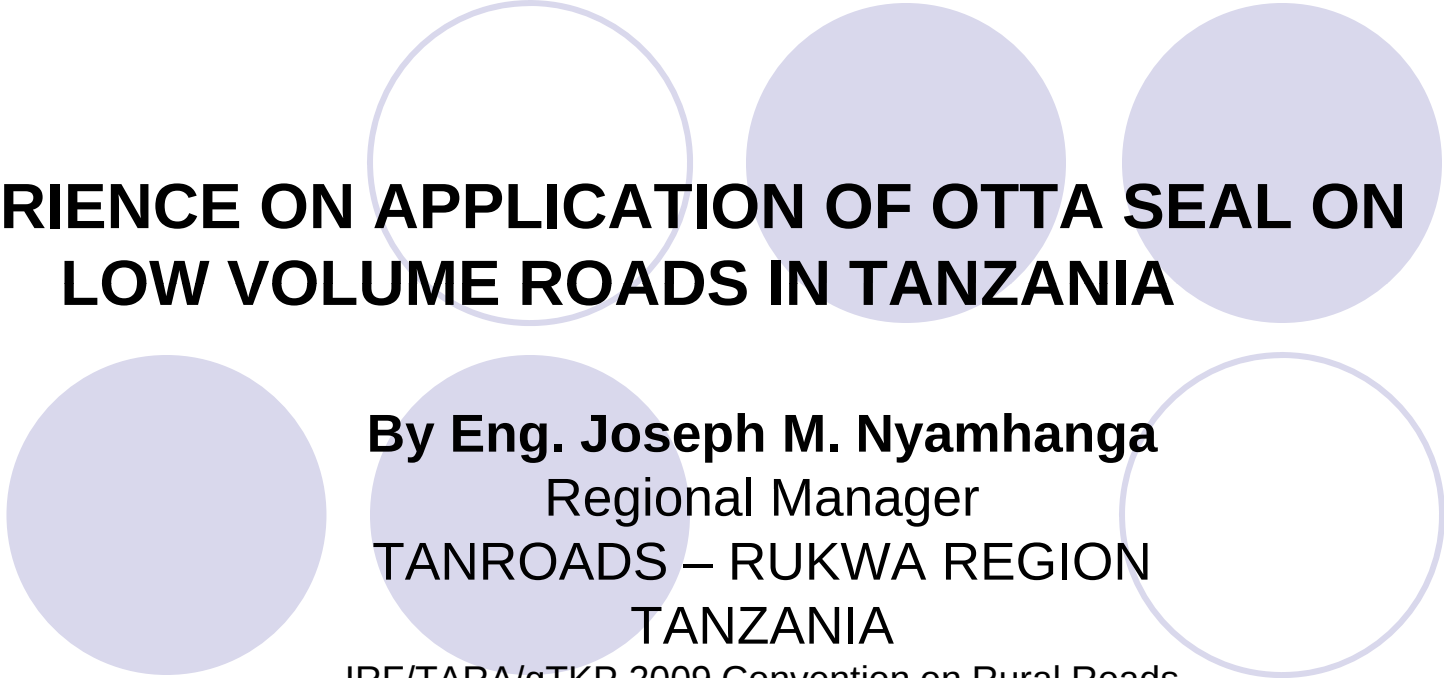
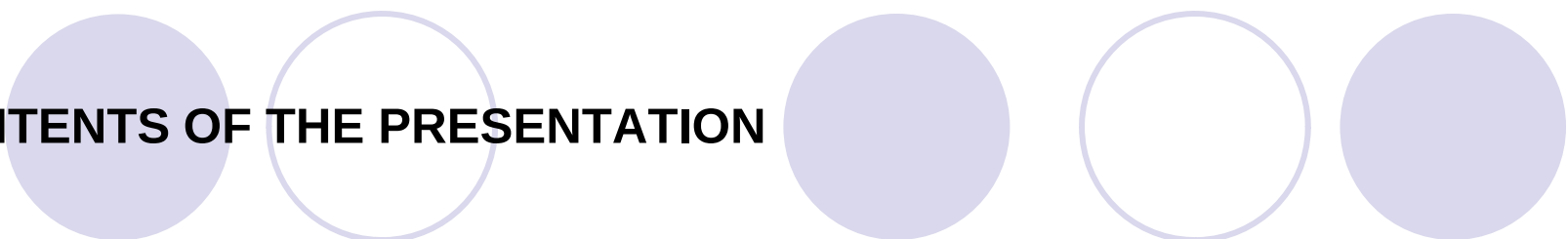




EXPERIENCE ON APPLICATION OF OTTA SEAL ON LOW VOLUME ROADS IN TANZANIA

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CONTENTS OF THE PRESENTATION

1. Introduction
2. Overview of Various Types of Bituminous Surfacing
3. Application of Otta Seal as Alternative Sprayed Bituminous Surfacing
4. Experience in Application of Otta Seal on Regional Roads in Tanzania
5. Conclusions and Recommendations

1.

