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The National Earthquake Hazards Reduction Program (NEHRP): Issues in Brief

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Summary

Under the National Earthquake Hazards Reduction Program (NEHRP), four federal agencies have responsibility for long-term earthquake risk reduction: the U.S. Geological Survey (USGS), the National Science Foundation (NSF), the Federal Emergency Management Agency (FEMA), and the National Institute of Standards and Technology (NIST). These agencies assess U.S. earthquake hazards, deliver notifications of seismic events, develop measures to reduce earthquake hazards, and conduct research to help reduce overall U.S. vulnerability to earthquakes. Congressional oversight of the NEHRP program encompasses how well the four agencies coordinate their activities to address the earthquake hazard. Better coordination was a concern that led to changes to the program in legislation enacted in 2004 (the National Earthquake Hazards Reduction Program Reauthorization Act of 2004; P.L. 108-360).

P.L. 108-360 authorized appropriations for NEHRP through FY2009. Although authorization for appropriations expired in 2009, Congress has continued to appropriate funds for NEHRP activities. Congress made available $138.9 million for program activities in FY2017 appropriations, slightly more than FY2016 spending of $134.9 million. The budget request for FY2018 would reduce total funding for NEHRP activities to $124.1 million, a decrease of about 8% compared to FY2017.

Legislation introduced in the 115th Congress, S. 1768 (the National Earthquake Hazards Reduction Program Reauthorization Act of 2017), largely would leave the current four-agency NEHRP program intact, while providing some new areas of emphasis. The bill, introduced on September 6, 2017, would emphasize activities to promote greater resilience to earthquakes and activities that would enhance the effectiveness of an earthquake early warning system, among other changes. S. 1768 would remove statutory language referring to an original purpose of the program to seek a capability to predict earthquakes. In its 1990 reauthorization, NEHRP shifted its program emphasis from prediction to hazard reduction, and S. 1768 would continue that emphasis along with enhancing the concept of resilience. Resilience would include, for example, designing and building structures that not only protect human lives during an earthquake, but would also continue to be functional structures after an earthquake. Those structures could then be reoccupied instead of being total losses.

S. 1768 was referred to the Senate Committee on Commerce, Science, and Transportation, which held a markup on December 13, 2017. The committee ordered the bill to be reported with an amendment in the nature of a substitute, which made several changes to the original legislation. Notably, the amended bill added a section authorizing appropriations for fiscal years 2018 through 2022. The amounts authorized would slightly exceed the appropriations Congress enacted for the four-agency program in FY2017.

No similar legislation has been introduced in the House.

Contents

Introduction 1
Changes to NEHRP Since Its Inception 1
A Shift in Program Emphasis to Hazard Reduction 2
Responsibilities of NEHRP Agencies Under P.L. 108-360 3
NEHRP Legislation in the 115th Congress: S. 1768 5
Changes to Findings, Purposes, Definition (Section 2) 5
Changes to Program Activities and Agency Responsibilities (Section 3) 6
NEHRP Agencies 7
Review of Earthquake Risks (Section 4) 8
Seismic Standards (Section 5) 8
Management Plan for Advanced National Seismic System (ANSS) (Section 6) 8
Authorization of Appropriations (Section 7) 9
Outlook 10

Figures

Figure 1. NEHRP Agency Responsibilities and End Users of NEHRP Outcomes 4

Tables

Table 1. Enacted Funding for NEHRP Since Enactment of P.L. 108-360 Through FY2017 (Including the FY2018 Budget Request) 5
Table 2. Authorization of Appropriations for NEHRP Agencies in S. 1768 (Amendment in the Nature of Substitute) 9

Contacts

Author Information 10

Introduction

Portions of all 50 states and the District of Columbia are vulnerable to earthquake hazards, although risks vary greatly across the country and within individual states. Seismic hazards are greatest in the western United States, particularly in California, Washington, Oregon, Alaska, and Hawaii. Alaska is the most earthquake-prone state, experiencing a magnitude-7 earthquake almost every year and a magnitude-8 earthquake every 13 years, on average, since 1900.[1] Because of its low population and infrastructure density, Alaska has a relatively low risk for large economic losses from an earthquake. In contrast, California has more citizens and infrastructure at risk than any other state because of its frequent seismic activity, large population, and extensive infrastructure.

