Proceedings of the
Annual Stability Conference
Structural Stability Research Council
St. Louis, Missouri, April 2-5, 2019

Accurate Direct Strength Method (DSM) prediction of column flexural-torsional failure loads

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Abstract

This work presents and discusses the latest results of an ongoing investigation aimed at assessing the accuracy of the currently codified Direct Strength Method (DSM) global strength curve to predict the ultimate strength of cold-formed steel columns failing in flexural-torsional modes. The first part of the paper is devoted exclusively to fixed-ended columns and continues recent work on the improvement of the flexural-torsional failure load estimation, in the moderate or high slenderness ranges – it is shown that the use of a novel set of strength curves, dependent on a cross-section normalized geometric parameter (involving the area, major and minor moments of inertia, and warping constant), leads to excellent failure load predictions, eliminating the large scatter stemming from the currently codified design curve. The second part of the paper aims at extending the investigation to columns with other support conditions, namely three types of pinned supports, all fixed with respect to torsion and having warping prevented: they correspond to end cross-sections attached to rigid plates resting on spherical or cylindrical hinges (*i.e.*, pinned with respect to major and/or minor-axis flexure). The study begins with a parametric study intended to gather failure loads of columns (i) exhibiting the same cross-section shapes considered earlier (plain channels, lipped channels, return lipped channels, hat-sections and rack-sections), (ii) various geometries (cross-section dimensions and lengths) and (iii) covering a wide slenderness range. These failure load data are then used to assess the quality of their estimates provided by the currently codified global DSM strength curve and by the strength curve set developed in the context of fixed-ended columns. It is found that neither of them yields consistently good failure load estimates, which prompts the proposal of modifications that lead to an efficient failure load prediction – although the set of failure loads obtained in this work is necessarily limited, the fact that their predictions by the proposed DSM global design curves (i) exhibit a very high quality and (ii) clearly outperform those yielded by the current design curve provides strong encouragement to search for further validation.

1. Introduction

Most cold-formed steel members display very slender thin-walled open cross-sections, a feature making them highly susceptible to several instability phenomena, namely local, distortional and global (flexural or flexural-torsional) buckling – Figs. 1(a)-(d) show cross-section deformed configuration of lipped channel

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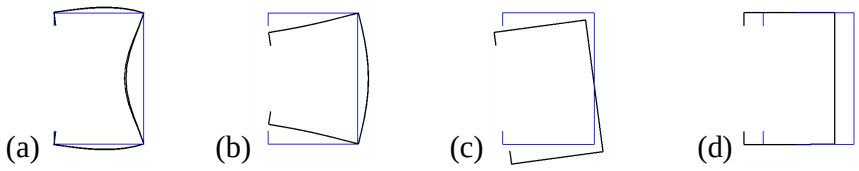

Figure 1: Cross-section deformed configuration of lipped channel columns buckling in (a) local, (b) distortional, (c) flexural-torsional and (d) flexural modes

columns buckling in these modes. Depending on the member length and cross-section shape and/or dimensions, any of the above buckling modes may be critical.

The Direct Strength Method (DSM – *e.g.*, Schafer 2008 or Camotim *et al.* 2016) was first proposed by Schafer & Peköz (1998), based on an original idea of Hancock *et al.* (1994), and is nowadays the most rational approach for the design of cold-formed steel columns. The currently codified design/strength curves are able to handle local, distortional, global and local-global interactive failures. In the context of this investigation, the relevant nominal strength is the global one (f_{nG}), which is given by

$$f_{nG} = \begin{cases} f_y \left(0.658^{\lambda_G^2} \right) & \text{if} \quad \lambda_G \leq 1.5 \\ f_y \left(\dfrac{0.877}{\lambda_G^2} \right) & \text{if} \quad \lambda_G > 1.5 \end{cases} \qquad \text{with} \qquad \lambda_G = \sqrt{\frac{f_y}{f_{crG}}} \quad , \quad (1)$$

where f_{crG} and λ_G are the column global critical buckling stress and global slenderness, and f_y is the material (steel) yield stress. This design curve, combining Johnson parabola (Ziemian 2010) with the (lowered) Euler curve, was first included in the cold-formed steel design manual in 1996 (AISI 1996), due to the work of Peköz & Sümer (1992), who showed that the above design curve, already codified in the context of hot-rolled steel members used in buildings (AISC 1986), provided better quality estimates than that adopted at that time by the cold-formed steel community (AISI 1986). These authors based their findings on 214 test results concerning concentrically loaded cold-formed steel columns with various cross-sections (lipped channels, hat-section, box-sections and I-sections formed by back-to-back plain channels), all exhibiting low-to-moderate global slenderness values ($\lambda_G \leq 1.75$).

Recently, the authors (Dinis *et al.* 2018a,b) reported numerical investigations intended to assess the accuracy of the current (AISI 2016) DSM column global strength curve in predicting the failure loads of fixed-ended cold-formed steel columns collapsing in flexural-torsional or flexural modes. While the latter were found to be quite well predicted (there was only room for slight improvements in the low and intermediate slenderness ranges), it was shown that the former are often considerably underestimated by the current design curve in the moderate and high slenderness ranges. It is worth noting that this underestimation was already perceptible in the results reported by Peköz & Sümer (1992) and was also pointed out about six years ago by Bandula Heva & Mahendran (2012). Indeed, the f_u/f_y values of (i) the five most slender specimens addressed in Figure 2 of Peköz & Sümer (1992), concerning lipped channel and hat-section columns with $\lambda_G > 1.6$, and (ii) three flexural-torsional buckling tests performed (at room temperature) by Bandula Heva & Mahendran (2012), concerning lipped channel columns with $\lambda_G > 1.7$, are visibly underestimated by the current DSM global design curve. This fact led Dinis *et al.* (2018a,b) to propose a new DSM-based set of strength curves dependent on the ratio between the major and minor moments of inertia. Although this geometric parameter enabled a fairly good estimation of the numerical failure loads obtained, it was also found that distinct strength curve sets were needed for columns with

cross-sections exhibiting with one-wall and two-wall end stiffeners – the latter are rack-section and double-fold return lipped channels.

This work continues the research effort described in the previous paragraph and has two main objectives. The first one consists of improving the prediction of the fixed-ended column major-axis flexural-torsional (F_MT) failure loads – in particular, a single set of DSM-based strength curves able to handle columns with arbitrary cross-sections is searched. The second objective consists of extending the investigation to columns with other support conditions, namely three types of pinned supports (all fixed with respect to torsion and having warping fully prevented), which correspond to end cross-sections rigidly attached to rigid plates resting on hinges that may be either spherical (*i.e.*, pinned with respect to major and minor-axis flexure – PS columns) or cylindrical (*i.e.*, pinned with respect to major or minor-axis flexure – PC_M and PC_m columns, respectively)[3].

Following a brief overview of the most relevant findings recently reported concerning the DSM-based F_MT failure load estimation for fixed-ended (F) columns (Dinis *et al.* 2018a,b), the paper shows that it is possible to further improve this estimation, by developing a novel set of strength curves, dependent on a cross-section normalized geometric parameter that involves the area, major and minor moments of inertia, and warping constant – the strength curve set proposed in (Dinis *et al.* 2018a,b) depended only on the ratio between the major and minor moments of inertia. Indeed, by using this new parameter it becomes possible to handle F columns with arbitrary cross-sections (including those with one-wall and two-wall end stiffeners) by means of a single set of DSM-based strength curves. The merits of the proposed DSM-based design approach are assessed through the comparison with numerical (shell finite element) F_MT failure load data previously gathered by Dinis *et al.* (2018b), concerning F columns with various (i) cross-section shapes (plain channels, lipped channels, return lipped channels, web-stiffened lipped channels, web/flange-stiffened lipped channels, hat-sections and rack-sections) and/or dimensions, and (ii) yield stresses, in order to cover a wide slenderness range –also included in the comparison are the experimental failure loads reported by Bandula Heva & Mahendran (2012). In particular, the reliability assessment prescribed in Section K2.1.1 of AISI (2016) (see Section 1.1 of this paper) shows that the LRFD resistance factors associated with the modified DSM-based design approach proposed are higher than 0.90, *i.e.*, visibly above the value currently recommended for compression members – ϕ_c=0.85.

Then, the paper addresses the DSM design of the aforementioned three types of pin-ended cold-formed steel columns collapsing in F_MT modes. Initially, the results of a numerical comparative study on the structural responses of fixed-ended and pin-ended columns are presented and discussed – although they shed some new light on the different mechanics involved in the buckling and post-buckling behaviors of F, PC_M, PC_m and PS columns, further research is needed to fully understand them. Then, in order to gather representative sets of PC_M, PC_m and PS column F_MT failure loads, a parametric study is performed –

[3] It is worth mentioning that pin-ended columns with free warping at the end cross-sections are extremely difficult to achieve experimentally, even if a good attempt has recently been made by Santos *et al.* (2018). This is much more easily done in numerical analyses, particularly in linear buckling ones – moreover, due to the nature of the analytical functions employed, such end support conditions are automatically modelled in virtually all the semi-analytical finite strip analyses. In shell finite element non-linear analyses (as those carried out in this work to obtain the column failure loads), modelling pinned end cross-sections with free warping requires preventing the (i) global transversal translations, (ii) torsional rotation and (iii) local transverse membrane and flexural displacements, while keeping the warping/axial displacements free. Such support condition arrangement tends to "artificially stiffen" the column response as the displacements and rotations cease to be small, making it impossible to obtain reliable failure loads – indeed, because the warping displacements become progressively more (partially) restrained, the column strength increases and, therefore, its failure load is larger (obviously, this effect is not captured by the DSM design approach, since the critical buckling stress is calculated for fully free warping displacements).

the columns analyzed exhibit the same cross-section shapes as the F columns addressed previously (plain channels, lipped channels, return lipped channels, hat-sections and rack-sections) and various geometries and yield stresses, selected to cover a wide slenderness ranges.

As before (Dinis *et al.* 2018a,b), all numerical F_MT failure loads obtained in this work (i) concern columns with critical-mode (F_MT) initial imperfections with $L/1000$ amplitude (value often prescribed in specifications) and (ii) are determined by means of ABAQUS non-linear elastic-plastic shell finite element analyses (SFEA), adopting a model profusely employed by the authors in the past: (i) columns discretized into fine meshes of 4-node isoparametric elements (length-to-width ratio roughly equal to 1), (ii) pin-ended support conditions modeled by attaching, to the column end cross-sections, rigid plates with the appropriate rotation restraints and (iii) steel material behavior described by Prandtl-Reuss's model – the rounded corner and the residual stress effects are disregard, since they are known to practically cancel each other (*e.g.*, Ellobody & Young 2005). Finally, the assembled F_MT failure loads, concerning columns with three (pin-ended) support conditions, are used to assess the quality of their estimation provided by (i) the current DSM column global design curve and (ii) the DSM-based strength curve set successfully developed in the context of the F columns. Since it is shown that neither of them is able to adequately handle the whole set of PC_M, PC_m and PS column failure loads, it is necessary to propose modifications for some of them. With the incorporation of those modifications, it is found that all the F_MT failure loads considered in this work are very well predicted by the appropriate DSM-base design curve or curve set – the predictions (i) outperform those yielded by the current design curve and (ii) lead to LRFD resistance factors higher than 0.90.

1.1 Load and Resistance Factor Design (LRFD)

According to Section K2.1.1of AISI (2016), the LFRD resistance factor ϕ is given by

$$\phi = C_\phi (M_m F_m P_m)\, e^{-\beta_0 \sqrt{V_M^2 + V_F^2 + C_P V_P^2 + V_Q^2}} \qquad \text{with} \qquad C_P = \left(1 + \frac{1}{n}\right)\frac{m}{m-2} \qquad , \quad (2)$$

where (i) C_ϕ is a calibration coefficient (C_ϕ=1.52 for LRFD), (ii) M_m=1.10 and F_m=1.00 are the mean values of the material and fabrication factors, respectively, (iii) β_0 is the target reliability index (β_0=2.5 for structural members in LRFD), (iv) V_M=0.10, V_F=0.05 and V_Q=0.21 are the coefficients of variation of the material factor, fabrication factor and load effect, respectively, (v) C_P is a correction factor depending on the numbers of tests (n) and degrees of freedom ($m=n-1$), and (vi) P_m and V_P are the mean and the coefficient of variation of the "exact"-to-predicted ultimate strength ratios. The value recommended for compression members is ϕ_c=0.85, regardless of the column failure mode nature.

2. Overview of the Available DSM-Based Design Approaches for Fixed-Ended Columns

This section summarizes the main findings unveiled in recent numerical investigations concerning the strength and DSM design of F columns failing in F_MT modes (Dinis *et al*. 2018a,b). These investigations dealt with columns exhibiting a wide variety of cross-section shapes: plain channels (U), unstiffened (C), return lip (RLC), web-stiffened (WSC) and web/flange-stiffened (WFSC) lipped channels, hat-sections (H) and rack-sections (R) – all cross-section dimensions and lengths are given in Annexes A to G. A total of 1710 columns were analyzed, all containing critical-mode initial geometrical imperfections with $L/1000$ amplitude and covering wide slenderness ranges (f_y=75,150,300,450,600 MPa). Figs. 2(a)-(g) compare the DSM global design curve (f_{nG}) with the obtained column f_u/f_y ratios. As for Figs. 3(a)-(g), they plot f_u/f_{nG} against λ_G for the seven column sets. It is observed that the f_u/f_y values (i) are well aligned

along the DSM global strength curve (marginally above and with small vertical dispersion) in the low-to-moderate slenderness range ($\lambda_G \leq 1.5$) and (ii) lie well above that curve and are clearly more scattered (the vertical dispersion increases with λ_G in the moderate and high slenderness range ($\lambda_G > 1.5$) – moreover, the f_u/f_y and f_u/f_{nG} "clouds" are quite similar for the U, C, H, R, RLC, WSC, WSFC column sets.

Following the above observation, it was decided to improve the current DSM column global design curve, in order to achieve a higher failure load prediction quality in the moderate and high slenderness range

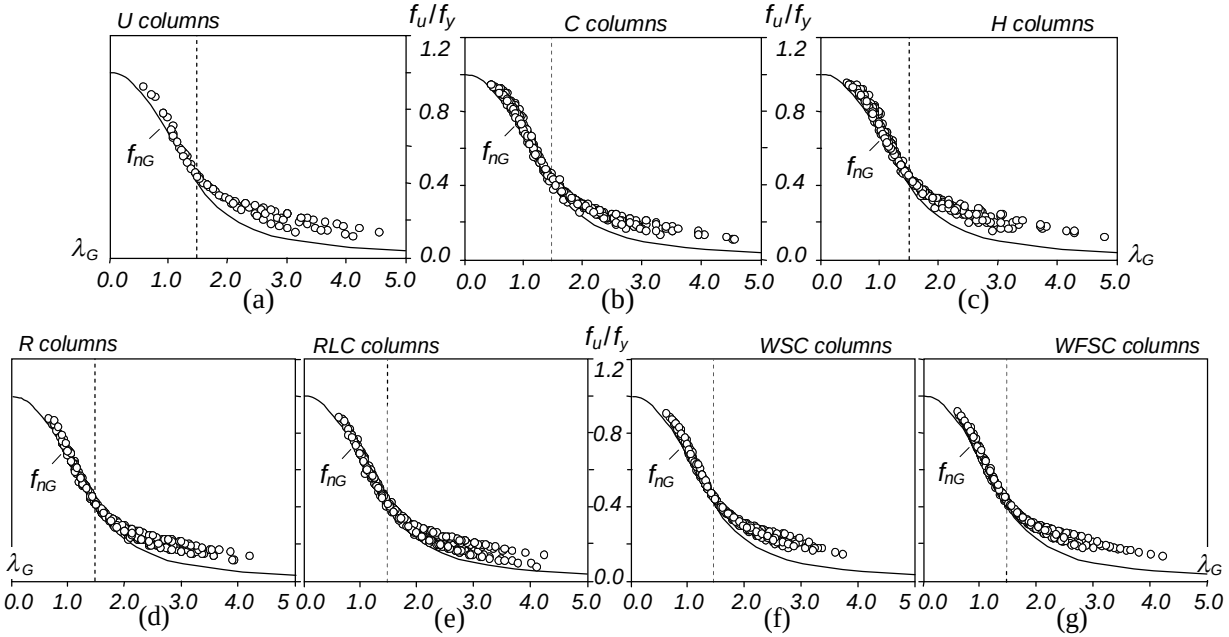

Figure 2: Plots f_u/f_y vs. λ_G for (a) U, (b) C, (c) H, (d) R, (e) RLC, (f) WSC, (g) WFSC columns

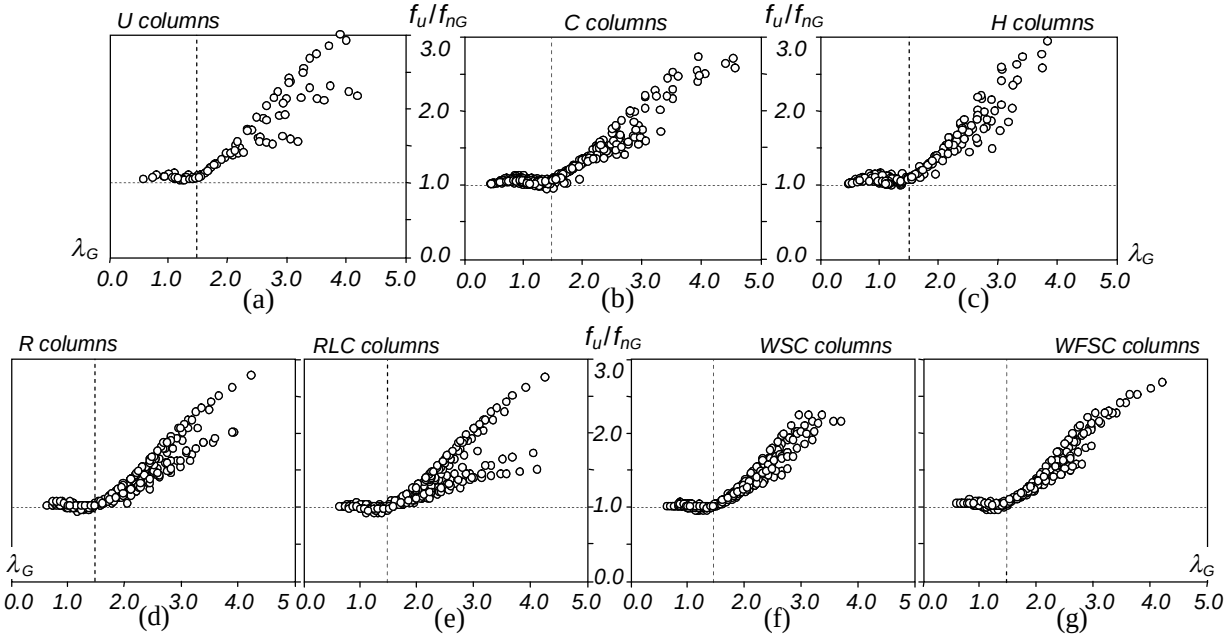

Figure 3: Plots f_u/f_{nG} vs. λ_G for (a) U, (b) C, (c) H, (d) R, (e) RLC, (f) WSC, (g) WFSC columns

(λ_G>1.5 – this means that the Johnson parabola is kept in the low-to-moderate slenderness range). The search for such improvement led to the proposal of a new DSM-based approach (f_{nFT}) involving a set of strength curves dependent on a geometric parameter $\beta=I_I/I_{II}$, relating the major (I_I) and minor (I_{II}) moments of inertia. For $\lambda_G(\equiv\lambda_{FT})$[4] >1.5, the strength curve becomes β-dependent and is defined by a general "Euler-type" expression similar to that appearing in the current DSM global strength curve (see Eq. (1)) – this strength curve set is defined by the expressions

$$f_{nFT}=\begin{cases} f_y\left(0.658^{\lambda_{FT}^2}\right) & if \quad \lambda_{FT}\le 1.5 \\ f_y\left(\dfrac{a}{\lambda_{FT}^b}\right) & if \quad \lambda_{FT}>1.5 \end{cases} \qquad \text{with} \qquad \lambda_{FT}=\sqrt{\frac{f_y}{f_{crFT}}}\ , \tag{3}$$

where the β-dependence is felt through parameters a and b, which are functions of β given by

$$a=0.39\times 1.5^b \tag{4}$$

$$b=\begin{cases} 0.10\beta+0.85 & if \quad \beta<11.5 \\ 2 & if \quad \beta\ge 11.5 \end{cases}\ , \tag{5}$$

for all the U, C, H, WSC and WFSC columns analyzed by Dinis *et al*. (2018b). Note that (i) these a and b expressions were obtained by means of a "trial-and-error curve-fitting procedure", and (ii) Eq. (1) is recovered for $\beta\ge$11.5, value beyond which the role played by torsion becomes negligible – one has then a=0.877 and b=2.0. However, in the case of the R and RLC columns (both exhibiting "two-wall" end stiffeners), it was found that the same high F_MT failure load prediction quality can only be obtained if the DSM-based strength curve set proposed is modified/lowered. The modification proposed for those columns involved exclusively parameter $b(\beta)$, which becomes

$$b=\begin{cases} 0.20\ \beta+0.90 & if \quad \beta<5.5 \\ 2 & if \quad \beta\ge 5.5 \end{cases}\ . \tag{6}$$

Note that parameter a is still given by Eq. (4) and the new flexural-torsional strength curve still coincides with Eq. (1) for columns with high β values (*i.e.*, a=0.877 and b=2).

The prediction quality achieved by the two sets of strength curves can be observed in Figs. 4(a)-(b), which plot, against λ_{FT}, the f_u/f_{nFT} values obtained (i) with Eq. (5), for all but the R and RLC column sets considered ("all but R+RLC columns"), and (ii) with Eq. (6), exclusively for the R and RLC column sets – the associated averages, standard deviations, maximum/minimum values, as well as the ϕ values they originate, are also included in these figures. It is clearly observed that the two strength curve sets yield accurate and mostly safe predictions of the numerical F_MT failure loads obtained by Dinis *et al*. (2018b) – the f_u/f_{nFT} averages and standard deviations are equal to 1.070/0.056 (all but R+RLC columns) and 1.059/0.064 (R+RLC columns), and lead to LRFD resistance factors visible superior to that recommended in AISI (2016) for compression members – ϕ_c=0.85.

[4] In order to make a clear distinction between the current DSM global design curve and the DSM-based strength curves proposed in this work, concerning exclusively columns failing in F_MT modes, λ_G is replaced by λ_{FT} in the latter.

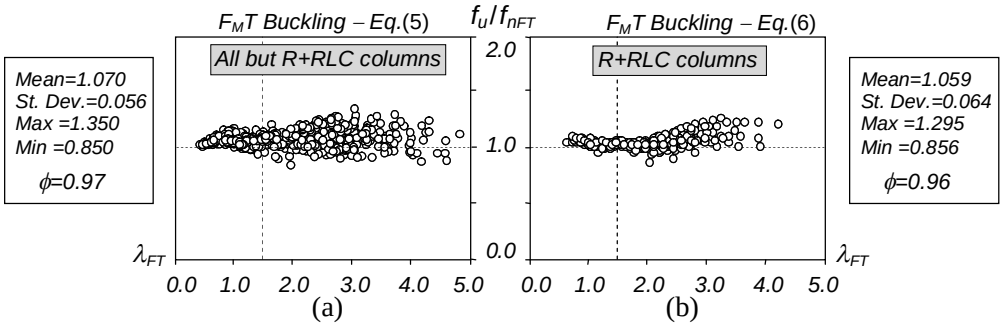

Figure 4: Plots f_u/f_{nFT} vs. λ_{FT} for the (a) "all but R+RLC columns" (Eq. (5)) and (b) "R+RLC columns" (Eq. (6))

Although the above DSM-based design approaches provide efficient (accurate and reliable) estimates of the available fixed-ended column numerical F_MT failure loads, and clearly outperform those yielded by the current global design curve, they still exhibit one non-negligible drawback: distinct strength curve sets are needed for column cross-sections with one-wall and two-wall end stiffeners. The next section addresses the development and merit assessment of another DSM-based design approach for F columns buckling/failing in F_MT modes, which (i) shares the positive performance indicators exhibited by the strength curves defined by Eqs. (3)-(6) and (ii) is able to handle column with arbitrary cross-sections (including those with one-wall and two-wall end stiffeners) – this is because it is founded on a structural reasoning more closely linked to the column flexural-torsional buckling mechanics.

3. New DSM-Based Design Approach for Fixed-Ended Columns

On the basis of the observation made in the previous section and with the objective of reaching a more inclusive and mechanically sound estimation of the column flexural-torsional ultimate strength (f_{nFT}), it was decided to modify the strength curve sets defined by Eqs. (3)-(6), valid for $\lambda_{FT}>1.5$ (moderate and high slenderness ranges) – naturally, this means that the Johnson' parabola is still kept in the low-to-moderate slenderness range ($\lambda_{FT}\leq 1.5$). The modification consist of considering a cross-section geometric parameter that involves not only the major (I_I) and minor (I_{II}) moments of inertia, but also the warping constant I_w – note that, nowadays, this constant can be easily calculated numerically, by means of freely available codes like CUFSM (Li *et al*. 2014) or GBTUL (Bebiano *et al*. 2017). The new parameter, termed β_{FT}, is given by

$$\beta_{FT} = \frac{I_I + I_w/A}{I_{II}} \quad , \quad (7)$$

where A is the gross cross-section area, included in the expression to keep its non-dimensional nature.

Following exactly the same strategy adopted previously (Dinis *et al*. 2018a,b), a new set of β_{FT}-dependent strength curves was sought to predict, as efficiently as possible, the column F_MT failure loads. After grouping all the column sets considered according to their β_{FT} values, a "trial-and-error curve-fitting procedure" was employed to reach a new expression for parameter $b(\beta_{FT})$ – parameter a is still given by Eq. (4) and the new flexural-torsional strength curve still coincides with Eq. (1) for columns with high β_{FT} values (*i.e.*, a=0.877 and b=2) – as mentioned before, torsion has a minute influence on the response of such columns. The output of the procedure just described was a b expression defined by

$$b = \begin{cases} 0.06\beta_{FT} + 0.71 & if \quad \beta_{FT} < 21.5 \\ 2 & if \quad \beta_{FT} \geq 21.5 \end{cases} . \quad (8)$$

In order to illustrate the prediction quality achieved by the new strength curve set, Figs. 5(a)-(b) plot, against λ_{FT}, the f_u/f_y values concerning against pairs of C and R columns exhibiting similar β values (β=1.55-2.83 and β=1.57-2.53, respectively), but different β_{FT} ones (β_{FT}=5.47-6.14 and β_{FT}=6.53-11.96) and compare them with the current DSM column global design curve and the strength curve set obtained with Eq. (8) (solid and dashed lines, respectively). It is clearly shown that the new DSM strength curves follow the f_u/f_y trends quite well, providing rather accurate underestimations of the numerical failure loads of columns with cross-sections exhibiting both one-wall and two-wall end stiffeners.

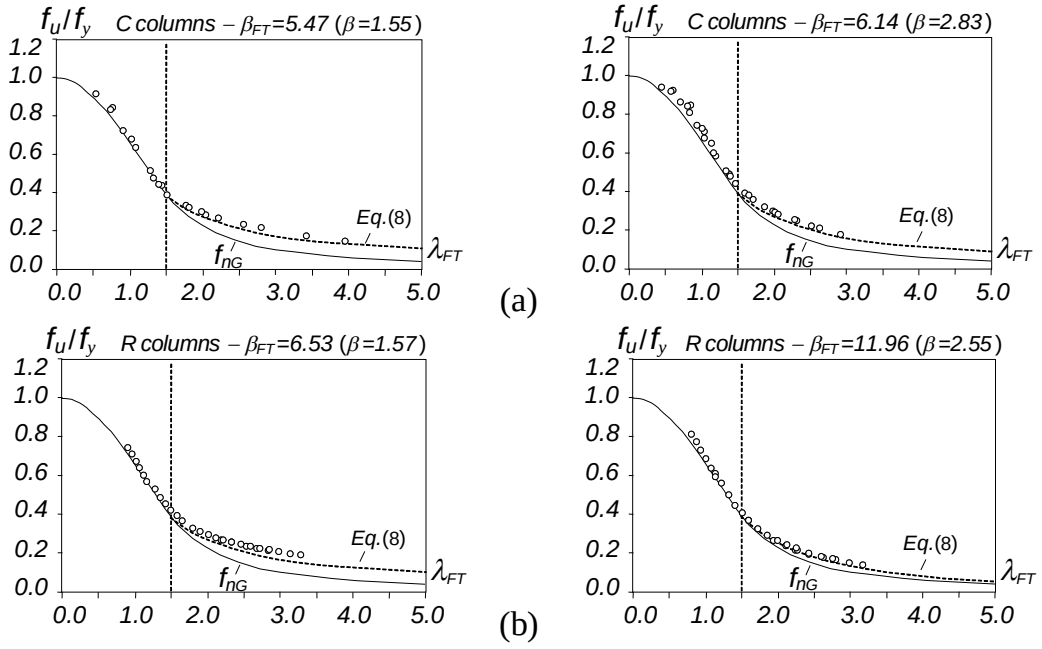

Figure 5: Comparison between the current DSM design curve (f_{nG}), the newly proposed DSM-based strength curves (f_{nFT}) and the f_u/f_y values concerning (a) C columns with β_{FT}=5.47-6.14 and (b) R columns with β_{FT}=6.53-11.96

The tables in Annexes A to G provide the new failure-to-predicted strength ratios f_u/f_{nFT} respectively for the U, C, H, R, RLC, WSC and WFSC columns analyzed by Dinis *et al.* (2018b), together with relevant quantities involved in their calculation, namely the cross-section warping constant I_w and the β_{FT} value. In order to assess the performance and merits of the newly proposed strength curve set, Figs. 6(a)-(g) plot, against λ_{FT}, the f_u/f_{nFT} values concerning the U, C, H, R, RLC, WSC and WFSC columns. Moreover, Table 1 provides, for each column set, the failure load numbers (n) and f_u/f_{nFT} averages, standard deviations and maximum/minimum values – the LRFD resistance factors (ϕ) obtained from the failure-to-predicted ultimate strength ratios of all the columns analyzed are also included. As for Figs. 7(a)-(b), they plot, also against λ_{FT}, the failure-to-predicted f_u/f_{nFT} ratios of (i) all numerical failure loads obtained by Dinis *et al.* (2018b), and (ii) the six experimental failure loads reported by Bandula Heva & Mahendran (2012), concerning lipped channel columns – these figures also include the f_u/f_{nFT} means, standard deviations and maximum/minimum values, as well as the LRFD resistance factor values they lead to. The observation of these results prompts the following remarks:

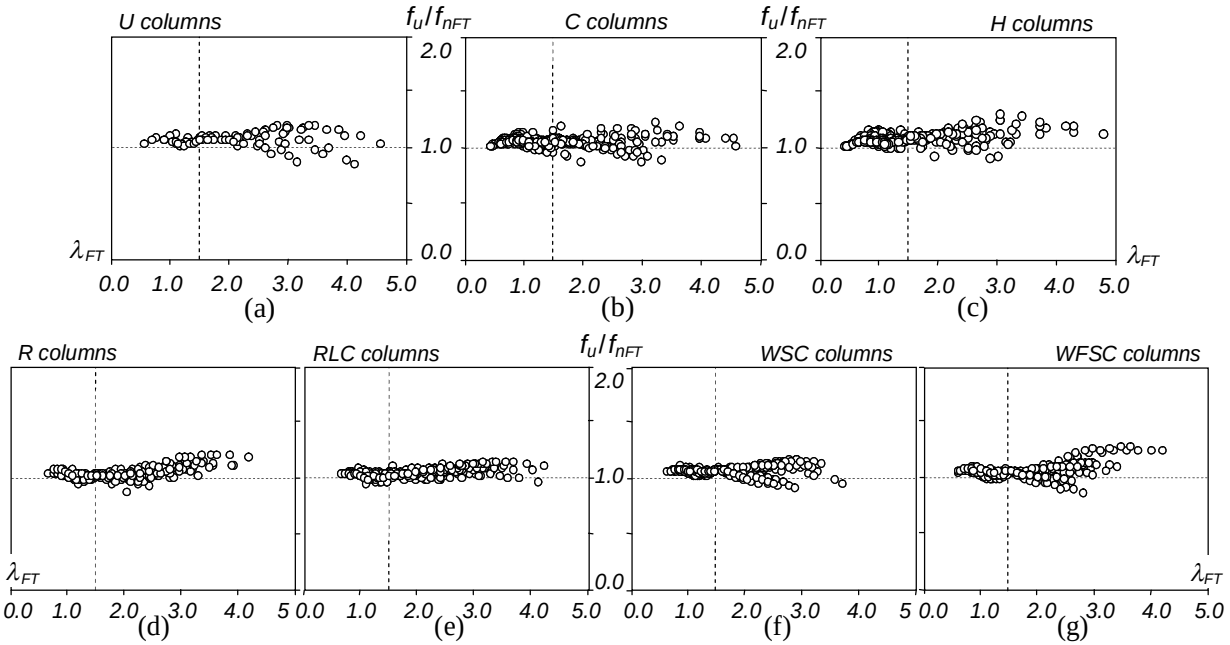

Figure 6: Plots f_u/f_{nFT} vs. λ_{FT} for the (a) U, (b) C, (c) H, (d) R, (e) RLC, (f) WSC, (g) WFSC columns

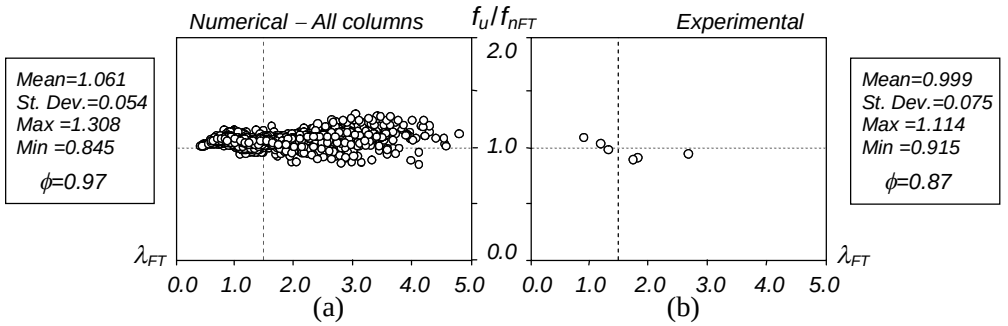

Figure 7: Plots f_u/f_{nFT} vs. λ_{FT} for the available (a) numerical and (b) experimental column failure loads

Table 1: Means, standard deviations, maximum/minimum values and LRFD resistance factors of the numerical failure-to-predicted ultimate strength ratios provided by the newly proposed DSM-based strength curve set

	U columns		C columns		H columns		R columns		RLC columns		WSC columns		WFSC columns		All columns		
λ_G	≤ 1.5	> 1.5	≤ 1.5	> 1.5	≤ 1.5	> 1.5	≤ 1.5	> 1.5	≤ 1.5	> 1.5	≤ 1.5	> 1.5	≤ 1.5	> 1.5	≤ 1.5	> 1.5	All
n	29	61	128	142	134	136	96	174	96	174	108	162	107	163	698	1012	1710
Mean	1.065	1.078	1.058	1.054	1.074	1.113	1.036	1.064	1.024	1.049	1.054	1.063	1.046	1.069	1.051	1.068	1.061
S. Dev.	0.028	0.082	0.035	0.061	0.037	0.066	0.025	0.056	0.027	0.041	0.019	0.054	0.024	0.077	0.033	0.064	0.054
Max	1.126	1.207	1.155	1.234	1.170	1.308	1.092	1.225	1.086	1.147	1.105	1.157	1.108	1.288	1.170	1.308	1.308
Min	1.014	0.845	0.958	0.875	0.093	0.906	0.953	0.888	0.939	0.965	1.010	0.901	0.982	0.860	0.939	0.845	0.845
ϕ	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.96	0.97	0.97

(i) This new global strength curve set leads to quite accurate numerical ultimate strength predictions in the $\lambda_{FT}>1.5$ slenderness range for all the seven column sets considered, which exhibit cross-sections with both one-wall and two-wall end stiffeners. Indeed, the corresponding f_u/f_{nFT} statistical indicators (averages, standard deviations, maximum/minimum values) all similarly good – they read 1.078-0.082-1.207-0.845 (U), 1.054-0.061-1.234-0.875 (C), 1.113-0.066-1.308-0.906 (H), 1.064-0.056-1.225-0.888 (R), 1.049-0.041-1.147-0.965 (RLC), 1.063-0.054-1.157-0.901 (WSC) and 1.069-0.077-1.288-0.860 (WFSC).

(ii) The LRFD resistance factors concerning $\lambda_{FT}\leq 1.5$ and $\lambda_{FT}>1.5$ are practically identical and well above $\phi_c=0.85$ – value recommended for compression members by the North American Specification (AISI 2016). Indeed, they read $\phi=0.96$ ($n=698$, $P_m=1.051$, $V_P=0.031$) and $\phi=0.97$ ($n=1012$, $P_m=1.068$, $V_P=0.060$), respectively.

(iii) Because only three of the C columns tested by Bandula Heva & Mahendran (2012) exhibit global slenderness values higher than 1.5, further experimental studies involving slender column specimens are required in order to provide adequate experimental validation for the proposed strength curves. Nevertheless, the six-value (three below $\lambda_{FT}=1.5$ and three above $\lambda_{FT}=1.5$) f_u/f_{nFT} statistical indicators obtained are quite good: average, standard deviation, maximum/minimum values equal to 0.999-0.075-1.114-0.915 – the associated LRFD resistance factor is also above 0.85.

4. Pin-Ended Column Flexural-Torsional Failure Load Data

4.1 Buckling Behavior – Column Geometry Selection

The signature curves depicted in Fig. 8(a) provide the variation of the critical buckling load P_{cr} with the length L (in logarithmic scale) for steel ($E=210$ GPa, $\nu=0.3$) U columns with $b_w=b_f=100$ mm, $t=3$ mm and four end support conditions: fixed, spherically-hinged and two cylindrically-hinged supports (axis along the cross-section major or minor principal axes) – F, PS, PC_M and PC_m columns/curves, respectively. These curves were obtained through Generalized Beam Theory (GBT) buckling analyses, carried out with code GBTUL (Bebiano *et al*. 2017) and including 9 deformation modes: 4 global (**1**-**4**) and 5 local (**5**-**9**). As for Fig. 8(b), it shows the associated modal participation diagrams, providing the contributions of each deformation mode (p_i – modes **2**-**5** shown in Fig. 8(c)) to the column critical buckling modes. Finally, Fig. 8(c) displays the critical buckling mode in-plane shapes of PS columns with lengths $L=200,600,1000$ cm. These buckling results prompt the following remarks:

(i) Each P_{cr} vs. L curve exhibits two distinct zones, one associated with local buckling in modes with several half-waves (p_5 is dominant) and the other with single half-wave global buckling – naturally, the length corresponding to the transition between local and global buckling depends on the column end support conditions: $L_T=320$ cm (PC_M and PS columns) and $L_T=358$ cm (F and PC_m columns).

(ii) Depending on the L value, the curve (global) descending branch may be associated with two buckling mode natures: major-axis flexural-torsional (modes **2**+**4**) or minor-axis flexural (mode **3**).

(iii) The relative participations of modes **2** and **4** in the column critical F_MT buckling mode varies with the column end supports – higher participation from mode **2** in the PC_m and PS columns.

(iv) In columns with these end support conditions, the F_MT buckling length range (L_{FT}) is quite large and the flexural-torsional (critical) and flexural buckling loads are quite far apart. The exception are the PC_m columns, for which the F_MT buckling length range is fairly small ($505\geq L_{FT}>358$ cm) and the flexural-torsional and flexural buckling loads are very close – *e.g.*, for $L\approx L_T$ the ratios between these buckling loads read $P_{b,fm}/P_{cr}=5.71$ (PC_M), 4.55 (F), 1.43 (PS) and 1.14 (PC_m).

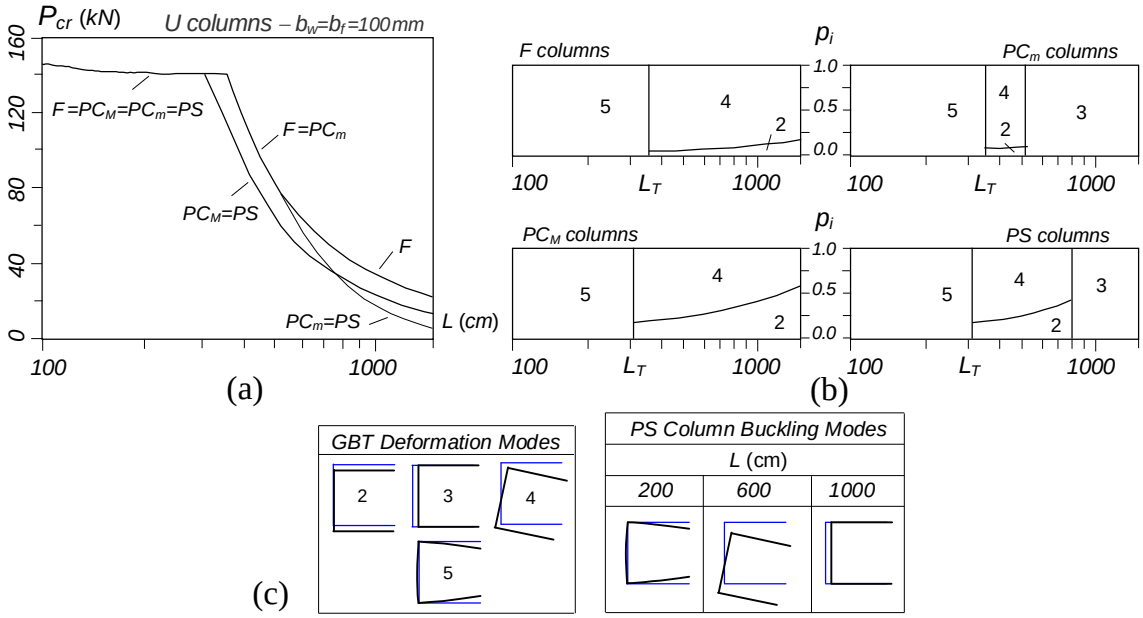

Figure 8: (a) f_{cr} vs. L signature curves and (b) GBT modal participation diagrams of U columns with b_w=b_f=100mm and four end support conditions, and (c) 4 GBT deformation mode in-plane shapes and 3 PS column critical buckling modes

4.2 Failure Load Data

The next task of this ongoing research effort is to address the DSM design of cold-formed steel pin-ended columns buckling and failing in F_MT modes – this study involves PC_M, PC_m and PS columns with (i) the five cross-sections shape depicted in Fig. 9: U, C, H, RLC and R columns. The first step consists of assessing the merits (accuracy and safety) of the current DSM global strength curve in predicting their failure loads, which must be preceded by the acquisition of significant numerical failure load data. This is done by means of a parametric study comprising ABAQUS non-linear elastic-plastic SFEA, adopting a model identical to that employed to analyze the F columns (Dinis *et al.* 2018a,b), of pin-ended columns with the cross-section dimensions and lengths given in Table 2, selected to ensure buckling in F_MT modes for the three end support conditions. As before, for each geometry the columns analyzed have yield stresses f_y selected to cover wide critical slenderness ranges – the values considered are 75,150, 300,450,600MPa (in order to achieve low slenderness values completion, some of these f_y values are unrealistically low) and contain critical-mode initial geometrical imperfections with amplitude L/1000. For each pin-ended support condition, the numerical failure load data concern (i) 60 U columns, such that $1.11 \geq b_w/b_f \geq 0.83$, (ii) 100 C and H column pairs sharing the same cross-section dimensions, such that $1.09 \geq b_w/b_f \geq 0.83$ and $12.00 \geq b_f/b_l \geq 5.00$, (iii) 100 R and RLC column pairs also sharing the same cross-section dimensions, such that $1.15 \geq b_w/b_f \geq 1.00$ and $6.50 \geq b_f/b_l \geq 5.00$. Therefore, a total of 460 columns are analyzed for each pin-ended support condition. Their critical buckling stresses f_{cr} and ultimate strengths f_u are given in Annexes H to L – each includes results concerning one cross-section shape. Figs. 10(a_1)-(a_2), concerning U_1(L_4) PC_M and PS columns with various yield stresses, illustrate the column equilibrium paths that it is necessary to determine in order to obtain the numerical failure loads presented in Annexes H to L. Moreover, Figs. 10(b_1)-(b_2) display the failure modes (deformed configurations at collapse) of the columns with $f_y/f_{cr} \approx 1.5$ – note that the two column failure modes under consideration are practically the same: the collapse occurs after the full yielding of the web-top flange corners at the column central region.

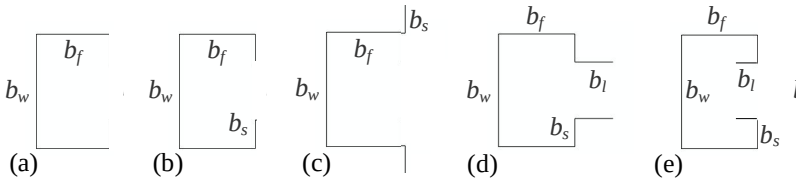

Figure 9: Pin-ended column cross-sections considered: (a) U, (b) C, (c), H, (d) R and (e) RLC

Table 2: Geometries of the PC_M, PC_m and PS columns: b_w, b_f, b_s, b_l, t, A, I_I, I_{II}, I_w, and L values (mm, mm^2, mm^4 and mm^6)

Column	b_w	b_f	b_s	b_l	t	A	b_w/b_f	b_f/b_l	I_I ($\times 10^4$)	I_{II} ($\times 10^4$)	I_w ($\times 10^6$)	β_{FT}	L_1	L_2	L_3	L_4
U_1	100	100	–	–	3.0	900	1.00	–	175.0	100.0	1790.2	3.74	3600	3800	4000	4200
U_2	100	110	–	–	3.0	960	0.91	–	190.0	129.0	2326.4	3.35	4200	4700	5200	5700
U_3	100	120	–	–	3.0	1020	0.83	–	205.1	162.7	2957.9	3.04	4500	5000	5500	6000
C_1	60	55	11	–	1.2	230.4	1.09	5.00	15.7	10.1	91.0	5.47	2300	2500	3000	35000
C_2	80	70	10	–	1.0	240	1.14	7.00	29.1	16.1	219.7	7.48	3000	3500	4000	4500
C_3	100	100	10	–	2.0	640	1.00	10.00	124.8	83.3	1676.3	4.64	4000	4500	5000	5500
C_4	100	120	10	–	2.0	720	0.83	12.00	144.8	131.2	2655.3	3.91	5000	5500	6000	6500
C_5	130	120	10	–	2.5	975	1.08	12.00	317.3	179.1	5805.8	5.10	5000	5500	6000	6500
H_1	60	55	11	–	1.2	230.4	1.09	5.00	17.4	10.1	51.4	3.93	2300	2500	3000	35000
H_2	80	70	10	–	1.0	240	1.14	7.00	30.7	16.1	159.2	6.03	3000	3500	4000	4500
H_3	100	100	10	–	2.0	640	1.00	10.00	128.8	83.3	1365.5	4.11	4000	4500	5000	5500
H_4	100	120	10	–	2.0	720	0.83	12.00	148.8	131.2	2209.8	3.47	5000	5500	6000	6500
H_5	130	120	10	–	2.5	975	1.08	12.00	323.8	179.1	5068.5	4.71	5000	5500	6000	6500
R_1	60	55	10	10	1.0	210	1.09	5.50	13.8	10.9	126.9	6.84	2000	25000	3000	3300
R_2	100	100	20	15	1.5	555	1.00	5.00	101.4	91.8	3304,6	7.59	5000	5500	6000	6500
R_3	110	100	20	15	1.5	570	1.10	5.00	125.3	95.0	3808.5	8.35	4000	4500	5000	5500
R_4	130	130	20	20	1.5	705	1.00	6.50	222.7	194.0	9975.9	8.44	6000	6500	7000	7500
R_5	150	130	20	15	2.5	1200	1.15	6.50	501.2	318.9	18992.6	6.53	5000	5500	6000	6500
RLC_1	60	55	10	10	1.0	210	1.09	5.50	13.8	9.7	114.6	7.08	2000	25000	3000	3300
RLC_2	100	100	20	15	1.5	555	1.00	5.00	101.4	84.5	3094.4	7.80	5000	5500	6000	6500
RLC_3	110	100	20	15	1.5	570	1.10	5.00	125.3	87.5	3552.5	8.55	4000	4500	5000	5500
RLC_4	130	130	20	20	1.5	705	1.00	6.50	222.7	176.8	9150.8	8.60	6000	6500	7000	7500
RLC_5	150	130	20	15	2.5	1200	1.15	6.50	501.2	301.9	17952.8	6.62	5000	5500	6000	6500

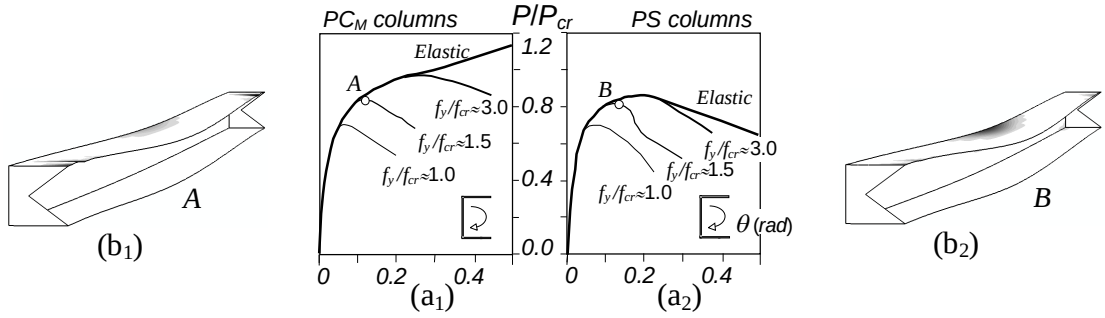

Figure 10: (a) Column elastic-plastic P/P_{cr} *vs.* v/t equilibrium paths ($f_y/f_{cr} \approx 1.0, 1.5, 3.0, \infty$), and (b) failure modes and plastic strains at collapse of the U_1 (L_4) columns with $f_y/f_{cr} \approx 1.5$ and ($_1$) PC_M or ($_2$) PS support conditions

5. DSM-Based Design Approaches for Pin-Ended Columns

The failure loads just obtained are now used to assess the merits of the current DSM global strength curve in predicting them and, if necessary, also to propose modifications/improvements to this design curve.

5.1 Current DSM Ultimate Strength Predictions

The tables included in Annexes H to L provide the f_{nG} estimates, corresponding numerical-to-predicted ratios f_u/f_{nG} and global slenderness values λ_G ($\equiv\lambda_{FT}$) for the U (Tables H_1-H_3), C (Tables I_1-I_3), H (Tables J_1-J_3), RLC (Tables K_1-K_3) and R (Tables L_1-L_3) columns analyzed. Figs. 11(a_1)-(c_5) compare the DSM global design curve with the f_u/f_y values of each column set with PC_M (Figs. 11(a_1)-(a_5)), PC_m (Figs. 11(b_1)-(b_5)) and PS (Figs. 11(c_1)-(c_5)) end support conditions. As for Figs. 12(a_1)-(c_5), they plot, against λ_G, the f_u/f_{nG} values of the U, C, H, RLC and R columns with the three support conditions – Table 3 provides, for each column set, the failure load numbers (n) and f_u/f_{nG} averages, standard deviations and maximum/minimum values. The observation of all these results prompts the following remarks:

(i) The five column sets exhibit similar f_u/f_y "clouds" for each support condition: they are well aligned along the DSM global strength curve, with relative small vertical dispersion. Indeed, for all columns analyzed the f_u/f_{nG} statistical indicators (averages, standard deviations, maximum/minimum values) read 1.176-0.193-1.922-0.942 (PC_M), 0.908-0.073-1.091-0.808 (PC_m), 0.987-0.027-1.080-0.916 (PS).

(ii) Although it may appear, at first sight, that the current DSM design curve provides fairly good ultimate strength estimates for the whole set of columns, a more careful observation shows that this assertion is only true for the PS columns (f_u/f_{nG} values with average equal to 1.0 and very low scatter). On the other hand, the f_u/f_y values of the PC_m and PC_M columns lie (ii_1) a bit below the design curve for $\lambda_G>1.0$, with little scatter (average and maximum/minimum values: 0.880-1.060-0.808) and (ii_2) above that curve for $\lambda_G>1.5$, with visible scatter (average, standard deviation, maximum/minimum values: 1.259-0.189-1.922-1.004) – note, however, that the latter ultimate strength underestimation is lower than that observed for the F columns (compare Figs. 2(a)-(g) and Figs. 11(a_1)-(a_5)).

(iii) In view of what was mentioned in the previous items, it can be concluded that the DSM design quality of the PC_m and PC_M columns can be improved. The search for such improvements is addressed in the next section of the paper. However, this can only be done after some mechanical insight on the differences between the elastic post-buckling strengths of F, PC_M, PC_m and PS columns has been acquired, which is the objective of the small numerical study presented next.

5.1.1 Elastic post-buckling strength of fixed-ended and pin-ended columns – comparative study

The columns analyzed (i) exhibit the U_1 (L_4) geometry shown in Table 2 and (ii) contain F_MT initial geometrical imperfections with $L/1000$ amplitude – note that the closeness between the major-axis flexural-torsional and minor-axis flexural buckling loads depend on the column support conditions: the $P_{b.fm}/P_{cr}$ ratio is equal to 4.35 (F), 5.38 (PC_M), 1.09 (PC_m) and 1.35 (PS).

The four post-buckling equilibrium paths P/P_{cr} *vs.* θ (θ: mid-span web chord rigid-body rotation) and P/P_{cr} *vs.* d_m/t (d_m: mid-web minor-axis flexural displacement) shown in Figs. 13(a)-(b) correspond to F, PC_M, PC_m and PS columns – the values inside brackets stand for the elastic limit points (P_u/P_{cr}). As for Fig. 14, it shows the PC_M and PC_m column post-buckling equilibrium paths P/P_{cr} *vs.* θ, already presented in Figs. 13(a), and a few column mid-span cross-section deformed configurations at advanced post-buckling stages. The joint observation of these post-buckling results prompts the following remarks:

(i) The F and PC_M columns exhibit the expected stable flexural-torsional post-buckling behaviors, with the F column post-critical strength visibly higher than its PC_M column counterpart. Moreover, note that the PC_M column equilibrium path exhibits a limit point at $\theta\approx0.6$ rad (for $P_u/P_{cr}=1.19$) – the F column equilibrium path exhibits no equilibrium point. Moreover, note also that the PC_M column mid-span cross-section deformed configuration evolution "changes" abruptly at $P_u/P_{cr}\approx1.0$, a loading level at which a mid-web flexural displacement reversal takes place.

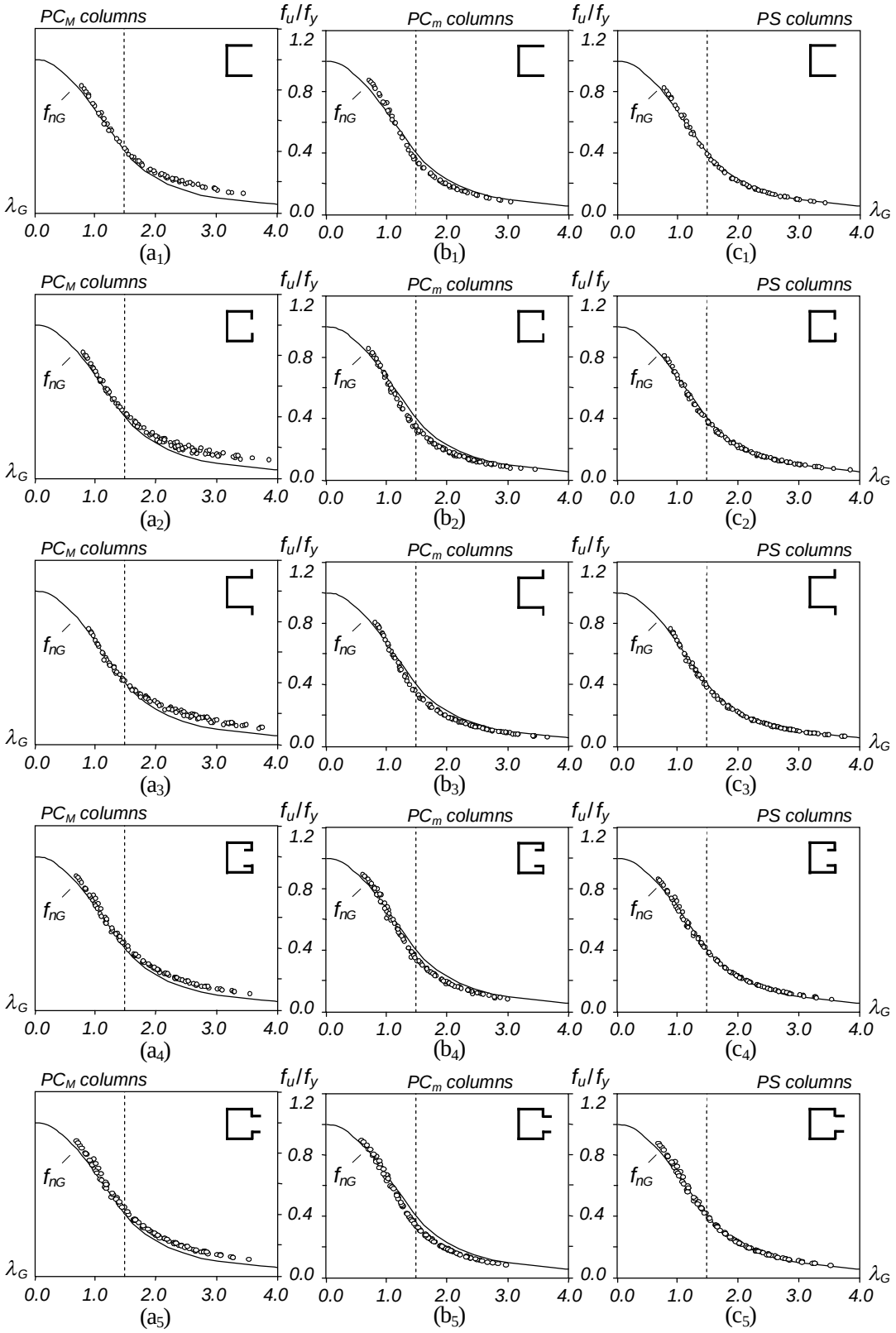

Figure 11: Plots f_u/f_y vs. λ_G for (a) PC_M, (b) PC_m and (c) PS columns with ($_1$) U, ($_2$) C, ($_3$), H, ($_4$) RLC and ($_5$) R cross-sections

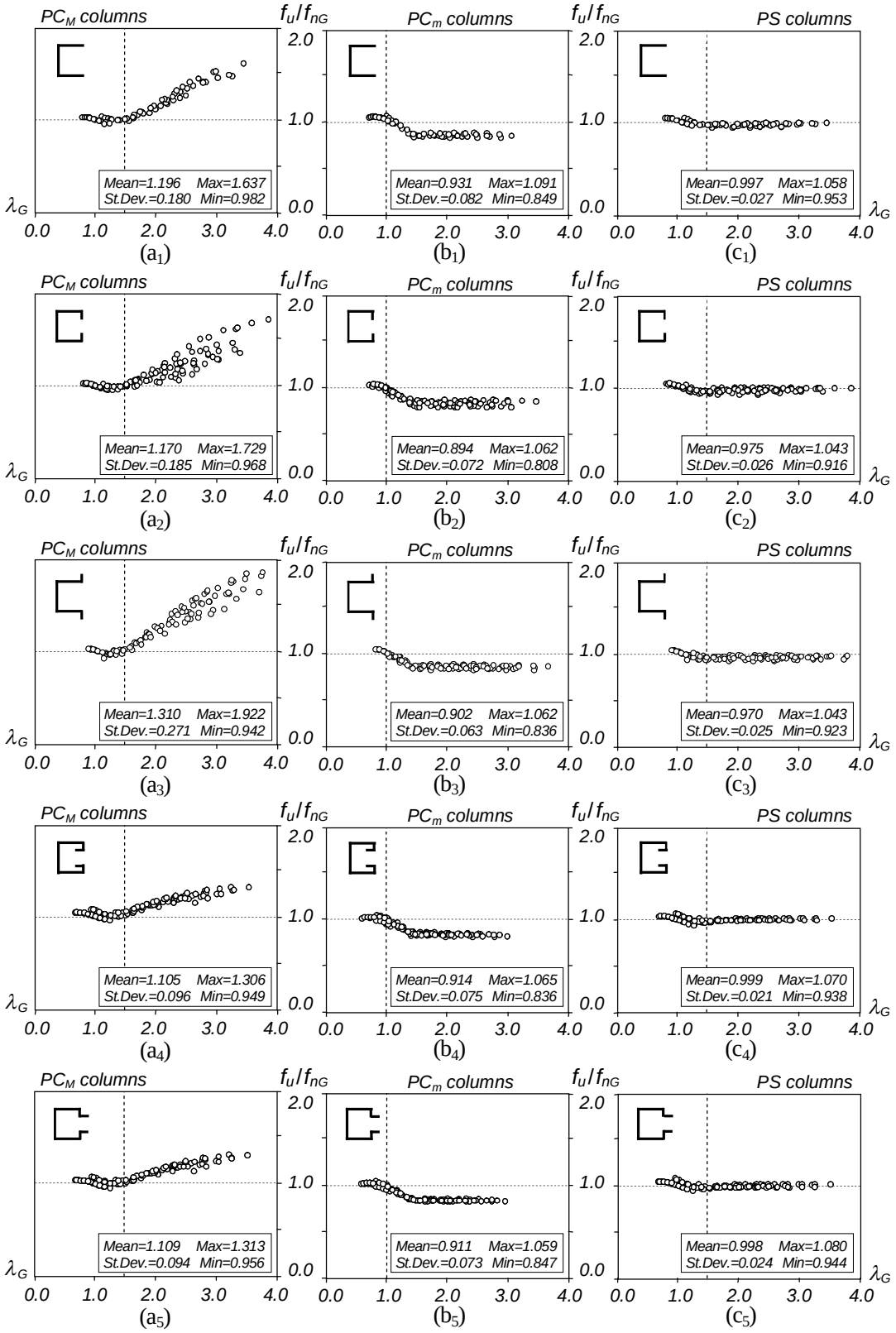

Figure 12: Plots f_u/f_{nG} vs. λ_G for (a) PC_M, (b) PC_m and (c) PS columns with ($_1$) U, ($_2$) C, ($_3$), H, ($_4$) RLC and ($_5$) R cross-sections

Table 3: Means, standard deviations, maximum/minimum values of the numerical-to-predicted ultimate strength ratios provided by the current DSM global design curve for PC_M, PC_m and PS columns

	PC_M columns			PC_m columns			PS columns		
λ_G	≤ 1.5	> 1.5	All	≤ 1.0	> 1.0	All	≤ 1.5	> 1.5	All
n	155	305	460	81	379	460	155	305	460
Mean	1.014	1.259	1.176	1.035	0.880	0.908	0.999	0.981	0.987
S. Dev.	0.026	0.189	0.193	0.026	0.046	0.073	0.034	0.021	0.027
Max	1.083	1.922	1.922	1.091	1.060	1.091	1.080	1.013	1.080
Min	0.942	1.004	0.942	0.968	0.808	0.808	0.933	0.916	0.916

(ii) In contrast, the PC_m and PS columns have much less post-critical strength and their equilibrium paths exhibit limit points at moderate rotations and for fairly loading levels – such limit points occur for P_u/P_{cr}=0.76 + β_u=0.14 rad (PC_m column) and P_u/P_{cr}=0.87 + β_u=0.20 rad (PS column).

(iii) The occurrence of the limit points is due to the combined influence of two effects: (iii$_1$) the closeness of $P_{b.fm}$ and P_{cr}, and (iii$_2$) the absence of reactive end moments (especially minor-axis ones). This explains why a limit point does not occur in the F column and only occurs at fairly advanced post-buckling stages in the PC_M column – both columns exhibit high $P_{b.fm}/P_{cr}$ values and reactive minor-axis bending end moments.

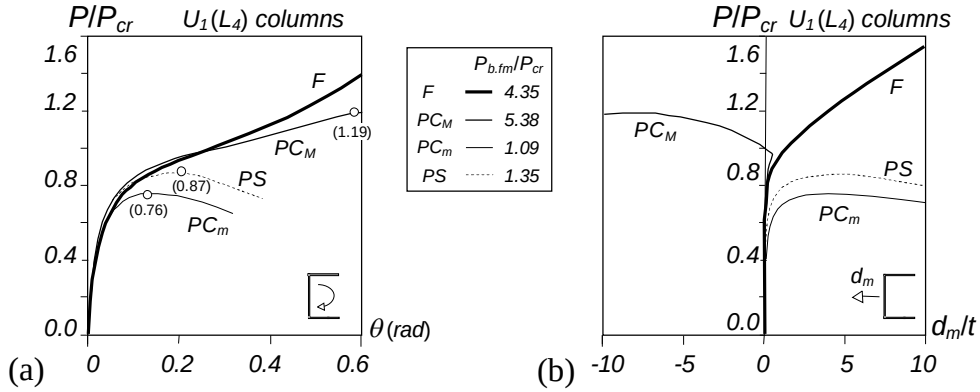

Figure 13: Elastic equilibrium paths (a) P/P_{cr} *vs.* θ and (b) P/P_{cr} *vs.* d_m/t of $U_1(L_4)$ F, PC_m, PC_M and PS columns

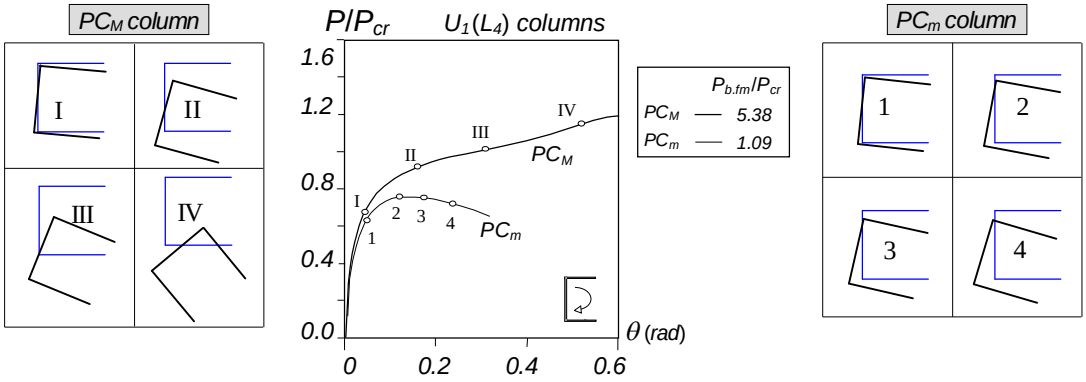

Figure 14: PC_M and PC_m column elastic equilibrium paths P/P_{cr} *vs.* θ and cross-section deformed configuration evolution

(iv) In order to acquire in-depth structural insight on the differences between the post-buckling behaviors of the F, PC_M, PC_m and PS columns, namely on the roles played by (iv_1) the buckling mode nature (relative importance of major-axis flexure and torsion) and (iv_2) the minor-axis flexural displacements (stemming from effective centroid shift effects and/or interaction with minor-axis flexural buckling), further research is needed. The authors are currently investigating this issue by means of GBT non-linear analyses, whose modal nature is essential to provide fresh knowledge about the above post-buckling behavioral differences – the output of this investigation will be reported in the near future.

