**Construction 1**

**27th February 2012**

**Introduction**

We may be better be able to **determine and describe construction methods for small buildings – which is a key component of what Construction 1 is about by introducing us again as to how to determine, describe and design foundations and structures from site geotechnical information for small buildings.**

Following on from last week’s lecture about forces this lecture is about the capabilities of building sites and how to determine their likely foundations. It requires a sense of weight.

**Definitions**

Firstly, we have to define the contexts of the following words used in the introduction.

1. Describe = means set forth in words, drawings, or notes
2. Determine = means settle, decide, come to a conclusion, be the decisive factor
3. Design = means mental plan, sketch, picture, and arrangements of linear drawings or adaptions of means to ends, or contrivances

That is, we want to describe the various ground conditions making up building sites and specifically what can various NZ materials in the ground support?

We then want to make a determination of the most likely forms of foundations to go over the various ground conditions – particularly, say, a Clay site’s ability to support Weight. Then, in later lectures we can design from NZS 3604’s charts the various suitable foundations and supporting structures with confidence.

**Describe the site**

**Bearing pressure - What is a kPa? – solve this and the many and varied world’s of building design and building construction open up.**

We looked at what if Rodney weighed 90 Kg and we compared this weight with the abilities of various site materials to support this weight.

1. Chrystalline Bedrock supports up to 56,400 Kg/M2
2. Exfoliated Rock 18,800 Kg/M2
3. Sandy Gravel 14,100 Kg /M2
4. Sand, Silt, Gravel, Clayey Sand, Silty Gravel, and Glayey Gravel 9,400 Kg/M2
5. Clay, sandy clay, silty clay, clayey silt, silt and sandy silt 7,050 Kg/M2

**Describe Force on Rodney,**

Rodneys weight is 90 Kg. What if he stands on Clay? What is the ability of the Clay to support Rod?

We note that;

Force = Mass x Acceleration.

Or in our building design and construction case;

Weight = Mass x Acceleration

We find that Mass refers to the Weight of Rodney in that a weighing machine being a spring stretched out to provide a sense of the substance of his body can be considered an electric Force at surface of the earth.

And that Acceleration, looking at Rodney’s fall after say 5 seconds – which would be described as accelerating in that the Seconds are being squared - would be the same for all bodies, including building foundations. In fact all bodies want to fall at the same increasing rate no matter where they are on the earth’s surface and especially, **no matter what their Mass is.**

But we want to know what Force or Weight is carried by Rodney and will there be sudden and rapid deformation of the clay into which Rodney will be displaced.

So, Rodney’s Weight of 90 Kg and in theory especially if Rodney was to begin falling towards the centre of earth, would then be falling at 9.8 Meters/Second 2.

**And**, (this is the crux of the matter), by multiplying any bodies Mass with this unique rate of fall of 9.8 Meters/Second 2 ,we get a sense of the Force on that body – or what we call Weight – which we can then compare with other bodies at rest.

That is, we want to measure Rodney’s body Weight at the exact moment before he starts to fall and his Seconds of fall are still just at zero. That is, he is at rest standing upon a Clay surface. Then we can begin to get a sense of the Forces or Weights which can be withstood by Clay.

We can describe Rodney’s Force or Weight as a Newton and give it the letter N.

In fact 1 N = 1Kg x 1 Metre/Second = 1 Kg Metre/Second 2

**That is;**

Force = Weight = 1 Rodney x 9.8 Metres/Second 2

= 90 Kg x 9.8 Metres/Second 2

= 882 Kg Metres/Second 2

= 882 N

So Rodney can be said to be at the time of his Weighing in – only just at rest - as having a Force of 882 Newtons.

But we need to relate these Newtons of Force describing Rodney’s Weight to a specific area, after all, we have noted up the top under **Describe the Site** that Clay, or sandy clay, or silty clay, or clayey silt, or silt and sandy silt can support 7,050 Kg/Meter squared.

This is where be bring in the Pascal. That is, 1 Pascal is the equivalent of 1 Newton over an area of 1M2. This means Rodney has a Force of 882 Pascals when he tries to stand on say an imaginary plate 1x Metre by 1x Metre on the Clay.

That is;

882 Newtons = 882 Pascals over 1M2

Also, we can rewrite 882 Pascals as being 0.882 kilo Pascals or 0.882 kPa, having multiplied by 1000 and moving the decimal by 3x places.

This is convenient for us as we will rapidly find out over other consequential work - that Pascal’s are often called on to describe “pressure” relating Force or Weight to an area – thus making it increasingly useful for us to compare building construction foundations types with each other because we shall be dealing with Forces or Weights as requiring support over various plan areas a lot of the time.

So, in order to compare Clay, sandy clay, silty clay, clayey silt, silt and sandy silt being 7,050 Kg/M2 at the moment it too is considered as a Force or Weight in order to counteract Rodney’s Force or Weight – then Clay should itself be multiplied by 9.8 Metres/Second 2.

**That is,**

Force = Weight = Clay 7050 Kg/M2 x 9.8 Metres/Second 2

= 69,090 Newtons

= 69,090 Pascals (1Pa is 1Newton over 1M2)

= 69.090 kPa.

In now making a comparison between Rodney’s Weight and Clay’s supporting ability, we firstly assemble layers of 10x lots of Rodneys per layer over a 1 M~~2~~ square plate and that each layer would have a combined Rodney pressure of 0.882 kPa x 10 or 8.820 kPa pressure per layer on the surface of the Clay.

Secondly, we know we can support a Force or Weight of 69.090 kPa over the clay or in other words 69.090 kPa/8.820 kPa = 7.83 layers of Rodneys.

That is we can support a total of 7.83 layers of Rodneys without deforming the surface of the Clay and in doing this calculation, one of the most difficult in the Construction 1 course, we now have the abilities to compare weighted objects with ground geotechnical conditions and avoid over or under founding of structures.

Please refer to the Geotechnical Reports on a site showing kPA’s .

It may be that we end up putting our houses and light weight structures on rafts or strips of 1M2 pads just to carry the weights of heavy portions of buildings such as load bearing walls..

**Illustrations**

* Geotechnical Test Results – examined on screen.
* Look at Loadings per M2 of Site Material
* Look at Loads per M2 of Types of Materials
* Look at photos of site excavations, getting to the clay or engineered fill level (free of organic material), depth of retaining structures, walls, gravity structures.
* The road.

**Assignment for this week**

None issued

**Next Week**

We will develop the next Construction 1 lectures around the following;

1. Determine the Substructure Describe the Substructure – Concrete/Pile/Steel
2. Determine the Foundations Describe the Foundations – Concrete/Pile/Steel

Following with we shall address;

* Design and Describe the Structure of a small building of non-specific design;
* Determine and describe the structure of a small building of specific design;
* Determine and describe the envelope of a small building;
* And determine and describe the methods used to construct the interior of a small building

Rodney Harvey