



General view of the construction during the upgrading of Main Road between St James and Kalk Bay, Cape Town; note continuous delineation and reclaimed stone kerbs being laid

Major environmental and construction challenges faced in the upgrading of Main Road between St James and Kalk Bay, Cape Town

BACKGROUND

The scenic 4.5 km stretch of coastal road between Muizenberg and Clovelly, one of only three routes linking the Cape Town metropolitan area with the far south, had been re-surfaced in 1994 using a hot in-situ recycling method which was designed to last approximately ten years.

As a result of this road starting to show signs of serious distress, the City of Cape Town appointed Kayad Knight Piesold Consulting Engineers to undertake an initial assessment of its condition in September 2006. It was subsequently determined that, in addition to the generally poor condition of the road pavement, the underground services (water mains, stormwater, and both gravity and pressure sewage pipes) were severely degraded and needed to be replaced urgently.

Due to the size of the project and the related budgetary constraints, it was decided to divide the project into three contractual phases, each to be undertaken as a separate contract:

■ Phase 1: Casa Labia, Muizenberg, to

Leighton Road, St James – a distance of 1.6 km. This phase commenced in January 2008 and was completed in September 2011. The work was carried out by Civils 2000 (Pty) Ltd at a value of R80 m.

■ Phase 2: Leighton Road, St James, to Kalk Bay Harbour (the subject of this article) – a distance of 1.1 km. The contract was awarded to Civils 2000 (Pty) Ltd towards the end of 2010 for an amount of R59 million. Work on this phase commenced in January 2011 and was due to be completed by the end of July 2013.

■ Phase 3: Kalk Bay Harbour to Clovelly Road, and Atlantic Road, Muizenberg, to Casa Labia – a distance of 1.8 km. This phase, which will have a three-year duration, is due to commence in September 2013.

AIMS AND OBJECTIVES

Main Road between Muizenberg and Clovelly also serves as a corridor for all the major services to the far south –

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electrical, telecommunications, water and sewerage. The fact that the road and these various underground services had deteriorated beyond repair made it an

urgent necessity to take action. Failure to undertake this work would have resulted in major service failures and the road deteriorating to such a poor state that it would become incapable of carrying the current daily heavy loads and large volumes of traffic.

Rehabilitation was vital, also in light of the fact that Main Road is one of only three access routes to the far south. The other two are Chapmans Peak Drive and Ou Kaapse Weg. Main Road currently carries 20 000 vehicles per day – traffic volumes had increased by approximately 1 000 vehicles per day per year from 2008 to 2011.

The old 500 mm diameter asbestos cement water main was the only supply

of water to the far south serving the communities of Clovelly, Fish Hoek, Simon's Town, Ocean View, Kommetjie and Noordhoek. This water main was over 50 years old and in urgent need of replacement. The 300 mm diameter cast iron reticulation main was also in need of replacement, as the old leaded joints had become fragile. It is being replaced with a new 315 mm diameter uPVC line.

The water main is being replaced by a 700 mm ductile iron pipe. It will connect to a new pump station which is in the process of being constructed under a separate contract at Clovelly. The larger diameter pipe and new pump station will provide the far south with water security for the next 30 to 40 years.

If the old 500 mm water main failed, traffic would have been severely affected, road side structures would have been affected and the supply of water to the far south compromised.

A camera survey had revealed that the old salt-glazed earthenware sewer pipes, some of which were over 100 years old, were all in a poor state of repair and a significant amount of sewage effluent was found to be leaking through the pipe joints and infiltrating into the substrata. *E coli* counts in the sea would therefore be reduced by the upgrading.

The benefits of the road rehabilitation project can be summarised as follows:

- The standard profile has been maintained over the whole length of the road.
- Improved horizontal and vertical alignments have been implemented.
- Traffic calming measures to reduce vehicle speed have been introduced.
- Safer pedestrian movements have been facilitated.
- Safer bicycle movements have been facilitated.
- Correct regulatory and information signage has been installed.
- There is greatly improved aesthetic appeal in terms of attractive brick-paved parking bays, pedestrian crossings, walkways and sidewalks.
- Construction of greatly improved stormwater drainage.
- Provision of improved landscaping and establishment of trees and shrubs.
- Provision of increased off-street parking capacity.
- Upgrading of adjacent parks, open spaces, parking areas and street furniture.
- The elimination of future traffic interruption/inconvenience due to service breakages and road repairs.



Breaking out hard core rock in excavation



Shoring required for deep excavation

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- Elimination of danger of contamination of substrata by sewage.
- Security of water supply to the far south.

