

Culturally Responsive Built Environments
Dr. Ram Sateesh Pasupuleti
Department of Architecture and Planning
Indian Institute of Technology, Roorkee

Lecture – 33
Timber Construction (A Journey from Advanced to Vernacular)

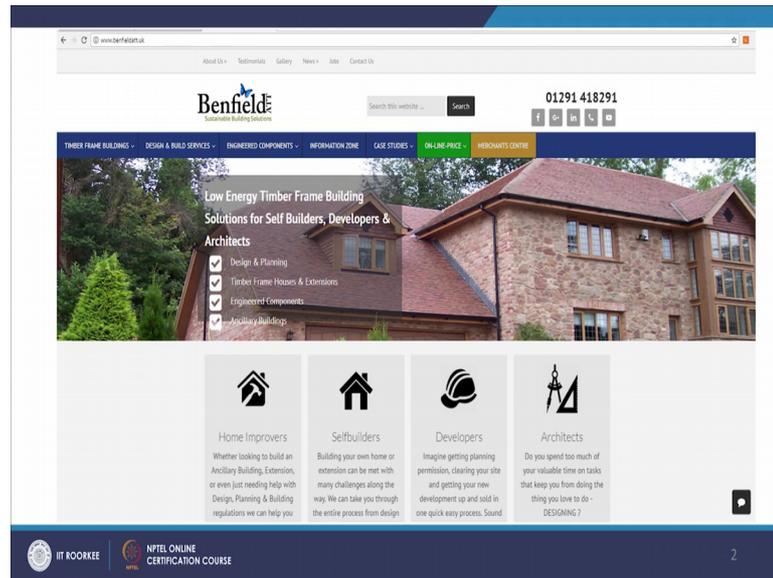
Welcome to the course culturally Responsive Built Environments. Today, we are going to continue from our discussion on the last discussion on timber constructions. And, in the last class, we have discussed about the various types of timber construction techniques. Especially, timber as a vernacular building material in the context of European context and especially in the British context where we have discussed about the Cruck truss and different ways of cladding types including the Vatican dove techniques, including the mathematical types and also the renders different renders we talked about.

So, that is just a kind of understand from the one perspective. And today, what I am going to discuss is, about my journey and how when I was working in England and how it started with the advance timber frame technologies and from there, how my whole journey has molded and today how from advanced to vernacular and what right now I am working on.

And so, I will give you give you a brief discussion on introduction to the advanced timber frame technologies what I have executed in UK and in other places. And, how some of the questions in my mind which came at that point of time, how it led to the long time research and that is where it has shown a direction into the study of vernacular issues.

So, and later in this lecture, we will be covering on our current project especially with the help of my PhD student Naina Singh. We are working on the Uttarakhand disaster recovery areas. So, that will be a brief insight on timber frame constructions and timber constructions as well.

(Refer Slide Time: 02:29)



So, in somewhere in 2005, I was working as a designer in a Benfield advanced timber frame technologies and this is where my very first interaction with the timber frame. Because, before that, I was working in India and I was introduced to timber frame technologies was so fascinating to learn a new technology and it is a very fast track position. Because, it was whole factory is there and the whole supply process as well as the manufacturing and direction systems.

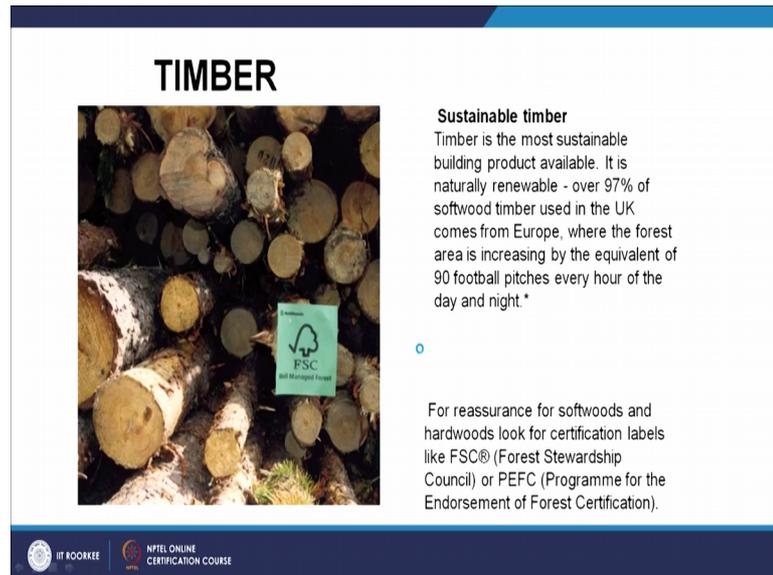
So, a building starting from A to Z is completely taken out and that is where this is a very holistic understanding of the timber constructions and that is where I have introduced with the trader and different regulatory systems and different manufacturing processes. And not only that, there are also issues in how we can reduce the waste and how we it can show a direction to the sustainability issues.

So, while I was working in this place, in fact, did a couple of projects on the timber frame designs as well as manufacturing. And, this one project where is it is a small project, it was about doing a kind of prototype houses, the United Nations world tourism organizations. After the Kashmir earthquake and when the client was someone from the United Nations and when they were trying to ask for a kind of prototype houses of which could be repeated it.

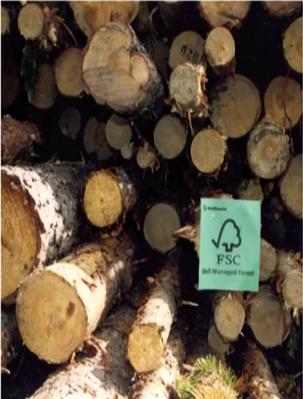
So, I was designing that and then there were all manufacture (Refer Time: 04:06) send back. That was the time I got a question in my mind; I have not visited the site, I have

not familiar with what is the site plan and you know what is the site context and how I am able to design the very uniform set of housing a solution to a different cultural context. So, that is where I started investigating and writing a proposal and that is how I got into the PhD and further, my journey has carried on. But, nevertheless, it is a good start to you know just to think what I am doing.

(Refer Slide Time: 04:39)



TIMBER



Sustainable timber
Timber is the most sustainable building product available. It is naturally renewable - over 97% of softwood timber used in the UK comes from Europe, where the forest area is increasing by the equivalent of 90 football pitches every hour of the day and night.*

For reassurance for softwoods and hardwoods look for certification labels like FSC® (Forest Stewardship Council) or PEFC (Programme for the Endorsement of Forest Certification).

