GUIDELINE FOR ANSS SEISMIC MONITORING OF ENGINEERED CIVIL SYSTEMS—Version 1.0

Public Review Draft

Prepared by the ANSS Structural Instrumentation Guideline Committee

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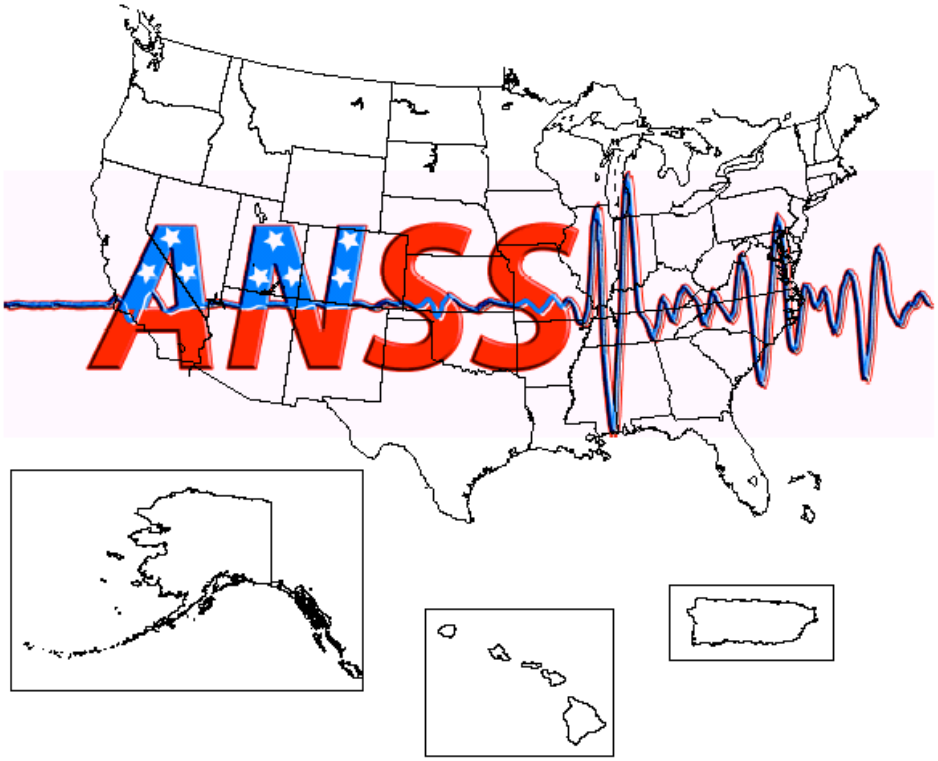
Appendices D, E, and F



U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

APPENDIX D: Selection Criteria for Buildings

Submission Form for Candidate Buildings

Fill in the information as completely as possible. Where the information is unknown, indicate "unknown".

General Information	
Proposer:	
Name:	
Address:	
Email:	
Building location:	
Address:	
City:	
State:	
Latitude/Longitude:	
Building information:	
Stories above grade:	
Stories below grade:	
Square footage:	
Date constructed:	
Building code used:	
ASCE 31-02 structure type(s):	
Foundation type:	
Seismically rehabilitated: Yes/No.	
Year of rehabilitation:	
Criteria for rehabilitation:	
Already instrumented: Yes/No.	
Photograph attached: Yes/No.	
Original structural drawings are available[1]: Yes/No	

[1]At a minimum, drawings depicting the original existing structural conditions of the buildings are required. These can be from the bid set or they can be drawings that have been created by field measurements. Do not submit the building as a candidate for ANSS instrumentation without this minimum level of documentation.

