ASCE 41-06 Survey Results
Structural Engineers Association of Northern California
Existing Buildings Committee
September 2010

Background

ASCE/SEI 41-06 (ASCE-41), *Seismic Rehabilitation of Existing Buildings*, is a relatively new national standard that applies performance-based engineering (PBE) concepts to existing buildings. The SEAONC Existing Buildings Committee (EBC) conducted an online web survey of members of the Structural Engineers Association of California (SEAOC) to gauge user experience and sentiments with ASCE-41. The survey was taken from August through November 2009 and had 204 respondents representing 5% of the state-wide membership. This report contains a summary of the results.

Additional background may be found in an *Insight* article appearing in *STRUCTURE* magazine (October 2010). The survey may be viewed at the link https://peercenter.wufoo.com/forms/asce41-survey/

The EBC Survey Project team consisted of Bruce Maison (project lead), Russell Berkowitz, Heidi Faison, Justin M. Spivey, and Mohamed Talaat.

Survey Results

Questions Q-1 through Q-8 mostly deals with the respondent profile. In brief, the typical respondent had the following qualities (based on most frequent and/or median responses).

- Role of Practitioner (Engineer, Architect or equivalent)
- Has moderate familiarity with ASCE-41 (have used it, but not regularly)
- Is using ASCE-41 because it is an industry trend and is constrained from using it by not having many projects needing it
- Used it on ≤ 10 projects
- Performed the calculations on the majority of the projects (> 50%)
- Has modified and/or ignored ASCE-41 provisions
- Had at least one project with external Peer Review

Several additional noteworthy observations:

- The survey respondents had a wide spectrum of experience with ASCE-41 (Q-2): Extensive (29%), Moderate (49%) and Some (22%)
- About 26% indicated that they had no factors inhibiting their use of ASCE-41 (Q-4)
- About 70% indicated they have modified and/or ignored specific ASCE-41 provisions on projects (Q-7)

ASCE 41-06 Survey Results
Structural Engineers Association of Northern California
Existing Buildings Committee
September 2010

Q-1. Which best describes your role in the evaluation and rehab of existing structures?

Practitioner (Engineer, Architect or equivalent)	91%
Regulator (Building Official or equivalent)	4%
Construction Contractor, Inspector, or Testing Engineer or equivalent	2%
Industry Representative (Product Manufacturer or equivalent)	1%
Owner (Representative or equivalent)	1%
Researcher	< 1%
Other	< 1%

Q-2. What is your familiarity with the detailed technical use of ASCE-41?

Moderate (have used it, but not regularly)	49%
Extensive (regularly use it)	29%
Some (basic understanding, but use it rarely, if ever)	22%
No response to question	< 1%

Q-3. What factors influenced you to use ASCE-41?

Industry trend	48%
Required by law for CA State-Owned Building projects (CBC Chapter 34)	39%
Company policy	36%
Provides a clear step-by-step procedure	33%
Requested by owner	24%
Other	20%
Requested by building official	16%
Limits liability	16%
No response to question	2%

Note: Respondents checked all that apply. Percentage refers to the number of those checked divided by total number of respondents. For example, Industry trend = 48% means that 98 respondents selected this factor (0.48 = 98 / 204).

Q-4. What factors may be inhibiting your use of ASCE-41?

Not having many projects needing it	37%
None	26%
Too complicated for practical use	22%
Clients unwilling to pay for its use	21%
Overly conservative leading to undesirable outcomes	18%
Not familiar with its use	17%
Other	9%
Reluctant to migrate from prior practices that are satisfactory	9%
No response to question	1%

Note: Respondents checked all that apply. Percentage refers to the number checked divided by total number of respondents. For example, None = 26% means that 53 respondents selected this factor (0.26 = 53 / 204).

Q-5. How many projects have you been involved with that used ASCE-41?

Several (1 to 3)	41%
Many (4 to 10)	29%
Large number (> 10)	17%
None	12%
No response to question	< 1%

Q-6. In how many of the Q-5 projects above did you personally perform calculations using ASCE-41?

Majority (> 50% of projects)	60%
None	15%
Some (20 to 50%)	13%
Few (> 0 and < 20%)	11%
No response to question	< 1%

Q-7. In how many of the Q-5 projects above did you modify and/or ignore specific ASCE-41 provisions?