INTRODUCTION

- The main objective of this paper is to share practical experience on application of Otta Seal on regional roads in Tanzania.
- First trials of Otta Seals were carried out in the Otta Valley in Norway where its name was derived from.
- In Otta Seal, graded aggregates are placed on a relatively thick film of soft (low viscosity) binder.
- In the case of conventional Surface Dressing, aggregates/chippings are placed on a film of hard (high viscosity) binder.

2. **OVERVIEW OF VARIOUS TYPES OF BITUMINOUS SURFACING**

Major functions of bituminous surfacing are as follows:-

- Provision of a durable and impervious surfacing which seals and protects the pavement layers from moisture ingress.
- Provide a skid-resistant surface.
- Prevention of formation of corrugations, dust and mud.



Types of Bituminous Surfacing

- Sand Seals
- Surface Dressings (Chip Seals)
- Cape Seals (Chip + Slurry Seal)
- Asphalt Concrete
- Otta Seals

3. APPLICATION OF OTTA SEAL AS AN ALTERNATIVE SPRAYED BITUMINOUS SURFACING

Main Types of Otta Seals:

- Single Otta Seal
- Double Otta Seals

Materials for Otta Seal:

- Aggregates (Natural Gravel, Crushed Gavel, Crushed Rock or Stone)
- MC 3000 or MC 800 Cutback Bitumen (80/100 or 150/200 Penetration Grade Bitumen, Bitumen Emulsions and Tar do not meet requirements for Otta Seal)

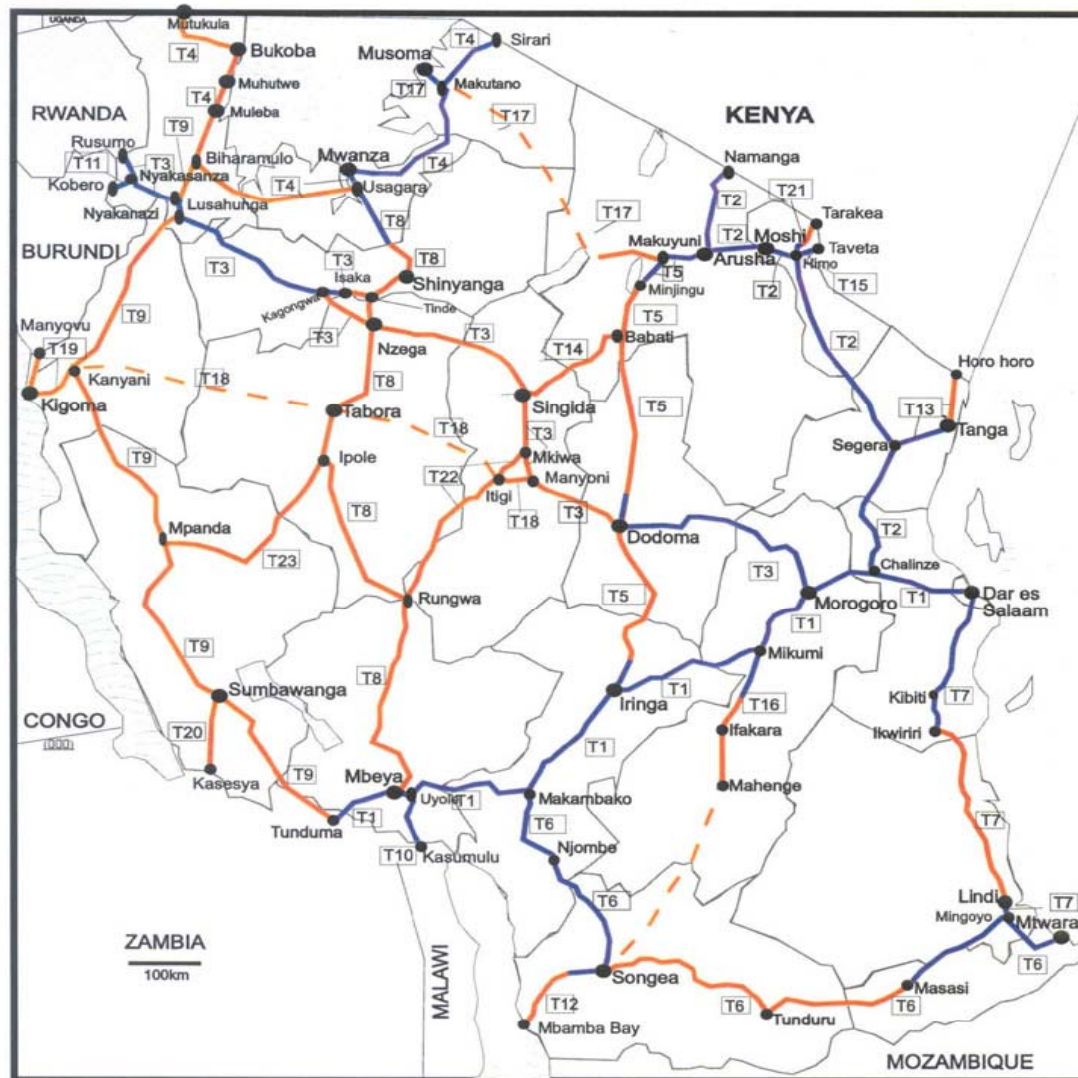
4. EXPERIENCE ON APPLICATION OF OTTA SEAL ON REGIONAL ROADS IN TANZANIA

Regions Covered in the Analysis:

