

Breaching of Concrete Walls

Charge weight.....	75 kilograms TNT
Free-air burst	
Contact detonation?.....	no
Adjusted charge mass.....	37.5 kilograms
Range from target to explosive CG.....	2.2 meters
Spall threshold thickness.....	26.27 cm
Breach threshold thickness.....	20.83 cm

	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	
1					<b>Error/Warning Messages</b>											
2	Retrieve	Save	Run Analysis	User's Guide	Print Input and Results	Hide Comments on Screen	Stirrups may be req'd for compression reinforcing since support rotation > 2 deg.									
3																
4	<b>Note: Prior to retrieving new input or changing Component Type on input sheet, save your input using the SAVE button - DO NOT use File/Save on Excel tool bar.</b>															
5	Building: _____ Component: _____ By: _____ Date: _____															
6	<b>SBEDS v5.1: Reinforced Concrete Slab</b>															
7	<b>User Info: Fill in Yellow Cells, See Note Below for White Cells<sup>1</sup></b>															
8	Slab Width, L:	7000 mm														
9	Slab Height, H:	12000 mm														
10	Two-Way, Four Sides Supported - All Simple															
11	Flexural Only															
12	Type I															
13	<b>Structural &amp; Material Properties</b>															
14	Slab Thickness, t:	300 mm														
15	Reinf. Steel Spacing for Bars Spanning Parallel to L, b <sub>s</sub> :	150 mm														
16	Reinf. Steel Spacing for Bars Spanning Parallel to H, b <sub>H</sub> :	150 mm														
17	Area of Reinforcing Steel <sup>2</sup> :	Inbound	Rebound													
18	Leave Blank for Simple Supports	200	200	mm <sup>2</sup>												
19	Positive Moment Steel Parallel to H:	0	0	mm <sup>2</sup>												
20	Leave Blank for Simple Supports	200	200	mm <sup>2</sup>												
21	Leave Blank for Simple Supports	0	0	mm <sup>2</sup>												
22	Thickness of Cover to Center of Bars, d <sub>c</sub> :	30 mm														
23	Loaded Side Spanning Parallel to L:	30 mm														
24	Non-Loaded Side Spanning Parallel to H:	30 mm														
25	Loaded Side Spanning Parallel to H:	30 mm														
26	Supported Weight, w:	0 kq/m <sup>2</sup>														
27	Concrete Density, γ <sub>c</sub> :	2500 kq/m <sup>3</sup>														
28	Poisson's Ratio, ν <sub>c</sub> :	0.167														
29	Concrete Static Strength Increase Factor (P>=1):	42 MPa														
30	Concrete Dynamic Compr. Increase Factor (P>=1):	1.19														
31	Concrete Dynamic Compr. Strength, F <sub>dc</sub> :	50 MPa														
32	Concrete Elastic Modulus, E <sub>c</sub> :	34,834 MPa														
33	Select Reinforcement:	User Defined														
34	Reinf. Steel Yield Strength, f <sub>y</sub> :	500 MPa														
35	Reinf. Steel Ultimate Strength, f <sub>u</sub> :	600 MPa														
36	Static Strength Increase Factor:	1.1														
37	Dynamic Increase Factor:	1.17														
38	Dynamic Reinf. Steel Yield Stress, f <sub>yd</sub> :	644 MPa														
39	Reinf. Steel Elastic Modulus, E <sub>s</sub> :	200,000 MPa														
40	No Dynamic Axial Load	0 N/mm Note: (P>=0)														
41	Leave Blank for No Axial Load	0 mm														
42	Leave Input Blank for No Axial Load	0 mm														
43	<b>Calculated Properties</b>															
44	Rebound Positive H-Direction Moment Capacity, M <sub>pr</sub> :	222,996 N-mm/mm														
45	Inbound Positive H-Direction Moment Capacity, M <sub>pr</sub> :	222,996 N-mm/mm														
46	Reinforcement Ratio, ρ <sub>pr</sub> (Tension only and Net <sup>3</sup> ):	0.005 0.000														
47	Rebound Negative H-Direction Moment Capacity, M <sub>pr</sub> :	0 N-mm/mm														
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55	Reinforcement Ratio, ρ <sub>pr</sub> (Tension only and Net <sup>3</sup> ):	0.000 0.000														
56	Reinforcement Ratio Check:	Reinforcement OK														
57	Equiv. Stress Block Factor, β <sub>1</sub> :	0.69														
58	Over-Reinf. Criteria - 75% of Balanced Reinf. Ratio	0.0164														
59	Average Cover Depth for Moment of Inertia	30 mm														
60	Average Moment of Inertia, I <sub>bc</sub> :	1,328,947 mm <sup>4</sup> /mm														
61	<b>Error/Warning Messages</b>															
62	Stirrups may be req'd for compression reinforcing since support rotation > 2 deg.															
63																
64																
65																
66																
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69	<b>Notes:</b>															
70	Used in calculating effect of cleaning on reflected blast load															
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74	Shear controlled response ONLY occurs if the user sets the "Shear Flag" > 0. This response typically has very limited ductility - a maximum value of 1 is assumed in SBEDS. The user should clearly understand															
75	shear-controlled response when using the shear flag - see User's Guide.															
76	Axial load per unit width on analyzed component from saved Dynamic Shear History file for															
77	supported component. Dynamic axial load includes static gravity load of supported horizontal member.															
78	Based on tensile steel reinf. minus any compression (i.e. rebound) steel reinf.															
79	For internal loading, user must check diaagonal shear at support (SBEDS does not check this)															
80	For Response Criteria: TM = tension membrane, F&C = Flexure and Compression															
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**Click to Input Blast Parameters**