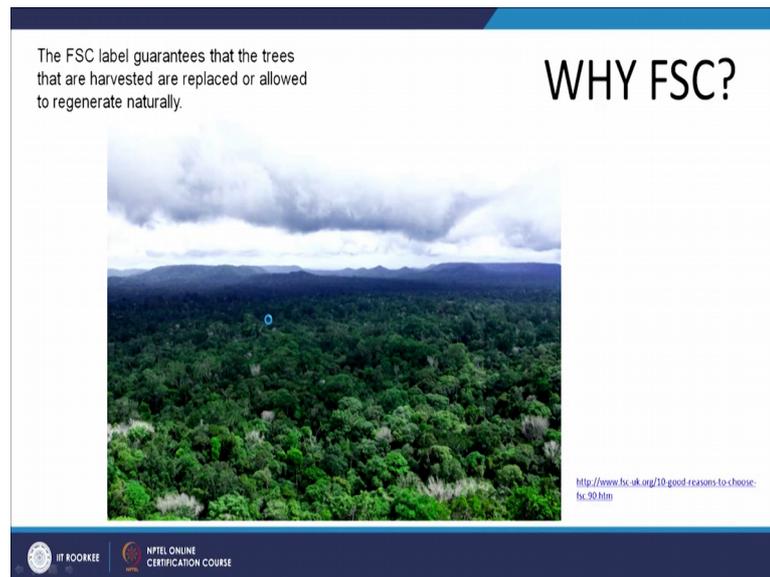
ITP ROORKEE NPTEL ONLINE CERTIFICATION COURSE

So, just to introduce you, first of all, much of the literature talks about the timber. Of course, this is a 2 versions which you talk in the Asian context, especially with the kind of limited timber resources. Obviously, it has been looking at the kind of why we have to cut down the trees.

But whereas, in the western context, timber is one of the abundantly available resource and that is where it is season, it is a naturally renewable resource and over 97 percent of the soft timber used in the UK comes from Europe where the forest area is increasing by the equivalent of 90 football pitches every hour of day and night. So, that is why, what you can see here is FSC, it is a Forest Stewardship Council.

And, what this symbolizes is how it is properly whether the timber is coming from a well-managed forest or not, it talks about the logistics and the supply chain phenomenon. And it also talks about the both afforestation and deforestation aspects of it and how we can have a control on the environment.

(Refer Slide Time: 05:56)



So, what is this FSC does? The FSC is it is a label Forest Stewardship Council label which guarantees that the trees that are harvested are replaced or allowed to regenerate naturally. So, apart from the trees, you know there are also other concerns. Because, the moment you are cutting down some trees, obviously, it is going to have an impact on the wildlife. Sometimes, it is going to create an impact on some very rare species.

In fact, I was recently in a Pulicat lake, somewhere in Tamilnadu and you know the birds travel from Canada or migrate for a particular few months you know, just to eat a small snake or a leach which is in that water species. The moment if this water systems or these ecosystem degenerates or degrades gradually, then what happens is, the migratory patterns disturbs. Then, obviously, there will be a bigger impact in the larger ecosystems and to the human environments.

So now, because of various deforestation methods, many of the wild species, they are now coming to the city because, their home has been captured. So, one has to make sure that you know you do not disturb the wildlife species and their home and their habitat and it also talks about the FSC, talks about the rights of indigenous people use of the forest.

(Refer Slide Time: 07:29)

FSC protects the rights of indigenous people to use the forest. If they have sacred sites in the forest these are exempt from felling.
FSC gives an assurance that future generations will be able to enjoy the benefits of the forest.

IIT ROORKEE NFTEL ONLINE CERTIFICATION COURSE

Because, it is their privilege to live in this forest and they have there are also certain sacred sites and which you have to protect. Because, it could be a waterfall, it could be a memory to a particular community, it could be a certain sacred environment.

So, this FSC also provides an assurance that future generations will be able to enjoy the benefits of the forest and whenever the indigenous tribes living in this forest, obviously, we should not create any impact on their lives and livelihoods. So, the moment a new company is coming and the so, obviously, how you cannot just send them away by giving some money or anything like that? So, basically, how you can actually engage them? How you can actually does not make any create an impact on their habitat? So, this is one thing we have to look at.

(Refer Slide Time: 08:33)



And, the forest owners must also use local workers to run the forest and provide training safety equipment and decent salary.

(Refer Slide Time: 08:39)



So, and again, you can see which are the FSC products. So, obviously, the label talks about which are the FSC and which are the non-forest timber which for example, you get all the latex gloves and they are all non-forest timber products. Then, the first thing we have to do is, choose and use of right timber.

(Refer Slide Time: 09:01)

CHOOSE AND USE OF RIGHT TIMBER

Timber used for structural applications must be graded and clearly marked to show it complies with the correct standards and strength requirements laid down by building codes and regulations.

The load a member can carry depends on several factors, including its span, thickness, width and species. Usually the deeper/wider the section, the longer the span.

Different species have different strength properties
– a factor that needs to be considered when choosing your timber.

IIT ROORKEE | NPTEL ONLINE CERTIFICATION COURSE

The timber use structural applications. First of all, it must be graded and clearly marked to show it complies with the correct standards because in UK, we have the British standards. So, each timber which you are applying for a particular spans is it a particular grade the thorough grade of it and a particular length and what kind of standard it is reflecting. That is why, we have to reflect with the span tables.

So, that is the after requirement of the building codes and regulations and the load of a member can carry depends on several factors. That is, the span of the floor, thickness, width and the type of species. If it is oak or if it is any other species like you know any other local trees, so, you the strength varies usually the deeper or the wider the section, the longer the span. So, different species have different strength properties. So, one have to be very careful in choosing the timber.

(Refer Slide Time: 10:07)

How timber is graded?

Visual strength grading
Visual strength grading rules define the size, type and number of strength-reducing characteristics allowed in each grade (for example, natural features such as knots, wane and slope of grain, plus splits and shakes which may have developed as a result of drying).



Wane: uneven edge caused by a residue of bark.

Shakes: fissure caused by the splitting of the wood fibres along the grain.

Certification body or logo mark	Company reference	Species or genetic group
	1234/5678 <small>(Producer Company logo)</small>	WPPA
BS 4978 EN 14081	DRY GRADED	GS C16
Standard reference	Timber condition	Strength class

IIT ROORKEE | NFTEL ONLINE CERTIFICATION COURSE

For example, you can see here, the vast how timber is graded. So now, you can see a C 16 here, which is C 16 grade and this is called visual strength grading. So, normally the trademark certification body and it is a British standard which is the standard reference which is the dry graded. And then, the company logo and it has a strength in class and a species of it. So, it is basically talks about that define the strength, define the size, the type and the number of strength reducing characteristics allowed in each grade.