None	30%
Few (> 0 and < 20%)	28%
Some (20 to 50%)	24%
Majority (> 50% of projects)	17%
No response to question	< 1%

Q-8. How many of the Q-5 projects had external Peer Review?

None	40%
Some (20 to 50%)	21%
Majority (> 50% of projects)	21%
Few (> 0 and < 20%)	18%
No response to question	< 1%

Questions Q-9 through Q-13 mostly deals with ASCE-41 state-of-practice aspects.

- Types of structures and materials that ASCE-41 has been applied to
- Purposes, procedures and performance levels used

In brief, several observations:

Q-9 Type of structures

- Low-rise buildings dominated with 48% indicating these were in the majority of their projects.
- 87% had at least one Low-rise building.

Q-10 Purpose of use

- Design of upgrades was the major use with 52% indicating this was an element the majority of their projects.
- Performance evaluation was a strong second purpose with 39% indicating this entered into the majority of their projects (not necessarily exclusive of upgrade design).

Q-11 Material types

- Concrete dominates followed by Steel, Masonry, and Wood and/or light metal framing by having respectively 33%, 18%, 12%, and 7% indicating these materials entered into the majority of their projects.
- 14% indicated that Seismic isolation and/or energy dissipation entered into at least one of their projects.
- 40% indicated nonstructural (architectural, mechanical, and electrical components) entered into at least one of their projects.

Q-12 Procedures used

- Linear static (LSP) dominated with 40% indicating this was used in the majority of their projects.
- Linear procedures dominated with 60% indicating its use in the majority of their work, versus 26% for nonlinear procedures.
- 38% indicated that nonlinear dynamic (NDP) entered into at least one of their projects.

Q-13 Performance levels used

- Life safety (LS) dominated with 63% indicating this structural performance level was used in the majority of their projects, followed by collapse prevention (CP) at 36%.
- For nonstructural performance levels, life safety (LS) dominated as well.
- 72% indicated they have not used immediate occupancy (IO) structural performance on any projects.

Following are the detailed results for questions: Q-9 Type of Structures, Q-10 Purpose of use, Q-11 Material types, Q-12 Procedures used, and Q-13 Performance levels used.

- The choices were: Majority (> 50% of projects), Some (20 to 50%), Few (> 0 and < 20%), None, or blank (no response).
- The categories were independent of one another—Majority could be selected for multiple categories. For example, it was possible that both Upgrade design and Performance evaluation could be selected as Majority of projects by a respondent because both of these aspects were work-scopes in the majority of their projects.
- The results for a particular category are presented as a percentage of the Total Respondents, i.e. those that entered a choice other than blank. Total Respondents varied from 188 (92%) to 124 (61%) of the total number of surveys submitted.
- There is a pattern of None responses varying inversely with Total Respondents (higher the None corresponds to lower the Total Respondents). This suggests that some may have skipped entering a choice instead of selecting None. The implication is that the non-None choices are over-represented in the tables below (percentages higher than actual). The data does not allow a way to determining how significant this effect may be.

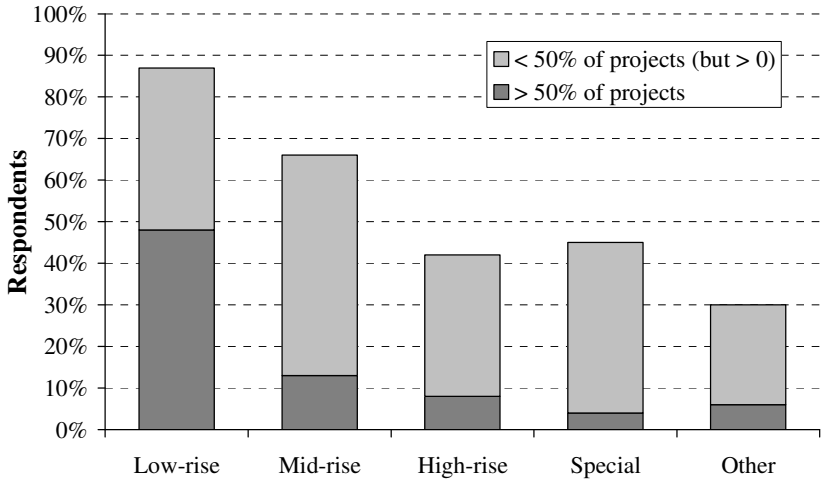
Q-9. Type of structures. For projects where you have used ASCE-41, what is the percentage for each of the categories below.

