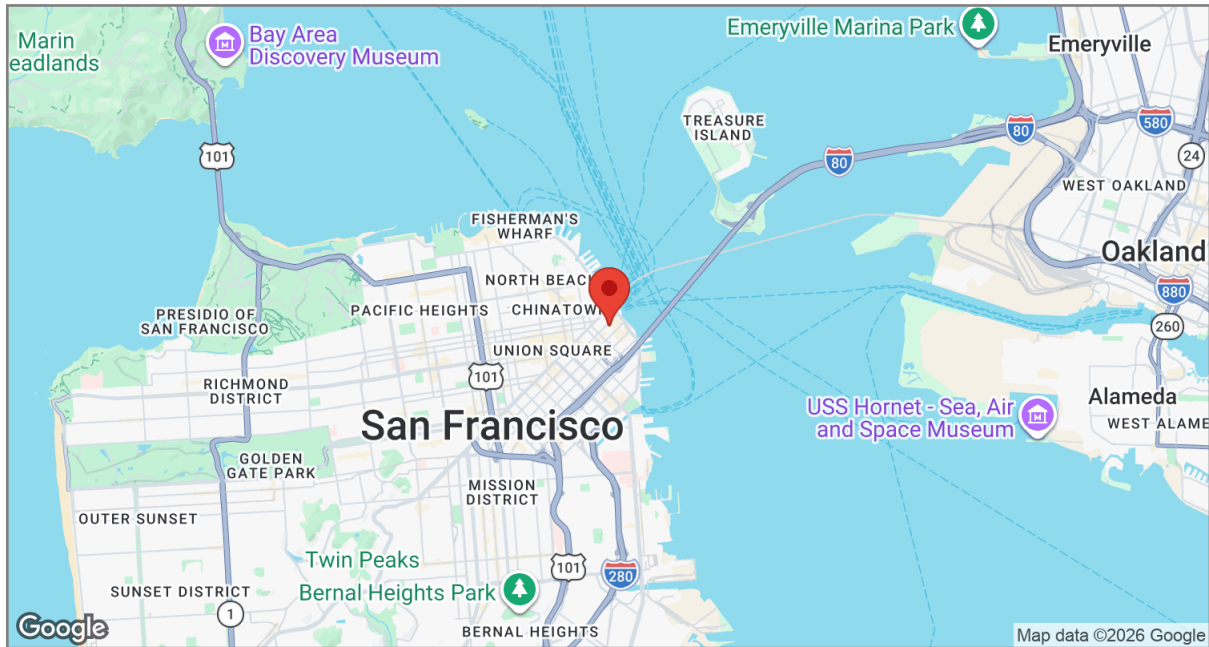


SEISMIC RISK ASSESSMENT REPORT

Created with the SP3-RiskModel *Advanced + Recovery*

Detailed Component Report



Report Generated for:

123 Main Street, San Francisco, CA

Latitude: 37.79166°

Longitude: -122.39442°

Report Generated by:

v14.7.1 of the SP3-RiskModel

May 22, 2026



**Seismic Performance
Prediction Platform**

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7 Disclaimer

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1 SUMMARY OF INPUTS AND RISK RESULTS

Risk Model Inputs

Primary	
Project Name:	Website
Model Name:	123 Main Street
Building Type:	Steel: BRBF CoreBrace with Back-up Frame
Design Code Year:	2010
Number of Stories:	8
Address:	123 Main Street San Francisco, CA
Latitude:	37.79166°
Longitude:	-122.39442°
Occupancy:	Commercial Office

Building Design Info		
Level of Detailing (Dir. 1, 2):	Special, Special	
Drift Limit (Dir. 1, 2):	1%, 1%	
Risk Category:	(Cat. III)	
Seismic Importance Factor, I_e :	—	
Component Importance Factor, I_p :	—	
Design Spectral Acceleration		
Mapped Short Period, S_s	—	
Mapped 1 Second, S_1	—	
Design Short Period, S_{Ds}	—	
Design 1 Second, S_{D1}	—	

Structural Properties		
Mode Shapes Specified?	No	
<i>Directional Properties</i>	<i>Dir. 1</i>	<i>Dir. 2</i>
Base Shear Strength (g):	—	—
Yield Drift (%):	—	—
Design Model Period (T_1) (s):	—	—
1 st Mode Period (T_1) (s):	—	—
2 nd Mode Period (T_2) (s):	—	—
3 rd Mode Period (T_3) (s):	—	—

Analysis Options	
Include Collapse in Analysis:	Yes
Consider Residual Drift:	Yes
Simulation Options	
Number of EQ Simulations:	2,500
Collapse Distribution Truncation?	Yes
Truncation Level:	—
Component Distribution Truncation?	No
Truncation Level:	—
Cost Multipliers	
Region Cost Multiplier:	—
Date Cost Multiplier:	—
Occupancy Cost Multiplier:	—
Component Soft Cost Modifier:	—

Component Information		
Selection Method	Automatic	

Building Stability		
Collapse Definition Method:	FEMA P-154	
Score Calc Method:	Rapid Visual Screening Checklist	
FEMA P-154 Score:	—	
Beta (Dispersion):	—	

Building Layout Information	
Cost per Square Foot:	—
Scale component repair costs with building value?	Yes
Total Square Feet:	—
Aspect Ratio:	—
First Story Height (ft):	—
Upper Story Heights (ft):	—

Ground Motion and Soil Information	
Site Class:	—
Site Hazard:	U.S. Geological Survey
Edition:	—

Recovery Time Options

Recovery Time Method	ATC-138 (Beta)
Building Replacement Time	–
Statistical Damage Correlation Model:	
Original FEMA P-58 Correlation Model (2012/2018)	

Factors Delaying Start of Repairs

Inspection	Yes
Financing	Yes
Permitting	Yes
Engineering Mobilization	Yes
Contractor Mobilization	Yes
Long Lead Time	No

Mitigation Factors

Inspector on Retainer	Yes
Engineer on Retainer	Yes
Contractor Relationship	Retainer
Funding Source	–
Cash on Hand	15.0%

Responses

Response	EDP	Method	Use as Default for Comps?	Derived From
Peak Story Drift Ratio	IDR	SP3 SRPE	Yes	–
Peak Floor Acceleration	PFA	SP3 SRPE	Yes	–
Residual Story Drift Ratio	RIDR	SP3 SRPE	Yes	Peak Story Drift Ratio
<i>Direction 1</i>				
Residual Drift Model:		–		
Record-to-Record Dispersion:		–		
<i>Direction 2</i>				
Residual Drift Model:		–		
Record-to-Record Dispersion:		–		

Structural Response Dispersion Options

Record-to-Record Dispersion Model:	FEMA P-58
Modeling dispersion:	–
Residual Drift Simulation Method:	–

Recovery Time Options Specific to ATC-138 (Beta)

HVAC			
Need Ventilation for Reoccupancy?	–	Need Ventilation for Function?	Yes
Need Heating for Reoccupancy?	–	Need Heating for Function?	Yes
Need Cooling for Reoccupancy?	–	Need Cooling for Function?	Yes
Need Exhaust for Reoccupancy?	–	Need Exhaust for Function?	Yes
Elevator			
Need Elevator for Function?	Yes	Max. Walkable Story	3
Use updated elevator components?	No		
Surge			
Include Surge Demand?	No		
Temporary Repair			
Allow Temporary Repairs?	Yes	Allow Temporary Shoring?	–
Fire			
Allow Fire Watch for Occupancy?	No		
Plumbing			
Is Potable Water Required for Occupancy?	–	Is Potable Water Required for Function?	–
Is Sanitary Piping Required for Occupancy?	–	Is Sanitary Piping Required for Function?	–
Electrical			
Is Electricity Required for Function?	–		
Egress			
Percentage of the Exits Required for Occupancy?	–	Minimum Number of Exits Required for Occupancy?	–
Door racking affects egress?	–		
Flooding			
Include flooding consequences?	Yes		
“Smart” Components			
Use “smart” piping components?	No		
Use “smart” equipment components?	No		

Component Checklist

Exterior

- Percent of Building Surface Glazed
 - > 80.0%
- Does the building have glazing?
 - > Yes
 - What type of glazing does the building have?
 - > Insulating Glass Unit (Untested)
- Does the building have cladding?
 - > Yes
 - What kind of cladding does the building have?
 - > Precast Concrete Panels

Interior Finishes

- Are there partition walls in the building?
 - > Yes
 - What kind of partition walls does the building have?
 - > Metal Studs
 - What finish do the partition walls have?
 - > Gypsum + Wallpaper
 - How are the partitions constructed?
 - > Full Height: Slip Tracks with Returns
 - Does the building have raised access floors?
 - > No

Continued on next page

Component Checklist (Continued)

- Does the building have suspended ceilings?
 - > *Yes*
- Are the ceilings laterally supported?
 - > *Yes (SDC D/E/F or equivalent)*
 - What is the I_p factor used to design the ceilings?
 - > *1.5*
- Does the building contain pendant (non-recessed) lighting?
 - > *No*

Stairs and Elevators

- Does the building have stairs?
 - > *Yes*
 - What type of stairs are in the building?
 - > *Prefabricated steel*
 - Do the stairs have seismic joints?
 - > *Yes*
- Are there elevators in the building?
 - > *Yes*
 - What type of elevators are in the building?
 - > *Traction*
 - From which era are the building's elevators?
 - > *Post-2000 Seismic Zone 3*

Fire Suppression

- Does the building contain a fire sprinkler system?
 - > *Yes*
- Does the fire sprinkler system have braced horizontal mains?
 - > *Yes*
 - Are the horizontal mains OSHPD certified (or equivalent)?
 - > *Yes*
- Are the fire sprinkler drops OSHPD certified (or equivalent)?
 - > *Yes*
 - What type of ceiling do the fire drops enter into?
 - > *Soft Braced*

Piping

- Does the building contain potable water piping?
 - > *Yes*
 - Is the building's water piping OSHPD certified or equivalent?
 - > *Yes*
- Does the building contain sanitary piping?
 - > *Yes*
 - Is the building's sanitary piping OSHPD certified or equivalent?
 - > *Yes*
 - What type of couplings do the pipes have?
 - > *Flexible*

HVAC

- Does the building have an HVAC system?
 - > *Yes*
 - Is the HVAC cooling/heating equipment seismically anchored?
 - > *Yes*
 - How is the cooling/heating system configured?
 - > *Roof Top Units*
 - Are the RTUs used for medical purposes (or equivalent)?
 - > *No*
 - Are the RTUs small or large?
 - > *Large*
-

Continued on next page

Component Checklist (Continued)

- Does the building have a control panel?
 - > *Yes*
- Is there an HVAC exhaust system in the building?
 - > *Yes*
- Is the HVAC exhaust system seismically anchored?
 - > *Yes*
- Does the HVAC distribution system meet OSHPD standards (or similar)?
 - > *Yes*
- Is there any large diameter ducting (6 SqFt+) in the HVAC system?
 - > *Yes*

Electrical

- Does the building have a backup battery/generator system?
 - > *Yes*
 - Is the battery backup system equipment seismically anchored?
 - > *Yes*
 - Which best describes the building's electrical system?
 - > *Full Commercial-grade Electrical System*
 - Is the electrical equipment seismically anchored?
 - > *Yes*
 - What best describes the buildings motor control centers?
 - > *Anchored*
-

Building Modifiers Checklist

Vertical Irregularities*Soft Story*

Soft or Weak Story Vertical Irregularity? —

Sloping Site

Full story grade change? (FEMA Type non-W1 buildings) —

Setback

Outboard vertical elements of the lateral system at an upper story? —

Inboard vertical elements of the lateral system at upper stories? —

In-plane offset of the lateral elements greater their length? —

Split Level

Split level at one of the floor levels or at the roof? —

Other

Other observable vertical irregularity? —

Plan Irregularities

Torsion Irregularity? —

Non-parallel system? —

Re-entrant corner projection 25% of plan dimension? —

Diaphragm opening over 50% of the total diaphragm width? —

Other observable plan irregularity? —

Redundancy

At least two bays of lateral elements? —

Pounding

Floors Unaligned? —

Different building heights? —

End of block? —

Steel Braced Frames (S1)

K bracing geometry is visible? —

Construction Quality

Structural Construction Quality —

Non-structural Construction Quality —

Structural Material Deterioration —

Notes

No notes were provided.

Expected Loss

Expected loss in percent of total building value			
Shaking Intensity	Return Period	SEL (%)	SUL (%)
90% in 50 years	22 Years	0.0	0.1
50% in 30 years	43 Years	0.1	0.2
50% in 50 years	72 Years	0.3	0.6
50% in 75 years	108 Years	0.5	1.2
50% in 100 years	144 Years	0.8	1.7
20% in 50 years	224 Years	1.6	3.0
10% in 50 years	475 Years	4.4	6.6
DE	920 Years	21	40
5% in 50 years	975 Years	23	43
2% in 50 years	2475 Years	56	90
MCE _R	2880 Years	60	96

Recovery Time

Reported recovery times are the time required for the entire building to reach a recovery state (re-occupancy, functional recovery, or full recovery).

Median recovery time summary					
Intensity	ATC-138 Functional Recovery (Beta) [†]			FEMA P-58 [‡]	
	Re-Occupancy	Functional	Full	Full (Parallel)	Full (Series)
90% in 50 years	0 days	0 days	6 days	0.19 days	0.58 days
50% in 30 years	0 days	0 days	8 days	0.27 days	1.2 days
50% in 50 years	0 days	3 days	10 days	0.55 days	2.4 days
50% in 75 years	2 days	4 days	13 days	1.2 days	4.2 days
50% in 100 years	3 days	5 days	2.3 weeks	2.1 days	6.8 days
20% in 50 years	4 days	6 days	4.9 weeks	5 days	12 days
10% in 50 years	7 days	5.6 weeks	2.7 months	11 days	3.8 weeks
DE	2.3 months	3.4 months	4.1 months	3.1 weeks	7.7 weeks
5% in 50 years	2.6 months	3.6 months	4.3 months	3.2 weeks	1.9 months
2% in 50 years	38 months	38 months	38 months	38 months	38 months
MCE _R	38 months	38 months	38 months	38 months	38 months

[†] Does include factors delaying start of repairs

[‡] Does **not** include factors delaying start of repairs

2 MOST DAMAGED COMPONENTS

Table 2.1. Most damaged Structural components at each intensity level.

Intensity	Component	Damage State	Expected Repair Cost
90% in 50 years	B1031.001	1	\$0
50% in 30 years	B1031.001	1	\$0
50% in 50 years	B1031.021b	1	\$116
50% in 75 years	B1033.653a	1	\$397
50% in 100 years	B1033.653a	1	\$2,873
20% in 50 years	B1033.653a	1	\$20,724
10% in 50 years	B1033.653a	1	\$95,050
DE	B1033.653a	1	\$187,249
5% in 50 years	B1033.653a	1	\$187,664
2% in 50 years	B1033.653a	1	\$220,473
MCE _R	B1033.653a	1	\$219,702

Table 2.2. Most damaged Non-Structural components at each intensity level.

Intensity	Component	Damage State	Expected Repair Cost
90% in 50 years	C3011.001c	1	\$13,809
50% in 30 years	C3011.001c	1	\$22,431
50% in 50 years	C1011.001c	1	\$40,703
50% in 75 years	C1011.001c	1	\$61,686
50% in 100 years	B2022.002	2	\$120,091
20% in 50 years	B2022.002	2	\$275,816
10% in 50 years	B2022.002	2	\$616,077
DE	B2022.002	2	\$839,622
5% in 50 years	B2022.002	2	\$835,480
2% in 50 years	B2022.002	2	\$766,151
MCE _R	B2022.002	2	\$730,682

Details of the most damaged components and their damage states:

- **B1031.001:** Bolted shear tab gravity connections
 - DS1a: Yielding of shear tab and elongation of bolt holes, possible crack initiation around bolt holes or at shear tab weld. Damage in field is either obscured or deemed to not warrant repair. No repair conducted.
 - DS1b: Yielding of shear tab and elongation of bolt holes, possible crack initiation around bolt holes or at shear tab weld.
- **B1031.021b:** Welded column splices, Column 150 plf < W < 300 plf
 - DS1a: Ductile fracture of the groove weld flange splice. Damage in field is either obscured or deemed to not warrant repair. No repair conducted.
 - DS1b: Ductile fracture of the groove weld flange splice.
- **B1033.653a:** CoreBrace Buckling Restrained Brace (BRB), Moment-Connected Beams, Chevron Brace, Bolted Connection, Steel Core Area = 5in², Story Height = 14ft, Bay Width = 30ft
 - DS1a: Cracking and tearing of welds and gussets adjacent to welds but crack length is less than critical for fracture. Significant yielding and local buckling in beams and columns adjacent to gusset.
 - DS1b: Severe yielding and buckling of beams and columns adjacent to the gusset with possibility of local tearing in buckled areas. Onset of weld fracture and buckling possible in gusset plates.
 - DS1c: Severe yielding and buckling of beams and columns adjacent to the gusset with possibility of local tearing in buckled areas. Onset of weld fracture and buckling possible in gusset plates. Remaining lateral strength of BRB system is questionable.

- **B2022.002:** Curtain Walls - Generic Midrise Stick-Built Curtain wall, Config: Insulating Glass Units (dual pane), Lamination: Unknown, Glass Type: Unknown, Details: Aspect ratio = 6:5, Other details Unknown
DS2: Glass falls from frame.
- **C1011.001c:** Wall Partition, Type: Gypsum with metal studs, Full Height, Fixed Below, Slip Track Above with returns
DS1: Screw pop-out, cracking of wall board, warping or cracking of tape, slight crushing of wall panel at corners.
- **C3011.001c:** Wall Partition, Type: Gypsum + Wallpaper, Full Height, Fixed Below, Slip Track Above w/ returns (friction connection)
DS1: Wall paper warped and torn.

3 DETAILED COMPONENT DAMAGE BREAKDOWNS

3.1 Repair Cost

This table shows the expected contribution to repair cost on a per-damage state basis. The header shows the total loss, the loss contribution from collapse, and the loss contribution from residual drift for reference.

The color scale is meant to indicate **relative** performance of components, not absolute performance. A “green” value does not indicate that the value falls in a pre-determined “good” range, just that it performs well compared to other components. Likewise, a “red” value does not indicate that the value falls in a pre-determined “bad” range, just that it performs worse compared to other components.

Table 3.1.1. Expected contribution to repair cost per damage state (Dollars)

	90% in 50 years	50% in 30 years	50% in 50 years	50% in 75 years	50% in 100 years	20% in 50 years	10% in 50 years	DE	5% in 50 years	2% in 50 years	MCE _R
Tot. Loss	22.6k	63.6k	171k	312k	459k	930k	2.58M	12.5M	13.7M	32.7M	35.2M
Collapse	0	0	0	0	0	0	0	0	0	908k	1.21M
Residual	0	0	0	0	0	117k	984k	10.3M	11.6M	29.7M	31.9M
B1031.001 #1 (B1031.001: Bolted shear tab gravity connections)											
DS1a	0	0	0	0	0	0	0	0	0	0	0
DS1b	0	0	0	82.4	449	2.55k	9.32k	18.1k	19.2k	22.5k	23.1k
DS2	0	0	0	0	124	708	5.23k	16.5k	15.3k	36k	37.1k
DS3	0	0	0	0	0	126	759	3.35k	2.64k	9.8k	10.8k
Total	0	0	0	82.4	573	3.39k	15.3k	37.9k	37.1k	68.3k	71k
B1031.011b #1 (B1031.011b: Steel Column Base Plates, Column 150 plf < W < 300 plf)											
DS1a	0	0	0	0	0	0	0	0	0	0	0
DS1b	0	0	0	0	33.2	188	1.25k	1.8k	2.81k	3k	2.98k
DS2	0	0	0	0	0	208	1.61k	5.71k	5.97k	12.8k	14.5k
DS3	0	0	0	0	0	0	360	995	1.9k	5.51k	6.07k
Total	0	0	0	0	33.2	396	3.22k	8.51k	10.7k	21.3k	23.5k
B1031.021b #1 (B1031.021b: Welded column splices, Column 150 plf < W < 300 plf)											
DS1a	0	0	0	0	0	0	0	0	0	0	0
DS1b	0	0	116	331	1.23k	2.33k	7.05k	10k	9.48k	8.3k	7.3k
DS2	0	0	0	0	111	1.34k	5.73k	12.9k	13.8k	20.2k	20.7k
Total	0	0	116	331	1.34k	3.67k	12.8k	23k	23.3k	28.5k	28k
B1033.652a #1 (B1033.652a: CoreBrace Buckling Restrained Brace (BRB), Moment-Connected Beams, Chevron...)											
DS1a	0	0	0	39.2	623	2.94k	18k	36.4k	37.4k	45.7k	47k
DS1b	0	0	0	0	284	2.08k	10.8k	18.6k	19.2k	24.4k	23.9k
DS1c	0	0	0	35.6	160	2.31k	10.5k	19.3k	19.7k	25.4k	23.4k
DS2	0	0	0	0	0	355	4.42k	14.2k	15.2k	32.4k	38.8k
Total	0	0	0	74.8	1.07k	7.69k	43.7k	88.5k	91.5k	128k	133k
B1033.653a #1 (B1033.653a: CoreBrace Buckling Restrained Brace (BRB), Moment-Connected Beams, Chevron...)											
DS1a	0	0	0	140	1.34k	9.65k	41.4k	79.3k	77.7k	85.2k	87.8k
DS1b	0	0	0	84.8	689	5.7k	22.5k	43.3k	42.4k	47.3k	45.5k
DS1c	0	0	0	172	840	4.12k	22.3k	41.7k	44.7k	50.1k	45.6k
DS2	0	0	0	0	0	1.26k	8.92k	23k	22.8k	37.8k	40.8k
Total	0	0	0	397	2.87k	20.7k	95.1k	187k	188k	220k	220k
B2011.201a #1 (B2011.201a: Precast Concrete Panels 4.5 inches thick - in plane deformation)											
DS1a	0	8.15	97.2	743	2.02k	6.86k	18.3k	25.2k	25.9k	24.7k	23.6k
DS1b	0	38.2	993	3.06k	10.9k	32.1k	91.7k	134k	127k	121k	115k
Total	0	46.4	1.09k	3.81k	12.9k	38.9k	110k	159k	153k	146k	139k
B2011.201b #1 (B2011.201b: Precast Concrete Panels 4.5 inches thick - out of plane deformation)											
DS1	0	144	1.65k	4.21k	5.54k	8.05k	11.2k	20.8k	22.7k	25.6k	23.2k

Continued on next page

Table 3.1.1 (Continued). Expected contribution to repair cost per damage state (Dollars)

	90% in 50 years	50% in 30 years	50% in 50 years	50% in 75 years	50% in 100 years	20% in 50 years	10% in 50 years	DE	5% in 50 years	2% in 50 years	MCE _R
Tot. Loss	22.6k	63.6k	171k	312k	459k	930k	2.58M	12.5M	13.7M	32.7M	35.2M
Collapse	0	0	0	0	0	0	0	0	0	908k	1.21M
Residual	0	0	0	0	0	117k	984k	10.3M	11.6M	29.7M	31.9M
B2022.002 #1 (B2022.002: Curtain Walls - Generic Midrise Stick-Built Curtain wall, Config:...)											
DS1	7.31	594	5.92k	24.2k	52.1k	102k	185k	210k	206k	153k	142k
DS2	3.47	401	5.03k	26.1k	68k	174k	431k	629k	630k	613k	589k
Total	10.8	995	10.9k	50.3k	120k	276k	616k	840k	835k	766k	731k
C1011.001c #1 (C1011.001c: Wall Partition, Type: Gypsum with metal studs, Full Height, Fixed Below,...)											
DS1	6.66k	19.1k	37.6k	50.3k	54.3k	55.4k	50.2k	35.7k	34.3k	16k	13.8k
DS2	14.3	315	3.07k	10.7k	21.9k	38.2k	62.8k	62.9k	59.6k	36.7k	32.1k
DS3	0	5.14	74.8	650	3.1k	13.1k	45.3k	74.3k	73.2k	73.4k	70.3k
Total	6.68k	19.5k	40.7k	61.7k	79.3k	107k	158k	173k	167k	126k	116k
C2011.001a #1 (C2011.001a: Prefabricated steel stair with steel treads and landings with seismic...)											
DS1	0	8.87	113	709	1.65k	4.05k	8.76k	10.9k	10.6k	8.38k	7.57k
DS2	0	0	21	186	520	1.92k	6.58k	9.3k	8.46k	8.21k	7.55k
DS3	0	0	0	162	1.08k	3.06k	13.2k	21.5k	21.7k	24.3k	26.2k
Total	0	8.87	134	1.06k	3.25k	9.03k	28.5k	41.7k	40.7k	40.9k	41.4k
C3011.001c #1 (C3011.001c: Wall Partition, Type: Gypsum + Wallpaper, Full Height, Fixed Below, Slip...)											
DS1	13.8k	22.4k	29k	32k	33.4k	34.9k	36.4k	30.9k	30.2k	18.1k	16.6k
C3032.004a #1 (C3032.004a: Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): A < 250, Vert & Lat...)											
DS1	9.32	73.5	396	775	905	1.27k	1.86k	2.44k	2.22k	1.88k	1.89k
DS2	4.82	142	543	866	942	1.46k	2.41k	3.33k	3.11k	2.9k	2.87k
DS3	72	376	2.38k	5.15k	5.52k	8.39k	13.8k	21.6k	19.7k	23k	21.5k
Total	86.1	592	3.32k	6.79k	7.36k	11.1k	18k	27.3k	25.1k	27.8k	26.3k
C3032.004b #1 (C3032.004b: Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): 250 < A < 1000, Vert & Lat...)											
DS1	25.2	175	937	1.61k	1.84k	2.76k	3.75k	4.53k	4.38k	3.85k	3.3k
DS2	0	91.1	1.05k	1.71k	1.82k	2.8k	3.88k	5.44k	5.31k	4.62k	4.9k
DS3	0	584	3.48k	7.43k	7.24k	12.1k	18.5k	27.3k	24.8k	27.7k	26.5k
Total	25.2	851	5.46k	10.7k	10.9k	17.7k	26.1k	37.2k	34.5k	36.2k	34.7k
C3032.004c #1 (C3032.004c: Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): 1000 < A < 2500, Vert & Lat...)											
DS1	80.3	626	2.67k	4.36k	5.15k	7.23k	10.3k	12.4k	11.3k	9.71k	9.03k
DS2	0	450	1.42k	3.58k	4.74k	7.1k	9.92k	13.1k	14k	10.2k	10.5k
DS3	126	104	6.13k	10.3k	12.5k	20.3k	28.7k	42.7k	38k	42.7k	40.1k
Total	207	1.18k	10.2k	18.3k	22.4k	34.6k	49k	68.2k	63.3k	62.6k	59.7k
C3032.004d #1 (C3032.004d: Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): A > 2500, Vert & Lat...)											
DS1	80.4	885	3.96k	7.05k	8.04k	11k	16.1k	18.9k	17.4k	14.4k	12.5k
DS2	0	428	3.18k	4.95k	4.64k	8.79k	13.7k	16.8k	17k	15.5k	15k
DS3	0	451	5.67k	12.3k	14.2k	23.4k	35.5k	56.7k	55.3k	58.9k	57.6k
Total	80.4	1.76k	12.8k	24.3k	26.9k	43.1k	65.3k	92.3k	89.7k	88.8k	85.1k
D1014.041 #1 (D1014.041: Traction Elevator Machine room component anchorage. Applies to Seismic Zone...)											
DS1	444	2.5k	6.83k	9.13k	11.2k	12.4k	15.4k	17.1k	15k	12k	10.5k
D1014.042 #1 (D1014.042: Traction Elevator Cab and Counterweight Components. Applies to Seismic Zone...)											
DS1	607	8.39k	28.4k	51.3k	71.5k	108k	168k	197k	195k	147k	134k
D1014.043 #1 (D1014.043: Traction Elevator Guide Rails. Applies to Seismic Zone 3 or greater and...)											
DS1	78	559	2.26k	3.79k	5.44k	8.18k	12.9k	15k	14.3k	11.3k	10.5k
D1014.044 #1 (D1014.044: Traction Elevator Guide Rail Brackets. Applies to Seismic Zone 3 or greater...)											
DS1	334	1.82k	6.74k	12.6k	17.1k	27.5k	42.1k	48.6k	47k	37.3k	34.5k

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Table 3.1.1 (Continued). Expected contribution to repair cost per damage state (Dollars)

	90% in 50 years	50% in 30 years	50% in 50 years	50% in 75 years	50% in 100 years	20% in 50 years	10% in 50 years	DE	5% in 50 years	2% in 50 years	MCE _R
Tot. Loss	22.6k	63.6k	171k	312k	459k	930k	2.58M	12.5M	13.7M	32.7M	35.2M
Collapse	0	0	0	0	0	0	0	0	0	908k	1.21M
Residual	0	0	0	0	0	117k	984k	10.3M	11.6M	29.7M	31.9M
D2021.014a #1 (D2021.014a: Cold or Hot Potable - Small Diameter Threaded Steel - (2.5 inches in...))											
DS1	0	8.68	59.6	117	121	207	314	471	403	417	415
DS2	0	0	27.1	56.8	99.3	77.1	248	445	392	500	471
Total	0	8.68	86.7	174	221	284	562	915	795	918	886
D2021.014b #1 (D2021.014b: Cold or Hot Potable - Small Diameter Threaded Steel - (2.5 inches in...))											
DS1	11.2	80.5	376	675	756	1.12k	1.55k	2.05k	1.88k	1.64k	1.53k
D2021.024a #1 (D2021.024a: Cold or Hot Potable Water Piping (dia > 2.5 inches), SDC D,E,F (OSPHD or...))											
DS1	1.4	5.86	40	92.8	96.8	152	272	384	364	342	334
DS2	0	4.44	27.6	52.6	65	116	183	402	319	463	358
Total	1.4	10.3	67.5	145	162	268	455	787	683	806	691
D2021.024b #1 (D2021.024b: Cold or Hot Potable Water Piping (dia > 2.5 inches), SDC D,E,F (OSPHD or...))											
DS1	6.34	45	187	300	368	486	735	886	835	670	635
DS2	0.97	8.9	44.2	96.4	98.6	171	252	424	385	366	414
Total	7.31	53.9	232	396	467	657	987	1.31k	1.22k	1.04k	1.05k
D2031.014b #1 (D2031.014b: Sanitary Waste Piping - Cast Iron w/flexible couplings, SDC D,E,F (OSHPD or...))											
DS1	0.8	8.18	39.2	62.3	89.8	146	231	344	336	357	335
D3032.013f #1 (D3032.013f: Compressor - Capacity: Large non medical air supply - Equipment that is...)											
DS1a	0	0	1.29	1.63	6.78	11.4	38.6	45.3	50.3	65.2	65.5
DS1b	0	0	0	0	21.4	37.1	183	233	103	273	347
DS1c	0	0	0	19.5	3.8	37.1	60.5	148	114	181	117
DS1d	0	0	20.1	14.3	103	121	196	326	315	445	385
Total	0	0	21.4	35.4	135	207	478	752	582	963	914
D3032.013f #2 (D3032.013f: Compressor - Capacity: Large non medical air supply - Equipment that is...)											
DS1a	0	0	3.04	7.42	11.7	23.6	55.4	82.2	69.5	119	89.3
DS1b	0	8.76	0	32.3	61.9	196	96.7	384	366	379	359
DS1c	0	0	11.6	27.9	17.5	74.7	124	192	162	177	215
DS1d	0	11.4	23.2	46.2	67.1	166	399	530	703	567	729
Total	0	20.1	37.9	114	158	460	675	1.19k	1.3k	1.24k	1.39k
D3032.013f #3 (D3032.013f: Compressor - Capacity: Large non medical air supply - Equipment that is...)											
DS1a	0	0	2.12	6.62	16.2	17.1	51.1	73.7	68.9	88.9	102
DS1b	0	0	32.3	48.2	20.9	61.6	289	332	380	305	422
DS1c	0	0	11.4	21.5	24.3	64.7	98.8	231	193	183	214
DS1d	0	0	47.5	69.9	146	117	368	751	554	573	570
Total	0	0	93.3	146	208	260	807	1.39k	1.2k	1.15k	1.31k
D3032.013f #4 (D3032.013f: Compressor - Capacity: Large non medical air supply - Equipment that is...)											
DS1a	0	0	6.74	12.6	27	50.9	95.8	124	121	133	115
DS1b	0	0	55.3	198	123	259	364	417	476	438	442
DS1c	0	0	39.8	79.8	81.1	71	235	320	346	308	256
DS1d	0	0	47.1	128	155	367	546	796	774	942	960
Total	0	0	149	418	386	748	1.24k	1.66k	1.72k	1.82k	1.77k
D3032.013f #5 (D3032.013f: Compressor - Capacity: Large non medical air supply - Equipment that is...)											
DS1a	1.01	4.12	10.7	28.1	27.3	37.5	89.1	102	75.7	109	127
DS1b	0	14.5	40	73.1	92.8	257	430	509	522	506	407
DS1c	3.21	4.91	21.7	78.1	95.2	114	195	292	316	241	221
DS1d	0	26.7	144	212	185	352	530	910	659	806	782
Total	4.22	50.3	216	391	400	761	1.24k	1.81k	1.57k	1.66k	1.54k

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Table 3.1.1 (Continued). Expected contribution to repair cost per damage state (Dollars)

	90% in 50 years	50% in 30 years	50% in 50 years	50% in 75 years	50% in 100 years	20% in 50 years	10% in 50 years	DE	5% in 50 years	2% in 50 years	MCE _R
Tot. Loss	22.6k	63.6k	171k	312k	459k	930k	2.58M	12.5M	13.7M	32.7M	35.2M
Collapse	0	0	0	0	0	0	0	0	0	908k	1.21M
Residual	0	0	0	0	0	117k	984k	10.3M	11.6M	29.7M	31.9M
D3032.013f #6 (D3032.013f: Compressor - Capacity: Large non medical air supply - Equipment that is...)											
DS1a	0	3.3	15.8	31.7	33.6	60.7	108	132	116	119	92.8
DS1b	0	21.9	104	148	166	317	479	537	586	445	405
DS1c	0	11.4	20.5	69.5	104	164	225	299	269	243	225
DS1d	0	0	150	203	229	441	510	1.05k	751	878	830
Total	0	36.6	291	452	533	983	1.32k	2.02k	1.72k	1.68k	1.55k
D3032.013f #7 (D3032.013f: Compressor - Capacity: Large non medical air supply - Equipment that is...)											
DS1a	0	6.97	24.4	37.3	43.7	58.3	73.2	113	91.8	94.9	88.8
DS1b	0	15.1	64.2	108	78.9	229	466	358	518	365	311
DS1c	0	7.72	21.3	68.8	99.3	105	196	255	254	245	181
DS1d	0	15.1	84.2	291	162	320	671	974	759	768	838
Total	0	44.9	194	505	384	712	1.41k	1.7k	1.62k	1.47k	1.42k
D3032.013f #8 (D3032.013f: Compressor - Capacity: Large non medical air supply - Equipment that is...)											
DS1a	1.78	17.9	53.3	88.5	111	106	142	154	135	136	113
DS1b	11.2	56.5	202	347	541	584	549	945	607	669	712
DS1c	12.6	57.1	185	274	223	296	406	411	397	294	268
DS1d	10.4	136	371	766	717	933	832	995	1.06k	998	771
Total	35.9	268	812	1.48k	1.59k	1.92k	1.93k	2.51k	2.2k	2.1k	1.86k
D3041.011f #1 (D3041.011f: (ATC-138 Beta) HVAC Galvanized Sheet Metal Ducting less than 6 sq. ft in...)											
DS1	0	3.21	19.7	47	45.2	74.5	117	195	192	210	206
DS2	0	0	24.3	78.5	73.9	87.1	166	376	297	445	433
Total	0	3.21	44	125	119	162	283	571	489	655	639
D3041.012d #1 (D3041.012d: HVAC Galvanized Sheet Metal Ducting - 6 sq. ft cross sectional area or...)											
DS1	0.29	0.17	1.21	2.92	5.21	8.25	12.1	19.8	24.6	22.3	21.7
DS2	0	2.27	10.5	23.3	14.7	39.8	54.9	118	115	173	128
Total	0.29	2.44	11.7	26.2	19.9	48	67	138	140	195	150
D3041.031e #1 (D3041.031e: (ATC-138 Beta) (RUGGED) HVAC Drops / Diffusers in suspended ceilings - With...)											
DS1	0	0	0	0	0	0	0	0	0	0	0
D3041.103c #1 (D3041.103c: HVAC Fan - Capacity: all - Equipment that is either hard anchored or is...)											
DS1a	6.23	35.5	136	309	310	440	559	755	635	599	571
DS1b	11.1	147	296	566	574	836	1.18k	1.57k	1.37k	1.2k	1.18k
DS1c	24.9	218	792	1.38k	1.6k	2.29k	3.4k	4.07k	3.78k	3.52k	3k
Total	42.2	401	1.22k	2.26k	2.49k	3.56k	5.14k	6.4k	5.79k	5.32k	4.74k
D4011.024a #1 (D4011.024a: Fire Sprinkler Water Piping - Horizontal Mains and Branches - Old Style...)											
DS1	1.8	47.3	200	392	461	685	994	1.35k	1.28k	1.17k	1.21k
DS2	3.39	13.1	114	317	296	542	782	1.52k	1.16k	1.54k	1.39k
Total	5.19	60.4	314	709	757	1.23k	1.78k	2.88k	2.45k	2.71k	2.6k
D4011.054a #1 (D4011.054a: Fire Sprinkler Drop Standard Threaded Steel - Dropping into braced lay-in...)											
DS1	4.44	30.9	149	263	296	459	699	897	789	765	743
DS2	0	2.32	14.8	48.3	61.5	82.2	152	233	192	219	233
Total	4.44	33.3	163	312	358	542	851	1.13k	981	985	976
D5011.013c #1 (D5011.013c: Transformer/primary service - Capacity: <100 kVA - Equipment that is either...)											
DS1a	0	0.97	14.5	26.8	48.1	69.9	134	172	185	193	180
DS1b	0	0	11.6	139	79.8	235	596	653	719	641	587
DS1c	0	20.6	136	256	359	788	1.35k	2.02k	1.95k	2k	1.81k
Total	0	21.6	162	421	487	1.09k	2.08k	2.85k	2.85k	2.83k	2.57k

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Table 3.1.1 (Continued). Expected contribution to repair cost per damage state (Dollars)

	90% in 50 years	50% in 30 years	50% in 50 years	50% in 75 years	50% in 100 years	20% in 50 years	10% in 50 years	DE	5% in 50 years	2% in 50 years	MCE _R
Tot. Loss	22.6k	63.6k	171k	312k	459k	930k	2.58M	12.5M	13.7M	32.7M	35.2M
Collapse	0	0	0	0	0	0	0	0	0	908k	1.21M
Residual	0	0	0	0	0	117k	984k	10.3M	11.6M	29.7M	31.9M
D5012.013d #1 (D5012.013d: Motor Control Center - Capacity: all - Equipment that is either hard...)											
DS1a	1.12	1.19	21.4	41.2	39	86.7	138	162	180	137	130
DS1b	0	6.66	79.2	148	230	327	571	675	805	618	634
DS1c	5.93	51.6	219	384	529	1.03k	1.75k	2.18k	2k	1.92k	1.72k
Total	7.05	59.5	320	573	798	1.44k	2.45k	3.02k	2.98k	2.68k	2.48k
D5012.023c #1 (D5012.023c: Low Voltage Switchgear - Capacity: 100 to <350 Amp - Equipment that is...)											
DS1a	0.56	6.41	16	34.1	39.6	73.7	135	203	169	139	134
DS1b	0	10.3	140	316	430	591	1.21k	1.46k	1.49k	1.21k	1.09k
DS1c	10.4	135	462	958	1.33k	2.39k	3.85k	4.92k	4.74k	4.11k	3.84k
Total	11	151	618	1.31k	1.8k	3.05k	5.19k	6.58k	6.4k	5.46k	5.06k
D5012.033c #1 (D5012.033c: Distribution Panel - Capacity: 100 to <350 Amp - Equipment that is either...)											
DS1a	3.61	35.9	85.5	213	218	296	425	521	501	437	375
DS1b	12.9	322	995	1.57k	1.79k	2.77k	3.32k	4.3k	3.89k	3.83k	3.31k
DS1c	115	943	3.16k	5.4k	5.83k	8.37k	11.7k	14k	13.3k	10.9k	11.1k
Total	132	1.3k	4.24k	7.18k	7.83k	11.4k	15.4k	18.8k	17.7k	15.2k	14.7k
D5092.013c #1 (D5092.013c: Battery Rack - Capacity: all - Equipment that is either hard anchored or is...)											
DS1a	0	1.53	8.23	24.8	34.6	73.3	155	231	212	198	199
DS1b	0	0	90.7	136	348	458	1.15k	1.26k	1.47k	1.65k	1.46k
DS1c	0	0	32.2	146	172	277	785	1.18k	1.19k	1.35k	1.13k
DS1d	0	17.4	72.5	226	392	626	1.34k	1.84k	1.77k	1.62k	1.72k
DS1e	0	50.1	22.7	65.2	102	425	528	1.25k	947	853	723
Total	0	69	226	599	1.05k	1.86k	3.95k	5.77k	5.58k	5.66k	5.24k
D5092.023c #1 (D5092.023c: Battery Charger - Capacity: all - Equipment that is either hard anchored or...)											
DS1a	0.96	0	9.48	22.8	33.3	55.1	137	188	143	154	130
DS1b	0	0	58.7	188	274	410	946	1.32k	1.4k	1.26k	1.16k
DS1c	0	36.3	81	310	380	740	1.13k	2.19k	2.09k	1.76k	2.23k
DS1d	0	21	40.4	74.3	398	685	1.46k	2.31k	1.69k	2.02k	1.82k
Total	0.96	57.3	190	595	1.09k	1.89k	3.67k	6.01k	5.32k	5.2k	5.34k
D5092.033c #1 (D5092.033c: Diesel generator - Capacity: 100 to <350 kVA - Equipment that is either...)											
DS1a	0.81	9.17	8.96	33.2	66.6	149	272	416	383	395	358
DS1b	0	155	1.28k	1.62k	3.16k	5.85k	12.4k	14.9k	14.6k	15.8k	11.6k
DS1c	0	1.11	3.72	9.8	16.2	32.3	67.8	85	82.2	75.3	82.4
DS1d	0	0	0	15.7	24.7	57.2	80.6	139	143	128	106
DS1e	0	0	1.06	2.04	2.39	13.4	24.2	23.5	27.7	20.2	27.9
Total	0.81	166	1.29k	1.68k	3.27k	6.11k	12.8k	15.5k	15.3k	16.5k	12.2k

3.2 Repair time

This table shows the expected worker days on a per-damage state basis. The header shows the probability of global failures (collapse and residual drift demolition) for reference.