The federal government has supported efforts to assess and monitor earthquake hazards and risk in the United States under the National Earthquake Hazards Reduction Program (NEHRP) since 1977. Four federal agencies responsible for long-term earthquake risk reduction coordinate their activities under NEHRP:

- U.S. Geological Survey (USGS);
- National Science Foundation (NSF);
- Federal Emergency Management Agency (FEMA); and
- National Institute of Standards and Technology (NIST).

Congress last made changes to NEHRP under the National Earthquake Hazards Reduction Program Reauthorization Act of 2004 (P.L. 108-360), which authorized appropriations through FY2009 at a total of $902.4 million over five years. Congress has continued to appropriate funds for NEHRP activities since authorization for appropriations expired in FY2009. (See **Table 1**.)

On September 6, 2017, Senator Feinstein introduced S. 1768, the National Earthquake Hazards Reduction Program Reauthorization Act of 2017, together with seven original cosponsors. The bill would largely leave the overall program structure in place, but would modify some of the intents and purposes of the original legislation, such as removing references to the goal of earthquake prediction, and substituting instead the goal of issuing early warnings and earthquake alerts. The bill was referred to the Senate Committee on Commerce, Science, and Transportation which held a markup on December 13, 2017. The committee ordered the bill to be reported with an amendment in the nature of a substitute offered by Senator Gardner. The amendment made several changes to the original legislation introduced by Senator Feinstein.

Changes to NEHRP Since Its Inception

In 1977, Congress passed the Earthquake Hazards Reduction Act (P.L. 95-124), establishing NEHRP as a long-term earthquake risk reduction program for the United States. The program, led by USGS and NSF, initially focused on research toward understanding and ultimately predicting earthquakes. However, earthquake prediction has proved intractable over time, and NEHRP shifted its focus in 1990 to minimizing losses from earthquakes after they occur.

Agency leadership of NEHRP has also changed since the program's inception. FEMA was created in 1979, and President Carter designated it as the lead agency for NEHRP. In 1980, Congress passed amendments to the Earthquake Hazards Reduction Act (P.L. 96-472) that

[1] State of Alaska, Alaska Seismic Hazards Safety Commission, "Earthquake Risk in Alaska," at http://seismic.alaska.gov/earthquake_risk.html.

defined FEMA as the lead agency for NEHRP and authorized additional funding for earthquake hazard preparedness and mitigation for FEMA and the National Bureau of Standards (now NIST).

A Shift in Program Emphasis to Hazard Reduction

Congress changed NEHRP's original focus on research to predict earthquakes in the National Earthquake Hazards Reduction Program Reauthorization Act of 1990 (P.L. 101-614). The law decreased the program's emphasis on earthquake prediction, clarified the role of FEMA, clarified and expanded the program objectives, and required federal agencies to adopt seismic safety standards for all existing federal buildings that were designed and constructed without adequate seismic design and construction standards.

In 2004, Congress enacted P.L. 108-360 and adjusted NEHRP again by shifting primary responsibility for planning and coordinating the program from FEMA to NIST. P.L. 108-360 also established an interagency coordinating committee and an advisory committee, both focused on earthquake hazard reduction.