- Kagera -Otta Seal + Surface Dressing
- Mwanza -Otta Seal
- Mtwara -Otta Seal
- Rukwa -Surface Dressing

Total Number of Kilometres Covered in the Analysis:

- Otta Seal -37.0 km
- Surface Dressing -16.3 km



TANZANIA

TRUNK ROAD NETWORK

- PAVED - TRUNK ROAD
- UNPAVED - TRUNK ROAD
- PROPOSED TRUNK ROAD



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EXPERIENCE ON APPLICATION OF OTTA SEAL ON REGIONAL ROADS IN TANZANIA (CONTD.)

Pilot Otta Seal projects in Tanzania commenced during financial year 2003/2004 and continued up to FY 2007/2008. Otta Seal projects in Kagera, Mwanza and Mtwara regions covered a total of 47 kilometres (**10km in Kagera Region have not been included in the analysis**).

EXPERIENCE ON APPLICATION OF OTTA SEAL ON REGIONAL ROADS IN KAGERA REGION (CONTD.)

Regional Roads Included in Pilot Otta Seal Projects in Kagera, Mwanza and Mtwara Regions:

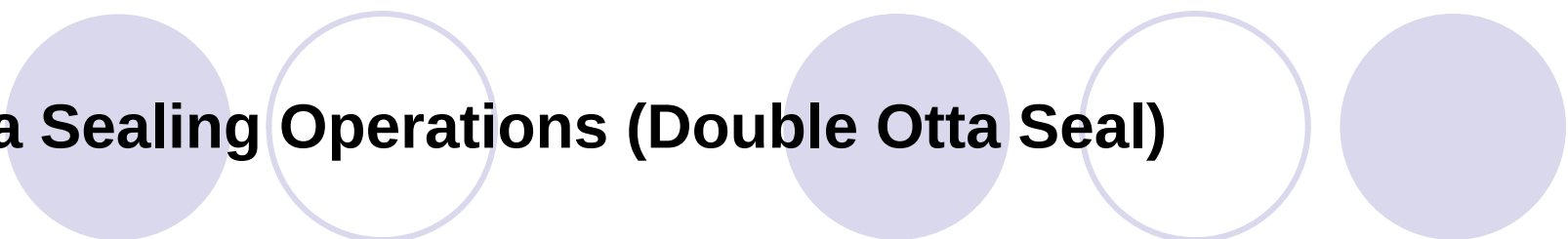
- Kyetema-Kanazi-Kanyinya regional road (10 km) in Bukoba District, Kagera Region.
- Chato Junction-Chato Ginnery (4 km) in Chato District, Kagera Region.
- Nyamirembe-Itale section (10 km) on Kyamyorwa-Bwanga regional road in Chato District, Kagera Region (**not included in the analysis**).
- Omugakorongo-Nyakahanga section (10 km) on Kyaka-Bugene-Kasulo regional road in Karagwe District, Kagera Region.
- Nansio-Bulamba regional road (5 km) in Ukerewe District, Mwanza Region.
- Mpeta-Lupaso regional road (8 km) in Masasi District, Mtwara Region.

Table 1: Details on Pilot Otta Seal Projects Implemented in Kagera, Mwanza and Mtwara Regions

S/No	Road Name	Region	Target Length (Km)	Name of Contractor	Cost (TShs) for Double Otta Seals	Cost per Kilometre (TShs Mio.) for Double Otta Seals
1.	Kyetema-Kanazi-Kanyinya	Kagera	10	Kagene Construction Ltd	693,933,186	69.393
2	Chato Junction-Chato Ginnery	Kagera	4	Jassie and Company Ltd	302,002,650	75.501
3	Omugakorongo-Nyakahanga	Kagera	10	Peter Mulima and Company Ltd	834,916,320	83.492
4.	Nansio-Bulamba	Mwanza	5	Jassie and Company Ltd	743,545,638	148.709
5.	Mpeta-Lupaso	Mtwara	8	Sinani Building Co. Ltd	535,000,000	66.875
	TOTAL		37		3,109,397,788	84.038

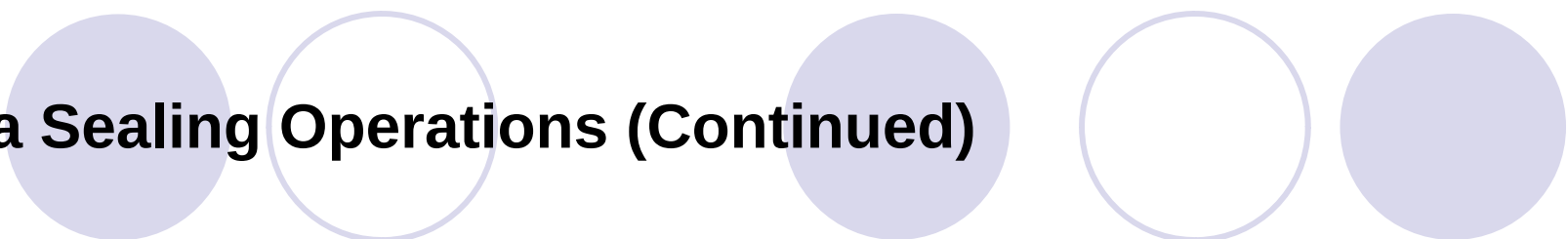
Table 2: Details on Low Volume Regional and Urban Roads in Kagera and Rukwa Regions Upgraded Recently to Bituminous Surface Dressing

