REQUIRED BASIC PROJECT INFORMATION

D2.1 – 2.1 Introduction:

As with any design job, there is certain basic information that is required before seismic restraints can be selected and placed. The building owner, architect, and structural engineer make the decisions that form the basis for the information required to select the seismic restraints for the pipe and duct systems in the building. This is information that should be included in the specification and bid package for the project. It also should appear on the first sheet of the structural drawings. For consistency, it is good practice to echo this information in the specification for each building system, and on the first sheet of the drawings for each system. In this fashion, this information is available to all of the contractors and suppliers that will have a need to know.

D2.1 – 2.2 Building Use – Nature of Occupancy (Section 1.5) [Section 1.5][1]:

How a building is to be used greatly affects the level of seismic restraint that is required for the MEP (Mechanical, Electrical, and Plumbing) components. In the 2006 IBC the building use is defined through the Occupancy Category, which ranges from I to IV. Occupancy Category I is applied to buildings where failure presents a low hazard to human life. At the other end of the range, Occupancy Category IV is applied to buildings which are deemed to be essential. In the previous two versions of the IBC (2000/2003), the building use was defined though the Seismic Use Group which varied from I to III. Table 1-1 of ASCE 7-98/02 and ASCE 7-05 describes which types of buildings are assigned to which Occupancy Category. Table 2-1 below summarizes the information found in Tables 1-1 and 9.1.3 of ASCE 7-98/02 and Table 1-1 of ASCE 7-05, and ties the Seismic Use Group from the previous versions of the IBC to the Occupancy Category. The nature of the building use, or its Occupancy Category, is determined by the building owner and the architect of record.

[1] References in brackets (Section 1.5) and [Section 1.5] apply to sections, tables, and/or equations in ASCE 7-98/02 ASCE 7-05 respectively which forms the basis for the seismic provisions in 2000/2003 IBC and 2006 IBC respectively.

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International: 614-889-0480
FAX 614-889-0540
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E-mail: sales@kineticsnoise.com
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Table 2-1; Building Use vs. Occupancy Category & Seismic Use Group (Table 1-1, Table 9.1.3) [Table 1-1]

OCCUPANCY CATEGORY 2000/2003 & 2006 IBC	SEISMIC USE GROUP 2000/2003 IBC	BUILDING USE OR NATURE OF OCCUPANCY
I	I	Buildings and structures in which failure would pose a low hazard to human life. These buildings include, but are not limited to: ➢ Agricultural buildings and structures. ➢ Certain temporary buildings and structures. ➢ Minor storage buildings and structures.
II		Buildings and structures that are not listed as Occupancy Category I, III, or IV. Also, cogeneration power plants that do not supply power to the national power grid.
III	II	Buildings and structures, in which failure would pose a substantial hazard to human life, have the potential to create a substantial economic impact, and/or cause a mass disruption of day-to-day civilian life. These buildings include, but are not limited to: ➢ Where more than 300 people congregate in one area. ➢ Daycare facilities with a capacity greater than 50. ➢ Elementary and Secondary school facilities with a capacity greater than 250 and colleges and adult educational facilities with a capacity greater than 500. ➢ Healthcare facilities with 50 or more resident patients that do not have surgery or emergency treatment facilities. ➢ Jails, prisons, and detention facilities. ➢ Power generation stations. ➢ Water and sewage treatment facilities. ➢ Telecommunication centers. Buildings and structures which are not in Occupancy Category IV which contain enough toxic or explosive materials that would be hazardous to the public if released.
IV	III	Buildings and structures which are designated as essential facilities which include but are not limited to: ➢ Hospitals & healthcare facilities with surgical or emergency treatment facilities. ➢ Fire, rescue, ambulance, police stations, & emergency vehicle garages. ➢ Designated emergency shelters. ➢ Facilities designated for emergency preparedness & response. ➢ Power generating stations and other public utilities required for emergency response and recovery. ➢ Ancillary structures required for the continued operation of Occupancy Category IV buildings and structures. ➢ Aviation control towers, air traffic control centers, and emergency aircraft hangers. ➢ Water storage facilities and pumping stations required for fire suppression. ➢ Buildings and structures required for national defense. ➢ Buildings and structures that contain highly toxic and/or explosive materials in sufficient quantity to pose a threat to the public.

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FAX 614-889-0540
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E-mail: sales@kineticsnoise.com

D2.1 – 2.3 Site Class – Soil Type (Sections 9.4.1.2.1, 9.4.1.2.2) [Section 11.4.2 & Chapter 20]:

The Site Class is related to the type of soil and rock strata that directly underlies the building site. The Site Class ranges from A to F progressing from the stiffest to the softest strata. Table 2-2 lists the various Site Classes and their corresponding strata.

Generally the structural engineer is responsible for determining the Site Class for a project. If the structural engineer's firm does not have a geotechnical engineer on staff, this job will be contracted to a geotechnical firm. The Site Class is determined in accordance with the references stated above from ASCE 7-98/02 and ASCE 7-05. The site profile is normally obtained by drilling several cores on the property. If there is insufficient information concerning the soil properties, then the default Site Class D is assigned to the project.

Table 2-2; Site Class vs. Soil Type (Table 9.4.1.2) [Table 20.3-1]

SITE CLASS	SOIL TYPE
A	Hard Rock
B	Rock
C	Very Dense Soil & Soft Rock
D	Stiff Soil (Default Site Class)
E	Soft Clay Soil
F	Liquefiable Soils, Quick Highly Sensitive Clays, Collapsible Weakly Cemented Soils, & etc. These require site response analysis.

