Peru Road Upgrade Project

U.S. Army Corps of Engineers
Mobile District
Latin America Area Office

Presented By

Michael P. Wielputz, P.E.
### U.S. Army Corps of Engineers – Andrade Gutierrez
#### Sections II & III

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Local Areas Affected
Original Design Improvements for Sections II & III

**Section II: 44.68 km**

**Campanilla-Pizarrón**
- Road Widening - 6.6 m
- Culverts replaced, added, or improved – approximately 270
- Subdrainage & Ditching added
- Retaining Walls
- Bridges added - 5

**Sample Road Cross Section**

**Section III: 46.2 km**

**Puerto Pizana-Pizarrón**
- Road Widening - 6.6 m (var.)
- Culverts replaced, added, or improved – approximately 203
- Subdrainage & Ditching added
- Retaining Walls
- Bridges added - 7

**Sample Paved Drain Ditch**

\[
\text{DITCH C-1} \quad \text{GROUTED STONE DITCH (F'c = 140 Kg/cm2 With Gravel max. 3°)}
\]

\[
\text{Scale 1/28}
\]
Challenges of Peru Road Project

Early Challenges

- Location – remote mountainous jungle area with limited access
- Environment – dense forest with significant rainfall
- Early condition of Road – practically impassable
- Original Design Problems, lack of foundation & slope stability studies
- Extensive variety of in-place Soil & Rock classifications
- Landslides – Cost $$$$$$, damaging completed work
- Drainage and De-watering
- Overcoming common construction practices
- Personnel Security
Early Conditions
Early Conditions
Need for Management of Drainage
Improvements
Clearing
Section III

Improvements
Road Widening
Section II

19/10/2004
Improvements in Drainage

Culvert Installations
Improvements
Low Water Crossing

Improvements
Bridge
Punta Arena Operations:
Rock Crushing & Sieving
Plant, Laboratory,
Maintenance Facility &
Materials Storage
Construction Methods
Construction Methods
Construction Methods
Construction Methods
Construction Methods
Construction Methods
Variety of Soil & Rock
Variety of Soil & Rock
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Variety of Soil & Rock
Landslides

Before

14 meters

After

6 meters
Landslides
Landslide “After”
Landslides $$$ exceed Contingencies

Cost of slide cleanup offset by Re-design

- Delete unnecessary bridges, add box culverts where applicable
- Extending/reusing satisfactory culverts
- Use of nearby select granular borrow for platform stabilizing, backfill, and subbase course
- Eliminate some cuts & fills, follow the “lay of the land” where practical
- Road re-alignment away from slides
- Adjusting pavement design layers
Drainage & De-watering
Construction Methods
Construction Methods
Personnel Security
Challenges of Peru Road Project

Lessons Learned/Solutions

- Minimize clearing & grubbing - only execute in immediate foundation areas, while promoting jungle growth
- Reduce slope cuts, contrary to common engineering practice of lowering slope angles for unstable areas. Some slides are exacerbated by larger exposed surfaces
- Locate additional satisfactory material borrow sources (granular)
- Continuous training/instruction for contract staff and labor force
- Avoiding deep culverts, relocating new ones and plugging old culverts
- Erosion control – adding “Trinchos” and stepped Grouted Cobble Flumes
- Continuous maintenance of drainage ditches & inlets during construction activities – Prevent water ponding
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