**Blast Load Type**

Manual input

**Gravity Displacement**

In direction of blast load

**Pressure-Time Input**

Time (ms)	Pressure (kPa)
0	3434
2	0
10	0
50	0
150	0
200	0
300	0
400	0

**Charge Weight (W) and Standoff (R)**

W (kg)	Explosive Type
N/A	N/A
W/TNT Equiv(kg)	R (m)
N/A	N/A

**Blast Load Phase**

N/A

**Blast Load Orientation**

N/A

**Parameters for Reflected Loads**

Wall Height (m) <sup>1</sup>	N/A
Wall Width (m) <sup>1</sup>	N/A
Incidence Angle <sup>2</sup>	N/A

See notes under B69

**Load File: AXIAL(above), BLAST(below)**

N/A
N/A

**Response Criteria**

Flexure/shear reinforcing or TM

LOP/Type<sup>3</sup>: MLOP/Secondary-NS

0 (deg)	μ
2	N/A

See Note 7 under error messages

**Dynamic Reaction Factors**

Shear Constant	Elastic	Plastic
F (long side) =	0.09	0.10
R (long side) =	0.26	0.25
F (short side) =	0.04	0.05
R (short side) =	0.11	0.10

**Solution Control**

Inbound Natural Period: 99.57 ms

Rebound Natural Period: 99.57 ms

Max Recommended Time Step: 0.07 msec

Time Step: 0.06 msec

% of Critical Damping: 2 %

Initial Velocity: 0 mm/ms

**SDOF Properties**

Property	Inbound	Rebound	Units
Mass, M	750.0	750.0	kq/mm <sup>2</sup>
Load-Mass Factors, K <sub>LM</sub>			
K <sub>LM1</sub>	0.74	0.74	
K <sub>LM2</sub>	0.74	0.74	
K <sub>LM3</sub>	0.56	0.56	
K <sub>LM4</sub>	0.56	0.56	
K <sub>LM5</sub>	0.56	0.56	
Stiffness, K			
K1	2.22	2.22	kPa/mm
K2	2.22	2.22	kPa/mm
K3	0.00	0.00	kPa/mm
K4	0.00	0.00	kPa/mm
K5	0.00	0.00	kPa/mm
Resistance, R			
R1	66.40	-66.40	kPa
R2	66.40	-66.40	kPa
R3	66.40	-66.40	kPa
R4	66.40	-66.40	kPa
Yield Displacement, x			
x1	29.87	-29.87	mm
x2	29.87	-29.87	mm
x3	29.87	-29.87	mm
x4	29.87	-29.87	mm
Equiv Yield Defl., X <sub>p</sub>	29.87	-29.87	mm