PROJECT DESCRIPTION

The scope of the work included, *inter alia*:

- Removal of the existing asphalt wearing course and Bitumen Treated Base (BTB) layer.
- Removal and stockpiling of all existing hand-dressed stone kerbs and channels. These elements date back to the late 1880s.
- Replacement of the 300 mm and 500 mm diameter water mains together with all the necessary fittings and specials.
- Replacement and/or rehabilitation of the existing 250 mm diameter gravity sewers and manholes.
- Construction of retaining walls and reinforced concrete slabs in selected areas.
- Replacement of existing concrete stormwater lines and/or rehabilitation of catch pits.
- Construction of a new 120 mm water-bound macadam sub-base and 120 mm BTB layers, together with new 50 mm asphalt surfacing as well as brick-paving of selected areas and entrances where required.
- New road markings and road signs.
- Improvements/replacement of existing stormwater inlets and drainage elements.
- Minor concrete works to retaining walls.
- New galvanised steel handrails.
- Replacement and relocation of all street light poles and fittings and traffic signals.

Details of the replacement of the sewers and water mains are as follows:

- New 700 mm diameter ductile iron water main wrapped in polyethylene tubes as corrosion protection.
- Construction of a new valve chamber at the southern end.
- New 315 mm diameter uPVC water main.
- Replacement of water meters to all residential and commercial units.
- Replacement of the old cast iron sewer rising main with a 450 mm diameter HDPE pipe using the old asbestos cement water pipe as a duct to reduce excavation and time.
- Where depth made it possible, the existing gravity sewers that were beyond

repair were replaced with a new Class 34, 250 mm diameter heavy-duty pipe.

- In deeper areas, as was the case along most of the route, the existing 250 mm diameter sewers were rehabilitated using cured-in-place polyethylene liner. Before and after camera surveys were undertaken on each section of pipe.
- 160 mm diameter Class 34 UPVC rider sewers were laid in areas where the sewer lines were too deep for connection.
- All the brick sewer manholes were rehabilitated and a few were replaced. The following additional ancillary work was also undertaken:
 - Upgrading of the Night Shelter and Public Ablution Block near Kalk Bay Harbour. This work included upgrading all the external plumbing and construction of retaining walls, wheelchair-friendly brick-paved ramps, landscaping and new fencing and hand rails.
 - Upgrading and widening the raised pedestrian promenade adjacent to Kalk Bay Harbour. This work included upgrading and repairing the existing stainless steel hand railing, re-plastering the promenade wall on the road side and widening and brick-paving the walkway to provide an attractive thoroughfare for pedestrians.
 - Reconstruction and paving of four well used parking areas.
 - Construction of new retaining walls to facilitate widening the sidewalks on the sea side of the road.
 - Landscaping and planting of trees and shrubs, including the installation of irrigation systems to landscape designs produced by the city's Urban Design Division.

PROBLEMS ENCOUNTERED AND INNOVATIONS

Difficulties and complexities of laying the new 700 mm diameter ductile iron water main

Lack of sufficient space because of the multitude of existing services which had to be 'kept live' for the full duration of the operation, and the fact that the road was constructed in half widths to maintain the flow of traffic, made it necessary in most cases to lay the new pipes in very close proximity to the old asbestos cement main.

In many instances unknown services or banks of very hard Table Mountain

sandstone were encountered. This necessitated the sudden making up of 'specials' in the form of a series of bends which are obviously not 'off the shelf' items, and innovative non-destructive blasting techniques such as 'boulder busting' using an explosive cartridge inserted into a pre-drilled water-filled hole.

Bearing in mind that the far south of the Cape Peninsula is wholly dependent on this pipe line for its water supply, any slight movement of the old joints could have resulted in absolute disaster, and many an anxious moment was shared by the site staff whenever this operation was carried out. It was therefore always a great relief to all involved when a 'blasting' operation had been successfully completed! Fortunately, this has been the case in respect of both the phases that have been completed thus far and no serious mishaps have occurred.

Maintaining existing services and access to properties

The contractor had to ensure that all existing underground services, such as water, sewerage, electricity, telecommunications and stormwater remained fully operational at all times. This required extremely careful work procedures to ensure that these fragile and essential services were not damaged.

In addition to the service mains under the road, care also had to be taken not to damage or disturb services to properties adjacent to the road. Maintenance of access to properties was also a major challenge that had to be dealt with. This was especially relevant in the busy Kalk Bay business district, which is a very popular tourist area with its many shops and restaurants.