(v) The differences in the post-buckling strength exhibited by the F, PC_M, PC_m and PS columns, which are not adequately reflected in the corresponding F_MT buckling loads, provide the explanation for the need to employ different design/strength curves for columns with distinct end support conditions.

5.2 Proposal of DSM-Based Design Approaches for Pin-Ended Columns

As shown in the previous section, the PS column F_MT failure loads are adequately (safely and accurately) predicted by the current DSM strength curve, regardless of the slenderness range – this is not surprising if one realizes that this strength curve was developed almost exclusively on the basis of failure loads (experimental and numerical) concerning columns (mostly hot-rolled) with these end support conditions.

Conversely, it was also shown in the previous section that the PC_M and PC_m column F_MT failure loads are only adequately estimated by the current DSM strength curve in the low-to-moderate slenderness range – this is also true for the F columns (Dinis *et al.* 2018a,b). Indeed, (i) the PC_M column F_MT failure loads are underestimated for $\lambda_G(\equiv\lambda_{FT})>1.5$ (but by smaller amounts than the F columns) and (ii) the PC_m column F_MT failure loads are slightly overestimated for $\lambda_G(\equiv\lambda_{FT})>1.0$. Proposals of DSM-based approaches for the design of PC_M and PC_m columns are presented in the next sections – they are aimed at improving failure load predictions provided by the current DSM design curve.

5.2.1 PC_M columns

Naturally, the first idea that sprung to mind to improve the quality of the PC_M column failure load predictions ultimate strength was to use the strength curve set developed for F columns (f_{nFT}), which depends on a cross-section geometric parameter β_{FT} (see Section 3) – recall that the Johnson parabola is kept in the low-to-moderate slenderness range ($\lambda_{FT}\leq 1.5$). However, this strength curve set leads to excessively unsafe failure load predictions – indeed, for $\lambda_{FT}>1.5$ the associated f_u/f_{nFT} average, standard deviation, maximum and minimum values read 0.839-0.099-1.038-0.639. Thus, it is necessary to develop new flexural-torsional strength curves for PC_M columns in the moderate and high slenderness ranges.

Following the same strategy already adopted for the F columns in Section 3, a new strength curve set, also dependent on β_{FT}, is sought for the PC_M columns. After grouping the columns according to their β_{FT} values, a "trial-and-error curve-fitting procedure" leads to a new expression for parameter $b(\beta_{FT})$,

$$b = \begin{cases} 0.06\beta_{FT} + 1.25 & \text{if} \quad \beta_{FT} < 12.5 \\ 2 & \text{if} \quad \beta_{FT} \geq 12.5 \end{cases} , \quad (9)$$

while parameter a is still given by Eq. (4) – the new flexural-torsional strength curves still coincide with Eq. (1) for high β_{FT} values (*i.e.*, a=0.877 and b=2). The tables included in Annexes H_1 to L_1 provide the f_{nFT} estimates and associated numerical-to-predicted ratios f_u/f_{nFT} for the PC_M columns analyzed in this

work. In order to assess the merits of the new strength curve set, Figs. 14(a)-(e) plot f_u/f_{nFT} against λ_{FT} for the U, C, H, RLC, R columns, showing also the f_u/f_{nFT} statistical indicators. It is found that:

(i) The proposed strength curve set leads to a fairly uniform failure load prediction quality along the whole slenderness range (see Figs. 14(a)-(e)). For the various column sets, the f_u/f_{nFT} statistical indicators read 1.021-0.024-1.061-0.973 (U columns), 1.015-0.046-1.117-0.874 (C columns), 1.083-0.067-1.216-0.906 (H columns), 1.028-0.027-1.100-0.949 (RLC columns), and 1.031-0.025-1.096-0.956 (R columns).

(ii) Considering now all the PC_M columns analyzed, the improvement, with respect to the predictions provided by the current DSM design curve, is also very impressive: for $\lambda_{FT}>1.5$, the statistical indicators read 1.049-0.053-1.216-0.874 (f_u/f_{nFT}) vs. 1.259-0.189-1.922-1.004 (f_u/f_{nG}). Moreover, the failure load prediction quality is now the same across the whole slenderness range – the associated LRFD resistance factors, for $\lambda_{FT}\leq 1.5$ and $\lambda_{FT}>1.5$, are ϕ=0.93 (n=155, P_m=1.014, V_P=0.026) and ϕ=0.95 (n=305, P_m=1.049, V_P=0.051), respectively.

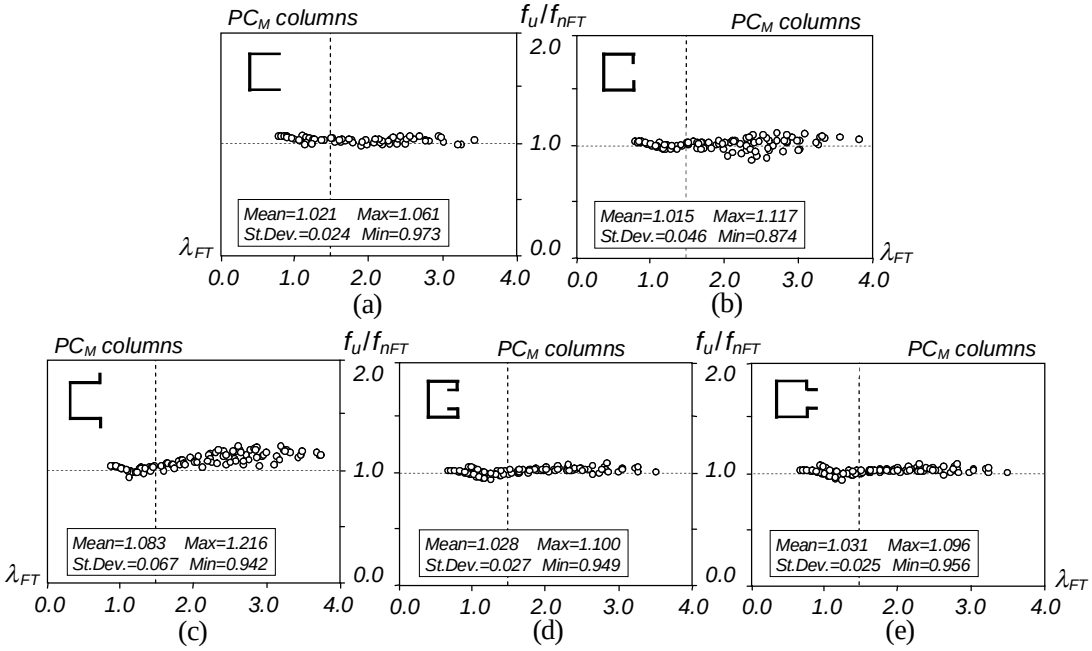

Figure 14: PC_M columns: plots f_u/f_{nFT} vs. λ_{FT} for the (a) U, (b) C, (c), H, (d) RLC and (e) R columns

5.2.2 PC_m columns

The proposal to improve the F_MT failure load prediction quality of the PC_m U, C, H, RLC and R columns consists of a single DSM-based strength curve (f_{nFT}), which only differs from the current one for $\lambda_{FT}>1.0$ – recall, from Section 5.1, that all the unsafe ultimate strength predictions provided by the current DSM design curve concern columns in this slenderness range (see Figs. 12(b_1)-(b_5)). It was found that perfectly adequate F_MT failure load predictions are achieved by merely (i) considering Johnson parabola only up to λ_{FT}=1.0 and (ii) lowering the Euler curve to match its end value. Therefore, the proposed strength/design curve is defined by

$$f_{nFT} = \begin{cases} f_y \left(0.658^{\lambda_{FT}^2} \right) & if \quad \lambda_{FT} \le 1.0 \\ f_y \left(\dfrac{0.658}{\lambda_{FT}^2} \right) & if \quad \lambda_{FT} > 1.0 \end{cases} \qquad \text{with} \qquad \lambda_{FT} = \sqrt{\frac{f_y}{f_{crFT}}} \quad . \quad (10)$$

Figs. 15(a)-(b) illustrate the comparison between the f_u/f_y values of C and R columns and the current (dashed – f_{nG}) and proposed (solid – f_{nFT}) DSM strength curves – similar plots can be obtained for the remaining U, H and RLC columns. It is readily noticed that the f_u/f_y values of the columns with $\lambda_{FT}>1.0$ are much better predicted by the proposed strength curve.

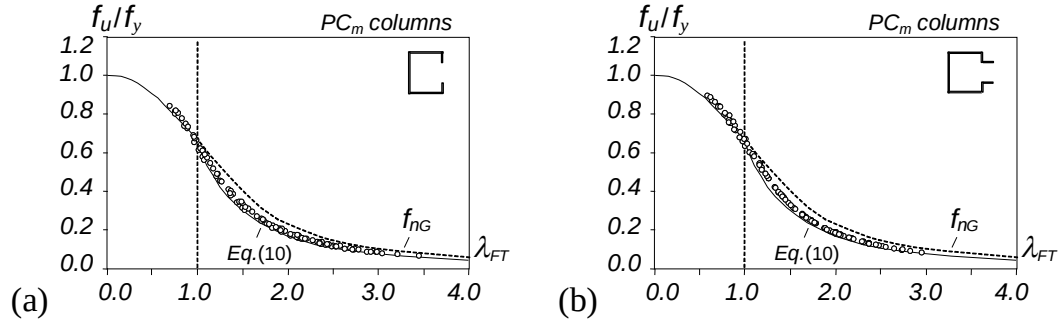

Figure 15: Comparison of the PC_m (a) C and (b) R column f_u/f_y values with the current (f_{nG}) and proposed (f_{nFT}) strength curves

The tables included in Annexes H_2 to L_2 provide the f_{nFT} estimates, corresponding numerical-to-predicted ratios f_u/f_{nFT} for the PC_m columns analyzed. In order to assess the merits of the proposed strength curve, Figs. 16(a)-(e) plot, against λ_{FT}, the f_u/f_{nFT} values of the U, C, H, RLC and R columns – the figures also show the f_u/f_{nFT} statistical indicators. These results prompt the following remarks:

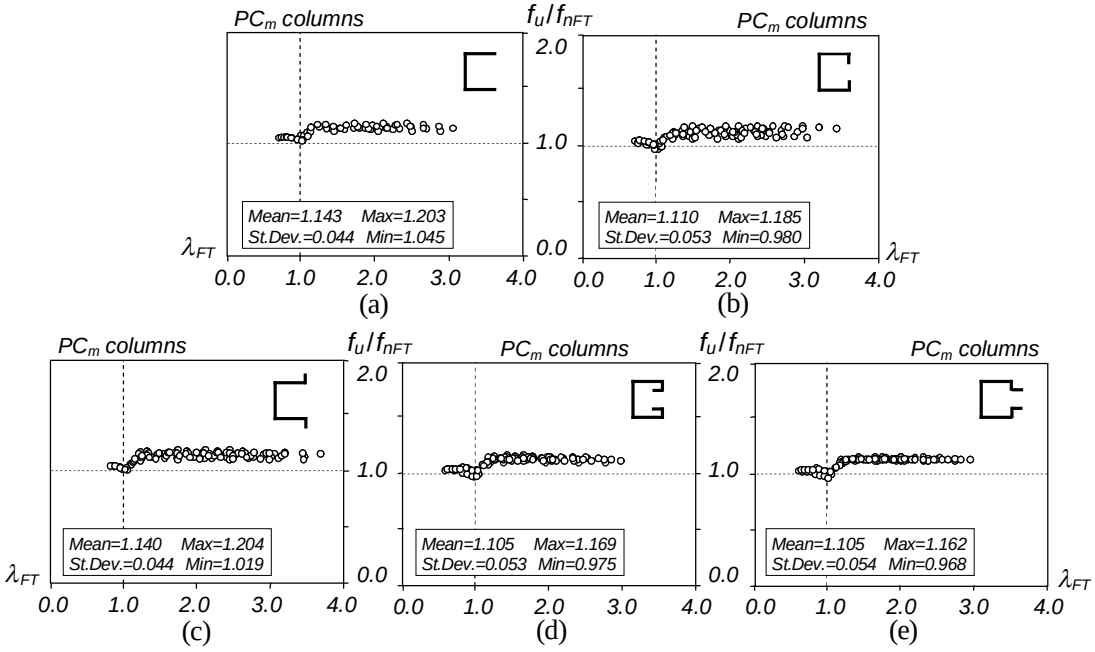

Figure 16: PC_m columns: plots f_u/f_{nFT} vs. λ_{FT} for (a) U, (b) C, (c), H, (d) RLC and (e) R columns

(i) The f_u/f_{nFT} ratios provide ample evidence of the prediction quality improvement achieved with the proposed design curve – the f_u/f_{nFT} averages, standard deviations and maximum/minimum values are 1.143-0.044-1.203-1.045 (U columns), 1.110-0.053-1.185-0.980 (C columns), 1.140-0.044-1.204-1.019 (H columns), 1.105-0.053-1.185-0.980 (RLC columns), 1.105-0.054-1.162-0.968 (R columns).

(ii) The improvement, with respect to the current global design curve predictions, is very significant again for $\lambda_{FT}>1.0$. The statistical indicators concerning all the columns analyzed read 1.136-0.038-1.204-0.977 (f_u/f_{nFT}) vs. 0.880-0.046-1.060-0.808 (f_u/f_{nG}), which means that the failure load prediction quality is now fairly similar across the whole slenderness range – the associated LRFD resistance factors, for $\lambda_{FT}\leq 1.0$ and $\lambda_{FT}>1.0$, are ϕ=0.95 (n=81, P_m=1.035, V_P=0.025) and ϕ=1.04 (n=379, P_m=1.136, V_P=0.033), respectively.

6. Summary of the Proposed DSM-Based Strength Curves

The proposed DSM-based strength approaches for the design of cold-formed steel F and PC_M columns collapsing in F_MT modes can be cast in a unified form, by means of the expressions

$$f_{nFT}=\begin{cases} f_y\left(0.658^{\lambda_{FT}^2}\right) & if \quad \lambda_{FT}\leq 1.5 \\ f_y\left(\dfrac{a}{\lambda_{FT}^b}\right) & if \quad \lambda_{FT}>1.5 \end{cases} \qquad \text{with} \qquad \lambda_{FT}=\sqrt{\frac{f_y}{f_{crFT}}} \quad , \quad (11)$$

where $a=0.39\times 1.5^b$ and b is given by either

$$b=\begin{cases} 0.06\beta_{FT}+0.71 & if \quad \beta_{FT}<21.5 \\ 2 & if \quad \beta_{FT}\geq 21.5 \end{cases} \quad , \quad (12)$$

or

$$b=\begin{cases} 0.06\,\beta_{FT}+1.25 & if \quad \beta_{FT}<12.5 \\ 2 & if \quad \beta_{FT}\geq 12.5 \end{cases} \quad , \quad (13)$$

respectively for the F and PC_M columns – recall that the cross-section geometric parameter β_{FT} reads

$$\beta_{FT}=\frac{I_I+I_w/A}{I_{II}} \quad , \quad (14)$$

where (i) I_I and I_{II} are the major and minor moments of inertia, (ii) I_w the warping constant and (iii) A the gross cross-section area.

As for the PC_m columns, the proposed strength/design curve is defined by

$$f_{nFT}=\begin{cases} f_y\left(0.658^{\lambda_{FT}^2}\right) & if \quad \lambda_{FT}\leq 1.0 \\ f_y\left(\dfrac{0.658}{\lambda_{FT}^2}\right) & if \quad \lambda_{FT}>1.0 \end{cases} \qquad \text{with} \qquad \lambda_{FT}=\sqrt{\frac{f_y}{f_{crFT}}} \quad . \quad (15)$$

Table 4 shows the values involved in the calculation of the LRFD resistance factor ϕ concerning the proposed DSM-based global strength curves to estimate all the column failure load sets considered in this work – a distinction is made between the slenderness ranges unaffected and affected by the strength curve proposal (the current DSM design curve is kept in the former). The table also includes the values obtained with the current DSM strength curve for the PS columns. It is readily observed that the proposed DSM-based strength lead to a high-quality F_MT failure load prediction along the whole slenderness ranges. Indeed, the corresponding LRFD resistance factors are ϕ=0.97 (F columns), ϕ=0.95 (PC_M columns), ϕ=1.02 (PC_m columns) and ϕ=0.91 (PS columns), all well above the value recommended by the North American Specification (AISI 2016) for compression members – ϕ_c=0.85.

Table 4: Means, standard deviations, maximum/minimum values and LRFD resistance factors (ϕ) of the numerical-to-predicted ultimate strength ratios for F, PC_M, PC_m and PS columns failing in FT_M modes

	F columns			PC_M columns			PC_m columns			PS columns		
λ_G	≤1.5	>1.5	All	≤1.5	>1.5	All	≤1.0	>1.0	All	≤1.5	>1.5	All
n	698	1012	1710	155	305	460	81	379	460	155	305	460
Mean	1.051	1.068	1.061	1.014	1.053	1.049	1.036	1.138	1.120	0.999	0.981	0.987
S. Dev.	0.033	0.064	0.054	0.027	0.053	0.049	0.026	0.039	0.054	0.034	0.021	0.027
Max	1.170	1.308	1.308	1.083	1.216	1.216	1.091	1.239	1.239	1.080	1.013	1.080
Min	0.939	0.845	0.845	0.942	0.874	0.874	0.968	0.977	0.968	0.933	0.916	0.918
ϕ	–	–	0.97	–	–	0.95	–	–	1.02	–	–	0.91

7. Conclusion

This work reported the results of a fairly extensive numerical investigation aimed at assessing the accuracy of the currently codified Direct Strength Method (DSM) global strength curve in predicting the ultimate strength of cold-formed steel columns failing in flexural-torsional modes. The first part of the paper was devoted exclusively to fixed-ended columns (F columns) and continued recent work by the authors (Dinis *et al.* 2018a,b) on improving the column flexural-torsional (F_MT) failure load estimation in the moderate and high slenderness ranges (λ_{FT}>1.5). The aim was overcoming a non-negligible drawback of the strength curve set proposed by Dinis *et al.* (2018a,b), namely the fact that distinct strength curve sets are needed for columns with cross-sections exhibiting one-wall and two-wall end stiffeners.

The second part of the paper extended the above investigation to columns with three types of pinned end supports, all fixed with respect to torsion and having warping prevented: end cross-sections attached to rigid plates resting on either spherical (PS columns) or cylindrical hinges – they later may be pinned with respect to major-axis or minor-axis bending (PC_M or PC_m columns, respectively). After briefly comparing the structural responses of fixed-ended and pin-ended columns, a parametric study was carried out with the objective of gathering flexural-torsional failure loads of columns (i) exhibiting different cross-section shapes (plain channels, lipped channels, return lipped channels, hat-sections and rack-sections), (ii) various geometries (cross-section dimensions and lengths) and (iii) covering wide slenderness ranges. These failure load data were then used to assess the quality of their estimates provided by the current DSM global design curve and, whenever necessary, also to propose and validate strength curves to improve the failure load prediction quality (for columns with moderate and high slenderness).

Among the various findings of this investigation, the following deserve to be specially mentioned:

(i) The new strength curve set proposed for F columns, dependent on a cross-section normalized geometric parameter β_{FT} (involving the area, major and minor moments of inertia, and warping constant), leads to excellent numerical failure load predictions for all the columns analyzed (with either one-wall and two-wall end stiffeners) with $\lambda_{FT}>1.5$ – the current DSM design curve provides adequate failure load estimation for $\lambda_{FT}\leq 1.5$. Moreover, the available six lipped channel column experimental failure loads are also quite well estimated by the new strength curves. Nevertheless, further test results are needed before adequate experimental validation can be claimed.

(ii) The PS column flexural-torsional failure loads are efficiently (safely and accurately) predicted by the current DSM design curve, regardless of the slenderness range. This is not surprising, since this strength curve was developed on the basis of experimental and numerical failure loads concerning mostly (hot-rolled) columns with these end support conditions.

(iii) The PC_M and PC_m column flexural-torsional failure loads are only adequately estimated by the current DSM design curve in the low-to-moderate slenderness range. Indeed, the PC_M column failure loads are underestimated for $\lambda_{FT}>1.5$ (but by smaller amounts than the F columns), the PC_m column failure loads are slightly overestimated for $\lambda_{FT}>1.0$.

(iv) A modification of the β_{FT}-dependent strength curve set developed for the F columns was proposed and shown to provide a high-quality estimation of the PC_M column flexural-torsional failure loads analyzed in this work.

(v) A single DSM-based strength curve was proposed to estimate the F_MT failure load prediction quality of the PC_m columns, which only differs from the current one for $\lambda_{FT}>1.0$, also exhibit a very high quality and clearly outperform those yielded by the current design curve.

(vi) Although the failure load data considered in this work was necessarily limited, the proposed DSM-based strength curves lead to LRFD resistance factors higher than 0.90, *i.e.*, considerably above the value currently recommended by the North American Specification (AISI 2016) for compression members ($\phi_c=0.85$), thus providing strong encouragement to search for further validation.

It should also be pointed out that further research is needed in order to acquire in-depth structural insight on the differences between the post-buckling mechanics of the F, PC_M, PC_m and PS columns, namely on the roles played by (i) the buckling mode nature (relative importance of major-axis flexure and torsion) and (ii) the minor-axis flexural displacements (stemming from effective centroid shift effects and/or interaction with minor-axis flexural buckling). The authors are currently investigating this issue by means of GBT non-linear analyses, whose modal nature is ideally suited to shed fresh light on the above post-buckling behavioral differences – the output of this investigation will be reported in the near future.

Finally, one last word to mention that (i) additional numerical and (mostly) (ii) experimental validation is indispensable before the above (possibly modified/improved) DSM-based columns global design curves can be considered for codification – in particular, it is essential to assess how efficiently they predict the experimental flexural-torsional failure loads of columns in the moderate and high slenderness range. In addition, it is also indispensable to assess the merits of the proposed DSM-based strength curves in prediction of flexural-torsional failure loads of columns with partially restrained end flexural rotations.

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ANNEX A: U Column Data

Table A: F columns: (i) geometries, (ii) buckling stresses and ultimate strengths, (iii) ultimate strength predictions by current and proposed DSM design curves, and (iv) numerical-to-predicted ultimate strength ratios (mm and MPa)

Column	Geometry								SFEA		DSM Design							
	b_w	b_f	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
U2_L1	100	40	2	2.5	360	100.5	14.9	2100	75	69.6	273	0.52	66.9	1.04	1.60	0.75	67.0	1.04
	100	40	2	2.5	360	100.5	14.9	2100	150	131	273	0.74	119.2	1.10	1.60	0.75	119.3	1.10
	100	40	2	2.5	360	100.5	14.9	2100	300	213	273	1.05	189.4	1.12	1.60	0.75	189.1	1.13
	100	40	2	2.5	360	100.5	14.9	2100	450	247	273	1.28	225.8	1.09	1.60	0.75	226.7	1.09
	100	40	2	2.5	360	100.5	14.9	2100	600	260	273	1.48	239.2	1.09	1.60	0.75	239.9	1.08
U3_L1	100	60	2	1.7	440	297.7	8.5	3200	75	66.2	166	0.67	62.1	1.07	1.22	0.64	62.2	1.07
	100	60	2	1.7	440	297.7	8.5	3200	150	114	166	0.95	102.8	1.11	1.22	0.64	102.8	1.11
	100	60	2	1.7	440	297.7	8.5	3200	300	150	166	1.34	141	1.06	1.22	0.64	141.5	1.06
	100	60	2	1.7	440	297.7	8.5	3200	450	174	166	1.64	145.8	1.19	1.22	0.64	157.4	1.11
	100	60	2	1.7	440	297.7	8.5	3200	600	193	166	1.9	145.8	1.32	1.22	0.64	175.4	1.10
U4_L1	100	60	2	1.7	440	297.7	8.5	4500	75	58.5	97	0.88	54.3	1.08	1.22	0.64	54.2	1.08
	100	60	2	1.7	440	297.7	8.5	4500	150	83.6	97	1.24	78.5	1.06	1.22	0.64	78.8	1.06
	100	60	2	1.7	440	297.7	8.5	4500	300	106	97	1.76	85.1	1.25	1.22	0.64	96.3	1.10
	100	60	2	1.7	440	297.7	8.5	4500	450	124	97	2.15	85.1	1.46	1.22	0.64	113.2	1.10
	100	60	2	1.7	440	297.7	8.5	4500	600	136	97	2.49	85.1	1.6	1.22	0.64	126.2	1.08
U5_L1	100	60	2	1.7	440	297.7	8.5	5500	75	51.9	73	1.01	48.8	1.06	1.22	0.64	48.9	1.06
	100	60	2	1.7	440	297.7	8.5	5500	150	68.7	73	1.43	63.6	1.08	1.22	0.64	63.7	1.08
	100	60	2	1.7	440	297.7	8.5	5500	300	87.7	73	2.02	64.2	1.37	1.22	0.64	81.4	1.08
	100	60	2	1.7	440	297.7	8.5	5500	450	98.8	73	2.48	64.2	1.54	1.22	0.64	95.1	1.04
	100	60	2	1.7	440	297.7	8.5	5500	600	104	73	2.86	64.2	1.62	1.22	0.64	106.6	0.98
U3_L2	100	60	2	1.7	440	297.7	8.5	5900	75	49.5	67	1.06	46.9	1.06	1.22	0.64	46.9	1.06
	100	60	2	1.7	440	297.7	8.5	5900	150	64.4	67	1.5	58.7	1.10	1.22	0.64	58.5	1.10
	100	60	2	1.7	440	297.7	8.5	5900	300	81.5	67	2.12	58.7	1.39	1.22	0.64	76.8	1.06
	100	60	2	1.7	440	297.7	8.5	5900	450	89.9	67	2.59	58.7	1.53	1.22	0.64	90.2	1.00
	100	60	2	1.7	440	297.7	8.5	5900	600	93	67	2.99	58.7	1.59	1.22	0.64	101.0	0.92
U4_L2	100	80	2	1.3	520	648.0	6.0	4400	75	58.7	100	0.87	54.8	1.07	1.07	0.60	54.6	1.07
	100	80	2	1.3	520	648.0	6.0	4400	150	84.7	100	1.22	80.1	1.06	1.07	0.60	80.5	1.05
	100	80	2	1.3	520	648.0	6.0	4400	300	109	100	1.73	87.8	1.24	1.07	0.60	100.4	1.09
	100	80	2	1.3	520	648.0	6.0	4400	450	126	100	2.12	87.8	1.44	1.07	0.60	121.2	1.04
	100	80	2	1.3	520	648.0	6.0	4400	600	140	100	2.45	87.8	1.59	1.07	0.60	138.4	1.01
U5_L2	100	80	2	1.3	520	648.0	6.0	5500	75	50.1	70	1.04	47.8	1.05	1.07	0.60	47.7	1.05
	100	80	2	1.3	520	648.0	6.0	5500	150	66.4	70	1.47	61	1.09	1.07	0.60	60.7	1.09
	100	80	2	1.3	520	648.0	6.0	5500	300	91.4	70	2.07	61.2	1.49	1.07	0.60	82.9	1.10
	100	80	2	1.3	520	648.0	6.0	5500	450	114	70	2.54	61.2	1.86	1.07	0.60	99.8	1.14
	100	80	2	1.3	520	648.0	6.0	5500	600	130	70	2.93	61.2	2.12	1.07	0.60	114.2	1.14
U3_L3	100	80	2	1.3	520	648.0	6.0	6500	75	43.3	54	1.18	42.1	1.03	1.07	0.60	41.9	1.03
	100	80	2	1.3	520	648.0	6.0	6500	150	56.8	54	1.66	47.6	1.19	1.07	0.60	52.5	1.08
	100	80	2	1.3	520	648.0	6.0	6500	300	80.8	54	2.35	47.6	1.70	1.07	0.60	72.3	1.12
	100	80	2	1.3	520	648.0	6.0	6500	450	98	54	2.88	47.6	2.06	1.07	0.60	87.3	1.12
	100	80	2	1.3	520	648.0	6.0	6500	600	108	54	3.32	47.6	2.27	1.07	0.60	99.9	1.08
U4_L3	100	80	2	1.3	520	648.0	6.0	7500	75	38.2	45	1.3	37	1.03	1.07	0.60	37.0	1.03
	100	80	2	1.3	520	648.0	6.0	7500	150	50.8	45	1.84	39	1.30	1.07	0.60	47.0	1.08
	100	80	2	1.3	520	648.0	6.0	7500	300	71.6	45	2.6	39	1.83	1.07	0.60	64.9	1.10
	100	80	2	1.3	520	648.0	6.0	7500	450	83.5	45	3.18	39	2.14	1.07	0.60	78.5	1.06
	100	80	2	1.3	520	648.0	6.0	7500	600	89.6	45	3.67	39	2.30	1.07	0.60	89.7	1.00
U5_L3	100	100	2	1	600	1191.8	4.7	5500	75	48.5	67	1.06	46.9	1.03	1.00	0.59	46.9	1.03
	100	100	2	1	600	1191.8	4.7	5500	150	64.1	67	1.5	58.7	1.09	1.00	0.59	58.5	1.10
	100	100	2	1	600	1191.8	4.7	5500	300	84.9	67	2.12	58.7	1.45	1.00	0.59	82.8	1.03
	100	100	2	1	600	1191.8	4.7	5500	450	119	67	2.59	58.7	2.03	1.00	0.59	101.6	1.17
	100	100	2	1	600	1191.8	4.7	5500	600	138	67	2.99	58.7	2.35	1.00	0.59	117.4	1.18
U3_L4	100	100	2	1	600	1191.8	4.7	6000	75	44.6	58	1.14	43.6	1.02	1.00	0.59	43.5	1.02
	100	100	2	1	600	1191.8	4.7	6000	150	58.8	58	1.61	50.8	1.16	1.00	0.59	54.5	1.08
	100	100	2	1	600	1191.8	4.7	6000	300	87.2	58	2.28	50.8	1.72	1.00	0.59	77.0	1.13
	100	100	2	1	600	1191.8	4.7	6000	450	113	58	2.79	50.8	2.23	1.00	0.59	94.4	1.20
	100	100	2	1	600	1191.8	4.7	6000	600	129	58	3.22	50.8	2.54	1.00	0.59	109.0	1.18
U4_L4	100	100	2	1	600	1191.8	4.7	6500	75	41.2	51	1.21	40.5	1.02	1.00	0.59	40.6	1.01
	100	100	2	1	600	1191.8	4.7	6500	150	54.7	51	1.72	44.6	1.23	1.00	0.59	51.0	1.07
	100	100	2	1	600	1191.8	4.7	6500	300	83.4	51	2.43	44.6	1.87	1.00	0.59	72.2	1.15
	100	100	2	1	600	1191.8	4.7	6500	450	107	51	2.97	44.6	2.40	1.00	0.59	88.6	1.21
	100	100	2	1	600	1191.8	4.7	6500	600	122	51	3.43	44.6	2.73	1.00	0.59	102.3	1.19
U5_L4	100	100	2	1	600	1191.8	4.7	7500	75	35.8	41	1.36	34.7	1.03	1.00	0.59	34.6	1.04
	100	100	2	1	600	1191.8	4.7	7500	150	49.4	41	1.92	35.7	1.38	1.00	0.59	45.7	1.08
	100	100	2	1	600	1191.8	4.7	7500	300	76.4	41	2.71	35.7	2.14	1.00	0.59	64.8	1.18
	100	100	2	1	600	1191.8	4.7	7500	450	95.3	41	3.33	35.7	2.67	1.00	0.59	79.1	1.21
	100	100	2	1	600	1191.8	4.7	7500	600	107	41	3.84	35.7	3.00	1.00	0.59	91.4	1.17

Column	Geometry								SFEA		DSM Design							
	b_w	b_f	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
U3_L5	100	60	2	1.7	440	297.7	8.5	6300	75	47.2	62	1.1	45.1	1.05	1.22	0.64	45.2	1.04
	100	60	2	1.7	440	297.7	8.5	6300	150	60.7	62	1.56	54.1	1.12	1.22	0.64	55.8	1.09
	100	60	2	1.7	440	297.7	8.5	6300	300	75.6	62	2.21	54.1	1.4	1.22	0.64	73.0	1.04
	100	60	2	1.7	440	297.7	8.5	6300	450	81.7	62	2.7	54.1	1.51	1.22	0.64	85.7	0.95
	100	60	2	1.7	440	297.7	8.5	6300	600	83.5	62	3.12	54.1	1.54	1.22	0.64	95.9	0.87
U4_L5	100	80	2	1.3	520	648.0	6.0	8500	75	34.3	38	1.41	32.8	1.05	1.07	0.60	32.6	1.05
	100	80	2	1.3	520	648.0	6.0	8500	150	46.2	38	1.99	33.2	1.39	1.07	0.60	43.2	1.07
	100	80	2	1.3	520	648.0	6.0	8500	300	62.9	38	2.81	33.2	1.89	1.07	0.60	59.7	1.05
	100	80	2	1.3	520	648.0	6.0	8500	450	70.6	38	3.45	33.2	2.12	1.07	0.60	71.9	0.98
	100	80	2	1.3	520	648.0	6.0	8500	600	73.8	38	3.98	33.2	2.22	1.07	0.60	82.3	0.90
U5_L5	100	100	2	1	600	1191.8	4.7	8500	75	31.9	34	1.49	29.7	1.07	1.00	0.59	29.6	1.08
	100	100	2	1	600	1191.8	4.7	8500	150	45.9	34	2.1	29.7	1.54	1.00	0.59	41.8	1.10
	100	100	2	1	600	1191.8	4.7	8500	300	69.7	34	2.97	29.7	2.34	1.00	0.59	59.1	1.18
	100	100	2	1	600	1191.8	4.7	8500	450	84.3	34	3.64	29.7	2.84	1.00	0.59	72.3	1.17
	100	100	2	1	600	1191.8	4.7	8500	600	92.7	34	4.21	29.7	3.12	1.00	0.59	83.4	1.11
U4_L6	100	80	2	1.3	520	648.0	6.0	9000	75	32.8	35	1.46	30.8	1.06	1.07	0.60	30.7	1.07
	100	80	2	1.3	520	648.0	6.0	9000	150	44.2	35	2.06	31	1.43	1.07	0.60	41.6	1.06
	100	80	2	1.3	520	648.0	6.0	9000	300	58.9	35	2.92	31	1.90	1.07	0.60	57.3	1.03
	100	80	2	1.3	520	648.0	6.0	9000	450	64.9	35	3.57	31	2.10	1.07	0.60	69.3	0.94
	100	80	2	1.3	520	648.0	6.0	9000	600	67	35	4.12	31	2.16	1.07	0.60	79.3	0.85
U5_L6	100	100	2	1	600	1191.8	4.7	9500	75	29.2	29	1.61	25.5	1.14	1.00	0.59	27.3	1.07
	100	100	2	1	600	1191.8	4.7	9500	150	43	29	2.27	25.5	1.68	1.00	0.59	38.7	1.11
	100	100	2	1	600	1191.8	4.7	9500	300	63.2	29	3.21	25.5	2.48	1.00	0.59	54.7	1.16
	100	100	2	1	600	1191.8	4.7	9500	450	74.3	29	3.93	25.5	2.91	1.00	0.59	67.0	1.11
	100	100	2	1	600	1191.8	4.7	9500	600	80	29	4.54	25.5	3.13	1.00	0.59	77.3	1.03
												Mean		1.601			Mean	1.074
												Sd. Dev.		0.582			Sd. Dev.	0.069
												Max		3.130			Max	1.207
												Min		1.020			Min	0.845

ANNEX B: C Column Data

Table B: F columns: (i) geometries, (ii) buckling stresses and ultimate strengths, (iii) ultimate strength predictions by current and proposed DSM design curves, and (iv) numerical-to-predicted ultimate strength ratios (mm and MPa)

Column	Geometry									SFEA		DSM Design							
	b_w	b_f	b_s	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
C1_L1	60	55	11	1.2	1.1	230.4	91.0	5.47	1700	75	69	263	0.53	66.6	1.04	1.04	0.59	66.7	1.03
	60	55	11	1.2	1.1	230.4	91.0	5.47	1700	150	128	263	0.76	118.1	1.08	1.04	0.59	117.8	1.09
	60	55	11	1.2	1.1	230.4	91.0	5.47	1700	300	193	263	1.07	186.1	1.04	1.04	0.59	185.8	1.04
	60	55	11	1.2	1.1	230.4	91.0	5.47	1700	450	217	263	1.31	219.9	0.99	1.04	0.59	219.4	0.99
	60	55	11	1.2	1.1	230.4	91.0	5.47	1700	600	238	263	1.51	230.7	1.03	1.04	0.59	232.4	1.02
C2_L1	100	60	10	2	1.7	480.0	482.5	7.72	2300	75	70	333	0.47	68.3	1.03	1.17	0.63	68.4	1.02
	100	60	10	2	1.7	480.0	482.5	7.72	2300	150	135	333	0.67	124.2	1.09	1.17	0.63	124.3	1.09
	100	60	10	2	1.7	480.0	482.5	7.72	2300	300	228	333	0.95	205.8	1.11	1.17	0.63	205.6	1.11
	100	60	10	2	1.7	480.0	482.5	7.72	2300	450	268	333	1.16	255.6	1.05	1.17	0.63	256.2	1.05
	100	60	10	2	1.7	480.0	482.5	7.72	2300	600	282	333	1.34	282.2	1.00	1.17	0.63	283.0	1.00
C3_L1	120	80	15	3	3.0	930.0	2618.7	6.14	2500	75	71	435	0.42	69.8	1.02	1.08	0.60	69.7	1.02
	120	80	15	3	3.0	930.0	2618.7	6.14	2500	150	139	435	0.59	129.8	1.07	1.08	0.60	129.7	1.07
	120	80	15	3	3.0	930.0	2618.7	6.14	2500	300	255	435	0.83	224.8	1.13	1.08	0.60	224.9	1.13
	120	80	15	3	3.0	930.0	2618.7	6.14	2500	450	321	435	1.02	291.9	1.10	1.08	0.60	291.1	1.10
	120	80	15	3	3.0	930.0	2618.7	6.14	2500	600	354	435	1.17	336.8	1.05	1.08	0.60	338.3	1.05
C4_L1	140	70	10	3	3.0	900.0	2167.7	9.27	2900	75	71	369	0.45	68.9	1.03	1.27	0.65	68.9	1.03
	140	70	10	3	3.0	900.0	2167.7	9.27	2900	150	137	369	0.64	126.5	1.08	1.27	0.65	126.4	1.08
	140	70	10	3	3.0	900.0	2167.7	9.27	2900	300	243	369	0.90	213.5	1.14	1.27	0.65	213.7	1.14
	140	70	10	3	3.0	900.0	2167.7	9.27	2900	450	295	369	1.10	270.1	1.09	1.27	0.65	271.2	1.09
	140	70	10	3	3.0	900.0	2167.7	9.27	2900	600	316	369	1.28	303.8	1.04	1.27	0.65	302.2	1.05
C5_L1	150	100	10	4	1.5	1480.0	8048.8	6.00	3600	75	70	316	0.49	67.9	1.04	1.07	0.60	67.8	1.03
	150	100	10	4	1.5	1480.0	8048.8	6.00	3600	150	135	316	0.69	123.0	1.10	1.07	0.60	122.9	1.10
	150	100	10	4	1.5	1480.0	8048.8	6.00	3600	300	230	316	0.97	201.6	1.14	1.07	0.60	202.3	1.14
	150	100	10	4	1.5	1480.0	8048.8	6.00	3600	450	267	316	1.19	247.9	1.08	1.07	0.60	248.8	1.07
	150	100	10	4	1.5	1480.0	8048.8	6.00	3600	600	280	316	1.38	271.0	1.03	1.07	0.60	270.4	1.04
C6_L1	80	65	15	1.2	1.2	288.0	295.8	7.54	2600	75	67	205	0.60	64.4	1.04	1.16	0.62	64.5	1.04
	80	65	15	1.2	1.2	288.0	295.8	7.54	2600	150	118	205	0.86	110.4	1.07	1.16	0.62	110.1	1.07
	80	65	15	1.2	1.2	288.0	295.8	7.54	2600	300	163	205	1.21	162.6	1.00	1.16	0.62	162.5	1.00
	80	65	15	1.2	1.2	288.0	295.8	7.54	2600	450	173	205	1.48	179.6	0.96	1.16	0.62	179.9	0.96
	80	65	15	1.2	1.2	288.0	295.8	7.54	2600	600	185	205	1.71	179.8	1.03	1.16	0.62	200.9	0.92
C7_L1	95	50	10	1.8	1.9	387.0	253.5	9.13	2100	75	70	349	0.46	68.5	1.03	1.26	0.65	68.6	1.02
	95	50	10	1.8	1.9	387.0	253.5	9.13	2100	150	136	349	0.66	125.3	1.09	1.26	0.65	125.0	1.09
	95	50	10	1.8	1.9	387.0	253.5	9.13	2100	300	234	349	0.93	209.3	1.12	1.26	0.65	208.9	1.12
	95	50	10	1.8	1.9	387.0	253.5	9.13	2100	450	280	349	1.14	262.3	1.07	1.26	0.65	261.2	1.07
	95	50	10	1.8	1.9	387.0	253.5	9.13	2100	600	297	349	1.31	292.2	1.02	1.26	0.65	292.6	1.02
C8_L1	75	60	10	1	1.3	215.0	133.3	7.76	2600	75	64	161	0.68	61.7	1.04	1.18	0.63	61.8	1.04
	75	60	10	1	1.3	215.0	133.3	7.76	2600	150	103	161	0.97	101.6	1.01	1.18	0.63	101.2	1.02
	75	60	10	1	1.3	215.0	133.3	7.76	2600	300	131	161	1.37	137.5	0.95	1.18	0.63	136.8	0.96
	75	60	10	1	1.3	215.0	133.3	7.76	2600	450	145	161	1.67	141.2	1.03	1.18	0.63	154.7	0.94
	75	60	10	1	1.3	215.0	133.3	7.76	2600	600	153	161	1.93	141.2	1.08	1.18	0.63	174.0	0.88
C9_L1	80	45	11	1.6	1.8	307.2	132.0	8.31	1700	75	71	411	0.43	69.5	1.02	1.21	0.64	69.4	1.02
	80	45	11	1.6	1.8	307.2	132.0	8.31	1700	150	138	411	0.60	128.8	1.07	1.21	0.64	129.0	1.07
	80	45	11	1.6	1.8	307.2	132.0	8.31	1700	300	249	411	0.85	221.0	1.13	1.21	0.64	221.7	1.12
	80	45	11	1.6	1.8	307.2	132.0	8.31	1700	450	310	411	1.05	284.6	1.09	1.21	0.64	283.7	1.09
	80	45	11	1.6	1.8	307.2	132.0	8.31	1700	600	338	411	1.21	325.7	1.04	1.21	0.64	325.1	1.04
C1_L2	60	55	11	1.2	1.1	230.4	91.0	5.47	2380	75	63	146	0.72	60.5	1.04	1.04	0.59	60.4	1.04
	60	55	11	1.2	1.1	230.4	91.0	5.47	2380	150	103	146	1.01	97.6	1.06	1.04	0.59	97.9	1.05
	60	55	11	1.2	1.1	230.4	91.0	5.47	2380	300	133	146	1.43	126.9	1.05	1.04	0.59	127.5	1.04
	60	55	11	1.2	1.1	230.4	91.0	5.47	2380	450	153	146	1.76	128.0	1.19	1.04	0.59	148.7	1.03
	60	55	11	1.2	1.1	230.4	91.0	5.47	2380	600	176	146	2.03	128.0	1.37	1.04	0.59	170.9	1.03
C2_L2	100	60	10	2	1.7	480.0	482.5	7.72	3220	75	66	184	0.64	63.2	1.05	1.17	0.63	63.2	1.04
	100	60	10	2	1.7	480.0	482.5	7.72	3220	150	117	184	0.90	106.6	1.10	1.17	0.63	106.9	1.09
	100	60	10	2	1.7	480.0	482.5	7.72	3220	300	162	184	1.28	151.6	1.07	1.17	0.63	151.1	1.07
	100	60	10	2	1.7	480.0	482.5	7.72	3220	450	180	184	1.56	161.4	1.12	1.17	0.63	167.6	1.07
	100	60	10	2	1.7	480.0	482.5	7.72	3220	600	197	184	1.81	161.4	1.22	1.17	0.63	187.7	1.05
C3_L2	120	80	15	3	3.0	930.0	2618.7	6.14	3500	75	69	242	0.56	65.9	1.04	1.08	0.60	65.8	1.05
	120	80	15	3	3.0	930.0	2618.7	6.14	3500	150	127	242	0.79	115.7	1.10	1.08	0.60	115.5	1.10
	120	80	15	3	3.0	930.0	2618.7	6.14	3500	300	196	242	1.11	178.4	1.10	1.08	0.60	179.1	1.09
	120	80	15	3	3.0	930.0	2618.7	6.14	3500	450	222	242	1.36	206.4	1.08	1.08	0.60	207.5	1.07
	120	80	15	3	3.0	930.0	2618.7	6.14	3500	600	238	242	1.58	211.9	1.12	1.08	0.60	221.2	1.08
C4_L2	140	70	10	3	3.0	900.0	2167.7	9.27	4060	75	68	206	0.60	64.4	1.05	1.27	0.65	64.5	1.05
	140	70	10	3	3.0	900.0	2167.7	9.27	4060	150	122	206	0.85	110.6	1.10	1.27	0.65	110.9	1.10
	140	70	10	3	3.0	900.0	2167.7	9.27	4060	300	177	206	1.21	163.1	1.09	1.27	0.65	162.5	1.09
	140	70	10	3	3.0	900.0	2167.7	9.27	4060	450	198	206	1.48	180.4	1.10	1.27	0.65	179.9	1.10
	140	70	10	3	3.0	900.0	2167.7	9.27	4060	600	214	206	1.71	180.7	1.18	1.27	0.65	198.2	1.08

Column	Geometry									SFEA		DSM Design							
	b_w	b_f	b_s	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
C5_L2	150	100	10	4	1.5	1480.0	8048.8	6.00	5040	75	67	179	0.65	63.0	1.06	1.07	0.60	62.8	1.07
	150	100	10	4	1.5	1480.0	8048.8	6.00	5040	150	117	179	0.91	105.7	1.11	1.07	0.60	106.1	1.10
	150	100	10	4	1.5	1480.0	8048.8	6.00	5040	300	161	179	1.29	149.0	1.08	1.07	0.60	149.5	1.08
	150	100	10	4	1.5	1480.0	8048.8	6.00	5040	450	181	179	1.58	157.3	1.15	1.07	0.60	166.0	1.09
	150	100	10	4	1.5	1480.0	8048.8	6.00	5040	600	201	179	1.83	157.3	1.28	1.07	0.60	189.2	1.06
C6_L2	80	65	15	1.2	1.2	288.0	295.8	7.54	3640	75	59	111	0.82	56.5	1.03	1.16	0.62	56.6	1.04
	80	65	15	1.2	1.2	288.0	295.8	7.54	3640	150	88	111	1.16	85.2	1.03	1.16	0.62	85.4	1.03
	80	65	15	1.2	1.2	288.0	295.8	7.54	3640	300	110	111	1.64	97.3	1.13	1.16	0.62	105.5	1.04
	80	65	15	1.2	1.2	288.0	295.8	7.54	3640	450	128	111	2.01	97.3	1.31	1.16	0.62	124.9	1.02
	80	65	15	1.2	1.2	288.0	295.8	7.54	3640	600	138	111	2.32	97.3	1.42	1.16	0.62	140.9	0.98
C7_L2	95	50	10	1.8	1.9	387.0	253.5	9.13	2940	75	67	191	0.63	63.6	1.05	1.26	0.65	63.5	1.05
	95	50	10	1.8	1.9	387.0	253.5	9.13	2940	150	118	191	0.89	108.0	1.09	1.26	0.65	107.7	1.10
	95	50	10	1.8	1.9	387.0	253.5	9.13	2940	300	166	191	1.25	155.6	1.07	1.26	0.65	156.0	1.06
	95	50	10	1.8	1.9	387.0	253.5	9.13	2940	450	185	191	1.53	167.7	1.10	1.26	0.65	171.2	1.08
	95	50	10	1.8	1.9	387.0	253.5	9.13	2940	600	200	191	1.77	167.7	1.19	1.26	0.65	190.0	1.05
C8_L2	75	60	10	1	1.3	215.0	133.3	7.76	3640	75	54	87	0.93	52.4	1.03	1.18	0.63	52.2	1.03
	75	60	10	1	1.3	215.0	133.3	7.76	3640	150	75	87	1.31	73.1	1.02	1.18	0.63	73.1	1.03
	75	60	10	1	1.3	215.0	133.3	7.76	3640	300	97	87	1.85	76.6	1.26	1.18	0.63	91.4	1.06
	75	60	10	1	1.3	215.0	133.3	7.76	3640	450	110	87	2.27	76.6	1.44	1.18	0.63	107.8	1.02
	75	60	10	1	1.3	215.0	133.3	7.76	3640	600	120	87	2.62	76.6	1.57	1.18	0.63	121.5	0.99
C9_L2	80	45	11	1.6	1.8	307.2	132.0	8.31	2380	75	68	224	0.58	65.2	1.04	1.21	0.64	65.1	1.04
	80	45	11	1.6	1.8	307.2	132.0	8.31	2380	150	124	224	0.82	113.3	1.09	1.21	0.64	113.2	1.10
	80	45	11	1.6	1.8	307.2	132.0	8.31	2380	300	185	224	1.16	171.2	1.08	1.21	0.64	170.8	1.08
	80	45	11	1.6	1.8	307.2	132.0	8.31	2380	450	207	224	1.42	194.0	1.07	1.21	0.64	193.5	1.07
	80	45	11	1.6	1.8	307.2	132.0	8.31	2380	600	221	224	1.64	196.4	1.13	1.21	0.64	210.1	1.05
C1_L3	60	55	11	1.2	1.1	230.4	91.0	5.47	3060	75	55	92	0.90	53.4	1.03	1.04	0.59	53.4	1.03
	60	55	11	1.2	1.1	230.4	91.0	5.47	3060	150	78	92	1.27	76.0	1.03	1.04	0.59	76.4	1.02
	60	55	11	1.2	1.1	230.4	91.0	5.47	3060	300	100	92	1.80	81.0	1.23	1.04	0.59	96.8	1.03
	60	55	11	1.2	1.1	230.4	91.0	5.47	3060	450	124	92	2.21	81.0	1.53	1.04	0.59	117.4	1.06
	60	55	11	1.2	1.1	230.4	91.0	5.47	3060	600	145	92	2.55	81.0	1.79	1.04	0.59	134.9	1.07
C2_L3	100	60	10	2	1.7	480.0	482.5	7.72	4140	75	61	119	0.79	57.6	1.06	1.17	0.63	57.8	1.06
	100	60	10	2	1.7	480.0	482.5	7.72	4140	150	94	119	1.12	88.5	1.06	1.17	0.63	88.7	1.06
	100	60	10	2	1.7	480.0	482.5	7.72	4140	300	119	119	1.59	104.4	1.14	1.17	0.63	109.3	1.09
	100	60	10	2	1.7	480.0	482.5	7.72	4140	450	138	119	1.94	104.4	1.32	1.17	0.63	129.8	1.06
	100	60	10	2	1.7	480.0	482.5	7.72	4140	600	155	119	2.25	104.4	1.49	1.17	0.63	145.4	1.07
C3_L3	120	80	15	3	3.0	930.0	2618.7	6.14	4500	75	65	157	0.69	61.4	1.06	1.08	0.60	61.4	1.06
	120	80	15	3	3.0	930.0	2618.7	6.14	4500	150	110	157	0.98	100.5	1.09	1.08	0.60	100.3	1.10
	120	80	15	3	3.0	930.0	2618.7	6.14	4500	300	145	157	1.38	134.8	1.08	1.08	0.60	135.2	1.07
	120	80	15	3	3.0	930.0	2618.7	6.14	4500	450	164	157	1.69	137.6	1.19	1.08	0.60	154.3	1.06
	120	80	15	3	3.0	930.0	2618.7	6.14	4500	600	183	157	1.96	137.6	1.33	1.08	0.60	175.4	1.04
C4_L3	140	70	10	3	3.0	900.0	2167.7	9.27	5220	75	64	138	0.74	59.7	1.07	1.27	0.65	59.6	1.07
	140	70	10	3	3.0	900.0	2167.7	9.27	5220	150	103	138	1.04	95.0	1.08	1.27	0.65	95.4	1.08
	140	70	10	3	3.0	900.0	2167.7	9.27	5220	300	132	138	1.48	120.4	1.10	1.27	0.65	119.9	1.10
	140	70	10	3	3.0	900.0	2167.7	9.27	5220	450	150	138	1.81	120.6	1.24	1.27	0.65	138.4	1.08
	140	70	10	3	3.0	900.0	2167.7	9.27	5220	600	164	138	2.09	120.6	1.36	1.27	0.65	153.8	1.07
C5_L3	150	100	10	4	1.5	1480.0	8048.8	6.00	6480	75	62	121	0.79	57.9	1.08	1.07	0.60	57.8	1.07
	150	100	10	4	1.5	1480.0	8048.8	6.00	6480	150	94	121	1.11	89.4	1.06	1.07	0.60	89.6	1.05
	150	100	10	4	1.5	1480.0	8048.8	6.00	6480	300	122	121	1.57	106.5	1.15	1.07	0.60	111.4	1.09
	150	100	10	4	1.5	1480.0	8048.8	6.00	6480	450	143	121	1.93	106.5	1.34	1.07	0.60	134.0	1.07
	150	100	10	4	1.5	1480.0	8048.8	6.00	6480	600	162	121	2.22	106.5	1.52	1.07	0.60	153.8	1.05
C6_L3	80	65	15	1.2	1.2	288.0	295.8	7.54	4680	75	48	70	1.04	47.9	1.01	1.16	0.62	47.7	1.01
	80	65	15	1.2	1.2	288.0	295.8	7.54	4680	150	64	70	1.46	61.1	1.05	1.16	0.62	61.5	1.04
	80	65	15	1.2	1.2	288.0	295.8	7.54	4680	300	86	70	2.07	61.3	1.39	1.16	0.62	80.5	1.07
	80	65	15	1.2	1.2	288.0	295.8	7.54	4680	450	101	70	2.54	61.3	1.65	1.16	0.62	95.1	1.06
	80	65	15	1.2	1.2	288.0	295.8	7.54	4680	600	111	70	2.93	61.3	1.81	1.16	0.62	107.4	1.03
C7_L3	95	50	10	1.8	1.9	387.0	253.5	9.13	3780	75	62	125	0.78	58.3	1.06	1.26	0.65	58.1	1.07
	95	50	10	1.8	1.9	387.0	253.5	9.13	3780	150	96	125	1.10	90.6	1.06	1.26	0.65	90.4	1.06
	95	50	10	1.8	1.9	387.0	253.5	9.13	3780	300	122	125	1.55	109.2	1.12	1.26	0.65	112.3	1.09
	95	50	10	1.8	1.9	387.0	253.5	9.13	3780	450	139	125	1.90	109.2	1.27	1.26	0.65	130.4	1.07
	95	50	10	1.8	1.9	387.0	253.5	9.13	3780	600	153	125	2.20	109.2	1.40	1.26	0.65	144.5	1.06
C8_L3	75	60	10	1	1.3	215.0	133.3	7.76	4680	75	42	55	1.16	42.5	0.99	1.18	0.63	42.7	0.98
	75	60	10	1	1.3	215.0	133.3	7.76	4680	150	56	55	1.65	48.5	1.15	1.18	0.63	52.3	1.07
	75	60	10	1	1.3	215.0	133.3	7.76	4680	300	78	55	2.33	48.5	1.61	1.18	0.63	69.7	1.12
	75	60	10	1	1.3	215.0	133.3	7.76	4680	450	90	55	2.85	48.5	1.85	1.18	0.63	82.5	1.09
	75	60	10	1	1.3	215.0	133.3	7.76	4680	600	98	55	3.29	48.5	2.02	1.18	0.63	92.9	1.05
C9_L3	80	45	11	1.6	1.8	307.2	132.0	8.31	3060	75	64	144	0.72	60.3	1.05	1.21	0.64	60.4	1.06
	80	45	11	1.6	1.8	307.2	132.0	8.31	3060	150	104	144	1.02	97.0	1.07	1.21	0.64	97.0	1.07
	80	45	11	1.6	1.8	307.2	132.0	8.31	3060	300	135	144	1.44	125.4	1.08	1.21	0.64	125.9	1.07
	80	45	11	1.6	1.8	307.2	132.0	8.31	3060	450	152	144	1.77	126.3	1.20	1.21	0.64	143.7	1.06
	80	45	11	1.6	1.8	307.2	132.0	8.31	3060	600	167	144	2.04	126.3	1.32	1.21	0.64	161.4	1.03

Column	Geometry									SFEA		DSM Design							
	b_w	b_f	b_s	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
C1_L4	60	55	11	1.2	1.1	230.4	91.0	5.47	3740	75	47	65	1.08	46.2	1.01	1.04	0.59	46.0	1.02
	60	55	11	1.2	1.1	230.4	91.0	5.47	3740	150	62	65	1.52	56.8	1.08	1.04	0.59	57.7	1.07
	60	55	11	1.2	1.1	230.4	91.0	5.47	3740	300	85	65	2.15	56.8	1.49	1.04	0.59	80.5	1.06
	60	55	11	1.2	1.1	230.4	91.0	5.47	3740	450	107	65	2.64	56.8	1.88	1.04	0.59	97.6	1.10
	60	55	11	1.2	1.1	230.4	91.0	5.47	3740	600	125	65	3.04	56.8	2.20	1.04	0.59	112.4	1.11
C2_L4	100	60	10	2	1.7	480.0	482.5	7.72	5060	75	55	87	0.93	52.3	1.05	1.17	0.63	52.2	1.05
	100	60	10	2	1.7	480.0	482.5	7.72	5060	150	76	87	1.31	72.9	1.04	1.17	0.63	73.1	1.04
	100	60	10	2	1.7	480.0	482.5	7.72	5060	300	97	87	1.86	76.3	1.27	1.17	0.63	90.9	1.07
	100	60	10	2	1.7	480.0	482.5	7.72	5060	450	114	87	2.27	76.3	1.49	1.17	0.63	107.9	1.06
	100	60	10	2	1.7	480.0	482.5	7.72	5060	600	127	87	2.63	76.3	1.66	1.17	0.63	121.1	1.05
C3_L4	120	80	15	3	3.0	930.0	2618.7	6.14	5500	75	61	113	0.81	56.9	1.06	1.08	0.60	57.0	1.07
	120	80	15	3	3.0	930.0	2618.7	6.14	5500	150	91	113	1.15	86.2	1.06	1.08	0.60	86.2	1.06
	120	80	15	3	3.0	930.0	2618.7	6.14	5500	300	115	113	1.63	99.4	1.16	1.08	0.60	107.0	1.08
	120	80	15	3	3.0	930.0	2618.7	6.14	5500	450	134	113	1.99	99.4	1.35	1.08	0.60	129.4	1.04
	120	80	15	3	3.0	930.0	2618.7	6.14	5500	600	153	113	2.30	99.4	1.54	1.08	0.60	147.6	1.04
C4_L4	140	70	10	3	3.0	900.0	2167.7	9.27	6380	75	59	103	0.85	55.2	1.07	1.27	0.65	55.4	1.06
	140	70	10	3	3.0	900.0	2167.7	9.27	6380	150	86	103	1.21	81.3	1.06	1.27	0.65	81.3	1.06
	140	70	10	3	3.0	900.0	2167.7	9.27	6380	300	107	103	1.71	90.0	1.19	1.27	0.65	99.1	1.08
	140	70	10	3	3.0	900.0	2167.7	9.27	6380	450	121	103	2.09	90.0	1.34	1.27	0.65	115.3	1.05
	140	70	10	3	3.0	900.0	2167.7	9.27	6380	600	129	103	2.42	90.0	1.43	1.27	0.65	127.7	1.01
C5_L4	150	100	10	4	1.5	1480.0	8048.8	6.00	7920	75	57	92	0.90	53.2	1.07	1.07	0.60	53.4	1.07
	150	100	10	4	1.5	1480.0	8048.8	6.00	7920	150	80	92	1.28	75.6	1.06	1.07	0.60	75.6	1.06
	150	100	10	4	1.5	1480.0	8048.8	6.00	7920	300	101	92	1.81	80.3	1.26	1.07	0.60	95.7	1.06
	150	100	10	4	1.5	1480.0	8048.8	6.00	7920	450	120	92	2.22	80.3	1.49	1.07	0.60	115.4	1.04
	150	100	10	4	1.5	1480.0	8048.8	6.00	7920	600	134	92	2.56	80.3	1.67	1.07	0.60	132.1	1.01
C6_L4	80	65	15	1.2	1.2	288.0	295.8	7.54	5720	75	39	49	1.24	39.4	0.99	1.16	0.62	39.4	0.99
	80	65	15	1.2	1.2	288.0	295.8	7.54	5720	150	51	49	1.76	42.7	1.20	1.16	0.62	48.6	1.05
	80	65	15	1.2	1.2	288.0	295.8	7.54	5720	300	73	49	2.48	42.7	1.71	1.16	0.62	65.2	1.12
	80	65	15	1.2	1.2	288.0	295.8	7.54	5720	450	87	49	3.04	42.7	2.04	1.16	0.62	77.2	1.13
	80	65	15	1.2	1.2	288.0	295.8	7.54	5720	600	93	49	3.51	42.7	2.17	1.16	0.62	87.1	1.07
C7_L4	95	50	10	1.8	1.9	387.0	253.5	9.13	4620	75	56	91	0.91	53.0	1.05	1.26	0.65	53.0	1.06
	95	50	10	1.8	1.9	387.0	253.5	9.13	4620	150	78	91	1.29	75.0	1.04	1.26	0.65	74.7	1.04
	95	50	10	1.8	1.9	387.0	253.5	9.13	4620	300	98	91	1.82	79.4	1.23	1.26	0.65	91.7	1.07
	95	50	10	1.8	1.9	387.0	253.5	9.13	4620	450	112	91	2.23	79.4	1.41	1.26	0.65	106.6	1.05
	95	50	10	1.8	1.9	387.0	253.5	9.13	4620	600	122	91	2.57	79.4	1.54	1.26	0.65	118.9	1.03
C8_L4	75	60	10	1	1.3	215.0	133.3	7.76	5720	75	34	39	1.39	33.4	1.02	1.18	0.63	33.4	1.02
	75	60	10	1	1.3	215.0	133.3	7.76	5720	150	46	39	1.97	34.0	1.36	1.18	0.63	42.5	1.08
	75	60	10	1	1.3	215.0	133.3	7.76	5720	300	67	39	2.78	34.0	1.98	1.18	0.63	56.6	1.18
	75	60	10	1	1.3	215.0	133.3	7.76	5720	450	75	39	3.41	34.0	2.21	1.18	0.63	66.8	1.12
	75	60	10	1	1.3	215.0	133.3	7.76	5720	600	82	39	3.93	34.0	2.40	1.18	0.63	75.4	1.09
C9_L4	80	45	11	1.6	1.8	307.2	132.0	8.31	3740	75	58	103	0.85	55.3	1.05	1.21	0.64	55.4	1.05
	80	45	11	1.6	1.8	307.2	132.0	8.31	3740	150	85	103	1.21	81.6	1.04	1.21	0.64	81.3	1.05
	80	45	11	1.6	1.8	307.2	132.0	8.31	3740	300	106	103	1.71	90.4	1.17	1.21	0.64	99.9	1.06
	80	45	11	1.6	1.8	307.2	132.0	8.31	3740	450	122	103	2.09	90.4	1.35	1.21	0.64	117.5	1.04
	80	45	11	1.6	1.8	307.2	132.0	8.31	3740	600	135	103	2.41	90.4	1.49	1.21	0.64	131.9	1.02
C1_L5	60	55	11	1.2	1.1	230.4	91.0	5.47	4420	75	39	49	1.24	39.4	1.00	1.04	0.59	39.4	0.99
	60	55	11	1.2	1.1	230.4	91.0	5.47	4420	150	52	49	1.76	42.7	1.21	1.04	0.59	49.6	1.05
	60	55	11	1.2	1.1	230.4	91.0	5.47	4420	300	75	49	2.48	42.7	1.76	1.04	0.59	69.4	1.08
	60	55	11	1.2	1.1	230.4	91.0	5.47	4420	450	95	49	3.04	42.7	2.21	1.04	0.59	84.3	1.13
	60	55	11	1.2	1.1	230.4	91.0	5.47	4420	600	108	49	3.51	42.7	2.53	1.04	0.59	96.8	1.12
C2_L5	100	60	10	2	1.7	480.0	482.5	7.72	5980	75	49	67	1.06	46.9	1.04	1.17	0.63	46.9	1.05
	100	60	10	2	1.7	480.0	482.5	7.72	5980	150	64	67	1.50	58.8	1.09	1.17	0.63	58.5	1.09
	100	60	10	2	1.7	480.0	482.5	7.72	5980	300	83	67	2.12	58.8	1.41	1.17	0.63	78.0	1.06
	100	60	10	2	1.7	480.0	482.5	7.72	5980	450	96	67	2.59	58.8	1.63	1.17	0.63	92.5	1.04
	100	60	10	2	1.7	480.0	482.5	7.72	5980	600	103	67	2.99	58.8	1.75	1.17	0.63	104.2	0.99
C3_L5	120	80	15	3	3.0	930.0	2618.7	6.14	6500	75	56	88	0.92	52.5	1.06	1.08	0.60	52.6	1.06
	120	80	15	3	3.0	930.0	2618.7	6.14	6500	150	77	88	1.31	73.5	1.05	1.08	0.60	73.1	1.05
	120	80	15	3	3.0	930.0	2618.7	6.14	6500	300	98	88	1.85	77.2	1.26	1.08	0.60	93.3	1.05
	120	80	15	3	3.0	930.0	2618.7	6.14	6500	450	116	88	2.26	77.2	1.50	1.08	0.60	112.8	1.03
	120	80	15	3	3.0	930.0	2618.7	6.14	6500	600	130	88	2.61	77.2	1.68	1.08	0.60	128.8	1.01
C4_L5	140	70	10	3	3.0	900.0	2167.7	9.27	6940	75	57	92	0.91	53.2	1.07	1.27	0.65	53.0	1.07
	140	70	10	3	3.0	900.0	2167.7	9.27	6940	150	80	92	1.28	75.5	1.05	1.27	0.65	75.6	1.06
	140	70	10	3	3.0	900.0	2167.7	9.27	6940	300	98	92	1.81	80.2	1.22	1.27	0.65	92.2	1.06
	140	70	10	3	3.0	900.0	2167.7	9.27	6940	450	109	92	2.22	80.2	1.36	1.27	0.65	106.8	1.02
	140	70	10	3	3.0	900.0	2167.7	9.27	6940	600	114	92	2.56	80.2	1.42	1.27	0.65	118.9	0.96
C5_L5	150	100	10	4	1.5	1480.0	8048.8	6.00	9360	75	52	74	1.01	49.1	1.06	1.07	0.60	48.9	1.06
	150	100	10	4	1.5	1480.0	8048.8	6.00	9360	150	69	74	1.42	64.4	1.07	1.07	0.60	64.5	1.07
	150	100	10	4	1.5	1480.0	8048.8	6.00	9360	300	88	74	2.01	65.1	1.34	1.07	0.60	85.5	1.03
	150	100	10	4	1.5	1480.0	8048.8	6.00	9360	450	101	74	2.46	65.1	1.55	1.07	0.60	103.4	0.98
	150	100	10	4	1.5	1480.0	8048.8	6.00	9360	600	109	74	2.84	65.1	1.68	1.07	0.60	118.2	0.92

