



Ultra-Thin Reinforced Concrete Pavements in Road Construction

Roads Pavement Forum

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Content of Presentation

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Background

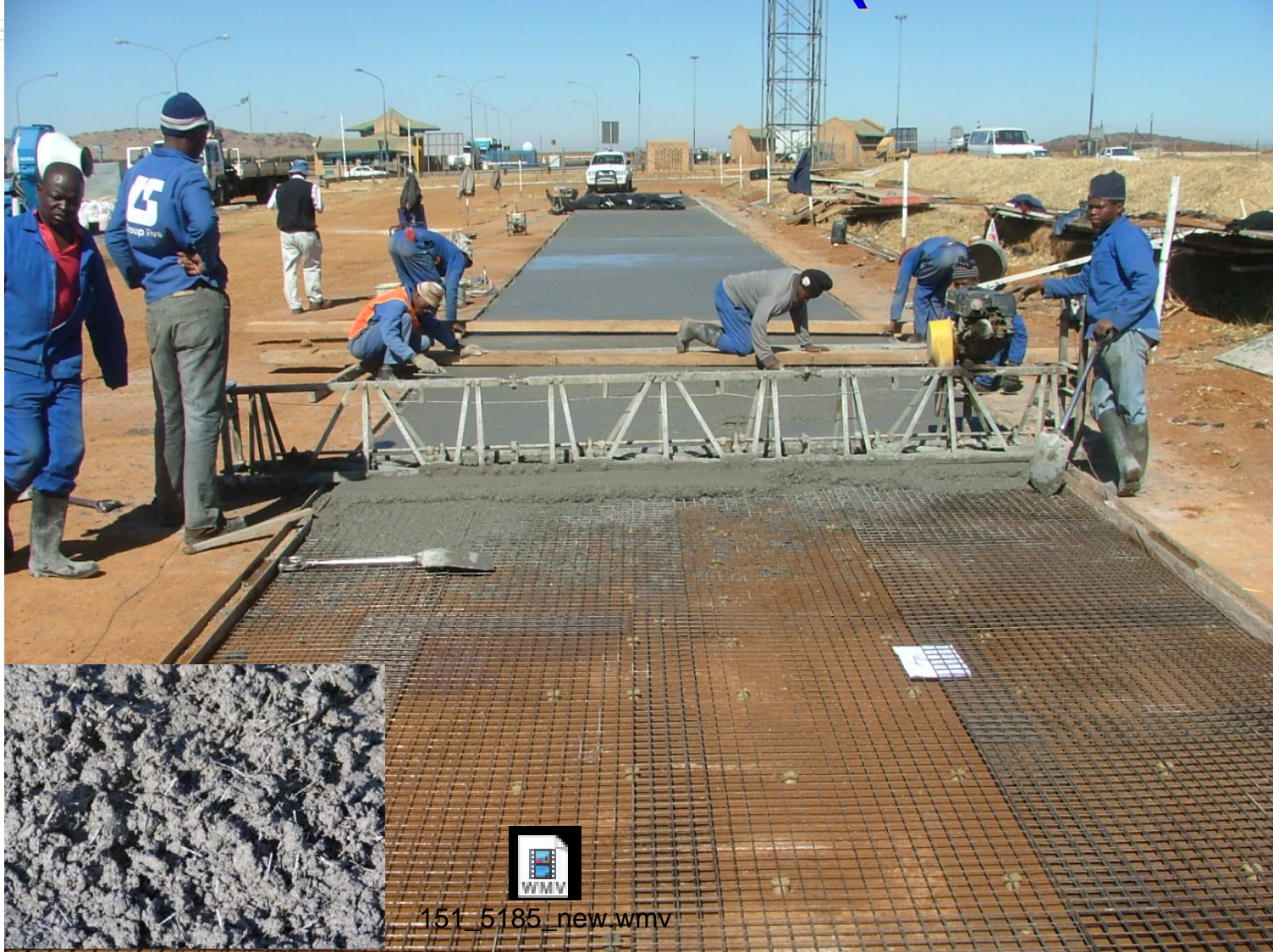
- **Very old network – more than 82% of roads older than 20 years design life**
- **Extensive surfacing backlogs (>2500km) with tarring of township roads**
- **Environmental issues – scarcity of road building materials**
- **Limited funding available for roads**
- **Up scaling of Expanded Public Works Programme (EPWP) very high priority:**
 - **Job creation**
 - **Training**
 - **Targeting women, youth, disabled, small businesses**
- **Innovative new technologies and construction methods required!**

