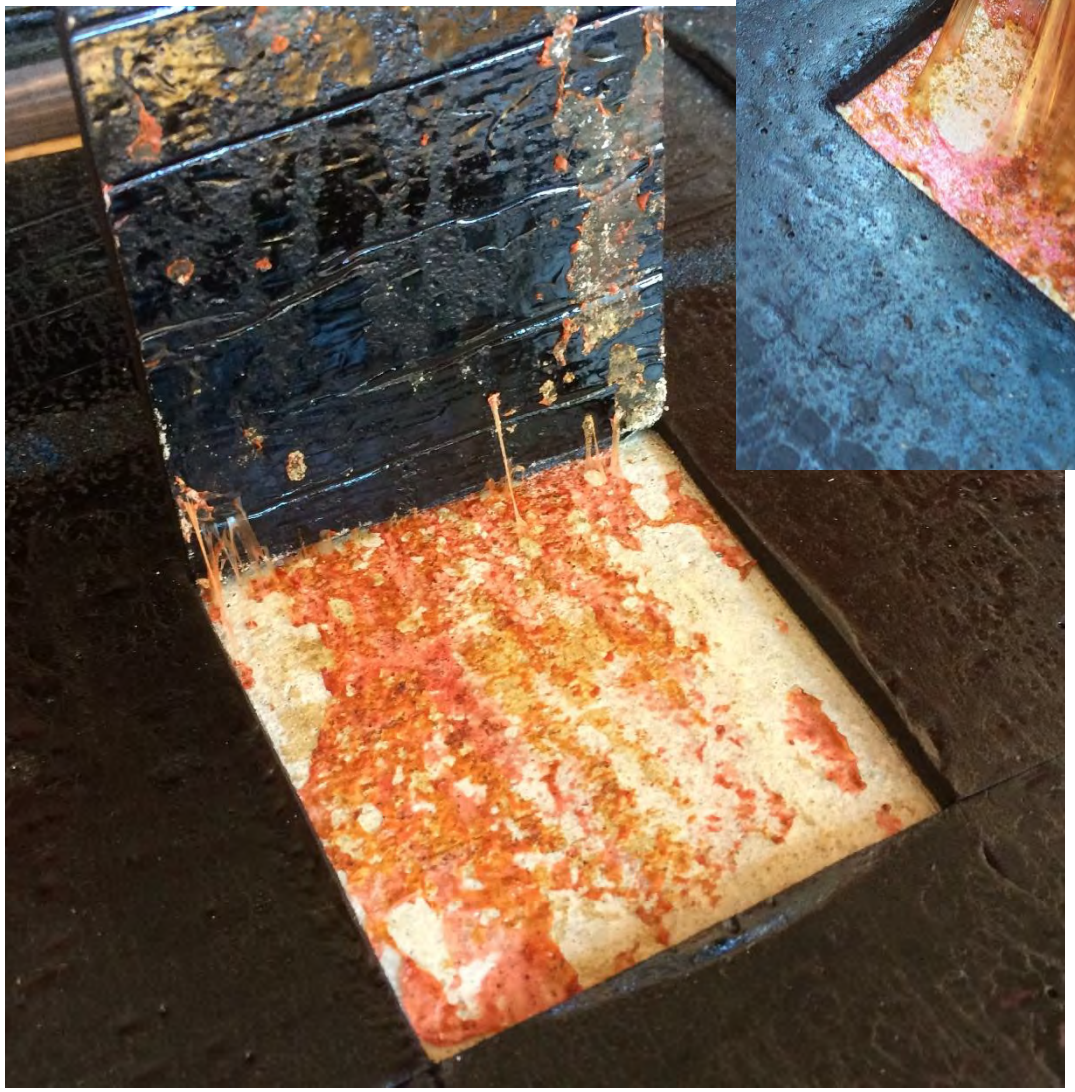
Day 14

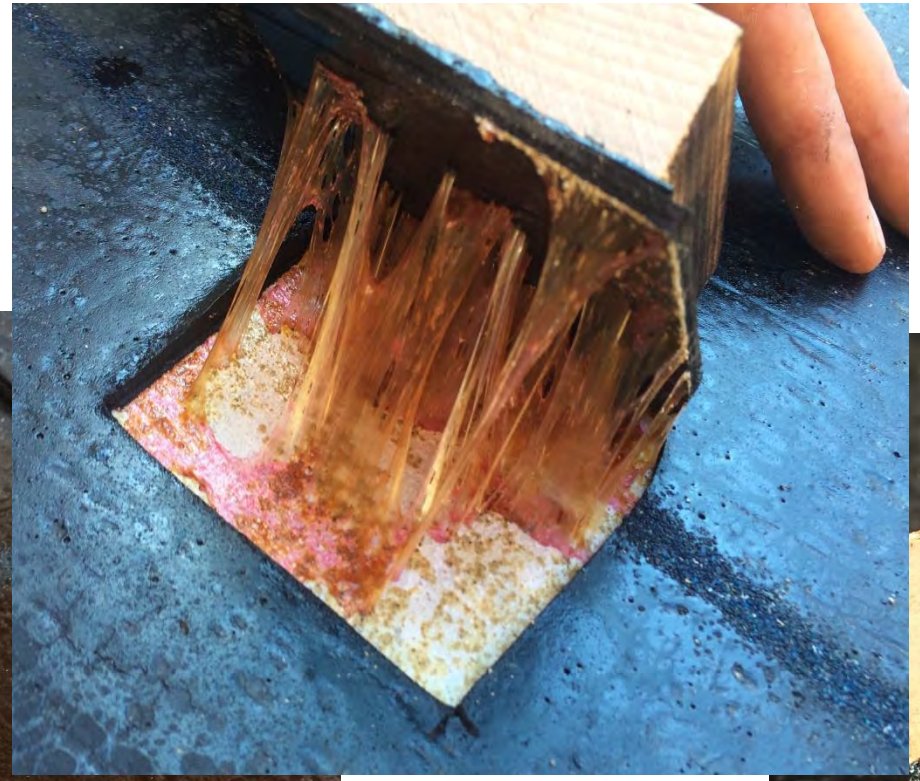


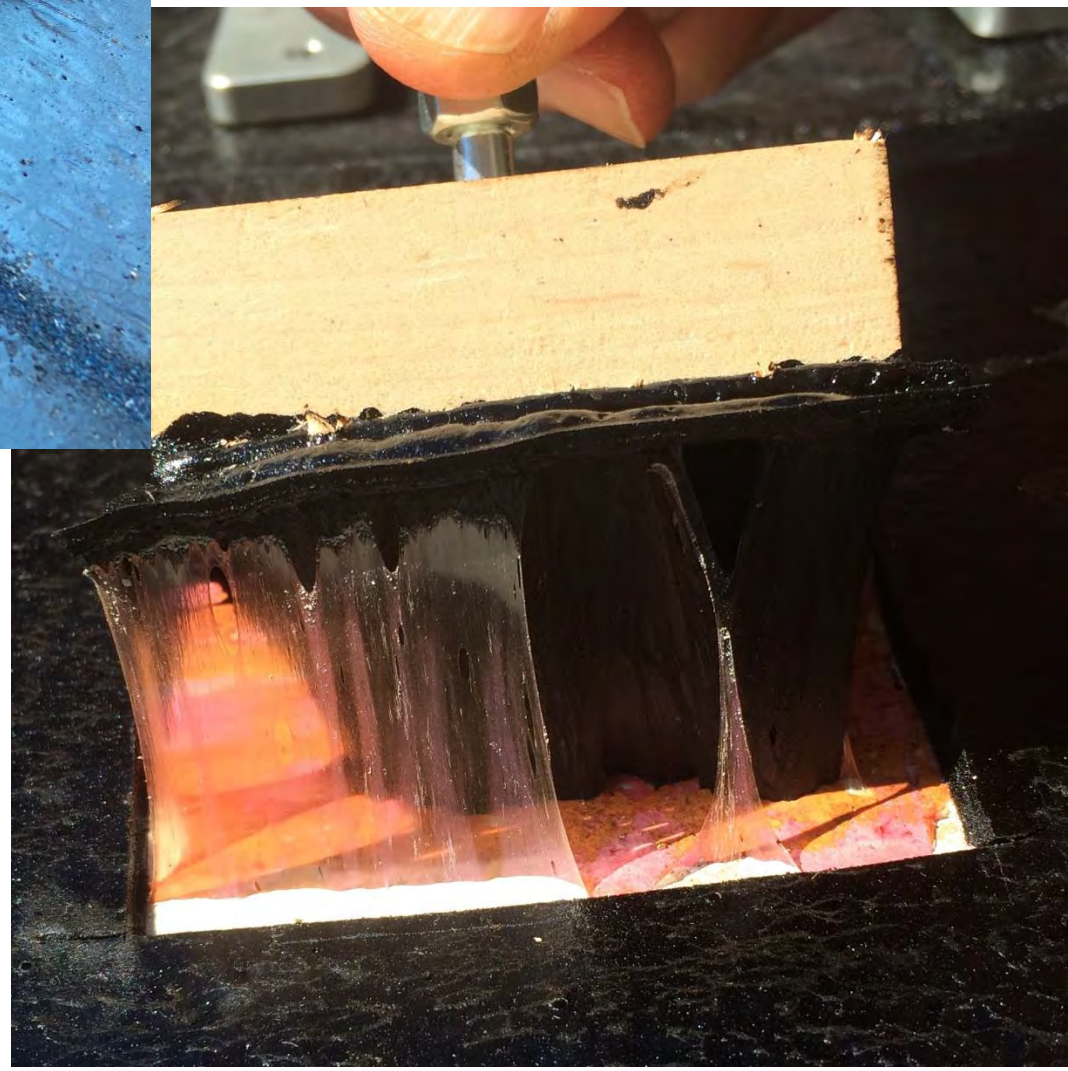
Day 18

Good primer adhesion to concrete

Day 28 SAM



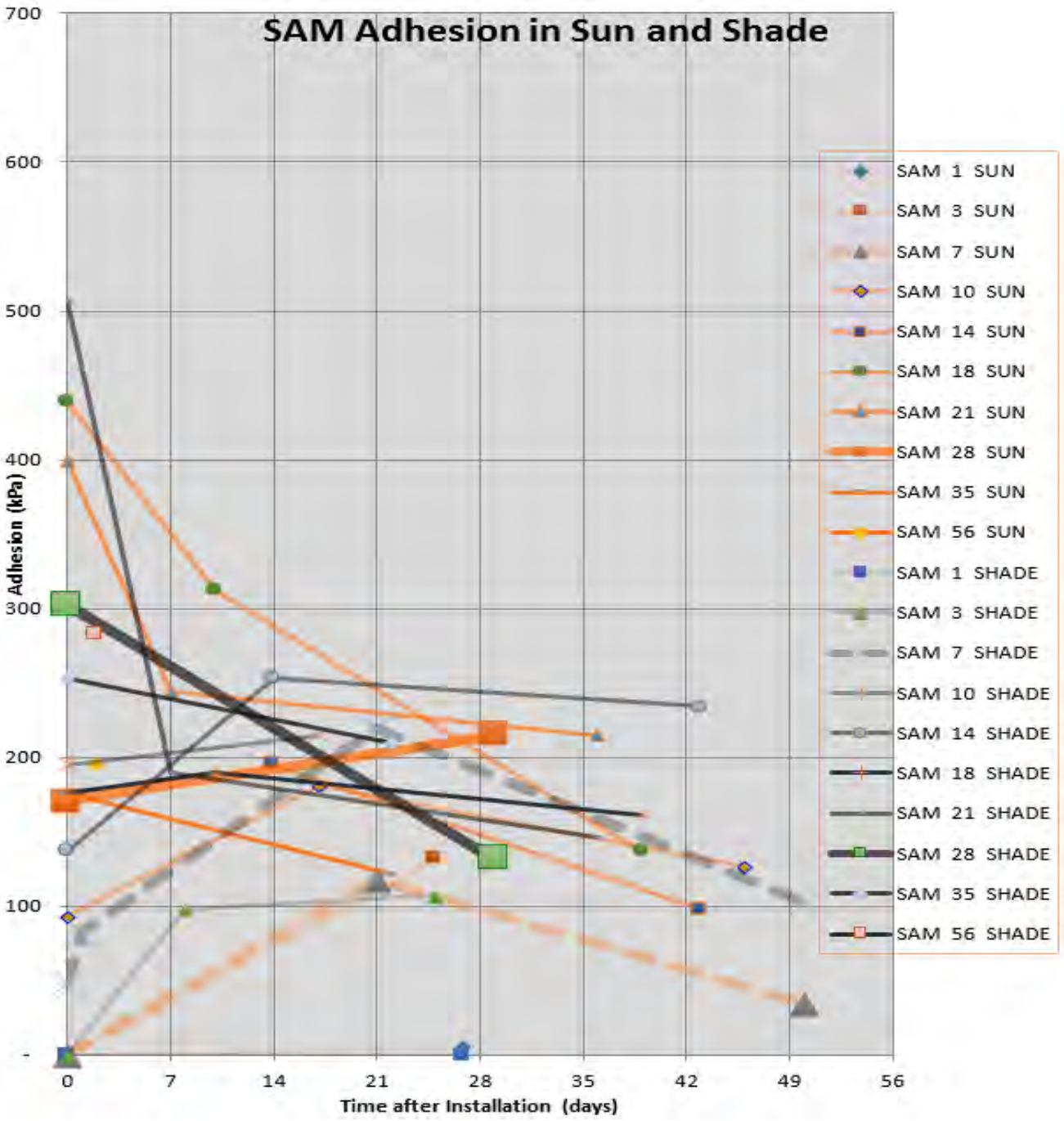




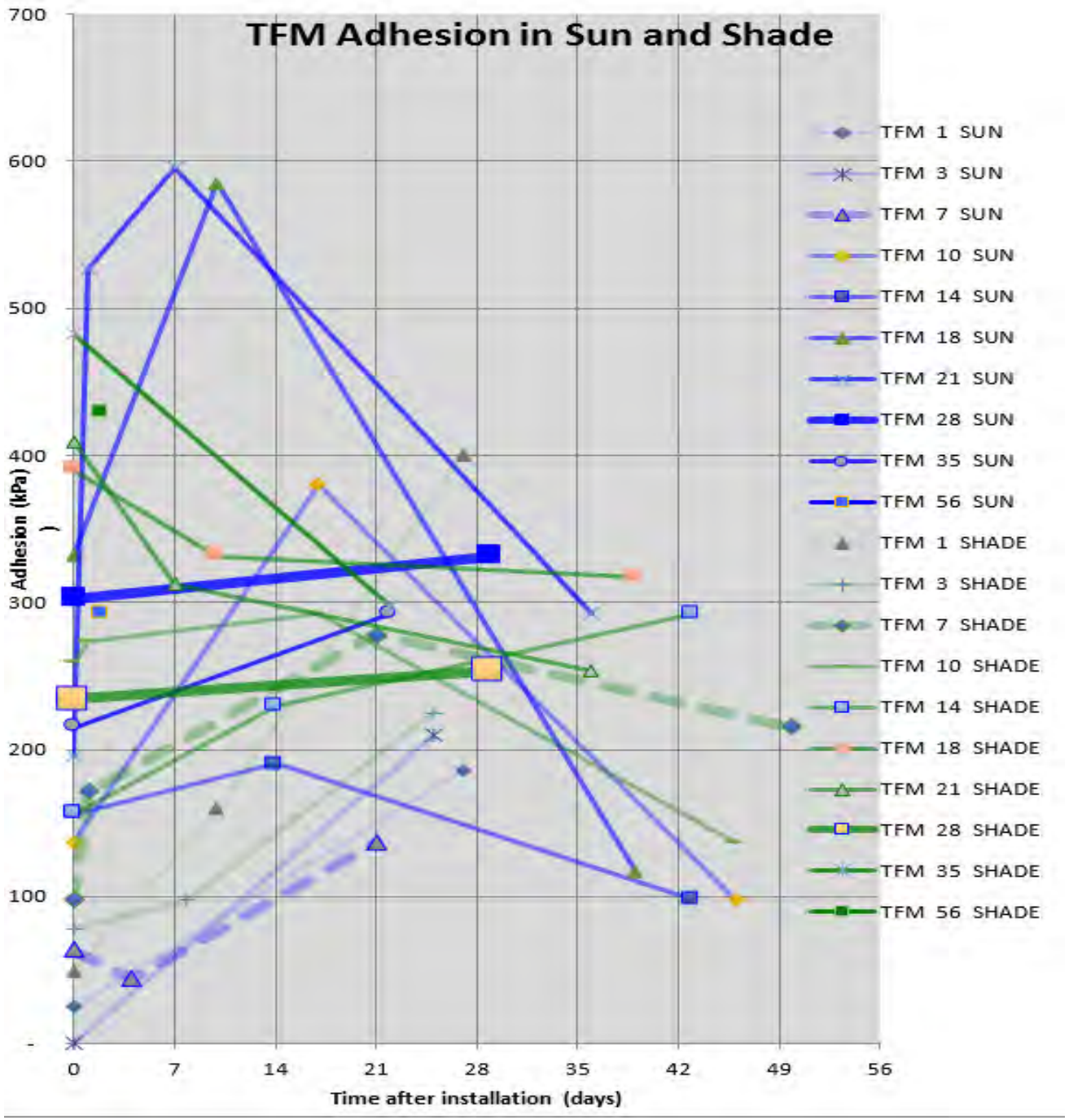
Day 35

- Blisters under Sun exposed slabs still visible
- Anecdotal experience says that protecting the membrane with insulation will decrease blistering
- Blistering related primarily to the TFM and primer system, vapour does not appear to diffuse away under the primer in this experiment

SAM Adhesion in Sun and Shade



TFM Adhesion in Sun and Shade



Day 83 – removing SAM

Day 83 - Demolition of slabs

Shade slab moved outdoors on Day 60

Conclusions

- SAM and TFM Membrane in the shade did not blister
- TFM blistered more than SAM
- Longer experimental time required to develop adhesion data at later ages
- Unknown cause of bond reduction at later ages. Possibly water or chemical action
- Rain undoes days of drying
- Moisture in slab seems to affect long term bond
- Most membrane installed before 28 days suffered bond reduction after 4 weeks on installation