

TOWN PLANNING SCHEME REGULATIONS

"controlled area" means any area demarcated upon the map by the overprinting of a red honeycomb pattern, where, by reasons of the topography, the unsuitability or instability of the soil or other like reasons, development or building may be prohibited, restricted, or permitted upon such conditions as may be specified having regard to the nature of the said area;

10. LIMITATIONS UPON DEVELOPMENT DUE TO LACK OF SERVICES, UNSUITABILITY OF LAND AND OTHER CAUSES.

(1) Subject to the provisions of Section 47(2) of the Ordinance, the Council may prohibit the erection of any building on land situated in any undeveloped part or parts of the area of this Scheme pending the extension thereto of road, sewer, water supply, light or other necessary public services.

(2) (a) No person shall within a controlled area (as defined in Clause 1) develop any land, or excavate or level any site, or remove any natural vegetation from, or erect any structure of any nature whatsoever or carry out any work upon such site without having obtained the prior approval of the Council in terms of this subclause.

(b) No such approval shall be given unless the City Engineer, after due examination, and subject to such conditions as he may specify, is satisfied that any such development, erection or other work referred to in paragraph (a) hereof can be carried out without danger to the site, or any adjoining site or any building thereon.

(c) For the purpose of any examination referred to in paragraph (b), the applicant shall, where required by the City Engineer, submit such plans or other information as the City Engineer may require. Without affecting the generality of the foregoing, such plans may be required by the City Engineer:-

(i) to be certified by a Land Surveyor or Consulting Engineer as being correct;

(ii) to show sections through the site over the area to be developed down the line of greatest slope, accurate to 50 millimetres and to scale of 1 : 100;

(iii) to show sections at intervals not exceeding 10 metres across the site or at such closer intervals as the City Engineer may require.

(d) The conditions referred to in paragraph (b) hereof may be such as to:-

(i) restrict the form or nature of the building or structure;

(ii) limit the size and/or shape of the building or structure;

(iii) prescribe the form of foundations for the building or structure;

- (iv) prescribe or restrict the materials of which the building or structure is to be constructed;
 - (v) determine the siting of any building or structure and of any soakpits or other drainage works;
 - (vi) prohibit or control any excavation on the site, the construction of any roadways, paths and other garden features;
 - (vii) prohibit or control the removal of any natural vegetation;
 - (viii) control any other aspects which the City Engineer considers to be desirable.
- (e) Notwithstanding anything contained in this sub-clause the Council shall not be liable for any loss or damage which may occur to any building, structure or any property whether within a controlled area or otherwise arising out of any action by the Council or the City Engineer in terms of this sub-clause.
- (3) The Council may in relation to the erection, alteration or extension of any building or use of land, impose such conditions as are in its opinion necessary having regard to the low-lying nature of the area.

SPECIAL BY-LAWS RELATING TO THE DEVELOPMENT ON BLUFF SLOPES
(Unstable Areas only)

1. **Structures**

1a No structure shall be permitted on slopes greater than 30° or within 4 metres of the top of such slopes.

1b Structures on slopes greater than 22° must be supported as follows:-

- (i) on bored piles founded at such depth that the minimum distance from the base of the pile to the face of the slope exceeds the estimated depth of sliding as set out in Table 1.

Table 1

Angle of Slope	Depth of sliding "D" measured at right angles to slope
22° and flatter	0,00 metres
23°	0,75 metres
24°	1,50 metres
25°	2,25 metres
26°	3,00 metres
27°	3,75 metres
28°	4,50 metres
29°	5,25 metres
30° and steeper	6,00 metres

- (ii) on a basement or semi-basement such that the weight of soil which is excavated and removed from the slope is at least equal to the total weight of the structure.

1c Where structures are proposed to be built in proximity to slopes exceeding 22° the criterion for depth of founding of all foundations shall be that no foundations shall be based above a line determined in accordance with the assumed depth of sliding from Table 1 for the major angle of slope. Where the major angle of slopes exceeds 30° both the depth and angle of sliding shall be based on a 30° slope.

1d Plans submitted to the City Engineer for approval are required:-

- (i) to be certified by a Consulting Engineer as being correct;
- (ii) to show sections through the site over the area to be developed down the line of greatest slope, accurate to 50 millimetres and to a scale of 1:100;
- (iii) to show sections at intervals not exceeding 10 metres across the site or at such closer intervals as the City Engineer may require.

2. **Construction of Septic Tanks**

2a In order to prevent concentration of water near the faces of slopes steeper than 22°, septic tank outlets should be placed as far back from the face of the slope as possible and, where conventional soakpits cannot be located behind or below the slip plane, septic tank outlets should be taken down to a minimum depth of 3 metres and not less than 0,6 metres below the estimated slip plane.