S/No.	Road Name	Region	Target Length (km)	Name of Contractor	Cost for Single Surface Dressing (TShs)	Cost per Kilometre for Single Surface Dressing (TShs Mio)
1.	Bukoba (CRDB)-Kabango Bay (Bukoba-Migera Section)	Kagera	1.2	Peter Mulima and Company Ltd	69,996,989	58.331
2.	Kanazi-Bulila	Kagera	1.7	Peter Mulima and Company Ltd	192,744,240	113.379
3.	Kashura Hill-Magoti	Kagera	2.0	Peter Mulima and Company Ltd	299,925,900	149.963
4.	>Muhutwe-Kamachumu-Muleba (1.2km) >Kashura Hill-Magoti (1.0km) >Chato Township-Chato Port (0.6km)	Kagera	2.8	Kajuna Investments Ltd	249,775,000	89.205
5.	Sumbawanga Town Roads	Rukwa	2.0	WEBCO-BESHU Joint Venture	324,298,500	162.149
6.	Mpanda Town Roads	Rukwa	6.6	Mayanga Contractors Co. Ltd	1,071,757,432	162.387
	TOTAL		16.3		2,208,498,065	135.491



Otta Sealing Operations (Double Otta Seal)

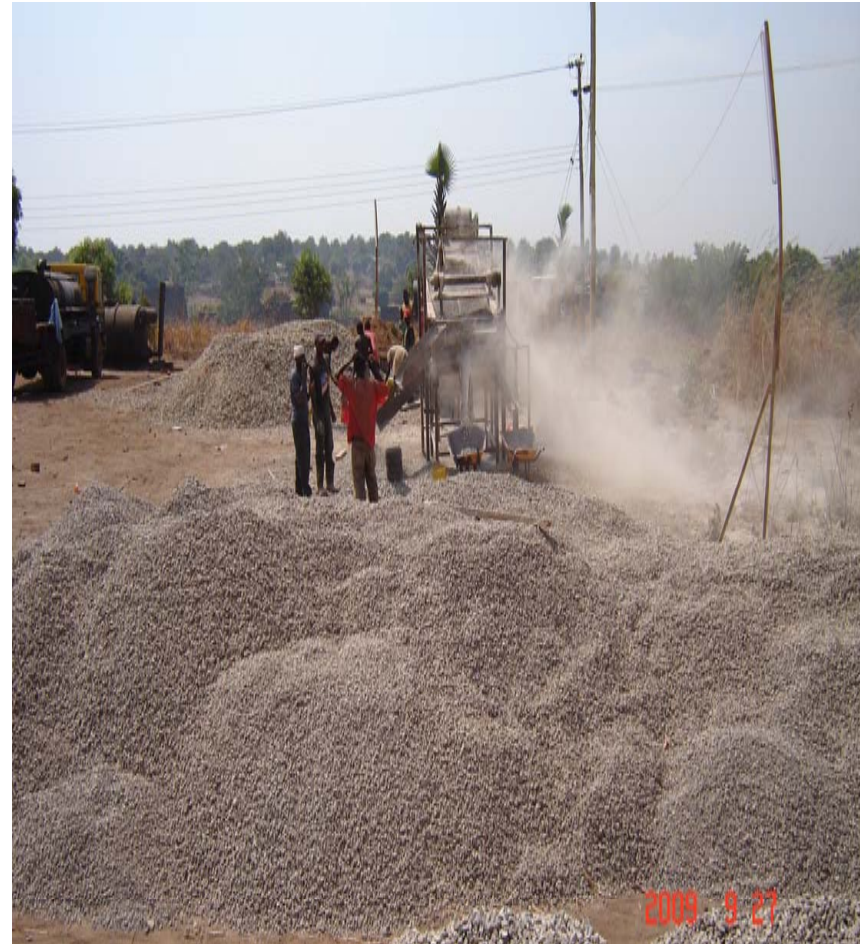
- Preparation of Base Course
 - Natural Gravel Base Course
 - No Priming of Base Course
- Screening of Aggregates from Natural Gravel
- Preparation of Binder
 - Cutting back 150/200 penetration grade bitumen using 8% kerosene to MC 3000 cutback bitumen



Otta Sealing Operations (Continued)

