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Modification of ground motions for use in Central North America: southern Illinois surface ground motions for structural analysis



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ABSTRACT

The lack of ground motion time history records with a 1000-year return period hazard for Central North America (CNA) often requires earthquake engineering researchers in the area to develop ground motions of their own. This report briefly describes a procedure for developing 1000-year return period ground motion time history records, and this procedure was applied for 10 sites in southern Illinois. Accompanying this report are 20 individual ground motion time history records developed at each of the 10 sites (for a total of 200 ground motions). These ground motions may be useful for various purposes including in dynamic structural analyses of bridges and other structures in southern Illinois (and potentially other CNA regions). The accompanying ground motions are developed following the detailed procedure presented in Kozak *et al.* [2017].

CONTENTS

	Page
ABSTRACT.....	I
CONTENTS.....	II
1 METHODOLOGY	1
2 GROUND MOTION RECORDS	2
REFERENCES.....	10

METHODOLOGY

Established procedures were used to modify existing ground motions such that they are appropriate for use as 1000-year return period hazard time histories in southern Illinois. The procedure used to modify the existing ground motions to usable ground motion time history records at 10 sites in southern Illinois (Anna, Benton, Cairo, Carbondale, East St. Louis, Eldorado, Elizabethtown, Mount Carmel, Salem, and Sparta) is briefly described in this report; for a more detailed description of the procedure, please refer to Kozak *et al.* [2017].

The first step is to begin with an existing ground motion time history. For the purpose of this study, the 138 Central and Eastern North America-appropriate ground motions presented in the NUREG/CR-6728 report [McGuire *et al.*, 2001] provide a sufficient number of ground motions as the basis for the process. These initial time history records act as seeds, which are then heavily modified in order to create time histories appropriate for southern Illinois. The selected ground motions are within reasonable magnitude and source-to-site distance ranges when compared to each site's median deaggregation results for a 1000-year return period event.

Conditional mean spectra (CMS) are then created at each site and conditioned upon a range of periods. The selected conditional periods (T^*) are 0.2 s, 0.3 s, 0.5 s, 1.0 s, and 2.0 s. These conditional periods indicate the point at which the CMS and uniform hazard response spectrum (UHS) are equivalent, and five of them are selected in order to promote the excitation of structural components having various fundamental periods. Once the CMS are produced, four initial ground motions that have similar spectral shapes to each of the five CMS are selected, leading to 20 initial ground motions being selected for each site. These 20 initial ground motions are further modified to match the shape of the CMS through the inclusion of wavelets in the time domain.

These ground motion time history records that match the CMS in the spectral domain are the ground motions at the bedrock level. It is often more desirable to acquire a surface level time history; therefore, the bedrock level time history records are further modified by propagating them through a soil profile appropriate for the site. Two general types of geology are found to be appropriate for southern Illinois – alluvial and non-alluvial – so the ground motions are propagated through one of these two soil profiles, depending on the site. The resulting ground motion time history records after propagation through the soil profiles are the surface level ground motions that can be used in dynamic structural analyses.

GROUND MOTION RECORDS

The surface level ground motion time history record files are provided along with this report. Each file comprises a single time history whose name is indicated in both the file name and in the header of the file. Also included in the header of the file is the southern Illinois site that it is created for, the number of time steps (NPTS), the time step size (DT), and the absolute maximum acceleration (in g). Please note that the acceleration unit used in the time histories is g 's.

The data provided in Table 1 below repeats the information that can be found in the header of each file, along with other data that may help the user to better understand the origin and modification process used to produce the final surface level ground motion time history.