Current program activities are focused on several broad areas:

1. Developing effective measures to reduce earthquake hazards.[2]
2. Promoting the adoption of earthquake hazard reduction activities by federal, state, and local governments; by national building standards and model building code organizations; and by engineers, architects, building owners, and others who play a role in planning and constructing buildings, bridges, structures, and critical infrastructure or lifelines.[3]
3. Improving the basic understanding of earthquakes and their effects on people and infrastructure through interdisciplinary research involving engineering; natural sciences; and social, economic, and decision sciences.
4. Developing and maintaining the Advanced National Seismic System (ANSS) and the Global Seismic Network (GSN).[4]

From FY2004 through FY2014, program activities also included the NSF-supported George E. Brown Jr. Network for Earthquake Engineering Simulation (NEES) that consisted of 15 experimental facilities and an information-technology infrastructure with a goal of mitigating earthquake damage by the use of improved materials, designs, construction techniques, and

[2] Hazard is not the same as risk. Earthquake *hazard* is related to the probability of a certain level of a shaking event caused by an earthquake within a certain time frame. *Risk* could be described as the combination of the hazard and the affected population (which includes the infrastructure supporting that population). High population centers would therefore be at a higher risk than low population centers for the same degree of earthquake hazard, in general. It is important to note that the original legislation, arguably, mistakenly conflated the terms hazard and risk. More recently, the term *resilience* has been introduced in discussions regarding reducing earthquake risk (i.e., indicating improving resilience to earthquake hazards).

[3] Lifelines are essential utility and transportation systems. Within the earthquake community, the term *lifelines* has generally given way to the term *lifeline infrastructure*. See the Earthquake Engineering Research Institute white paper, "Improve Reliability of Lifeline Infrastructure Systems," April 5, 2016, https://www.eeri.org/wp-content/uploads/eeri-policy-lifelines.pdf.

[4] The Advanced National Seismic System is a nationwide network of seismographic stations operated by USGS. The Global Seismic Network is a global network of stations coordinated by the Incorporated Research Institutions for Seismology, a nonprofit organization.

monitoring tools. Currently, NSF supports the successor to NEES, the Natural Hazards Engineering Research Infrastructure (NEHRI).[5]

Responsibilities of NEHRP Agencies Under P.L. 108-360

The House Science Committee report in the 108th Congress on H.R. 2608 (P.L. 108-360) noted that NEHRP has produced a wealth of useful information since 1977, but it also stated that the program's potential has been limited by the inability of the NEHRP agencies to coordinate their efforts.[6] The committee asserted that restructuring the program with NIST as the lead agency, directing funding toward appropriate priorities, and implementing NEHRP as a true interagency program would lead to improvement.

The 2004 law made the director of NIST chair of the Interagency Coordinating Committee. Other members of the committee include the directors of FEMA, USGS, NSF, the Office of Science and Technology Policy, and the Office of Management and Budget. The Interagency Coordinating Committee is charged with overseeing the planning, management, and coordination of the program. Primary responsibilities for the NEHRP agencies break down as follows (see also **Figure 1**):