**Results Summary**

θ<sub>max</sub> = 2.47 deg Design Criteria: MLOP/Secondary-NS

β<sub>1</sub> = 5.06 Response DOES NOT MEET input design criteria

X <sub>max</sub> Inbound =	151.01 mm	at time =	46.50 msec
X <sub>max</sub> Rebound =	0.00 mm	at time =	0.00 msec
R <sub>max</sub> =	66.40 kPa	at time =	46.50 msec
R <sub>min</sub> =	-48.09 kPa	at time =	96.30 msec

Shortest Yield Line Distance to Determine θ: 3,500.0 mm

**Equivalent Static Reactions (1)**

**Peak Reactions Based on Ultimate Flexural Resistance: Vu**

Vu_H at support along H (3) (See Figures - Cell Q41)	170.0 N/mm
Vu_L at support along L (3)	169.7 N/mm
Maximum Vu at distance d from support (3) =	158.9 N/mm

**Concrete Shear Capacities**

Direct Shear (monolithic joint) V<sub>dc</sub> = 2,159 N/mm

Diagonal Shear Capacity: V<sub>diag</sub> = 318 N/mm

Tensile steel depth for shear calculations, d: 270.0 mm

**Results based on Max Shear Region (See Note 6A)**

Direct Shear at support: Shear is OK

Diagonal Shear at distance d from support: Shear is OK

**Shear Steel Area per unit spacing, A<sub>vs</sub> Required in Max Shear Region (2)**

Diagonal bars @ support per unit spacing (s): 0.0000 mm<sup>2</sup>/mm<sup>2</sup>

Stirrups for shear @ d from support per unit spacing (s): 0.0000 mm<sup>2</sup>/mm<sup>2</sup>

**Notes for Shear Information:**

(1) Based on larger of inbound and rebound ultimate flexural resistance, not including tension or compression membrane.

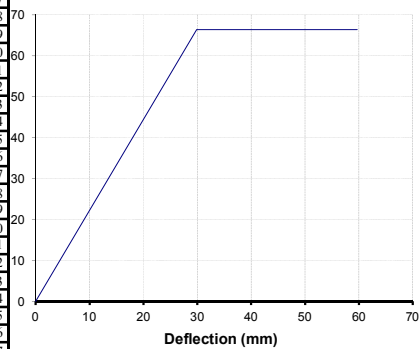
(2) Multiply A<sub>vs</sub> values by flexural bar spacing and stirrup spacing to get stirrup area

(3) V<sub>max</sub> at distance d from support is conservatively overestimated

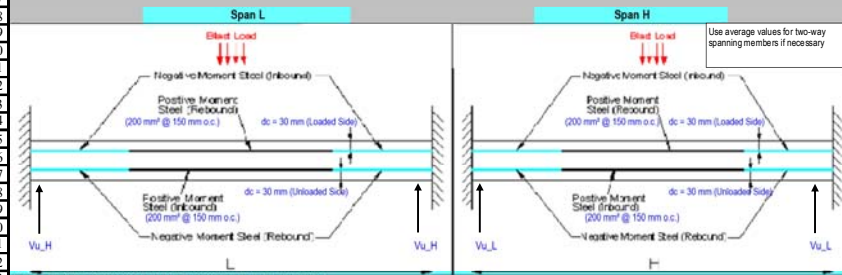
Resistance (kPa)

	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI
1					Stiffness Code					Comp. No.	4								
2					5					Input sheet	1								
3										Shortest Yield Line Distance to Determine $\theta$	3500.0								
4										Maximum Length Dimension	12000.0								
5										Minimum Length Dimension	7000.0								
6										Steel Dynamic Yield Strain	0.0032175								
7										Shear Flag for Macro	0								
8										Check Shear Results, Provide Required Stirrups or Set Shear Flag >0 in Cell H45 and I	4								
9										R <sub>u,inbound</sub>	66.40								
10										R <sub>u,rebound</sub>	-66.39794808								
11										(Shear Flag =1 for Controlling Shear at Support, =2 for Controlling Shear at distance d from Support)									
12										One layer of steel flag (horz)	1								
13										One layer of steel flag (horz)	1								
14										Error Message Conditional Formats									
15										Input has Deep Beam and Tension I	0								
16																			
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**Resistance vs Deflection**



x	R
0	0
29.87	66.40
29.87	66.40
29.87	66.40
29.87	66.40
59.75	66.40



Note 1: Always enter values for both rebound and inbound steel.  
 Note 2: When there is one layer of steel, enter the same steel area for both inbound and Rebound. The summed Thickness of Cover from each face should equal the total slab thickness.