Table 1: Details of the ground motion time history records

Time History Name	Site	Site Geology	Conditional Period, T^* (s)	Time Step Size, DT (s)	Time Steps, $NPTS$	Maximum Acceleration, a_{max} (g)	Initial Time History ¹
Ana01	Anna, IL	Non-Alluvial	0.2	0.005	7475	0.218121	M75D010.050\GBZ\GBZ270
Ana02	Anna, IL	Non-Alluvial	0.2	0.005	16670	0.207523	M75D010.050\TCU046\TCU046-W
Ana03	Anna, IL	Non-Alluvial	0.2	0.005	17468	0.227811	M75D000.010\TCU128\TCU128-W
Ana04	Anna, IL	Non-Alluvial	0.2	0.005	6984	0.236641	M75D010.050\GYN\GYN090
Ana05	Anna, IL	Non-Alluvial	0.3	0.005	7512	0.221797	M75D010.050\GBZ\GBZ270
Ana06	Anna, IL	Non-Alluvial	0.3	0.005	16644	0.222616	M75D010.050\TCU046\TCU046-W
Ana07	Anna, IL	Non-Alluvial	0.3	0.005	17222	0.2143	M75D000.010\TCU128\TCU128-W
Ana08	Anna, IL	Non-Alluvial	0.3	0.005	6905	0.22405	M75D010.050\GYN\GYN090
Ana09	Anna, IL	Non-Alluvial	0.5	0.005	7342	0.201216	M75D010.050\GBZ\GBZ270
Ana10	Anna, IL	Non-Alluvial	0.5	0.005	16643	0.217924	M75D010.050\TCU046\TCU046-W
Ana11	Anna, IL	Non-Alluvial	0.5	0.005	17333	0.197528	M75D000.010\TCU128\TCU128-W
Ana12	Anna, IL	Non-Alluvial	0.5	0.005	7020	0.219437	M75D010.050\GYN\GYN090
Ana13	Anna, IL	Non-Alluvial	1.0	0.005	11407	0.242094	M75D050.100\ABY\ABY000
Ana14	Anna, IL	Non-Alluvial	1.0	0.005	11144	0.225645	M75D050.100\ABY\ABY090
Ana15	Anna, IL	Non-Alluvial	1.0	0.005	7224	0.217198	M75D010.050\GBZ\GBZ270
Ana16	Anna, IL	Non-Alluvial	1.0	0.005	16686	0.216351	M75D010.050\TCU046\TCU046-W

Ana17	Anna, IL	Non-Alluvial	2.0	0.005	11487	0.199546	M75D050.100\ABY\ABY000
Ana18	Anna, IL	Non-Alluvial	2.0	0.005	7204	0.192424	M75D010.050\GBZ\GBZ270
Ana19	Anna, IL	Non-Alluvial	2.0	0.005	11349	0.206127	M75D050.100\ABY\ABY090
Ana20	Anna, IL	Non-Alluvial	2.0	0.005	16651	0.197445	M75D010.050\TCU046\TCU046-W
Ben01	Benton, IL	Alluvial	0.2	0.005	8107	0.210185	M65D050.100\SOR\SOR225
Ben02	Benton, IL	Alluvial	0.2	0.005	8208	0.189216	M65D050.100\SOR\SOR315
Ben03	Benton, IL	Alluvial	0.2	0.005	10710	0.183885	M75D050.100\ABY\ABY000
Ben04	Benton, IL	Alluvial	0.2	0.005	6811	0.209711	M65D050.100\SOD\SOD015
Ben05	Benton, IL	Alluvial	0.3	0.005	8034	0.185412	M65D050.100\SOR\SOR225
Ben06	Benton, IL	Alluvial	0.3	0.005	8196	0.205726	M65D050.100\SOR\SOR315
Ben07	Benton, IL	Alluvial	0.3	0.005	18214	0.17651	M75D050.100\HWA026\HWA026-W
Ben08	Benton, IL	Alluvial	0.3	0.005	16156	0.18036	M75D050.100\ILA031\ILA031-N
Ben09	Benton, IL	Alluvial	0.5	0.005	12547	0.15811	M75D100.200\TAP072\TAP072-N
Ben10	Benton, IL	Alluvial	0.5	0.005	18106	0.167106	M75D050.100\HWA026\HWA026-N
Ben11	Benton, IL	Alluvial	0.5	0.005	6467	0.1924	M75D050.100\TCU025\TCU025-N
Ben12	Benton, IL	Alluvial	0.5	0.005	16151	0.174666	M75D050.100\ILA031\ILA031-N
Ben13	Benton, IL	Alluvial	1.0	0.005	12479	0.165843	M75D100.200\TAP072\TAP072-N
Ben14	Benton, IL	Alluvial	1.0	0.005	16708	0.153059	M75D050.100\ILA051\ILA051-N
Ben15	Benton, IL	Alluvial	1.0	0.005	16250	0.145957	M75D100.200\TAP067\TAP067-N
Ben16	Benton, IL	Alluvial	1.0	0.005	18152	0.153079	M75D050.100\HWA026\HWA026-N
Ben17	Benton, IL	Alluvial	2.0	0.005	16641	0.149096	M75D050.100\ILA051\ILA051-N
Ben18	Benton, IL	Alluvial	2.0	0.005	16209	0.151887	M75D100.200\TAP067\TAP067-N
Ben19	Benton, IL	Alluvial	2.0	0.005	12408	0.145844	M75D100.200\TAP072\TAP072-N
Ben20	Benton, IL	Alluvial	2.0	0.005	18638	0.140987	M75D100.200\TAP075\TAP075-N
Cro01	Cairo, IL	Alluvial	0.2	0.005	19666	0.284788	M75D000.010\TCU089\TCU089-N
Cro02	Cairo, IL	Alluvial	0.2	0.005	15691	0.291466	M75D000.010\TCU120\TCU120-N
Cro03	Cairo, IL	Alluvial	0.2	0.005	18824	0.326537	M75D000.010\LCN\LCN260

