



public works

Department:
Public Works
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF PUBLIC WORKS

PARLIAMENTARY PRECINCT: STALPLEIN: STRUCTURAL REPAIRS TO GRANITE STRUCTURES

WCS 050967S

32076-REP-001 REV 1

PRELIM STRUCTURAL REPORT

NOVEMBER 2015

PREPARED FOR:



DEPARTMENT OF PUBLIC WORKS
PRIVATE BAG X9027
CAPE TOWN
8000

PREPARED BY:



BVi CONSULTING ENGINEERS WC (PTY) LTD
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CENTURY CITY
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ISSUE & REVISION RECORD

QUALITY APPROVAL

	Capacity	Name	Signature	Date
By Author	Project Engineer	Johan de Lange		10/11/2015
Approved by Design Centre Leader	Project Director	Chris Lourens		10/11/2015

This report has been prepared in accordance with BVi Consulting Engineers Quality Management System. BVi Consulting Engineers is ISO 9001: 2008 registered and certified by NQA Africa.



REVISION RECORD

Revision Number	Objective	Change	Date
0	Issue to Clients for comments		10/11/2015
1		Cost estimate revised	23/11/2015

TABLE OF CONTENTS

ISSUE & REVISION RECORD.....	i
SECTION 1- INTRODUCTION.....	3
SECTION 2- BACKGROUND.....	4
SECTION 3- EXECUTIVE SUMMARY.....	5
SECTION 4- OBSERVATIONS.....	6
SECTION 5- REMEDIAL OPTIONS.....	15
SECTION 6- COST ESTIMATES AND TIME FRAMES.....	19
SECTION 7- CONCLUSION.....	22

SECTION 1- INTRODUCTION

BVi Consulting Engineers have been appointed to provide Professional Engineering services to the Department of Public Works on the above mentioned project, which is mainly:

- Granite cladding panels becoming dislodged from the concrete surface (some of which were located at the entrance to the Basement underground parking and has already fallen off)
- Cracks in the concrete slab/soffit in the basement
- Water ingress problems caused by surface water on the Plein penetrating through the cobblestone paving joints and finding their way through joints into the interior of the basement.
- General repair work to finishes on the Stalplein area (granite or cement pavers and joint sealing) and damaged fixtures (handrails, electrical lighting, tree rings, etc...)



Photo 1.1: Aerial photo of Cape Town CBD, indicating position of Stalplein

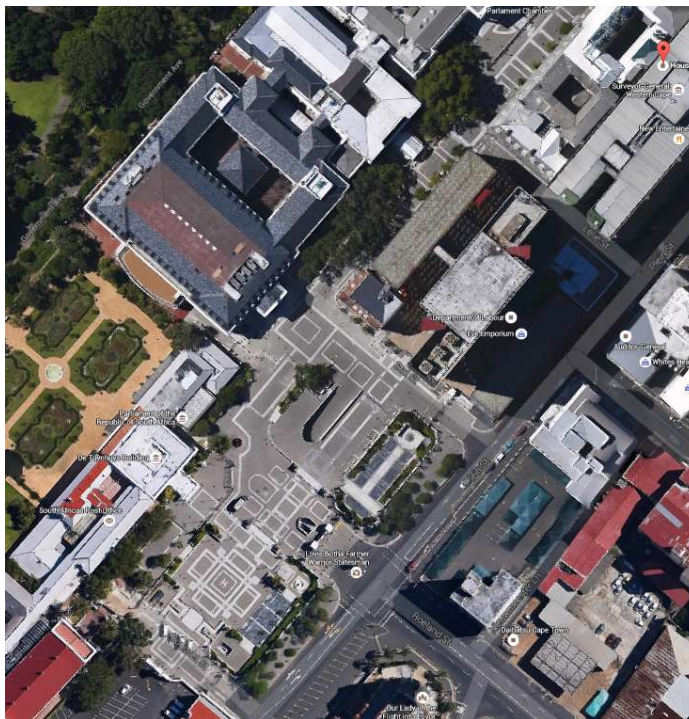


Photo 1.2: Close up aerial photo of Stalplein, at the Parliamentary Precinct

SECTION 2- BACKGROUND

The large open area between the main gates on Plein Street in front of Parliament and the front of Tuynhuys is called Stalplein. This name is derived from the Governor's horse stables. This area was originally the back yard of the building, with the main entrance on the side of the Government Avenue and the Public Gardens.