The categories were: Low-rise (1 to 3 story buildings), Mid-rise (4 to 7), High-rise (>7), Special-use (e.g., town halls, auditoriums), and Other structures.

Structure	Majority	Some	Few	None	Total Respondents
Low-rise	48%	27%	12%	13%	188
Mid-rise	13%	34%	19%	34%	158
High-rise	8%	14%	20%	58%	148
Special-use	4%	17%	24%	55%	142
Other structures	6%	7%	17%	71%	136

Note for example, 48% or 90 respondents indicated their ASCE-41 projects included Low-rise structures in the Majority of projects, out of 188 respondents that answered this category (90 = 0.48x188); and 16 surveys had this category left blank (16 = 204 – 188).

In graphical form with the Some and Few choices combined:



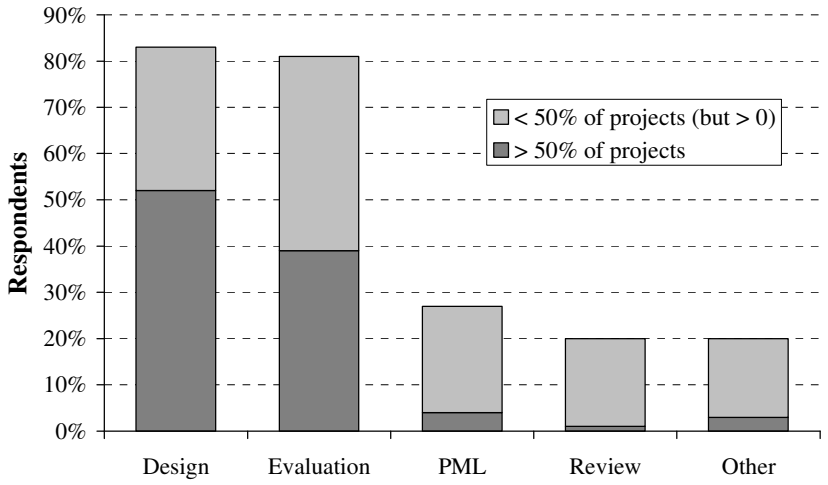
Q-10. Purpose of use. For projects where you have used ASCE-41, what is the percentage for each of the categories below.

The categories were: Upgrade design, Performance evaluation, Probable Maximum Loss (PML) estimation, Project design review, and Other purposes.

Purpose	Majority	Some	Few	None	Total Respondents
Design	52%	24%	7%	17%	183
Evaluation	39%	35%	7%	18%	175
PML	4%	7%	15%	73%	137
Review	1%	5%	14%	79%	134
Other	3%	7%	9%	80%	127

For example, 52% or 95 respondents indicated their ASCE-41 projects included Upgrade design in the Majority of projects, out of 183 respondents that answered this category (95 = 0.52x183); and 21 surveys had this category blank (21 = 204 – 183).

In graphical form with the Some and Few choices combined:



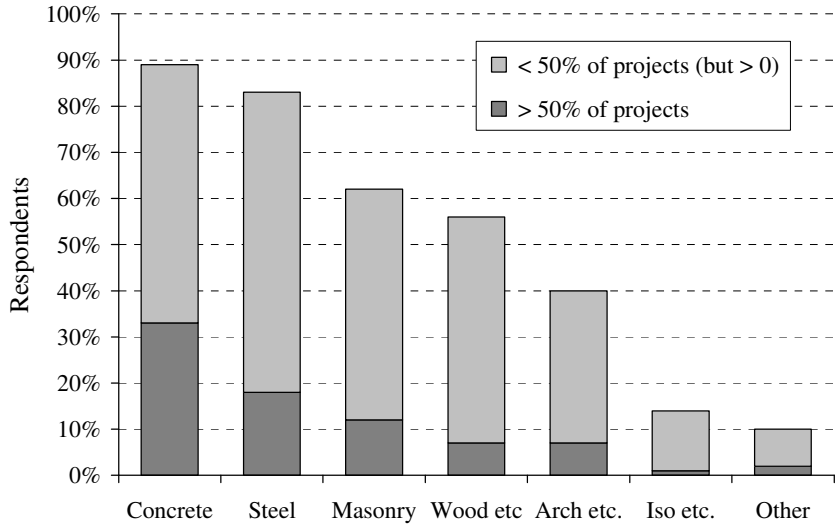
Q-11. Material types. For projects where you have used ASCE-41, what is the percentage for each of the categories below.