Cro04	Cairo, IL	Alluvial	0.2	0.005	19130	0.342944	M75D000.010\LCN\LCN 345
Cro05	Cairo, IL	Alluvial	0.3	0.005	19810	0.273706	M75D000.010\TCU089\ TCU089-N
Cro06	Cairo, IL	Alluvial	0.3	0.005	15728	0.304421	M75D000.010\TCU120\ TCU120-N
Cro07	Cairo, IL	Alluvial	0.3	0.005	18841	0.276097	M75D000.010\LCN\LCN 260
Cro08	Cairo, IL	Alluvial	0.3	0.005	18856	0.305731	M75D000.010\LCN\LCN 345
Cro09	Cairo, IL	Alluvial	0.5	0.005	18942	0.316152	M75D000.010\TCU089\ TCU089-N
Cro10	Cairo, IL	Alluvial	0.5	0.005	18838	0.260068	M75D000.010\TCU120\ TCU120-N
Cro11	Cairo, IL	Alluvial	0.5	0.005	15746	0.304945	M75D000.010\LCN\LCN 260
Cro12	Cairo, IL	Alluvial	0.5	0.005	19882	0.286011	M75D000.010\LCN\LCN 345
Cro13	Cairo, IL	Alluvial	1.0	0.005	18976	0.304959	M75D000.010\TCU120\ TCU120-N
Cro14	Cairo, IL	Alluvial	1.0	0.005	15674	0.326543	M75D000.010\LCN\LCN 260
Cro15	Cairo, IL	Alluvial	1.0	0.005	15734	0.30476	M75D000.010\LCN\LCN 345
Cro16	Cairo, IL	Alluvial	1.0	0.005	19872	0.297101	M75D010.050\TCU047\ TCU047-W
Cro17	Cairo, IL	Alluvial	2.0	0.005	18849	0.287035	M75D000.010\LCN\LCN 260
Cro18	Cairo, IL	Alluvial	2.0	0.005	15786	0.313557	M75D000.010\LCN\LCN 345
Cro19	Cairo, IL	Alluvial	2.0	0.005	15719	0.320165	M75D000.010\TCU120\ TCU120-W
Cro20	Cairo, IL	Alluvial	2.0	0.005	19874	0.314394	M75D010.050\TCU047\ TCU047-W
Car01	Carbondale, IL	Non- Alluvial	0.2	0.005	11275	0.188781	M75D050.100\ABY\ABY 000
Car02	Carbondale, IL	Non- Alluvial	0.2	0.005	6688	0.201611	M75D010.050\GYN\GY N090
Car03	Carbondale, IL	Non- Alluvial	0.2	0.005	7327	0.204026	M75D010.050\MDR\MD R090
Car04	Carbondale, IL	Non- Alluvial	0.2	0.005	11410	0.185775	M75D050.100\ABY\ABY 090
Car05	Carbondale, IL	Non- Alluvial	0.3	0.005	7289	0.186337	M75D010.050\MDR\MD R090
Car06	Carbondale, IL	Non- Alluvial	0.3	0.005	18612	0.194689	M75D050.100\HWA026 \HWA026-N
Car07	Carbondale, IL	Non- Alluvial	0.3	0.005	18738	0.198628	M75D010.050\TCU015\ TCU015-W
Car08	Carbondale, IL	Non- Alluvial	0.3	0.005	11387	0.189644	M75D050.100\ABY\ABY 000
Car09	Carbondale, IL	Non- Alluvial	0.5	0.005	11352	0.209869	M75D050.100\ABY\ABY 000
Car10	Carbondale, IL	Non- Alluvial	0.5	0.005	18671	0.179722	M75D050.100\HWA026 \HWA026-N