- Application of First Otta Seal
 - MC 3000 cutback bitumen sprayed at 1.8 litres/m²
 - Screened aggregates spread at the rate of 0.02m³/m²
- Curing of the first Otta Seal for 8-12 weeks before application of the second Otta Seal
- Application of the second Otta Seal
 - MC 3000 sprayed at the rate of 1.6 litres/m²
 - Screened aggregates spread at the rate of 0.015m³/m²
- Curing the second Otta Seal

Photo 1 and 2: Small Locally Fabricated Aggregate Screening Plant for Otta Seal Project in Kagera Region (Left) and Chipping Production Plant for Conventional Bituminous Surface Dressing Project in Rukwa Region (Right)



**Photo 3 and 4: First Otta Seal on Omugakorongo-Nyakahanga
Regional Road in Kagera Region After About 3 Months of Trafficking**



Photo 5 and 6: Second Otta Seal on Omugakorongo-Nyakahanga Regional Road (Left) Few Days After Application and Second Otta Seal on Kyetema-Kanazi-Kanyinya Regional Road (Right) in Kagera Region After More Than 3 Years of Application and Trafficking

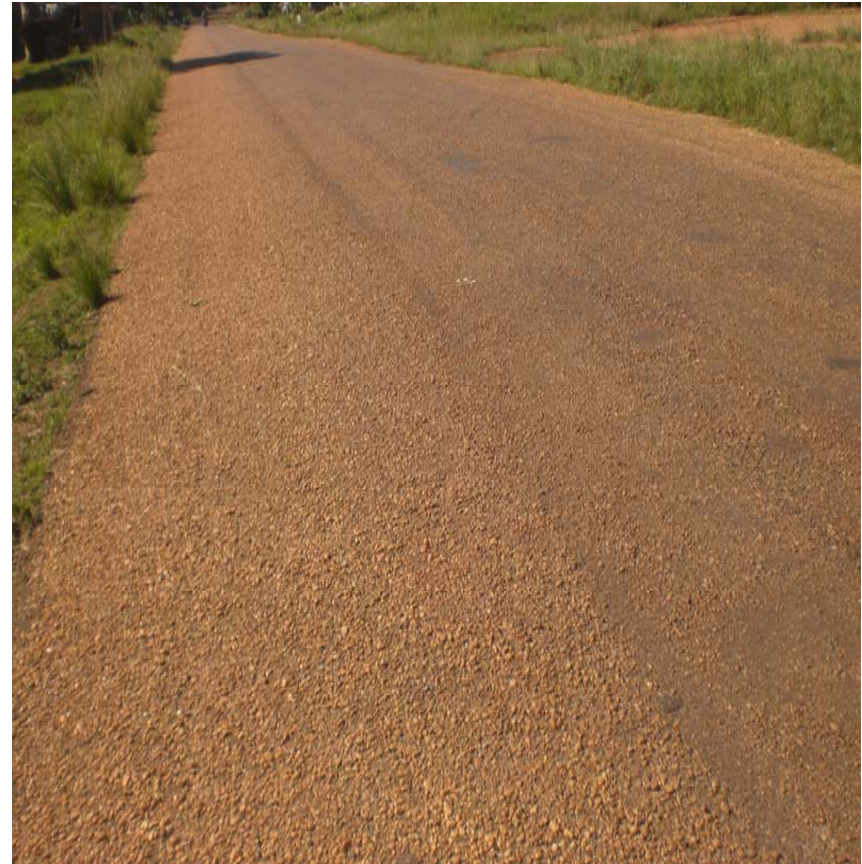


Photo 7, 8, 9 and 10: Otta Seal on Nansio-Bulamba Regional Road in Ukerewe District, Mwanza Region