Types of Ultra Thin Reinforced Concrete Pavements (UTRCP)

- Ultra thin reinforced concrete pavements defined as roads built with a very thin (<75mm) concrete layer
- Two types used in South Africa:
 - High strength concrete (120-140MPa), heavily reinforced (50x50 mesh, Ø4mm to Ø8mm steel)
 - Used mainly on National Roads
 - Normal concrete (30Mpa), nominally reinforced with steel (200x200 mesh, Ø4mm steel)
 - Used for Provincial and township roads



UTRC: High Strength, Heavily Reinforced Concrete (50mm thick)



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UTRC: Normal Strength, Nominally Reinforced Concrete (50mm thick)



Benefits of Ultra Thin Reinforced Concrete Pavements (UTRCP)

- Increase of labour content by an estimated 350%
- Training and skills acquired, e.g. concreting can be applied in other sectors
- Community participation
- Reduced layer works required, which reduces amount of work to be carried out by plant
- Reduces depth of layer works (box cut), which limits damage to and need for relocation existing underground services
- Less maintenance required, and more durable
- Investment in equipment fairly low (no barrier to entry)
- Environmental benefits – fly ash, waste product is used
- Reduced the reliance on imported material (aggregates & bitumen)
- Reduced construction costs and contract period
- Less energy required for illumination (street lights)



Thin Concrete Pavement History

- **Case study presented at Conference in IOWA - road with a 100mm un-reinforced and 100mm reinforced pavement.**
- **Impressive performance of mesh reinforced (15 years)**
- **Council for Scientific and Industrial Research (CSIR) initiated ultra thin concrete pavement pilot projects in:**
 - Streets in Tembisa township
 - Roodekrans quarry access road
 - Mtatha quarry access road
 - Tests at University of Pretoria
- **South African National Roads Agency Limited (SANRAL)**
 - Heavy Vehicle Simulator testing in Heidelberg
 - Rollout on two sections (Gauteng Freeway Improvement Scheme)
- **Gauteng Department of Public Transport Roads & Works**
 - Demonstration project in Soshanguve 2008
 - Rollout to 17 other township roads in 2009
 - Testing with heavy vehicle simulator (HVS)



Twenty Townships Upgrading of Roads Project

TSHWANE REGION



Why?

- **EXPLORE NEW TECHNOLOGY**
 - Use local resources
 - Economically feasible over its lifespan
 - Job creation and upscaling of the EPWP – link to
- **CONTRACTOR DEVELOPMENT PROGRAMME**
 - Focus on existing small contractors
 - Provide contractors access to Construction Contractor Learnership (National Qualification)
 - Opportunity to train and establish supervisors and technical trained staff



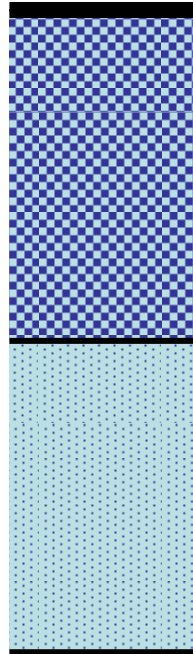
UTRCP DESIGN

Typical Design

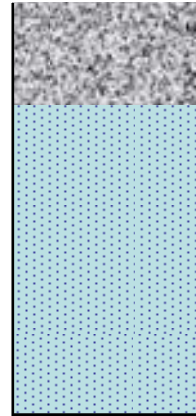
UTRCP Design

Cape seal
150 mm G5 imported
subbase compacted to
95% Mod. AASHTO

150 mm In-situ layer
compacted to 93%
Mod. AASHTO



50 mm UTRCP
150 mm In-situ layer
compacted to 95%
Mod. AASHTO



PROJECT 1 - SOSHANGUVE



- Length: Approximately 1 200 meters
 - Link road between residential areas
 - Mainly cars and taxis
 - First Demonstration project by GAUTENG DEPARTMENT OF PUBLIC TRANSPORT, ROADS AND WORKS together with CITY OF TSHWANE and the CSIR.
 - Tender awarded in March 2008.
 - Project includes a section of UTRCP with various subbases for testing by the HVS next to the R80 Highway.
 - Design
 - 50mm UTRCP (ref 193 mesh, 200 x 200 x 5.6 mm)
 - 150mm in-situ material (stabilised where PI requires with % lime), top 50 mm is scarified, mixed with diluted emulsion and compacted to provide platform for the concrete pavement.