Column	Geometry									SFEA		DSM Design							
	b_w	b_f	b_s	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
C6_L5	80	65	15	1.2	1.2	288.0	295.8	7.54	6760	75	32	37	1.43	31.7	1.02	1.16	0.62	31.9	1.00
	80	65	15	1.2	1.2	288.0	295.8	7.54	6760	150	44	37	2.03	32.0	1.37	1.16	0.62	41.2	1.07
	80	65	15	1.2	1.2	288.0	295.8	7.54	6760	300	64	37	2.87	32.0	1.99	1.16	0.62	55.0	1.16
	80	65	15	1.2	1.2	288.0	295.8	7.54	6760	450	73	37	3.51	32.0	2.29	1.16	0.62	65.3	1.12
	80	65	15	1.2	1.2	288.0	295.8	7.54	6760	600	80	37	4.05	32.0	2.50	1.16	0.62	73.7	1.08
C7_L5	95	50	10	1.8	1.9	387.0	253.5	9.13	5060	75	53	71	1.03	48.1	1.09	1.26	0.65	48.1	1.10
	95	50	10	1.8	1.9	387.0	253.5	9.13	5060	150	71	71	1.46	61.8	1.15	1.26	0.65	61.5	1.16
	95	50	10	1.8	1.9	387.0	253.5	9.13	5060	300	89	71	2.06	62.1	1.43	1.26	0.65	78.5	1.13
	95	50	10	1.8	1.9	387.0	253.5	9.13	5060	450	101	71	2.52	62.1	1.63	1.26	0.65	91.4	1.11
	95	50	10	1.8	1.9	387.0	253.5	9.13	5060	600	108	71	2.91	62.1	1.74	1.26	0.65	101.7	1.06
C8_L5	75	60	10	1	1.3	215.0	133.3	7.76	6760	75	29	29	1.60	25.6	1.11	1.18	0.63	27.1	1.07
	75	60	10	1	1.3	215.0	133.3	7.76	6760	150	41	29	2.27	25.6	1.59	1.18	0.63	35.9	1.14
	75	60	10	1	1.3	215.0	133.3	7.76	6760	300	59	29	3.21	25.6	2.29	1.18	0.63	47.8	1.23
	75	60	10	1	1.3	215.0	133.3	7.76	6760	450	65	29	3.93	25.6	2.55	1.18	0.63	56.5	1.15
	75	60	10	1	1.3	215.0	133.3	7.76	6760	600	70	29	4.53	25.6	2.72	1.18	0.63	63.8	1.10
C9_L5	80	45	11	1.6	1.8	307.2	132.0	8.31	4420	75	53	80	0.97	50.5	1.04	1.21	0.64	50.6	1.05
	80	45	11	1.6	1.8	307.2	132.0	8.31	4420	150	71	80	1.37	68.1	1.04	1.21	0.64	68.4	1.04
	80	45	11	1.6	1.8	307.2	132.0	8.31	4420	300	89	80	1.94	69.7	1.28	1.21	0.64	85.7	1.04
	80	45	11	1.6	1.8	307.2	132.0	8.31	4420	450	102	80	2.38	69.7	1.46	1.21	0.64	100.5	1.02
	80	45	11	1.6	1.8	307.2	132.0	8.31	4420	600	111	80	2.75	69.7	1.59	1.21	0.64	112.5	0.99
C1_L6	60	55	11	1.2	1.1	230.4	91.0	5.47	5100	75	34	39	1.39	33.3	1.02	1.04	0.59	33.4	1.02
	60	55	11	1.2	1.1	230.4	91.0	5.47	5100	150	46	39	1.97	33.9	1.35	1.04	0.59	44.1	1.04
	60	55	11	1.2	1.1	230.4	91.0	5.47	5100	300	68	39	2.79	33.9	2.00	1.04	0.59	61.4	1.11
	60	55	11	1.2	1.1	230.4	91.0	5.47	5100	450	83	39	3.41	33.9	2.45	1.04	0.59	74.8	1.11
	60	55	11	1.2	1.1	230.4	91.0	5.47	5100	600	93	39	3.94	33.9	2.74	1.04	0.59	85.9	1.08
C2_L6	100	60	10	2	1.7	480.0	482.5	7.72	6900	75	43	55	1.17	42.4	1.02	1.17	0.63	42.3	1.02
	100	60	10	2	1.7	480.0	482.5	7.72	6900	150	56	55	1.65	48.2	1.15	1.17	0.63	52.3	1.07
	100	60	10	2	1.7	480.0	482.5	7.72	6900	300	71	55	2.34	48.2	1.48	1.17	0.63	69.4	1.02
	100	60	10	2	1.7	480.0	482.5	7.72	6900	450	80	55	2.86	48.2	1.65	1.17	0.63	82.3	0.97
	100	60	10	2	1.7	480.0	482.5	7.72	6900	600	83	55	3.30	48.2	1.72	1.17	0.63	92.8	0.89
C3_L6	120	80	15	3	3.0	930.0	2618.7	6.14	7500	75	51	72	1.02	48.5	1.04	1.08	0.60	48.5	1.05
	120	80	15	3	3.0	930.0	2618.7	6.14	7500	150	67	72	1.44	62.7	1.06	1.08	0.60	63.0	1.06
	120	80	15	3	3.0	930.0	2618.7	6.14	7500	300	86	72	2.04	63.1	1.36	1.08	0.60	84.0	1.02
	120	80	15	3	3.0	930.0	2618.7	6.14	7500	450	101	72	2.50	63.1	1.60	1.08	0.60	101.2	1.00
	120	80	15	3	3.0	930.0	2618.7	6.14	7500	600	111	72	2.89	63.1	1.76	1.08	0.60	115.4	0.96
C4_L6	140	70	10	3	3.0	900.0	2167.7	9.27	7500	75	55	82	0.95	51.2	1.07	1.27	0.65	51.4	1.07
	140	70	10	3	3.0	900.0	2167.7	9.27	7500	150	74	82	1.35	70.0	1.06	1.27	0.65	70.0	1.06
	140	70	10	3	3.0	900.0	2167.7	9.27	7500	300	90	82	1.91	72.2	1.25	1.27	0.65	86.2	1.04
	140	70	10	3	3.0	900.0	2167.7	9.27	7500	450	99	82	2.34	72.2	1.36	1.27	0.65	99.9	0.99
	140	70	10	3	3.0	900.0	2167.7	9.27	7500	600	102	82	2.70	72.2	1.41	1.27	0.65	111.2	0.92
C5_L6	150	100	10	4	1.5	1480.0	8048.8	6.00	10000	75	50	69	1.05	47.5	1.05	1.07	0.60	47.3	1.06
	150	100	10	4	1.5	1480.0	8048.8	6.00	10000	150	65	69	1.48	60.1	1.08	1.07	0.60	60.0	1.08
	150	100	10	4	1.5	1480.0	8048.8	6.00	10000	300	82	69	2.09	60.2	1.36	1.07	0.60	82.1	1.00
	150	100	10	4	1.5	1480.0	8048.8	6.00	10000	450	93	69	2.56	60.2	1.55	1.07	0.60	99.1	0.94
	150	100	10	4	1.5	1480.0	8048.8	6.00	10000	600	99	69	2.96	60.2	1.65	1.07	0.60	113.1	0.88
C6_L6	80	65	15	1.2	1.2	288.0	295.8	7.54	7800	75	28	29	1.61	25.3	1.10	1.16	0.62	26.9	1.04
	80	65	15	1.2	1.2	288.0	295.8	7.54	7800	150	39	29	2.28	25.3	1.55	1.16	0.62	36.0	1.08
	80	65	15	1.2	1.2	288.0	295.8	7.54	7800	300	56	29	3.23	25.3	2.21	1.16	0.62	48.0	1.17
	80	65	15	1.2	1.2	288.0	295.8	7.54	7800	450	63	29	3.95	25.3	2.48	1.16	0.62	56.9	1.11
	80	65	15	1.2	1.2	288.0	295.8	7.54	7800	600	65	29	4.56	25.3	2.59	1.16	0.62	64.2	1.01
C7_L6	95	50	10	1.8	1.9	387.0	253.5	9.13	5500	75	50	58	1.13	43.8	1.13	1.26	0.65	43.9	1.14
	95	50	10	1.8	1.9	387.0	253.5	9.13	5500	150	65	58	1.60	51.1	1.28	1.26	0.65	53.9	1.21
	95	50	10	1.8	1.9	387.0	253.5	9.13	5500	300	82	58	2.27	51.1	1.59	1.26	0.65	69.5	1.18
	95	50	10	1.8	1.9	387.0	253.5	9.13	5500	450	91	58	2.78	51.1	1.78	1.26	0.65	80.8	1.13
	95	50	10	1.8	1.9	387.0	253.5	9.13	5500	600	95	58	3.21	51.1	1.86	1.26	0.65	89.9	1.06
C8_L6	75	60	10	1	1.3	215.0	133.3	7.76	7800	75	25	23	1.80	20.3	1.23	1.18	0.63	23.6	1.06
	75	60	10	1	1.3	215.0	133.3	7.76	7800	150	37	23	2.54	20.3	1.81	1.18	0.63	31.5	1.17
	75	60	10	1	1.3	215.0	133.3	7.76	7800	300	50	23	3.60	20.3	2.47	1.18	0.63	41.8	1.20
	75	60	10	1	1.3	215.0	133.3	7.76	7800	450	54	23	4.40	20.3	2.65	1.18	0.63	49.5	1.09
	75	60	10	1	1.3	215.0	133.3	7.76	7800	600	55	23	5.09	20.3	2.72	1.18	0.63	55.6	0.99
C9_L6	80	45	11	1.6	1.8	307.2	132.0	8.31	5100	75	47	65	1.08	46.1	1.02	1.21	0.64	46.0	1.02
	80	45	11	1.6	1.8	307.2	132.0	8.31	5100	150	61	65	1.52	56.6	1.08	1.21	0.64	57.6	1.06
	80	45	11	1.6	1.8	307.2	132.0	8.31	5100	300	77	65	2.16	56.6	1.35	1.21	0.64	75.3	1.02
	80	45	11	1.6	1.8	307.2	132.0	8.31	5100	450	86	65	2.64	56.6	1.52	1.21	0.64	88.6	0.97
	80	45	11	1.6	1.8	307.2	132.0	8.31	5100	600	91	65	3.05	56.6	1.60	1.21	0.64	99.3	0.92
												.	Mean		1.321			Mean	1.056
													Sd. Dev		0.396			Sd. Dev.	0.051
													Max		2.740			Max	1.234
													Min		0.950			Min	0.875

ANNEX C: H Column Data

Table C: F columns: (i) geometries, (ii) buckling stresses and ultimate strengths, (iii) ultimate strength predictions by current and proposed DSM design curves, and (iv) numerical-to-predicted ultimate strength ratios (mm and MPa)

Column	Geometry									SFEA		DSM Design							
	b_w	b_f	b_s	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
H1_L1	60	55	11	1.2	1.1	230.4	51.4	3.9	1000	75	71	330	0.48	68.2	1.05	1.00	0.59	68.1	1.04
	60	55	11	1.2	1.1	230.4	51.4	3.9	1000	150	138	330	0.67	124.0	1.11	1.00	0.59	124.3	1.11
	60	55	11	1.2	1.1	230.4	51.4	3.9	1000	300	239	330	0.95	205.1	1.17	1.00	0.59	205.6	1.16
	60	55	11	1.2	1.1	230.4	51.4	3.9	1000	450	292	330	1.17	254.3	1.15	1.00	0.59	253.7	1.15
	60	55	11	1.2	1.1	230.4	51.4	3.9	1000	600	324	330	1.35	280.3	1.16	1.00	0.59	279.8	1.16
H2_L1	100	60	10	2	1.7	480.0	368.8	6.9	2000	75	70	334	0.47	68.3	1.03	1.12	0.62	68.4	1.02
	100	60	10	2	1.7	480.0	368.8	6.9	2000	150	136	334	0.67	124.3	1.09	1.12	0.62	124.3	1.09
	100	60	10	2	1.7	480.0	368.8	6.9	2000	300	236	334	0.95	206.0	1.15	1.12	0.62	205.6	1.15
	100	60	10	2	1.7	480.0	368.8	6.9	2000	450	278	334	1.16	256.0	1.09	1.12	0.62	256.2	1.08
	100	60	10	2	1.7	480.0	368.8	6.9	2000	600	292	334	1.34	282.8	1.03	1.12	0.62	283.0	1.03
H3_L1	120	80	15	3	1.5	930.0	1815.3	5.3	1900	75	72	476	0.40	70.2	1.03	1.03	0.59	70.1	1.03
	120	80	15	3	1.5	930.0	1815.3	5.3	1900	150	142	476	0.56	131.5	1.08	1.03	0.59	131.5	1.08
	120	80	15	3	1.5	930.0	1815.3	5.3	1900	300	267	476	0.79	230.4	1.16	1.03	0.59	231.0	1.16
	120	80	15	3	1.5	930.0	1815.3	5.3	1900	450	355	476	0.97	302.8	1.17	1.03	0.59	303.5	1.17
	120	80	15	3	1.5	930.0	1815.3	5.3	1900	600	397	476	1.12	353.9	1.12	1.03	0.59	354.9	1.12
H4_L1	140	70	10	3	2.0	900.0	1833.8	8.8	2600	75	71	385	0.44	69.1	1.02	1.24	0.64	69.2	1.03
	140	70	10	3	2.0	900.0	1833.8	8.8	2600	150	138	385	0.62	127.4	1.08	1.24	0.64	127.7	1.08
	140	70	10	3	2.0	900.0	1833.8	8.8	2600	300	249	385	0.88	216.5	1.15	1.24	0.64	216.9	1.15
	140	70	10	3	2.0	900.0	1833.8	8.8	2600	450	311	385	1.08	275.9	1.13	1.24	0.64	276.2	1.13
	140	70	10	3	2.0	900.0	1833.8	8.8	2600	600	334	385	1.25	312.5	1.07	1.24	0.64	312.0	1.07
H5_L1	150	100	10	4	1.5	1480.0	6166.9	6.3	3300	75	71	330	0.48	68.2	1.04	1.09	0.61	68.1	1.04
	150	100	10	4	1.5	1480.0	6166.9	6.3	3300	150	136	330	0.67	124.0	1.10	1.09	0.61	124.3	1.09
	150	100	10	4	1.5	1480.0	6166.9	6.3	3300	300	236	330	0.95	205.1	1.15	1.09	0.61	205.6	1.15
	150	100	10	4	1.5	1480.0	6166.9	6.3	3300	450	281	330	1.17	254.4	1.10	1.09	0.61	253.7	1.11
	150	100	10	4	1.5	1480.0	6166.9	6.3	3300	600	296	330	1.35	280.4	1.06	1.09	0.61	279.8	1.06
H6_L1	80	65	15	1.2	1.2	288.0	158.6	5.2	1900	75	68	204	0.61	64.3	1.05	1.02	0.59	64.2	1.06
	80	65	15	1.2	1.2	288.0	158.6	5.2	1900	150	123	204	0.86	110.2	1.12	1.02	0.59	110.1	1.12
	80	65	15	1.2	1.2	288.0	158.6	5.2	1900	300	177	204	1.21	162.0	1.09	1.02	0.59	162.5	1.09
	80	65	15	1.2	1.2	288.0	158.6	5.2	1900	450	197	204	1.49	178.6	1.10	1.02	0.59	177.7	1.11
	80	65	15	1.2	1.2	288.0	158.6	5.2	1900	600	206	204	1.72	178.7	1.15	1.02	0.59	203.5	1.01
H7_L1	95	50	10	1.8	1.9	387.0	186.1	8.1	1800	75	70	346	0.47	68.5	1.03	1.20	0.63	68.4	1.02
	95	50	10	1.8	1.9	387.0	186.1	8.1	1800	150	136	346	0.66	125.1	1.09	1.20	0.63	125.0	1.09
	95	50	10	1.8	1.9	387.0	186.1	8.1	1800	300	239	346	0.93	208.7	1.14	1.20	0.63	208.9	1.14
	95	50	10	1.8	1.9	387.0	186.1	8.1	1800	450	288	346	1.14	261.2	1.10	1.20	0.63	261.2	1.10
	95	50	10	1.8	1.9	387.0	186.1	8.1	1800	600	305	346	1.32	290.5	1.05	1.20	0.63	289.4	1.05
H8_L1	75	60	10	1	1.3	215.0	91.7	6.1	2100	75	66	164	0.68	61.9	1.06	1.08	0.60	61.8	1.07
	75	60	10	1	1.3	215.0	91.7	6.1	2100	150	112	164	0.96	102.3	1.09	1.08	0.60	102.0	1.10
	75	60	10	1	1.3	215.0	91.7	6.1	2100	300	147	164	1.35	139.6	1.05	1.08	0.60	139.9	1.05
	75	60	10	1	1.3	215.0	91.7	6.1	2100	450	158	164	1.66	144.0	1.10	1.08	0.60	157.3	1.00
	75	60	10	1	1.3	215.0	91.7	6.1	2100	600	166	164	1.91	144.0	1.15	1.08	0.60	180.4	0.92
H9_L1	80	45	11	1.6	1.8	307.2	83.6	6.9	1400	75	71	381	0.44	69.1	1.03	1.13	0.62	69.2	1.03
	80	45	11	1.6	1.8	307.2	83.6	6.9	1400	150	138	381	0.63	127.2	1.09	1.13	0.62	127.0	1.09
	80	45	11	1.6	1.8	307.2	83.6	6.9	1400	300	248	381	0.89	215.7	1.15	1.13	0.62	215.3	1.15
	80	45	11	1.6	1.8	307.2	83.6	6.9	1400	450	310	381	1.09	274.3	1.13	1.13	0.62	273.7	1.13
	80	45	11	1.6	1.8	307.2	83.6	6.9	1400	600	336	381	1.26	310.1	1.08	1.13	0.62	308.7	1.09
H1_L2	60	55	11	1.2	1.1	230.4	51.4	3.9	1400	75	69	225	0.58	65.2	1.05	1.00	0.59	65.1	1.06
	60	55	11	1.2	1.1	230.4	51.4	3.9	1400	150	127	225	0.82	113.4	1.12	1.00	0.59	113.2	1.12
	60	55	11	1.2	1.1	230.4	51.4	3.9	1400	300	189	225	1.16	171.5	1.10	1.00	0.59	170.8	1.11
	60	55	11	1.2	1.1	230.4	51.4	3.9	1400	450	217	225	1.42	194.5	1.12	1.00	0.59	193.5	1.12
	60	55	11	1.2	1.1	230.4	51.4	3.9	1400	600	246	225	1.63	197.0	1.25	1.00	0.59	215.3	1.14
H2_L2	100	60	10	2	1.7	480.0	368.8	6.9	2800	75	67	189	0.63	63.5	1.05	1.12	0.62	63.5	1.05
	100	60	10	2	1.7	480.0	368.8	6.9	2800	150	119	189	0.89	107.7	1.11	1.12	0.62	107.7	1.11
	100	60	10	2	1.7	480.0	368.8	6.9	2800	300	166	189	1.26	154.6	1.07	1.12	0.62	154.4	1.08
	100	60	10	2	1.7	480.0	368.8	6.9	2800	450	187	189	1.54	166.1	1.13	1.12	0.62	170.4	1.10
	100	60	10	2	1.7	480.0	368.8	6.9	2800	600	209	189	1.78	166.1	1.26	1.12	0.62	193.1	1.08
H3_L2	120	80	15	3	1.5	930.0	1815.3	5.3	2660	75	70	291	0.51	67.3	1.04	1.03	0.59	67.3	1.04
	120	80	15	3	1.5	930.0	1815.3	5.3	2660	150	133	291	0.72	120.9	1.10	1.03	0.59	120.7	1.10
	120	80	15	3	1.5	930.0	1815.3	5.3	2660	300	221	291	1.02	194.9	1.13	1.03	0.59	194.1	1.14
	120	80	15	3	1.5	930.0	1815.3	5.3	2660	450	257	291	1.24	235.6	1.09	1.03	0.59	236.4	1.09
	120	80	15	3	1.5	930.0	1815.3	5.3	2660	600	276	291	1.44	253.2	1.09	1.03	0.59	251.9	1.10
H4_L2	140	70	10	3	2.0	900.0	1833.8	8.8	3640	75	68	217	0.59	64.9	1.05	1.24	0.64	64.8	1.05
	140	70	10	3	2.0	900.0	1833.8	8.8	3640	150	124	217	0.83	112.3	1.10	1.24	0.64	112.4	1.10
	140	70	10	3	2.0	900.0	1833.8	8.8	3640	300	184	217	1.18	168.1	1.09	1.24	0.64	167.5	1.10
	140	70	10	3	2.0	900.0	1833.8	8.8	3640	450	207	217	1.44	188.7	1.10	1.24	0.64	188.9	1.10
	140	70	10	3	2.0	900.0	1833.8	8.8	3640	600	226	217	1.66	190.0	1.19	1.24	0.64	206.4	1.09

Column	Geometry									SFEA		DSM Design							
	b_w	b_f	b_s	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
H5_L2	150	100	10	4	1.5	1480.0	6166.9	6.3	4620	75	67	189	0.63	63.5	1.06	1.09	0.61	63.5	1.05
	150	100	10	4	1.5	1480.0	6166.9	6.3	4620	150	120	189	0.89	107.6	1.12	1.09	0.61	107.7	1.11
	150	100	10	4	1.5	1480.0	6166.9	6.3	4620	300	167	189	1.26	154.4	1.08	1.09	0.61	154.4	1.08
	150	100	10	4	1.5	1480.0	6166.9	6.3	4620	450	189	189	1.54	165.8	1.14	1.09	0.61	170.5	1.11
	150	100	10	4	1.5	1480.0	6166.9	6.3	4620	600	211	189	1.78	165.8	1.27	1.09	0.61	194.3	1.09
H6_L2	80	65	15	1.2	1.2	288.0	158.6	5.2	2660	75	61	121	0.79	57.8	1.05	1.02	0.59	57.8	1.06
	80	65	15	1.2	1.2	288.0	158.6	5.2	2660	150	94	121	1.12	89.1	1.05	1.02	0.59	88.7	1.06
	80	65	15	1.2	1.2	288.0	158.6	5.2	2660	300	121	121	1.58	105.7	1.14	1.02	0.59	111.0	1.09
	80	65	15	1.2	1.2	288.0	158.6	5.2	2660	450	145	121	1.93	105.7	1.37	1.02	0.59	135.7	1.07
	80	65	15	1.2	1.2	288.0	158.6	5.2	2660	600	154	121	2.23	105.7	1.46	1.02	0.59	156.2	0.99
H7_L2	95	50	10	1.8	1.9	387.0	186.1	8.1	2520	75	67	195	0.62	63.8	1.05	1.20	0.63	63.9	1.05
	95	50	10	1.8	1.9	387.0	186.1	8.1	2520	150	119	195	0.88	108.6	1.10	1.20	0.63	108.5	1.10
	95	50	10	1.8	1.9	387.0	186.1	8.1	2520	300	169	195	1.24	157.4	1.07	1.20	0.63	157.6	1.07
	95	50	10	1.8	1.9	387.0	186.1	8.1	2520	450	191	195	1.52	170.7	1.12	1.20	0.63	172.7	1.11
	95	50	10	1.8	1.9	387.0	186.1	8.1	2520	600	212	195	1.76	170.7	1.24	1.20	0.63	193.3	1.10
H8_L2	75	60	10	1	1.3	215.0	91.7	6.1	2940	75	56	96	0.88	54.0	1.04	1.08	0.60	54.2	1.03
	75	60	10	1	1.3	215.0	91.7	6.1	2940	150	81	96	1.25	77.9	1.03	1.08	0.60	78.0	1.04
	75	60	10	1	1.3	215.0	91.7	6.1	2940	300	105	96	1.77	84.0	1.25	1.08	0.60	97.9	1.07
	75	60	10	1	1.3	215.0	91.7	6.1	2940	450	121	96	2.17	84.0	1.44	1.08	0.60	117.9	1.03
	75	60	10	1	1.3	215.0	91.7	6.1	2940	600	132	96	2.50	84.0	1.57	1.08	0.60	134.9	0.98
H9_L2	80	45	11	1.6	1.8	307.2	83.6	6.9	1960	75	68	218	0.59	64.9	1.04	1.13	0.62	64.8	1.05
	80	45	11	1.6	1.8	307.2	83.6	6.9	1960	150	123	218	0.83	112.5	1.09	1.13	0.62	112.4	1.09
	80	45	11	1.6	1.8	307.2	83.6	6.9	1960	300	183	218	1.17	168.6	1.09	1.13	0.62	169.2	1.08
	80	45	11	1.6	1.8	307.2	83.6	6.9	1960	450	207	218	1.44	189.7	1.09	1.13	0.62	188.9	1.10
	80	45	11	1.6	1.8	307.2	83.6	6.9	1960	600	228	218	1.66	191.2	1.19	1.13	0.62	208.7	1.09
H1_L3	60	55	11	1.2	1.1	230.4	51.4	3.9	1800	75	65	154	0.70	61.2	1.06	1.00	0.59	61.1	1.06
	60	55	11	1.2	1.1	230.4	51.4	3.9	1800	150	108	154	0.99	99.8	1.08	1.00	0.59	99.5	1.09
	60	55	11	1.2	1.1	230.4	51.4	3.9	1800	300	143	154	1.40	132.7	1.08	1.00	0.59	132.1	1.08
	60	55	11	1.2	1.1	230.4	51.4	3.9	1800	450	169	154	1.71	135.1	1.25	1.00	0.59	153.9	1.10
	60	55	11	1.2	1.1	230.4	51.4	3.9	1800	600	198	154	1.97	135.1	1.47	1.00	0.59	178.2	1.11
H2_L3	100	60	10	2	1.7	480.0	368.8	6.9	3600	75	62	124	0.78	58.2	1.06	1.12	0.62	58.1	1.07
	100	60	10	2	1.7	480.0	368.8	6.9	3600	150	96	124	1.10	90.4	1.07	1.12	0.62	90.4	1.06
	100	60	10	2	1.7	480.0	368.8	6.9	3600	300	124	124	1.56	108.7	1.14	1.12	0.62	112.0	1.11
	100	60	10	2	1.7	480.0	368.8	6.9	3600	450	148	124	1.91	108.7	1.36	1.12	0.62	133.8	1.11
	100	60	10	2	1.7	480.0	368.8	6.9	3600	600	172	124	2.20	108.7	1.58	1.12	0.62	152.1	1.13
H3_L3	120	80	15	3	1.5	930.0	1815.3	5.3	3420	75	67	192	0.63	63.7	1.05	1.03	0.59	63.5	1.05
	120	80	15	3	1.5	930.0	1815.3	5.3	3420	150	119	192	0.89	108.1	1.10	1.03	0.59	107.7	1.11
	120	80	15	3	1.5	930.0	1815.3	5.3	3420	300	168	192	1.25	155.7	1.08	1.03	0.59	156.0	1.08
	120	80	15	3	1.5	930.0	1815.3	5.3	3420	450	190	192	1.53	167.9	1.13	1.03	0.59	172.0	1.10
	120	80	15	3	1.5	930.0	1815.3	5.3	3420	600	214	192	1.77	167.9	1.27	1.03	0.59	197.4	1.08
H4_L3	140	70	10	3	3.0	900.0	1833.8	8.8	4680	75	64	145	0.72	60.4	1.07	1.24	0.64	60.4	1.06
	140	70	10	3	2.0	900.0	1833.8	8.8	4680	150	106	145	1.02	97.2	1.09	1.24	0.64	97.0	1.09
	140	70	10	3	2.0	900.0	1833.8	8.8	4680	300	138	145	1.44	125.9	1.10	1.24	0.64	125.9	1.10
	140	70	10	3	2.0	900.0	1833.8	8.8	4680	450	160	145	1.76	126.8	1.26	1.24	0.64	144.0	1.11
	140	70	10	3	2.0	900.0	1833.8	8.8	4680	600	179	145	2.04	126.8	1.41	1.24	0.64	160.0	1.12
H5_L3	150	100	10	4	1.5	1480.0	6166.9	6.3	5940	75	63	128	0.77	58.7	1.08	1.09	0.61	58.5	1.08
	150	100	10	4	1.5	1480.0	6166.9	6.3	5940	150	99	128	1.08	91.8	1.08	1.09	0.61	92.1	1.08
	150	100	10	4	1.5	1480.0	6166.9	6.3	5940	300	127	128	1.53	112.2	1.13	1.09	0.61	114.5	1.11
	150	100	10	4	1.5	1480.0	6166.9	6.3	5940	450	150	128	1.88	112.2	1.34	1.09	0.61	137.3	1.09
	150	100	10	4	1.5	1480.0	6166.9	6.3	5940	600	174	128	2.17	112.2	1.55	1.09	0.61	156.6	1.11
H6_L3	80	65	15	1.2	1.2	288.0	158.6	5.2	3420	75	51	78	0.98	50.1	1.02	1.02	0.59	50.2	1.02
	80	65	15	1.2	1.2	288.0	158.6	5.2	3420	150	70	78	1.39	67.0	1.05	1.02	0.59	66.8	1.05
	80	65	15	1.2	1.2	288.0	158.6	5.2	3420	300	98	78	1.96	68.3	1.44	1.02	0.59	89.1	1.10
	80	65	15	1.2	1.2	288.0	158.6	5.2	3420	450	119	78	2.40	68.3	1.74	1.02	0.59	108.7	1.09
	80	65	15	1.2	1.2	288.0	158.6	5.2	3420	600	133	78	2.78	68.3	1.95	1.02	0.59	124.8	1.07
H7_L3	95	50	10	1.8	1.9	387.0	186.1	8.1	3240	75	62	128	0.77	58.6	1.06	1.20	0.63	58.5	1.06
	95	50	10	1.8	1.9	387.0	186.1	8.1	3240	150	98	128	1.08	91.7	1.07	1.20	0.63	92.1	1.06
	95	50	10	1.8	1.9	387.0	186.1	8.1	3240	300	126	128	1.53	111.9	1.13	1.20	0.63	114.3	1.10
	95	50	10	1.8	1.9	387.0	186.1	8.1	3240	450	150	128	1.88	111.9	1.34	1.20	0.63	133.9	1.12
	95	50	10	1.8	1.9	387.0	186.1	8.1	3240	600	172	128	2.17	111.9	1.54	1.20	0.63	150.4	1.14
H8_L3	75	60	10	1	1.3	215.0	91.7	6.1	3780	75	45	62	1.10	45.0	1.00	1.08	0.60	45.2	1.00
	75	60	10	1	1.3	215.0	91.7	6.1	3780	150	60	62	1.56	53.9	1.11	1.08	0.60	56.1	1.07
	75	60	10	1	1.3	215.0	91.7	6.1	3780	300	87	62	2.21	53.9	1.61	1.08	0.60	77.1	1.13
	75	60	10	1	1.3	215.0	91.7	6.1	3780	450	102	62	2.71	53.9	1.89	1.08	0.60	92.8	1.10
	75	60	10	1	1.3	215.0	91.7	6.1	3780	600	113	62	3.12	53.9	2.10	1.08	0.60	106.3	1.06
H9_L3	80	45	11	1.6	1.8	307.2	83.6	6.9	2520	75	63	142	0.73	60.2	1.05	1.13	0.62	60.0	1.05
	80	45	11	1.6	1.8	307.2	83.6	6.9	2520	150	104	142	1.03	96.5	1.08	1.13	0.62	96.2	1.08
	80	45	11	1.6	1.8	307.2	83.6	6.9	2520	300	136	142	1.45	124.2	1.09	1.13	0.62	124.4	1.09
	80	45	11	1.6	1.8	307.2	83.6	6.9	2520	450	160	142	1.78	124.9	1.28	1.13	0.62	144.7	1.11
	80	45	11	1.6	1.8	307.2	83.6	6.9	2520	600	186	142	2.05	124.9	1.49	1.13	0.62	164.6	1.13

Column	Geometry									SFEA		DSM Design							
	b_w	b_f	b_s	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
H1_L4	60	55	11	1.2	1.1	230.4	51.4	3.9	2200	75	59	110	0.83	56.4	1.05	1.00	0.59	56.2	1.05
	60	55	11	1.2	1.1	230.4	51.4	3.9	2200	150	89	110	1.17	84.8	1.05	1.00	0.59	84.6	1.05
	60	55	11	1.2	1.1	230.4	51.4	3.9	2200	300	115	110	1.65	96.5	1.19	1.00	0.59	106.4	1.08
	60	55	11	1.2	1.1	230.4	51.4	3.9	2200	450	146	110	2.02	96.5	1.51	1.00	0.59	130.3	1.12
	60	55	11	1.2	1.1	230.4	51.4	3.9	2200	600	173	110	2.34	96.5	1.79	1.00	0.59	150.0	1.15
H2_L4	100	60	10	2	1.7	480.0	368.8	6.9	4400	75	56	90	0.91	53.0	1.05	1.12	0.62	53.0	1.06
	100	60	10	2	1.7	480.0	368.8	6.9	4400	150	79	90	1.29	74.8	1.05	1.12	0.62	74.7	1.06
	100	60	10	2	1.7	480.0	368.8	6.9	4400	300	103	90	1.82	79.1	1.30	1.12	0.62	94.1	1.09
	100	60	10	2	1.7	480.0	368.8	6.9	4400	450	128	90	2.23	79.1	1.62	1.12	0.62	112.4	1.14
	100	60	10	2	1.7	480.0	368.8	6.9	4400	600	147	90	2.58	79.1	1.86	1.12	0.62	127.2	1.16
H3_L4	120	80	15	3	1.5	930.0	1815.3	5.3	4180	75	64	138	0.74	59.8	1.06	1.03	0.59	59.6	1.07
	120	80	15	3	1.5	930.0	1815.3	5.3	4180	150	103	138	1.04	95.2	1.08	1.03	0.59	95.4	1.08
	120	80	15	3	1.5	930.0	1815.3	5.3	4180	300	134	138	1.47	120.8	1.11	1.03	0.59	121.4	1.10
	120	80	15	3	1.5	930.0	1815.3	5.3	4180	450	158	138	1.81	121.1	1.30	1.03	0.59	144.7	1.09
	120	80	15	3	1.5	930.0	1815.3	5.3	4180	600	185	138	2.08	121.1	1.53	1.03	0.59	167.2	1.11
H4_L4	140	70	10	3	3.0	900.0	1833.8	8.8	5720	75	60	108	0.83	56.0	1.07	1.24	0.64	56.2	1.07
	140	70	10	3	2.0	900.0	1833.8	8.8	5720	150	89	108	1.18	83.7	1.06	1.24	0.64	83.8	1.06
	140	70	10	3	2.0	900.0	1833.8	8.8	5720	300	114	108	1.67	94.5	1.21	1.24	0.64	102.5	1.11
	140	70	10	3	2.0	900.0	1833.8	8.8	5720	450	133	108	2.04	94.5	1.41	1.24	0.64	120.0	1.11
	140	70	10	3	2.0	900.0	1833.8	8.8	5720	600	147	108	2.36	94.5	1.56	1.24	0.64	133.6	1.10
H5_L4	150	100	10	4	1.5	1480.0	6166.9	6.3	7260	75	58	96	0.88	54.2	1.08	1.09	0.61	54.2	1.07
	150	100	10	4	1.5	1480.0	6166.9	6.3	7260	150	83	96	1.25	78.2	1.06	1.09	0.61	78.0	1.06
	150	100	10	4	1.5	1480.0	6166.9	6.3	7260	300	107	96	1.76	84.5	1.27	1.09	0.61	98.3	1.09
	150	100	10	4	1.5	1480.0	6166.9	6.3	7260	450	129	96	2.16	84.5	1.53	1.09	0.61	118.1	1.09
	150	100	10	4	1.5	1480.0	6166.9	6.3	7260	600	147	96	2.49	84.5	1.74	1.09	0.61	134.9	1.09
H6_L4	80	65	15	1.2	1.2	288.0	158.6	5.2	4180	75	42	55	1.17	42.3	0.99	1.02	0.59	42.3	0.99
	80	65	15	1.2	1.2	288.0	158.6	5.2	4180	150	57	55	1.65	48.1	1.18	1.02	0.59	53.1	1.07
	80	65	15	1.2	1.2	288.0	158.6	5.2	4180	300	88	55	2.34	48.1	1.82	1.02	0.59	74.4	1.18
	80	65	15	1.2	1.2	288.0	158.6	5.2	4180	450	104	55	2.86	48.1	2.16	1.02	0.59	90.9	1.14
	80	65	15	1.2	1.2	288.0	158.6	5.2	4180	600	117	55	3.31	48.1	2.43	1.02	0.59	104.4	1.12
H7_L4	95	50	10	1.8	1.9	387.0	186.1	8.1	3960	75	56	93	0.90	53.5	1.05	1.20	0.63	53.4	1.05
	95	50	10	1.8	1.9	387.0	186.1	8.1	3960	150	80	93	1.27	76.4	1.05	1.20	0.63	76.4	1.05
	95	50	10	1.8	1.9	387.0	186.1	8.1	3960	300	105	93	1.80	81.6	1.29	1.20	0.63	94.1	1.12
	95	50	10	1.8	1.9	387.0	186.1	8.1	3960	450	128	93	2.20	81.6	1.57	1.20	0.63	111.0	1.15
	95	50	10	1.8	1.9	387.0	186.1	8.1	3960	600	144	93	2.54	81.6	1.76	1.20	0.63	124.6	1.16
H8_L4	75	60	10	1	1.3	215.0	91.7	6.1	4620	75	36	43	1.32	36.3	1.00	1.08	0.60	36.2	1.00
	75	60	10	1	1.3	215.0	91.7	6.1	4620	150	51	43	1.86	38.0	1.33	1.08	0.60	46.4	1.10
	75	60	10	1	1.3	215.0	91.7	6.1	4620	300	77	43	2.63	38.0	2.03	1.08	0.60	63.9	1.21
	75	60	10	1	1.3	215.0	91.7	6.1	4620	450	90	43	3.22	38.0	2.36	1.08	0.60	77.0	1.17
	75	60	10	1	1.3	215.0	91.7	6.1	4620	600	99	43	3.72	38.0	2.59	1.08	0.60	87.9	1.13
H9_L4	80	45	11	1.6	1.8	307.2	83.6	6.9	3080	75	58	103	0.85	55.3	1.05	1.13	0.62	55.4	1.05
	80	45	11	1.6	1.8	307.2	83.6	6.9	3080	150	85	103	1.21	81.5	1.05	1.13	0.62	81.3	1.05
	80	45	11	1.6	1.8	307.2	83.6	6.9	3080	300	112	103	1.71	90.3	1.24	1.13	0.62	100.9	1.11
	80	45	11	1.6	1.8	307.2	83.6	6.9	3080	450	139	103	2.09	90.3	1.54	1.13	0.62	120.8	1.15
	80	45	11	1.6	1.8	307.2	83.6	6.9	3080	600	161	103	2.41	90.3	1.78	1.13	0.62	137.2	1.17
H1_L5	60	55	11	1.2	1.1	230.4	51.4	3.9	2600	75	53	83	0.95	51.3	1.03	1.00	0.59	51.4	1.03
	60	55	11	1.2	1.1	230.4	51.4	3.9	2600	150	73	83	1.35	70.1	1.04	1.00	0.59	70.0	1.04
	60	55	11	1.2	1.1	230.4	51.4	3.9	2600	300	101	83	1.91	72.4	1.39	1.00	0.59	91.9	1.10
	60	55	11	1.2	1.1	230.4	51.4	3.9	2600	450	134	83	2.33	72.4	1.85	1.00	0.59	113.0	1.19
	60	55	11	1.2	1.1	230.4	51.4	3.9	2600	600	157	83	2.70	72.4	2.17	1.00	0.59	130.0	1.21
H2_L5	100	60	10	2	1.7	480.0	368.8	6.9	5200	75	50	71	1.03	48.0	1.04	1.12	0.62	48.1	1.04
	100	60	10	2	1.7	480.0	368.8	6.9	5200	150	67	71	1.46	61.6	1.08	1.12	0.62	61.5	1.09
	100	60	10	2	1.7	480.0	368.8	6.9	5200	300	92	71	2.06	61.8	1.48	1.12	0.62	81.9	1.12
	100	60	10	2	1.7	480.0	368.8	6.9	5200	450	112	71	2.53	61.8	1.81	1.12	0.62	97.5	1.15
	100	60	10	2	1.7	480.0	368.8	6.9	5200	600	124	71	2.92	61.8	2.01	1.12	0.62	110.7	1.12
H3_L5	120	80	15	3	1.5	930.0	1815.3	5.3	4940	75	59	107	0.84	55.9	1.06	1.03	0.59	55.8	1.06
	120	80	15	3	1.5	930.0	1815.3	5.3	4940	150	88	107	1.19	83.3	1.05	1.03	0.59	82.9	1.06
	120	80	15	3	1.5	930.0	1815.3	5.3	4940	300	114	107	1.68	93.7	1.22	1.03	0.59	104.1	1.09
	120	80	15	3	1.5	930.0	1815.3	5.3	4940	450	141	107	2.05	93.7	1.51	1.03	0.59	127.3	1.11
	120	80	15	3	1.5	930.0	1815.3	5.3	4940	600	166	107	2.37	93.7	1.77	1.03	0.59	146.1	1.14
H4_L5	140	70	10	3	3.0	900.0	1833.8	8.8	6760	75	56	86	0.93	52.1	1.06	1.24	0.64	52.2	1.07
	140	70	10	3	2.0	900.0	1833.8	8.8	6760	150	77	86	1.32	72.5	1.06	1.24	0.64	72.3	1.06
	140	70	10	3	2.0	900.0	1833.8	8.8	6760	300	98	86	1.86	75.7	1.29	1.24	0.64	89.7	1.09
	140	70	10	3	2.0	900.0	1833.8	8.8	6760	450	112	86	2.28	75.7	1.48	1.24	0.64	104.6	1.07
	140	70	10	3	2.0	900.0	1833.8	8.8	6760	600	119	86	2.64	75.7	1.57	1.24	0.64	116.3	1.02
H5_L5	150	100	10	4	1.5	1480.0	6166.9	6.3	8580	75	53	78	0.98	50.2	1.06	1.09	0.61	50.2	1.06
	150	100	10	4	1.5	1480.0	6166.9	6.3	8580	150	72	78	1.39	67.1	1.07	1.09	0.61	66.8	1.08
	150	100	10	4	1.5	1480.0	6166.9	6.3	8580	300	93	78	1.96	68.4	1.37	1.09	0.61	87.5	1.06
	150	100	10	4	1.5	1480.0	6166.9	6.3	8580	450	111	78	2.40	68.4	1.62	1.09	0.61	105.3	1.05
	150	100	10	4	1.5	1480.0	6166.9	6.3	8580	600	122	78	2.77	68.4	1.78	1.09	0.61	120.1	1.02

Column	Geometry									SFEA		DSM Design							
	b_w	b_f	b_s	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
H6_L5	80	65	15	1.2	1.2	288.0	158.6	5.2	4940	75	35	41	1.35	35.1	1.01	1.02	0.59	35.0	1.00
	80	65	15	1.2	1.2	288.0	158.6	5.2	4940	150	51	41	1.90	36.3	1.39	1.02	0.59	46.0	1.11
	80	65	15	1.2	1.2	288.0	158.6	5.2	4940	300	80	41	2.69	36.3	2.21	1.02	0.59	64.5	1.24
	80	65	15	1.2	1.2	288.0	158.6	5.2	4940	450	96	41	3.30	36.3	2.64	1.02	0.59	78.6	1.22
	80	65	15	1.2	1.2	288.0	158.6	5.2	4940	600	107	41	3.81	36.3	2.95	1.02	0.59	90.5	1.18
H7_L5	95	50	10	1.8	1.9	387.0	186.1	8.1	4680	75	51	73	1.01	48.8	1.04	1.20	0.63	48.9	1.04
	95	50	10	1.8	1.9	387.0	186.1	8.1	4680	150	68	73	1.43	63.5	1.07	1.20	0.63	63.7	1.07
	95	50	10	1.8	1.9	387.0	186.1	8.1	4680	300	92	73	2.03	64.1	1.44	1.20	0.63	81.5	1.13
	95	50	10	1.8	1.9	387.0	186.1	8.1	4680	450	110	73	2.48	64.1	1.72	1.20	0.63	96.2	1.14
	95	50	10	1.8	1.9	387.0	186.1	8.1	4680	600	120	73	2.86	64.1	1.87	1.20	0.63	108.1	1.11
H8_L5	75	60	10	1	1.3	215.0	91.7	6.1	5460	75	31	33	1.51	28.7	1.07	1.08	0.60	29.0	1.07
	75	60	10	1	1.3	215.0	91.7	6.1	5460	150	46	33	2.14	28.7	1.61	1.08	0.60	39.9	1.15
	75	60	10	1	1.3	215.0	91.7	6.1	5460	300	69	33	3.03	28.7	2.42	1.08	0.60	54.8	1.26
	75	60	10	1	1.3	215.0	91.7	6.1	5460	450	80	33	3.71	28.7	2.78	1.08	0.60	66.1	1.21
	75	60	10	1	1.3	215.0	91.7	6.1	5460	600	87	33	4.28	28.7	3.03	1.08	0.60	75.6	1.15
H9_L5	80	45	11	1.6	1.8	307.2	83.6	6.9	3640	75	53	80	0.97	50.7	1.04	1.13	0.62	50.6	1.05
	80	45	11	1.6	1.8	307.2	83.6	6.9	3640	150	72	80	1.37	68.5	1.06	1.13	0.62	68.4	1.05
	80	45	11	1.6	1.8	307.2	83.6	6.9	3640	300	99	80	1.94	70.2	1.41	1.13	0.62	87.6	1.13
	80	45	11	1.6	1.8	307.2	83.6	6.9	3640	450	123	80	2.37	70.2	1.75	1.13	0.62	104.8	1.17
	80	45	11	1.6	1.8	307.2	83.6	6.9	3640	600	140	80	2.74	70.2	1.99	1.13	0.62	118.7	1.18
H1_L6	60	55	11	1.2	1.1	230.4	51.4	3.9	3000	75	47	65	1.07	46.2	1.01	1.00	0.59	46.4	1.01
	60	55	11	1.2	1.1	230.4	51.4	3.9	3000	150	63	65	1.52	56.9	1.10	1.00	0.59	57.7	1.09
	60	55	11	1.2	1.1	230.4	51.4	3.9	3000	300	94	65	2.15	56.9	1.65	1.00	0.59	81.6	1.15
	60	55	11	1.2	1.1	230.4	51.4	3.9	3000	450	125	65	2.63	56.9	2.20	1.00	0.59	100.1	1.25
	60	55	11	1.2	1.1	230.4	51.4	3.9	3000	600	146	65	3.04	56.9	2.57	1.00	0.59	115.5	1.26
H2_L6	100	60	10	2	1.7	480.0	368.8	6.9	6000	75	45	58	1.14	43.7	1.02	1.12	0.62	43.5	1.03
	100	60	10	2	1.7	480.0	368.8	6.9	6000	150	59	58	1.61	51.0	1.16	1.12	0.62	54.0	1.09
	100	60	10	2	1.7	480.0	368.8	6.9	6000	300	82	58	2.27	51.0	1.60	1.12	0.62	73.4	1.12
	100	60	10	2	1.7	480.0	368.8	6.9	6000	450	96	58	2.78	51.0	1.89	1.12	0.62	87.7	1.09
	100	60	10	2	1.7	480.0	368.8	6.9	6000	600	104	58	3.21	51.0	2.04	1.12	0.62	99.5	1.05
H3_L6	120	80	15	3	1.5	930.0	1815.3	5.3	5700	75	55	87	0.93	52.3	1.06	1.03	0.59	52.2	1.05
	120	80	15	3	1.5	930.0	1815.3	5.3	5700	150	77	87	1.31	72.8	1.05	1.03	0.59	73.1	1.05
	120	80	15	3	1.5	930.0	1815.3	5.3	5700	300	102	87	1.86	76.2	1.34	1.03	0.59	93.8	1.09
	120	80	15	3	1.5	930.0	1815.3	5.3	5700	450	128	87	2.28	76.2	1.68	1.03	0.59	114.1	1.12
	120	80	15	3	1.5	930.0	1815.3	5.3	5700	600	149	87	2.63	76.2	1.96	1.03	0.59	131.3	1.13
H4_L6	140	70	10	3	3.0	900.0	1833.8	8.8	7800	75	51	73	1.02	48.7	1.05	1.24	0.64	48.5	1.05
	140	70	10	3	2.0	900.0	1833.8	8.8	7800	150	68	73	1.44	63.2	1.07	1.24	0.64	63.0	1.08
	140	70	10	3	2.0	900.0	1833.8	8.8	7800	300	85	73	2.03	63.8	1.33	1.24	0.64	80.5	1.06
	140	70	10	3	2.0	900.0	1833.8	8.8	7800	450	93	73	2.49	63.8	1.45	1.24	0.64	93.8	0.99
	140	70	10	3	2.0	900.0	1833.8	8.8	7800	600	95	73	2.87	63.8	1.49	1.24	0.64	104.9	0.91
H5_L6	150	100	10	4	1.5	1480.0	6166.9	6.3	9900	75	49	66	1.06	46.7	1.05	1.09	0.61	46.9	1.05
	150	100	10	4	1.5	1480.0	6166.9	6.3	9900	150	64	66	1.51	58.1	1.10	1.09	0.61	58.1	1.10
	150	100	10	4	1.5	1480.0	6166.9	6.3	9900	300	83	66	2.13	58.1	1.42	1.09	0.61	79.9	1.04
	150	100	10	4	1.5	1480.0	6166.9	6.3	9900	450	95	66	2.61	58.1	1.63	1.09	0.61	96.1	0.99
	150	100	10	4	1.5	1480.0	6166.9	6.3	9900	600	101	66	3.01	58.1	1.74	1.09	0.61	109.7	0.92
H6_L6	80	65	15	1.2	1.2	288.0	158.6	5.2	5700	75	31	33	1.51	28.8	1.08	1.02	0.59	29.1	1.07
	80	65	15	1.2	1.2	288.0	158.6	5.2	5700	150	48	33	2.14	28.8	1.65	1.02	0.59	40.7	1.18
	80	65	15	1.2	1.2	288.0	158.6	5.2	5700	300	75	33	3.02	28.8	2.60	1.02	0.59	57.3	1.31
	80	65	15	1.2	1.2	288.0	158.6	5.2	5700	450	87	33	3.70	28.8	3.03	1.02	0.59	69.9	1.24
	80	65	15	1.2	1.2	288.0	158.6	5.2	5700	600	96	33	4.28	28.8	3.32	1.02	0.59	80.4	1.19
H7_L6	95	50	10	1.8	1.9	387.0	186.1	8.1	5400	75	46	60	1.11	44.6	1.02	1.20	0.63	44.8	1.03
	95	50	10	1.8	1.9	387.0	186.1	8.1	5400	150	61	60	1.58	53.0	1.14	1.20	0.63	55.0	1.11
	95	50	10	1.8	1.9	387.0	186.1	8.1	5400	300	82	60	2.23	53.0	1.54	1.20	0.63	72.8	1.13
	95	50	10	1.8	1.9	387.0	186.1	8.1	5400	450	94	60	2.73	53.0	1.77	1.20	0.63	85.7	1.10
	95	50	10	1.8	1.9	387.0	186.1	8.1	5400	600	99	60	3.15	53.0	1.86	1.20	0.63	96.3	1.03
H8_L6	75	60	10	1	1.3	215.0	91.7	6.1	6300	75	27	26	1.70	22.8	1.20	1.08	0.60	25.6	1.06
	75	60	10	1	1.3	215.0	91.7	6.1	6300	150	43	26	2.40	22.8	1.89	1.08	0.60	35.3	1.22
	75	60	10	1	1.3	215.0	91.7	6.1	6300	300	63	26	3.40	22.8	2.74	1.08	0.60	48.4	1.30
	75	60	10	1	1.3	215.0	91.7	6.1	6300	450	70	26	4.16	22.8	3.08	1.08	0.60	58.5	1.20
	75	60	10	1	1.3	215.0	91.7	6.1	6300	600	75	26	4.80	22.8	3.29	1.08	0.60	66.8	1.12
H9_L6	80	45	11	1.6	1.8	307.2	83.6	6.9	4200	75	48	66	1.07	46.5	1.02	1.13	0.62	46.4	1.03
	80	45	11	1.6	1.8	307.2	83.6	6.9	4200	150	64	66	1.51	57.5	1.11	1.13	0.62	58.1	1.10
	80	45	11	1.6	1.8	307.2	83.6	6.9	4200	300	90	66	2.14	57.5	1.56	1.13	0.62	78.4	1.15
	80	45	11	1.6	1.8	307.2	83.6	6.9	4200	450	109	66	2.62	57.5	1.89	1.13	0.62	93.6	1.16
	80	45	11	1.6	1.8	307.2	83.6	6.9	4200	600	120	66	3.02	57.5	2.09	1.13	0.62	106.4	1.13
													Mean		1.361			Mean	1.093
													Sd. Dev.		0.458			Sd. Dev.	0.057
													Max		3.320			Max	1.308
													Min		0.990			Min	0.906

ANNEX D: R Column Data

Table D: F columns: (i) geometries, (ii) buckling stresses and ultimate strengths, (iii) ultimate strength predictions by current and proposed DSM design curves, and (iv) numerical-to-predicted ultimate strength ratios (mm and MPa)

Column	Geometry										SFEA		DSM Design							
	b_w	b_f	b_s	b_l	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
R1_L1	80	50	15	20	1	1.60	250.0	333.0	11.38	3500	75	64	144	0.72	60.3	1.05	1.39	0.69	60.3	1.05
	80	50	15	20	1	1.60	250.0	333.0	11.38	3500	150	105	144	1.02	96.9	1.08	1.39	0.69	96.9	1.08
	80	50	15	20	1	1.60	250.0	333.0	11.38	3500	300	127	144	1.45	125.1	1.02	1.39	0.69	125.1	1.02
	80	50	15	20	1	1.60	250.0	333.0	11.38	3500	450	135	144	1.77	125.9	1.07	1.39	0.69	139.3	0.97
	80	50	15	20	1	1.60	250.0	333.0	11.38	3500	600	135	144	2.04	125.9	1.07	1.39	0.69	152.0	0.89
R1_L2	80	50	15	20	1	1.60	250.0	333.0	11.38	4200	75	58	102	0.86	55.1	1.05	1.39	0.69	55.1	1.05
	80	50	15	20	1	1.60	250.0	333.0	11.38	4200	150	84	102	1.21	81.0	1.03	1.39	0.69	81.0	1.03
	80	50	15	20	1	1.60	250.0	333.0	11.38	4200	300	98	102	1.72	89.3	1.10	1.39	0.69	96.9	1.01
	80	50	15	20	1	1.60	250.0	333.0	11.38	4200	450	111	102	2.10	89.3	1.24	1.39	0.69	109.6	1.01
	80	50	15	20	1	1.60	250.0	333.0	11.38	4200	600	114	102	2.43	89.3	1.27	1.39	0.69	119.6	0.95
R1_L3	80	50	15	20	1	1.60	250.0	333.0	11.38	4900	75	51	76	0.99	49.6	1.03	1.39	0.69	49.6	1.03
	80	50	15	20	1	1.60	250.0	333.0	11.38	4900	150	67	76	1.40	65.7	1.02	1.39	0.69	65.7	1.02
	80	50	15	20	1	1.60	250.0	333.0	11.38	4900	300	81	76	1.99	66.7	1.21	1.39	0.69	79.1	1.02
	80	50	15	20	1	1.60	250.0	333.0	11.38	4900	450	95	76	2.43	66.7	1.42	1.39	0.69	89.5	1.06
	80	50	15	20	1	1.60	250.0	333.0	11.38	4900	600	99	76	2.81	66.7	1.49	1.39	0.69	97.6	1.02
R1_L4	80	50	15	20	1	1.60	250.0	333.0	11.38	5600	75	44	59	1.13	44.1	1.00	1.39	0.69	44.1	1.00
	80	50	15	20	1	1.60	250.0	333.0	11.38	5600	150	55	59	1.59	51.9	1.07	1.39	0.69	53.8	1.03
	80	50	15	20	1	1.60	250.0	333.0	11.38	5600	300	70	59	2.25	51.9	1.35	1.39	0.69	66.4	1.05
	80	50	15	20	1	1.60	250.0	333.0	11.38	5600	450	83	59	2.76	51.9	1.61	1.39	0.69	75.1	1.11
	80	50	15	20	1	1.60	250.0	333.0	11.38	5600	600	90	59	3.19	51.9	1.74	1.39	0.69	82.0	1.10
R1_L5	80	50	15	20	1	1.60	250.0	333.0	11.38	6300	75	38	48	1.26	38.7	0.99	1.39	0.69	38.7	0.99
	80	50	15	20	1	1.60	250.0	333.0	11.38	6300	150	47	48	1.78	41.7	1.14	1.39	0.69	46.2	1.02
	80	50	15	20	1	1.60	250.0	333.0	11.38	6300	300	62	48	2.51	41.7	1.49	1.39	0.69	57.0	1.09
	80	50	15	20	1	1.60	250.0	333.0	11.38	6300	450	74	48	3.08	41.7	1.77	1.39	0.69	64.5	1.14
	80	50	15	20	1	1.60	250.0	333.0	11.38	6300	600	79	48	3.55	41.7	1.90	1.39	0.69	70.4	1.12
R1_L6	80	50	15	20	1	1.60	250.0	333.0	11.38	7000	75	33	39	1.38	33.6	0.99	1.39	0.69	33.6	0.99
	80	50	15	20	1	1.60	250.0	333.0	11.38	7000	150	42	39	1.96	34.3	1.21	1.39	0.69	40.4	1.03
	80	50	15	20	1	1.60	250.0	333.0	11.38	7000	300	56	39	2.77	34.3	1.63	1.39	0.69	49.8	1.12
	80	50	15	20	1	1.60	250.0	333.0	11.38	7000	450	65	39	3.39	34.3	1.90	1.39	0.69	56.4	1.16
	80	50	15	20	1	1.60	250.0	333.0	11.38	7000	600	70	39	3.91	34.3	2.03	1.39	0.69	61.5	1.13
R2_L1	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	7000	75	64	142	0.73	60.1	1.06	1.39	0.69	60.1	1.06
	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	7000	150	103	142	1.03	96.3	1.07	1.39	0.69	96.3	1.07
	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	7000	300	128	142	1.46	123.6	1.04	1.39	0.69	123.6	1.04
	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	7000	450	140	142	1.78	124.2	1.13	1.39	0.69	138.0	1.01
	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	7000	600	150	142	2.06	124.2	1.21	1.39	0.69	150.7	1.00
R2_L2	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	7500	75	62	125	0.78	58.3	1.06	1.39	0.69	58.3	1.06
	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	7500	150	96	125	1.10	90.6	1.06	1.39	0.69	90.6	1.06
	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	7500	300	118	125	1.55	109.3	1.08	1.39	0.69	111.6	1.05
	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	7500	450	131	125	1.90	109.3	1.20	1.39	0.69	126.3	1.04
	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	7500	600	143	125	2.19	109.3	1.31	1.39	0.69	137.9	1.04
R2_L3	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	8000	75	60	111	0.82	56.5	1.06	1.39	0.69	56.5	1.06
	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	8000	150	89	111	1.16	85.1	1.05	1.39	0.69	85.1	1.05
	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	8000	300	109	111	1.65	97.1	1.12	1.39	0.69	102.8	1.06
	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	8000	450	123	111	2.02	97.1	1.27	1.39	0.69	116.3	1.06
	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	8000	600	135	111	2.33	97.1	1.39	1.39	0.69	127.0	1.06
R2_L4	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	8500	75	58	99	0.87	54.6	1.06	1.39	0.69	54.6	1.06
	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	8500	150	83	99	1.23	79.6	1.04	1.39	0.69	79.6	1.04
	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	8500	300	102	99	1.74	86.8	1.17	1.39	0.69	95.2	1.07
	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	8500	450	116	99	2.13	86.8	1.34	1.39	0.69	107.7	1.08
	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	8500	600	127	99	2.46	86.8	1.46	1.39	0.69	117.6	1.08
R2_L5	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	9000	75	56	89	0.92	52.8	1.05	1.39	0.69	52.8	1.05
	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	9000	150	77	89	1.30	74.2	1.04	1.39	0.69	74.2	1.04
	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	9000	300	96	89	1.83	78.3	1.22	1.39	0.69	88.5	1.08
	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	9000	450	111	89	2.25	78.3	1.41	1.39	0.69	100.2	1.10
	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	9000	600	121	89	2.59	78.3	1.55	1.39	0.69	109.3	1.11
R2_L6	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	9500	75	53	81	0.96	50.9	1.05	1.39	0.69	50.9	1.05
	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	9500	150	72	81	1.36	69.0	1.04	1.39	0.69	69.0	1.04
	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	9500	300	91	81	1.93	71.0	1.28	1.39	0.69	82.7	1.09
	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	9500	450	106	81	2.36	71.0	1.49	1.39	0.69	93.6	1.13
	200	105	12	15	2.3	1.43	408.0	1842.1	11.33	9500	600	115	81	2.72	71.0	1.63	1.39	0.69	102.2	1.13
R3_L1	67	35	10	20	0.8	1.91	157.6	73.5	11.16	3000	75	62	122	0.78	58.0	1.06	1.38	0.68	58.0	1.06
	67	35	10	20	0.8	1.91	157.6	73.5	11.16	3000	150	95	122	1.11	89.7	1.06	1.38	0.68	89.7	1.06
	67	35	10	20	0.8	1.91	157.6	73.5	11.16	3000	300	111	122	1.57	107.0	1.04	1.38	0.68	110.1	1.01
	67	35	10	20	0.8	1.91	157.6	73.5	11.16	3000	450	124	122	1.92	107.0	1.16	1.38	0.68	124.8	0.99
	67	35	10	20	0.8	1.91	157.6	73.5	11.16	3000	600	131	122	2.22	107.0	1.23	1.38	0.68	136.5	0.96