D2.1 – 2.4 Mapped Acceleration Parameters (Sections 9.4.1.2.4 & 9.4.1.2.5) [Sections 11.4.3 & 11.4.4 and Chapters 21 & 22]

The United States Geological Survey, USGS, has mapped all of the known fault lines in the United States and its possessions. They have assigned ground level acceleration values to each location based on the Maximum Considered Earthquake, MCE, for two earthquake periods, 0.2 sec and 1.0 sec, at 5% damping. The mapped values are listed in terms of %g, where 1g is 32.2 ft/sec^2, 386.4 in/sec^2, 9.8 m/sec^2. The long period values are generally applied to the buildings and other

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structures since they react more strongly to the long period excitation due to their relatively high mass and low stiffness. The code specifies the use of short period values when evaluating non-structural components, which include pipe and duct, as they respond more strongly to the short period excitation due to their relatively low mass and high stiffness.

The Mapped Acceleration Parameters are available in ASCE 7-98/02 for 2000/2003 IBC and ASCE 7-05 for 2006 IBC, or may be obtained from the USGS cataloged by ZIP Code. The short period Mapped Acceleration Parameter is usually denoted as S_S and the Long period Mapped Acceleration Parameter is denoted as S_1. Note that the values for S_S and S_1 may be different for 2000/2003 IBC and 2006 IBC. Be sure the correct values are being used for the code that is in force in your jurisdiction.

Special Note: For the purpose of making preliminary estimates, the long and short period mapped acceleration parameters for selected U. S. cities are given in Table 2.4, and for selected international cities in Table 2.5. Please be aware that these values do not necessarily represent the maximum acceleration values that may occur in the named cities. For the U. S. cities please refer to the data compiled by the USGS by ZIP CODE. For international locations, local geological assessments should be sought from reputable sources at that location.

The Site Class information is then used to determine the Design Spectral Acceleration Parameters, S_{DS} and S_{D1}, for the short and long period MCE respectively. Equations 2-1 and 2-2 may be used to estimate the Design Spectral Acceleration Parameters.

$$S_{DS} = \frac{2}{3} F_a S_S$$ **Equation 2-1 (9.4.1.2.4-1) [11.4-3]**

And

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$$S_{D1} = \frac{2}{3} F_v S_1$$ **Equation 2-2 (9.4.1.2.4-2) [11.4-5]**

Where:

F_a = the short period Site Coefficient which is listed in Table 2-5. The values for F_a which correspond to values of S_S that fall between those listed in Table 2-5 may be obtained through linear interpolation.

F_v = the long period Site Coefficient which is listed in Table 2-6. The values for F_v which correspond to values of S_1 that fall between those listed in Table 2-6 may be obtained through linear interpolation.

S_{DS} = the Design Short Period Spectral Acceleration Parameter which has been corrected for the Site Class.

S_{D1} = the Design Long Period Spectral Acceleration Parameter which has been corrected for the Site Class.

S_S = the Mapped Short Period Acceleration Parameter for the MCE @ 5% damping.

S_1 = the Mapped Long Period Acceleration Parameter for the MCE @ 5% damping.

If not otherwise listed for the project, the structural engineer should be contacted for the values of S_{DS} and S_{D1}. These values are not only required to determine the design accelerations, but also to determine the Seismic Design Category for the building, which will be discussed next.

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Table S2-3; Mapped Acceleration Parameters for Selected U.S. Cities
2000/2003 IBC & 2006 IBC