Car11	Carbondale, IL	Non-Alluvial	0.5	0.005	17183	0.178413	M75D050.100\ILA051\LA051-W
Car12	Carbondale, IL	Non-Alluvial	0.5	0.005	18733	0.192198	M75D010.050\TCU015\TCU015-W
Car13	Carbondale, IL	Non-Alluvial	1.0	0.005	11200	0.165472	M75D050.100\ABY\ABY000
Car14	Carbondale, IL	Non-Alluvial	1.0	0.005	18631	0.181784	M75D050.100\HWA026\HWA026-N
Car15	Carbondale, IL	Non-Alluvial	1.0	0.005	17112	0.189865	M75D050.100\ILA051\LA051-W
Car16	Carbondale, IL	Non-Alluvial	1.0	0.005	18791	0.185841	M75D010.050\TCU015\TCU015-W
Car17	Carbondale, IL	Non-Alluvial	2.0	0.005	18360	0.180916	M75D050.100\HWA026\HWA026-W
Car18	Carbondale, IL	Non-Alluvial	2.0	0.005	18590	0.172274	M75D050.100\HWA026\HWA026-N
Car19	Carbondale, IL	Non-Alluvial	2.0	0.005	11169	0.172025	M75D050.100\ABY\ABY000
Car20	Carbondale, IL	Non-Alluvial	2.0	0.005	16897	0.168846	M75D050.100\TAP035\TAP035-N
ESL01	E. St. Louis, IL	Alluvial	0.2	0.005	8880	0.153476	M65D100.200\A-SON\A-SON303
ESL02	E. St. Louis, IL	Alluvial	0.2	0.005	8355	0.145651	M75D050.100\RM\RIV270
ESL03	E. St. Louis, IL	Alluvial	0.2	0.005	11908	0.136991	M65D100.200\RM\RIV180
ESL04	E. St. Louis, IL	Alluvial	0.2	0.005	11876	0.142843	M75D050.100\PLC\PLC090
ESL05	E. St. Louis, IL	Alluvial	0.3	0.005	8283	0.16502	M75D100.200\SUL\SUL320
ESL06	E. St. Louis, IL	Alluvial	0.3	0.005	8231	0.140629	M65D100.200\A-SON\A-SON303
ESL07	E. St. Louis, IL	Alluvial	0.3	0.005	11939	0.135405	M75D100.200\SUL\SUL230
ESL08	E. St. Louis, IL	Alluvial	0.3	0.005	8846	0.147504	M65D100.200\MA1\MA1220
ESL09	E. St. Louis, IL	Alluvial	0.5	0.005	14086	0.134712	M75D100.200\SER\SER000
ESL10	E. St. Louis, IL	Alluvial	0.5	0.005	16734	0.112785	M75D100.200\TAP060\TAP060-W
ESL11	E. St. Louis, IL	Alluvial	0.5	0.005	11876	0.12418	M75D100.200\GRN\GRN270
ESL12	E. St. Louis, IL	Alluvial	0.5	0.005	16033	0.116106	M75D100.200\TAP078\TAP078-W
ESL13	E. St. Louis, IL	Alluvial	1.0	0.005	14065	0.111353	M75D100.200\SER\SER000
ESL14	E. St. Louis, IL	Alluvial	1.0	0.005	16018	0.0842943	M75D100.200\KSH\KSH-L1
ESL15	E. St. Louis, IL	Alluvial	1.0	0.005	9934	0.0921158	M75D100.200\TAP069\TAP069-N
ESL16	E. St. Louis, IL	Alluvial	1.0	0.005	11746	0.0953182	M75D100.200\GRN\GRN270
ESL17	E. St. Louis, IL	Alluvial	2.0	0.005	13966	0.125356	M75D100.200\SUL\SUL320