3. **Disposal of Stormwater from Buildings**

3a Wherever possible, stormwater from roofs should be taken into stormwater drains. Where this is not possible, such stormwater must be led to soakpits constructed entirely behind and below the slip plane as determined, or taken directly to the bottom of the slope in open channels which should be well keyed into the ground. Great care must be taken to maintain such channels in good repair.

4. **Development of Terraces and Gardening**

4a Terracing or site levelling must be carried out in such a way that it results in a reduction in the weight on the slope. Excess material must not be dumped anywhere on the slopes.

4b The removal of any natural vegetation from slopes steeper than 22° is prohibited without the prior approval of the City Engineer.

4c In planning a garden, every effort must be made to ensure dispersion and not concentration of stormwater.

5. **Construction of Private Access Roads and Steps**

5a Road development on slopes exceeding 30° shall be prohibited.

5b Private Access Roads cutting across the natural slopes steeper than 22° must be entirely cut in and all banks so formed retained by walls of adequate design. Excess cut material must not be dumped anywhere on the slopes.

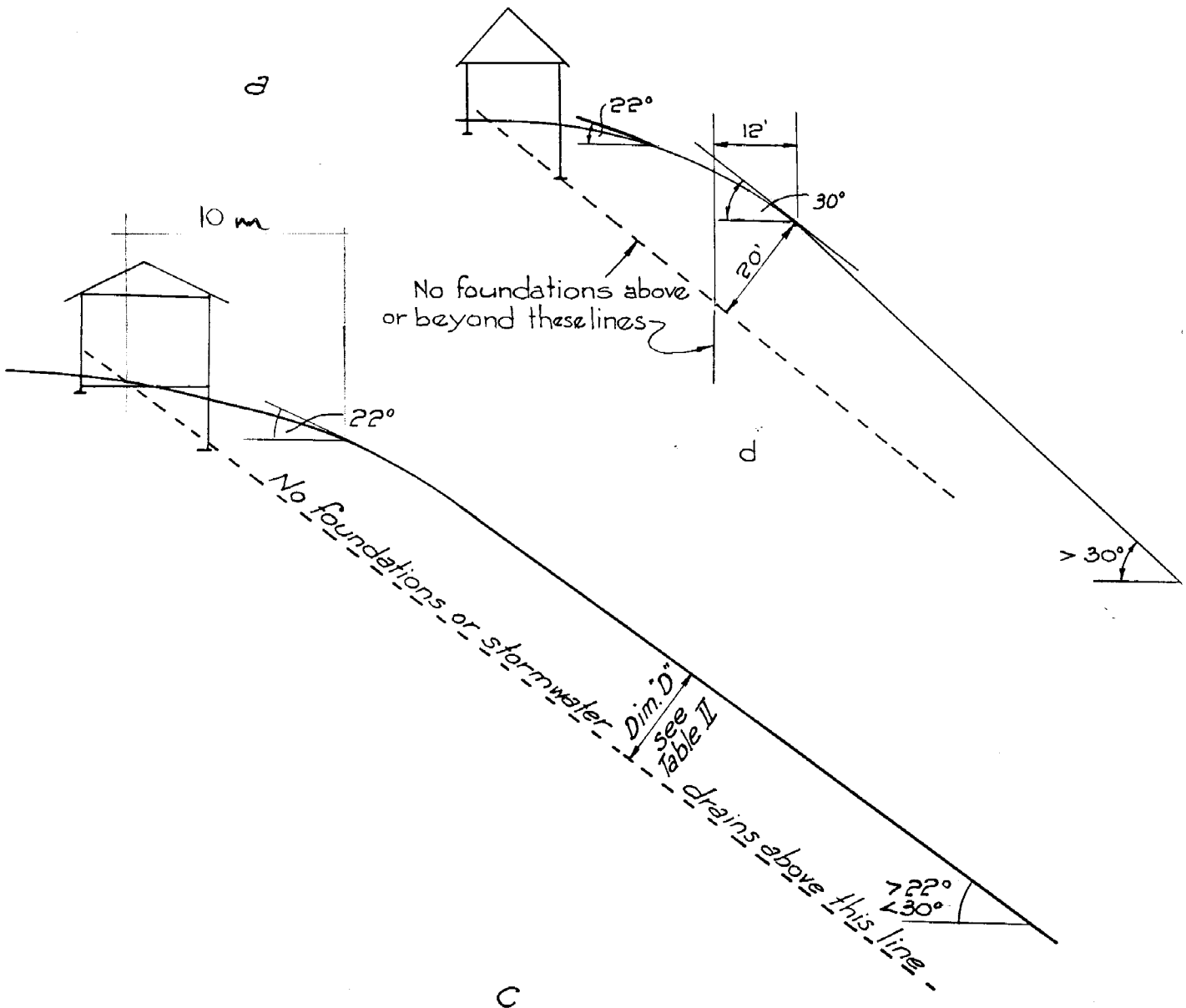
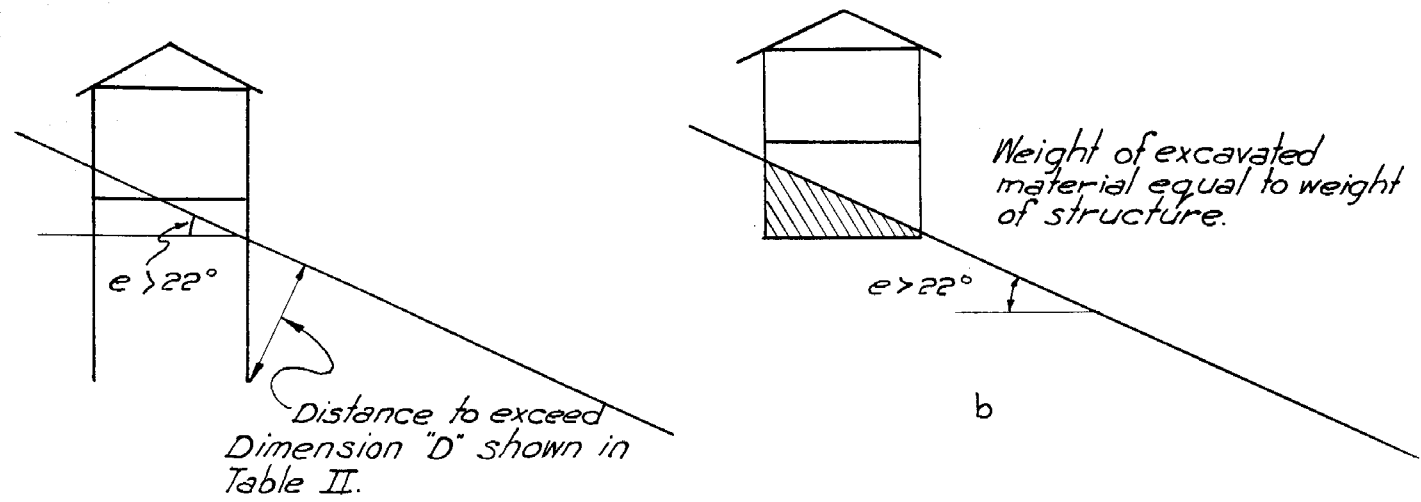
5c Pedestrian steps must be excavated into and running directly down the line of the slope.

