

KUSALA CARPETS FACTORY BUILDING REPORT

- submitted by Pauline Merlet -



June 2016



kusala
carpets

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INTRODUCTION



HOW DID IT BEGIN? - *The story of Kusala Carpets*



On January 2016, Sofie and Carla were organizing the second blanket project in Sindhupalchowk when they met Alisha and she decided to join.

When they arrived in Selang, a camp of people from Golche and Gumba, they were shocked because of the conditions these people were living in, it was the worst they had ever seen and the option of going back home to their village is not possible.

The blankets were a great help for the winter but by far not enough to start up the lives of the people again.

In a next visit they found out this people were skilled in making carpets and that they really wanted to work. So back in Kathmandu Alisha, Carla, Sophie and Sofie made the decision to make a carpet factory together with the community in the camp so they could work again and to create a new economy in the whole village.

THE SITE - *Selang Camp, Sindhupalchowk, Nepal*



The site for the Carpets Factory building is situated in the middle of Selang camp, in Sindhupalchowk district, Nepal. The camp is around 4 hours bus from the nearest city Chautara, and about 2000m altitude.

The chosen site is ideal - it's a flat land (one of the only ones in the area), and located in between two different communities who doesn't get along inside the camp.

This social project of a carpet factory aims to provide jobs to these displaced people, but has also the ambition to gather those two communities together inside this camp/village.

GEOLOGICAL SURVEY -

Engineering Geological Site Investigation for Kusala Carpet, Selan, Sindhupalchwok Central Nepal.



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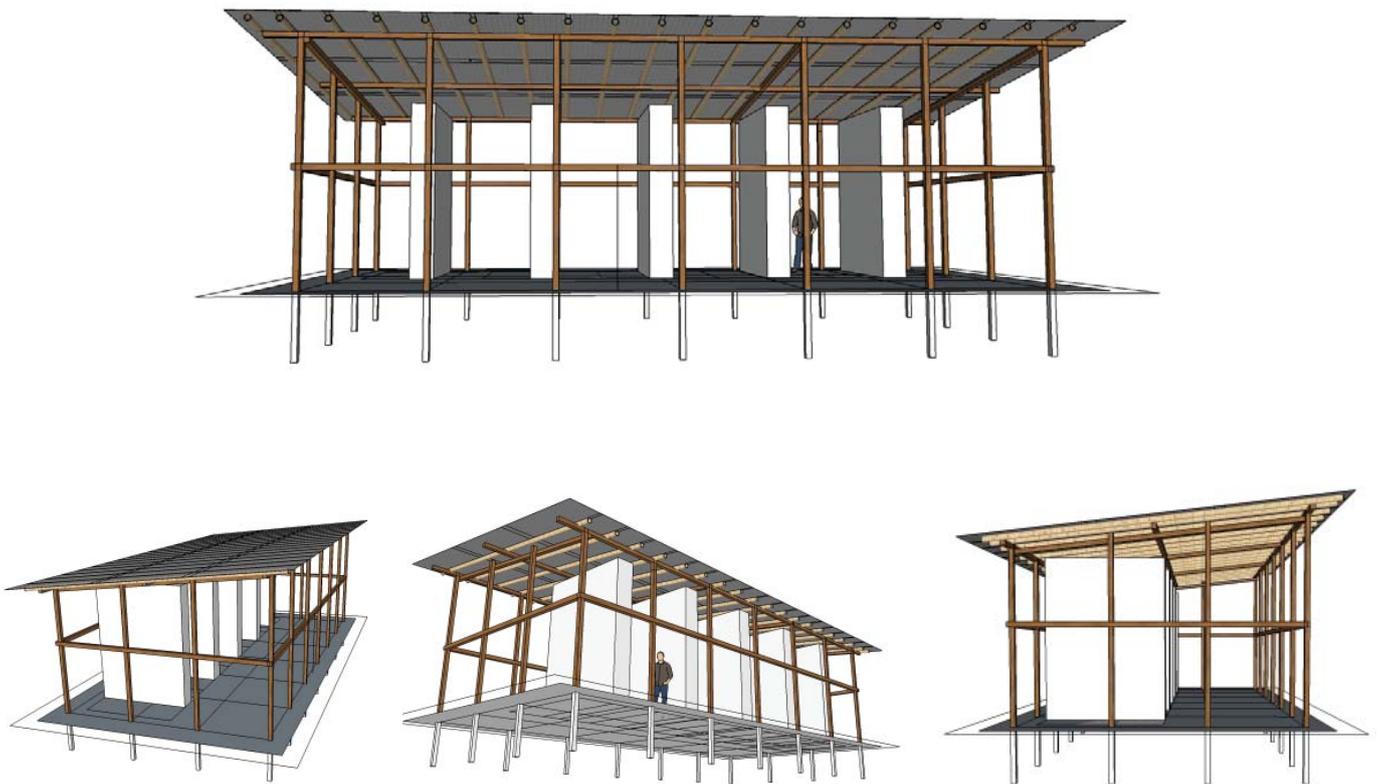
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(See the report in Annex)