ESL18	E. St. Louis, IL	Alluvial	2.0	0.005	9881	0.0978836	M75D100.200\TAP078\TAP078-N
ESL19	E. St. Louis, IL	Alluvial	2.0	0.005	13383	0.105594	M75D100.200\KSH\KSH-T1
ESL20	E. St. Louis, IL	Alluvial	2.0	0.005	13398	0.0958478	M75D100.200\SER\SER270
Eld01	Eldorado, IL	Non-Alluvial	0.2	0.005	8354	0.17777	M65D050.100\SOR\SOR225
Eld02	Eldorado, IL	Non-Alluvial	0.2	0.005	8377	0.175251	M65D050.100\SOR\SOR315
Eld03	Eldorado, IL	Non-Alluvial	0.2	0.005	11005	0.181871	M75D050.100\ABY\ABY000
Eld04	Eldorado, IL	Non-Alluvial	0.2	0.005	10814	0.191389	M75D050.100\ABY\ABY090
Eld05	Eldorado, IL	Non-Alluvial	0.3	0.005	8404	0.164581	M65D050.100\SOR\SOR225
Eld06	Eldorado, IL	Non-Alluvial	0.3	0.005	8352	0.18874	M65D050.100\SOR\SOR315
Eld07	Eldorado, IL	Non-Alluvial	0.3	0.005	18373	0.175547	M75D050.100\HWA026\HWA026-W
Eld08	Eldorado, IL	Non-Alluvial	0.3	0.005	16389	0.186457	M75D050.100\ILA031\ILA031-N
Eld09	Eldorado, IL	Non-Alluvial	0.5	0.005	18251	0.174524	M75D050.100\HWA026\HWA026-N
Eld10	Eldorado, IL	Non-Alluvial	0.5	0.005	10884	0.181048	M75D050.100\ABY\ABY000
Eld11	Eldorado, IL	Non-Alluvial	0.5	0.005	16826	0.171779	M75D050.100\ILA051\ILA051-W
Eld12	Eldorado, IL	Non-Alluvial	0.5	0.005	16363	0.18185	M75D050.100\ILA031\ILA031-N
Eld13	Eldorado, IL	Non-Alluvial	1.0	0.005	12646	0.153474	M75D100.200\TAP072\TAP072-N
Eld14	Eldorado, IL	Non-Alluvial	1.0	0.005	16303	0.158828	M75D100.200\TAP067\TAP067-N
Eld15	Eldorado, IL	Non-Alluvial	1.0	0.005	6648	0.161716	M75D050.100\TCU025\TCU025-N
Eld16	Eldorado, IL	Non-Alluvial	1.0	0.005	18212	0.163729	M75D050.100\HWA026\HWA026-N
Eld17	Eldorado, IL	Non-Alluvial	2.0	0.005	12705	0.129517	M75D100.200\TAP072\TAP072-N
Eld18	Eldorado, IL	Non-Alluvial	2.0	0.005	17149	0.139929	M75D050.100\ILA051\ILA051-N
Eld19	Eldorado, IL	Non-Alluvial	2.0	0.005	16232	0.149955	M75D100.200\TAP067\TAP067-N
Eld20	Eldorado, IL	Non-Alluvial	2.0	0.005	18254	0.132722	M75D050.100\HWA026\HWA026-N
Elz01	Elizabethtown, IL	Non-Alluvial	0.2	0.005	8871	0.179359	M65D050.100\SOR\SOR225
Elz02	Elizabethtown, IL	Non-Alluvial	0.2	0.005	8630	0.191346	M65D050.100\SOR\SOR315
Elz03	Elizabethtown, IL	Non-Alluvial	0.2	0.005	6794	0.186179	M75D010.050\GYN\GYN090
Elz04	Elizabethtown, IL	Non-Alluvial	0.2	0.005	11309	0.194638	M75D050.100\ABY\ABY000