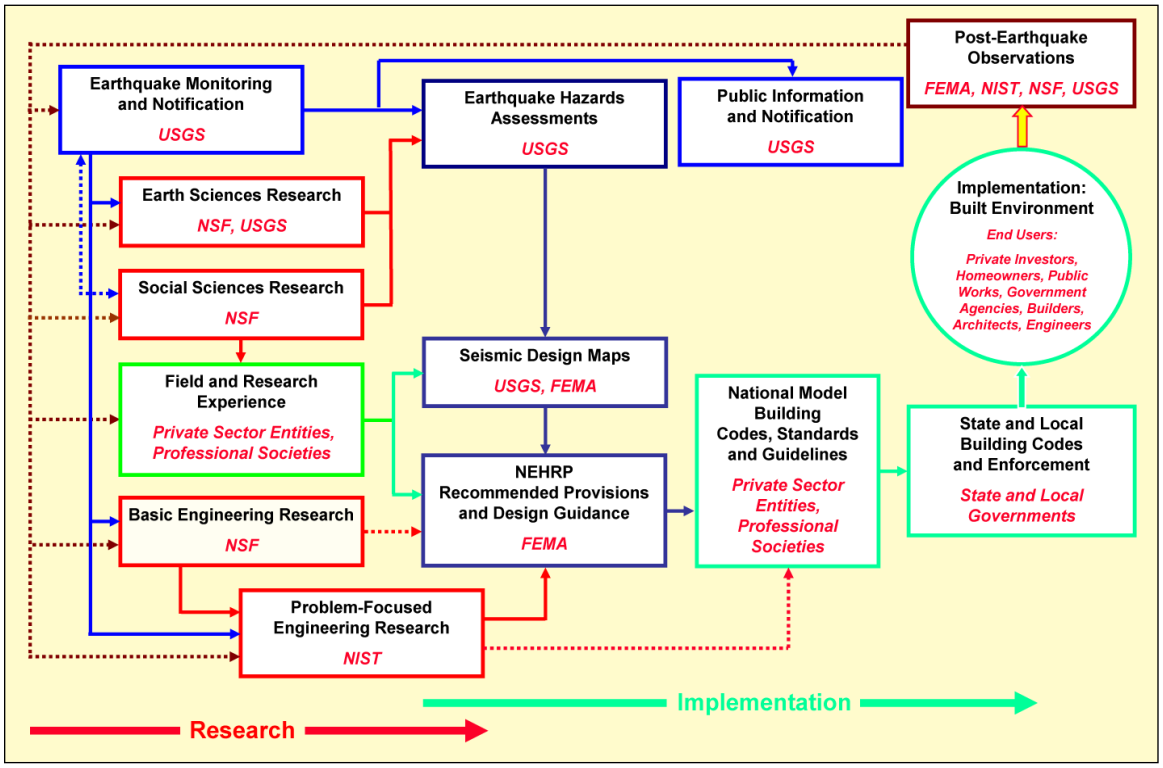
- NIST is the lead NEHRP agency and has primary responsibility for NEHRP planning and coordination. NIST supports the development of performance-based seismic engineering tools and works with FEMA and other groups to promote the commercial application of the tools through building codes, standards, and construction practices.[7]
- FEMA assists other agencies and private-sector groups to prepare and disseminate building codes and practices for structures and lifelines, and it aids development of performance-based codes for buildings and other structures.
- USGS conducts research and other activities to characterize and assess earthquake risks. The agency (1) operates a forum, using the National Earthquake Information Center (NEIC), for the international exchange of earthquake information; (2) works with other NEHRP agencies to coordinate activities with earthquake-reduction efforts in other countries; and (3) maintains seismic-hazard maps in support of building codes for structures and lifelines and other maps needed for performance-based design approaches.
- NSF supports research to improve safety and performance of buildings, structures, and lifelines.

[5] NEHRI is a distributed, multiuser, national facility that provides research infrastructure for the natural hazards research community, including earthquake and wind engineering experimental facilities, cyber infrastructure, computational modeling and simulation tools, and research data. Personal communication from Karen Pearce, senior legislative affairs specialist, October 6, 2017.

[6] U.S. House of Representatives, Committee on Science, *National Earthquake Hazards Reduction Program Reauthorization Act of 2003*, 108th Cong., 1st sess., H.Rept. 108-246 (August 14, 2003), p. 13.

[7] Building codes typically are developed by independent standards organizations, such as the International Code Council (ICC). According to the ICC, 50 states and the District of Columbia have adopted International Codes© developed by the ICC at the state or jurisdictional level. See https://www.iccsafe.org/about-icc/overview/about-international-code-council/.

Figure 1. NEHRP Agency Responsibilities and End Users of NEHRP Outcomes



Source: National Earthquake Hazards Reduction Program (NEHRP) program office at http://www.nehrp.gov/pdf/ppt_sdr.pdf (modified by CRS).

Notes: FEMA = Federal Emergency Management Agency; NIST = National Institute of Standards and Technology; NSF = National Science Foundation; USGS = U.S. Geological Survey.

Table 1 shows the enacted budgets for NEHRP agencies from FY2005 through FY2017 (and the budget request for FY2018). Enacted appropriations for FY2005-FY2009 totaled $613.2 million, or 68% of the $902.4 million total amount authorized in P.L. 108-360 over the five-year span (see **Table 1**). Authorization of appropriations for the program under P.L. 108-360 expired at the end of FY2009. Congress has continued to appropriate funds for NEHRP program activities.

