Appendix A

Uniform green roof and weight of beam: w = 5'P + 12 lb/ft

W 10 x 12 Beam 17ft in length

Shear

$$V_{max} = \frac{wL}{2} = 8.5'w$$

ΦV_n comes from the AISC LRFD Manual of Steel Construction, 3rd Edition

$$\Phi V_n = 50.6\ k \geq V_u = 8.5'\ w$$

Solving for w:

$$w \leq 5.95\ k/ft$$

Moment

$$M_{max} = \frac{wL^2}{8} = 36.125'w$$

ΦM_{rx} comes from the AISC LRFD Manual of Steel Construction, 3rd Edition

$$\Phi M_{rx} = 32.7\ 'k \geq M_u = 36.125'\ w$$

Solving for w:

$$w \leq 0.905\ k/ft$$

Deflection

$$\frac{L}{240} \geq \frac{5\ wL^4}{384\ EI_x}$$

Solving for w:

$$w \leq 0.705 \text{ k/ft}$$

W 27 x 84 Girder 40ft in length

Shear

$$V_{max} = \frac{17w \times 7 + 84x40}{2} = 59.5w + 1680 \text{ lbs}$$

ΦV_n comes from the AISC LRFD Manual of Steel Construction, 3rd Edition

$$\Phi V_n = 332 \text{ k} \geq V_u = 59.5\ w + 1.680$$

Solving for w:

$$w \leq 5.55 \text{ k/ft}$$

$w' = 7*17w / 40 = 2.975\ w$

Moment

$$M_{max} = \frac{w'L^2}{8} + \frac{w'L^2}{8} = 595w + 16800'lb$$

ΦM_{rx} comes from the AISC LRFD Manual of Steel Construction, 3rd Edition

$$\Phi M_{rx} = 915\ 'k \geq M_u = 595w + 16800'lb$$

Solving for w:

$$w \leq 1.50 \text{ k/ft}$$

Deflection

$$\frac{L}{240} \geq \frac{5\ wL^4}{384\ EI_x}$$

Solving for w:

$$w \leq 2.86 \text{ k/ft}$$

The limiting factor in this case is the deflection for the beam. The next step is to solve for P, the maximum load of the green roof.

$$w \leq 0.705 \text{ k/ft}$$

$$705\text{lb/ft} \geq 5\text{'}P + 12 \text{ lb/ft}$$

$$P \leq 138.6 \text{ psf}$$

From the structural steel drawings, the design loads are noted to be 30 psf for live and 19.3 for snow. With the appropriate factors applied, the following equation must be solved for the green roof load being treated as a dead load.

$$138.6 \text{ psf} \geq 1.6\ (30) + .5\ (19.3) + 1.2\ x$$

$$x \leq 67 \text{ psf}$$

Howard Community College
Arts & Humanities Instructional Building
Assemblies Estimate Details
April 3, 2005

Noah J. Ashbaugh
Construction Management

UNIT COST DETAILS

Roof, 4ply built up roof

		Unit Costs			Total Costs		
	Unit	Mat.	Inst	Total	Mat.	Inst	Total
3,648 sf of 4ply built up roof	sf	0.62	1.09	1.71	$ 2,261.76	$ 3,976.32	$ 6,238.08
Total					$ 2,261.76	$ 3,976.32	$ 6,238.08

Cost is to supply and install
includes location factor

Tax	5%	$ 6,549.98
Overhead	7%	$ 7,008.48
Profit	3.50%	$ 7,253.78
		$ 7,253.78

Scheduling Information

Daily Output 2,000 sf
Duration = Total SF / Daily Output

Duration 2 days
0.4 wks

UNIT COST DETAILS

Extensive Greenroof

		Unit Costs			Total Costs		
	Unit	Mat.	Inst	Total	Mat.	Inst	Total
3,648 sf of Extensive Greenroof	sf			14.43	$ -	$ -	$ 52,640.64
Total					$ -	$ -	$ 52,640.64

Cost is to supply and install
includes overhead, profit, location factor and general conditions and tax

Scheduling Information

Daily Output 1,800 sf
Duration = Total SF / Daily Output

Duration 3 days
0.6 wks