For example, natural features such as knots, wane. Wane is nothing but an uneven edge caused by the residue of a bark. Whereas, the slope of a grain, how the slope of the grain you all have a plus splits if there is any cracks or splits shakes. Shakes is nothing but a kind of fissure caused by the splitting of wood fibers along the grain.

(Refer Slide Time: 11:07)

Machine strength grading
Machine grading is based on the relationship between strength and stiffness. The machine grades each piece and stamps it with the appropriate mark.

Machine strength grading
Machine grading is based on the relationship between strength and stiffness. The machine grades each piece and stamps it with the appropriate mark.

Standard reference Timber condition: DRY Machine graded

IIT ROORKEE NPTEL ONLINE CERTIFICATION COURSE

So, the other one is while looking at a piece, you are grading. The second one is the machine strength grading. So, here you can see is a M, that is what reflects the machine grade.

(Refer Slide Time: 11:19)

GS (General Structural) and SS (Special Structural), are the visual grades of the timber assigned by the grader.

The table below shows how some of the softwood species and grades most commonly used in UK construction are grouped into strength classes.

SOURCE AND SPECIES	GRADING RULES	STRENGTH CLASSES					
		C14	C16	C18	C22	C24	TR26
BRITISH							
British pine	BS 4978 visual	GS			SS		
	BS EN 14081 parts 1-4 machine		*			*	*
British spruce	BS 4978 visual	GS		SS			
	BS EN 14081 parts 1-4 machine		*			*	
Douglas fir	BS 4978 visual	GS		SS			
	BS EN 14081 parts 1-4 machine		*			*	
Larch	BS 4978 visual	GS				SS	

Produced by BM TRADA, part of the Eurova Group, on behalf of the Timber Research and Development Association (www.trada.co.uk), and supported by Wood for Good and Swedish Wood
© BM TRADA 2015

IIT ROORKEE NPTEL ONLINE CERTIFICATION COURSE

And then, for example, I just show you a brief classification; one is you have the British pine, the Spruce Douglas fir and Larch and you have the grading rules here and you have the general structural C 14, C 16, C 18, C 22, C 24, TR 26. So, like that, you have certain strength classes and there also special structural. So, that is how it is classified.

(Refer Slide Time: 11:45)

The following examples which apply to solid timber members show how to use span tables for domestic floor joists at 400mm centres.

Size of joist (mm)	C16 clear maximum span (m)	C24 clear maximum span (m)
38 x 97	1.76	2.05
47 x 97	1.95	2.26
38 x 220	4.29	4.78
47 x 220	4.60	5.12

Changing to 600mm centres will change the span distances for the same timber sizes.

Size of joist (mm)	C16 clear maximum span (m)	C24 clear maximum span (m)
38 x 97	1.43	1.68
47 x 97	1.60	1.87
38 x 220	3.74	4.17
47 x 220	4.02	4.48

So if you wanted to span four metres at 600mm centres, you could use 38mm x 220mm C24 instead of 47mm x 220mm C16, a lighter-weight option.

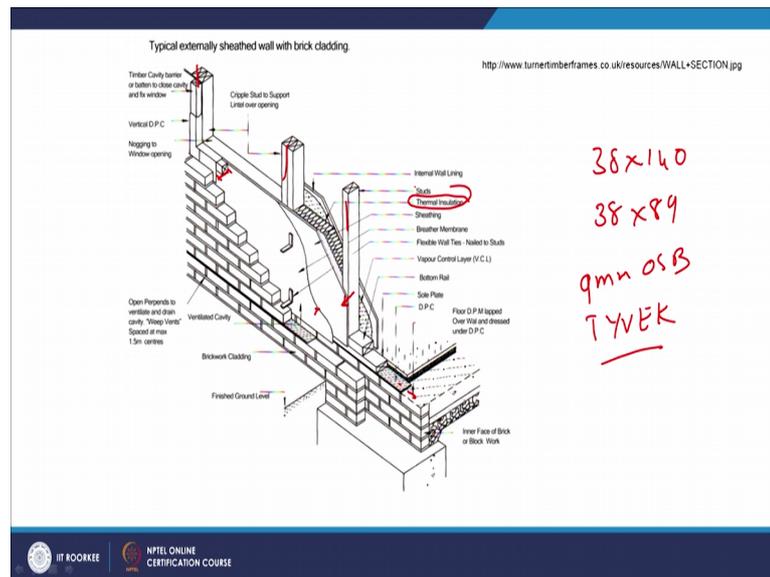


 IIT ROORKEE  NFTEL ONLINE CERTIFICATION COURSE

And then, what we do is, like you have the following in pieces, like you know the sizes 38 by 97, 47 by 97, 47 by 220. So, for instance, you can see if you are using 38 by 97, so, in fact, in C 16, clear maximum span you can go for 1.76. Whereas, in C 24 you can go for 2.5. So, which means by changing the grade, you can go for the bigger lengths.

So, if you wanted to span 4 meters at 600 mm centers. So, which is like let us say, this is a 600 centers a floor joint and you could use 38 by 220 C 24 instead of 47 by 220. So, which means, is the depth of the timber is changing bit and if you are changing the grade of the timber.

(Refer Slide Time: 12:30)



This is how a typical wall section is in the most of the UK in the recent times and this is what you see the timber studs and this is the window sill and you have a 50 mm cavity. The panels, the timber panels are normally external. Usually, we used to follow about 38 by 140 that is a common width.

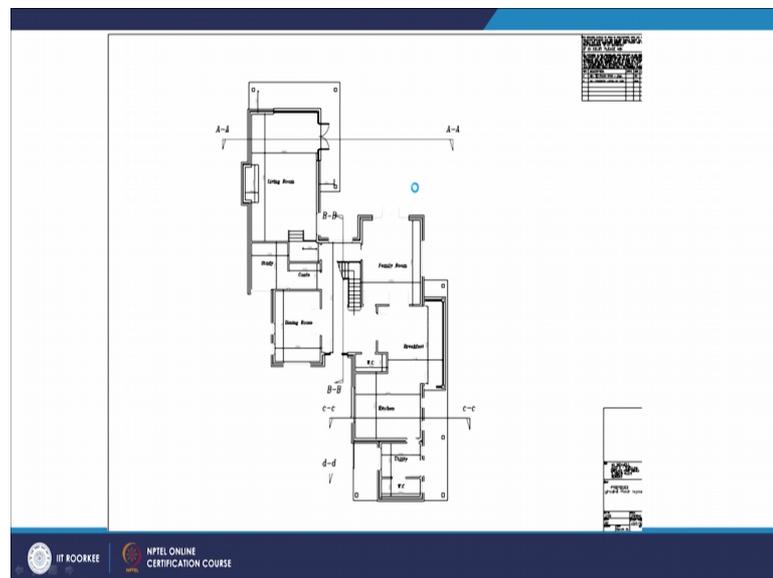
And, whereas, if it is the internal panels 38 by 89, but in 140 you have this which is a kind of 9 mm OSB, Oriented Strand Board. And over that, you have TYVEK membrane which is a breathable membrane and then, you have about 50 mm cavity and then the brick wall continuous. So, and you have the DPC here. So, this is how and in between this panels you have the insulation material as well thermal insulation.

