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CONCRETE MASONRY COMPRESSIVE STRENGTH USING THE UNIT STRENGTH METHOD

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Background

The current Canadian Masonry Design Standard (S304.1-2004) stipulates one of two methods to determine the compressive strength of concrete masonry for design. That is, testing of prisms built using materials representative of the actual construction materials or the use of tabulated values given in Table 4 of the Standard that are based on correlating the concrete unit compressive strength to the prism compressive strength based on research that was carried out in the 1970s and 1980s (Maurenbrecher, 1986). The objective of the analysis summarized in this report is to re-establish the correlations between unit strength and prism strength using recent test results. These correlations were examined using a large database of available test results of prism testing conducted mostly in North America, including a test program currently underway at the University of Alberta.

The tabulated values in Table 4 of the Canadian Standard were constructed from best-fit linear correlations between average concrete block compressive strength and average prism compressive strength values. Prism strength values were neither corrected for the prism height to thickness ratio nor for the effect of the mortar bedding type (full-bedded versus face-shell bedded). However, prism strength values were adjusted for the correct mortar bedding area resisting the load. A 20% reduction from the best-fit line was applied to the average prism strength values. These reduced values represent the basis for the current values in Table 4.

Description of the Database

For the analysis reported herein, a database was constructed for the compressive strength of both hollow and grouted concrete masonry construction. For hollow concrete block construction, 282 average/specified masonry compressive strength data points were computed from the test results of 1376 individual prisms. For grouted block construction, 89 data points from 310 individual prism tests were collected. Prism strength computations were performed according to CSA S304.1-04. The majority of the collected data ranged in sample size from 3 to 5 prisms. A full list of the collected data points and the references used in this analysis are given in Appendices I and II for hollow and grouted construction, respectively.

The database herein includes research subsequent to the research used in developing Table 4. Appropriate correction factors were applied to the computed masonry compressive strength values to take into account the effect of the following influential parameters:

- Prism height to thickness ratio— compressive strength values were multiplied by the correction factors given in Table D.1 of CSA S304.1-04 (see Table 1)

- Prism bedded area used for strength computation— where face-shell bedded prisms were tested and the reported masonry compressive strength was computed based on the average net area, strength values were increased by the area factors shown in Table 2. These factors represent the rations between the average net area to the face-shell bedded area for different block sizes.

- Effect of type of mortar bedding— research has shown that fully bedded prisms and face-shell bedded prisms do not have direct strength correlation to load resisting areas. Two major investigations have

examined this parameter and have shown that face-shell bedded prisms have 10% (Maurenbrecher, 1986) to 15% (Gaynor et al., 1987) higher compressive strength than similar but fully bedded prisms. The more conservative value of 10% was used in this analysis to increase the strength of fully bedded prisms.

TABLE 1- Height to Thickness Correction Factors (CSA S304.1-04)

Correction factor			
		Hollow and semi-solid units	
Height-to-thickness ratio*	Solid units†	Concrete‡	Clay
1.4	—	1.00	0.85
2	0.80	1.00	0.85
3	0.90	1.00	0.90
4	0.95	1.00	0.95
5 to 10	1.00	1.00	1.00

**Linear interpolation is permitted.*
†Including fully grouted hollow and semi-solid units.
‡For two-unit-high, hollow and semi-solid concrete block prisms, a correction factor of 0.90 shall be applied.

TABLE 2- Bedding Area Correction Factor for Strength Computation (Maurenbrecher, 1986)

Block Size (mm)	Area Factor (net/face-shell)
90	1.05
140	1.14
190	1.36
240	1.46
290	1.64

Results and Discussion

Using the data shown in Appendix I for hollow masonry prisms constructed using Type S and Type N mortars, best-fit correlations were developed between the average block compressive strength and the average prism compressive strength, Figures 1 and 2 respectively. A power correlation ($y = a \bullet x^b$) yielded the highest R^2 values. The correlation curve was lowered by a factor of 0.82 and 0.81 for Type S and Type N mortars so that 90% of the prism average compressive strength points fall above the correlation curve. This approach is similar to what was followed in developing Table 4 of CSA S304.1-04.

In addition, correlations were established between the average block strength and the specified prism compressive strength. These correlations are shown in Figures 3 and 4 for Type S and Type N mortars; respectively. This is a very conservative approach as a correlation between the average block strength and the specified prism strength yields lower prism strength vale for a given designated/nominal block strength than a correlation between the specified block strength and specified prism strength would.

Based on these two sets of correlations (average block vs reduced average prism strength and specified block vs specified prism strength), updated tabulated values for the compressive strength of hollow masonry were derived and are given in Table 3.

Data for grouted masonry prisms were deemed insufficient to construct reliable correlations between block strength and prism strength. Further data is needed and a recently recruited Masters student at the University of Alberta is currently working on expanding the database for grouted masonry.

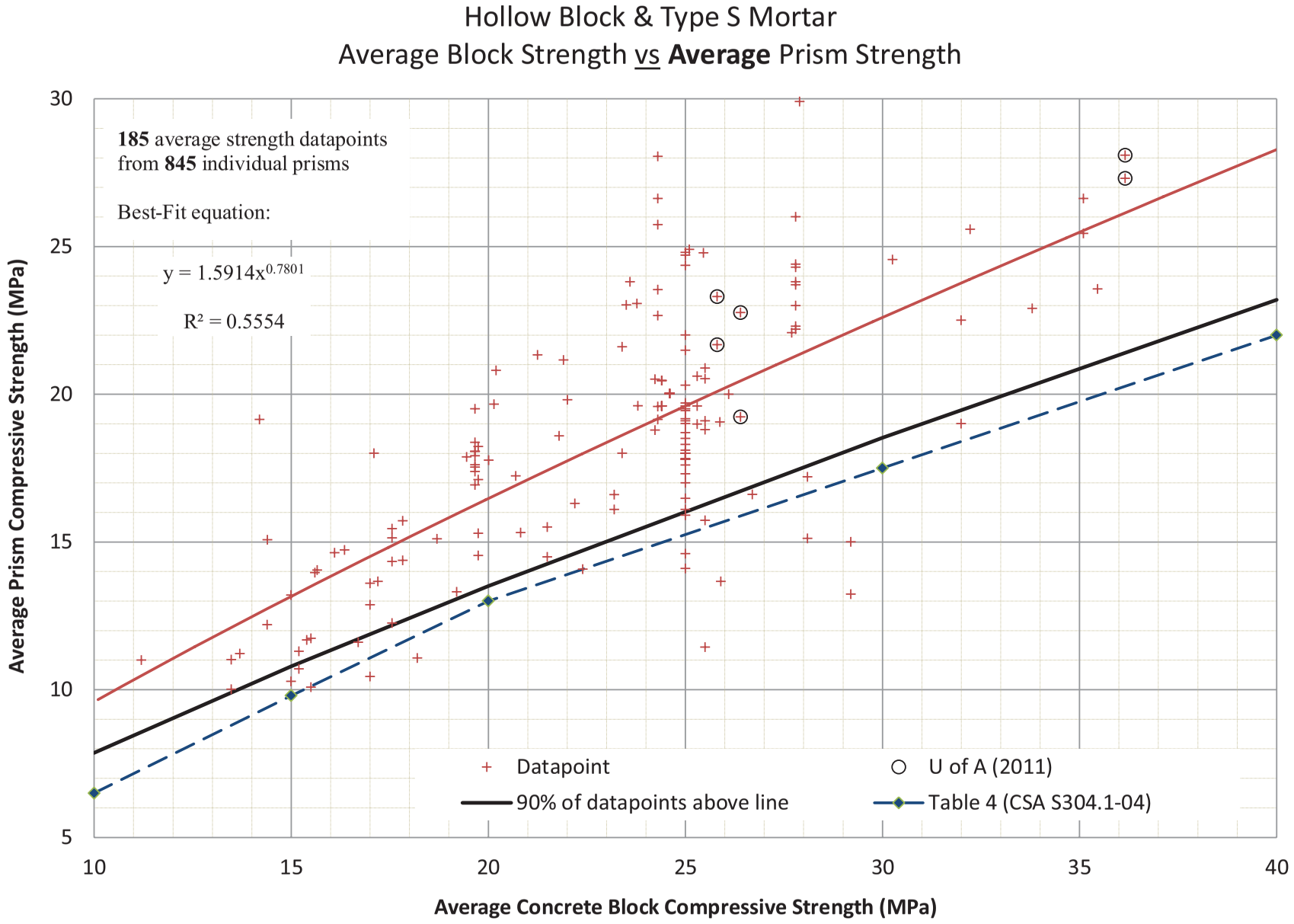

FIGURE 1- Correlation between Average Block and Average Prism Strength for Hollow Masonry with Type S Mortar

