Open Data supporting the Journal Paper Wet casting of multiple mix horizontally layered concrete elements

File

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Data provided

The data presented in the following figures and tables is included in this file:

Table 1, Table 2, Table 3, and Table 4
Figure 2, Figure 8, Figure 9, Figure 10, and Figure 11c

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Table 1: Concrete mix designations, constituent proportions, densities, and slump measurements.

Mix	Water [kg/m^3]	Cement [kg/m^3]	w/c	Sand [kg/m^3]	Coarse Agg. [kg/m^3]	Lytag [kg/m^3]	SP [%]	Red Dye [kg/m^3]	Density [kg/m3]	Slump [mm]
1NC	180	514	0.35	605	1076	0	0	10	2380	15
1LWAC	180	514	0.35	605	0	538	1	0	1900	230
2NC	205	586	0.35	588	1045	0	0	10	2210	130
2LWAC	180	514	0.35	605	0	538	0	0	2040	80
3NC	205	586	0.35	588	1045	0	1.5	10	2300	270
3LWAC	180	514	0.35	605	0	538	0	0	2030	60
4NC	205	586	0.35	588	1045	0	0.3	10	2340	30
4LWAC	180	514	0.35	605	0	538	1.5	0	1920	270
5NC	205	586	0.35	588	1045	0	1.6	10	2200	275
5LWAC	180	514	0.35	605	0	538	1.5	0	1900	280
6NC	205	586	0.35	588	1045	0	0.5	10	2250	145
6LWAC	180	514	0.35	605	0	538	1.5	0	1980	275
7NC	205	586	0.35	588	1045	0	1.8	10	2200	265
7LWAC	180	514	0.35	605	0	538	0.3	0	1880	220
8NC	180	514	0.35	605	1076	0	0	10	2380	20
8LWAC	150	429	0.35	638	0	567	0	0	2060	20
9NC	180	514	0.35	606	1076	0	1.2	10	2320	130
9LWAC	150	429	0.35	638	0	567	1.5	0	1940	135

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Table 2: Concrete mix constituent densities.

Constituent Description	Density [kg/m^3]
Coarse Aggregate *<10 mm, uncrushed*	2600
Lytag Concrete Aggregates (LWA) *4-14 mm, uncrushed*	1300
Sand *60% passing 600 µm sieve, <4 mm*	2600
Cement *CEM II/A-LL strength class 32.5R*	3200
Water	1000
Super Plasticizer (SP) *Polycarboxylate ether (PCE)*	1100
Red Concrete Dye	3000

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Table 3: Vibration times.

	Vibration time [s]																	
Specimen	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B	7A	7B	8A	8B	9A	9B
Bottom layer	6	9	9	5	8	4	4	9	3	2	4	4	3	3	15	18	7	8
Top layer	5	5	4	3	0	4	4	3	2	1	3	2	1	3	16	14	4	7

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Table 4: All specimen results, including CAD schematics of every cut.

	Int_{max}	$\Delta\rho$	Top τ_o	Bottom τ_o	$\Delta\tau_o$
	[mm]	[kg/m^3]	[Pa]	[Pa]	[Pa]
1A	66	-480	2433	509	-1924
1B	10	480	509	2433	1924
2A	25	-170	1439	1719	280
2B	32	170	1719	1439	-280
3A	10	-270	254	1866	1612
3B	52	270	1866	254	-1612
4A	79	-420	2420	228	-2192
4B	12	420	228	2420	2192
5A	79	-300	246	157	-89
5B	21	300	157	246	89
6A	55	-270	1336	208	-1128
6B	9	270	208	1336	1128
7A	16	-320	263	565	302
7B	20	320	565	263	-302
8A	20	-320	2402	2087	-315
8B	16	320	2087	2402	315
9A	10	-380	1511	1226	-285
9B	13	380	1226	1511	285