The color scale is meant to indicate **relative** performance of components, not absolute performance. A “green” value does not indicate that the value falls in a pre-determined “good” range, just that it performs well compared to other components. Likewise, a “red” value does not indicate that the value falls in a pre-determined “bad” range, just that it performs worse compared to other components.

Table 3.2.1. Expected worker days per damage state (Worker Days)

	90% in 50 years	50% in 30 years	50% in 50 years	50% in 75 years	50% in 100 years	20% in 50 years	10% in 50 years	DE	5% in 50 years	2% in 50 years	MCE _R
P[Col](%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	2.1
P[Res](%)	0.0	0.0	0.0	0.0	0.0	0.2	1.7	18	20	51	54
B1031.001 #1 (B1031.001: Bolted shear tab gravity connections)											
DS1a	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DS1b	0.0	0.0	0.0	0.0	0.1	0.8	3.1	5.7	6.2	7.3	7.4
DS2	0.0	0.0	0.0	0.0	0.0	0.2	1.6	5.4	4.8	11	12
DS3	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.0	0.9	2.6	3.9
Total	0.0	0.0	0.0	0.0	0.2	1.0	5.0	12	12	21	24
B1031.011b #1 (B1031.011b: Steel Column Base Plates, Column 150 plf < W < 300 plf)											
DS1a	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DS1b	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.5	0.7	0.7	0.8
DS2	0.0	0.0	0.0	0.0	0.0	0.1	0.4	1.2	1.5	3.2	3.7
DS3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.4	1.5	1.5
Total	0.0	0.0	0.0	0.0	0.0	0.1	0.8	2.0	2.6	5.4	5.9
B1031.021b #1 (B1031.021b: Welded column splices, Column 150 plf < W < 300 plf)											
DS1a	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DS1b	0.0	0.0	0.0	0.1	0.3	0.6	1.7	2.5	2.3	1.9	1.9
DS2	0.0	0.0	0.0	0.0	0.0	0.3	1.5	3.2	3.5	4.7	5.1
Total	0.0	0.0	0.0	0.1	0.3	0.9	3.2	5.7	5.8	6.6	6.9
B1033.652a #1 (B1033.652a: CoreBrace Buckling Restrained Brace (BRB), Moment-Connected Beams, Chevron...)											
DS1a	0.0	0.0	0.0	0.0	0.1	0.7	4.0	7.7	8.3	10	10
DS1b	0.0	0.0	0.0	0.0	0.1	0.5	2.5	4.2	4.4	5.4	5.1
DS1c	0.0	0.0	0.0	0.0	0.0	0.6	2.3	4.1	4.6	5.3	5.1
DS2	0.0	0.0	0.0	0.0	0.0	0.1	1.0	3.1	3.4	7.1	8.3
Total	0.0	0.0	0.0	0.0	0.2	1.8	10	19	21	28	29
B1033.653a #1 (B1033.653a: CoreBrace Buckling Restrained Brace (BRB), Moment-Connected Beams, Chevron...)											
DS1a	0.0	0.0	0.0	0.0	0.4	2.1	8.9	17	17	19	19
DS1b	0.0	0.0	0.0	0.0	0.2	1.2	4.9	8.9	9.4	11	10
DS1c	0.0	0.0	0.0	0.0	0.2	0.9	5.2	9.2	10	11	10
DS2	0.0	0.0	0.0	0.0	0.0	0.3	2.0	5.0	5.1	8.5	9.0
Total	0.0	0.0	0.0	0.1	0.7	4.5	21	40	42	49	49
B2011.201a #1 (B2011.201a: Precast Concrete Panels 4.5 inches thick - in plane deformation)											
DS1a	0.0	0.0	0.0	0.0	0.1	0.3	0.9	1.2	1.2	1.2	1.2
DS1b	0.0	0.0	0.0	0.1	0.5	1.6	4.5	6.6	6.2	5.9	5.6
Total	0.0	0.0	0.0	0.2	0.6	1.9	5.4	7.8	7.5	7.1	6.7
B2011.201b #1 (B2011.201b: Precast Concrete Panels 4.5 inches thick - out of plane deformation)											
DS1	0.0	0.0	0.1	0.2	0.3	0.4	0.6	1.0	1.1	1.3	1.2

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Table 3.2.1 (Continued). Expected worker days per damage state (Worker Days)

	90% in 50 years	50% in 30 years	50% in 50 years	50% in 75 years	50% in 100 years	20% in 50 years	10% in 50 years	DE	5% in 50 years	2% in 50 years	MCE _R
P[Col](%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	2.1
P[Res](%)	0.0	0.0	0.0	0.0	0.0	0.2	1.7	18	20	51	54
B2022.002 #1 (B2022.002: Curtain Walls - Generic Midrise Stick-Built Curtain wall, Config:...)											
DS1	0.0	0.1	0.9	3.5	7.5	15	27	31	30	22	21
DS2	0.0	0.1	0.8	3.8	10	25	63	92	94	90	86
Total	0.0	0.1	1.6	7.4	18	40	90	123	123	112	107
C1011.001c #1 (C1011.001c: Wall Partition, Type: Gypsum with metal studs, Full Height, Fixed Below,...)											
DS1	1.7	4.4	8.7	12	13	13	12	8.3	8.1	3.8	3.2
DS2	0.0	0.1	0.8	2.8	5.5	10	17	16	16	9.1	8.6
DS3	0.0	0.0	0.0	0.2	0.8	3.3	12	19	19	19	19
Total	1.7	4.5	10	15	19	26	40	44	43	32	30
C2011.001a #1 (C2011.001a: Prefabricated steel stair with steel treads and landings with seismic...)											
DS1	0.0	0.0	0.0	0.2	0.4	1.1	2.2	2.9	2.8	2.2	1.9
DS2	0.0	0.0	0.0	0.0	0.2	0.5	1.7	2.5	2.3	2.2	1.9
DS3	0.0	0.0	0.0	0.0	0.3	0.9	3.4	5.3	5.7	6.2	6.6
Total	0.0	0.0	0.0	0.3	0.9	2.4	7.3	11	11	11	10
C3011.001c #1 (C3011.001c: Wall Partition, Type: Gypsum + Wallpaper, Full Height, Fixed Below, Slip...)											
DS1	4.3	6.9	8.9	10	10	11	11	10	9.3	5.6	5.2
C3032.004a #1 (C3032.004a: Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): A < 250, Vert & Lat...)											
DS1	0.0	0.0	0.1	0.3	0.3	0.4	0.6	0.8	0.7	0.6	0.6
DS2	0.0	0.0	0.2	0.3	0.3	0.4	0.8	1.1	1.0	0.9	0.9
DS3	0.0	0.1	0.8	1.6	1.7	2.7	4.2	6.8	6.3	7.4	6.8
Total	0.0	0.2	1.1	2.2	2.3	3.5	5.6	8.7	8.0	9.0	8.3
C3032.004b #1 (C3032.004b: Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): 250 < A < 1000, Vert & Lat...)											
DS1	0.0	0.0	0.3	0.5	0.6	0.8	1.1	1.4	1.3	1.1	1.0
DS2	0.0	0.0	0.3	0.5	0.6	0.8	1.1	1.6	1.6	1.4	1.4
DS3	0.0	0.1	1.1	2.3	2.1	3.8	5.5	8.2	7.5	8.3	8.0
Total	0.0	0.2	1.6	3.3	3.3	5.4	7.7	11	10	11	10
C3032.004c #1 (C3032.004c: Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): 1000 < A < 2500, Vert & Lat...)											
DS1	0.0	0.2	0.7	1.3	1.5	2.2	3.2	3.7	3.4	2.9	2.8
DS2	0.0	0.1	0.4	1.2	1.5	2.0	2.8	3.9	3.7	3.1	2.9
DS3	0.0	0.1	1.8	2.8	3.7	6.2	8.2	13	12	12	12
Total	0.0	0.4	3.0	5.4	6.8	10	14	20	19	18	18
C3032.004d #1 (C3032.004d: Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): A > 2500, Vert & Lat...)											
DS1	0.0	0.3	1.1	1.9	2.3	3.1	4.7	5.2	4.8	3.9	3.8
DS2	0.0	0.2	0.8	1.4	1.3	2.3	3.9	5.3	4.8	4.8	4.5
DS3	0.0	0.1	1.4	3.5	3.9	6.7	10	15	16	17	16
Total	0.0	0.5	3.3	6.8	7.4	12	19	26	26	25	24
D1014.041 #1 (D1014.041: Traction Elevator Machine room component anchorage. Applies to Seismic Zone...)											
DS1	0.1	0.6	2.1	3.4	3.4	3.6	4.7	5.1	4.7	3.3	3.3
D1014.042 #1 (D1014.042: Traction Elevator Cab and Counterweight Components. Applies to Seismic Zone...)											
DS1	0.3	2.5	10	17	23	35	53	63	62	47	44
D1014.043 #1 (D1014.043: Traction Elevator Guide Rails. Applies to Seismic Zone 3 or greater and...)											
DS1	0.0	0.2	0.7	1.2	1.8	2.6	4.1	4.7	4.5	3.6	3.2
D1014.044 #1 (D1014.044: Traction Elevator Guide Rail Brackets. Applies to Seismic Zone 3 or greater...)											
DS1	0.1	0.4	1.5	2.8	3.9	6.0	10	11	10	8.5	7.6

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Table 3.2.1 (Continued). Expected worker days per damage state (Worker Days)

	90% in 50 years	50% in 30 years	50% in 50 years	50% in 75 years	50% in 100 years	20% in 50 years	10% in 50 years	DE	5% in 50 years	2% in 50 years	MCE _R
P[Col](%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	2.1
P[Res](%)	0.0	0.0	0.0	0.0	0.0	0.2	1.7	18	20	51	54
D2021.014a #1 (D2021.014a: Cold or Hot Potable - Small Diameter Threaded Steel - (2.5 inches in...))											
DS1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.1	0.2
DS2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.2	0.2
Total	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.4	0.3	0.3	0.3
D2021.014b #1 (D2021.014b: Cold or Hot Potable - Small Diameter Threaded Steel - (2.5 inches in...))											
DS1	0.0	0.0	0.1	0.2	0.3	0.4	0.6	0.7	0.7	0.6	0.5
D2021.024a #1 (D2021.024a: Cold or Hot Potable Water Piping (dia > 2.5 inches), SDC D,E,F (OSPHD or...))											
DS1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
DS2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.1
Total	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.3	0.2	0.3	0.3
D2021.024b #1 (D2021.024b: Cold or Hot Potable Water Piping (dia > 2.5 inches), SDC D,E,F (OSPHD or...))											
DS1	0.0	0.0	0.1	0.1	0.1	0.2	0.3	0.3	0.3	0.2	0.2
DS2	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Total	0.0	0.0	0.1	0.1	0.2	0.2	0.4	0.5	0.4	0.4	0.4
D2031.014b #1 (D2031.014b: Sanitary Waste Piping - Cast Iron w/flexible couplings, SDC D,E,F (OSHPD or...))											
DS1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
D3032.013f #1 (D3032.013f: Compressor - Capacity: Large non medical air supply - Equipment that is...)											
DS1a	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DS1b	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
DS1c	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0
DS1d	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.1
Total	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.2	0.3	0.3
D3032.013f #2 (D3032.013f: Compressor - Capacity: Large non medical air supply - Equipment that is...)											
DS1a	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DS1b	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0
DS1c	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
DS1d	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.3	0.2	0.3
Total	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.4	0.4	0.4	0.4
D3032.013f #3 (D3032.013f: Compressor - Capacity: Large non medical air supply - Equipment that is...)											
DS1a	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DS1b	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1
DS1c	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
DS1d	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.3	0.2	0.2	0.2
Total	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.5	0.4	0.4	0.4
D3032.013f #4 (D3032.013f: Compressor - Capacity: Large non medical air supply - Equipment that is...)											
DS1a	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DS1b	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
DS1c	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
DS1d	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.3	0.3	0.4	0.4
Total	0.0	0.0	0.0	0.1	0.1	0.2	0.4	0.5	0.6	0.6	0.6
D3032.013f #5 (D3032.013f: Compressor - Capacity: Large non medical air supply - Equipment that is...)											
DS1a	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
DS1b	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
DS1c	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
DS1d	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.4	0.3	0.3	0.3
Total	0.0	0.0	0.1	0.1	0.1	0.3	0.4	0.6	0.5	0.5	0.5

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Table 3.2.1 (Continued). Expected worker days per damage state (Worker Days)

	90% in 50 years	50% in 30 years	50% in 50 years	50% in 75 years	50% in 100 years	20% in 50 years	10% in 50 years	DE	5% in 50 years	2% in 50 years	MCE _R
P[Col](%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	2.1
P[Res](%)	0.0	0.0	0.0	0.0	0.0	0.2	1.7	18	20	51	54
D3032.013f #6 (D3032.013f: Compressor - Capacity: Large non medical air supply - Equipment that is...)											
DS1a	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0
DS1b	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
DS1c	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
DS1d	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.4	0.3	0.4	0.3
Total	0.0	0.0	0.1	0.1	0.2	0.3	0.4	0.7	0.5	0.6	0.5
D3032.013f #7 (D3032.013f: Compressor - Capacity: Large non medical air supply - Equipment that is...)											
DS1a	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DS1b	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0
DS1c	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
DS1d	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.4	0.3	0.3	0.3
Total	0.0	0.0	0.1	0.2	0.1	0.2	0.4	0.6	0.5	0.5	0.5
D3032.013f #8 (D3032.013f: Compressor - Capacity: Large non medical air supply - Equipment that is...)											
DS1a	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.0
DS1b	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1
DS1c	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.1
DS1d	0.0	0.1	0.1	0.3	0.3	0.4	0.3	0.4	0.4	0.4	0.3
Total	0.0	0.1	0.3	0.5	0.5	0.6	0.6	0.8	0.7	0.7	0.5
D3041.011f #1 (D3041.011f: (ATC-138 Beta) HVAC Galvanized Sheet Metal Ducting less than 6 sq. ft in...)											
DS1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
DS2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
D3041.012d #1 (D3041.012d: HVAC Galvanized Sheet Metal Ducting - 6 sq. ft cross sectional area or...)											
DS1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DS2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D3041.031e #1 (D3041.031e: (ATC-138 Beta) (RUGGED) HVAC Drops / Diffusers in suspended ceilings - With...)											
DS1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D3041.103c #1 (D3041.103c: HVAC Fan - Capacity: all - Equipment that is either hard anchored or is...)											
DS1a	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.3	0.2	0.2	0.2
DS1b	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
DS1c	0.0	0.1	0.3	0.5	0.6	0.9	1.3	1.5	1.5	1.4	1.1
Total	0.0	0.1	0.4	0.7	0.8	1.1	1.6	1.9	1.8	1.7	1.4
D4011.024a #1 (D4011.024a: Fire Sprinkler Water Piping - Horizontal Mains and Branches - Old Style...)											
DS1	0.0	0.0	0.1	0.1	0.2	0.3	0.4	0.5	0.5	0.5	0.5
DS2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
Total	0.0	0.0	0.1	0.2	0.2	0.3	0.5	0.6	0.6	0.6	0.5
D4011.054a #1 (D4011.054a: Fire Sprinkler Drop Standard Threaded Steel - Dropping into braced lay-in...)											
DS1	0.0	0.0	0.1	0.1	0.1	0.2	0.3	0.4	0.3	0.3	0.3
DS2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	0.0	0.1	0.1	0.1	0.2	0.3	0.4	0.3	0.3	0.3
D5011.013c #1 (D5011.013c: Transformer/primary service - Capacity: <100 kVA - Equipment that is either...)											
DS1a	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
DS1b	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.1
DS1c	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.1
Total	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.3	0.3	0.3

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Table 3.2.1 (Continued). Expected worker days per damage state (Worker Days)

	90% in 50 years	50% in 30 years	50% in 50 years	50% in 75 years	50% in 100 years	20% in 50 years	10% in 50 years	DE	5% in 50 years	2% in 50 years	MCE _R
P[Col](%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	2.1
P[Res](%)	0.0	0.0	0.0	0.0	0.0	0.2	1.7	18	20	51	54
D5012.013d #1 (D5012.013d: Motor Control Center - Capacity: all - Equipment that is either hard...)											
DS1a	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
DS1b	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
DS1c	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2
Total	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.4	0.4	0.3	0.3
D5012.023c #1 (D5012.023c: Low Voltage Switchgear - Capacity: 100 to <350 Amp - Equipment that is...)											
DS1a	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
DS1b	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.1	0.1
DS1c	0.0	0.0	0.1	0.1	0.1	0.3	0.4	0.5	0.5	0.4	0.4
Total	0.0	0.0	0.1	0.2	0.2	0.3	0.6	0.7	0.7	0.6	0.6
D5012.033c #1 (D5012.033c: Distribution Panel - Capacity: 100 to <350 Amp - Equipment that is either...)											
DS1a	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2
DS1b	0.0	0.0	0.1	0.2	0.2	0.4	0.4	0.5	0.4	0.4	0.3
DS1c	0.0	0.1	0.4	0.7	0.7	1.0	1.4	1.5	1.5	1.1	1.1
Total	0.0	0.2	0.6	1.0	1.1	1.5	2.0	2.2	2.1	1.7	1.6
D5092.013c #1 (D5092.013c: Battery Rack - Capacity: all - Equipment that is either hard anchored or is...)											
DS1a	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
DS1b	0.0	0.0	0.0	0.1	0.2	0.2	0.5	0.6	0.6	0.7	0.7
DS1c	0.0	0.0	0.0	0.1	0.1	0.1	0.3	0.5	0.5	0.6	0.5
DS1d	0.0	0.0	0.0	0.1	0.2	0.3	0.6	0.8	0.8	0.7	0.8
DS1e	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.6	0.4	0.4	0.3
Total	0.0	0.0	0.1	0.3	0.5	0.8	1.8	2.6	2.5	2.5	2.4
D5092.023c #1 (D5092.023c: Battery Charger - Capacity: all - Equipment that is either hard anchored or...)											
DS1a	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0
DS1b	0.0	0.0	0.0	0.1	0.1	0.1	0.4	0.5	0.6	0.5	0.5
DS1c	0.0	0.0	0.0	0.1	0.1	0.3	0.5	0.8	0.8	0.7	0.9
DS1d	0.0	0.0	0.0	0.0	0.2	0.3	0.5	0.9	0.7	0.8	0.7
Total	0.0	0.0	0.1	0.2	0.4	0.7	1.5	2.3	2.1	2.0	2.0
D5092.033c #1 (D5092.033c: Diesel generator - Capacity: 100 to <350 kVA - Equipment that is either...)											
DS1a	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DS1b	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.1
DS1c	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DS1d	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DS1e	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2

3.3 Casualties

Table 3.3.1 shows the total expected casualty results broken into collapse and non-collapse sources. The non-parenthetical values are casualties in terms of number of people and the parenthetical values show the probability of casualty for an individual person placed randomly in the building.

Table 3.3.2 shows the casualty breakdown on a per component basis. The values in this table are in terms of number of people, not probabilities.

The color scale is meant to indicate **relative** performance of components, not absolute performance. A “green” value does not indicate that the value falls in a pre-determined “good” range, just that it performs well compared to other components. Likewise, a “red” value does not indicate that the value falls in a pre-determined “bad” range, just that it performs worse compared to other components.

Table 3.3.1. Total expected casualties (Number of People (%))

	90% in 50 years	50% in 30 years	50% in 50 years	50% in 75 years	50% in 100 years	20% in 50 years	10% in 50 years	DE	5% in 50 years	2% in 50 years	MCE _R
Total Non-Collapse Casualties											
Injury	0.000036 (0.000)	0.00195 (0.003)	0.0222 (0.029)	0.0451 (0.059)	0.0613 (0.081)	0.125 (0.164)	0.254 (0.335)	0.446 (0.588)	0.465 (0.612)	0.922 (1.22)	0.873 (1.15)
Death	0.000010 (0.000)	0.000111 (0.000)	0.000494 (0.001)	0.000830 (0.001)	0.000958 (0.001)	0.00156 (0.002)	0.00252 (0.003)	0.00339 (0.004)	0.00354 (0.005)	0.00434 (0.006)	0.00439 (0.006)
Total Collapse Casualties											
Injury	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.532 (0.702)	0.709 (0.934)
Death	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.0591 (0.078)	0.0787 (0.104)
Total Collapse and Non-Collapse Casualties											
Injury	0.000036 (0.000)	0.00195 (0.003)	0.0222 (0.029)	0.0451 (0.059)	0.0613 (0.081)	0.125 (0.164)	0.254 (0.335)	0.446 (0.588)	0.465 (0.612)	1.44 (1.90)	1.56 (2.06)
Death	0.000010 (0.000)	0.000111 (0.000)	0.000494 (0.001)	0.000830 (0.001)	0.000958 (0.001)	0.00156 (0.002)	0.00252 (0.003)	0.00339 (0.004)	0.00354 (0.005)	0.0634 (0.084)	0.0830 (0.109)

Table 3.3.2. Expected casualties per component (Number of People)

	90% in 50 years	50% in 30 years	50% in 50 years	50% in 75 years	50% in 100 years	20% in 50 years	10% in 50 years	DE	5% in 50 years	2% in 50 years	MCE _R
B2022.002 #1 (B2022.002: Curtain Walls - Generic Midrise Stick-Built Curtain wall, Config:...)											
Injury	0.00	0.000023	0.000438	0.00250	0.00764	0.0237	0.0664	0.142	0.154	0.278	0.271
Death	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C3032.004a #1 (C3032.004a: Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): A < 250, Vert & Lat...)											
Injury	0.000010	0.000613	0.00410	0.00753	0.0104	0.0197	0.0368	0.0584	0.0640	0.144	0.120
Death	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C3032.004b #1 (C3032.004b: Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): 250 < A < 1000, Vert & Lat...)											
Injury	0.00	0.000896	0.00559	0.0132	0.0122	0.0264	0.0497	0.0703	0.0727	0.157	0.158
Death	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C3032.004c #1 (C3032.004c: Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): 1000 < A < 2500, Vert & Lat...)											
Injury	0.00	0.00	0.00606	0.0110	0.0122	0.0225	0.0448	0.0797	0.0716	0.153	0.148
Death	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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Table 3.3.2 (Continued). Expected casualties per component (Number of People)

	90% in 50 years	50% in 30 years	50% in 50 years	50% in 75 years	50% in 100 years	20% in 50 years	10% in 50 years	DE	5% in 50 years	2% in 50 years	MCE _R
C3032.004d #1 (C3032.004d: Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): A > 2500, Vert & Lat...)											
Injury	0.00	0.000216	0.00511	0.00926	0.0168	0.0292	0.0515	0.0893	0.0958	0.181	0.167
Death	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D1014.042 #1 (D1014.042: Traction Elevator Cab and Counterweight Components. Applies to Seismic Zone...)											
Injury	0.000026	0.000201	0.000845	0.00155	0.00212	0.00313	0.00492	0.00665	0.00673	0.00880	0.00874
Death	0.000010	0.000111	0.000494	0.000830	0.000958	0.00156	0.00252	0.00339	0.00354	0.00434	0.00439
D3041.011f #1 (D3041.011f: (ATC-138 Beta) HVAC Galvanized Sheet Metal Ducting less than 6 sq. ft in...)											
Injury	0.00	0.00	0.000001	0.000003	0.000001	0.000003	0.000003	0.000014	0.000018	0.000047	0.000038
Death	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D3041.012d #1 (D3041.012d: HVAC Galvanized Sheet Metal Ducting - 6 sq. ft cross sectional area or...)											
Injury	0.00	0.000001	0.000005	0.000005	0.000003	0.000007	0.000015	0.000040	0.000034	0.000094	0.000078
Death	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D3041.031e #1 (D3041.031e: (ATC-138 Beta) (RUGGED) HVAC Drops / Diffusers in suspended ceilings - With...)											
Injury	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Death	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.4 Quantity Damaged

This table shows the expected percentage of the components that are in a given damage state (normalized to the total quantity of that component in the entire building). The small parenthetical value is the probability that any component throughout the building is in that damage state (the percentage of realizations that have a component in that damage state).

All of these values are conditioned on no global failure. The header shows the probability of global failures (collapse and residual drift demolition) for reference.

The color scale is meant to indicate **relative** performance of components, not absolute performance. A “green” value does not indicate that the value falls in a pre-determined “good” range, just that it performs well compared to other components. Likewise, a “red” value does not indicate that the value falls in a pre-determined “bad” range, just that it performs worse compared to other components.

Table 3.4.1. Expected percentage of damaged components (% of total qty. (% of realizations))

	90% in 50 years	50% in 30 years	50% in 50 years	50% in 75 years	50% in 100 years	20% in 50 years	10% in 50 years	DE	5% in 50 years	2% in 50 years	MCE _R
P[Col](%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	2.1
P[Res](%)	0.0	0.0	0.0	0.0	0.0	0.2	1.7	18	20	51	54
B1031.001 #1 (B1031.001: Bolted shear tab gravity connections)											
DS1a	0.0 (0.0)	0.0 (0.0)	0.0 (0.2)	0.0 (2.4)	0.0 (8.3)	0.2 (26)	1.0 (59)	2.4 (81)	2.5 (82)	5.5 (95)	6.2 (96)
DS1b	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.2)	0.0 (0.6)	0.0 (4.5)	0.1 (17)	0.1 (33)	0.1 (35)	0.3 (58)	0.3 (61)
DS2	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.3)	0.0 (1.4)	0.0 (7.2)	0.1 (19)	0.1 (19)	0.4 (45)	0.5 (48)
DS3	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.2)	0.0 (1.6)	0.0 (5.8)	0.0 (5.6)	0.1 (17)	0.2 (21)
Total	0.0 (0.0)	0.0 (0.0)	0.0 (0.2)	0.0 (2.5)	0.0 (8.4)	0.2 (27)	1.1 (60)	2.7 (82)	2.8 (83)	6.3 (95)	7.2 (96)
B1031.011b #1 (B1031.011b: Steel Column Base Plates, Column 150 plf < W < 300 plf)											
DS1a	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.1)	0.1 (0.6)	0.4 (3.6)	2.1 (17)	5.4 (35)	5.7 (37)	13 (63)	15 (66)
DS1b	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.1)	0.0 (0.3)	0.1 (1.5)	0.2 (2.9)	0.4 (4.1)	0.6 (6.9)	0.8 (8.7)
DS2	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.2)	0.1 (1.4)	0.5 (5.1)	0.6 (6.2)	2.2 (18)	2.9 (22)
DS3	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.3)	0.1 (0.9)	0.2 (1.7)	0.8 (6.5)	0.9 (7.8)
Total	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.1)	0.1 (0.7)	0.4 (3.9)	2.4 (18)	6.3 (37)	6.9 (39)	17 (66)	19 (69)
B1031.021b #1 (B1031.021b: Welded column splices, Column 150 plf < W < 300 plf)											
DS1a	0.0 (0.0)	0.0 (0.2)	0.1 (2.7)	0.4 (11)	1.0 (26)	2.9 (51)	8.1 (79)	14 (92)	14 (91)	21 (98)	22 (98)
DS1b	0.0 (0.0)	0.0 (0.0)	0.0 (0.3)	0.0 (0.9)	0.1 (2.9)	0.1 (5.7)	0.4 (17)	0.8 (29)	0.8 (29)	1.2 (42)	1.2 (41)
DS2	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.3)	0.1 (2.0)	0.3 (9.1)	0.9 (21)	0.9 (23)	2.4 (42)	2.7 (45)
Total	0.0 (0.0)	0.0 (0.2)	0.1 (2.8)	0.4 (12)	1.1 (27)	3.1 (51)	8.8 (79)	16 (93)	16 (92)	25 (98)	26 (98)
B1033.652a #1 (B1033.652a: CoreBrace Buckling Restrained Brace (BRB), Moment-Connected Beams, Chevron...)											
DS1a	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.1 (0.5)	0.3 (2.3)	2.1 (13)	5.2 (28)	5.5 (31)	11 (54)	13 (58)
DS1b	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.2)	0.2 (1.7)	1.2 (8.4)	2.6 (17)	2.7 (18)	5.8 (34)	6.1 (37)
DS1c	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.2)	0.2 (1.8)	1.2 (8.3)	2.6 (17)	2.9 (19)	5.7 (35)	6.2 (36)
DS2	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.2)	0.4 (2.7)	1.5 (8.4)	1.7 (9.0)	6.1 (25)	8.1 (30)
Total	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.1)	0.1 (0.8)	0.9 (4.6)	5.0 (22)	12 (42)	13 (46)	29 (73)	33 (76)
B1033.653a #1 (B1033.653a: CoreBrace Buckling Restrained Brace (BRB), Moment-Connected Beams, Chevron...)											
DS1a	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.2)	0.0 (1.2)	0.2 (5.7)	0.8 (22)	1.9 (41)	1.9 (40)	3.7 (63)	4.3 (67)
DS1b	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.1)	0.0 (0.6)	0.1 (3.9)	0.4 (15)	1.0 (30)	1.0 (31)	1.9 (52)	2.1 (53)
DS1c	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.1)	0.0 (0.7)	0.1 (2.8)	0.4 (14)	0.9 (29)	1.0 (32)	2.0 (52)	2.1 (54)
DS2	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.8)	0.1 (4.9)	0.5 (12)	0.5 (13)	1.4 (27)	1.7 (30)
Total	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.4)	0.1 (2.0)	0.4 (8.8)	1.7 (30)	4.3 (52)	4.4 (52)	9.2 (76)	10 (78)
B2011.201a #1 (B2011.201a: Precast Concrete Panels 4.5 inches thick - in plane deformation)											
DS1a	0.0 (0.0)	0.0 (0.0)	0.0 (0.4)	0.1 (2.3)	0.3 (6.1)	0.9 (18)	2.7 (40)	4.9 (59)	5.1 (59)	8.8 (82)	9.5 (81)
DS1b	0.0 (0.0)	0.0 (0.0)	0.0 (0.5)	0.1 (2.1)	0.3 (6.8)	0.9 (17)	2.7 (41)	5.1 (60)	5.1 (60)	8.7 (80)	9.3 (82)
Total	0.0 (0.0)	0.0 (0.0)	0.0 (0.6)	0.2 (2.8)	0.6 (8.2)	1.8 (21)	5.4 (48)	10 (68)	10 (68)	17 (88)	19 (88)

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Table 3.4.1 (Continued). Expected percentage of damaged components (% of total qty. (% of realizations))

	90% in 50 years	50% in 30 years	50% in 50 years	50% in 75 years	50% in 100 years	20% in 50 years	10% in 50 years	DE	5% in 50 years	2% in 50 years	MCE _R
P[Col](%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	2.1
P[Res](%)	0.0	0.0	0.0	0.0	0.0	0.2	1.7	18	20	51	54
B2011.201b #1 (B2011.201b: Precast Concrete Panels 4.5 inches thick - out of plane deformation)											
DS1	0.0 (0.0)	0.0 (0.0)	0.0 (0.5)	0.1 (0.9)	0.1 (1.4)	0.1 (2.2)	0.2 (2.8)	0.5 (5.9)	0.5 (6.5)	1.0 (11)	1.0 (12)
B2022.002 #1 (B2022.002: Curtain Walls - Generic Midrise Stick-Built Curtain wall, Config:...)											
DS1	0.0 (0.1)	0.0 (4.8)	0.1 (28)	0.2 (62)	0.6 (84)	1.3 (95)	2.9 (99)	4.3 (100)	4.3 (100)	5.5 (100)	5.6 (100)
DS2	0.0 (0.0)	0.0 (3.1)	0.0 (21)	0.3 (53)	0.8 (77)	2.4 (93)	7.1 (99)	13 (99)	13 (100)	22 (100)	24 (100)
Total	0.0 (0.1)	0.0 (6.8)	0.1 (35)	0.5 (70)	1.4 (89)	3.7 (97)	10 (100)	17 (100)	18 (100)	28 (100)	29 (100)
C1011.001c #1 (C1011.001c: Wall Partition, Type: Gypsum with metal studs, Full Height, Fixed Below,...)											
DS1	2.8 (73)	17 (100)	36 (100)	48 (100)	53 (100)	54 (100)	50 (100)	42 (100)	42 (100)	33 (100)	31 (100)
DS2	0.0 (0.2)	0.1 (6.9)	1.1 (38)	4.1 (72)	7.9 (88)	15 (97)	24 (100)	29 (100)	29 (100)	29 (100)	28 (100)
DS3	0.0 (0.0)	0.0 (0.0)	0.0 (0.8)	0.1 (4.8)	0.6 (16)	2.6 (42)	9.1 (76)	18 (92)	18 (91)	30 (99)	32 (99)
Total	2.8 (73)	17 (100)	38 (100)	53 (100)	61 (100)	71 (100)	83 (100)	89 (100)	89 (100)	92 (100)	91 (100)
C2011.001a #1 (C2011.001a: Prefabricated steel stair with steel treads and landings with seismic...)											
DS1	0.0 (0.0)	0.0 (0.1)	0.1 (0.8)	0.3 (5.0)	0.8 (11)	2.1 (26)	4.8 (48)	7.9 (67)	8.0 (66)	12 (82)	12 (81)
DS2	0.0 (0.0)	0.0 (0.0)	0.0 (0.1)	0.0 (0.6)	0.1 (1.5)	0.4 (5.7)	1.5 (20)	2.7 (32)	2.7 (32)	4.9 (51)	4.8 (52)
DS3	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.2)	0.1 (1.2)	0.2 (3.0)	1.0 (13)	2.1 (24)	2.3 (26)	4.9 (45)	5.9 (51)
Total	0.0 (0.0)	0.0 (0.1)	0.1 (0.8)	0.4 (5.7)	1.0 (13)	2.7 (29)	7.3 (57)	13 (77)	13 (76)	22 (92)	23 (90)
C3011.001c #1 (C3011.001c: Wall Partition, Type: Gypsum + Wallpaper, Full Height, Fixed Below, Slip...)											
DS1	28 (99)	55 (100)	74 (100)	81 (100)	85 (100)	89 (100)	94 (100)	96 (100)	96 (100)	97 (100)	97 (100)
C3032.004a #1 (C3032.004a: Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): A < 250, Vert & Lat...)											
DS1	0.0 (0.2)	0.1 (2.9)	0.4 (13)	0.9 (21)	1.0 (23)	1.5 (30)	2.6 (41)	4.4 (57)	4.2 (53)	6.6 (70)	7.2 (72)
DS2	0.0 (0.1)	0.0 (0.8)	0.1 (3.5)	0.1 (6.6)	0.2 (7.1)	0.3 (11)	0.5 (18)	0.8 (27)	0.8 (25)	1.4 (41)	1.5 (42)
DS3	0.0 (0.1)	0.0 (0.9)	0.2 (5.2)	0.5 (10)	0.5 (11)	0.9 (16)	1.5 (22)	3.1 (35)	2.9 (32)	6.0 (50)	6.2 (50)
Total	0.0 (0.3)	0.1 (3.5)	0.7 (14)	1.5 (23)	1.6 (25)	2.7 (32)	4.6 (45)	8.3 (59)	7.8 (56)	14 (72)	15 (73)
C3032.004b #1 (C3032.004b: Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): 250 < A < 1000, Vert & Lat...)											
DS1	0.0 (0.4)	0.1 (2.8)	0.7 (12)	1.4 (19)	1.6 (22)	2.5 (29)	4.0 (39)	6.6 (54)	6.3 (52)	10 (69)	10 (70)
DS2	0.0 (0.0)	0.0 (0.3)	0.1 (2.3)	0.2 (4.8)	0.2 (5.6)	0.4 (8.6)	0.7 (14)	1.2 (23)	1.1 (22)	1.9 (33)	2.2 (36)
DS3	0.0 (0.0)	0.0 (0.6)	0.2 (3.5)	0.5 (7.4)	0.5 (7.3)	1.0 (12)	1.7 (17)	3.3 (28)	3.1 (26)	6.1 (42)	6.6 (44)
Total	0.0 (0.4)	0.1 (3.2)	1.0 (14)	2.1 (22)	2.3 (24)	3.9 (31)	6.3 (41)	11 (56)	10 (54)	18 (72)	19 (73)
C3032.004c #1 (C3032.004c: Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): 1000 < A < 2500, Vert & Lat...)											
DS1	0.0 (0.2)	0.4 (2.9)	1.8 (12)	3.4 (18)	3.8 (20)	5.7 (26)	8.9 (38)	13 (50)	13 (49)	19 (65)	20 (68)
DS2	0.0 (0.0)	0.0 (0.2)	0.1 (1.1)	0.4 (3.0)	0.5 (3.6)	0.8 (5.1)	1.2 (8.0)	2.0 (13)	2.2 (14)	3.1 (20)	3.6 (21)
DS3	0.0 (0.0)	0.0 (0.0)	0.3 (1.8)	0.6 (3.2)	0.7 (4.0)	1.2 (6.3)	1.9 (9.6)	3.9 (17)	3.6 (15)	7.2 (27)	7.7 (29)
Total	0.0 (0.3)	0.5 (3.2)	2.2 (13)	4.4 (19)	5.0 (22)	7.6 (29)	12 (40)	19 (53)	19 (52)	29 (68)	31 (71)
C3032.004d #1 (C3032.004d: Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): A > 2500, Vert & Lat...)											
DS1	0.0 (0.4)	0.6 (4.0)	2.8 (15)	5.0 (23)	5.8 (27)	8.3 (36)	13 (47)	18 (61)	18 (59)	24 (73)	26 (76)
DS2	0.0 (0.0)	0.0 (0.3)	0.3 (2.0)	0.5 (3.3)	0.5 (3.3)	0.9 (5.8)	1.5 (9.9)	2.4 (15)	2.3 (14)	3.9 (24)	4.3 (25)
DS3	0.0 (0.0)	0.0 (0.2)	0.2 (1.6)	0.6 (3.8)	0.7 (4.2)	1.2 (6.8)	2.0 (10)	4.2 (17)	4.2 (17)	7.8 (28)	8.3 (31)
Total	0.0 (0.4)	0.6 (4.2)	3.3 (16)	6.1 (25)	6.9 (29)	10 (37)	16 (49)	25 (63)	24 (61)	36 (75)	38 (78)
D1014.041 #1 (D1014.041: Traction Elevator Machine room component anchorage. Applies to Seismic Zone...)											
DS1	0.6 (1.7)	3.1 (7.9)	8.8 (20)	12 (27)	14 (29)	15 (32)	18 (37)	24 (46)	22 (45)	30 (54)	31 (58)
D1014.042 #1 (D1014.042: Traction Elevator Cab and Counterweight Components. Applies to Seismic Zone...)											
DS1	0.1 (0.4)	1.8 (4.6)	6.5 (15)	11 (25)	15 (33)	23 (44)	37 (64)	52 (79)	53 (79)	66 (89)	68 (90)
D1014.043 #1 (D1014.043: Traction Elevator Guide Rails. Applies to Seismic Zone 3 or greater and...)											
DS1	0.2 (0.6)	1.7 (4.2)	6.4 (15)	11 (24)	16 (32)	24 (45)	37 (64)	52 (79)	51 (79)	68 (90)	69 (91)
D1014.044 #1 (D1014.044: Traction Elevator Guide Rail Brackets. Applies to Seismic Zone 3 or greater...)											
DS1	0.3 (0.8)	1.6 (4.3)	5.9 (14)	11 (25)	15 (32)	24 (46)	37 (64)	51 (78)	51 (78)	68 (89)	69 (92)