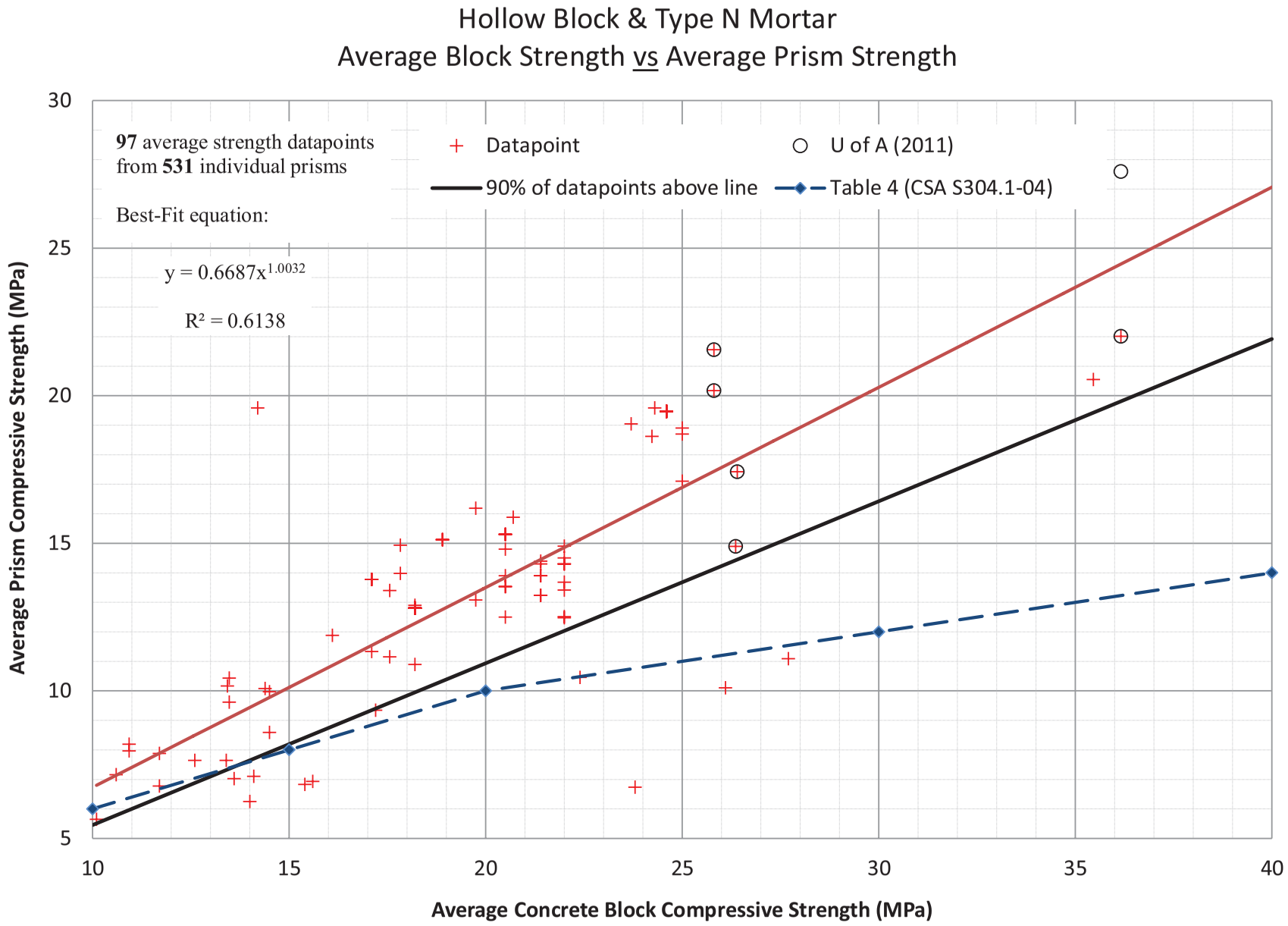

FIGURE 2- Correlation between Average Block and Average Prism Strength for Hollow Masonry with Type N Mortar

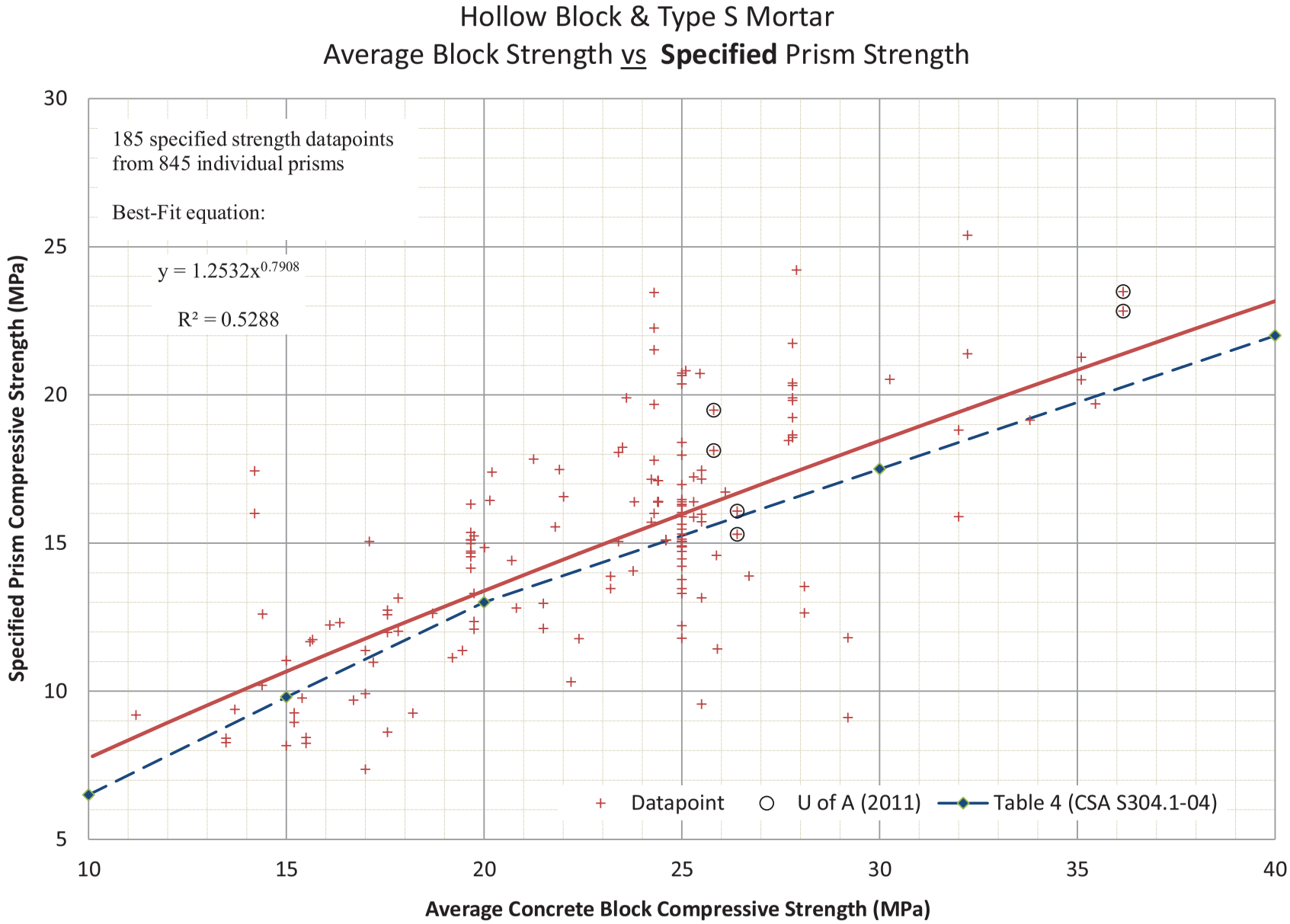

FIGURE 3- Correlation between Average Block and Specified Prism Strength for Hollow Masonry with Type S Mortar