Supplementary data for Int_{max} determination

Cut 1		Cut 2		Cut 3		Total		
U	L	U	L	U	L	U_{max}	L_{max}	Int_{max}
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
11	16	50	-6	-3	13	50	16	66
6	4	0	3	3	1	6	4	10
9	9	16	-4	7	-3	16	9	25
7	5	27	3	19	-1	27	5	32
9	0	4	1	8	-1	9	1	10
17	21	30	12	31	17	31	21	52
39	29	50	6	6	28	50	29	79
11	1	3	0	8	1	11	1	12
36	43	31	28	27	22	36	43	79
9	12	5	0	4	7	9	12	21
27	20	35	12	5	17	35	20	55
6	1	1	2	0	3	6	3	9
8	8	5	2	6	4	8	8	16
10	10	9	3	3	7	10	10	20
16	4	6	0	7	0	16	4	20
7	3	13	-1	6	2	13	3	16
6	4	5	1	5	3	6	4	10
6	6	7	3	4	2	7	6	13

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Figure 2: Concrete mix slump measurements versus density.

Mix	Density [kg/m3]	Slump [mm]	Compressive cube strengths [MPa]	LWAC vertical lines	
1NC	2380	15		1880	0
1LWAC	1900	230		1880	300
2NC	2210	130		2060	0
2LWAC	2040	80	51	2060	300
3NC	2300	270	43		
3LWAC	2030	60			
4NC	2340	30	41	NC vertical lines	
4LWAC	1920	270	50	2200	0
5NC	2200	275		2200	300
5LWAC	1900	280		2380	0
6NC	2250	145		2380	300
6LWAC	1980	275			
7NC	2200	265			
7LWAC	1880	220		Horizontal lines	
8NC	2380	20	51	1500	100
8LWAC	2060	20	49	2500	100
9NC	2320	130		1500	250
9LWAC	1940	135		2500	250

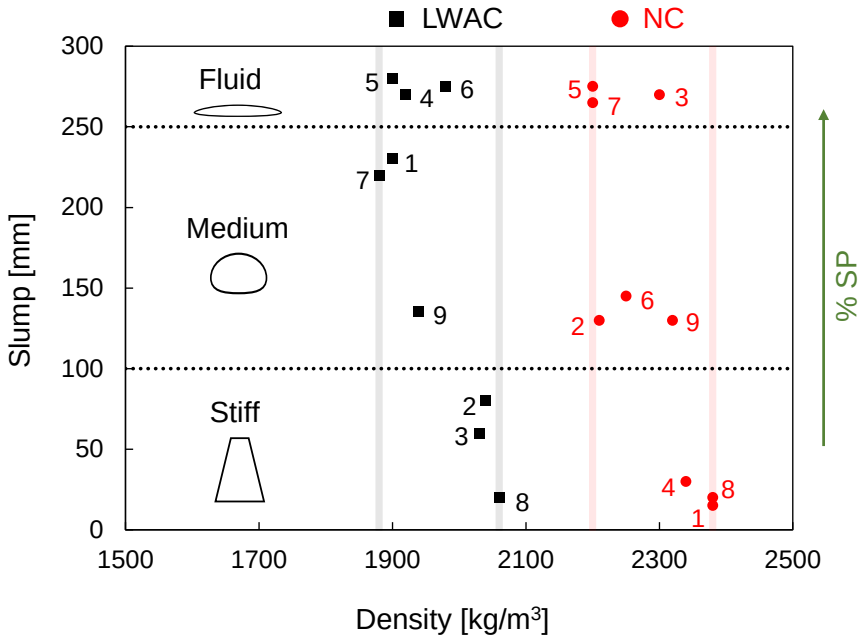

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Figure 8: Comparison between maximum interface depth (Intmax) and various specimen properties: a) Intmax vs. yield stress of bottom layer mix, b) Intmax vs. the ratio of the top mix density over the bottom mix yield stress, c) Intmax vs. the yield stress difference between the top and bottom mix (top subtracted from bottom), and d) Intmax vs. the density difference between top and bottom mix (top subtracted from bottom.