(Refer Slide Time: 13:35)



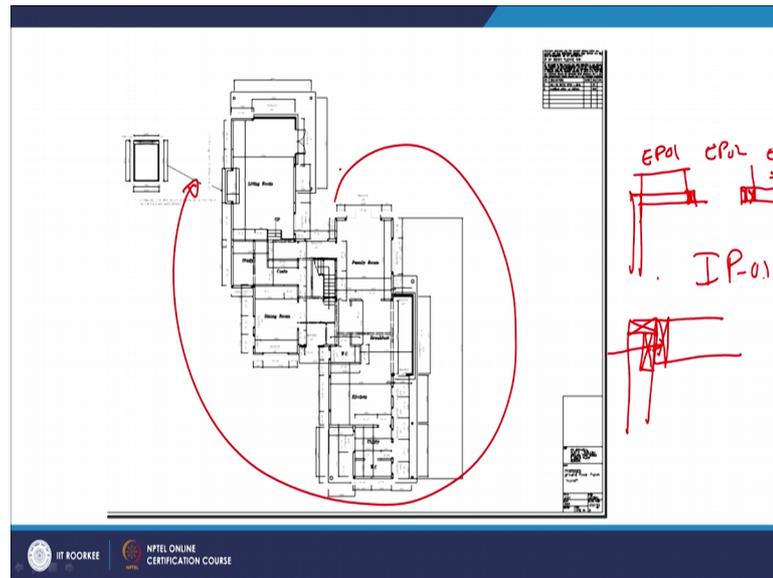
So, what is one does is, this will protect from the weather conditions and this is a general makeup of the wall and I just show you a small project how it is done.

(Refer Slide Time: 13:39)



So, somewhere in Oxford, and in generally, when the architects gives you the plan. So, you actually study the plan and the sections and the elevations.

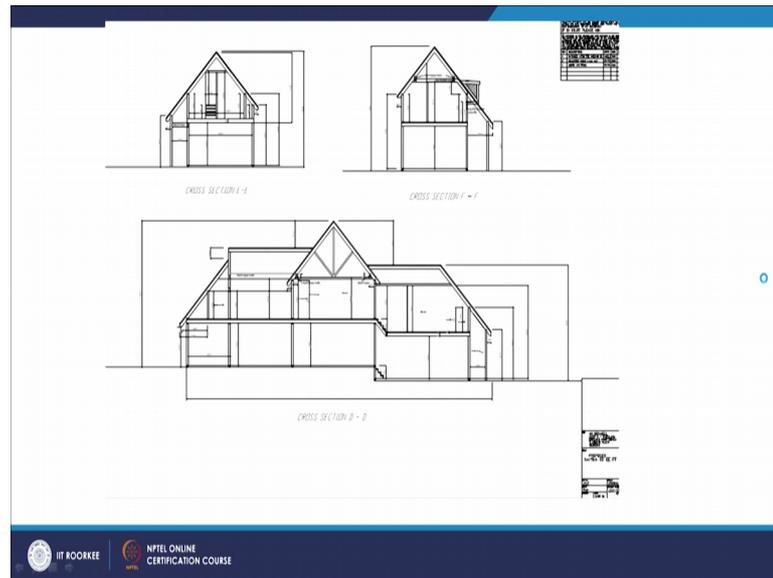
(Refer Slide Time: 13:46)



And the first thing what we do is normally. So, you have draw all the sections and elevations. Then, what we do is, we actually break let us say, this is a wall, this is a wall and this is a window. So, what we do is, we take from one edge and then we mark into E P 1, E P 2, E P 3.

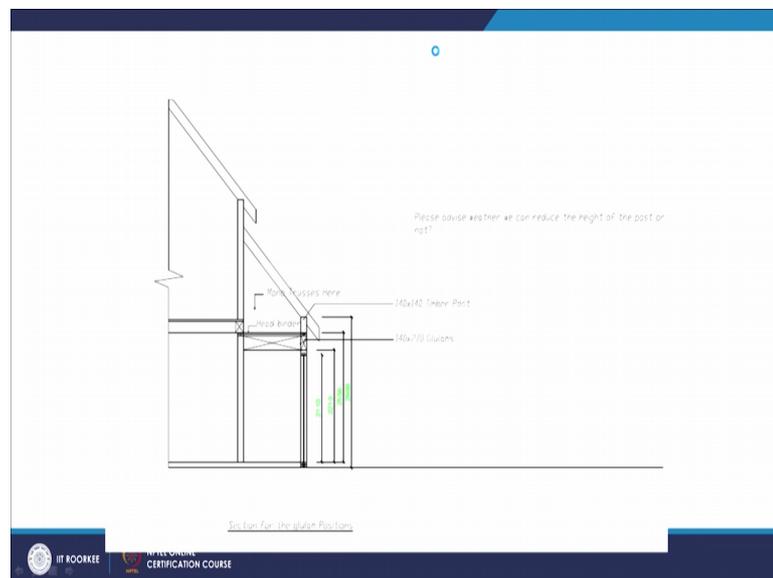
So, in that, works actually we have because, we need to give a little buffer place for placing the lintel load, 2 studs or 3 studs. So, at the same time, in the corner stud, how it works is, so, you have 1 panel sits here and another panel sits here and the other ternary stud so, that we can nail it here. So, this is how the panels are done in a kind of cyclic process, right. So, 1 2 3 4 5 6 at the same time the internals are normally represent by I P 0 1, 0 2, like that. So, similarly, the first floor we do.

(Refer Slide Time: 14:55)



And then, when we draw the sections, the structural engineer also already have mentioned where to keep the beams, right. So, when we are when we know these are the places we need to give the beams or the steel members steel sections.