**Calculated Compression and Tension Membrane Properties**

57	Ultimate compressive membrane resistance, one way slab, $f_{uc,1way}$ :	72.14	kPa	26.91202809	205920	1-way Compression Membrane Calculations	
58	Ultimate compressive membrane resistance, two way slab, $f_{uc,2way}$ :	203.08	kPa	0.466403927	-0.025781902	0 558925.7143 2-way Compression Membrane Calculations	
59	Midspan deflection at which Ruc is reached, $\Delta_{d,c}$ :	150.00	mm				
60	Midspan deflection at snap-through, $\Delta_{d,s}$ :	240.00	mm				
61	Type II resistance, $f_{u,2}$ (inbound, rebound):	66.40	66.40	kPa			
62	Central defl in the tensile membrane region of response, $\Delta_{T1}$ :	900	900.00	mm			
63	Tension membrane slope, one way slab, $f_T/\Delta_T$ 1way:	0.00	0.00	kPa/mm	n	A $(A/n^2(-1)^{n-1/2})$ 2-way Tension Membrane Calculations	
64	Tension membrane slope, two way slab, $f_T/\Delta_T$ 2way:	0.00	0.00	kPa/mm	1	#DIV/0! #DIV/0!	
65	Positive Compression membrane slope, $K'_{c,+}$ :	0.00	0.00	kPa/mm	3	#DIV/0! #DIV/0!	
66	Negative Compression membrane slope, $K'_{c,-}$ :	0.00	0.00	kPa/mm	5	#DIV/0! #DIV/0!	
67	<b>Supporting Calculations For Compression and Tension Membrane</b>						
68	Compression force per unit width in the reinforcing steel at middle yield lines and supports, respectively,	$C_{x,mid}$	=	888.00	N/mm	Sum #DIV/0!	
69		$C_{x,sup}$	=	0.00	N/mm	Min Span T 0	
70		$C_{y,mid}$	=	888.00	N/mm	Max Span T 0	
71		$C_{y,sup}$	=	0.00</			