This changed in 1913 when Government Ave was closed to vehicular traffic, and it became the main entrance to Tuynhuys. Stalplein was redeveloped in the early 1980s, with 3 levels of basement parking underneath. Stalplein was inaugurated in 1986 (29 years ago), by the then President of Republic of South Africa, PW Botha.

In 2014, a bronze bust of Nelson Mandela was installed in Stalplein, in front of Parliament building, to commemorate 20 years after the 1994 elections.



Photo 2.1: Parliament building with the bronze plaque of Nelson Mandela in front of it, facing the Stalplein area.

SECTION 3- EXECUTIVE SUMMARY

A 12 month construction timeframe and a budget estimate for the construction works of R4.5m (incl. VAT), has been provided as a guideline.

The following remedial measures to the granite elements on Stalplein are proposed.

3.1 BASEMENT PARKING ENTRANCE AREA

- Overhead granite panels at basement parking entrance where corrosion of existing fixings is found to be excessive, additional stainless steel pins drill or alternative support fixing to the concrete above is to be provided.
- Movement of vertical cladded granite panels above basement parking entrance & also water seepage onto granite needs to be addressed. Secret fixed stainless steel pins should be installed to re-fix all loose panels.
- Install stormwater grating at top of wall inside paving level & waterproof, to prevent efflorescence forming on granite elements.

3.2 GRANITE PLANTER BOXES

- Granite elements that have moved vertically and laterally, to be reconstructed, after redoing the water drainage system & replacing plants with slower growing alternatives

3.3 GRANITE POT PLANT PLINTHS

- Remove top side coping to further investigate the cause of the movement and to determine the best solution to rectify.

3.4 GRANITE PAVERS & KERBS

- All granite floor slabs that are settling or which have cracked, to be repaired and/or replaced.
- Damaged jointing between all granite slabs to be replaced.

3.5 PAVING COBBLES

- Make good of settlement areas and clean paint stained cobbles.

3.6 SLATE TILES

- Replace damaged slate tiles.

3.7 EFFLORESCENCE & CORROSION STAINING ON GRANITE WALL CLADDING

- Clean away with sand paper or metal scrapers, and address the cause of the staining where excessive staining occurs.

3.8 CORRODING BALLUSTRADES & HAND RAILINGS

- Cast Iron steelwork that is corroding. Should be replaced with stainless steel balustrading, to avoid future staining of granite.

3.9 MISCELLANEOUS ITEMS

- Trimming of tree routes that are impacting on granite pavers around the tree and also cleaning of stained marble fountain should be considered.
- Addressing of basement ground water leak that is depositing silt in the basement

SECTION 4- OBSERVATIONS

4.1 BASEMENT PARKING ENTRANCE AREA



Photo 4.1: Efflorescence visible on curved granite element and also missing overhead granite panel on right hand corner.



Photo 4.2 – Overhead granite panel that has fallen off.
Could happen to other overhead panels as well.



Photo 4.3 – Close-up of remnants of fixing anchor that is showing signs of corrosion.



Photo 4.4 & 4.5: Skimming grout covering fixing lugs is popping off due to corrosion at the fixing lug.

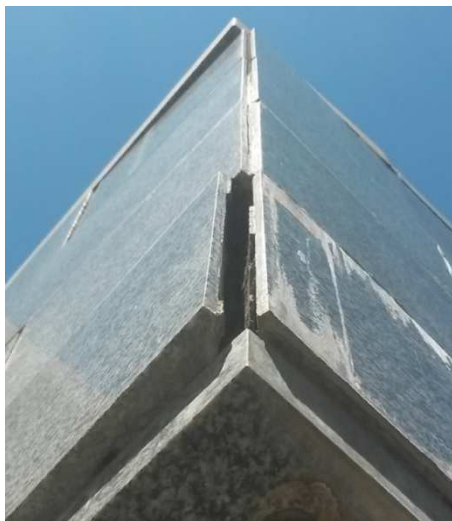


Photo 4.6: Vertical panels on left hand corner of curved entrance where lateral movement of granite is visible.



Photo 4.7: Curved granite entrance with concrete pavers at the top where water ingress through the granite elements occurs.