Column	Geometry										SFEA		DSM Design							
	b_w	b_f	b_s	b_l	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
R3_L2	67	35	10	20	0.8	1.91	157.6	73.5	11.16	3500	75	56	91	0.91	53.2	1.05	1.38	0.68	53.2	1.05
	67	35	10	20	0.8	1.91	157.6	73.5	11.16	3500	150	77	91	1.28	75.5	1.02	1.38	0.68	75.5	1.02
	67	35	10	20	0.8	1.91	157.6	73.5	11.16	3500	300	91	91	1.81	80.2	1.14	1.38	0.68	90.2	1.01
	67	35	10	20	0.8	1.91	157.6	73.5	11.16	3500	450	106	91	2.22	80.2	1.33	1.38	0.68	102.3	1.04
	67	35	10	20	0.8	1.91	157.6	73.5	11.16	3500	600	117	91	2.56	80.2	1.45	1.38	0.68	111.8	1.04
R3_L3	67	35	10	20	0.8	1.91	157.6	73.5	11.16	4000	75	50	71	1.03	48.3	1.03	1.38	0.68	48.3	1.03
	67	35	10	20	0.8	1.91	157.6	73.5	11.16	4000	150	64	71	1.45	62.1	1.03	1.38	0.68	62.1	1.03
	67	35	10	20	0.8	1.91	157.6	73.5	11.16	4000	300	79	71	2.05	62.5	1.26	1.38	0.68	75.9	1.03
	67	35	10	20	0.8	1.91	157.6	73.5	11.16	4000	450	93	71	2.51	62.5	1.49	1.38	0.68	86.1	1.08
	67	35	10	20	0.8	1.91	157.6	73.5	11.16	4000	600	104	71	2.90	62.5	1.66	1.38	0.68	94.1	1.10
R3_L4	67	35	10	20	0.8	1.91	157.6	73.5	11.16	4500	75	43	57	1.14	43.3	1.00	1.38	0.68	43.3	1.00
	67	35	10	20	0.8	1.91	157.6	73.5	11.16	4500	150	54	57	1.62	50.2	1.08	1.38	0.68	52.7	1.03
	67	35	10	20	0.8	1.91	157.6	73.5	11.16	4500	300	70	57	2.29	50.2	1.39	1.38	0.68	65.3	1.07
	67	35	10	20	0.8	1.91	157.6	73.5	11.16	4500	450	83	57	2.80	50.2	1.65	1.38	0.68	74.0	1.12
	67	35	10	20	0.8	1.91	157.6	73.5	11.16	4500	600	91	57	3.24	50.2	1.82	1.38	0.68	81.0	1.13
R3_L5	67	35	10	20	0.8	1.91	157.6	73.5	11.16	5000	75	38	47	1.26	38.6	0.99	1.38	0.68	38.6	0.99
	67	35	10	20	0.8	1.91	157.6	73.5	11.16	5000	150	47	47	1.78	41.4	1.15	1.38	0.68	46.1	1.03
	67	35	10	20	0.8	1.91	157.6	73.5	11.16	5000	300	63	47	2.52	41.4	1.51	1.38	0.68	57.1	1.10
	67	35	10	20	0.8	1.91	157.6	73.5	11.16	5000	450	74	47	3.09	41.4	1.78	1.38	0.68	64.8	1.14
	67	35	10	20	0.8	1.91	157.6	73.5	11.16	5000	600	80	47	3.57	41.4	1.95	1.38	0.68	70.9	1.14
R3_L6	67	35	10	20	0.8	1.91	157.6	73.5	11.16	5500	75	34	40	1.37	34.0	0.99	1.38	0.68	34.0	0.99
	67	35	10	20	0.8	1.91	157.6	73.5	11.16	5500	150	42	40	1.94	34.8	1.22	1.38	0.68	40.9	1.04
	67	35	10	20	0.8	1.91	157.6	73.5	11.16	5500	300	57	40	2.75	34.8	1.63	1.38	0.68	50.7	1.12
	67	35	10	20	0.8	1.91	157.6	73.5	11.16	5500	450	66	40	3.37	34.8	1.90	1.38	0.68	57.5	1.15
	67	35	10	20	0.8	1.91	157.6	73.5	11.16	5500	600	71	40	3.89	34.8	2.04	1.38	0.68	62.9	1.13
R4_L1	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	5500	75	66	182	0.64	63.1	1.04	1.19	0.63	63.1	1.04
	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	5500	150	116	182	0.91	106.3	1.09	1.19	0.63	106.3	1.09
	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	5500	300	158	182	1.28	150.7	1.05	1.19	0.63	150.7	1.05
	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	5500	450	170	182	1.57	159.9	1.06	1.19	0.63	166.1	1.02
	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	5500	600	186	182	1.81	159.9	1.16	1.19	0.63	186.6	1.00
R4_L2	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	6300	75	63	142	0.73	60.1	1.05	1.19	0.63	60.1	1.05
	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	6300	150	103	142	1.03	96.3	1.07	1.19	0.63	96.3	1.07
	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	6300	300	130	142	1.45	123.7	1.05	1.19	0.63	123.7	1.05
	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	6300	450	144	142	1.78	124.3	1.16	1.19	0.63	143.0	1.01
	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	6300	600	162	142	2.06	124.3	1.30	1.19	0.63	160.6	1.01
R4_L3	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	7000	75	60	116	0.80	57.3	1.05	1.19	0.63	57.3	1.05
	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	7000	150	92	116	1.13	87.5	1.05	1.19	0.63	87.5	1.05
	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	7000	300	112	116	1.60	102.2	1.10	1.19	0.63	108.0	1.04
	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	7000	450	129	116	1.97	102.2	1.26	1.19	0.63	127.2	1.01
	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	7000	600	147	116	2.27	102.2	1.44	1.19	0.63	142.9	1.03
R4_L4	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	7800	75	56	95	0.89	53.9	1.04	1.19	0.63	53.9	1.04
	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	7800	150	80	95	1.25	77.6	1.03	1.19	0.63	77.6	1.03
	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	7800	300	98	95	1.77	83.6	1.17	1.19	0.63	95.8	1.02
	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	7800	450	116	95	2.17	83.6	1.39	1.19	0.63	112.8	1.03
	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	7800	600	134	95	2.51	83.6	1.60	1.19	0.63	126.8	1.06
R4_L5	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	8600	75	52	80	0.97	50.6	1.03	1.19	0.63	50.6	1.03
	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	8600	150	70	80	1.37	68.2	1.03	1.19	0.63	68.2	1.03
	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	8600	300	88	80	1.94	69.8	1.26	1.19	0.63	86.1	1.02
	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	8600	450	107	80	2.38	69.8	1.53	1.19	0.63	101.4	1.05
	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	8600	600	123	80	2.75	69.8	1.76	1.19	0.63	113.9	1.08
R4_L6	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	9500	75	47	66	1.06	46.7	1.01	1.19	0.63	46.7	1.01
	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	9500	150	62	66	1.50	58.2	1.06	1.19	0.63	58.4	1.05
	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	9500	300	80	66	2.13	58.2	1.37	1.19	0.63	77.3	1.03
	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	9500	450	98	66	2.60	58.2	1.68	1.19	0.63	91.0	1.08
	150	110	23	20	2.4	1.36	1094.4	15531.6	8.02	9500	600	112	66	3.01	58.2	1.92	1.19	0.63	102.2	1.10
R5_L1	110	100	20	15	2	1.10	760.0	5079.0	6.60	6000	75	56	94	0.89	53.7	1.04	1.11	0.61	53.7	1.04
	110	100	20	15	2	1.10	760.0	5079.0	6.60	6000	150	79	94	1.27	76.8	1.03	1.11	0.61	76.8	1.03
	110	100	20	15	2	1.10	760.0	5079.0	6.60	6000	300	98	94	1.79	82.2	1.19	1.11	0.61	96.3	1.02
	110	100	20	15	2	1.10	760.0	5079.0	6.60	6000	450	118	94	2.19	82.2	1.44	1.11	0.61	115.4	1.02
	110	100	20	15	2	1.10	760.0	5079.0	6.60	6000	600	138	94	2.53	82.2	1.67	1.11	0.61	131.3	1.05
R5_L2	110	100	20	15	2	1.10	760.0	5079.0	6.60	6500	75	52	81	0.96	50.9	1.03	1.11	0.61	50.9	1.03
	110	100	20	15	2	1.10	760.0	5079.0	6.60	6500	150	71	81	1.36	69.0	1.03	1.11	0.61	69.0	1.03
	110	100	20	15	2	1.10	760.0	5079.0	6.60	6500	300	90	81	1.93	70.8	1.27	1.11	0.61	88.7	1.01
	110	100	20	15	2	1.10	760.0	5079.0	6.60	6500	450	110	81	2.36	70.8	1.56	1.11	0.61	106.3	1.04
	110	100	20	15	2	1.10	760.0	5079.0	6.60	6500	600	129	81	2.73	70.8	1.82	1.11	0.61	120.9	1.07
R5_L3	110	100	20	15	2	1.10	760.0	5079.0	6.60	7000	75	49	70	1.03	48.0	1.02	1.11	0.61	48.0	1.02
	110	100	20	15	2	1.10	760.0	5079.0	6.60	7000	150	64	70	1.46	61.5	1.05	1.11	0.61	61.5	1.05
	110	100	20	15	2	1.10	760.0	5079.0	6.60	7000	300	84	70	2.06	61.8	1.36	1.11	0.61	82.2	1.02
	110	100	20	15	2	1.10	760.0	5079.0	6.60	7000	450	104	70	2.53	61.8	1.68	1.11	0.61	98.6	1.06
	110	100	20	15	2	1.10	760.0	5079.0	6.60	7000	600	121	70	2.92	61.8	1.96	1.11	0.61	112.1	1.08

Column	Geometry										SFEA		DSM Design							
	b_w	b_f	b_s	b_l	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
R5_L4	110	100	20	15	2	1.10	760.0	5079.0	6.60	7500	75	46	62	1.10	45.2	1.01	1.11	0.61	45.2	1.01
	110	100	20	15	2	1.10	760.0	5079.0	6.60	7500	150	59	62	1.55	54.5	1.08	1.11	0.61	56.3	1.05
	110	100	20	15	2	1.10	760.0	5079.0	6.60	7500	300	79	62	2.20	54.5	1.45	1.11	0.61	76.7	1.03
	110	100	20	15	2	1.10	760.0	5079.0	6.60	7500	450	98	62	2.69	54.5	1.81	1.11	0.61	91.9	1.07
	110	100	20	15	2	1.10	760.0	5079.0	6.60	7500	600	114	62	3.11	54.5	2.10	1.11	0.61	104.5	1.09
R5_L5	110	100	20	15	2	1.10	760.0	5079.0	6.60	8000	75	40	55	1.17	42.5	0.95	1.11	0.61	42.5	0.95
	110	100	20	15	2	1.10	760.0	5079.0	6.60	8000	150	52	55	1.65	48.4	1.08	1.11	0.61	52.7	0.99
	110	100	20	15	2	1.10	760.0	5079.0	6.60	8000	300	70	55	2.33	48.4	1.45	1.11	0.61	71.9	0.98
	110	100	20	15	2	1.10	760.0	5079.0	6.60	8000	450	88	55	2.85	48.4	1.81	1.11	0.61	86.2	1.02
	110	100	20	15	2	1.10	760.0	5079.0	6.60	8000	600	102	55	3.30	48.4	2.10	1.11	0.61	98.0	1.04
R5_L6	110	100	20	15	2	1.10	760.0	5079.0	6.60	8500	75	40	50	1.23	39.8	0.99	1.11	0.61	39.8	0.99
	110	100	20	15	2	1.10	760.0	5079.0	6.60	8500	150	51	50	1.74	43.5	1.17	1.11	0.61	49.6	1.02
	110	100	20	15	2	1.10	760.0	5079.0	6.60	8500	300	71	50	2.46	43.5	1.64	1.11	0.61	67.7	1.05
	110	100	20	15	2	1.10	760.0	5079.0	6.60	8500	450	89	50	3.01	43.5	2.05	1.11	0.61	81.1	1.10
	110	100	20	15	2	1.10	760.0	5079.0	6.60	8500	600	102	50	3.48	43.5	2.34	1.11	0.61	92.3	1.10
R6_L1	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	7500	75	56	96	0.89	54.0	1.04	1.10	0.61	54.0	1.04
	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	7500	150	80	96	1.25	77.8	1.03	1.10	0.61	77.8	1.03
	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	7500	300	100	96	1.77	83.9	1.19	1.10	0.61	97.4	1.03
	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	7500	450	122	96	2.17	83.9	1.46	1.10	0.61	116.9	1.05
	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	7500	600	144	96	2.50	83.9	1.72	1.10	0.61	133.0	1.08
R6_L2	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	8000	75	53	85	0.94	51.8	1.03	1.10	0.61	51.8	1.03
	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	8000	150	74	85	1.33	71.6	1.03	1.10	0.61	71.6	1.03
	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	8000	300	94	85	1.88	74.5	1.26	1.10	0.61	91.3	1.03
	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	8000	450	116	85	2.30	74.5	1.56	1.10	0.61	109.5	1.06
	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	8000	600	137	85	2.66	74.5	1.84	1.10	0.61	124.6	1.10
R6_L3	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	8500	75	51	76	0.99	49.6	1.02	1.10	0.61	49.6	1.02
	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	8500	150	68	76	1.40	65.7	1.04	1.10	0.61	65.7	1.04
	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	8500	300	89	76	1.99	66.7	1.33	1.10	0.61	85.8	1.04
	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	8500	450	111	76	2.43	66.7	1.67	1.10	0.61	103.0	1.08
	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	8500	600	131	76	2.81	66.7	1.97	1.10	0.61	117.2	1.12
R6_L4	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	9000	75	48	69	1.05	47.4	1.01	1.10	0.61	47.4	1.01
	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	9000	150	63	69	1.48	60.0	1.06	1.10	0.61	60.0	1.06
	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	9000	300	85	69	2.09	60.1	1.41	1.10	0.61	81.1	1.04
	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	9000	450	107	69	2.56	60.1	1.78	1.10	0.61	97.2	1.10
	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	9000	600	125	69	2.96	60.1	2.09	1.10	0.61	110.7	1.13
R6_L5	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	9500	75	45	62	1.10	45.2	1.01	1.10	0.61	45.2	1.01
	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	9500	150	59	62	1.55	54.5	1.09	1.10	0.61	56.3	1.05
	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	9500	300	81	62	2.20	54.5	1.49	1.10	0.61	76.8	1.06
	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	9500	450	103	62	2.69	54.5	1.89	1.10	0.61	92.1	1.12
	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	9500	600	120	62	3.11	54.5	2.20	1.10	0.61	104.8	1.14
R6_L6	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	10000	75	43	57	1.15	43.1	1.00	1.10	0.61	43.1	1.00
	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	10000	150	56	57	1.63	49.7	1.12	1.10	0.61	53.5	1.04
	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	10000	300	78	57	2.30	49.7	1.57	1.10	0.61	73.0	1.07
	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	10000	450	99	57	2.82	49.7	1.99	1.10	0.61	87.6	1.13
	150	130	20	15	2.5	1.15	1200.0	18991.6	6.53	10000	600	115	57	3.25	49.7	2.32	1.10	0.61	99.7	1.16
R7_L1	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	5500	75	61	121	0.79	57.9	1.06	1.43	0.70	57.9	1.06
	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	5500	150	92	121	1.11	89.4	1.03	1.43	0.70	89.4	1.03
	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	5500	300	112	121	1.57	106.3	1.05	1.43	0.70	109.3	1.03
	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	5500	450	122	121	1.93	106.3	1.14	1.43	0.70	122.8	0.99
	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	5500	600	132	121	2.22	106.3	1.24	1.43	0.70	133.3	0.99
R7_L2	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	6000	75	58	103	0.85	55.3	1.06	1.43	0.70	55.3	1.06
	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	6000	150	85	103	1.21	81.5	1.04	1.43	0.70	81.5	1.04
	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	6000	300	99	103	1.71	90.3	1.10	1.43	0.70	97.3	1.02
	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	6000	450	110	103	2.09	90.3	1.22	1.43	0.70	109.2	1.01
	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	6000	600	121	103	2.41	90.3	1.34	1.43	0.70	118.6	1.02
R7_L3	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	6500	75	55	89	0.92	52.6	1.05	1.43	0.70	52.6	1.05
	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	6500	150	76	89	1.30	73.8	1.02	1.43	0.70	73.8	1.02
	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	6500	300	89	89	1.84	77.7	1.14	1.43	0.70	87.4	1.02
	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	6500	450	101	89	2.25	77.7	1.30	1.43	0.70	98.1	1.03
	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	6500	600	111	89	2.60	77.7	1.43	1.43	0.70	106.6	1.04
R7_L4	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	7000	75	52	77	0.99	49.9	1.04	1.43	0.70	49.9	1.04
	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	7000	150	68	77	1.39	66.5	1.02	1.43	0.70	66.5	1.02
	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	7000	300	81	77	1.97	67.7	1.20	1.43	0.70	79.2	1.02
	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	7000	450	93	77	2.42	67.7	1.37	1.43	0.70	88.9	1.04
	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	7000	600	102	77	2.79	67.7	1.51	1.43	0.70	96.6	1.06
R7_L5	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	7500	75	48	68	1.05	47.2	1.02	1.43	0.70	47.2	1.02
	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	7500	150	62	68	1.49	59.5	1.03	1.43	0.70	59.5	1.03
	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	7500	300	74	68	2.10	59.5	1.25	1.43	0.70	72.3	1.03
	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	7500	450	86	68	2.57	59.5	1.44	1.43	0.70	81.2	1.06
	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	7500	600	94	68	2.97	59.5	1.58	1.43	0.70	88.2	1.07

Column	Geometry										SFEA		DSM Design							
	b_w	b_f	b_s	b_l	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
R7_L6	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	8000	75	45	60	1.12	44.6	1.01	1.43	0.70	44.6	1.01
	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	8000	150	56	60	1.58	52.9	1.06	1.43	0.70	54.5	1.03
	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	8000	300	69	60	2.23	52.9	1.31	1.43	0.70	66.4	1.04
	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	8000	450	80	60	2.73	52.9	1.51	1.43	0.70	74.6	1.07
	120	60	20	30	1.5	2.00	510.0	2204.9	11.96	8000	600	87	60	3.15	52.9	1.64	1.43	0.70	81.0	1.07
R8_L1	60	55	10	5.5	1	1.09	201.0	122.2	7.78	3000	75	57	102	0.86	55.1	1.04	1.18	0.63	55.1	1.04
	60	55	10	5.5	1	1.09	201.0	122.2	7.78	3000	150	83	102	1.21	80.9	1.03	1.18	0.63	80.9	1.03
	60	55	10	5.5	1	1.09	201.0	122.2	7.78	3000	300	104	102	1.72	89.2	1.16	1.18	0.63	99.8	1.04
	60	55	10	5.5	1	1.09	201.0	122.2	7.78	3000	450	125	102	2.10	89.2	1.40	1.18	0.63	117.9	1.06
	60	55	10	5.5	1	1.09	201.0	122.2	7.78	3000	600	146	102	2.43	89.2	1.63	1.18	0.63	132.7	1.10
R8_L2	60	55	10	5.5	1	1.09	201.0	122.2	7.78	3500	75	51	76	0.99	49.7	1.02	1.18	0.63	49.7	1.02
	60	55	10	5.5	1	1.09	201.0	122.2	7.78	3500	150	68	76	1.40	65.9	1.04	1.18	0.63	65.9	1.04
	60	55	10	5.5	1	1.09	201.0	122.2	7.78	3500	300	89	76	1.98	67.0	1.32	1.18	0.63	84.3	1.05
	60	55	10	5.5	1	1.09	201.0	122.2	7.78	3500	450	110	76	2.43	67.0	1.65	1.18	0.63	99.6	1.11
	60	55	10	5.5	1	1.09	201.0	122.2	7.78	3500	600	129	76	2.80	67.0	1.93	1.18	0.63	112.2	1.15
R8_L3	60	55	10	5.5	1	1.09	201.0	122.2	7.78	4000	75	44	60	1.12	44.4	1.00	1.18	0.63	44.4	1.00
	60	55	10	5.5	1	1.09	201.0	122.2	7.78	4000	150	58	60	1.58	52.4	1.10	1.18	0.63	54.9	1.05
	60	55	10	5.5	1	1.09	201.0	122.2	7.78	4000	300	79	60	2.24	52.4	1.51	1.18	0.63	73.0	1.08
	60	55	10	5.5	1	1.09	201.0	122.2	7.78	4000	450	100	60	2.74	52.4	1.90	1.18	0.63	86.2	1.16
	60	55	10	5.5	1	1.09	201.0	122.2	7.78	4000	600	116	60	3.17	52.4	2.21	1.18	0.63	97.1	1.19
R8_L4	60	55	10	5.5	1	1.09	201.0	122.2	7.78	4500	75	39	48	1.25	39.2	0.99	1.18	0.63	39.2	0.99
	60	55	10	5.5	1	1.09	201.0	122.2	7.78	4500	150	51	48	1.76	42.4	1.19	1.18	0.63	48.4	1.05
	60	55	10	5.5	1	1.09	201.0	122.2	7.78	4500	300	73	48	2.49	42.4	1.71	1.18	0.63	64.4	1.13
	60	55	10	5.5	1	1.09	201.0	122.2	7.78	4500	450	91	48	3.05	42.4	2.15	1.18	0.63	76.1	1.20
	60	55	10	5.5	1	1.09	201.0	122.2	7.78	4500	600	104	48	3.52	42.4	2.46	1.18	0.63	85.7	1.22
R8_L5	60	55	10	5.5	1	1.09	201.0	122.2	7.78	5000	75	34	40	1.37	34.3	1.01	1.18	0.63	34.3	1.01
	60	55	10	5.5	1	1.09	201.0	122.2	7.78	5000	150	46	40	1.93	35.1	1.30	1.18	0.63	43.4	1.05
	60	55	10	5.5	1	1.09	201.0	122.2	7.78	5000	300	67	40	2.74	35.1	1.91	1.18	0.63	57.7	1.16
	60	55	10	5.5	1	1.09	201.0	122.2	7.78	5000	450	83	40	3.35	35.1	2.36	1.18	0.63	68.2	1.22
	60	55	10	5.5	1	1.09	201.0	122.2	7.78	5000	600	93	40	3.87	35.1	2.66	1.18	0.63	76.7	1.22
R8_L6	60	55	10	5.5	1	1.09	201.0	122.2	7.78	5500	75	31	34	1.49	29.8	1.04	1.18	0.63	29.8	1.04
	60	55	10	5.5	1	1.09	201.0	122.2	7.78	5500	150	42	34	2.10	29.8	1.41	1.18	0.63	39.3	1.07
	60	55	10	5.5	1	1.09	201.0	122.2	7.78	5500	300	62	34	2.97	29.8	2.09	1.18	0.63	52.3	1.19
	60	55	10	5.5	1	1.09	201.0	122.2	7.78	5500	450	76	34	3.64	29.8	2.54	1.18	0.63	61.8	1.22
	60	55	10	5.5	1	1.09	201.0	122.2	7.78	5500	600	84	34	4.20	29.8	2.81	1.18	0.63	69.6	1.20
R9_L1	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	5500	75	65	137	0.74	59.6	1.09	1.44	0.70	59.6	1.09
	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	5500	150	103	137	1.05	94.9	1.09	1.44	0.70	94.9	1.09
	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	5500	300	124	137	1.48	120.0	1.04	1.44	0.70	120.0	1.04
	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	5500	450	132	137	1.81	120.1	1.10	1.44	0.70	133.7	0.99
	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	5500	600	141	137	2.09	120.1	1.17	1.44	0.70	145.0	0.97
R9_L2	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	6000	75	62	116	0.80	57.3	1.09	1.44	0.70	57.3	1.09
	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	6000	150	92	116	1.14	87.4	1.05	1.44	0.70	87.4	1.05
	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	6000	300	109	116	1.61	102.0	1.07	1.44	0.70	106.0	1.03
	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	6000	450	120	116	1.97	102.0	1.17	1.44	0.70	118.9	1.01
	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	6000	600	131	116	2.27	102.0	1.29	1.44	0.70	128.9	1.02
R9_L3	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	6500	75	59	100	0.87	54.8	1.08	1.44	0.70	54.8	1.08
	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	6500	150	84	100	1.22	80.1	1.05	1.44	0.70	80.1	1.05
	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	6500	300	98	100	1.73	87.7	1.11	1.44	0.70	95.1	1.03
	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	6500	450	110	100	2.12	87.7	1.25	1.44	0.70	106.6	1.03
	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	6500	600	117	100	2.45	87.7	1.34	1.44	0.70	115.6	1.01
R9_L4	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	7000	75	56	87	0.93	52.3	1.07	1.44	0.70	52.3	1.07
	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	7000	150	76	87	1.31	72.9	1.04	1.44	0.70	72.9	1.04
	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	7000	300	89	87	1.86	76.2	1.16	1.44	0.70	86.0	1.03
	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	7000	450	102	87	2.28	76.2	1.33	1.44	0.70	96.4	1.06
	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	7000	600	110	87	2.63	76.2	1.45	1.44	0.70	104.6	1.05
R9_L5	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	7500	75	52	76	0.99	49.7	1.05	1.44	0.70	49.7	1.05
	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	7500	150	68	76	1.40	65.9	1.03	1.44	0.70	65.9	1.03
	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	7500	300	82	76	1.98	67.0	1.22	1.44	0.70	78.4	1.04
	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	7500	450	95	76	2.43	67.0	1.41	1.44	0.70	87.9	1.08
	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	7500	600	104	76	2.80	67.0	1.55	1.44	0.70	95.3	1.09
R9_L6	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	8000	75	49	68	1.05	47.2	1.03	1.44	0.70	47.2	1.03
	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	8000	150	62	68	1.49	59.3	1.04	1.44	0.70	59.3	1.04
	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	8000	300	76	68	2.11	59.4	1.28	1.44	0.70	71.9	1.05
	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	8000	450	89	68	2.58	59.4	1.49	1.44	0.70	80.6	1.10
	130	70	20	30	1.5	1.86	555.0	3388.2	12.12	8000	600	97	68	2.98	59.4	1.64	1.44	0.70	87.4	1.12
														Mean		1.329			Mean	1.054
														Sd. Dev.		0.363			Sd. Dev.	0.049
														Max		2.814			Max	1.225
														Min		0.953			Min	0.888

ANNEX E: RLC Column Data

Table E: F columns: (i) geometries, (ii) buckling stresses and ultimate strengths, (iii) ultimate strength predictions by current and proposed DSM design curves, and (iv) numerical-to-predicted ultimate strength ratios (mm and MPa)

Column	Geometry										SFEA		DSM Design							
	b_w	b_f	b_s	b_l	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
RLC1_L1	80	50	15	20	1	1.60	250.0	257.8	13.1	3500	75	62	135	0.75	59.5	1.04	1.50	0.72	59.5	1.04
	80	50	15	20	1	1.60	250.0	257.8	13.1	3500	150	100	135	1.05	94.3	1.06	1.50	0.72	94.3	1.06
	80	50	15	20	1	1.60	250.0	257.8	13.1	3500	300	123	135	1.49	118.4	1.04	1.50	0.72	118.4	1.04
	80	50	15	20	1	1.60	250.0	257.8	13.1	3500	450	132	135	1.82	118.5	1.11	1.50	0.72	130.8	1.01
	80	50	15	20	1	1.60	250.0	257.8	13.1	3500	600	139	135	2.11	118.5	1.17	1.50	0.72	140.6	0.99
RLC1_L2	80	50	15	20	1	1.60	250.0	257.8	13.1	4200	75	56	95	0.89	54.0	1.03	1.50	0.72	54.0	1.03
	80	50	15	20	1	1.60	250.0	257.8	13.1	4200	150	79	95	1.25	77.6	1.01	1.50	0.72	77.6	1.01
	80	50	15	20	1	1.60	250.0	257.8	13.1	4200	300	92	95	1.77	83.6	1.11	1.50	0.72	91.0	1.02
	80	50	15	20	1	1.60	250.0	257.8	13.1	4200	450	102	95	2.17	83.6	1.22	1.50	0.72	100.7	1.01
	80	50	15	20	1	1.60	250.0	257.8	13.1	4200	600	110	95	2.51	83.6	1.32	1.50	0.72	108.2	1.02
RLC1_L3	80	50	15	20	1	1.60	250.0	257.8	13.1	4900	75	49	71	1.03	48.3	1.01	1.50	0.72	48.3	1.01
	80	50	15	20	1	1.60	250.0	257.8	13.1	4900	150	63	71	1.45	62.1	1.01	1.50	0.72	62.1	1.01
	80	50	15	20	1	1.60	250.0	257.8	13.1	4900	300	74	71	2.05	62.4	1.19	1.50	0.72	73.1	1.02
	80	50	15	20	1	1.60	250.0	257.8	13.1	4900	450	84	71	2.51	62.4	1.35	1.50	0.72	80.9	1.04
	80	50	15	20	1	1.60	250.0	257.8	13.1	4900	600	92	71	2.90	62.4	1.47	1.50	0.72	87.0	1.05
RLC1_L4	80	50	15	20	1	1.60	250.0	257.8	13.1	5600	75	42	56	1.16	42.6	0.98	1.50	0.72	42.6	0.98
	80	50	15	20	1	1.60	250.0	257.8	13.1	5600	150	52	56	1.64	48.7	1.06	1.50	0.72	51.0	1.01
	80	50	15	20	1	1.60	250.0	257.8	13.1	5600	300	63	56	2.32	48.7	1.29	1.50	0.72	60.7	1.03
	80	50	15	20	1	1.60	250.0	257.8	13.1	5600	450	72	56	2.85	48.7	1.47	1.50	0.72	67.2	1.07
	80	50	15	20	1	1.60	250.0	257.8	13.1	5600	600	78	56	3.29	48.7	1.60	1.50	0.72	72.2	1.08
RLC1_L5	80	50	15	20	1	1.60	250.0	257.8	13.1	6300	75	36	45	1.29	37.2	0.96	1.50	0.72	37.2	0.96
	80	50	15	20	1	1.60	250.0	257.8	13.1	6300	150	44	45	1.83	39.3	1.12	1.50	0.72	43.4	1.01
	80	50	15	20	1	1.60	250.0	257.8	13.1	6300	300	54	45	2.59	39.3	1.39	1.50	0.72	51.6	1.05
	80	50	15	20	1	1.60	250.0	257.8	13.1	6300	450	62	45	3.17	39.3	1.58	1.50	0.72	57.2	1.08
	80	50	15	20	1	1.60	250.0	257.8	13.1	6300	600	66	45	3.66	39.3	1.69	1.50	0.72	61.4	1.08
RLC1_L6	80	50	15	20	1	1.60	250.0	257.8	13.1	7000	75	31	37	1.42	32.1	0.97	1.50	0.72	32.1	0.97
	80	50	15	20	1	1.60	250.0	257.8	13.1	7000	150	38	37	2.01	32.5	1.17	1.50	0.72	37.7	1.01
	80	50	15	20	1	1.60	250.0	257.8	13.1	7000	300	48	37	2.85	32.5	1.48	1.50	0.72	44.8	1.07
	80	50	15	20	1	1.60	250.0	257.8	13.1	7000	450	54	37	3.49	32.5	1.66	1.50	0.72	49.6	1.09
	80	50	15	20	1	1.60	250.0	257.8	13.1	7000	600	57	37	4.02	32.5	1.75	1.50	0.72	53.3	1.07
RLC2_L1	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	7000	75	63	135	0.75	59.4	1.06	1.41	0.69	59.4	1.06
	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	7000	150	99	135	1.05	94.2	1.05	1.41	0.69	94.2	1.05
	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	7000	300	125	135	1.49	118.3	1.05	1.41	0.69	118.3	1.05
	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	7000	450	139	135	1.83	118.3	1.18	1.41	0.69	132.9	1.05
	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	7000	600	145	135	2.11	118.3	1.23	1.41	0.69	144.7	1.00
RLC2_L2	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	7500	75	61	119	0.79	57.6	1.06	1.41	0.69	57.6	1.06
	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	7500	150	94	119	1.12	88.4	1.06	1.41	0.69	88.4	1.06
	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	7500	300	114	119	1.59	104.1	1.09	1.41	0.69	107.8	1.06
	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	7500	450	129	119	1.95	104.1	1.24	1.41	0.69	121.5	1.06
	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	7500	600	136	119	2.25	104.1	1.30	1.41	0.69	132.3	1.02
RLC2_L3	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	8000	75	59	105	0.84	55.7	1.06	1.41	0.69	55.7	1.06
	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	8000	150	86	105	1.19	82.7	1.05	1.41	0.69	82.7	1.05
	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	8000	300	105	105	1.69	92.5	1.14	1.41	0.69	99.2	1.06
	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	8000	450	119	105	2.07	92.5	1.28	1.41	0.69	111.8	1.06
	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	8000	600	128	105	2.39	92.5	1.39	1.41	0.69	121.7	1.05
RLC2_L4	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	8500	75	57	94	0.89	53.8	1.05	1.41	0.69	53.8	1.05
	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	8500	150	80	94	1.26	77.1	1.04	1.41	0.69	77.1	1.04
	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	8500	300	98	94	1.78	82.8	1.19	1.41	0.69	91.7	1.07
	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	8500	450	112	94	2.18	82.8	1.35	1.41	0.69	103.4	1.08
	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	8500	600	120	94	2.52	82.8	1.45	1.41	0.69	112.6	1.07
RLC2_L5	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	9000	75	54	85	0.94	51.9	1.05	1.41	0.69	51.9	1.05
	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	9000	150	74	85	1.33	71.7	1.03	1.41	0.69	71.7	1.03
	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	9000	300	92	85	1.88	74.6	1.24	1.41	0.69	85.3	1.08
	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	9000	450	104	85	2.30	74.6	1.40	1.41	0.69	96.1	1.09
	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	9000	600	111	85	2.65	74.6	1.48	1.41	0.69	104.6	1.06
RLC2_L6	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	9500	75	52	77	0.99	50.0	1.04	1.41	0.69	50.0	1.04
	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	9500	150	69	77	1.39	66.5	1.04	1.41	0.69	66.5	1.04
	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	9500	300	87	77	1.97	67.7	1.29	1.41	0.69	79.6	1.10
	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	9500	450	100	77	2.41	67.7	1.48	1.41	0.69	89.7	1.12
	200	105	12	15	2.3	1.90	1067.2	15010.8	11.7	9500	600	106	77	2.79	67.7	1.56	1.41	0.69	97.7	1.08
RLC3_L1	67	35	10	20	0.8	1.91	157.6	45.5	14.0	3000	75	58	106	0.84	55.8	1.04	1.55	0.73	55.8	1.04
	67	35	10	20	0.8	1.91	157.6	45.5	14.0	3000	150	84	106	1.19	83.0	1.02	1.55	0.73	83.0	1.02
	67	35	10	20	0.8	1.91	157.6	45.5	14.0	3000	300	99	106	1.68	93.1	1.07	1.55	0.73	98.1	1.01
	67	35	10	20	0.8	1.91	157.6	45.5	14.0	3000	450	107	106	2.06	93.1	1.15	1.55	0.73	107.5	1.00
	67	35	10	20	0.8	1.91	157.6	45.5	14.0	3000	600	113	106	2.38	93.1	1.22	1.55	0.73	114.7	0.99

Column	Geometry										SFEA		DSM Design							
	b_w	b_f	b_s	b_l	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
RLC3_L2	67	35	10	20	0.8	1.91	157.6	45.5	14.0	3500	75	51	80	0.97	50.6	1.01	1.55	0.73	50.6	1.01
	67	35	10	20	0.8	1.91	157.6	45.5	14.0	3500	150	68	80	1.37	68.2	0.99	1.55	0.73	68.2	0.99
	67	35	10	20	0.8	1.91	157.6	45.5	14.0	3500	300	79	80	1.94	69.8	1.13	1.55	0.73	78.5	1.01
	67	35	10	20	0.8	1.91	157.6	45.5	14.0	3500	450	87	80	2.38	69.8	1.24	1.55	0.73	86.0	1.01
	67	35	10	20	0.8	1.91	157.6	45.5	14.0	3500	600	93	80	2.75	69.8	1.33	1.55	0.73	91.8	1.01
RLC3_L3	67	35	10	20	0.8	1.91	157.6	45.5	14.0	4000	75	45	62	1.10	45.3	0.98	1.55	0.73	45.3	0.98
	67	35	10	20	0.8	1.91	157.6	45.5	14.0	4000	150	56	62	1.55	54.6	1.02	1.55	0.73	55.5	1.01
	67	35	10	20	0.8	1.91	157.6	45.5	14.0	4000	300	66	62	2.19	54.6	1.20	1.55	0.73	64.9	1.01
	67	35	10	20	0.8	1.91	157.6	45.5	14.0	4000	450	73	62	2.69	54.6	1.34	1.55	0.73	71.2	1.03
	67	35	10	20	0.8	1.91	157.6	45.5	14.0	4000	600	78	62	3.10	54.6	1.42	1.55	0.73	75.9	1.02
RLC3_L4	67	35	10	20	0.8	1.91	157.6	45.5	14.0	4500	75	39	50	1.22	40.2	0.96	1.55	0.73	40.2	0.96
	67	35	10	20	0.8	1.91	157.6	45.5	14.0	4500	150	47	50	1.72	44.2	1.07	1.55	0.73	47.1	1.00
	67	35	10	20	0.8	1.91	157.6	45.5	14.0	4500	300	56	50	2.44	44.2	1.28	1.55	0.73	55.1	1.02
	67	35	10	20	0.8	1.91	157.6	45.5	14.0	4500	450	62	50	2.99	44.2	1.41	1.55	0.73	60.4	1.03
	67	35	10	20	0.8	1.91	157.6	45.5	14.0	4500	600	66	50	3.45	44.2	1.48	1.55	0.73	64.5	1.02
RLC3_L5	67	35	10	20	0.8	1.91	157.6	45.5	14.0	5000	75	34	42	1.34	35.5	0.96	1.55	0.73	35.5	0.96
	67	35	10	20	0.8	1.91	157.6	45.5	14.0	5000	150	41	42	1.89	36.8	1.11	1.55	0.73	40.9	1.00
	67	35	10	20	0.8	1.91	157.6	45.5	14.0	5000	300	49	42	2.68	36.8	1.34	1.55	0.73	47.8	1.03
	67	35	10	20	0.8	1.91	157.6	45.5	14.0	5000	450	54	42	3.28	36.8	1.46	1.55	0.73	52.4	1.03
	67	35	10	20	0.8	1.91	157.6	45.5	14.0	5000	600	56	42	3.78	36.8	1.52	1.55	0.73	55.9	1.00
RLC3_L6	67	35	10	20	0.8	1.91	157.6	45.5	14.0	5500	75	30	36	1.45	31.1	0.96	1.55	0.73	31.1	0.96
	67	35	10	20	0.8	1.91	157.6	45.5	14.0	5500	150	36	36	2.05	31.2	1.16	1.55	0.73	36.0	1.00
	67	35	10	20	0.8	1.91	157.6	45.5	14.0	5500	300	43	36	2.90	31.2	1.39	1.55	0.73	42.1	1.03
	67	35	10	20	0.8	1.91	157.6	45.5	14.0	5500	450	47	36	3.55	31.2	1.49	1.55	0.73	46.2	1.01
	67	35	10	20	0.8	1.91	157.6	45.5	14.0	5500	600	48	36	4.10	31.2	1.52	1.55	0.73	49.3	0.97
RLC4_L1	150	110	23	20	2.4	1.36	1094.40	14054.2	8.3	5500	75	65	176	0.65	62.8	1.04	1.21	0.64	62.8	1.04
	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	5500	150	114	176	0.92	105.1	1.09	1.21	0.64	105.1	1.09
	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	5500	300	155	176	1.30	147.2	1.05	1.21	0.64	147.2	1.05
	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	5500	450	169	176	1.60	154.7	1.09	1.21	0.64	162.7	1.04
	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	5500	600	182	176	1.84	154.7	1.18	1.21	0.64	182.3	1.00
RLC4_L2	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	6300	75	62	137	0.74	59.6	1.04	1.21	0.64	59.6	1.04
	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	6300	150	101	137	1.05	94.8	1.07	1.21	0.64	94.8	1.07
	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	6300	300	127	137	1.48	119.8	1.06	1.21	0.64	119.8	1.06
	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	6300	450	141	137	1.81	119.9	1.18	1.21	0.64	139.5	1.01
	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	6300	600	157	137	2.09	119.9	1.31	1.21	0.64	156.3	1.00
RLC4_L3	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	7000	75	59	112	0.82	56.7	1.04	1.21	0.64	56.7	1.04
	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	7000	150	90	112	1.16	85.8	1.04	1.21	0.64	85.8	1.04
	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	7000	300	110	112	1.63	98.5	1.11	1.21	0.64	105.5	1.04
	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	7000	450	125	112	2.00	98.5	1.27	1.21	0.64	123.8	1.01
	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	7000	600	141	112	2.31	98.5	1.43	1.21	0.64	138.8	1.02
RLC4_L4	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	7800	75	55	92	0.90	53.3	1.04	1.21	0.64	53.3	1.04
	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	7800	150	78	92	1.28	75.7	1.03	1.21	0.64	75.7	1.03
	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	7800	300	95	92	1.81	80.6	1.18	1.21	0.64	93.4	1.02
	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	7800	450	112	92	2.21	80.6	1.39	1.21	0.64	109.7	1.02
	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	7800	600	128	92	2.56	80.6	1.59	1.21	0.64	122.9	1.04
RLC4_L5	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	8600	75	51	77	0.99	49.8	1.02	1.21	0.64	49.8	1.02
	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	8600	150	68	77	1.40	66.2	1.03	1.21	0.64	66.2	1.03
	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	8600	300	85	77	1.98	67.4	1.27	1.21	0.64	83.9	1.02
	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	8600	450	102	77	2.42	67.4	1.52	1.21	0.64	98.5	1.04
	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	8600	600	117	77	2.79	67.4	1.74	1.21	0.64	110.3	1.06
RLC4_L6	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	9500	75	43	64	1.08	46.0	0.94	1.21	0.64	46.0	0.94
	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	9500	150	63	64	1.53	56.3	1.12	1.21	0.64	57.2	1.11
	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	9500	300	78	64	2.16	56.3	1.38	1.21	0.64	75.2	1.03
	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	9500	450	94	64	2.65	56.3	1.67	1.21	0.64	88.3	1.06
	150	110	23	20	2.4	1.36	1094.4	14054.2	8.3	9500	600	100	64	3.06	56.3	1.78	1.21	0.64	99.0	1.01
RLC5_L1	110	100	20	15	2	1.10	760.00	5029.3	7.1	6000	75	55	92	0.90	53.2	1.03	1.14	0.62	53.2	1.03
	110	100	20	15	2	1.10	760.0	5029.3	7.1	6000	150	78	92	1.28	75.6	1.03	1.14	0.62	75.6	1.03
	110	100	20	15	2	1.10	760.0	5029.3	7.1	6000	300	96	92	1.81	80.3	1.20	1.14	0.62	94.5	1.02
	110	100	20	15	2	1.10	760.0	5029.3	7.1	6000	450	115	92	2.22	80.3	1.43	1.14	0.62	112.6	1.02
	110	100	20	15	2	1.10	760.0	5029.3	7.1	6000	600	133	92	2.56	80.3	1.66	1.14	0.62	127.5	1.05
RLC5_L2	110	100	20	15	2	1.10	760.0	5029.3	7.1	6500	75	51	79	0.97	50.4	1.02	1.14	0.62	50.4	1.02
	110	100	20	15	2	1.10	760.0	5029.3	7.1	6500	150	70	79	1.38	67.7	1.03	1.14	0.62	67.7	1.03
	110	100	20	15	2	1.10	760.0	5029.3	7.1	6500	300	88	79	1.95	69.2	1.27	1.14	0.62	86.9	1.01
	110	100	20	15	2	1.10	760.0	5029.3	7.1	6500	450	107	79	2.39	69.2	1.55	1.14	0.62	103.5	1.04
	110	100	20	15	2	1.10	760.0	5029.3	7.1	6500	600	125	79	2.76	69.2	1.80	1.14	0.62	117.2	1.07
RLC5_L3	110	100	20	15	2	1.10	760.0	5029.3	7.1	7000	75	48	69	1.04	47.5	1.01	1.14	0.62	47.5	1.01
	110	100	20	15	2	1.10	760.0	5029.3	7.1	7000	150	63	69	1.48	60.3	1.05	1.14	0.62	60.3	1.05
	110	100	20	15	2	1.10	760.0	5029.3	7.1	7000	300	82	69	2.09	60.4	1.35	1.14	0.62	80.4	1.02
	110	100	20	15	2	1.10	760.0	5029.3	7.1	7000	450	101	69	2.56	60.4	1.67	1.14	0.62	95.8	1.05
	110	100	20	15	2	1.10	760.0	5029.3	7.1	7000	600	117	69	2.95	60.4	1.94	1.14	0.62	108.5	1.08

Column	Geometry										SFEA		DSM Design							
	b_w	b_f	b_s	b_l	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
RLC5_L4	110	100	20	15	2	1.10	760.0	5029.3	7.1	7500	75	45	61	1.11	44.7	1.00	1.14	0.62	44.7	1.00
	110	100	20	15	2	1.10	760.0	5029.3	7.1	7500	150	58	61	1.57	53.3	1.08	1.14	0.62	55.5	1.04
	110	100	20	15	2	1.10	760.0	5029.3	7.1	7500	300	77	61	2.22	53.3	1.44	1.14	0.62	74.9	1.03
	110	100	20	15	2	1.10	760.0	5029.3	7.1	7500	450	95	61	2.72	53.3	1.79	1.14	0.62	89.2	1.07
	110	100	20	15	2	1.10	760.0	5029.3	7.1	7500	600	110	61	3.14	53.3	2.07	1.14	0.62	101.0	1.09
RLC5_L5	110	100	20	15	2	1.10	760.0	5029.3	7.1	8000	75	42	54	1.18	42.0	0.99	1.14	0.62	42.0	0.99
	110	100	20	15	2	1.10	760.0	5029.3	7.1	8000	150	53	54	1.67	47.4	1.12	1.14	0.62	51.9	1.03
	110	100	20	15	2	1.10	760.0	5029.3	7.1	8000	300	73	54	2.36	47.4	1.53	1.14	0.62	70.1	1.04
	110	100	20	15	2	1.10	760.0	5029.3	7.1	8000	450	91	54	2.89	47.4	1.91	1.14	0.62	83.5	1.08
	110	100	20	15	2	1.10	760.0	5029.3	7.1	8000	600	104	54	3.33	47.4	2.19	1.14	0.62	94.5	1.10
RLC5_L6	110	100	20	15	2	1.10	760.0	5029.3	7.1	8500	75	39	49	1.24	39.3	0.99	1.14	0.62	39.3	0.99
	110	100	20	15	2	1.10	760.0	5029.3	7.1	8500	150	50	49	1.76	42.5	1.17	1.14	0.62	48.8	1.02
	110	100	20	15	2	1.10	760.0	5029.3	7.1	8500	300	69	49	2.49	42.5	1.63	1.14	0.62	65.9	1.05
	110	100	20	15	2	1.10	760.0	5029.3	7.1	8500	450	86	49	3.05	42.5	2.02	1.14	0.62	78.5	1.09
	110	100	20	15	2	1.10	760.0	5029.3	7.1	8500	600	99	49	3.52	42.5	2.32	1.14	0.62	88.9	1.11
RLC6_L1	150	130	20	15	2.5	1.15	1200.00	17951.9	6.6	7500	75	56	93	0.90	53.6	1.04	1.11	0.61	53.6	1.04
	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	7500	150	79	93	1.27	76.6	1.03	1.11	0.61	76.6	1.03
	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	7500	300	99	93	1.79	82.0	1.20	1.11	0.61	96.1	1.03
	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	7500	450	120	93	2.19	82.0	1.46	1.11	0.61	115.2	1.04
	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	7500	600	141	93	2.53	82.0	1.72	1.11	0.61	131.0	1.07
RLC6_L2	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	8000	75	53	83	0.95	51.4	1.03	1.11	0.61	51.4	1.03
	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	8000	150	73	83	1.34	70.4	1.03	1.11	0.61	70.4	1.03
	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	8000	300	92	83	1.90	72.8	1.27	1.11	0.61	90.0	1.03
	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	8000	450	114	83	2.33	72.8	1.57	1.11	0.61	107.9	1.06
	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	8000	600	134	83	2.69	72.8	1.84	1.11	0.61	122.7	1.09
RLC6_L3	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	8500	75	50	74	1.00	49.2	1.02	1.11	0.61	49.2	1.02
	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	8500	150	67	74	1.42	64.5	1.04	1.11	0.61	64.5	1.04
	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	8500	300	87	74	2.01	65.2	1.34	1.11	0.61	84.7	1.03
	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	8500	450	109	74	2.46	65.2	1.68	1.11	0.61	101.5	1.08
	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	8500	600	128	74	2.84	65.2	1.96	1.11	0.61	115.4	1.11
RLC6_L4	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	9000	75	48	67	1.06	46.9	1.01	1.11	0.61	46.9	1.01
	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	9000	150	62	67	1.50	58.8	1.06	1.11	0.61	58.8	1.06
	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	9000	300	83	67	2.12	58.8	1.42	1.11	0.61	79.9	1.04
	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	9000	450	105	67	2.59	58.8	1.78	1.11	0.61	95.8	1.09
	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	9000	600	122	67	2.99	58.8	2.08	1.11	0.61	108.9	1.12
RLC6_L5	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	9500	75	45	61	1.11	44.7	1.00	1.11	0.61	44.7	1.00
	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	9500	150	58	61	1.57	53.3	1.09	1.11	0.61	55.6	1.05
	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	9500	300	80	61	2.22	53.3	1.50	1.11	0.61	75.7	1.05
	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	9500	450	101	61	2.72	53.3	1.89	1.11	0.61	90.8	1.11
	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	9500	600	117	61	3.14	53.3	2.19	1.11	0.61	103.2	1.13
RLC6_L6	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	10000	75	43	55	1.16	42.6	1.00	1.11	0.61	42.6	1.00
	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	10000	150	55	55	1.64	48.6	1.13	1.11	0.61	52.8	1.04
	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	10000	300	77	55	2.33	48.6	1.58	1.11	0.61	72.0	1.07
	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	10000	450	97	55	2.85	48.6	1.99	1.11	0.61	86.3	1.12
	150	130	20	15	2.5	1.15	1200.0	17951.9	6.6	10000	600	112	55	3.29	48.6	2.30	1.11	0.61	98.1	1.14
RLC7_L1	120	60	20	30	1.5	2.00	510.00	1534.4	14.5	4000	75	66	199	0.61	64.1	1.03	1.58	0.74	64.1	1.03
	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	4000	150	113	199	0.87	109.4	1.04	1.58	0.74	109.4	1.04
	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	4000	300	167	199	1.23	159.6	1.05	1.58	0.74	159.6	1.05
	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	4000	450	180	199	1.50	174.5	1.03	1.58	0.74	174.8	1.03
	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	4000	600	184	199	1.74	174.5	1.05	1.58	0.74	185.7	0.99
RLC7_L2	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	4500	75	64	159	0.69	61.6	1.04	1.58	0.74	61.6	1.04
	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	4500	150	106	159	0.97	101.0	1.05	1.58	0.74	101.0	1.05
	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	4500	300	139	159	1.37	136.1	1.02	1.58	0.74	136.1	1.02
	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	4500	450	148	159	1.68	139.3	1.06	1.58	0.74	146.3	1.01
	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	4500	600	152	159	1.94	139.3	1.09	1.58	0.74	155.4	0.98
RLC7_L3	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	5000	75	61	130	0.76	58.9	1.04	1.58	0.74	58.9	1.04
	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	5000	150	97	130	1.07	92.6	1.05	1.58	0.74	92.6	1.05
	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	5000	300	118	130	1.52	114.0	1.03	1.58	0.74	114.7	1.03
	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	5000	450	125	130	1.86	114.0	1.10	1.58	0.74	124.9	1.00
	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	5000	600	130	130	2.15	114.0	1.14	1.58	0.74	132.6	0.98
RLC7_L4	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	5500	75	58	109	0.83	56.2	1.04	1.58	0.74	56.2	1.04
	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	5500	150	86	109	1.17	84.2	1.02	1.58	0.74	84.2	1.02
	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	5500	300	101	109	1.66	95.3	1.06	1.58	0.74	99.5	1.02
	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	5500	450	108	109	2.03	95.3	1.14	1.58	0.74	108.3	1.00
	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	5500	600	114	109	2.35	95.3	1.19	1.58	0.74	115.1	0.99
RLC7_L5	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	6000	75	55	92	0.90	53.4	1.03	1.58	0.74	53.4	1.03
	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	6000	150	76	92	1.27	76.0	1.00	1.58	0.74	76.0	1.00
	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	6000	300	89	92	1.80	81.0	1.09	1.58	0.74	87.5	1.01
	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	6000	450	96	92	2.21	81.0	1.18	1.58	0.74	95.3	1.00
	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	6000	600	101	92	2.55	81.0	1.24	1.58	0.74	101.2	0.99

Column	Geometry										SFEA		DSM Design							
	b_w	b_f	b_s	b_l	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
RLC7_L6	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	6500	75	52	80	0.97	50.6	1.02	1.58	0.74	50.6	1.02
	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	6500	150	68	80	1.37	68.2	0.99	1.58	0.74	68.2	0.99
	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	6500	300	79	80	1.94	69.9	1.13	1.58	0.74	77.9	1.01
	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	6500	450	85	80	2.38	69.9	1.22	1.58	0.74	84.8	1.01
	120	60	20	30	1.5	2.00	510.0	1534.4	14.5	6500	600	90	80	2.74	69.9	1.29	1.58	0.74	90.1	1.00
RLC8_L1	60	55	10	5.5	1	1.09	201.00	96.8	6.7	3000	75	57	100	0.87	54.8	1.03	1.11	0.61	54.8	1.03
	60	55	10	5.5	1	1.09	201.0	96.8	6.7	3000	150	82	100	1.22	80.2	1.03	1.11	0.61	80.2	1.03
	60	55	10	5.5	1	1.09	201.0	96.8	6.7	3000	300	103	100	1.73	87.9	1.17	1.11	0.61	99.8	1.03
	60	55	10	5.5	1	1.09	201.0	96.8	6.7	3000	450	123	100	2.12	87.9	1.40	1.11	0.61	119.4	1.03
	60	55	10	5.5	1	1.09	201.0	96.8	6.7	3000	600	144	100	2.45	87.9	1.63	1.11	0.61	135.7	1.06
RLC8_L2	60	55	10	5.5	1	1.09	201.0	96.8	6.7	3500	75	50	75	1.00	49.4	1.02	1.11	0.61	49.4	1.02
	60	55	10	5.5	1	1.09	201.0	96.8	6.7	3500	150	68	75	1.41	65.1	1.04	1.11	0.61	65.1	1.04
	60	55	10	5.5	1	1.09	201.0	96.8	6.7	3500	300	87	75	2.00	66.0	1.33	1.11	0.61	85.1	1.03
	60	55	10	5.5	1	1.09	201.0	96.8	6.7	3500	450	109	75	2.45	66.0	1.65	1.11	0.61	101.9	1.07
	60	55	10	5.5	1	1.09	201.0	96.8	6.7	3500	600	127	75	2.82	66.0	1.93	1.11	0.61	115.7	1.10
RLC8_L3	60	55	10	5.5	1	1.09	201.0	96.8	6.7	4000	75	44	59	1.13	44.0	1.00	1.11	0.61	44.0	1.00
	60	55	10	5.5	1	1.09	201.0	96.8	6.7	4000	150	57	59	1.60	51.7	1.10	1.11	0.61	54.6	1.04
	60	55	10	5.5	1	1.09	201.0	96.8	6.7	4000	300	78	59	2.26	51.7	1.51	1.11	0.61	74.3	1.05
	60	55	10	5.5	1	1.09	201.0	96.8	6.7	4000	450	98	59	2.76	51.7	1.91	1.11	0.61	88.9	1.11
	60	55	10	5.5	1	1.09	201.0	96.8	6.7	4000	600	114	59	3.19	51.7	2.21	1.11	0.61	101.0	1.13
RLC8_L4	60	55	10	5.5	1	1.09	201.0	96.8	6.7	4500	75	38	48	1.25	38.8	0.99	1.11	0.61	38.8	0.99
	60	55	10	5.5	1	1.09	201.0	96.8	6.7	4500	150	50	48	1.77	41.8	1.19	1.11	0.61	48.5	1.03
	60	55	10	5.5	1	1.09	201.0	96.8	6.7	4500	300	72	48	2.51	41.8	1.71	1.11	0.61	66.0	1.08
	60	55	10	5.5	1	1.09	201.0	96.8	6.7	4500	450	90	48	3.07	41.8	2.14	1.11	0.61	79.0	1.13
	60	55	10	5.5	1	1.09	201.0	96.8	6.7	4500	600	102	48	3.55	41.8	2.45	1.11	0.61	89.7	1.14
RLC8_L5	60	55	10	5.5	1	1.09	201.0	96.8	6.7	5000	75	34	40	1.38	33.9	1.00	1.11	0.61	33.9	1.00
	60	55	10	5.5	1	1.09	201.0	96.8	6.7	5000	150	45	40	1.95	34.7	1.30	1.11	0.61	43.7	1.03
	60	55	10	5.5	1	1.09	201.0	96.8	6.7	5000	300	66	40	2.75	34.7	1.91	1.11	0.61	59.5	1.11
	60	55	10	5.5	1	1.09	201.0	96.8	6.7	5000	450	82	40	3.37	34.7	2.35	1.11	0.61	71.2	1.15
	60	55	10	5.5	1	1.09	201.0	96.8	6.7	5000	600	92	40	3.90	34.7	2.64	1.11	0.61	80.9	1.13
RLC8_L6	60	55	10	5.5	1	1.09	201.0	96.8	6.7	5500	75	30	34	1.50	29.4	1.04	1.11	0.61	29.4	1.04
	60	55	10	5.5	1	1.09	201.0	96.8	6.7	5500	150	41	34	2.11	29.4	1.41	1.11	0.61	39.9	1.04
	60	55	10	5.5	1	1.09	201.0	96.8	6.7	5500	300	61	34	2.99	29.4	2.08	1.11	0.61	54.3	1.13
	60	55	10	5.5	1	1.09	201.0	96.8	6.7	5500	450	74	34	3.66	29.4	2.53	1.11	0.61	65.0	1.14
	60	55	10	5.5	1	1.09	201.0	96.8	6.7	5500	600	82	34	4.23	29.4	2.79	1.11	0.61	73.8	1.11
RLC9_L1	130	70	20	30	1.5	1.86	310.00	811.0	15.7	5500	75	59	124	0.78	58.2	1.01	1.65	0.76	58.2	1.01
	130	70	20	30	1.5	1.86	310.0	811.0	15.7	5500	150	92	124	1.10	90.2	1.01	1.65	0.76	90.2	1.01
	130	70	20	30	1.5	1.86	310.0	811.0	15.7	5500	300	111	124	1.56	108.3	1.03	1.65	0.76	109.9	1.01
	130	70	20	30	1.5	1.86	310.0	811.0	15.7	5500	450	120	124	1.91	108.3	1.10	1.65	0.76	118.0	1.01
	130	70	20	30	1.5	1.86	310.0	811.0	15.7	5500	600	124	124	2.20	108.3	1.15	1.65	0.76	124.1	1.00
RLC9_L2	130	70	20	30	1.5	1.86	310.0	811.0	15.7	6000	75	58	105	0.85	55.6	1.04	1.65	0.76	55.6	1.04
	130	70	20	30	1.5	1.86	310.0	811.0	15.7	6000	150	84	105	1.20	82.4	1.02	1.65	0.76	82.4	1.02
	130	70	20	30	1.5	1.86	310.0	811.0	15.7	6000	300	99	105	1.69	91.8	1.08	1.65	0.76	95.9	1.03
	130	70	20	30	1.5	1.86	310.0	811.0	15.7	6000	450	108	105	2.07	91.8	1.17	1.65	0.76	102.9	1.05
	130	70	20	30	1.5	1.86	310.0	811.0	15.7	6000	600	114	105	2.39	91.8	1.24	1.65	0.76	108.2	1.05
RLC9_L3	130	70	20	30	1.5	1.86	310.0	811.0	15.7	6500	75	55	90	0.91	52.9	1.03	1.65	0.76	52.9	1.03
	130	70	20	30	1.5	1.86	310.0	811.0	15.7	6500	150	75	90	1.29	74.7	1.01	1.65	0.76	74.7	1.01
	130	70	20	30	1.5	1.86	310.0	811.0	15.7	6500	300	88	90	1.83	79.0	1.12	1.65	0.76	84.6	1.04
	130	70	20	30	1.5	1.86	310.0	811.0	15.7	6500	450	97	90	2.24	79.0	1.22	1.65	0.76	90.9	1.06
	130	70	20	30	1.5	1.86	310.0	811.0	15.7	6500	600	103	90	2.58	79.0	1.31	1.65	0.76	95.6	1.08
RLC9_L4	130	70	20	30	1.5	1.86	310.0	811.0	15.7	7000	75	51	78	0.98	50.2	1.02	1.65	0.76	50.2	1.02
	130	70	20	30	1.5	1.86	310.0	811.0	15.7	7000	150	67	78	1.38	67.3	1.00	1.65	0.76	67.3	1.00
	130	70	20	30	1.5	1.86	310.0	811.0	15.7	7000	300	79	78	1.96	68.7	1.15	1.65	0.76	75.5	1.05
	130	70	20	30	1.5	1.86	310.0	811.0	15.7	7000	450	88	78	2.40	68.7	1.28	1.65	0.76	81.0	1.09
	130	70	20	30	1.5	1.86	310.0	811.0	15.7	7000	600	94	78	2.77	68.7	1.37	1.65	0.76	85.2	1.11
RLC9_L5	130	70	20	30	1.5	1.86	310.0	811.0	15.7	7500	75	48	69	1.04	47.6	1.00	1.65	0.76	47.6	1.00
	130	70	20	30	1.5	1.86	310.0	811.0	15.7	7500	150	61	69	1.48	60.3	1.01	1.65	0.76	60.3	1.01
	130	70	20	30	1.5	1.86	310.0	811.0	15.7	7500	300	72	69	2.09	60.5	1.19	1.65	0.76	67.9	1.06
	130	70	20	30	1.5	1.86	310.0	811.0	15.7	7500	450	81	69	2.55	60.5	1.34	1.65	0.76	72.9	1.11
	130	70	20	30	1.5	1.86	310.0	811.0	15.7	7500	600	87	69	2.95	60.5	1.43	1.65	0.76	76.7	1.13
RLC9_L6	130	70	20	30	1.5	1.86	310.0	811.0	15.7	8000	75	44	61	1.11	44.9	0.99	1.65	0.76	44.9	0.99
	130	70	20	30	1.5	1.86	310.0	811.0	15.7	8000	150	56	61	1.57	53.7	1.04	1.65	0.76	54.5	1.02
	130	70	20	30	1.5	1.86	310.0	811.0	15.7	8000	300	66	61	2.21	53.7	1.24	1.65	0.76	61.6	1.08
	130	70	20	30	1.5	1.86	310.0	811.0	15.7	8000	450	75	61	2.71	53.7	1.39	1.65	0.76	66.1	1.13
	130	70	20	30	1.5	1.86	310.0	811.0	15.7	8000	600	80	61	3.13	53.7	1.48	1.65	0.76	69.5	1.14
														Mean		1.290			Mean	1.040
														Sd. Dev.		0.347			Sd. Dev.	0.039
														Max		2.791			Max	1.147
														Min		0.939			Min	0.939

ANNEX F: WSC Column Data

Table F: F columns: (i) geometries, (ii) buckling stresses and ultimate strengths, (iii) ultimate strength predictions by current and proposed DSM design curves, and (iv) numerical-to-predicted ultimate strength ratios (mm and MPa)