The categories were set according to the chapters of ASCE-41 and they were as follows: Steel (Chapter 5), Concrete (6), Masonry (7), Wood and/or light metal framing (8), Seismic isolation and/or energy dissipation (9), Architectural, mechanical, and electrical components (11), and Other materials.

Material	Majority	Some	Few	None	Total Respondents
Steel	18%	50%	15%	16%	176
Concrete	33%	45%	11%	11%	183
Masonry	12%	33%	17%	39%	147
Wood and/or light metal framing	7%	28%	21%	44%	149
Seismic isolation and/or energy dissipation	< 1%	4%	9%	86%	137
Architectural, mechanical, and electrical components	7%	10%	23%	60%	136
Other materials	2%	0	8%	90%	129

For example, 18% or 32 respondents indicated their ASCE-41 projects included Steel material in the Majority of projects, out of 176 respondents that answered this category (32 = 0.18x176); and 28 surveys had this category blank (28 = 204 – 176).

In graphical form with the Some and Few choices combined:



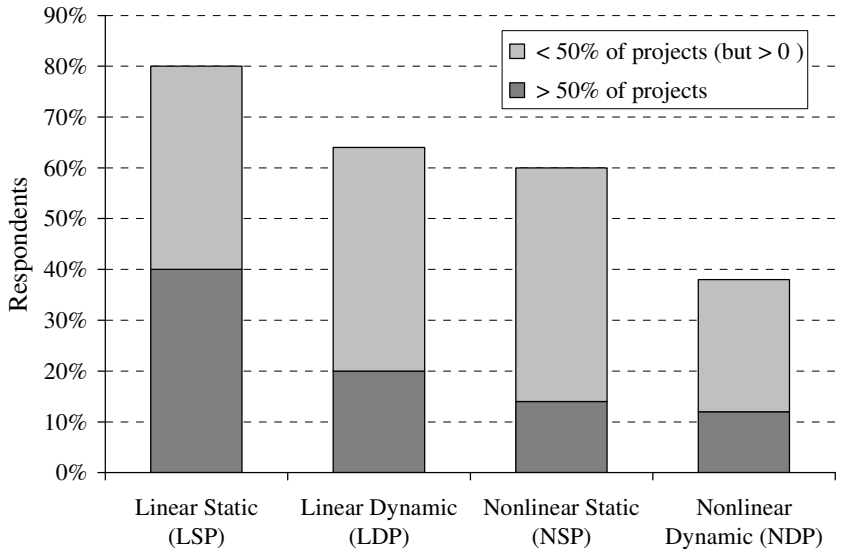
Q-12. Procedures used. For projects where you have used ASCE-41, what is the percentage for each of the categories below.

The categories were: Choices were: Linear static (LSP), Linear dynamic (LDP), Nonlinear static (NSP), Nonlinear dynamic (NDP).

Procedure	Majority	Some	Few	None	Total Respondents
Linear static (LSP)	40%	21%	19%	20%	173
Linear dynamic (LDP)	20%	31%	13%	36%	156
Nonlinear static (NSP)	14%	32%	14%	40%	160
Nonlinear dynamic (NDP)	12%	13%	12%	62%	145

For example, 40% or 69 respondents indicated their ASCE-41 projects included use of LSP in the Majority of projects, out of 173 respondents that answered this category (69 = 0.40x173); and 31 surveys had this category blank (31 = 204 – 173).

In graphical form with the Some and Few choices combined:



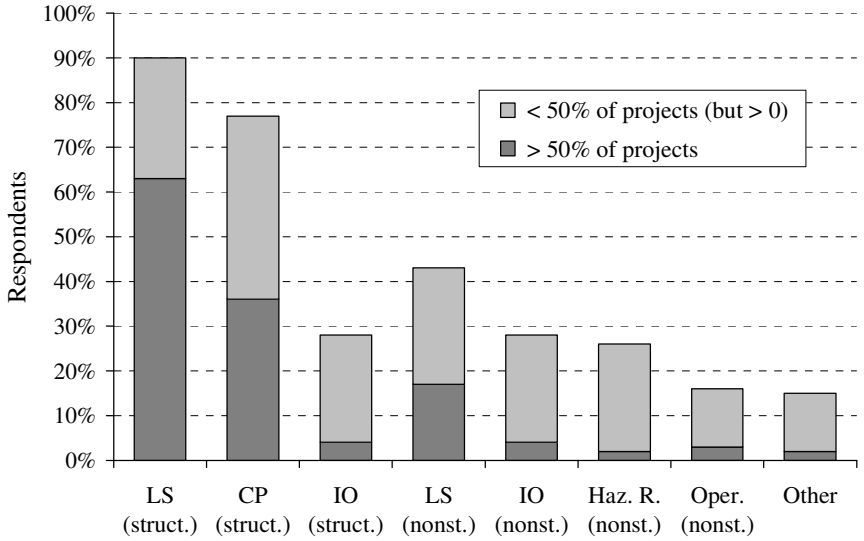
Q-13. Performance levels used. For projects where you have used ASCE-41, what is the percentage for each of the categories below.