Photo 4.8-10: Granite elements on top of curved entrance where movement of elements have occurred.

4.2 GRANITE PLANTER BOXES



Photo 4.11: Granite planter boxes with lateral movement of coping and vertical movement of cladding elements & efflorescence visible

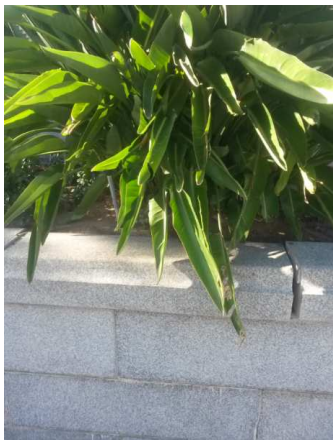


Photo 4.12-14: Lateral movement of planter box coping.



Photo 4.15-16: Vertical movement of planter box cladding elements



Photo 4.17: Localized efflorescence visible at bottom of planter

4.3 GRANITE POT PLANT PLINTHS



Photo 4.18-19: Plinths with visible differential settlement of +/- 20mm on a number of plinths at the potplant base.

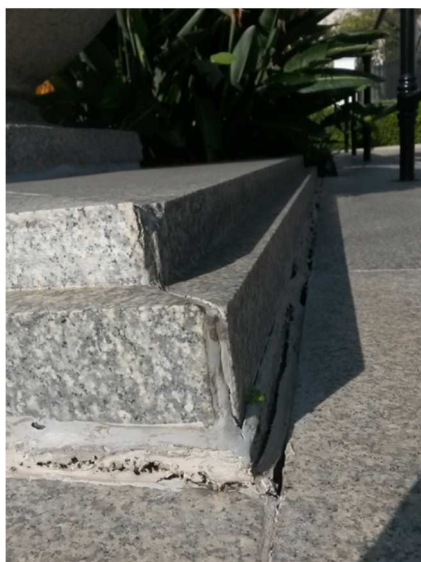


Photo 4.20: Close-up of pot plant base, with granite elements lifting on one side, as a result of settling at far corner.



Photo 4.21: Close-up of pot plant base, where the one element has settled, while the adjoining element has not moved.

4.4 GRANITE PAVERS & KERBS



Photo 4.22 & 23: Granite slabs that have cracked in Parliament street



Photo 4.24 & 25: Granite slabs with exposed joints & chipped edges



Photo 4.26 & 27: Standing water underneath granite slabs at basement emergency exit and granite kerb that has been dislodged.

4.5 PAVING COBBLES

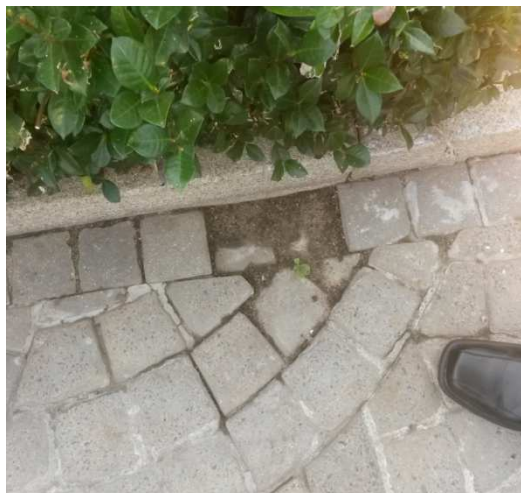
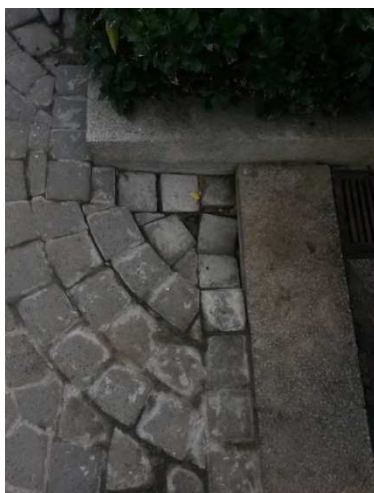


Photo 4.28 & 29: Paving cobbles with some sign of differential settlement



Photo 4.30: Paving cobbles that are in need of treatment to remove paint marks

4.6 SLATE TILES



Photo 4.31-33: Cracked and damaged slate tiles.