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Table 3.4.1 (Continued). Expected percentage of damaged components (% of total qty. (% of realizations))

	90% in 50 years	50% in 30 years	50% in 50 years	50% in 75 years	50% in 100 years	20% in 50 years	10% in 50 years	DE	5% in 50 years	2% in 50 years	MCE _R
P[Col](%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	2.1
P[Res](%)	0.0	0.0	0.0	0.0	0.0	0.2	1.7	18	20	51	54
D2021.014a #1 (D2021.014a: Cold or Hot Potable - Small Diameter Threaded Steel - (2.5 inches in...))											
DS1	0.0 (0.0)	0.1 (0.6)	0.6 (4.1)	1.2 (7.3)	1.3 (8.4)	2.1 (12)	3.5 (18)	6.0 (29)	5.7 (26)	9.5 (39)	10 (44)
DS2	0.0 (0.0)	0.0 (0.0)	0.0 (0.2)	0.1 (0.5)	0.1 (0.8)	0.1 (0.8)	0.3 (2.0)	0.6 (4.0)	0.6 (3.5)	1.2 (6.7)	1.2 (7.8)
Total	0.0 (0.0)	0.1 (0.6)	0.6 (4.2)	1.3 (7.4)	1.4 (8.9)	2.2 (12)	3.8 (19)	6.7 (30)	6.3 (27)	11 (40)	12 (45)
D2021.014b #1 (D2021.014b: Cold or Hot Potable - Small Diameter Threaded Steel - (2.5 inches in...))											
DS1	0.1 (0.5)	0.6 (4.0)	3.1 (17)	5.5 (25)	6.0 (27)	8.7 (36)	13 (46)	21 (60)	19 (58)	29 (74)	31 (76)
D2021.024a #1 (D2021.024a: Cold or Hot Potable Water Piping (dia > 2.5 inches), SDC D,E,F (OSPHD or...))											
DS1	0.0 (0.2)	0.1 (0.6)	0.5 (3.6)	1.1 (7.3)	1.4 (8.0)	1.9 (11)	3.6 (18)	6.2 (29)	5.9 (27)	9.3 (39)	10 (43)
DS2	0.0 (0.0)	0.0 (0.0)	0.0 (0.4)	0.1 (0.4)	0.1 (0.7)	0.2 (1.1)	0.3 (1.8)	0.7 (4.0)	0.6 (3.7)	1.3 (7.7)	1.3 (7.4)
Total	0.0 (0.2)	0.1 (0.6)	0.6 (3.8)	1.2 (7.5)	1.5 (8.3)	2.1 (11)	3.9 (19)	6.8 (29)	6.5 (28)	11 (40)	12 (44)
D2021.024b #1 (D2021.024b: Cold or Hot Potable Water Piping (dia > 2.5 inches), SDC D,E,F (OSPHD or...))											
DS1	0.1 (0.6)	0.6 (4.4)	2.3 (14)	4.0 (22)	4.7 (25)	6.5 (32)	9.8 (44)	14 (56)	14 (55)	19 (70)	20 (72)
DS2	0.0 (0.1)	0.1 (1.0)	0.6 (3.8)	1.3 (7.7)	1.3 (8.0)	2.4 (13)	3.6 (17)	6.7 (30)	6.5 (28)	10 (40)	12 (46)
Total	0.1 (0.6)	0.8 (5.0)	2.9 (16)	5.3 (25)	6.1 (28)	9.0 (35)	13 (47)	21 (61)	20 (59)	29 (74)	31 (79)
D2031.014b #1 (D2031.014b: Sanitary Waste Piping - Cast Iron w/flexible couplings, SDC D,E,F (OSHPD or...))											
DS1	0.0 (0.2)	0.1 (0.4)	0.4 (2.5)	0.7 (4.4)	0.8 (5.1)	1.4 (8.5)	2.1 (13)	3.9 (20)	3.7 (20)	6.4 (31)	6.8 (34)
D3032.013f #1 (D3032.013f: Compressor - Capacity: Large non medical air supply - Equipment that is...)											
DS1a	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.1 (0.1)	0.2 (0.2)	0.4 (0.4)	1.3 (1.3)	2.0 (2.0)	2.5 (2.5)	4.8 (4.8)	5.2 (5.2)
DS1b	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.1 (0.1)	0.1 (0.1)	0.6 (0.6)	1.0 (1.0)	0.4 (0.4)	2.0 (2.0)	2.7 (2.7)
DS1c	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.2 (0.2)	0.0 (0.0)	0.4 (0.4)	0.6 (0.6)	1.8 (1.8)	1.4 (1.4)	3.7 (3.7)	2.5 (2.5)
DS1d	0.0 (0.0)	0.0 (0.0)	0.1 (0.1)	0.0 (0.0)	0.3 (0.3)	0.4 (0.4)	0.7 (0.7)	1.4 (1.4)	1.4 (1.4)	3.1 (3.1)	2.9 (2.9)
Total	0.0 (0.0)	0.0 (0.0)	0.1 (0.1)	0.3 (0.3)	0.7 (0.7)	1.3 (1.3)	3.2 (3.2)	6.2 (6.2)	5.7 (5.7)	14 (14)	13 (13)
D3032.013f #2 (D3032.013f: Compressor - Capacity: Large non medical air supply - Equipment that is...)											
DS1a	0.0 (0.0)	0.0 (0.0)	0.1 (0.2)	0.1 (0.2)	0.2 (0.3)	0.4 (0.7)	0.9 (1.7)	1.9 (3.7)	1.6 (3.1)	4.0 (7.7)	3.7 (6.8)
DS1b	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.1 (0.1)	0.1 (0.2)	0.3 (0.7)	0.2 (0.4)	0.8 (1.6)	0.7 (1.4)	1.3 (2.6)	1.4 (2.9)
DS1c	0.0 (0.0)	0.0 (0.0)	0.1 (0.1)	0.2 (0.3)	0.1 (0.2)	0.4 (0.7)	0.7 (1.2)	1.2 (2.3)	1.0 (1.9)	1.9 (3.6)	2.4 (4.9)
DS1d	0.0 (0.0)	0.0 (0.0)	0.0 (0.1)	0.1 (0.2)	0.1 (0.2)	0.3 (0.6)	0.7 (1.4)	1.0 (2.0)	1.5 (3.0)	2.0 (3.6)	2.9 (5.4)
Total	0.0 (0.0)	0.0 (0.1)	0.2 (0.4)	0.4 (0.8)	0.4 (0.8)	1.4 (2.6)	2.4 (4.4)	5.0 (8.9)	4.9 (8.5)	9.2 (16)	10 (18)
D3032.013f #3 (D3032.013f: Compressor - Capacity: Large non medical air supply - Equipment that is...)											
DS1a	0.0 (0.0)	0.0 (0.0)	0.1 (0.1)	0.1 (0.2)	0.3 (0.5)	0.4 (0.7)	0.9 (1.8)	1.6 (3.1)	1.5 (3.0)	3.3 (6.4)	4.1 (7.9)
DS1b	0.0 (0.0)	0.0 (0.0)	0.1 (0.1)	0.1 (0.2)	0.0 (0.1)	0.1 (0.2)	0.4 (0.9)	0.7 (1.4)	0.8 (1.6)	1.1 (2.3)	1.6 (3.2)
DS1c	0.0 (0.0)	0.0 (0.0)	0.1 (0.1)	0.1 (0.2)	0.1 (0.2)	0.3 (0.6)	0.5 (1.1)	1.4 (2.8)	1.2 (2.3)	2.0 (3.9)	2.4 (4.6)
DS1d	0.0 (0.0)	0.0 (0.0)	0.1 (0.2)	0.1 (0.2)	0.3 (0.5)	0.2 (0.4)	0.7 (1.3)	1.6 (2.9)	1.2 (2.4)	2.0 (3.8)	2.3 (4.6)
Total	0.0 (0.0)	0.0 (0.0)	0.3 (0.6)	0.4 (0.8)	0.7 (1.3)	1.0 (1.9)	2.5 (4.8)	5.2 (9.3)	4.8 (8.5)	8.5 (14)	10 (18)
D3032.013f #4 (D3032.013f: Compressor - Capacity: Large non medical air supply - Equipment that is...)											
DS1a	0.0 (0.0)	0.0 (0.0)	0.1 (0.2)	0.3 (0.7)	0.2 (0.4)	0.4 (0.9)	0.7 (1.3)	0.8 (1.7)	1.0 (2.0)	1.5 (3.1)	1.7 (3.5)
DS1b	0.0 (0.0)	0.0 (0.0)	0.2 (0.4)	0.4 (0.8)	0.4 (0.8)	0.4 (0.8)	1.2 (2.3)	2.0 (3.9)	2.3 (4.3)	3.2 (6.3)	2.9 (5.6)
DS1c	0.0 (0.0)	0.0 (0.0)	0.1 (0.2)	0.2 (0.4)	0.3 (0.6)	0.7 (1.3)	1.0 (2.0)	1.7 (3.3)	1.6 (3.1)	3.3 (6.2)	3.9 (7.2)
DS1d	0.0 (0.0)	0.0 (0.0)	0.1 (0.2)	0.2 (0.4)	0.3 (0.6)	0.7 (1.3)	1.0 (2.0)	1.7 (3.3)	1.6 (3.1)	3.3 (6.2)	3.9 (7.2)
Total	0.0 (0.0)	0.0 (0.0)	0.5 (1.0)	1.3 (2.3)	1.3 (2.4)	2.4 (4.6)	4.5 (7.9)	7.0 (12)	7.7 (13)	13 (22)	13 (23)
D3032.013f #5 (D3032.013f: Compressor - Capacity: Large non medical air supply - Equipment that is...)											
DS1a	0.0 (0.0)	0.1 (0.2)	0.2 (0.4)	0.5 (0.9)	0.4 (0.8)	0.6 (1.2)	1.6 (3.1)	2.2 (4.2)	1.8 (3.5)	4.0 (7.8)	5.5 (10)
DS1b	0.0 (0.0)	0.0 (0.0)	0.1 (0.1)	0.1 (0.2)	0.2 (0.3)	0.4 (0.8)	0.7 (1.5)	1.1 (2.1)	1.2 (2.2)	1.8 (3.6)	1.7 (3.4)
DS1c	0.0 (0.0)	0.0 (0.0)	0.1 (0.2)	0.4 (0.8)	0.5 (1.0)	0.5 (1.1)	1.0 (1.8)	1.8 (3.5)	2.1 (4.0)	2.6 (4.9)	2.6 (5.2)
DS1d	0.0 (0.0)	0.0 (0.1)	0.2 (0.4)	0.4 (0.8)	0.3 (0.7)	0.6 (1.2)	0.9 (1.8)	1.9 (3.8)	1.5 (2.9)	3.0 (5.9)	3.2 (6.4)
Total	0.0 (0.1)	0.2 (0.4)	0.6 (1.1)	1.4 (2.6)	1.4 (2.6)	2.2 (4.2)	4.3 (7.6)	7.0 (12)	6.6 (12)	11 (19)	13 (22)

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Table 3.4.1 (Continued). Expected percentage of damaged components (% of total qty. (% of realizations))

	90% in 50 years	50% in 30 years	50% in 50 years	50% in 75 years	50% in 100 years	20% in 50 years	10% in 50 years	DE	5% in 50 years	2% in 50 years	MCE _R
P[Col](%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	2.1
P[Res](%)	0.0	0.0	0.0	0.0	0.0	0.2	1.7	18	20	51	54
D3032.013f #6 (D3032.013f: Compressor - Capacity: Large non medical air supply - Equipment that is...)											
DS1a	0.0 (0.0)	0.1 (0.1)	0.3 (0.6)	0.6 (1.1)	0.6 (1.3)	1.1 (2.0)	2.0 (3.8)	3.0 (5.7)	2.6 (4.8)	4.8 (9.1)	4.0 (7.7)
DS1b	0.0 (0.0)	0.0 (0.1)	0.2 (0.4)	0.3 (0.5)	0.3 (0.6)	0.5 (1.0)	0.8 (1.7)	1.1 (2.0)	1.2 (2.3)	1.6 (3.2)	1.7 (3.3)
DS1c	0.0 (0.0)	0.1 (0.1)	0.1 (0.2)	0.3 (0.7)	0.5 (1.0)	0.9 (1.7)	1.1 (2.2)	1.9 (3.7)	1.7 (3.3)	2.7 (5.2)	2.7 (5.2)
DS1d	0.0 (0.0)	0.0 (0.0)	0.3 (0.5)	0.4 (0.7)	0.4 (0.7)	0.7 (1.4)	1.0 (1.9)	2.2 (4.3)	1.7 (3.3)	3.2 (6.3)	3.4 (6.4)
Total	0.0 (0.0)	0.2 (0.3)	0.8 (1.6)	1.5 (2.9)	1.8 (3.5)	3.1 (5.8)	4.9 (9.0)	8.1 (14)	7.1 (12)	12 (21)	12 (20)
D3032.013f #7 (D3032.013f: Compressor - Capacity: Large non medical air supply - Equipment that is...)											
DS1a	0.0 (0.0)	0.1 (0.2)	0.4 (0.8)	0.6 (1.2)	0.7 (1.4)	0.9 (1.7)	1.3 (2.5)	2.6 (5.0)	1.9 (3.7)	3.5 (6.5)	3.7 (7.3)
DS1b	0.0 (0.0)	0.0 (0.0)	0.1 (0.2)	0.2 (0.4)	0.1 (0.3)	0.4 (0.8)	0.8 (1.7)	0.8 (1.6)	1.2 (2.3)	1.3 (2.5)	1.2 (2.3)
DS1c	0.0 (0.0)	0.0 (0.1)	0.1 (0.2)	0.3 (0.6)	0.5 (1.0)	0.5 (1.0)	1.0 (2.0)	1.6 (3.1)	1.6 (3.2)	2.6 (4.9)	2.2 (4.0)
DS1d	0.0 (0.0)	0.0 (0.0)	0.2 (0.3)	0.5 (1.0)	0.3 (0.6)	0.6 (1.2)	1.1 (2.2)	2.0 (4.0)	1.6 (3.1)	2.7 (5.4)	3.2 (6.3)
Total	0.0 (0.0)	0.2 (0.4)	0.8 (1.6)	1.7 (3.0)	1.6 (3.0)	2.4 (4.3)	4.3 (7.9)	7.0 (13)	6.4 (12)	10 (17)	10 (18)
D3032.013f #8 (D3032.013f: Compressor - Capacity: Large non medical air supply - Equipment that is...)											
DS1a	0.0 (0.1)	0.3 (0.5)	1.1 (2.1)	1.6 (3.0)	1.9 (3.6)	2.0 (3.8)	2.6 (5.0)	3.3 (6.3)	2.8 (5.4)	5.1 (9.4)	4.6 (8.7)
DS1b	0.0 (0.0)	0.1 (0.2)	0.4 (0.7)	0.6 (1.2)	0.9 (1.8)	1.0 (1.9)	0.9 (1.8)	2.0 (4.0)	1.4 (2.6)	2.4 (4.6)	2.9 (5.4)
DS1c	0.1 (0.1)	0.3 (0.6)	0.9 (1.8)	1.4 (2.7)	1.2 (2.4)	1.5 (3.1)	2.1 (4.1)	2.6 (5.0)	2.5 (4.9)	3.2 (6.3)	3.2 (6.1)
DS1d	0.0 (0.0)	0.2 (0.5)	0.6 (1.3)	1.3 (2.6)	1.3 (2.5)	1.6 (3.2)	1.5 (2.9)	2.2 (4.3)	2.2 (4.4)	3.8 (7.0)	3.2 (6.2)
Total	0.1 (0.3)	0.9 (1.7)	3.0 (5.6)	4.9 (9.0)	5.3 (9.5)	6.2 (11)	7.1 (13)	10 (17)	8.9 (16)	14 (24)	14 (24)
D3041.011f #1 (D3041.011f: (ATC-138 Beta) HVAC Galvanized Sheet Metal Ducting less than 6 sq. ft in...)											
DS1	0.0 (0.0)	0.0 (0.2)	0.1 (1.0)	0.4 (2.5)	0.4 (2.5)	0.6 (3.8)	1.0 (6.0)	1.9 (11)	1.9 (12)	3.5 (19)	3.7 (19)
DS2	0.0 (0.0)	0.0 (0.0)	0.0 (0.2)	0.1 (0.4)	0.1 (0.5)	0.1 (0.5)	0.1 (0.9)	0.4 (2.2)	0.3 (1.9)	0.8 (4.6)	0.9 (5.4)
Total	0.0 (0.0)	0.0 (0.2)	0.2 (1.1)	0.4 (2.8)	0.4 (2.8)	0.6 (4.1)	1.1 (6.4)	2.3 (12)	2.2 (12)	4.3 (20)	4.6 (21)
D3041.012d #1 (D3041.012d: HVAC Galvanized Sheet Metal Ducting - 6 sq. ft cross sectional area or...)											
DS1	0.0 (0.0)	0.0 (0.0)	0.0 (0.2)	0.1 (0.4)	0.1 (0.9)	0.2 (1.1)	0.2 (1.8)	0.5 (3.7)	0.6 (4.0)	0.9 (6.3)	1.0 (6.5)
DS2	0.0 (0.0)	0.0 (0.0)	0.0 (0.2)	0.1 (0.4)	0.0 (0.3)	0.1 (0.7)	0.1 (1.0)	0.3 (2.1)	0.3 (2.1)	0.9 (5.1)	0.7 (4.9)
Total	0.0 (0.0)	0.0 (0.1)	0.1 (0.3)	0.1 (0.8)	0.1 (1.1)	0.3 (1.7)	0.4 (2.6)	0.8 (5.2)	0.9 (5.4)	1.8 (9.6)	1.7 (9.8)
D3041.031e #1 (D3041.031e: (ATC-138 Beta) (RUGGED) HVAC Drops / Diffusers in suspended ceilings - With...)											
DS1	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
D3041.103c #1 (D3041.103c: HVAC Fan - Capacity: all - Equipment that is either hard anchored or is...)											
DS1a	0.0 (0.2)	0.2 (1.4)	0.8 (5.4)	1.5 (11)	1.8 (12)	2.5 (16)	3.4 (21)	5.3 (30)	4.7 (28)	7.6 (40)	7.9 (41)
DS1b	0.0 (0.1)	0.2 (1.4)	0.3 (2.6)	0.7 (4.6)	0.6 (4.8)	1.0 (7.3)	1.5 (10)	2.3 (16)	2.1 (15)	3.2 (20)	3.5 (23)
DS1c	0.0 (0.3)	0.3 (2.4)	1.2 (8.1)	2.1 (13)	2.4 (15)	3.4 (21)	5.2 (29)	7.7 (38)	7.3 (37)	12 (52)	11 (51)
Total	0.1 (0.5)	0.7 (4.6)	2.3 (14)	4.2 (22)	4.8 (26)	6.9 (33)	10 (43)	15 (54)	14 (53)	22 (68)	22 (70)
D4011.024a #1 (D4011.024a: Fire Sprinkler Water Piping - Horizontal Mains and Branches - Old Style...)											
DS1	0.0 (0.2)	0.3 (3.6)	1.1 (11)	2.2 (19)	2.5 (22)	3.9 (30)	6.0 (39)	9.6 (53)	9.1 (52)	15 (67)	16 (71)
DS2	0.0 (0.0)	0.0 (0.2)	0.1 (1.3)	0.2 (2.5)	0.2 (2.8)	0.4 (4.7)	0.7 (6.8)	1.5 (13)	1.2 (11)	2.7 (21)	2.7 (23)
Total	0.0 (0.3)	0.3 (3.8)	1.2 (12)	2.4 (20)	2.7 (23)	4.3 (30)	6.7 (39)	11 (54)	10 (53)	17 (67)	19 (72)
D4011.054a #1 (D4011.054a: Fire Sprinkler Drop Standard Threaded Steel - Dropping into braced lay-in...)											
DS1	0.0 (0.2)	0.2 (1.8)	1.1 (7.6)	2.0 (12)	2.3 (14)	3.5 (19)	5.6 (28)	8.7 (39)	8.1 (38)	13 (52)	14 (55)
DS2	0.0 (0.0)	0.0 (0.1)	0.1 (0.9)	0.4 (2.6)	0.5 (3.2)	0.7 (4.2)	1.2 (6.9)	2.3 (13)	2.1 (11)	4.0 (19)	4.6 (23)
Total	0.0 (0.2)	0.2 (1.9)	1.3 (7.8)	2.4 (13)	2.8 (16)	4.2 (20)	6.9 (30)	11 (42)	10 (40)	17 (55)	19 (58)
D5011.013c #1 (D5011.013c: Transformer/primary service - Capacity: <100 kVA - Equipment that is either...)											
DS1a	0.0 (0.0)	0.0 (0.0)	0.4 (0.4)	0.7 (0.7)	1.4 (1.4)	2.1 (2.1)	4.4 (4.4)	6.6 (6.6)	7.0 (7.0)	12 (12)	13 (13)
DS1b	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.5 (0.5)	0.3 (0.3)	0.9 (0.9)	2.2 (2.2)	2.8 (2.8)	3.1 (3.1)	4.4 (4.4)	5.0 (5.0)
DS1c	0.0 (0.0)	0.1 (0.1)	0.5 (0.5)	1.0 (1.0)	1.4 (1.4)	3.1 (3.1)	5.5 (5.5)	9.9 (9.9)	9.8 (9.8)	17 (17)	17 (17)
Total	0.0 (0.0)	0.1 (0.1)	1.0 (1.0)	2.2 (2.2)	3.1 (3.1)	6.1 (6.1)	12 (12)	19 (19)	20 (20)	33 (33)	34 (34)

Continued on next page

Table 3.4.1 (Continued). Expected percentage of damaged components (% of total qty. (% of realizations))

	90% in 50 years	50% in 30 years	50% in 50 years	50% in 75 years	50% in 100 years	20% in 50 years	10% in 50 years	DE	5% in 50 years	2% in 50 years	MCE _R
P[Col](%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	2.1
P[Res](%)	0.0	0.0	0.0	0.0	0.0	0.2	1.7	18	20	51	54
D5012.013d #1 (D5012.013d: Motor Control Center - Capacity: all - Equipment that is either hard...)											
DS1a	0.0 (0.0)	0.1 (0.1)	1.3 (1.3)	2.5 (2.5)	2.4 (2.4)	5.4 (5.4)	8.4 (8.4)	12 (12)	13 (13)	17 (17)	19 (19)
DS1b	0.0 (0.0)	0.0 (0.0)	0.6 (0.6)	0.9 (0.9)	1.4 (1.4)	2.1 (2.1)	3.8 (3.8)	5.3 (5.3)	6.5 (6.5)	8.5 (8.5)	9.6 (9.6)
DS1c	0.0 (0.0)	0.4 (0.4)	1.6 (1.6)	2.8 (2.8)	3.9 (3.9)	7.5 (7.5)	13 (13)	19 (19)	18 (18)	30 (30)	29 (29)
Total	0.1 (0.1)	0.6 (0.6)	3.4 (3.4)	6.2 (6.2)	7.7 (7.7)	15 (15)	25 (25)	37 (37)	38 (38)	55 (55)	57 (57)
D5012.023c #1 (D5012.023c: Low Voltage Switchgear - Capacity: 100 to <350 Amp - Equipment that is...)											
DS1a	0.0 (0.0)	0.4 (0.4)	1.0 (1.0)	2.0 (2.0)	2.4 (2.4)	4.3 (4.3)	8.6 (8.6)	14 (14)	13 (13)	18 (18)	19 (19)
DS1b	0.0 (0.0)	0.0 (0.0)	0.4 (0.4)	1.0 (1.0)	1.3 (1.3)	1.9 (1.9)	3.7 (3.7)	5.5 (5.5)	5.8 (5.8)	7.9 (7.9)	7.7 (7.7)
DS1c	0.0 (0.0)	0.4 (0.4)	1.5 (1.5)	3.0 (3.0)	4.4 (4.4)	7.7 (7.7)	13 (13)	19 (19)	19 (19)	28 (28)	29 (29)
Total	0.1 (0.1)	0.8 (0.8)	3.0 (3.0)	6.0 (6.0)	8.1 (8.1)	14 (14)	25 (25)	39 (39)	38 (38)	53 (53)	55 (55)
D5012.033c #1 (D5012.033c: Distribution Panel - Capacity: 100 to <350 Amp - Equipment that is either...)											
DS1a	0.0 (0.2)	0.3 (2.0)	0.7 (4.6)	1.7 (11)	1.6 (11)	2.3 (15)	3.5 (21)	5.3 (31)	5.1 (29)	7.9 (42)	7.5 (41)
DS1b	0.0 (0.0)	0.1 (0.9)	0.4 (2.8)	0.6 (4.6)	0.7 (5.0)	1.1 (7.9)	1.4 (9.9)	2.2 (15)	2.0 (14)	3.4 (23)	3.3 (23)
DS1c	0.0 (0.3)	0.4 (2.7)	1.2 (8.6)	2.1 (14)	2.4 (15)	3.5 (21)	5.1 (29)	7.5 (38)	7.3 (37)	11 (50)	12 (53)
Total	0.1 (0.6)	0.7 (5.2)	2.3 (13)	4.4 (24)	4.6 (25)	6.9 (33)	10 (42)	15 (55)	14 (54)	22 (69)	23 (71)
D5092.013c #1 (D5092.013c: Battery Rack - Capacity: all - Equipment that is either hard anchored or is...)											
DS1a	0.0 (0.0)	0.0 (0.0)	0.2 (0.2)	0.7 (0.7)	1.0 (1.0)	2.1 (2.1)	4.4 (4.4)	7.7 (7.7)	7.3 (7.3)	11 (11)	13 (13)
DS1b	0.0 (0.0)	0.0 (0.0)	0.2 (0.2)	0.2 (0.2)	0.6 (0.6)	0.8 (0.8)	2.1 (2.1)	2.6 (2.6)	3.1 (3.1)	5.9 (5.9)	5.9 (5.9)
DS1c	0.0 (0.0)	0.0 (0.0)	0.1 (0.1)	0.3 (0.3)	0.4 (0.4)	0.6 (0.6)	1.8 (1.8)	3.3 (3.3)	3.4 (3.4)	6.4 (6.4)	5.9 (5.9)
DS1d	0.0 (0.0)	0.0 (0.0)	0.2 (0.2)	0.5 (0.5)	0.9 (0.9)	1.3 (1.3)	2.9 (2.9)	4.9 (4.9)	4.9 (4.9)	7.4 (7.4)	8.6 (8.6)
DS1e	0.0 (0.0)	0.1 (0.1)	0.0 (0.0)	0.1 (0.1)	0.2 (0.2)	0.7 (0.7)	0.9 (0.9)	2.5 (2.5)	1.8 (1.8)	3.0 (3.0)	2.7 (2.7)
Total	0.0 (0.0)	0.2 (0.2)	0.6 (0.6)	1.8 (1.8)	3.0 (3.0)	5.5 (5.5)	12 (12)	21 (21)	21 (21)	34 (34)	36 (36)
D5092.023c #1 (D5092.023c: Battery Charger - Capacity: all - Equipment that is either hard anchored or...)											
DS1a	0.0 (0.0)	0.0 (0.0)	0.4 (0.4)	0.8 (0.8)	1.2 (1.2)	2.1 (2.1)	5.0 (5.0)	8.3 (8.3)	6.6 (6.6)	12 (12)	11 (11)
DS1b	0.0 (0.0)	0.0 (0.0)	0.1 (0.1)	0.4 (0.4)	0.6 (0.6)	0.8 (0.8)	1.9 (1.9)	3.2 (3.2)	3.4 (3.4)	5.4 (5.4)	5.2 (5.2)
DS1c	0.0 (0.0)	0.1 (0.1)	0.2 (0.2)	0.7 (0.7)	0.8 (0.8)	1.5 (1.5)	2.5 (2.5)	5.6 (5.6)	5.4 (5.4)	7.9 (7.9)	11 (11)
DS1d	0.0 (0.0)	0.0 (0.0)	0.1 (0.1)	0.2 (0.2)	0.8 (0.8)	1.5 (1.5)	3.1 (3.1)	5.9 (5.9)	4.4 (4.4)	8.9 (8.9)	8.8 (8.8)
Total	0.0 (0.0)	0.1 (0.1)	0.7 (0.7)	2.0 (2.0)	3.4 (3.4)	6.0 (6.0)	12 (12)	23 (23)	20 (20)	34 (34)	36 (36)
D5092.033c #1 (D5092.033c: Diesel generator - Capacity: 100 to <350 kVA - Equipment that is either...)											
DS1a	0.0 (0.0)	0.1 (0.2)	0.2 (0.3)	0.6 (1.1)	1.0 (2.1)	2.0 (3.9)	4.2 (7.9)	7.7 (14)	7.1 (13)	13 (23)	13 (23)
DS1b	0.0 (0.0)	0.0 (0.0)	0.2 (0.4)	0.3 (0.5)	0.5 (0.9)	0.9 (1.7)	1.9 (3.7)	2.6 (5.1)	2.8 (5.5)	4.9 (9.5)	4.2 (8.2)
DS1c	0.0 (0.0)	0.1 (0.2)	0.3 (0.6)	0.8 (1.5)	1.2 (2.4)	2.5 (4.4)	5.1 (9.8)	8.0 (15)	8.0 (14)	12 (22)	15 (25)
DS1d	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.1 (0.2)	0.2 (0.3)	0.4 (0.7)	0.5 (1.0)	1.0 (2.0)	1.1 (2.1)	1.6 (3.2)	1.6 (3.1)
DS1e	0.0 (0.0)	0.0 (0.0)	0.0 (0.1)	0.1 (0.1)	0.1 (0.2)	0.4 (0.8)	0.8 (1.5)	0.9 (1.7)	1.1 (2.1)	1.3 (2.7)	2.0 (4.0)
Total	0.0 (0.0)	0.2 (0.4)	0.7 (1.3)	1.7 (3.2)	3.0 (5.5)	6.1 (11)	13 (22)	20 (32)	20 (32)	33 (49)	35 (52)

4 COMPONENT DAMAGEABILITY AND COST OVERVIEW

This section provides an overview of key component parameters for loss assessment. The components are broken into groups such that the specified component modifiers are applied to all components in the given table.

Some notes on the columns are as follows:

- **DS: Median (Unit Repair Cost Range):** This presents median EDP for each damage state as well as the associated repair cost range to repair one unit of the component (varies based on quantity).
- **Max Repair Potential:** This is the cost to completely replace this component throughout the building assuming the most expensive damage state for all components (includes volume discounting). The number in parenthesis is the value as a percentage of building replacement value. Note that this does not need to add up to the total building replacement value, but rather gives a sense of how much potential the component has to contribute to the mean loss when it is damaged.

Table 4.1. "Structural" component list.

Component	Description	DS: Median (Unit Repair Cost Range)			Max Repair Potential
B1031.001	Bolted shear tab gravity connections	EDP	Peak Story Drift Ratio		\$17,027,257 (29.1%)
		DS1a:	0.04	(\$0 - \$0)	
		DS1b:	0.04	(\$30,697 - \$49,882)	
		DS2:	0.08	(\$33,256 - \$46,950)	
		DS3:	0.11	(\$32,615 - \$46,045)	
B1031.011b	Steel Column Base Plates, Column 150 plf < W < 300 plf	EDP	Peak Story Drift Ratio		\$1,299,162 (2.22%)
		DS1a:	0.04	(\$0 - \$0)	
		DS1b:	0.04	(\$49,014 - \$79,647)	
		DS2:	0.07	(\$72,359 - \$102,154)	
		DS3:	0.1	(\$88,769 - \$125,321)	
B1031.021b	Welded column splices, Column 150 plf < W < 300 plf	EDP	Peak Story Drift Ratio		\$1,641,844 (2.80%)
		DS1a:	0.02	(\$0 - \$0)	
		DS1b:	0.02	(\$24,471 - \$39,765)	
		DS2:	0.05	(\$34,205 - \$48,290)	
B1033.652a	CoreBrace Buckling Restrained Brace (BRB), Moment-Connected Beams, Chevron Brace, Bolted Connection, Steel Core Area =5in^2, Story Height = 16ft, Bay Width = 30ft	EDP	Peak Story Drift Ratio		\$1,040,747 (1.78%)
		DS1a:	0.03	(\$65,007 - \$105,641)	
		DS1b:	0.03	(\$69,110 - \$112,308)	
		DS1c:	0.03	(\$69,110 - \$112,308)	
		DS2:	0.052	(\$86,727 - \$140,935)	
B1033.653a	CoreBrace Buckling Restrained Brace (BRB), Moment-Connected Beams, Chevron Brace, Bolted Connection, Steel Core Area =5in^2, Story Height = 14ft, Bay Width = 30ft	EDP	Peak Story Drift Ratio		\$4,599,933 (7.85%)
		DS1a:	0.03	(\$62,383 - \$101,357)	
		DS1b:	0.03	(\$66,486 - \$108,024)	
		DS1c:	0.03	(\$66,486 - \$108,024)	
		DS2:	0.051	(\$82,142 - \$133,484)	
Total:				\$25,608,942 (43.7%)	

Table 4.2. "Exterior Finishes" component list.

Component	Description	DS: Median (Unit Repair Cost Range)		Max Repair Potential
B2011.201a	Precast Concrete Panels 4.5 inches thick - in plane deformation	EDP	Peak Story Drift Ratio	\$2,362,649
		DS1a:	0.028 (\$20,386 - \$33,127)	(4.03%)
		DS1b:	0.028 (\$101,928 - \$165,634)	
B2011.201b	Precast Concrete Panels 4.5 inches thick - out of plane deformation	EDP	Peak Floor Acceleration	\$3,543,974
		DS1:	3.82 (\$152,893 - \$248,451)	(6.05%)
B2022.002	Curtain Walls - Generic Midrise Stick-Built Curtain wall, Config: Insulating Glass Units (dual pane), Lamination: Unknown, Glass Type: Unknown, Details: Aspect ratio = 6:5, Other details Unknown	EDP	Peak Story Drift Ratio	\$5,730,324
		DS1:	0.021 (\$4,754 - \$8,914)	(9.78%)
		DS2:	0.024 (\$4,754 - \$8,914)	
Total:				\$11,636,948 (19.9%)

Table 4.3. "Partition Walls" component list.

Component	Description	DS: Median (Unit Repair Cost Range)		Max Repair Potential
C1011.001c	Wall Partition, Type: Gypsum with metal studs, Full Height, Fixed Below, Slip Track Above with returns	EDP	Peak Story Drift Ratio	\$506,787
		DS1:	0.004 (\$1,292 - \$4,308)	(0.86%)
		DS2:	0.011 (\$3,294 - \$10,980)	
		DS3:	0.019 (\$6,335 - \$21,116)	
Total:				\$506,787 (0.86%)

Table 4.4. "Other Nonstructural" component list.

Component	Description	DS: Median (Unit Repair Cost Range)		Max Repair Potential
C2011.001a	Prefabricated steel stair with steel treads and landings with seismic joints that accommodate drift.	EDP	Peak Story Drift Ratio	\$490,859
		DS1:	0.025 (\$3,928 - \$13,092)	(0.84%)
		DS2:	0.037 (\$10,045 - \$33,484)	
		DS3:	0.048 (\$30,679 - \$102,262)	
C3011.001c	Wall Partition, Type: Gypsum + Wallpaper, Full Height, Fixed Below, Slip Track Above w/ returns (friction connection)	EDP	Peak Story Drift Ratio	\$39,408
		DS1:	0.002 (\$6,516 - \$9,774)	(0.07%)
D4011.024a	Fire Sprinkler Water Piping - Horizontal Mains and Branches - Old Style Victaulic - Thin Wall Steel - with designed bracing, SDC D, E, or F (OSHDP or sim), PIPING FRAGILITY	EDP	Peak Floor Acceleration	\$115,113
		DS1:	1.9 (\$950 - \$1,161)	(0.20%)
		DS2:	3.4 (\$7,195 - \$8,793)	
D4011.054a	Fire Sprinkler Drop Standard Threaded Steel - Dropping into braced lay-in tile SOFT ceiling - 6 ft. long drop maximum, SDC D, E, or F (OSHDP or sim)	EDP	Peak Floor Acceleration	\$10,860
		DS1:	1.9 (\$1,357 - \$1,659)	(0.02%)
		DS2:	3 (\$1,357 - \$1,659)	

Continued on next page

Table 4.4 (Continued). "Other Nonstructural" component list.