Column	Geometry									SFEA		DSM Design							
	b_w	b_f	b_s	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
WSC1_L1	170	130	12	3.5	1.31	1618.0	18949.9	5.8	6000	75	65	155	0.70	61.3	1.06	1.06	0.60	61.3	1.06
	170	130	12	3.5	1.31	1618.0	18949.9	5.8	6000	150	109	155	0.98	100.1	1.09	1.06	0.60	100.1	1.09
	170	130	12	3.5	1.31	1618.0	18949.9	5.8	6000	300	141	155	1.39	133.5	1.06	1.06	0.60	133.5	1.06
	170	130	12	3.5	1.31	1618.0	18949.9	5.8	6000	450	166	155	1.70	136.0	1.22	1.06	0.60	153.4	1.08
	170	130	12	3.5	1.31	1618.0	18949.9	5.8	6000	600	185	155	1.97	136.0	1.36	1.06	0.60	175.6	1.06
WSC1_L2	170	130	12	3.5	1.31	1618.0	18949.9	5.8	6500	75	63	135	0.75	59.4	1.07	1.06	0.60	59.4	1.07
	170	130	12	3.5	1.31	1618.0	18949.9	5.8	6500	150	101	135	1.05	94.2	1.08	1.06	0.60	94.2	1.08
	170	130	12	3.5	1.31	1618.0	18949.9	5.8	6500	300	129	135	1.49	118.3	1.09	1.06	0.60	118.3	1.09
	170	130	12	3.5	1.31	1618.0	18949.9	5.8	6500	450	150	135	1.83	118.3	1.27	1.06	0.60	142.5	1.05
	170	130	12	3.5	1.31	1618.0	18949.9	5.8	6500	600	174	135	2.11	118.3	1.47	1.06	0.60	163.1	1.07
WSC1_L3	170	130	12	3.5	1.31	1618.0	18949.9	5.8	7000	75	62	119	0.79	57.6	1.07	1.06	0.60	57.6	1.07
	170	130	12	3.5	1.31	1618.0	18949.9	5.8	7000	150	94	119	1.12	88.4	1.06	1.06	0.60	88.4	1.06
	170	130	12	3.5	1.31	1618.0	18949.9	5.8	7000	300	118	119	1.59	104.2	1.13	1.06	0.60	110.1	1.07
	170	130	12	3.5	1.31	1618.0	18949.9	5.8	7000	450	141	119	1.95	104.2	1.36	1.06	0.60	133.2	1.06
	170	130	12	3.5	1.31	1618.0	18949.9	5.8	7000	600	165	119	2.25	104.2	1.59	1.06	0.60	152.5	1.08
WSC1_L4	170	130	12	3.5	1.31	1618.0	18949.9	5.8	8000	75	57	95	0.89	53.9	1.06	1.06	0.60	53.9	1.06
	170	130	12	3.5	1.31	1618.0	18949.9	5.8	8000	150	81	95	1.26	77.4	1.04	1.06	0.60	77.4	1.04
	170	130	12	3.5	1.31	1618.0	18949.9	5.8	8000	300	104	95	1.78	83.2	1.24	1.06	0.60	97.7	1.06
	170	130	12	3.5	1.31	1618.0	18949.9	5.8	8000	450	128	95	2.18	83.2	1.54	1.06	0.60	118.2	1.08
	170	130	12	3.5	1.31	1618.0	18949.9	5.8	8000	600	150	95	2.51	83.2	1.80	1.06	0.60	135.3	1.11
WSC1_L5	170	130	12	3.5	1.31	1618.0	18949.9	5.8	9000	75	53	78	0.98	50.2	1.05	1.06	0.60	50.2	1.05
	170	130	12	3.5	1.31	1618.0	18949.9	5.8	9000	150	71	78	1.38	67.3	1.05	1.06	0.60	67.3	1.05
	170	130	12	3.5	1.31	1618.0	18949.9	5.8	9000	300	94	78	1.96	68.7	1.37	1.06	0.60	88.2	1.07
	170	130	12	3.5	1.31	1618.0	18949.9	5.8	9000	450	117	78	2.40	68.7	1.71	1.06	0.60	106.8	1.10
	170	130	12	3.5	1.31	1618.0	18949.9	5.8	9000	600	136	78	2.77	68.7	1.98	1.06	0.60	122.2	1.11
WSC1_L6	170	130	12	3.5	1.31	1618.0	18949.9	5.8	9500	75	50	72	1.02	48.5	1.04	1.06	0.60	48.5	1.04
	170	130	12	3.5	1.31	1618.0	18949.9	5.8	9500	150	67	72	1.44	62.6	1.06	1.06	0.60	62.6	1.06
	170	130	12	3.5	1.31	1618.0	18949.9	5.8	9500	300	90	72	2.04	63.0	1.43	1.06	0.60	84.3	1.07
	170	130	12	3.5	1.31	1618.0	18949.9	5.8	9500	450	113	72	2.50	63.0	1.79	1.06	0.60	102.0	1.10
	170	130	12	3.5	1.31	1618.0	18949.9	5.8	9500	600	130	72	2.89	63.0	2.06	1.06	0.60	116.8	1.11
WSC2_L1	150	110	10	2.4	1.36	955.9	6161.6	7.1	7000	75	56	90	0.91	52.9	1.05	1.14	0.62	52.9	1.05
	150	110	10	2.4	1.36	955.9	6161.6	7.1	7000	150	77	90	1.29	74.5	1.04	1.14	0.62	74.5	1.04
	150	110	10	2.4	1.36	955.9	6161.6	7.1	7000	300	100	90	1.83	78.7	1.27	1.14	0.62	93.5	1.07
	150	110	10	2.4	1.36	955.9	6161.6	7.1	7000	450	124	90	2.24	78.7	1.57	1.14	0.62	111.4	1.11
	150	110	10	2.4	1.36	955.9	6161.6	7.1	7000	600	144	90	2.59	78.7	1.82	1.14	0.62	126.1	1.14
WSC2_L2	150	110	10	2.4	1.36	955.9	6161.6	7.1	7500	75	53	80	0.97	50.6	1.04	1.14	0.62	50.6	1.04
	150	110	10	2.4	1.36	955.9	6161.6	7.1	7500	150	71	80	1.37	68.2	1.04	1.14	0.62	68.2	1.04
	150	110	10	2.4	1.36	955.9	6161.6	7.1	7500	300	94	80	1.94	69.9	1.35	1.14	0.62	87.3	1.08
	150	110	10	2.4	1.36	955.9	6161.6	7.1	7500	450	117	80	2.38	69.9	1.68	1.14	0.62	104.1	1.13
	150	110	10	2.4	1.36	955.9	6161.6	7.1	7500	600	136	80	2.74	69.9	1.94	1.14	0.62	117.8	1.15
WSC2_L3	150	110	10	2.4	1.36	955.9	6161.6	7.1	8000	75	50	71	1.03	48.3	1.03	1.14	0.62	48.3	1.03
	150	110	10	2.4	1.36	955.9	6161.6	7.1	8000	150	66	71	1.45	62.2	1.06	1.14	0.62	62.2	1.06
	150	110	10	2.4	1.36	955.9	6161.6	7.1	8000	300	90	71	2.05	62.5	1.43	1.14	0.62	82.0	1.09
	150	110	10	2.4	1.36	955.9	6161.6	7.1	8000	450	112	71	2.51	62.5	1.78	1.14	0.62	97.7	1.14
	150	110	10	2.4	1.36	955.9	6161.6	7.1	8000	600	128	71	2.90	62.5	2.04	1.14	0.62	110.7	1.16
WSC2_L4	150	110	10	2.4	1.36	955.9	6161.6	7.1	8500	75	47	64	1.08	46.1	1.02	1.14	0.62	46.1	1.02
	150	110	10	2.4	1.36	955.9	6161.6	7.1	8500	150	62	64	1.53	56.5	1.09	1.14	0.62	57.4	1.07
	150	110	10	2.4	1.36	955.9	6161.6	7.1	8500	300	86	64	2.16	56.5	1.52	1.14	0.62	77.4	1.11
	150	110	10	2.4	1.36	955.9	6161.6	7.1	8500	450	106	64	2.64	56.5	1.88	1.14	0.62	92.2	1.15
	150	110	10	2.4	1.36	955.9	6161.6	7.1	8500	600	121	64	3.05	56.5	2.13	1.14	0.62	104.4	1.15
WSC2_L5	150	110	10	2.4	1.36	955.9	6161.6	7.1	9000	75	44	59	1.13	43.9	1.01	1.14	0.62	43.9	1.01
	150	110	10	2.4	1.36	955.9	6161.6	7.1	9000	150	58	59	1.60	51.4	1.13	1.14	0.62	54.3	1.07
	150	110	10	2.4	1.36	955.9	6161.6	7.1	9000	300	82	59	2.26	51.4	1.60	1.14	0.62	73.3	1.12
	150	110	10	2.4	1.36	955.9	6161.6	7.1	9000	450	101	59	2.77	51.4	1.97	1.14	0.62	87.4	1.16
	150	110	10	2.4	1.36	955.9	6161.6	7.1	9000	600	113	59	3.20	51.4	2.21	1.14	0.62	98.9	1.15
WSC2_L6	150	110	10	2.4	1.36	955.9	6161.6	7.1	9500	75	42	54	1.18	41.8	1.01	1.14	0.62	41.8	1.01
	150	110	10	2.4	1.36	955.9	6161.6	7.1	9500	150	55	54	1.67	47.0	1.17	1.14	0.62	51.7	1.07
	150	110	10	2.4	1.36	955.9	6161.6	7.1	9500	300	79	54	2.37	47.0	1.67	1.14	0.62	69.7	1.13
	150	110	10	2.4	1.36	955.9	6161.6	7.1	9500	450	96	54	2.90	47.0	2.04	1.14	0.62	83.1	1.16
	150	110	10	2.4	1.36	955.9	6161.6	7.1	9500	600	107	54	3.35	47.0	2.27	1.14	0.62	94.1	1.13
WSC3_L1	120	90	10	2.4	1.33	787.9	2306.3	6.1	5500	75	58	101	0.86	55.0	1.06	1.07	0.60	55.0	1.06
	120	90	10	2.4	1.33	787.9	2306.3	6.1	5500	150	84	101	1.22	80.6	1.05	1.07	0.60	80.6	1.05
	120	90	10	2.4	1.33	787.9	2306.3	6.1	5500	300	107	101	1.72	88.7	1.20	1.07	0.60	100.9	1.06
	120	90	10	2.4	1.33	787.9	2306.3	6.1	5500	450	130	101	2.11	88.7	1.47	1.07	0.60	121.7	1.07
	120	90	10	2.4	1.33	787.9	2306.3	6.1	5500	600	152	101	2.44	88.7	1.71	1.07	0.60	139.0	1.09

Column	Geometry									SFEA		DSM Design							
	b_w	b_f	b_s	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
WSC3_L2	120	90	10	2.4	1.33	787.9	2306.3	6.1	6000	75	55	87	0.93	52.4	1.05	1.07	0.60	52.4	1.05
	120	90	10	2.4	1.33	787.9	2306.3	6.1	6000	150	76	87	1.31	73.2	1.04	1.07	0.60	73.2	1.04
	120	90	10	2.4	1.33	787.9	2306.3	6.1	6000	300	99	87	1.85	76.7	1.29	1.07	0.60	93.3	1.06
	120	90	10	2.4	1.33	787.9	2306.3	6.1	6000	450	122	87	2.27	76.7	1.59	1.07	0.60	112.6	1.08
	120	90	10	2.4	1.33	787.9	2306.3	6.1	6000	600	141	87	2.62	76.7	1.84	1.07	0.60	128.6	1.10
WSC3_L3	120	90	10	2.4	1.33	787.9	2306.3	6.1	7000	75	49	68	1.05	47.3	1.03	1.07	0.60	47.3	1.03
	120	90	10	2.4	1.33	787.9	2306.3	6.1	7000	150	64	68	1.48	59.8	1.07	1.07	0.60	59.8	1.07
	120	90	10	2.4	1.33	787.9	2306.3	6.1	7000	300	87	68	2.10	59.9	1.46	1.07	0.60	81.7	1.07
	120	90	10	2.4	1.33	787.9	2306.3	6.1	7000	450	108	68	2.57	59.9	1.80	1.07	0.60	98.5	1.09
	120	90	10	2.4	1.33	787.9	2306.3	6.1	7000	600	123	68	2.97	59.9	2.05	1.07	0.60	112.6	1.09
WSC3_L4	120	90	10	2.4	1.33	787.9	2306.3	6.1	8000	75	43	56	1.16	42.7	1.02	1.07	0.60	42.7	1.02
	120	90	10	2.4	1.33	787.9	2306.3	6.1	8000	150	56	56	1.64	48.8	1.15	1.07	0.60	53.1	1.06
	120	90	10	2.4	1.33	787.9	2306.3	6.1	8000	300	79	56	2.32	48.8	1.61	1.07	0.60	73.2	1.08
	120	90	10	2.4	1.33	787.9	2306.3	6.1	8000	450	95	56	2.84	48.8	1.95	1.07	0.60	88.3	1.08
	120	90	10	2.4	1.33	787.9	2306.3	6.1	8000	600	106	56	3.28	48.8	2.16	1.07	0.60	100.9	1.05
WSC3_L5	120	90	10	2.4	1.33	787.9	2306.3	6.1	9000	75	39	47	1.26	38.5	1.01	1.07	0.60	38.5	1.01
	120	90	10	2.4	1.33	787.9	2306.3	6.1	9000	150	51	47	1.79	41.2	1.24	1.07	0.60	48.5	1.05
	120	90	10	2.4	1.33	787.9	2306.3	6.1	9000	300	71	47	2.53	41.2	1.73	1.07	0.60	66.8	1.06
	120	90	10	2.4	1.33	787.9	2306.3	6.1	9000	450	84	47	3.09	41.2	2.03	1.07	0.60	80.7	1.04
	120	90	10	2.4	1.33	787.9	2306.3	6.1	9000	600	90	47	3.57	41.2	2.19	1.07	0.60	92.1	0.98
WSC3_L6	120	90	10	2.4	1.33	787.9	2306.3	6.1	9500	75	37	44	1.31	36.5	1.01	1.07	0.60	36.5	1.01
	120	90	10	2.4	1.33	787.9	2306.3	6.1	9500	150	49	44	1.85	38.3	1.28	1.07	0.60	46.6	1.05
	120	90	10	2.4	1.33	787.9	2306.3	6.1	9500	300	68	44	2.62	38.3	1.77	1.07	0.60	64.2	1.05
	120	90	10	2.4	1.33	787.9	2306.3	6.1	9500	450	78	44	3.21	38.3	2.05	1.07	0.60	77.5	1.01
	120	90	10	2.4	1.33	787.9	2306.3	6.1	9500	600	84	44	3.71	38.3	2.19	1.07	0.60	88.5	0.95
WSC4_L1	160	100	13	2.4	1.60	946.3	6139.3	8.7	6500	75	60	113	0.81	56.9	1.06	1.23	0.64	56.9	1.06
	160	100	13	2.4	1.60	946.3	6139.3	8.7	6500	150	91	113	1.15	86.2	1.05	1.23	0.64	86.2	1.05
	160	100	13	2.4	1.60	946.3	6139.3	8.7	6500	300	112	113	1.63	99.5	1.13	1.23	0.64	105.9	1.06
	160	100	13	2.4	1.60	946.3	6139.3	8.7	6500	450	132	113	1.99	99.5	1.33	1.23	0.64	123.9	1.07
	160	100	13	2.4	1.60	946.3	6139.3	8.7	6500	600	151	113	2.30	99.5	1.51	1.23	0.64	138.4	1.09
WSC4_L2	160	100	13	2.4	1.60	946.3	6139.3	8.7	7000	75	58	100	0.87	54.7	1.06	1.23	0.64	54.7	1.06
	160	100	13	2.4	1.60	946.3	6139.3	8.7	7000	150	83	100	1.23	79.8	1.04	1.23	0.64	79.8	1.04
	160	100	13	2.4	1.60	946.3	6139.3	8.7	7000	300	104	100	1.74	87.3	1.19	1.23	0.64	97.8	1.06
	160	100	13	2.4	1.60	946.3	6139.3	8.7	7000	450	124	100	2.13	87.3	1.42	1.23	0.64	114.3	1.09
	160	100	13	2.4	1.60	946.3	6139.3	8.7	7000	600	141	100	2.46	87.3	1.61	1.23	0.64	127.7	1.10
WSC4_L3	160	100	13	2.4	1.60	946.3	6139.3	8.7	8000	75	52	79	0.97	50.4	1.04	1.23	0.64	50.4	1.04
	160	100	13	2.4	1.60	946.3	6139.3	8.7	8000	150	71	79	1.38	67.8	1.04	1.23	0.64	67.8	1.04
	160	100	13	2.4	1.60	946.3	6139.3	8.7	8000	300	92	79	1.95	69.3	1.32	1.23	0.64	84.8	1.08
	160	100	13	2.4	1.60	946.3	6139.3	8.7	8000	450	110	79	2.39	69.3	1.59	1.23	0.64	99.2	1.11
	160	100	13	2.4	1.60	946.3	6139.3	8.7	8000	600	124	79	2.76	69.3	1.78	1.23	0.64	110.8	1.12
WSC4_L4	160	100	13	2.4	1.60	946.3	6139.3	8.7	8500	75	50	71	1.03	48.3	1.03	1.23	0.64	48.3	1.03
	160	100	13	2.4	1.60	946.3	6139.3	8.7	8500	150	66	71	1.45	62.2	1.06	1.23	0.64	62.2	1.06
	160	100	13	2.4	1.60	946.3	6139.3	8.7	8500	300	87	71	2.05	62.6	1.39	1.23	0.64	79.6	1.09
	160	100	13	2.4	1.60	946.3	6139.3	8.7	8500	450	104	71	2.51	62.6	1.67	1.23	0.64	93.1	1.12
	160	100	13	2.4	1.60	946.3	6139.3	8.7	8500	600	116	71	2.90	62.6	1.85	1.23	0.64	104.0	1.11
WSC4_L5	160	100	13	2.4	1.60	946.3	6139.3	8.7	9000	75	47	65	1.08	46.2	1.02	1.23	0.64	46.2	1.02
	160	100	13	2.4	1.60	946.3	6139.3	8.7	9000	150	61	65	1.52	56.9	1.08	1.23	0.64	57.5	1.07
	160	100	13	2.4	1.60	946.3	6139.3	8.7	9000	300	83	65	2.15	56.9	1.45	1.23	0.64	75.1	1.10
	160	100	13	2.4	1.60	946.3	6139.3	8.7	9000	450	98	65	2.63	56.9	1.73	1.23	0.64	87.8	1.12
	160	100	13	2.4	1.60	946.3	6139.3	8.7	9000	600	108	65	3.04	56.9	1.90	1.23	0.64	98.1	1.10
WSC4_L6	160	100	13	2.4	1.60	946.3	6139.3	8.7	9500	75	45	59	1.12	44.2	1.01	1.23	0.64	44.2	1.01
	160	100	13	2.4	1.60	946.3	6139.3	8.7	9500	150	58	59	1.59	52.1	1.11	1.23	0.64	54.5	1.06
	160	100	13	2.4	1.60	946.3	6139.3	8.7	9500	300	79	59	2.25	52.1	1.51	1.23	0.64	71.2	1.11
	160	100	13	2.4	1.60	946.3	6139.3	8.7	9500	450	93	59	2.75	52.1	1.78	1.23	0.64	83.2	1.12
	160	100	13	2.4	1.60	946.3	6139.3	8.7	9500	600	101	59	3.18	52.1	1.94	1.23	0.64	93.0	1.09
WSC5_L1	140	128	12	3	1.09	1284.9	10259.6	4.7	6000	75	60	112	0.82	56.7	1.06	1.00	0.59	56.7	1.06
	140	128	12	3	1.09	1284.9	10259.6	4.7	6000	150	90	112	1.16	85.7	1.05	1.00	0.59	85.7	1.05
	140	128	12	3	1.09	1284.9	10259.6	4.7	6000	300	113	112	1.64	98.3	1.15	1.00	0.59	107.3	1.06
	140	128	12	3	1.09	1284.9	10259.6	4.7	6000	450	139	112	2.00	98.3	1.42	1.00	0.59	131.4	1.06
	140	128	12	3	1.09	1284.9	10259.6	4.7	6000	600	166	112	2.31	98.3	1.69	1.00	0.59	151.7	1.10
WSC5_L2	140	128	12	3	1.09	1284.9	10259.6	4.7	6500	75	57	98	0.88	54.4	1.06	1.00	0.59	54.4	1.06
	140	128	12	3	1.09	1284.9	10259.6	4.7	6500	150	82	98	1.24	78.8	1.04	1.00	0.59	78.8	1.04
	140	128	12	3	1.09	1284.9	10259.6	4.7	6500	300	105	98	1.75	85.6	1.23	1.00	0.59	100.1	1.05
	140	128	12	3	1.09	1284.9	10259.6	4.7	6500	450	132	98	2.15	85.6	1.54	1.00	0.59	122.6	1.08
	140	128	12	3	1.09	1284.9	10259.6	4.7	6500	600	158	98	2.48	85.6	1.85	1.00	0.59	141.6	1.12
WSC5_L3	140	128	12	3	1.09	1284.9	10259.6	4.7	7000	75	55	86	0.93	52.1	1.05	1.00	0.59	52.1	1.05
	140	128	12	3	1.09	1284.9	10259.6	4.7	7000	150	75	86	1.32	72.3	1.04	1.00	0.59	72.3	1.04
	140	128	12	3	1.09	1284.9	10259.6	4.7	7000	300	99	86	1.87	75.4	1.31	1.00	0.59	94.0	1.05
	140	128	12	3	1.09	1284.9	10259.6	4.7	7000	450	126	86	2.29	75.4	1.67	1.00	0.59	115.1	1.10
	140	128	12	3	1.09	1284.9	10259.6	4.7	7000	600	151	86	2.64	75.4	2.00	1.00	0.59	132.9	1.13

Column	Geometry									SFEA		DSM Design							
	b_w	b_f	b_s	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
WSC5_L4	140	128	12	3	1.09	1284.9	10259.6	4.7	7500	75	52	77	0.99	49.8	1.04	1.00	0.59	49.8	1.04
	140	128	12	3	1.09	1284.9	10259.6	4.7	7500	150	70	77	1.40	66.1	1.05	1.00	0.59	66.1	1.05
	140	128	12	3	1.09	1284.9	10259.6	4.7	7500	300	94	77	1.98	67.1	1.40	1.00	0.59	88.7	1.06
	140	128	12	3	1.09	1284.9	10259.6	4.7	7500	450	121	77	2.42	67.1	1.80	1.00	0.59	108.6	1.11
	140	128	12	3	1.09	1284.9	10259.6	4.7	7500	600	144	77	2.80	67.1	2.14	1.00	0.59	125.4	1.15
WSC5_L5	140	128	12	3	1.09	1284.9	10259.6	4.7	8000	75	49	69	1.04	47.5	1.03	1.00	0.59	47.5	1.03
	140	128	12	3	1.09	1284.9	10259.6	4.7	8000	150	65	69	1.48	60.2	1.07	1.00	0.59	60.2	1.07
	140	128	12	3	1.09	1284.9	10259.6	4.7	8000	300	90	69	2.09	60.3	1.50	1.00	0.59	84.0	1.07
	140	128	12	3	1.09	1284.9	10259.6	4.7	8000	450	116	69	2.56	60.3	1.93	1.00	0.59	102.9	1.13
	140	128	12	3	1.09	1284.9	10259.6	4.7	8000	600	137	69	2.95	60.3	2.27	1.00	0.59	118.8	1.15
WSC5_L6	140	128	12	3	1.09	1284.9	10259.6	4.7	8500	75	46	62	1.10	45.3	1.02	1.00	0.59	45.3	1.02
	140	128	12	3	1.09	1284.9	10259.6	4.7	8500	150	61	62	1.55	54.6	1.11	1.00	0.59	56.6	1.07
	140	128	12	3	1.09	1284.9	10259.6	4.7	8500	300	87	62	2.19	54.6	1.59	1.00	0.59	80.0	1.09
	140	128	12	3	1.09	1284.9	10259.6	4.7	8500	450	112	62	2.69	54.6	2.04	1.00	0.59	98.0	1.14
	140	128	12	3	1.09	1284.9	10259.6	4.7	8500	600	125	62	3.10	54.6	2.28	1.00	0.59	113.1	1.10
WSC6_L1	180	90	10	2.5	2.00	970.7	5868.0	11.6	6000	75	64	143	0.72	60.2	1.06	1.40	0.69	60.2	1.06
	180	90	10	2.5	2.00	970.7	5868.0	11.6	6000	150	104	143	1.02	96.7	1.08	1.40	0.69	96.7	1.08
	180	90	10	2.5	2.00	970.7	5868.0	11.6	6000	300	132	143	1.45	124.7	1.06	1.40	0.69	124.7	1.06
	180	90	10	2.5	2.00	970.7	5868.0	11.6	6000	450	147	143	1.77	125.5	1.17	1.40	0.69	138.7	1.06
	180	90	10	2.5	2.00	970.7	5868.0	11.6	6000	600	161	143	2.05	125.5	1.28	1.40	0.69	151.1	1.07
WSC6_L2	180	90	10	2.5	2.00	970.7	5868.0	11.6	6500	75	62	124	0.78	58.3	1.07	1.40	0.69	58.3	1.07
	180	90	10	2.5	2.00	970.7	5868.0	11.6	6500	150	96	124	1.10	90.5	1.06	1.40	0.69	90.5	1.06
	180	90	10	2.5	2.00	970.7	5868.0	11.6	6500	300	119	124	1.55	108.9	1.09	1.40	0.69	111.3	1.07
	180	90	10	2.5	2.00	970.7	5868.0	11.6	6500	450	135	124	1.90	108.9	1.24	1.40	0.69	125.6	1.08
	180	90	10	2.5	2.00	970.7	5868.0	11.6	6500	600	149	124	2.20	108.9	1.36	1.40	0.69	136.8	1.09
WSC6_L3	180	90	10	2.5	2.00	970.7	5868.0	11.6	7000	75	60	109	0.83	56.3	1.06	1.40	0.69	56.3	1.06
	180	90	10	2.5	2.00	970.7	5868.0	11.6	7000	150	88	109	1.17	84.4	1.04	1.40	0.69	84.4	1.04
	180	90	10	2.5	2.00	970.7	5868.0	11.6	7000	300	109	109	1.66	95.8	1.14	1.40	0.69	101.7	1.07
	180	90	10	2.5	2.00	970.7	5868.0	11.6	7000	450	125	109	2.03	95.8	1.31	1.40	0.69	114.7	1.09
	180	90	10	2.5	2.00	970.7	5868.0	11.6	7000	600	137	109	2.34	95.8	1.43	1.40	0.69	125.0	1.10
WSC6_L4	180	90	10	2.5	2.00	970.7	5868.0	11.6	7500	75	57	97	0.88	54.3	1.06	1.40	0.69	54.3	1.06
	180	90	10	2.5	2.00	970.7	5868.0	11.6	7500	150	81	97	1.24	78.6	1.03	1.40	0.69	78.6	1.03
	180	90	10	2.5	2.00	970.7	5868.0	11.6	7500	300	101	97	1.76	85.1	1.19	1.40	0.69	93.6	1.08
	180	90	10	2.5	2.00	970.7	5868.0	11.6	7500	450	117	97	2.15	85.1	1.37	1.40	0.69	105.6	1.11
	180	90	10	2.5	2.00	970.7	5868.0	11.6	7500	600	127	97	2.49	85.1	1.49	1.40	0.69	115.1	1.10
WSC6_L5	180	90	10	2.5	2.00	970.7	5868.0	11.6	8000	75	55	87	0.93	52.3	1.05	1.40	0.69	52.3	1.05
	180	90	10	2.5	2.00	970.7	5868.0	11.6	8000	150	75	87	1.31	73.0	1.03	1.40	0.69	73.0	1.03
	180	90	10	2.5	2.00	970.7	5868.0	11.6	8000	300	95	87	1.86	76.4	1.24	1.40	0.69	86.8	1.09
	180	90	10	2.5	2.00	970.7	5868.0	11.6	8000	450	109	87	2.27	76.4	1.43	1.40	0.69	97.9	1.11
	180	90	10	2.5	2.00	970.7	5868.0	11.6	8000	600	117	87	2.62	76.4	1.54	1.40	0.69	106.6	1.10
WSC6_L6	180	90	10	2.5	2.00	970.7	5868.0	11.6	8500	75	53	79	0.98	50.4	1.04	1.40	0.69	50.4	1.04
	180	90	10	2.5	2.00	970.7	5868.0	11.6	8500	150	70	79	1.38	67.6	1.04	1.40	0.69	67.6	1.04
	180	90	10	2.5	2.00	970.7	5868.0	11.6	8500	300	89	79	1.95	69.1	1.29	1.40	0.69	80.9	1.10
	180	90	10	2.5	2.00	970.7	5868.0	11.6	8500	450	102	79	2.39	69.1	1.47	1.40	0.69	91.3	1.11
	180	90	10	2.5	2.00	970.7	5868.0	11.6	8500	600	108	79	2.76	69.1	1.57	1.40	0.69	99.4	1.09
WSC7_L1	130	70	20	2.5	1.86	795.7	2322.1	8.9	4500	75	66	178	0.65	62.9	1.05	1.24	0.65	62.9	1.05
	130	70	20	2.5	1.86	795.7	2322.1	8.9	4500	150	115	178	0.92	105.5	1.09	1.24	0.65	105.5	1.09
	130	70	20	2.5	1.86	795.7	2322.1	8.9	4500	300	156	178	1.30	148.3	1.06	1.24	0.65	148.3	1.06
	130	70	20	2.5	1.86	795.7	2322.1	8.9	4500	450	172	178	1.59	156.3	1.10	1.24	0.65	163.3	1.05
	130	70	20	2.5	1.86	795.7	2322.1	8.9	4500	600	185	178	1.83	156.3	1.18	1.24	0.65	182.1	1.01
WSC7_L2	130	70	20	2.5	1.86	795.7	2322.1	8.9	5000	75	64	148	0.71	60.7	1.06	1.24	0.65	60.7	1.06
	130	70	20	2.5	1.86	795.7	2322.1	8.9	5000	150	106	148	1.01	98.2	1.08	1.24	0.65	98.2	1.08
	130	70	20	2.5	1.86	795.7	2322.1	8.9	5000	300	136	148	1.42	128.6	1.06	1.24	0.65	128.6	1.06
	130	70	20	2.5	1.86	795.7	2322.1	8.9	5000	450	150	148	1.74	130.0	1.16	1.24	0.65	145.7	1.03
	130	70	20	2.5	1.86	795.7	2322.1	8.9	5000	600	163	148	2.01	130.0	1.26	1.24	0.65	162.5	1.01
WSC7_L3	130	70	20	2.5	1.86	795.7	2322.1	8.9	5500	75	62	126	0.77	58.5	1.06	1.24	0.65	58.5	1.06
	130	70	20	2.5	1.86	795.7	2322.1	8.9	5500	150	97	126	1.09	91.2	1.06	1.24	0.65	91.2	1.06
	130	70	20	2.5	1.86	795.7	2322.1	8.9	5500	300	120	126	1.54	110.6	1.09	1.24	0.65	113.0	1.06
	130	70	20	2.5	1.86	795.7	2322.1	8.9	5500	450	134	126	1.89	110.6	1.22	1.24	0.65	131.7	1.02
	130	70	20	2.5	1.86	795.7	2322.1	8.9	5500	600	147	126	2.18	110.6	1.33	1.24	0.65	146.9	1.00
WSC7_L4	130	70	20	2.5	1.86	795.7	2322.1	8.9	6000	75	60	109	0.83	56.3	1.06	1.24	0.65	56.3	1.06
	130	70	20	2.5	1.86	795.7	2322.1	8.9	6000	150	88	109	1.17	84.4	1.04	1.24	0.65	84.4	1.04
	130	70	20	2.5	1.86	795.7	2322.1	8.9	6000	300	108	109	1.66	95.7	1.13	1.24	0.65	103.3	1.04
	130	70	20	2.5	1.86	795.7	2322.1	8.9	6000	450	122	109	2.03	95.7	1.27	1.24	0.65	120.4	1.01
	130	70	20	2.5	1.86	795.7	2322.1	8.9	6000	600	133	109	2.34	95.7	1.39	1.24	0.65	134.3	0.99
WSC7_L5	130	70	20	2.5	1.86	795.7	2322.1	8.9	6500	75	57	96	0.88	54.1	1.06	1.24	0.65	54.1	1.06
	130	70	20	2.5	1.86	795.7	2322.1	8.9	6500	150	81	96	1.25	77.9	1.03	1.24	0.65	77.9	1.03
	130	70	20	2.5	1.86	795.7	2322.1	8.9	6500	300	98	96	1.77	84.1	1.17	1.24	0.65	95.3	1.03
	130	70	20	2.5	1.86	795.7	2322.1	8.9	6500	450	111	96	2.17	84.1	1.33	1.24	0.65	111.2	1.00
	130	70	20	2.5	1.86	795.7	2322.1	8.9	6500	600	121	96	2.50	84.1	1.44	1.24	0.65	123.9	0.98

Column	Geometry									SFEA		DSM Design							
	b_w	b_f	b_s	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
WSC7_L6	130	70	20	2.5	1.86	795.7	2322.1	8.9	7000	75	54	85	0.94	51.9	1.05	1.24	0.65	51.9	1.05
	130	70	20	2.5	1.86	795.7	2322.1	8.9	7000	150	74	85	1.33	71.9	1.03	1.24	0.65	71.9	1.03
	130	70	20	2.5	1.86	795.7	2322.1	8.9	7000	300	90	85	1.87	74.9	1.21	1.24	0.65	88.7	1.02
	130	70	20	2.5	1.86	795.7	2322.1	8.9	7000	450	102	85	2.30	74.9	1.37	1.24	0.65	103.4	0.99
	130	70	20	2.5	1.86	795.7	2322.1	8.9	7000	600	110	85	2.65	74.9	1.47	1.24	0.65	115.3	0.96
WSC8_L1	100	70	20	3	1.43	864.9	1715.7	5.5	3500	75	68	216	0.59	64.9	1.05	1.04	0.59	64.9	1.05
	100	70	20	3	1.43	864.9	1715.7	5.5	3500	150	124	216	0.83	112.2	1.11	1.04	0.59	112.2	1.11
	100	70	20	3	1.43	864.9	1715.7	5.5	3500	300	182	216	1.18	167.9	1.08	1.04	0.59	167.9	1.08
	100	70	20	3	1.43	864.9	1715.7	5.5	3500	450	203	216	1.44	188.4	1.08	1.04	0.59	188.4	1.08
	100	70	20	3	1.43	864.9	1715.7	5.5	3500	600	218	216	1.67	189.7	1.15	1.04	0.59	209.9	1.04
WSC8_L2	100	70	20	3	1.43	864.9	1715.7	5.5	4000	75	66	173	0.66	62.5	1.06	1.04	0.59	62.5	1.06
	100	70	20	3	1.43	864.9	1715.7	5.5	4000	150	114	173	0.93	104.2	1.10	1.04	0.59	104.2	1.10
	100	70	20	3	1.43	864.9	1715.7	5.5	4000	300	155	173	1.32	144.9	1.07	1.04	0.59	144.9	1.07
	100	70	20	3	1.43	864.9	1715.7	5.5	4000	450	171	173	1.61	151.3	1.13	1.04	0.59	162.6	1.05
	100	70	20	3	1.43	864.9	1715.7	5.5	4000	600	187	173	1.86	151.3	1.23	1.04	0.59	186.7	1.00
WSC8_L3	100	70	20	3	1.43	864.9	1715.7	5.5	4500	75	64	142	0.73	60.2	1.07	1.04	0.59	60.2	1.07
	100	70	20	3	1.43	864.9	1715.7	5.5	4500	150	104	142	1.03	96.5	1.08	1.04	0.59	96.5	1.08
	100	70	20	3	1.43	864.9	1715.7	5.5	4500	300	133	142	1.45	124.2	1.07	1.04	0.59	124.2	1.07
	100	70	20	3	1.43	864.9	1715.7	5.5	4500	450	149	142	1.78	124.8	1.19	1.04	0.59	147.1	1.01
	100	70	20	3	1.43	864.9	1715.7	5.5	4500	600	166	142	2.05	124.8	1.33	1.04	0.59	169.0	0.98
WSC8_L4	100	70	20	3	1.43	864.9	1715.7	5.5	5000	75	62	121	0.79	57.8	1.07	1.04	0.59	57.8	1.07
	100	70	20	3	1.43	864.9	1715.7	5.5	5000	150	95	121	1.12	89.1	1.06	1.04	0.59	89.1	1.06
	100	70	20	3	1.43	864.9	1715.7	5.5	5000	300	118	121	1.58	105.8	1.11	1.04	0.59	111.1	1.06
	100	70	20	3	1.43	864.9	1715.7	5.5	5000	450	134	121	1.93	105.8	1.26	1.04	0.59	135.0	0.99
	100	70	20	3	1.43	864.9	1715.7	5.5	5000	600	149	121	2.23	105.8	1.41	1.04	0.59	155.1	0.96
WSC8_L5	100	70	20	3	1.43	864.9	1715.7	5.5	5500	75	59	104	0.85	55.5	1.07	1.04	0.59	55.5	1.07
	100	70	20	3	1.43	864.9	1715.7	5.5	5500	150	86	104	1.20	82.2	1.05	1.04	0.59	82.2	1.05
	100	70	20	3	1.43	864.9	1715.7	5.5	5500	300	106	104	1.69	91.6	1.15	1.04	0.59	103.1	1.02
	100	70	20	3	1.43	864.9	1715.7	5.5	5500	450	122	104	2.08	91.6	1.33	1.04	0.59	125.3	0.97
	100	70	20	3	1.43	864.9	1715.7	5.5	5500	600	136	104	2.40	91.6	1.48	1.04	0.59	143.9	0.94
WSC8_L6	100	70	20	3	1.43	864.9	1715.7	5.5	6000	75	57	92	0.90	53.3	1.06	1.04	0.59	53.3	1.06
	100	70	20	3	1.43	864.9	1715.7	5.5	6000	150	79	92	1.28	75.8	1.04	1.04	0.59	75.8	1.04
	100	70	20	3	1.43	864.9	1715.7	5.5	6000	300	96	92	1.81	80.7	1.19	1.04	0.59	96.5	1.00
	100	70	20	3	1.43	864.9	1715.7	5.5	6000	450	111	92	2.21	80.7	1.38	1.04	0.59	117.3	0.95
	100	70	20	3	1.43	864.9	1715.7	5.5	6000	600	124	92	2.55	80.7	1.53	1.04	0.59	134.8	0.92
WSC9_L1	110	90	15	4	1.22	1313.1	3904.7	4.0	5500	75	62	118	0.80	57.5	1.08	1.00	0.59	57.5	1.08
	110	90	15	4	1.22	1313.1	3904.7	4.0	5500	150	94	118	1.13	88.2	1.07	1.00	0.59	88.2	1.07
	110	90	15	4	1.22	1313.1	3904.7	4.0	5500	300	118	118	1.59	103.7	1.14	1.00	0.59	110.2	1.07
	110	90	15	4	1.22	1313.1	3904.7	4.0	5500	450	139	118	1.95	103.7	1.34	1.00	0.59	135.0	1.03
	110	90	15	4	1.22	1313.1	3904.7	4.0	5500	600	159	118	2.25	103.7	1.53	1.00	0.59	155.8	1.02
WSC9_L2	110	90	15	4	1.22	1313.1	3904.7	4.0	6000	75	60	105	0.85	55.6	1.08	1.00	0.59	55.6	1.08
	110	90	15	4	1.22	1313.1	3904.7	4.0	6000	150	87	105	1.20	82.5	1.06	1.00	0.59	82.5	1.06
	110	90	15	4	1.22	1313.1	3904.7	4.0	6000	300	109	105	1.69	92.0	1.18	1.00	0.59	103.8	1.05
	110	90	15	4	1.22	1313.1	3904.7	4.0	6000	450	129	105	2.07	92.0	1.40	1.00	0.59	127.1	1.02
	110	90	15	4	1.22	1313.1	3904.7	4.0	6000	600	148	105	2.39	92.0	1.61	1.00	0.59	146.8	1.01
WSC9_L3	110	90	15	4	1.22	1313.1	3904.7	4.0	6500	75	58	94	0.89	53.8	1.08	1.00	0.59	53.8	1.08
	110	90	15	4	1.22	1313.1	3904.7	4.0	6500	150	81	94	1.26	77.2	1.05	1.00	0.59	77.2	1.05
	110	90	15	4	1.22	1313.1	3904.7	4.0	6500	300	101	94	1.78	82.8	1.22	1.00	0.59	98.5	1.03
	110	90	15	4	1.22	1313.1	3904.7	4.0	6500	450	121	94	2.18	82.8	1.46	1.00	0.59	120.6	1.00
	110	90	15	4	1.22	1313.1	3904.7	4.0	6500	600	138	94	2.52	82.8	1.66	1.00	0.59	139.3	0.99
WSC9_L4	110	90	15	4	1.22	1313.1	3904.7	4.0	7000	75	56	86	0.93	52.1	1.07	1.00	0.59	52.1	1.07
	110	90	15	4	1.22	1313.1	3904.7	4.0	7000	150	76	86	1.32	72.3	1.05	1.00	0.59	72.3	1.05
	110	90	15	4	1.22	1313.1	3904.7	4.0	7000	300	95	86	1.87	75.5	1.26	1.00	0.59	94.0	1.01
	110	90	15	4	1.22	1313.1	3904.7	4.0	7000	450	113	86	2.29	75.5	1.50	1.00	0.59	115.1	0.99
	110	90	15	4	1.22	1313.1	3904.7	4.0	7000	600	128	86	2.64	75.5	1.70	1.00	0.59	132.9	0.96
WSC9_L5	110	90	15	4	1.22	1313.1	3904.7	4.0	7500	75	54	79	0.97	50.4	1.06	1.00	0.59	50.4	1.06
	110	90	15	4	1.22	1313.1	3904.7	4.0	7500	150	71	79	1.38	67.8	1.05	1.00	0.59	67.8	1.05
	110	90	15	4	1.22	1313.1	3904.7	4.0	7500	300	90	79	1.95	69.4	1.30	1.00	0.59	90.1	1.00
	110	90	15	4	1.22	1313.1	3904.7	4.0	7500	450	106	79	2.38	69.4	1.53	1.00	0.59	110.4	0.96
	110	90	15	4	1.22	1313.1	3904.7	4.0	7500	600	119	79	2.75	69.4	1.72	1.00	0.59	127.5	0.93
WSC9_L6	110	90	15	4	1.22	1313.1	3904.7	4.0	8000	75	52	73	1.01	48.9	1.06	1.00	0.59	48.9	1.06
	110	90	15	4	1.22	1313.1	3904.7	4.0	8000	150	67	73	1.43	63.8	1.05	1.00	0.59	63.8	1.05
	110	90	15	4	1.22	1313.1	3904.7	4.0	8000	300	85	73	2.02	64.4	1.32	1.00	0.59	86.8	0.98
	110	90	15	4	1.22	1313.1	3904.7	4.0	8000	450	100	73	2.48	64.4	1.55	1.00	0.59	106.3	0.94
	110	90	15	4	1.22	1313.1	3904.7	4.0	8000	600	111	73	2.86	64.4	1.72	1.00	0.59	122.7	0.90
													Mean		1.328			Mean	1.059
													Sd. Dev.		0.330			Sd. Dev.	0.044
													Max		2.279			Max	1.157
													Min		1.010			Min	0.901

ANNEX G: WFSC Column Data

Table G: F columns: (i) geometries, (ii) buckling stresses and ultimate strengths, (iii) ultimate strength predictions by current and proposed DSM design curves, and (iv) numerical-to-predicted ultimate strength ratios (mm and MPa)

Column	Geometry									SFEA		DSM Design							
	b_w	b_f	b_s	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
WFSC1_L1	170	130	13	3.5	1.31	1683.0	18820.8	5.6	6500	75	62	128	0.77	58.7	1.06	1.05	0.60	58.7	1.06
	170	130	13	3.5	1.31	1683.0	18820.8	5.6	6500	150	97	128	1.08	91.8	1.06	1.05	0.60	91.8	1.06
	170	130	13	3.5	1.31	1683.0	18820.8	5.6	6500	300	123	128	1.53	112.1	1.09	1.05	0.60	114.5	1.07
	170	130	13	3.5	1.31	1683.0	18820.8	5.6	6500	450	143	128	1.88	112.1	1.28	1.05	0.60	138.8	1.03
	170	130	13	3.5	1.31	1683.0	18820.8	5.6	6500	600	168	128	2.17	112.1	1.50	1.05	0.60	159.2	1.05
WFSC1_L2	170	130	13	3.5	1.31	1683.0	18820.8	5.6	7000	75	60	113	0.82	56.8	1.06	1.05	0.60	56.8	1.06
	170	130	13	3.5	1.31	1683.0	18820.8	5.6	7000	150	90	113	1.15	85.9	1.05	1.05	0.60	85.9	1.05
	170	130	13	3.5	1.31	1683.0	18820.8	5.6	7000	300	113	113	1.63	98.8	1.14	1.05	0.60	107.1	1.05
	170	130	13	3.5	1.31	1683.0	18820.8	5.6	7000	450	135	113	2.00	98.8	1.37	1.05	0.60	129.9	1.04
	170	130	13	3.5	1.31	1683.0	18820.8	5.6	7000	600	159	113	2.31	98.8	1.61	1.05	0.60	149.0	1.07
WFSC1_L3	170	130	13	3.5	1.31	1683.0	18820.8	5.6	7500	75	58	100	0.86	54.8	1.06	1.05	0.60	54.8	1.06
	170	130	13	3.5	1.31	1683.0	18820.8	5.6	7500	150	83	100	1.22	80.2	1.04	1.05	0.60	80.2	1.04
	170	130	13	3.5	1.31	1683.0	18820.8	5.6	7500	300	105	100	1.73	87.9	1.19	1.05	0.60	100.8	1.04
	170	130	13	3.5	1.31	1683.0	18820.8	5.6	7500	450	129	100	2.12	87.9	1.47	1.05	0.60	122.2	1.05
	170	130	13	3.5	1.31	1683.0	18820.8	5.6	7500	600	151	100	2.45	87.9	1.72	1.05	0.60	140.2	1.08
WFSC1_L4	170	130	13	3.5	1.31	1683.0	18820.8	5.6	8500	75	53	82	0.96	51.1	1.04	1.05	0.60	51.1	1.04
	170	130	13	3.5	1.31	1683.0	18820.8	5.6	8500	150	72	82	1.36	69.5	1.04	1.05	0.60	69.5	1.04
	170	130	13	3.5	1.31	1683.0	18820.8	5.6	8500	300	94	82	1.92	71.6	1.32	1.05	0.60	90.5	1.04
	170	130	13	3.5	1.31	1683.0	18820.8	5.6	8500	450	118	82	2.35	71.6	1.65	1.05	0.60	109.7	1.08
	170	130	13	3.5	1.31	1683.0	18820.8	5.6	8500	600	138	82	2.71	71.6	1.92	1.05	0.60	125.8	1.09
WFSC1_L5	170	130	13	3.5	1.31	1683.0	18820.8	5.6	9000	75	51	74	1.00	49.2	1.03	1.05	0.60	49.2	1.03
	170	130	13	3.5	1.31	1683.0	18820.8	5.6	9000	150	68	74	1.42	64.6	1.05	1.05	0.60	64.6	1.05
	170	130	13	3.5	1.31	1683.0	18820.8	5.6	9000	300	90	74	2.01	65.3	1.38	1.05	0.60	86.2	1.05
	170	130	13	3.5	1.31	1683.0	18820.8	5.6	9000	450	113	74	2.46	65.3	1.73	1.05	0.60	104.6	1.08
	170	130	13	3.5	1.31	1683.0	18820.8	5.6	9000	600	131	74	2.84	65.3	2.01	1.05	0.60	119.9	1.09
WFSC1_L6	170	130	13	3.5	1.31	1683.0	18820.8	5.6	9500	75	48	68	1.05	47.4	1.02	1.05	0.60	47.4	1.02
	170	130	13	3.5	1.31	1683.0	18820.8	5.6	9500	150	64	68	1.48	59.9	1.06	1.05	0.60	59.9	1.06
	170	130	13	3.5	1.31	1683.0	18820.8	5.6	9500	300	87	68	2.09	60.0	1.45	1.05	0.60	82.5	1.05
	170	130	13	3.5	1.31	1683.0	18820.8	5.6	9500	450	109	68	2.56	60.0	1.81	1.05	0.60	100.0	1.09
	170	130	13	3.5	1.31	1683.0	18820.8	5.6	9500	600	125	68	2.96	60.0	2.08	1.05	0.60	114.7	1.09
WFSC2_L1	150	110	13	2.4	1.36	1010.0	6448.5	6.8	6500	75	57	97	0.88	54.3	1.05	1.12	0.61	54.3	1.05
	150	110	13	2.4	1.36	1010.0	6448.5	6.8	6500	150	81	97	1.24	78.6	1.03	1.12	0.61	78.6	1.03
	150	110	13	2.4	1.36	1010.0	6448.5	6.8	6500	300	102	97	1.76	85.2	1.19	1.12	0.61	98.1	1.04
	150	110	13	2.4	1.36	1010.0	6448.5	6.8	6500	450	125	97	2.15	85.2	1.47	1.12	0.61	117.3	1.06
	150	110	13	2.4	1.36	1010.0	6448.5	6.8	6500	600	146	97	2.48	85.2	1.72	1.12	0.61	133.3	1.10
WFSC2_L2	150	110	13	2.4	1.36	1010.0	6448.5	6.8	7000	75	54	85	0.94	51.9	1.04	1.12	0.61	51.9	1.04
	150	110	13	2.4	1.36	1010.0	6448.5	6.8	7000	150	74	85	1.33	71.9	1.03	1.12	0.61	71.9	1.03
	150	110	13	2.4	1.36	1010.0	6448.5	6.8	7000	300	95	85	1.87	74.9	1.27	1.12	0.61	91.2	1.04
	150	110	13	2.4	1.36	1010.0	6448.5	6.8	7000	450	118	85	2.30	74.9	1.58	1.12	0.61	109.1	1.08
	150	110	13	2.4	1.36	1010.0	6448.5	6.8	7000	600	138	85	2.65	74.9	1.84	1.12	0.61	124.0	1.11
WFSC2_L3	150	110	13	2.4	1.36	1010.0	6448.5	6.8	7500	75	51	76	1.00	49.6	1.03	1.12	0.61	49.6	1.03
	150	110	13	2.4	1.36	1010.0	6448.5	6.8	7500	150	68	76	1.41	65.5	1.04	1.12	0.61	65.5	1.04
	150	110	13	2.4	1.36	1010.0	6448.5	6.8	7500	300	90	76	1.99	66.4	1.36	1.12	0.61	85.3	1.05
	150	110	13	2.4	1.36	1010.0	6448.5	6.8	7500	450	113	76	2.44	66.4	1.70	1.12	0.61	102.1	1.10
	150	110	13	2.4	1.36	1010.0	6448.5	6.8	7500	600	131	76	2.81	66.4	1.97	1.12	0.61	116.0	1.13
WFSC2_L4	150	110	13	2.4	1.36	1010.0	6448.5	6.8	8000	75	48	68	1.05	47.2	1.01	1.12	0.61	47.2	1.01
	150	110	13	2.4	1.36	1010.0	6448.5	6.8	8000	150	63	68	1.49	59.4	1.06	1.12	0.61	59.4	1.06
	150	110	13	2.4	1.36	1010.0	6448.5	6.8	8000	300	86	68	2.10	59.5	1.44	1.12	0.61	80.3	1.07
	150	110	13	2.4	1.36	1010.0	6448.5	6.8	8000	450	107	68	2.58	59.5	1.80	1.12	0.61	96.0	1.12
	150	110	13	2.4	1.36	1010.0	6448.5	6.8	8000	600	123	68	2.97	59.5	2.07	1.12	0.61	109.0	1.13
WFSC2_L5	150	110	13	2.4	1.36	1010.0	6448.5	6.8	9000	75	43	56	1.16	42.7	1.00	1.12	0.61	42.7	1.00
	150	110	13	2.4	1.36	1010.0	6448.5	6.8	9000	150	55	56	1.64	48.9	1.13	1.12	0.61	52.9	1.04
	150	110	13	2.4	1.36	1010.0	6448.5	6.8	9000	300	79	56	2.32	48.9	1.61	1.12	0.61	71.9	1.09
	150	110	13	2.4	1.36	1010.0	6448.5	6.8	9000	450	97	56	2.84	48.9	1.99	1.12	0.61	86.0	1.13
	150	110	13	2.4	1.36	1010.0	6448.5	6.8	9000	600	110	56	3.28	48.9	2.25	1.12	0.61	97.7	1.13
WFSC2_L6	150	110	13	2.4	1.36	1010.0	6448.5	6.8	9500	75	40	51	1.21	40.5	1.00	1.12	0.61	40.5	1.00
	150	110	13	2.4	1.36	1010.0	6448.5	6.8	9500	150	53	51	1.71	44.8	1.18	1.12	0.61	50.4	1.04
	150	110	13	2.4	1.36	1010.0	6448.5	6.8	9500	300	76	51	2.42	44.8	1.69	1.12	0.61	68.5	1.10
	150	110	13	2.4	1.36	1010.0	6448.5	6.8	9500	450	93	51	2.97	44.8	2.07	1.12	0.61	81.9	1.13
	150	110	13	2.4	1.36	1010.0	6448.5	6.8	9500	600	102	51	3.43	44.8	**2.28**	1.12	0.61	93.0	1.10
WFSC3_L1	120	90	13	1.2	1.33	421.0	1206.2	9.0	6500	75	44	61	1.11	44.8	0.99	1.25	0.65	44.8	0.99
	120	90	13	1.2	1.33	421.0	1206.2	9.0	6500	150	58	61	1.57	53.3	1.08	1.25	0.65	55.2	1.04
	120	90	13	1.2	1.33	421.0	1206.2	9.0	6500	300	80	61	2.22	53.3	1.51	1.25	0.65	71.7	1.12
	120	90	13	1.2	1.33	421.0	1206.2	9.0	6500	450	100	61	2.72	53.3	1.88	1.25	0.65	83.5	1.20
	120	90	13	1.2	1.33	421.0	1206.2	9.0	6500	600	114	61	3.14	53.3	2.13	1.25	0.65	93.0	1.22

Column	Geometry									SFEA		DSM Design							
	b_w	b_f	b_s	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
WFSC3_L2	120	90	13	1.2	1.33	421.0	1206.2	9.0	7000	75	41	53	1.19	41.5	0.98	1.25	0.65	41.5	0.98
	120	90	13	1.2	1.33	421.0	1206.2	9.0	7000	150	53	53	1.68	46.6	1.14	1.25	0.65	50.8	1.04
	120	90	13	1.2	1.33	421.0	1206.2	9.0	7000	300	76	53	2.38	46.6	1.63	1.25	0.65	65.9	1.16
	120	90	13	1.2	1.33	421.0	1206.2	9.0	7000	450	94	53	2.91	46.6	2.03	1.25	0.65	76.7	1.23
	120	90	13	1.2	1.33	421.0	1206.2	9.0	7000	600	106	53	3.36	46.6	**2.28**	1.25	0.65	85.5	1.24
WFSC3_L3	120	90	13	1.2	1.33	421.0	1206.2	9.0	7500	75	38	47	1.27	38.4	0.98	1.25	0.65	38.4	0.98
	120	90	13	1.2	1.33	421.0	1206.2	9.0	7500	150	49	47	1.79	41.1	1.20	1.25	0.65	46.9	1.05
	120	90	13	1.2	1.33	421.0	1206.2	9.0	7500	300	73	47	2.53	41.1	1.77	1.25	0.65	60.9	1.19
	120	90	13	1.2	1.33	421.0	1206.2	9.0	7500	450	89	47	3.10	41.1	2.17	1.25	0.65	70.9	1.26
	120	90	13	1.2	1.33	421.0	1206.2	9.0	7500	600	99	47	3.58	41.1	**2.41**	1.25	0.65	79.0	1.25
WFSC3_L4	120	90	13	1.2	1.33	421.0	1206.2	9.0	8000	75	35	42	1.34	35.3	0.99	1.25	0.65	35.3	0.99
	120	90	13	1.2	1.33	421.0	1206.2	9.0	8000	150	47	42	1.90	36.5	1.28	1.25	0.65	43.6	1.07
	120	90	13	1.2	1.33	421.0	1206.2	9.0	8000	300	69	42	2.68	36.5	1.89	1.25	0.65	56.6	1.22
	120	90	13	1.2	1.33	421.0	1206.2	9.0	8000	450	84	42	3.29	36.5	**2.30**	1.25	0.65	65.9	1.27
	120	90	13	1.2	1.33	421.0	1206.2	9.0	8000	600	92	42	3.80	36.5	**2.52**	1.25	0.65	73.5	1.25
WFSC3_L5	120	90	13	1.2	1.33	421.0	1206.2	9.0	8500	75	32	37	1.42	32.4	1.00	1.25	0.65	32.4	1.00
	120	90	13	1.2	1.33	421.0	1206.2	9.0	8500	150	44	37	2.00	32.8	1.36	1.25	0.65	40.8	1.09
	120	90	13	1.2	1.33	421.0	1206.2	9.0	8500	300	66	37	2.83	32.8	2.02	1.25	0.65	52.9	1.25
	120	90	13	1.2	1.33	421.0	1206.2	9.0	8500	450	79	37	3.47	32.8	**2.41**	1.25	0.65	61.6	1.28
	120	90	13	1.2	1.33	421.0	1206.2	9.0	8500	600	86	37	4.01	32.8	**2.62**	1.25	0.65	68.6	1.25
WFSC3_L6	120	90	13	1.2	1.33	421.0	1206.2	9.0	9000	75	30	34	1.49	29.6	1.03	1.25	0.65	29.6	1.03
	120	90	13	1.2	1.33	421.0	1206.2	9.0	9000	150	42	34	2.11	29.6	1.44	1.25	0.65	38.2	1.11
	120	90	13	1.2	1.33	421.0	1206.2	9.0	9000	300	63	34	2.98	29.6	2.13	1.25	0.65	49.6	1.27
	120	90	13	1.2	1.33	421.0	1206.2	9.0	9000	450	74	34	3.65	29.6	**2.52**	1.25	0.65	57.8	1.29
	120	90	13	1.2	1.33	421.0	1206.2	9.0	9000	600	80	34	4.22	29.6	**2.70**	1.25	0.65	64.4	1.24
WFSC4_L1	160	100	13	3	1.60	1232.6	7348.5	7.3	6500	75	60	112	0.82	56.6	1.06	1.15	0.62	56.6	1.06
	160	100	13	3	1.60	1232.6	7348.5	7.3	6500	150	89	112	1.16	85.6	1.05	1.15	0.62	85.6	1.05
	160	100	13	3	1.60	1232.6	7348.5	7.3	6500	300	111	112	1.64	98.1	1.14	1.15	0.62	105.8	1.05
	160	100	13	3	1.60	1232.6	7348.5	7.3	6500	450	131	112	2.01	98.1	1.34	1.15	0.62	125.7	1.04
	160	100	13	3	1.60	1232.6	7348.5	7.3	6500	600	150	112	2.32	98.1	1.53	1.15	0.62	142.1	1.05
WFSC4_L2	160	100	13	3	1.60	1232.6	7348.5	7.3	7000	75	58	99	0.87	54.6	1.06	1.15	0.62	54.6	1.06
	160	100	13	3	1.60	1232.6	7348.5	7.3	7000	150	82	99	1.23	79.5	1.04	1.15	0.62	79.5	1.04
	160	100	13	3	1.60	1232.6	7348.5	7.3	7000	300	103	99	1.74	86.8	1.18	1.15	0.62	98.6	1.04
	160	100	13	3	1.60	1232.6	7348.5	7.3	7000	450	123	99	2.13	86.8	1.42	1.15	0.62	117.2	1.05
	160	100	13	3	1.60	1232.6	7348.5	7.3	7000	600	140	99	2.46	86.8	1.62	1.15	0.62	132.4	1.06
WFSC4_L3	160	100	13	3	1.60	1232.6	7348.5	7.3	7500	75	55	89	0.92	52.6	1.05	1.15	0.62	52.6	1.05
	160	100	13	3	1.60	1232.6	7348.5	7.3	7500	150	76	89	1.30	73.8	1.03	1.15	0.62	73.8	1.03
	160	100	13	3	1.60	1232.6	7348.5	7.3	7500	300	96	89	1.84	77.6	1.24	1.15	0.62	92.5	1.04
	160	100	13	3	1.60	1232.6	7348.5	7.3	7500	450	116	89	2.25	77.6	1.49	1.15	0.62	109.9	1.06
	160	100	13	3	1.60	1232.6	7348.5	7.3	7500	600	131	89	2.60	77.6	1.69	1.15	0.62	124.2	1.06
WFSC4_L4	160	100	13	3	1.60	1232.6	7348.5	7.3	8000	75	53	80	0.97	50.7	1.04	1.15	0.62	50.7	1.04
	160	100	13	3	1.60	1232.6	7348.5	7.3	8000	150	71	80	1.37	68.4	1.03	1.15	0.62	68.4	1.03
	160	100	13	3	1.60	1232.6	7348.5	7.3	8000	300	91	80	1.94	70.1	1.30	1.15	0.62	87.2	1.04
	160	100	13	3	1.60	1232.6	7348.5	7.3	8000	450	110	80	2.37	70.1	1.56	1.15	0.62	103.7	1.06
	160	100	13	3	1.60	1232.6	7348.5	7.3	8000	600	123	80	2.74	70.1	1.76	1.15	0.62	117.2	1.05
WFSC4_L5	160	100	13	3	1.60	1232.6	7348.5	7.3	8500	75	50	73	1.01	48.7	1.03	1.15	0.62	48.7	1.03
	160	100	13	3	1.60	1232.6	7348.5	7.3	8500	150	66	73	1.43	63.4	1.04	1.15	0.62	63.4	1.04
	160	100	13	3	1.60	1232.6	7348.5	7.3	8500	300	86	73	2.03	63.9	1.35	1.15	0.62	82.7	1.05
	160	100	13	3	1.60	1232.6	7348.5	7.3	8500	450	104	73	2.49	63.9	1.62	1.15	0.62	98.3	1.05
	160	100	13	3	1.60	1232.6	7348.5	7.3	8500	600	115	73	2.87	63.9	1.80	1.15	0.62	111.1	1.04
WFSC4_L6	160	100	13	3	1.60	1232.6	7348.5	7.3	9000	75	48	67	1.06	46.9	1.02	1.15	0.62	46.9	1.02
	160	100	13	3	1.60	1232.6	7348.5	7.3	9000	150	62	67	1.50	58.7	1.06	1.15	0.62	58.7	1.06
	160	100	13	3	1.60	1232.6	7348.5	7.3	9000	300	82	67	2.12	58.7	1.40	1.15	0.62	78.7	1.05
	160	100	13	3	1.60	1232.6	7348.5	7.3	9000	450	98	67	2.59	58.7	1.67	1.15	0.62	93.6	1.05
	160	100	13	3	1.60	1232.6	7348.5	7.3	9000	600	108	67	3.00	58.7	1.84	1.15	0.62	105.7	1.02
WFSC5_L1	140	128	10	3	1.09	1322.6	9325.7	4.5	6000	75	58	103	0.85	55.3	1.05	1.00	0.59	55.3	1.05
	140	128	10	3	1.09	1322.6	9325.7	4.5	6000	150	85	103	1.21	81.7	1.04	1.00	0.59	81.7	1.04
	140	128	10	3	1.09	1322.6	9325.7	4.5	6000	300	106	103	1.70	90.6	1.18	1.00	0.59	103.0	1.03
	140	128	10	3	1.09	1322.6	9325.7	4.5	6000	450	133	103	2.09	90.6	1.47	1.00	0.59	126.1	1.06
	140	128	10	3	1.09	1322.6	9325.7	4.5	6000	600	160	103	2.41	90.6	1.76	1.00	0.59	145.6	1.10
WFSC5_L2	140	128	10	3	1.09	1322.6	9325.7	4.5	6500	75	55	90	0.91	52.9	1.04	1.00	0.59	52.9	1.04
	140	128	10	3	1.09	1322.6	9325.7	4.5	6500	150	77	90	1.29	74.7	1.03	1.00	0.59	74.7	1.03
	140	128	10	3	1.09	1322.6	9325.7	4.5	6500	300	100	90	1.82	79.0	1.26	1.00	0.59	96.2	1.04
	140	128	10	3	1.09	1322.6	9325.7	4.5	6500	450	127	90	2.23	79.0	1.60	1.00	0.59	117.8	1.08
	140	128	10	3	1.09	1322.6	9325.7	4.5	6500	600	152	90	2.58	79.0	1.92	1.00	0.59	136.0	1.12
WFSC5_L3	140	128	10	3	1.09	1322.6	9325.7	4.5	7000	75	52	80	0.97	50.6	1.03	1.00	0.59	50.6	1.03
	140	128	10	3	1.09	1322.6	9325.7	4.5	7000	150	71	80	1.37	68.1	1.04	1.00	0.59	68.1	1.04
	140	128	10	3	1.09	1322.6	9325.7	4.5	7000	300	94	80	1.94	69.8	1.35	1.00	0.59	90.4	1.04
	140	128	10	3	1.09	1322.6	9325.7	4.5	7000	450	122	80	2.38	69.8	1.74	1.00	0.59	110.7	1.10
	140	128	10	3	1.09	1322.6	9325.7	4.5	7000	600	145	80	2.75	69.8	2.08	1.00	0.59	127.8	1.13