DESIGN PROCESS -



The building was designed according to the sizes of the future looms. We calculated it with the size of the biggest/highest loom, as we didn't know at that stage which size we would be able to find/buy.

This design evolved during the building process, for example we added two columns in the middle of the building for the structure to be safer, and the roof materials evolved with more small section timber.

SOURCING MATERIALS

The next step in the project is to source the materials needed for the construction.

This step took place before and during the building process. It's always needed to seek for building materials gradually as the construction is going on.

Tools and construction materials that we were not able to find in Sindhupalchowk, we brought them from Kathmandu. Some tools and materials were found in Chautara, but not everything could be found there, as for the lime that we had to order from Kathmandu with a truck.

Transportation problems also occurred during this phase, it wasn't easy to find a truck to transport our materials and because the monsoon had started, the road conditions were really bad and no bus could come.

As much as we could, we sourced the main building materials as locally as possible such as wood, bamboo and straw.

SOURCING MATERIALS - *The wood*



The wood is coming from the forest nearby the camp. People from the community, having wood skills, were hired to cut the trees, to load and unload them to the worksite and then to prepare them for the building : chopping and cutting at the appropriate sizes required by the design.

The trees selected in the forest were the ones already half-broken or broken by the wind, the ones disturbing the well growth of other trees and some of them were already cut by the government for electricity wires.

SOURCING MATERIALS - *The straw*



The straw, needed for the good insulation of the building was a struggle to find.

As last year the earthquake happened right before season of rice planting, and because of the aftershocks and landslides, they couldn't plant rice that much that year.

So there was a lack of straw and at the time of the construction we were still off season of rice plantation - still one more month before planting rice.

It resulted as a quest to find straw, going in each household of the area to find someone willing to sell us their straw.

SOURCING MATERIALS - *The bamboo*



The bamboo is coming from Selang, the closest town. One of the villagers has bamboo in his land so he sold us some of his bamboos.

Same as the wood, people from the camp were hired to cut the bamboos and load and unload them from the truck.

THE BUILDING PROCESS



The construction of the Carpet factory in Selang Camp took us around 6 weeks to build. The construction was lead by Alisha, Karla, Ahmed (engineer and COB specialist) and Pauline (architect).

Workers on the building site are mostly people from the community of Selang Camp, along with some international volunteers.

Here we will be explaining the differents steps of the building process. These steps are presented in order of construction, even though most of the steps are done simeountanously with others.

This is mainly to be able to have a lot of people working at the same time, but also for pratical reasons.

STEP 1 - Location, Orientation and Mapping



The aim of the first step of the construction is to find the best location for the building within the given site. This implies to look at the surroundings, and the ideal orientation for the building.

The main facade is facing South, in order to be able to catch the sun and the warmth inside the building in winter.

The building footprints are then mapped on the site according to the design and chosen orientation.

STEP 2 - Digging trenches and foundations holes



When everything is mapped with string and stakes, the workers are able to start the construction work by first digging the trenches for the drain as well as the deep holes for the main posts.

STEP 3 - *The water drain*



The system used for the water evacuation is called «french drain».

The trench is first filled up with rocks (as rocks were hard to find around the site, another challenge was digging for rocks and break them into smaller pieces).

Once the trench is filled with a first layer of rocks, the pipe can be placed on top, after having drilled holes on that pipe.

Then the pipe is covered with rocks again, and a thin layer of gravels is added to finish.

This trench is all around the building, and when it's raining the water from the roof is falling directly in this drain.