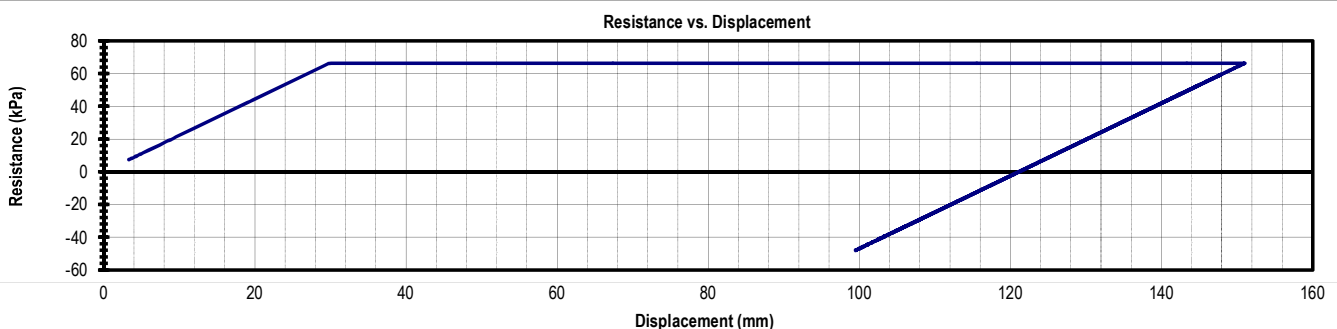
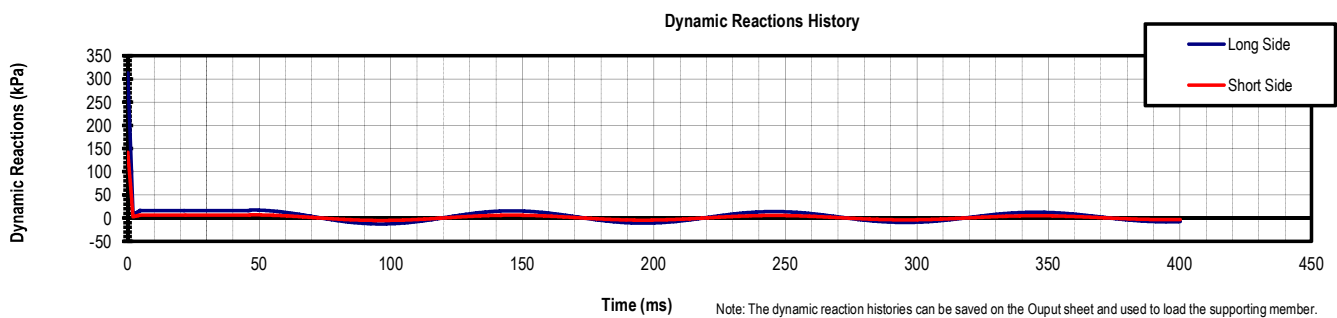
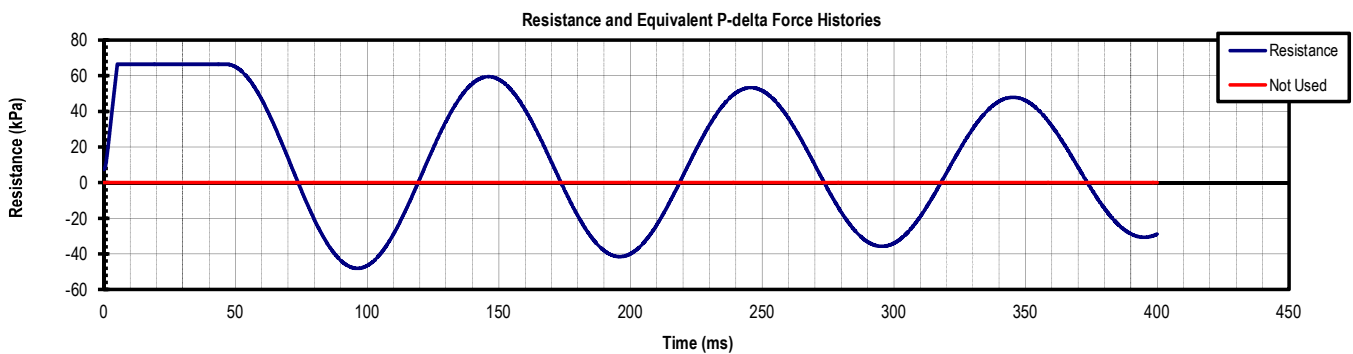
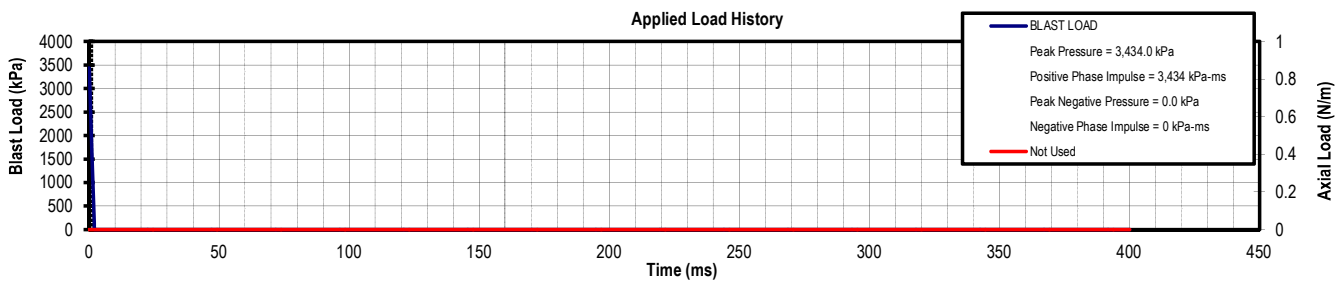
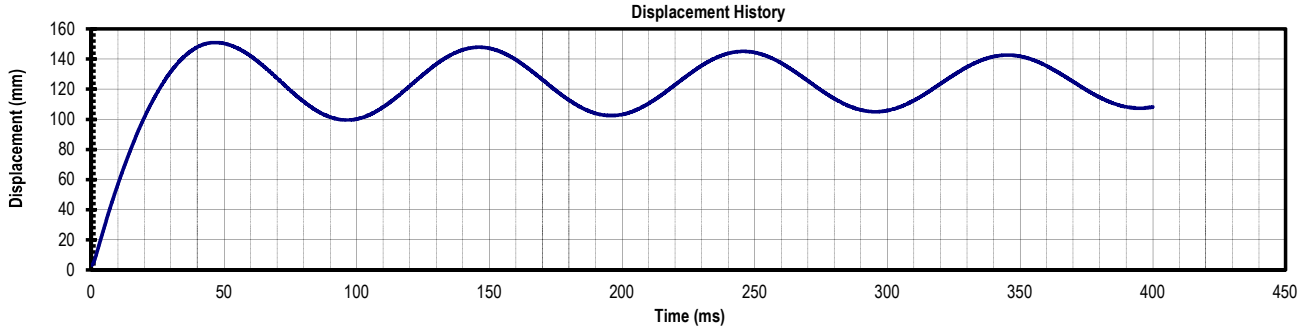
**SBEDS v5.1: Reinforced Concrete Slab**

