ETHEKWINI MUNICIPALITY
PROCUREMENT AND INFRASTRUCTURE CLUSTER
ENGINEERING UNIT, ROADS PROVISION DEPARTMENT
PAVEMENT & GEOTECHNICAL ENGINEERING

Tel : 031-3117367 Fax : 086 581 9947 Email : debbie.abel@durban.gov.za

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Structures
by email : roxanne.mudali@durban.gov.za

Attention : Ms. R. Mudali

GEOTECHNICAL ASSESSMENT OF FOUNDING CONDITIONS FOR PROPOSED PEDESTRIAN BRIDGE, BURBREEZE, TONGAAT

It is proposed to construct a pedestrian bridge across a tributary of the uTongathi River at the southern extent of Impumelelo Place (610291 Street), Burbreeze, Tongaat. No design details of the bridge are yet available. To this end a preliminary geotechnical appraisal of the site was carried out, the findings of which follow.

1. Observations

The present stream channel (water body) is barely 5m wide at the position of the proposed crossing although the basin and 1:100 year flood line (as recorded on the GIS) are considerably wider, incorporating a number of residences on the low lying western areas. Within the constraints of prevailing cadastral boundaries and taking the present river basin contours into account, the 'crossing', is expected to be in the order of 50m wide.

Looking at the contours and geology upstream and west of the crossing it is possible that the river course has been a little (50 – 100m) to the west of its present alignment in the past and it is possible that alluvial sediments with the associated deeper bedrock levels extend to the west. The 'dry channel' along the western cadastral boundary (between the line of gum trees and the adjacent residences) may reflect a more recent high flow period 'overflow' from the usual stream alignment.

The site is expected to be underlain at depth by Pietermaritzburg Formation shale and the associated residual clay soils however the river has deposited alluvial sands and clayey sands over the bedrock. No bedrock was seen in the vicinity of the proposed crossing. There is a possibility of dolerite intrusions in the vicinity, particularly in light of the fault zone.

An intra-formational fault zone (shale against shale) is mapped to the immediate south east of the site. Faults are not thin lines in the ground as perhaps inferred from a map but rather broad zones of disturbance. It is possible that the bedrock at depth below the site has been disturbed in places (typically fractured and more deeply weathered, but occasionally hardened) so variations in the nature and depth to competent rock can occur over short distances and some flexibility of design must be allowed for, particularly in founding depth if soft spots are encountered.

With limited drive-on access and budget field testing was confined to a traverse of five Dynamic Cone Penetrometer tests across the river channel on or about the proposed bridge alignment (site plan, Figure 1, attached). Test results are summarized in Table 1 at the end of this report. Test positions do not correspond to pier positions. Refusal was met at depths of between 1.8 and 3.9m below present ground levels (no refusal was met at DCP 4 on a high point). In the absence of deep inspection pits or boreholes it cannot be categorically stated that refusal was on competent bedrock rather than boulders or a dense residual layer but the depths are quite uniform across most of the traverse and no boulders were noted near the crossing so it is considered probable that the refusal was on or near weathered bedrock.

2. Geotechnical Assessment

Ideally, all bridges should be anchored into the bedrock to reduce the potential for undermining by erosion and rotating or toppling during high flow volumes. Although this stream is currently barely 5m wide at the proposed crossing there is a considerable catchment area including a sizable irrigation dam. The topography is depressed to the west, resulting in a wide flood plain for the size stream. Previous geological mapping recorded on the municipal GIS also suggests a past stream course to the west. The stream therefore should not be underestimated.

In the absence of a complete survey (particularly the western abutment) the elevations of the DCP positions have been visually estimated relative to the stream level in order to infer the depth to rock founding. Assuming a (relative) water level of about 23.5m, a fairly consistent ‘rock’ elevation of 22 – 22.5m was inferred from DCP refusal on the eastern bank and adjacent to the present stream channel. On the western side, in the ‘dry channel’, refusal appears to drop to about 20.5m. This could reflect a past stream course as discussed above. Although the surface is currently dry, water is expected at shallow depth in the western channel as the DCP rods were recovered wet from a bout 1m depth (equivalent to present stream level).

3. Founding Options

Founding recommendations are subject to confirmation once a contractor is on site with excavation plant that the expected depth to rock can be checked by test pitting.

Founding options suggested by inferred site conditions include :

- Footings anchored into bedrock. Inferred excavation depths to weathered rock are in the order of 2 – 4m below present ground levels, about 2 – 3m of which will be below water level. The footings could either be socketed into rock or anchored by drilling dowels into the bedrock. Excavating into saturated sands and clayey sands to 2 - 4m could be challenging and the trenches will certainly require dewatering and shoring but such excavations have been achieved on other bridge sites in larger streams than this. The apparent lack of a concentrated boulder layer does simplify the process.
- Grout injected auger piles socketed into shale bedrock are another option. There does not appear to be a boulder layer below the site that may interfere with the augering process, however, the condition and hardness of the bedrock at depth is unknown for socketing by auger. Where rock appears to be at about 2m depth, a pile would be considered a little short of optimum (pile length should be greater than 10x pile diameter). Further field investigation would be recommended to confirm the conditions for sockets at depth.