STEP 4 - Foundations : posts



Once the holes are dug, they need to be filled with a layer of rocks. Then the post is put in by making sure that it is straight, and it's held with bamboos. More rocks are added around the post, as well as a layer of gravels, and finally concrete is displayed around the post to make it very strong.

STEP 4 - Foundations : walls footings



The walls footings are made with a mixture of soil and concrete. Wooden boxes are made at the appropriate size, to work as a matrix for filling with the mixture at the width of the future walls.

Once it's done, we connect all these footings with the same mixture, to have continuous footings on the whole building.

STEP 5 - *Wooden Structure*



The main structure of the building is made of timber. Once the wood has been cut at the required dimensions, the posts are the first being put in. Then, little by little, the whole structure is taking shape with hand-cut wooden connections, using nails instead of bolts for a better earthquake resistance.

STEP 6 - Roofing



The roof rafters are made of bamboos and timber. Half-cut bamboos, lighters, only supports the CGI sheets while they are nailed to the timber. Three transparent CGI sheets have been added to provide more light inside the factory.

STEP 7 - Walls : Bamboo



Once the wooden structure is up, the next step is to put bamboos on both sides of the timber posts. The bamboos are first cutten and splitted, and then attached to the wooden posts.

STEP 8 - Walls : Straw



Once the bamboos are in place, the space in between them is filled up with straw. The straw is first soaked into water containing a lot of turmeric. The turmeric is anti-termites and prevents the walls of being eaten by termites. After being soaked, the straw is directly put inside the walls as compact as possible for a high insulation of the building. The other advantage is the light weight of the walls with this technique.

STEP 9 - Walls : COB



The next step is the COB. Cob is a mix of earth, sand, straw and water. As the soil on the building site was containing enough sand, we were using only earth straw and water to build our cob balls.

Mixing with feet was a lot of fun; and dancing in the mud was happening on the worksite! After mixing the soil with water, straw was added and then mixed again and straw was added again until the consistence was strong enough. From there, cob balls were made and then applied to the walls, from the bottom to the top.

STEP 10 - Windows and Bottle Walls



The walls containing the glass bottles were made in a different way. Only cob was used. This required more cob and also to build 30cm only per day, letting it dry before going more high the next day.

The design was made by the workers of the community, like this they could express their creativity and put a part of themselves in the building.

On the bottom of one of the windows, you can read «Nepal» by the shape of the glass bottles.

The Kusala logo is also made by glass bottle design on the front part of the building.

STEP 11 - Walls : Second Layer



The second layer of cob on the walls is containing lime; to help for the waterproofing of the walls.

STEP 13 - Floor



The floor was made by stones aligned in nepali way and recovered by concrete to make a very stable floor to support the weight of the heavy machines.

HIGHLIGHTS OF THE CONSTRUCTION

WORKSHOPS



Workshops were held once or twice a week by Ahmed. He would explain to the community about design, natural building, and especially Cob buildings. The community was participating by creating their own drawings or debating about the best location for building a house. Short educational movies regarding those subjects would be shown as well during these workshop times.

MOVIE NIGHTS



Movie nights would also happen every week, and especially kid movies. As the children inside this camp don't have any access to TV, they are overjoyed each time a movie is displayed on the white sheet.

Now that the building of the factory is done, the movie projections are taking place inside the factory.

It's the one source of entertainment inside the camp that makes everyone happy!

«COMMUNITY WORK DAY»



As we wanted the whole community to be involved and part of this project, we organized a «Community Work Day» on Friday 20th of May. Everyone was welcome on site to work all together and donate their labour for one day.

It was a great day, full of positive energy and everyone working alongside each other. It was also pretty productive, with the help of almost 40 people working during the day!

CELEBRATION



On the following day, on Saturday 21st, we did a celebration with everyone involved.

That day happened to be Buddha's birthday, so we also had a small buddhist ceremony. All the community was there and they even worked again in the morning!

This was also a way to say goodbye to some members of the project who were leaving on the following days.

SOME NUMBERS...

HOW MANY PEOPLE INVOLVED DURING THE BUILDING ?

The total number of local people from the community who worked for the construction of the building is 53.

Some of them worked only for 2 days, some of them the whole time.. Some of them for wood working, some chopping bamboo or building a fence...

The total money spent on workers wages is **284 400 Rps.**

9 international volunteers also worked alongside the community (Australian, American, Spanish, French, Swiss, Nepali ...)

53 local people and **9** volunteers worked together for the construction of the carpet factory.