Specimen	Int_{max} [mm]	Bottom τ_o [Pa]	Top density [kg/m^3]	$\Delta\tau_o$ [Pa]	$\Delta\rho$ [kg/m^3]	Top density/Bottom τo [kg Pa^{-1} m^{-3}]
1A	66	509	2380	-1924	-480	4.7
1B	10	2433	1900	1924	480	0.8
2A	25	1719	2210	280	-170	1.3
2B	32	1439	2040	-280	170	1.4
3A	10	1866	2300	1612	-270	1.2
3B	52	254	2030	-1612	270	8.0
4A	79	228	2340	-2192	-420	10.3
4B	12	2420	1920	2192	420	0.8
5A	79	157	2200	-89	-300	14.0
5B	21	246	1900	89	300	7.7
6A	55	208	2250	-1128	-270	10.8
6B	9	1336	1980	1128	270	1.5
7A	16	565	2200	302	-320	3.9
7B	20	263	1880	-302	320	7.1
8A	20	2087	2380	-315	-320	1.1
8B	16	2402	2060	315	320	0.9
9A	10	1226	2320	-285	-380	1.9
9B	13	1511	1940	285	380	1.3

Figure 8a

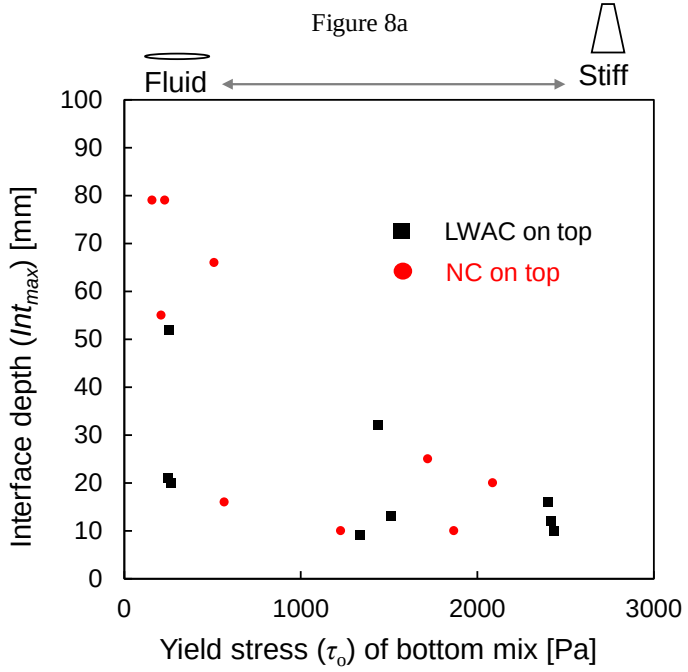

Figure 8b

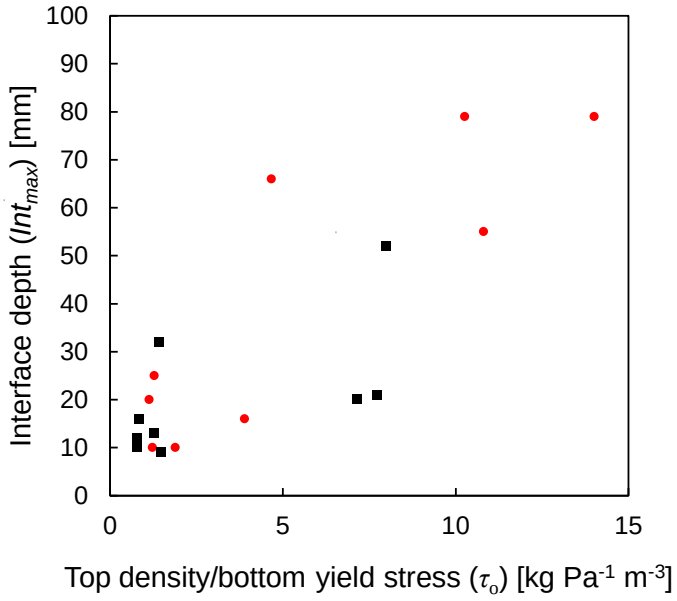