PROJECT 1 - SOSHANGUVE

- Project complete: Nov 2008
- 16 supervisors of the 11 contractors on the Learnership attended NQF4 supervisors skills programme in Labour Intensive Construction Methods and in Concrete Technology.
- Job creation
 - 71 people employed
 - 4 389 person days worked
 - 31% women
 - 34 % youth
- Training to workers
 - Training: 230 person days
 - Number of persons: 68

PROJECT 1 - SOSHANGUVE



Shaping and constructing 50 mm ETB (test section only)



Laying reinforcing mesh and concrete.
Note texturing and
Plastic curing sheet





PROJECT 1 - SOSHANGUVE BUS ROUTE



Road opening in November 2008



PROJECT 2 - ATTERIDGEVILLE

- **Design**
- **50mm UTRCP**
- **200x200x5.6mm (Ref 193) mesh**
- **Local streets 2,5km long**
- **Material**
 - **Mostly black turf with PI of 10 plus**
 - **CBR: 30 – 50 at 93% mod AASHTO with 3% lime**
- **Design**
 - **Cut to line and level**
 - **150 mm subbase of in-site material scarified and treated with lime**
 - **Top 40 mm scarified and treated with SS 60 emulsion**



ATTERIDGEVILLE CONSTRUCTION





ATTERIDGEVILLE CONSTRUCTION





ATTERIDGEVILLE CONSTRUCTION



PROJECT 3 – MAMELODI – Community meeting





PROPOSED PROJECTS IN TSHWANE

- **22.6 km roads in Soshanguve Block M and L in 2009/2010**
- **Design**
 - **50mm CRCP 200x200x5,6mm (Ref 193) mesh**
 - **SS 60 diluted emulsion**
 - **150mm in-situ material scarified and compacted to 95% Mod. AASHTO**



Progress Report: Ultra-Thin Reinforced Concrete Pavements (UTRCP)

- **Implementation in Gauteng**
- **20T Projects outside Tshwane**
- **The following projects, for the upgrading of streets, incorporating UTRCP are in various stages of design, documentation and tendering:**
 - **Katlehong: Tshongweni, Moshoeshoe, Credi, Maphanga and Nhlapo: Upgrading of gravel roads to surfaced roads**
 - **Sharpville: Upgrading of roads**
 - **Kwa-Thema: Riverside: Upgrade of roads and stormwater**
- **A first draft of a special specification applicable to COLTO – Section 7100A: Ultra-Thin Reinforced Concrete Pavements has been prepared by the CSIR and is included in the documentation for Katlehong**



Progress Report: Ultra-Thin Reinforced Concrete Pavements (UTRCP)

- **Presentations have been made to and the Tshwane projects and HVS site visited by councillors and technical staff from the following authorities in Gauteng:**
 - **Ekurhuleni Metropolitan Municipality**
 - **Sedibeng District Municipality**

- **The Tshwane and HVS sites have also been visited by external representatives and delegations from inter-alia:**
 - **Free State and Western Cape: Provincial roads departments**
 - **Ethiopia**
 - **Cape Town Municipality**



Way forward: UTRCP

- **Design software (cncPAVE) and**
- **Design guidelines (manual) by Cement & Concrete Institute (C&CI)**
- **Standard specifications, typical drawings and**
- **Construction best practices by CSIR**
- **Comprehensive testing with Heavy Vehicle Simulator to determine design parameters**
- **Information sharing between implementing agencies**
- **Fill knowledge gap between heavily reinforced high strength concrete pavements and normal strength lightly reinforced**

Contact details

- **Development of CRCP Technology:**
 - **CSIR:**
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 - Louw du Plessis (8412922; lplessis@csir.co.za
 - **Gauteng Department of Public Transport, Roads and Works**
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 - **Consultant 20 Township Project and Contractor Learnerships**
 - Mr J H Wiggett, (012) 346 5580, johanw@buzwa.co.za
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