BUILDING COSTS

Materials > **347 675** NPR

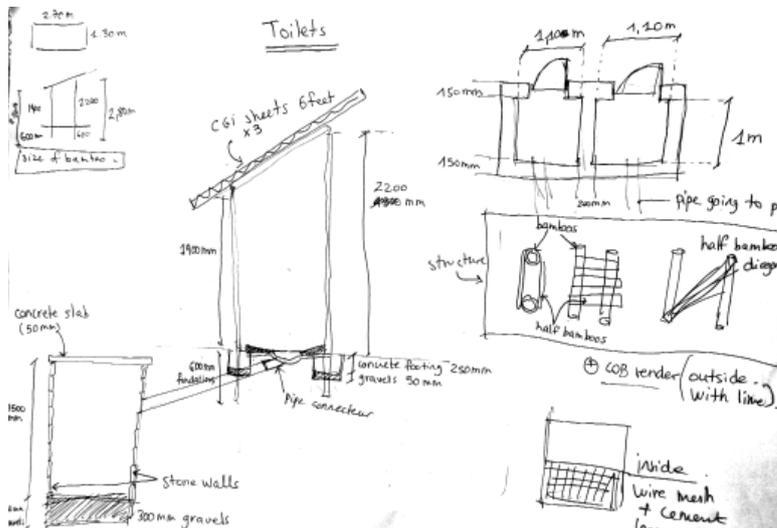
Workers wages > **284 400** NPR

Truck delivery > **130 500** NPR

Transportation > **10 830** NPR

AND WHAT'S NEXT ?

BUILDING TOILETS



toilets are under construction now, even if the building process is slowed down by the monsoon conditions. The materials are very difficult to transport and it's raining everyday, which makes labour work more difficult and sometimes impossible under the rain.

PROVIDE THE LOOMS



These are the looms we might buy for the project. They are made of wood and iron. There is 5 looms in total : 3 looms of 9x11 feet and 2 looms of 10x14 feet. The price of per looms is 44 000 NPR. The loom comes with full set containing adjustable bench, tools like scissors, especial carpet gloves, and all the big and small tools needed to make a carpet.

We hope being able to buy and bring these looms as soon as possible in Selang camp.

ANNEX

Engineering Geological Site Investigation for Kusala Carpet, Selan, Sindhupalchwok Central Nepal.



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1. INTRODUCTION

Geology play vital role for slope stability and natural hazards and is the major factor controlling the type of slope movement. Lithological and structural variations also determines the slope and slope stability of the hills in the area. Besides, lithology is also equally important to determine the hazard vulnerability of landslides, soil creep and floods. Vegetation and vegetation density is also equally reliant on the lithological condition of any area. Rock and soil investigation were done in the field in and around the Kusala Carpet factory. Geological map prepared by Department of Mines and Geology which was prepared in a 1:250,000 scales were used in the field. Geological map gives the information on lithology, geological structures, status of joints and fractures in the area. Google earth images were studies for slope stability problem in the regional scale.

Soils are classified into three major groups, coarse grained, fine grained and highly organic. The classification was based on Universal soil Classification (Table 2). In addition to these classifications, a soil was described by its color, particle angularity and consistency. Moreover, bearing capacity was calculated based on visual inspection for lightly loaded and small sized structures (two storied or less) where the presumptive bearing values (allowable) as given in table 1 assumed for uniform soil in the absence of test results. Similarly, Nepal Building code 205 was also taken in consideration (Table 3).

Table 1: Presumptive values of Bearing Capacity for Lightly Loaded Structures*

SN	Soil Description	Safe Bearing Capacity, KPa
1	Soft rock or shale	440
2	Gravel, sandy gravel, silty sandy gravel; very dense and offer high resistance to penetration during excavation (soil shall include the group GW, GP, GM, GC)	400**
3	Sand (other than fine sand), gravelly sand, silty sand; dry (soil shall include the group SW, SP, SM, SC)	200**
4	Fine sand; loose and dry (soil shall include the groups SW,SP)	100**
5	Silt, clayey silt, clayey sand; dry lumps which can be easily crushed by finger (soil shall include the groups ML, SC and MH)	150
6	Clay, sandy clay; can be indented with modest thumb pressure (soil shall include the groups CL and CH)	150
7	Sift clay; can be indented with modest thumb pressure (soil shall include the groups CL and CH)	100
8	Very soft clay; can be penetrated several centimeters with thumb pressure (soil shall include the groups CL and CH)	50
9	Organic clay and peat (soil shall include the groups OH, OL, PT)	To be determined after investigation
10	Fills	To be determined after investigation

*Two stories or less

** 50% of these values shall be used where water table is above the base or below it within a distance equal to the least dimension of foundation.

