

Below is a short narrative of my understanding. Also attached is the quick draft.

dead load is 50 psf and the live load is 40 psf.

I calculated sigma LD steel as 3.8 deformations controlled and for force controlled its 2 by applying these loads to the floor above the affected area of the column removal it magnified the loads coming on the braces.

Applied a load combination of $3.8*(1.2DL+0.5LL)$. for the hatched areas above the removed column. This load combination is creating huge loads on the braces.

While my brace sizes are good for the loads the connections are becoming crazy.

IF per equation 3-10 I am multiplying by 3.8 to the load combination I am also checking its capacity by $\phi*m*Q_{ce}$.

ASCE 41-13 says connections are typically designed for force controlled but table 3-1 of the same manual says connections shall be designed for both deformation and force controlled.

Slide 10 and 9 of the attachment says to design connections for force controlled.

this is a huge difference in loads. Obviously by engineering judgment says to use the deformation controlled loads as they are high for my connections.

**Increased Gravity Loads for Floor Areas
ABOVE Removed Column or Wall**

Eq. 3-10: $G_{LD} = \Omega (1.2D + 0.5L)$

G_{LD} = Increased Gravity Loads for deformation-controlled actions (LSP)

D = Dead Load (psf) including façade loads

L = Live Load (psf) including Live Load Reduction (LLR) per 3-2.3

Ω_{LD} = Load Increase Factor for calculating deformation-LD

controlled actions for LSP; use appropriate value for framed or load-bearing wall structure per 3-2.11.5

m_{LIF} = smallest m of any primary beam, girder, spandrel, or wall element that is directly connected to the columns or walls directly about the column or wall removal location

$\Omega_{LD, steel} = 3.8$ Per Table 3-4 of UFC, $\Omega_{LD} = 0.9m_{LIF} + 1.1$

$m_{LIF, steel} = 3$ [Per section 5-4.3 of the UFC, m factors shall come from Chapter 9 of ASCE 41]

$\Omega_{LD, conc} = 2.27$ Per Table 3-4 of UFC, $\Omega_{LD} = 1.2m_{LIF} + 0.8$

$m_{LIF, conc} = 1.3$ [Per section 4-4.3 of the UFC, m factors shall come from Chapter 10 of ASCE 41]

Eq. 3-12: $G_{LF} = \Omega_{LF} (1.2D + 0.5L)$

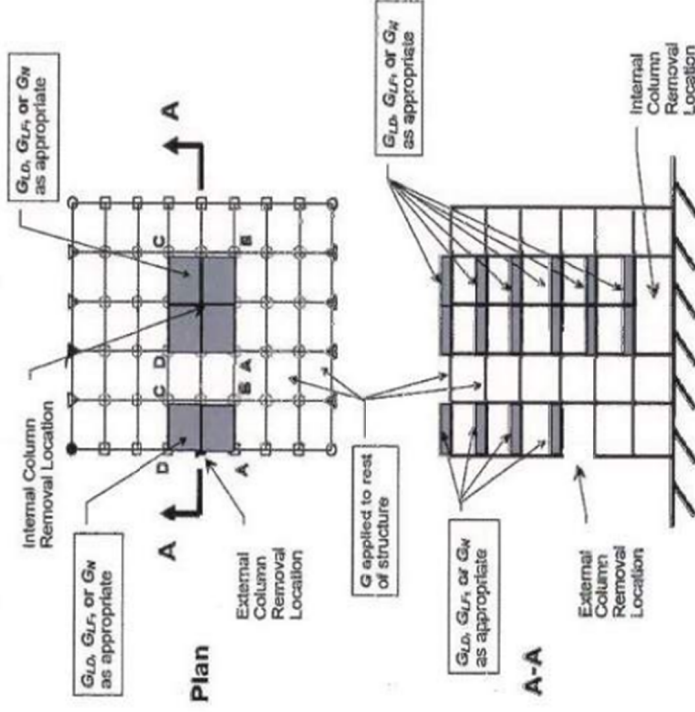
G_{LF} = Increased Gravity Loads for force-controlled actions (LSP)

Ω_{LF} = Load Increase Factor for calculating force-controlled actions for LSP; use appropriate value for framed or load-bearing wall structure per 3-2.11.5

