Trancas Associates is a group of four undergraduate Civil Engineering students in the iDesign program at Michigan Technological University. In August 2016, Trancas Associates travelled to Panamá to collect data for a vehicle bridge design project on a mountainous, unpaved roadway servicing the village of Las Trancas.

**Community Background & Problem Description**
- Indigenous Ngäbe community, subsistence farmers
- 1500 - 2000 community members, 100 - 200 households
- Single, unpaved roadway to village from Pan-American highway for transport of people and supplies
- Community has constructed bridges over a problem stream crossing on this roadway; bridges have washed out in rainy season
- Vehicles currently using ford through stream when water level is low enough; stream unpassable in the rainy season
- Permanent solution needed to keep route safe and accessible year-round

**Data Collection & Analysis**
- Surveyed the stream crossing using level surveying and created topographical map
- Performed visual analysis of soils: fat clay with stones
- Estimated hydrologic conditions and peak flow using watershed area and 100-year, 24-hour rainfall event
- Data was used to establish design requirements, such as:
  - Ease of mobilization on unpaved roads
  - Cost effectiveness
  - Minimal differential settlement of footings
  - Sufficient flow and drainage capacity
  - Resistance to environmental factors
    - Corrosion, upstream bank wall erosion, footing scour

**Final Design Recommendations**
- A flexible buried steel bridge was selected as the final design; best fit design constraints
- Gravel is backfilled and compacted overtop the structure; strength of gravel gives structure load-carrying capacity
- Stream channel will be graded and lined with rip-rap to control flow and protect structure
- Roadway leading to the structure will be filled with gravel and reasonably graded
- Roadway will be enclosed by headwall to control drainage and prevent roadbed washout
- Expected 50-year service life if properly maintained

**Project Scheduling & Estimate**
- Can be constructed in 55 working days
- Fully constructed in the short, dry season of the year (Jan. — Apr.)
- Estimate close to typical grant allowance for projects of a similar scope

**Overall Project Cost - $67,000**
- Material - $38,000
- Labor - $30,000
- Equipment - $18,000

**Figure 1. Map of Panama with Las Trancas starred**

**Figure 2. Map of transportation routes near Las Trancas with project site starred**

**Figure 3. Project Site Overview**

**Figure 4. Structure, Footings, & Roadway Profile View**

**Figure 5. Model of Structure**

**Figure 6. Similar Real-World Example**

**Figure 7. Project Estimate**