Table 2: Universal Soil Classification.

CALIFORNIA DEPARTMENT OF TRANSPORTATION (CALTRANS)

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART		LABORATORY CLASSIFICATION CRITERIA	
COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)		
	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3
	GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines	
	Gravels with fines (More than 12% fines)		
	GM	Silty gravels, gravel-sand-silt mixtures	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
	GC	Clayey gravels, gravel-sand-clay mixtures	
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)		
	SW	Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3
	SP	Poorly graded sands, gravelly sands, little or no fines	
	Sands with fines (More than 12% fines)		
	SM	Silty sands, sand-silt mixtures	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
	SC	Clayey sands, sand-clay mixtures	
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
SILTS AND CLAYS Liquid limit less than 50%	ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 percent GW, GP, SW, SP More than 12 percent GM, GC, SM, SC 5 to 12 percent Borderline cases requiring dual symbols
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
	OL	Organic silts and organic silty clays of low plasticity	
SILTS AND CLAYS Liquid limit 50% or greater	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
	CH	Inorganic clays of high plasticity, fat clays	
	OH	Organic clays of medium to high plasticity, organic silts	
PT	Peat and other highly organic soils		

PLASTICITY CHART	
	A LINE: $PI = 0.73(LL-20)$

Table 3: Foundation soil classification and safe bearing capacity

SN	Types of Foundation Material	Foundation classification	Presumed safe bearing capacity kPa
1	Rocks in different state of weathering, boulder bed, Gravel, sandy gravel and sand gravel mixture, dense or loose coarse to medium sand offering high resistance to penetration when excavated by tools, stiff to medium clay which is readily indented with a thumb nail.	Hard	≥ 200
2	Fine sand and silt (dry lumps easily pulverized by the finger), moist clay and sand-clay mixture which can be indented with strong thumb pressure	Medium	≥ 150 and < 200
3	Fine sand, loose and dry; soft clay indented with moderate thumb pressure	Soft	≥ 100 and < 150
4	Very soft clay which can be penetrated several centimeters with the thumb, wet clays	Weak	≥ 50 and < 100

2. OBJECTIVES

The main objectives of the engineering geological site investigation are as;

- Propose and suggest appropriate site for the foundation.
- Investigation of geology of the site area.
- Investigation of engineering geological parameters of the site area.

3. METHODOLOGY

The methodology adopted to achieve the objectives consists of two phases.

3.1. Desk Study

Under this stage, the consultant primarily collected the secondary information relevant to the study, which primarily included the topographic map of the study area, existing relevant photographs. The experts involved for this study critically reviewed the collected materials. During the desk study, the consultant collected all physical data, photographs, geological and geographical information of the project area and others.

3.2. Field Study

The main objective of the field study is to verify the data collected during the desk study stage, seek additional data, and collect on-the-spot data and information relevant to the objective of the

study. After the completion of the fieldwork by the Consultant started the post field works based upon the results of field data.

4. LOCATION AND ACCESSIBILITY

The proposed project area for the geo-technical investigation of Kusala Carpet lies in the Sindhupalchwok district of Bagmati Zone of Central development region of Nepal (Figure 1 and Figure 2). This area is assessable through the Kathmandu- Chautara Road up to Selan. It is 9 km far towards north from the Sindhupalchwok district headquarter (Chautara). The location of the site is $27^{\circ}50'20.17''$ N and $85^{\circ}42'59.56''$ E and the elevation of about 2070 m.