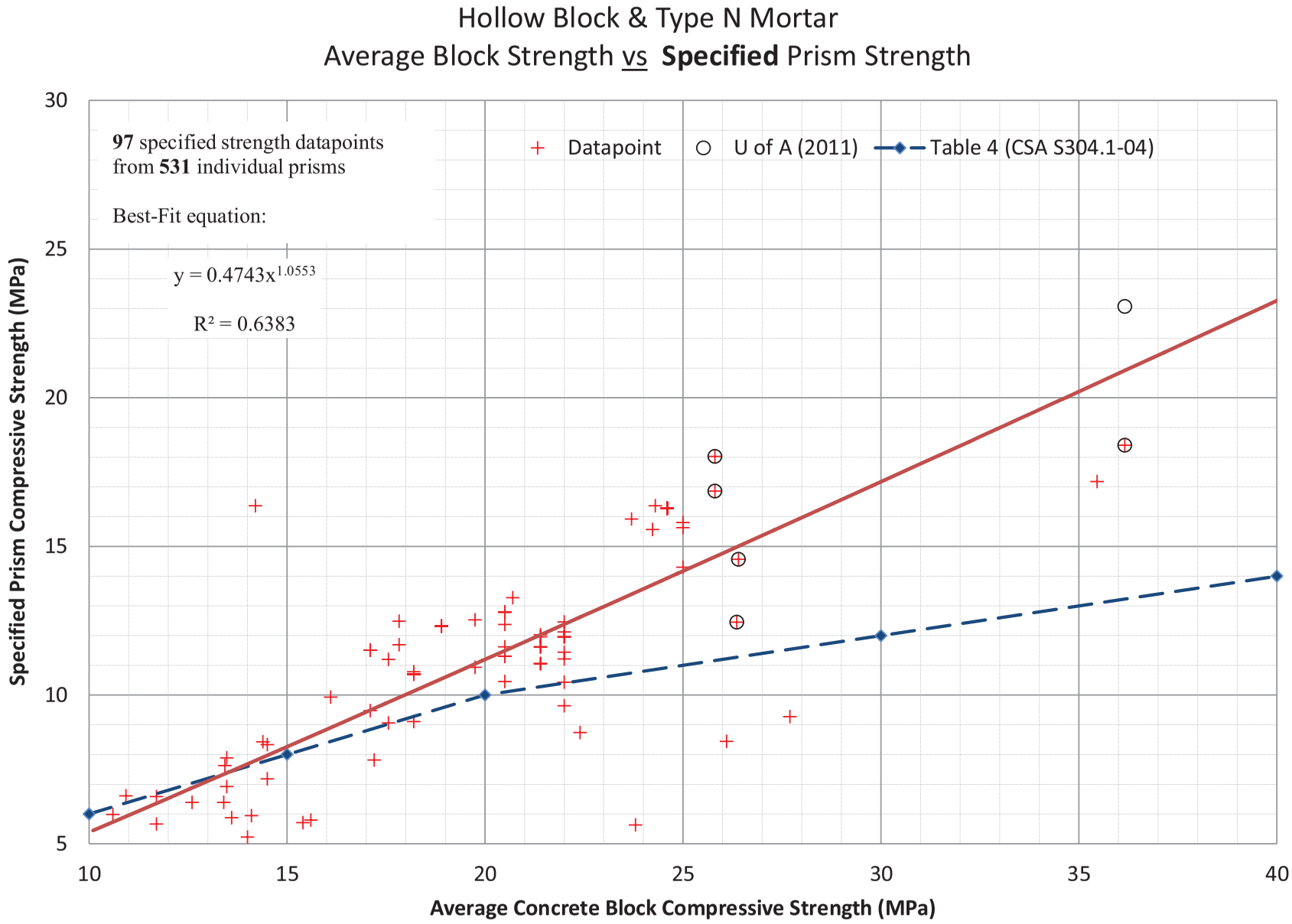

FIGURE 4- Correlation between Average Block and Specified Prism Strength for Hollow Masonry with Type N Mortar

Table 3- Summary of Proposed Updated Compressive Strength Values for Hollow Masonry

Block Strength (MPa)	Hollow Concrete Masonry Compressive Strength (f'_m)											
	Type S Mortar						Type N Mortar					
	Current Value	90% Line (Average)	Best Fit (Specified)	Proposed Value	% Increase	f'_m/f_u	Current Value	90% Line (Average)	Best Fit (Specified)	Proposed Value	% Increase	f'_m/f_u
40 or more	22.0	23.2	23.2	**23.0**	4.5	0.58	14	21.9	23.3	**18.0**	28.6	0.45
30	17.5	18.5	18.5	**18.5**	5.7	0.62	12	16.4	17.2	**15.0**	25.0	0.50
20	13.0	13.5	13.4	**13.5**	3.8	0.68	10	10.9	11.2	**11.0**	10.0	0.55
15	9.8	10.8	10.7	**10.5**	7.1	0.70	8	8.2	8.3	**8.5**	6.3	0.57
10	6.5	7.9	7.7	**7.5**	15.4	0.75	6	5.5	5.4	**6.0**	0.0	0.60

Note: Test data for prisms constructed using 30 MPa and 40 MPa concrete blocks and Type N mortar is limited. This explains the caution exercised in proposing new values for these high strength blocks. An experimental program to determine the compressive strength of hollow and grouted masonry prisms constructed of concrete blocks having compressive strength from 10 MPa to 40 MPa and Type S or Type N mortar is currently ongoing at the University of Alberta. The test program includes both masonry cement mortar and PCL mortar.

APPENDIX I

COMPRESSIVE STRENGTH OF HOLLOW PRISMS

	Prism Dimensions						Mortar					Block		Prism					
Reference	Height (h)	Length (l)	Thickness (t)	h/t	Courses	Correction Factor	Type	Thickness	Strength	C.O.V	Bedding	Compressive Strength	St. Dev.	Average Strength	C.O.V.	Number of Tests	Bedding Area Factor	Bedding Type Factor	Calculated Specified Strength f'm
	(mm)						(C:L:S)	(mm)	(MPa)	(%)		(MPa)	(MPa)	(MPa)	(%)				(MPa)
1	397	397	194	2.05	2	0.9	S	9.5	14.9	8	Full	25.9	4.8	19.3	14.3	8	1.00	1.10	14.6
	397	397	194	2.05	2	0.9	S	12.7	14.9	8	Full	25.9	4.8	13.8	3.3	3	1.00	1.10	11.4
2	590	390	200	2.95	3	1.0	-	10.0	15.6	6	FS	19.8	2.3	13.4	9.3	6	1.36	1.00	15.2
	590	390	200	2.95	3	1.0	-	10.0	15.6	6	Full	19.8	2.3	13.9	11.7	6	1.00	1.10	12.3
	590	390	200	2.95	3	1.0	-	10.0	12.2	8	FS	19.8	2.3	12.6	13.6	6	1.36	1.00	13.3
	590	390	200	2.95	3	1.0	-	10.0	12.2	8	Full	19.8	2.3	13.2	10.3	6	1.00	1.10	12.1
	590	390	200	2.95	3	1.0	-	10.0	5.0	15	FS	19.8	2.3	11.9	13.8	6	1.36	1.00	12.5
	590	390	200	2.95	3	1.0	-	10.0	5.0	15	Full	19.8	2.3	11.9	7.7	6	1.00	1.10	10.9
	590	390	200	2.95	3	1.0	-	10.0	15.6	6	FS	17.6	1.4	11.4	10.7	6	1.36	1.00	12.7
	590	390	200	2.95	3	1.0	-	10.0	15.6	6	Full	17.6	1.4	13.8	10.3	6	1.00	1.10	12.6
	590	390	200	2.95	3	1.0	-	10.0	12.2	8	FS	17.6	1.4	10.5	9.4	6	1.36	1.00	12.0
	590	390	200	2.95	3	1.0	-	10.0	12.2	8	Full	17.6	1.4	11.1	18.1	6	1.00	1.10	8.6
	590	390	200	2.95	3	1.0	-	10.0	5.0	15	FS	17.6	1.4	9.9	9.9	6	1.36	1.00	11.2
	590	390	200	2.95	3	1.0	-	10.0	5.0	15	Full	17.6	1.4	10.1	11.4	6	1.00	1.10	9.1
	590	390	200	2.95	3	1.0	-	10.0	12.2	8	FS	13.5	1.4	8.1	14.4	6	1.36	1.00	8.4
	590	390	200	2.95	3	1.0	-	10.0	12.2	8	Full	13.5	1.4	9.1	10.7	6	1.00	1.10	8.3
	590	390	200	2.95	3	1.0	-	10.0	5.0	15	FS	13.5	1.4	7.7	14.9	6	1.36	1.00	7.9
	590	390	200	2.95	3	1.0	-	10.0	5.0	15	Full	13.5	1.4	8.7	17.0	6	1.00	1.10	6.9
	590	390	200	2.95	3	1.0	-	10.0	5.0	15	FS	10.9	1.3	6.0	25.1	6	1.36	1.00	4.8
	590	390	200	2.95	3	1.0	-	10.0	5.0	15	Full	10.9	1.3	7.2	10.4	6	1.00	1.10	6.6
3	600	390	143	4.20	3	1.0	S	9.5	15.1	-	Full	19.7	0.8	15.8	4.2	5	1.00	1.10	14.5
	600	390	143	4.20	3	1.0	S	9.5	16.7	-	Full	19.7	0.8	16.0	7.5	5	1.00	1.10	14.7
	600	390	143	4.20	3	1.0	S	9.5	17.3	-	Full	19.7	0.8	15.9	3.3	5	1.00	1.10	14.7
	600	390	143	4.20	3	1.0	S	9.5	14.7	-	Full	19.7	0.8	16.4	3.6	5	1.00	1.10	15.1
	600	390	143	4.20	3	1.0	S	9.5	14.2	-	Full	32.2	2.2	27.6	4.9	4	1.00	1.10	25.4
	600	390	143	4.20	3	1.0	S	19.1	14.2	-	Full	32.2	2.2	23.3	1.1	2	1.00	1.10	21.4
	600	390	143	4.20	3	1.0	S	9.5	14.2	-	Full	16.4	2.1	13.4	4.0	3	1.00	1.10	12.3
	600	390	143	4.20	3	1.0	S	9.5	14.2	-	Full	22.0	0.9	18.0	1.7	4	1.00	1.10	16.6
	600	390	143	4.20	3	1.0	S	9.5	14.2	-	Full	21.3	1.3	19.4	1.5	3	1.00	1.10	17.8
	600	390	143	4.20	3	1.0	S	9.5	14.2	-	Full	20.1	1.1	17.9	5.1	4	1.00	1.10	16.4
	600	390	143	4.20	3	1.0	S	9.5	14.2	-	Full	20.0	1.2	16.1	6.9	4	1.00	1.10	14.8
	600	390	143	4.20	3	1.0	S	9.5	14.2	-	Full	15.7	1.3	12.8	8.4	3	1.00	1.10	11.7
	600	390	143	4.20	3	1.0	S	9.5	12.8	-	Full	19.7	0.8	16.7	1.1	3	1.00	1.10	15.4
	600	390	143	4.20	3	1.0	S	9.5	12.8	-	Full	19.7	0.8	17.7	4.6	4	1.00	1.10	16.3
4	590	195	190	3.11	3	1.0	S	10.0	17.0	-	FS	25.1	-	24.9	6.8	4	1.00	1.00	20.8
	590	195	190	3.11	3	1.0	S	10.0	17.0	-	FS	17.1	-	18.0	7.3	3	1.00	1.00	15.0
	590	195	190	3.11	3	1.0	S	10.0	17.0	-	FS	27.9	-	29.9	11.6	3	1.00	1.00	24.2
	590	195	190	3.11	3	1.0	S	10.0	17.0	-	FS	20.2	-	20.8	1.5	3	1.00	1.00	17.4

