THE GEOLOGICAL SOCIETY OF AMERICA®

GSA Position Statement
Adopted October 2014

The Role of the Geoscientist in Building and Maintaining Infrastructure

Position Statement. Geoscientists have a fundamental role in the engineering and architectural design, planning, construction, and maintenance of infrastructure systems with respect to their relationship to local geology, hazards and the environmental setting.

Purpose. This position statement (1) summarizes The Geological Society of America's consensus view on the importance of geoscientists' contribution to infrastructure concerns, (2) describes geoscientists' roles in addressing aging and expanded infrastructure, and (3) recommends actions to incorporate geoscientists, expand consistency of skills, and educate the public on the natural resource setting for infrastructure systems.

RATIONALE

Infrastructure comprises the interdependent technical structures and public works systems that support society—including roads, rail lines, bridges, dams, waterways, water supply, pipelines, electrical grids, and telecommunications. These systems provide services and resources essential to maintaining the health, safety, and sustainability of communities. A large portion of existing infrastructure was constructed over the past century; however, without ongoing maintenance and improvement infrastructure systems deteriorate over time. In many locations, existing infrastructure is approaching and even exceeding its original design life. Additionally, recent gains in prosperity and population in emerging economies has placed increased demand for improvement and expansion of infrastructure systems. The viability and integrity of public works is also dependent on the quality and availability of industrial minerals and rocks used in the construction process. While it is clear that society's infrastructure needs crucial assessment, maintenance, and upgrades, future infrastructure likely will require new design approaches and priorities. The dependent nature of the built environment on geology necessitates a thorough understanding of earth dynamics and geologic materials in infrastructure engineering and construction.

Geoscientists are essential in the planning, design, and construction stages of infrastructure, and its maintenance and modernization in many ways: (1) characterization of subsurface geological conditions with respect to their effect on the design, construction and on-going sustainability of infrastructure projects; (2) planning for new infrastructure and the assessment of existing infrastructure, with respect to environmental impact, natural resource availability, and the incorporation of regional and site-specific natural-hazard analysis; (3) evaluating and monitoring construction methods in high risk areas (for example: unstable slopes, high water table, sensitive soil conditions); and (4) continual monitoring of potential geologic hazards and environmental conditions in sensitive and critical facilities (e.g., power plants, dams, landfills).

Competent infrastructure is not only dependent on the geologic conditions where it is built, but also on the expertise of the geoscientist involved in the environmental and geotechnical study that complements the engineering. This expertise is the result of education, experience, and qualification. Licensure or a similar form of certification of applied geologists ensures minimum criteria of knowledge and work history necessary to promote consistent best practices and ethical conduct.

RECOMMENDATIONS

1. **Governments at all levels are encouraged to incorporate licensed geologists or geological engineers in the infrastructure design and planning process.**[1] In some municipalities, geologists are required to provide

recommendations and participate in the design process for development on steep slopes in known landslide hazard areas. Similar planning-level participation from geologists is essential for construction in flood zones, earthquake prone regions, and karst environments. Geoscientists' involvement with planning and design will raise awareness and consideration of geologic conditions.

2. **Legislative bodies and government agencies are encouraged to include geoscientists within the public process.** If not properly planned, the basic infrastructure of communities can be quickly overwhelmed, especially in the face of disaster. Flood damage from levee failures along the Mississippi River in 2011, damage to power grids and transportation systems in the northeastern United States due to Hurricane Sandy in 2012, and hindering of post-typhoon aid to the Philippines due to substantial airport damage from Typhoon Haiyan in 2013 are reminders of the havoc resulting from poor planning and infrastructure disrepair. Inclusion of geoscientists in legislative forums, especially those concerning policy, can provide needed awareness and relevance of the role the earth sciences play in the planning of public works.

3. **Establish and promote consistent requirements of professional geologist licensure programs.** Some countries, notably Canada, Australia, and parts of the United States and Europe require licensure or comparable certification if geosciences activities are to be performed in the public domain[*]. In the United States, several states are members of the National Association of State Boards of Geology (ASBOG®), which uses standardized examinations to license professional geologists and provide guidance in maintaining a professional geologist licensure program. Licensure requirements promote technical consistency in the profession as well as reinforce best practices to ensure public safety and welfare.

4. **Increase awareness about natural hazards in high risk communities.**[2, 3] The scientific knowledge afforded by geoscientists is essential in providing guidance for infrastructure design when building in areas that are threatened by natural hazards (e.g., floods, earthquakes, landslides, tsunamis, and storm surges).

5. **Institutions of higher learning are invited to partner with applied earth science professionals to contribute practical curricula with a focus on infrastructure systems.**[1] Increasing urbanization and projected expansion into marginally stable lands and vulnerable coastal zones, and the demands for improvement in existing infrastructure, require a highly skilled, versatile, and innovative workforce of applied earth science professionals. Given the growing demands with infrastructure needs, the role of the applied geoscientist—especially one who has geotechnical and engineering expertise—will be crucial in the coming years.

Referenced GSA Position Statements That Support These Recommendations:

1. Promoting Earth Science Literacy for Public Decision Making, GSA, April 2013.
2. Geoscience and Natural Hazards Policy, GSA, revised April 2012.
3. Managing U.S. Coastal Hazards, GSA, October 2013.

About the Geological Society of America

The Geological Society of America, founded in 1888, is a scientific society with more than 26,000 members from academia, government, and industry in more than 100 countries. Through its meetings, publications, and programs, GSA enhances the professional growth of its members and promotes the geosciences in the service of humankind. GSA encourages cooperative research among earth, life, planetary, and social scientists, fosters public dialogue on geoscience issues, and supports all levels of earth science education. Inquiries about the GSA or this position statement should be directed to GSA's Director for Geoscience Policy, Kasey S. White, at +1-202-669-0466 or kwhite@geosociety.org.

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[*] Licensure and certification are different in scope and implementation. Licensure has governmental authority and oversight; certification is conferred by a professional association. Certification may or may not include testing of knowledge.

Opportunities for GSA and its Members to Help Implement Recommendations

- Licensing geologists, or certifying geologists where licensure laws are absent, is an important component for increasing public and political recognition and support for the science and profession. Professional geoscientists in countries or provinces without licensure should consider developing accreditation programs. In the United States, geologists in states without licensure are encouraged to contact ASBOG® to learn how to bring licensure into their states or obtain professional certification from a national organization such as the American Institute of Professional Geologists (AIPG) or a comparable professional organization relevant to the practice of geological engineering. Members can also contact legislatures to promote the addition of geologist licensure to state or national legislation.

- Work with local and regional planning boards or institutions to educate them on the value of geoscientists in the planning and design of infrastructure systems. This might include field trips to illustrate pertinent engineering and environmental issues.

- Support government geologic surveys. These institutions provide essential knowledge and resources needed for the development and building of infrastructure.

- Encourage and provide expert input on public policy that will improve society's resilience to natural hazards.

- Promote partnerships among geology departments, especially those working in tandem with civil engineering programs, and practicing professional geoscientists to review academic curricula with a focus on skills used in infrastructure planning, development and maintenance. Encourage experienced earth science professionals with pertinent industry knowledge to share their knowledge and perspective with geology and geologic engineering programs. Fostering such partnerships would provide useful insight into developing pertinent curricula that would prepare college graduates to meet the future challenges of society. As part of the curriculum review, consider coursework that would satisfy educational requirements in countries or regions where certification or licensure is required to practice geology in the public domain.