Figure 8c

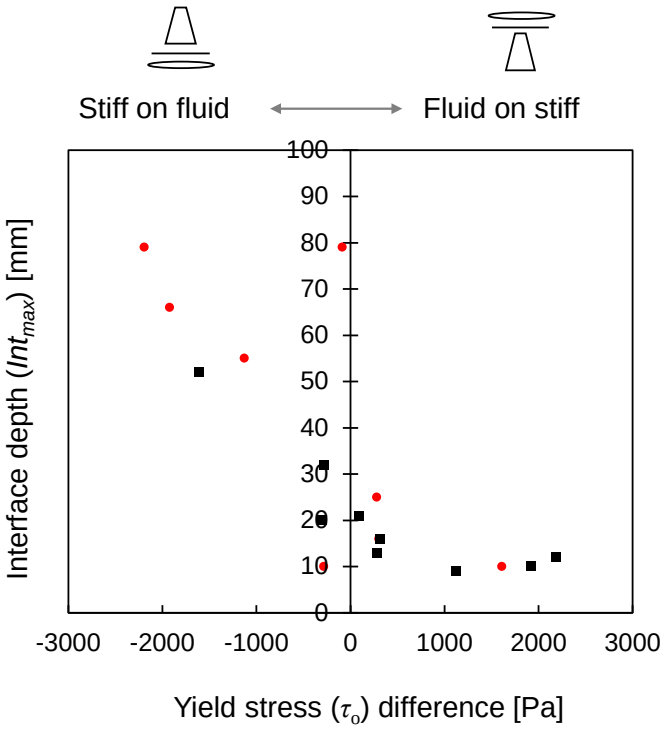

Figure 8d

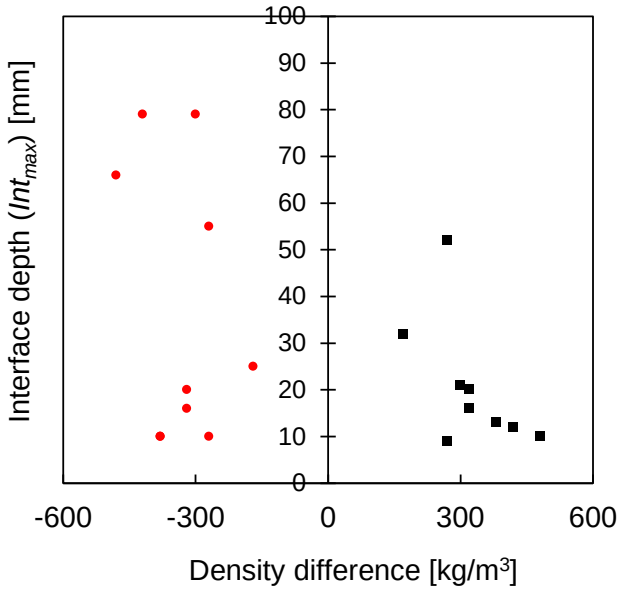

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Figure 9: Yield stress of top mix vs yield stress of bottom mix with zones of different hardened interface types demarcated.

Specimen	*Int_{max} [mm]	Bottom τ_o [Pa]	Top τ_o [Pa]	Horizontal line	
1A	66	509	2433	0	400
1B	10	2433	509	3000	400
2A	25	1719	1439	Vertical line	
2B	32	1439	1719	400	0
3A	10	1866	254	400	3000
3B	52	254	1866	Top diagonal	
4A	79	228	2420	0	400
4B	12	2420	228	2600	3000
5A	79	157	246	Bottom diagonal	
5B	21	246	157	400	0
6A	55	208	1336	3000	2600
6B	9	1336	208		
7A	16	565	263		
7B	20	263	565		
8A	20	2087	2402		
8B	16	2402	2087		
9A	10	1226	1511		
9B	13	1511	1226		

