

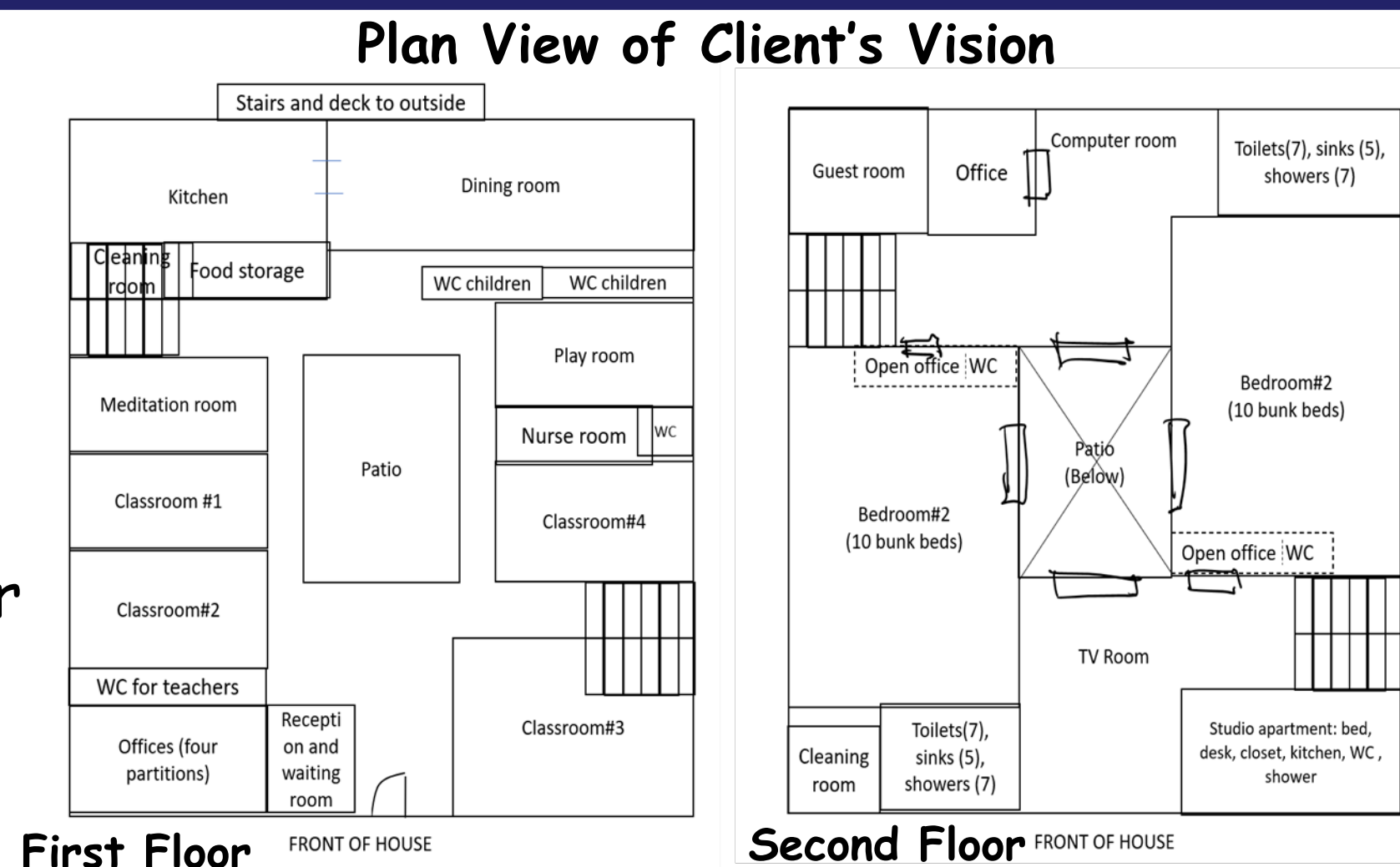
Design of Shelter for Underprivileged Children in Colombia

Introduction

A Colombian nonprofit organization approached our university to develop a design for a shelter that would house about 40 at-risk children and protect them from a widespread cycle of poverty and crime. The project was assigned to a civil engineering capstone team.