Table 1. Enacted Funding for NEHRP Since Enactment of P.L. 108-360 Through FY2017 (Including the FY2018 Budget Request)

(in millions of current dollars)

		USGS	NSF	FEMA	NIST	Total
FY2005	Enacted	58.3	53.1	14.7	0.9	**127.0**
FY2006	Enacted	54.5	53.8	9.5	0.9	**118.7**
FY2007	Enacted	55.4	54.8	9.1	1.7	**121.0**
FY2008	Enacted	58.1	55.6	6.1	1.7	**121.5**
FY2009	Enacted	61.2	55.3	9.1	4.1	**129.7**
FY2010	Enacted	62.8	55.3	9.0	4.1	**131.2**
FY2011	Enacted	61.4	53.3	7.8	4.1	**126.6**
FY2012	Enacted	60.4	53.2	7.8	4.1	**125.5**
FY2013	Enacted	55.6	52.2	`7.8	3.9	**119.5**
FY2014	Enacted	58.7	51.0	7.8	3.9	**121.4**
FY2015	Enacted	64.4	52.2	7.4	3.9	**127.9**
FY2016	Enacted	67.0	54.2	8.5	5.2	**134.9**
FY2017	Enacted	71.0	54.2	8.5	5.2	**138.9**
FY2018	Request	56.4	54.0	8.5	5.2	**124.1**

Sources: NEHRP program office, 2005-2017 NEHRP Agency Budgets, http://www.nehrp.gov/pdf/2005-2017_NEHRP_Agency_Budgets_for_website_15Aug2017.pdf; 2018 Requested Funding for NEHRP Agencies (reported as of July 19, 2017), http://www.nehrp.gov/pdf/2018_Requested_Funding_for_NEHRPAgencies_15Aug2017.pdf.

Notes: According to the NEHRP program office, FEMA, NIST, and NSF budgets are those agencies' planned allocations for NEHRP activities from the total requested agency appropriations for FY2018. The USGS-enacted funding reflects the amount appropriated for USGS, and the USGS amount is what was requested for USGS NEHRP activities.

NEHRP Legislation in the 115th Congress: S. 1768

S. 1768, the National Earthquake Hazards Reduction Program Reauthorization Act of 2017, largely would leave the current four-agency NEHRP program intact, while providing some new areas of emphasis and omitting specific authorization of appropriations levels for the member agencies. The bill, introduced by Senator Feinstein on September 6, 2017, has seven original cosponsors. No similar legislation has been introduced in the House.

Upon introduction, S. 1768 was referred to the Senate Committee on Commerce, Science, and Transportation, which held a markup on December 13, 2017. An amendment in the nature of a substitute, introduced by Senator Gardner, was accepted by the committee, and the bill was ordered to be reported favorably out of committee. The sections below discuss the original legislation and note where the amendment in the nature of a substitute made changes.

Changes to Findings, Purposes, Definition (Section 2)

As noted above, NEHRP activities shifted long ago from a goal of earthquake prediction to earthquake hazard reduction. S. 1768 would codify that shift by removing references to earthquake prediction throughout the bill. For example, Section 2 of the bill would modify the congressional findings section (42 U.S.C. 7701) by omitting the linkage between seismological

research and earthquake prediction and substituting the finding that "a well-funded seismological research program could provide the scientific understanding needed to fully implement an effective earthquake early warning system."[8] An earthquake early warning system would automatically send an alert to areas in danger of potential shaking after the earthquake is initially triggered. The alert would potentially allow components of the lifeline infrastructure,[9] such as electric utilities, railway systems, and even hospital operating rooms, to cease activities that could be impaired by violent shaking before the first earthquake-triggered surface waves reach them.

