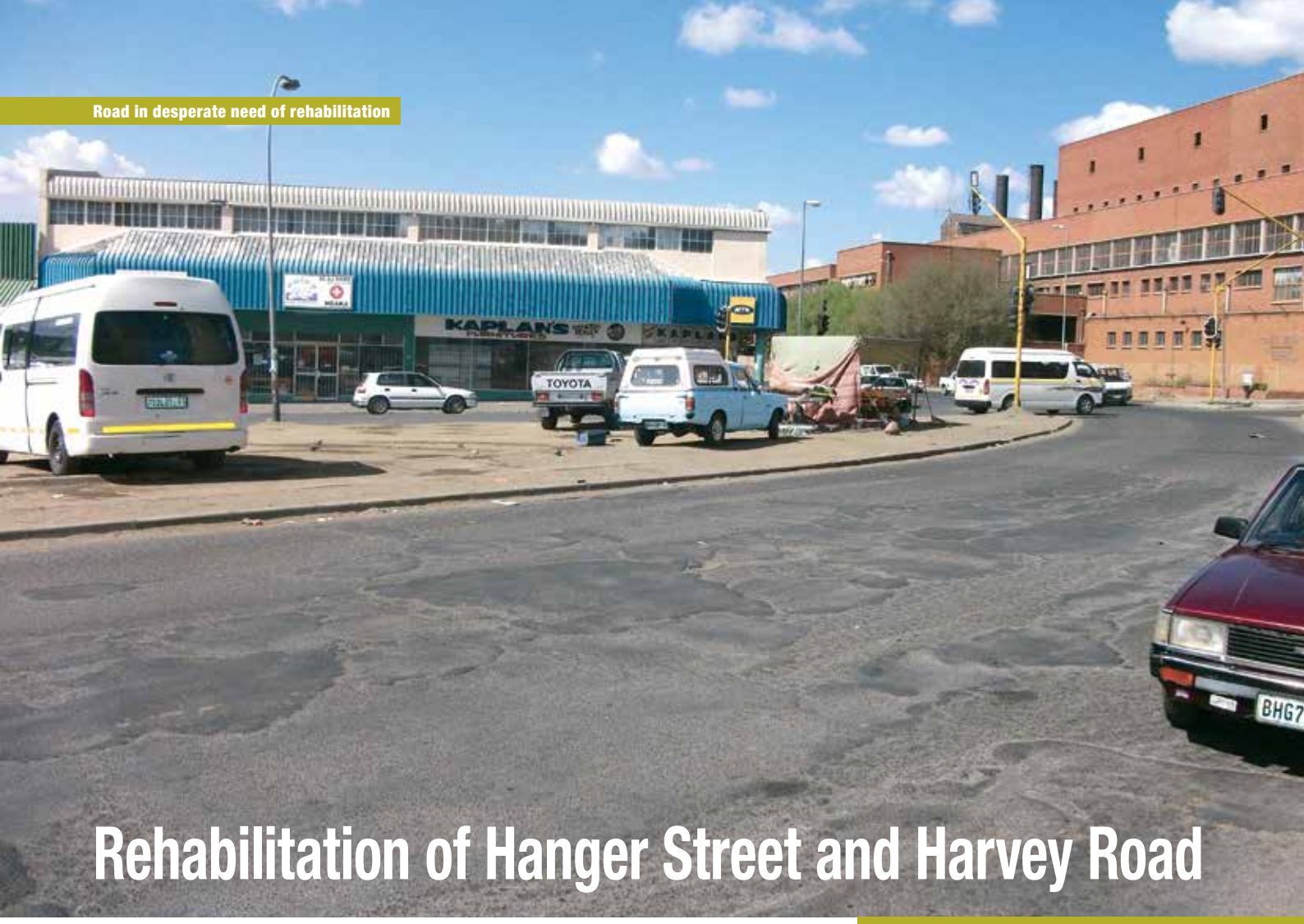


Road in desperate need of rehabilitation

Rehabilitation of Hanger Street and Harvey Road

FINALIST
Technical Excellence Category

KEY PLAYERS

Client
Mangaung Metropolitan Municipality

Professional team
Royal HaskoningDHV

Main contractor
Taupele Construction (Pty) Ltd

Sub-contractor
Kaytech South Africa

OVERVIEW

Hanger Street and Harvey Road in Bloemfontein's CBD were in desperate need of rehabilitation due to the severe extent of crocodile cracking, deformation, longitudinal and transverse cracking, degraded patches, potholes and undulations.