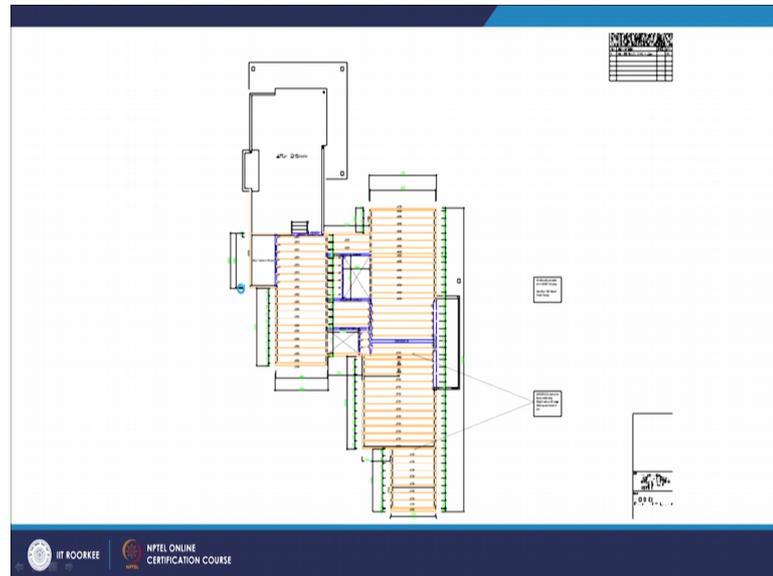
(Refer Slide Time: 15:13)



So, one has to really carefully draft with the spacing aspect of the joist as well as if there is any other structural considerations, we have to give it to give support for those structural elements.

Like, for example, here he mentioned about 140 by 270 glue lamps. So, obviously, we need to the other side of it, how we can create a beam and then a provide and this particular roof is basically a kind of cut roof.

(Refer Slide Time: 15:41)



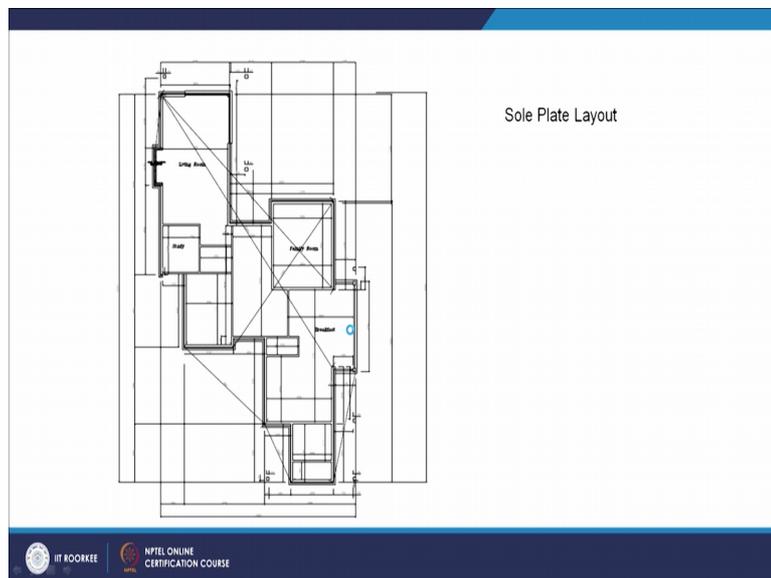
So, this is how a joist layout looks like. You can see the blue lines here. These are the steel sections where the staircase is coming and wherever the complicated areas. So, that is where the structural engineer have mentioned, yeah keep these places here. So, the moment you are keeping this, this is an obviously, at these places you have to give a structural provision which having some more studs under it.

(Refer Slide Time: 16:05)



So, this is how another project in the clan restoration project and you have the beam and block foundations over this.

(Refer Slide Time: 16:13)



Then, the first thing what we do is, after doing every layout of the manufacturing process, then they goes to erection team, that is where we get the sole plate layout.

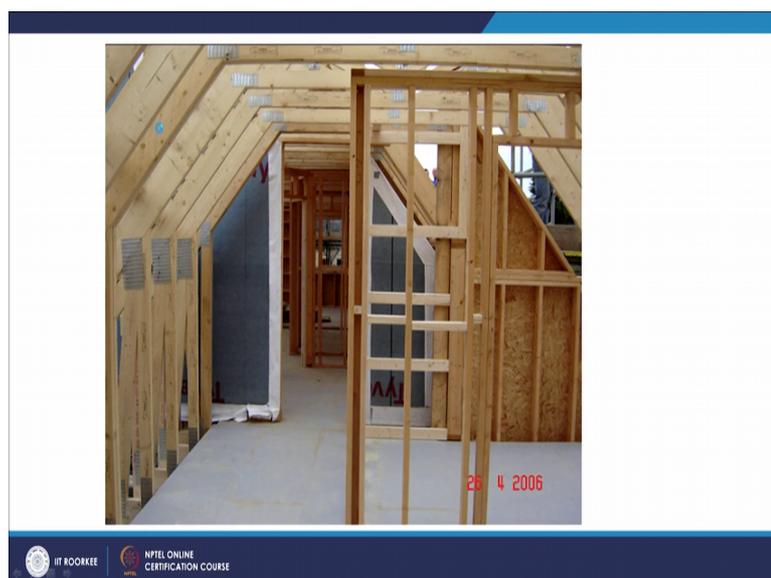
(Refer Slide Time: 16:27)



So, diagonally what we do measure and we make sure that a sole plate layout is made and then the panels are erected and this is how you can see this is a stone (Refer Time: 16:31) because, the restoration project.

So, this is where this is the context of the stone facade is needed. So, the what we did was, instead of brick, we kept for the stone and you can see the attic truss. The whole truss is manufactured and sent to the site and they are erected.

(Refer Slide Time: 16:49)



And this is how a panels looks like.

(Refer Slide Time: 16:52)



And, the 9 mm OSB Oriented Strand Board and you have the nail plates and this is the panel, this is the head binder and then again on the top of the panel.

(Refer Slide Time: 17:08)



So, this is how a window is made and this is how the lintels which is resting here and this is any packer material we fill it. And, whenever there is a load coming up, the engineer suggest to have these as per the span tables.

(Refer Slide Time: 17:23)



And then, if there are, also how they erect.