Component	Description	DS: Median (Repair Cost Range)			Max Repair Potential
D5011.013c	Transformer/primary service - Capacity: <100 kVA - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility	EDP	Peak Floor Acceleration		
		DS1a:	1.53 (\$2,715 - \$3,318)		\$28,454 (0.05%)
		DS1b:	1.53 (\$23,281 - \$28,454)		
		DS1c:	1.53 (\$20,566 - \$25,136)		
D5012.013d	Motor Control Center - Capacity: all - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility	EDP	Peak Floor Acceleration		
		DS1a:	1.09 (\$1,357 - \$1,659)		\$15,430 (0.03%)
		DS1b:	1.09 (\$12,624 - \$15,430)		
		DS1c:	1.09 (\$11,267 - \$13,771)		
D5012.023c	Low Voltage Switchgear - Capacity: 100 to <350 Amp - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility	EDP	Peak Floor Acceleration		
		DS1a:	1.09 (\$1,357 - \$1,659)		\$32,436 (0.06%)
		DS1b:	1.09 (\$26,538 - \$32,436)		
		DS1c:	1.09 (\$25,181 - \$30,777)		
D5012.033c	Distribution Panel - Capacity: 100 to <350 Amp - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility	EDP	Peak Floor Acceleration		
		DS1a:	1.82 (\$1,207 - \$1,810)		\$188,718 (0.32%)
		DS1b:	1.82 (\$23,590 - \$35,385)		
		DS1c:	1.82 (\$22,383 - \$33,575)		
D5092.013c	Battery Rack - Capacity: all - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility	EDP	Peak Floor Acceleration		
		DS1a:	1.53 (\$2,413 - \$3,620)		\$61,176 (0.10%)
		DS1b:	1.53 (\$38,974 - \$58,461)		
		DS1c:	1.53 (\$28,959 - \$43,439)		
		DS1d:	1.53 (\$30,769 - \$46,154)		
		DS1e:	1.53 (\$40,784 - \$61,176)		
D5092.023c	Battery Charger - Capacity: all - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility	EDP	Peak Floor Acceleration		
		DS1a:	1.53 (\$1,900 - \$2,745)		\$50,392 (0.09%)
		DS1b:	1.53 (\$34,887 - \$50,392)		
		DS1c:	1.53 (\$32,986 - \$47,647)		
		DS1d:	1.53 (\$32,986 - \$47,647)		
D5092.033c	Diesel generator - Capacity: 100 to <350 kVA - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility	EDP	Peak Floor Acceleration		
		DS1a:	1.53 (\$2,112 - \$3,318)		\$647,420 (1.10%)
		DS1b:	1.53 (\$277,466 - \$339,125)		
		DS1c:	1.53 (\$543 - \$664)		
		DS1d:	1.53 (\$6,787 - \$8,296)		
		DS1e:	1.53 (\$1,357 - \$1,659)		
Total:					\$1,680,265 (2.87%)

Table 4.5. "Ceilings" component list.

Component	Description	DS: Median (Unit Repair Cost Range)		Max Repair Potential
C3032.004a	Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): A < 250, Vert & Lat support	EDP	Peak Floor Acceleration	\$760,723 (1.30%)
		DS1:	1.92 (\$656 - \$2,187)	
		DS2:	2.34 (\$5,136 - \$17,119)	
		DS3:	2.48 (\$10,566 - \$35,219)	
C3032.004b	Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): 250 < A < 1000, Vert & Lat support	EDP	Peak Floor Acceleration	\$760,723 (1.30%)
		DS1:	1.76 (\$1,575 - \$5,249)	
		DS2:	2.26 (\$12,326 - \$41,086)	
		DS3:	2.44 (\$25,357 - \$84,525)	
C3032.004c	Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): 1000 < A < 2500, Vert & Lat support	EDP	Peak Floor Acceleration	\$760,723 (1.30%)
		DS1:	1.45 (\$4,724 - \$15,747)	
		DS2:	2.1 (\$36,977 - \$123,258)	
		DS3:	2.34 (\$76,072 - \$253,574)	
C3032.004d	Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): A > 2500, Vert & Lat support	EDP	Peak Floor Acceleration	\$1,312,951 (2.24%)
		DS1:	1.31 (\$6,561 - \$21,870)	
		DS2:	2.03 (\$51,357 - \$171,191)	
		DS3:	2.29 (\$105,656 - \$352,187)	
Total:				\$3,595,120 (6.13%)

Table 4.6. "Elevators" component list.

Component	Description	DS: Median (Unit Repair Cost Range)		Max Repair Potential
D1014.041	Traction Elevator Machine room component anchorage. Applies to Seismic Zone 3 or greater and elevators designed according to the ASME A17.1-2007 Standard or similar.	EDP	Peak Floor Acceleration	\$81,448 (0.14%)
		DS1:	1.72 (\$8,145 - \$27,149)	
D1014.042	Traction Elevator Cab and Counterweight Components. Applies to Seismic Zone 3 or greater and elevators designed according to the ASME A17.1-2007 Standard or similar.	EDP	Peak Floor Acceleration	\$460,017 (0.79%)
		DS1:	0.86 (\$46,003 - \$153,339)	
D1014.043	Traction Elevator Guide Rails. Applies to Seismic Zone 3 or greater and elevators designed according to the ASME A17.1-2007 Standard or similar.	EDP	Peak Floor Acceleration	\$34,833 (0.06%)
		DS1:	0.86 (\$3,439 - \$11,611)	
D1014.044	Traction Elevator Guide Rail Brackets. Applies to Seismic Zone 3 or greater and elevators designed according to the ASME A17.1-2007 Standard or similar.	EDP	Peak Floor Acceleration	\$115,285 (0.20%)
		DS1:	0.86 (\$11,529 - \$38,428)	
Total:				\$691,583 (1.18%)

Table 4.7. "Piping" component list.

Component	Description	DS: Median (Unit Repair Cost Range)				Max Repair Potential
D2021.014a	Cold or Hot Potable - Small Diameter Threaded Steel - (2.5 inches in diameter or less), SDC D, E, or F (OSHDP or sim), PIPING FRAGILITY	EDP	Peak Floor Acceleration			\$72,521 (0.12%)
		DS1:	2.25 (\$787 - \$962)			
		DS2:	4.1 (\$7,195 - \$8,793)			
D2021.014b	Cold or Hot Potable - Small Diameter Threaded Steel - (2.5 inches in diameter or less), SDC D, E, or F (OSHDP or sim), BRACING FRAGILITY	EDP	Peak Floor Acceleration			\$10,399 (0.02%)
		DS1:	1.5 (\$1,032 - \$1,261)			
D2021.024a	Cold or Hot Potable Water Piping (dia > 2.5 inches), SDC D,E,F (OSPFD or sim), PIPING FRAGILITY	EDP	Peak Floor Acceleration			\$72,760 (0.12%)
		DS1:	2.25 (\$633 - \$2,112)			
		DS2:	4.1 (\$6,063 - \$20,211)			
D2021.024b	Cold or Hot Potable Water Piping (dia > 2.5 inches), SDC D,E,F (OSPFD or sim), BRACING FRAGILITY	EDP	Peak Floor Acceleration			\$7,602 (0.01%)
		DS1:	1.5 (\$633 - \$2,112)			
		DS2:	2.25 (\$633 - \$2,112)			
D2031.014b	Sanitary Waste Piping - Cast Iron w/flexible couplings, SDC D,E,F (OSHDP or sim), BRACING FRAGILITY	EDP	Peak Floor Acceleration			\$11,005 (0.02%)
		DS1:	3 (\$724 - \$2,413)			
Total:						\$174,287 (0.30%)

Table 4.8. "HVAC" component list.

Component	Description	DS: Median (Unit Repair Cost Range)				Max Repair Potential
D3032.013f	Compressor - Capacity: Large non medical air supply - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility	EDP	Peak Floor Acceleration			\$29,366 (0.05%)
		DS1a:	2.45 (\$2,308 - \$2,821)			
		DS1b:	2.45 (\$24,027 - \$29,366)			
		DS1c:	2.45 (\$8,145 - \$9,955)			
		DS1d:	2.45 (\$24,027 - \$29,366)			
D3032.013f	Compressor - Capacity: Large non medical air supply - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility	EDP	Peak Floor Acceleration			\$56,063 (0.10%)
		DS1a:	2.45 (\$2,308 - \$2,821)			
		DS1b:	2.45 (\$24,027 - \$29,366)			
		DS1c:	2.45 (\$8,145 - \$9,955)			
		DS1d:	2.45 (\$24,027 - \$29,366)			
D3032.013f	Compressor - Capacity: Large non medical air supply - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility	EDP	Peak Floor Acceleration			\$56,063 (0.10%)
		DS1a:	2.45 (\$2,308 - \$2,821)			
		DS1b:	2.45 (\$24,027 - \$29,366)			
		DS1c:	2.45 (\$8,145 - \$9,955)			
		DS1d:	2.45 (\$24,027 - \$29,366)			

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Table 4.8 (Continued). "HVAC" component list.

Component	Description	DS: Median (Repair Cost Range)			Max Repair Potential
D3032.013f	Compressor - Capacity: Large non medical air supply - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility	EDP	Peak Floor Acceleration		
		DS1a:	2.45 (\$2,308 - \$2,821)		\$56,063
		DS1b:	2.45 (\$24,027 - \$29,366)		(0.10%)
		DS1c:	2.45 (\$8,145 - \$9,955)		
		DS1d:	2.45 (\$24,027 - \$29,366)		
D3032.013f	Compressor - Capacity: Large non medical air supply - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility	EDP	Peak Floor Acceleration		
		DS1a:	2.45 (\$2,308 - \$2,821)		\$56,063
		DS1b:	2.45 (\$24,027 - \$29,366)		(0.10%)
		DS1c:	2.45 (\$8,145 - \$9,955)		
		DS1d:	2.45 (\$24,027 - \$29,366)		
D3032.013f	Compressor - Capacity: Large non medical air supply - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility	EDP	Peak Floor Acceleration		
		DS1a:	2.45 (\$2,308 - \$2,821)		\$56,063
		DS1b:	2.45 (\$24,027 - \$29,366)		(0.10%)
		DS1c:	2.45 (\$8,145 - \$9,955)		
		DS1d:	2.45 (\$24,027 - \$29,366)		
D3032.013f	Compressor - Capacity: Large non medical air supply - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility	EDP	Peak Floor Acceleration		
		DS1a:	2.45 (\$2,308 - \$2,821)		\$56,063
		DS1b:	2.45 (\$24,027 - \$29,366)		(0.10%)
		DS1c:	2.45 (\$8,145 - \$9,955)		
		DS1d:	2.45 (\$24,027 - \$29,366)		
D3032.013f	Compressor - Capacity: Large non medical air supply - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility	EDP	Peak Floor Acceleration		
		DS1a:	2.45 (\$2,308 - \$2,821)		\$56,063
		DS1b:	2.45 (\$24,027 - \$29,366)		(0.10%)
		DS1c:	2.45 (\$8,145 - \$9,955)		
		DS1d:	2.45 (\$24,027 - \$29,366)		
D3041.011f	(ATC-138 Beta) HVAC Galvanized Sheet Metal Ducting less than 6 sq. ft in cross sectional area, above code-minimum bracing similar to larger ducting, SDC D, E, or F (OSHDP or Sim)	EDP	Peak Floor Acceleration		
		DS1:	3 (\$1,765 - \$2,157)		\$103,439
		DS2:	4.5 (\$17,240 - \$21,071)		(0.18%)
D3041.012d	HVAC Galvanized Sheet Metal Ducting - 6 sq. ft cross sectional area or greater, SDC D, E, or F (OSHDP or sim)	EDP	Peak Floor Acceleration		
		DS1:	3.75 (\$2,579 - \$3,152)		\$41,057
		DS2:	4.5 (\$21,584 - \$26,380)		(0.07%)
D3041.031e	(ATC-138 Beta) (RUGGED) HVAC Drops / Diffusers in suspended ceilings - With independent safety wires, SDC D, E, or F (OSHDP or sim)	EDP	Peak Floor Acceleration		
		DS1:	500 (\$8,145 - \$9,955)		\$586,424
					(1.00%)
D3041.103c	HVAC Fan - Capacity: all - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility	EDP	Peak Floor Acceleration		
		DS1a:	1.82 (\$1,900 - \$2,323)		\$72,760
		DS1b:	1.82 (\$9,095 - \$11,116)		(0.12%)
		DS1c:	1.82 (\$7,195 - \$8,793)		
Total:					\$1,225,490
					(2.09%)

Table 4.9. Summary of component value breakdown (building replacement value = \$58,600,692).

Component Category	Max Repair Potential	% of Building Replacement Value
Structural	\$25,608,942	43.7%
Exterior Finishes	\$11,636,948	19.9%
Partition Walls	\$506,787	0.86%
Other Nonstructural	\$1,680,265	2.87%
Ceilings	\$3,595,120	6.13%
Elevators	\$691,583	1.18%
Piping	\$174,287	0.30%
HVAC	\$1,225,490	2.09%
Total	\$45,119,420	77.0%

5 COMPONENT QUANTITIES AND MODIFICATION FACTORS

Table 5.1. Component quantity and modification summary.

Location	Qty. Dir 1	Qty. Dir 2	Qty. ND	Cost Scale	Capacity Scale	Time Scale
B1031.001 (B1031.001 #1): Bolted shear tab gravity connections						
1-8	32	32	–	1	1	1
B1031.011b (B1031.011b #1): Steel Column Base Plates, Column 150 plf < W < 300 plf						
1	6	6	–	1	1	1
B1031.021b (B1031.021b #1): Welded column splices, Column 150 plf < W < 300 plf						
2, 4, 6, 8	6	6	–	1	1	1
B1033.652a (B1033.652a #1): CoreBrace Buckling Restrained Brace (BRB), Moment-Connected Beams, Chevron Brace, Bolted Connection, Steel Core Area = 5in^2, Story Height = 16ft, Bay Width = 30ft						
1	4	4	–	1	1	1
B1033.653a (B1033.653a #1): CoreBrace Buckling Restrained Brace (BRB), Moment-Connected Beams, Chevron Brace, Bolted Connection, Steel Core Area = 5in^2, Story Height = 14ft, Bay Width = 30ft						
2-8	4	4	–	1	1	1
B2011.201a (B2011.201a #1): Precast Concrete Panels 4.5 inches thick - in plane deformation						
1	1.538461538	1.538461538	–	1	1	1
2-8	1.435897436	1.435897436	–	1	1	1
B2011.201b (B2011.201b #1): Precast Concrete Panels 4.5 inches thick - out of plane deformation						
2	1.538461538	1.538461538	–	1	1	1
3-R	1.435897436	1.435897436	–	1	1	1
B2022.002 (B2022.002 #1): Curtain Walls - Generic Midrise Stick-Built Curtain wall, Config: Insulating Glass Units (dual pane), Lamination: Unknown, Glass Type: Unknown, Details: Aspect ratio = 6:5, Other details Unknown						
1	80	80	–	1	1	1
2-8	74.666666667	74.666666667	–	1	1	1
C1011.001c (C1011.001c #1): Wall Partition, Type: Gypsum with metal studs, Full Height, Fixed Below, Slip Track Above with returns						
1-8	5	5	–	1	1	1
C2011.001a (C2011.001a #1): Prefabricated steel stair with steel treads and landings with seismic joints that accommodate drift.						
1-8	1	1	–	1	1	1
C3011.001c (C3011.001c #1): Wall Partition, Type: Gypsum + Wallpaper, Full Height, Fixed Below, Slip Track Above w/ returns (friction connection)						
1-8	0.378	0.378	–	1	1	1
C3032.004a (C3032.004a #1): Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): A < 250, Vert & Lat support						
2-R	–	–	9	1	1	1
C3032.004b (C3032.004b #1): Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): 250 < A < 1000, Vert & Lat support						
2-R	–	–	3.75	1	1	1
C3032.004c (C3032.004c #1): Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): 1000 < A < 2500, Vert & Lat support						
2-R	–	–	1.25	1	1	1
C3032.004d (C3032.004d #1): Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): A > 2500, Vert & Lat support						
2-R	–	–	0.9	1	1	1
D1014.041 (D1014.041 #1): Traction Elevator Machine room component anchorage. Applies to Seismic Zone 3 or greater and elevators designed according to the ASME A17.1-2007 Standard or similar.						
R	–	–	3	1	1	1

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Table 5.1 (Continued). Component quantity and modification summary.

Location	Qty. Dir 1	Qty. Dir 2	Qty. ND	Cost Scale	Capacity Scale	Time Scale
D1014.042 (D1014.042 #1): Traction Elevator Cab and Counterweight Components. Applies to Seismic Zone 3 or greater and elevators designed according to the ASME A17.1-2007 Standard or similar.						
G	–	–	3	1	1	1
D1014.043 (D1014.043 #1): Traction Elevator Guide Rails. Applies to Seismic Zone 3 or greater and elevators designed according to the ASME A17.1-2007 Standard or similar.						
G	–	–	3	1	1	1
D1014.044 (D1014.044 #1): Traction Elevator Guide Rail Brackets. Applies to Seismic Zone 3 or greater and elevators designed according to the ASME A17.1-2007 Standard or similar.						
G	–	–	3	1	1	1
D2021.014a (D2021.014a #1): Cold or Hot Potable - Small Diameter Threaded Steel - (2.5 inches in diameter or less), SDC D, E, or F (OSHPD or sim), PIPING FRAGILITY						
2-R	–	–	1.26	1	1	1
D2021.014b (D2021.014b #1): Cold or Hot Potable - Small Diameter Threaded Steel - (2.5 inches in diameter or less), SDC D, E, or F (OSHPD or sim), BRACING FRAGILITY						
2-R	–	–	1.26	1	1	1
D2021.024a (D2021.024a #1): Cold or Hot Potable Water Piping (dia > 2.5 inches), SDC D,E,F (OSHPD or sim), PIPING FRAGILITY						
2-R	–	–	0.45	1	1	1
D2021.024b (D2021.024b #1): Cold or Hot Potable Water Piping (dia > 2.5 inches), SDC D,E,F (OSHPD or sim), BRACING FRAGILITY						
2-R	–	–	0.45	1	1	1
D2031.014b (D2031.014b #1): Sanitary Waste Piping - Cast Iron w/flexible couplings, SDC D,E,F (OSHPD or sim), BRACING FRAGILITY						
2-R	–	–	0.57	1	1	1
D3032.013f (D3032.013f #1): Compressor - Capacity: Large non medical air supply - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility						
G	–	–	1	1	1	1
D3032.013f (D3032.013f #2): Compressor - Capacity: Large non medical air supply - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility						
2	–	–	2	1	1	1
D3032.013f (D3032.013f #3): Compressor - Capacity: Large non medical air supply - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility						
3	–	–	2	1	1	1
D3032.013f (D3032.013f #4): Compressor - Capacity: Large non medical air supply - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility						
4	–	–	2	1	1	1
D3032.013f (D3032.013f #5): Compressor - Capacity: Large non medical air supply - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility						
5	–	–	2	1	1	1
D3032.013f (D3032.013f #6): Compressor - Capacity: Large non medical air supply - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility						
6	–	–	2	1	1	1
D3032.013f (D3032.013f #7): Compressor - Capacity: Large non medical air supply - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility						
7	–	–	2	1	1	1

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Table 5.1 (Continued). Component quantity and modification summary.

Location	Qty. Dir 1	Qty. Dir 2	Qty. ND	Cost Scale	Capacity Scale	Time Scale
D3032.013f (D3032.013f #8): Compressor - Capacity: Large non medical air supply - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility						
R	–	–	2	1	1	1
D3041.011f (D3041.011f #1): (ATC-138 Beta) HVAC Galvanized Sheet Metal Ducting less than 6 sq. ft in cross sectional area, above code-minimum bracing similar to larger ducting, SDC D, E, or F (OSHDP or Sim)						
2-R	–	–	0.75	1	1	1
D3041.012d (D3041.012d #1): HVAC Galvanized Sheet Metal Ducting - 6 sq. ft cross sectional area or greater, SDC D, E, or F (OSHDP or sim)						
2-R	–	–	0.2	1	1	1
D3041.031e (D3041.031e #1): (ATC-138 Beta) (RUGGED) HVAC Drops / Diffusers in suspended ceilings - With independent safety wires, SDC D, E, or F (OSHDP or sim)						
2-R	–	–	9	1	1	1
D3041.103c (D3041.103c #1): HVAC Fan - Capacity: all - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility						
2-R	–	–	1	1	1	1
D4011.024a (D4011.024a #1): Fire Sprinkler Water Piping - Horizontal Mains and Branches - Old Style Victaulic - Thin Wall Steel - with designed bracing, SDC D, E, or F (OSHDP or sim), PIPING FRAGILITY						
2-R	–	–	2	1	1	1
D4011.054a (D4011.054a #1): Fire Sprinkler Drop Standard Threaded Steel - Dropping into braced lay-in tile SOFT ceiling - 6 ft. long drop maximum, SDC D, E, or F (OSHDP or sim)						
2-R	–	–	1	1	1	1
D5011.013c (D5011.013c #1): Transformer/primary service - Capacity: <100 kVA - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility						
G	–	–	1	1	1	1
D5012.013d (D5012.013d #1): Motor Control Center - Capacity: all - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility						
G	–	–	1	1	1	1
D5012.023c (D5012.023c #1): Low Voltage Switchgear - Capacity: 100 to <350 Amp - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility						
G	–	–	1	1	1	1
D5012.033c (D5012.033c #1): Distribution Panel - Capacity: 100 to <350 Amp - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility						
2-R	–	–	1	1	1	1
D5092.013c (D5092.013c #1): Battery Rack - Capacity: all - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility						
G	–	–	1	1	1	1
D5092.023c (D5092.023c #1): Battery Charger - Capacity: all - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility						
G	–	–	1	1	1	1
D5092.033c (D5092.033c #1): Diesel generator - Capacity: 100 to <350 kVA - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility						
G	–	–	2	1	1	1

6 FRAGILITY INFORMATION

6.1 B1031.001 #1: (B1031.001) Bolted shear tab gravity connections

NISTIR Classification	B1031.001
Author	Greg Deierlein
Normalized Unit	1.0 each
Engineering Demand Parameter	Peak Story Drift Ratio
Number of Damage States	3
Is correlated?	No
Is directional?	Yes

Groupings:

Loss Aggregation Group	Structural
System	Steel
Element	Gravity

Calculation:

Is Calculated?	No
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ATC-138 Properties:

System	Structural
Subsystem	N/A
Structural System	Steel Gravity Columns
Alt. Structural System	N/A
Structural Series	1

Component modifications applied:

Component Group	Structural
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.1.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
1-8	1	1	1

Table 6.1.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1a	Yielding of shear tab and elongation of bolt holes, possible crack initiation around bolt holes or at shear tab weld. Damage in field is either obscured or deemed to not warrant repair. No repair conducted.	Careful inspection and welded repair to any cracks and possible replacement of shear tab if bolt hole deformations are excessive (possible for deeper 6-bolt or deeper shear tabs). Field condition is deemed to not warrant repair by field observation. This Damage State is Mutually Exclusive with DS2. See fragility DS1 and DS2 probabilities.	
DS1b	Yielding of shear tab and elongation of bolt holes, possible crack initiation around bolt holes or at shear tab weld.	Careful inspection and welded repair to any cracks and possible replacement of shear tab if bolt hole deformations are excessive (possible for deeper 6-bolt or deeper shear tabs).	
DS2	Partial tearing of shear tab and possibility of bolt shear failure (6-bolt or deeper connections).	Repairs will include either welded repair of shear tab or possible complete replacement of shear tab and installation of new bolts. Repairs may require shoring of beam.	
DS3	Complete separation of shear tab, close to complete loss of vertical load resistance.	Repair will include complete replacement of shear tab and installation of new bolts. Repairs will require shoring of beam.	

Table 6.1.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1a	DS1b	DS2	DS3
Type	Mut. Excl.	Mut. Excl.	Sequential	Sequential
Probability	0.95	0.05	–	–
Median	0.04	0.04	0.08	0.11
β	0.4	0.4	0.4	0.4

Table 6.1.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1a	DS1b	DS2	DS3
Distribution Type	LogNormal	Normal	Normal	Normal
Lower Qty.	5.0	5.0	5.0	5.0
Upper Qty.	20.0	20.0	20.0	20.0
Highest Cost Median	\$0	\$49,882	\$46,950	\$46,045
Lowest Cost Median	\$0	\$30,697	\$33,256	\$32,615
β (COV)	0.0	0.37	0.38	0.38

Table 6.1.5. Parameters for the repair time distributions.

	DS1a	DS1b	DS2	DS3
Distribution Type	LogNormal	Normal	Normal	Normal
Lower Qty.	5.0	5.0	5.0	5.0
Upper Qty.	20.0	20.0	20.0	20.0
Highest Median Repair Time (Days)	0	16.05	15.11	14.82
Lowest Median Repair Time (Days)	0	9.88	10.7	10.49
β (COV)	0.0	0.45	0.45	0.46

Table 6.1.6. Life safety information.

	DS1a	DS1b	DS2	DS3
Non-collapse casualties	No	No	No	No
Affected Area	--	--	--	--
Serious Injury Median	–	–	–	–
Serious Injury β	–	–	–	–
Loss of Life Median	–	–	–	–
Loss of Life β	–	–	–	–
Can Cause Red Tag	No	No	Yes	Yes
Unsafe Placard Median	–	–	0.2	0.1
Unsafe Placard β	–	–	0.5	0.5

Table 6.1.7. REDi repair class.

	DS1a	DS1b	DS2	DS3
REDi Repair Class	3	3	3	3

Table 6.1.8. ATC-138 parameters.

	DS1a	DS1b	DS2	DS3
Safety				
Safety Class	0	0	2	2
Envelope				
Affects Roof Function	No	No	No	No
Affects Envelope Safety	No	No	No	No
Damages Envelope Seal	No	No	No	No
Exterior Surface Area Factor	—	—	—	—
Exterior Falling Hazard				
Poses an Exterior Falling Hazard	No	No	No	No
Exterior Falling Length Factor	—	—	—	—
Interior Space				
Poses an Interior Falling Hazard	No	No	Yes	Yes
Obstructs Interior Space	No	No	Yes	Yes
Interior Area Conversion Type	—	—	bay	bay
Interior Area Conversion Factor	—	—	1.0	1.0
Repair Schedule				
Crew Size	4	4	6	6
Permit Type (Rapid or Full)	N/A	Full	Full	Full
Requires Redesign	Yes	Yes	Yes	Yes
Long Lead Time	No	No	No	No
Requires Shoring	No	No	Yes	Yes
Resolved by Scaffolding	No	No	No	No
Temporary Repair Class	—	—	Skilled labor (shoring)	Skilled labor (shoring)
Temporary Repair Time Lower (days)	—	—	3.0	3.0
Temporary Repair Time Upper (days)	—	—	3.0	3.0
Temporary Repair Crew Size	—	—	3.0	3.0
Miscellaneous				
Hazardous Material Scope	N/A	N/A	N/A	N/A
Weakens Fire Break	No	No	No	No
Impairs System Operation	No	No	No	No
Causes Flooding	No	No	No	No
Affects Access	No	No	No	No

6.2 B1031.011b #1: (B1031.011b) Steel Column Base Plates, Column 150 plf < W < 300 plf

NISTIR Classification	B1031.011b
Author	Greg Deierlein
Normalized Unit	1.0 each
Engineering Demand Parameter	Peak Story Drift Ratio
Number of Damage States	3
Is correlated?	No
Is directional?	Yes

Groupings:

Loss Aggregation Group	Structural
System	Steel
Element	Base Plates

Calculation:

Is Calculated?	No
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ATC-138 Properties:

System	Structural
Subsystem	N/A
Structural System	Steel Braces
Alt. Structural System	Steel Moment Frames
Structural Series	2

Component modifications applied:

Component Group	Structural
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.2.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
1-8	1	1	1

Table 6.2.2. Damage state progression.

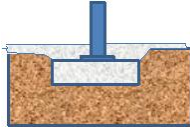
Damage State	Description	Repair Description	Image
DS1a	Initiation of crack at the fusion line between the column flange and the base plate weld. Damage in field is either obscured or deemed to not warrant repair. No repair conducted.	The repair will involve removal of a portion of grade slab, gouging out material surrounding the fracture initiating and re-welding, then repair of slab. Field condition is deemed to not warrant repair by field observation. This Damage State is Mutually Exclusive with DS2. See fragility DS1 and DS2 probabilities.	
DS1b	Initiation of crack at the fusion line between the column flange and the base plate weld.	The repair will involve removal of a portion of grade slab, gouging out material surrounding the fracture initiating and re-welding, then repair of slab.	
DS2	Propagation of brittle crack into column and/or base plate.	Depending on the crack trajectory, the repair will range from replacement of a portion of the column or base plate to full replacement of the column base. Replacement will require shoring of column, torch cutting to remove damaged material, and fabrication and field welding to install replacement material.	Not Available
DS3	Complete fracture of the column (or column weld) and dislocation of column relative to the base.	Repair would likely involve replacing the entire base plate assembly and most of the column in the story above the base plate.	Not Available

Table 6.2.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1a	DS1b	DS2	DS3
Type	Mut. Excl.	Mut. Excl.	Sequential	Sequential
Probability	0.95	0.05	–	–
Median	0.04	0.04	0.07	0.1
β	0.4	0.4	0.4	0.4

Table 6.2.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1a	DS1b	DS2	DS3
Distribution Type	LogNormal	LogNormal	LogNormal	LogNormal
Lower Qty.	5.0	5.0	5.0	5.0
Upper Qty.	20.0	20.0	20.0	20.0
Highest Cost Median	\$0	\$79,647	\$102,154	\$125,321
Lowest Cost Median	\$0	\$49,014	\$72,359	\$88,769
β (COV)	0.0	0.39	0.34	0.31

Table 6.2.5. Parameters for the repair time distributions.

	DS1a	DS1b	DS2	DS3
Distribution Type	LogNormal	LogNormal	LogNormal	LogNormal
Lower Qty.	5.0	5.0	5.0	5.0
Upper Qty.	20.0	20.0	20.0	20.0
Highest Median Repair Time (Days)	0	19.41	24.9	30.55
Lowest Median Repair Time (Days)	0	11.95	17.64	21.64
β (COV)	0.0	0.46	0.42	0.39

Table 6.2.6. Life safety information.

	DS1a	DS1b	DS2	DS3
Non-collapse casualties	No	No	No	No
Affected Area	--	--	--	--
Serious Injury Median	—	—	—	—
Serious Injury β	—	—	—	—
Loss of Life Median	—	—	—	—
Loss of Life β	—	—	—	—
Can Cause Red Tag	No	No	Yes	Yes
Unsafe Placard Median	—	—	0.25	0.1
Unsafe Placard β	—	—	0.5	0.5

Table 6.2.7. REDi repair class.

	DS1a	DS1b	DS2	DS3
REDi Repair Class	3	3	3	3

Table 6.2.8. ATC-138 parameters.

	DS1a	DS1b	DS2	DS3
Safety				
Safety Class	0	0	2	3
Envelope				
Affects Roof Function	No	No	No	No
Affects Envelope Safety	No	No	No	No
Damages Envelope Seal	No	No	No	No
Exterior Surface Area Factor	—	—	—	—
Exterior Falling Hazard				
Poses an Exterior Falling Hazard	No	No	No	No
Exterior Falling Length Factor	—	—	—	—
Interior Space				
Poses an Interior Falling Hazard	No	No	No	Yes
Obstructs Interior Space	No	No	No	Yes
Interior Area Conversion Type	—	—	—	bay
Interior Area Conversion Factor	—	—	—	1.0
Repair Schedule				
Crew Size	4	4	6	6
Permit Type (Rapid or Full)	N/A	Full	Full	Full
Requires Redesign	No	Yes	Yes	Yes
Long Lead Time	No	No	No	No
Requires Shoring	No	No	No	Yes
Resolved by Scaffolding	No	No	No	No
Temporary Repair Class	—	—	—	—
Temporary Repair Time Lower (days)	—	—	—	—
Temporary Repair Time Upper (days)	—	—	—	—
Temporary Repair Crew Size	—	—	—	—
Miscellaneous				
Hazardous Material Scope	N/A	N/A	N/A	N/A
Weakens Fire Break	No	No	No	No
Impairs System Operation	No	No	No	No
Causes Flooding	No	No	No	No
Affects Access	No	No	No	No

6.3 B1031.021b #1: (B1031.021b) Welded column splices, Column 150 plf < W < 300 plf

NISTIR Classification	B1031.021b
Author	Greg Deierlein
Normalized Unit	1.0 each
Engineering Demand Parameter	Peak Story Drift Ratio
Number of Damage States	2
Is correlated?	No
Is directional?	Yes

Groupings:

Loss Aggregation Group	Structural
System	Steel
Element	Splices

Calculation:

Is Calculated?	No
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ATC-138 Properties:

System	Structural
Subsystem	N/A
Structural System	Steel Braces
Alt. Structural System	Steel Moment Frames
Structural Series	3

Component modifications applied:

Component Group	Structural
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.3.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
1-8	1	1	1

Table 6.3.2. Damage state progression.

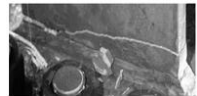
Damage State	Description	Repair Description	Image
DS1a	Ductile fracture of the groove weld flange splice. Damage in field is either obscured or deemed to not warrant repair. No repair conducted.	Repair would involve gouging out the material adjacent to the fracture and repairing with a new groove weld. Field condition is deemed to not warrant repair by field observation. This Damage State is Mutually Exclusive with DS2. See fragility DS1 and DS2 probabilities.	
DS1b	Ductile fracture of the groove weld flange splice.	Repair would involve gouging out the material adjacent to the fracture and repairing with a new groove weld.	
DS2	DS1 followed by complete failure of the web splice plate and dislocation of the two column segments on either side of the splice.	Repair may not be practically feasible, but would require either realignment or replacement of adjacent column segments and rewelding of splice.	

Table 6.3.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1a	DS1b	DS2
Type	Mut. Excl.	Mut. Excl.	Sequential
Probability	0.95	0.05	–
Median	0.02	0.02	0.05
β	0.4	0.4	0.4

Table 6.3.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1a	DS1b	DS2
Distribution Type	LogNormal	Normal	Normal
Lower Qty.	5.0	5.0	5.0
Upper Qty.	20.0	20.0	20.0
Highest Cost Median	\$0	\$39,765	\$48,290
Lowest Cost Median	\$0	\$24,471	\$34,205
β (COV)	0.0	0.3	0.27

Table 6.3.5. Parameters for the repair time distributions.

	DS1a	DS1b	DS2
Distribution Type	LogNormal	Normal	Normal
Lower Qty.	5.0	5.0	5.0
Upper Qty.	20.0	20.0	20.0
Highest Median Repair Time (Days)	0	9.69	11.77
Lowest Median Repair Time (Days)	0	5.96	8.34
β (COV)	0.0	0.39	0.37

Table 6.3.6. Life safety information.

	DS1a	DS1b	DS2
Non-collapse casualties	No	No	No
Affected Area	--	--	--
Serious Injury Median	–	–	–
Serious Injury β	–	–	–
Loss of Life Median	–	–	–
Loss of Life β	–	–	–
Can Cause Red Tag	No	No	Yes
Unsafe Placard Median	–	–	0.02
Unsafe Placard β	–	–	0.5

Table 6.3.7. REDi repair class.

	DS1a	DS1b	DS2
REDi Repair Class	3	3	3

Table 6.3.8. ATC-138 parameters.

	DS1a	DS1b	DS2
Safety			
Safety Class	0	0	3
Envelope			
Affects Roof Function	No	No	No
Affects Envelope Safety	No	No	No
Damages Envelope Seal	No	No	No
Exterior Surface Area Factor	—	—	—
Exterior Falling Hazard			
Poses an Exterior Falling Hazard	No	No	No
Exterior Falling Length Factor	—	—	—
Interior Space			
Poses an Interior Falling Hazard	No	No	Yes
Obstructs Interior Space	No	No	Yes
Interior Area Conversion Type	—	—	bay
Interior Area Conversion Factor	—	—	1.0
Repair Schedule			
Crew Size	4	4	6
Permit Type (Rapid or Full)	N/A	Full	Full
Requires Redesign	No	Yes	Yes
Long Lead Time	No	No	No
Requires Shoring	No	No	Yes
Resolved by Scaffolding	No	No	No
Temporary Repair Class	—	—	—
Temporary Repair Time Lower (days)	—	—	—
Temporary Repair Time Upper (days)	—	—	—
Temporary Repair Crew Size	—	—	—
Miscellaneous			
Hazardous Material Scope	N/A	N/A	N/A
Weakens Fire Break	No	No	No
Impairs System Operation	No	No	No
Causes Flooding	No	No	No
Affects Access	No	No	No

6.4 B1033.652a #1: (B1033.652a) CoreBrace Buckling Restrained Brace (BRB), Moment-Connected Beams, Chevron Brace, Bolted Connection, Steel Core Area = 5in^2 , Story Height = 16ft, Bay Width = 30ft

NISTIR Classification	B1033.652a
Author	HBRG
Normalized Unit	1.0 bay
Engineering Demand Parameter	Peak Story Drift Ratio
Number of Damage States	2
Is correlated?	No
Is directional?	Yes

Groupings:

Loss Aggregation Group	Structural
System	Steel
Element	Braces

Calculation:

Is Calculated?	No
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ATC-138 Properties:

System	Structural
Subsystem	N/A
Structural System	Steel Braces
Alt. Structural System	N/A
Structural Series	1

Component modifications applied:

Component Group	Structural
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.4.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
1-8	1	1	1

Table 6.4.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1a	Cracking and tearing of welds and gussets adjacent to welds but crack length is less than critical for fracture. Significant yielding and local buckling in beams and columns adjacent to gusset.	Repair gusset welds and heat straighten gussets, if necessary. Frame members require heat straightening but additional stiffening likely not required. BRB is salvageable.	Not Available
DS1b	Severe yielding and buckling of beams and columns adjacent to the gusset with possibility of local tearing in buckled areas. Onset of weld fracture and buckling possible in gusset plates.	Gusset and gusset welds are severely damaged, likely requiring replacement. Yielding and local buckling of beams and columns may be repaired by heat straightening, stiffeners or reinforcement, if there is no cracking or tearing. If cracking or tearing has initiated more substantial repair is needed. BRB is salvageable.	Not Available
DS1c	Severe yielding and buckling of beams and columns adjacent to the gusset with possibility of local tearing in buckled areas. Onset of weld fracture and buckling possible in gusset plates. Remaining lateral strength of BRB system is questionable.	Gusset and gusset welds are severely damaged, likely requiring replacement. Yielding and local buckling of beams and columns may be repaired by heat straightening, stiffeners or reinforcement, if there is no cracking or tearing. If cracking or tearing has initiated more substantial repair is needed. BRB is salvageable.	Not Available
DS2	Fracture of brace or gusset. Buckling of gusset. Severe yielding of beams and columns adjacent to the gusset with possibility of local buckling and cracking in the yielded areas. Severe loss of lateral resistance.	Brace and gusset are severely damaged with significant loss in stiffness and resistance, and both likely require replacement. Yielding and local buckling of beams and columns may be repaired by heat straightening, stiffeners or reinforcement, if there is no cracking or tearing. If cracking or tearing has initiated more substantial repair is needed.	Not Available

Table 6.4.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1a	DS1b	DS1c	DS2
Type	Mut. Excl.	Mut. Excl.	Mut. Excl.	Sequential
Probability	0.5	0.25	0.25	–
Median	0.03	0.03	0.03	0.052
β	0.3	0.3	0.3	0.306

Table 6.4.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1a	DS1b	DS1c	DS2
Distribution Type	Normal	Normal	Normal	Normal
Lower Qty.	5.0	5.0	5.0	5.0
Upper Qty.	20.0	20.0	20.0	20.0
Highest Cost Median	\$105,641	\$112,308	\$112,308	\$140,935
Lowest Cost Median	\$65,007	\$69,110	\$69,110	\$86,727
β (COV)	0.3	0.29	0.29	0.1

Table 6.4.5. Parameters for the repair time distributions.