Section 2 of S. 1768 also introduces the concept of resilience to earthquake hazards. For example, Section 2 cites a National Research Council study that includes goals and objectives for achieving national earthquake resilience.[10] Section 2 also would amend the congressional statement-of-purpose section (42 U.S.C. 7702) to include the purpose of increasing the resilience of communities to future earthquakes in addition to the purpose of reducing the risks to life and property. The bill would define community resilience in the definitions section of the law (42 U.S.C. 7703) to mean "the ability of a community to prepare and plan for, absorb, recover from, and more successfully adapt to seismic events."

Section 2 of S. 1768 also takes note of the aspect of resilience that includes design and construction of buildings so that those structures are built to potentially continue functioning, or to be reoccupied, in spite of earthquake damage. The legislation notes that the built environment has historically been constructed and maintained to prevent severe injuries or loss of life, but not necessarily to continue functioning or to be reoccupied without a complete reconstruction. Section 2 introduces the language of "re-occupancy, recovery, reconstruction" following an earthquake to capture this trend within the seismic community.

Changes to Program Activities and Agency Responsibilities (Section 3)

Within the four broad areas of NEHRP program activities, Section 3 of S. 1768 would add a new component to help promote earthquake hazards reduction. The bill would add to the activities listed under 42 U.S.C. 7704(a)(2)(b) the requirement of "publishing a systematic set of maps of active faults and folds, liquefaction susceptibility, susceptibility for earthquake induced landslides, and other seismically induced hazards." If carried out, such a repository of maps would likely be considered an important tool for reducing earthquake risk by the spectrum of potential users at the federal, state, local, and tribal government level, as well as the developers of national building codes, developers, building owners, and others involved in planning and construction of the structural environment. It is not clear whether this new requirement involves the compilation and organization of existing maps, or the creation of new maps; either or both could represent a significant undertaking by the NEHRP agencies.

Section 3 would also add new duties for the Interagency Coordinating Committee. In addition to developing a strategic plan for NEHRP, a management plan to implement the strategic plan, and a coordinated interagency budget on a biennial basis, the committee would also be required to develop memorandums of understanding with other federal agencies, such as the National

[8] An early-warning system would send a warning after an earthquake occurred but before the damaging seismic waves reach a community that would be affected by the seismic waves. In contrast, an earthquake prediction would provide a date, time, and location of a future earthquake.

[9] S. 1768 would replace the term *lifelines* with the term *lifeline infrastructure* wherever it appears in the *U.S. Code*.

[10] National Research Council, *National Earthquake Resilience, Research, Implementation, and Outreach*, 2011, http://www.nehrp.gov/pdf/nrc2011.pdf.

Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration (NOAA), on data sharing and resource commitments in the event of an earthquake disaster. Further, the committee would coordinate with the Secretaries of Agriculture and the Interior on the use of federal lands for monitoring, research, and data collection. The committee would also be required to coordinate with the Secretaries of Transportation and Housing and Urban Development on the effects of earthquakes on transportation and building stocks (part of the lifeline infrastructure described above).

NEHRP Agencies

Under S. 1768, NIST would remain the lead agency for the program, with its duties and responsibilities largely unchanged. FEMA would also retain most of its duties and responsibilities, with a few modifications. For example, current law allows FEMA discretion in entering cooperative agreements or contracts with states, local jurisdictions, or other federal agencies to establish demonstration projects on earthquake hazard modification, linking research and mitigation efforts with emergency management programs, or preparing educational materials for national distribution. Section 3 of S. 1768 would require FEMA to enter cooperative agreements or contracts for these purposes (substituting the word "shall" for the word "may" in the bill language). Also, states that enter into these agreements would be required to provide a 25% cost share, unless FEMA lowers or waives the cost share requirement.