STATE, CITY	ZIP CODE	S_S		S_1		STATE, CITY	ZIP CODE	S_S		S_1	
		2000 2003	2006	2000 2003	2006			2000 2003	2006	2000 2003	2006
Alabama	-------	------	------	------	------	**Illinois**	-------	------	------	------	------
Birmingham	35217	0.33	0.31	0.12	0.10	Chicago	60620	0.19	0.17	0.07	0.06
Mobile	36610	0.13	0.12	0.06	0.05	Moline	61265	0.14	0.14	0.06	0.06
Montgomery	36104	0.17	0.16	0.08	0.07	Peoria	61605	0.18	0.18	0.09	0.08
Arkansas	-------	------	------	------	------	Rock Island	61201	0.13	0.13	0.06	0.06
Little Rock	72205	0.48	0.50	0.18	0.16	Rockford	61108	0.17	0.15	0.06	0.06
Arizona	-------	------	------	------	------	Springfield	62703	0.27	0.29	0.12	0.11
Phoenix	85034	0.23	0.19	0.07	0.06	**Indiana**	-------	------	------	------	------
Tucson	85739	0.33	0.29	0.09	0.08	Evansville	47712	0.82	0.72	0.23	0.21
California	-------	------	------	------	------	Ft. Wayne	46835	0.17	0.15	0.06	0.06
Fresno	93706	0.76	0.78	0.30	0.29	Gary	46402	0.18	0.16	0.07	0.06
Los Angeles	90026	1.55	2.25	0.60	0.83	Indianapolis	46260	0.18	0.19	0.09	0.08
Oakland	94621	1.98	1.97	0.87	0.77	South Bend	46637	0.12	0.12	0.06	0.05
Sacramento	95823	0.59	0.64	0.23	0.25	**Kansas**	-------	------	------	------	------
San Diego	92101	1.61	1.62	0.86	0.82	Kansas City	66103	0.12	0.13	0.06	0.06
San Francisco	94114	1.50	1.61	0.86	0.82	Topeka	66614	0.19	0.17	0.06	0.05
San Jose	95139	2.17	1.60	0.78	0.60	Wichita	67217	0.14	0.14	0.06	0.05
Colorado	-------	------	------	------	------	**Kentucky**	-------	------	------	------	------
Colorado Springs	80913	0.18	0.22	0.06	0.06	Ashland	41101	0.22	0.19	0.09	0.07
Denver	80239	0.19	0.21	0.06	0.06	Covington	41011	0.19	0.18	0.09	0.08
Connecticut	-------	------	------	------	------	Louisville	40202	0.25	0.25	0.12	0.10
Bridgeport	06606	0.34	0.27	0.09	0.06	**Louisiana**	-------	------	------	------	------
Hartford	06120	0.27	0.24	0.09	0.06	Baton Rouge	70807	0.14	0.12	0.06	0.05
New Haven	06511	0.29	0.25	0.08	0.06	New Orleans	70116	0.13	0.11	0.06	0.05
Waterbury	06702	0.29	0.25	0.09	0.06	Shreveport	71106	0.17	0.15	0.08	0.07
Florida	-------	------	------	------	------	**Massachusetts**	-------	------	------	------	------
Ft. Lauderdale	33328	0.07	0.06	0.03	0.02	Boston	02127	0.33	0.28	0.09	0.07
Jacksonville	32222	0.14	0.14	0.07	0.06	Lawrence	01843	0.38	0.33	0.09	0.07
Miami	33133	0.06	0.05	0.02	0.02	Lowell	01851	0.36	0.31	0.09	0.07
St. Petersburg	33709	0.08	0.07	0.04	0.03	New Bedford	02740	0.26	0.22	0.08	0.06
Tampa	33635	0.08	0.07	0.03	0.03	Springfield	01107	0.26	0.23	0.09	0.07
Georgia	-------	------	------	------	------	Worchester	01602	0.27	0.24	0.09	0.07
Atlanta	30314	0.26	0.23	0.11	0.09	**Maryland**	-------	------	------	------	------
Augusta	30904	0.42	0.38	0.15	0.12	Baltimore	21218	0.20	0.17	0.06	0.05
Columbia	31907	0.17	0.15	0.09	0.07	**Maine**	-------	------	------	------	------
Savannah	31404	0.42	0.43	0.15	0.13	Augusta	04330	0.33	0.30	0.10	0.08
Iowa	-------	------	------	------	------	Portland	04101	0.37	0.32	0.10	0.08
Council Bluffs	41011	0.19	0.18	0.09	0.08	**Michigan**	-------	------	------	------	------
Davenport	52803	0.13	0.13	0.06	0.06	Detroit	48207	0.12	0.12	0.05	0.04
Des Moines	50310	0.07	0.08	0.04	0.04	Flint	48506	0.09	0.09	0.04	0.04
Iowa	-------	------	------	------	------	Grand Rapids	49503	0.09	0.09	0.04	0.04
Boise	83705	0.35	0.30	0.11	0.10	Kalamazoo	49001	0.12	0.11	0.05	0.05
Pocatello	83201	0.60	0.63	0.18	0.19	Lansing	48910	0.11	0.10	0.04	0.04

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FAX 614-889-0540
World Wide Web: www.kineticsnoise.com
E-mail: sales@kineticsnoise.com

Table 2-3 Continued; Mapped Acceleration Parameters for Selected U.S. Cities
2000/2003 IBC & 2006 IBC