Traffic and pedestrian accommodation

The road was constructed in eight half-width sections for both Phases 1 and 2 which required very carefully planned accommodation of traffic facilities in terms of full-time 24-hour temporary stop/go traffic lights and flagmen. Use was also made of CCTV cameras for the full duration of the project. These proved to be invaluable in terms of traffic monitoring and recording violations and other incidents. Use was also made of VMS signs at all the approach roads to the contract section so as to permit motorists to decide to take an alternative route – generally via Ou Kaapse Weg.



View of new 700 mm and 315 mm diameter water mains in shared trench



Installation of bend in 700 mm diameter water main



Installed 700 mm diameter water main underneath other services

The final sections of road in Phase 2 from the intersection at Clairvaux Road (at the southern end of Boyes Drive) to just past the Kalk Bay Harbour entrance proved to be particularly challenging, because up to that stage motorists could bypass the construction work by using Boyes Drive. The harbour entrance, which includes a signalised railway level crossing adjacent to the road, was especially difficult to control, particularly during the school holiday periods and over weekends when huge numbers of people visited the fishing harbour with its many attractions and restaurants.

The accommodation of pedestrians also proved to be very challenging, especially in the Kalk Bay CBD and its close proximity to the busy Kalk Bay railway station where it was found that a large number of visitors from foreign countries could not read or speak English.

Other challenges that had to be met

- Working within confined spaces with the concomitant occupational health and safety risks.
- Necessity for extensive hand excavations because of the close proximity of adjacent services and in many instances lack of space to operate a machine.
- Uncertainty regarding the exact positions and depths of existing services.
- On-going unavoidable design changes necessitated by the lack of reliable as-built details and the presence of unknown services and other unanticipated obstacles, such as large boulders, above existing services.
- Limited working hours due to the project being in a residential and business area.
- Accommodation of major public sporting events (Peninsula Marathon, Big Walk, Argus/Pick n Pay Cycle Tour and the Two Oceans Marathon), which all used this road as a portion of their respective routes.
- The need to allow for through access for emergency service vehicles whenever necessary and often at short notice, or without notice.
- The additional precautions that had to be taken because of the project being located in an environmentally sensitive and heritage area.
- Lack of sufficient areas to store and stockpile materials.
- The difficulties and delays experienced in loading, delivering and off-loading

materials because of the restricted work areas, stop/go system and through traffic.

The employment of professional public relations consultants who were *inter alia* responsible for the on-going public participation process contributed greatly towards assisting the site staff with many of the above challenges. Their input, which included regular electronic updates, newsletters, notices of delays and notices of pending road closures and service disruptions, proved to be invaluable in keeping all the interested and affected parties (I&APs) fully informed at all times. The bi-monthly community liaison meetings to which all registered I&APs were invited also proved to be invaluable in this regard.

David Biggs, the well-known columnist for the *Cape Argus*, very appropriately summed up the complexities of this project when he recently wrote in his daily column:

"This project is like changing the pistons on a motor car engine while it is still running."



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PROJECT STATUS

Phase 2 achieved practical completion on 24 June 2013, the day on which the final section of road was opened to two-way traffic. It is scheduled to be fully completed in mid-August 2013, and is well within the budget allowed.

CONCLUSION

Despite all the difficulties and complexities outlined in this article, it is considered that the newly rehabilitated road, services and ancillary work have considerably enhanced the attractiveness of this popular and charming area. It has been reliably learned that property values along the completed sections of road have increased considerably due to the aesthetic benefits, as well as the increase in off-street parking areas.

The employment of a firm of professional public liaison consultants has proved to be invaluable in terms of keeping the public informed on all matters and happenings concerning the project on an on-going basis.

The many challenges faced by the contractor were met as a result of the extremely close liaison and cooperation between all the members of the project team. The input of the client, City of Cape Town Roads and Stormwater Department, is particularly acknowledged for their vision, valued input and support. □

PROJECT TEAM

Client

City of Cape Town Roads and Stormwater Department
(Paul Booth, Mark Doubell, Ian McDonald)

Consulting Engineer

Kayad Knight Piesold Consulting Engineers (John Craig, Andy Rush, Darryl Carver)

Contractor

Civils 2000 (Pty) Ltd (Rob Starke, Chris Ford, Alan Espey)

Community Liaison Consultants

Chand Environmental Consultants (Sadia Chand, Kim Diedericks, Victoria Donaldson)

OHS

Engelbrecht and Associates (Rod de Witt)

Environmental Consultants

Envirowise (Lynda Muller)

Landscape Architect

City of Cape Town Urban Design (Ancunel Steyn)



Restricted roadway width available to traffic during the upgrading



Asphalt paving in progress



View of completed brick paving