	590	195	190	3.11	3	1.0	S	10.0	17.0	-	FS	22.2	-	16.3	22.4	3	1.00	1.00	10.3
	590	195	140	4.21	3	1.0	S	10.0	17.0	-	FS	23.6	-	23.8	3.6	3	1.00	1.00	19.9
	590	195	240	2.46	3	1.0	S	10.0	17.0	-	FS	23.4	-	21.6	8.9	3	1.00	1.00	18.1
5	587	390	190	3.09	3	1.0	1:1:6	10.0	9.2	-	Full	14.2	1.5	17.8	6.2	3	1.00	1.10	16.4
	587	390	190	3.09	3	1.0	1:0.5:4.5	10.0	15.4	-	Full	14.2	1.5	17.4	5.2	3	1.00	1.10	16.0
	587	390	190	3.09	3	1.0	1:0.5:4.5	10.0	15.4	-	Full	14.2	1.5	20.6	14.1	3	1.00	1.10	17.4
6	602	395	194	3.10	3	1.0	N	10.0	-	-	FS	18.2	-	12.9	6.0	6	1.00	1.00	10.8
	602	100	240	2.51	3	1.0	S	10.0	-	-	FS	23.4	-	18.0	10.0	3	1.00	1.00	15.0
	599	396	142	4.22	3	1.0	S	10.0	-	-	FS	15.2	-	11.3	11.0	5	1.00	1.00	9.3
	599	792	142	4.22	3	1.0	S	10.0	-	-	FS	15.2	-	10.7	10.0	3	1.00	1.00	8.9
	398	397	194	2.05	2	0.9	S	10.0	-	-	Full	17.0	-	13.0	14.0	10	1.00	1.10	9.9
	398	397	194	2.05	2	0.9	S	10.0	-	-	FS	17.0	-	11.6	18.0	10	1.00	1.00	7.4
	1010	993	194	5.21	5	1.0	S	10.0	-	-	FS	17.0	-	13.6	10.0	2	1.00	1.00	11.4
	396	397	194	2.04	2	1.0	N	10.0	-	-	FS	22.0	1.8	14.9	4.0	12	1.00	1.00	12.5
	1005	397	194	5.18	5	1.0	N	10.0	-	-	FS	22.0	1.8	14.3	4.0	12	1.00	1.00	12.0
	396	397	194	2.04	2	0.9	N	10.0	-	-	FS	22.0	1.8	15.2	5.0	10	1.00	1.00	11.4
	396	397	194	2.04	2	0.9	N	10.0	-	-	FS	22.0	1.8	13.9	14.0	10	1.00	1.00	9.6
	396	397	194	2.04	2	0.9	N	10.0	-	-	Full	22.0	1.8	12.6	10.0	10	1.00	1.10	10.4
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	386	391	140	2.76	2	0.9	N	10.0	-	-	Full	21.4	0.9	14.7	4.0	10	1.00	1.09	12.0
	782	391	140	5.59	4	1.0	N	10.0	-	-	FS	21.4	0.9	13.9	4.0	10	1.00	1.00	11.6
	790	391	140	5.64	4	1.0	N	10.0	-	-	FS	20.5	1.6	12.5	7.0	10	1.00	1.00	10.5
	790	391	140	5.64	4	1.0	N	10.0	-	-	Full	20.5	1.6	12.3	10.0	5	1.00	1.10	11.3
	790	391	140	5.64	4	1.0	N	10.0	-	-	Full	20.5	1.6	12.3	10.0	5	1.00	1.10	11.3
	794	391	140	5.67	4	1.0	N	10.0	-	-	FS	20.5	2.3	15.3	7.0	5	1.00	1.00	12.8
	794	391	140	5.67	4	1.0	N	10.0	-	-	FS	20.5	2.3	15.3	7.0	5	1.00	1.00	12.8
	794	391	140	5.67	4	1.0	N	10.0	-	-	FS	20.5	2.3	15.3	7.0	5	1.00	1.00	12.8
	794	391	140	5.67	4	1.0	N	10.0	-	-	FS	20.5	2.3	14.8	9.0	5	1.00	1.00	12.4
	1397	1173	140	9.98	7	1.0	N	10.0	-	-	FS	20.5	2.3	13.9	5.0	10	1.00	1.00	11.6
	392	391	140	2.80	2	0.9	N	10.0	-	-	FS	18.2	1.3	12.1	6.0	12	1.00	1.00	9.1
	392	391	140	2.80	2	0.9	S	10.0	-	-	FS	18.2	1.3	12.3	6.0	12	1.00	1.00	9.3
	398	397	92	4.33	2	0.9	S	10.0	-	-	Full	17.2	-	13.8	12.0	6	1.00	1.10	11.0
	398	397	92	4.33	2	0.9	N	10.0	-	-	Full	17.2	-	9.4	10.0	3	1.00	1.10	7.8
	398	397	92	4.33	2	0.9	S	10.0	-	-	Full	26.1	-	20.2	5.0	6	1.00	1.10	16.7
	398	397	92	4.33	2	0.9	N	10.0	-	-	Full	26.1	-	10.2	10.0	3	1.00	1.10	8.4
	398	397	143	2.78	2	0.9	S	10.0	-	-	Full	15.4	-	11.8	7.0	6	1.00	1.10	9.8
	398	397	143	2.78	2	0.9	N	10.0	-	-	Full	15.4	-	6.9	10.0	3	1.00	1.10	5.7
	398	397	143	2.78	2	0.9	S	10.0	-	-	Full	23.8	-	19.8	9.0	6	1.00	1.10	16.4
	398	397	143	2.78	2	0.9	N	10.0	-	-	Full	23.8	-	6.8	10.0	3	1.00	1.10	5.6
	398	397	194	2.05	2	0.9	S	10.0	-	-	Full	15.6	-	14.1	6.0	6	1.00	1.10	11.7
	398	397	194	2.05	2	0.9	N	10.0	-	-	Full	15.6	-	7.0	10.0	3	1.00	1.10	5.8
	398	397	194	2.05	2	0.9	S	10.0	-	-	Full	27.7	-	22.3	7.0	6	1.00	1.10	18.5
	398	397	194	2.05	2	0.9	N	10.0	-	-	Full	27.7	-	11.2	10.0	3	1.00	1.10	9.3
	398	397	143	2.78	2	1.0	S	10.0	-	-	Full	24.6	-	18.2	15.0	5	1.00	1.10	15.1
	398	397	143	2.78	2	1.0	S	10.0	-	-	Full	24.6	-	18.2	15.0	5	1.00	1.10	15.1
	398	397	143	2.78	2	1.0	S	10.0	-	-	Full	24.6	-	18.2	15.0	5	1.00	1.10	15.1
	398	397	143	2.78	2	1.0	S	10.0	-	-	Full	24.6	-	18.2	15.0	5	1.00	1.10	15.1
	398	397	143	2.78	2	1.0	S	10.0	-	-	Full	24.6	-	18.2	15.0	5	1.00	1.10	15.1
	398	397	143	2.78	2	1.0	S	10.0	-	-	Full	24.6	-	18.2	15.0	5	1.00	1.10	15.1
	398	397	143	2.78	2	1.0	S	10.0	-	-	Full	24.6	-	18.2	15.0	5	1.00	1.10	15.1
	398	397	143	2.78	2	1.0	S	10.0	-	-	Full	24.6	-	18.2	15.0	5	1.00	1.10	15.1
	398	397	143	2.78	2	1.0	S	10.0	-	-	Full	24.6	-	18.2	15.0	5	1.00	1.10	15.1
	398	397	143	2.78	2	1.0	S	10.0	-	-	Full	24.6	-	18.2	15.0	5	1.00	1.10	15.1
	398	397	143	2.78	2	1.0	S	10.0	-	-	Full	24.6	-	18.2	15.0	5	1.00	1.10	15.1