Column	Geometry									SFEA		DSM Design							
	b_w	b_f	b_s	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
WFSC5_L4	140	128	10	3	1.09	1322.6	9325.7	4.5	7500	75	49	71	1.03	48.2	1.02	1.00	0.59	48.2	1.02
	140	128	10	3	1.09	1322.6	9325.7	4.5	7500	150	65	71	1.45	62.0	1.05	1.00	0.59	62.0	1.05
	140	128	10	3	1.09	1322.6	9325.7	4.5	7500	300	90	71	2.06	62.3	1.45	1.00	0.59	85.4	1.06
	140	128	10	3	1.09	1322.6	9325.7	4.5	7500	450	117	71	2.52	62.3	1.88	1.00	0.59	104.6	1.12
	140	128	10	3	1.09	1322.6	9325.7	4.5	7500	600	138	71	2.91	62.3	2.22	1.00	0.59	120.7	1.15
WFSC5_L5	140	128	10	3	1.09	1322.6	9325.7	4.5	8000	75	46	64	1.08	45.9	1.01	1.00	0.59	45.9	1.01
	140	128	10	3	1.09	1322.6	9325.7	4.5	8000	150	61	64	1.53	56.1	1.09	1.00	0.59	57.3	1.06
	140	128	10	3	1.09	1322.6	9325.7	4.5	8000	300	87	64	2.17	56.1	1.55	1.00	0.59	81.0	1.07
	140	128	10	3	1.09	1322.6	9325.7	4.5	8000	450	112	64	2.65	56.1	2.00	1.00	0.59	99.2	1.13
	140	128	10	3	1.09	1322.6	9325.7	4.5	8000	600	128	64	3.06	56.1	**2.28**	1.00	0.59	114.6	1.12
WFSC5_L6	140	128	10	3	1.09	1322.6	9325.7	4.5	8500	75	44	58	1.14	43.7	1.00	1.00	0.59	43.7	1.00
	140	128	10	3	1.09	1322.6	9325.7	4.5	8500	150	57	58	1.61	50.9	1.12	1.00	0.59	54.6	1.05
	140	128	10	3	1.09	1322.6	9325.7	4.5	8500	300	84	58	2.27	50.9	1.65	1.00	0.59	77.2	1.09
	140	128	10	3	1.09	1322.6	9325.7	4.5	8500	450	108	58	2.78	50.9	2.12	1.00	0.59	94.6	1.14
	140	128	10	3	1.09	1322.6	9325.7	4.5	8500	600	116	58	3.21	50.9	**2.28**	1.00	0.59	109.2	1.06
WFSC6_L1	180	90	10	2.5	2.00	1012.1	5648.7	11.1	5500	75	65	154	0.70	61.2	1.06	1.38	0.68	61.2	1.06
	180	90	10	2.5	2.00	1012.1	5648.7	11.1	5500	150	108	154	0.99	99.9	1.08	1.38	0.68	99.9	1.08
	180	90	10	2.5	2.00	1012.1	5648.7	11.1	5500	300	138	154	1.39	133.0	1.04	1.38	0.68	133.0	1.04
	180	90	10	2.5	2.00	1012.1	5648.7	11.1	5500	450	153	154	1.71	135.4	1.13	1.38	0.68	146.8	1.04
	180	90	10	2.5	2.00	1012.1	5648.7	11.1	5500	600	168	154	1.97	135.4	1.24	1.38	0.68	160.6	1.05
WFSC6_L2	180	90	10	2.5	2.00	1012.1	5648.7	11.1	6000	75	63	132	0.75	59.2	1.06	1.38	0.68	59.2	1.06
	180	90	10	2.5	2.00	1012.1	5648.7	11.1	6000	150	99	132	1.06	93.3	1.06	1.38	0.68	93.3	1.06
	180	90	10	2.5	2.00	1012.1	5648.7	11.1	6000	300	124	132	1.51	116.1	1.07	1.38	0.68	116.4	1.06
	180	90	10	2.5	2.00	1012.1	5648.7	11.1	6000	450	140	132	1.84	116.1	1.20	1.38	0.68	132.0	1.06
	180	90	10	2.5	2.00	1012.1	5648.7	11.1	6000	600	154	132	2.13	116.1	1.33	1.38	0.68	144.4	1.07
WFSC6_L3	180	90	10	2.5	2.00	1012.1	5648.7	11.1	6500	75	60	115	0.81	57.1	1.06	1.38	0.68	57.1	1.06
	180	90	10	2.5	2.00	1012.1	5648.7	11.1	6500	150	91	115	1.14	86.9	1.04	1.38	0.68	86.9	1.04
	180	90	10	2.5	2.00	1012.1	5648.7	11.1	6500	300	112	115	1.61	100.9	1.11	1.38	0.68	105.7	1.06
	180	90	10	2.5	2.00	1012.1	5648.7	11.1	6500	450	129	115	1.98	100.9	1.28	1.38	0.68	119.9	1.07
	180	90	10	2.5	2.00	1012.1	5648.7	11.1	6500	600	143	115	2.28	100.9	1.41	1.38	0.68	131.1	1.09
WFSC6_L4	180	90	10	2.5	2.00	1012.1	5648.7	11.1	7000	75	58	101	0.86	55.0	1.05	1.38	0.68	55.0	1.05
	180	90	10	2.5	2.00	1012.1	5648.7	11.1	7000	150	83	101	1.22	80.7	1.03	1.38	0.68	80.7	1.03
	180	90	10	2.5	2.00	1012.1	5648.7	11.1	7000	300	103	101	1.72	88.8	1.16	1.38	0.68	96.8	1.06
	180	90	10	2.5	2.00	1012.1	5648.7	11.1	7000	450	120	101	2.11	88.8	1.35	1.38	0.68	109.8	1.09
	180	90	10	2.5	2.00	1012.1	5648.7	11.1	7000	600	132	101	2.43	88.8	1.49	1.38	0.68	120.1	1.10
WFSC6_L5	180	90	10	2.5	2.00	1012.1	5648.7	11.1	7500	75	56	90	0.91	53.0	1.05	1.38	0.68	53.0	1.05
	180	90	10	2.5	2.00	1012.1	5648.7	11.1	7500	150	77	90	1.29	74.8	1.03	1.38	0.68	74.8	1.03
	180	90	10	2.5	2.00	1012.1	5648.7	11.1	7500	300	96	90	1.82	79.1	1.21	1.38	0.68	89.4	1.07
	180	90	10	2.5	2.00	1012.1	5648.7	11.1	7500	450	112	90	2.23	79.1	1.41	1.38	0.68	101.4	1.10
	180	90	10	2.5	2.00	1012.1	5648.7	11.1	7500	600	122	90	2.58	79.1	1.55	1.38	0.68	110.9	1.10
WFSC6_L6	180	90	10	2.5	2.00	1012.1	5648.7	11.1	8000	75	53	81	0.96	50.9	1.04	1.38	0.68	50.9	1.04
	180	90	10	2.5	2.00	1012.1	5648.7	11.1	8000	150	71	81	1.36	69.1	1.03	1.38	0.68	69.1	1.03
	180	90	10	2.5	2.00	1012.1	5648.7	11.1	8000	300	90	81	1.92	71.1	1.26	1.38	0.68	83.0	1.08
	180	90	10	2.5	2.00	1012.1	5648.7	11.1	8000	450	104	81	2.36	71.1	1.47	1.38	0.68	94.2	1.11
	180	90	10	2.5	2.00	1012.1	5648.7	11.1	8000	600	113	81	2.72	71.1	1.59	1.38	0.68	103.0	1.10
WFSC7_L1	130	70	20	2.5	1.86	837.1	2140.4	8.3	4000	75	67	198	0.62	64.0	1.05	1.21	0.64	64.0	1.05
	130	70	20	2.5	1.86	837.1	2140.4	8.3	4000	150	119	198	0.87	109.2	1.09	1.21	0.64	109.2	1.09
	130	70	20	2.5	1.86	837.1	2140.4	8.3	4000	300	168	198	1.23	159.1	1.06	1.21	0.64	159.1	1.06
	130	70	20	2.5	1.86	837.1	2140.4	8.3	4000	450	186	198	1.51	173.6	1.07	1.21	0.64	174.4	1.06
	130	70	20	2.5	1.86	837.1	2140.4	8.3	4000	600	198	198	1.74	173.6	1.14	1.21	0.64	195.4	1.01
WFSC7_L2	130	70	20	2.5	1.86	837.1	2140.4	8.3	4500	75	65	161	0.68	61.7	1.06	1.21	0.64	61.7	1.06
	130	70	20	2.5	1.86	837.1	2140.4	8.3	4500	150	110	161	0.97	101.6	1.08	1.21	0.64	101.6	1.08
	130	70	20	2.5	1.86	837.1	2140.4	8.3	4500	300	144	161	1.37	137.5	1.05	1.21	0.64	137.5	1.05
	130	70	20	2.5	1.86	837.1	2140.4	8.3	4500	450	159	161	1.67	141.2	1.13	1.21	0.64	153.9	1.03
	130	70	20	2.5	1.86	837.1	2140.4	8.3	4500	600	172	161	1.93	141.2	1.22	1.21	0.64	172.5	1.00
WFSC7_L3	130	70	20	2.5	1.86	837.1	2140.4	8.3	5000	75	63	134	0.75	59.4	1.06	1.21	0.64	59.4	1.06
	130	70	20	2.5	1.86	837.1	2140.4	8.3	5000	150	100	134	1.06	94.0	1.06	1.21	0.64	94.0	1.06
	130	70	20	2.5	1.86	837.1	2140.4	8.3	5000	300	126	134	1.49	117.9	1.06	1.21	0.64	117.9	1.06
	130	70	20	2.5	1.86	837.1	2140.4	8.3	5000	450	140	134	1.83	117.9	1.19	1.21	0.64	138.0	1.01
	130	70	20	2.5	1.86	837.1	2140.4	8.3	5000	600	154	134	2.11	117.9	1.30	1.21	0.64	154.6	0.99
WFSC7_L4	130	70	20	2.5	1.86	837.1	2140.4	8.3	5500	75	60	115	0.81	57.0	1.06	1.21	0.64	57.0	1.06
	130	70	20	2.5	1.86	837.1	2140.4	8.3	5500	150	90	115	1.14	86.8	1.04	1.21	0.64	86.8	1.04
	130	70	20	2.5	1.86	837.1	2140.4	8.3	5500	300	111	115	1.62	100.6	1.11	1.21	0.64	106.8	1.04
	130	70	20	2.5	1.86	837.1	2140.4	8.3	5500	450	126	115	1.98	100.6	1.25	1.21	0.64	125.4	1.00
	130	70	20	2.5	1.86	837.1	2140.4	8.3	5500	600	139	115	2.29	100.6	1.38	1.21	0.64	140.5	0.99
WFSC7_L5	130	70	20	2.5	1.86	837.1	2140.4	8.3	6000	75	58	100	0.87	54.7	1.05	1.21	0.64	54.7	1.05
	130	70	20	2.5	1.86	837.1	2140.4	8.3	6000	150	82	100	1.23	79.9	1.03	1.21	0.64	79.9	1.03
	130	70	20	2.5	1.86	837.1	2140.4	8.3	6000	300	100	100	1.74	87.4	1.15	1.21	0.64	98.1	1.02
	130	70	20	2.5	1.86	837.1	2140.4	8.3	6000	450	115	100	2.13	87.4	1.31	1.21	0.64	115.2	1.00
	130	70	20	2.5	1.86	837.1	2140.4	8.3	6000	600	126	100	2.45	87.4	1.45	1.21	0.64	129.0	0.98

Column	Geometry									SFEA		DSM Design							
	b_w	b_f	b_s	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
WFSC7_L6	130	70	20	2.5	1.86	837.1	2140.4	8.3	6500	75	55	88	0.92	52.5	1.05	1.21	0.64	52.5	1.05
	130	70	20	2.5	1.86	837.1	2140.4	8.3	6500	150	75	88	1.31	73.4	1.02	1.21	0.64	73.4	1.02
	130	70	20	2.5	1.86	837.1	2140.4	8.3	6500	300	92	88	1.85	77.1	1.19	1.21	0.64	90.9	1.01
	130	70	20	2.5	1.86	837.1	2140.4	8.3	6500	450	105	88	2.26	77.1	1.37	1.21	0.64	106.7	0.99
	130	70	20	2.5	1.86	837.1	2140.4	8.3	6500	600	115	88	2.61	77.1	1.49	1.21	0.64	119.6	0.96
WFSC8_L1	100	70	20	3	1.43	914.6	1544.5	5.0	4000	75	65	156	0.69	61.3	1.06	1.01	0.59	61.3	1.06
	100	70	20	3	1.43	914.6	1544.5	5.0	4000	150	108	156	0.98	100.2	1.08	1.01	0.59	100.2	1.08
	100	70	20	3	1.43	914.6	1544.5	5.0	4000	300	142	156	1.39	133.9	1.06	1.01	0.59	133.9	1.06
	100	70	20	3	1.43	914.6	1544.5	5.0	4000	450	158	156	1.70	136.5	1.15	1.01	0.59	154.6	1.02
	100	70	20	3	1.43	914.6	1544.5	5.0	4000	600	174	156	1.96	136.5	1.28	1.01	0.59	178.2	0.98
WFSC8_L2	100	70	20	3	1.43	914.6	1544.5	5.0	4500	75	63	129	0.76	58.8	1.07	1.01	0.59	58.8	1.07
	100	70	20	3	1.43	914.6	1544.5	5.0	4500	150	98	129	1.08	92.3	1.06	1.01	0.59	92.3	1.06
	100	70	20	3	1.43	914.6	1544.5	5.0	4500	300	123	129	1.52	113.3	1.08	1.01	0.59	115.2	1.07
	100	70	20	3	1.43	914.6	1544.5	5.0	4500	450	139	129	1.87	113.3	1.23	1.01	0.59	140.7	0.99
	100	70	20	3	1.43	914.6	1544.5	5.0	4500	600	156	129	2.15	113.3	1.37	1.01	0.59	162.2	0.96
WFSC8_L3	100	70	20	3	1.43	914.6	1544.5	5.0	5000	75	60	110	0.82	56.4	1.06	1.01	0.59	56.4	1.06
	100	70	20	3	1.43	914.6	1544.5	5.0	5000	150	89	110	1.17	84.9	1.05	1.01	0.59	84.9	1.05
	100	70	20	3	1.43	914.6	1544.5	5.0	5000	300	109	110	1.65	96.6	1.13	1.01	0.59	106.2	1.03
	100	70	20	3	1.43	914.6	1544.5	5.0	5000	450	126	110	2.02	96.6	1.30	1.01	0.59	129.8	0.97
	100	70	20	3	1.43	914.6	1544.5	5.0	5000	600	141	110	2.33	96.6	1.46	1.01	0.59	149.6	0.94
WFSC8_L4	100	70	20	3	1.43	914.6	1544.5	5.0	5500	75	57	96	0.88	54.1	1.06	1.01	0.59	54.1	1.06
	100	70	20	3	1.43	914.6	1544.5	5.0	5500	150	81	96	1.25	78.0	1.03	1.01	0.59	78.0	1.03
	100	70	20	3	1.43	914.6	1544.5	5.0	5500	300	99	96	1.77	84.2	1.17	1.01	0.59	99.1	1.00
	100	70	20	3	1.43	914.6	1544.5	5.0	5500	450	115	96	2.17	84.2	1.36	1.01	0.59	121.1	0.95
	100	70	20	3	1.43	914.6	1544.5	5.0	5500	600	129	96	2.50	84.2	1.53	1.01	0.59	139.5	0.92
WFSC8_L5	100	70	20	3	1.43	914.6	1544.5	5.0	6000	75	54	85	0.94	51.9	1.05	1.01	0.59	51.9	1.05
	100	70	20	3	1.43	914.6	1544.5	5.0	6000	150	74	85	1.33	71.7	1.03	1.01	0.59	71.7	1.03
	100	70	20	3	1.43	914.6	1544.5	5.0	6000	300	91	85	1.88	74.6	1.21	1.01	0.59	93.2	0.97
	100	70	20	3	1.43	914.6	1544.5	5.0	6000	450	105	85	2.30	74.6	1.41	1.01	0.59	113.9	0.93
	100	70	20	3	1.43	914.6	1544.5	5.0	6000	600	117	85	2.66	74.6	1.57	1.01	0.59	131.3	0.89
WFSC8_L6	100	70	20	3	1.43	914.6	1544.5	5.0	6500	75	52	77	0.99	49.8	1.04	1.01	0.59	49.8	1.04
	100	70	20	3	1.43	914.6	1544.5	5.0	6500	150	68	77	1.40	66.0	1.03	1.01	0.59	66.0	1.03
	100	70	20	3	1.43	914.6	1544.5	5.0	6500	300	84	77	1.98	67.1	1.25	1.01	0.59	88.3	0.95
	100	70	20	3	1.43	914.6	1544.5	5.0	6500	450	97	77	2.42	67.1	1.45	1.01	0.59	107.9	0.90
	100	70	20	3	1.43	914.6	1544.5	5.0	6500	600	107	77	2.80	67.1	1.59	1.01	0.59	124.4	0.86
WFSC9_L1	110	90	15	4	1.22	1379.4	3624.2	3.8	3500	75	69	217	0.59	64.9	1.06	1.00	0.59	64.9	1.06
	110	90	15	4	1.22	1379.4	3624.2	3.8	3500	150	124	217	0.83	112.3	1.11	1.00	0.59	112.3	1.11
	110	90	15	4	1.22	1379.4	3624.2	3.8	3500	300	182	217	1.18	168.2	1.08	1.00	0.59	168.2	1.08
	110	90	15	4	1.22	1379.4	3624.2	3.8	3500	450	204	217	1.44	188.9	1.08	1.00	0.59	188.9	1.08
	110	90	15	4	1.22	1379.4	3624.2	3.8	3500	600	221	217	1.66	190.3	1.16	1.00	0.59	211.1	1.05
WFSC9_L2	110	90	15	4	1.22	1379.4	3624.2	3.8	4000	75	67	175	0.65	62.7	1.07	1.00	0.59	62.7	1.07
	110	90	15	4	1.22	1379.4	3624.2	3.8	4000	150	115	175	0.92	104.9	1.10	1.00	0.59	104.9	1.10
	110	90	15	4	1.22	1379.4	3624.2	3.8	4000	300	156	175	1.31	146.7	1.06	1.00	0.59	146.7	1.06
	110	90	15	4	1.22	1379.4	3624.2	3.8	4000	450	175	175	1.60	153.9	1.13	1.00	0.59	164.4	1.06
	110	90	15	4	1.22	1379.4	3624.2	3.8	4000	600	194	175	1.85	153.9	1.26	1.00	0.59	189.8	1.02
WFSC9_L3	110	90	15	4	1.22	1379.4	3624.2	3.8	4500	75	65	147	0.72	60.6	1.07	1.00	0.59	60.6	1.07
	110	90	15	4	1.22	1379.4	3624.2	3.8	4500	150	106	147	1.01	97.8	1.08	1.00	0.59	97.8	1.08
	110	90	15	4	1.22	1379.4	3624.2	3.8	4500	300	136	147	1.43	127.5	1.07	1.00	0.59	127.5	1.07
	110	90	15	4	1.22	1379.4	3624.2	3.8	4500	450	155	147	1.75	128.6	1.21	1.00	0.59	150.3	1.03
	110	90	15	4	1.22	1379.4	3624.2	3.8	4500	600	176	147	2.02	128.6	1.37	1.00	0.59	173.6	1.02
WFSC9_L4	110	90	15	4	1.22	1379.4	3624.2	3.8	5000	75	63	126	0.77	58.4	1.08	1.00	0.59	58.4	1.08
	110	90	15	4	1.22	1379.4	3624.2	3.8	5000	150	97	126	1.09	91.1	1.07	1.00	0.59	91.1	1.07
	110	90	15	4	1.22	1379.4	3624.2	3.8	5000	300	122	126	1.54	110.4	1.10	1.00	0.59	113.7	1.07
	110	90	15	4	1.22	1379.4	3624.2	3.8	5000	450	142	126	1.89	110.4	1.29	1.00	0.59	139.2	1.02
	110	90	15	4	1.22	1379.4	3624.2	3.8	5000	600	163	126	2.18	110.4	1.48	1.00	0.59	160.8	1.01
WFSC9_L5	110	90	15	4	1.22	1379.4	3624.2	3.8	5500	75	61	110	0.82	56.4	1.07	1.00	0.59	56.4	1.07
	110	90	15	4	1.22	1379.4	3624.2	3.8	5500	150	89	110	1.17	84.9	1.05	1.00	0.59	84.9	1.05
	110	90	15	4	1.22	1379.4	3624.2	3.8	5500	300	111	110	1.65	96.7	1.15	1.00	0.59	106.4	1.04
	110	90	15	4	1.22	1379.4	3624.2	3.8	5500	450	132	110	2.02	96.7	1.36	1.00	0.59	130.3	1.01
	110	90	15	4	1.22	1379.4	3624.2	3.8	5500	600	151	110	2.33	96.7	1.57	1.00	0.59	150.5	1.01
WFSC9_L6	110	90	15	4	1.22	1379.4	3624.2	3.8	6000	75	58	98	0.87	54.5	1.07	1.00	0.59	54.5	1.07
	110	90	15	4	1.22	1379.4	3624.2	3.8	6000	150	82	98	1.23	79.2	1.04	1.00	0.59	79.2	1.04
	110	90	15	4	1.22	1379.4	3624.2	3.8	6000	300	103	98	1.75	86.3	1.19	1.00	0.59	100.5	1.02
	110	90	15	4	1.22	1379.4	3624.2	3.8	6000	450	123	98	2.14	86.3	1.43	1.00	0.59	123.1	1.00
	110	90	15	4	1.22	1379.4	3624.2	3.8	6000	600	141	98	2.47	86.3	1.64	1.00	0.59	142.1	0.99
													Mean		1.343			Mean	1.060
													Sd. Dev.		0.379			Sd. Dev.	0.062
													Max		2.700			Max	1.288
													Min		0.982			Min	0.860

ANNEX H: U Column Data

Table H_1: PC_M columns: (i) geometries, (ii) buckling stresses and ultimate strengths, (iii) ultimate strength predictions by current and proposed DSM design curves, and (iv) numerical-to-predicted ultimate strength ratios (mm and MPa)

Column	Geometry								SFEA		DSM Design							
	b_w	b_f	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
U1_L1	100	100	3	1.00	900.0	1790.2	3.74	3600	75	62	127	0.77	58.6	1.06	1.47	0.71	58.6	1.06
	100	100	3	1.00	900.0	1790.2	3.74	3600	150	97	127	1.09	91.4	1.06	1.47	0.71	91.4	1.06
	100	100	3	1.00	900.0	1790.2	3.74	3600	300	113	127	1.54	111.2	1.02	1.47	0.71	112.7	1.00
	100	100	3	1.00	900.0	1790.2	3.74	3600	450	122	127	1.88	111.2	1.10	1.47	0.71	125.4	0.97
	100	100	3	1.00	900.0	1790.2	3.74	3600	600	133	127	2.18	111.2	1.20	1.47	0.71	135.3	0.98
U1_L2	100	100	3	1.00	900.0	1790.2	3.74	3800	75	60	115	0.81	57.1	1.06	1.47	0.71	57.1	1.06
	100	100	3	1.00	900.0	1790.2	3.74	3800	150	91	115	1.14	87.1	1.05	1.47	0.71	87.1	1.05
	100	100	3	1.00	900.0	1790.2	3.74	3800	300	106	115	1.61	101.2	1.05	1.47	0.71	105.2	1.01
	100	100	3	1.00	900.0	1790.2	3.74	3800	450	115	115	1.97	101.2	1.14	1.47	0.71	117.0	0.98
	100	100	3	1.00	900.0	1790.2	3.74	3800	600	125	115	2.28	101.2	1.24	1.47	0.71	126.2	0.99
U1_L3	100	100	3	1.00	900.0	1790.2	3.74	4000	75	59	106	0.84	55.7	1.05	1.47	0.71	55.7	1.05
	100	100	3	1.00	900.0	1790.2	3.74	4000	150	86	106	1.19	82.8	1.04	1.47	0.71	82.8	1.04
	100	100	3	1.00	900.0	1790.2	3.74	4000	300	100	106	1.69	92.6	1.08	1.47	0.71	98.5	1.01
	100	100	3	1.00	900.0	1790.2	3.74	4000	450	109	106	2.06	92.6	1.18	1.47	0.71	109.6	0.99
	100	100	3	1.00	900.0	1790.2	3.74	4000	600	117	106	2.38	92.6	1.26	1.47	0.71	118.2	0.99
U1_L4	100	100	3	1.00	900.0	1790.2	3.74	4200	75	57	97	0.88	54.3	1.05	1.47	0.71	54.3	1.05
	100	100	3	1.00	900.0	1790.2	3.74	4200	150	81	97	1.24	78.6	1.03	1.47	0.71	78.6	1.03
	100	100	3	1.00	900.0	1790.2	3.74	4200	300	95	97	1.76	85.2	1.11	1.47	0.71	92.6	1.02
	100	100	3	1.00	900.0	1790.2	3.74	4200	450	103	97	2.15	85.2	1.21	1.47	0.71	103.0	1.00
	100	100	3	1.00	900.0	1790.2	3.74	4200	600	110	97	2.49	85.2	1.29	1.47	0.71	111.1	0.99
U2_L1	100	110	3	0.91	960.0	2326.4	3.35	4200	75	57	95	0.89	53.9	1.05	1.45	0.70	53.9	1.05
	100	110	3	0.91	960.0	2326.4	3.35	4200	150	80	95	1.26	77.5	1.03	1.45	0.70	77.5	1.03
	100	110	3	0.91	960.0	2326.4	3.35	4200	300	91	95	1.78	83.4	1.09	1.45	0.70	91.6	1.00
	100	110	3	0.91	960.0	2326.4	3.35	4200	450	104	95	2.18	83.4	1.25	1.45	0.70	102.3	1.02
	100	110	3	0.91	960.0	2326.4	3.35	4200	600	114	95	2.51	83.4	1.37	1.45	0.70	110.7	1.03
U2_L2	100	110	3	0.91	960.0	2326.4	3.35	4700	75	52	78	0.98	50.3	1.03	1.45	0.70	50.3	1.03
	100	110	3	0.91	960.0	2326.4	3.35	4700	150	69	78	1.38	67.3	1.02	1.45	0.70	67.3	1.02
	100	110	3	0.91	960.0	2326.4	3.35	4700	300	81	78	1.96	68.8	1.18	1.45	0.70	79.6	1.02
	100	110	3	0.91	960.0	2326.4	3.35	4700	450	92	78	2.40	68.8	1.33	1.45	0.70	89.0	1.03
	100	110	3	0.91	960.0	2326.4	3.35	4700	600	99	78	2.77	68.8	1.43	1.45	0.70	96.3	1.02
U2_L3	100	110	3	0.91	960.0	2326.4	3.35	5200	75	47	66	1.07	46.6	1.01	1.45	0.70	46.6	1.01
	100	110	3	0.91	960.0	2326.4	3.35	5200	150	61	66	1.51	58.0	1.04	1.45	0.70	58.1	1.04
	100	110	3	0.91	960.0	2326.4	3.35	5200	300	72	66	2.13	58.0	1.25	1.45	0.70	70.3	1.03
	100	110	3	0.91	960.0	2326.4	3.35	5200	450	81	66	2.61	58.0	1.39	1.45	0.70	78.6	1.03
	100	110	3	0.91	960.0	2326.4	3.35	5200	600	86	66	3.01	58.0	1.48	1.45	0.70	85.1	1.01
U2_L4	100	110	3	0.91	960.0	2326.4	3.35	5700	75	43	57	1.15	43.2	1.00	1.45	0.70	43.2	1.00
	100	110	3	0.91	960.0	2326.4	3.35	5700	150	54	57	1.63	49.8	1.08	1.45	0.70	52.1	1.03
	100	110	3	0.91	960.0	2326.4	3.35	5700	300	65	57	2.30	49.8	1.31	1.45	0.70	63.0	1.03
	100	110	3	0.91	960.0	2326.4	3.35	5700	450	71	57	2.81	49.8	1.43	1.45	0.70	70.4	1.01
	100	110	3	0.91	960.0	2326.4	3.35	5700	600	75	57	3.25	49.8	1.50	1.45	0.70	76.2	0.98
U3_L1	100	120	3	0.83	1020.0	2957.9	3.04	4500	75	53	83	0.95	51.3	1.03	1.43	0.70	51.3	1.03
	100	120	3	0.83	1020.0	2957.9	3.04	4500	150	72	83	1.35	70.2	1.02	1.43	0.70	70.2	1.02
	100	120	3	0.83	1020.0	2957.9	3.04	4500	300	84	83	1.90	72.5	1.15	1.43	0.70	83.1	1.01
	100	120	3	0.83	1020.0	2957.9	3.04	4500	450	97	83	2.33	72.5	1.34	1.43	0.70	93.2	1.04
	100	120	3	0.83	1020.0	2957.9	3.04	4500	600	107	83	2.69	72.5	1.48	1.43	0.70	101.2	1.06
U3_L2	100	120	3	0.83	1020.0	2957.9	3.04	5000	75	48	69	1.04	47.6	1.02	1.43	0.70	47.6	1.02
	100	120	3	0.83	1020.0	2957.9	3.04	5000	150	63	69	1.48	60.3	1.04	1.43	0.70	60.3	1.04
	100	120	3	0.83	1020.0	2957.9	3.04	5000	300	75	69	2.09	60.4	1.24	1.43	0.70	72.9	1.03
	100	120	3	0.83	1020.0	2957.9	3.04	5000	450	87	69	2.56	60.4	1.43	1.43	0.70	81.8	1.06
	100	120	3	0.83	1020.0	2957.9	3.04	5000	600	94	69	2.95	60.4	1.55	1.43	0.70	88.8	1.05
U3_L3	100	120	3	0.83	1020.0	2957.9	3.04	5500	75	43	59	1.13	43.9	0.98	1.43	0.70	43.9	0.98
	100	120	3	0.83	1020.0	2957.9	3.04	5500	150	54	59	1.60	51.4	1.06	1.43	0.70	53.3	1.02
	100	120	3	0.83	1020.0	2957.9	3.04	5500	300	66	59	2.26	51.4	1.28	1.43	0.70	64.9	1.01
	100	120	3	0.83	1020.0	2957.9	3.04	5500	450	74	59	2.77	51.4	1.43	1.43	0.70	72.8	1.01
	100	120	3	0.83	1020.0	2957.9	3.04	5500	600	78	59	3.20	51.4	1.51	1.43	0.70	79.0	0.98
U3_L4	100	120	3	0.83	1020.0	2957.9	3.04	6000	75	40	51	1.22	40.4	0.99	1.43	0.70	40.4	0.99
	100	120	3	0.83	1020.0	2957.9	3.04	6000	150	50	51	1.72	44.5	1.12	1.43	0.70	48.1	1.03
	100	120	3	0.83	1020.0	2957.9	3.04	6000	300	62	51	2.43	44.5	1.39	1.43	0.70	58.5	1.05
	100	120	3	0.83	1020.0	2957.9	3.04	6000	450	69	51	2.98	44.5	1.55	1.43	0.70	65.7	1.05
	100	120	3	0.83	1020.0	2957.9	3.04	6000	600	73	51	3.44	44.5	1.64	1.43	0.70	71.3	1.02
													Mean	1.196			Mean	1.021
													Sd. Dev.	0.180			Sd. Dev.	0.024
													Max	1.637			Max	1.061
													Min	0.982			Min	0.973

Table H_2: PC_m columns: (i) geometries, (ii) buckling stresses and ultimate strengths, (iii) ultimate strength predictions by current and proposed DSM design curves, and (iv) numerical-to-predicted ultimate strength ratios (mm and MPa)

Column	Geometry						SFEA		DSM Design					
	b_w	b_f	t	b_w/b_t	A	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	f_{nFT}	f_u/f_{nFT}
U1_L1	100	100	3	1.00	900	3600	75	66	154	0.70	61.2	1.07	61.2	1.07
	100	100	3	1.00	900	3600	150	109	154	0.99	99.9	1.09	99.9	1.09
	100	100	3	1.00	900	3600	300	118	154	1.39	133.0	0.89	101.6	1.16
	100	100	3	1.00	900	3600	450	118	154	1.71	135.4	0.87	101.6	1.16
	100	100	3	1.00	900	3600	600	118	154	1.97	135.4	0.87	101.6	1.16
U1_L2	100	100	3	1.00	900	3800	75	65	141	0.73	60.1	1.08	60.1	1.08
	100	100	3	1.00	900	3800	150	102	141	1.03	96.2	1.06	93.0	1.10
	100	100	3	1.00	900	3800	300	108	141	1.46	123.4	0.87	93.0	1.16
	100	100	3	1.00	900	3800	450	108	141	1.78	124.0	0.87	93.0	1.16
	100	100	3	1.00	900	3800	600	108	141	2.06	124.0	0.87	93.0	1.16
U1_L3	100	100	3	1.00	900	4000	75	64	130	0.76	58.9	1.08	58.9	1.08
	100	100	3	1.00	900	4000	150	96	130	1.07	92.5	1.04	85.5	1.12
	100	100	3	1.00	900	4000	300	99	130	1.52	114.0	0.87	85.5	1.16
	100	100	3	1.00	900	4000	450	99	130	1.86	114.0	0.87	85.5	1.16
	100	100	3	1.00	900	4000	600	99	130	2.15	114.0	0.87	85.5	1.16
U1_L4	100	100	3	1.00	900	4200	75	62	120	0.79	57.8	1.08	57.8	1.08
	100	100	3	1.00	900	4200	150	89	120	1.12	89.0	1.00	79.1	1.13
	100	100	3	1.00	900	4200	300	91	120	1.58	105.4	0.86	79.1	1.15
	100	100	3	1.00	900	4200	450	91	120	1.93	105.4	0.86	79.1	1.15
	100	100	3	1.00	900	4200	600	91	120	2.23	105.4	0.86	79.1	1.15
U2_L1	100	110	3	0.91	960	4200	75	62	117	0.80	57.4	1.08	57.4	1.08
	100	110	3	0.91	960	4200	150	90	117	1.13	87.7	1.02	77.0	1.16
	100	110	3	0.91	960	4200	300	91	117	1.60	102.6	0.89	77.0	1.19
	100	110	3	0.91	960	4200	450	91	117	1.96	102.6	0.89	77.0	1.19
	100	110	3	0.91	960	4200	600	91	117	2.26	102.6	0.89	77.0	1.19
U2_L2	100	110	3	0.91	960	4700	75	58	98	0.88	54.4	1.07	54.4	1.07
	100	110	3	0.91	960	4700	150	75	98	1.24	78.8	0.95	64.2	1.17
	100	110	3	0.91	960	4700	300	75	98	1.75	85.5	0.88	64.2	1.17
	100	110	3	0.91	960	4700	450	75	98	2.15	85.5	0.88	64.2	1.17
	100	110	3	0.91	960	4700	600	75	98	2.48	85.5	0.88	64.2	1.17
U2_L3	100	110	3	0.91	960	5200	75	54	83	0.95	51.4	1.06	51.4	1.06
	100	110	3	0.91	960	5200	150	63	83	1.34	70.5	0.89	54.7	1.15
	100	110	3	0.91	960	5200	300	63	83	1.90	73.0	0.86	54.7	1.15
	100	110	3	0.91	960	5200	450	63	83	2.33	73.0	0.86	54.7	1.15
	100	110	3	0.91	960	5200	600	63	83	2.69	73.0	0.86	54.7	1.15
U2_L4	100	110	3	0.91	960	5700	75	50	72	1.02	48.6	1.03	47.6	1.05
	100	110	3	0.91	960	5700	150	54	72	1.44	63.0	0.86	47.6	1.13
	100	110	3	0.91	960	5700	300	54	72	2.04	63.5	0.85	47.6	1.13
	100	110	3	0.91	960	5700	450	54	72	2.49	63.5	0.85	47.6	1.13
	100	110	3	0.91	960	5700	600	54	72	2.88	63.5	0.85	47.6	1.13
U3_L1	100	120	3	0.83	1020	4500	75	59	102	0.86	55.1	1.07	55.1	1.07
	100	120	3	0.83	1020	4500	150	80	102	1.21	80.9	0.99	66.9	1.19
	100	120	3	0.83	1020	4500	300	81	102	1.72	89.2	0.90	66.9	1.20
	100	120	3	0.83	1020	4500	450	81	102	2.10	89.2	0.90	66.9	1.20
	100	120	3	0.83	1020	4500	600	81	102	2.43	89.2	0.90	66.9	1.20
U3_L2	100	120	3	0.83	1020	5000	75	55	86	0.94	52.0	1.06	52.0	1.06
	100	120	3	0.83	1020	5000	150	67	86	1.32	72.1	0.93	56.4	1.19
	100	120	3	0.83	1020	5000	300	67	86	1.87	75.2	0.90	56.4	1.19
	100	120	3	0.83	1020	5000	450	67	86	2.29	75.2	0.90	56.4	1.19
	100	120	3	0.83	1020	5000	600	67	86	2.65	75.2	0.90	56.4	1.19
U3_L3	100	120	3	0.83	1020	5500	75	51	74	1.01	49.0	1.03	48.5	1.05
	100	120	3	0.83	1020	5500	150	57	74	1.43	64.0	0.89	48.5	1.18
	100	120	3	0.83	1020	5500	300	57	74	2.02	64.6	0.88	48.5	1.18
	100	120	3	0.83	1020	5500	450	57	74	2.47	64.6	0.88	48.5	1.18
	100	120	3	0.83	1020	5500	600	57	74	2.85	64.6	0.88	48.5	1.18
U3_L4	100	120	3	0.83	1020	6000	75	46	65	1.08	46.1	1.00	42.4	1.09
	100	120	3	0.83	1020	6000	150	49	65	1.52	56.6	0.87	42.4	1.16
	100	120	3	0.83	1020	6000	300	49	65	2.16	56.6	0.87	42.4	1.16
	100	120	3	0.83	1020	6000	450	49	65	2.64	56.6	0.87	42.4	1.16
	100	120	3	0.83	1020	6000	600	49	65	3.05	56.6	0.87	42.4	1.16
										Mean		0.931		1.143
										Sd. Dev.		0.082		0.044
										Max		1.091		1.203
										Min		0.849		1.045

Table H_3: PS columns: (i) geometries, (ii) buckling stresses and ultimate strengths, (iii) ultimate strength predictions by current and proposed DSM design curves, and (iv) numerical-to-predicted ultimate strength ratios (mm and MPa)

Column	Geometry						SFEA		DSM Design			
	b_w	b_f	t	b_w/b_t	A	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}
U1_L1	100	100	3	1.00	900	3600	75	62	127	0.77	58.6	1.06
	100	100	3	1.00	900	3600	150	97	127	1.09	91.4	1.06
	100	100	3	1.00	900	3600	300	106	127	1.54	111.2	0.95
	100	100	3	1.00	900	3600	450	106	127	1.88	111.2	0.95
	100	100	3	1.00	900	3600	600	106	127	2.18	111.2	0.95
U1_L2	100	100	3	1.00	900	3800	75	60	115	0.81	57.1	1.06
	100	100	3	1.00	900	3800	150	91	115	1.14	87.1	1.04
	100	100	3	1.00	900	3800	300	98	115	1.61	101.2	0.97
	100	100	3	1.00	900	3800	450	98	115	1.97	101.2	0.97
	100	100	3	1.00	900	3800	600	98	115	2.28	101.2	0.97
U1_L3	100	100	3	1.00	900	4000	75	59	106	0.84	55.7	1.05
	100	100	3	1.00	900	4000	150	85	106	1.19	82.8	1.03
	100	100	3	1.00	900	4000	300	91	106	1.69	92.6	0.98
	100	100	3	1.00	900	4000	450	91	106	2.06	92.6	0.98
	100	100	3	1.00	900	4000	600	91	106	2.38	92.6	0.98
U1_L4	100	100	3	1.00	900	4200	75	57	97	0.88	54.3	1.05
	100	100	3	1.00	900	4200	150	80	97	1.24	78.6	1.01
	100	100	3	1.00	900	4200	300	84	97	1.76	85.2	0.99
	100	100	3	1.00	900	4200	450	84	97	2.15	85.2	0.99
	100	100	3	1.00	900	4200	600	84	97	2.49	85.2	0.99
U2_L1	100	110	3	0.91	960	4200	75	57	95	0.89	53.9	1.05
	100	110	3	0.91	960	4200	150	78	95	1.26	77.5	1.01
	100	110	3	0.91	960	4200	300	81	95	1.78	83.4	0.97
	100	110	3	0.91	960	4200	450	81	95	2.18	83.4	0.97
	100	110	3	0.91	960	4200	600	81	95	2.51	83.4	0.97
U2_L2	100	110	3	0.91	960	4700	75	52	78	0.98	50.3	1.03
	100	110	3	0.91	960	4700	150	67	78	1.38	67.3	0.99
	100	110	3	0.91	960	4700	300	68	78	1.96	68.8	0.99
	100	110	3	0.91	960	4700	450	68	78	2.40	68.8	0.99
	100	110	3	0.91	960	4700	600	68	78	2.77	68.8	0.99
U2_L3	100	110	3	0.91	960	5200	75	47	66	1.07	46.6	1.01
	100	110	3	0.91	960	5200	150	57	66	1.51	58.0	0.98
	100	110	3	0.91	960	5200	300	58	66	2.13	58.0	1.00
	100	110	3	0.91	960	5200	450	58	66	2.61	58.0	1.00
	100	110	3	0.91	960	5200	600	58	66	3.01	58.0	1.00
U2_L4	100	110	3	0.91	960	5700	75	43	57	1.15	43.2	0.99
	100	110	3	0.91	960	5700	150	49	57	1.63	49.8	0.99
	100	110	3	0.91	960	5700	300	50	57	2.30	49.8	0.99
	100	110	3	0.91	960	5700	450	50	57	2.81	49.8	0.99
	100	110	3	0.91	960	5700	600	50	57	3.25	49.8	0.99
U3_L1	100	120	3	0.83	1020	4500	75	53	83	0.95	51.3	1.03
	100	120	3	0.83	1020	4500	150	69	83	1.35	70.2	0.98
	100	120	3	0.83	1020	4500	300	70	83	1.90	72.5	0.96
	100	120	3	0.83	1020	4500	450	70	83	2.33	72.5	0.96
	100	120	3	0.83	1020	4500	600	70	83	2.69	72.5	0.96
U3_L2	100	120	3	0.83	1020	5000	75	48	69	1.04	47.6	1.02
	100	120	3	0.83	1020	5000	150	59	69	1.48	60.3	0.98
	100	120	3	0.83	1020	5000	300	60	69	2.09	60.4	0.99
	100	120	3	0.83	1020	5000	450	60	69	2.56	60.4	0.99
	100	120	3	0.83	1020	5000	600	60	69	2.95	60.4	0.99
U3_L3	100	120	3	0.83	1020	5500	75	44	59	1.13	43.9	0.99
	100	120	3	0.83	1020	5500	150	51	59	1.60	51.4	0.99
	100	120	3	0.83	1020	5500	300	51	59	2.26	51.4	1.00
	100	120	3	0.83	1020	5500	450	51	59	2.77	51.4	1.00
	100	120	3	0.83	1020	5500	600	51	59	3.20	51.4	1.00
U3_L4	100	120	3	0.83	1020	6000	75	39	51	1.22	40.4	0.98
	100	120	3	0.83	1020	6000	150	44	51	1.72	44.5	1.00
	100	120	3	0.83	1020	6000	300	45	51	2.43	44.5	1.00
	100	120	3	0.83	1020	6000	450	45	51	2.98	44.5	1.00
	100	120	3	0.83	1020	6000	600	45	51	3.44	44.5	1.00
										Mean		0.996
										Sd. Dev.		0.027
										Max		1.058
										Min		0.953

ANNEX I: C Column Data

Table I_1: PC_M columns: (i) geometries, (ii) buckling stresses and ultimate strengths, (iii) ultimate strength predictions by current and proposed DSM design curves, and (iv) numerical-to-predicted ultimate strength ratios (mm and MPa)

Column	Geometry									SFEA		DSM Design							
	b_w	b_f	b_s	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
C1_L1	60	55	11	1.2	1.09	230.4	91.0	5.47	2300	75	60	122	0.79	57.9	1.04	1.58	0.74	57.9	1.04
	60	55	11	1.2	1.09	230.4	91.0	5.47	2300	150	92	122	1.11	89.5	1.03	1.58	0.74	89.5	1.03
	60	55	11	1.2	1.09	230.4	91.0	5.47	2300	300	113	122	1.57	106.6	1.06	1.58	0.74	108.7	1.03
	60	55	11	1.2	1.09	230.4	91.0	5.47	2300	450	122	122	1.92	106.6	1.14	1.58	0.74	118.4	1.03
	60	55	11	1.2	1.09	230.4	91.0	5.47	2300	600	129	122	2.22	106.6	1.21	1.58	0.74	125.8	1.02
C1_L2	60	55	11	1.2	1.09	230.4	91.0	5.47	2500	75	57	104	0.85	55.4	1.03	1.58	0.74	55.4	1.03
	60	55	11	1.2	1.09	230.4	91.0	5.47	2500	150	83	104	1.20	81.9	1.01	1.58	0.74	81.9	1.01
	60	55	11	1.2	1.09	230.4	91.0	5.47	2500	300	99	104	1.70	91.1	1.09	1.58	0.74	96.0	1.03
	60	55	11	1.2	1.09	230.4	91.0	5.47	2500	450	108	104	2.08	91.1	1.18	1.58	0.74	104.6	1.03
	60	55	11	1.2	1.09	230.4	91.0	5.47	2500	600	114	104	2.40	91.1	1.25	1.58	0.74	111.2	1.03
C1_L3	60	55	11	1.2	1.09	230.4	91.0	5.47	3000	75	49	74	1.01	49.0	1.00	1.58	0.74	49.0	1.00
	60	55	11	1.2	1.09	230.4	91.0	5.47	3000	150	64	74	1.43	64.0	1.00	1.58	0.74	64.0	1.00
	60	55	11	1.2	1.09	230.4	91.0	5.47	3000	300	76	74	2.02	64.7	1.17	1.58	0.74	73.3	1.03
	60	55	11	1.2	1.09	230.4	91.0	5.47	3000	450	83	74	2.47	64.7	1.28	1.58	0.74	79.9	1.04
	60	55	11	1.2	1.09	230.4	91.0	5.47	3000	600	87	74	2.85	64.7	1.35	1.58	0.74	84.8	1.03
C1_L4	60	55	11	1.2	1.09	230.4	91.0	5.47	3500	75	41	55	1.16	42.6	0.97	1.58	0.74	42.6	0.97
	60	55	11	1.2	1.09	230.4	91.0	5.47	3500	150	51	55	1.65	48.6	1.05	1.58	0.74	50.5	1.01
	60	55	11	1.2	1.09	230.4	91.0	5.47	3500	300	61	55	2.33	48.6	1.25	1.58	0.74	58.5	1.04
	60	55	11	1.2	1.09	230.4	91.0	5.47	3500	450	66	55	2.85	48.6	1.36	1.58	0.74	63.7	1.03
	60	55	11	1.2	1.09	230.4	91.0	5.47	3500	600	68	55	3.29	48.6	1.40	1.58	0.74	67.7	1.01
C2_L1	80	70	10	1	1.14	240.0	219.7	7.48	3000	75	59	112	0.82	56.7	1.03	1.70	0.78	56.7	1.03
	80	70	10	1	1.14	240.0	219.7	7.48	3000	150	85	112	1.16	85.8	0.99	1.70	0.78	85.8	0.99
	80	70	10	1	1.14	240.0	219.7	7.48	3000	300	99	112	1.63	98.5	1.00	1.70	0.78	101.1	0.98
	80	70	10	1	1.14	240.0	219.7	7.48	3000	450	104	112	2.00	98.5	1.05	1.70	0.78	107.5	0.97
	80	70	10	1	1.14	240.0	219.7	7.48	3000	600	108	112	2.31	98.5	1.10	1.70	0.78	112.3	0.96
C2_L2	80	70	10	1	1.14	240.0	219.7	7.48	3500	75	52	84	0.94	51.7	1.02	1.70	0.78	51.7	1.02
	80	70	10	1	1.14	240.0	219.7	7.48	3500	150	70	84	1.33	71.3	0.98	1.70	0.78	71.3	0.98
	80	70	10	1	1.14	240.0	219.7	7.48	3500	300	80	84	1.89	74.0	1.08	1.70	0.78	79.3	1.01
	80	70	10	1	1.14	240.0	219.7	7.48	3500	450	85	84	2.31	74.0	1.14	1.70	0.78	84.3	1.00
	80	70	10	1	1.14	240.0	219.7	7.48	3500	600	88	84	2.67	74.0	1.19	1.70	0.78	88.1	1.00
C2_L3	80	70	10	1	1.14	240.0	219.7	7.48	4000	75	46	66	1.07	46.5	0.99	1.70	0.78	46.5	0.99
	80	70	10	1	1.14	240.0	219.7	7.48	4000	150	58	66	1.51	57.5	1.01	1.70	0.78	57.7	1.01
	80	70	10	1	1.14	240.0	219.7	7.48	4000	300	67	66	2.14	57.5	1.16	1.70	0.78	64.1	1.04
	80	70	10	1	1.14	240.0	219.7	7.48	4000	450	71	66	2.62	57.5	1.24	1.70	0.78	68.1	1.05
	80	70	10	1	1.14	240.0	219.7	7.48	4000	600	75	66	3.02	57.5	1.30	1.70	0.78	71.1	1.05
C2_L4	80	70	10	1	1.14	240.0	219.7	7.48	4500	75	40	53	1.19	41.3	0.97	1.70	0.78	41.3	0.97
	80	70	10	1	1.14	240.0	219.7	7.48	4500	150	49	53	1.69	46.1	1.07	1.70	0.78	47.8	1.03
	80	70	10	1	1.14	240.0	219.7	7.48	4500	300	58	53	2.39	46.1	1.26	1.70	0.78	53.0	1.10
	80	70	10	1	1.14	240.0	219.7	7.48	4500	450	61	53	2.93	46.1	1.33	1.70	0.78	56.4	1.08
	80	70	10	1	1.14	240.0	219.7	7.48	4500	600	63	53	3.38	46.1	1.37	1.70	0.78	58.9	1.07
C3_L1	100	100	10	2	1.00	640.0	1676.3	4.64	4000	75	57	101	0.86	55.0	1.04	1.53	0.72	55.0	1.04
	100	100	10	2	1.00	640.0	1676.3	4.64	4000	150	81	101	1.22	80.6	1.01	1.53	0.72	80.6	1.01
	100	100	10	2	1.00	640.0	1676.3	4.64	4000	300	93	101	1.72	88.7	1.05	1.53	0.72	94.7	0.98
	100	100	10	2	1.00	640.0	1676.3	4.64	4000	450	98	101	2.11	88.7	1.11	1.53	0.72	104.2	0.94
	100	100	10	2	1.00	640.0	1676.3	4.64	4000	600	102	101	2.44	88.7	1.15	1.53	0.72	111.5	0.91
C3_L2	100	100	10	2	1.00	640.0	1676.3	4.64	4500	75	52	81	0.96	51.0	1.02	1.53	0.72	51.0	1.02
	100	100	10	2	1.00	640.0	1676.3	4.64	4500	150	70	81	1.36	69.4	1.00	1.53	0.72	69.4	1.00
	100	100	10	2	1.00	640.0	1676.3	4.64	4500	300	82	81	1.92	71.4	1.15	1.53	0.72	80.3	1.02
	100	100	10	2	1.00	640.0	1676.3	4.64	4500	450	85	81	2.35	71.4	1.20	1.53	0.72	88.3	0.97
	100	100	10	2	1.00	640.0	1676.3	4.64	4500	600	99	81	2.71	71.4	1.39	1.53	0.72	94.5	1.05
C3_L3	100	100	10	2	1.00	640.0	1676.3	4.64	5000	75	47	67	1.06	47.0	1.00	1.53	0.72	47.0	1.00
	100	100	10	2	1.00	640.0	1676.3	4.64	5000	150	60	67	1.49	58.9	1.03	1.53	0.72	58.9	1.03
	100	100	10	2	1.00	640.0	1676.3	4.64	5000	300	72	67	2.11	58.9	1.23	1.53	0.72	69.3	1.05
	100	100	10	2	1.00	640.0	1676.3	4.64	5000	450	81	67	2.59	58.9	1.38	1.53	0.72	76.2	1.06
	100	100	10	2	1.00	640.0	1676.3	4.64	5000	600	86	67	2.99	58.9	1.46	1.53	0.72	81.5	1.05
C3_L4	100	100	10	2	1.00	640.0	1676.3	4.64	5500	75	42	56	1.15	43.0	0.98	1.53	0.72	43.0	0.98
	100	100	10	2	1.00	640.0	1676.3	4.64	5500	150	53	56	1.63	49.5	1.07	1.53	0.72	51.5	1.03
	100	100	10	2	1.00	640.0	1676.3	4.64	5500	300	65	56	2.31	49.5	1.31	1.53	0.72	60.7	1.07
	100	100	10	2	1.00	640.0	1676.3	4.64	5500	450	70	56	2.82	49.5	1.41	1.53	0.72	66.7	1.05
	100	100	10	2	1.00	640.0	1676.3	4.64	5500	600	73	56	3.26	49.5	1.48	1.53	0.72	71.4	1.02
C4_L1	100	120	10	2	0.83	720.0	2655.3	3.91	5000	75	46	65	1.07	46.4	1.00	1.48	0.71	46.4	1.00
	100	120	10	2	0.83	720.0	2655.3	3.91	5000	150	58	65	1.52	57.3	1.02	1.48	0.71	57.6	1.01
	100	120	10	2	0.83	720.0	2655.3	3.91	5000	300	72	65	2.14	57.3	1.26	1.48	0.71	68.9	1.05
	100	120	10	2	0.83	720.0	2655.3	3.91	5000	450	74	65	2.62	57.3	1.29	1.48	0.71	76.5	0.96
	100	120	10	2	0.83	720.0	2655.3	3.91	5000	600	80	65	3.03	57.3	1.39	1.48	0.71	82.4	0.97

Column	Geometry									SFEA		DSM Design							
	b_w	b_f	b_s	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
C4_L2	100	120	10	2	0.83	720.0	2655.3	3.91	5500	75	41	55	1.17	42.3	0.98	1.48	0.71	42.3	0.98
	100	120	10	2	0.83	720.0	2655.3	3.91	5500	150	52	55	1.65	48.1	1.07	1.48	0.71	50.6	1.02
	100	120	10	2	0.83	720.0	2655.3	3.91	5500	300	65	55	2.34	48.1	1.35	1.48	0.71	60.5	1.08
	100	120	10	2	0.83	720.0	2655.3	3.91	5500	450	74	55	2.86	48.1	1.54	1.48	0.71	67.2	1.10
	100	120	10	2	0.83	720.0	2655.3	3.91	5500	600	78	55	3.31	48.1	1.62	1.48	0.71	72.3	1.08
C4_L3	100	120	10	2	0.83	720.0	2655.3	3.91	6000	75	37	47	1.27	38.3	0.97	1.48	0.71	38.3	0.97
	100	120	10	2	0.83	720.0	2655.3	3.91	6000	150	46	47	1.79	41.0	1.13	1.48	0.71	45.0	1.03
	100	120	10	2	0.83	720.0	2655.3	3.91	6000	300	59	47	2.53	41.0	1.44	1.48	0.71	53.8	1.10
	100	120	10	2	0.83	720.0	2655.3	3.91	6000	450	66	47	3.10	41.0	1.62	1.48	0.71	59.7	1.11
	100	120	10	2	0.83	720.0	2655.3	3.91	6000	600	69	47	3.58	41.0	1.69	1.48	0.71	64.3	1.08
C4_L4	100	120	10	2	0.83	720.0	2655.3	3.91	6500	75	34	40	1.36	34.5	0.97	1.48	0.71	34.5	0.97
	100	120	10	2	0.83	720.0	2655.3	3.91	6500	150	42	40	1.93	35.5	1.19	1.48	0.71	40.4	1.04
	100	120	10	2	0.83	720.0	2655.3	3.91	6500	300	54	40	2.72	35.5	1.52	1.48	0.71	48.3	1.12
	100	120	10	2	0.83	720.0	2655.3	3.91	6500	450	58	40	3.34	35.5	1.65	1.48	0.71	53.6	1.09
	100	120	10	2	0.83	720.0	2655.3	3.91	6500	600	61	40	3.85	35.5	1.73	1.48	0.71	57.7	1.06
C5_L1	130	120	10	2.5	1.08	975.0	5805.8	5.10	5000	75	58	107	0.84	55.9	1.04	1.56	0.73	55.9	1.04
	130	120	10	2.5	1.08	975.0	5805.8	5.10	5000	150	84	107	1.18	83.4	1.01	1.56	0.73	83.4	1.01
	130	120	10	2.5	1.08	975.0	5805.8	5.10	5000	300	95	107	1.68	93.8	1.02	1.56	0.73	98.5	0.97
	130	120	10	2.5	1.08	975.0	5805.8	5.10	5000	450	98	107	2.05	93.8	1.05	1.56	0.73	107.8	0.91
	130	120	10	2.5	1.08	975.0	5805.8	5.10	5000	600	100	107	2.37	93.8	1.07	1.56	0.73	114.9	0.87
C5_L2	130	120	10	2.5	1.08	975.0	5805.8	5.10	5500	75	55	90	0.91	52.9	1.03	1.56	0.73	52.9	1.03
	130	120	10	2.5	1.08	975.0	5805.8	5.10	5500	150	75	90	1.29	74.5	1.00	1.56	0.73	74.5	1.00
	130	120	10	2.5	1.08	975.0	5805.8	5.10	5500	300	84	90	1.83	78.8	1.07	1.56	0.73	86.0	0.98
	130	120	10	2.5	1.08	975.0	5805.8	5.10	5500	450	88	90	2.24	78.8	1.11	1.56	0.73	94.1	0.93
	130	120	10	2.5	1.08	975.0	5805.8	5.10	5500	600	90	90	2.58	78.8	1.14	1.56	0.73	100.3	0.89
C5_L3	130	120	10	2.5	1.08	975.0	5805.8	5.10	6000	75	51	77	0.99	49.8	1.02	1.56	0.73	49.8	1.02
	130	120	10	2.5	1.08	975.0	5805.8	5.10	6000	150	67	77	1.40	66.1	1.01	1.56	0.73	66.1	1.01
	130	120	10	2.5	1.08	975.0	5805.8	5.10	6000	300	78	77	1.98	67.2	1.16	1.56	0.73	76.0	1.02
	130	120	10	2.5	1.08	975.0	5805.8	5.10	6000	450	79	77	2.42	67.2	1.18	1.56	0.73	83.2	0.95
	130	120	10	2.5	1.08	975.0	5805.8	5.10	6000	600	84	77	2.80	67.2	1.26	1.56	0.73	88.7	0.95
C5_L4	130	120	10	2.5	1.08	975.0	5805.8	5.10	6500	75	47	66	1.06	46.7	1.00	1.56	0.73	46.7	1.00
	130	120	10	2.5	1.08	975.0	5805.8	5.10	6500	150	60	66	1.50	58.1	1.03	1.56	0.73	58.2	1.03
	130	120	10	2.5	1.08	975.0	5805.8	5.10	6500	300	71	66	2.13	58.1	1.22	1.56	0.73	67.9	1.04
	130	120	10	2.5	1.08	975.0	5805.8	5.10	6500	450	73	66	2.61	58.1	1.26	1.56	0.73	74.3	0.98
	130	120	10	2.5	1.08	975.0	5805.8	5.10	6500	600	76	66	3.01	58.1	1.30	1.56	0.73	79.2	0.96
													Mean		1.170			Mean	1.015
													Sd. Dev.		0.185			Sd. Dev.	0.046
													Max		1.729			Max	1.117
													Min		0.968			Min	0.874

Table I$_2$: PC$_m$ columns: (i) geometries, (ii) buckling stresses and ultimate strengths, (iii) ultimate strength predictions by current and proposed DSM design curves, and (iv) numerical-to-predicted ultimate strength ratios (mm and MPa)

Column	Geometry							SFEA		DSM Design					
	b_w	b_f	b_s	t	b_w/b_t	A	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	f_{nFT}	f_u/f_{nFT}
C1_L1	60	55	11	1.2	1.09	230.4	2300	75	64	155	0.70	61.3	1.05	61.3	1.05
	60	55	11	1.2	1.09	230.4	2300	150	102	155	0.98	100.1	1.02	100.1	1.02
	60	55	11	1.2	1.09	230.4	2300	300	118	155	1.39	133.5	0.88	102.0	1.16
	60	55	11	1.2	1.09	230.4	2300	450	118	155	1.70	136.0	0.87	102.0	1.16
	60	55	11	1.2	1.09	230.4	2300	600	118	155	1.97	136.0	0.87	102.0	1.16
C1_L2	60	55	11	1.2	1.09	230.4	2500	75	62	133	0.75	59.3	1.05	59.3	1.05
	60	55	11	1.2	1.09	230.4	2500	150	92	133	1.06	93.6	0.99	87.7	1.05
	60	55	11	1.2	1.09	230.4	2500	300	101	133	1.50	116.9	0.86	87.7	1.15
	60	55	11	1.2	1.09	230.4	2500	450	101	133	1.84	116.9	0.86	87.7	1.15
	60	55	11	1.2	1.09	230.4	2500	600	101	133	2.12	116.9	0.86	87.7	1.15
C1_L3	60	55	11	1.2	1.09	230.4	3000	75	55	96	0.88	54.0	1.02	54.0	1.02
	60	55	11	1.2	1.09	230.4	3000	150	69	96	1.25	77.9	0.89	63.0	1.10
	60	55	11	1.2	1.09	230.4	3000	300	71	96	1.77	84.0	0.84	63.0	1.12
	60	55	11	1.2	1.09	230.4	3000	450	71	96	2.17	84.0	0.84	63.0	1.12
	60	55	11	1.2	1.09	230.4	3000	600	71	96	2.50	84.0	0.84	63.0	1.12
C1_L4	60	55	11	1.2	1.09	230.4	3500	75	47	73	1.02	48.7	0.96	47.9	0.98
	60	55	11	1.2	1.09	230.4	3500	150	52	73	1.44	63.3	0.82	47.9	1.09
	60	55	11	1.2	1.09	230.4	3500	300	52	73	2.03	63.8	0.82	47.9	1.09
	60	55	11	1.2	1.09	230.4	3500	450	52	73	2.49	63.8	0.82	47.9	1.09
	60	55	11	1.2	1.09	230.4	3500	600	52	73	2.87	63.8	0.82	47.9	1.09

Column	Geometry							SFEA		DSM Design					
	b_w	b_f	b_s	t	b_w/b_t	A	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	f_{nFT}	f_u/f_{nFT}
C2_L1	80	70	10	1	1.14	240.0	3000	75	61	134	0.75	59.4	1.03	59.4	1.03
	80	70	10	1	1.14	240.0	3000	150	88	134	1.06	94.0	0.94	88.5	1.00
	80	70	10	1	1.14	240.0	3000	300	95	134	1.49	117.9	0.81	88.5	1.08
	80	70	10	1	1.14	240.0	3000	450	95	134	1.83	117.9	0.81	88.5	1.08
	80	70	10	1	1.14	240.0	3000	600	95	134	2.11	117.9	0.81	88.5	1.08
C2_L2	80	70	10	1	1.14	240.0	3500	75	56	103	0.85	55.2	1.02	55.2	1.02
	80	70	10	1	1.14	240.0	3500	150	73	103	1.21	81.4	0.89	67.5	1.08
	80	70	10	1	1.14	240.0	3500	300	74	103	1.71	90.0	0.83	67.5	1.10
	80	70	10	1	1.14	240.0	3500	450	74	103	2.09	90.0	0.83	67.5	1.10
	80	70	10	1	1.14	240.0	3500	600	74	103	2.42	90.0	0.83	67.5	1.10
C2_L3	80	70	10	1	1.14	240.0	4000	75	50	81	0.97	50.8	0.98	50.8	0.98
	80	70	10	1	1.14	240.0	4000	150	58	81	1.36	68.8	0.84	53.0	1.09
	80	70	10	1	1.14	240.0	4000	300	58	81	1.93	70.6	0.82	53.0	1.09
	80	70	10	1	1.14	240.0	4000	450	58	81	2.36	70.6	0.82	53.0	1.09
	80	70	10	1	1.14	240.0	4000	600	58	81	2.73	70.6	0.82	53.0	1.09
C2_L4	80	70	10	1	1.14	240.0	4500	75	43	65	1.08	46.2	0.93	42.7	1.01
	80	70	10	1	1.14	240.0	4500	150	46	65	1.52	56.9	0.81	42.7	1.08
	80	70	10	1	1.14	240.0	4500	300	46	65	2.15	56.9	0.81	42.7	1.08
	80	70	10	1	1.14	240.0	4500	450	46	65	2.63	56.9	0.81	42.7	1.08
	80	70	10	1	1.14	240.0	4500	600	46	65	3.04	56.9	0.81	42.7	1.08
C3_L1	100	100	10	2	1.00	640.0	4000	75	61	123	0.78	58.1	1.06	58.1	1.06
	100	100	10	2	1.00	640.0	4000	150	88	123	1.10	90.0	0.98	80.9	1.09
	100	100	10	2	1.00	640.0	4000	300	94	123	1.56	107.8	0.88	80.9	1.17
	100	100	10	2	1.00	640.0	4000	450	94	123	1.91	107.8	0.88	80.9	1.17
	100	100	10	2	1.00	640.0	4000	600	94	123	2.21	107.8	0.88	80.9	1.17
C3_L2	100	100	10	2	1.00	640.0	4500	75	57	100	0.87	54.8	1.05	54.8	1.05
	100	100	10	2	1.00	640.0	4500	150	75	100	1.23	80.0	0.93	65.8	1.14
	100	100	10	2	1.00	640.0	4500	300	76	100	1.73	87.7	0.87	65.8	1.16
	100	100	10	2	1.00	640.0	4500	450	76	100	2.12	87.7	0.87	65.8	1.16
	100	100	10	2	1.00	640.0	4500	600	76	100	2.45	87.7	0.87	65.8	1.16
C3_L3	100	100	10	2	1.00	640.0	5000	75	53	83	0.95	51.4	1.03	51.4	1.03
	100	100	10	2	1.00	640.0	5000	150	63	83	1.34	70.4	0.89	54.6	1.15
	100	100	10	2	1.00	640.0	5000	300	63	83	1.90	72.8	0.86	54.6	1.15
	100	100	10	2	1.00	640.0	5000	450	63	83	2.33	72.8	0.86	54.6	1.15
	100	100	10	2	1.00	640.0	5000	600	63	83	2.69	72.8	0.86	54.6	1.15
C3_L4	100	100	10	2	1.00	640.0	5500	75	48	70	1.03	48.0	0.99	46.3	1.03
	100	100	10	2	1.00	640.0	5500	150	52	70	1.46	61.4	0.85	46.3	1.13
	100	100	10	2	1.00	640.0	5500	300	52	70	2.07	61.7	0.85	46.3	1.13
	100	100	10	2	1.00	640.0	5500	450	52	70	2.53	61.7	0.85	46.3	1.13
	100	100	10	2	1.00	640.0	5500	600	52	70	2.92	61.7	0.85	46.3	1.13
C4_L1	100	120	10	2	0.83	720.0	5000	75	52	80	0.97	50.6	1.02	50.6	1.02
	100	120	10	2	0.83	720.0	5000	150	62	80	1.37	68.4	0.90	52.6	1.17
	100	120	10	2	0.83	720.0	5000	300	62	80	1.94	70.1	0.89	52.6	1.18
	100	120	10	2	0.83	720.0	5000	450	62	80	2.37	70.1	0.89	52.6	1.18
	100	120	10	2	0.83	720.0	5000	600	62	80	2.74	70.1	0.89	52.6	1.18
C4_L2	100	120	10	2	0.83	720.0	5500	75	47	68	1.05	47.1	0.99	44.5	1.05
	100	120	10	2	0.83	720.0	5500	150	53	68	1.49	59.2	0.89	44.5	1.18
	100	120	10	2	0.83	720.0	5500	300	53	68	2.11	59.3	0.89	44.5	1.18
	100	120	10	2	0.83	720.0	5500	450	53	68	2.58	59.3	0.89	44.5	1.18
	100	120	10	2	0.83	720.0	5500	600	53	68	2.98	59.3	0.89	44.5	1.18
C4_L3	100	120	10	2	0.83	720.0	6000	75	42	58	1.14	43.6	0.96	38.2	1.10
	100	120	10	2	0.83	720.0	6000	150	45	58	1.61	50.8	0.88	38.2	1.17
	100	120	10	2	0.83	720.0	6000	300	45	58	2.27	50.8	0.88	38.2	1.17
	100	120	10	2	0.83	720.0	6000	450	45	58	2.79	50.8	0.88	38.2	1.17
	100	120	10	2	0.83	720.0	6000	600	45	58	3.22	50.8	0.88	38.2	1.17
C4_L4	100	120	10	2	0.83	720.0	6500	75	37	50	1.22	40.2	0.93	33.2	1.12
	100	120	10	2	0.83	720.0	6500	150	39	50	1.72	44.2	0.87	33.2	1.16
	100	120	10	2	0.83	720.0	6500	300	39	50	2.44	44.2	0.87	33.2	1.16
	100	120	10	2	0.83	720.0	6500	450	39	50	2.99	44.2	0.87	33.2	1.16
	100	120	10	2	0.83	720.0	6500	600	39	50	3.45	44.2	0.87	33.2	1.16
C5_L1	130	120	10	2.5	1.08	975.0	5000	75	62	129	0.76	58.8	1.06	58.8	1.06
	130	120	10	2.5	1.08	975.0	5000	150	90	129	1.08	92.1	0.98	84.7	1.06
	130	120	10	2.5	1.08	975.0	5000	300	97	129	1.53	112.9	0.86	84.7	1.14
	130	120	10	2.5	1.08	975.0	5000	450	97	129	1.87	112.9	0.86	84.7	1.14
	130	120	10	2.5	1.08	975.0	5000	600	97	129	2.16	112.9	0.86	84.7	1.14
C5_L2	130	120	10	2.5	1.08	975.0	5500	75	59	109	0.83	56.2	1.06	56.2	1.06
	130	120	10	2.5	1.08	975.0	5500	150	79	109	1.17	84.3	0.94	71.7	1.11
	130	120	10	2.5	1.08	975.0	5500	300	82	109	1.66	95.5	0.85	71.7	1.14
	130	120	10	2.5	1.08	975.0	5500	450	82	109	2.03	95.5	0.85	71.7	1.14
	130	120	10	2.5	1.08	975.0	5500	600	82	109	2.35	95.5	0.85	71.7	1.14