4.7 EFFLORESCENCE & CORROSION STAINING ON GRANITE WALL CLADDING



Photo 4.34-35: Typical efflorescence staining from rainwater running down granite facade



Photo 4.36-37: Abnormal efflorescence staining – possibly a block underground drain & also corrosive staining



Photo 4.38: More visible efflorescence and corrosive staining on the same staircase.

4.8 CORRODING BALLUSTRADES & HAND RAILINGS



Photo 4.39 & 40: Cast Iron steelwork that is corroding should be replaced with stainless steel base fixing with sleeve and cast iron railing on top, to avoid future staining of granite.

4.9 MISCELLANEOUS ITEMS



Photo 4.41: Tree close to Parliament entrance that has damaged the tree ring and also lifted granite pavers. Tree ring should be removed or modified to suite and granite pavers lifted to review extent of root growth, for trimming of roots and relaying of pavers. Investigate other trees as well

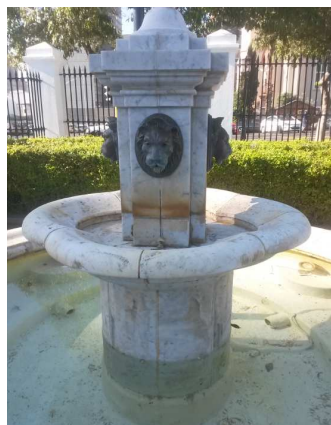


Photo 4.42: Water marks on granite fountain to be cleaned

4.10 WATER LEAK INTO BASEMENT AT MOVEMENT JOINT OF STRUCTURE



Photo 4.43 & 44: Movement joint +/- 40m from basement entrance, to be made good and waterproofing on top of slab to be reviewed on site.



Photo 4.45 & 46: Ground water leak at bottom level of basement depositing silt from the foundations of Africa House into the basement.

SECTION 5- REMEDIAL OPTIONS

5.1 BASEMENT PARKING AREA – HONED PAARL GREY GRANITE

This area poses the biggest threat to the safety to pedestrians as well as occupants of vehicles entering the basement parking area, from falling granite elements.

It is recommended that a Scaffold bridge be constructed to protect people from any possible falling granite elements. This bridge can then be used during the restoration process to work safely, without obstructing the access for people and vehicles. See elevation below indicating conceptually where the bridge will be positioned.



5.1.1 Overhead hanging granite elements

- Replace missing granite element with new fixing lugs with stainless steel dome heads.
- Expose fixing lug heads of vertically hanging granite slabs and treat with an anti-corrosive treatment and reseal soffit with a stainless steel dome heads.
- Where the condition of the existing lugs is suspect, install additional central 2xM12 stainless steel lugs through the granite into the concrete, with stainless steel dome heads.

5.1.2 Vertically hanging granite elements that are loose

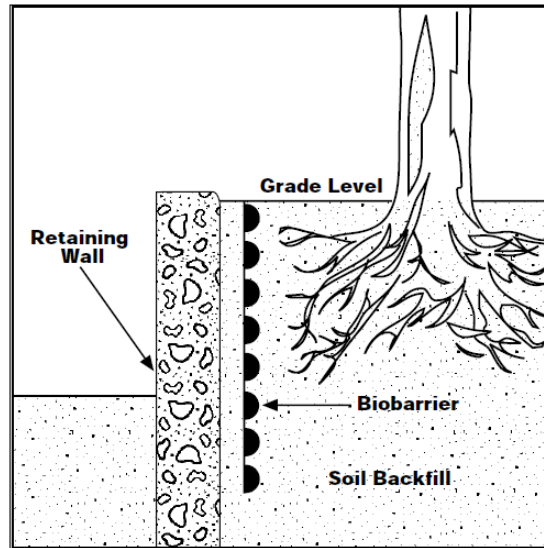
- As-built drawings indicate a 10mm stainless steel bracket at corners of bottom vertical panels. (TBC on site)
- Remove all loose granite panels, or panels that have moved.
- Old grout and material build-up behind panels to be cleaned out. Rehabilitate concrete behind, if required, with anti-corrosive treatment, like MCI (Migratory corrosion inhibitor)
- Drill holes into the concrete structure with adequate edge distance to avoid spalling or cracking of the concrete
- Drill fix 2 x secret fix lugs onto the back of the granite panel that has been removed, to match the holes in the concrete structure.
- Fix the granite slab with lugs into the concrete, with epoxy resin.