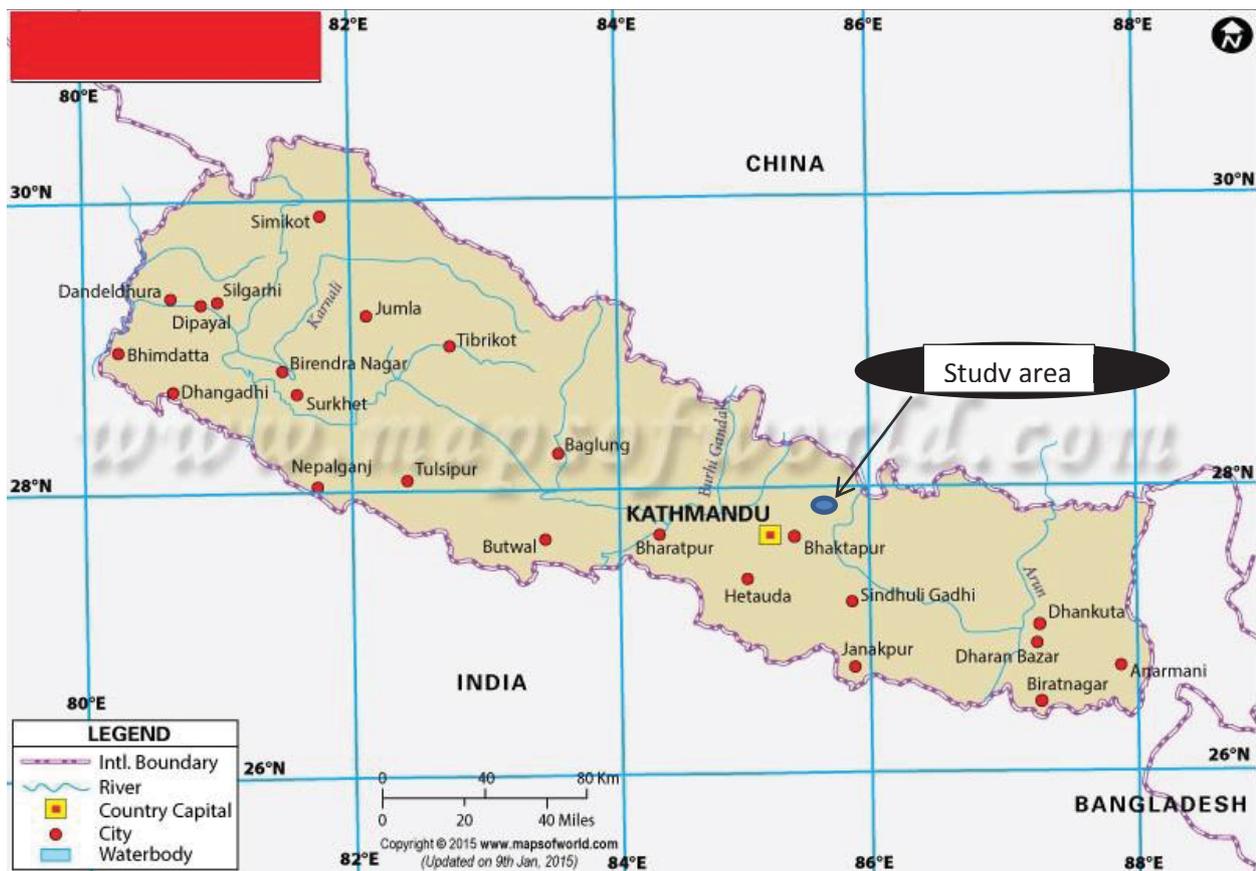


Figure 1: Location map of the study area.