Column	Geometry							SFEA		DSM Design					
	b_w	b_f	b_s	t	b_w/b_t	A	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	f_{nFT}	f_u/f_{nFT}
C5_L3	130	120	10	2.5	1.08	975.0	6000	75	56	94	0.90	53.6	1.04	53.6	1.04
	130	120	10	2.5	1.08	975.0	6000	150	69	94	1.27	76.6	0.90	61.5	1.12
	130	120	10	2.5	1.08	975.0	6000	300	69	94	1.79	82.0	0.85	61.5	1.13
	130	120	10	2.5	1.08	975.0	6000	450	69	94	2.19	82.0	0.85	61.5	1.13
	130	120	10	2.5	1.08	975.0	6000	600	69	94	2.53	82.0	0.85	61.5	1.13
C5_L4	130	120	10	2.5	1.08	975.0	6500	75	52	81	0.96	51.0	1.02	51.0	1.02
	130	120	10	2.5	1.08	975.0	6500	150	60	81	1.36	69.3	0.86	53.5	1.11
	130	120	10	2.5	1.08	975.0	6500	300	60	81	1.92	71.3	0.84	53.5	1.11
	130	120	10	2.5	1.08	975.0	6500	450	60	81	2.35	71.3	0.84	53.5	1.11
	130	120	10	2.5	1.08	975.0	6500	600	60	81	2.72	71.3	0.84	53.5	1.11
											Mean		0.894		1.110
											Sd. Dev.		0.072		0.053
											Max		1.062		1.185
											Min		0.808		0.980

Table I$_3$: PS columns: (i) geometries, (ii) buckling stresses and ultimate strengths, (iii) ultimate strength predictions by current and proposed DSM design curves, and (iv) numerical-to-predicted ultimate strength ratios (mm and MPa)

Column	Geometry							SFEA		DSM Design			
	b_w	b_f	b_s	t	b_w/b_t	A	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}
C1_L1	60	55	11	1.2	1.09	230.4	2300	75	60	122	0.79	57.9	1.04
	60	55	11	1.2	1.09	230.4	2300	150	91	122	1.11	89.5	1.02
	60	55	11	1.2	1.09	230.4	2300	300	105	122	1.57	106.6	0.99
	60	55	11	1.2	1.09	230.4	2300	450	106	122	1.92	106.6	1.00
	60	55	11	1.2	1.09	230.4	2300	600	106	122	2.22	106.6	1.00
C1_L2	60	55	11	1.2	1.09	230.4	2500	75	57	104	0.85	55.4	1.03
	60	55	11	1.2	1.09	230.4	2500	150	82	104	1.20	81.9	1.00
	60	55	11	1.2	1.09	230.4	2500	300	91	104	1.70	91.1	0.99
	60	55	11	1.2	1.09	230.4	2500	450	91	104	2.08	91.1	1.00
	60	55	11	1.2	1.09	230.4	2500	600	91	104	2.40	91.1	1.00
C1_L3	60	55	11	1.2	1.09	230.4	3000	75	49	74	1.01	49.0	1.00
	60	55	11	1.2	1.09	230.4	3000	150	62	74	1.43	64.0	0.96
	60	55	11	1.2	1.09	230.4	3000	300	64	74	2.02	64.7	0.99
	60	55	11	1.2	1.09	230.4	3000	450	64	74	2.47	64.7	0.99
	60	55	11	1.2	1.09	230.4	3000	600	64	74	2.85	64.7	0.99
C1_L4	60	55	11	1.2	1.09	230.4	3500	75	41	55	1.16	42.6	0.96
	60	55	11	1.2	1.09	230.4	3500	150	47	55	1.65	48.6	0.97
	60	55	11	1.2	1.09	230.4	3500	300	48	55	2.33	48.6	0.99
	60	55	11	1.2	1.09	230.4	3500	450	48	55	2.85	48.6	0.99
	60	55	11	1.2	1.09	230.4	3500	600	48	55	3.29	48.6	0.99
C2_L1	80	70	10	1	1.14	240.0	3000	75	58	112	0.82	56.7	1.03
	80	70	10	1	1.14	240.0	3000	150	82	112	1.16	85.8	0.96
	80	70	10	1	1.14	240.0	3000	300	90	112	1.63	98.5	0.92
	80	70	10	1	1.14	240.0	3000	450	90	112	2.00	98.5	0.92
	80	70	10	1	1.14	240.0	3000	600	90	112	2.31	98.5	0.92
C2_L2	80	70	10	1	1.14	240.0	3500	75	52	84	0.94	51.7	1.01
	80	70	10	1	1.14	240.0	3500	150	66	84	1.33	71.3	0.93
	80	70	10	1	1.14	240.0	3500	300	70	84	1.89	74.0	0.94
	80	70	10	1	1.14	240.0	3500	450	70	84	2.31	74.0	0.94
	80	70	10	1	1.14	240.0	3500	600	70	84	2.67	74.0	0.94
C2_L3	80	70	10	1	1.14	240.0	4000	75	45	66	1.07	46.5	0.98
	80	70	10	1	1.14	240.0	4000	150	54	66	1.51	57.5	0.93
	80	70	10	1	1.14	240.0	4000	300	55	66	2.14	57.5	0.95
	80	70	10	1	1.14	240.0	4000	450	55	66	2.62	57.5	0.95
	80	70	10	1	1.14	240.0	4000	600	55	66	3.02	57.5	0.95
C2_L4	80	70	10	1	1.14	240.0	4500	75	39	53	1.19	41.3	0.95
	80	70	10	1	1.14	240.0	4500	150	44	53	1.69	46.1	0.95
	80	70	10	1	1.14	240.0	4500	300	44	53	2.39	46.1	0.95
	80	70	10	1	1.14	240.0	4500	450	44	53	2.93	46.1	0.95
	80	70	10	1	1.14	240.0	4500	600	44	53	3.38	46.1	0.95
C3_L1	100	100	10	2	1.00	640.0	4000	75	57	101	0.86	55.0	1.04
	100	100	10	2	1.00	640.0	4000	150	79	101	1.22	80.6	0.98
	100	100	10	2	1.00	640.0	4000	300	86	101	1.72	88.7	0.97
	100	100	10	2	1.00	640.0	4000	450	86	101	2.11	88.7	0.97
	100	100	10	2	1.00	640.0	4000	600	86	101	2.44	88.7	0.97

Column	Geometry							SFEA		DSM Design			
	b_w	b_f	b_s	t	b_w/b_t	A	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}
C3_L2	100	100	10	2	1.00	640.0	4500	75	52	81	0.96	51.0	1.02
	100	100	10	2	1.00	640.0	4500	150	67	81	1.36	69.4	0.96
	100	100	10	2	1.00	640.0	4500	300	70	81	1.92	71.4	0.98
	100	100	10	2	1.00	640.0	4500	450	70	81	2.35	71.4	0.98
	100	100	10	2	1.00	640.0	4500	600	70	81	2.71	71.4	0.98
C3_L3	100	100	10	2	1.00	640.0	5000	75	47	67	1.06	47.0	1.00
	100	100	10	2	1.00	640.0	5000	150	56	67	1.49	58.9	0.96
	100	100	10	2	1.00	640.0	5000	300	58	67	2.11	58.9	0.98
	100	100	10	2	1.00	640.0	5000	450	58	67	2.59	58.9	0.98
	100	100	10	2	1.00	640.0	5000	600	58	67	2.99	58.9	0.98
C3_L4	100	100	10	2	1.00	640.0	5500	75	42	56	1.15	43.0	0.97
	100	100	10	2	1.00	640.0	5500	150	48	56	1.63	49.5	0.97
	100	100	10	2	1.00	640.0	5500	300	49	56	2.31	49.5	0.98
	100	100	10	2	1.00	640.0	5500	450	49	56	2.82	49.5	0.98
	100	100	10	2	1.00	640.0	5500	600	49	56	3.26	49.5	0.98
C4_L1	100	120	10	2	0.83	720.0	5000	75	46	65	1.07	46.4	0.99
	100	120	10	2	0.83	720.0	5000	150	54	65	1.52	57.3	0.94
	100	120	10	2	0.83	720.0	5000	300	56	65	2.14	57.3	0.97
	100	120	10	2	0.83	720.0	5000	450	56	65	2.62	57.3	0.97
	100	120	10	2	0.83	720.0	5000	600	56	65	3.03	57.3	0.97
C4_L2	100	120	10	2	0.83	720.0	5500	75	41	55	1.17	42.3	0.96
	100	120	10	2	0.83	720.0	5500	150	46	55	1.65	48.1	0.96
	100	120	10	2	0.83	720.0	5500	300	47	55	2.34	48.1	0.98
	100	120	10	2	0.83	720.0	5500	450	47	55	2.86	48.1	0.98
	100	120	10	2	0.83	720.0	5500	600	47	55	3.31	48.1	0.98
C4_L3	100	120	10	2	0.83	720.0	6000	75	36	47	1.27	38.3	0.95
	100	120	10	2	0.83	720.0	6000	150	40	47	1.79	41.0	0.98
	100	120	10	2	0.83	720.0	6000	300	41	47	2.53	41.0	0.99
	100	120	10	2	0.83	720.0	6000	450	41	47	3.10	41.0	0.99
	100	120	10	2	0.83	720.0	6000	600	41	47	3.58	41.0	0.99
C4_L4	100	120	10	2	0.83	720.0	6500	75	32	40	1.36	34.5	0.94
	100	120	10	2	0.83	720.0	6500	150	35	40	1.93	35.5	0.98
	100	120	10	2	0.83	720.0	6500	300	35	40	2.72	35.5	0.99
	100	120	10	2	0.83	720.0	6500	450	35	40	3.34	35.5	0.99
	100	120	10	2	0.83	720.0	6500	600	35	40	3.85	35.5	0.99
C5_L1	130	120	10	2.5	1.08	975.0	5000	75	58	107	0.84	55.9	1.04
	130	120	10	2.5	1.08	975.0	5000	150	82	107	1.18	83.4	0.98
	130	120	10	2.5	1.08	975.0	5000	300	89	107	1.68	93.8	0.95
	130	120	10	2.5	1.08	975.0	5000	450	89	107	2.05	93.8	0.95
	130	120	10	2.5	1.08	975.0	5000	600	89	107	2.37	93.8	0.95
C5_L2	130	120	10	2.5	1.08	975.0	5500	75	55	90	0.91	52.9	1.03
	130	120	10	2.5	1.08	975.0	5500	150	72	90	1.29	74.5	0.96
	130	120	10	2.5	1.08	975.0	5500	300	76	90	1.83	78.8	0.96
	130	120	10	2.5	1.08	975.0	5500	450	76	90	2.24	78.8	0.96
	130	120	10	2.5	1.08	975.0	5500	600	76	90	2.58	78.8	0.96
C5_L3	130	120	10	2.5	1.08	975.0	6000	75	51	77	0.99	49.8	1.02
	130	120	10	2.5	1.08	975.0	6000	150	63	77	1.40	66.1	0.95
	130	120	10	2.5	1.08	975.0	6000	300	65	77	1.98	67.2	0.97
	130	120	10	2.5	1.08	975.0	6000	450	65	77	2.42	67.2	0.97
	130	120	10	2.5	1.08	975.0	6000	600	65	77	2.80	67.2	0.97
C5_L4	130	120	10	2.5	1.08	975.0	6500	75	47	66	1.06	46.7	1.00
	130	120	10	2.5	1.08	975.0	6500	150	55	66	1.50	58.1	0.95
	130	120	10	2.5	1.08	975.0	6500	300	56	66	2.13	58.1	0.97
	130	120	10	2.5	1.08	975.0	6500	450	56	66	2.61	58.1	0.97
	130	120	10	2.5	1.08	975.0	6500	600	56	66	3.01	58.1	0.97
											Mean		0.975
											Sd. Dev.		0.026
											Max		1.043
											Min		0.916

ANNEX J: H Column Data

Table J$_1$: PC$_M$ columns: (i) geometries, (ii) buckling stresses and ultimate strengths, (iii) ultimate strength predictions by current and proposed DSM design curves, and (iv) numerical-to-predicted ultimate strength ratios (mm and MPa)

Column	Geometry									SFEA		DSM Design							
	b_w	b_f	b_s	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
H1_L1	60	55	11	1.2	1.09	230.4	51.4	3.93	2300	75	55	90	0.91	52.8	1.04	1.49	0.71	52.8	1.04
	60	55	11	1.2	1.09	230.4	51.4	3.93	2300	150	76	90	1.29	74.5	1.03	1.49	0.71	74.5	1.03
	60	55	11	1.2	1.09	230.4	51.4	3.93	2300	300	96	90	1.83	78.6	1.21	1.49	0.71	87.1	1.10
	60	55	11	1.2	1.09	230.4	51.4	3.93	2300	450	111	90	2.24	78.6	1.42	1.49	0.71	96.7	1.15
	60	55	11	1.2	1.09	230.4	51.4	3.93	2300	600	123	90	2.59	78.6	1.56	1.49	0.71	104.1	1.18
H1_L2	60	55	11	1.2	1.09	230.4	51.4	3.93	2500	75	51	77	0.98	50.0	1.03	1.49	0.71	50.0	1.03
	60	55	11	1.2	1.09	230.4	51.4	3.93	2500	150	69	77	1.39	66.6	1.03	1.49	0.71	66.6	1.03
	60	55	11	1.2	1.09	230.4	51.4	3.93	2500	300	87	77	1.97	67.8	1.28	1.49	0.71	78.1	1.11
	60	55	11	1.2	1.09	230.4	51.4	3.93	2500	450	101	77	2.41	67.8	1.49	1.49	0.71	86.6	1.17
	60	55	11	1.2	1.09	230.4	51.4	3.93	2500	600	111	77	2.79	67.8	1.63	1.49	0.71	93.3	1.19
H1_L3	60	55	11	1.2	1.09	230.4	51.4	3.93	3000	75	43	56	1.16	42.9	0.99	1.49	0.71	42.9	0.99
	60	55	11	1.2	1.09	230.4	51.4	3.93	3000	150	55	56	1.63	49.3	1.11	1.49	0.71	51.5	1.06
	60	55	11	1.2	1.09	230.4	51.4	3.93	3000	300	71	56	2.31	49.3	1.45	1.49	0.71	61.6	1.16
	60	55	11	1.2	1.09	230.4	51.4	3.93	3000	450	82	56	2.83	49.3	1.66	1.49	0.71	68.3	1.20
	60	55	11	1.2	1.09	230.4	51.4	3.93	3000	600	87	56	3.27	49.3	1.77	1.49	0.71	73.6	1.18
H1_L4	60	55	11	1.2	1.09	230.4	51.4	3.93	3500	75	36	43	1.32	36.3	0.99	1.49	0.71	36.3	0.99
	60	55	11	1.2	1.09	230.4	51.4	3.93	3500	150	46	43	1.86	37.9	1.21	1.49	0.71	42.4	1.08
	60	55	11	1.2	1.09	230.4	51.4	3.93	3500	300	60	43	2.64	37.9	1.58	1.49	0.71	50.6	1.18
	60	55	11	1.2	1.09	230.4	51.4	3.93	3500	450	66	43	3.23	37.9	1.76	1.49	0.71	56.2	1.18
	60	55	11	1.2	1.09	230.4	51.4	3.93	3500	600	69	43	3.73	37.9	1.82	1.49	0.71	60.5	1.14
H2_L1	80	70	10	1	1.14	240.0	159.2	6.02	3000	75	55	92	0.90	53.3	1.04	1.61	0.75	53.3	1.04
	80	70	10	1	1.14	240.0	159.2	6.02	3000	150	77	92	1.28	75.6	1.02	1.61	0.75	75.6	1.02
	80	70	10	1	1.14	240.0	159.2	6.02	3000	300	94	92	1.81	80.4	1.17	1.61	0.75	86.5	1.09
	80	70	10	1	1.14	240.0	159.2	6.02	3000	450	107	92	2.22	80.4	1.33	1.61	0.75	93.6	1.14
	80	70	10	1	1.14	240.0	159.2	6.02	3000	600	109	92	2.56	80.4	1.36	1.61	0.75	99.0	1.10
H2_L2	80	70	10	1	1.14	240.0	159.2	6.02	3500	75	48	70	1.04	47.8	1.01	1.61	0.75	47.8	1.01
	80	70	10	1	1.14	240.0	159.2	6.02	3500	150	63	70	1.47	60.9	1.03	1.61	0.75	60.9	1.03
	80	70	10	1	1.14	240.0	159.2	6.02	3500	300	79	70	2.08	61.0	1.29	1.61	0.75	69.3	1.13
	80	70	10	1	1.14	240.0	159.2	6.02	3500	450	88	70	2.54	61.0	1.44	1.61	0.75	75.0	1.17
	80	70	10	1	1.14	240.0	159.2	6.02	3500	600	89	70	2.94	61.0	1.46	1.61	0.75	79.3	1.12
H2_L3	80	70	10	1	1.14	240.0	159.2	6.02	4000	75	42	55	1.17	42.2	0.99	1.61	0.75	42.2	0.99
	80	70	10	1	1.14	240.0	159.2	6.02	4000	150	53	55	1.66	47.8	1.10	1.61	0.75	49.8	1.06
	80	70	10	1	1.14	240.0	159.2	6.02	4000	300	67	55	2.35	47.8	1.40	1.61	0.75	56.9	1.18
	80	70	10	1	1.14	240.0	159.2	6.02	4000	450	74	55	2.87	47.8	1.55	1.61	0.75	61.6	1.20
	80	70	10	1	1.14	240.0	159.2	6.02	4000	600	76	55	3.32	47.8	1.58	1.61	0.75	65.2	1.16
H2_L4	80	70	10	1	1.14	240.0	159.2	6.02	4500	75	36	44	1.31	36.7	0.99	1.61	0.75	36.7	0.99
	80	70	10	1	1.14	240.0	159.2	6.02	4500	150	46	44	1.85	38.5	1.18	1.61	0.75	41.8	1.09
	80	70	10	1	1.14	240.0	159.2	6.02	4500	300	58	44	2.61	38.5	1.51	1.61	0.75	47.9	1.22
	80	70	10	1	1.14	240.0	159.2	6.02	4500	450	63	44	3.20	38.5	1.63	1.61	0.75	51.8	1.21
	80	70	10	1	1.14	240.0	159.2	6.02	4500	600	64	44	3.69	38.5	1.65	1.61	0.75	54.8	1.16
H3_L1	100	100	10	2	1.00	640.0	1365.5	4.11	4000	75	55	90	0.91	53.0	1.04	1.50	0.72	53.0	1.04
	100	100	10	2	1.00	640.0	1365.5	4.11	4000	150	76	90	1.29	74.8	1.02	1.50	0.72	74.8	1.02
	100	100	10	2	1.00	640.0	1365.5	4.11	4000	300	92	90	1.82	79.1	1.16	1.50	0.72	87.3	1.05
	100	100	10	2	1.00	640.0	1365.5	4.11	4000	450	105	90	2.23	79.1	1.33	1.50	0.72	96.7	1.09
	100	100	10	2	1.00	640.0	1365.5	4.11	4000	600	112	90	2.58	79.1	1.42	1.50	0.72	104.0	1.08
H3_L2	100	100	10	2	1.00	640.0	1365.5	4.11	4500	75	50	73	1.01	48.8	1.02	1.50	0.72	48.8	1.02
	100	100	10	2	1.00	640.0	1365.5	4.11	4500	150	65	73	1.43	63.5	1.02	1.50	0.72	63.5	1.02
	100	100	10	2	1.00	640.0	1365.5	4.11	4500	300	81	73	2.03	64.0	1.26	1.50	0.72	74.6	1.08
	100	100	10	2	1.00	640.0	1365.5	4.11	4500	450	92	73	2.48	64.0	1.44	1.50	0.72	82.6	1.12
	100	100	10	2	1.00	640.0	1365.5	4.11	4500	600	99	73	2.87	64.0	1.55	1.50	0.72	88.8	1.12
H3_L3	100	100	10	2	1.00	640.0	1365.5	4.11	5000	75	45	60	1.11	44.6	1.00	1.50	0.72	44.6	1.00
	100	100	10	2	1.00	640.0	1365.5	4.11	5000	150	57	60	1.57	53.1	1.07	1.50	0.72	54.4	1.04
	100	100	10	2	1.00	640.0	1365.5	4.11	5000	300	72	60	2.23	53.1	1.35	1.50	0.72	64.8	1.11
	100	100	10	2	1.00	640.0	1365.5	4.11	5000	450	82	60	2.73	53.1	1.54	1.50	0.72	71.7	1.14
	100	100	10	2	1.00	640.0	1365.5	4.11	5000	600	87	60	3.15	53.1	1.63	1.50	0.72	77.1	1.12
H3_L4	100	100	10	2	1.00	640.0	1365.5	4.11	5500	75	40	51	1.21	40.6	0.98	1.50	0.72	40.6	0.98
	100	100	10	2	1.00	640.0	1365.5	4.11	5500	150	50	51	1.71	44.8	1.12	1.50	0.72	48.0	1.05
	100	100	10	2	1.00	640.0	1365.5	4.11	5500	300	64	51	2.42	44.8	1.44	1.50	0.72	57.1	1.13
	100	100	10	2	1.00	640.0	1365.5	4.11	5500	450	72	51	2.97	44.8	1.61	1.50	0.72	63.2	1.14
	100	100	10	2	1.00	640.0	1365.5	4.11	5500	600	76	51	3.43	44.8	1.69	1.50	0.72	68.0	1.11
H4_L1	100	120	10	2	0.83	720.0	2209.8	3.47	5000	75	42	59	1.13	44.1	0.94	1.46	0.70	44.1	0.94
	100	120	10	2	0.83	720.0	2209.8	3.47	5000	150	54	59	1.59	51.9	1.03	1.46	0.70	53.6	1.00
	100	120	10	2	0.83	720.0	2209.8	3.47	5000	300	69	59	2.25	51.9	1.33	1.46	0.70	64.7	1.07
	100	120	10	2	0.83	720.0	2209.8	3.47	5000	450	79	59	2.76	51.9	1.53	1.46	0.70	72.2	1.10
	100	120	10	2	0.83	720.0	2209.8	3.47	5000	600	86	59	3.18	51.9	1.65	1.46	0.70	78.1	1.10

Column	Geometry									SFEA		DSM Design							
	b_w	b_f	b_s	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
H4_L2	100	120	10	2	0.83	720.0	2209.8	3.47	5500	75	39	50	1.23	40.0	0.98	1.46	0.70	40.0	0.98
	100	120	10	2	0.83	720.0	2209.8	3.47	5500	150	49	50	1.73	43.7	1.13	1.46	0.70	47.3	1.04
	100	120	10	2	0.83	720.0	2209.8	3.47	5500	300	65	50	2.45	43.7	1.49	1.46	0.70	57.1	1.14
	100	120	10	2	0.83	720.0	2209.8	3.47	5500	450	74	50	3.00	43.7	1.70	1.46	0.70	63.7	1.16
	100	120	10	2	0.83	720.0	2209.8	3.47	5500	600	79	50	3.47	43.7	1.80	1.46	0.70	68.9	1.14
H4_L3	100	120	10	2	0.83	720.0	2209.8	3.47	6000	75	35	43	1.33	35.9	0.98	1.46	0.70	35.9	0.98
	100	120	10	2	0.83	720.0	2209.8	3.47	6000	150	45	43	1.87	37.4	1.20	1.46	0.70	42.3	1.06
	100	120	10	2	0.83	720.0	2209.8	3.47	6000	300	59	43	2.65	37.4	1.59	1.46	0.70	51.0	1.16
	100	120	10	2	0.83	720.0	2209.8	3.47	6000	450	67	43	3.25	37.4	1.78	1.46	0.70	56.9	1.17
	100	120	10	2	0.83	720.0	2209.8	3.47	6000	600	70	43	3.75	37.4	1.87	1.46	0.70	61.5	1.14
H4_L4	100	120	10	2	0.83	720.0	2209.8	3.47	6500	75	32	37	1.42	32.1	0.99	1.46	0.70	32.1	0.99
	100	120	10	2	0.83	720.0	2209.8	3.47	6500	150	41	37	2.01	32.5	1.26	1.46	0.70	38.1	1.08
	100	120	10	2	0.83	720.0	2209.8	3.47	6500	300	54	37	2.85	32.5	1.67	1.46	0.70	46.0	1.18
	100	120	10	2	0.83	720.0	2209.8	3.47	6500	450	60	37	3.49	32.5	1.85	1.46	0.70	51.3	1.17
	100	120	10	2	0.83	720.0	2209.8	3.47	6500	600	62	37	4.03	32.5	1.92	1.46	0.70	55.5	1.13
H5_L1	130	120	10	2.5	1.08	975.0	5068.5	4.71	5000	75	57	99	0.87	54.6	1.04	1.53	0.73	54.6	1.04
	130	120	10	2.5	1.08	975.0	5068.5	4.71	5000	150	78	99	1.23	79.5	0.98	1.53	0.73	79.5	0.98
	130	120	10	2.5	1.08	975.0	5068.5	4.71	5000	300	94	99	1.74	86.8	1.09	1.53	0.73	93.1	1.01
	130	120	10	2.5	1.08	975.0	5068.5	4.71	5000	450	105	99	2.13	86.8	1.21	1.53	0.73	102.4	1.02
	130	120	10	2.5	1.08	975.0	5068.5	4.71	5000	600	115	99	2.46	86.8	1.33	1.53	0.73	109.5	1.05
H5_L2	130	120	10	2.5	1.08	975.0	5068.5	4.71	5500	75	53	83	0.95	51.5	1.04	1.53	0.73	51.5	1.04
	130	120	10	2.5	1.08	975.0	5068.5	4.71	5500	150	72	83	1.34	70.6	1.01	1.53	0.73	70.6	1.01
	130	120	10	2.5	1.08	975.0	5068.5	4.71	5500	300	85	83	1.90	73.1	1.17	1.53	0.73	81.6	1.05
	130	120	10	2.5	1.08	975.0	5068.5	4.71	5500	450	95	83	2.32	73.1	1.30	1.53	0.73	89.8	1.06
	130	120	10	2.5	1.08	975.0	5068.5	4.71	5500	600	101	83	2.68	73.1	1.38	1.53	0.73	96.0	1.05
H5_L3	130	120	10	2.5	1.08	975.0	5068.5	4.71	6000	75	49	71	1.03	48.3	1.02	1.53	0.73	48.3	1.02
	130	120	10	2.5	1.08	975.0	5068.5	4.71	6000	150	64	71	1.45	62.2	1.03	1.53	0.73	62.2	1.03
	130	120	10	2.5	1.08	975.0	5068.5	4.71	6000	300	77	71	2.05	62.5	1.24	1.53	0.73	72.4	1.07
	130	120	10	2.5	1.08	975.0	5068.5	4.71	6000	450	86	71	2.51	62.5	1.37	1.53	0.73	79.6	1.07
	130	120	10	2.5	1.08	975.0	5068.5	4.71	6000	600	89	71	2.90	62.5	1.42	1.53	0.73	85.2	1.04
H5_L4	130	120	10	2.5	1.08	975.0	5068.5	4.71	6500	75	45	62	1.10	45.1	1.00	1.53	0.73	45.1	1.00
	130	120	10	2.5	1.08	975.0	5068.5	4.71	6500	150	57	62	1.56	54.2	1.06	1.53	0.73	55.2	1.04
	130	120	10	2.5	1.08	975.0	5068.5	4.71	6500	300	71	62	2.20	54.2	1.30	1.53	0.73	64.9	1.09
	130	120	10	2.5	1.08	975.0	5068.5	4.71	6500	450	78	62	2.70	54.2	1.43	1.53	0.73	71.4	1.09
	130	120	10	2.5	1.08	975.0	5068.5	4.71	6500	600	80	62	3.11	54.2	1.47	1.53	0.73	76.4	1.05
													Mean		1.310			Mean	1.083
													Sd. Dev.		0.271			Sd. Dev.	0.067
													Max		1.922			Max	1.216
													Min		0.942			Min	0.942

Table J_2: PC_m columns: (i) geometries, (ii) buckling stresses and ultimate strengths, (iii) ultimate strength predictions by current and proposed DSM design curves, and (iv) numerical-to-predicted ultimate strength ratios (mm and MPa)

Column	Geometry							SFEA		DSM Design					
	b_w	b_f	b_s	t	b_w/b_t	A	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	f_{nFT}	f_u/f_{nFT}
H1_L1	60	55	11	1.2	1.1		1000	75	71	330	0.48	68.2	1.05	68.2	1.05
	60	55	11	1.2	1.1		1000	150	138	330	0.67	124.0	1.11	124.0	1.11
	60	55	11	1.2	1.1		1000	300	239	330	0.95	205.1	1.17	205.1	1.17
	60	55	11	1.2	1.1		1000	450	292	330	1.17	254.3	1.15	254.3	1.15
	60	55	11	1.2	1.1		1000	600	324	330	1.35	280.3	1.16	280.3	1.16
H2_L1	100	60	10	2	1.7		2000	75	70	334	0.47	68.3	1.03	68.3	1.03
	100	60	10	2	1.7		2000	150	136	334	0.67	124.3	1.09	124.3	1.09
	100	60	10	2	1.7		2000	300	236	334	0.95	206.0	1.15	206.0	1.15
	100	60	10	2	1.7		2000	450	278	334	1.16	256.0	1.09	256.0	1.09
	100	60	10	2	1.7		2000	600	292	334	1.34	282.8	1.03	282.8	1.03
H3_L1	120	80	15	3	1.5		1900	75	72	476	0.40	70.2	1.03	70.2	1.03
	120	80	15	3	1.5		1900	150	142	476	0.56	131.5	1.08	131.5	1.08
	120	80	15	3	1.5		1900	300	267	476	0.79	230.4	1.16	230.4	1.16
	120	80	15	3	1.5		1900	450	355	476	0.97	302.8	1.17	302.8	1.17
	120	80	15	3	1.5		1900	600	397	476	1.12	353.9	1.12	353.9	1.12
H4_L1	140	70	10	3	3.0		2600	75	71	385	0.44	69.1	1.02	69.1	1.02
	140	70	10	3	2.0		2600	150	138	385	0.62	127.4	1.08	127.4	1.08
	140	70	10	3	2.0		2600	300	249	385	0.88	216.5	1.15	216.5	1.15
	140	70	10	3	2.0		2600	450	311	385	1.08	275.9	1.13	275.9	1.13
	140	70	10	3	2.0		2600	600	334	385	1.25	312.5	1.07	312.5	1.07

Column	Geometry							SFEA		DSM Design					
	b_w	b_f	b_s	t	b_w/b_t	A	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	f_{nFT}	f_u/f_{nFT}
H5_L1	150	100	10	4	1.5		3300	75	71	330	0.48	68.2	1.04	68.2	1.04
	150	100	10	4	1.5		3300	150	136	330	0.67	124.0	1.10	124.0	1.10
	150	100	10	4	1.5		3300	300	236	330	0.95	205.1	1.15	205.1	1.15
	150	100	10	4	1.5		3300	450	281	330	1.17	254.4	1.10	254.4	1.10
	150	100	10	4	1.5		3300	600	296	330	1.35	280.4	1.06	280.4	1.06
H6_L1	80	65	15	1.2	1.2		1900	75	68	204	0.61	64.3	1.05	64.3	1.05
	80	65	15	1.2	1.2		1900	150	123	204	0.86	110.2	1.12	110.2	1.12
	80	65	15	1.2	1.2		1900	300	177	204	1.21	162.0	1.09	162.0	1.09
	80	65	15	1.2	1.2		1900	450	197	204	1.49	178.6	1.10	178.6	1.10
	80	65	15	1.2	1.2		1900	600	206	204	1.72	178.7	1.15	202.9	1.02
H7_L1	95	50	10	1.8	1.9		1800	75	70	346	0.47	68.5	1.03	68.5	1.03
	95	50	10	1.8	1.9		1800	150	136	346	0.66	125.1	1.09	125.1	1.09
	95	50	10	1.8	1.9		1800	300	239	346	0.93	208.7	1.14	208.7	1.14
	95	50	10	1.8	1.9		1800	450	288	346	1.14	261.2	1.10	261.2	1.10
	95	50	10	1.8	1.9		1800	600	305	346	1.32	290.5	1.05	290.5	1.05
H8_L1	75	60	10	1	1.3		2100	75	66	164	0.68	61.9	1.06	61.9	1.06
	75	60	10	1	1.3		2100	150	112	164	0.96	102.3	1.09	102.3	1.09
	75	60	10	1	1.3		2100	300	147	164	1.35	139.6	1.05	139.6	1.05
	75	60	10	1	1.3		2100	450	158	164	1.66	144.0	1.10	157.9	1.00
	75	60	10	1	1.3		2100	600	166	164	1.91	144.0	1.15	180.5	0.92
H9_L1	80	45	11	1.6	1.8		1400	75	71	381	0.44	69.1	1.03	69.1	1.03
	80	45	11	1.6	1.8		1400	150	138	381	0.63	127.2	1.09	127.2	1.09
	80	45	11	1.6	1.8		1400	300	248	381	0.89	215.7	1.15	215.7	1.15
	80	45	11	1.6	1.8		1400	450	310	381	1.09	274.3	1.13	274.3	1.13
	80	45	11	1.6	1.8		1400	600	336	381	1.26	310.1	1.08	310.1	1.08
H1_L2	60	55	11	1.2	1.1		1400	75	69	225	0.58	65.2	1.05	65.2	1.05
	60	55	11	1.2	1.1		1400	150	127	225	0.82	113.4	1.12	113.4	1.12
	60	55	11	1.2	1.1		1400	300	189	225	1.16	171.5	1.10	171.5	1.10
	60	55	11	1.2	1.1		1400	450	217	225	1.42	194.5	1.12	194.5	1.12
	60	55	11	1.2	1.1		1400	600	246	225	1.63	197.0	1.25	214.3	1.15
H2_L2	100	60	10	2	1.7		2800	75	67	189	0.63	63.5	1.05	63.5	1.05
	100	60	10	2	1.7		2800	150	119	189	0.89	107.7	1.11	107.7	1.11
	100	60	10	2	1.7		2800	300	166	189	1.26	154.6	1.07	154.6	1.07
	100	60	10	2	1.7		2800	450	187	189	1.54	166.1	1.13	169.7	1.10
	100	60	10	2	1.7		2800	600	209	189	1.78	166.1	1.26	189.9	1.10
H2_L2	100	60	10	2	1.7		2800	75	67	189	0.63	63.5	1.05	63.5	1.05
	100	60	10	2	1.7		2800	150	119	189	0.89	107.7	1.11	107.7	1.11
	100	60	10	2	1.7		2800	300	166	189	1.26	154.6	1.07	154.6	1.07
	100	60	10	2	1.7		2800	450	187	189	1.54	166.1	1.13	169.7	1.10
	100	60	10	2	1.7		2800	600	209	189	1.78	166.1	1.26	189.9	1.10
H2_L2	100	60	10	2	1.7		2800	75	67	189	0.63	63.5	1.05	63.5	1.05
	100	60	10	2	1.7		2800	150	119	189	0.89	107.7	1.11	107.7	1.11
	100	60	10	2	1.7		2800	300	166	189	1.26	154.6	1.07	154.6	1.07
	100	60	10	2	1.7		2800	450	187	189	1.54	166.1	1.13	169.7	1.10
	100	60	10	2	1.7		2800	600	209	189	1.78	166.1	1.26	189.9	1.10
H2_L2	100	60	10	2	1.7		2800	75	67	189	0.63	63.5	1.05	63.5	1.05
	100	60	10	2	1.7		2800	150	119	189	0.89	107.7	1.11	107.7	1.11
	100	60	10	2	1.7		2800	300	166	189	1.26	154.6	1.07	154.6	1.07
	100	60	10	2	1.7		2800	450	187	189	1.54	166.1	1.13	169.7	1.10
	100	60	10	2	1.7		2800	600	209	189	1.78	166.1	1.26	189.9	1.10
H2_L2	100	60	10	2	1.7		2800	75	67	189	0.63	63.5	1.05	63.5	1.05
	100	60	10	2	1.7		2800	150	119	189	0.89	107.7	1.11	107.7	1.11
	100	60	10	2	1.7		2800	300	166	189	1.26	154.6	1.07	154.6	1.07
	100	60	10	2	1.7		2800	450	187	189	1.54	166.1	1.13	169.7	1.10
	100	60	10	2	1.7		2800	600	209	189	1.78	166.1	1.26	189.9	1.10
H2_L2	100	60	10	2	1.7		2800	75	67	189	0.63	63.5	1.05	63.5	1.05
	100	60	10	2	1.7		2800	150	119	189	0.89	107.7	1.11	107.7	1.11
	100	60	10	2	1.7		2800	300	166	189	1.26	154.6	1.07	154.6	1.07
	100	60	10	2	1.7		2800	450	187	189	1.54	166.1	1.13	169.7	1.10
	100	60	10	2	1.7		2800	600	209	189	1.78	166.1	1.26	189.9	1.10
H2_L2	100	60	10	2	1.7		2800	75	67	189	0.63	63.5	1.05	63.5	1.05
	100	60	10	2	1.7		2800	150	119	189	0.89	107.7	1.11	107.7	1.11
	100	60	10	2	1.7		2800	300	166	189	1.26	154.6	1.07	154.6	1.07
	100	60	10	2	1.7		2800	450	187	189	1.54	166.1	1.13	169.7	1.10
	100	60	10	2	1.7		2800	600	209	189	1.78	166.1	1.26	189.9	1.10
H2_L2	100	60	10	2	1.7		2800	75	67	189	0.63	63.5	1.05	63.5	1.05
	100	60	10	2	1.7		2800	150	119	189	0.89	107.7	1.11	107.7	1.11
	100	60	10	2	1.7		2800	300	166	189	1.26	154.6	1.07	154.6	1.07
	100	60	10	2	1.7		2800	450	187	189	1.54	166.1	1.13	169.7	1.10
	100	60	10	2	1.7		2800	600	209	189	1.78	166.1	1.26	189.9	1.10

Column	Geometry							SFEA		DSM Design					
	b_w	b_f	b_s	t	b_w/b_t	A	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	f_{nFT}	f_u/f_{nFT}
H2_L2	100	60	10	2	1.7		2800	75	67	189	0.63	63.5	1.05	63.5	1.05
	100	60	10	2	1.7		2800	150	119	189	0.89	107.7	1.11	107.7	1.11
	100	60	10	2	1.7		2800	300	166	189	1.26	154.6	1.07	154.6	1.07
	100	60	10	2	1.7		2800	450	187	189	1.54	166.1	1.13	169.7	1.10
	100	60	10	2	1.7		2800	600	209	189	1.78	166.1	1.26	189.9	1.10
H3_L2	120	80	15	3	1.5		2660	75	70	291	0.51	67.3	1.04	67.3	1.04
	120	80	15	3	1.5		2660	150	133	291	0.72	120.9	1.10	120.9	1.10
	120	80	15	3	1.5		2660	300	221	291	1.02	194.9	1.13	194.9	1.13
	120	80	15	3	1.5		2660	450	257	291	1.24	235.6	1.09	235.6	1.09
	120	80	15	3	1.5		2660	600	276	291	1.44	253.2	1.09	253.2	1.09
											Mean		0.902		1.140
											Sd. Dev.		0.063		0.044
											Max		1.062		1.204
											Min		0.836		1.019

Table J$_3$: PS columns: (i) geometries, (ii) buckling stresses and ultimate strengths, (iii) ultimate strength predictions by current and proposed DSM design curves, and (iv) numerical-to-predicted ultimate strength ratios (mm and MPa)

Column	Geometry							SFEA		DSM Design			
	b_w	b_f	b_s	t	b_w/b_t	A	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}
H1_L1	60	55	11	1.09	230.4	2300	75	55	90	0.91	52.8	1.04	1.05
	60	55	11	1.09	230.4	2300	150	74	90	1.29	74.5	0.99	1.11
	60	55	11	1.09	230.4	2300	300	77	90	1.83	78.6	0.99	1.17
	60	55	11	1.09	230.4	2300	450	77	90	2.24	78.6	0.99	1.15
	60	55	11	1.09	230.4	2300	600	77	90	2.59	78.6	0.99	1.16
H1_L2	60	55	11	1.09	230.4	2500	75	51	77	0.98	50.0	1.03	1.03
	60	55	11	1.09	230.4	2500	150	65	77	1.39	66.6	0.98	1.09
	60	55	11	1.09	230.4	2500	300	67	77	1.97	67.8	0.98	1.15
	60	55	11	1.09	230.4	2500	450	67	77	2.41	67.8	0.98	1.09
	60	55	11	1.09	230.4	2500	600	67	77	2.79	67.8	0.98	1.03
H1_L3	60	55	11	1.09	230.4	3000	75	42	56	1.16	42.9	0.98	1.03
	60	55	11	1.09	230.4	3000	150	48	56	1.63	49.3	0.98	1.08
	60	55	11	1.09	230.4	3000	300	48	56	2.31	49.3	0.98	1.16
	60	55	11	1.09	230.4	3000	450	48	56	2.83	49.3	0.98	1.17
	60	55	11	1.09	230.4	3000	600	48	56	3.27	49.3	0.98	1.12
H1_L4	60	55	11	1.09	230.4	3500	75	34	43	1.32	36.3	0.95	1.02
	60	55	11	1.09	230.4	3500	150	37	43	1.86	37.9	0.97	1.08
	60	55	11	1.09	230.4	3500	300	37	43	2.64	37.9	0.97	1.15
	60	55	11	1.09	230.4	3500	450	37	43	3.23	37.9	0.97	1.13
	60	55	11	1.09	230.4	3500	600	37	43	3.73	37.9	0.97	1.07
H2_L1	80	70	10	1.14	240.0	3000	75	55	92	0.90	53.3	1.04	1.04
	80	70	10	1.14	240.0	3000	150	73	92	1.28	75.6	0.97	1.10
	80	70	10	1.14	240.0	3000	300	74	92	1.81	80.4	0.92	1.15
	80	70	10	1.14	240.0	3000	450	74	92	2.22	80.4	0.92	1.10
	80	70	10	1.14	240.0	3000	600	74	92	2.56	80.4	0.92	1.06
H2_L2	80	70	10	1.14	240.0	3500	75	48	70	1.04	47.8	1.01	1.05
	80	70	10	1.14	240.0	3500	150	57	70	1.47	60.9	0.94	1.12
	80	70	10	1.14	240.0	3500	300	57	70	2.08	61.0	0.94	1.09
	80	70	10	1.14	240.0	3500	450	57	70	2.54	61.0	0.94	1.10
	80	70	10	1.14	240.0	3500	600	57	70	2.94	61.0	0.94	1.15
H2_L3	80	70	10	1.14	240.0	4000	75	41	55	1.17	42.2	0.97	1.03
	80	70	10	1.14	240.0	4000	150	45	55	1.66	47.8	0.94	1.09
	80	70	10	1.14	240.0	4000	300	45	55	2.35	47.8	0.94	1.14
	80	70	10	1.14	240.0	4000	450	45	55	2.87	47.8	0.94	1.10
	80	70	10	1.14	240.0	4000	600	45	55	3.32	47.8	0.94	1.05
H2_L4	80	70	10	1.14	240.0	4500	75	35	44	1.31	36.7	0.94	1.06
	80	70	10	1.14	240.0	4500	150	36	44	1.85	38.5	0.94	1.09
	80	70	10	1.14	240.0	4500	300	36	44	2.61	38.5	0.94	1.05
	80	70	10	1.14	240.0	4500	450	36	44	3.20	38.5	0.94	1.10
	80	70	10	1.14	240.0	4500	600	36	44	3.69	38.5	0.94	1.15
H3_L1	100	100	10	1.00	640.0	4000	75	55	90	0.91	53.0	1.04	1.03
	100	100	10	1.00	640.0	4000	150	74	90	1.29	74.8	0.98	1.09
	100	100	10	1.00	640.0	4000	300	76	90	1.82	79.1	0.96	1.15
	100	100	10	1.00	640.0	4000	450	76	90	2.23	79.1	0.96	1.13
	100	100	10	1.00	640.0	4000	600	76	90	2.58	79.1	0.96	1.08

Column	Geometry							SFEA		DSM Design			
	b_w	b_f	b_s	t	b_w/b_t	A	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}
H3_L2	100	100	10	1.00	640.0	4500	75	49	73	1.01	48.8	1.01	1.05
	100	100	10	1.00	640.0	4500	150	61	73	1.43	63.5	0.97	1.12
	100	100	10	1.00	640.0	4500	300	62	73	2.03	64.0	0.97	1.10
	100	100	10	1.00	640.0	4500	450	62	73	2.48	64.0	0.97	1.12
	100	100	10	1.00	640.0	4500	600	62	73	2.87	64.0	0.97	1.25
H3_L3	100	100	10	1.00	640.0	5000	75	44	60	1.11	44.6	0.99	1.05
	100	100	10	1.00	640.0	5000	150	51	60	1.57	53.1	0.97	1.11
	100	100	10	1.00	640.0	5000	300	52	60	2.23	53.1	0.97	1.07
	100	100	10	1.00	640.0	5000	450	52	60	2.73	53.1	0.97	1.13
	100	100	10	1.00	640.0	5000	600	52	60	3.15	53.1	0.97	1.26
H3_L4	100	100	10	1.00	640.0	5500	75	39	51	1.21	40.6	0.97	1.05
	100	100	10	1.00	640.0	5500	150	44	51	1.71	44.8	0.97	1.11
	100	100	10	1.00	640.0	5500	300	44	51	2.42	44.8	0.97	1.07
	100	100	10	1.00	640.0	5500	450	44	51	2.97	44.8	0.97	1.13
	100	100	10	1.00	640.0	5500	600	44	51	3.43	44.8	0.97	1.26
H4_L1	100	120	10	0.83	720.0	5000	75	41	59	1.13	44.1	0.94	1.05
	100	120	10	0.83	720.0	5000	150	49	59	1.59	51.9	0.95	1.11
	100	120	10	0.83	720.0	5000	300	49	59	2.25	51.9	0.95	1.07
	100	120	10	0.83	720.0	5000	450	49	59	2.76	51.9	0.95	1.13
	100	120	10	0.83	720.0	5000	600	49	59	3.18	51.9	0.95	1.26
H4_L2	100	120	10	0.83	720.0	5500	75	38	50	1.23	40.0	0.96	1.05
	100	120	10	0.83	720.0	5500	150	43	50	1.73	43.7	0.97	1.11
	100	120	10	0.83	720.0	5500	300	43	50	2.45	43.7	0.97	1.07
	100	120	10	0.83	720.0	5500	450	43	50	3.00	43.7	0.97	1.13
	100	120	10	0.83	720.0	5500	600	43	50	3.47	43.7	0.97	1.26
H4_L3	100	120	10	0.83	720.0	6000	75	34	43	1.33	35.9	0.94	1.05
	100	120	10	0.83	720.0	6000	150	37	43	1.87	37.4	0.98	1.11
	100	120	10	0.83	720.0	6000	300	37	43	2.65	37.4	0.98	1.07
	100	120	10	0.83	720.0	6000	450	37	43	3.25	37.4	0.98	1.13
	100	120	10	0.83	720.0	6000	600	37	43	3.75	37.4	0.98	1.26
H4_L4	100	120	10	0.83	720.0	6500	75	30	37	1.42	32.1	0.94	1.05
	100	120	10	0.83	720.0	6500	150	32	37	2.01	32.5	0.98	1.11
	100	120	10	0.83	720.0	6500	300	32	37	2.85	32.5	0.98	1.07
	100	120	10	0.83	720.0	6500	450	32	37	3.49	32.5	0.98	1.13
	100	120	10	0.83	720.0	6500	600	32	37	4.03	32.5	0.98	1.26
H5_L1	130	120	10	1.08	975.0	5000	75	57	99	0.87	54.6	1.04	1.05
	130	120	10	1.08	975.0	5000	150	80	99	1.23	79.5	1.01	1.11
	130	120	10	1.08	975.0	5000	300	82	99	1.74	86.8	0.95	1.07
	130	120	10	1.08	975.0	5000	450	82	99	2.13	86.8	0.95	1.13
	130	120	10	1.08	975.0	5000	600	82	99	2.46	86.8	0.95	1.26
H5_L2	130	120	10	1.08	975.0	5500	75	53	83	0.95	51.5	1.03	1.05
	130	120	10	1.08	975.0	5500	150	69	83	1.34	70.6	0.97	1.11
	130	120	10	1.08	975.0	5500	300	70	83	1.90	73.1	0.96	1.07
	130	120	10	1.08	975.0	5500	450	70	83	2.32	73.1	0.96	1.13
	130	120	10	1.08	975.0	5500	600	70	83	2.68	73.1	0.96	1.26
H5_L3	130	120	10	1.08	975.0	6000	75	49	71	1.03	48.3	1.01	1.05
	130	120	10	1.08	975.0	6000	150	60	71	1.45	62.2	0.96	1.11
	130	120	10	1.08	975.0	6000	300	60	71	2.05	62.5	0.96	1.07
	130	120	10	1.08	975.0	6000	450	60	71	2.51	62.5	0.96	1.13
	130	120	10	1.08	975.0	6000	600	60	71	2.90	62.5	0.96	1.26
H5_L4	130	120	10	1.08	975.0	6500	75	45	62	1.10	45.1	0.99	1.04
	130	120	10	1.08	975.0	6500	150	52	62	1.56	54.2	0.96	1.10
	130	120	10	1.08	975.0	6500	300	52	62	2.20	54.2	0.96	1.13
	130	120	10	1.08	975.0	6500	450	52	62	2.70	54.2	0.96	1.09
	130	120	10	1.08	975.0	6500	600	52	62	3.11	54.2	0.96	1.09
											Mean		0.970
											Sd. Dev.		0.025
											Max		1.043
											Min		0.923

ANNEX K: RLC Column Data

Table K_1: PC_M columns: (i) geometries, (ii) buckling stresses and ultimate strengths, (iii) ultimate strength predictions by current and proposed DSM design curves, and (iv) numerical-to-predicted ultimate strength ratios (mm and MPa)

Column	Geometry										SFEA		DSM Design							
	b_w	b_f	b_s	b_l	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
RLC1_L1	60	55	10	10	1	1.09	210.0	114.6	7.08	2000	75	64	167	0.67	62.1	1.03	1.67	0.77	62.1	1.03
	60	55	10	10	1	1.09	210.0	114.6	7.08	2000	150	110	167	0.95	102.9	1.07	1.67	0.77	102.9	1.07
	60	55	10	10	1	1.09	210.0	114.6	7.08	2000	300	146	167	1.34	141.1	1.03	1.67	0.77	141.1	1.03
	60	55	10	10	1	1.09	210.0	114.6	7.08	2000	450	157	167	1.64	146.0	1.07	1.67	0.77	150.5	1.04
	60	55	10	10	1	1.09	210.0	114.6	7.08	2000	600	162	167	1.90	146.0	1.11	1.67	0.77	157.7	1.03
RLC1_L2	60	55	10	10	1	1.09	210.0	114.6	7.08	2500	75	58	109	0.83	56.2	1.03	1.67	0.77	56.2	1.03
	60	55	10	10	1	1.09	210.0	114.6	7.08	2500	150	85	109	1.18	84.1	1.02	1.67	0.77	84.1	1.02
	60	55	10	10	1	1.09	210.0	114.6	7.08	2500	300	102	109	1.66	95.2	1.07	1.67	0.77	98.5	1.03
	60	55	10	10	1	1.09	210.0	114.6	7.08	2500	450	108	109	2.04	95.2	1.14	1.67	0.77	105.2	1.03
	60	55	10	10	1	1.09	210.0	114.6	7.08	2500	600	112	109	2.35	95.2	1.18	1.67	0.77	110.2	1.02
RLC1_L3	60	55	10	10	1	1.09	210.0	114.6	7.08	3000	75	50	76	0.99	49.7	1.00	1.67	0.77	49.7	1.00
	60	55	10	10	1	1.09	210.0	114.6	7.08	3000	150	65	76	1.40	65.9	0.99	1.67	0.77	65.9	0.99
	60	55	10	10	1	1.09	210.0	114.6	7.08	3000	300	75	76	1.98	67.0	1.13	1.67	0.77	73.4	1.03
	60	55	10	10	1	1.09	210.0	114.6	7.08	3000	450	81	76	2.43	67.0	1.20	1.67	0.77	78.4	1.03
	60	55	10	10	1	1.09	210.0	114.6	7.08	3000	600	83	76	2.80	67.0	1.25	1.67	0.77	82.1	1.02
RLC1_L4	60	55	10	10	1	1.09	210.0	114.6	7.08	3300	75	45	64	1.09	45.8	0.98	1.67	0.77	45.8	0.98
	60	55	10	10	1	1.09	210.0	114.6	7.08	3300	150	56	64	1.54	55.8	1.01	1.67	0.77	56.2	1.00
	60	55	10	10	1	1.09	210.0	114.6	7.08	3300	300	65	64	2.17	55.8	1.16	1.67	0.77	62.9	1.03
	60	55	10	10	1	1.09	210.0	114.6	7.08	3300	450	69	64	2.66	55.8	1.24	1.67	0.77	67.2	1.03
	60	55	10	10	1	1.09	210.0	114.6	7.08	3300	600	72	64	3.07	55.8	1.28	1.67	0.77	70.5	1.02
RLC2_L1	100	100	20	15	1.5	1.00	555.0	3094.4	7.80	5000	75	51	80	0.97	50.6	1.00	1.72	0.78	50.6	1.00
	100	100	20	15	1.5	1.00	555.0	3094.4	7.80	5000	150	68	80	1.37	68.3	0.99	1.72	0.78	68.3	0.99
	100	100	20	15	1.5	1.00	555.0	3094.4	7.80	5000	300	78	80	1.94	69.9	1.11	1.72	0.78	75.2	1.03
	100	100	20	15	1.5	1.00	555.0	3094.4	7.80	5000	450	82	80	2.38	69.9	1.18	1.72	0.78	79.7	1.03
	100	100	20	15	1.5	1.00	555.0	3094.4	7.80	5000	600	84	80	2.74	69.9	1.20	1.72	0.78	83.0	1.01
RLC2_L2	100	100	20	15	1.5	1.00	555.0	3094.4	7.80	5500	75	46	66	1.06	46.7	0.98	1.72	0.78	46.7	0.98
	100	100	20	15	1.5	1.00	555.0	3094.4	7.80	5500	150	58	66	1.50	58.1	1.00	1.72	0.78	58.2	1.00
	100	100	20	15	1.5	1.00	555.0	3094.4	7.80	5500	300	67	66	2.13	58.1	1.15	1.72	0.78	64.2	1.04
	100	100	20	15	1.5	1.00	555.0	3094.4	7.80	5500	450	71	66	2.61	58.1	1.21	1.72	0.78	67.9	1.04
	100	100	20	15	1.5	1.00	555.0	3094.4	7.80	5500	600	72	66	3.01	58.1	1.24	1.72	0.78	70.8	1.02
RLC2_L3	100	100	20	15	1.5	1.00	555.0	3094.4	7.80	6000	75	41	56	1.16	42.8	0.96	1.72	0.78	42.8	0.96
	100	100	20	15	1.5	1.00	555.0	3094.4	7.80	6000	150	51	56	1.64	49.1	1.03	1.72	0.78	50.3	1.01
	100	100	20	15	1.5	1.00	555.0	3094.4	7.80	6000	300	58	56	2.32	49.1	1.18	1.72	0.78	55.5	1.05
	100	100	20	15	1.5	1.00	555.0	3094.4	7.80	6000	450	62	56	2.84	49.1	1.25	1.72	0.78	58.8	1.05
	100	100	20	15	1.5	1.00	555.0	3094.4	7.80	6000	600	62	56	3.27	49.1	1.27	1.72	0.78	61.2	1.02
RLC2_L4	100	100	20	15	1.5	1.00	555.0	3094.4	7.80	6500	75	37	48	1.25	38.9	0.95	1.72	0.78	38.9	0.95
	100	100	20	15	1.5	1.00	555.0	3094.4	7.80	6500	150	45	48	1.77	42.0	1.06	1.72	0.78	44.0	1.02
	100	100	20	15	1.5	1.00	555.0	3094.4	7.80	6500	300	51	48	2.50	42.0	1.22	1.72	0.78	48.6	1.06
	100	100	20	15	1.5	1.00	555.0	3094.4	7.80	6500	450	54	48	3.06	42.0	1.29	1.72	0.78	51.4	1.05
	100	100	20	15	1.5	1.00	555.0	3094.4	7.80	6500	600	55	48	3.54	42.0	1.30	1.72	0.78	53.6	1.02
RLC3_L1	110	100	20	15	1.5	1.10	570.0	3552.5	8.55	4000	75	62	142	0.73	60.2	1.03	1.76	0.80	60.2	1.03
	110	100	20	15	1.5	1.10	570.0	3552.5	8.55	4000	150	101	142	1.03	96.5	1.05	1.76	0.80	96.5	1.05
	110	100	20	15	1.5	1.10	570.0	3552.5	8.55	4000	300	128	142	1.45	124.1	1.03	1.76	0.80	124.1	1.03
	110	100	20	15	1.5	1.10	570.0	3552.5	8.55	4000	450	136	142	1.78	124.8	1.09	1.76	0.80	130.0	1.05
	110	100	20	15	1.5	1.10	570.0	3552.5	8.55	4000	600	137	142	2.05	124.8	1.10	1.76	0.80	134.5	1.02
RLC3_L2	110	100	20	15	1.5	1.10	570.0	3552.5	8.55	4500	75	58	114	0.81	56.9	1.03	1.76	0.80	56.9	1.03
	110	100	20	15	1.5	1.10	570.0	3552.5	8.55	4500	150	88	114	1.15	86.3	1.02	1.76	0.80	86.3	1.02
	110	100	20	15	1.5	1.10	570.0	3552.5	8.55	4500	300	105	114	1.63	99.6	1.06	1.76	0.80	101.5	1.04
	110	100	20	15	1.5	1.10	570.0	3552.5	8.55	4500	450	112	114	1.99	99.6	1.12	1.76	0.80	106.5	1.05
	110	100	20	15	1.5	1.10	570.0	3552.5	8.55	4500	600	114	114	2.30	99.6	1.14	1.76	0.80	110.2	1.03
RLC3_L3	110	100	20	15	1.5	1.10	570.0	3552.5	8.55	5000	75	54	93	0.90	53.4	1.01	1.76	0.80	53.4	1.01
	110	100	20	15	1.5	1.10	570.0	3552.5	8.55	5000	150	76	93	1.27	76.1	1.00	1.76	0.80	76.1	1.00
	110	100	20	15	1.5	1.10	570.0	3552.5	8.55	5000	300	88	93	1.80	81.2	1.09	1.76	0.80	84.8	1.04
	110	100	20	15	1.5	1.10	570.0	3552.5	8.55	5000	450	94	93	2.20	81.2	1.15	1.76	0.80	89.0	1.05
	110	100	20	15	1.5	1.10	570.0	3552.5	8.55	5000	600	96	93	2.55	81.2	1.18	1.76	0.80	92.1	1.04
RLC3_L4	110	100	20	15	1.5	1.10	570.0	3552.5	8.55	5500	75	50	77	0.99	49.9	1.00	1.76	0.80	49.9	1.00
	110	100	20	15	1.5	1.10	570.0	3552.5	8.55	5500	150	66	77	1.40	66.4	0.99	1.76	0.80	66.4	0.99
	110	100	20	15	1.5	1.10	570.0	3552.5	8.55	5500	300	76	77	1.97	67.5	1.12	1.76	0.80	72.1	1.05
	110	100	20	15	1.5	1.10	570.0	3552.5	8.55	5500	450	80	77	2.42	67.5	1.19	1.76	0.80	75.6	1.06
	110	100	20	15	1.5	1.10	570.0	3552.5	8.55	5500	600	82	77	2.79	67.5	1.21	1.76	0.80	78.2	1.05
RLC4_L1	130	130	20	20	1.5	1.00	705.0	9150.8	8.60	6000	75	52	85	0.94	51.9	1.01	1.77	0.80	51.9	1.01
	130	130	20	20	1.5	1.00	705.0	9150.8	8.60	6000	150	72	85	1.33	71.8	1.00	1.77	0.80	71.8	1.00
	130	130	20	20	1.5	1.00	705.0	9150.8	8.60	6000	300	83	85	1.88	74.7	1.12	1.77	0.80	78.8	1.06
	130	130	20	20	1.5	1.00	705.0	9150.8	8.60	6000	450	85	85	2.30	74.7	1.14	1.77	0.80	82.6	1.03
	130	130	20	20	1.5	1.00	705.0	9150.8	8.60	6000	600	85	85	2.65	74.7	1.14	1.77	0.80	85.4	1.00

Column	Geometry										SFEA		DSM Design							
	b_w	b_f	b_s	b_l	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
RLC4_L2	130	130	20	20	1.5	1.00	705.0	9150.8	8.60	6500	75	48	73	1.01	48.8	0.99	1.77	0.80	48.8	0.99
	130	130	20	20	1.5	1.00	705.0	9150.8	8.60	6500	150	64	73	1.43	63.5	1.00	1.77	0.80	63.5	1.00
	130	130	20	20	1.5	1.00	705.0	9150.8	8.60	6500	300	73	73	2.03	64.1	1.15	1.77	0.80	68.8	1.07
	130	130	20	20	1.5	1.00	705.0	9150.8	8.60	6500	450	76	73	2.48	64.1	1.18	1.77	0.80	72.1	1.05
	130	130	20	20	1.5	1.00	705.0	9150.8	8.60	6500	600	76	73	2.87	64.1	1.18	1.77	0.80	74.6	1.02
RLC4_L3	130	130	20	20	1.5	1.00	705.0	9150.8	8.60	7000	75	45	63	1.09	45.7	0.98	1.77	0.80	45.7	0.98
	130	130	20	20	1.5	1.00	705.0	9150.8	8.60	7000	150	57	63	1.54	55.6	1.02	1.77	0.80	55.9	1.01
	130	130	20	20	1.5	1.00	705.0	9150.8	8.60	7000	300	65	63	2.18	55.6	1.18	1.77	0.80	60.7	1.08
	130	130	20	20	1.5	1.00	705.0	9150.8	8.60	7000	450	69	63	2.66	55.6	1.24	1.77	0.80	63.6	1.08
	130	130	20	20	1.5	1.00	705.0	9150.8	8.60	7000	600	69	63	3.08	55.6	1.24	1.77	0.80	65.8	1.04
RLC4_L4	130	130	20	20	1.5	1.00	705.0	9150.8	8.60	7500	75	41	55	1.16	42.6	0.96	1.77	0.80	42.6	0.96
	130	130	20	20	1.5	1.00	705.0	9150.8	8.60	7500	150	51	55	1.64	48.6	1.05	1.77	0.80	49.7	1.02
	130	130	20	20	1.5	1.00	705.0	9150.8	8.60	7500	300	59	55	2.33	48.6	1.21	1.77	0.80	53.9	1.09
	130	130	20	20	1.5	1.00	705.0	9150.8	8.60	7500	450	62	55	2.85	48.6	1.28	1.77	0.80	56.5	1.10
	130	130	20	20	1.5	1.00	705.0	9150.8	8.60	7500	600	62	55	3.29	48.6	1.28	1.77	0.80	58.5	1.06
RLC5_L1	150	130	20	15	2.5	1.15	1200.0	17952.8	6.62	5000	75	64	156	0.69	61.3	1.04	1.65	0.76	61.3	1.04
	150	130	20	15	2.5	1.15	1200.0	17952.8	6.62	5000	150	107	156	0.98	100.2	1.07	1.65	0.76	100.2	1.07
	150	130	20	15	2.5	1.15	1200.0	17952.8	6.62	5000	300	139	156	1.39	133.9	1.03	1.65	0.76	133.9	1.03
	150	130	20	15	2.5	1.15	1200.0	17952.8	6.62	5000	450	150	156	1.70	136.5	1.10	1.65	0.76	142.8	1.05
	150	130	20	15	2.5	1.15	1200.0	17952.8	6.62	5000	600	157	156	1.96	136.5	1.15	1.65	0.76	150.2	1.04
RLC5_L2	150	130	20	15	2.5	1.15	1200.0	17952.8	6.62	5500	75	61	130	0.76	58.9	1.04	1.65	0.76	58.9	1.04
	150	130	20	15	2.5	1.15	1200.0	17952.8	6.62	5500	150	96	130	1.07	92.6	1.04	1.65	0.76	92.6	1.04
	150	130	20	15	2.5	1.15	1200.0	17952.8	6.62	5500	300	119	130	1.52	114.1	1.05	1.65	0.76	114.6	1.04
	150	130	20	15	2.5	1.15	1200.0	17952.8	6.62	5500	450	129	130	1.86	114.1	1.13	1.65	0.76	123.2	1.04
	150	130	20	15	2.5	1.15	1200.0	17952.8	6.62	5500	600	135	130	2.15	114.1	1.18	1.65	0.76	129.6	1.04
RLC5_L3	150	130	20	15	2.5	1.15	1200.0	17952.8	6.62	6000	75	58	110	0.82	56.4	1.03	1.65	0.76	56.4	1.03
	150	130	20	15	2.5	1.15	1200.0	17952.8	6.62	6000	150	87	110	1.17	84.9	1.02	1.65	0.76	84.9	1.02
	150	130	20	15	2.5	1.15	1200.0	17952.8	6.62	6000	300	104	110	1.65	96.7	1.08	1.65	0.76	100.1	1.04
	150	130	20	15	2.5	1.15	1200.0	17952.8	6.62	6000	450	112	110	2.02	96.7	1.16	1.65	0.76	107.5	1.04
	150	130	20	15	2.5	1.15	1200.0	17952.8	6.62	6000	600	117	110	2.33	96.7	1.21	1.65	0.76	113.1	1.04
RLC5_L4	150	130	20	15	2.5	1.15	1200.0	17952.8	6.62	6500	75	55	95	0.89	53.8	1.02	1.65	0.76	53.8	1.02
	150	130	20	15	2.5	1.15	1200.0	17952.8	6.62	6500	150	78	95	1.26	77.3	1.00	1.65	0.76	77.3	1.00
	150	130	20	15	2.5	1.15	1200.0	17952.8	6.62	6500	300	92	95	1.78	83.0	1.10	1.65	0.76	88.3	1.04
	150	130	20	15	2.5	1.15	1200.0	17952.8	6.62	6500	450	99	95	2.18	83.0	1.19	1.65	0.76	94.8	1.04
	150	130	20	15	2.5	1.15	1200.0	17952.8	6.62	6500	600	103	95	2.52	83.0	1.25	1.65	0.76	99.8	1.04
														Mean		1.104			Mean	1.028
														Sd. Dev.		0.095			Sd. Dev.	0.027
														Max		1.305			Max	1.100
														Min		0.946			Min	0.949