The categories were: Collapse Prevention (Structural), Life Safety (Structural), Immediate Occupancy (Structural), Hazards Reduced (Nonstructural), Life Safety (Nonstructural), Immediate Occupancy (Nonstructural), Operational (Nonstructural), and Other performance levels

Procedure	Majority	Some	Few	None	Total Respondents
Collapse Prevention (Structural)	36%	27%	14%	23%	162
Life Safety (Structural)	63%	22%	5%	10%	185
Immediate Occupancy (Structural)	4%	12%	13%	72%	135
Hazards Reduced (Nonstructural)	2%	7%	17%	74%	129
Life Safety (Nonstructural)	17%	13%	13%	57%	137
Immediate Occupancy (Nonstructural)	4%	12%	13%	72%	135
Operational (Nonstructural)	3%	2%	11%	84%	131
Other performance levels	2%	2%	10%	85%	124

For example, 36% or 58 respondents indicated their ASCE-41 projects included use of the Collapse Prevention performance level in the Majority of projects, out of 162 respondents that answered this category (58 = 0.36x162); and 42 surveys had this category blank (42 = 204 – 162).

In graphical form with the Some and Few choices combined:



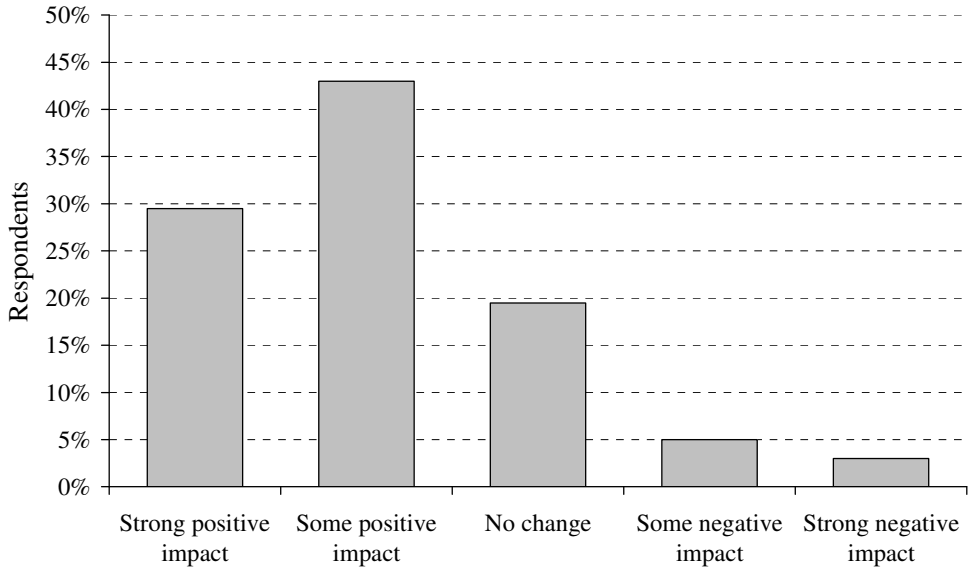
Questions Q-14 and Q-15 requested a response with text answers. The results for these are voluminous and not included in this report.

- Q-14 Please state one (only) aspect you LIKE about it.
- Q-15 Please state one (only) aspect you DISLIKE about it.

Q-16. How has it affected your technical practice of earthquake engineering?

The choices were: Strong positive impact, Some positive impact, No change, Some negative impact, Strong negative impact; or the question could be left unanswered (blank).

There were 200 total respondents out of 204 surveys submitted (98%) and the results are shown below. The percentages refer the percentage of total respondents.