Results Summary			
$\theta_{max}$	=	2.47	deg.
$\mu$	=	5.06	
$X_{max}$	=	151.01	mm at time = 46.50 msec
$X_{min}$	=	0.00	mm at time = 0.00 msec
$R_{max}$	=	66.40	kPa at time = 46.50 msec
$R_{min}$	=	-48.09	kPa at time = 96.30 msec

Peak Dynamic Reactions		
$V_{max,Long}$	=	313.29 kPa
$V_{max,Short}$	=	141.57 kPa
Strain Rate to Yield*		
Steel	0.63	1/sec
Concrete	0.39	1/sec

Note: See General Items section of User's Guide for information on maximum time of calculated response.

\*Per Section 4.3 of UFC 3-340-02. Note: Based on max. response (instead of yield) when ductility ratio < 1.0



Breaching of Concrete Walls

Charge weight.....	100 kilograms TNT
Free-air burst	
Contact detonation?.....	no
Adjusted charge mass.....	50 kilograms
Range from target to explosive CG.....	2.2 meters
Spall threshold thickness.....	34.87 cm
Breach threshold thickness.....	24.96 cm

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17					200		114		mm <sup>2</sup>							
18	Leave Blank for Simple Supports				0		0		mm <sup>2</sup>							
19	Positive Moment Steel Parallel to H:				114		200		mm <sup>2</sup>							
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91																

**Click to Input Blast Parameters**

**Blast Load Type**

Manual input

**Gravity Displacement**

In direction of blast load

**Pressure-Time Input**

Time (ms)	Pressure (kPa)
0	4413
1.81	0
10	0
50	0
150	0
200	0
300	0
400	0

**Charge Weight (W) and Standoff (R)**

W (kg)	Explosive Type
N/A	N/A
W/TNT Equiv(kg)	R (m)
N/A	N/A

**Blast Load Phase**

N/A

**Blast Load Orientation**

N/A

**Parameters for Reflected Loads**

Wall Height (m) <sup>4</sup>	N/A
Wall Width (m) <sup>5</sup>	N/A
Incidence Angle <sup>6</sup>	N/A

See notes under B69

**Load File (AXIAL/above)/BLAST (below)**

N/A

**Response Criteria**

Flexure/no shear reinforcing or TM

LOP/Type<sup>7</sup>: MLOP/Secondary-NS

0 (deg)	μ
2	N/A

See Note 7 under error messages

**Dynamic Reaction Factors**

Shear Constant	Elastic	Plastic
F (long side) =	0.09	0.10
R (long side) =	0.26	0.25
F (short side) =	0.04	0.05
R (short side) =	0.11	0.10