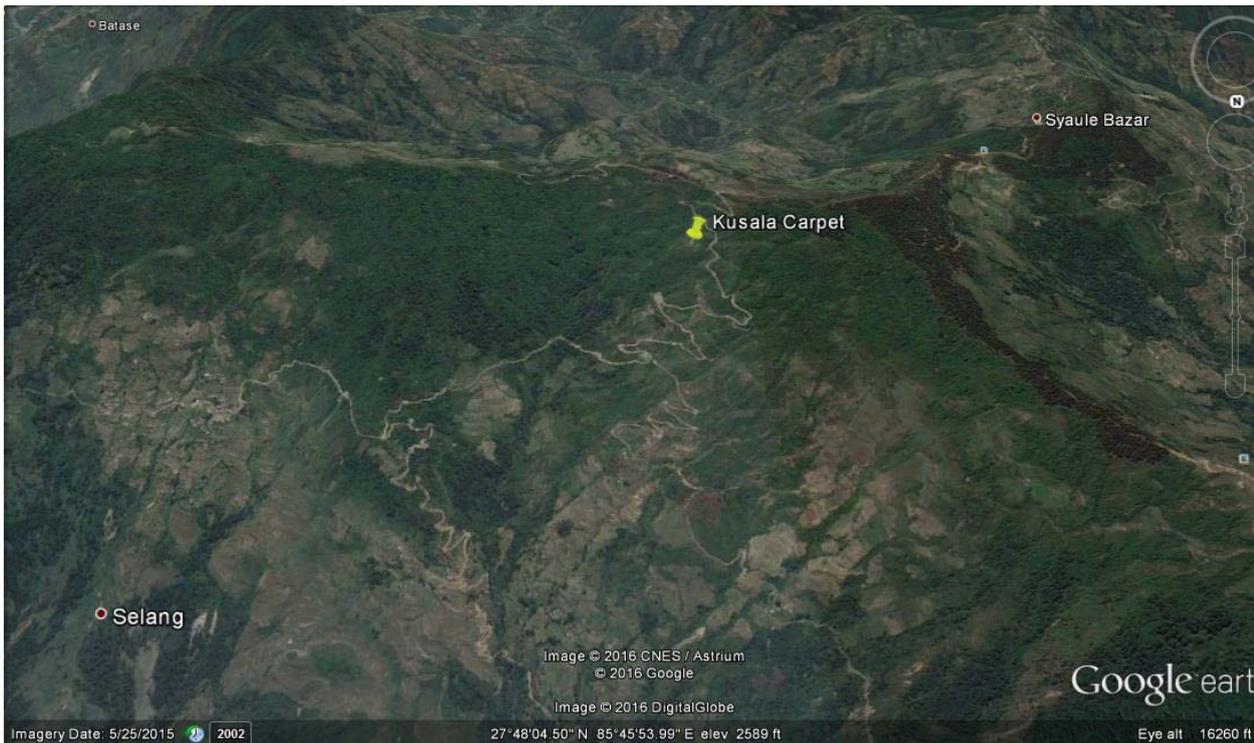


Figure 2: Location map of Kusala Carpet (Google map, 2015).

5. GEOLOGY OF THE AREA

The study area lies within the Himal Group of Pre-Cambrian age (Figure 3). The lithology is comprised of augen gneiss, mica schist and meta-quartzite (Figure 4,5 &6). The study area lies within the mica schist and meta-quartzite. The basement of the main foundation lies in the highly weathered schist with organic soil. The orientation of the foliation is $42^{\circ}/260^{\circ}$ (Dip amount/Dip Universal Soil Classification Direction). The exposed rock is highly weathered with persistent foliation joints.

6. ENGINEERING GEOLOGY INVESTIGATION

The study was carried out a walk-through survey of the site and its surrounding areas.

The area is geologically stable and no change of large scale natural disaster. There is gentle slope on the site of the building and the rock dips opposite of the slope indicating stable slope however small scale slope failure might occur at the eastern boundary of the site area.

The Soil is composed of thick (more than 5m) residual soils of poorly graded sands, silt and clay sand. On the northern side of the site thick layers of residual soil formed by the disintegration of schist and some augen gneiss while rock is exposed on the southern part of the site (Figure 7).

Grain size of soil was found as,

S.N.	Sand	Silt	Clay
1.	70%	19%	11%
2.	83%	10%	7%
3.	73%	17%	10%
Average	75.33%	15.33%	9.33%

Thus, soil type is clay-silty sand which includes SM (silty sands, silt-sand mixture) dominantly with ML (Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity), MH (Inorganic silts, micaceous fine sandy or silty soils, elastic silts) in low proportions. As well as about 10-20 cm layer of outer shell of soil is rich in organic silts and organic clay. The south-east part of the site has rock with high strength of bearing capacity (> 400 kPa).

The bearing capacity of soil is 150 kPa of table 2 and belongs to medium according to Nepal Building code 205 based on soil type and visual estimation.

7. CONCLUSION

The comprehensive study was carried out for the Kusala Carpet in Sindhupalchwok district. All the necessary information gathered from the field is listed below.

- The geology of the study area is characterized by the presence of augen gneiss, mica schists and meta-quartzite.
- The main part of the site is covered by the thick (>5 m) residual soil formed by the decomposition of the mica schist and gneiss.
- The relation of rock orientation and the hill slope shows stability of slope.
- The site comprises by the clayey silty sand (sand =75%, silt =15% & clay = 10%).
- The bearing capacity of soil is 150 kPa of table 2 and belongs to medium according to Nepal Building code 205 based on soil type and visual estimation.