	398	397	143	2.78	2	1.0	S	10.0	-	-	Full	24.6	-	18.2	15.0	5	1.00	1.10	15.1
	398	397	143	2.78	2	1.0	S	10.0	-	-	Full	24.6	-	18.2	15.0	5	1.00	1.10	15.1
	398	397	143	2.78	2	1.0	S	10.0	-	-	Full	24.6	-	18.2	15.0	5	1.00	1.10	15.1
	398	397	143	2.78	2	1.0	S	10.0	-	-	Full	24.6	-	18.2	15.0	5	1.00	1.10	15.1
	398	397	143	2.78	2	1.0	S	10.0	-	-	Full	24.6	-	18.2	15.0	5	1.00	1.10	15.1
	398	397	143	2.78	2	1.0	S	10.0	-	-	Full	24.6	-	18.2	15.0	5	1.00	1.10	15.1
	398	397	143	2.78	2	1.0	S	10.0	-	-	Full	24.6	-	18.2	15.0	5	1.00	1.10	15.1
	398	397	143	2.78	2	1.0	S	10.0	-	-	Full	24.6	-	18.2	15.0	5	1.00	1.10	15.1
	398	397	143	2.78	2	1.0	S	10.0	-	-	Full	24.6	-	18.2	15.0	5	1.00	1.10	15.1
	398	397	143	2.78	2	1.0	N	10.0	-	-	Full	24.6	-	17.7	10.0	5	1.00	1.10	16.3
	398	397	143	2.78	2	1.0	N	10.0	-	-	Full	24.6	-	17.7	10.0	5	1.00	1.10	16.3
	398	397	143	2.78	2	1.0	N	10.0	-	-	Full	24.6	-	17.7	10.0	5	1.00	1.10	16.3
	398	397	143	2.78	2	1.0	N	10.0	-	-	Full	24.6	-	17.7	10.0	5	1.00	1.10	16.3
	398	397	143	2.78	2	1.0	N	10.0	-	-	Full	24.6	-	17.7	10.0	5	1.00	1.10	16.3
	398	397	143	2.78	2	1.0	N	10.0	-	-	Full	24.6	-	17.7	10.0	5	1.00	1.10	16.3
	398	397	143	2.78	2	1.0	N	10.0	-	-	Full	24.6	-	17.7	10.0	5	1.00	1.10	16.3
	398	397	143	2.78	2	1.0	N	10.0	-	-	Full	24.6	-	17.7	10.0	5	1.00	1.10	16.3
	398	397	143	2.78	2	1.0	N	10.0	-	-	Full	24.6	-	17.7	10.0	5	1.00	1.10	16.3
	398	397	143	2.78	2	1.0	N	10.0	-	-	Full	24.6	-	17.7	10.0	5	1.00	1.10	16.3
	1268	812	203	6.25	6	1.0	N	10.0	-	-	Full	11.7	-	7.2	10.0	2	1.00	1.10	6.6
	1268	812	203	6.25	6	1.0	N	10.0	-	-	FS	11.7	-	6.8	10.0	2	1.00	1.00	5.7
	1268	812	203	6.25	6	1.0	N	10.0	-	-	Full	14.1	-	6.5	10.0	2	1.00	1.10	5.9
	1268	812	203	6.25	6	1.0	N	10.0	-	-	Full	14.0	-	5.7	10.0	2	1.00	1.10	5.2
	1268	812	203	6.25	6	1.0	N	10.0	-	-	Full	10.6	-	6.5	10.0	2	1.00	1.10	6.0
	1268	812	203	6.25	6	1.0	N	10.0	-	-	Full	13.4	-	7.0	10.0	2	1.00	1.10	6.4
	1268	812	203	6.25	6	1.0	N	10.0	-	-	Full	12.6	-	7.0	10.0	2	1.00	1.10	6.4
	1268	812	203	6.25	6	1.0	N	10.0	-	-	Full	17.1	-	10.3	10.0	2	1.00	1.10	9.5
	1268	812	203	6.25	6	1.0	N	10.0	-	-	Full	10.1	-	5.1	10.0	2	1.00	1.10	4.7
	398	397	194	2.05	2	0.9	S	10.0	-	-	Full	35.1	-	25.7	10.0	2	1.00	1.10	21.3
	602	397	194	3.10	3	1.0	S	10.0	-	-	Full	35.1	-	24.2	14.0	4	1.00	1.10	20.5
	398	397	194	2.05	2	0.9	S	10.0	-	-	Full	51.0	-	31.8	10.0	2	1.00	1.10	26.3
	602	397	194	3.10	3	1.0	S	10.0	-	-	Full	51.0	-	31.9	5.0	4	1.00	1.10	29.3
	806	395	395	2.04	4	1.0	S	10.0	-	-	Full	25.5	-	14.3	9.0	5	1.00	1.10	13.2
	1826	395	395	4.62	9	1.0	S	10.0	-	-	Full	25.5	-	10.4	10.0	2	1.00	1.10	9.6
	590	195	240	2.46	3	1.0	S	10.0	-	-	Full	26.7	-	15.1	10.0	3	1.00	1.10	13.9
	590	195	190	3.11	3	1.0	S	10.0	-	-	Full	19.2	-	12.1	10.0	3	1.00	1.10	11.1
	590	195	190	3.11	3	1.0	S	10.0	-	-	Full	14.4	-	13.7	10.0	3	1.00	1.10	12.6
	398	396	194	2.05	2	0.9	S	10.0	-	-	FS	29.2	-	14.7	19.0	7	1.00	1.00	9.1
	602	396	194	3.10	3	1.0	S	10.0	-	-	FS	29.2	-	15.0	13.0	7	1.00	1.00	11.8
	398	397	143	2.78	2	0.9	S	10.0	-	-	FS	28.1	-	16.8	9.0	7	1.00	1.00	12.6
	602	397	143	4.21	3	1.0	S	10.0	-	-	FS	28.1	-	17.2	13.0	7	1.00	1.00	13.5
	602	397	194	3.10	3	1.0	N	10.0	-	-	FS	14.5	-	8.6	10.0	5	1.00	1.00	7.2
	602	397	194	3.10	3	1.0	N	10.0	-	-	Full	14.5	-	9.1	10.0	11	1.00	1.10	8.3
	596	398	195	3.06	3	1.0	N	10.0	-	-	FS	18.2	-	12.8	6.0	5	1.00	1.00	10.7
	596	398	195	3.06	3	1.0	N	10.0	-	-	FS	18.2	-	12.8	6.0	5	1.00	1.00	10.7
	596	398	195	3.06	3	1.0	N	10.0	-	-	FS	18.2	-	12.8	6.0	5	1.00	1.00	10.7
	596	398	195	3.06	3	1.0	N	10.0	-	-	FS	18.2	-	12.8	6.0	5	1.00	1.00	10.7
	596	398	195	3.06	3	1.0	N	10.0	-	-	FS	18.2	-	12.8	6.0	5	1.00	1.00	10.7
	596	398	195	3.06	3	1.0	N	10.0	-	-	FS	18.2	-	12.8	6.0	5	1.00	1.00	10.7
	596	398	195	3.06	3	1.0	N	10.0	-	-	FS	18.2	-	12.8	6.0	5	1.00	1.00	10.7
	596	398	195	3.06	3	1.0	N	10.0	-	-	FS	18.2	-	12.8	6.0	5	1.00	1.00	10.7
	596	398	195	3.06	3	1.0	N	10.0	-	-	FS	18.2	-	12.8	6.0	5	1.00	1.00	10.7
	599	397	194	3.09	3	1.0	S	10.0	-	-	Full	24.4	-	18.6	3.0	5	1.00	1.10	17.1