STATE, CITY	ZIP CODE	S_S		S_1		STATE, CITY	ZIP CODE	S_S		S_1	
		2000 2003	2006	2000 2003	2006			2000 2003	2006	2000 2003	2006
Minnesota	-------	------	------	------	------	Raleigh	27610	0.22	0.21	0.10	0.08
Duluth	55803	0.06	0.06	0.02	0.02	Winston-Salem	27106	0.28	0.24	0.12	0.09
Minneapolis	55422	0.06	0.06	0.03	0.03	**North Dakota**	-------	------	------	------	------
Rochester	55901	0.06	0.06	0.03	0.03	Fargo	58103	0.07	0.08	0.02	0.02
St. Paul	55111	0.06	0.06	0.03	0.03	Grand Forks	58201	0.05	0.06	0.02	0.02
Missouri	-------	------	------	------	------	**Ohio**	-------	------	------	------	------
Carthage	64836	0.16	0.17	0.09	0.08	Akron	44312	0.18	0.17	0.06	0.05
Columbia	65202	0.19	0.21	0.10	0.09	Canton	44702	0.16	0.14	0.06	0.05
Jefferson City	65109	0.22	0.23	0.11	0.10	Cincinnati	45245	0.19	0.18	0.09	0.07
Joplin	64801	0.15	0.16	0.08	0.08	Cleveland	44130	0.20	0.19	0.06	0.05
Kansas City	64108	0.15	0.13	0.06	0.06	Columbus	43217	0.17	0.15	0.07	0.06
Springfield	65801	0.21	0.22	0.10	0.10	Dayton	45440	0.21	0.18	0.08	0.07
St. Joseph	64501	0.12	0.12	0.05	0.05	Springfield	45502	0.26	0.21	0.08	0.07
St. Louis	63166	0.59	0.58	0.19	0.17	Toledo	43608	0.17	0.16	0.06	0.05
Mississippi	-------	------	------	------	------	Youngstown	44515	0.17	0.16	0.06	0.05
Jackson	39211	0.19	0.20	0.10	0.09	**Oklahoma**	-------	------	------	------	------
Montana	-------	------	------	------	------	Oklahoma City	73145	0.34	0.33	0.09	0.07
Billings	59101	0.16	0.17	0.06	0.07	Tulsa	74120	0.16	0.16	0.07	0.07
Butte	59701	0.74	0.65	0.21	0.20	**Oregon**	-------	------	------	------	------
Great Falls	59404	0.29	0.26	0.09	0.09	Portland	97222	1.05	0.99	0.35	0.34
Nebraska	-------	------	------	------	------	Salem	97301	1.00	0.80	0.4	0.34
Lincoln	68502	0.18	0.18	0.05	0.05	**Pennsylvania**	-------	------	------	------	------
Omaha	68144	0.13	0.13	0.04	0.04	Allentown	18104	0.29	0.26	0.08	0.06
Nevada	-------	------	------	------	------	Bethlehem	18015	0.31	0.27	0.08	0.07
Las Vegas	89106	0.64	0.57	0.19	0.18	Erie	16511	0.17	0.16	0.05	0.05
Reno	89509	1.36	1.92	0.50	0.77	Harrisburg	17111	0.23	0.20	0.07	0.05
New Mexico	-------	------	------	------	------	Philadelphia	19125	0.33	0.27	0.08	0.06
Albuquerque	87105	0.63	0.59	0.19	0.18	Pittsburgh	15235	0.13	0.13	0.06	0.05
Santa Fe	87507	0.62	0.54	0.19	0.17	Reading	19610	0.30	0.26	0.08	0.06
New York	-------	------	------	------	------	Scranton	18504	0.23	0.20	0.08	0.06
Albany	12205	0.28	0.24	0.09	0.07	**Rhode Island**	-------	------	------	------	------
Binghamton	13903	0.19	0.17	0.07	0.06	Providence	02907	0.27	0.23	0.08	0.06
Buffalo	14222	0.32	0.28	0.07	0.06	**South Carolina**	-------	------	------	------	------
Elmira	14905	0.17	0.15	0.06	0.05	Charleston	29406	1.60	2.19	0.45	0.56
New York	10014	0.43	0.36	0.09	0.07	Columbia	29203	0.60	0.55	0.19	0.15
Niagara Falls	14303	0.31	0.28	0.07	0.06	**South Dakota**	-------	------	------	------	------
Rochester	14619	0.25	0.21	0.07	0.06	Rapid City	57703	0.16	0.17	0.04	0.04
Schenectady	12304	0.28	0.24	0.09	0.09	Sioux Falls	57104	0.11	0.11	0.04	0.03
Syracuse	13219	0.19	0.18	0.08	0.06	**Tennessee**	-------	------	------	------	------
Utica	13501	0.25	0.22	0.09	0.07	Chattanooga	37415	0.52	0.46	0.14	0.12
North Carolina	-------	------	------	------	------	Knoxville	37920	0.59	0.53	0.15	0.12
Charlotte	28216	0.35	0.32	0.14	0.11	Memphis	38109	1.40	1.40	0.42	0.38
Greensboro	27410	0.26	0.23	0.11	0.08	Nashville	49503	0.09	0.09	0.04	0.04

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International: 614-889-0480
FAX 614-889-0540
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Table 2-3 Continued; Mapped Acceleration Parameters for Selected U.S. Cities
2000/2003 IBC & 2006 IBC

STATE, CITY	ZIP CODE	S_S		S_1	
		2000 2003	2006	2000 2003	2006
Texas	-------	------	------	------	------
Amarillo	79111	0.17	0.18	0.05	0.04
Austin	78703	0.09	0.08	0.04	0.03
Beaumont	77705	0.12	0.10	0.05	0.04
Corpus Christi	78418	0.10	0.08	0.02	0.02
Dallas	75233	0.12	0.11	0.06	0.05
El Paso	79932	0.37	0.33	0.11	0.11
Ft. Worth	76119	0.11	0.11	0.06	0.05
Houston	77044	0.11	0.10	0.05	0.04
Lubbock	79424	0.10	0.11	0.03	0.03
San Antonio	78235	0.14	0.12	0.03	0.03
Waco	76704	0.10	0.09	0.05	0.04
Utah	-------	------	------	------	------
Salt Lake City	84111	1.82	1.71	0.78	0.09
Virginia	-------	------	------	------	------
Norfolk	23504	0.13	0.12	0.06	0.05
Richmond	23233	0.32	0.25	0.09	0.06
Roanoke	24017	0.30	0.26	0.10	0.08
Vermont	-------	------	------	------	------
Burlington	05401	0.47	0.40	0.13	0.10
Washington	-------	------	------	------	------
Seattle	98108	1.56	1.57	0.54	0.54
Spokane	99201	0.38	0.40	0.09	0.11
Tacoma	98402	1.24	1.22	0.40	0.42
Washington, D.C.	-------	------	------	------	------
Washington	20002	0.18	0.15	0.06	0.05
Wisconsin	-------	------	------	------	------
Green Bay	54302	0.07	0.06	0.03	0.03
Kenosha	53140	0.14	0.12	0.05	0.05
Madison	53714	0.12	0.11	0.05	0.04
Milwaukee	53221	0.12	0.11	0.05	0.05
Racine	53402	0.13	0.12	0.05	0.05
Superior	54880	0.06	0.06	0.02	0.2
West Virginia	-------	------	------	------	------
Charleston	25303	0.21	0.19	0.08	0.07
Huntington	25704	0.23	0.20	0.09	0.07
Wyoming	-------	------	------	------	------
Casper	82601	0.38	0.39	0.08	0.08
Cheyenne	82001	0.19	0.20	0.06	0.05
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FAX 614-889-0540
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E-mail: sales@kineticsnoise.com