5.1.3 Vertically hanging granite elements with efflorescence staining

- Clean efflorescence from vertical bottom hanging elements with metal scrapers or soluble solution (non acidic)
- Lift paver behind the wall, to expose the source of the efflorescence. If the water is coming from the paving level, then a waterproofed stainless steel drainage channel should be installed, to try and limit the water seepage through the concrete parapet.

5.2 GRANITE PLANTER BOXES – FINE MACHINE PUNCHED PAARL GREY GRANITE

- Remove plants and expose existing soil and drainage.
- Remove all granite block and copings that have moved, and reconstruct.
- Redo existing agricultural drainage system, as well as internal waterproofing against granite.
- Install a Bio barrier membrane (a membrane system that blocks the growth of tree roots through it) against inside of granite planter box. (see diagram below)



- Replanting the existing strelitzia's is not recommended, as they have outgrown the available space in the planter boxes.
- After gaining advice from a Horticulturalist, it is recommended that a slow growing variant (known as Mandela's Gold) be planted to replace the existing strelitzia's,
- See some general information on this plant below.

Strelitzia reginae Aiton 'Mandela's Gold'

Family: Strelitziaceae (Strelitzia family)

Common names: Mandela's gold strelitzia, yellow strelitzia, yellow crane flower, yellow bird of paradise, geelkraanvoel blom, geel piesang



Strelitzia reginae 'Mandela's Gold' is a rare yellow form of the well-known crane flower, *Strelitzia reginae*.

Yellow-flowering strelitzias have been known for a number of years, plants have cropped up in France, California, Australia, Japan and in South Africa at a few locations in Eastern Cape and at Kirstenbosch and the Karoo Desert National Botanical Gardens, but always as isolated specimens. Left to their own devices, the seeds from these yellow forms will not breed true as they will most likely have been pollinated by an orange plant. To get yellow progeny, two yellow plants must be crossed. At Kirstenbosch in the 1970's, there were seven yellow plants in the nursery. John Winter, who was curator during this period, began a project to increase the stock. It took nearly twenty years of careful selection and hand-pollination, and in 1994 the original stock had been built up enough to enable us to introduce the yellow strelitzia to horticulture. It was released and traded under the name 'Kirstenbosch Gold' until 1996 when the NBI was granted permission to re-name it in honour of Nelson Mandela.



'Mandela's Gold' is a stemless, evergreen clump-forming perennial. Greyish green, banana-like leaves grow to a height of about 1.5 m and during winter and spring the large bird-like flowers are held above the foliage on the tips of long, sturdy stalks. The structure and pollination of the flowers is fascinating. The hard, beak-like sheath from which the flower emerges, is called the spathe. This is held at right angles to the stem, and has the appearance of a bird's head. Each spathe contains 4 to 6 flowers, and these emerge one at a time from the spathe. Each flower consists of 3 clear yellow sepals and 3 deep purple petals. The yellow sepals give the appearance of a crest on the 'bird's' head. Two of the purple petals are joined together around the stamens and the style to form an arrow-like structure. The third purple petal is visible as a small scale.

5.3 GRANITE POT PLANT PLINTHS - FINE MACHINE PUNCHED PAARL GREY GRANITE

- Remove top coping on the side of the plinth, to investigate further, what the cause of the differential settlement is. Once the cause is determined, possible solutions can be considered.
- Risk of damaging the pot plants should be avoided at all cost.

5.4 GRANITE PAVERS & KERBS - FINE MACHINE PUNCHED PAARL GREY GRANITE

- Remove all cracked 50mm thick slabs and make good and level out compacted sub-base underneath.
- Replace all cracked granite slabs, with slabs of similar site dimensions.
- Contractor to reseal joints with sand cement grout in general, but should make allowance for an elastomeric joints every 10m length of granite (not oil based as they will stain the granite).
- Where joints between granite slabs are not consistent, the slabs are to be cut on site, and re-sealed.
- The granite pavers at the bottom of the access stairwells, to be lifted where standing water occurs. Existing drainage system underneath the paver level is to be cleaned, to allow proper drainage.