Seismicity (2003 NEHRP map values): S_s:	
S_1:	
ASCE-7 Site Class (Soil type): A, B, C, D, E, F	
A geotechnical report is available: Yes/No:	
Owner:	
Name:	
Address:	
Public or private:	
Access[2]:	
The owner has been contacted and agreed to allow ANSS instrumentation and post-earthquake access: Yes/No.	
The owner has been contacted and may allow ANSS instrumentation and post-earthquake access: Yes/No.	
Shared Funding: The owner or another entity will provide partial funding for instrumentation: Yes/No/Unknown.	
WEIGHTED SCORING	
Seismicity (up to 30 points): Seismicity shall be defined by NEHRP map values, using the high, medium and low seismicity categories in ASCE 31-03. Use ASCE-7 Site Class D when the site class is not known.	
High *($S_{DS} \geq 0.5g$ and $S_{D1} \geq 0.2g$)* (30)	
Medium *(Not High or Low)* (5)	
Low *($S_{DS} \leq 0.167g$ and $S_{D1} \leq 0.067g$)* (1)	

[2] If the owner has been contacted and will not agree to instrumentation, do not submit the building as a candidate for ANSS instrumentation. For buildings that are short-listed, a letter from the owner will be required agreeing to all ANSS instrumentation and usage of the data.

Reference Instrument Availability (up to 20 points)	
Free-field station(s) already installed (20)	
Free-field location(s) available (16)	
SMRS-OG (see COSMOS(2001)) Urban reference station(s) already installed (10)	
SMRS-OG Urban reference location(s) available (8)	
No reference locations available (0)	
Unknown (0)	
Existing Instrumentation (up to 10 points):	
Over 10 sensors (10)	
3-10 sensors (8)	
1-3 sensors (6)	
No sensors (0)	
Unknown (0)	
Current Metadata Availability (up to 13 points):	
Computer models (5):	
Nonlinear 3-D computer model available (5)	
Linear 3-D computer model available (3)	
2-D computer model(s) available (2)	
Record Drawings[3] *(3):*	
Architectural and structural record drawings (3)	
Structural record drawings only (2)	
Architectural record drawings only (1)	
No record drawings available (0)	
Previous instrumentation information (5):	
Studies using instrumentation records (5)	

[3] As noted previously, original bid drawings or their equivalent are required. Record drawings define the final "as-built" conditions and incorporate changes made to the bid documents during construction. To qualify for additional points here, the record drawings must also cover modifications made to the building since the original construction period.

Records only (3)	
No previous records (0)	
Unknown (0)	
Building Simplicity (up to 10 points):	
No 2003 IBC irregularities (10)	
Either 2003 IBC plan (Table 1616.5.1.1) or vertical (Table 1616.5.1.2) irregularities present but not both (5)	
Both 2003 UBC plan and vertical irregularities present (0)	
Unknown (0)	
Building Types With Large Portfolios and High Life Safety Risk (up to 20 points)	
Unrehabilitated woodframe apartment over open parking on at least one side (tuck-under apartment) (20)	
Rehabilitated tuckunder apartments with moment frame on open front (20)	
Unrehabilitated URM bearing wall with flexible diaphragm (20)	
URM bearing wall rehabilitated to the equivalent of the UCBC or more stringent (20)	
URM bearing wall rehabilitated to the less stringent criteria than the UCBC (15)	
Unrehabilitated tilt-up with flexible diaphragm (15)	
Unrehabilitated nonductile concrete frame without URM infill (15)	
Unrehabilitated nonductile concrete frame with URM infill (10)	
Building Types With Large Portfolios and Uncertain Life Safety Risk (up to 15 points)	
Ordinary concentric steel braced frame (15)	
Pre-Northridge moment frame (15)	
Other Building Types with Large Portfolios (up to 10 points)	
Post-Northridge special moment-resisting frames (10)	
Special concentrically-braced frame (10)	
Midrise (3-6 stories) concrete shear wall (5)	
Building Types With Small Portfolios but of Important Engineering Interest (up to 10 points)	

Buckling-restrained (unbonded) braced frame (10)	
Seismically-isolated (10)	
Passively-damped (10)	
Concrete special moment-resisting frame (5)	
Coupled shear wall (5)	
Precast moment frames (5)	
Issues (up to 20 points)	
Founded on piles (5)	
Underground structure (5)	
Very large structure with potential ground motion coherency issues (5)	
Rocking response anticipated (5)	
Total Score from Categories with Listed Point Values:	
Statement of Purpose (Engineering Rationale) for Instrumenting and Monitoring System:	

Objectives of the Measurement System:

Estimated number of sensors	
Type of sensors anticipated	
Desired type of recording system	

Other Issues: Other building types besides those identified above will be considered. List any other issues of interest for instrumenting and monitoring this building that the ANSS SRMC should consider as part of their review.