Table 2-4; Mapped Acceleration Parameters for Selected International Cities
UFC 3-310-03A (1 March 2005)

COUNTRY, CITY	S_S	S_1	COUNTRY, CITY	S_S	S_1	COUNTRY, CITY	S_S	S_1
AFRICA	------	------	**Kenya**	------	------	**South Africa**	------	------
Algeria	------	------	Nairobi	0.62	0.28	Cape Town	1.24	0.56
Alger	1.24	0.56	**Lesotho**	------	------	Durban	0.62	0.28
Oran	1.24	0.56	Maseru	0.62	0.28	Johannesburg	0.62	0.28
Angola	------	------	**Liberia**	------	------	Natal	0.31	0.14
Luanda	0.06	0.06	Monrovia	0.31	0.14	Pretoria	0.62	0.28
Benin	------	------	**Libya**	------	------	**Swaziland**	------	------
Cotonou	0.06	0.06	Tripoli	0.62	0.28	Mbabane	0.62	0.28
otswana	------	------	Wheelus AFB	0.62	0.28	**Tanzania**	------	------
Gaborone	0.06	0.06	**Malagasy Republic**	------	------	Dar es Salaam	0.62	0.28
Burundi	------	------	Tananarive	0.06	0.06	Zanzibar	0.62	0.28
Bujumbura	1.24	0.56	**Malawi**	------	------	**Togo**	------	------
Cameroon	------	------	Blantyre	1.24	0.56	Lome	0.31	0.14
Douala	0.06	0.06	Lilongwe	1.24	0.56	**Tunisia**	------	------
Yaounde	0.06	0.06	Zomba	1.24	0.56	Tunis	1.24	0.56
Cape Verde	------	------	**Mali**	------	------	**Uganda**	------	------
Praia	0.06	0.06	[illegible]	[illegible]	[illegible]	Kampala	0.62	0.28
Central African Republic	------	------	[illegible]	[illegible]	[illegible]	**pper Volta**	------	------
Bangui	0.06	0.06	[illegible]	[illegible]	[illegible]	ugadougou	0.06	0.06
Chad	------	------	[illegible]	[illegible]	[illegible]	**Zaire**	------	------
Ndjamena	0.06	0.06	[illegible]	[illegible]	[illegible]	Bukavu	1.24	0.56
Congo	------	------	[illegible]	[illegible]	[illegible]	Kinshasa	0.06	0.06
Brazzaville	0.06	0.06	[illegible]	[illegible]	[illegible]	ubumbashi	0.62	0.28
Djibouti	------	------	[illegible]	[illegible]	[illegible]	**Zambia**	------	------
Djibouti	1.24	0.56	[illegible]	[illegible]	[illegible]	Lusaka	0.62	0.28
Egypt	------	------	Tangier	1.24	0.56	**Zimbabwe**	------	------
Alexandria	0.62	0.28	**Mozambique**	------	------	Harare	1.24	0.56
Cairo	0.62	0.28	Maputo	0.62	0.28	**ASIA**	------	------
Port Said	0.62	0.28	**Niger**	------	------	**Afghanistan**	------	------
Equatorial Guinea	------	------	Niamey	0.06	0.06	Kabul	1.65	0.75
Malabo	0.06	0.06	**Nigeria**	------	------	**Bahrain**	------	------
Ethiopia	------	------	Ibadan	0.06	0.06	Manama	0.06	0.06
Addis Ababa	1.24	0.56	Kaduna	0.06	0.06	**Bangladesh**	------	------
Asmara	1.24	0.56	Lagos	0.06	0.06	Dacca	1.24	0.56
Gabon	------	------	**Republic of Rwanda**	------	------	**Brunei**	------	------
Libreville	0.06	0.06	Kigali	1.24	0.56	Bandar Seri Begawan	0.31	0.14
Gambia	------	------	**Senegal**	------	------	**Burma**	------	------
Banjul	0.06	0.06	Dakar	0.06	0.06	Mandalay	1.24	0.56
Guinea	------	------	**Seychelles**	------	------	Rangoon	1.24	0.56
Bissau	0.31	0.14	Victoria	0.06	0.06	**China**	------	------
Conakry	0.06	0.06	**Sierra Leone**	------	------	Canton	0.62	0.28
Ivory Coast	------	------	Freetown	0.06	0.06	Chengdu	1.24	0.56
Abidijan	0.06	0.06	**Somalia**	------	------	Nanking	0.62	0.28
----------	------	------	Mogadishu	0.06	0.06	Peking	1.65	0.75

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UFC 3-310-03A (1 March 2005)