Table K_2: PC_m columns: (i) geometries, (ii) buckling stresses and ultimate strengths, (iii) ultimate strength predictions by current and proposed DSM design curves, and (iv) numerical-to-predicted ultimate strength ratios (mm and MPa)

Column	Geometry								SFEA		DSM Design					
	b_w	b_f	b_s	b_l	t	b_w/b_t	A	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	f_{nFT}	f_u/f_{nFT}
RLC1_L1	60	55	10	10	1	1.09	210.0	2000	75	67	220	0.58	65.0	1.03	65.0	1.03
	60	55	10	10	1	1.09	210.0	2000	150	120	220	0.83	112.8	1.07	112.8	1.07
	60	55	10	10	1	1.09	210.0	2000	300	166	220	1.17	169.6	0.98	144.8	1.15
	60	55	10	10	1	1.09	210.0	2000	450	169	220	1.43	191.2	0.89	144.8	1.17
	60	55	10	10	1	1.09	210.0	2000	600	169	220	1.65	193.0	0.88	144.8	1.17
RLC1_L2	60	55	10	10	1	1.09	210.0	2500	75	63	146	0.72	60.5	1.04	60.5	1.04
	60	55	10	10	1	1.09	210.0	2500	150	99	146	1.01	97.5	1.02	96.0	1.03
	60	55	10	10	1	1.09	210.0	2500	300	110	146	1.43	126.9	0.87	96.0	1.15
	60	55	10	10	1	1.09	210.0	2500	450	110	146	1.76	128.0	0.86	96.0	1.15
	60	55	10	10	1	1.09	210.0	2500	600	110	146	2.03	128.0	0.86	96.0	1.15
RLC1_L3	60	55	10	10	1	1.09	210.0	3000	75	57	104	0.85	55.4	1.02	55.4	1.02
	60	55	10	10	1	1.09	210.0	3000	150	76	104	1.20	81.8	0.92	68.2	1.11
	60	55	10	10	1	1.09	210.0	3000	300	77	104	1.70	90.9	0.84	68.2	1.13
	60	55	10	10	1	1.09	210.0	3000	450	77	104	2.08	90.9	0.84	68.2	1.13
	60	55	10	10	1	1.09	210.0	3000	600	77	104	2.41	90.9	0.84	68.2	1.13
RLC1_L4	60	55	10	10	1	1.09	210.0	3300	75	52	87	0.93	52.2	1.00	52.2	1.00
	60	55	10	10	1	1.09	210.0	3300	150	63	87	1.32	72.7	0.87	57.0	1.11
	60	55	10	10	1	1.09	210.0	3300	300	63	87	1.86	75.9	0.83	57.0	1.11
	60	55	10	10	1	1.09	210.0	3300	450	63	87	2.28	75.9	0.83	57.0	1.11
	60	55	10	10	1	1.09	210.0	3300	600	63	87	2.63	75.9	0.83	57.0	1.11

Column	Geometry								SFEA		DSM Design					
	b_w	b_f	b_s	b_l	t	b_w/b_t	A	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	f_{nFT}	f_u/f_{nFT}
RLC2_L1	100	100	20	15	1.5	1.00	555.0	5000	75	57	111	0.82	56.5	1.01	56.5	1.01
	100	100	20	15	1.5	1.00	555.0	5000	150	81	111	1.16	85.2	0.95	73.0	1.11
	100	100	20	15	1.5	1.00	555.0	5000	300	84	111	1.64	97.3	0.87	73.0	1.15
	100	100	20	15	1.5	1.00	555.0	5000	450	84	111	2.01	97.3	0.87	73.0	1.15
	100	100	20	15	1.5	1.00	555.0	5000	600	84	111	2.33	97.3	0.87	73.0	1.15
RLC2_L2	100	100	20	15	1.5	1.00	555.0	5500	75	53	93	0.90	53.4	1.00	53.4	1.00
	100	100	20	15	1.5	1.00	555.0	5500	150	69	93	1.27	76.2	0.90	60.9	1.13
	100	100	20	15	1.5	1.00	555.0	5500	300	70	93	1.80	81.2	0.86	60.9	1.14
	100	100	20	15	1.5	1.00	555.0	5500	450	70	93	2.20	81.2	0.86	60.9	1.14
	100	100	20	15	1.5	1.00	555.0	5500	600	70	93	2.55	81.2	0.86	60.9	1.14
RLC2_L3	100	100	20	15	1.5	1.00	555.0	6000	75	49	79	0.98	50.3	0.98	50.3	0.98
	100	100	20	15	1.5	1.00	555.0	6000	150	58	79	1.38	67.4	0.86	51.7	1.13
	100	100	20	15	1.5	1.00	555.0	6000	300	58	79	1.95	68.9	0.85	51.7	1.13
	100	100	20	15	1.5	1.00	555.0	6000	450	58	79	2.39	68.9	0.85	51.7	1.13
	100	100	20	15	1.5	1.00	555.0	6000	600	58	79	2.76	68.9	0.85	51.7	1.13
RLC2_L4	100	100	20	15	1.5	1.00	555.0	6500	75	44	67	1.05	47.1	0.94	44.4	1.00
	100	100	20	15	1.5	1.00	555.0	6500	150	49	67	1.49	59.1	0.84	44.4	1.11
	100	100	20	15	1.5	1.00	555.0	6500	300	49	67	2.11	59.2	0.84	44.4	1.11
	100	100	20	15	1.5	1.00	555.0	6500	450	49	67	2.58	59.2	0.84	44.4	1.11
	100	100	20	15	1.5	1.00	555.0	6500	600	49	67	2.98	59.2	0.84	44.4	1.11
RLC3_L1	110	100	20	15	1.5	1.10	570.0	4000	75	66	190	0.63	63.6	1.04	63.6	1.04
	110	100	20	15	1.5	1.10	570.0	4000	150	114	190	0.89	107.7	1.06	107.7	1.06
	110	100	20	15	1.5	1.10	570.0	4000	300	145	190	1.26	154.7	0.94	124.7	1.16
	110	100	20	15	1.5	1.10	570.0	4000	450	145	190	1.54	166.2	0.87	124.7	1.17
	110	100	20	15	1.5	1.10	570.0	4000	600	145	190	1.78	166.2	0.87	124.7	1.17
RLC3_L2	110	100	20	15	1.5	1.10	570.0	4500	75	64	153	0.70	61.1	1.04	61.1	1.04
	110	100	20	15	1.5	1.10	570.0	4500	150	103	153	0.99	99.4	1.03	99.4	1.03
	110	100	20	15	1.5	1.10	570.0	4500	300	116	153	1.40	131.8	0.88	100.5	1.16
	110	100	20	15	1.5	1.10	570.0	4500	450	116	153	1.72	133.9	0.87	100.5	1.16
	110	100	20	15	1.5	1.10	570.0	4500	600	116	153	1.98	133.9	0.87	100.5	1.16
RLC3_L3	110	100	20	15	1.5	1.10	570.0	5000	75	61	125	0.77	58.4	1.04	58.4	1.04
	110	100	20	15	1.5	1.10	570.0	5000	150	90	125	1.09	90.9	0.99	82.5	1.09
	110	100	20	15	1.5	1.10	570.0	5000	300	95	125	1.55	110.0	0.86	82.5	1.15
	110	100	20	15	1.5	1.10	570.0	5000	450	95	125	1.89	110.0	0.86	82.5	1.15
	110	100	20	15	1.5	1.10	570.0	5000	600	95	125	2.19	110.0	0.86	82.5	1.15
RLC3_L4	110	100	20	15	1.5	1.10	570.0	5400	75	57	109	0.83	56.2	1.01	56.2	1.01
	110	100	20	15	1.5	1.10	570.0	5400	150	78	109	1.18	84.1	0.92	71.4	1.09
	110	100	20	15	1.5	1.10	570.0	5400	300	80	109	1.66	95.2	0.84	71.4	1.12
	110	100	20	15	1.5	1.10	570.0	5400	450	80	109	2.04	95.2	0.84	71.4	1.12
	110	100	20	15	1.5	1.10	570.0	5400	600	80	109	2.35	95.2	0.84	71.4	1.12
RLC4_L1	130	130	20	20	1.5	1.00	705.0	6000	75	57	111	0.82	56.5	1.01	56.5	1.01
	130	130	20	20	1.5	1.00	705.0	6000	150	80	111	1.16	85.1	0.94	72.9	1.10
	130	130	20	20	1.5	1.00	705.0	6000	300	84	111	1.65	97.1	0.86	72.9	1.15
	130	130	20	20	1.5	1.00	705.0	6000	450	84	111	2.02	97.1	0.86	72.9	1.15
	130	130	20	20	1.5	1.00	705.0	6000	600	84	111	2.33	97.1	0.86	72.9	1.15
RLC4_L2	130	130	20	20	1.5	1.00	705.0	6500	75	54	96	0.89	54.0	1.00	54.0	1.00
	130	130	20	20	1.5	1.00	705.0	6500	150	71	96	1.25	77.8	0.91	62.9	1.13
	130	130	20	20	1.5	1.00	705.0	6500	300	72	96	1.77	83.9	0.86	62.9	1.15
	130	130	20	20	1.5	1.00	705.0	6500	450	72	96	2.17	83.9	0.86	62.9	1.15
	130	130	20	20	1.5	1.00	705.0	6500	600	72	96	2.51	83.9	0.86	62.9	1.15
RLC4_L3	130	130	20	20	1.5	1.00	705.0	7000	75	51	83	0.95	51.4	0.98	51.4	0.98
	130	130	20	20	1.5	1.00	705.0	7000	150	62	83	1.34	70.6	0.88	54.8	1.14
	130	130	20	20	1.5	1.00	705.0	7000	300	63	83	1.90	73.0	0.86	54.8	1.14
	130	130	20	20	1.5	1.00	705.0	7000	450	63	83	2.32	73.0	0.86	54.8	1.14
	130	130	20	20	1.5	1.00	705.0	7000	600	63	83	2.68	73.0	0.86	54.8	1.14
RLC4_L4	130	130	20	20	1.5	1.00	705.0	7500	75	47	73	1.01	48.8	0.96	48.1	0.98
	130	130	20	20	1.5	1.00	705.0	7500	150	55	73	1.43	63.6	0.86	48.1	1.13
	130	130	20	20	1.5	1.00	705.0	7500	300	55	73	2.02	64.2	0.85	48.1	1.13
	130	130	20	20	1.5	1.00	705.0	7500	450	55	73	2.48	64.2	0.85	48.1	1.13
	130	130	20	20	1.5	1.00	705.0	7500	600	55	73	2.86	64.2	0.85	48.1	1.13
RLC5_L1	150	130	20	15	2.5	1.15	1200.0	5000	75	66	196	0.62	63.9	1.04	63.9	1.04
	150	130	20	15	2.5	1.15	1200.0	5000	150	115	196	0.87	108.9	1.05	108.9	1.05
	150	130	20	15	2.5	1.15	1200.0	5000	300	147	196	1.24	158.2	0.93	129.1	1.14
	150	130	20	15	2.5	1.15	1200.0	5000	450	148	196	1.51	172.1	0.86	129.1	1.15
	150	130	20	15	2.5	1.15	1200.0	5000	600	148	196	1.75	172.1	0.86	129.1	1.15
RLC5_L2	150	130	20	15	2.5	1.15	1200.0	5500	75	65	165	0.67	62.0	1.04	62.0	1.04
	150	130	20	15	2.5	1.15	1200.0	5500	150	106	165	0.95	102.6	1.03	102.6	1.03
	150	130	20	15	2.5	1.15	1200.0	5500	300	124	165	1.35	140.4	0.88	108.8	1.14
	150	130	20	15	2.5	1.15	1200.0	5500	450	124	165	1.65	145.0	0.86	108.8	1.14
	150	130	20	15	2.5	1.15	1200.0	5500	600	124	165	1.90	145.0	0.86	108.8	1.14

Column	Geometry								SFEA		DSM Design					
	b_w	b_f	b_s	b_l	t	b_w/b_t	A	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	f_{nFT}	f_u/f_{nFT}
RLC5_L3	150	130	20	15	2.5	1.15	1200.0	6000	75	63	141	0.73	60.0	1.04	60.0	1.04
	150	130	20	15	2.5	1.15	1200.0	6000	150	96	141	1.03	96.1	1.00	92.8	1.04
	150	130	20	15	2.5	1.15	1200.0	6000	300	105	141	1.46	123.2	0.85	92.8	1.13
	150	130	20	15	2.5	1.15	1200.0	6000	450	105	141	1.79	123.7	0.85	92.8	1.13
	150	130	20	15	2.5	1.15	1200.0	6000	600	105	141	2.06	123.7	0.85	92.8	1.13
RLC5_L4	150	130	20	15	2.5	1.15	1200.0	6500	75	60	122	0.78	58.0	1.04	58.0	1.04
	150	130	20	15	2.5	1.15	1200.0	6500	150	86	122	1.11	89.6	0.96	80.1	1.07
	150	130	20	15	2.5	1.15	1200.0	6500	300	90	122	1.57	106.8	0.84	80.1	1.12
	150	130	20	15	2.5	1.15	1200.0	6500	450	90	122	1.92	106.8	0.84	80.1	1.12
	150	130	20	15	2.5	1.15	1200.0	6500	600	90	122	2.22	106.8	0.84	80.1	1.12
												Mean		0.910		1.105
												Sd. Dev.		0.075		0.053
												Max		1.065		1.169
												Min		0.833		0.975

Table K$_3$: PS columns: (i) geometries, (ii) buckling stresses and ultimate strengths, (iii) ultimate strength predictions by current and proposed DSM design curves, and (iv) numerical-to-predicted ultimate strength ratios (mm and MPa)

Column	Geometry								SFEA		DSM Design			
	b_w	b_f	b_s	b_l	t	b_w/b_t	A	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}
RLC1_L1	60	55	10	10	1	1.09	210.0	2000	75	64	167	0.67	62.1	1.03
	60	55	10	10	1	1.09	210.0	2000	150	110	167	0.95	102.9	1.07
	60	55	10	10	1	1.09	210.0	2000	300	143	167	1.34	141.1	1.01
	60	55	10	10	1	1.09	210.0	2000	450	146	167	1.64	146.0	1.00
	60	55	10	10	1	1.09	210.0	2000	600	146	167	1.90	146.0	1.00
RLC1_L2	60	55	10	10	1	1.09	210.0	2500	75	58	109	0.83	56.2	1.03
	60	55	10	10	1	1.09	210.0	2500	150	85	109	1.18	84.1	1.01
	60	55	10	10	1	1.09	210.0	2500	300	96	109	1.66	95.2	1.01
	60	55	10	10	1	1.09	210.0	2500	450	96	109	2.04	95.2	1.01
	60	55	10	10	1	1.09	210.0	2500	600	96	109	2.35	95.2	1.01
RLC1_L3	60	55	10	10	1	1.09	210.0	3000	75	50	76	0.99	49.7	1.00
	60	55	10	10	1	1.09	210.0	3000	150	64	76	1.40	65.9	0.97
	60	55	10	10	1	1.09	210.0	3000	300	67	76	1.98	67.0	1.01
	60	55	10	10	1	1.09	210.0	3000	450	67	76	2.43	67.0	1.01
	60	55	10	10	1	1.09	210.0	3000	600	67	76	2.80	67.0	1.01
RLC1_L4	60	55	10	10	1	1.09	210.0	3300	75	45	64	1.09	45.8	0.97
	60	55	10	10	1	1.09	210.0	3300	150	55	64	1.54	55.8	0.98
	60	55	10	10	1	1.09	210.0	3300	300	56	64	2.17	55.8	1.01
	60	55	10	10	1	1.09	210.0	3300	450	56	64	2.66	55.8	1.01
	60	55	10	10	1	1.09	210.0	3300	600	56	64	3.07	55.8	1.01
RLC2_L1	100	100	20	15	1.5	1.00	555.0	5000	75	51	80	0.97	50.6	1.00
	100	100	20	15	1.5	1.00	555.0	5000	150	66	80	1.37	68.3	0.97
	100	100	20	15	1.5	1.00	555.0	5000	300	71	80	1.94	69.9	1.01
	100	100	20	15	1.5	1.00	555.0	5000	450	71	80	2.38	69.9	1.01
	100	100	20	15	1.5	1.00	555.0	5000	600	71	80	2.74	69.9	1.01
RLC2_L2	100	100	20	15	1.5	1.00	555.0	5500	75	46	66	1.06	46.7	0.98
	100	100	20	15	1.5	1.00	555.0	5500	150	57	66	1.50	58.1	0.97
	100	100	20	15	1.5	1.00	555.0	5500	300	59	66	2.13	58.1	1.01
	100	100	20	15	1.5	1.00	555.0	5500	450	59	66	2.61	58.1	1.01
	100	100	20	15	1.5	1.00	555.0	5500	600	59	66	3.01	58.1	1.01
RLC2_L3	100	100	20	15	1.5	1.00	555.0	6000	75	41	56	1.16	42.8	0.95
	100	100	20	15	1.5	1.00	555.0	6000	150	49	56	1.64	49.1	0.99
	100	100	20	15	1.5	1.00	555.0	6000	300	50	56	2.32	49.1	1.01
	100	100	20	15	1.5	1.00	555.0	6000	450	50	56	2.84	49.1	1.01
	100	100	20	15	1.5	1.00	555.0	6000	600	50	56	3.27	49.1	1.01
RLC2_L4	100	100	20	15	1.5	1.00	555.0	6500	75	37	48	1.25	38.9	0.94
	100	100	20	15	1.5	1.00	555.0	6500	150	42	48	1.77	42.0	1.00
	100	100	20	15	1.5	1.00	555.0	6500	300	42	48	2.50	42.0	1.01
	100	100	20	15	1.5	1.00	555.0	6500	450	42	48	3.06	42.0	1.01
	100	100	20	15	1.5	1.00	555.0	6500	600	42	48	3.54	42.0	1.01
RLC3_L1	110	100	20	15	1.5	1.10	570.0	4000	75	62	142	0.73	60.2	1.03
	110	100	20	15	1.5	1.10	570.0	4000	150	101	142	1.03	96.5	1.05
	110	100	20	15	1.5	1.10	570.0	4000	300	123	142	1.45	124.1	0.99
	110	100	20	15	1.5	1.10	570.0	4000	450	124	142	1.78	124.8	0.99
	110	100	20	15	1.5	1.10	570.0	4000	600	124	142	2.05	124.8	0.99

Column	Geometry								SFEA		DSM Design			
	b_w	b_f	b_s	b_l	t	b_w/b_t	A	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}
RLC3_L2	110	100	20	15	1.5	1.10	570.0	4500	75	58	114	0.81	56.9	1.03
	110	100	20	15	1.5	1.10	570.0	4500	150	87	114	1.15	86.3	1.01
	110	100	20	15	1.5	1.10	570.0	4500	300	99	114	1.63	99.6	1.00
	110	100	20	15	1.5	1.10	570.0	4500	450	99	114	1.99	99.6	1.00
	110	100	20	15	1.5	1.10	570.0	4500	600	99	114	2.30	99.6	1.00
RLC3_L3	110	100	20	15	1.5	1.10	570.0	5000	75	54	93	0.90	53.4	1.01
	110	100	20	15	1.5	1.10	570.0	5000	150	75	93	1.27	76.1	0.98
	110	100	20	15	1.5	1.10	570.0	5000	300	81	93	1.80	81.2	1.00
	110	100	20	15	1.5	1.10	570.0	5000	450	81	93	2.20	81.2	1.00
	110	100	20	15	1.5	1.10	570.0	5000	600	81	93	2.55	81.2	1.00
RLC3_L4	110	100	20	15	1.5	1.10	570.0	5500	75	50	77	0.99	49.9	1.00
	110	100	20	15	1.5	1.10	570.0	5500	150	64	77	1.40	66.4	0.97
	110	100	20	15	1.5	1.10	570.0	5500	300	68	77	1.97	67.5	1.00
	110	100	20	15	1.5	1.10	570.0	5500	450	68	77	2.42	67.5	1.00
	110	100	20	15	1.5	1.10	570.0	5500	600	68	77	2.79	67.5	1.00
RLC4_L1	130	130	20	20	1.5	1.00	705.0	6000	75	52	85	0.94	51.9	1.01
	130	130	20	20	1.5	1.00	705.0	6000	150	70	85	1.33	71.8	0.97
	130	130	20	20	1.5	1.00	705.0	6000	300	74	85	1.88	74.7	0.99
	130	130	20	20	1.5	1.00	705.0	6000	450	74	85	2.30	74.7	0.99
	130	130	20	20	1.5	1.00	705.0	6000	600	74	85	2.65	74.7	0.99
RLC4_L2	130	130	20	20	1.5	1.00	705.0	6500	75	48	73	1.01	48.8	0.99
	130	130	20	20	1.5	1.00	705.0	6500	150	61	73	1.43	63.5	0.97
	130	130	20	20	1.5	1.00	705.0	6500	300	63	73	2.03	64.1	0.99
	130	130	20	20	1.5	1.00	705.0	6500	450	63	73	2.48	64.1	0.99
	130	130	20	20	1.5	1.00	705.0	6500	600	63	73	2.87	64.1	0.99
RLC4_L3	130	130	20	20	1.5	1.00	705.0	7000	75	44	63	1.09	45.7	0.97
	130	130	20	20	1.5	1.00	705.0	7000	150	54	63	1.54	55.6	0.97
	130	130	20	20	1.5	1.00	705.0	7000	300	55	63	2.18	55.6	0.99
	130	130	20	20	1.5	1.00	705.0	7000	450	55	63	2.66	55.6	0.99
	130	130	20	20	1.5	1.00	705.0	7000	600	55	63	3.08	55.6	0.99
RLC4_L4	130	130	20	20	1.5	1.00	705.0	7500	75	41	55	1.16	42.6	0.95
	130	130	20	20	1.5	1.00	705.0	7500	150	48	55	1.64	48.6	0.98
	130	130	20	20	1.5	1.00	705.0	7500	300	48	55	2.33	48.6	0.99
	130	130	20	20	1.5	1.00	705.0	7500	450	48	55	2.85	48.6	0.99
	130	130	20	20	1.5	1.00	705.0	7500	600	48	55	3.29	48.6	0.99
RLC5_L1	150	130	20	15	2.5	1.15	1200.0	5000	75	64	156	0.69	61.3	1.04
	150	130	20	15	2.5	1.15	1200.0	5000	150	106	156	0.98	100.2	1.06
	150	130	20	15	2.5	1.15	1200.0	5000	300	133	156	1.39	133.9	0.99
	150	130	20	15	2.5	1.15	1200.0	5000	450	134	156	1.70	136.5	0.98
	150	130	20	15	2.5	1.15	1200.0	5000	600	134	156	1.96	136.5	0.98
RLC5_L2	150	130	20	15	2.5	1.15	1200.0	5500	75	61	130	0.76	58.9	1.04
	150	130	20	15	2.5	1.15	1200.0	5500	150	96	130	1.07	92.6	1.04
	150	130	20	15	2.5	1.15	1200.0	5500	300	112	130	1.52	114.1	0.98
	150	130	20	15	2.5	1.15	1200.0	5500	450	113	130	1.86	114.1	0.99
	150	130	20	15	2.5	1.15	1200.0	5500	600	113	130	2.15	114.1	0.99
RLC5_L3	150	130	20	15	2.5	1.15	1200.0	6000	75	58	110	0.82	56.4	1.03
	150	130	20	15	2.5	1.15	1200.0	6000	150	86	110	1.17	84.9	1.01
	150	130	20	15	2.5	1.15	1200.0	6000	300	96	110	1.65	96.7	0.99
	150	130	20	15	2.5	1.15	1200.0	6000	450	96	110	2.02	96.7	0.99
	150	130	20	15	2.5	1.15	1200.0	6000	600	96	110	2.33	96.7	0.99
RLC5_L4	150	130	20	15	2.5	1.15	1200.0	6500	75	55	95	0.89	53.8	1.02
	150	130	20	15	2.5	1.15	1200.0	6500	150	76	95	1.26	77.3	0.99
	150	130	20	15	2.5	1.15	1200.0	6500	300	82	95	1.78	83.0	0.99
	150	130	20	15	2.5	1.15	1200.0	6500	450	82	95	2.18	83.0	0.99
	150	130	20	15	2.5	1.15	1200.0	6500	600	82	95	2.52	83.0	0.99
												Mean		0.999
												Sd. Dev.		0.021
												Max		1.070
												Min		0.938

ANNEX L: R Column Data

Table L_1: PC_M columns: (i) geometries, (ii) buckling stresses and ultimate strengths, (iii) ultimate strength predictions by current and proposed DSM design curves, and (iv) numerical-to-predicted ultimate strength ratios (mm and MPa)

Column	Geometry										SFEA		DSM Design							
	b_w	b_f	b_s	b_l	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
R1_L1	60	55	10	10	1	1.09	210.0	126.9	6.84	2000	75	65	169	0.67	62.3	1.04	1.66	0.76	62.3	1.04
	60	55	10	10	1	1.09	210.0	126.9	6.84	2000	150	112	169	0.94	103.5	1.08	1.66	0.76	103.5	1.08
	60	55	10	10	1	1.09	210.0	126.9	6.84	2000	300	149	169	1.33	142.8	1.04	1.66	0.76	142.8	1.04
	60	55	10	10	1	1.09	210.0	126.9	6.84	2000	450	160	169	1.63	148.3	1.08	1.66	0.76	152.7	1.04
	60	55	10	10	1	1.09	210.0	126.9	6.84	2000	600	165	169	1.88	148.3	1.11	1.66	0.76	160.3	1.03
R1_L2	60	55	10	10	1	1.09	210.0	126.9	6.84	2500	75	59	111	0.82	56.5	1.04	1.66	0.76	56.5	1.04
	60	55	10	10	1	1.09	210.0	126.9	6.84	2500	150	87	111	1.16	85.2	1.03	1.66	0.76	85.2	1.03
	60	55	10	10	1	1.09	210.0	126.9	6.84	2500	300	104	111	1.64	97.3	1.07	1.66	0.76	100.4	1.04
	60	55	10	10	1	1.09	210.0	126.9	6.84	2500	450	111	111	2.01	97.3	1.14	1.66	0.76	107.6	1.03
	60	55	10	10	1	1.09	210.0	126.9	6.84	2500	600	115	111	2.33	97.3	1.18	1.66	0.76	113.0	1.02
R1_L3	60	55	10	10	1	1.09	210.0	126.9	6.84	3000	75	51	78	0.98	50.2	1.01	1.66	0.76	50.2	1.01
	60	55	10	10	1	1.09	210.0	126.9	6.84	3000	150	67	78	1.39	67.2	1.00	1.66	0.76	67.2	1.00
	60	55	10	10	1	1.09	210.0	126.9	6.84	3000	300	78	78	1.96	68.5	1.13	1.66	0.76	75.1	1.03
	60	55	10	10	1	1.09	210.0	126.9	6.84	3000	450	83	78	2.40	68.5	1.21	1.66	0.76	80.4	1.03
	60	55	10	10	1	1.09	210.0	126.9	6.84	3000	600	86	78	2.77	68.5	1.25	1.66	0.76	84.5	1.02
R1_L4	60	55	10	10	1	1.09	210.0	126.9	6.84	3300	75	46	65	1.07	46.3	0.99	1.66	0.76	46.3	0.99
	60	55	10	10	1	1.09	210.0	126.9	6.84	3300	150	58	65	1.52	57.0	1.02	1.66	0.76	57.3	1.01
	60	55	10	10	1	1.09	210.0	126.9	6.84	3300	300	67	65	2.15	57.0	1.17	1.66	0.76	64.5	1.04
	60	55	10	10	1	1.09	210.0	126.9	6.84	3300	450	72	65	2.63	57.0	1.26	1.66	0.76	69.1	1.04
	60	55	10	10	1	1.09	210.0	126.9	6.84	3300	600	74	65	3.04	57.0	1.29	1.66	0.76	72.5	1.02
R2_L1	100	100	20	15	1.5	1.00	555.0	3304.6	7.59	5000	75	51	81	0.96	50.9	1.01	1.71	0.78	50.9	1.01
	100	100	20	15	1.5	1.00	555.0	3304.6	7.59	5000	150	69	81	1.36	69.0	1.00	1.71	0.78	69.0	1.00
	100	100	20	15	1.5	1.00	555.0	3304.6	7.59	5000	300	79	81	1.93	70.9	1.12	1.71	0.78	76.3	1.04
	100	100	20	15	1.5	1.00	555.0	3304.6	7.59	5000	450	84	81	2.36	70.9	1.18	1.71	0.78	81.0	1.03
	100	100	20	15	1.5	1.00	555.0	3304.6	7.59	5000	600	86	81	2.73	70.9	1.21	1.71	0.78	84.5	1.01
R2_L2	100	100	20	15	1.5	1.00	555.0	3304.6	7.59	5500	75	46	67	1.06	47.0	0.99	1.71	0.78	47.0	0.99
	100	100	20	15	1.5	1.00	555.0	3304.6	7.59	5500	150	59	67	1.49	58.9	1.01	1.71	0.78	58.9	1.01
	100	100	20	15	1.5	1.00	555.0	3304.6	7.59	5500	300	68	67	2.11	58.9	1.15	1.71	0.78	65.2	1.04
	100	100	20	15	1.5	1.00	555.0	3304.6	7.59	5500	450	72	67	2.59	58.9	1.22	1.71	0.78	69.2	1.04
	100	100	20	15	1.5	1.00	555.0	3304.6	7.59	5500	600	73	67	2.99	58.9	1.25	1.71	0.78	72.2	1.02
R2_L3	100	100	20	15	1.5	1.00	555.0	3304.6	7.59	6000	75	42	57	1.15	43.1	0.97	1.71	0.78	43.1	0.97
	100	100	20	15	1.5	1.00	555.0	3304.6	7.59	6000	150	52	57	1.63	49.8	1.04	1.71	0.78	51.0	1.01
	100	100	20	15	1.5	1.00	555.0	3304.6	7.59	6000	300	59	57	2.30	49.8	1.19	1.71	0.78	56.5	1.05
	100	100	20	15	1.5	1.00	555.0	3304.6	7.59	6000	450	63	57	2.82	49.8	1.26	1.71	0.78	59.9	1.05
	100	100	20	15	1.5	1.00	555.0	3304.6	7.59	6000	600	64	57	3.25	49.8	1.28	1.71	0.78	62.5	1.02
R2_L4	100	100	20	15	1.5	1.00	555.0	3304.6	7.59	6500	75	38	49	1.24	39.3	0.96	1.71	0.78	39.3	0.96
	100	100	20	15	1.5	1.00	555.0	3304.6	7.59	6500	150	46	49	1.76	42.6	1.07	1.71	0.78	44.7	1.02
	100	100	20	15	1.5	1.00	555.0	3304.6	7.59	6500	300	52	49	2.49	42.6	1.23	1.71	0.78	49.5	1.06
	100	100	20	15	1.5	1.00	555.0	3304.6	7.59	6500	450	55	49	3.04	42.6	1.30	1.71	0.78	52.5	1.05
	100	100	20	15	1.5	1.00	555.0	3304.6	7.59	6500	600	56	49	3.51	42.6	1.31	1.71	0.78	54.8	1.02
R3_L1	110	100	20	15	1.5	1.10	570.0	3808.5	8.35	4000	75	63	144	0.72	60.3	1.04	1.75	0.79	60.3	1.04
	110	100	20	15	1.5	1.10	570.0	3808.5	8.35	4000	150	103	144	1.02	96.9	1.06	1.75	0.79	96.9	1.06
	110	100	20	15	1.5	1.10	570.0	3808.5	8.35	4000	300	130	144	1.44	125.3	1.04	1.75	0.79	125.3	1.04
	110	100	20	15	1.5	1.10	570.0	3808.5	8.35	4000	450	138	144	1.77	126.1	1.09	1.75	0.79	131.5	1.05
	110	100	20	15	1.5	1.10	570.0	3808.5	8.35	4000	600	139	144	2.04	126.1	1.10	1.75	0.79	136.3	1.02
R3_L2	110	100	20	15	1.5	1.10	570.0	3808.5	8.35	4500	75	59	115	0.81	57.1	1.03	1.75	0.79	57.1	1.03
	110	100	20	15	1.5	1.10	570.0	3808.5	8.35	4500	150	90	115	1.14	86.9	1.03	1.75	0.79	86.9	1.03
	110	100	20	15	1.5	1.10	570.0	3808.5	8.35	4500	300	107	115	1.61	100.9	1.06	1.75	0.79	102.8	1.04
	110	100	20	15	1.5	1.10	570.0	3808.5	8.35	4500	450	113	115	1.98	100.9	1.12	1.75	0.79	108.2	1.05
	110	100	20	15	1.5	1.10	570.0	3808.5	8.35	4500	600	116	115	2.28	100.9	1.15	1.75	0.79	112.1	1.03
R3_L3	110	100	20	15	1.5	1.10	570.0	3808.5	8.35	5000	75	55	94	0.89	53.7	1.02	1.75	0.79	53.7	1.02
	110	100	20	15	1.5	1.10	570.0	3808.5	8.35	5000	150	77	94	1.26	76.9	1.01	1.75	0.79	76.9	1.01
	110	100	20	15	1.5	1.10	570.0	3808.5	8.35	5000	300	90	94	1.79	82.5	1.09	1.75	0.79	86.2	1.05
	110	100	20	15	1.5	1.10	570.0	3808.5	8.35	5000	450	95	94	2.19	82.5	1.16	1.75	0.79	90.6	1.05
	110	100	20	15	1.5	1.10	570.0	3808.5	8.35	5000	600	98	94	2.53	82.5	1.19	1.75	0.79	93.9	1.04
R3_L4	110	100	20	15	1.5	1.10	570.0	3808.5	8.35	5500	75	50	78	0.98	50.2	1.00	1.75	0.79	50.2	1.00
	110	100	20	15	1.5	1.10	570.0	3808.5	8.35	5500	150	67	78	1.38	67.2	1.00	1.75	0.79	67.2	1.00
	110	100	20	15	1.5	1.10	570.0	3808.5	8.35	5500	300	77	78	1.96	68.6	1.12	1.75	0.79	73.3	1.05
	110	100	20	15	1.5	1.10	570.0	3808.5	8.35	5500	450	82	78	2.40	68.6	1.19	1.75	0.79	77.1	1.06
	110	100	20	15	1.5	1.10	570.0	3808.5	8.35	5500	600	84	78	2.77	68.6	1.22	1.75	0.79	79.9	1.05
R4_L1	130	130	20	20	1.5	1.00	705.0	9975.9	8.44	6000	75	53	87	0.93	52.2	1.02	1.76	0.79	52.2	1.02
	130	130	20	20	1.5	1.00	705.0	9975.9	8.44	6000	150	73	87	1.31	72.8	1.01	1.76	0.79	72.8	1.01
	130	130	20	20	1.5	1.00	705.0	9975.9	8.44	6000	300	85	87	1.86	76.1	1.11	1.76	0.79	80.2	1.06
	130	130	20	20	1.5	1.00	705.0	9975.9	8.44	6000	450	87	87	2.28	76.1	1.14	1.76	0.79	84.3	1.03
	130	130	20	20	1.5	1.00	705.0	9975.9	8.44	6000	600	87	87	2.63	76.1	1.14	1.76	0.79	87.3	0.99

Column	Geometry										SFEA		DSM Design							
	b_w	b_f	b_s	b_l	t	b_w/b_t	A	I_w $\times 10^6$	β_{FT}	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	b	a	f_{nFT}	f_u/f_{nFT}
R4_L2	130	130	20	20	1.5	1.00	705.0	9975.9	8.44	6500	75	49	75	1.00	49.2	1.00	1.76	0.79	49.2	1.00
	130	130	20	20	1.5	1.00	705.0	9975.9	8.44	6500	150	65	75	1.42	64.6	1.00	1.76	0.79	64.6	1.00
	130	130	20	20	1.5	1.00	705.0	9975.9	8.44	6500	300	75	75	2.01	65.4	1.15	1.76	0.79	70.2	1.07
	130	130	20	20	1.5	1.00	705.0	9975.9	8.44	6500	450	78	75	2.46	65.4	1.19	1.76	0.79	73.8	1.05
	130	130	20	20	1.5	1.00	705.0	9975.9	8.44	6500	600	78	75	2.84	65.4	1.19	1.76	0.79	76.4	1.01
R4_L3	130	130	20	20	1.5	1.00	705.0	9975.9	8.44	7000	75	46	65	1.08	46.2	0.99	1.76	0.79	46.2	0.99
	130	130	20	20	1.5	1.00	705.0	9975.9	8.44	7000	150	58	65	1.52	56.8	1.02	1.76	0.79	57.0	1.02
	130	130	20	20	1.5	1.00	705.0	9975.9	8.44	7000	300	67	65	2.15	56.8	1.18	1.76	0.79	62.0	1.08
	130	130	20	20	1.5	1.00	705.0	9975.9	8.44	7000	450	70	65	2.64	56.8	1.24	1.76	0.79	65.2	1.08
	130	130	20	20	1.5	1.00	705.0	9975.9	8.44	7000	600	70	65	3.04	56.8	1.24	1.76	0.79	67.5	1.04
R4_L4	130	130	20	20	1.5	1.00	705.0	9975.9	8.44	7500	75	42	57	1.15	43.1	0.97	1.76	0.79	43.1	0.97
	130	130	20	20	1.5	1.00	705.0	9975.9	8.44	7500	150	52	57	1.63	49.7	1.05	1.76	0.79	50.7	1.03
	130	130	20	20	1.5	1.00	705.0	9975.9	8.44	7500	300	60	57	2.30	49.7	1.21	1.76	0.79	55.2	1.09
	130	130	20	20	1.5	1.00	705.0	9975.9	8.44	7500	450	64	57	2.82	49.7	1.28	1.76	0.79	58.0	1.10
	130	130	20	20	1.5	1.00	705.0	9975.9	8.44	7500	600	64	57	3.25	49.7	1.28	1.76	0.79	60.1	1.06
R5_L1	150	130	20	15	2.5	1.15	1200.0	18992.6	6.53	5000	75	64	158	0.69	61.5	1.04	1.64	0.76	61.5	1.04
	150	130	20	15	2.5	1.15	1200.0	18992.6	6.53	5000	150	108	158	0.97	100.8	1.07	1.64	0.76	100.8	1.07
	150	130	20	15	2.5	1.15	1200.0	18992.6	6.53	5000	300	140	158	1.38	135.5	1.03	1.64	0.76	135.5	1.03
	150	130	20	15	2.5	1.15	1200.0	18992.6	6.53	5000	450	151	158	1.69	138.5	1.09	1.64	0.76	144.6	1.04
	150	130	20	15	2.5	1.15	1200.0	18992.6	6.53	5000	600	157	158	1.95	138.5	1.13	1.64	0.76	152.2	1.03
R5_L2	150	130	20	15	2.5	1.15	1200.0	18992.6	6.53	5500	75	62	132	0.75	59.1	1.04	1.64	0.76	59.1	1.04
	150	130	20	15	2.5	1.15	1200.0	18992.6	6.53	5500	150	98	132	1.07	93.3	1.05	1.64	0.76	93.3	1.05
	150	130	20	15	2.5	1.15	1200.0	18992.6	6.53	5500	300	121	132	1.51	115.9	1.04	1.64	0.76	116.1	1.04
	150	130	20	15	2.5	1.15	1200.0	18992.6	6.53	5500	450	130	132	1.85	115.9	1.12	1.64	0.76	124.9	1.04
	150	130	20	15	2.5	1.15	1200.0	18992.6	6.53	5500	600	136	132	2.13	115.9	1.17	1.64	0.76	131.5	1.03
R5_L3	150	130	20	15	2.5	1.15	1200.0	18992.6	6.53	6000	75	59	112	0.82	56.7	1.04	1.64	0.76	56.7	1.04
	150	130	20	15	2.5	1.15	1200.0	18992.6	6.53	6000	150	88	112	1.16	85.7	1.02	1.64	0.76	85.7	1.02
	150	130	20	15	2.5	1.15	1200.0	18992.6	6.53	6000	300	105	112	1.64	98.3	1.07	1.64	0.76	101.5	1.04
	150	130	20	15	2.5	1.15	1200.0	18992.6	6.53	6000	450	113	112	2.00	98.3	1.15	1.64	0.76	109.1	1.04
	150	130	20	15	2.5	1.15	1200.0	18992.6	6.53	6000	600	119	112	2.31	98.3	1.21	1.64	0.76	114.9	1.03
R5_L4	150	130	20	15	2.5	1.15	1200.0	18992.6	6.53	6500	75	56	96	0.88	54.1	1.03	1.64	0.76	54.1	1.03
	150	130	20	15	2.5	1.15	1200.0	18992.6	6.53	6500	150	79	96	1.25	78.1	1.01	1.64	0.76	78.1	1.01
	150	130	20	15	2.5	1.15	1200.0	18992.6	6.53	6500	300	93	96	1.77	84.4	1.10	1.64	0.76	89.5	1.04
	150	130	20	15	2.5	1.15	1200.0	18992.6	6.53	6500	450	100	96	2.16	84.4	1.19	1.64	0.76	96.3	1.04
	150	130	20	15	2.5	1.15	1200.0	18992.6	6.53	6500	600	105	96	2.50	84.4	1.24	1.64	0.76	101.4	1.04
														Mean		1.109			Mean	1.031
														Sd. Dev.		0.094			Sd. Dev.	0.025
														Max		1.313			Max	1.096
														Min		0.956			Min	0.933

Table L_2: PC_m columns: (i) geometries, (ii) buckling stresses and ultimate strengths, (iii) ultimate strength predictions by current and proposed DSM design curves, and (iv) numerical-to-predicted ultimate strength ratios (mm and MPa)

Column	Geometry								SFEA		DSM Design					
	b_w	b_f	b_s	b_l	t	b_w/b_t	A	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	f_{nFT}	f_u/f_{nFT}
R1_L1	60	55	10	10	1	1.09	210.0	2000	75	67	221	0.58	65.1	1.04	65.1	1.04
	60	55	10	10	1	1.09	210.0	2000	150	120	221	0.82	113.0	1.06	113.0	1.06
	60	55	10	10	1	1.09	210.0	2000	300	165	221	1.16	170.1	0.97	145.7	1.13
	60	55	10	10	1	1.09	210.0	2000	450	167	221	1.43	192.2	0.87	145.7	1.14
	60	55	10	10	1	1.09	210.0	2000	600	167	221	1.65	194.2	0.86	145.7	1.14
R1_L2	60	55	10	10	1	1.09	210.0	2500	75	63	150	0.71	60.8	1.04	60.8	1.04
	60	55	10	10	1	1.09	210.0	2500	150	101	150	1.00	98.7	1.03	98.6	1.03
	60	55	10	10	1	1.09	210.0	2500	300	114	150	1.41	129.8	0.88	98.6	1.16
	60	55	10	10	1	1.09	210.0	2500	450	114	150	1.73	131.5	0.87	98.6	1.16
	60	55	10	10	1	1.09	210.0	2500	600	114	150	2.00	131.5	0.87	98.6	1.16
R1_L3	60	55	10	10	1	1.09	210.0	3000	75	58	107	0.84	55.9	1.03	55.9	1.03
	60	55	10	10	1	1.09	210.0	3000	150	79	107	1.18	83.4	0.94	70.4	1.12
	60	55	10	10	1	1.09	210.0	3000	300	81	107	1.67	93.9	0.86	70.4	1.15
	60	55	10	10	1	1.09	210.0	3000	450	81	107	2.05	93.9	0.86	70.4	1.15
	60	55	10	10	1	1.09	210.0	3000	600	81	107	2.37	93.9	0.86	70.4	1.15
R1_L4	60	55	10	10	1	1.09	210.0	3300	75	53	90	0.91	52.8	1.01	52.8	1.01
	60	55	10	10	1	1.09	210.0	3300	150	67	90	1.29	74.4	0.89	59.0	1.13
	60	55	10	10	1	1.09	210.0	3300	300	67	90	1.83	78.6	0.85	59.0	1.13
	60	55	10	10	1	1.09	210.0	3300	450	67	90	2.24	78.6	0.85	59.0	1.13
	60	55	10	10	1	1.09	210.0	3300	600	67	90	2.59	78.6	0.85	59.0	1.13

Column	Geometry								SFEA		DSM Design					
	b_w	b_f	b_s	b_l	t	b_w/b_t	A	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	f_{nFT}	f_u/f_{nFT}
R2_L1	100	100	20	15	1.5	1.00	555.0	5000	75	58	113	0.82	56.8	1.02	56.8	1.02
	100	100	20	15	1.5	1.00	555.0	5000	150	82	113	1.15	86.0	0.96	74.3	1.11
	100	100	20	15	1.5	1.00	555.0	5000	300	86	113	1.63	99.0	0.87	74.3	1.16
	100	100	20	15	1.5	1.00	555.0	5000	450	86	113	2.00	99.0	0.87	74.3	1.16
	100	100	20	15	1.5	1.00	555.0	5000	600	86	113	2.31	99.0	0.87	74.3	1.16
R2_L2	100	100	20	15	1.5	1.00	555.0	5500	75	54	94	0.89	53.8	1.01	53.8	1.01
	100	100	20	15	1.5	1.00	555.0	5500	150	70	94	1.26	77.1	0.91	62.1	1.13
	100	100	20	15	1.5	1.00	555.0	5500	300	72	94	1.78	82.8	0.87	62.1	1.15
	100	100	20	15	1.5	1.00	555.0	5500	450	72	94	2.18	82.8	0.87	62.1	1.15
	100	100	20	15	1.5	1.00	555.0	5500	600	72	94	2.52	82.8	0.87	62.1	1.15
R2_L3	100	100	20	15	1.5	1.00	555.0	6000	75	50	80	0.97	50.7	0.98	50.7	0.98
	100	100	20	15	1.5	1.00	555.0	6000	150	60	80	1.37	68.5	0.88	52.7	1.14
	100	100	20	15	1.5	1.00	555.0	6000	300	60	80	1.94	70.2	0.86	52.7	1.14
	100	100	20	15	1.5	1.00	555.0	6000	450	60	80	2.37	70.2	0.86	52.7	1.14
	100	100	20	15	1.5	1.00	555.0	6000	600	60	80	2.74	70.2	0.86	52.7	1.14
R2_L4	100	100	20	15	1.5	1.00	555.0	6500	75	45	69	1.04	47.5	0.95	45.3	1.00
	100	100	20	15	1.5	1.00	555.0	6500	150	51	69	1.48	60.3	0.85	45.3	1.13
	100	100	20	15	1.5	1.00	555.0	6500	300	51	69	2.09	60.4	0.85	45.3	1.13
	100	100	20	15	1.5	1.00	555.0	6500	450	51	69	2.56	60.4	0.85	45.3	1.13
	100	100	20	15	1.5	1.00	555.0	6500	600	51	69	2.95	60.4	0.85	45.3	1.13
R3_L1	110	100	20	15	1.5	1.10	570.0	4000	75	66	190	0.63	63.6	1.03	63.6	1.03
	110	100	20	15	1.5	1.10	570.0	4000	150	112	190	0.89	107.8	1.03	107.8	1.03
	110	100	20	15	1.5	1.10	570.0	4000	300	142	190	1.26	155.0	0.91	125.1	1.13
	110	100	20	15	1.5	1.10	570.0	4000	450	142	190	1.54	166.8	0.85	125.1	1.13
	110	100	20	15	1.5	1.10	570.0	4000	600	142	190	1.78	166.8	0.85	125.1	1.13
R3_L2	110	100	20	15	1.5	1.10	570.0	4500	75	63	155	0.70	61.2	1.03	61.2	1.03
	110	100	20	15	1.5	1.10	570.0	4500	150	101	155	0.98	100.0	1.01	100.0	1.01
	110	100	20	15	1.5	1.10	570.0	4500	300	116	155	1.39	133.3	0.87	101.9	1.14
	110	100	20	15	1.5	1.10	570.0	4500	450	116	155	1.70	135.8	0.85	101.9	1.14
	110	100	20	15	1.5	1.10	570.0	4500	600	116	155	1.97	135.8	0.85	101.9	1.14
R3_L3	110	100	20	15	1.5	1.10	570.0	5000	75	60	128	0.77	58.7	1.03	58.7	1.03
	110	100	20	15	1.5	1.10	570.0	5000	150	89	128	1.08	91.8	0.97	84.1	1.06
	110	100	20	15	1.5	1.10	570.0	5000	300	95	128	1.53	112.0	0.85	84.1	1.14
	110	100	20	15	1.5	1.10	570.0	5000	450	95	128	1.88	112.0	0.85	84.1	1.14
	110	100	20	15	1.5	1.10	570.0	5000	600	95	128	2.17	112.0	0.85	84.1	1.14
R3_L4	110	100	20	15	1.5	1.10	570.0	5500	75	57	107	0.84	55.9	1.01	55.9	1.01
	110	100	20	15	1.5	1.10	570.0	5500	150	77	107	1.18	83.4	0.93	70.4	1.10
	110	100	20	15	1.5	1.10	570.0	5500	300	79	107	1.67	93.8	0.85	70.4	1.13
	110	100	20	15	1.5	1.10	570.0	5500	450	79	107	2.05	93.8	0.85	70.4	1.13
	110	100	20	15	1.5	1.10	570.0	5500	600	79	107	2.37	93.8	0.85	70.4	1.13
R4_L1	130	130	20	20	1.5	1.00	705.0	6000	75	57	113	0.82	56.8	1.01	56.8	1.01
	130	130	20	20	1.5	1.00	705.0	6000	150	81	113	1.15	85.9	0.94	74.1	1.09
	130	130	20	20	1.5	1.00	705.0	6000	300	84	113	1.63	98.7	0.85	74.1	1.13
	130	130	20	20	1.5	1.00	705.0	6000	450	84	113	2.00	98.7	0.85	74.1	1.13
	130	130	20	20	1.5	1.00	705.0	6000	600	84	113	2.31	98.7	0.85	74.1	1.13
R4_L2	130	130	20	20	1.5	1.00	705.0	6500	75	54	98	0.88	54.4	1.00	54.4	1.00
	130	130	20	20	1.5	1.00	705.0	6500	150	72	98	1.24	78.9	0.91	64.4	1.12
	130	130	20	20	1.5	1.00	705.0	6500	300	73	98	1.75	85.8	0.85	64.4	1.14
	130	130	20	20	1.5	1.00	705.0	6500	450	73	98	2.15	85.8	0.85	64.4	1.14
	130	130	20	20	1.5	1.00	705.0	6500	600	73	98	2.48	85.8	0.85	64.4	1.14
R4_L3	130	130	20	20	1.5	1.00	705.0	7000	75	51	86	0.94	52.0	0.99	52.0	0.99
	130	130	20	20	1.5	1.00	705.0	7000	150	64	86	1.32	72.0	0.89	56.3	1.13
	130	130	20	20	1.5	1.00	705.0	7000	300	64	86	1.87	75.0	0.85	56.3	1.14
	130	130	20	20	1.5	1.00	705.0	7000	450	64	86	2.29	75.0	0.85	56.3	1.14
	130	130	20	20	1.5	1.00	705.0	7000	600	64	86	2.65	75.0	0.85	56.3	1.14
R4_L4	130	130	20	20	1.5	1.00	705.0	7500	75	48	75	1.00	49.4	0.97	49.4	0.97
	130	130	20	20	1.5	1.00	705.0	7500	150	56	75	1.41	65.2	0.87	49.5	1.14
	130	130	20	20	1.5	1.00	705.0	7500	300	56	75	2.00	66.0	0.85	49.5	1.14
	130	130	20	20	1.5	1.00	705.0	7500	450	56	75	2.44	66.0	0.85	49.5	1.14
	130	130	20	20	1.5	1.00	705.0	7500	600	56	75	2.82	66.0	0.85	49.5	1.14
R5_L1	150	130	20	15	2.5	1.15	1200.0	5000	75	67	199	0.61	64.1	1.04	64.1	1.04
	150	130	20	15	2.5	1.15	1200.0	5000	150	115	199	0.87	109.4	1.05	109.4	1.05
	150	130	20	15	2.5	1.15	1200.0	5000	300	148	199	1.23	159.7	0.93	131.0	1.13
	150	130	20	15	2.5	1.15	1200.0	5000	450	149	199	1.50	174.7	0.85	131.0	1.14
	150	130	20	15	2.5	1.15	1200.0	5000	600	149	199	1.74	174.7	0.85	131.0	1.14
R5_L2	150	130	20	15	2.5	1.15	1200.0	5500	75	65	169	0.67	62.3	1.04	62.3	1.04
	150	130	20	15	2.5	1.15	1200.0	5500	150	107	169	0.94	103.3	1.03	103.3	1.03
	150	130	20	15	2.5	1.15	1200.0	5500	300	127	169	1.33	142.4	0.89	110.9	1.14
	150	130	20	15	2.5	1.15	1200.0	5500	450	127	169	1.63	147.8	0.86	110.9	1.14
	150	130	20	15	2.5	1.15	1200.0	5500	600	127	169	1.89	147.8	0.86	110.9	1.14

Column	Geometry								SFEA		DSM Design					
	b_w	b_f	b_s	b_l	t	b_w/b_t	A	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}	f_{nFT}	f_u/f_{nFT}
R5_L3	150	130	20	15	2.5	1.15	1200.0	6000	75	63	144	0.72	60.3	1.05	60.3	1.05
	150	130	20	15	2.5	1.15	1200.0	6000	150	98	144	1.02	97.0	1.01	94.8	1.03
	150	130	20	15	2.5	1.15	1200.0	6000	300	108	144	1.44	125.5	0.86	94.8	1.14
	150	130	20	15	2.5	1.15	1200.0	6000	450	108	144	1.77	126.3	0.85	94.8	1.14
	150	130	20	15	2.5	1.15	1200.0	6000	600	108	144	2.04	126.3	0.85	94.8	1.14
R5_L4	150	130	20	15	2.5	1.15	1200.0	6500	75	61	124	0.78	58.3	1.04	58.3	1.04
	150	130	20	15	2.5	1.15	1200.0	6500	150	88	124	1.10	90.6	0.97	81.9	1.07
	150	130	20	15	2.5	1.15	1200.0	6500	300	93	124	1.55	109.1	0.85	81.9	1.13
	150	130	20	15	2.5	1.15	1200.0	6500	450	93	124	1.90	109.1	0.85	81.9	1.13
	150	130	20	15	2.5	1.15	1200.0	6500	600	93	124	2.20	109.1	0.85	81.9	1.13
												Mean		0.911		1.105
												Sd. Dev.		0.073		0.054
												Max		1.059		1.162
												Min		0.847		0.968

Table L$_3$: PS columns: (i) geometries, (ii) buckling stresses and ultimate strengths, (iii) ultimate strength predictions by current and proposed DSM design curves, and (iv) numerical-to-predicted ultimate strength ratios (mm and MPa)

Column	Geometry								SFEA		DSM Design			
	b_w	b_f	b_s	b_l	t	b_w/b_t	A	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}
R1_L1	60	55	10	10	1	1.09	210.0	2000	75	65	169	0.67	62.3	1.04
	60	55	10	10	1	1.09	210.0	2000	150	112	169	0.94	103.5	1.08
	60	55	10	10	1	1.09	210.0	2000	300	144	169	1.33	142.8	1.01
	60	55	10	10	1	1.09	210.0	2000	450	147	169	1.63	148.3	0.99
	60	55	10	10	1	1.09	210.0	2000	600	147	169	1.88	148.3	0.99
R1_L2	60	55	10	10	1	1.09	210.0	2500	75	58	111	0.82	56.5	1.03
	60	55	10	10	1	1.09	210.0	2500	150	87	111	1.16	85.2	1.02
	60	55	10	10	1	1.09	210.0	2500	300	97	111	1.64	97.3	1.00
	60	55	10	10	1	1.09	210.0	2500	450	98	111	2.01	97.3	1.00
	60	55	10	10	1	1.09	210.0	2500	600	98	111	2.33	97.3	1.00
R1_L3	60	55	10	10	1	1.09	210.0	3000	75	50	78	0.98	50.2	1.01
	60	55	10	10	1	1.09	210.0	3000	150	66	78	1.39	67.2	0.98
	60	55	10	10	1	1.09	210.0	3000	300	69	78	1.96	68.5	1.01
	60	55	10	10	1	1.09	210.0	3000	450	69	78	2.40	68.5	1.01
	60	55	10	10	1	1.09	210.0	3000	600	69	78	2.77	68.5	1.01
R1_L4	60	55	10	10	1	1.09	210.0	3300	75	45	65	1.07	46.3	0.98
	60	55	10	10	1	1.09	210.0	3300	150	56	65	1.52	57.0	0.98
	60	55	10	10	1	1.09	210.0	3300	300	58	65	2.15	57.0	1.01
	60	55	10	10	1	1.09	210.0	3300	450	58	65	2.63	57.0	1.01
	60	55	10	10	1	1.09	210.0	3300	600	58	65	3.04	57.0	1.01
R2_L1	100	100	20	15	1.5	1.00	555.0	5000	75	51	81	0.96	50.9	1.01
	100	100	20	15	1.5	1.00	555.0	5000	150	67	81	1.36	69.0	0.97
	100	100	20	15	1.5	1.00	555.0	5000	300	72	81	1.93	70.9	1.01
	100	100	20	15	1.5	1.00	555.0	5000	450	72	81	2.36	70.9	1.01
	100	100	20	15	1.5	1.00	555.0	5000	600	72	81	2.73	70.9	1.01
R2_L2	100	100	20	15	1.5	1.00	555.0	5500	75	46	67	1.06	47.0	0.98
	100	100	20	15	1.5	1.00	555.0	5500	150	57	67	1.49	58.9	0.97
	100	100	20	15	1.5	1.00	555.0	5500	300	60	67	2.11	58.9	1.01
	100	100	20	15	1.5	1.00	555.0	5500	450	60	67	2.59	58.9	1.01
	100	100	20	15	1.5	1.00	555.0	5500	600	60	67	2.99	58.9	1.01
R2_L3	100	100	20	15	1.5	1.00	555.0	6000	75	41	57	1.15	43.1	0.96
	100	100	20	15	1.5	1.00	555.0	6000	150	49	57	1.63	49.8	0.99
	100	100	20	15	1.5	1.00	555.0	6000	300	50	57	2.30	49.8	1.01
	100	100	20	15	1.5	1.00	555.0	6000	450	50	57	2.82	49.8	1.01
	100	100	20	15	1.5	1.00	555.0	6000	600	50	57	3.25	49.8	1.01
R2_L4	100	100	20	15	1.5	1.00	555.0	6500	75	37	49	1.24	39.3	0.94
	100	100	20	15	1.5	1.00	555.0	6500	150	43	49	1.76	42.6	1.00
	100	100	20	15	1.5	1.00	555.0	6500	300	43	49	2.49	42.6	1.01
	100	100	20	15	1.5	1.00	555.0	6500	450	43	49	3.04	42.6	1.01
	100	100	20	15	1.5	1.00	555.0	6500	600	43	49	3.51	42.6	1.01
R3_L1	110	100	20	15	1.5	1.10	570.0	4000	75	63	144	0.72	60.3	1.04
	110	100	20	15	1.5	1.10	570.0	4000	150	102	144	1.02	96.9	1.06
	110	100	20	15	1.5	1.10	570.0	4000	300	124	144	1.44	125.3	0.99
	110	100	20	15	1.5	1.10	570.0	4000	450	124	144	1.77	126.1	0.99
	110	100	20	15	1.5	1.10	570.0	4000	600	124	144	2.04	126.1	0.99

Column	Geometry								SFEA		DSM Design			
	b_w	b_f	b_s	b_l	t	b_w/b_t	A	L	f_y	f_u	f_{crG}	λ_G	f_{nG}	f_u/f_{nG}
R3_L2	110	100	20	15	1.5	1.10	570.0	4500	75	59	115	0.81	57.1	1.04
	110	100	20	15	1.5	1.10	570.0	4500	150	89	115	1.14	86.9	1.02
	110	100	20	15	1.5	1.10	570.0	4500	300	100	115	1.61	100.9	0.99
	110	100	20	15	1.5	1.10	570.0	4500	450	100	115	1.98	100.9	0.99
	110	100	20	15	1.5	1.10	570.0	4500	600	100	115	2.28	100.9	0.99
R3_L3	110	100	20	15	1.5	1.10	570.0	5000	75	55	94	0.89	53.7	1.02
	110	100	20	15	1.5	1.10	570.0	5000	150	76	94	1.26	76.9	0.99
	110	100	20	15	1.5	1.10	570.0	5000	300	82	94	1.79	82.5	1.00
	110	100	20	15	1.5	1.10	570.0	5000	450	82	94	2.19	82.5	1.00
	110	100	20	15	1.5	1.10	570.0	5000	600	82	94	2.53	82.5	1.00
R3_L4	110	100	20	15	1.5	1.10	570.0	5500	75	50	78	0.98	50.2	1.00
	110	100	20	15	1.5	1.10	570.0	5500	150	65	78	1.38	67.2	0.97
	110	100	20	15	1.5	1.10	570.0	5500	300	69	78	1.96	68.6	1.00
	110	100	20	15	1.5	1.10	570.0	5500	450	69	78	2.40	68.6	1.00
	110	100	20	15	1.5	1.10	570.0	5500	600	69	78	2.77	68.6	1.00
R4_L1	130	130	20	20	1.5	1.00	705.0	6000	75	53	87	0.93	52.2	1.02
	130	130	20	20	1.5	1.00	705.0	6000	150	71	87	1.31	72.8	0.97
	130	130	20	20	1.5	1.00	705.0	6000	300	74	87	1.86	76.1	0.97
	130	130	20	20	1.5	1.00	705.0	6000	450	74	87	2.28	76.1	0.97
	130	130	20	20	1.5	1.00	705.0	6000	600	74	87	2.63	76.1	0.97
R4_L2	130	130	20	20	1.5	1.00	705.0	6500	75	49	75	1.00	49.2	1.00
	130	130	20	20	1.5	1.00	705.0	6500	150	62	75	1.42	64.6	0.96
	130	130	20	20	1.5	1.00	705.0	6500	300	64	75	2.01	65.4	0.98
	130	130	20	20	1.5	1.00	705.0	6500	450	64	75	2.46	65.4	0.98
	130	130	20	20	1.5	1.00	705.0	6500	600	64	75	2.84	65.4	0.98
R4_L3	130	130	20	20	1.5	1.00	705.0	7000	75	45	65	1.08	46.2	0.98
	130	130	20	20	1.5	1.00	705.0	7000	150	55	65	1.52	56.8	0.96
	130	130	20	20	1.5	1.00	705.0	7000	300	56	65	2.15	56.8	0.98
	130	130	20	20	1.5	1.00	705.0	7000	450	56	65	2.64	56.8	0.98
	130	130	20	20	1.5	1.00	705.0	7000	600	56	65	3.04	56.8	0.98
R4_L4	130	130	20	20	1.5	1.00	705.0	7500	75	41	57	1.15	43.1	0.96
	130	130	20	20	1.5	1.00	705.0	7500	150	48	57	1.63	49.7	0.98
	130	130	20	20	1.5	1.00	705.0	7500	300	49	57	2.30	49.7	0.99
	130	130	20	20	1.5	1.00	705.0	7500	450	49	57	2.82	49.7	0.99
	130	130	20	20	1.5	1.00	705.0	7500	600	49	57	3.25	49.7	0.99
R5_L1	150	130	20	15	2.5	1.15	1200.0	5000	75	64	158	0.69	61.5	1.04
	150	130	20	15	2.5	1.15	1200.0	5000	150	107	158	0.97	100.8	1.06
	150	130	20	15	2.5	1.15	1200.0	5000	300	134	158	1.38	135.5	0.99
	150	130	20	15	2.5	1.15	1200.0	5000	450	135	158	1.69	138.5	0.97
	150	130	20	15	2.5	1.15	1200.0	5000	600	135	158	1.95	138.5	0.97
R5_L2	150	130	20	15	2.5	1.15	1200.0	5500	75	62	132	0.75	59.1	1.04
	150	130	20	15	2.5	1.15	1200.0	5500	150	97	132	1.07	93.3	1.04
	150	130	20	15	2.5	1.15	1200.0	5500	300	113	132	1.51	115.9	0.98
	150	130	20	15	2.5	1.15	1200.0	5500	450	114	132	1.85	115.9	0.98
	150	130	20	15	2.5	1.15	1200.0	5500	600	114	132	2.13	115.9	0.98
R5_L3	150	130	20	15	2.5	1.15	1200.0	6000	75	59	112	0.82	56.7	1.04
	150	130	20	15	2.5	1.15	1200.0	6000	150	87	112	1.16	85.7	1.01
	150	130	20	15	2.5	1.15	1200.0	6000	300	97	112	1.64	98.3	0.99
	150	130	20	15	2.5	1.15	1200.0	6000	450	97	112	2.00	98.3	0.99
	150	130	20	15	2.5	1.15	1200.0	6000	600	97	112	2.31	98.3	0.99
R5_L4	150	130	20	15	2.5	1.15	1200.0	6500	75	56	96	0.88	54.1	1.03
	150	130	20	15	2.5	1.15	1200.0	6500	150	77	96	1.25	78.1	0.99
	150	130	20	15	2.5	1.15	1200.0	6500	300	83	96	1.77	84.4	0.99
	150	130	20	15	2.5	1.15	1200.0	6500	450	83	96	2.16	84.4	0.99
	150	130	20	15	2.5	1.15	1200.0	6500	600	83	96	2.50	84.4	0.99
												Mean		0.998
												Sd. Dev.		0.024
												Max		1.080
												Min		0.944