APPENDIX E: Selection Criteria for Geosystems

Submission Form for Candidate Geosystems

Circle or fill in the information as completely as possible. Where the information is unknown, indicate "unknown".

General Information	
Proposer:	
Name:	
Address:	
Email:	
Geosystem location:	
Address:	
City:	
State:	
Geosystem information:	
Type of geosystem	
Materials used in construction	
Approximate footprint area and height	
Date constructed:	
Seismically rehabilitated: Yes/No.	
Year of rehabilitation:	
Criteria for rehabilitation:	
Already instrumented: Yes/No.	
Photograph attached: Yes/No.	
Original geosystems drawings are available[4]: Yes/No	
Seismicity (2003 NEHRP map values): S_s:	
S_1:	
ASCE-7 Site Class (Soil type): A, B, C, D, E, F	
A geotechnical report is available: Yes/No:	

[4]At a minimum, drawings depicting the original existing construction conditions are required. These can be from the bid set or they can be drawings that have been created by field measurements.

Owner:	
Name:	
Address:	
Public or private:	
Access[5]:	
The owner has been contacted and agreed to allow ANSS instrumentation and post-earthquake access: Yes/No.	
The owner has been contacted and may allow ANSS instrumentation and post-earthquake access: Yes/No.	
Shared Funding: The owner or another entity will provide partial funding for instrumentation: Yes/No/Unknown.	
WEIGHTED SCORING	
Seismicity (20 points): Seismicity shall be defined by NEHRP map values, using the high, medium and low seismicity categories in ASCE 31-03. Use ASCE-7 Site Class D when the site class is not known.	
High *($S_{DS} \geq 0.5g$ and $S_{D1} \geq 0.2g$)* (20)	
Medium *(Not High or Low)* (10)	
Low *($S_{DS} \leq 0.167g$ and $S_{D1} \leq 0.067g$)* (3)	
Reference Instrument Availability (up to 20 points)	
Free-field station(s) or COSMOS SMRS-OG stations already installed or available (20)	

[5] If the owner has been contacted and will not agree to instrumentation, do not submit the geosystem as a candidate for ANSS instrumentation. For geosystems that are short-listed, a letter from the owner will be required agreeing to all ANSS instrumentation and usage of the data.

No reference locations available (0)	
Unknown (0)	
Existing Instrumentation and availability of Previous Records (10 points):	
Existing array with > 10 sensors and previous recordings (10)	
Existing array with 3-10 sensors and previous recordings (8)	
Existing array with 1-3 sensors and previous recordings (6)	
Existing array but no previous recordings (3)	
No sensors (0)	
Unknown (0)	
Metadata Availability (20 points):	
Drawings (10):	
Plan and profile views of geosystem (10)	
No information (0)	
Material properties (10)	
Properties known well enough to allow detailed modeling of seismic performance (e.g., soil types, index properties, shear wave velocity, shear strength) (10)	
Properties only known well enough to allow simplified modeling of seismic performance (e.g., soil types and index properties, but no shear wave velocity or strength data) (5)	
Insufficient information to enable an engineering assessment of seismic performance (0)	
Is the Geosystem Common? (10 points):	
No unusual 3D geometries or irregular ground conditions (10)	
Ordinary soil types but highly 3D shape (5)	
Non-representative geosystem (2)	
Unknown (0)	
Likelihood of Significant Response of Engineering Interest (30 points)	
Significant geosystem for which there is currently a lack of instrumented sites (e.g., tunnels, retaining walls). (30)	

Geosystem for which the existing state-of-knowledge provides relatively low confidence in the prediction of both the seismic response (i.e., ground motion variations across the geosystem) and performance (i.e., accrual of permanent displacements within the geosystem). Moreover, the regional seismicity may be expected to trigger site performance of engineering interest. (30)	
Geosystem for which the existing state-of-knowledge provides relatively high confidence in the prediction of seismic response (e.g., systems with a nearly 1D geometry) but lower confidence in the prediction of performance. The regional seismicity may be expected to trigger site performance of engineering interest. (20)	
Either of the above two cases, but regional seismicity is unlikely to produce site performance of engineering interest (i.e., expected motions are unlikely to induce permanent deformations). (10)	
Total Score from Categories with Listed Point Values:	
Statement of Purpose (Engineering Rationale) for Instrumenting and Monitoring System:	

Objectives of the Measurement System:

Estimated number of sensors	
Type of sensors anticipated	
Desired type of recording system	

Other Issues: Displacement and pore water pressure instrumentation should be considered in addition to accelerometers for many geosystems.