Question Q-17 requested engineers to express their opinion on 24 statements by selecting one of four views (Strongly Agree, Generally Agree, Generally Disagree, Strongly Disagree), or by leaving the response blank.

The majority of responses were Generally Agree or Generally Disagree. Hence, the Strongly Agree responses were combined with the Generally Agree to form an Agree category. Likewise for Disagree. The results were grouped into three tables according to the strength of the consensus (see Tables 1, 2, and 3 below).

The results suggest engineers have the following views.

1. ASCE-41 is doing a satisfactory job of meeting engineer's needs. For example, refer to responses for statements a, c, e and g in Tables 1, 2 and 3.

2. ASCE-41 users want more education about its use.
   - Example applications manual (86% response for statement b)
   - Better informed Building Officials (82% for d)
   - Training classes (79% for h)

3. ASCE-41 needs revision to address deficiencies.
   - Calibration with building code (74% for i)
   - Reconciliation between nonlinear static and nonlinear dynamic procedures (64% for o)
   - Reduction in linear procedure conservatism (64% for p)
   - Elimination of inconsistencies and glitches (60% for s)
   - Improvement in text wording (60% for t)

4. ASCE-41 has a conundrum on freedom of use. Engineers would like it to be a Guideline allowing optional use of various provisions (70% for k), yet they also think that it is not overly prescriptive (63% for r).

Table 1: Q-17 Statements having huge consensus with ≥ 80% of respondents having similar views. (≥ 8 out of every 10 have this opinion)

Statement	Response	Total Respondents
a. ASCE-41 does a good job of implementing Performance Based Engineering concepts into industry practice.	86% Agree	178
b. ASCE-41 needs a companion example cases manual illustrating its intended use.	86% Agree	171
c. ASCE-41 is well suited for the design of building upgrades.	84% Agree	179
d. ASCE-41's projects need to be judged by Peer Review engineers rather than Building Department staff due to its technical nature.	82% Agree	180
e. ASCE-41 is better for existing building rehabilitation than using Building Code provisions for new construction.	81% Agree	180
f. ASCE-41 has Nonlinear procedures that are sufficiently accurate to capture probable structure performance.	80% Agree	138

Notes:
Agree = Respondents that selected Strongly Agree or Generally Agree.
Disagree = Respondents that selected Strongly Disagree or Generally Disagree.
Response = Percentage of Total Respondents that Agreed (or vice versa).
Total Respondents = Total number that expressed a view on the statement out of 204 total surveys.
For example, a statement having 86% Agree and 178 Total Respondents means that 153 (= 0.86x178) agreed and 25 (= 0.14x178) disagreed; and 26 (= 204 – 178) surveys had no response.

Table 2: Q-17 Statements having large consensus with 60 to 79% of respondents having similar views. (e.g. 6 or 7 out of every 10 have this opinion)

Statement	Response	Total Respondents
g. ASCE-41 is well suited for the evaluation of building probable behavior.	79% Agree	174
h. ASCE-41 needs industry-wide training classes on its use.	79% Agree	170
i. ASCE-41 needs calibration with the new construction provisions of the Building Code.	74% Agree	157
j. ASCE-41 can utilize the commentary in FEMA-356 to provide sufficient explanation of ASCE-41 provisions.	71% Agree	148
k. ASCE-41 is better suited for use as a Guideline (allowing optional use of various provisions) rather than a Standard (requiring strict adherence).	70% Agree	171
l. ASCE-41 produces consistency across the industry for the design of building upgrades.	69% Agree	173
m. ASCE-41 works well in conjunction with the standard ASCE/SEI 31-03 Seismic Evaluation of Existing Buildings.	67% Agree	146
n. ASCE-41 has wide flexibility so it can handle virtually all situations, structures and materials.	65% Agree	155
o. ASCE-41 results from the Nonlinear Dynamic Procedure (NDP) are often at odds with those from the Nonlinear Static Procedure (NSP).	64% Agree	129
p. ASCE-41 has Linear procedures (LSP, LDP) that are too conservative thus leading to excessive upgrades.	64% Agree	149
q. ASCE-41 is too complicated for effective use in design office practice.	64% Disagree	165
r. ASCE-41 is over-prescriptive thus inhibiting the use of engineering judgment.	63% Disagree	184
s. ASCE-41 has significant inconsistencies and/or glitches that need remedy.	60% Agree	172
t. ASCE 41 is written in a clear manner and thus it can be used without much difficulty.	60% Disagree	179