COUNTRY, CITY	S_S	S_1	COUNTRY, CITY	S_S	S_1	COUNTRY, CITY	S_S	S_1
ASIA	------	------	**Jordan**	------	------	**Thailand**	------	------
China	------	------	Amman	1.24	0.56	Bangkok	0.31	0.14
Shanghai	0.62	0.28	**Korea**	------	------	Chinmg Mai	0.62	0.28
Shengyang	1.65	0.75	Kwangju	0.31	0.14	Songkhia	0.06	0.06
Tibwa	1.65	0.75	Kimhae	0.31	0.14	Udom	0.31	0.14
Tsingtao	1.24	0.56	Pusan	0.31	0.14	**Turkey**	------	------
Wuhan	0.62	0.28	Seoul	0.06	0.06	Adana	0.62	0.28
Cyprus	------	------	**Kuwait**	------	------	Ankara	0.62	0.28
Nicosia	1.24	0.56	Kuwait	0.31	0.14	Istanbul	1.65	0.75
Hong Kong	------	------	**Laos**	------	------	Izmir	1.65	0.75
Hong Kong	0.62	0.28	Vientiane	0.31	0.14	Karamursel	1.24	0.56
India	------	------	**Lebanon**	------	------	**United Arab Emirates**	------	------
Bombay	1.24	0.56	Beirut	1.24	0.56	Abu Dhabi	0.06	0.06
Calcutta	0.62	0.28	**Malaysia**	------	------	Dubai	0.06	0.06
Madras	0.31					**Viet Nam**	------	------
New Delhi	1.24					o Chi Min City	0.06	0.06
Indonesia	------					**n Arab Republic**	------	------
Bandung	1.65					Sanaa	1.24	0.56
Jakarta	1.65					**TIC OCEAN AREA**	------	------
Medan	1.24					**Azorea**	------	------
Surabaya	1.65					All Locations	0.62	0.28
Iran	------					**Bermuda**	------	------
Isfahan	1.24					All Locations	0.31	0.14
Shiraz	1.24	0.56	Peshawar	1.65	0.75	**CARIBBEAN SEA**	------	------
Tabriz	1.65	0.75	**Quatar**	------	------	**Bahama Islands**	------	------
Tehran	1.65	0.75	Doha	0.06	0.06	All Locations	0.31	0.14
Iraq	------	------	**Saudi Arabia**	------	------	**Cuba**	------	------
Baghdad	1.24	0.56	Al Batin	0.31	0.14	All Locations	0.62	0.28
Basra	0.31	0.14	Dhahran	0.31	0.14	**Dominican Republic**	------	------
Israel	------	------	Jiddah	0.62	0.28	Santo Domingo	1.24	0.56
Haifa	1.24	0.56	Khamis Mushayf	0.31	0.14	**French West Indies**	------	------
Jerusalem	1.24	0.56	Riyadh	0.06	0.06	Martinique	1.24	0.56
Tel Aviv	1.24	0.56	**Singapore**	------	------	**Grenada**	------	------
Japan	------	------	All Locations	0.31	0.14	Saint Georges	1.24	0.56
Fukuoka	1.24	0.56	**South Yemen**	------	------	**Haiti**	------	------
Itazuke AFB	1.24	0.56	Aden City	1.24	0.56	Port au Prince	1.24	0.56
Misawa AFB	1.24	0.56	**Sri Lanka**	------	------	**Jamaica**	------	------
Naha, Okinawa	1.65	0.75	Colombo	0.06	0.06	Kingston	1.24	0.56
Osaka/Kobe	1.65	0.75	**Syria**	------	------	**Leeward Islands**	------	------
Sapporo	1.24	0.56	Aleppo	1.24	0.56	All Locations	1.24	0.56
Tokyo	1.65	0.75	Damascus	1.24	0.56	**Puerto Rico**	------	------
Wakkanai	1.24	0.56	**Taiwan**	------	------	All Locations	0.83	0.38
Yokohama	1.65	0.75	All Locations	1.65	0.75	**Trinidad & Tobago**	------	------
Yokota	1.65	0.75	----------	------	------	All Locations	1.24	0.56

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Table 2-4 Continued; Mapped Acceleration Parameters for Selected International Cities
UFC 3-310-03A (1 March 2005)