Elz05	Elizabethtown, IL	Non-Alluvial	0.3	0.005	11293	0.152271	M75D050.100\ABY\ABY000
Elz06	Elizabethtown, IL	Non-Alluvial	0.3	0.005	18711	0.184947	M75D050.100\HWA026\HWA026-N
Elz07	Elizabethtown, IL	Non-Alluvial	0.3	0.005	17300	0.204734	M75D050.100\ILA051\ILA051-W
Elz08	Elizabethtown, IL	Non-Alluvial	0.3	0.005	7314	0.181253	M75D010.050\MDR\MDR090
Elz09	Elizabethtown, IL	Non-Alluvial	0.5	0.005	17298	0.188532	M75D050.100\TAP035\TAP035-N
Elz10	Elizabethtown, IL	Non-Alluvial	0.5	0.005	18697	0.150857	M75D050.100\HWA026\HWA026-N
Elz11	Elizabethtown, IL	Non-Alluvial	0.5	0.005	17301	0.181465	M75D050.100\ILA051\ILA051-W
Elz12	Elizabethtown, IL	Non-Alluvial	0.5	0.005	18788	0.159487	M75D010.050\TCU015\TCU015-W
Elz13	Elizabethtown, IL	Non-Alluvial	1.0	0.005	16365	0.157191	M75D050.100\ILA031\ILA031-N
Elz14	Elizabethtown, IL	Non-Alluvial	1.0	0.005	18600	0.148941	M75D050.100\HWA026\HWA026-N
Elz15	Elizabethtown, IL	Non-Alluvial	1.0	0.005	17351	0.167713	M75D050.100\ILA051\ILA051-W
Elz16	Elizabethtown, IL	Non-Alluvial	1.0	0.005	11927	0.185636	M75D050.100\ABY\ABY000
Elz17	Elizabethtown, IL	Non-Alluvial	2.0	0.005	18505	0.163481	M75D050.100\HWA026\HWA026-N
Elz18	Elizabethtown, IL	Non-Alluvial	2.0	0.005	7217	0.15907	M75D050.100\TCU025\TCU025-N
Elz19	Elizabethtown, IL	Non-Alluvial	2.0	0.005	16360	0.156801	M75D050.100\ILA031\ILA031-N
Elz20	Elizabethtown, IL	Non-Alluvial	2.0	0.005	12368	0.161715	M75D050.100\SIL\SIL090
MtC01	Mt. Carmel, IL	Alluvial	0.2	0.005	8900	0.157892	M65D100.200\RM\RIV270
MtC02	Mt. Carmel, IL	Alluvial	0.2	0.005	12639	0.16382	M65D050.100\WWJ\WWJ090
MtC03	Mt. Carmel, IL	Alluvial	0.2	0.005	6840	0.173206	M65D050.100\SLO\SLO234
MtC04	Mt. Carmel, IL	Alluvial	0.2	0.005	7188	0.160833	M65D100.200\MA2\MA2130
MtC05	Mt. Carmel, IL	Alluvial	0.3	0.005	8935	0.135863	M65D100.200\MA1\MA1220
MtC06	Mt. Carmel, IL	Alluvial	0.3	0.005	7148	0.1521	M65D100.200\ISD\ISD014
MtC07	Mt. Carmel, IL	Alluvial	0.3	0.005	9037	0.140122	M65D100.200\MA2\MA2130
MtC08	Mt. Carmel, IL	Alluvial	0.3	0.005	8883	0.171756	M65D100.200\SON\SON033
MtC09	Mt. Carmel, IL	Alluvial	0.5	0.005	8319	0.165342	M75D050.100\FER\FER-L1
MtC10	Mt. Carmel, IL	Alluvial	0.5	0.005	11918	0.128892	M75D050.100\FER\FER-T1
MtC11	Mt. Carmel, IL	Alluvial	0.5	0.005	8307	0.12362	M75D050.100\RM\RIV270