The roads, consisting of two to four lanes and several cross roads and intersections, form an important bus and taxi route serving the intermodal facilities, linking taxis, buses and rail with thousands of pedestrians crossing them daily. The roads also serve as link roads between the two major arterials of the N6 and N8 national roads.

DESIGN CHALLENGES

An innovative shallow rehabilitation pavement design and construction process was undertaken to overcome the numerous challenges encountered on this project:

- The materials present in the lower layers of the existing pavement would not provide the necessary support for future traffic, so the material with a low-bearing capacity needed to be replaced by better quality material.
- The addition of pavement layers as overlays was not feasible, as the final level of the rehabilitated road would be fixed by the existing levels of the kerbing.
- The use of conventional crushed stone, i.e. G2 material base layer, posed a challenge due to dust levels, watering and slushing. In addition, the investigated pavement structure fit for the design traffic, which incorporates a G2 base material, necessitated the replacement of the low CBR selected.
- The two roads necessitated pedestrian-friendly construction methods, as they are located around the intermodal facility where thousands of pedestrians move across the roads daily.

CONSTRUCTION INNOVATION

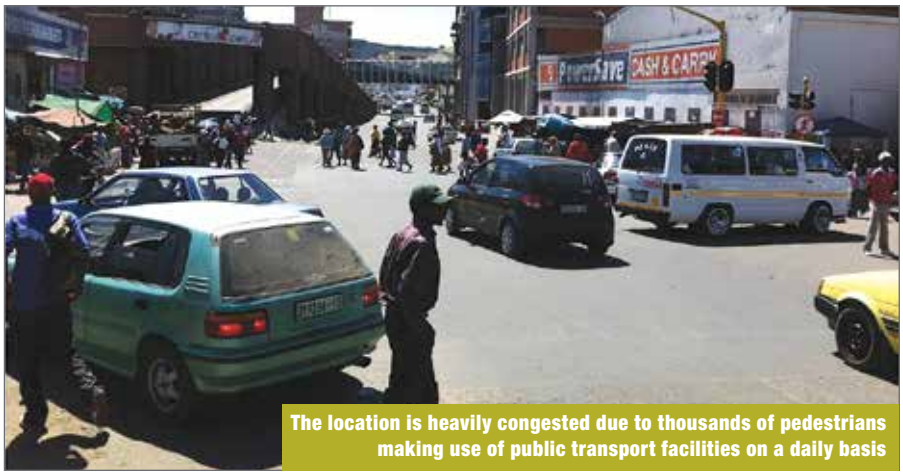
Amongst the numerous challenges to be dealt with were limited space, unobtainable compaction densities, and heavy traffic and pedestrian conditions, to the extent that the normal rehabilitation techniques of deep excavation were not possible.

A shallow rehabilitation pavement design was thus opted for, using a mechanical grid below the base layer instead of installing it below the whole pavement structure on top of the subgrade.

Stabilising grids compensated for the low bearing capacity of the lower layers and served as a stabilising layer. Normal practice would have been to back-tip material onto the stabilising grid and work the material with graders onto the grid without driving on top of it, which in this case was not possible. Therefore, the only material suitable to carry the design traffic would be bitumen-stabilised crushed stone on top of the stabilising grid. These two technologies used in isolation are not new, but the combination of the two is.

The bitumen-stabilised crushed stone was paved with an asphalt paver on top of the grid, but a normal asphalt paver with wheels was also able to drive on the grid without damaging it – the correct roller combination ensured a smooth finish and a dense layer.

The relatively small size of the project (Hanger Street: 588 m; Harvey Road: 1 050 m of single carriageway and 503 m of dual carriageway) also saw the contractor design and build an innovative small pug mill inside a terminal container. The pug mill could deliver quantities of 30 to 100 tons of bitumen-stabilised crushed stone per hour. The mix consisted of 25% reclaimed asphalt, 75% crushed stone, 2.5% net bitumen and 1.2% cement.