8. REFERENCE

Dhital, M.R., 2015, Geology of the Nepal Himalaya, Regional Perspective of the Classic Collided Orogen, Springer.

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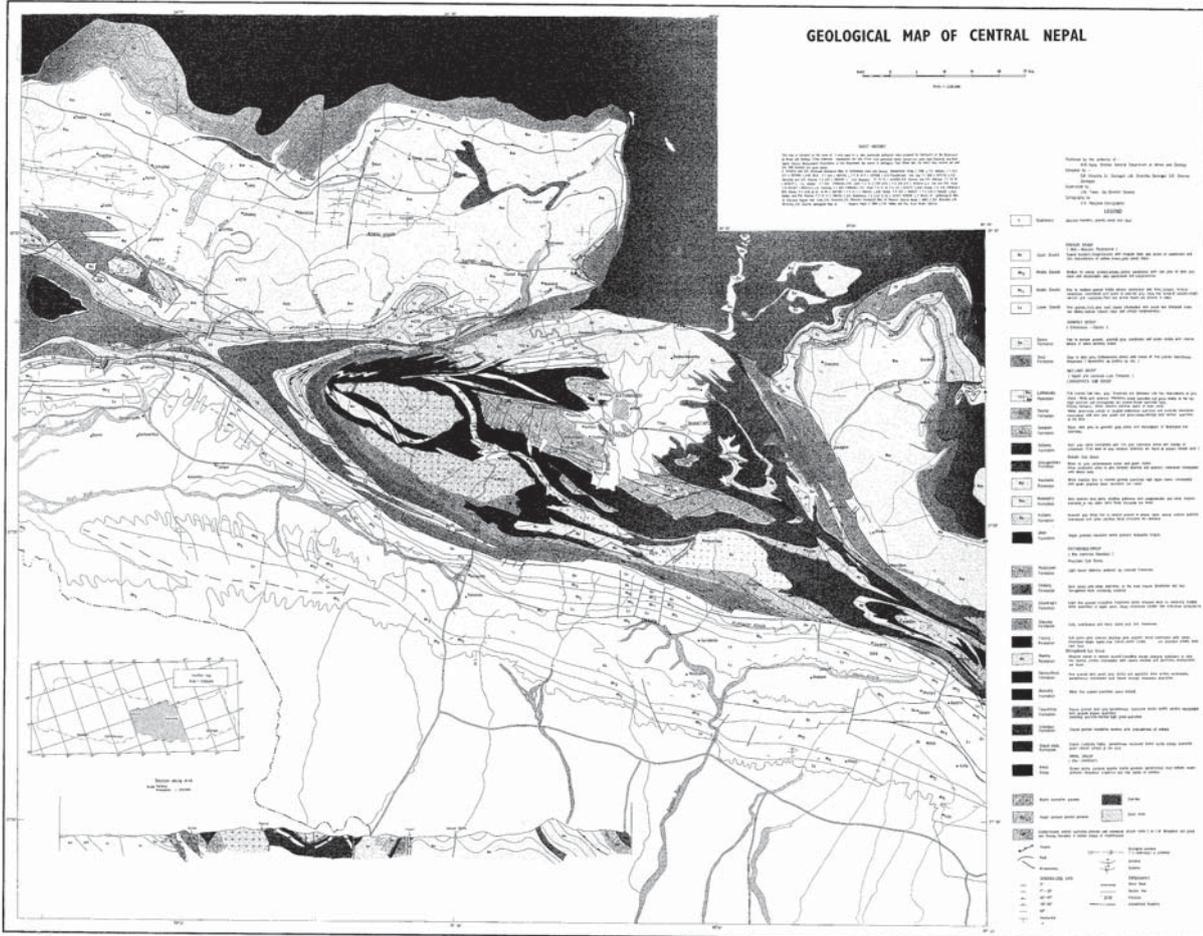


Figure 3: Geological map of Central Nepal (Compiled Geological Map by DMG).



Figure 4: Weathered augen gneiss south-west of site.



Figure 5: Meta- quartzite nearly at the middle of the site.



Figure 6: Weathered mica-schist west of the site.



Figure 7: Grain size analysis of the soil.



Figure 8: Three glasses of soil samples with water for soil size analysis.



Figure 9: Site area of Kusala Carpet.