Table 3: Q-17 Statements having basic consensus with 50 to 59% of respondents having similar views. (e.g. < 6 out of every 10 have this opinion)

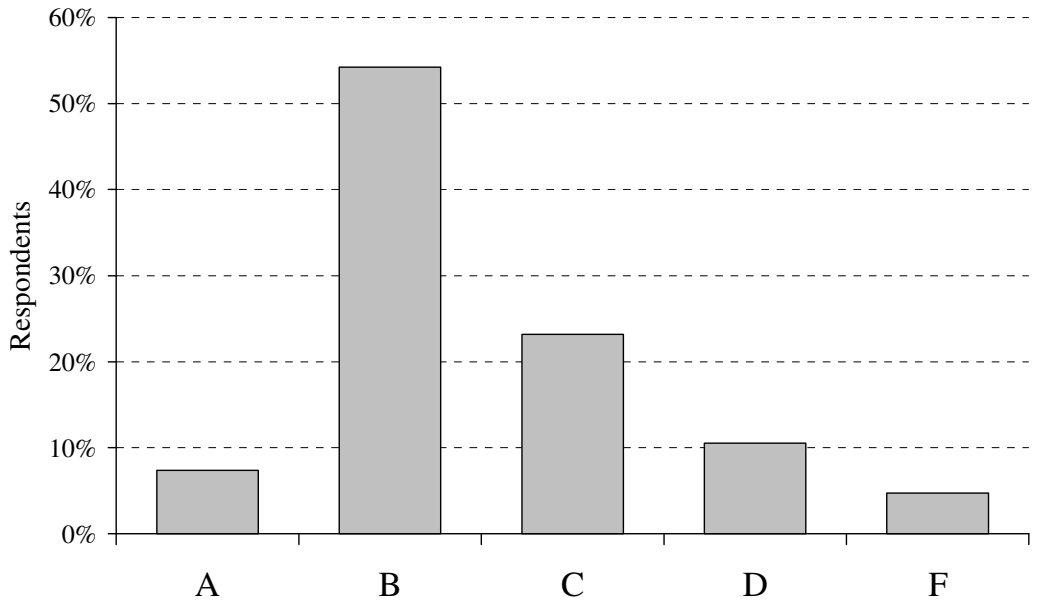
Statement	Response	Total Respondents
u. ASCE-41 is a preferred method of evaluation as compared to ASCE-31.	59% Agree	145
v. ASCE-41's title designation of Life Safety Performance Level is an overstatement because the corresponding provisions do not specifically ensure occupant safety.	58% Disagree	163
w. ASCE-41's Linear procedures (LSP, LDP) are more useful than the Nonlinear procedures (NSP, NDP).	57% Disagree	144
x. ASCE-41 is well suited for Probable Maximum Loss (PML) estimation calculations.	50% Agree	136

Q-18. Assign an overall grade to ASCE-41, considering the document format, usability, technical quality, usefulness, and evaluation/design outcomes.

The choices were as follows.

- A (excellent, could not expect much more from a pioneering effort)
- B (very good effort, but can have improvements)
- C (equivalent to most other industry codes and standards)
- D (misses the mark, needs revision)
- F (poor, does not satisfy industry needs and requires major changes)
- No answer (blank)

There were 190 total respondents out of 204 surveys submitted (93%) and the results are shown below. The percentages refer the percentage of total respondents.



Q-19. Do you think the results from this survey will be of value?

Yes	84%
No	10%
No response	6%

Q-20. Would you find value in the results from surveys on ASCE-41 and ASCE-31 detailed technical aspects?

Yes	77%
No	18%
No response	5%

Q-21. Would you respond to surveys of greater detail taking more time (say 1 to 2 hours)?

No	75%
Yes	21%
No response	4%

Question Q-22 allowed the respondent to enter text response. The results are voluminous and not included in this report.

- Q-22. Please enter any additional comments you want to share with the survey project team. Do not feel obligated to make an entry.

Q-23. Please indicate the association of which you are a member.

Structural Engineers Association of Northern California (SEAONC)	53%
Structural Engineers Association of Southern California (SEAOSC)	24%
Structural Engineers Association of Central California (SEAOCC)	9%
None	8%
Structural Engineers Association of San Diego (SEAOSD)	5%