The amended bill ordered to be reported out of committee on December 13, 2017, added a requirement that the Interagency Coordinating Committee provide a statement in its reports to Congress whether FEMA lowered or waived the 25% cost-share requirement. The amended bill also changed the criteria under which FEMA may lower or waive the cost-share requirement. The original legislation would have provided FEMA with discretion to reduce or waive the cost-share requirement "in exceptional cases of economic hardship." The amended bill is more specific and would allow reducing or waiving the requirement for "a small impoverished community," as defined in Section 203 of the Disaster Relief Act of 1974 (42 U.S.C. 5133(a)).[11]

Statutory language requiring USGS to develop procedures for making earthquake predictions would be removed under Section 3 of S. 1768, and replaced with language for developing procedures for issuing alerts and early warnings. Further, the bill would require USGS to issue an actual alert and an earthquake warning, when necessary and feasible, to FEMA, NIST, and state and local officials, in the event of an earthquake.

Language in current law that requires NSF to support earthquake-related research using the George E. Brown Jr. Network for Earthquake Engineering Simulation (NEES) would have been updated in the original legislation by replacing reference to NEES with reference to the Natural Hazards Engineering Research Infrastructure (NEHRI), to reflect the facility currently supported by NSF (see footnote 5). The amended bill deletes the language referring to NEHRI and instead refers generically to "experimental and computational facilities."

Also, Section 3 of S. 1768 would add a new subsection requiring NSF to identify and track grant funding that is part of the NEHRP program and to provide a report at least every two years specifying the amount of NSF funding awarded to conduct research that enhances the understanding of earthquake science. The amended bill adds the phrase "to the extent practicable" to the requirements to identify and track grant funding.

[11] Commonly referred to as the Stafford Act.

Review of Earthquake Risks (Section 4)

Section 4 of S. 1768 would require a report from the Comptroller General of the United States reviewing the risks posed by earthquakes to the nation. The review would be required to contain an assessment of

- the risks and hazards to the United States, including tsunami and landslide hazards, resulting from earthquakes;
- the efforts by FEMA and NIST to improve earthquake resilience, including gaps in the U.S. resilience to earthquakes;
- the progress on coordinating the NEHRP budget and activities and how coordination among NEHRP agencies may be improved;
- the extent to which federal, state, local, and tribal governments, and the private sector, are already implementing strategies to improve earthquake resilience; and
- the extent to which research over the past 40 years has been applied to reducing public and private earthquake risk and hazards.

Section 4 would also require the Comptroller General to identify legislative or administrative action to improve NEHRP and U.S. resilience to earthquakes. The bill would require the report within three years of enactment.

Seismic Standards (Section 5)

S. 1768 would replace the language in current law that called for the adoption of seismic safety standards for buildings constructed or leased by the federal government with a requirement instead for an assessment and recommendations for improving the built environment and critical infrastructure specifically "to reflect performance goals stated in terms of post-earthquake reoccupancy and functional recovery times." This language highlights one of the changes in overall NEHRP program direction to enhance the aspect of earthquake resilience, meaning building structures that would allow for continued use and reoccupancy following an earthquake. The assessment and recommendations would come from a committee of experts, appointed by the directors of NIST and of FEMA, representing federal agencies, nongovernmental organizations, the private sector, disaster management associations, engineering associations, and construction and homebuilding industry associations. Section 5 of the bill would require a report to Congress with recommended options no later than June 30, 2020. The amended bill, accepted by the Senate Committee on Commerce, Science, and Transportation on December 13, 2017, would specify that the report be submitted to specific committees in the House and the Senate instead to Congress as a whole.[12]

Management Plan for Advanced National Seismic System (ANSS) (Section 6)

The ANSS is a nationwide network of seismographic stations operated by USGS. It consists of a "backbone" network of about 100 seismic stations throughout the United States, the National Earthquake Information Center, the National Strong Motion Project, and 15 regional seismic

[12] For the Senate, the report would go to the Committees on Commerce, Science, and Transportation; Energy and Natural Resources; and Homeland Security and Governmental Affairs. For the House, the report would go to the Committees on Science, Space, and Technology; Natural Resources; and Homeland Security.

networks operated by USGS and partner institutions.[13] S. 1768 would require a new five-year management plan for ANSS that would include

- strategies to continue developing an earthquake early warning system;
- a mechanism for securing participation of state and regional earthquake monitoring entities in ANSS;
- a plan to encourage and support integration of geospatial data products into monitoring activities in earthquake-prone regions; and
- a plan to ensure a geographically diverse management and advisory structure for ANSS.