(Refer Slide Time: 17:26)

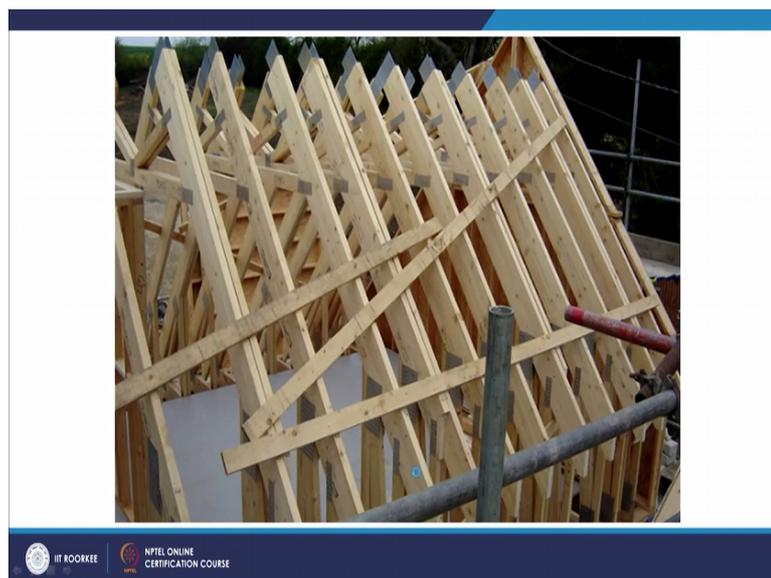


And the roof.

(Refer Slide Time: 17:27)



(Refer Slide Time: 17:29)



They follow the safety aspects as well.

(Refer Slide Time: 17:30)



So, how you can actually go step by step and take put some kind of temporary supports.

(Refer Slide Time: 17:35)



And, this is called bird's mouth.

(Refer Slide Time: 17:39)

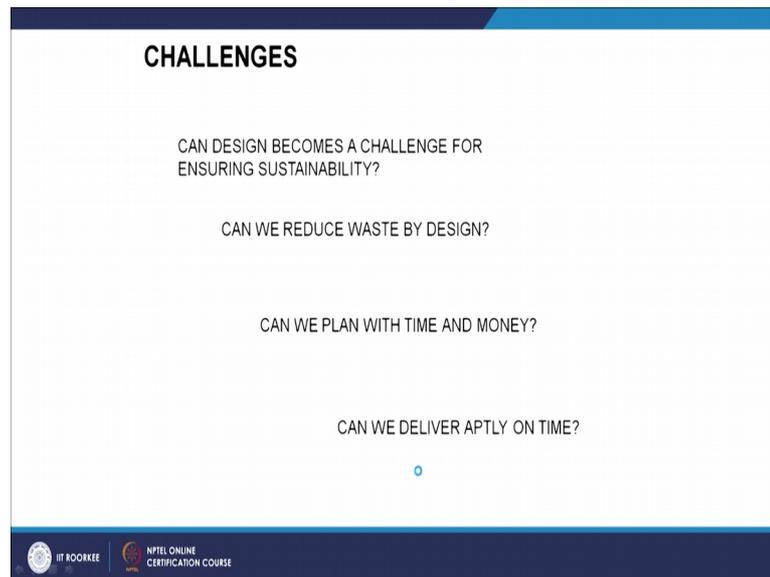


And this is how a wooden deck 22 mm wooden deck is placed.

(Refer Slide Time: 17:42)



(Refer Slide Time: 17:44)



So, this is how a brief introduction of how the timber frame construction is made. It is a free fab kind of thing. Everything manufacture in the in the factory and sent to the site. They are erected in 1 2 weeks 3 weeks time and that is the end of the project and then, the brick work comes on. So, it is a very quick process. But, only thing is, we have to take care of each and every minute details into considerations. Even a 2 mm mistake happens a bigger cost and time in the site.

So now, the challenges is can design becomes a challenge for ensuring sustainability can we reduce waste by design. As I said, the moment we do any mistake in our drawing, it becomes more waste in the site, it becomes more cost and it becomes more travel time. So, obviously, this is one important aspect. So, can we plan with time and money and can we deliver aptly on time. Especially, in the cold countries, because of the weather conditions, how we can actually how this particular system have to worked out in such a way the whole project management is carried out so that, we can deliver it on time.

So, this was my learning and as I said, by doing this projects I just realized that how why not these kind of advanced technologies are not taken to the Indian context and to Uttarakhand. So, that is where I still have not found an answer so far. But still, I would give you my journey and how, right. Now, we are working in Uttarakhand especially on the hilly areas of Uttarakhand.

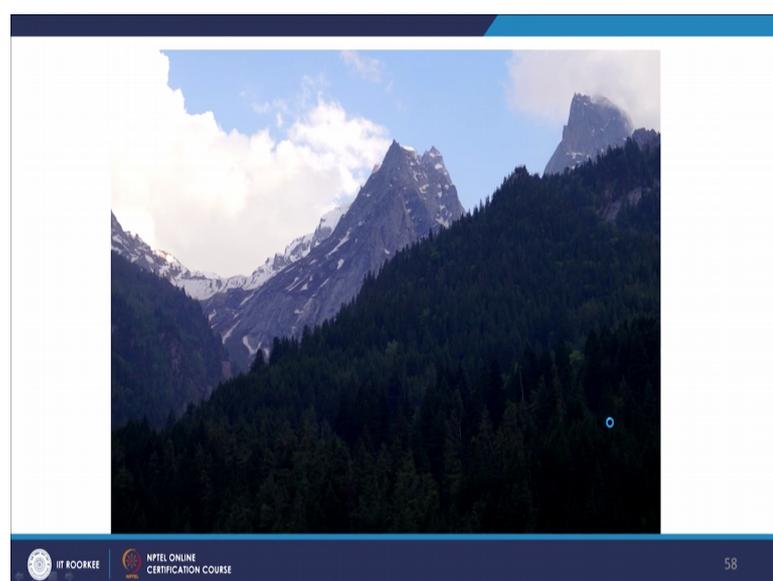
(Refer Slide Time: 19:20)



And along with one of my PhD student is also working on disaster affected areas on especially, she is looking at the indigenous knowledge.