	DS1a	DS1b	DS1c	DS2
Distribution Type	Normal	Normal	Normal	Normal
Lower Qty.	5.0	5.0	5.0	5.0
Upper Qty.	20.0	20.0	20.0	20.0
Highest Median Repair Time (Days)	23.2	24.6	24.6	30.9
Lowest Median Repair Time (Days)	14.3	15.2	15.2	19
β (COV)	0.39	0.39	0.39	0.14

Table 6.4.6. Life safety information.

	DS1a	DS1b	DS1c	DS2
Non-collapse casualties	No	No	No	No
Affected Area	--	--	--	--
Serious Injury Median	–	–	–	–
Serious Injury β	–	–	–	–
Loss of Life Median	–	–	–	–
Loss of Life β	–	–	–	–
Can Cause Red Tag	No	No	Yes	Yes
Unsafe Placard Median	–	–	0.2	0.2
Unsafe Placard β	–	–	0.5	0.5

Table 6.4.7. REDi repair class.

	DS1a	DS1b	DS1c	DS2
REDi Repair Class	3	3	3	3

Table 6.4.8. ATC-138 parameters.

	DS1a	DS1b	DS1c	DS2
Safety				
Safety Class	0	0	2	2
Envelope				
Affects Roof Function	No	No	No	No
Affects Envelope Safety	No	No	No	No
Damages Envelope Seal	No	No	No	No
Exterior Surface Area Factor	—	—	—	—
Exterior Falling Hazard				
Poses an Exterior Falling Hazard	No	No	No	No
Exterior Falling Length Factor	—	—	—	—
Interior Space				
Poses an Interior Falling Hazard	No	No	No	No
Obstructs Interior Space	No	No	No	No
Interior Area Conversion Type	—	—	—	—
Interior Area Conversion Factor	—	—	—	—
Repair Schedule				
Crew Size	6	6	6	6
Permit Type (Rapid or Full)	Full	Full	Full	Full
Requires Redesign	Yes	Yes	Yes	Yes
Long Lead Time	No	No	No	No
Requires Shoring	No	No	No	No
Resolved by Scaffolding	No	No	No	No
Temporary Repair Class	—	—	—	—
Temporary Repair Time Lower (days)	—	—	—	—
Temporary Repair Time Upper (days)	—	—	—	—
Temporary Repair Crew Size	—	—	—	—
Miscellaneous				
Hazardous Material Scope	N/A	N/A	N/A	N/A
Weakens Fire Break	No	No	No	No
Impairs System Operation	No	No	No	No
Causes Flooding	No	No	No	No
Affects Access	No	No	No	No

6.5 B1033.653a #1: (B1033.653a) CoreBrace Buckling Restrained Brace (BRB), Moment-Connected Beams, Chevron Brace, Bolted Connection, Steel Core Area = 5in^2 , Story Height = 14ft, Bay Width = 30ft

NISTIR Classification	B1033.653a
Author	HBRG
Normalized Unit	1.0 bay
Engineering Demand Parameter	Peak Story Drift Ratio
Number of Damage States	2
Is correlated?	No
Is directional?	Yes

Groupings:

Loss Aggregation Group	Structural
System	Steel
Element	Braces

Calculation:

Is Calculated?	No
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ATC-138 Properties:

System	Structural
Subsystem	N/A
Structural System	Steel Braces
Alt. Structural System	N/A
Structural Series	1

Component modifications applied:

Component Group	Structural
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.5.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
1-8	1	1	1

Table 6.5.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1a	Cracking and tearing of welds and gussets adjacent to welds but crack length is less than critical for fracture. Significant yielding and local buckling in beams and columns adjacent to gusset.	Repair gusset welds and heat straighten gussets, if necessary. Frame members require heat straightening but additional stiffening likely not required. BRB is salvageable.	Not Available
DS1b	Severe yielding and buckling of beams and columns adjacent to the gusset with possibility of local tearing in buckled areas. Onset of weld fracture and buckling possible in gusset plates.	Gusset and gusset welds are severely damaged, likely requiring replacement. Yielding and local buckling of beams and columns may be repaired by heat straightening, stiffeners or reinforcement, if there is no cracking or tearing. If cracking or tearing has initiated more substantial repair is needed. BRB is salvageable.	Not Available
DS1c	Severe yielding and buckling of beams and columns adjacent to the gusset with possibility of local tearing in buckled areas. Onset of weld fracture and buckling possible in gusset plates. Remaining lateral strength of BRB system is questionable.	Gusset and gusset welds are severely damaged, likely requiring replacement. Yielding and local buckling of beams and columns may be repaired by heat straightening, stiffeners or reinforcement, if there is no cracking or tearing. If cracking or tearing has initiated more substantial repair is needed. BRB is salvageable.	Not Available
DS2	Fracture of brace or gusset. Buckling of gusset. Severe yielding of beams and columns adjacent to the gusset with possibility of local buckling and cracking in the yielded areas. Severe loss of lateral resistance.	Brace and gusset are severely damaged with significant loss in stiffness and resistance, and both likely require replacement. Yielding and local buckling of beams and columns may be repaired by heat straightening, stiffeners or reinforcement, if there is no cracking or tearing. If cracking or tearing has initiated more substantial repair is needed.	Not Available

Table 6.5.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1a	DS1b	DS1c	DS2
Type	Mut. Excl.	Mut. Excl.	Mut. Excl.	Sequential
Probability	0.5	0.25	0.25	–
Median	0.03	0.03	0.03	0.051
β	0.3	0.3	0.3	0.307

Table 6.5.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1a	DS1b	DS1c	DS2
Distribution Type	Normal	Normal	Normal	Normal
Lower Qty.	5.0	5.0	5.0	5.0
Upper Qty.	20.0	20.0	20.0	20.0
Highest Cost Median	\$101,357	\$108,024	\$108,024	\$133,484
Lowest Cost Median	\$62,383	\$66,486	\$66,486	\$82,142
β (COV)	0.29	0.29	0.29	0.11

Table 6.5.5. Parameters for the repair time distributions.

	DS1a	DS1b	DS1c	DS2
Distribution Type	Normal	Normal	Normal	Normal
Lower Qty.	5.0	5.0	5.0	5.0
Upper Qty.	20.0	20.0	20.0	20.0
Highest Median Repair Time (Days)	22.2	23.7	23.7	29.3
Lowest Median Repair Time (Days)	13.7	14.6	14.6	18
β (COV)	0.39	0.38	0.38	0.15

Table 6.5.6. Life safety information.

	DS1a	DS1b	DS1c	DS2
Non-collapse casualties	No	No	No	No
Affected Area	--	--	--	--
Serious Injury Median	–	–	–	–
Serious Injury β	–	–	–	–
Loss of Life Median	–	–	–	–
Loss of Life β	–	–	–	–
Can Cause Red Tag	No	No	Yes	Yes
Unsafe Placard Median	–	–	0.2	0.2
Unsafe Placard β	–	–	0.5	0.5

Table 6.5.7. REDi repair class.

	DS1a	DS1b	DS1c	DS2
REDi Repair Class	3	3	3	3

Table 6.5.8. ATC-138 parameters.

	DS1a	DS1b	DS1c	DS2
Safety				
Safety Class	0	0	2	2
Envelope				
Affects Roof Function	No	No	No	No
Affects Envelope Safety	No	No	No	No
Damages Envelope Seal	No	No	No	No
Exterior Surface Area Factor	—	—	—	—
Exterior Falling Hazard				
Poses an Exterior Falling Hazard	No	No	No	No
Exterior Falling Length Factor	—	—	—	—
Interior Space				
Poses an Interior Falling Hazard	No	No	No	No
Obstructs Interior Space	No	No	No	No
Interior Area Conversion Type	—	—	—	—
Interior Area Conversion Factor	—	—	—	—
Repair Schedule				
Crew Size	6	6	6	6
Permit Type (Rapid or Full)	Full	Full	Full	Full
Requires Redesign	Yes	Yes	Yes	Yes
Long Lead Time	No	No	No	No
Requires Shoring	No	No	No	No
Resolved by Scaffolding	No	No	No	No
Temporary Repair Class	—	—	—	—
Temporary Repair Time Lower (days)	—	—	—	—
Temporary Repair Time Upper (days)	—	—	—	—
Temporary Repair Crew Size	—	—	—	—
Miscellaneous				
Hazardous Material Scope	N/A	N/A	N/A	N/A
Weakens Fire Break	No	No	No	No
Impairs System Operation	No	No	No	No
Causes Flooding	No	No	No	No
Affects Access	No	No	No	No

6.6 B2011.201a #1: (B2011.201a) Precast Concrete Panels 4.5 inches thick - in plane deformation

NISTIR Classification	B2011.201a
Author	By User
Normalized Unit	30.0 If
Engineering Demand Parameter	Peak Story Drift Ratio
Number of Damage States	1
Is correlated?	No
Is directional?	Yes

Groupings:

Loss Aggregation Group	Exterior Finishes
System	Envelope
Element	Cladding

Calculation:

Is Calculated?	Yes
Calculation Type	Cladding Drift Capacity
Anchorage Ductility	N/A
ID Component Class	N/A

ATC-138 Properties:

System	Exterior
Subsystem	N/A

Component modifications applied:

Component Group	Exterior Finishes
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.6.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
1-8	1	1	1

Table 6.6.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1a	Cladding units damaged by impact at corners at column covers. Damage in field is either attributed to natural edge chipping / damage, or is deemed to not warrant full repair. Repair assumes cosmetic chip patching.	By User, Repair cost assumed to equal 20% of DS2.	Not Available
DS1b	Cladding units damaged by impact at corners at column covers.	By User, Cost listed assumed the replacement of the panel	Not Available

Table 6.6.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1a	DS1b
Type	Mut. Excl.	Mut. Excl.
Probability	0.5	0.5
Median	0.028	0.028
β	0.5	0.5

Table 6.6.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1a	DS1b
Distribution Type	Normal	Normal
Lower Qty.	2.0	2.0
Upper Qty.	8.0	8.0
Highest Cost Median	\$33,127	\$165,634
Lowest Cost Median	\$20,386	\$101,928
β (COV)	0.19	0.19

Table 6.6.5. Parameters for the repair time distributions.

	DS1a	DS1b
Distribution Type	Normal	Normal
Lower Qty.	2.0	2.0
Upper Qty.	8.0	8.0
Highest Median Repair Time (Days)	1.62	8.08
Lowest Median Repair Time (Days)	0.99	4.97
β (COV)	0.32	0.32

Table 6.6.6. Life safety information.

	DS1a	DS1b
Non-collapse casualties	No	No
Affected Area	--	--
Serious Injury Median	–	–
Serious Injury β	–	–
Loss of Life Median	–	–
Loss of Life β	–	–
Can Cause Red Tag	No	No
Unsafe Placard Median	–	–
Unsafe Placard β	–	–

Table 6.6.7. REDi repair class.

	DS1a	DS1b
REDi Repair Class	2	2

Table 6.6.8. ATC-138 parameters.

	DS1a	DS1b
Safety		
Safety Class	0	0
Envelope		
Affects Roof Function	No	No
Affects Envelope Safety	No	No
Damages Envelope Seal	No	Yes
Exterior Surface Area Factor	–	1.0
Exterior Falling Hazard		
Poses an Exterior Falling Hazard	No	Yes
Exterior Falling Length Factor	–	1.0
Interior Space		
Poses an Interior Falling Hazard	No	No
Obstructs Interior Space	No	No
Interior Area Conversion Type	–	–
Interior Area Conversion Factor	–	–
Repair Schedule		
Crew Size	5	5
Permit Type (Rapid or Full)	Rapid	Full
Requires Redesign	No	Yes
Long Lead Time	No	No
Requires Shoring	No	No
Resolved by Scaffolding	No	Yes
Temporary Repair Class	–	–
Temporary Repair Time Lower (days)	–	–
Temporary Repair Time Upper (days)	–	–
Temporary Repair Crew Size	–	–
Miscellaneous		
Hazardous Material Scope	N/A	N/A
Weakens Fire Break	No	No
Impairs System Operation	No	No
Causes Flooding	No	No
Affects Access	No	No

6.7 B2011.201b #1: (B2011.201b) Precast Concrete Panels 4.5 inches thick - out of plane deformation

NISTIR Classification	B2011.201b
Author	By User
Normalized Unit	30.0 If
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	1
Is correlated?	No
Is directional?	Yes

Groupings:

Loss Aggregation Group	Exterior Finishes
System	Envelope
Element	Cladding

Calculation:

Is Calculated?	Yes
Calculation Type	Cladding Anchorage
Anchorage Ductility	Brittle
ID Component Class	Limited deformability elements and attachments

ATC-138 Properties:

System	Exterior
Subsystem	N/A

Component modifications applied:

Component Group	Exterior Finishes
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.7.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.7.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1	Cladding units damaged by out of plane anchorage failure. Unit requires replacement.	By User - Replace cladding panel.	Not Available

Table 6.7.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

DS1	
Type	Sequential
Probability	–
Median	3.821
β	0.5

Table 6.7.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

DS1	
Distribution Type	Normal
Lower Qty.	2.0
Upper Qty.	8.0
Highest Cost Median	\$248,451
Lowest Cost Median	\$152,893
β (COV)	0.19

Table 6.7.5. Parameters for the repair time distributions.

DS1	
Distribution Type	Normal
Lower Qty.	2.0
Upper Qty.	8.0
Highest Median Repair Time (Days)	12.12
Lowest Median Repair Time (Days)	7.46
β (COV)	0.32

Table 6.7.6. Life safety information.

DS1	
Non-collapse casualties	No
Affected Area	– –
Serious Injury Median	–
Serious Injury β	–
Loss of Life Median	–
Loss of Life β	–
Can Cause Red Tag	Yes
Unsafe Placard Median	0.25
Unsafe Placard β	0.5

Table 6.7.7. REDi repair class.

DS1	
REDi Repair Class	3

Table 6.7.8. ATC-138 parameters.

	DS1
Safety	
Safety Class	0
Envelope	
Affects Roof Function	No
Affects Envelope Safety	Yes
Damages Envelope Seal	Yes
Exterior Surface Area Factor	1.0
Exterior Falling Hazard	
Poses an Exterior Falling Hazard	Yes
Exterior Falling Length Factor	1.0
Interior Space	
Poses an Interior Falling Hazard	No
Obstructs Interior Space	Yes
Interior Area Conversion Type	component
Interior Area Conversion Factor	1.0
Repair Schedule	
Crew Size	5
Permit Type (Rapid or Full)	Full
Requires Redesign	Yes
Long Lead Time	No
Requires Shoring	No
Resolved by Scaffolding	No
Temporary Repair Class	Specialized laborer and equipment
Temporary Repair Time Lower (days)	40.0
Temporary Repair Time Upper (days)	20.0
Temporary Repair Crew Size	4.0
Miscellaneous	
Hazardous Material Scope	N/A
Weakens Fire Break	No
Impairs System Operation	No
Causes Flooding	No
Affects Access	No

6.8 B2022.002 #1: (B2022.002) Curtain Walls - Generic Midrise Stick-Built Curtain wall, Config: Insulating Glass Units (dual pane), Lamination: Unknown, Glass Type: Unknown, Details: Aspect ratio = 6:5, Other details Unknown

NISTIR Classification	B2022.002
Author	Not Given
Normalized Unit	30.0 sf
Engineering Demand Parameter	Peak Story Drift Ratio
Number of Damage States	2
Is correlated?	No
Is directional?	Yes

Groupings:

Loss Aggregation Group	Exterior Finishes
System	Envelope
Element	Glazing

Calculation:

Is Calculated?	No
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ATC-138 Properties:

System	Exterior
Subsystem	N/A

Component modifications applied:

Component Group	Exterior Finishes
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.8.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
1-8	1	1	1

Table 6.8.2. Damage state progression.

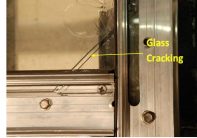
Damage State	Description	Repair Description	Image
DS1	Glass cracking.	Replace cracked glass panel.	
DS2	Glass falls from frame.	Replace cracked glass panel; cover exposure in meantime.	

Table 6.8.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1	DS2
Type	Sequential	Sequential
Probability	–	–
Median	0.021	0.024
β	0.45	0.45

Table 6.8.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1	DS2
Distribution Type	LogNormal	LogNormal
Lower Qty.	20.0	20.0
Upper Qty.	100.0	100.0
Highest Cost Median	\$8,914	\$8,914
Lowest Cost Median	\$4,754	\$4,754
β (COV)	0.12	0.12

Table 6.8.5. Parameters for the repair time distributions.

	DS1	DS2
Distribution Type	LogNormal	LogNormal
Lower Qty.	20.0	20.0
Upper Qty.	100.0	100.0
Highest Median Repair Time (Days)	1.3	1.3
Lowest Median Repair Time (Days)	0.7	0.7
β (COV)	0.28	0.28

Table 6.8.6. Life safety information.

	DS1	DS2
Non-collapse casualties	No	Yes
Affected Area	--	36.0 SF
Serious Injury Median	–	0.02
Serious Injury β	–	0.5
Loss of Life Median	–	0.0
Loss of Life β	–	0.0
Can Cause Red Tag	No	Yes
Unsafe Placard Median	–	0.9
Unsafe Placard β	–	0.5

Table 6.8.7. REDi repair class.

	DS1	DS2
REDi Repair Class	1	3

Table 6.8.8. ATC-138 parameters.

	DS1	DS2
Safety		
Safety Class	0	0
Envelope		
Affects Roof Function	No	No
Affects Envelope Safety	No	Yes
Damages Envelope Seal	No	Yes
Exterior Surface Area Factor	–	1.0
Exterior Falling Hazard		
Poses an Exterior Falling Hazard	No	Yes
Exterior Falling Length Factor	–	1.0
Interior Space		
Poses an Interior Falling Hazard	No	No
Obstructs Interior Space	No	Yes
Interior Area Conversion Type	–	component
Interior Area Conversion Factor	–	1.0
Repair Schedule		
Crew Size	5	5
Permit Type (Rapid or Full)	Rapid	Rapid
Requires Redesign	No	No
Long Lead Time	No	No
Requires Shoring	No	No
Resolved by Scaffolding	No	Yes
Temporary Repair Class	–	Basic carpenter/laborers
Temporary Repair Time Lower (days)	–	0.25
Temporary Repair Time Upper (days)	–	0.25
Temporary Repair Crew Size	–	5.0
Miscellaneous		
Hazardous Material Scope	N/A	N/A
Weakens Fire Break	No	No
Impairs System Operation	No	No
Causes Flooding	No	No
Affects Access	No	No

6.9 C1011.001c #1: (C1011.001c) Wall Partition, Type: Gypsum with metal studs, Full Height, Fixed Below, Slip Track Above with returns

NISTIR Classification	C1011.001c
Author	Not Given
Normalized Unit	100.0 lf
Engineering Demand Parameter	Peak Story Drift Ratio
Number of Damage States	3
Is correlated?	No
Is directional?	Yes

Groupings:

Loss Aggregation Group	Partition Walls
System	Interior
Element	Partition Walls

Calculation:

Is Calculated?	No
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ATC-138 Properties:

System	Interior
Subsystem	N/A

Component modifications applied:

Component Group	Partition Walls
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.9.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
1-8	1	1	1

Table 6.9.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1	Screw pop-out, cracking of wall board, warping or cracking of tape, slight crushing of wall panel at corners.	Retape joints, paste and repaint. May require cutting and replacing corner sections of board. Repair 5% wallboard, 10% retape, 25% repaint.	Not Available
DS2	Moderate cracking or crushing of gypsum wall boards (typically in corners). Moderate corner gap openings, bending of boundary studs.	Remove and replace 10% of wall board (both sides), retape and paste 25% of wall, paint 50% of wall. Replace boundary studs of approximately 5 intersections per 100 ft of wall length.	Not Available
DS3	Buckling of studs and tearing of tracks. Tearing or bending of top track, tearing at corners with transverse walls, large gap openings, walls displaced.	Remove and replace 50% of length of metal stud wall, 50% of both sides of the gypsum, and any embedded utilities. Retape and paste as required. Repaint 100%.	Not Available

Table 6.9.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1	DS2	DS3
Type	Sequential	Sequential	Sequential
Probability	—	—	—
Median	0.004	0.011	0.019
β	0.45	0.35	0.25

Table 6.9.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1	DS2	DS3
Distribution Type	Normal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0
Upper Qty.	10.0	10.0	10.0
Highest Cost Median	\$4,308	\$10,980	\$21,116
Lowest Cost Median	\$1,292	\$3,294	\$6,335
β (COV)	0.48	0.56	0.2

Table 6.9.5. Parameters for the repair time distributions.

	DS1	DS2	DS3
Distribution Type	Normal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0
Upper Qty.	10.0	10.0	10.0
Highest Median Repair Time (Days)	1.08	2.85	5.46
Lowest Median Repair Time (Days)	0.3	0.86	1.64
β (COV)	0.54	0.61	0.32

Table 6.9.6. Life safety information.

	DS1	DS2	DS3
Non-collapse casualties	No	No	No
Affected Area	--	--	--
Serious Injury Median	–	–	–
Serious Injury β	–	–	–
Loss of Life Median	–	–	–
Loss of Life β	–	–	–
Can Cause Red Tag	No	No	No
Unsafe Placard Median	–	–	–
Unsafe Placard β	–	–	–

Table 6.9.7. REDi repair class.

	DS1	DS2	DS3
REDi Repair Class	1	1	3

Table 6.9.8. ATC-138 parameters.

	DS1	DS2	DS3
Safety			
Safety Class	0	0	0
Envelope			
Affects Roof Function	No	No	No
Affects Envelope Safety	No	No	No
Damages Envelope Seal	No	No	No
Exterior Surface Area Factor	–	–	–
Exterior Falling Hazard			
Poses an Exterior Falling Hazard	No	No	No
Exterior Falling Length Factor	–	–	–
Interior Space			
Poses an Interior Falling Hazard	No	No	No
Obstructs Interior Space	No	No	Yes
Interior Area Conversion Type	–	–	component
Interior Area Conversion Factor	–	–	1.0
Repair Schedule			
Crew Size	2	5	11
Permit Type (Rapid or Full)	Rapid	Rapid	Rapid
Requires Redesign	No	No	No
Long Lead Time	No	No	No
Requires Shoring	No	No	No
Resolved by Scaffolding	No	No	No
Temporary Repair Class	–	–	Janitorial / general
Temporary Repair Time Lower (days)	–	–	0.0625
Temporary Repair Time Upper (days)	–	–	0.0625
Temporary Repair Crew Size	–	–	10.0
Miscellaneous			
Hazardous Material Scope	N/A	N/A	N/A
Weakens Fire Break	No	No	No
Impairs System Operation	No	No	No
Causes Flooding	No	No	No
Affects Access	No	No	No

6.10 C2011.001a #1: (C2011.001a) Prefabricated steel stair with steel treads and landings with seismic joints that accommodate drift.

NISTIR Classification	C2011.001a
Author	Not Given
Normalized Unit	1.0 each
Engineering Demand Parameter	Peak Story Drift Ratio
Number of Damage States	3
Is correlated?	No
Is directional?	Yes

Groupings:

Loss Aggregation Group	Other Nonstructural
System	Stairs
Element	Stairs

Calculation:

Is Calculated?	Yes
Calculation Type	Stair Seismic Gap
Anchorage Ductility	N/A
ID Component Class	N/A

ATC-138 Properties:

System	Stairs
Subsystem	N/A

Component modifications applied:

Component Group	Other Nonstructural
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.10.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
1-8	1	1	1

Table 6.10.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1	Non structural damage, local steel yielding.	Patch, paint.	
DS2	Structural damage but live load capacity remains intact. Buckling of steel, weld cracking.	Removal and replacement of damaged components. Field repair of damage (such as welding). Repair finishes.	
DS3	Loss of live load capacity. Connection and or weld fracture.	Replace stair and handrail. Repair and replace affected soffits and floor finishes.	

Table 6.10.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1	DS2	DS3
Type	Sequential	Sequential	Sequential
Probability	—	—	—
Median	0.025	0.037	0.048
β	0.5	0.5	0.5

Table 6.10.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1	DS2	DS3
Distribution Type	Normal	Normal	LogNormal
Lower Qty.	1.0	1.0	1.0
Upper Qty.	10.0	10.0	10.0
Highest Cost Median	\$13,092	\$33,484	\$102,262
Lowest Cost Median	\$3,928	\$10,045	\$30,679
β (COV)	0.46	0.49	0.24

Table 6.10.5. Parameters for the repair time distributions.

	DS1	DS2	DS3
Distribution Type	Normal	Normal	LogNormal
Lower Qty.	1.0	1.0	1.0
Upper Qty.	10.0	10.0	10.0
Highest Median Repair Time (Days)	3.38	8.62	26.47
Lowest Median Repair Time (Days)	1.01	2.56	7.98
β (COV)	0.52	0.55	0.34

Table 6.10.6. Life safety information.

	DS1	DS2	DS3
Non-collapse casualties	No	No	No
Affected Area	--	--	--
Serious Injury Median	–	–	–
Serious Injury β	–	–	–
Loss of Life Median	–	–	–
Loss of Life β	–	–	–
Can Cause Red Tag	No	No	Yes
Unsafe Placard Median	–	–	0.75
Unsafe Placard β	–	–	0.5

Table 6.10.7. REDi repair class.

	DS1	DS2	DS3
REDi Repair Class	1	3	3

Table 6.10.8. ATC-138 parameters.

	DS1	DS2	DS3
Safety			
Safety Class	0	0	0
Envelope			
Affects Roof Function	No	No	No
Affects Envelope Safety	No	No	No
Damages Envelope Seal	No	No	No
Exterior Surface Area Factor	—	—	—
Exterior Falling Hazard			
Poses an Exterior Falling Hazard	No	No	No
Exterior Falling Length Factor	—	—	—
Interior Space			
Poses an Interior Falling Hazard	No	No	No
Obstructs Interior Space	No	No	No
Interior Area Conversion Type	—	—	—
Interior Area Conversion Factor	—	—	—
Repair Schedule			
Crew Size	2	3	4
Permit Type (Rapid or Full)	Rapid	Full	Full
Requires Redesign	No	Yes	Yes
Long Lead Time	No	No	No
Requires Shoring	No	No	No
Resolved by Scaffolding	No	No	No
Temporary Repair Class	—	—	—
Temporary Repair Time Lower (days)	—	—	—
Temporary Repair Time Upper (days)	—	—	—
Temporary Repair Crew Size	—	—	—
Miscellaneous			
Hazardous Material Scope	N/A	N/A	N/A
Weakens Fire Break	No	No	No
Impairs System Operation	No	No	No
Causes Flooding	No	No	No
Affects Access	No	Yes	Yes

6.11 C3011.001c #1: (C3011.001c) Wall Partition, Type: Gypsum + Wallpaper, Full Height, Fixed Below, Slip Track Above w/ returns (friction connection)

NISTIR Classification	C3011.001c
Author	Not Given
Normalized Unit	100.0 lf
Engineering Demand Parameter	Peak Story Drift Ratio
Number of Damage States	1
Is correlated?	No
Is directional?	Yes

Groupings:

Loss Aggregation Group	Other Nonstructural
System	Interior
Element	Partition Walls

Calculation:

Is Calculated?	No
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ATC-138 Properties:

System	Interior
Subsystem	N/A

Component modifications applied:

Component Group	Other Nonstructural
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.11.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
1-8	1	1	1

Table 6.11.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1	Wall paper warped and torn.	Remove existing wall paper (or wall) and install new wall paper for full 100 foot length of wall. Existing wall damage per wall type NISTIR file.	Not Available

Table 6.11.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

DS1	
Type	Sequential
Probability	–
Median	0.002
β	0.7

Table 6.11.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

DS1	
Distribution Type	LogNormal
Lower Qty.	1.0
Upper Qty.	3.0
Highest Cost Median	\$9,774
Lowest Cost Median	\$6,516
β (COV)	0.15

Table 6.11.5. Parameters for the repair time distributions.

DS1	
Distribution Type	LogNormal
Lower Qty.	1.0
Upper Qty.	3.0
Highest Median Repair Time (Days)	3.02
Lowest Median Repair Time (Days)	2.02
β (COV)	0.29

Table 6.11.6. Life safety information.

DS1	
Non-collapse casualties	No
Affected Area	– –
Serious Injury Median	–
Serious Injury β	–
Loss of Life Median	–
Loss of Life β	–
Can Cause Red Tag	No
Unsafe Placard Median	–
Unsafe Placard β	–

Table 6.11.7. REDi repair class.

DS1	
REDi Repair Class	1

Table 6.11.8. ATC-138 parameters.

	DS1
Safety	
Safety Class	0
Envelope	
Affects Roof Function	No
Affects Envelope Safety	No
Damages Envelope Seal	No
Exterior Surface Area Factor	–
Exterior Falling Hazard	
Poses an Exterior Falling Hazard	No
Exterior Falling Length Factor	–
Interior Space	
Poses an Interior Falling Hazard	No
Obstructs Interior Space	No
Interior Area Conversion Type	–
Interior Area Conversion Factor	–
Repair Schedule	
Crew Size	3
Permit Type (Rapid or Full)	Rapid
Requires Redesign	No
Long Lead Time	No
Requires Shoring	No
Resolved by Scaffolding	No
Temporary Repair Class	–
Temporary Repair Time Lower (days)	–
Temporary Repair Time Upper (days)	–
Temporary Repair Crew Size	–
Miscellaneous	
Hazardous Material Scope	N/A
Weakens Fire Break	No
Impairs System Operation	No
Causes Flooding	No
Affects Access	No

6.12 C3032.004a #1: (C3032.004a) Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): A < 250, Vert & Lat support

NISTIR Classification	C3032.004a
Author	Not Given
Normalized Unit	250.0 sf
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	3
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	Ceilings
System	Interior
Element	Ceilings

Calculation:

Is Calculated?	No
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ATC-138 Properties:

System	Interior
Subsystem	N/A

Component modifications applied:

Component Group	Ceilings
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.12.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.12.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1	5 % of ceiling grid and tile damage.	Reinstall, repair, or replace 5% of the ceiling area.	Not Available
DS2	30% of ceiling grid and tile damage.	Replace 30% of the ceiling area.	Not Available
DS3	50% of ceiling grid and tile damage.	Replace the entire ceiling	Not Available

Table 6.12.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1	DS2	DS3
Type	Sequential	Sequential	Sequential
Probability	–	–	–
Median	1.92	2.34	2.48
β	0.3	0.3	0.3

Table 6.12.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1	DS2	DS3
Distribution Type	Normal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0
Upper Qty.	10.0	10.0	10.0
Highest Cost Median	\$2,187	\$17,119	\$35,219
Lowest Cost Median	\$656	\$5,136	\$10,566
β (COV)	0.55	0.52	0.2

Table 6.12.5. Parameters for the repair time distributions.

	DS1	DS2	DS3
Distribution Type	Normal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0
Upper Qty.	10.0	10.0	10.0
Highest Median Repair Time (Days)	0.7	5.41	11.15
Lowest Median Repair Time (Days)	0.21	1.62	3.34
β (COV)	0.6	0.58	0.32

Table 6.12.6. Life safety information.

	DS1	DS2	DS3
Non-collapse casualties	No	No	Yes
Affected Area	–	–	250.0 SF
Serious Injury Median	–	–	0.1
Serious Injury β	–	–	0.5
Loss of Life Median	–	–	0.0
Loss of Life β	–	–	0.0
Can Cause Red Tag	No	No	No
Unsafe Placard Median	–	–	–
Unsafe Placard β	–	–	–

Table 6.12.7. REDi repair class.

	DS1	DS2	DS3
REDi Repair Class	1	3	3

Table 6.12.8. ATC-138 parameters.

	DS1	DS2	DS3
Safety			
Safety Class	0	0	0
Envelope			
Affects Roof Function	No	No	No
Affects Envelope Safety	No	No	No
Damages Envelope Seal	No	No	No
Exterior Surface Area Factor	—	—	—
Exterior Falling Hazard			
Poses an Exterior Falling Hazard	No	No	No
Exterior Falling Length Factor	—	—	—
Interior Space			
Poses an Interior Falling Hazard	No	Yes	Yes
Obstructs Interior Space	No	Yes	Yes
Interior Area Conversion Type	—	component	component
Interior Area Conversion Factor	—	0.3	0.5
Repair Schedule			
Crew Size	1	3	7
Permit Type (Rapid or Full)	Rapid	Rapid	Rapid
Requires Redesign	No	No	No
Long Lead Time	No	No	No
Requires Shoring	No	No	No
Resolved by Scaffolding	No	No	No
Temporary Repair Class	—	Basic carpenter/laborers	Basic carpenter/laborers
Temporary Repair Time Lower (days)	—	0.125	0.25
Temporary Repair Time Upper (days)	—	0.125	0.25
Temporary Repair Crew Size	—	5.0	5.0
Miscellaneous			
Hazardous Material Scope	N/A	N/A	N/A
Weakens Fire Break	No	No	No
Impairs System Operation	No	No	No
Causes Flooding	No	No	No
Affects Access	No	No	No

6.13 C3032.004b #1: (C3032.004b) Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): 250 < A < 1000, Vert & Lat support

NISTIR Classification	C3032.004b
Author	Not Given
Normalized Unit	600.0 sf
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	3
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	Ceilings
System	Interior
Element	Ceilings

Calculation:

Is Calculated?	No
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ATC-138 Properties:

System	Interior
Subsystem	N/A

Component modifications applied:

Component Group	Ceilings
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.13.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.13.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1	5 % of ceiling grid and tile damage.	Reinstall, repair, or replace 5% of the ceiling area.	Not Available
DS2	30% of ceiling grid and tile damage.	Replace 30% of the ceiling area.	Not Available
DS3	50% of ceiling grid and tile damage.	Replace the entire ceiling	Not Available

Table 6.13.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1	DS2	DS3
Type	Sequential	Sequential	Sequential
Probability	–	–	–
Median	1.76	2.26	2.44
β	0.3	0.3	0.3

Table 6.13.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1	DS2	DS3
Distribution Type	Normal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0
Upper Qty.	10.0	10.0	10.0
Highest Cost Median	\$5,249	\$41,086	\$84,525
Lowest Cost Median	\$1,575	\$12,326	\$25,357
β (COV)	0.55	0.52	0.2

Table 6.13.5. Parameters for the repair time distributions.

	DS1	DS2	DS3
Distribution Type	Normal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0
Upper Qty.	10.0	10.0	10.0
Highest Median Repair Time (Days)	1.57	12.39	25.55
Lowest Median Repair Time (Days)	0.46	3.7	7.67
β (COV)	0.6	0.58	0.32

Table 6.13.6. Life safety information.

	DS1	DS2	DS3
Non-collapse casualties	No	No	Yes
Affected Area	–	–	650.0 SF
Serious Injury Median	–	–	0.1
Serious Injury β	–	–	0.5
Loss of Life Median	–	–	0.0
Loss of Life β	–	–	0.0
Can Cause Red Tag	No	No	No
Unsafe Placard Median	–	–	–
Unsafe Placard β	–	–	–

Table 6.13.7. REDi repair class.

	DS1	DS2	DS3
REDi Repair Class	1	3	3

Table 6.13.8. ATC-138 parameters.

	DS1	DS2	DS3
Safety			
Safety Class	0	0	0
Envelope			
Affects Roof Function	No	No	No
Affects Envelope Safety	No	No	No
Damages Envelope Seal	No	No	No
Exterior Surface Area Factor	–	–	–
Exterior Falling Hazard			
Poses an Exterior Falling Hazard	No	No	No
Exterior Falling Length Factor	–	–	–
Interior Space			
Poses an Interior Falling Hazard	No	Yes	Yes
Obstructs Interior Space	No	Yes	Yes
Interior Area Conversion Type	–	component	component
Interior Area Conversion Factor	–	0.3	0.5
Repair Schedule			
Crew Size	1	3	7
Permit Type (Rapid or Full)	Rapid	Rapid	Rapid
Requires Redesign	No	No	No
Long Lead Time	No	No	No
Requires Shoring	No	No	No
Resolved by Scaffolding	No	No	No
Temporary Repair Class	–	Basic carpenter/laborers	Basic carpenter/laborers
Temporary Repair Time Lower (days)	–	0.3125	0.625
Temporary Repair Time Upper (days)	–	0.3125	0.625
Temporary Repair Crew Size	–	5.0	5.0
Miscellaneous			
Hazardous Material Scope	N/A	N/A	N/A
Weakens Fire Break	No	No	No
Impairs System Operation	No	No	No
Causes Flooding	No	No	No
Affects Access	No	No	No

6.14 C3032.004c #1: (C3032.004c) Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): 1000 < A < 2500, Vert & Lat support

NISTIR Classification	C3032.004c
Author	Not Given
Normalized Unit	1800.0 sf
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	3
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	Ceilings
System	Interior
Element	Ceilings

Calculation:

Is Calculated?	No
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ATC-138 Properties:

System	Interior
Subsystem	N/A

Component modifications applied:

Component Group	Ceilings
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.14.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.14.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1	5 % of ceiling grid and tile damage.	Reinstall, repair, or replace 5% of the ceiling area.	Not Available
DS2	30% of ceiling grid and tile damage.	Replace 30% of the ceiling area.	Not Available
DS3	50% of ceiling grid and tile damage.	Replace the entire ceiling	Not Available

Table 6.14.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1	DS2	DS3
Type	Sequential	Sequential	Sequential
Probability	–	–	–
Median	1.45	2.1	2.34
β	0.3	0.3	0.3

Table 6.14.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1	DS2	DS3
Distribution Type	Normal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0
Upper Qty.	10.0	10.0	10.0
Highest Cost Median	\$15,747	\$123,258	\$253,574
Lowest Cost Median	\$4,724	\$36,977	\$76,072
β (COV)	0.55	0.52	0.2

Table 6.14.5. Parameters for the repair time distributions.