The location is heavily congested due to thousands of pedestrians making use of public transport facilities on a daily basis

Cleaning out the milled section

Rolling out the mechanically stabilising grid onto the sub-base

ENVIRONMENTAL CONSIDERATIONS

Pedestrians and public transport vehicles comprise the major type of traffic in Hanger Street and Harvey Road. The whole operation therefore required pedestrian and traffic-safe construction methods and materials. The shallow milling and cold-paved bitumen-stabilised base allowed for quick and effective construction. On average, construction took place over two days for each section, while intersections could be done overnight.

During the rehabilitation of the roads, unwanted environmental impact was reduced by the following measures:

- The uniform designed pavement structure eliminated the need for different pavement structures and various material sources.
- The existing surface was milled off and used as reclaimed asphalt in the base material.
- The existing base was milled out and stockpiled for future use by the municipality. The existing base consisted of very good natural gravel – an excellent source for patching work or even sub-base or base material. Also, the inferior bottom layers of the pavement did not need to be excavated, spoiled or replaced.
- The construction method limited the noise, exhaust and dust emissions (bitumen-stabilised material is paved cold and no fumes are present).
- The excavation depth, as well as the exposure of services such as electrical cables, was limited, which made it safer for pedestrians and vehicles to cross the excavated section.
- The mechanical stabilising grid compensated for the low bearing capacity of the lower layers and had the advantage of reducing the layer depth needed on top. It also saved on replacing the lower layers.
- Closure of intersections and lanes was limited. It only took 12 days (usually 45 days for conventional rehabilitation) to mill out the asphalt and base, lay the stabilising grid and pave the bitumen emulsion-stabilised base and final asphalt layer. Traffic could be diverted back onto the newly paved base within three hours, lessening the frustration to drivers.

PROJECT LENGTH AND BUDGET

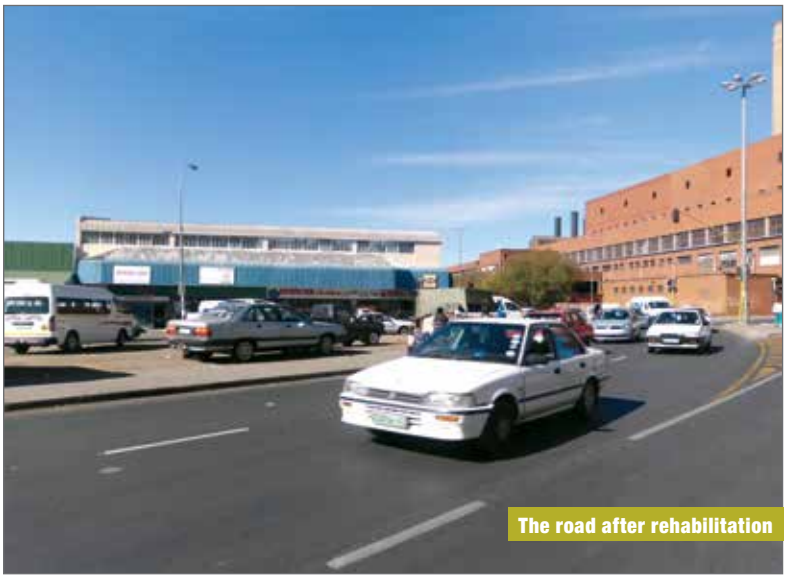
The budget for the rehabilitation was R2.6 million, and eight months were allocated for completion of the project. However, due to the quick and easy construction method, safe traffic and pedestrian accommodation, as well as the absence of services and culverts in the rehabilitation depth, an additional 435 m of dual carriageway on Harvey Road could be rehabilitated with the money saved.

CONCLUSION

The innovative pavement structure gave pedestrians and vehicles a safe and functional surface to use even before the final asphalt layer could be paved. An added benefit was the construction and upgrading of walkways and wheelchair ramps along the route.

This sustainable, environmentally friendly pavement caused minimal disruption to the travelling public and the structure can now carry high-density traffic (8 – 18 million E80s – 80 KN equivalent axles). □

Asphalt paver working on top of the stabilising grid



The road after rehabilitation