MtC12	Mt. Carmel, IL	Alluvial	0.5	0.005	11889	0.123617	M65D100.200\RM\RIV180
MtC13	Mt. Carmel, IL	Alluvial	1.0	0.005	14062	0.10549	M75D100.200\GRN\GRN180
MtC14	Mt. Carmel, IL	Alluvial	1.0	0.005	16735	0.128328	M75D100.200\SER\SER000
MtC15	Mt. Carmel, IL	Alluvial	1.0	0.005	16089	0.0930036	M75D100.200\TAP060\TAP060-W
MtC16	Mt. Carmel, IL	Alluvial	1.0	0.005	11862	0.132961	M75D100.200\GRN\GRN270
MtC17	Mt. Carmel, IL	Alluvial	2.0	0.005	16730	0.107633	M75D100.200\SER\SER000
MtC18	Mt. Carmel, IL	Alluvial	2.0	0.005	11820	0.108953	M75D100.200\TAP059\TAP059-W
MtC19	Mt. Carmel, IL	Alluvial	2.0	0.005	16044	0.121268	M75D100.200\GRN\GRN270
MtC20	Mt. Carmel, IL	Alluvial	2.0	0.005	13460	0.109854	M75D100.200\TAP078\TAP078-W
Sal01	Salem, IL	Alluvial	0.2	0.005	8624	0.140258	M65D100.200\A-SON\A-SON033
Sal02	Salem, IL	Alluvial	0.2	0.005	6010	0.169042	M65D100.200\RM\RIV180
Sal03	Salem, IL	Alluvial	0.2	0.005	8592	0.161305	M65D100.200\A-SON\A-SON303
Sal04	Salem, IL	Alluvial	0.2	0.005	5994	0.175235	M65D100.200\RM\RIV270
Sal05	Salem, IL	Alluvial	0.3	0.005	8033	0.168035	M75D100.200\MEL\MEL090
Sal06	Salem, IL	Alluvial	0.3	0.005	8560	0.152875	M65D100.200\A-SON\A-SON303
Sal07	Salem, IL	Alluvial	0.3	0.005	8059	0.153039	M75D100.200\MEL\MEL180
Sal08	Salem, IL	Alluvial	0.3	0.005	11518	0.146437	M75D100.200\SER\SER270
Sal09	Salem, IL	Alluvial	0.5	0.005	7965	0.131832	M75D100.200\MEL\MEL090
Sal10	Salem, IL	Alluvial	0.5	0.005	12263	0.121343	M75D100.200\TAP072\TAP072-W
Sal11	Salem, IL	Alluvial	0.5	0.005	12257	0.135273	M75D100.200\TAP072\TAP072-N
Sal12	Salem, IL	Alluvial	0.5	0.005	16039	0.124454	M75D100.200\TAP067\TAP067-W
Sal13	Salem, IL	Alluvial	1.0	0.005	13784	0.0947893	M75D100.200\TAP069\TAP069-W
Sal14	Salem, IL	Alluvial	1.0	0.005	16646	0.116216	M75D100.200\TAP078\TAP078-N
Sal15	Salem, IL	Alluvial	1.0	0.005	12151	0.106766	M75D100.200\TAP072\TAP072-N
Sal16	Salem, IL	Alluvial	1.0	0.005	15786	0.104312	M75D100.200\TAP059\TAP059-N
Sal17	Salem, IL	Alluvial	2.0	0.005	16635	0.0927487	M75D100.200\TAP078\TAP078-N
Sal18	Salem, IL	Alluvial	2.0	0.005	13784	0.0900193	M75D100.200\TAP069\TAP069-W