*Int_{max} used to size the data points proportionately

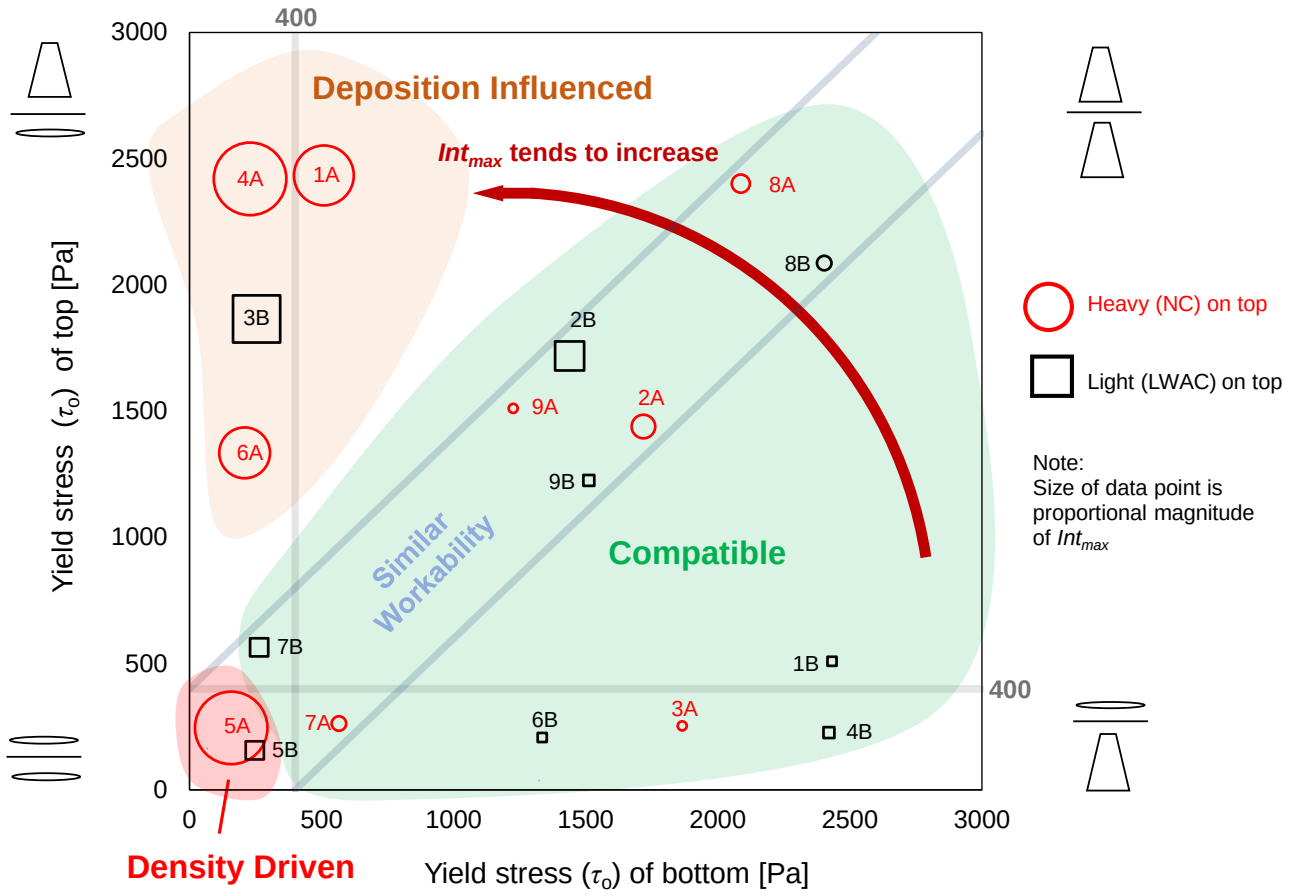

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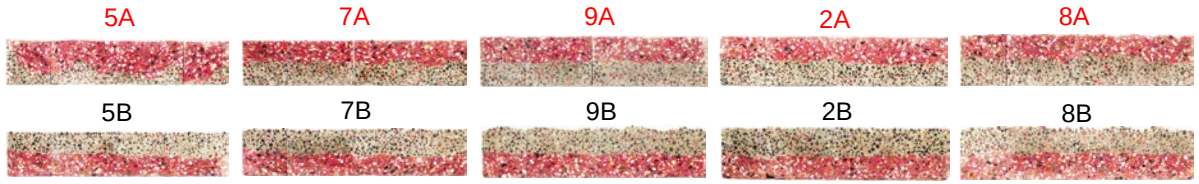
Figure 10: Interface depth vs the average yield stress of both mixes for any specimen with similar workability on top and bottom (yield within 400 Pa of each other).



	Top τ_o [Pa]	Bottom τ_o [Pa]	Average τ_o [Pa]	Int_{max} [mm]
2A	1439	1719	1579	25
2B	1719	1439	1579	32
5A	246	157	202	79
5B	157	246	202	21
7A	263	565	414	16
7B	565	263	414	20
8A	2402	2087	2245	20