COUNTRY, CITY	S_S	S_1	COUNTRY, CITY	S_S	S_1	COUNTRY, CITY	S_S	S_1
Belize	------	------	**Denmark**	------	------	Trieste	1.24	0.56
Beimopan	0.62	0.28	Copenhagen	0.31	0.14	Turin	0.62	0.28
Canal Zone	------	------	**Finland**	------	------	**Luxembourg**	------	------
All Locations	0.62	0.28	Helsinki	0.31	0.14	Luxembourg	0.31	0.14
Costa Rica	------	------	**France**	------	------	**Malta**	------	------
San Jose	1.24	0.56	Bordeaux	0.62	0.28	Valletta	0.62	0.28
El Salvador	------	------	Lyon	0.31	0.14	**Netherlands**	------	------
San Slavador	1.65	0.75	Marseille	1.24	0.56	All Locations	0.06	0.06
Guatemala	------	------	Nice	1.24	0.56	**Norway**	------	------
Guatemala	1.65	0.75	Strasbourg	0.62	0.28	Oslo	0.62	0.28
Honduras	------	------	**Germany**	------	------	**Poland**	------	------
Tegucigalpa	1.24	0.56	Berlin	0.06	0.06	Krakow	0.62	0.28
Nicaragua	------	------	Bonn	0.62	0.28	Poznan	0.31	0.14
Managua	1.65	0.75	Bremen	0.06	0.06	Waraszawa	0.31	0.14
Panama	------	------	Düsseldorf	0.31	0.14	**Portugal**	------	------
Colon	1.24	0.56	Frankfurt	0.62	0.28	Lisbon	1.65	0.75
Galeta	0.83	0.28	Hamburg	0.06	0.06	Oporto	1.24	0.56
Panama	1.24	(				**mania**	------	------
Mexico	------	-				charest	1.24	0.56
Ciudad Juarez	0.62	(				**pain**	------	------
Guadalajara	1.24	(				celona	0.62	0.28
Hermosillo	1.24	(				ilbao	0.62	0.28
Matamoros	0.06	(				adrid	0.06	0.06
Mazatlan	0.60	(				Rota	0.62	0.28
Merida	0.06	(				eville	0.62	0.28
Mexico City	1.24	0.56	Sauda Bay	1.65	0.56	**Sweden**	------	------
Monterrey	0.06	0.06	Thessaloniki	1.65	0.56	Goteborg	0.62	0.28
Nuevo Laredo	0.06	0.06	**Hungary**	------	------	Stockholm	0.31	0.14
Tijuana	1.24	0.56	Budapest	0.62	0.28	**Switzerland**	------	------
EUROPE	------	------	**Iceland**	------	------	Bern	0.62	0.28
Albania	------	------	Keflavick	1.24	0.56	Geneva	0.31	0.14
Tirana	1.24	0.56	Reykjavik	1.65	0.75	Zurich	0.62	0.28
Austria	------	------	**Ireland**	------	------	**United Kingdom**	------	------
Salzburg	0.62	0.28	Dublin	0.06	0.06	Belfast	0.06	0.06
Vienna	0.62	0.28	**Italy**	------	------	Edinburgh	0.31	0.14
Belgium	------	------	Aviano AFB	1.24	0.56	Edzell	0.31	0.14
Antwerp	0.31	0.14	Brindisi	0.06	0.06	Glasgow/Renfrew	0.31	0.14
Brussels	0.62	0.28	Florence	1.24	0.56	Hamilton	0.31	0.14
Bulgaria	------	------	Genoa	1.24	0.56	Liverpool	0.31	0.14
Sofia	1.24	0.56	Milan	0.62	0.28	London	0.62	0.28
Czechoslovakia	------	------	Naples	1.24	0.56	Londonderry	0.31	0.14
Bratislava	0.62	0.28	Palermo	1.24	0.56	Thurso	0.31	0.14
Prague	0.31	0.14	Rome	0.62	0.28	**U. S. S. R.**	------	------
----------	------	------	Sicily	1.24	0.56	Kiev	0.06	0.06

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Table 2-4 Continued; Mapped Acceleration Parameters for Selected International Cities
UFC 3-310-03A (1 March 2005)

COUNTRY, CITY	S_S	S_1	COUNTRY, CITY	S_S	S_1	COUNTRY, CITY	S_S	S_1
U. S. S. R.	------	------	Valparaiso	1.65	0.75	Baguio	1.24	0.56
Leningrad	0.06	0.06	**Colombia**	------	------	**Samoa**	------	------
Moscow	0.06	0.06	Bogotá	1.24	0.56	All Locations	1.24	0.56
Yugoslavia	------	------	**Ecuador**	------	------	**Wake Island**	------	------
Belgrade	0.62	0.28	Quito	1.65	0.75	All Locations	0.06	0.06
Zagreb	1.24	0.56	Guayaquil	1.24	0.56	----------	------	------
NORTH AMERICA	------	------	**Paraguay**	------	------	----------	------	------
Greenland	------	------	Asuncion	0.06	0.06	----------	------	------
All Locations	0.31	0.14	**Peru**	------	------	----------	------	------
Canada	------	------	Lima	1.65	0.75	----------	------	------
Argentia NAS	0.62	0.28	Piura	1.65	0.75	----------	------	------
Calgary, Alb	0.31	0.14	**Uruguay**	------	------	----------	------	------
Churchill, Man	0.06	0.06	Montevideo	0.06	0.06	----------	------	------
Cold Lake, Alb	0.31	0.14	**Venezuela**	------	------	----------	------	------
Edmonton, Alb	0.31	0.14	Maracaibo	0.62	0.28	----------	------	------
East Harmon AFB	0.62	0.28	Caracas	1.65	0.75	----------	------	------
Fort Williams, Ont.	0.06	0.06	**PACIFIC OCEAN AREA**			----------	------	------
Frobisher N. W. Ter.	0.06	0				----------	------	------
Goose Airport	0.31	0				----------	------	------
Halifax	0.31	0				----------	------	------
Montreal, Quebec	1.24	0				----------	------	------
Ottawa, Ont.	0.31	0				----------	------	------
St. John's, Nfld.	1.24	0				----------	------	------
Toronto, Ont.	0.31	0				----------	------	------
Vancouver	1.24	0				----------	------	------
Winnipeg, Man.	0.31	0.14	Ponape	0.06	0.06	----------	------	------
SOUTH AMERICA	------	------	**Fiji**	------	------	----------	------	------
Argentina	------	------	Suva	1.24	0.56	----------	------	------
Buenos Aires	0.25	0.10	**Johnson Island**	------	------	----------	------	------
Brazil	------	------	All Locations	0.31	0.14	----------	------	------
Belem	0.06	0.06	**Mariana Islands**	------	------	----------	------	------
Belo Horizonte	0.06	0.06	Guam	1.24	0.56	----------	------	------
Brasilia	0.06	0.06	Saipan	1.24	0.56	----------	------	------
Manaus	0.06	0.06	Tinian	1.24	0.56	----------	------	------
Porto Allegre	0.06	0.06	**Marshall Islands**	------	------	----------	------	------
Recife	0.06	0.06	All Locations	0.31	0.14	----------	------	------
Rio de Janeiro	0.06	0.06	**New Zealand**	------	------	----------	------	------
Salvador	0.06	0.06	Auckland	1.24	0.56	----------	------	------
Sao Paulo	0.31	0.14	Wellington	1.65	0.75	----------	------	------
Bolivia	------	------	**Papua New Guinea**	------	------	----------	------	------
La Paz	1.24	0.56	Port Moresby	1.65	0.75	----------	------	------
Santa Cruz	0.31	0.14	**Philippine Islands**	------	------	----------	------	------
Chile	------	------	Cebu	1.65	0.75	----------	------	------
Santiago	1.65	0.75	Manila	1.65	0.75	----------	------	------