	599	397	194	3.09	3	1.0	S	10.0	-	-	Full	24.4	-	18.6	3.0	5	1.00	1.10	17.1
	599	397	194	3.09	3	1.0	S	10.0	-	-	Full	24.4	-	18.6	3.0	5	1.00	1.10	17.1
	599	397	194	3.09	3	1.0	S	10.0	-	-	FS	24.4	-	19.6	6.0	5	1.00	1.00	16.4
	599	397	194	3.09	3	1.0	S	10.0	-	-	FS	24.4	-	19.6	6.0	5	1.00	1.00	16.4
	599	397	194	3.09	3	1.0	S	10.0	-	-	FS	24.4	-	19.6	6.0	5	1.00	1.00	16.4
	599	397	194	3.09	3	1.0	S	10.0	-	-	FS	24.4	-	19.6	6.0	5	1.00	1.00	16.4
	599	397	194	3.09	3	1.0	S	10.0	-	-	FS	24.4	-	19.6	6.0	5	1.00	1.00	16.4
	599	397	194	3.09	3	1.0	S	10.0	-	-	FS	24.4	-	19.6	6.0	5	1.00	1.00	16.4
7	600	178	143	4.20	3	1.0	S	9.5	14.5	8	Full	19.7	0.8	16.4	3.6	5	1.00	1.10	15.1
	600	178	143	4.20	3	1.0	S	9.5	18.2	6	Full	19.7	0.8	16.3	3.3	4	1.00	1.10	15.0
	600	178	143	4.20	3	1.0	N	9.5	5.7	5	Full	19.7	0.8	15.4	5.5	4	1.00	1.10	14.2
8	590	390	140	4.21	3	1.0	S	10.0	9.4	11	Full	13.7	0.4	10.2	1.9	3	1.00	1.10	9.4
	590	390	140	4.21	3	1.0	S	10.0	7.7	14	Full	11.2	0.5	10.0	3.7	3	1.00	1.10	9.2
	590	390	140	4.21	3	1.0	S	10.0	15.5	2	Full	15.0	0.3	12.0	4.8	3	1.00	1.10	11.0
	590	390	140	4.21	3	1.0	S	10.0	22.2	22	Full	21.8	0.5	16.9	3.9	3	1.00	1.10	15.5
9	590	390	190	3.11	3	1.0	cls	10.0	9.2	-	Full	24.3	-	17.8	6.2	3	1.00	1.10	16.4
	590	390	190	3.11	3	1.0	cls	10.0	15.4	-	Full	24.3	-	17.4	5.2	3	1.00	1.10	16.0
	590	390	190	3.11	3	1.0	cls	10.0	15.4	-	Full	24.3	-	21.4	1.9	3	1.00	1.10	19.7
	590	390	190	3.11	3	1.0	cls	10.0	21.2	-	Full	24.3	-	20.6	13.1	3	1.00	1.10	17.8
	590	390	190	3.11	3	1.0	cls	5.0	21.2	-	Full	24.3	-	24.2	2.9	3	1.00	1.10	22.3
	610	390	190	3.21	3	1.0	cls	20.0	21.2	-	Full	24.3	-	25.5	1.6	3	1.00	1.10	23.4
	390	195	190	2.05	2	0.9	cls	10.0	21.2	-	Full	24.3	-	26.0	1.5	3	1.00	1.10	21.5
10	390	390	190	2.05	2	0.9	S	10.0	8.4	9	FS	25.5	1.2	22.8	4.4	5	1.00	1.00	17.2
	390	390	190	2.05	2	0.9	S	10.0	8.4	9	FS	25.5	1.2	23.2	2.4	5	1.00	1.00	17.5
	390	390	190	2.05	2	0.9	S	10.0	8.4	9	FS	32.0	5.5	25.0	4.1	5	1.00	1.00	18.8
	390	390	190	2.05	2	0.9	S	10.0	8.4	9	FS	21.5	6.2	16.1	4.2	5	1.00	1.00	12.1
	390	390	190	2.05	2	0.9	S	10.0	8.4	9	FS	25.3	3.8	22.9	1.8	5	1.00	1.00	17.2
	390	390	190	2.05	2	0.9	S	10.0	8.4	9	FS	25.3	3.8	21.1	3.7	5	1.00	1.00	15.9
	790	390	190	4.16	4	1.0	S	10.0	8.4	9	FS	25.5	1.2	18.8	4.8	5	1.00	1.00	15.7
	790	390	190	4.16	4	1.0	S	10.0	8.4	9	FS	25.5	1.2	19.1	1.6	5	1.00	1.00	16.0
	790	390	190	4.16	4	1.0	S	10.0	8.4	9	FS	32.0	5.5	19.0	8.4	5	1.00	1.00	15.9
	790	390	190	4.16	4	1.0	S	10.0	8.4	9	FS	21.5	6.2	15.5	6.4	5	1.00	1.00	13.0
	790	390	190	4.16	4	1.0	S	10.0	8.4	9	FS	25.3	3.8	19.6	3.0	5	1.00	1.00	16.4
11	590	390	190	3.11	3	1.0	1:0:5	10.0	10.6	6	FS	27.8	1.4	24.4	2.0	3	1.00	1.00	20.4
	590	390	190	3.11	3	1.0	1:0:6	10.0	10.6	6	FS	27.8	1.4	26.0	1.0	3	1.00	1.00	21.7
	590	390	190	3.11	3	1.0	1:0:7	10.0	10.6	6	FS	27.8	1.4	23.8	4.0	3	1.00	1.00	19.9
	590	390	190	3.11	3	1.0	1:0:8	10.0	10.6	6	FS	27.8	1.4	24.3	2.0	3	1.00	1.00	20.3
	590	390	190	3.11	3	1.0	1:0:9	10.0	10.6	6	FS	27.8	1.4	23.0	10.0	1	1.00	1.00	19.2
	590	390	190	3.11	3	1.0	1:0:10	10.0	10.6	6	FS	27.8	1.4	23.7	10.0	1	1.00	1.00	19.8
	990	390	190	5.21	5	1.0	1:0:11	10.0	10.6	6	FS	27.8	1.4	22.2	10.0	1	1.00	1.00	18.6
	990	390	190	5.21	5	1.0	1:0:12	10.0	10.6	6	FS	27.8	1.4	22.3	10.0	1	1.00	1.00	18.6
12	842	396	194	4.34	4	1.00	S	10.0	19.2	-	FS	33.8	1.3	22.9	9.6	5	1.00	1.00	19.1
13	590	390	190	3.11	3	1.00	S	10.0	-	-	FS	25.0	-	15.8	0.0	1	1.36	1.00	18.0
	590	390	190	3.11	3	1.00	(1:1:6)	10.0	-	-	FS	23.7	-	14.0	0.0	1	1.36	1.00	15.9
14	665	440	140	4.75	3	1.0	N	10.0	4.0	-	Full	16.1	-	10.8	0.0	1	1.00	1.10	9.9
	665	440	140	4.75	3	1.0	S	10.0	-	-	Full	16.1	-	13.3	0.0	1	1.00	1.10	12.2
	665	440	190	3.50	3	1.0	N	10.0	4.0	-	Full	22.4	-	9.5	0.0	1	1.00	1.10	8.7
	665	440	190	3.50	3	1.0	S	10.0	-	-	Full	22.4	-	12.8	0.0	1	1.00	1.10	11.8
15	-	-	-	2.80	2	0.9	N	-	-	-	FS	17.1	1.7	15.3	6.7	5	1.00	1.00	11.5
	-	-	-	2.80	2	0.9	N	-	-	-	FS	17.1	1.7	15.3	6.7	5	1.00	1.00	11.5
	-	-	-	2.80	2	0.9	N	-	-	-	FS	17.1	1.7	15.3	6.7	5	1.00	1.00	11.5
	-	-	-	2.80	2	0.9	N	-	-	-	FS	17.1	1.7	15.3	6.7	5	1.00	1.00	11.5
16	590	390	190	3.11	3	1.0	S	10.0	12.4	27	FS	15.0	-	10.3	12.6	7	1.00	1.00	8.2
17	-	-	-	-	2	0.9	S	10.0	17.9	-	FS	25.0	-	21.6	8.8	5	1.00	1.00	16.3

	-	-	-	-	2	0.9	S	10.0	17.9	-	FS	25.0	-	18.3	5.1	5	1.00	1.00	13.8
	-	-	-	-	2	0.9	S	10.0	16.2	-	FS	25.0	-	21.3	2.6	5	1.00	1.00	16.0
	-	-	-	-	2	0.9	S	10.0	16.2	-	FS	25.0	-	19.8	6.1	5	1.00	1.00	14.9
	-	-	-	-	3	1.0	S	10.0	9.6	-	FS	25.0	-	19.0	8.9	5	1.00	1.00	15.9
	-	-	-	-	3	1.0	S	10.0	9.0	-	FS	25.0	-	18.3	3.8	5	1.00	1.00	15.3
	-	-	-	-	3	1.0	S	10.0	11.5	-	FS	25.0	-	19.5	6.1	5	1.00	1.00	16.3
	-	-	-	-	3	1.0	S	10.0	11.5	-	FS	25.0	-	18.5	5.1	5	1.00	1.00	15.5
	-	-	-	-	4	1.0	S	10.0	8.7	-	FS	25.0	-	17.8	4.4	10	1.00	1.00	14.9
	-	-	-	-	4	1.0	S	10.0	8.8	-	FS	25.0	-	18.0	5.9	10	1.00	1.00	15.0
	-	-	-	-	4	1.0	S	10.0	9.9	-	FS	25.0	-	18.0	2.8	5	1.00	1.00	15.0
	-	-	-	-	4	1.0	S	10.0	9.8	-	FS	25.0	-	18.0	4.9	10	1.00	1.00	15.0
	-	-	-	-	4	1.0	S	10.0	9.2	-	FS	25.0	-	20.3	6.1	5	1.00	1.00	17.0
	-	-	-	-	4	1.0	S	10.0	9.9	-	FS	25.0	-	19.6	6.5	5	1.00	1.00	16.4
	-	-	-	-	4	1.0	S	10.0	9.2	-	FS	25.0	-	19.1	5.0	5	1.00	1.00	16.0
	-	-	-	-	4	1.0	S	10.0	10.7	-	FS	25.0	-	17.8	5.1	5	1.00	1.00	14.9
	-	-	-	-	4	1.0	S	10.0	7.5	-	FS	25.0	-	17.6	5.6	5	1.00	1.00	14.7
	-	-	-	-	4	1.0	N	10.0	6.1	-	FS	25.0	-	18.9	4.5	5	1.00	1.00	15.8
	-	-	-	-	4	1.0	N	10.0	6.1	-	FS	25.0	-	17.1	4.1	5	1.00	1.00	14.3
	-	-	-	-	4	1.0	N	10.0	6.6	-	FS	25.0	-	18.7	2.4	5	1.00	1.00	15.6
	-	-	-	-	4	1.0	S	6.0	8.7	-	FS	25.0	-	18.0	2.5	5	1.00	1.00	15.0
	-	-	-	-	4	1.0	S	6.0	9.8	-	FS	25.0	-	17.8	7.6	5	1.00	1.00	14.9
	-	-	-	-	4	1.0	S	15.0	9.0	-	FS	25.0	-	15.9	6.3	5	1.00	1.00	13.3
	-	-	-	-	4	1.0	S	15.0	9.0	-	FS	25.0	-	16.1	8.3	5	1.00	1.00	13.5
	-	-	-	-	4	1.0	S	10.0	9.9	-	FS	25.0	-	14.6	3.8	5	1.00	1.00	12.2
	-	-	-	-	4	1.0	S	10.0	9.9	-	FS	25.0	-	14.1	4.2	5	1.00	1.00	11.8
	-	-	-	-	4	1.0	S	10.0	10.9	-	FS	25.0	-	24.7	7.0	5	1.00	1.00	20.6
	-	-	-	-	4	1.0	S	10.0	10.9	-	FS	25.0	-	22.0	6.5	5	1.00	1.00	18.4
	-	-	-	-	4	1.0	S	10.0	10.0	-	FS	25.0	-	24.4	7.8	5	1.00	1.00	20.4
	-	-	-	-	4	1.0	S	10.0	10.9	-	FS	25.0	-	24.8	1.9	5	1.00	1.00	20.7
	-	-	-	-	4	1.0	S	10.0	10.7	-	FS	25.0	-	19.7	10.0	5	1.00	1.00	16.5
	-	-	-	-	4	1.0	S	10.0	10.7	-	FS	25.0	-	17.0	7.4	5	1.00	1.00	14.2
	-	-	-	-	4	1.0	S	10.0	7.5	-	FS	25.0	-	18.7	3.5	5	1.00	1.00	15.6
	-	-	-	-	5	1.0	S	10.0	8.5	-	FS	25.0	-	17.3	4.0	5	1.00	1.00	14.5
	-	-	-	-	5	1.0	S	10.0	8.5	-	FS	25.0	-	18.1	5.3	5	1.00	1.00	15.1
18	97	99	48	2.00	2	0.9	N	10	6.76	-	Full	20.8	2.9	15.5	5.4	3	1.00	1.10	12.8
	97	99	48	2.00	2	0.9	N	10	6.76	-	Full	30.3	2.8	24.8	6.5	3	1.00	1.10	20.5
19	596	397	194	3.07	3	1.0	N	10.0	11.9	-	FS	24.2	-	13.7	4.9	3	1.36	1.00	15.6
	596	397	194	3.07	3	1.0	S	10.0	17.7	-	FS	24.2	-	13.8	7.4	3	1.36	1.00	15.7
	596	397	194	3.07	3	1.0	N	10.0	11.9	-	FS	17.8	-	10.3	4.2	3	1.36	1.00	11.7
	596	397	194	3.07	3	1.0	S	10.0	17.7	-	FS	17.8	-	10.6	6.1	3	1.36	1.00	12.0
	596	397	194	3.07	3	1.0	S	10.0	17.7	-	Full	24.2	-	18.6	5.4	3	1.00	1.10	17.1
	596	397	194	3.07	3	1.0	N	10.0	11.9	-	Full	17.8	-	13.6	3.1	3	1.00	1.10	12.5
	596	397	194	3.07	3	1.0	S	10.0	17.7	-	Full	17.8	-	14.3	4.0	3	1.00	1.10	13.1
20	590	290	140	4.21	3	1.0	N	10.0	4.9	-	Full	13.4	2.1	9.2	15.2	5	1.00	1.10	7.6
21	990	390	140	7.07	5	1.0	N	10.0	17.3	9	FS	23.2	2.7	16.6	3.7	3	1.00	1.00	13.9
	590	390	140	4.21	3	1.0	N	10.0	17.3	9	FS	23.2	2.7	16.1	8.1	3	1.00	1.00	13.5
22	400	400	200	2.00	2	0.9	N	-	7.6	13	FS	18.9	10.3	16.8	11.3	6	1.00	1.00	12.3
	400	400	200	2.00	2	0.9	N	-	7.6	13	FS	18.9	10.3	16.8	11.3	6	1.00	1.00	12.3
	400	400	200	2.00	2	0.9	N	-	7.6	13	FS	18.9	10.3	16.8	11.3	6	1.00	1.00	12.3
23	590	390	140	4.21	3	1.00	-	10.0	4.8	7	FS	14.4	-	10.1	10.0	3	1.00	1.00	8.4
	590	390	140	4.21	3	1.00	-	10.0	3.9	7	FS	20.7	-	15.9	10.0	3	1.00	1.00	13.3
	590	390	140	4.21	3	1.00	-	10.0	4.3	7	FS	35.5	-	20.6	10.0	3	1.00	1.00	17.2
	590	390	140	4.21	3	1.00	-	10.0	7.9	5	FS	14.4	-	12.2	10.0	3	1.00	1.00	10.2

