CivE 495 Assignment 2

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Question 1

Built-up Beam

Category	Value	Reason
Species Group	S-P-F	Parents don't need most expensive wood, S-P-F is readily available in Guelph
Proposed Grade	No.1	Structural Purpose, SS overkill, No 2 doesn't look as nice because of the knots
Use	Bending	Load-bearing the line-load from the upstairs floor
Estimated Size	3-ply 38x235mm	Deeper than wide to maximize bending capacity
f_b	11 MPa	See Table 6.6 (Exceeds small dim by more than 51mm)
f_v	1.2 MPa	See Table 6.6
f_c		Axial not a consideration
E/E_{05}	8500/6000 MPa	See Table 6.6
K_D	1.0	Standard term
K_{Sb}	1.0	Dry; See table 6.10
K_{Sv}	1.0	Dry; See table 6.10
K_{Sc}		Axial not a consideration
K_{SE}	1.0	Untreated - inside;See Table 6.10
K_T	1.0	Untreated; See Table 6.11
K_{Zb}/K_{Zv}	1.1	See Table 6.13
K_H	1.0	Doesn't meet Case 1 or Case 2; See Table 6.12

Tower Column

Category	Value	Reason
Species Group	D.Fir-L	Locally available in BC, strong
Proposed Grade	No.1	High winds in BC will require structurally strong wood, but SS is overkill
Use	Bending, axial	Dead load of tower, snow load, and live load cause axial; high winds up high cause bending

Category	Value	Reason
Estimated Size	235x235mm	Thickness prevents bending, while depth supports axial and square cross-section prevents buckling
f_b	13.8 MPa	See Table 6.7
f_v	1.5	See Table 6.7
f_c	12.2 MPa	See Table 6.7
E/E_{05}	10500/6500	See Table 6.7
K_D	1.0	Most of wind load will be translated to axial through bracing. Thus, standard load governs
K_{Sb}	1.0	Wet condition; See Table 6.10
K_{Sv}	1.0	Wet condition; See Table 6.10
K_{Sc}	0.67	Wet condition; See Table 6.10
K_{SE}	1.0	Wet condition; See Table 6.10
K_T	1.0	Treated for outdoors; See Table 6.11
K_{Zb}/K_{Zv}	1.2	Seee Table 6.13
K_H	1.0	Doesn't meet Case 1 or Case 2; See Table 6.12

Fence Post

S-P-F chosen because it's readily available. A square section was chosen because this is a fence post.

Category	Value	Reason
Species Group	S-P-F	Readily available
Proposed Grade	No. 2	Temporary construction material should be inexpensive. There is no architectural requirement or stringent load requirement
Use	Bending	Lateral wind forces dominate

Category	Value	Reason
Estimated Size	114x114mm	Posts are square; big cross-section for stability, but not massive for rotting due to the temporary nature of the fence
f_b	4.2 MPa	See Table 6.7
f_v	1.2 MPa	See Table 6.7
f_c		Axial not a consideration
E/E_{05}	6500/4500	See Table 6.7
K_D	1.15	Short term wind load
K_{Sb}	0.84	Wet; See Table 6.10
K_{Sv}	0.70	Wet; See Table 6.10
K_{Sc}		Axial not a consideration
K_{SE}	0.94	Wet; See Table 6.10
K_T	1.0	Not treated - temporary. See Table 6.11
K_{Zb}/K_{Zv}	1.3	See Table 6.13
K_H	1.0	Doesn't meet Case 1 or Case 2; See Table 6.12

Harbour Pier

Category	Value	Reason
Species Group	S-P-F (Pine)	Pine is relatively inexpensive, available, and is more resistant to rot than spruce
Proposed Grade	Not graded	Graded by Clause 14.3
Use	Axial, Bending	Holds up people walking along the harbour; Waves
Estimated Size	9" (230mm) ø	Size needs to be reasonable given restrictions on cross-section of tree
f_b	5.04 MPa	80% of value in Table 6.6 (No. 2 values used since large likelihood of knots)

Category	Value	Reason
f_v	0.96 MPa	80% of value in Table 6.6 (No. 2 values used since large likelihood of knots)
f_c	4.16 MPa	80% of value in Table 6.6 (No. 2 values used since large likelihood of knots)
E/E_{05}	6500/4500	See Table 6.6
K_D	1.0	Live load dominates (busy pier)
K_{Sb}		
K_{Sv}	0.96	Wet; See Table 6.10
K_{Sc}	0.69	Wet; See Table 6.10
K_{SE}	0.94	Wet; See Table 6.10
K_T	0.85 (Other Properties)	Wet, treated to prevent rot, incised due to large cross section, axial higher consideration than bending
K_{Zb}/K_{Zv}	1.1	$\pi r^2 = \pi 115^2 = 41548mm$. This is between 191x191mm and 235x235mm Table 6.13. 235x235 was taken to be conservative, which had size factor 1.1
K_H	1.0	Doesn't meet Case 1 or Case 2; See Table 6.12

Deck Joist

Category	Value	Reason
Species Group	S-P-F (pine)	As long as it is treated, pine will do well against rot. It is also readily available
Proposed Grade	No.1/No.2	SS overkill, No.3 not visually appealing
Use	Bending	Live load from people main loading

Category	Value	Reason
Estimated Size	38x140mm	A deck joist doesn't need to be too big. My backyard deck has 2x6" joists
f_b	11.8 MPa	See Table 6.4
f_v	1.5 MPa	See Table 6.4
f_c		Axial not considered
E/E_{05}	9500/6500 MPa	See Table 6.4
K_D	1.0	Live load dominates
K_{Sb}	0.84	Dry (high ventilation
K_{Sv}	0.96	Wet; See Table 6.10
K_{Sc}		
K_{SE}	0.94	Wet; See Table 6.10
K_T	1.0	Treated, non-incised; See Table 6.11
K_{Zb}/K_{Zv}	1.4	See Table 6.13
K_H	1.1	In bending, met Case 1 but not Case 2, as deck doesn't have sheathing; See Table 6.12

Floor Joist

Category	Value	Reason
Species Group	S-P-F	Available, Can be stained to have "rustic" aesthetic
Proposed Grade	No.1/No.2	Although fancy spots like select structural, floor joists aren't visible.
Use	Bending	Supports live loads, snow loads, and dead weight of items
Estimated Size	38x140mm	Common joist dimension
f_b	11.8 MPa	See Table 6.4
f_v	1.5 MPa	See Table 6.4
f_c		Axial not considered
E/E_{05}	9500/6500 MPa	See Table 6.4
K_D	1.0	Live load dominates
K_{Sb}	1.0	Dry; See Table 6.10
K_{Sv}	1.0	Dry; See Table 6.10
K_{Sc}		Axial not a consideration

Category	Value	Reason
K_{SE}	1.0	Dry; See Table 6.10
K_T	1.0	Untreated; See Table 6.11
K_{Zb}/K_{Zv}	1.4	See Table 6.13
K_H	1.4 (Bending and longitudinal shear)	Meets Case 2 criteria; See Table 6.12