List any other issues of interest in instrumenting this geosystem that the ANSS SRMC should consider as part of their review.

APPENDIX F: Selection Criteria for Infrastructure

Submission Form for Candidate Infrastructure System (including bridges)

Fill in the information as completely as possible. Where the information is unknown, indicate "unknown".

General Information	
Proposer:	
Name:	
Address:	
Email:	
Infrastructure system location:	
Address or location description:	
City (or nearest city/town):	
State:	
Latitude/Longitude:	
Infrastructure system information:	
Type of infrastructure system:	
Structural type/description:	
Structure use (such as ADT):	
Materials used in construction:	
Design code/year:	
Approximate footprint area and height:	
Date constructed:	
Seismically rehabilitated: Yes/No.	
Year of rehabilitation:	
Criteria for rehabilitation:	
Already instrumented: Yes/No.	
Photograph attached: Yes/No.	
Original construction drawings are available[6]: Yes/No	

[6]At a minimum, drawings depicting the original existing construction conditions are required. These can be from the bid set or they can be drawings that have been created by field measurements.

Seismicity (2003 NEHRP map values): S_s:	
S_1:	
ASCE-7 Site Class (Soil type): A, B, C, D, E, F	
A geotechnical report is available: Yes/No:	
Owner:	
Name:	
Address:	
Public or private:	
Access[7]:	
The owner has been contacted and agreed to allow ANSS instrumentation and post-earthquake access: Yes/No.	
The owner has been contacted and may allow ANSS instrumentation and post-earthquake access: Yes/No.	
Shared Funding: The owner or another entity will provide partial funding for instrumentation: Yes/No/Unknown.	
WEIGHTED SCORING	
Seismicity (up to 30 points): Seismicity shall be defined by NEHRP map values, using the high, medium and low seismicity categories in ASCE 31-03. Use ASCE-7 Site Class D when the site class is not known. .	
High *($S_{DS} \geq 0.5g$ and $S_{D1} \geq 0.2g$)* (30)	
Medium *(Not High or Low)* (5)	
Low *($S_{DS} \leq 0.167g$ and $S_{D1} \leq 0.067g$)* (1)	
Reference Instrument Availability (up to 10 points)	

[7] If the owner has been contacted and will not agree to instrumentation, do not submit the infrastructure system as a candidate for ANSS instrumentation. For an infrastructure system that is short-listed, a letter from the owner will be required agreeing to all ANSS instrumentation and usage of the data.

Free-field station(s) already installed (10)	
Free-field location(s) available (8)	
SMRS-OG (see COSMOS(2001)) Urban reference station(s) already installed (5)	
SMRS-OG Urban reference location(s) available (4)	
No reference locations available (0)	
Unknown (0)	
Existing Seismic Instrumentation (up to 10 points):	
Over 10 sensors (10)	
3-10 sensors (8)	
1-3 sensors (6)	
No sensors (0)	
Unknown (0)	
Current Metadata Availability (up to 25 points):	
Computer models (5):	
Nonlinear 3-D computer model available (5)	
Linear 3-D computer model available (3)	
2-D computer model(s) available (2)	
Drawings (10):	
As-built structural (10)	
Structural design only (4)	
None available (0)	
Previous instrumentation information (5):	
Studies using instrumentation records (5)	
Records only (3)	
No previous records (0)	
Unknown (0)	
Material properties (5):	
Measured properties (5)	
Specified properties (2)	

For remaining issues provide points on a sliding scale based on the judgment of reviewer. Details must be provided as to why the candidate structure should be selected. What data from this structure can assist the greater infrastructure community?	
Structure Type (15 points)	
Site Conditions (15 points) .	
Special Issues (10 points)	
Total Score from Categories with Listed Point Values:	
Statement of Purpose (Engineering Rationale) for Instrumenting and Monitoring System:	

Objectives of the Measurement System:

Estimated number of sensors	
Type of sensors anticipated	
Desired type of recording system	

Other Issues: List any other issues of interest in instrumenting this infrastructure system that the ANSS SRMC should consider as part of their review.