	590	390	140	4.21	3	1.00	-	10.0	9.8	5	FS	20.7	-	17.2	10.0	3	1.00	1.00	14.4
	590	390	140	4.21	3	1.00	-	10.0	7.1	5	FS	35.5	-	23.6	10.0	3	1.00	1.00	19.7
24	590	400	200	2.95	3	1.0	S	10.0	-	-	FS	18.7	2.0	15.1	10.0	5	1.00	1.00	12.6
	590	400	200	2.95	3	1.0	S	10.0	-	-	FS	16.7	1.1	11.6	10.0	5	1.00	1.00	9.7
25	-	-	-	-	3	1.0	S	-	-	-	FS	15.5	-	8.6	18.2	4	1.36	1.00	8.2
	-	-	-	-	3	1.0	S	-	-	-	FS	15.5	-	7.4	4.9	4	1.36	1.00	8.4
26	-	-	-	-	2	0.9	S	9.5	22.9	7	FS	23.8	3.1	17.0	19.7	5	1.36	1.00	14.1
	-	-	-	-	3	1.0	S	9.5	22.9	7	FS	23.5	2.4	16.9	12.7	5	1.36	1.00	18.2
	-	-	-	-	3	1.0	S	9.5	22.9	7	FS	25.5	3.9	18.2	7.7	5	1.36	1.00	20.7
	-	-	-	-	4	1.0	S	9.5	22.9	7	FS	21.9	1.1	15.6	10.6	5	1.36	1.00	17.5
	-	-	-	-	2	0.9	S	9.5	22.9	7	FS	19.5	2.5	13.1	17.9	5	1.36	1.00	11.4
27	-	-	-	-	2	0.9	N	-	-	-	FS	13.6	0.7	5.7	6.8	10	1.36	1.00	5.9
28	390	390	140	2.79	2	0.9	N	10.0	6.6	-	FS	21.4	0.8	14.7	4.8	10	1.00	1.00	11.1
	590	390	140	4.21	3	1.0	N	10.0	6.6	-	FS	21.4	0.8	14.3	3.0	10	1.00	1.00	12.0
	790	390	140	5.64	4	1.0	N	10.0	6.6	-	FS	21.4	0.8	13.9	4.3	10	1.00	1.00	11.6
	390	390	190	2.05	2	0.9	N	10.0	6.6	-	FS	22.0	1.9	14.9	3.6	10	1.00	1.00	11.2
	590	390	190	3.11	3	1.0	N	10.0	6.6	-	FS	22.0	1.9	14.5	5.4	10	1.00	1.00	12.1
	990	390	190	5.21	5	1.0	N	10.0	6.6	-	FS	22.0	1.9	14.3	3.9	10	1.00	1.00	12.0
29	590	390	190	3.11	3	1.0	PCL-N	10.0	7.4	12	FS	26.4	2.8	14.9	7	5	1.00	1.00	12.4
	590	390	190	3.11	3	1.0	MC-N	10.0	7.8	11	FS	26.4	2.8	17.4	2	5	1.00	1.00	14.6
	590	390	190	3.11	3	1.0	PCL-S	10.0	12.7	5	FS	26.4	2.8	19.2	10	5	1.00	1.00	16.1
	590	390	190	3.11	3	1.0	MC-S	10.0	13.8	19	FS	26.4	2.8	22.8	20	5	1.00	1.00	15.3
	590	390	190	3.11	3	1.0	PCL-N	10.0	7.4	12	FS	25.8	1.8	20.2	9	5	1.00	1.00	16.9
	590	390	190	3.11	3	1.0	MC-N	10.0	7.8	11	FS	25.8	1.8	21.6	10.0	5	1.00	1.00	18.0
	590	390	190	3.11	3	1.0	PCL-S	10.0	12.7	5	FS	25.8	1.8	23.3	3	5	1.00	1.00	19.5
	590	390	190	3.11	3	1.0	MC-S	10.0	13.8	19	FS	25.8	1.8	21.7	8	5	1.00	1.00	18.1
	590	390	190	3.11	3	1.0	PCL-N	10.0	7.4	12	FS	36.2	1.4	22.0	9	5	1.00	1.00	18.4
	590	390	190	3.11	3	1.0	MC-N	10.0	7.8	11	FS	36.2	1.4	27.6	7	4	1.00	1.00	23.1
	590	390	190	3.11	3	1.0	PCL-S	10.0	12.7	5	FS	36.2	1.4	27.3	8	5	1.00	1.00	22.8
	590	390	190	3.11	3	1.0	MC-S	10.0	13.8	19	FS	36.2	1.4	28.1	7	5	1.00	1.00	23.5