6. Function of Conditions

6a The conditions referred to in paragraphs 1 to 5 hereof may be such as to:-

- (i) restrict the form or nature of the building or structure;
- (ii) limit the size and/or shape of the building or structure;
- (iii) prescribe the form of foundations for the building or structure;
- (iv) prescribe or restrict the materials of which the building or structure is to be constructed;
- (v) determine the siting of any building or structure and of any soakpits or other drainage works;
- (vi) prohibit or control any excavations on the site, the construction of any roadways, paths and other garden features;
- (vii) control any other aspects which the City Engineer considers to be desirable.

6b Notwithstanding anything contained in this sub-clause the Council shall not be liable for any loss or damage which may occur to any building, structure or any property, whether within the controlled area or otherwise, arising out of any action by the Council or the City Engineer in terms of this sub-clause.



PROPOSED BUILDING REGULATIONS
FOR BLUFF SLOPES
FIG. NO. 2

TOWN PLANNING SCHEME REGULATIONS

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(3) The Council may in relation to the erection, alteration or extension of any building or use of land, impose such conditions as are in its opinion necessary having regard to the low-lying nature of the area.

REPORT TO
THE CITY ENGINEER, DURBAN

ON

AN INVESTIGATION INTO THE STABILITY

OF THE SEAWARD SLOPES OF THE DURBAN BLUFF

Kentey, von Geusau & Partners
Consulting Civil Engineers & Geologists
Atkinson House
Cape Town

REPORT ON AN INVESTIGATION INTO THE STABILITY OF THE BLUFF SLOPES, DURBAN

1. Terms of Reference:

In terms of letter ref. 34/2 & 3/1/39 dated 1 July 1957, it was requested that an investigation of the Durban Bluff seaward slopes be undertaken in order to determine those areas in which new buildings should perhaps be prohibited altogether, and those where special precautions should be taken. It was later requested verbally that special attention should be devoted to the problem of the three houses affected by the recent slip at Netford Road. Specific attention was drawn to the possible legal implications of total prohibition of buildings as this might involve the Council in expropriation costs of the plots on which buildings would be prohibited.