5.5 PAVING COBBLES – PORTLAND CEMENT

- Where settlement of pavers have occurred, the pavers are to be lifted and sub-base to be re-compacted and levelled out, before repaving the affected area's.
- Cobble pavers that have been stained with green paint blotches to be cleaned with biodegradable paint cleaner.

5.6 SLATE TILES

- Remove damaged slate tiles and re-compact sub-base and install new slate tiles, matching the existing.

5.7 EFFLORESCENCE & CORROSION STAINING ON GRANITE WALL CLADDING

- Remove efflorescence and corrosion staining by means of scraping or using sanding equipment. The granite is a hard wearing surface so the majority of the staining should be removed, but some remnants could still remain.
- Investigate where the very white line of efflorescence is coming from, behind the wall. Possible a blocked drain, which should be cleaned out.

5.8 CORRODING BALLUSTRADES & HAND RAILINGS

- Remove and replace rusted balustrading with galvanized or stainless steel members.
- Clean and repoint joints around granite coping, after re-fixing balustrading to concrete below.

5.9 MISCELLANEOUS ITEMS

- Remove steel tree ring & lift granite slabs around tree to evaluate options for cutting back root system. Horticulturalist to advise.
- Clean stains on marble fountain with sandpaper.

5.10 RAIN WATER LEAK INTO BASEMENT AT MOVEMENT JOINT OF STRUCTURE

- Movement joint to be made good at soffit of slab.
- Review waterproofing on top of slab, underneath paving. If waterproofing has perished, it should be redone.

5.11 GROUND WATER LEAK INTO BASEMENT AT CORNER OF AFRICA HOUSE

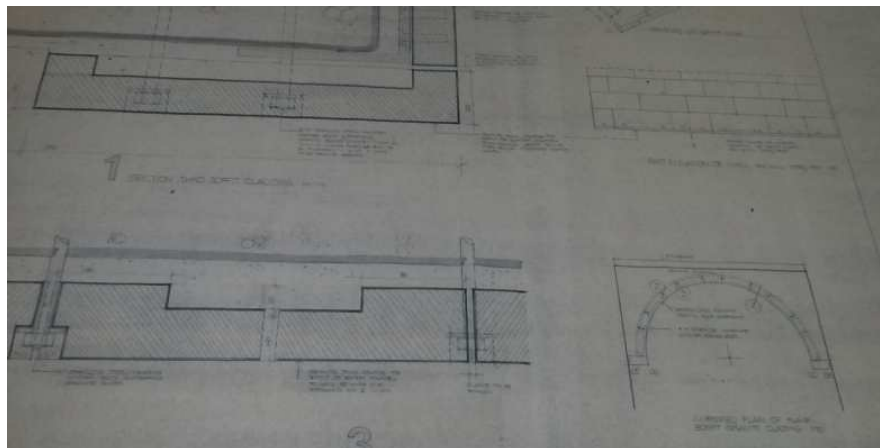
- Water has been tested to confirm it is groundwater (no traces of chlorine in the water).
- The silt deposition is the main issue of concern, as it is undermining the foundations of Africa house.
- Temporary proposal is to try and seal the joint with waterproofing products, but this proposal will probably not be a long term solution, as the ground water table will rise and the water will leach elsewhere.
- The long term solution is to drill a borehole next to the basement and install a ground water pump, to permanently lower the ground water table in the area close to the basement.

SECTION 6- COST ESTIMATES AND TIME FRAMES

The contractor who did the original granite work back in 1985, is J.A. Clift Granite contractors & Monumentalists, in Paarl. They have been in business since 1909 with their first major project was Rhodes Memorial against Table Mountain. They provided 21 granite slabs for some localized repair work in the Stalplein precinct about a year ago. They were so kind as to give us costing information for these slabs, to assist in cost calculations for our project.



They also assisted in giving information on the types of granite elements at Stalplein (Honed Paarl grey granite at the basement entrance and Fine machine punched Paarl grey granite elsewhere), which was sourced originally from their granite quarry in Paarl. They also provided a detail drawing of the granite fixing brackets, at the basement entrance.



J.A. Clift indicated that a site team consisting of 1 skilled granite artisan and 3 labourers to do the heavy lifting, which would have to travel from Paarl every day, would cost about R4000/day on site, for the labour only. An estimated timeframe for repairing each of the problem areas.