The client provided a sketch of the vision of the shelter

- Two story structure with about 400 sq.m/floor
- Optional basement with laundry/storage facilities

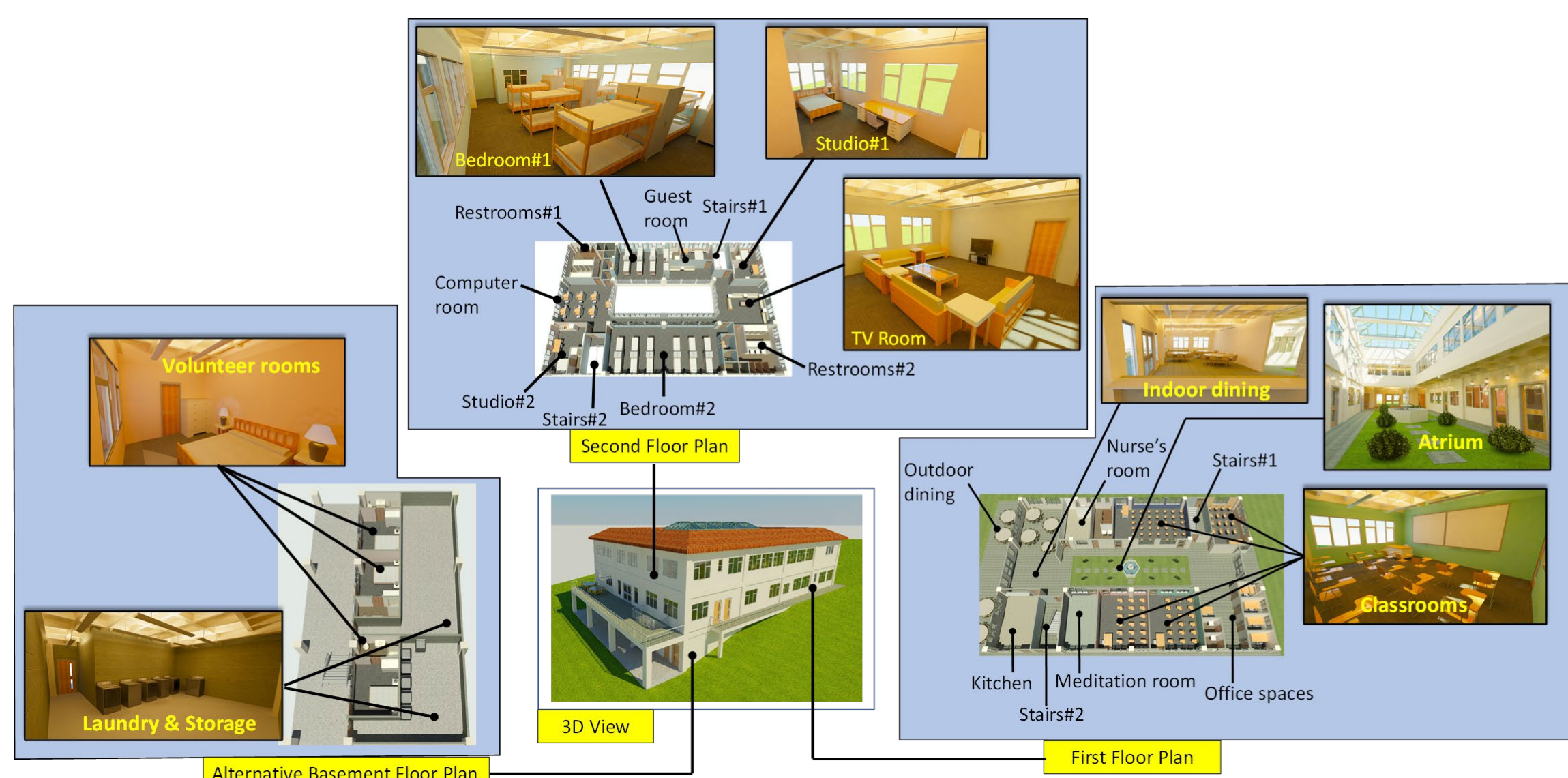


Student-Practitioner-Allied Professional Partnership

- Five civil engineering seniors
- A faculty (licensed PE/SE) as advisor
- Two civil engineering practitioners (both PEs) as mentors
- A civil engineer from Colombia providing feedback on local construction practices
- An industrial engineer as the client
- An architect as a resource on layout and functional/code requirements.