Sal19	Salem, IL	Alluvial	2.0	0.005	11489	0.0918635	M75D100.200\SER\SER270
Sal20	Salem, IL	Alluvial	2.0	0.005	15830	0.0974574	M75D100.200\TAP059\TAP059-N
Spa01	Sparta, IL	Alluvial	0.2	0.005	10629	0.18607	M75D050.100\RIV\RIV270
Spa02	Sparta, IL	Alluvial	0.2	0.005	12663	0.191754	M65D050.100\WWJ\WWJ180
Spa03	Sparta, IL	Alluvial	0.2	0.005	6929	0.198168	M65D050.100\SER\SER270
Spa04	Sparta, IL	Alluvial	0.2	0.005	8932	0.188684	M65D050.100\CUC\CUC090
Spa05	Sparta, IL	Alluvial	0.3	0.005	12614	0.166188	M75D100.200\TAP072\TAP072-N
Spa06	Sparta, IL	Alluvial	0.3	0.005	16263	0.184417	M75D100.200\TAP067\TAP067-N
Spa07	Sparta, IL	Alluvial	0.3	0.005	16765	0.167372	M75D050.100\TAP035\TAP035-W
Spa08	Sparta, IL	Alluvial	0.3	0.005	16996	0.152995	M75D050.100\TAP035\TAP035-N
Spa09	Sparta, IL	Alluvial	0.5	0.005	11580	0.146713	M75D100.200\SER\SER270
Spa10	Sparta, IL	Alluvial	0.5	0.005	16810	0.138051	M75D050.100\ILA051\ILA051-N
Spa11	Sparta, IL	Alluvial	0.5	0.005	16128	0.138515	M75D100.200\TAP059\TAP059-N
Spa12	Sparta, IL	Alluvial	0.5	0.005	16182	0.172016	M75D100.200\TAP067\TAP067-N
Spa13	Sparta, IL	Alluvial	1.0	0.005	16750	0.133704	M75D050.100\ILA051\ILA051-N
Spa14	Sparta, IL	Alluvial	1.0	0.005	16147	0.127397	M75D100.200\TAP067\TAP067-W
Spa15	Sparta, IL	Alluvial	1.0	0.005	8081	0.156814	M75D100.200\MEL\MEL090
Spa16	Sparta, IL	Alluvial	1.0	0.005	11629	0.145355	M75D100.200\SER\SER000
Spa17	Sparta, IL	Alluvial	2.0	0.005	8064	0.120311	M75D100.200\MEL\MEL090
Spa18	Sparta, IL	Alluvial	2.0	0.005	11714	0.127964	M75D100.200\SER\SER000
Spa19	Sparta, IL	Alluvial	2.0	0.005	12192	0.125302	M75D100.200\TAP072\TAP072-N
Spa20	Sparta, IL	Alluvial	2.0	0.005	8096	0.130705	M75D100.200\MEL\MEL180

¹Initial time history refers to the initial time history record, which is subsequently modified. The presented information describes the location of the time history within the NUREG/CR-6728 ground motion database for Central and Eastern North America [McGuire *et al.*, 2001].

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