	DS1	DS2	DS3
Distribution Type	Normal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0
Upper Qty.	10.0	10.0	10.0
Highest Median Repair Time (Days)	4.64	36.03	74.17
Lowest Median Repair Time (Days)	1.42	10.79	22.25
β (COV)	0.6	0.58	0.32

Table 6.14.6. Life safety information.

	DS1	DS2	DS3
Non-collapse casualties	No	No	Yes
Affected Area	–	–	1700.0 SF
Serious Injury Median	–	–	0.1
Serious Injury β	–	–	0.5
Loss of Life Median	–	–	0.0
Loss of Life β	–	–	0.0
Can Cause Red Tag	No	No	No
Unsafe Placard Median	–	–	–
Unsafe Placard β	–	–	–

Table 6.14.7. REDi repair class.

	DS1	DS2	DS3
REDi Repair Class	1	3	3

Table 6.14.8. ATC-138 parameters.

	DS1	DS2	DS3
Safety			
Safety Class	0	0	0
Envelope			
Affects Roof Function	No	No	No
Affects Envelope Safety	No	No	No
Damages Envelope Seal	No	No	No
Exterior Surface Area Factor	—	—	—
Exterior Falling Hazard			
Poses an Exterior Falling Hazard	No	No	No
Exterior Falling Length Factor	—	—	—
Interior Space			
Poses an Interior Falling Hazard	No	Yes	Yes
Obstructs Interior Space	No	Yes	Yes
Interior Area Conversion Type	—	component	component
Interior Area Conversion Factor	—	0.3	0.5
Repair Schedule			
Crew Size	1	3	7
Permit Type (Rapid or Full)	Rapid	Rapid	Rapid
Requires Redesign	No	No	No
Long Lead Time	No	No	No
Requires Shoring	No	No	No
Resolved by Scaffolding	No	No	No
Temporary Repair Class	—	Basic carpenter/laborers	Basic carpenter/laborers
Temporary Repair Time Lower (days)	—	0.75	1.5
Temporary Repair Time Upper (days)	—	0.75	1.5
Temporary Repair Crew Size	—	5.0	5.0
Miscellaneous			
Hazardous Material Scope	N/A	N/A	N/A
Weakens Fire Break	No	No	No
Impairs System Operation	No	No	No
Causes Flooding	No	No	No
Affects Access	No	No	No

6.15 C3032.004d #1: (C3032.004d) Suspended Ceiling, SDC D,E,F (Ip=1.5), Area (A): A > 2500, Vert & Lat support

NISTIR Classification	C3032.004d
Author	Not Given
Normalized Unit	2500.0 sf
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	3
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	Ceilings
System	Interior
Element	Ceilings

Calculation:

Is Calculated?	No
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ATC-138 Properties:

System	Interior
Subsystem	N/A

Component modifications applied:

Component Group	Ceilings
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.15.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.15.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1	5 % of ceiling grid and tile damage.	Reinstall, repair, or replace 5% of the ceiling area.	Not Available
DS2	30% of ceiling grid and tile damage.	Replace 30% of the ceiling area.	Not Available
DS3	50% of ceiling grid and tile damage.	Replace the entire ceiling	Not Available

Table 6.15.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1	DS2	DS3
Type	Sequential	Sequential	Sequential
Probability	–	–	–
Median	1.31	2.03	2.29
β	0.3	0.3	0.3

Table 6.15.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1	DS2	DS3
Distribution Type	Normal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0
Upper Qty.	10.0	10.0	10.0
Highest Cost Median	\$21,870	\$171,191	\$352,187
Lowest Cost Median	\$6,561	\$51,357	\$105,656
β (COV)	0.55	0.52	0.2

Table 6.15.5. Parameters for the repair time distributions.

	DS1	DS2	DS3
Distribution Type	Normal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0
Upper Qty.	10.0	10.0	10.0
Highest Median Repair Time (Days)	6.09	48.45	99.54
Lowest Median Repair Time (Days)	1.76	14.57	29.83
β (COV)	0.6	0.58	0.32

Table 6.15.6. Life safety information.

	DS1	DS2	DS3
Non-collapse casualties	No	No	Yes
Affected Area	–	–	2500.0 SF
Serious Injury Median	–	–	0.1
Serious Injury β	–	–	0.5
Loss of Life Median	–	–	0.0
Loss of Life β	–	–	0.0
Can Cause Red Tag	No	Yes	Yes
Unsafe Placard Median	–	0.75	0.5
Unsafe Placard β	–	0.5	0.5

Table 6.15.7. REDi repair class.

	DS1	DS2	DS3
REDi Repair Class	1	3	3

Table 6.15.8. ATC-138 parameters.

	DS1	DS2	DS3
Safety			
Safety Class	0	0	0
Envelope			
Affects Roof Function	No	No	No
Affects Envelope Safety	No	No	No
Damages Envelope Seal	No	No	No
Exterior Surface Area Factor	—	—	—
Exterior Falling Hazard			
Poses an Exterior Falling Hazard	No	No	No
Exterior Falling Length Factor	—	—	—
Interior Space			
Poses an Interior Falling Hazard	No	Yes	Yes
Obstructs Interior Space	No	Yes	Yes
Interior Area Conversion Type	—	component	component
Interior Area Conversion Factor	—	0.3	0.5
Repair Schedule			
Crew Size	1	3	7
Permit Type (Rapid or Full)	Rapid	Rapid	Rapid
Requires Redesign	No	No	No
Long Lead Time	No	No	No
Requires Shoring	No	No	No
Resolved by Scaffolding	No	No	No
Temporary Repair Class	—	Basic carpenter/laborers	Basic carpenter/laborers
Temporary Repair Time Lower (days)	—	1.0	2.0
Temporary Repair Time Upper (days)	—	1.0	2.0
Temporary Repair Crew Size	—	5.0	5.0
Miscellaneous			
Hazardous Material Scope	N/A	N/A	N/A
Weakens Fire Break	No	No	No
Impairs System Operation	No	No	No
Causes Flooding	No	No	No
Affects Access	No	No	No

6.16 D1014.041 #1: (D1014.041) Traction Elevator Machine room component anchorage. Applies to Seismic Zone 3 or greater and elevators designed according to the ASME A17.1-2007 Standard or similar.

NISTIR Classification	D1014.041
Author	HBRG
Normalized Unit	1.0 each
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	1
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	Elevators
System	Conveying
Element	Elevators

Calculation:

Is Calculated?	No
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ATC-138 Properties:

System	Elevators
Subsystem	Elevator Lift Mechanism
Requires Service Locations	No
Service Location	Building

Component modifications applied:

Component Group	Elevators
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.16.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.16.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1	Controller anchorage failure, machine anchorage failure, motor Generator anchorage failure, governor anchorage failure, and rope guard/tail sheave anchorage failure.	Reinstall or replace controller. Reinstall or replace motor generator and or Install new generator with appropriate anchors. Install new governor. Reinstall or replace rope guards and or repair or replace tail sheave.	Not Available

Table 6.16.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

DS1	
Type	Sequential
Probability	–
Median	1.72
β	0.5

Table 6.16.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

DS1	
Distribution Type	LogNormal
Lower Qty.	5.0
Upper Qty.	10.0
Highest Cost Median	\$27,149
Lowest Cost Median	\$8,145
β (COV)	0.8

Table 6.16.5. Parameters for the repair time distributions.

DS1	
Distribution Type	LogNormal
Lower Qty.	5.0
Upper Qty.	10.0
Highest Median Repair Time (Days)	8.6
Lowest Median Repair Time (Days)	2.6
β (COV)	0.84

Table 6.16.6. Life safety information.

DS1	
Non-collapse casualties	No
Affected Area	– –
Serious Injury Median	–
Serious Injury β	–
Loss of Life Median	–
Loss of Life β	–
Can Cause Red Tag	No
Unsafe Placard Median	–
Unsafe Placard β	–

Table 6.16.7. REDi repair class.

DS1	
REDi Repair Class	2

Table 6.16.8. ATC-138 parameters.

	DS1
Safety	
Safety Class	0
Envelope	
Affects Roof Function	No
Affects Envelope Safety	No
Damages Envelope Seal	No
Exterior Surface Area Factor	–
Exterior Falling Hazard	
Poses an Exterior Falling Hazard	No
Exterior Falling Length Factor	–
Interior Space	
Poses an Interior Falling Hazard	No
Obstructs Interior Space	No
Interior Area Conversion Type	–
Interior Area Conversion Factor	–
Repair Schedule	
Crew Size	2
Permit Type (Rapid or Full)	Rapid
Requires Redesign	No
Long Lead Time	Yes
Requires Shoring	No
Resolved by Scaffolding	No
Temporary Repair Class	–
Temporary Repair Time Lower (days)	–
Temporary Repair Time Upper (days)	–
Temporary Repair Crew Size	–
Miscellaneous	
Hazardous Material Scope	N/A
Weakens Fire Break	No
Impairs System Operation	Yes
Causes Flooding	No
Affects Access	No

6.17 D1014.042 #1: (D1014.042) Traction Elevator Cab and Counterweight Components. Applies to Seismic Zone 3 or greater and elevators designed according to the ASME A17.1-2007 Standard or similar.

NISTIR Classification	D1014.042
Author	HBRG
Normalized Unit	1.0 each
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	1
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	Elevators
System	Conveying
Element	Elevators

Calculation:

Is Calculated?	No
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ATC-138 Properties:

System	Elevators
Subsystem	Elevator Cab
Requires Service Locations	No
Service Location	Building

Component modifications applied:

Component Group	Elevators
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.17.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.17.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1	Car guide shoes damaged, counterweight guide shoes damaged, counterweight distorted frame, cab ceiling damaged, cab stabilizer brackets bent, and or cab walls, and or cab doors damaged.	Repalce car guide shoes. Replace counterweight guide shoe. Repair or replace counterweight frame. Repair or replace cab ceiling. Repair or replace cab walls.	Not Available

Table 6.17.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

DS1	
Type	Sequential
Probability	–
Median	0.86
β	0.5

Table 6.17.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

DS1	
Distribution Type	Normal
Lower Qty.	5.0
Upper Qty.	10.0
Highest Cost Median	\$153,339
Lowest Cost Median	\$46,003
β (COV)	0.36

Table 6.17.5. Parameters for the repair time distributions.

DS1	
Distribution Type	Normal
Lower Qty.	5.0
Upper Qty.	10.0
Highest Median Repair Time (Days)	48.6
Lowest Median Repair Time (Days)	14.6
β (COV)	0.44

Table 6.17.6. Life safety information.

	DS1
Non-collapse casualties	Yes
Affected Area	40.0 SF
Serious Injury Median	0.1
Serious Injury β	0.5
Loss of Life Median	0.05
Loss of Life β	0.5
Can Cause Red Tag	No
Unsafe Placard Median	–
Unsafe Placard β	–

Table 6.17.7. REDi repair class.

	DS1
REDi Repair Class	2

Table 6.17.8. ATC-138 parameters.

	DS1
Safety	
Safety Class	0
Envelope	
Affects Roof Function	No
Affects Envelope Safety	No
Damages Envelope Seal	No
Exterior Surface Area Factor	–
Exterior Falling Hazard	
Poses an Exterior Falling Hazard	No
Exterior Falling Length Factor	–
Interior Space	
Poses an Interior Falling Hazard	No
Obstructs Interior Space	No
Interior Area Conversion Type	–
Interior Area Conversion Factor	–
Repair Schedule	
Crew Size	2
Permit Type (Rapid or Full)	Rapid
Requires Redesign	No
Long Lead Time	Yes
Requires Shoring	No
Resolved by Scaffolding	No
Temporary Repair Class	–
Temporary Repair Time Lower (days)	–
Temporary Repair Time Upper (days)	–
Temporary Repair Crew Size	–
Miscellaneous	
Hazardous Material Scope	N/A
Weakens Fire Break	No
Impairs System Operation	Yes
Causes Flooding	No
Affects Access	No

6.18 D1014.043 #1: (D1014.043) Traction Elevator Guide Rails. Applies to Seismic Zone 3 or greater and elevators designed according to the ASME A17.1-2007 Standard or similar.

NISTIR Classification	D1014.043
Author	HBRG
Normalized Unit	1.0 each
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	1
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	Elevators
System	Conveying
Element	Elevators

Calculation:

Is Calculated?	No
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ATC-138 Properties:

System	Elevators
Subsystem	Elevator Guide Mechanism
Requires Service Locations	No
Service Location	Building

Component modifications applied:

Component Group	Elevators
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.18.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.18.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1	Guide rail distortion	Replace rail.	Not Available

Table 6.18.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

DS1	
Type	Sequential
Probability	–
Median	0.86
β	0.5

Table 6.18.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

DS1	
Distribution Type	LogNormal
Lower Qty.	5.0
Upper Qty.	10.0
Highest Cost Median	\$11,611
Lowest Cost Median	\$3,439
β (COV)	0.19

Table 6.18.5. Parameters for the repair time distributions.

DS1	
Distribution Type	LogNormal
Lower Qty.	5.0
Upper Qty.	10.0
Highest Median Repair Time (Days)	3.7
Lowest Median Repair Time (Days)	1.1
β (COV)	0.32

Table 6.18.6. Life safety information.

DS1	
Non-collapse casualties	No
Affected Area	– –
Serious Injury Median	–
Serious Injury β	–
Loss of Life Median	–
Loss of Life β	–
Can Cause Red Tag	No
Unsafe Placard Median	–
Unsafe Placard β	–

Table 6.18.7. REDi repair class.

DS1	
REDi Repair Class	2

Table 6.18.8. ATC-138 parameters.

	DS1
Safety	
Safety Class	0
Envelope	
Affects Roof Function	No
Affects Envelope Safety	No
Damages Envelope Seal	No
Exterior Surface Area Factor	–
Exterior Falling Hazard	
Poses an Exterior Falling Hazard	No
Exterior Falling Length Factor	–
Interior Space	
Poses an Interior Falling Hazard	No
Obstructs Interior Space	No
Interior Area Conversion Type	–
Interior Area Conversion Factor	–
Repair Schedule	
Crew Size	2
Permit Type (Rapid or Full)	Rapid
Requires Redesign	No
Long Lead Time	Yes
Requires Shoring	No
Resolved by Scaffolding	No
Temporary Repair Class	–
Temporary Repair Time Lower (days)	–
Temporary Repair Time Upper (days)	–
Temporary Repair Crew Size	–
Miscellaneous	
Hazardous Material Scope	N/A
Weakens Fire Break	No
Impairs System Operation	Yes
Causes Flooding	No
Affects Access	No

6.19 D1014.044 #1: (D1014.044) Traction Elevator Guide Rail Brackets. Applies to Seismic Zone 3 or greater and elevators designed according to the ASME A17.1-2007 Standard or similar.

NISTIR Classification	D1014.044
Author	HBRG
Normalized Unit	1.0 each
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	1
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	Elevators
System	Conveying
Element	Elevators

Calculation:

Is Calculated?	No
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ATC-138 Properties:

System	Elevators
Subsystem	Elevator Guide Mechanism
Requires Service Locations	No
Service Location	Building

Component modifications applied:

Component Group	Elevators
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.19.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.19.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1	Intermediate guide rail brackets break or bend, car guide rail brackets break or bend, and counterweight guide rail brackets break or bend.	Replace intermediate brackets. Replace brackets r tie rod. Replace counterweight brackets.	Not Available

Table 6.19.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

DS1	
Type	Sequential
Probability	–
Median	0.86
β	0.5

Table 6.19.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

DS1	
Distribution Type	Normal
Lower Qty.	5.0
Upper Qty.	10.0
Highest Cost Median	\$38,428
Lowest Cost Median	\$11,529
β (COV)	0.28

Table 6.19.5. Parameters for the repair time distributions.

DS1	
Distribution Type	Normal
Lower Qty.	5.0
Upper Qty.	10.0
Highest Median Repair Time (Days)	8.6
Lowest Median Repair Time (Days)	3.7
β (COV)	0.38

Table 6.19.6. Life safety information.

DS1	
Non-collapse casualties	No
Affected Area	– –
Serious Injury Median	–
Serious Injury β	–
Loss of Life Median	–
Loss of Life β	–
Can Cause Red Tag	No
Unsafe Placard Median	–
Unsafe Placard β	–

Table 6.19.7. REDi repair class.

DS1	
REDi Repair Class	2

Table 6.19.8. ATC-138 parameters.

	DS1
Safety	
Safety Class	0
Envelope	
Affects Roof Function	No
Affects Envelope Safety	No
Damages Envelope Seal	No
Exterior Surface Area Factor	—
Exterior Falling Hazard	
Poses an Exterior Falling Hazard	No
Exterior Falling Length Factor	—
Interior Space	
Poses an Interior Falling Hazard	No
Obstructs Interior Space	No
Interior Area Conversion Type	—
Interior Area Conversion Factor	—
Repair Schedule	
Crew Size	2
Permit Type (Rapid or Full)	Rapid
Requires Redesign	No
Long Lead Time	Yes
Requires Shoring	No
Resolved by Scaffolding	No
Temporary Repair Class	—
Temporary Repair Time Lower (days)	—
Temporary Repair Time Upper (days)	—
Temporary Repair Crew Size	—
Miscellaneous	
Hazardous Material Scope	N/A
Weakens Fire Break	No
Impairs System Operation	Yes
Causes Flooding	No
Affects Access	No

6.20 D2021.014a #1: (D2021.014a) Cold or Hot Potable - Small Diameter Threaded Steel - (2.5 inches in diameter or less), SDC D, E, or F (OSHDP or sim), PIPING FRAGILITY

NISTIR Classification	D2021.014a
Author	Not Given
Normalized Unit	1000.0 lf
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	2
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	Piping
System	Plumbing
Element	Domestic

Calculation:

Is Calculated?	No
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ATC-138 Properties:

System	Plumbing
Subsystem	Fluid Distribution: Potable
Requires Service Locations	No
Service Location	Unit

Component modifications applied:

Component Group	Piping
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.20.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.20.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1	Minor leakage at flange connections - 1 leak per 1000 feet of pipe.	Retighten flange bolts at leaking joints. One joint per 1000 LF.	Not Available
DS2	Pipe Break - 1 break per 1000 feet of pipe.	Replace 20 foot sections of pipe where breaks occur. One repair per 1000 LF.	Not Available

Table 6.20.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1	DS2
Type	Sequential	Sequential
Probability	–	–
Median	2.25	4.1
β	0.4	0.4

Table 6.20.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1	DS2
Distribution Type	LogNormal	LogNormal
Lower Qty.	3.0	3.0
Upper Qty.	10.0	10.0
Highest Cost Median	\$962	\$8,793
Lowest Cost Median	\$787	\$7,195
β (COV)	0.76	0.41

Table 6.20.5. Parameters for the repair time distributions.

	DS1	DS2
Distribution Type	LogNormal	LogNormal
Lower Qty.	3.0	3.0
Upper Qty.	10.0	10.0
Highest Median Repair Time (Days)	0.34	3.09
Lowest Median Repair Time (Days)	0.28	2.53
β (COV)	0.8	0.48

Table 6.20.6. Life safety information.

	DS1	DS2
Non-collapse casualties	No	No
Affected Area	–	–
Serious Injury Median	–	–
Serious Injury β	–	–
Loss of Life Median	–	–
Loss of Life β	–	–
Can Cause Red Tag	No	No
Unsafe Placard Median	–	–
Unsafe Placard β	–	–

Table 6.20.7. REDi repair class.

	DS1	DS2
REDi Repair Class	2	3

Table 6.20.8. ATC-138 parameters.

	DS1	DS2
Safety		
Safety Class	0	0
Envelope		
Affects Roof Function	No	No
Affects Envelope Safety	No	No
Damages Envelope Seal	No	No
Exterior Surface Area Factor	—	—
Exterior Falling Hazard		
Poses an Exterior Falling Hazard	No	No
Exterior Falling Length Factor	—	—
Interior Space		
Poses an Interior Falling Hazard	No	Yes
Obstructs Interior Space	No	Yes
Interior Area Conversion Type	—	component
Interior Area Conversion Factor	—	0.01
Repair Schedule		
Crew Size	3	5
Permit Type (Rapid or Full)	Rapid	Rapid
Requires Redesign	No	No
Long Lead Time	No	No
Requires Shoring	No	No
Resolved by Scaffolding	No	No
Temporary Repair Class	—	Basic carpenter/laborers
Temporary Repair Time Lower (days)	—	0.5
Temporary Repair Time Upper (days)	—	0.5
Temporary Repair Crew Size	—	2.0
Miscellaneous		
Hazardous Material Scope	N/A	N/A
Weakens Fire Break	No	No
Impairs System Operation	No	Yes
Causes Flooding	No	Yes
Affects Access	No	No

6.21 D2021.014b #1: (D2021.014b) Cold or Hot Potable - Small Diameter Threaded Steel - (2.5 inches in diameter or less), SDC D, E, or F (OSHDP or sim), BRACING FRAGILITY

NISTIR Classification	D2021.014b
Author	Not Given
Normalized Unit	1000.0 lf
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	1
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	Piping
System	Plumbing
Element	Domestic

Calculation:

Is Calculated?	No
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ATC-138 Properties:

System	Plumbing
Subsystem	Fluid Distribution: Potable
Requires Service Locations	No
Service Location	Unit

Component modifications applied:

Component Group	Piping
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.21.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.21.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1	Lateral Brace Failure - 1 failure per 1000 feet of pipe.	Replace failed lateral braces. One repair per 1000 LF.	Not Available

Table 6.21.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

DS1	
Type	Sequential
Probability	–
Median	1.5
β	0.4

Table 6.21.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

DS1	
Distribution Type	LogNormal
Lower Qty.	3.0
Upper Qty.	10.0
Highest Cost Median	\$1,261
Lowest Cost Median	\$1,032
β (COV)	0.6

Table 6.21.5. Parameters for the repair time distributions.

DS1	
Distribution Type	LogNormal
Lower Qty.	3.0
Upper Qty.	10.0
Highest Median Repair Time (Days)	0.44
Lowest Median Repair Time (Days)	0.36
β (COV)	0.65

Table 6.21.6. Life safety information.

DS1	
Non-collapse casualties	No
Affected Area	– –
Serious Injury Median	–
Serious Injury β	–
Loss of Life Median	–
Loss of Life β	–
Can Cause Red Tag	No
Unsafe Placard Median	–
Unsafe Placard β	–

Table 6.21.7. REDi repair class.

DS1	
REDi Repair Class	2

Table 6.21.8. ATC-138 parameters.

	DS1
Safety	
Safety Class	0
Envelope	
Affects Roof Function	No
Affects Envelope Safety	No
Damages Envelope Seal	No
Exterior Surface Area Factor	–
Exterior Falling Hazard	
Poses an Exterior Falling Hazard	No
Exterior Falling Length Factor	–
Interior Space	
Poses an Interior Falling Hazard	No
Obstructs Interior Space	No
Interior Area Conversion Type	–
Interior Area Conversion Factor	–
Repair Schedule	
Crew Size	3
Permit Type (Rapid or Full)	Rapid
Requires Redesign	No
Long Lead Time	No
Requires Shoring	No
Resolved by Scaffolding	No
Temporary Repair Class	–
Temporary Repair Time Lower (days)	–
Temporary Repair Time Upper (days)	–
Temporary Repair Crew Size	–
Miscellaneous	
Hazardous Material Scope	N/A
Weakens Fire Break	No
Impairs System Operation	Yes
Causes Flooding	No
Affects Access	No

6.22 D2021.024a #1: (D2021.024a) Cold or Hot Potable Water Piping (dia > 2.5 inches), SDC D,E,F (OSPHD or sim), PIPING FRAGILITY

NISTIR Classification	D2021.024a
Author	Not Given
Normalized Unit	1000.0 lf
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	2
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	Piping
System	Plumbing
Element	Domestic

Calculation:

Is Calculated?	No
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ATC-138 Properties:

System	Plumbing
Subsystem	Fluid Distribution: Potable
Requires Service Locations	No
Service Location	Building

Component modifications applied:

Component Group	Piping
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.22.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.22.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1	Minor leakage at flange connections - 1 leak per 1000 feet of pipe.	Retighten flange bolts at leaking joints. One joint per 1000 LF.	Not Available
DS2	Pipe Break - 1 break per 1000 feet of pipe.	Replace 20 foot sections of pipe where breaks occur. One repair per 1000 LF.	Not Available

Table 6.22.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1	DS2
Type	Sequential	Sequential
Probability	–	–
Median	2.25	4.1
β	0.4	0.4

Table 6.22.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1	DS2
Distribution Type	LogNormal	LogNormal
Lower Qty.	5.0	5.0
Upper Qty.	10.0	10.0
Highest Cost Median	\$2,112	\$20,211
Lowest Cost Median	\$633	\$6,063
β (COV)	0.65	0.4

Table 6.22.5. Parameters for the repair time distributions.

	DS1	DS2
Distribution Type	LogNormal	LogNormal
Lower Qty.	5.0	5.0
Upper Qty.	10.0	10.0
Highest Median Repair Time (Days)	0.74	7.09
Lowest Median Repair Time (Days)	0.22	2.13
β (COV)	0.7	0.47

Table 6.22.6. Life safety information.

	DS1	DS2
Non-collapse casualties	No	No
Affected Area	–	–
Serious Injury Median	–	–
Serious Injury β	–	–
Loss of Life Median	–	–
Loss of Life β	–	–
Can Cause Red Tag	No	No
Unsafe Placard Median	–	–
Unsafe Placard β	–	–

Table 6.22.7. REDi repair class.

	DS1	DS2
REDi Repair Class	2	3

Table 6.22.8. ATC-138 parameters.

	DS1	DS2
Safety		
Safety Class	0	0
Envelope		
Affects Roof Function	No	No
Affects Envelope Safety	No	No
Damages Envelope Seal	No	No
Exterior Surface Area Factor	—	—
Exterior Falling Hazard		
Poses an Exterior Falling Hazard	No	No
Exterior Falling Length Factor	—	—
Interior Space		
Poses an Interior Falling Hazard	No	Yes
Obstructs Interior Space	No	Yes
Interior Area Conversion Type	—	component
Interior Area Conversion Factor	—	0.01
Repair Schedule		
Crew Size	3	5
Permit Type (Rapid or Full)	Rapid	Rapid
Requires Redesign	No	No
Long Lead Time	No	No
Requires Shoring	No	No
Resolved by Scaffolding	No	No
Temporary Repair Class	—	Basic carpenter/laborers
Temporary Repair Time Lower (days)	—	0.5
Temporary Repair Time Upper (days)	—	0.5
Temporary Repair Crew Size	—	2.0
Miscellaneous		
Hazardous Material Scope	N/A	N/A
Weakens Fire Break	No	No
Impairs System Operation	No	Yes
Causes Flooding	No	Yes
Affects Access	No	No

6.23 D2021.024b #1: (D2021.024b) Cold or Hot Potable Water Piping (dia > 2.5 inches), SDC D,E,F (OSPHD or sim), BRACING FRAGILITY

NISTIR Classification	D2021.024b
Author	Not Given
Normalized Unit	1000.0 lf
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	2
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	Piping
System	Plumbing
Element	Domestic

Calculation:

Is Calculated?	No
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ATC-138 Properties:

System	Plumbing
Subsystem	Fluid Distribution: Potable
Requires Service Locations	No
Service Location	Building

Component modifications applied:

Component Group	Piping
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.23.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.23.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1	Lateral Brace Failure - 1 failure per 1000 feet of pipe.	Replace failed lateral braces. One repair per 1000 LF.	Not Available
DS2	Vertical Brace Failure - 1 failure per 1000 feet of pipe	Replace failed vertical braces. One repair per 1000 LF.	Not Available

Table 6.23.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1	DS2
Type	Sequential	Sequential
Probability	–	–
Median	1.5	2.25
β	0.4	0.4

Table 6.23.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1	DS2
Distribution Type	LogNormal	LogNormal
Lower Qty.	5.0	5.0
Upper Qty.	10.0	10.0
Highest Cost Median	\$2,112	\$2,112
Lowest Cost Median	\$633	\$633
β (COV)	0.65	0.65

Table 6.23.5. Parameters for the repair time distributions.

	DS1	DS2
Distribution Type	LogNormal	LogNormal
Lower Qty.	5.0	5.0
Upper Qty.	10.0	10.0
Highest Median Repair Time (Days)	0.74	0.74
Lowest Median Repair Time (Days)	0.22	0.22
β (COV)	0.7	0.7

Table 6.23.6. Life safety information.

	DS1	DS2
Non-collapse casualties	No	No
Affected Area	–	–
Serious Injury Median	–	–
Serious Injury β	–	–
Loss of Life Median	–	–
Loss of Life β	–	–
Can Cause Red Tag	No	No
Unsafe Placard Median	–	–
Unsafe Placard β	–	–

Table 6.23.7. REDi repair class.

	DS1	DS2
REDi Repair Class	2	3

Table 6.23.8. ATC-138 parameters.

	DS1	DS2
Safety		
Safety Class	0	0
Envelope		
Affects Roof Function	No	No
Affects Envelope Safety	No	No
Damages Envelope Seal	No	No
Exterior Surface Area Factor	—	—
Exterior Falling Hazard		
Poses an Exterior Falling Hazard	No	No
Exterior Falling Length Factor	—	—
Interior Space		
Poses an Interior Falling Hazard	No	Yes
Obstructs Interior Space	No	Yes
Interior Area Conversion Type	—	component
Interior Area Conversion Factor	—	0.01
Repair Schedule		
Crew Size	3	3
Permit Type (Rapid or Full)	Rapid	Rapid
Requires Redesign	No	No
Long Lead Time	No	No
Requires Shoring	No	No
Resolved by Scaffolding	No	No
Temporary Repair Class	—	Basic carpenter/laborers
Temporary Repair Time Lower (days)	—	0.5
Temporary Repair Time Upper (days)	—	0.5
Temporary Repair Crew Size	—	2.0
Miscellaneous		
Hazardous Material Scope	N/A	N/A
Weakens Fire Break	No	No
Impairs System Operation	Yes	Yes
Causes Flooding	No	No
Affects Access	No	No

6.24 D2031.014b #1: (D2031.014b) Sanitary Waste Piping - Cast Iron w/flexible couplings, SDC D,E,F (OSHDP or sim), BRACING FRAGILITY

NISTIR Classification	D2031.014b
Author	Not Given
Normalized Unit	1000.0 lf
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	1
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	Piping
System	Plumbing
Element	Waste

Calculation:

Is Calculated?	No
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ATC-138 Properties:

System	Plumbing
Subsystem	Fluid Distribution: Sanitary
Requires Service Locations	No
Service Location	Building

Component modifications applied:

Component Group	Piping
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.24.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.24.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1	Isolated support failure w/o leakage - 0.5 support failures per 1000 feet of pipe (assuming supports every 20 feet).	Replace failed supports.	Not Available

Table 6.24.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

DS1	
Type	Sequential
Probability	–
Median	3
β	0.5

Table 6.24.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

DS1	
Distribution Type	LogNormal
Lower Qty.	5.0
Upper Qty.	10.0
Highest Cost Median	\$2,413
Lowest Cost Median	\$724
β (COV)	0.58

Table 6.24.5. Parameters for the repair time distributions.

DS1	
Distribution Type	LogNormal
Lower Qty.	5.0
Upper Qty.	10.0
Highest Median Repair Time (Days)	0.85
Lowest Median Repair Time (Days)	0.25
β (COV)	0.63

Table 6.24.6. Life safety information.

DS1	
Non-collapse casualties	No
Affected Area	– –
Serious Injury Median	–
Serious Injury β	–
Loss of Life Median	–
Loss of Life β	–
Can Cause Red Tag	No
Unsafe Placard Median	–
Unsafe Placard β	–

Table 6.24.7. REDi repair class.

DS1	
REDi Repair Class	2

Table 6.24.8. ATC-138 parameters.

	DS1
Safety	
Safety Class	0
Envelope	
Affects Roof Function	No
Affects Envelope Safety	No
Damages Envelope Seal	No
Exterior Surface Area Factor	–
Exterior Falling Hazard	
Poses an Exterior Falling Hazard	No
Exterior Falling Length Factor	–
Interior Space	
Poses an Interior Falling Hazard	No
Obstructs Interior Space	No
Interior Area Conversion Type	–
Interior Area Conversion Factor	–
Repair Schedule	
Crew Size	3
Permit Type (Rapid or Full)	Rapid
Requires Redesign	No
Long Lead Time	No
Requires Shoring	No
Resolved by Scaffolding	No
Temporary Repair Class	–
Temporary Repair Time Lower (days)	–
Temporary Repair Time Upper (days)	–
Temporary Repair Crew Size	–
Miscellaneous	
Hazardous Material Scope	N/A
Weakens Fire Break	No
Impairs System Operation	Yes
Causes Flooding	No
Affects Access	No

6.25 D3032.013f #1: (D3032.013f) Compressor - Capacity: Large non medical air supply - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility

NISTIR Classification	D3032.013f
Author	Not Given
Normalized Unit	1.0 each
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	1
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	HVAC
System	HVAC
Element	Compressor

Calculation:

Is Calculated?	Yes
Calculation Type	Anchorage (Combined Fragility)
Anchorage Ductility	Brittle
ID Component Class	Engines, turbines, pumps, compressors, and pressure vessels not supported on skirts and not within the scope of Chapter 15.

ATC-138 Properties:

System	HVAC
Subsystem	HVAC Equipment: Roof top Units
Requires Service Locations	Yes
Service Location	Unit

Component modifications applied:

Component Group	HVAC
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.25.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.25.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1a	Anchorage failure.	Repair anchorage and concrete pad and re-mount equipment.	
DS1b	Anchorage failure & Equipment damaged beyond repair.	Replace equipment including attached utilities in addition to repairing anchorage and concrete pad.	Not Available
DS1c	Motor damaged but anchorage is OK.	Repair Motor - Anchorage and Concrete do not require repair.	Not Available
DS1d	Equipment damaged beyond repair but anchorage is OK.	Replace and install equipment including new anchorage if anchorage is post-installed.	Not Available

Table 6.25.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1a	DS1b	DS1c	DS1d
Type	Mut. Excl.	Mut. Excl.	Mut. Excl.	Mut. Excl.
Probability	0.35	0.15	0.25	0.25
Median	2.445	2.445	2.445	2.445
β	0.5	0.5	0.5	0.5

Table 6.25.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1a	DS1b	DS1c	DS1d
Distribution Type	LogNormal	LogNormal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0	5.0
Highest Cost Median	\$2,821	\$29,366	\$9,955	\$29,366
Lowest Cost Median	\$2,308	\$24,027	\$8,145	\$24,027
β (COV)	0.44	0.22	0.17	0.22

Table 6.25.5. Parameters for the repair time distributions.

	DS1a	DS1b	DS1c	DS1d
Distribution Type	LogNormal	LogNormal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0	5.0
Highest Median Repair Time (Days)	1.1	4.16	3.88	11.45
Lowest Median Repair Time (Days)	0.9	2.08	3.18	9.37
β (COV)	0.51	0.33	0.3	0.33

Table 6.25.6. Life safety information.

	DS1a	DS1b	DS1c	DS1d
Non-collapse casualties	No	No	No	No
Affected Area	--	--	--	--
Serious Injury Median	—	—	—	—
Serious Injury β	—	—	—	—
Loss of Life Median	—	—	—	—
Loss of Life β	—	—	—	—
Can Cause Red Tag	No	No	No	No
Unsafe Placard Median	—	—	—	—
Unsafe Placard β	—	—	—	—

Table 6.25.7. REDi repair class.

	DS1a	DS1b	DS1c	DS1d
REDi Repair Class	2	2	2	2

Table 6.25.8. ATC-138 parameters.

	DS1a	DS1b	DS1c	DS1d
Safety				
Safety Class	0	0	0	0
Envelope				
Affects Roof Function	No	No	No	No
Affects Envelope Safety	No	No	No	No
Damages Envelope Seal	No	No	No	No
Exterior Surface Area Factor	—	—	—	—
Exterior Falling Hazard				
Poses an Exterior Falling Hazard	No	No	No	No
Exterior Falling Length Factor	—	—	—	—
Interior Space				
Poses an Interior Falling Hazard	No	No	No	No
Obstructs Interior Space	No	No	No	No
Interior Area Conversion Type	—	—	—	—
Interior Area Conversion Factor	—	—	—	—
Repair Schedule				
Crew Size	3	3	3	3
Permit Type (Rapid or Full)	Rapid	Rapid	Rapid	Rapid
Requires Redesign	No	No	No	No
Long Lead Time	No	Yes	No	Yes
Requires Shoring	No	No	No	No
Resolved by Scaffolding	No	No	No	No
Temporary Repair Class	—	—	—	—
Temporary Repair Time Lower (days)	—	—	—	—
Temporary Repair Time Upper (days)	—	—	—	—
Temporary Repair Crew Size	—	—	—	—
Miscellaneous				
Hazardous Material Scope	N/A	N/A	N/A	N/A
Weakens Fire Break	No	No	No	No
Impairs System Operation	No	Yes	Yes	Yes
Causes Flooding	No	No	No	No
Affects Access	No	No	No	No

6.26 D3032.013f #2: (D3032.013f) Compressor - Capacity: Large non medical air supply - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility

NISTIR Classification	D3032.013f
Author	Not Given
Normalized Unit	1.0 each
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	1
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	HVAC
System	HVAC
Element	Compressor

Calculation:

Is Calculated?	Yes
Calculation Type	Anchorage (Combined Fragility)
Anchorage Ductility	Brittle
ID Component Class	Engines, turbines, pumps, compressors, and pressure vessels not supported on skirts and not within the scope of Chapter 15.

ATC-138 Properties:

System	HVAC
Subsystem	HVAC Equipment: Roof top Units
Requires Service Locations	Yes
Service Location	Unit

Component modifications applied:

Component Group	HVAC
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.26.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.26.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1a	Anchorage failure.	Repair anchorage and concrete pad and re-mount equipment.	
DS1b	Anchorage failure & Equipment damaged beyond repair.	Replace equipment including attached utilities in addition to repairing anchorage and concrete pad.	Not Available
DS1c	Motor damaged but anchorage is OK.	Repair Motor - Anchorage and Concrete do not require repair.	Not Available
DS1d	Equipment damaged beyond repair but anchorage is OK.	Replace and install equipment including new anchorage if anchorage is post-installed.	Not Available

Table 6.26.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1a	DS1b	DS1c	DS1d
Type	Mut. Excl.	Mut. Excl.	Mut. Excl.	Mut. Excl.
Probability	0.35	0.15	0.25	0.25
Median	2.445	2.445	2.445	2.445
β	0.5	0.5	0.5	0.5

Table 6.26.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1a	DS1b	DS1c	DS1d
Distribution Type	LogNormal	LogNormal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0	5.0
Highest Cost Median	\$2,821	\$29,366	\$9,955	\$29,366
Lowest Cost Median	\$2,308	\$24,027	\$8,145	\$24,027
β (COV)	0.44	0.22	0.17	0.22

Table 6.26.5. Parameters for the repair time distributions.

	DS1a	DS1b	DS1c	DS1d
Distribution Type	LogNormal	LogNormal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0	5.0
Highest Median Repair Time (Days)	1.1	4.16	3.88	11.45
Lowest Median Repair Time (Days)	0.9	2.08	3.18	9.37
β (COV)	0.51	0.33	0.3	0.33

Table 6.26.6. Life safety information.