**Solution Control**

Inbound Natural Period: 101.06 ms

Rebound Natural Period: 101.06 ms

Max Recommended Time Step: 0.06 msec

Time Step: 0.06 msec

% of Critical Damping: 2 %

Initial Velocity: 0 mm/ms

**SDOF Properties**

Property	Inbound	Rebound	Units
Mass, M	750.0	750.0	kg/mm <sup>2</sup>
Load-Mass Factors, K <sub>LM</sub>			
K <sub>LM1</sub>	0.74	0.74	
K <sub>LM2</sub>	0.74	0.74	
K <sub>LM3</sub>	0.58	0.58	
K <sub>LM4</sub>	0.58	0.58	
K <sub>LM5</sub>	0.58	0.58	
Stiffness, K			
K1	2.16	2.16	kPa/mm
K2	2.16	2.16	kPa/mm
K3	0.00	0.00	kPa/mm
K4	0.00	0.00	kPa/mm
K5	0.00	0.00	kPa/mm
Resistance, R			
R1	57.63	-99.45	kPa
R2	57.63	-99.45	kPa
R3	57.63	-99.45	kPa
R4	57.63	-99.45	kPa
Yield Displacement, x			
x1	26.71	-46.09	mm
x2	26.71	-46.09	mm
x3	26.71	-46.09	mm
x4	26.71	-46.09	mm
Equiv Yield Defl., X <sub>p</sub>	26.71	-46.09	mm

**Results Summary**

θ<sub>max</sub> = 3.87 deg Design Criteria: MLOP/Secondary-NS

β<sub>1</sub> = 0.69 Response DOES NOT MEET input design criteria

X <sub>max</sub> Inbound = 235.39 mm	at time = 64.02 msec
X <sub>max</sub> Rebound = 0.00 mm	at time = 0.00 msec
R <sub>max</sub> = 57.64 kPa	at time = 64.02 msec
R <sub>min</sub> = -39.86 kPa	at time = 114.54 msec

Shortest Yield Line Distance to Determine θ: 3,479.7 mm

**Equivalent Static Reactions (1)**

Peak Reactions Based on Ultimate Flexural Resistance: V<sub>u</sub>

V <sub>u,H</sub> at support along H (3) (See Figures - Cell Q41)	273.6	N/mm
V <sub>u,L</sub> at support along L (3)	207.6	N/mm
Maximum V <sub>u</sub> at distance d from support (3) =	252.5	N/mm

**Concrete Shear Capacities**

Direct Shear (monolithic joint) V <sub>dc</sub> =	2,159	N/mm
Diagonal Shear Capacity: V <sub>diag</sub> =	318	N/mm
Tensile steel depth for shear calculations, d:	270.0	mm

**Results based on Max Shear Region (See Note 6A)**

Direct Shear at support: Shear is OK

Diagonal Shear at distance d from support: Shear is OK

**Shear Steel Area per unit spacing, A<sub>vs</sub> Required in Max Shear Region (2)**

Diagonal bars @ support per unit spacing (s):	0.0000	mm <sup>2</sup> /mm <sup>2</sup>
Stirrups for shear @ d from support per unit spacing (s):	0.0000	mm <sup>2</sup> /mm <sup>2</sup>

**Notes for Shear Information:**

(1) Based on larger of inbound and rebound ultimate flexural resistance, not including tension or compression membrane.

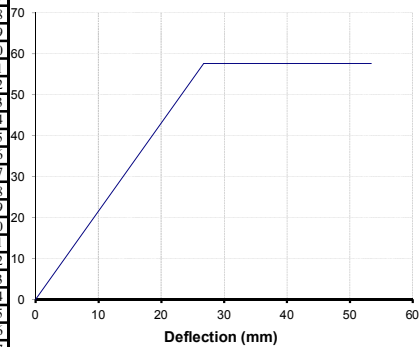
(2) Multiply A<sub>vs</sub> values by flexural bar spacing and stirrup spacing to get stirrup area

(3) V<sub>max</sub> at distance d from support is conservatively overestimated

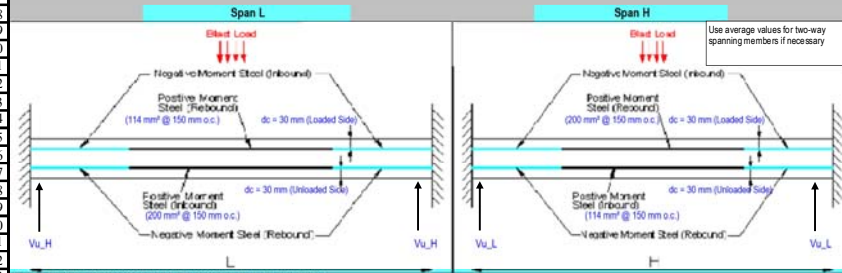
Resistance (kPa)