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Table 2-5; Short Period Site Coefficient, F_a (Table 9.4.1.2.4a) [Table 11.4-1]

SITE CLASS	MAPPED MCE SHORT PERIOD SPECTRAL RESPONSE ACCELERATION PARAMETER (LINEAR INTERPOLATION IS PERMITTED)				
	$S_S \leq 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \geq 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	These values to be determined by site response analysis.				

Table 2-6; Long Period Site Coefficient, F_v (Table 9.4.1.2.4b) [Table 11.4-2]

SITE CLASS	MAPPED MCE LONG PERIOD SPECTRAL RESPONSE ACCELERATION PARAMETER (LINEAR INTERPOLATION IS PERMITTED)				
	$S_1 \leq 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \geq 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	These values to be determined by site response analysis.				

D2.1 – 2.5 Seismic Design Category (Section 9.4.2.1) [Section 11.6]:

This parameter is of great importance to everyone involved with MEP systems. The Seismic Design Category to which a building has been assigned will determine whether seismic restraints are required or not, and if they qualify for exemption, which MEP components may be exempted, and which will need to have seismic restraints selected and installed. The MEP components within

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a building will be assigned to the same Seismic Design Category as the building itself. There are six Seismic Design Categories, A, B, C, D, E, and F. The level of restraint required increases from Seismic Design Category A through F. Up through Seismic Design Category D, the Seismic Design Category to which a building or structure is assigned is determined though the use of Tables 2-6 and 2-7.

To determine the Seismic Design Category both the Long (S_{D1}) and Short (S_{DS}) Period Design Response Acceleration Parameter must be determined. The most stringent Seismic Design Category, resulting from the two acceleration parameters, will be assigned to the project.

For Occupancy I, II, or III (Seismic Use Group I or II) structures, if the Mapped Spectral Response Acceleration Parameter is greater than or equal to 0.75, $S_1 \geq 0.75$, then the structure will be assigned to Seismic Design Category E. For Occupancy Category IV (Seismic Use Group III) structures, if the Mapped Spectral Response Acceleration Parameter is greater than or equal to 0.75, $S_1 \geq 0.75$, then the structure will be assigned to Seismic Design Category F. To ensure consistency, the Seismic Design Category should be determined by the structural engineer.

Table 2-7; Seismic Design Category Based on the Short Period Design Response Acceleration Parameter (Table 9.4.2.1a) [Table 11.6-1]

VALUE OF S_{DS}	OCCUPANCY CATEGORY (SEISMIC USE GROUP)		
	I or II (I)	III (II)	IV (III)
$S_{DS} < 0.167$	A	A	A
$0.167 \leq S_{DS} < 0.33$	B	B	C
$0.33 \leq S_{DS} < 0.50$	C	C	D
$0.50 \leq S_{DS}$	D	D	D

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Table 2-8; Seismic Design Category Based on the Long Period Design Response Acceleration Parameter (Table 9.4.2.1b) [Table 11.6-2]

VALUE OF S_{D1}	OCCUPANCY CATEGORY (SEISMIC DESIGN CATEGORY)		
	I or II (I)	III (II)	IV (III)
$S_{D1} < 0.067$	A	A	A
$0.067 \le S_{D1} < 0.133$	B	B	C
$0.133 \le S_{D1} < 0.20$	C	C	D
$0.20 \le S_{D1}$	D	D	D

D2.1 – 2.6 Summary:

The following parameters will be required by the design professionals having responsibility for MEP systems in a building, and should be determined by the structural engineer of record.

1. Occupancy Category (Seismic Use Group for 2000/2003 IBC): This defines the building use and specifies which buildings are required for emergency response or disaster recovery.
2. Seismic Design Category: This determines whether or not seismic restraint is required.
3. Short Period Design Response Acceleration Parameter (S_{DS}): This value is used to compute the horizontal seismic force used to design and/or select seismic restraints required.

These parameters should be repeated in the specification and drawing package for the particular system, mechanical, electrical, or plumbing, in question.

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