6.1 CONSTRUCTION COSTS

Area:	Labour (R4000/day):	Material estimate:	Total (ex VAT):
6.1 Basement Parking Entrance			
Scaffold bridge and lifting equipment			R100 000
Re-fixing of granite slabs with stainless steel pins	14 days: R56 000	R100 000 for new pins, new slab, grout etc..	R 156 000
Cleaning of efflorescence	3 days: R12 000	R 3000 for tools	R 15 000
Installing drain around top of entrance	5 days: R16 000	R50 000, drain + waterproofing	R 66 000
Restoring jointing, etc	7 days: R28 000	R20 000, grout, etc	R 48 000
6.2 Granite Planter Boxes	21 days: R84 000	R140 000 for grout and waterproofing & drains	R 224 000
6.3 Granite Pot Plant Plinths	24 days: R120 000	R240 000 for regrouting of copings, lifting equipment, etc	R 360 000
6.4 Granite Pavers & Kerbs & general joint sealing	30 days: R120 000	25m ² x R7000/m ² = R175 000 + R25 000 (grouting)	R 420 000
6.5 Paving Cobbles	10 days: R40 000	R10 000 for regrouting	R 50 000
6.6 Slate Tiles	5 days: R20 000	10m ² x R1000/m ² = R10 000	R 30 000
6.7 Efflorescence & Corrosion	14 days: R56 000	R20 000 for tools and scrapers	R 76 000
6.8 Balustrades & Hand Railings	10 days: R40 000	New balustrading estimate: R250 000	R 290 000
6.9 Miscellaneous Items (New plants, electrical refurbishment, waterproofing etc)	14 days: R56 000	R300 000	R 356 000
6.10 Water Leaks into Basement	20 days: R80 000	Sealing joints, Drilling of borehole and pump installation R250 000	R330 000
Sub-Total	146 working days = 6 month estimate.		R 2 521 000
Provisional & General costs (15% of Sub-Total)			R 378 150
Contingency (30 % Sub-Total)			R 756 300
CPAP (8.5% of Sub-Total)			R 214 285
Total (ex VAT)			R 3 869 735
14% VAT			R 541 763
GRAND TOTAL (incl VAT)			R 4 411 498
COST ESTIMATE APRIL 2014 (incl VAT)			R1 995 000

6.2 PROFESSIONAL FEES

FEE FOR NORMAL SERVICE				
Initial estimate of the construction cost for the structural work.	Initial estimated normal fees	Unit	Percentage of normal fees tendered	Financial offer by tenderer for value based fees
R 1 750 000	R 262 400	%	61	R160 064
Latest estimate of the construction cost	Latest estimated normal fees (15%)			Revised fees based on revised construction costs November 2015.
R 3 869 735	R 580 460.25	%	61	R 354 080.75
FEE FOR ADDITIONAL SERVICE	QUANTITY		RATE	
Level one, part time construction monitoring	12 months	months	R3 500	R42 000
Cost of geotechnical investigation	Trial hole and cost of laboratory testing	Lump sum		R1 000
Sub-consultant to review test results and foundation recommendations	Lump sum			R1 000
Engineering survey of the site	Lump sum			<u>R 3 000</u>
Sub-total additional service				R47 000
Normal +Additional service based on latest construction cost				R 401 080.75
14% VAT				R56 151.30
PROFESSIONAL FEES TOTAL BASED ON REVISED CONSTRUCTION COST ESTIMATE (NOV 2015)				R 457 232.05
TOTAL FINANCIAL OFFER FOR PROFESSIONAL FEES (APRIL 2014)				R236 052.96

SECTION 7- CONCLUSION

Restoration of the Stalplein area requires the use of granite from the same Paarl granite quarry, to achieve a similar look, where damaged elements are to be replaced.

The latest Health & Safety regulations stipulates a maximum lifting weight of 20kg per person, while working with granite results in some heavy lifting which will probably exceed this regulation.

The work should accordingly be done by qualified and experienced artisan with a labour staff to assist with the heavy lifting, to achieve the desired outcome, which is a Stalplein precinct with granite elements that have been restored back to the original state. This will be an asset to the people of the Republic of South Africa for the next 30+ years.

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