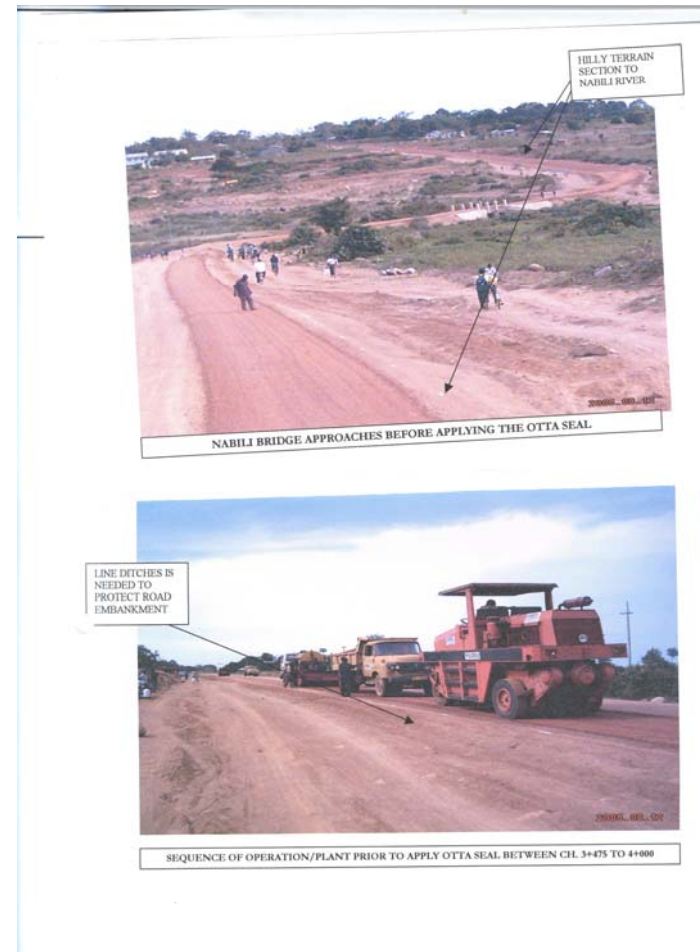
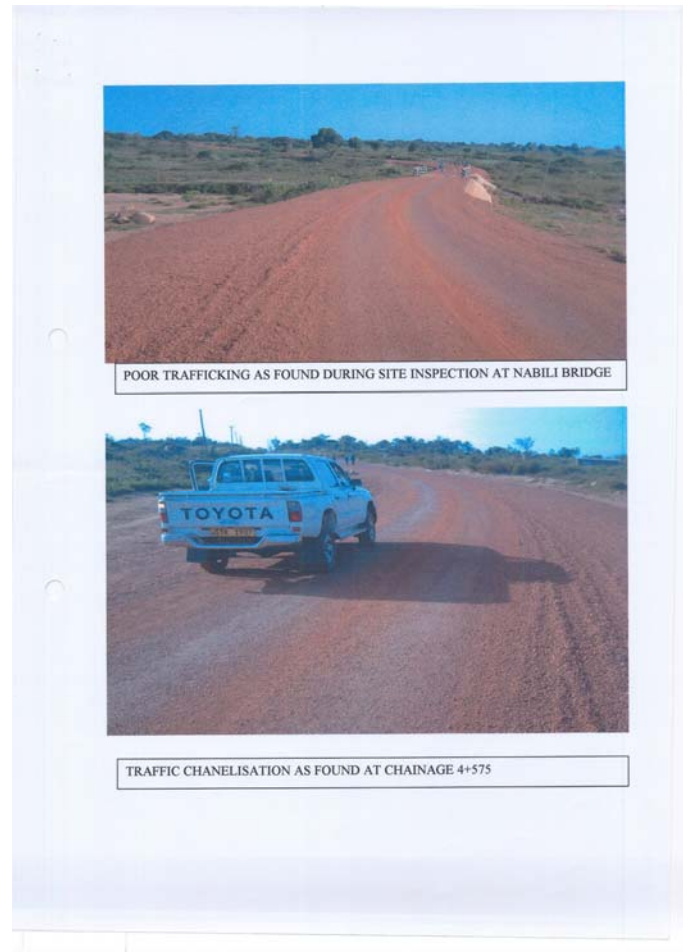


Photo 11, 12 and 13: Otta Seal on Nansio-Bulamba Regional Road in Mwanza Region (Left) and Mpeta-Lupaso Regional Road in Mtwara Region (Right)

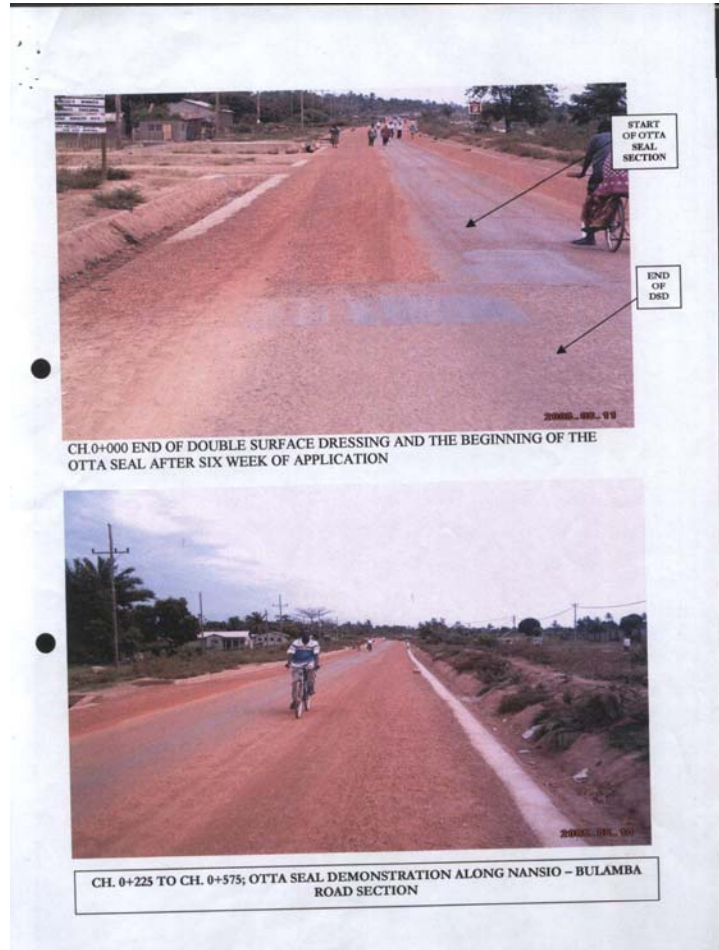


Photo 14 and 15: Otta Seal on Mpetá-Lupaso Regional Road in Mtwara Region



Photo 16 and 17: Second Otta Seal on a section with very low traffic volume on Kyetema-Kanazi-Kanyinya regional road (Kanazi-Kanyinya Section) in Kagera Region after more than 3 years of application and trafficking