	DS1a	DS1b	DS1c	DS1d
Non-collapse casualties	No	No	No	No
Affected Area	--	--	--	--
Serious Injury Median	—	—	—	—
Serious Injury β	—	—	—	—
Loss of Life Median	—	—	—	—
Loss of Life β	—	—	—	—
Can Cause Red Tag	No	No	No	No
Unsafe Placard Median	—	—	—	—
Unsafe Placard β	—	—	—	—

Table 6.26.7. REDi repair class.

	DS1a	DS1b	DS1c	DS1d
REDi Repair Class	2	2	2	2

Table 6.26.8. ATC-138 parameters.

	DS1a	DS1b	DS1c	DS1d
Safety				
Safety Class	0	0	0	0
Envelope				
Affects Roof Function	No	No	No	No
Affects Envelope Safety	No	No	No	No
Damages Envelope Seal	No	No	No	No
Exterior Surface Area Factor	—	—	—	—
Exterior Falling Hazard				
Poses an Exterior Falling Hazard	No	No	No	No
Exterior Falling Length Factor	—	—	—	—
Interior Space				
Poses an Interior Falling Hazard	No	No	No	No
Obstructs Interior Space	No	No	No	No
Interior Area Conversion Type	—	—	—	—
Interior Area Conversion Factor	—	—	—	—
Repair Schedule				
Crew Size	3	3	3	3
Permit Type (Rapid or Full)	Rapid	Rapid	Rapid	Rapid
Requires Redesign	No	No	No	No
Long Lead Time	No	Yes	No	Yes
Requires Shoring	No	No	No	No
Resolved by Scaffolding	No	No	No	No
Temporary Repair Class	—	—	—	—
Temporary Repair Time Lower (days)	—	—	—	—
Temporary Repair Time Upper (days)	—	—	—	—
Temporary Repair Crew Size	—	—	—	—
Miscellaneous				
Hazardous Material Scope	N/A	N/A	N/A	N/A
Weakens Fire Break	No	No	No	No
Impairs System Operation	No	Yes	Yes	Yes
Causes Flooding	No	No	No	No
Affects Access	No	No	No	No

6.27 D3032.013f #3: (D3032.013f) Compressor - Capacity: Large non medical air supply - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility

NISTIR Classification	D3032.013f
Author	Not Given
Normalized Unit	1.0 each
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	1
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	HVAC
System	HVAC
Element	Compressor

Calculation:

Is Calculated?	Yes
Calculation Type	Anchorage (Combined Fragility)
Anchorage Ductility	Brittle
ID Component Class	Engines, turbines, pumps, compressors, and pressure vessels not supported on skirts and not within the scope of Chapter 15.

ATC-138 Properties:

System	HVAC
Subsystem	HVAC Equipment: Roof top Units
Requires Service Locations	Yes
Service Location	Unit

Component modifications applied:

Component Group	HVAC
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.27.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.27.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1a	Anchorage failure.	Repair anchorage and concrete pad and re-mount equipment.	
DS1b	Anchorage failure & Equipment damaged beyond repair.	Replace equipment including attached utilities in addition to repairing anchorage and concrete pad.	Not Available
DS1c	Motor damaged but anchorage is OK.	Repair Motor - Anchorage and Concrete do not require repair.	Not Available
DS1d	Equipment damaged beyond repair but anchorage is OK.	Replace and install equipment including new anchorage if anchorage is post-installed.	Not Available

Table 6.27.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1a	DS1b	DS1c	DS1d
Type	Mut. Excl.	Mut. Excl.	Mut. Excl.	Mut. Excl.
Probability	0.35	0.15	0.25	0.25
Median	2.445	2.445	2.445	2.445
β	0.5	0.5	0.5	0.5

Table 6.27.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1a	DS1b	DS1c	DS1d
Distribution Type	LogNormal	LogNormal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0	5.0
Highest Cost Median	\$2,821	\$29,366	\$9,955	\$29,366
Lowest Cost Median	\$2,308	\$24,027	\$8,145	\$24,027
β (COV)	0.44	0.22	0.17	0.22

Table 6.27.5. Parameters for the repair time distributions.

	DS1a	DS1b	DS1c	DS1d
Distribution Type	LogNormal	LogNormal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0	5.0
Highest Median Repair Time (Days)	1.1	4.16	3.88	11.45
Lowest Median Repair Time (Days)	0.9	2.08	3.18	9.37
β (COV)	0.51	0.33	0.3	0.33

Table 6.27.6. Life safety information.

	DS1a	DS1b	DS1c	DS1d
Non-collapse casualties	No	No	No	No
Affected Area	--	--	--	--
Serious Injury Median	—	—	—	—
Serious Injury β	—	—	—	—
Loss of Life Median	—	—	—	—
Loss of Life β	—	—	—	—
Can Cause Red Tag	No	No	No	No
Unsafe Placard Median	—	—	—	—
Unsafe Placard β	—	—	—	—

Table 6.27.7. REDi repair class.

	DS1a	DS1b	DS1c	DS1d
REDi Repair Class	2	2	2	2

Table 6.27.8. ATC-138 parameters.

	DS1a	DS1b	DS1c	DS1d
Safety				
Safety Class	0	0	0	0
Envelope				
Affects Roof Function	No	No	No	No
Affects Envelope Safety	No	No	No	No
Damages Envelope Seal	No	No	No	No
Exterior Surface Area Factor	—	—	—	—
Exterior Falling Hazard				
Poses an Exterior Falling Hazard	No	No	No	No
Exterior Falling Length Factor	—	—	—	—
Interior Space				
Poses an Interior Falling Hazard	No	No	No	No
Obstructs Interior Space	No	No	No	No
Interior Area Conversion Type	—	—	—	—
Interior Area Conversion Factor	—	—	—	—
Repair Schedule				
Crew Size	3	3	3	3
Permit Type (Rapid or Full)	Rapid	Rapid	Rapid	Rapid
Requires Redesign	No	No	No	No
Long Lead Time	No	Yes	No	Yes
Requires Shoring	No	No	No	No
Resolved by Scaffolding	No	No	No	No
Temporary Repair Class	—	—	—	—
Temporary Repair Time Lower (days)	—	—	—	—
Temporary Repair Time Upper (days)	—	—	—	—
Temporary Repair Crew Size	—	—	—	—
Miscellaneous				
Hazardous Material Scope	N/A	N/A	N/A	N/A
Weakens Fire Break	No	No	No	No
Impairs System Operation	No	Yes	Yes	Yes
Causes Flooding	No	No	No	No
Affects Access	No	No	No	No

6.28 D3032.013f #4: (D3032.013f) Compressor - Capacity: Large non medical air supply - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility

NISTIR Classification	D3032.013f
Author	Not Given
Normalized Unit	1.0 each
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	1
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	HVAC
System	HVAC
Element	Compressor

Calculation:

Is Calculated?	Yes
Calculation Type	Anchorage (Combined Fragility)
Anchorage Ductility	Brittle
ID Component Class	Engines, turbines, pumps, compressors, and pressure vessels not supported on skirts and not within the scope of Chapter 15.

ATC-138 Properties:

System	HVAC
Subsystem	HVAC Equipment: Roof top Units
Requires Service Locations	Yes
Service Location	Unit

Component modifications applied:

Component Group	HVAC
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.28.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.28.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1a	Anchorage failure.	Repair anchorage and concrete pad and re-mount equipment.	
DS1b	Anchorage failure & Equipment damaged beyond repair.	Replace equipment including attached utilities in addition to repairing anchorage and concrete pad.	Not Available
DS1c	Motor damaged but anchorage is OK.	Repair Motor - Anchorage and Concrete do not require repair.	Not Available
DS1d	Equipment damaged beyond repair but anchorage is OK.	Replace and install equipment including new anchorage if anchorage is post-installed.	Not Available

Table 6.28.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1a	DS1b	DS1c	DS1d
Type	Mut. Excl.	Mut. Excl.	Mut. Excl.	Mut. Excl.
Probability	0.35	0.15	0.25	0.25
Median	2.445	2.445	2.445	2.445
β	0.5	0.5	0.5	0.5

Table 6.28.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1a	DS1b	DS1c	DS1d
Distribution Type	LogNormal	LogNormal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0	5.0
Highest Cost Median	\$2,821	\$29,366	\$9,955	\$29,366
Lowest Cost Median	\$2,308	\$24,027	\$8,145	\$24,027
β (COV)	0.44	0.22	0.17	0.22

Table 6.28.5. Parameters for the repair time distributions.

	DS1a	DS1b	DS1c	DS1d
Distribution Type	LogNormal	LogNormal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0	5.0
Highest Median Repair Time (Days)	1.1	4.16	3.88	11.45
Lowest Median Repair Time (Days)	0.9	2.08	3.18	9.37
β (COV)	0.51	0.33	0.3	0.33

Table 6.28.6. Life safety information.

	DS1a	DS1b	DS1c	DS1d
Non-collapse casualties	No	No	No	No
Affected Area	--	--	--	--
Serious Injury Median	—	—	—	—
Serious Injury β	—	—	—	—
Loss of Life Median	—	—	—	—
Loss of Life β	—	—	—	—
Can Cause Red Tag	No	No	No	No
Unsafe Placard Median	—	—	—	—
Unsafe Placard β	—	—	—	—

Table 6.28.7. REDi repair class.

	DS1a	DS1b	DS1c	DS1d
REDi Repair Class	2	2	2	2

Table 6.28.8. ATC-138 parameters.

	DS1a	DS1b	DS1c	DS1d
Safety				
Safety Class	0	0	0	0
Envelope				
Affects Roof Function	No	No	No	No
Affects Envelope Safety	No	No	No	No
Damages Envelope Seal	No	No	No	No
Exterior Surface Area Factor	—	—	—	—
Exterior Falling Hazard				
Poses an Exterior Falling Hazard	No	No	No	No
Exterior Falling Length Factor	—	—	—	—
Interior Space				
Poses an Interior Falling Hazard	No	No	No	No
Obstructs Interior Space	No	No	No	No
Interior Area Conversion Type	—	—	—	—
Interior Area Conversion Factor	—	—	—	—
Repair Schedule				
Crew Size	3	3	3	3
Permit Type (Rapid or Full)	Rapid	Rapid	Rapid	Rapid
Requires Redesign	No	No	No	No
Long Lead Time	No	Yes	No	Yes
Requires Shoring	No	No	No	No
Resolved by Scaffolding	No	No	No	No
Temporary Repair Class	—	—	—	—
Temporary Repair Time Lower (days)	—	—	—	—
Temporary Repair Time Upper (days)	—	—	—	—
Temporary Repair Crew Size	—	—	—	—
Miscellaneous				
Hazardous Material Scope	N/A	N/A	N/A	N/A
Weakens Fire Break	No	No	No	No
Impairs System Operation	No	Yes	Yes	Yes
Causes Flooding	No	No	No	No
Affects Access	No	No	No	No

6.29 D3032.013f #5: (D3032.013f) Compressor - Capacity: Large non medical air supply - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility

NISTIR Classification	D3032.013f
Author	Not Given
Normalized Unit	1.0 each
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	1
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	HVAC
System	HVAC
Element	Compressor

Calculation:

Is Calculated?	Yes
Calculation Type	Anchorage (Combined Fragility)
Anchorage Ductility	Brittle
ID Component Class	Engines, turbines, pumps, compressors, and pressure vessels not supported on skirts and not within the scope of Chapter 15.

ATC-138 Properties:

System	HVAC
Subsystem	HVAC Equipment: Roof top Units
Requires Service Locations	Yes
Service Location	Unit

Component modifications applied:

Component Group	HVAC
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.29.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.29.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1a	Anchorage failure.	Repair anchorage and concrete pad and re-mount equipment.	
DS1b	Anchorage failure & Equipment damaged beyond repair.	Replace equipment including attached utilities in addition to repairing anchorage and concrete pad.	Not Available
DS1c	Motor damaged but anchorage is OK.	Repair Motor - Anchorage and Concrete do not require repair.	Not Available
DS1d	Equipment damaged beyond repair but anchorage is OK.	Replace and install equipment including new anchorage if anchorage is post-installed.	Not Available

Table 6.29.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1a	DS1b	DS1c	DS1d
Type	Mut. Excl.	Mut. Excl.	Mut. Excl.	Mut. Excl.
Probability	0.35	0.15	0.25	0.25
Median	2.445	2.445	2.445	2.445
β	0.5	0.5	0.5	0.5

Table 6.29.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1a	DS1b	DS1c	DS1d
Distribution Type	LogNormal	LogNormal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0	5.0
Highest Cost Median	\$2,821	\$29,366	\$9,955	\$29,366
Lowest Cost Median	\$2,308	\$24,027	\$8,145	\$24,027
β (COV)	0.44	0.22	0.17	0.22

Table 6.29.5. Parameters for the repair time distributions.

	DS1a	DS1b	DS1c	DS1d
Distribution Type	LogNormal	LogNormal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0	5.0
Highest Median Repair Time (Days)	1.1	4.16	3.88	11.45
Lowest Median Repair Time (Days)	0.9	2.08	3.18	9.37
β (COV)	0.51	0.33	0.3	0.33

Table 6.29.6. Life safety information.

	DS1a	DS1b	DS1c	DS1d
Non-collapse casualties	No	No	No	No
Affected Area	--	--	--	--
Serious Injury Median	—	—	—	—
Serious Injury β	—	—	—	—
Loss of Life Median	—	—	—	—
Loss of Life β	—	—	—	—
Can Cause Red Tag	No	No	No	No
Unsafe Placard Median	—	—	—	—
Unsafe Placard β	—	—	—	—

Table 6.29.7. REDi repair class.

	DS1a	DS1b	DS1c	DS1d
REDi Repair Class	2	2	2	2

Table 6.29.8. ATC-138 parameters.

	DS1a	DS1b	DS1c	DS1d
Safety				
Safety Class	0	0	0	0
Envelope				
Affects Roof Function	No	No	No	No
Affects Envelope Safety	No	No	No	No
Damages Envelope Seal	No	No	No	No
Exterior Surface Area Factor	—	—	—	—
Exterior Falling Hazard				
Poses an Exterior Falling Hazard	No	No	No	No
Exterior Falling Length Factor	—	—	—	—
Interior Space				
Poses an Interior Falling Hazard	No	No	No	No
Obstructs Interior Space	No	No	No	No
Interior Area Conversion Type	—	—	—	—
Interior Area Conversion Factor	—	—	—	—
Repair Schedule				
Crew Size	3	3	3	3
Permit Type (Rapid or Full)	Rapid	Rapid	Rapid	Rapid
Requires Redesign	No	No	No	No
Long Lead Time	No	Yes	No	Yes
Requires Shoring	No	No	No	No
Resolved by Scaffolding	No	No	No	No
Temporary Repair Class	—	—	—	—
Temporary Repair Time Lower (days)	—	—	—	—
Temporary Repair Time Upper (days)	—	—	—	—
Temporary Repair Crew Size	—	—	—	—
Miscellaneous				
Hazardous Material Scope	N/A	N/A	N/A	N/A
Weakens Fire Break	No	No	No	No
Impairs System Operation	No	Yes	Yes	Yes
Causes Flooding	No	No	No	No
Affects Access	No	No	No	No

6.30 D3032.013f #6: (D3032.013f) Compressor - Capacity: Large non medical air supply - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility

NISTIR Classification	D3032.013f
Author	Not Given
Normalized Unit	1.0 each
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	1
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	HVAC
System	HVAC
Element	Compressor

Calculation:

Is Calculated?	Yes
Calculation Type	Anchorage (Combined Fragility)
Anchorage Ductility	Brittle
ID Component Class	Engines, turbines, pumps, compressors, and pressure vessels not supported on skirts and not within the scope of Chapter 15.

ATC-138 Properties:

System	HVAC
Subsystem	HVAC Equipment: Roof top Units
Requires Service Locations	Yes
Service Location	Unit

Component modifications applied:

Component Group	HVAC
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.30.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.30.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1a	Anchorage failure.	Repair anchorage and concrete pad and re-mount equipment.	
DS1b	Anchorage failure & Equipment damaged beyond repair.	Replace equipment including attached utilities in addition to repairing anchorage and concrete pad.	Not Available
DS1c	Motor damaged but anchorage is OK.	Repair Motor - Anchorage and Concrete do not require repair.	Not Available
DS1d	Equipment damaged beyond repair but anchorage is OK.	Replace and install equipment including new anchorage if anchorage is post-installed.	Not Available

Table 6.30.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1a	DS1b	DS1c	DS1d
Type	Mut. Excl.	Mut. Excl.	Mut. Excl.	Mut. Excl.
Probability	0.35	0.15	0.25	0.25
Median	2.445	2.445	2.445	2.445
β	0.5	0.5	0.5	0.5

Table 6.30.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1a	DS1b	DS1c	DS1d
Distribution Type	LogNormal	LogNormal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0	5.0
Highest Cost Median	\$2,821	\$29,366	\$9,955	\$29,366
Lowest Cost Median	\$2,308	\$24,027	\$8,145	\$24,027
β (COV)	0.44	0.22	0.17	0.22

Table 6.30.5. Parameters for the repair time distributions.

	DS1a	DS1b	DS1c	DS1d
Distribution Type	LogNormal	LogNormal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0	5.0
Highest Median Repair Time (Days)	1.1	4.16	3.88	11.45
Lowest Median Repair Time (Days)	0.9	2.08	3.18	9.37
β (COV)	0.51	0.33	0.3	0.33

Table 6.30.6. Life safety information.

	DS1a	DS1b	DS1c	DS1d
Non-collapse casualties	No	No	No	No
Affected Area	--	--	--	--
Serious Injury Median	—	—	—	—
Serious Injury β	—	—	—	—
Loss of Life Median	—	—	—	—
Loss of Life β	—	—	—	—
Can Cause Red Tag	No	No	No	No
Unsafe Placard Median	—	—	—	—
Unsafe Placard β	—	—	—	—

Table 6.30.7. REDi repair class.

	DS1a	DS1b	DS1c	DS1d
REDi Repair Class	2	2	2	2

Table 6.30.8. ATC-138 parameters.

	DS1a	DS1b	DS1c	DS1d
Safety				
Safety Class	0	0	0	0
Envelope				
Affects Roof Function	No	No	No	No
Affects Envelope Safety	No	No	No	No
Damages Envelope Seal	No	No	No	No
Exterior Surface Area Factor	—	—	—	—
Exterior Falling Hazard				
Poses an Exterior Falling Hazard	No	No	No	No
Exterior Falling Length Factor	—	—	—	—
Interior Space				
Poses an Interior Falling Hazard	No	No	No	No
Obstructs Interior Space	No	No	No	No
Interior Area Conversion Type	—	—	—	—
Interior Area Conversion Factor	—	—	—	—
Repair Schedule				
Crew Size	3	3	3	3
Permit Type (Rapid or Full)	Rapid	Rapid	Rapid	Rapid
Requires Redesign	No	No	No	No
Long Lead Time	No	Yes	No	Yes
Requires Shoring	No	No	No	No
Resolved by Scaffolding	No	No	No	No
Temporary Repair Class	—	—	—	—
Temporary Repair Time Lower (days)	—	—	—	—
Temporary Repair Time Upper (days)	—	—	—	—
Temporary Repair Crew Size	—	—	—	—
Miscellaneous				
Hazardous Material Scope	N/A	N/A	N/A	N/A
Weakens Fire Break	No	No	No	No
Impairs System Operation	No	Yes	Yes	Yes
Causes Flooding	No	No	No	No
Affects Access	No	No	No	No

6.31 D3032.013f #7: (D3032.013f) Compressor - Capacity: Large non medical air supply - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility

NISTIR Classification	D3032.013f
Author	Not Given
Normalized Unit	1.0 each
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	1
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	HVAC
System	HVAC
Element	Compressor

Calculation:

Is Calculated?	Yes
Calculation Type	Anchorage (Combined Fragility)
Anchorage Ductility	Brittle
ID Component Class	Engines, turbines, pumps, compressors, and pressure vessels not supported on skirts and not within the scope of Chapter 15.

ATC-138 Properties:

System	HVAC
Subsystem	HVAC Equipment: Roof top Units
Requires Service Locations	Yes
Service Location	Unit

Component modifications applied:

Component Group	HVAC
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.31.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.31.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1a	Anchorage failure.	Repair anchorage and concrete pad and re-mount equipment.	
DS1b	Anchorage failure & Equipment damaged beyond repair.	Replace equipment including attached utilities in addition to repairing anchorage and concrete pad.	Not Available
DS1c	Motor damaged but anchorage is OK.	Repair Motor - Anchorage and Concrete do not require repair.	Not Available
DS1d	Equipment damaged beyond repair but anchorage is OK.	Replace and install equipment including new anchorage if anchorage is post-installed.	Not Available

Table 6.31.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1a	DS1b	DS1c	DS1d
Type	Mut. Excl.	Mut. Excl.	Mut. Excl.	Mut. Excl.
Probability	0.35	0.15	0.25	0.25
Median	2.445	2.445	2.445	2.445
β	0.5	0.5	0.5	0.5

Table 6.31.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1a	DS1b	DS1c	DS1d
Distribution Type	LogNormal	LogNormal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0	5.0
Highest Cost Median	\$2,821	\$29,366	\$9,955	\$29,366
Lowest Cost Median	\$2,308	\$24,027	\$8,145	\$24,027
β (COV)	0.44	0.22	0.17	0.22

Table 6.31.5. Parameters for the repair time distributions.

	DS1a	DS1b	DS1c	DS1d
Distribution Type	LogNormal	LogNormal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0	5.0
Highest Median Repair Time (Days)	1.1	4.16	3.88	11.45
Lowest Median Repair Time (Days)	0.9	2.08	3.18	9.37
β (COV)	0.51	0.33	0.3	0.33

Table 6.31.6. Life safety information.

	DS1a	DS1b	DS1c	DS1d
Non-collapse casualties	No	No	No	No
Affected Area	--	--	--	--
Serious Injury Median	—	—	—	—
Serious Injury β	—	—	—	—
Loss of Life Median	—	—	—	—
Loss of Life β	—	—	—	—
Can Cause Red Tag	No	No	No	No
Unsafe Placard Median	—	—	—	—
Unsafe Placard β	—	—	—	—

Table 6.31.7. REDi repair class.

	DS1a	DS1b	DS1c	DS1d
REDi Repair Class	2	2	2	2

Table 6.31.8. ATC-138 parameters.

	DS1a	DS1b	DS1c	DS1d
Safety				
Safety Class	0	0	0	0
Envelope				
Affects Roof Function	No	No	No	No
Affects Envelope Safety	No	No	No	No
Damages Envelope Seal	No	No	No	No
Exterior Surface Area Factor	—	—	—	—
Exterior Falling Hazard				
Poses an Exterior Falling Hazard	No	No	No	No
Exterior Falling Length Factor	—	—	—	—
Interior Space				
Poses an Interior Falling Hazard	No	No	No	No
Obstructs Interior Space	No	No	No	No
Interior Area Conversion Type	—	—	—	—
Interior Area Conversion Factor	—	—	—	—
Repair Schedule				
Crew Size	3	3	3	3
Permit Type (Rapid or Full)	Rapid	Rapid	Rapid	Rapid
Requires Redesign	No	No	No	No
Long Lead Time	No	Yes	No	Yes
Requires Shoring	No	No	No	No
Resolved by Scaffolding	No	No	No	No
Temporary Repair Class	—	—	—	—
Temporary Repair Time Lower (days)	—	—	—	—
Temporary Repair Time Upper (days)	—	—	—	—
Temporary Repair Crew Size	—	—	—	—
Miscellaneous				
Hazardous Material Scope	N/A	N/A	N/A	N/A
Weakens Fire Break	No	No	No	No
Impairs System Operation	No	Yes	Yes	Yes
Causes Flooding	No	No	No	No
Affects Access	No	No	No	No

6.32 D3032.013f #8: (D3032.013f) Compressor - Capacity: Large non medical air supply - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility

NISTIR Classification	D3032.013f
Author	Not Given
Normalized Unit	1.0 each
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	1
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	HVAC
System	HVAC
Element	Compressor

Calculation:

Is Calculated?	Yes
Calculation Type	Anchorage (Combined Fragility)
Anchorage Ductility	Brittle
ID Component Class	Engines, turbines, pumps, compressors, and pressure vessels not supported on skirts and not within the scope of Chapter 15.

ATC-138 Properties:

System	HVAC
Subsystem	HVAC Equipment: Roof top Units
Requires Service Locations	Yes
Service Location	Unit

Component modifications applied:

Component Group	HVAC
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.32.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.32.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1a	Anchorage failure.	Repair anchorage and concrete pad and re-mount equipment.	
DS1b	Anchorage failure & Equipment damaged beyond repair.	Replace equipment including attached utilities in addition to repairing anchorage and concrete pad.	Not Available
DS1c	Motor damaged but anchorage is OK.	Repair Motor - Anchorage and Concrete do not require repair.	Not Available
DS1d	Equipment damaged beyond repair but anchorage is OK.	Replace and install equipment including new anchorage if anchorage is post-installed.	Not Available

Table 6.32.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1a	DS1b	DS1c	DS1d
Type	Mut. Excl.	Mut. Excl.	Mut. Excl.	Mut. Excl.
Probability	0.35	0.15	0.25	0.25
Median	2.445	2.445	2.445	2.445
β	0.5	0.5	0.5	0.5

Table 6.32.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1a	DS1b	DS1c	DS1d
Distribution Type	LogNormal	LogNormal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0	5.0
Highest Cost Median	\$2,821	\$29,366	\$9,955	\$29,366
Lowest Cost Median	\$2,308	\$24,027	\$8,145	\$24,027
β (COV)	0.44	0.22	0.17	0.22

Table 6.32.5. Parameters for the repair time distributions.

	DS1a	DS1b	DS1c	DS1d
Distribution Type	LogNormal	LogNormal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0	5.0
Highest Median Repair Time (Days)	1.1	4.16	3.88	11.45
Lowest Median Repair Time (Days)	0.9	2.08	3.18	9.37
β (COV)	0.51	0.33	0.3	0.33

Table 6.32.6. Life safety information.

	DS1a	DS1b	DS1c	DS1d
Non-collapse casualties	No	No	No	No
Affected Area	--	--	--	--
Serious Injury Median	—	—	—	—
Serious Injury β	—	—	—	—
Loss of Life Median	—	—	—	—
Loss of Life β	—	—	—	—
Can Cause Red Tag	No	No	No	No
Unsafe Placard Median	—	—	—	—
Unsafe Placard β	—	—	—	—

Table 6.32.7. REDi repair class.

	DS1a	DS1b	DS1c	DS1d
REDi Repair Class	2	2	2	2

Table 6.32.8. ATC-138 parameters.

	DS1a	DS1b	DS1c	DS1d
Safety				
Safety Class	0	0	0	0
Envelope				
Affects Roof Function	No	No	No	No
Affects Envelope Safety	No	No	No	No
Damages Envelope Seal	No	No	No	No
Exterior Surface Area Factor	—	—	—	—
Exterior Falling Hazard				
Poses an Exterior Falling Hazard	No	No	No	No
Exterior Falling Length Factor	—	—	—	—
Interior Space				
Poses an Interior Falling Hazard	No	No	No	No
Obstructs Interior Space	No	No	No	No
Interior Area Conversion Type	—	—	—	—
Interior Area Conversion Factor	—	—	—	—
Repair Schedule				
Crew Size	3	3	3	3
Permit Type (Rapid or Full)	Rapid	Rapid	Rapid	Rapid
Requires Redesign	No	No	No	No
Long Lead Time	No	Yes	No	Yes
Requires Shoring	No	No	No	No
Resolved by Scaffolding	No	No	No	No
Temporary Repair Class	—	—	—	—
Temporary Repair Time Lower (days)	—	—	—	—
Temporary Repair Time Upper (days)	—	—	—	—
Temporary Repair Crew Size	—	—	—	—
Miscellaneous				
Hazardous Material Scope	N/A	N/A	N/A	N/A
Weakens Fire Break	No	No	No	No
Impairs System Operation	No	Yes	Yes	Yes
Causes Flooding	No	No	No	No
Affects Access	No	No	No	No

6.33 D3041.011f #1: (D3041.011f) (ATC-138 Beta) HVAC Galvanized Sheet Metal Ducting less than 6 sq. ft in cross sectional area, above code-minimum bracing similar to larger ducting, SDC D, E, or F (OSHPD or Sim)

NISTIR Classification	D3041.011f
Author	Not Given
Normalized Unit	1000.0 lf
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	2
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	HVAC
System	HVAC
Element	Air Dist

Calculation:

Is Calculated?	No
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ATC-138 Properties:

System	HVAC
Subsystem	Air Distribution: Ducts Branches
Requires Service Locations	No
Service Location	Unit

Component modifications applied:

Component Group	HVAC
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.33.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.33.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1	Individual supports fail and duct sags - 1 failed support per 1000 feet of ducting.	Replace failed supports and repair ducting in vicinity of failed supports.	Not Available
DS2	Several adjacent supports fail and sections of ducting fall - 60 feet of ducting fail and fall per 1000 foot of ducting.	Replace sections of failed ducting and supports.	Not Available

Table 6.33.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1	DS2
Type	Sequential	Sequential
Probability	–	–
Median	3	4.5
β	0.4	0.4

Table 6.33.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1	DS2
Distribution Type	LogNormal	LogNormal
Lower Qty.	1.0	1.0
Upper Qty.	5.0	5.0
Highest Cost Median	\$2,157	\$21,071
Lowest Cost Median	\$1,765	\$17,240
β (COV)	0.37	0.1

Table 6.33.5. Parameters for the repair time distributions.

	DS1	DS2
Distribution Type	LogNormal	LogNormal
Lower Qty.	1.0	1.0
Upper Qty.	5.0	5.0
Highest Median Repair Time (Days)	0.84	2.99
Lowest Median Repair Time (Days)	0.69	1.49
β (COV)	0.44	0.27

Table 6.33.6. Life safety information.

	DS1	DS2
Non-collapse casualties	No	Yes
Affected Area	--	15.0 SF
Serious Injury Median	–	0.05
Serious Injury β	–	0.5
Loss of Life Median	–	0.0
Loss of Life β	–	0.0
Can Cause Red Tag	No	No
Unsafe Placard Median	–	–
Unsafe Placard β	–	–

Table 6.33.7. REDi repair class.

	DS1	DS2
REDi Repair Class	3	3

Table 6.33.8. ATC-138 parameters.

	DS1	DS2
Safety		
Safety Class	0	0
Envelope		
Affects Roof Function	No	No
Affects Envelope Safety	No	No
Damages Envelope Seal	No	No
Exterior Surface Area Factor	–	–
Exterior Falling Hazard		
Poses an Exterior Falling Hazard	No	No
Exterior Falling Length Factor	–	–
Interior Space		
Poses an Interior Falling Hazard	No	Yes
Obstructs Interior Space	No	Yes
Interior Area Conversion Type	–	component
Interior Area Conversion Factor	–	0.1
Repair Schedule		
Crew Size	3	5
Permit Type (Rapid or Full)	Rapid	Rapid
Requires Redesign	No	No
Long Lead Time	No	No
Requires Shoring	No	No
Resolved by Scaffolding	No	No
Temporary Repair Class	–	Skilled labor
Temporary Repair Time Lower (days)	–	1.0
Temporary Repair Time Upper (days)	–	1.0
Temporary Repair Crew Size	–	2.0
Miscellaneous		
Hazardous Material Scope	N/A	N/A
Weakens Fire Break	No	No
Impairs System Operation	No	Yes
Causes Flooding	No	No
Affects Access	No	No

6.34 D3041.012d #1: (D3041.012d) HVAC Galvanized Sheet Metal Ducting - 6 sq. ft cross sectional area or greater, SDC D, E, or F (OSH PD or sim)

NISTIR Classification	D3041.012d
Author	Not Given
Normalized Unit	1000.0 lf
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	2
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	HVAC
System	HVAC
Element	Air Dist

Calculation:

Is Calculated?	No
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ATC-138 Properties:

System	HVAC
Subsystem	Air Distribution: Duct Main
Requires Service Locations	No
Service Location	Unit

Component modifications applied:

Component Group	HVAC
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.34.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.34.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1	Individual supports fail and duct sags - 1 failed support per 1000 feet of ducting.	Replace failed supports and repair ducting in vicinity of failed supports.	Not Available
DS2	Several adjacent supports fail and sections of ducting fall - 60 feet of ducting fail and fall per 1000 foot of ducting.	Replace sections of failed ducting and supports.	Not Available

Table 6.34.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1	DS2
Type	Sequential	Sequential
Probability	–	–
Median	3.75	4.5
β	0.4	0.4

Table 6.34.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1	DS2
Distribution Type	LogNormal	LogNormal
Lower Qty.	1.0	1.0
Upper Qty.	5.0	5.0
Highest Cost Median	\$3,152	\$26,380
Lowest Cost Median	\$2,579	\$21,584
β (COV)	0.26	0.08

Table 6.34.5. Parameters for the repair time distributions.

	DS1	DS2
Distribution Type	LogNormal	LogNormal
Lower Qty.	1.0	1.0
Upper Qty.	5.0	5.0
Highest Median Repair Time (Days)	1.23	3.74
Lowest Median Repair Time (Days)	1.01	1.87
β (COV)	0.36	0.26

Table 6.34.6. Life safety information.

	DS1	DS2
Non-collapse casualties	No	Yes
Affected Area	--	50.0 SF
Serious Injury Median	–	0.1
Serious Injury β	–	0.5
Loss of Life Median	–	0.0
Loss of Life β	–	0.0
Can Cause Red Tag	No	No
Unsafe Placard Median	–	–
Unsafe Placard β	–	–

Table 6.34.7. REDi repair class.

	DS1	DS2
REDi Repair Class	3	3

Table 6.34.8. ATC-138 parameters.

	DS1	DS2
Safety		
Safety Class	0	0
Envelope		
Affects Roof Function	No	No
Affects Envelope Safety	No	No
Damages Envelope Seal	No	No
Exterior Surface Area Factor	–	–
Exterior Falling Hazard		
Poses an Exterior Falling Hazard	No	No
Exterior Falling Length Factor	–	–
Interior Space		
Poses an Interior Falling Hazard	No	Yes
Obstructs Interior Space	No	Yes
Interior Area Conversion Type	–	component
Interior Area Conversion Factor	–	0.1
Repair Schedule		
Crew Size	3	5
Permit Type (Rapid or Full)	Rapid	Rapid
Requires Redesign	No	No
Long Lead Time	No	No
Requires Shoring	No	No
Resolved by Scaffolding	No	No
Temporary Repair Class	–	Skilled labor
Temporary Repair Time Lower (days)	–	1.0
Temporary Repair Time Upper (days)	–	1.0
Temporary Repair Crew Size	–	2.0
Miscellaneous		
Hazardous Material Scope	N/A	N/A
Weakens Fire Break	No	No
Impairs System Operation	No	Yes
Causes Flooding	No	No
Affects Access	No	No

6.35 D3041.031e #1: (D3041.031e) (ATC-138 Beta) (RUGGED) HVAC Drops / Diffusers in suspended ceilings - With independent safety wires, SDC D, E, or F (OSHPD or sim)

NISTIR Classification	D3041.031e
Author	Not Given
Normalized Unit	10.0 each
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	1
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	HVAC
System	HVAC
Element	Air Dist

Calculation:

Is Calculated?	No
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ATC-138 Properties:

System	HVAC
Subsystem	Air Distribution: Drops/Diffusers
Requires Service Locations	No
Service Location	Unit

Component modifications applied:

Component Group	HVAC
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.35.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.35.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1	HVAC drops or diffusers with safety wires remain in tact.	Diffuser/drop reconnected to ceiling when ceiling repair conducted.	Not Available

Table 6.35.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

DS1	
Type	Sequential
Probability	–
Median	500
β	0.1

Table 6.35.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

DS1	
Distribution Type	Normal
Lower Qty.	1.0
Upper Qty.	5.0
Highest Cost Median	\$9,955
Lowest Cost Median	\$8,145
β (COV)	0.21

Table 6.35.5. Parameters for the repair time distributions.

DS1	
Distribution Type	Normal
Lower Qty.	1.0
Upper Qty.	5.0
Highest Median Repair Time (Days)	2.91
Lowest Median Repair Time (Days)	2.38
β (COV)	0.32

Table 6.35.6. Life safety information.

DS1	
Non-collapse casualties	Yes
Affected Area	4.0 SF
Serious Injury Median	0.1
Serious Injury β	0.5
Loss of Life Median	0.0
Loss of Life β	0.0
Can Cause Red Tag	No
Unsafe Placard Median	–
Unsafe Placard β	–

Table 6.35.7. REDi repair class.

DS1	
REDi Repair Class	3

Table 6.35.8. ATC-138 parameters.

	DS1
Safety	
Safety Class	0
Envelope	
Affects Roof Function	No
Affects Envelope Safety	No
Damages Envelope Seal	No
Exterior Surface Area Factor	—
Exterior Falling Hazard	
Poses an Exterior Falling Hazard	No
Exterior Falling Length Factor	—
Interior Space	
Poses an Interior Falling Hazard	Yes
Obstructs Interior Space	Yes
Interior Area Conversion Type	component
Interior Area Conversion Factor	10.0
Repair Schedule	
Crew Size	3
Permit Type (Rapid or Full)	Rapid
Requires Redesign	No
Long Lead Time	No
Requires Shoring	No
Resolved by Scaffolding	No
Temporary Repair Class	—
Temporary Repair Time Lower (days)	—
Temporary Repair Time Upper (days)	—
Temporary Repair Crew Size	—
Miscellaneous	
Hazardous Material Scope	N/A
Weakens Fire Break	No
Impairs System Operation	Yes
Causes Flooding	No
Affects Access	No

6.36 D3041.103c #1: (D3041.103c) HVAC Fan - Capacity: all - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility

NISTIR Classification	D3041.103c
Author	Not Given
Normalized Unit	1.0 each
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	1
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	HVAC
System	HVAC
Element	Air Dist

Calculation:

Is Calculated?	Yes
Calculation Type	Anchorage (Combined Fragility)
Anchorage Ductility	Brittle
ID Component Class	Air side HVAC, fans, air handlers, AC units, cabinet heaters, air distribution boxes, and other mechanical components constructed of sheet metal framing

ATC-138 Properties:

System	HVAC
Subsystem	HVAC Equipment: Exhaust Fans
Requires Service Locations	No
Service Location	Unit

Component modifications applied:

Component Group	HVAC
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.36.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.36.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1a	Anchorage failure.	Repair anchorage and remount equipment.	
DS1b	Anchorage failure & Equipment damaged beyond repair.	Repair anchorage and replace equipment.	Not Available
DS1c	Damaged, Inoperative but anchorage is OK	Repair equipment.	Not Available

Table 6.36.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1a	DS1b	DS1c
Type	Mut. Excl.	Mut. Excl.	Mut. Excl.
Probability	0.35	0.15	0.5
Median	1.819	1.819	1.819
β	0.5	0.5	0.5

Table 6.36.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1a	DS1b	DS1c
Distribution Type	LogNormal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0
Highest Cost Median	\$2,323	\$11,116	\$8,793
Lowest Cost Median	\$1,900	\$9,095	\$7,195
β (COV)	0.34	0.18	0.14

Table 6.36.5. Parameters for the repair time distributions.

