

Most people do not understand the difference between cement and concrete. I was guilty of this until I took a Civil Materials class my junior year at UNLV. In this class, I was surprised to learn that these two terms are not analogous as most people seem to think. Cement is the binding material within concrete that holds all of the aggregates together. I also learned that cement production accounts for 5-7% of total global emissions (Huntzinger and Eatmon, 2009).

I have always been interested in sustainability, so I was intrigued by the thought that there must be a more sustainable material other than cement that can be incorporated into concrete. I approached my Civil Materials professor with this idea and he told me about his desire to begin research on alkali-activated natural pozzolans as a cement replacement. Subsequently, I applied for the National Science Foundation's Experimental Program to Stimulate Competitive Research (NSF EPSCoR) Award and began my initial phases of research in the summer of 2013. From this, I broadened my research scope to utilize this project as my Honors College Departmental thesis.

My research consisted of two phases, a literature review followed by nearly three months of experimental work. Prior to the experimental work, I had to research the production, chemical structure, and types of natural pozzolans as well as their potential benefits to the concrete industry. To begin this research, I turned to UNLV's online databases. I found the database Academic Search Premier to be particularly helpful as it enabled me to engage the various search modes and expanders to fine-tune the multiple relevant topics of my search.

During this initial search, I found that current research on natural pozzolans was limited because of their fairly novel application as a cement replacement material. To overcome this difficulty, I had to widen the vocabulary of terms entered into the database search bars. I used terms such as "geo-polymers," "alkali-activated binders," and "inorganic polymeric binders." I

even looked into research on other cement replacement materials, such as slag and fly ash, to understand the chemical reactions occurring between these materials and alkali activators.

As I found articles, I read through their references to find additional sources that were pertinent to my project. The majority of my articles were primary sources, as the authors actively engaged in research and reported their results. However, there were a few articles, such as those by Pacheco-Torgal et al., that were secondary sources and summarized literature previously written about alkali-activated binders.

I had to venture outside of the library and locate local sources of natural pozzolans to use for my experimental work. Through the internet, I found two possible sources and distributors in Nevada. The Nevada Cement Company donated the natural pozzolans used in my research as well as supplied the data specification sheets for these materials, thus adding another type of resource to my thesis.

For testing standards within the civil engineering discipline, the American Society for Testing and Materials (ASTM) standard experimental methods are used. I found current versions of these standards for flow, compressive strength, flexural strength, density, absorption, voids, and chloride ion penetration within UNLV Lied Library's book stacks, and I incorporated all of these methods into my research. I also had to locate a specific experimental method for another chloride ion penetration test provided by Nordtest. To find the required method, I gained access and searched within the online Nordtest database.

When I first agreed to this research project, I had no idea what I was getting myself into. The experimental work was quite laborious, requiring me to mix nearly 100 pounds of concrete each day. After my lab work, I would go home covered in concrete dust and completely exhausted, but throughout the whole experience I was motivated to keep going by the thought

that my research could contribute to more sustainable practices. Overall, my research has significance to the concrete industry as it provides performance information about a sustainable and economical cement replacement material as well as identifies how research can be furthered within this area. In addition to my thesis, I hope to publish two journal articles and a conference paper in the near future.