Photo 18 and 19: Conventional Bituminous Surface Dressing on Low Volume Regional and Urban Roads in Kagera Region (Left) and Rukwa Region (Right) Few Months After Construction



Photo 20 and 21: Adjacent Sections on Kyetema-Kanazi-Kanyinya Regional Road in Kagera Region Surface Dressed and Otta Sealed More Than 3 Years Ago

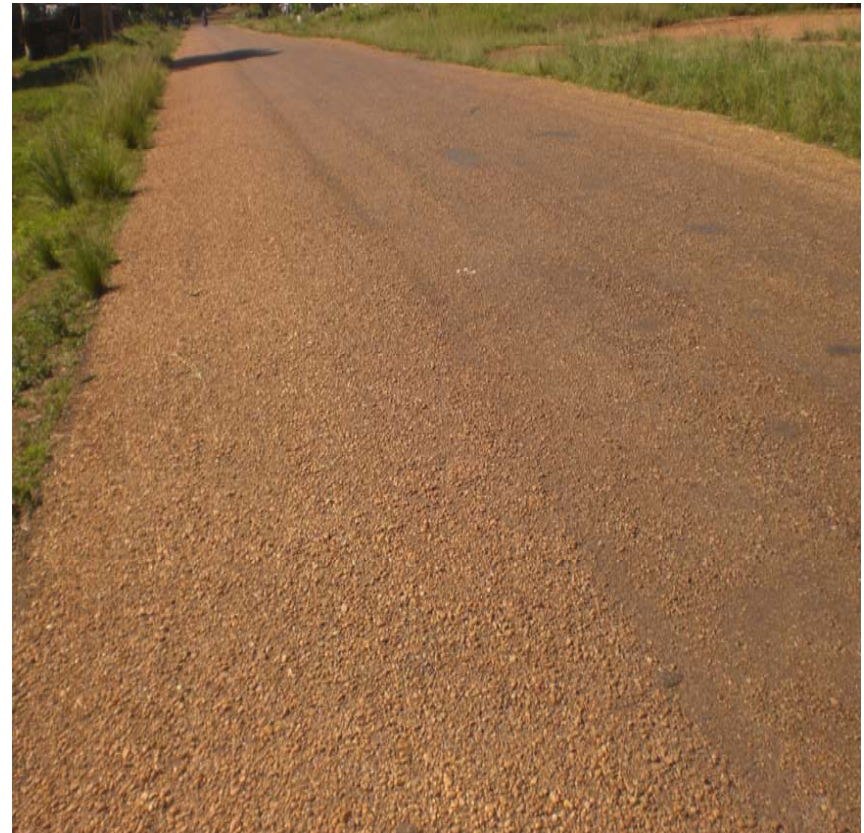
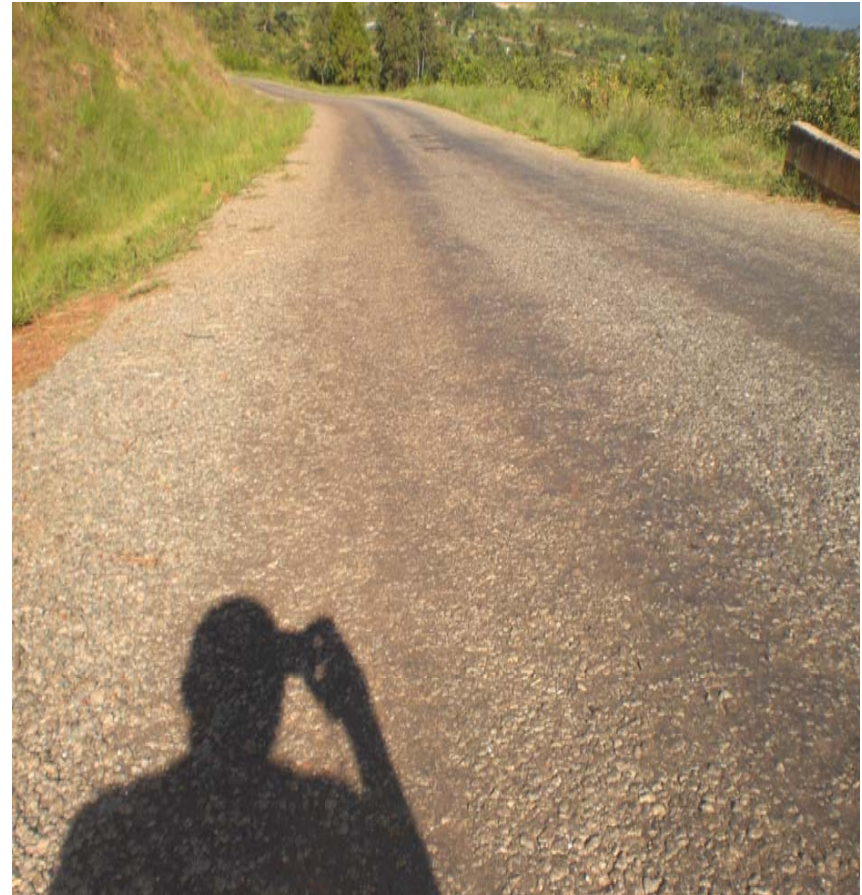
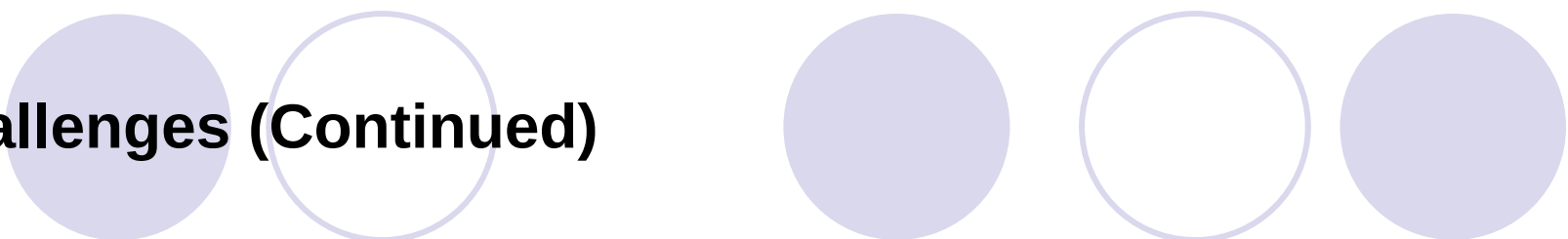


