Climate Adaption
Making Rural Roads More Resilient
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Introduction

- Mozambique is one of the more vulnerable countries in Africa
- Climate change associated roads damages have direct socio-economic effect
- 50 km unpaved road identified for construction of demonstration section (N/C Mohambe/Maqueze)
- Climate adaption programme funded by world Bank

Objective
Identify, characterize and demonstrate the appropriate engineering and non-engineering adaptation procedures that may be implemented to strengthen the resilience of rural roads.

Methodology
Phase 1: Road assessment, identification of problems and design of the solutions.
Phase 2: Construction of demonstration sections.
Road assessment

1. Un-engineered earth road with minimal side drainage
2. Some ineffective mitre drains
3. Made by local silty-sand material as wearing course
4. Two wheel tracks and very few corrugation
5. Culverts under-designed
Problems identified
- Undercutting and collapse of fords
- Drainage problems
- Erosion on surface
- Damage to culvert due to erosion
- Ineffective mitre drains
- Culverts unable to move water
Demonstration sections

- 1. Erosion and undercutting of concrete fords
- 2. Damage to culvert and erosion protection
- 3. Damage to road approaching concrete ford
- 4. Ineffective drainage of road surface, poor shape and side-drains

For 4 sections 4 solutions designed
Section 1: Construct a vertical wall, backfill and a slab.

- Eroded black clay
- Existing weak concrete
- Existing medium concrete
- Existing concrete slab
- Water flow
- Compacted inert fill (PI < 15%)
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- 40 mm Ø weep-holes
- 16 mm “tie rods” every 1 m
- 30 MPa concrete
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- 16 mm Ø reinforcement at 250 mm intervals

Section 2: Shape the road and level off at the top of the culverts. Materials to be compacted to at least 95% Mod AASHTO density. Stone pitching for protection and concrete strips.
Section 3: Rollcrete (concrete slab).
   Improved gravel road along 45 m.
Section 4: Improved gravel road with wearing course material 150mm 98% mod AASHTO.
   Reconstruct the culvert.
Extend calcrete wearing course to shoulder breakpoint (compacted to 98% Mod AASHTO)

150 mm Calcrete wearing course complying with specification (GC = 16 – 34 and SP = 100 – 365)

Use soil from side-drains or borrow to level and create platform

Raise road level to 300 mm above NGL before placing wearing course (local soil with CBR > 8%)

Side-drains to be 350 mm below NGL and lead into mitre drains every 40 m

600 mm
7.0 m
> 9.0 m
Construction pictures
Conclusions

- Project ongoing.
- The contractor is finalizing the sections.
- This project is expected to produce manuals and guidelines with engineering solutions that will improve road maintenance works with low traffic volumes and expected to address the effect of climate changes on the structures.

Thank you for your attention

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