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APPENDIX II

COMPRESSIVE STRENGTH OF GROUTED PRISMS

	Prism Dimensions, mm						Mortar properties					Block		Grout	Prism			
Reference	Height (h)	Length	Thickness (t)	h/t	Courses	Correction factor	Type	Thickness	Strength	St. Dev.	C.O.V	Average Compressive Strength	St. Dev.	Average Compressive Strength	Average Compressive Strength	C.O.V.	Number of Prisms	Calculated Specified Strength f'm
	(mm)						(C:L:S)	(mm)	(MPa)	(MPa)	(%)	(MPa)	(MPa)	(MPa)	(MPa)	(%)		(MPa)
1	397	397	194	2.05	2	0.80	S	9.5	12.4	1.5	12	25.9	4.8	30.0	13.1	15	8	9.8
	397	397	194	2.05	2	0.80	S	9.5	12.1	1.7	14	25.9	4.8	24.6	13.7	3	6	11.4
	397	397	194	2.05	2	0.80	S	9.5	12.1	1.7	14	25.9	4.8	24.6	15.6	7	5	13.0
	397	397	194	2.05	2	0.80	S	9.5	12.1	1.7	14	25.9	4.8	24.6	15.4	11	11	12.6
	397	397	194	2.05	2	0.80	S	9.5	12.1	1.7	14	25.9	4.8	24.6	16.2	7	7	13.6
2	600	-	178	3.38	3	0.92	S	9.5	15.1	-	-	19.7	0.8	15.9	10.8	6	5	9.1
	600	-	178	3.38	3	0.92	S	9.5	16.7	-	-	19.7	0.8	15.3	11.2	6	5	9.3
	600	-	178	3.38	3	0.92	S	9.5	17.3	-	-	19.7	0.8	15.3	11.3	4	5	9.5
	600	-	178	3.38	3	0.92	S	9.5	14.2	-	-	19.7	0.8	15.3	11.3	14	5	8.8
	600	-	178	3.38	3	0.92	S	9.5	15.8	-	-	19.7	0.8	21.3	12.8	6	5	10.7
	600	-	178	3.38	3	0.92	S	9.5	13.5	-	-	19.7	0.8	17.4	12.1	3	4	10.1
	600	-	178	3.38	3	0.92	S	9.5	14.2	-	-	32.2	2.2	19.8	16.9	2	4	14.1
	600	-	178	3.38	3	0.92	S	9.5	14.2	-	-	22.0	0.9	22.0	13.2	4	4	11.0
	600	-	178	3.38	3	0.92	S	9.5	14.2	-	-	21.3	1.3	22.0	14.1	5	4	11.8
	600	-	178	3.38	3	0.92	S	9.5	14.2	-	-	20.1	1.1	19.8	12.1	1	4	10.2
	600	-	178	3.38	3	0.92	S	9.5	14.2	-	-	20.0	1.2	22.0	14.7	9	4	12.3
	600	-	178	3.38	3	0.92	S	9.5	14.2	-	-	15.7	1.3	21.4	9.2	3	3	7.7
	600	-	178	3.38	3	0.92	S	9.5	12.8	-	-	19.7	0.8	16.5	11.9	5	3	10.0
	600	-	178	3.38	3	0.92	S	9.5	12.8	-	-	19.7	0.8	16.5	13.3	5	4	11.1
3	590	195	190	3.11	3	0.91	S	10.0	17.0	-	-	25.1	-	21.1	14.4	3	5	12.0
	590	195	190	3.11	3	0.91	S	10.0	17.0	-	-	25.1	-	13.7	14.1	11	4	11.5
	590	195	190	3.11	3	0.91	S	10.0	17.0	-	-	17.1	-	21.1	11.0	16	3	8.1
	590	195	190	3.11	3	0.91	S	10.0	17.0	-	-	27.9	-	21.1	15.0	7	3	12.5
	590	195	190	3.11	3	0.91	S	10.0	17.0	-	-	20.2	-	21.1	14.1	2	4	11.8
	590	195	190	3.11	3	0.91	S	10.0	17.0	-	-	22.2	-	21.1	14.5	5	3	12.1
	590	195	140	4.21	3	0.96	S	10.0	17.0	-	-	23.6	-	21.1	13.8	7	4	11.5
	590	195	240	2.46	3	0.85	S	10.0	17.0	-	-	23.4	-	21.1	11.4	12	4	9.2
4	600	178	143	4.20	3	0.96	S	9.5	14.5		8	19.7	0.8	12.4	11.3	14	5	8.8
	600	178	143	4.20	3	0.96	S	9.5	18.2		6	19.7	0.8	14.1	12.1	3	4	10.1
	600	178	143	4.20	3	0.96	N	9.5	5.7		5	19.7	0.8	14.1	10.4	3	4	8.7
	600	178	143	4.20	3	0.96	S	9.5	14.5		8	19.7	0.8	17.3	12.8	6	5	10.7
	600	178	143	4.20	3	0.96	S	9.5	14.5		8	19.7	0.8	25.0	13.4	7	4	11.2
	600	178	143	4.20	3	0.96	S	9.5	14.5		8	19.7	0.8	14.1	12.1	3	4	10.1
5	590	390	190	3.11	3	0.91	N	10.0	5.6	-		13.1		14.8	7.9	0	1	6.6
	590	390	190	3.11	3	0.91	N	10.0	5.6	-		13.1		20.3	9.1	0	1	7.6
	590	390	190	3.11	3	0.91	N	10.0	8.4	-		13.1		14.8	8.7	0	1	7.3
	590	390	190	3.11	3	0.91	N	10.0	8.4	-		13.1		20.3	9.9	0	1	8.3
	590	390	190	3.11	3	0.91	S	10.0	12.4	-		13.1		14.8	10.5	0	1	8.8
	590	390	190	3.11	3	0.91	S	10.0	12.4	-		13.1		20.3	11.2	0	1	9.4
	590	390	190	3.11	3	0.91	N	10.0	5.6	-		16.7		14.8	8.3	0	1	6.9
	590	390	190	3.11	3	0.91	N	10.0	5.6	-		16.7		20.3	9.5	0	1	8.0
	590	390	190	3.11	3	0.91	N	10.0	8.4	-		16.7		14.8	9.2	0	1	7.6
	590	390	190	3.11	3	0.91	N	10.0	8.4	-		16.7		20.3	10.3	0	1	8.6
	590	390	190	3.11	3	0.91	S	10.0	12.4	-		16.7		14.8	11.2	0	1	9.4

	590	390	190	3.11	3	0.91	S	10.0	12.4	-		16.7		20.3	11.7	0	1	9.8
	590	390	190	3.11	3	0.91	N	10.0	5.6	-		20.0		14.8	8.5	0	1	7.1
	590	390	190	3.11	3	0.91	N	10.0	5.6	-		20.0		20.3	9.7	0	1	8.1
	590	390	190	3.11	3	0.91	N	10.0	8.4	-		20.0		14.8	9.4	0	1	7.8
	590	390	190	3.11	3	0.91	N	10.0	8.4	-		20.0		20.3	10.5	0	1	8.8
	590	390	190	3.11	3	0.91	S	10.0	12.4	-		20.0		14.8	11.5	0	1	9.6
	590	390	190	3.11	3	0.91	S	10.0	12.4	-		20.0		20.3	11.8	0	1	9.9
6	397	194	194	2.05	2	0.80	S	-	22.0			25.0		15.9	18.5	2	5	15.5
7	590	390	190	3.11	3	0.91	-	10.0	9.2	-	-	24.3	-	19.4	15.8	13	3	12.5
	590	390	190	3.11	3	0.91	-	10.0	13.5	-	-	24.3	-	32.0	17.9	3	3	15.0
	590	390	190	3.11	3	0.91	-	10.0	15.4	-	-	24.3	-	8.6	13.8	9	3	11.5
	590	390	190	3.11	3	0.91	-	10.0	15.4	-	-	24.3	-	15.7	11.4	2	3	9.5
	590	390	190	3.11	3	0.91	-	10.0	20.2	-	-	24.3	-	23.5	13.4	8	3	11.2
	390	390	190	2.05	2	0.81	-	10.0	21.2	-	-	24.3	-	17.1	16.8	6	2	14.0
	390	195	190	2.05	2	0.81	-	10.0	21.2	-	-	24.3	-	17.1	23.2	2	2	19.4
8	406	394	152	2.66	4	0.87	N (1:1:6)	-	11.6		10	24.7	-	29.2	28.2	10	5	23.6
	406	394	102	4.	4	0.95	N (1:1:6)	-	11.6		10	26.9	-	29.2	21.0	10	5	17.5
	406	394	203	2.	4	0.80	N (1:1:6)	-	11.6		10	21.6	-	29.2	27.9	10	5	23.3
	406	394	152	2.66	4	0.87	N (1:1:6)	-	11.6		10	24.7	-	29.2	25.0	10	5	20.9
	406	394	152	2.66	4	0.87	S (1:1/2:4-1/2)	-	24.3		8	24.7	-	29.2	28.8	10	5	24.1
	406	394	152	2.66	4	0.87	N (1:1:6)	-	11.6		10	24.7	-	30.6	29.0	10	5	24.2
	406	394	152	2.66	4	0.87	N (1:1:6)	-	11.6		10	24.7	-	29.2	28.8	10	5	24.1
	406	394	152	2.66	4	0.87	N (1:1:6)	-	11.6		10	24.7	-	29.2	24.1	10	5	20.1
9	416	406	203	2.05	2	0.80	S	10.0	11.2	-	-	24.5	-	15.5	17.1	6	3	14.3
	629	406	203	3.1	3	0.90	S	10.0	11.2	-	-	24.5	-	15.5	14.8	6	3	12.4
	842	406	203	4.14	4	0.96	S	10.0	11.2	-	-	24.5	-	15.5	13.2	6	3	11.0
	1055	406	203	5.19	5	1.00	S	10.0	11.2	-	-	24.5	-	15.5	12.6	6	3	10.5
	416	406	203	2.05	2	0.80	S	10.0	11.2	-	-	21.0	-	15.5	16.2	6	3	13.5
	629	406	203	3.1	3	0.90	S	10.0	11.2	-	-	21.0	-	15.5	15.0	6	3	12.5
	842	406	203	4.14	4	0.96	S	10.0	11.2	-	-	21.0	-	15.5	14.6	6	3	12.2
	1055	406	203	5.19	5	1.00	S	10.0	11.2	-	-	21.0	-	15.5	14.8	6	3	12.4
10	-	-	-	4.	4	0.95	S	-	10.9	-	-	25.0	-	10.2	12.9	5	5	10.8
	-	-	-	4.	4	0.95	S	-	10.9	-	-	25.0	-	11.6	14.0	5	5	11.7
	-	-	-	4.	4	0.95	S	-	11.3	-	-	25.0	-	34.9	14.8	11	5	12.2
				4.	4	0.95	S	-	11.3	-	-	25.0	-	37.4	13.6	8	5	11.4
11	990	390	140	7.07	5	1.00	N	10.0	17.3	1.6	9	23.2	2.7	15.3	10.6	2	3	8.9
	590	390	140	4.21	3	0.96	N	10.0	17.3	1.6	9	23.2	2.7	15.3	10.9	12	3	8.8
12	590	390	140	4.21	3	0.96	-	10.0	7.9	-	5	14.4	-	12.5	13.1	10	3	11.0
	590	390	140	4.21	3	0.96	-	10.0	9.8	-	5	20.7	-	28.5	18.5	10	3	15.5
	590	390	140	4.21	3	0.96	-	10.0	7.1	-	5	35.5	-	34.7	25.1	10	3	21.0
13	-	-	-	3.16	3	0.91	S	-	-	-	-	15.5	-	11.4	10.7	10	4	9.0
	-	-	-	3.16	3	0.91	S	-	-	-	-	15.5	-	11.4	8.4	10	4	7.0

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