	DS1a	DS1b	DS1c
Distribution Type	LogNormal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0
Highest Median Repair Time (Days)	0.91	0.79	3.43
Lowest Median Repair Time (Days)	0.74	0.2	2.81
β (COV)	0.42	0.31	0.29

Table 6.36.6. Life safety information.

	DS1a	DS1b	DS1c
Non-collapse casualties	No	No	No
Affected Area	--	--	--
Serious Injury Median	—	—	—
Serious Injury β	—	—	—
Loss of Life Median	—	—	—
Loss of Life β	—	—	—
Can Cause Red Tag	No	No	No
Unsafe Placard Median	—	—	—
Unsafe Placard β	—	—	—

Table 6.36.7. REDi repair class.

	DS1a	DS1b	DS1c
REDi Repair Class	2	2	2

Table 6.36.8. ATC-138 parameters.

	DS1a	DS1b	DS1c
Safety			
Safety Class	0	0	0
Envelope			
Affects Roof Function	No	No	No
Affects Envelope Safety	No	No	No
Damages Envelope Seal	No	No	No
Exterior Surface Area Factor	—	—	—
Exterior Falling Hazard			
Poses an Exterior Falling Hazard	No	No	No
Exterior Falling Length Factor	—	—	—
Interior Space			
Poses an Interior Falling Hazard	No	No	No
Obstructs Interior Space	No	No	No
Interior Area Conversion Type	—	—	—
Interior Area Conversion Factor	—	—	—
Repair Schedule			
Crew Size	3	3	5
Permit Type (Rapid or Full)	Rapid	Rapid	Rapid
Requires Redesign	No	No	No
Long Lead Time	No	Yes	No
Requires Shoring	No	No	No
Resolved by Scaffolding	No	No	No
Temporary Repair Class	—	—	—
Temporary Repair Time Lower (days)	—	—	—
Temporary Repair Time Upper (days)	—	—	—
Temporary Repair Crew Size	—	—	—
Miscellaneous			
Hazardous Material Scope	N/A	N/A	N/A
Weakens Fire Break	No	No	No
Impairs System Operation	No	Yes	Yes
Causes Flooding	No	No	No
Affects Access	No	No	No

6.37 D4011.024a #1: (D4011.024a) Fire Sprinkler Water Piping - Horizontal Mains and Branches - Old Style Victaulic - Thin Wall Steel - with designed bracing, SDC D, E, or F (OSHPD or sim), PIPING FRAGILITY

NISTIR Classification	D4011.024a
Author	Not Given
Normalized Unit	1000.0 lf
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	2
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	Other Nonstructural
System	Fire
Element	Piping

Calculation:

Is Calculated?	No
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ATC-138 Properties:

System	Fire Suppression
Subsystem	N/A
Requires Service Locations	No
Service Location	Building

Component modifications applied:

Component Group	Other Nonstructural
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.37.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.37.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1	Spraying & Dripping Leakage at joints - 0.02 leaks per 20 ft section of pipe.	Replace leaking joints and minor water cleanup.	Not Available
DS2	Joints Break - Major Leakage - 0.02 breaks per 20 ft section of pipe.	Replace 20 ft section of pipe, joints and major water cleanup at leaking joints.	Not Available

Table 6.37.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1	DS2
Type	Sequential	Sequential
Probability	–	–
Median	1.9	3.4
β	0.4	0.4

Table 6.37.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1	DS2
Distribution Type	LogNormal	LogNormal
Lower Qty.	3.0	3.0
Upper Qty.	10.0	10.0
Highest Cost Median	\$1,161	\$8,793
Lowest Cost Median	\$950	\$7,195
β (COV)	0.65	0.41

Table 6.37.5. Parameters for the repair time distributions.

	DS1	DS2
Distribution Type	LogNormal	LogNormal
Lower Qty.	3.0	3.0
Upper Qty.	10.0	10.0
Highest Median Repair Time (Days)	0.45	0.94
Lowest Median Repair Time (Days)	0.37	0.31
β (COV)	0.7	0.48

Table 6.37.6. Life safety information.

	DS1	DS2
Non-collapse casualties	No	No
Affected Area	–	–
Serious Injury Median	–	–
Serious Injury β	–	–
Loss of Life Median	–	–
Loss of Life β	–	–
Can Cause Red Tag	No	No
Unsafe Placard Median	–	–
Unsafe Placard β	–	–

Table 6.37.7. REDi repair class.

	DS1	DS2
REDi Repair Class	2	3

Table 6.37.8. ATC-138 parameters.

	DS1	DS2
Safety		
Safety Class	0	0
Envelope		
Affects Roof Function	No	No
Affects Envelope Safety	No	No
Damages Envelope Seal	No	No
Exterior Surface Area Factor	—	—
Exterior Falling Hazard		
Poses an Exterior Falling Hazard	No	No
Exterior Falling Length Factor	—	—
Interior Space		
Poses an Interior Falling Hazard	No	Yes
Obstructs Interior Space	No	Yes
Interior Area Conversion Type	—	component
Interior Area Conversion Factor	—	0.01
Repair Schedule		
Crew Size	3	5
Permit Type (Rapid or Full)	Rapid	Rapid
Requires Redesign	No	No
Long Lead Time	No	No
Requires Shoring	No	No
Resolved by Scaffolding	No	No
Temporary Repair Class	—	Basic carpenter/laborers
Temporary Repair Time Lower (days)	—	0.5
Temporary Repair Time Upper (days)	—	0.5
Temporary Repair Crew Size	—	2.0
Miscellaneous		
Hazardous Material Scope	N/A	N/A
Weakens Fire Break	No	No
Impairs System Operation	No	Yes
Causes Flooding	No	Yes
Affects Access	No	No

6.38 D4011.054a #1: (D4011.054a) Fire Sprinkler Drop Standard Threaded Steel - Dropping into braced lay-in tile SOFT ceiling - 6 ft. long drop maximum, SDC D, E, or F (OSHDP or sim)

NISTIR Classification	D4011.054a
Author	Not Given
Normalized Unit	100.0 each
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	2
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	Other Nonstructural
System	Fire
Element	Drops

Calculation:

Is Calculated?	No
----------------	----

ATC-138 Properties:

System	Fire Suppression
Subsystem	Fire Sprinkler Drops
Requires Service Locations	No
Service Location	Unit

Component modifications applied:

Component Group	Other Nonstructural
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.38.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.38.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1	Spraying & Dripping Leakage at drop joints - 0.01 leaks per drop.	Replace sprinkler drops and minor water cleanup at broken joints.	Not Available
DS2	Drop Joints Break - Major Leakage - 0.01 breaks per drop.	Replace sprinkler drops and major water cleanup at broken joints	Not Available

Table 6.38.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1	DS2
Type	Sequential	Sequential
Probability	–	–
Median	1.9	3
β	0.4	0.4

Table 6.38.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1	DS2
Distribution Type	LogNormal	LogNormal
Lower Qty.	2.0	2.0
Upper Qty.	5.0	5.0
Highest Cost Median	\$1,659	\$1,659
Lowest Cost Median	\$1,357	\$1,357
β (COV)	0.37	0.37

Table 6.38.5. Parameters for the repair time distributions.

	DS1	DS2
Distribution Type	LogNormal	LogNormal
Lower Qty.	2.0	2.0
Upper Qty.	5.0	5.0
Highest Median Repair Time (Days)	0.65	0.18
Lowest Median Repair Time (Days)	0.53	0.06
β (COV)	0.44	0.44

Table 6.38.6. Life safety information.

	DS1	DS2
Non-collapse casualties	No	No
Affected Area	–	–
Serious Injury Median	–	–
Serious Injury β	–	–
Loss of Life Median	–	–
Loss of Life β	–	–
Can Cause Red Tag	No	No
Unsafe Placard Median	–	–
Unsafe Placard β	–	–

Table 6.38.7. REDi repair class.

	DS1	DS2
REDi Repair Class	2	3

Table 6.38.8. ATC-138 parameters.

	DS1	DS2
Safety		
Safety Class	0	0
Envelope		
Affects Roof Function	No	No
Affects Envelope Safety	No	No
Damages Envelope Seal	No	No
Exterior Surface Area Factor	—	—
Exterior Falling Hazard		
Poses an Exterior Falling Hazard	No	No
Exterior Falling Length Factor	—	—
Interior Space		
Poses an Interior Falling Hazard	No	No
Obstructs Interior Space	No	No
Interior Area Conversion Type	—	—
Interior Area Conversion Factor	—	—
Repair Schedule		
Crew Size	3	5
Permit Type (Rapid or Full)	Rapid	Rapid
Requires Redesign	No	No
Long Lead Time	No	No
Requires Shoring	No	No
Resolved by Scaffolding	No	No
Temporary Repair Class	—	—
Temporary Repair Time Lower (days)	—	—
Temporary Repair Time Upper (days)	—	—
Temporary Repair Crew Size	—	—
Miscellaneous		
Hazardous Material Scope	N/A	N/A
Weakens Fire Break	No	No
Impairs System Operation	No	Yes
Causes Flooding	No	Yes
Affects Access	No	No

6.39 D5011.013c #1: (D5011.013c) Transformer/primary service - Capacity: <100 kVA - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility

NISTIR Classification	D5011.013c
Author	Not Given
Normalized Unit	75.0 kva
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	1
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	Other Nonstructural
System	Electrical
Element	Transformer

Calculation:

Is Calculated?	Yes
Calculation Type	Anchorage (Combined Fragility)
Anchorage Ductility	Brittle
ID Component Class	Generators, batteries, inverters, motors, transformers, and other electrical components constructed of high deformability materials.

ATC-138 Properties:

System	Electrical
Subsystem	General Building Equipment
Requires Service Locations	No
Service Location	Building

Component modifications applied:

Component Group	Other Nonstructural
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.39.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.39.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1a	Anchorage failure.	Repair anchorage and concrete pad and re-mount equipment.	Not Available
DS1b	Anchorage failure & Equipment damaged beyond repair.	Replace equipment including attached utilities in addition to repairing anchorage and concrete pad. Transformer tower removed, repaired offsite, and reinstalled.	
DS1c	Damaged, Inoperative but anchorage is OK.	Service and repair existing transformer. Transformer tower removed, repaired offsite, and reinstalled.	Not Available

Table 6.39.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1a	DS1b	DS1c
Type	Mut. Excl.	Mut. Excl.	Mut. Excl.
Probability	0.35	0.15	0.5
Median	1.528	1.528	1.528
β	0.5	0.5	0.5

Table 6.39.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1a	DS1b	DS1c
Distribution Type	LogNormal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0
Highest Cost Median	\$3,318	\$28,454	\$25,136
Lowest Cost Median	\$2,715	\$23,281	\$20,566
β (COV)	0.45	0.22	0.19

Table 6.39.5. Parameters for the repair time distributions.

	DS1a	DS1b	DS1c
Distribution Type	LogNormal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0
Highest Median Repair Time (Days)	1.05	2.46	2.17
Lowest Median Repair Time (Days)	0.86	0.82	0.72
β (COV)	0.52	0.33	0.31

Table 6.39.6. Life safety information.

	DS1a	DS1b	DS1c
Non-collapse casualties	No	No	No
Affected Area	--	--	--
Serious Injury Median	—	—	—
Serious Injury β	—	—	—
Loss of Life Median	—	—	—
Loss of Life β	—	—	—
Can Cause Red Tag	No	No	No
Unsafe Placard Median	—	—	—
Unsafe Placard β	—	—	—

Table 6.39.7. REDi repair class.

	DS1a	DS1b	DS1c
REDi Repair Class	2	2	2

Table 6.39.8. ATC-138 parameters.

	DS1a	DS1b	DS1c
Safety			
Safety Class	0	0	0
Envelope			
Affects Roof Function	No	No	No
Affects Envelope Safety	No	No	No
Damages Envelope Seal	No	No	No
Exterior Surface Area Factor	—	—	—
Exterior Falling Hazard			
Poses an Exterior Falling Hazard	No	No	No
Exterior Falling Length Factor	—	—	—
Interior Space			
Poses an Interior Falling Hazard	No	No	No
Obstructs Interior Space	No	No	No
Interior Area Conversion Type	—	—	—
Interior Area Conversion Factor	—	—	—
Repair Schedule			
Crew Size	3	3	3
Permit Type (Rapid or Full)	Rapid	Rapid	Rapid
Requires Redesign	No	No	No
Long Lead Time	No	Yes	No
Requires Shoring	No	No	No
Resolved by Scaffolding	No	No	No
Temporary Repair Class	—	—	—
Temporary Repair Time Lower (days)	—	—	—
Temporary Repair Time Upper (days)	—	—	—
Temporary Repair Crew Size	—	—	—
Miscellaneous			
Hazardous Material Scope	N/A	N/A	N/A
Weakens Fire Break	No	No	No
Impairs System Operation	No	Yes	Yes
Causes Flooding	No	No	No
Affects Access	No	No	No

6.40 D5012.013d #1: (D5012.013d) Motor Control Center - Capacity: all - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility

NISTIR Classification	D5012.013d
Author	Not Given
Normalized Unit	1.0 each
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	1
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	Other Nonstructural
System	Electrical
Element	Mcc

Calculation:

Is Calculated?	Yes
Calculation Type	Anchorage (Combined Fragility)
Anchorage Ductility	Brittle
ID Component Class	Motor control centers, panel boards, switch gear, instrumentation cabinets, and other components constructed of sheet metal framing.

ATC-138 Properties:

System	Elevators
Subsystem	Motor Control Center
Requires Service Locations	No
Service Location	Building

Component modifications applied:

Component Group	Other Nonstructural
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.40.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.40.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1a	Anchorage failure.	If anchored repair anchorage and concrete pad and remount equipment.	Not Available
DS1b	Anchorage failure & Equipment damaged beyond repair.	Replace equipment including attached utilities in addition to repairing anchorage and concrete pad if anchored.	
DS1c	Damaged, Inoperative but anchorage is OK.	Replace equipment.	Not Available

Table 6.40.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1a	DS1b	DS1c
Type	Mut. Excl.	Mut. Excl.	Mut. Excl.
Probability	0.35	0.15	0.5
Median	1.092	1.092	1.092
β	0.5	0.5	0.5

Table 6.40.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1a	DS1b	DS1c
Distribution Type	Normal	Normal	Normal
Lower Qty.	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0
Highest Cost Median	\$1,659	\$15,430	\$13,771
Lowest Cost Median	\$1,357	\$12,624	\$11,267
β (COV)	0.28	0.19	0.18

Table 6.40.5. Parameters for the repair time distributions.

	DS1a	DS1b	DS1c
Distribution Type	Normal	Normal	Normal
Lower Qty.	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0
Highest Median Repair Time (Days)	0.65	1.64	1.46
Lowest Median Repair Time (Days)	0.53	0.55	0.49
β (COV)	0.38	0.32	0.31

Table 6.40.6. Life safety information.

	DS1a	DS1b	DS1c
Non-collapse casualties	No	No	No
Affected Area	--	--	--
Serious Injury Median	—	—	—
Serious Injury β	—	—	—
Loss of Life Median	—	—	—
Loss of Life β	—	—	—
Can Cause Red Tag	No	No	No
Unsafe Placard Median	—	—	—
Unsafe Placard β	—	—	—

Table 6.40.7. REDi repair class.

	DS1a	DS1b	DS1c
REDi Repair Class	2	2	2

Table 6.40.8. ATC-138 parameters.

	DS1a	DS1b	DS1c
Safety			
Safety Class	0	0	0
Envelope			
Affects Roof Function	No	No	No
Affects Envelope Safety	No	No	No
Damages Envelope Seal	No	No	No
Exterior Surface Area Factor	—	—	—
Exterior Falling Hazard			
Poses an Exterior Falling Hazard	No	No	No
Exterior Falling Length Factor	—	—	—
Interior Space			
Poses an Interior Falling Hazard	No	No	No
Obstructs Interior Space	No	No	No
Interior Area Conversion Type	—	—	—
Interior Area Conversion Factor	—	—	—
Repair Schedule			
Crew Size	3	3	3
Permit Type (Rapid or Full)	Rapid	Rapid	Rapid
Requires Redesign	No	No	No
Long Lead Time	No	No	No
Requires Shoring	No	No	No
Resolved by Scaffolding	No	No	No
Temporary Repair Class	—	—	—
Temporary Repair Time Lower (days)	—	—	—
Temporary Repair Time Upper (days)	—	—	—
Temporary Repair Crew Size	—	—	—
Miscellaneous			
Hazardous Material Scope	N/A	N/A	N/A
Weakens Fire Break	No	No	No
Impairs System Operation	No	Yes	Yes
Causes Flooding	No	No	No
Affects Access	No	No	No

6.41 D5012.023c #1: (D5012.023c) Low Voltage Switchgear - Capacity: 100 to <350 Amp - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility

NISTIR Classification	D5012.023c
Author	Not Given
Normalized Unit	225.0 amp
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	1
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	Other Nonstructural
System	Electrical
Element	Switchgear

Calculation:

Is Calculated?	Yes
Calculation Type	Anchorage (Combined Fragility)
Anchorage Ductility	Brittle
ID Component Class	Motor control centers, panel boards, switch gear, instrumentation cabinets, and other components constructed of sheet metal framing.

ATC-138 Properties:

System	Electrical
Subsystem	General Building Equipment
Requires Service Locations	No
Service Location	Building

Component modifications applied:

Component Group	Other Nonstructural
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.41.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.41.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1a	Anchorage failure.	Repair anchorage and concrete pad and re-mount equipment.	Not Available
DS1b	Anchorage failure & Equipment damaged beyond repair.	Replace equipment including attached utilities in addition to repairing anchorage and concrete pad.	Not Available
DS1c	Damaged, Inoperative but anchorage is OK.	Replace fiberglass insulator supporting the vertical bus bars in the rear of the switchgear assembly	Not Available

Table 6.41.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1a	DS1b	DS1c
Type	Mut. Excl.	Mut. Excl.	Mut. Excl.
Probability	0.35	0.15	0.5
Median	1.092	1.092	1.092
β	0.5	0.5	0.5

Table 6.41.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1a	DS1b	DS1c
Distribution Type	Normal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0
Highest Cost Median	\$1,659	\$32,436	\$30,777
Lowest Cost Median	\$1,357	\$26,538	\$25,181
β (COV)	0.28	0.16	0.16

Table 6.41.5. Parameters for the repair time distributions.

	DS1a	DS1b	DS1c
Distribution Type	Normal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0
Highest Median Repair Time (Days)	0.65	3.45	3.27
Lowest Median Repair Time (Days)	0.53	1.15	1.09
β (COV)	0.38	0.3	0.3

Table 6.41.6. Life safety information.

	DS1a	DS1b	DS1c
Non-collapse casualties	No	No	No
Affected Area	--	--	--
Serious Injury Median	—	—	—
Serious Injury β	—	—	—
Loss of Life Median	—	—	—
Loss of Life β	—	—	—
Can Cause Red Tag	No	No	No
Unsafe Placard Median	—	—	—
Unsafe Placard β	—	—	—

Table 6.41.7. REDi repair class.

	DS1a	DS1b	DS1c
REDi Repair Class	2	2	2

Table 6.41.8. ATC-138 parameters.

	DS1a	DS1b	DS1c
Safety			
Safety Class	0	0	0
Envelope			
Affects Roof Function	No	No	No
Affects Envelope Safety	No	No	No
Damages Envelope Seal	No	No	No
Exterior Surface Area Factor	—	—	—
Exterior Falling Hazard			
Poses an Exterior Falling Hazard	No	No	No
Exterior Falling Length Factor	—	—	—
Interior Space			
Poses an Interior Falling Hazard	No	No	No
Obstructs Interior Space	No	No	No
Interior Area Conversion Type	—	—	—
Interior Area Conversion Factor	—	—	—
Repair Schedule			
Crew Size	3	3	3
Permit Type (Rapid or Full)	Rapid	Rapid	Rapid
Requires Redesign	No	No	No
Long Lead Time	No	Yes	Yes
Requires Shoring	No	No	No
Resolved by Scaffolding	No	No	No
Temporary Repair Class	—	—	—
Temporary Repair Time Lower (days)	—	—	—
Temporary Repair Time Upper (days)	—	—	—
Temporary Repair Crew Size	—	—	—
Miscellaneous			
Hazardous Material Scope	N/A	N/A	N/A
Weakens Fire Break	No	No	No
Impairs System Operation	No	Yes	Yes
Causes Flooding	No	No	No
Affects Access	No	No	No

6.42 D5012.033c #1: (D5012.033c) Distribution Panel - Capacity: 100 to <350 Amp - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility

NISTIR Classification	D5012.033c
Author	Not Given
Normalized Unit	225.0 amp
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	1
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	Other Nonstructural
System	Electrical
Element	Distribution

Calculation:

Is Calculated?	Yes
Calculation Type	Anchorage (Combined Fragility)
Anchorage Ductility	Brittle
ID Component Class	Motor control centers, panel boards, switch gear, instrumentation cabinets, and other components constructed of sheet metal framing.

ATC-138 Properties:

System	Electrical
Subsystem	General Building Equipment
Requires Service Locations	No
Service Location	Unit

Component modifications applied:

Component Group	Other Nonstructural
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.42.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.42.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1a	Anchorage failure.	Repair anchorage and concrete pad (if floor mounted and wall if wall mounted) and re-mount equipment.	Not Available
DS1b	Anchorage failure & Equipment damaged beyond repair.	Replace equipment in addition to repairing anchorage and concrete pad if floor mounted or wall if wall mounted.	Not Available
DS1c	Damaged, Inoperative but anchorage is OK.	Replace equipment.	Not Available

Table 6.42.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1a	DS1b	DS1c
Type	Mut. Excl.	Mut. Excl.	Mut. Excl.
Probability	0.35	0.15	0.5
Median	1.819	1.819	1.819
β	0.5	0.5	0.5

Table 6.42.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1a	DS1b	DS1c
Distribution Type	Normal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0
Highest Cost Median	\$1,810	\$35,385	\$33,575
Lowest Cost Median	\$1,207	\$23,590	\$22,383
β (COV)	0.28	0.16	0.16

Table 6.42.5. Parameters for the repair time distributions.

	DS1a	DS1b	DS1c
Distribution Type	Normal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0
Highest Median Repair Time (Days)	0.79	5.17	4.91
Lowest Median Repair Time (Days)	0.53	1.29	1.23
β (COV)	0.38	0.3	0.3

Table 6.42.6. Life safety information.

	DS1a	DS1b	DS1c
Non-collapse casualties	No	No	No
Affected Area	--	--	--
Serious Injury Median	—	—	—
Serious Injury β	—	—	—
Loss of Life Median	—	—	—
Loss of Life β	—	—	—
Can Cause Red Tag	No	No	No
Unsafe Placard Median	—	—	—
Unsafe Placard β	—	—	—

Table 6.42.7. REDi repair class.

	DS1a	DS1b	DS1c
REDi Repair Class	2	2	2

Table 6.42.8. ATC-138 parameters.

	DS1a	DS1b	DS1c
Safety			
Safety Class	0	0	0
Envelope			
Affects Roof Function	No	No	No
Affects Envelope Safety	No	No	No
Damages Envelope Seal	No	No	No
Exterior Surface Area Factor	—	—	—
Exterior Falling Hazard			
Poses an Exterior Falling Hazard	No	No	No
Exterior Falling Length Factor	—	—	—
Interior Space			
Poses an Interior Falling Hazard	No	No	No
Obstructs Interior Space	No	No	No
Interior Area Conversion Type	—	—	—
Interior Area Conversion Factor	—	—	—
Repair Schedule			
Crew Size	3	3	3
Permit Type (Rapid or Full)	Rapid	Rapid	Rapid
Requires Redesign	No	No	No
Long Lead Time	No	Yes	Yes
Requires Shoring	No	No	No
Resolved by Scaffolding	No	No	No
Temporary Repair Class	—	—	—
Temporary Repair Time Lower (days)	—	—	—
Temporary Repair Time Upper (days)	—	—	—
Temporary Repair Crew Size	—	—	—
Miscellaneous			
Hazardous Material Scope	N/A	N/A	N/A
Weakens Fire Break	No	No	No
Impairs System Operation	No	Yes	Yes
Causes Flooding	No	No	No
Affects Access	No	No	No

6.43 D5092.013c #1: (D5092.013c) Battery Rack - Capacity: all - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility

NISTIR Classification	D5092.013c
Author	Not Given
Normalized Unit	1.0 each
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	1
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	Other Nonstructural
System	Electrical
Element	Battery

Calculation:

Is Calculated?	Yes
Calculation Type	Anchorage (Combined Fragility)
Anchorage Ductility	Brittle
ID Component Class	Generators, batteries, inverters, motors, transformers, and other electrical components constructed of high deformability materials.

ATC-138 Properties:

System	Electrical
Subsystem	Utility Backup Equipment
Requires Service Locations	No
Service Location	Building

Component modifications applied:

Component Group	Other Nonstructural
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.43.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.43.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1a	Anchorage failure.	Repair anchorage and concrete pad and re-mount equipment.	Not Available
DS1b	Anchorage failure & Equipment damaged beyond repair.	Replace equipment including attached utilities in addition to repairing anchorage and concrete pad.	Not Available
DS1c	Equipment is damaged and inoperative.	Replace batteries.	Not Available
DS1d	Equipment is damaged and inoperative.	Replace batteries and clean up acid.	Not Available
DS1e	Equipment is damaged and inoperative.	Replace rack including batteries and clean up acid.	Not Available

Table 6.43.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1a	DS1b	DS1c	DS1d	DS1e
Type	Mut. Excl.	Mut. Excl.	Mut. Excl.	Mut. Excl.	Mut. Excl.
Probability	0.35	0.15	0.15	0.25	0.1
Median	1.528	1.528	1.528	1.528	1.528
β	0.5	0.5	0.5	0.5	0.5

Table 6.43.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1a	DS1b	DS1c	DS1d	DS1e
Distribution Type	Normal	LogNormal	LogNormal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0	5.0	5.0
Highest Cost Median	\$3,620	\$58,461	\$43,439	\$46,154	\$61,176
Lowest Cost Median	\$2,413	\$38,974	\$28,959	\$30,769	\$40,784
β (COV)	0.14	0.13	0.1	0.11	0.13

Table 6.43.5. Parameters for the repair time distributions.

	DS1a	DS1b	DS1c	DS1d	DS1e
Distribution Type	Normal	LogNormal	LogNormal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0	5.0	5.0
Highest Median Repair Time (Days)	1.59	25.65	19.06	20.25	26.84
Lowest Median Repair Time (Days)	1.06	17.1	12.71	13.5	17.89
β (COV)	0.29	0.28	0.27	0.27	0.28

Table 6.43.6. Life safety information.

	DS1a	DS1b	DS1c	DS1d	DS1e
Non-collapse casualties	No	No	No	No	No
Affected Area	--	--	--	--	--
Serious Injury Median	—	—	—	—	—
Serious Injury β	—	—	—	—	—
Loss of Life Median	—	—	—	—	—
Loss of Life β	—	—	—	—	—
Can Cause Red Tag	No	No	No	No	No
Unsafe Placard Median	—	—	—	—	—
Unsafe Placard β	—	—	—	—	—

Table 6.43.7. REDi repair class.

	DS1a	DS1b	DS1c	DS1d	DS1e
REDi Repair Class	2	2	2	2	2

Table 6.43.8. ATC-138 parameters.

	DS1a	DS1b	DS1c	DS1d	DS1e
Safety					
Safety Class	0	0	0	0	0
Envelope					
Affects Roof Function	No	No	No	No	No
Affects Envelope Safety	No	No	No	No	No
Damages Envelope Seal	No	No	No	No	No
Exterior Surface Area Factor	—	—	—	—	—
Exterior Falling Hazard					
Poses an Exterior Falling Hazard	No	No	No	No	No
Exterior Falling Length Factor	—	—	—	—	—
Interior Space					
Poses an Interior Falling Hazard	No	No	No	No	No
Obstructs Interior Space	No	No	No	No	No
Interior Area Conversion Type	—	—	—	—	—
Interior Area Conversion Factor	—	—	—	—	—
Repair Schedule					
Crew Size	3	3	3	3	3
Permit Type (Rapid or Full)	Rapid	Rapid	Rapid	Rapid	Rapid
Requires Redesign	No	No	No	No	No
Long Lead Time	No	Yes	Yes	Yes	Yes
Requires Shoring	No	No	No	No	No
Resolved by Scaffolding	No	No	No	No	No
Temporary Repair Class	—	—	—	—	—
Temporary Repair Time Lower (days)	—	—	—	—	—
Temporary Repair Time Upper (days)	—	—	—	—	—
Temporary Repair Crew Size	—	—	—	—	—
Miscellaneous					
Hazardous Material Scope	N/A	N/A	N/A	N/A	N/A
Weakens Fire Break	No	No	No	No	No
Impairs System Operation	No	Yes	Yes	Yes	Yes
Causes Flooding	No	No	No	No	No
Affects Access	No	No	No	No	No

6.44 D5092.023c #1: (D5092.023c) Battery Charger - Capacity: all - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility

NISTIR Classification	D5092.023c
Author	Not Given
Normalized Unit	1.0 each
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	1
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	Other Nonstructural
System	Electrical
Element	Battery

Calculation:

Is Calculated?	Yes
Calculation Type	Anchorage (Combined Fragility)
Anchorage Ductility	Brittle
ID Component Class	Generators, batteries, inverters, motors, transformers, and other electrical components constructed of high deformability materials.

ATC-138 Properties:

System	Electrical
Subsystem	Utility Backup Equipment
Requires Service Locations	No
Service Location	Building

Component modifications applied:

Component Group	Other Nonstructural
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.44.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.44.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1a	Anchorage failure.	Repair anchorage and concrete pad (if floor mounted and wall if wall mounted) and re-mount equipment.	Not Available
DS1b	Anchorage failure & Equipment damaged beyond repair.	Replace equipment including attached utilities in addition to repairing anchorage and concrete pad / wall.	Not Available
DS1c	Equipment is damaged and inoperative.	Service for intermittent voltage output or for blown surge suppressor.	Not Available
DS1d	Equipment is damaged and inoperative.	Replace equipment.	Not Available

Table 6.44.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1a	DS1b	DS1c	DS1d
Type	Mut. Excl.	Mut. Excl.	Mut. Excl.	Mut. Excl.
Probability	0.35	0.15	0.25	0.25
Median	1.528	1.528	1.528	1.528
β	0.5	0.5	0.5	0.5

Table 6.44.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1a	DS1b	DS1c	DS1d
Distribution Type	Normal	Normal	Normal	Normal
Lower Qty.	1.0	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0	5.0
Highest Cost Median	\$2,745	\$50,392	\$47,647	\$47,647
Lowest Cost Median	\$1,900	\$34,887	\$32,986	\$32,986
β (COV)	0.2	0.13	0.13	0.13

Table 6.44.5. Parameters for the repair time distributions.

	DS1a	DS1b	DS1c	DS1d
Distribution Type	Normal	Normal	Normal	Normal
Lower Qty.	1.0	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0	5.0
Highest Median Repair Time (Days)	1.07	19.65	18.58	18.58
Lowest Median Repair Time (Days)	0.74	13.61	12.86	12.86
β (COV)	0.32	0.28	0.28	0.28

Table 6.44.6. Life safety information.

	DS1a	DS1b	DS1c	DS1d
Non-collapse casualties	No	No	No	No
Affected Area	--	--	--	--
Serious Injury Median	—	—	—	—
Serious Injury β	—	—	—	—
Loss of Life Median	—	—	—	—
Loss of Life β	—	—	—	—
Can Cause Red Tag	No	No	No	No
Unsafe Placard Median	—	—	—	—
Unsafe Placard β	—	—	—	—

Table 6.44.7. REDi repair class.

	DS1a	DS1b	DS1c	DS1d
REDi Repair Class	2	2	2	2

Table 6.44.8. ATC-138 parameters.

	DS1a	DS1b	DS1c	DS1d
Safety				
Safety Class	0	0	0	0
Envelope				
Affects Roof Function	No	No	No	No
Affects Envelope Safety	No	No	No	No
Damages Envelope Seal	No	No	No	No
Exterior Surface Area Factor	—	—	—	—
Exterior Falling Hazard				
Poses an Exterior Falling Hazard	No	No	No	No
Exterior Falling Length Factor	—	—	—	—
Interior Space				
Poses an Interior Falling Hazard	No	No	No	No
Obstructs Interior Space	No	No	No	No
Interior Area Conversion Type	—	—	—	—
Interior Area Conversion Factor	—	—	—	—
Repair Schedule				
Crew Size	3	3	3	3
Permit Type (Rapid or Full)	Rapid	Rapid	Rapid	Rapid
Requires Redesign	No	No	No	No
Long Lead Time	No	Yes	No	Yes
Requires Shoring	No	No	No	No
Resolved by Scaffolding	No	No	No	No
Temporary Repair Class	—	—	—	—
Temporary Repair Time Lower (days)	—	—	—	—
Temporary Repair Time Upper (days)	—	—	—	—
Temporary Repair Crew Size	—	—	—	—
Miscellaneous				
Hazardous Material Scope	N/A	N/A	N/A	N/A
Weakens Fire Break	No	No	No	No
Impairs System Operation	No	Yes	Yes	Yes
Causes Flooding	No	No	No	No
Affects Access	No	No	No	No

6.45 D5092.033c #1: (D5092.033c) Diesel generator - Capacity: 100 to <350 kVA - Equipment that is either hard anchored or is vibration isolated with seismic snubbers/restraints - Combined anchorage/isolator & equipment fragility

NISTIR Classification	D5092.033c
Author	Not Given
Normalized Unit	250.0 kva
Engineering Demand Parameter	Peak Floor Acceleration
Number of Damage States	1
Is correlated?	No
Is directional?	No

Groupings:

Loss Aggregation Group	Other Nonstructural
System	Electrical
Element	Generator

Calculation:

Is Calculated?	Yes
Calculation Type	Anchorage (Combined Fragility)
Anchorage Ductility	Brittle
ID Component Class	Generators, batteries, inverters, motors, transformers, and other electrical components constructed of high deformability materials.

ATC-138 Properties:

System	Electrical
Subsystem	Utility Backup Equipment
Requires Service Locations	No
Service Location	Building

Component modifications applied:

Component Group	Other Nonstructural
Quantity Scale Factor	1.0
Damage Median Scale Factor	1.0
Total Cost Scale Factor	3.017
User cost modification factor	1.0
Regional Cost Scale Factor	1
Date multiplier (to convert from 2011 USD)	2.038
Occupancy Cost Scale Factor	1.139
Building Value Cost Scale Factor	1
Component Soft Cost Modifier	1.3

Table 6.45.1. Per-level fragility modifications (applied in addition to the values shown for the fragility).

Location	Cost	Time	Capacity
G-R	1	1	1

Table 6.45.2. Damage state progression.

Damage State	Description	Repair Description	Image
DS1a	Anchorage failure.	Repair anchorage and concrete pad and re-mount equipment.	
DS1b	Anchorage failure & Equipment damaged beyond repair.	Replace equipment including attached utilities in addition to repairing anchorage and concrete pad.	Not Available
DS1c	Damaged, Inoperative but anchorage is OK	Repair fracture pipes & damaged nozzles, and or reconnect exhaust line.	Not Available
DS1d	Equipment is damaged and inoperative but anchorage is OK.	Overhaul because of drive shaft misalignment.	Not Available
DS1e	Equipment is damaged and inoperative but anchorage is OK.	minor electrical repair e.g., replace relays.	Not Available

Table 6.45.3. Parameters for the damage state distributions. The medians reflect a scale factor of **1.0** applied to the default values.

	DS1a	DS1b	DS1c	DS1d	DS1e
Type	Mut. Excl.	Mut. Excl.	Mut. Excl.	Mut. Excl.	Mut. Excl.
Probability	0.35	0.15	0.4	0.05	0.05
Median	1.528	1.528	1.528	1.528	1.528
β	0.5	0.5	0.5	0.5	0.5

Table 6.45.4. Parameters for the cost distributions. The cost values reflect a total scale factor of **3.017** applied to the default values. This scale factor includes the user input scale factor, a regional scale factor, an occupancy scale factor, building value scale factor, a component soft cost factor, and scale factor to convert the initial 2011 cost estimate to modern day costs.

	DS1a	DS1b	DS1c	DS1d	DS1e
Distribution Type	LogNormal	LogNormal	LogNormal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0	5.0	5.0
Highest Cost Median	\$3,318	\$339,125	\$664	\$8,296	\$1,659
Lowest Cost Median	\$2,112	\$277,466	\$543	\$6,787	\$1,357
β (COV)	0.45	0.17	0.17	0.17	0.17

Table 6.45.5. Parameters for the repair time distributions.

	DS1a	DS1b	DS1c	DS1d	DS1e
Distribution Type	LogNormal	LogNormal	LogNormal	LogNormal	LogNormal
Lower Qty.	1.0	1.0	1.0	1.0	1.0
Upper Qty.	5.0	5.0	5.0	5.0	5.0
Highest Median Repair Time (Days)	0.16	4.51	0.03	0.4	0.08
Lowest Median Repair Time (Days)	0.1	1.5	0.03	0.33	0.07
β (COV)	0.52	0.3	0.3	0.3	0.3

Table 6.45.6. Life safety information.

	DS1a	DS1b	DS1c	DS1d	DS1e
Non-collapse casualties	No	No	No	No	No
Affected Area	--	--	--	--	--
Serious Injury Median	—	—	—	—	—
Serious Injury β	—	—	—	—	—
Loss of Life Median	—	—	—	—	—
Loss of Life β	—	—	—	—	—
Can Cause Red Tag	No	No	No	No	No
Unsafe Placard Median	—	—	—	—	—
Unsafe Placard β	—	—	—	—	—

Table 6.45.7. REDi repair class.

	DS1a	DS1b	DS1c	DS1d	DS1e
REDi Repair Class	2	2	2	2	2

Table 6.45.8. ATC-138 parameters.

	DS1a	DS1b	DS1c	DS1d	DS1e
Safety					
Safety Class	0	0	0	0	0
Envelope					
Affects Roof Function	No	No	No	No	No
Affects Envelope Safety	No	No	No	No	No
Damages Envelope Seal	No	No	No	No	No
Exterior Surface Area Factor	—	—	—	—	—
Exterior Falling Hazard					
Poses an Exterior Falling Hazard	No	No	No	No	No
Exterior Falling Length Factor	—	—	—	—	—
Interior Space					
Poses an Interior Falling Hazard	No	No	No	No	No
Obstructs Interior Space	No	No	No	No	No
Interior Area Conversion Type	—	—	—	—	—
Interior Area Conversion Factor	—	—	—	—	—
Repair Schedule					
Crew Size	3	3	3	3	3
Permit Type (Rapid or Full)	Rapid	Rapid	Rapid	Rapid	Rapid
Requires Redesign	No	No	No	No	No
Long Lead Time	No	Yes	No	No	No
Requires Shoring	No	No	No	No	No
Resolved by Scaffolding	No	No	No	No	No
Temporary Repair Class	—	—	—	—	—
Temporary Repair Time Lower (days)	—	—	—	—	—
Temporary Repair Time Upper (days)	—	—	—	—	—
Temporary Repair Crew Size	—	—	—	—	—
Miscellaneous					
Hazardous Material Scope	N/A	N/A	N/A	N/A	N/A
Weakens Fire Break	No	No	No	No	No
Impairs System Operation	No	Yes	Yes	Yes	Yes
Causes Flooding	No	No	No	No	No
Affects Access	No	No	No	No	No

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