Photo 22 and 23: Kanazi-Bulila Regional Road in Kagera Region Surface Dressed About 2 Years Ago



Challenges Encountered During Otta Seal Operations in Tanzania

- Difficulty in screening large quantity of aggregates from natural gravel
- Prolonged heavy rains in some regions such as Kagera
- Difficulty in cutting back Pen 150/200 to MC 3000 cutback
- Contractors waiting for a long period before application of the second Otta Seal
- Aesthetics/appearance of Otta sealed roads raised concern and criticism at the beginning due to absence of “black top” and presence of dust



Challenges (Continued)

- Insufficient knowledge and experience on application of Otta Seal
- Lack of equipment and plant for bituminous works caused delays
- Steep gradients on sections of some of the roads made it difficult to apply Otta Seal
- Very low traffic volume on some of the project roads led to very slow curing of the Otta Seal



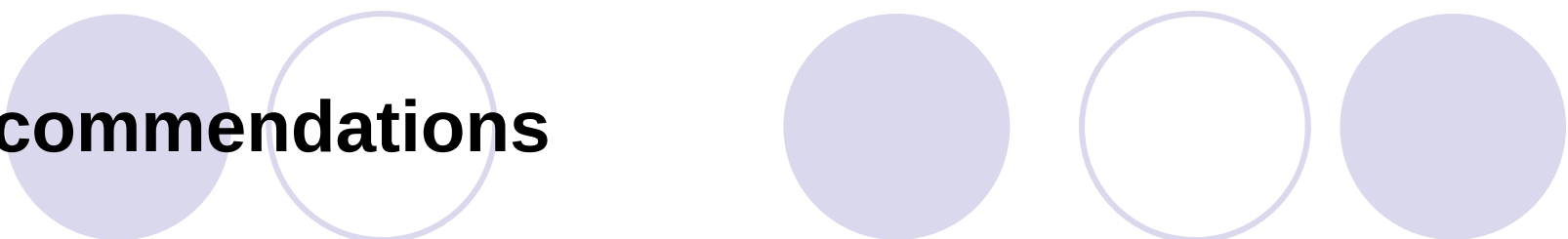
5. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

- Despite challenges encountered during Otta Seal operations in Tanzania, Otta Seal is considered to be a viable and cost-effective bituminous surfacing option in Tanzania especially in areas where there is abundant natural gravel.
- The cost for application of **double** Otta Seals in Tanzania is much less than the cost for application of a **single** Surface Dressing.

Conclusions (Continued)

- Otta sealing is considered to be inappropriate on road sections with very low traffic volume as trafficking plays an important role in curing of the Otta Seal.
- Otta Seal is difficult to apply on road sections with steep gradients.
- A number of contractual issues such as the requirement for the first Otta Seal to be trafficked for a minimum of 8-12 weeks before the second Otta Seal is applied have to be taken into consideration
- Generally, Otta sealed regional roads in Tanzania are performing quite well after about 4 years of trafficking to-date.



Recommendations

- Use experience on Otta Seal application gained from Kagera, Mwanza and Mtwara regions to introduce large-scale Otta Seal application in Tanzania.
- Continue monitoring performance of roads improved through pilot Otta Seal projects in Tanzania with a view to evaluating merits and limitations for application of Otta Seal technology.

THE END

THANK YOU FOR YOUR ATTENTION!