$\Omega_{LF} = 2$ Per Table 3-4 of UFC 4-023-03

**Increased Gravity Loads for Floor Areas
AWAY Removed Column or Wall**

Eq. 3-11: $G = 1.2D + 0.5L = \text{Gravity Loads}$



DEFORMATION CONTROLLED

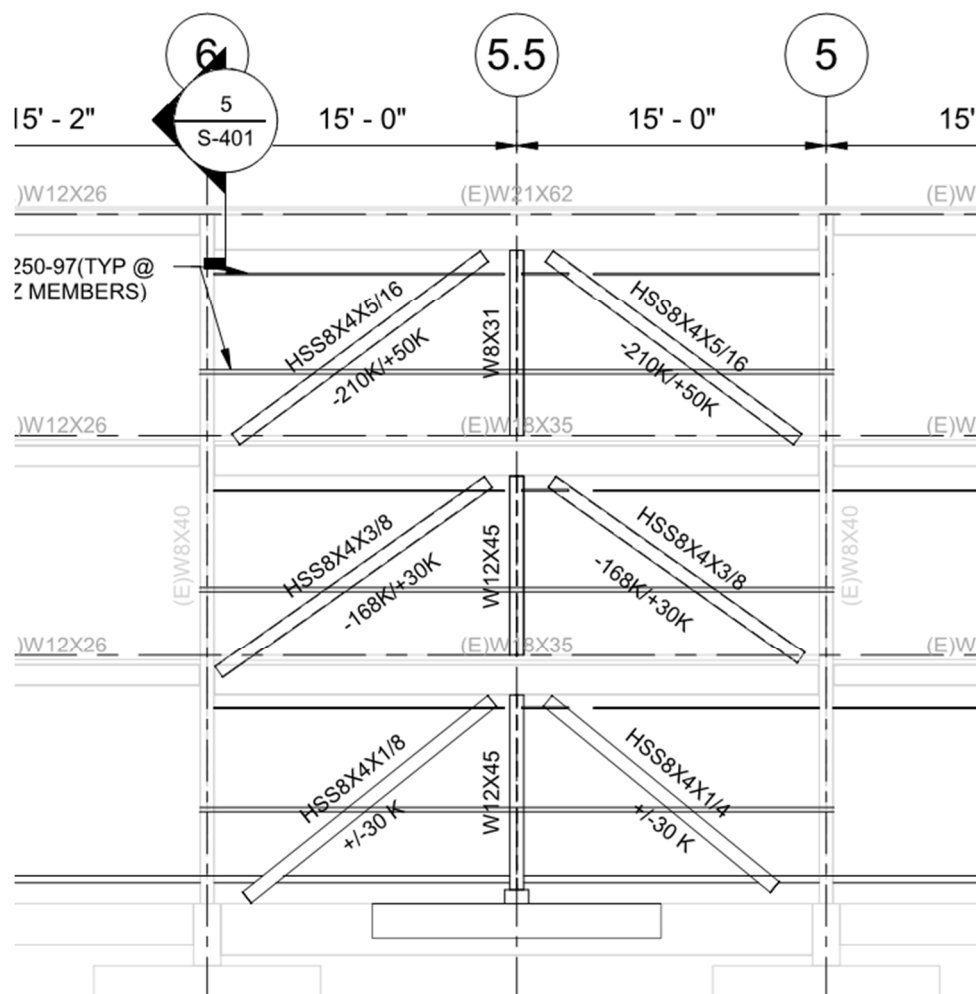
Original Working Loads		Area Loads	
Room		DL	LL
Squad Room		50	40
Bathrooms		78	40
Corridors		50	60
Mechanical rooms		50	60
Laundry Room		50	60
Supply		50	60
Roof		18	
Exterior Wall [KLF]Roof		0.171	Exterior wall @ Floor N&S
Stair Wall [KLF]		0.280	Exterior wall @ Floor E&W
Roof Built up DL N&S [KLF]		0.24	8 psf for built up roof Load goes to perimeter beams
Roof Built up DL E&W [KLF]		0.04	20 psf LL goes to perimeter beams
Roof Built up DL N&S [KLF] TOTAL		0.411	KLF
Roof Built up DL E&W [KLF]		0.211	KLF
Adjusted Working Loads $\Omega_{LD}=3.8$			
Away @ Rem. Element		Area Loads	
Room		DL	FDL =
Squad Room		190	LL
Bathrooms		296	152
Corridors		190	152
Mechanical rooms		190	228
Laundry Room		190	228
Supply		190	228
Roof		68	
Exterior Wall [KLF]Roof		0.650	Exterior wall @ Floor N&S
Stair Wall [KLF]		1.064	Exterior wall @ Floor E&W
Roof Built up DL N&S [KLF]		0.912	2.28
Roof Built up DL E&W [KLF]		0.152	0.38
Roof Built up DL N&S [KLF] TOTAL		1.562	KLF
Roof Built up DL E&W [KLF]		0.802	KLF
			1.805
			2.5118

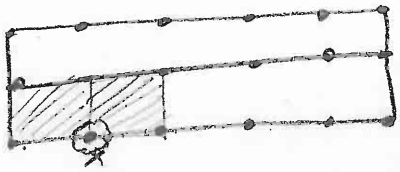
Table 3-1. Examples of Deformation-Controlled and Force-Controlled Actions, from ASCE 41

Component	Deformation-Controlled Action	Force-Controlled Action
Moment Frames <ul style="list-style-type: none"> • Beams • Columns • Joints 	Moment (M) M --	Shear (V) Axial load (P), V V' P
Shear Walls	M, V	P
Braced Frames <ul style="list-style-type: none"> • Braces • Beams • Columns • Shear Link 	P -- -- V	-- P P P, M
Connections	P, V, M ²	P, V, M

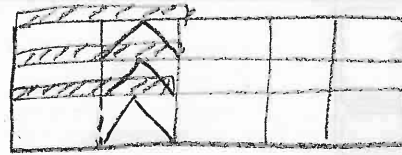
Table 3-3. Calculation of Component Capacities for the Linear Static Procedure

Parameter	Deformation-Controlled	Force-Controlled
Material Strength	Expected Material Strength	Lower Bound Strength
Strength Capacity	$\phi m Q_{CE}$	ϕQ_{CL}





PLAN VIEW



Progressive collapse & col removal.

lets say $DL = 50 \text{ PSF}$
 $LL = 40 \text{ PSF}$

calculated R_{LD} steel as 3.8.

so $G_{LD} = R_{LD} (1.2D + 0.5L)$ eq 3-10

so q applied $3.8 * (1.2D + 0.5L)$

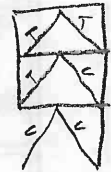
Applied $3.8 * 50 \text{ PSF} = 190 \text{ PSF}$
 $3.8 * 40 \text{ PSF} = 152 \text{ PSF}$ } in the areas hatched.

above the column that is removed. Followed UFC & ASCE 41-13.

→

This creates very heavy loads on braces

with the load combinations q have -164 K Tension & $+62 \text{ K}$ Comp.



on 2nd level braces.

→ Does connections have to be designed for this heavy loads?

Deformation controlled has $R_{LD} = 3.8$

Force controlled has $R_{LF} = 2.0$.

ASCE 41-13 says we can design connections for force controlled.

