



Avenida Vallegrande

UV-108 Roadway and Drainage Systems

ISD - Santa Cruz, Bolivia - 2007

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INTERNATIONAL SENIOR DESIGN:

Since the year 2000, students from Michigan Technological University have chosen to complete their senior design requirement in developing countries including Bolivia and The Dominican Republic. In August of 2007, VOLO Engineering Group traveled to Santa Cruz, Bolivia to perform in country construction and initial site investigations in order to prepare a technical design report with construction plans for improvements to Avenida Vallegrande.

INTRODUCTION:

At the request of the District 10 government in Santa Cruz Bolivia, VOLO Engineering Group proposed a design solution to address seasonal flooding of Avenida Vallegrande. Stagnant water collects in two low spots (Problem Areas A and C) on Avenida Vallegrande and in portions of UV-108 (Problem Area B) as shown below. This project includes pavement, storm water drainage plans and construction specifications to address these issues.



HEALTH EFFECTS:

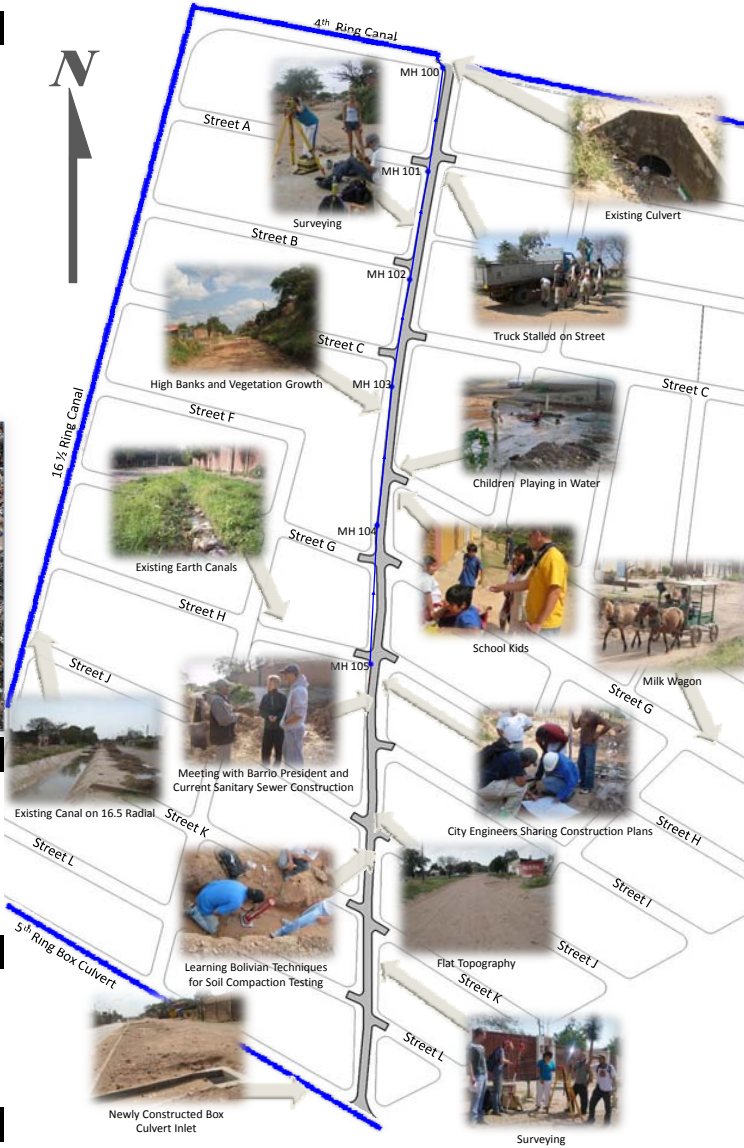
Stagnant water caused by poor drainage is a breeding ground for disease causing mosquitoes and bacteria. Diseases associated with stagnant water include dengue and malaria.

SOCIAL EFFECTS:

During the rainy season from December to March, portions of Avenida Vallegrande become impassible leading to missed work and school.

EXISTING DRAINAGE:

The area surrounding AV can be divided up into two watersheds with the west watershed draining to the new 16.5 Radial canal. The east watershed drains to AV. However, the storm water draining to AV encounters several low spots (Problem Areas A and C) and cannot easily flow to 16.5 Radial canal or 4th Ring Canal. A low point (Problem Area A) located 300 to 350 meters from the north end is the most problematic area. Additional problem areas include the low point 300 meters from the south end.



DESIGN OPTIONS:

Multiple design options were considered to address the drainage problems in UV-108.

- **Option 1:** Continuous grade concrete roadway with one high point
- **Option 2:** Concrete roadway following existing grade with drainage to 16.5 Radial Canal through paved side roads and underground pipes (2A) or under ground pipes without concrete paved road (2B)
- **Option 3:** Concrete roadway with single low point and additional drainage culvert flowing to 4th Ring Canal

	Bolivianos	US Dollar
Option 1	\$b 2,715,000	\$360,000
Option 2A	\$b 2,866,000	\$380,000
Option 2B	\$b 3,586,000	\$470,000
Option 3	\$b 2,692,000	\$355,000

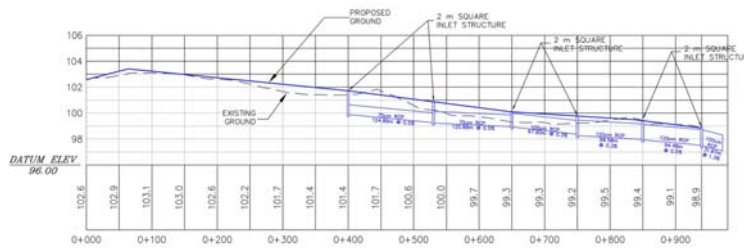
RECOMMENDATIONS:

The roadway and drainage improvements should be completed using Design Option 1 based on cost and reliability to prevent flooding. The following should be implemented to improve the system and address constructability and effectiveness of the project:

- The roadway should be paved using 18 cm of concrete and a 12 cm base layer.
- Drainage should be achieved using the curbed roadway and storm sewer pipe ranging from 75 cm to 120 cm connecting to 4th Ring Canal.
- Retaining walls should be installed between Street C and Street H to prevent collapsing of the high banks.

CONCLUSION:

This project has been designed considering Bolivian construction techniques which allows construction to be limited to a cost of \$b 2,720,000 Bolivianos (\$360,000 US) . This construction can be completed in 121 days, which allows the project to be finished during one dry season. If implemented, the health, safety and quality of life will improve for the residents of UV-108.



PROPOSED PROFILE:

The proposed roadway profile was designed with a single high point draining the majority of the storm runoff to the 4th Ring Canal. Pipes were designed to handle the storm runoff when the roadway reached its drainage capacity.

