Finding a Global View at the Intersection of Geology and Engineering

by LeAnne Teruya

On January 12, 2010, Haiti was struck by a magnitude 7.0 earthquake that caused massive destruction and an astounding loss of 316,000 lives. Little more than a month later, an even larger, magnitude 8.8 earthquake struck off the coast of Chile, causing 550 lives to be lost. The consequences of Haiti and Chile earthquakes stand in stark contrast to each other. Each result was influenced by both the geology and the level of engineering each country requires for its infrastructure. This intersection between geology and engineering is a connection that forms a basis for integrating the two disciplines in my introductory geology course for civil engineers.

Geology and engineering both impact our lives everyday, but for the most part, the intersection of the two exists slightly below our level of consciousness. If we bring this connection into view, we will all have a more global view through which to approach the common goals of both fields (Fig.1). The case of the 2010 Haiti and Chile earthquakes is a good example of the intersection between geology and engineering. Geology and better building codes favored the outcome in Chile. In contrast, the close proximity of the earthquake epicenter to populated areas and the lack of engineering standards in Haiti produced an overwhelming loss of life and property. Studying examples that demonstrate the intersection between geology and engineering is a primary step in connecting these two fields.

Next, understanding how engineering and the geosciences intersect will help prevent manmade and geologically spurred problems by allowing engineers and geologists to do "pre-disaster" problem solving. This includes learning to predict areas at risk, and planning to prevent, minimize, or mitigate natural disasters. Knowing where faults lie and the type of rocks they cut through allows for structures to be placed away from the fault and be built to withstand the energy release expected from an earthquake near that location. Recognizing where past slope failures have occurred and where potential failures are likely to happen will likewise prevent structures, major throughways, and utility lines or facilities from being placed in those locations. Although we cannot predict when geologically triggered disasters will occur, we can identify the potential for these natural disasters and locations that will likely be affected by them. Geoscience and engineering knowledge combined will allow us to plan appropriately for the unexpected.

In my classroom, case studies offer a way to demonstrate the intersection between geoscience and engineering because they provide real world examples for students to examine. Every topic from rocks and minerals, to plate tectonics, to natural processes and disasters is tied to practical applications in civil engineering. Field trips illustrate where geology and engineering coexist and how both work together to resolve problems. We analyze the channeling of our local river, examine rock facades on buildings, and discuss the structural integrity of local buildings affected by an earthquake centered 48 miles away. To further encourage integration of the two fields, we could do more cross pollination: Allow geology courses to count as electives for an engineering major and allow engineering courses to count as electives for a geology degree.

The major benefit of integrating geology and engineering is that lives will be preserved and the effects of natural disasters will be prevented or lessened. We can start

by finding connections between the two fields and focusing on the interface between the two disciplines. The knowledge exchanged will produce a more global view for reaching our common goals.

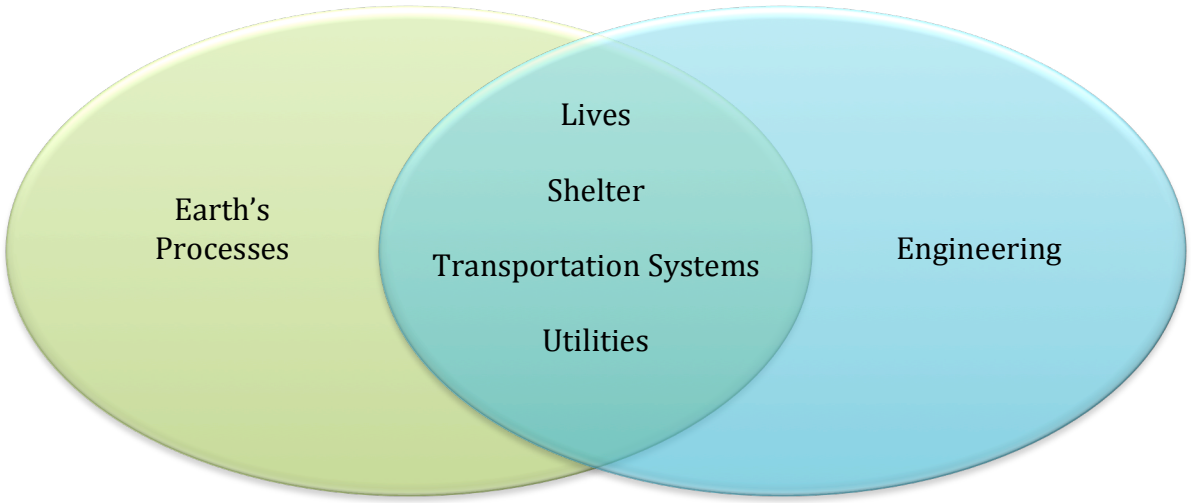

Figure 1. Geoscience and Engineering focus on the Same Goals. Geoscientists use knowledge of Earth's processes to protect lives, shelter, transportation and utility systems. Engineers design and build to reach the same goals.