Authorization of Appropriations (Section 7)

The previous NEHRP reauthorization bill, P.L. 108-360, authorized appropriations for NEHRP through FY2009. As introduced, S. 1768 would have repealed the section of current law authorizing appropriations entirely. However, the amended bill would provide a new authorization of appropriations for each NEHRP agency for fiscal years 2018 through 2022. **Table 2** shows the amounts for each year and by agency.

Table 2. Authorization of Appropriations for NEHRP Agencies in S. 1768 (Amendment in the Nature of Substitute)

(in millions of dollars)

Fiscal Year	USGS	NSF	FEMA	NIST	Total
2018	72.42	55.08	8.67	5.30	**141.47**
2019	73.87	56.18	8.84	5.41	**144.30**
2020	75.35	57.31	9.02	5.52	**147.20**
2021	75.85	58.45	9.20	5.63	**149.13**
2022	78.39	59.62	9.39	5.74	**153.14**

Source: S. 1768.

Note: The bill would require that $30 million of the total USGS authorization of appropriations each year be made available for completion of the Advanced National Seismic System (ANSS).

As **Table 1** shows, Congress has continued to appropriate funds for NEHRP without an authorization of appropriations (generally at levels well below the authorized amounts for the years when appropriations were authorized). The authorization of appropriations levels in the amendment to S. 1768 would exceed the total amounts appropriated for the four-agency program in FY2017 by slightly less than 2% in FY2018 and by almost 10% by 2022 (not adjusted for inflation).

The findings section (Section 2) of the legislation recognizes that the National Research Council in 2011 recommended funding of approximately $300 million annually for 20 years (in 2009 dollars).[14] That amount would be approximately two times the average annual amount authorized for appropriations for the total NEHRP program in S. 1768.

[13] For more information, see U.S. Geological Survey, Earthquake Hazards Program, *ANSS—Advanced National Seismic System*, at https://earthquake.usgs.gov/monitoring/anss/.

[14] National Research Council, *National Earthquake Resilience, Research, Implementation, and Outreach*, 2011, p. 4, http://www.nehrp.gov/pdf/nrc2011.pdf.

Outlook

At present, earthquakes cannot be accurately predicted. In its 1990 reauthorization, NEHRP shifted its program emphasis from prediction to hazard reduction. Since then, the program's focus has been on understanding the earthquake hazard and its risk to populations and infrastructure in the United States, developing effective measures to reduce earthquake hazards, and promoting the adoption of earthquake hazard reduction measures in vulnerable areas.

Legislation enacted to modify NEHRP in the 108th Congress (P.L. 108-360) reflected congressional concerns about how well the four NEHRP agencies coordinated their efforts to maximize the program's potential. Legislation introduced in the 115th Congress, S. 1768, would leave the program largely intact, while emphasizing activities to promote greater resilience to earthquakes and activities that would enhance the effectiveness of an earthquake early warning system, among other changes. The bill as amended would authorize annual appropriations levels for NEHRP at slightly higher levels than the amount of enacted appropriations for the program in FY2017. The bill also would remove statutory language regarding earthquake prediction.

Since NEHRP shifted its emphasis toward reducing losses during an earthquake, one persistent question has been how to establish a precise relationship between NEHRP activities and reduced earthquake risk and actual losses from earthquakes. Section 4 of S. 1768 appears to address that question by requiring the Comptroller General of the United States to review the activities of the program and produce a report for Congress that addresses the earthquake risks and hazards in the nation. The review and report would look at how federal activities are addressing those risks and hazards, including how states, tribes, and local governments are using NEHRP-generated information and implementing measures to reduce their earthquake risk.

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