	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI
1					Stiffness Code					Comp. No.	4								
2					5					Input sheet	1								
3																			
4																			
5																			
6										Shortest Yield Line Distance to Determine $\theta$	3.479	7							
7										Maximum Length Dimension	12000	0							
8										Minimum Length Dimension	7000	0							
9										Steel Dynamic Yield Strain	0.0032175								
10										Check Shear Results, Provide Required Stirrups or Set Shear Flag >0 in Cell H45 and I	4								
11										R <sub>u_rebound</sub>	57.63								
12										R <sub>u_rebound</sub>	-99.4523265								
13										(Shear Flag =1 for Controlling Shear at Support, =2 for Controlling Shear at distance d from Support)									
14										One layer of steel flag (horz)	1								
15										One layer of steel flag (horz)	1								
16										Error Message Conditional Formats									
17										Input has Deep Beam and Tension I	0								
18																			
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**Resistance vs Deflection**



x	R
0	0
26.71	57.63
26.71	57.63
26.71	57.63
26.71	57.63
53.43	57.63



Note 1: Always enter values for both rebound and inbound steel.  
 Note 2: When there is one layer of steel, enter the same steel area for both inbound and Rebound. The summed Thickness of Cover from each face should equal the total slab thickness.

**Calculated Compression and Tension Membrane Properties**

57	Ultimate compressive membrane resistance, one way slab, $f_{uc,1way}$ :	69.63	kPa	
58	Ultimate compressive membrane resistance, two way slab, $f_{uc,2way}$ :	186.56	kPa	
59	Midspan deflection at which $R_{uc}$ is reached, $\Delta_{d,c}$ :	150.00	mm	
60	Midspan deflection at snap-through, $\Delta_{d,s}$ :	240.00	mm	
61	Type II resistance, $f_{u,2}$ (rebound, rebound):	57.63	99.45	kPa
62	Central defl in the tensile membrane region of response, $\Delta_{T1}$ :	900	900.00	mm
63	Tension membrane slope, one way slab, $f_T/\Delta_{T,1way}$ :	0.00	0.00	kPa/mm
64	Tension membrane slope, two way slab, $f_T/\Delta_{T,2way}$ :	0.00	0.00	kPa/mm
65	Positive Compression membrane slope, $K'_{c,+}$ :	0.00	0.00	kPa/mm
66	Negative Compression membrane slope, $K'_{c,-}$ :	0.00	0.00	kPa/mm
67	<b>Supporting Calculations For Compression and Tension Membrane</b>			
68	Compression force per unit width in the reinforcing steel at middle yield lines and supports, respectively,	$C_{x,mid} =$	489.06	N/mm
69		$C_{x,sup} =$	0.00	N/mm
70		$C_{y,mid} =$	858.00	N/mm
71		$C_{y,sup} =$	0.00	N/mm
72	Tension force per unit width in the reinforcing steel at the middle yield lines and supports, respectively,	$T_{x,mid} =$	858.00	N/mm
73		$T_{x,sup} =$	0.00	N/mm
74		$T_{y,mid} =$	489.06	N/mm
75		$T_{y,sup} =$	0.00	N/mm
76	Lateral stiffness of the supports,	$S =$	6966.80	MPa
77	Fraction of length from support			

# נספחי חישוב למעבר טאבה

Building: \_\_\_\_\_

Component: \_\_\_\_\_

By: \_\_\_\_\_

Date: \_\_\_\_\_

## SBEDS v5.1: Reinforced Concrete Slab

Results Summary			
$\theta_{max}$	= 3.87	deg.	
$\mu$	= 8.81		
$X_{max}$	= 235.39	mm	at time = 64.02 msec
$X_{min}$	= 0.00	mm	at time = 0.00 msec
$R_{max}$	= 57.64	kPa	at time = 64.02 msec
$R_{min}$	= -39.86	kPa	at time = 114.54 msec

Peak Dynamic Reactions	
$V_{max,Long}$	= 402.05 kPa
$V_{max,Short}$	= 181.71 kPa
Strain Rate to Yield*	
Steel	0.82 1/sec
Concrete	0.51 1/sec

Note: See General Items section of User's Guide for information on maximum time of calculated response.

\*Per Section 4.3 of UFC 3-340-02. Note: Based on max. response (instead of yield) when ductility ratio < 1.0