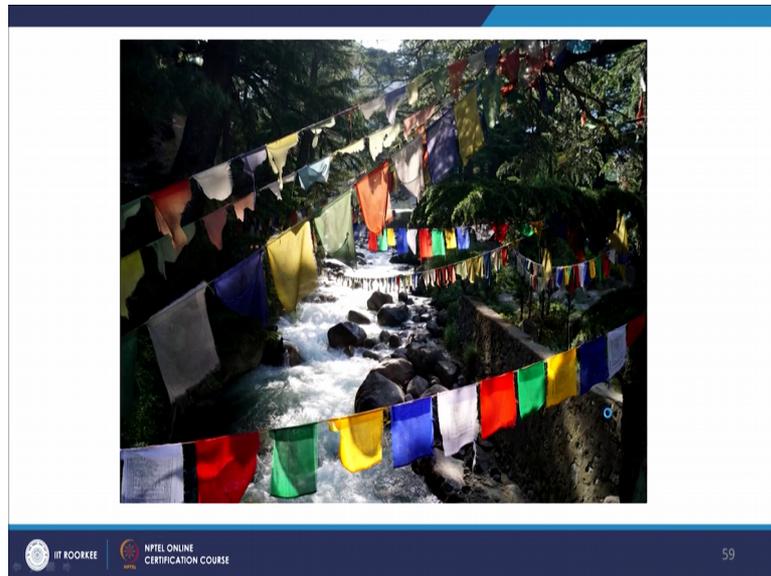
So, from advanced, I am taking you to the indigenous systems, how the traditional timber buildings have sustained and what is the present state of it and how people are responding to it. So, so this is in the Himalayan region, the greater and the lesser Himalayan region.

(Refer Slide Time: 19:44)



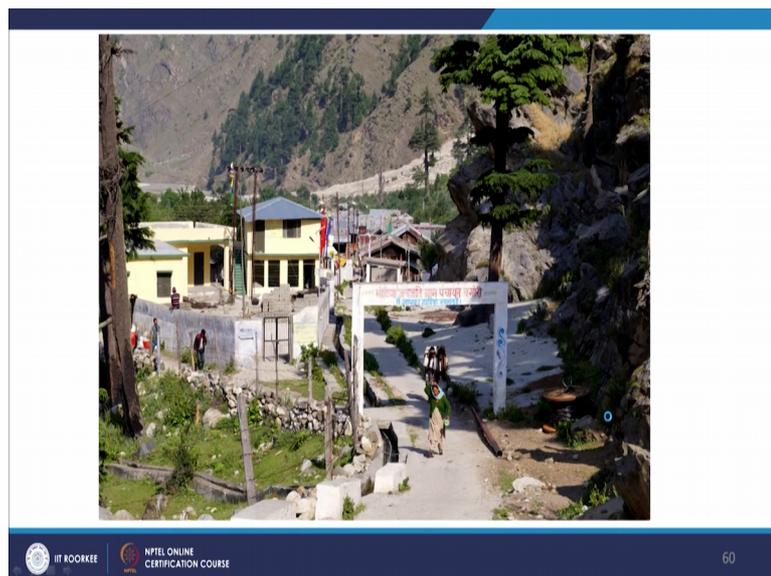
And this is, the site which I am showing you from the a couple of sites which we travelled around and they are from ranges from Gangotri glacier to the Yamunotri glacier. So, this one is near Harsil, which is before Gangotri.

(Refer Slide Time: 19:57)



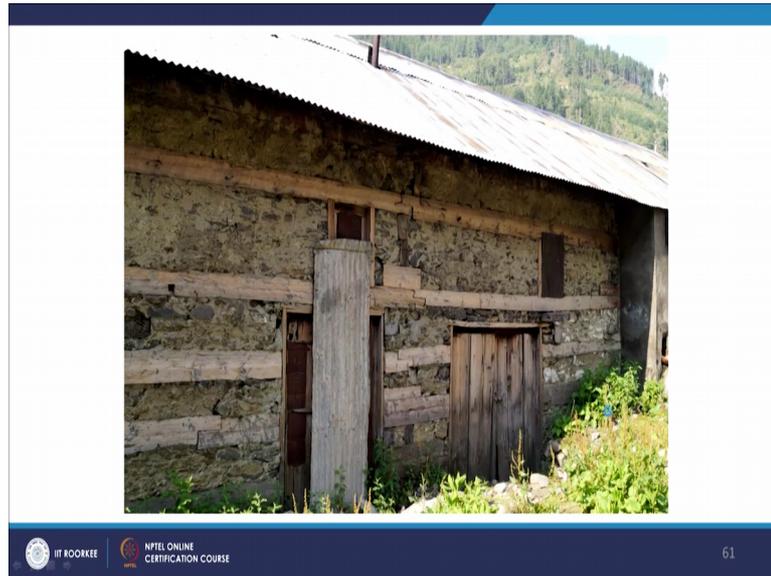
You have a small (Refer Time: 20:00) site of (Refer Time: 20:01) is the cantonment area as well as a small village.

(Refer Slide Time: 20:03)



And this is called Bhagori, which is a kind of a (Refer Time: 20:07) village and it is a tribal village sort of thing.

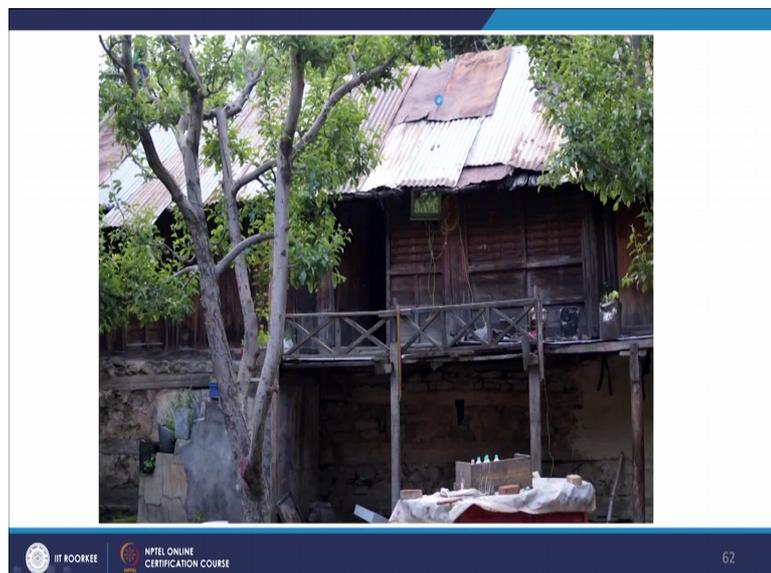
(Refer Slide Time: 20:11)



And, what you can see is a kind of traditional timber construction. It is a kind of a (Refer Time: 20:21) type of constructions where you have the horizontal members of timber and their intermediate construction intermediate is full of the stone components. So, that because, being an earthquake prone area this is one of the important traditional constructions which this region has adopted.