4. Conclusion

Based on limited field testing it appears that weathered bedrock, likely shale, is to be found at depths of between 2 and 4m below current ground levels, or 2 – 3m below water level. While potentially challenging, it would be possible to excavate trenches (shored and dewatered) to that depth to place footing foundations, anchored into the rock. Alternatively, grout injected auger piles may be an option, although, at 2m, these may be considered short of optimum. A moderately weathered, soft rock shale in this setting could conservatively provide, say, 400kPa bearing capacity but this would be subject to confirmation once the rock as been exposed for inspection by a geologist during construction.

Any construction near a steam bed should be carried out in the drier winter months as the lowered water levels will facilitate excavations into the sandy alluvial soils.

If there are any further queries, please contact the writer.

Yours faithfully,

D. J. ABEL (Mrs) Pr.Sci.Nat.
Engineering Geologist

Table 1 : DCP Test Results (10kg hammer)

Depth (mm)	DCP1	DCP2	DCP3	DCP4	DCP5
300	6	17	4	11	5
600	10	10	4	9	6
900	16	26	7	11	10
1200	14	16	3	6	7
1500	20	47	1	16	12
1800	48	43Ref	2	18	9
2100	34		2Ref	22	7
2400	33			20	5
2700	48			21	8
3000	71			46	6
3300	30			57	2
3600	100Ref			60	5
3900					7Ref

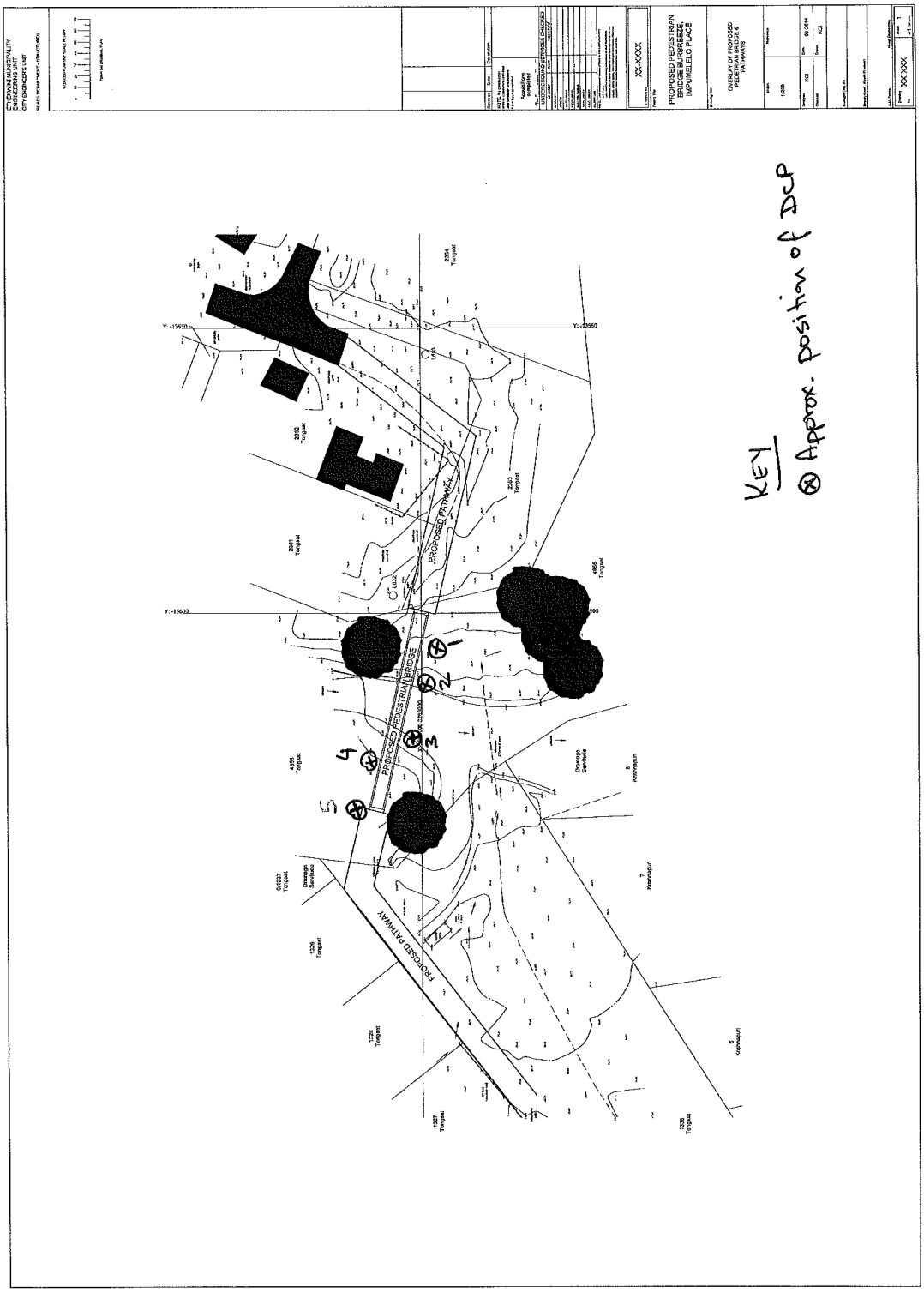

Figure 1 : Site Sketch Showing Approximate Locations of DCP Tests

Plate 1 : Low lying western palaeo-channel

Plate 2 : Approx. alignment of proposed crossing, looking east

Plate 3 : Approx. alignment of crossing, looking west