2. Information Supplied:

In order to assist in the investigation, various large scale contour plans, prepared from aerial surveys, aerial photographs, photographs of the slide at Netford Road and rainfall data requested by ourselves, was supplied. Appropriate extracts from this data supplied are referred to in the text of this report.

3. Field Investigations:

Figure 1 attached is a site plan of the extent of the Bluff investigated. Various hand auger holes were put down at the positions shown, in order to obtain information on the variation in soil profile along and across the Bluff. These borings were put down to depths limited by the efficacy of the equipment used; however, it was considered that, in view of the slides that had occurred and the geology of the Bluff, the depths achieved were sufficient for the purposes of this report. Various disturbed samples were extracted from these borings and submitted to our laboratories for testing.

At Netford Road, Test pits were put down to limited depth and undisturbed samples extracted from these test pits, and submitted to our laboratories for testing.

In addition, detailed visual examination of the Bluff was carried out in order to determine the nature of the various slides that have occurred and to form some opinion on the type and cause of those slides.

4. Laboratory Investigations:

Grading analyses of the various undisturbed samples submitted to our laboratories was carried out in order to determine the variability of material encountered in the borings. The results of these tests are given on Figure 4 attached.

Permeability tests were carried out on selected materials from the samples submitted to our laboratories and the results of these are given on Table 1 attached.

Triaxial Shear Tests were carried out on the undisturbed samples submitted to our laboratories and the results of these tests are given on Figure 5 attached.

5. Geology of the Durban Bluff:

The bluff consists of sand, partially cemented into Bluff sandstone, underlain by Cretaceous and Karroo sediments.

The sand is of Pleistocene age and is known to be contemporaneous with red Berea sands, and with similar formations along the east coast, e.g. at the mouth of the Umtamvuna River and at Lourenco Margues. The presence of cross-bedding in some horizons and horizontal laminations in others indicate that the sand is partly wind-blown in origin and partly lagoon sediment. Below sea level, and in some parts up to as much as 20 feet above M.S.L., the sand has become cemented into hard sandstone by the precipitation of calcium carbonate and other salts from brak waters.

6. Interpretation of Soil Profiles:

Soil Profiles obtained from the Hand-auger borings are recorded in Figure 2 attached, and a descriptive stratigraphical legend is given on Figure 3.

Stratum A is the leached topsoil which occurs at the surface through-out the length of the Bluff. Stratum B, light reddish brown sand, is an oxidised material which occurs at higher levels; Stratum B' is similar to B, occurs at the same stratigraphical horizon, but is distinguished by a higher percentage of fine material. Stratum C is the unoxidised yellow sand occurring at lower levels and grading into Stratum D, the cemented sand or Bluff sandstone. The general soil profile is therefore, leached grey topsoil; reddish oxidised sand; yellow oxidised sand; Bluff Sandstone.

Examination of the various soil profiles shows that the leached topsoil layer is present in all cases, but that the underlying sands do not always show an oxidised layer. It seems probable that the zone of oxidisation is a function of height as it will be noted that this zone is absent only above R.L. 220 and below R.L. 120. As shown later in this report, the degree of oxidation of the sands does not affect the main stability problem and it is therefore considered that, for practical purposes, the profile may be assumed as consisting of topsoil, sands and sandstone.

The underlying sandstones are found at variable depths ranging from only 2 feet below ground level in BH 6 to greater than 42 feet in BH 7. No discernable pattern can be traced governing its depth or occurrence and consequently, its high strength must be ignored and the problem considered as one of the stability of the upper sands only. Within these limitations, and for practical purposes, therefore, the Bluff may be considered as uniform both along and across its slope. Any variation from the above assumption will then only improve the factor of safety.

7. Interpretation of Laboratory Investigations:

- a) Grading Analysis: Figure 4 attached shows the results of grading analyses on samples extracted from the various borings. These results are shown in the form of an envelope as the gradings were found to be extremely uniform. The variation in grading between A, B and C strata are scarcely noticeable, except in the finer fraction of the materials and typical examples of the various strata are given. Even in the finer fraction, the variation is almost within the range of practical error for the type of test and consequently, all the sandy materials may be considered, for practical purposes, as being reasonably uniform in grading.
- b) Permeability Tests: It was not found possible to extract suitable undisturbed samples for permeability tests in sands of the type forming the Bluff. The method therefore adopted was to compact disturbed samples of the three basic sand strata, A, B and C to Proctor density, measure its permeability at this density, and, using Slichter's tables, adjust the permeability to the actual measured field density. Using this method, the permeabilities of Table 1 were found and it can be seen that the permeability increases with descending strata. While it is not considered that these interpolated permeabilities are extremely accurate, it is considered that the field permeabilities will be higher and consequently that any calculations based on the given figures will be on the safe side. The main object however, was to ascertain the order of variation in permeability of the different strata encountered.