8B	2087	2402	2245	16
9A	1511	1226	1369	10
9B	1226	1511	1369	13

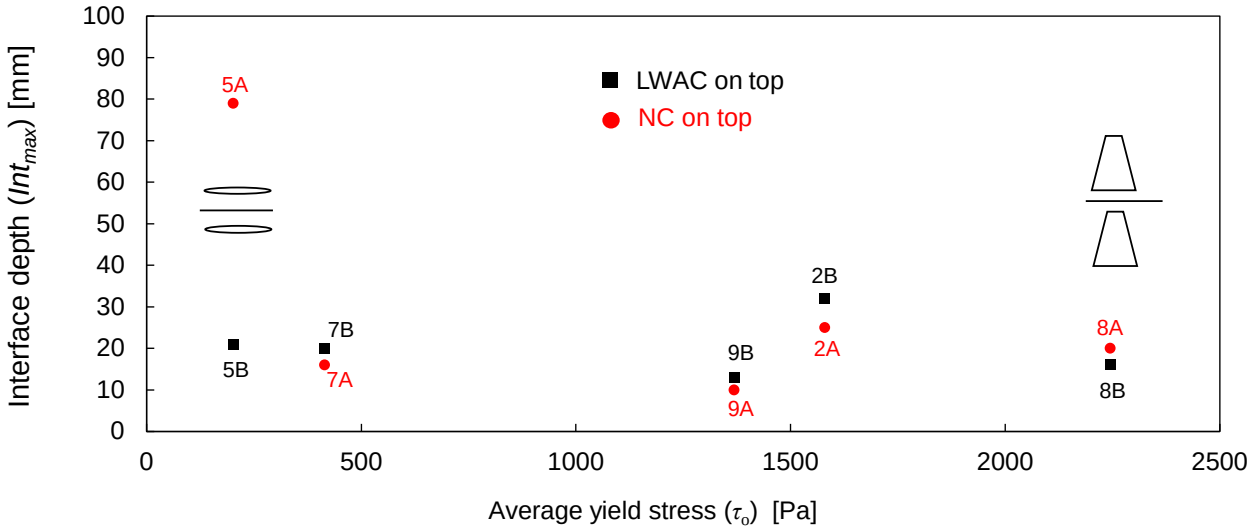


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Figure 11: Deposition influenced interface characteristics: c) vibration time vs. yield stress

Data for Figure 11c

Mix	Vibration time [s]	Yield stress [Pa]
1NC	6	509
1LWAC	9	2433
2NC	9	1719
2LWAC	5	1439
3NC	8	1866
3LWAC	4	254
4NC	4	228
4LWAC	9	2420
5NC	3	157
5LWAC	2	246
6NC	4	208
6LWAC	4	1336
7NC	3	565
7LWAC	3	263
8NC	15	2087
8LWAC	18	2402
9NC	7	1226
9LWAC	8	1511

Figure 11c