Design Approach and Deliverables

Phase 1: Team met with a US architect to refine the client's vision so the facility could meet all functional requirements; the team developed architectural drawings and renderings using the software Autodesk Revit®

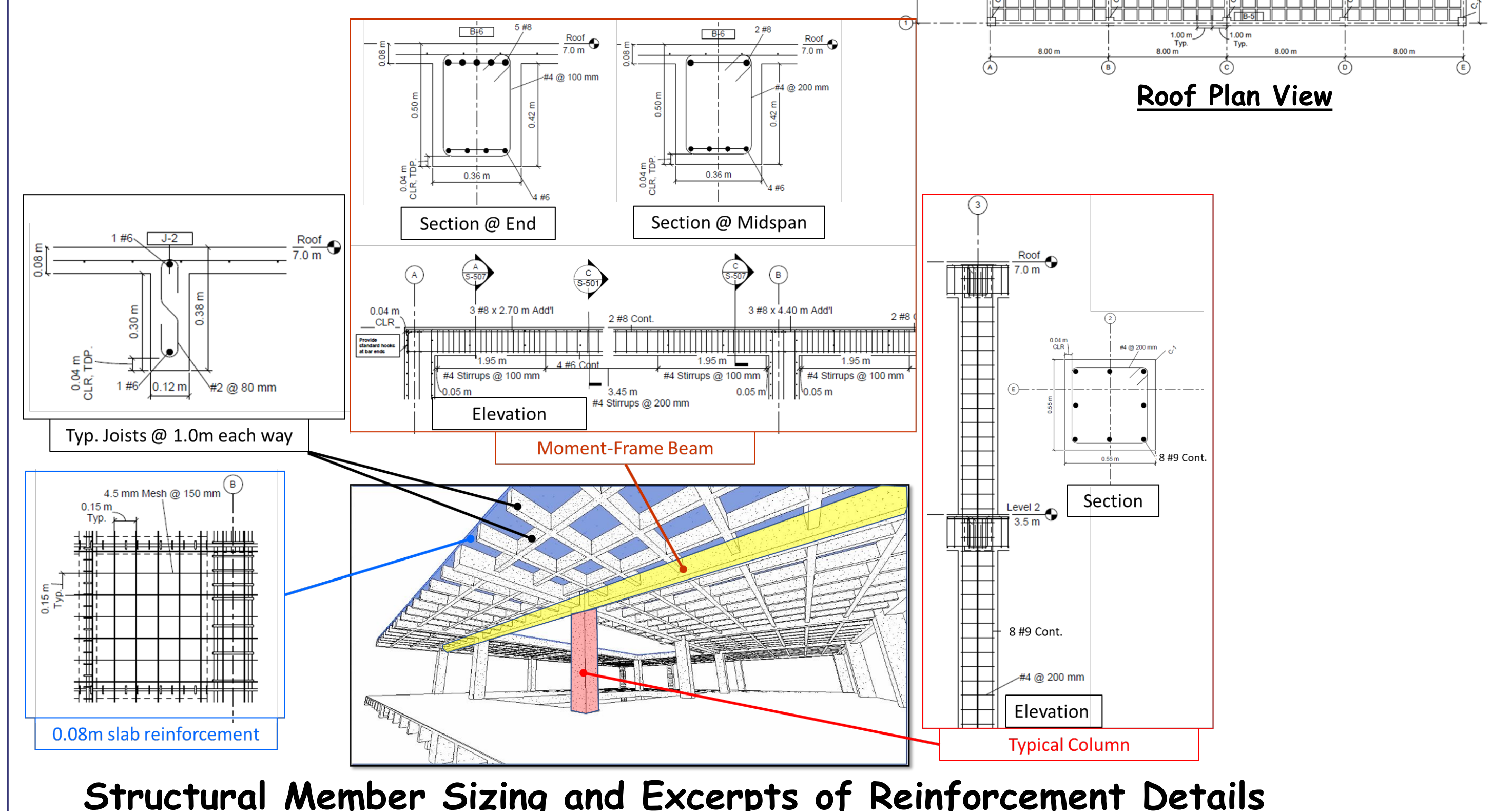


Architectural Layout of Facility prepared using Autodesk Revit®

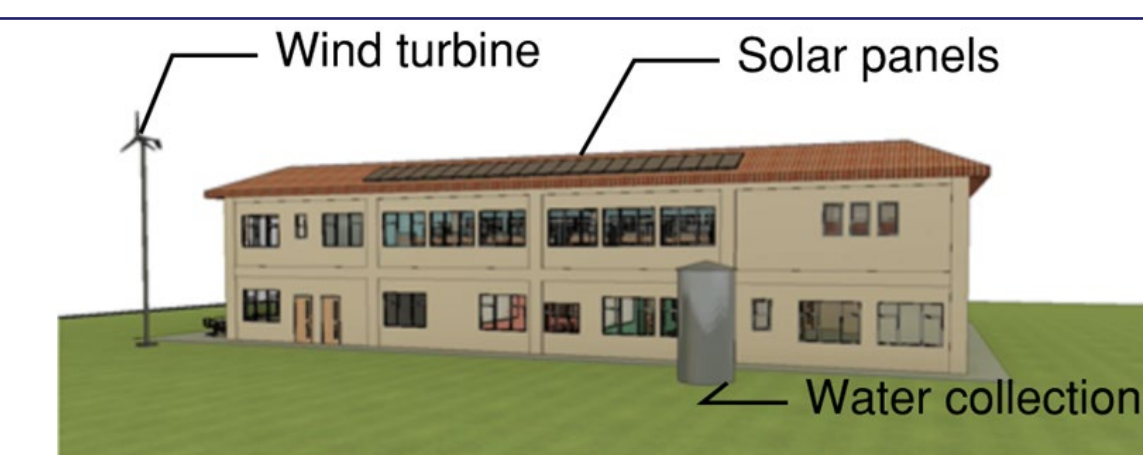
Phase 2: Team researched applicable design codes/standards as well as construction materials and practices in Colombia.

- Reinforced concrete frames with masonry infills is local practice.
- Design to withstand earthquake forces.
- Design to follow Colombian and US design codes.

Phase 3: Team selected concrete moment resisting frames for consistency with local practice; they calculated gravity and earthquake forces; carried out structural analyses and developed **engineering design** which consisted of **sizing structural members** and **reinforcement requirements and details**.



Phase 4: Team recommended sustainable features for the shelter based on favorable environmental conditions: solar panels, wind turbine, rainwater harvesting; prepared a fly-through video of the shelter for marketing use.



Knowledge and Skills Gained

- **Technical expertise**
 - Working knowledge of **American Concrete Institute 318 code**, **Colombian building code NRS-10**.
 - Effective use of various design software: **SAP2000®**, **spcolumn®**, **Autodesk Revit®**.
- **Communication and Collaboration**
 - Honing **Public speaking** and **technical writing** skills.
 - Interpersonal communication with an **international client**, **professional engineers**, **architect**.
 - Working in a **virtual environment**.
- **Professional skills**
 - **Project Management skills:** running meetings, preparing **meeting agenda**, following up on **action items**, **scheduling** and **professional responsibility**.
 - Ability to be **team players**.
 - Exposure to **economic and social issues**.
 - Appreciation for **human-centered engineering**, **public safety** and **welfare**.

Safety, Health and Welfare

- Goal is to provide a safe haven for at-risk children who are victims of a humanitarian crisis.
- Located in a region of intermediate seismic risk, shelter had to be earthquake resistant
- In case of emergency, building had to have proper entry and egress, and also provide a minimum 1-hour fire rating.

Benefit to Owner

Drawings and Flythrough video will be helpful for **fundraising efforts** for the shelter.