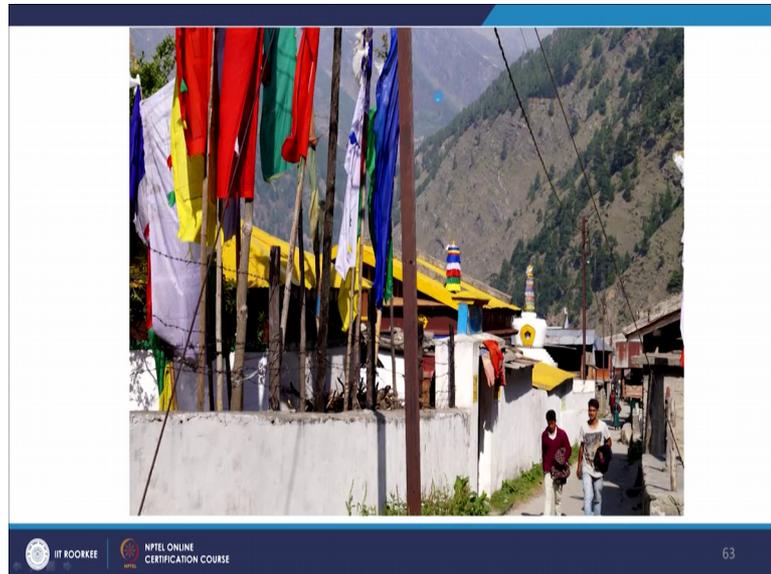
And most of the cases, what they do is, in the in the bottom, they have this is a staples or for as the granary or maybe for the animals to be there.

(Refer Slide Time: 20:52)



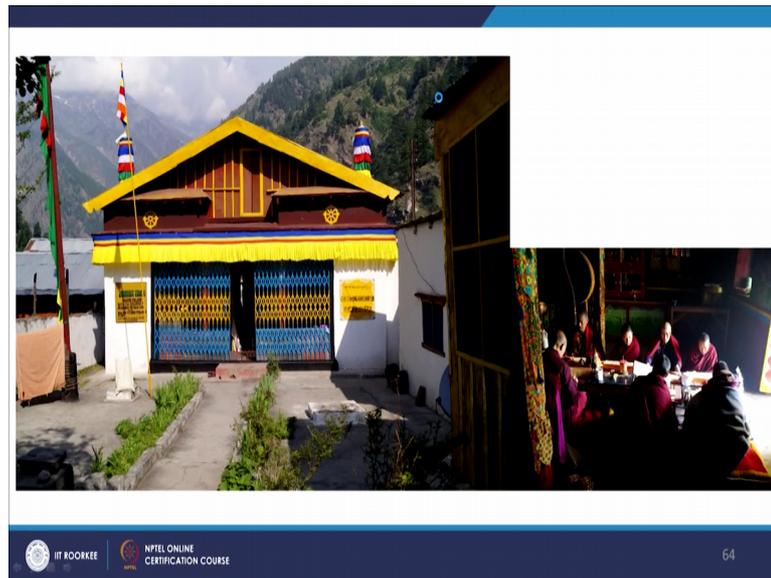
And you can see some of the dwellings; you have a small little piles and then, they are all on the timber frames.

(Refer Slide Time: 21:00)



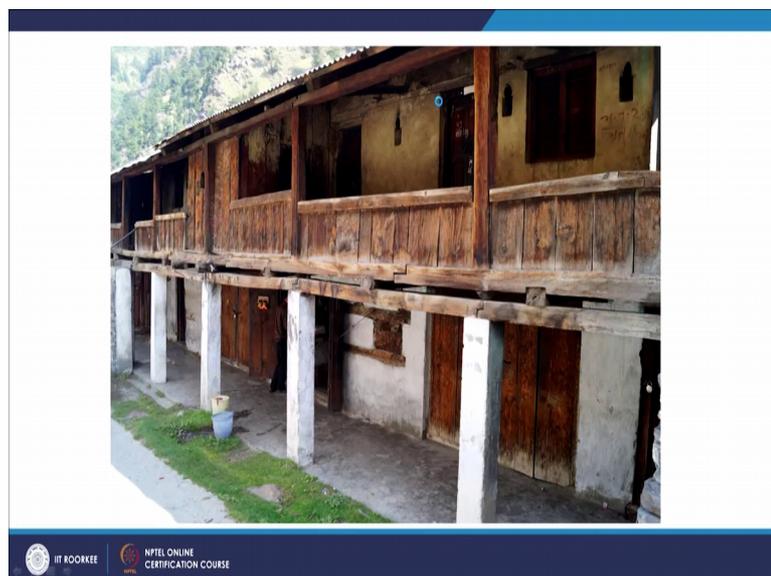
And being a Buddhist society, they also have the traditional temple look, constructed with a bright colors. Because of these particular dark, much of the winter time, you know that is one thing. Having a bright colors also give a visual access wherever you are going around near the mountains, you can see that yellowish color or these red and blue, you can see that settlement do existed here. So, that is one of the reason you know that symbolically the colors also talk about the context.

(Refer Slide Time: 21:33)



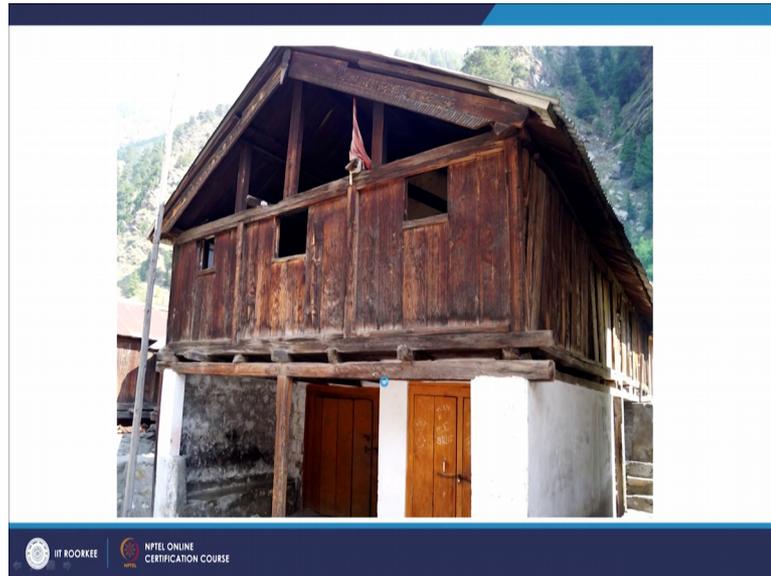
So, this is how the Buddhist environment.

(Refer Slide Time: 21:36)



And you can see here in the bottom of a ground floor is either it is a shop converted into shops or sometimes, it is meant for cattle and the first floor, people normally stay.

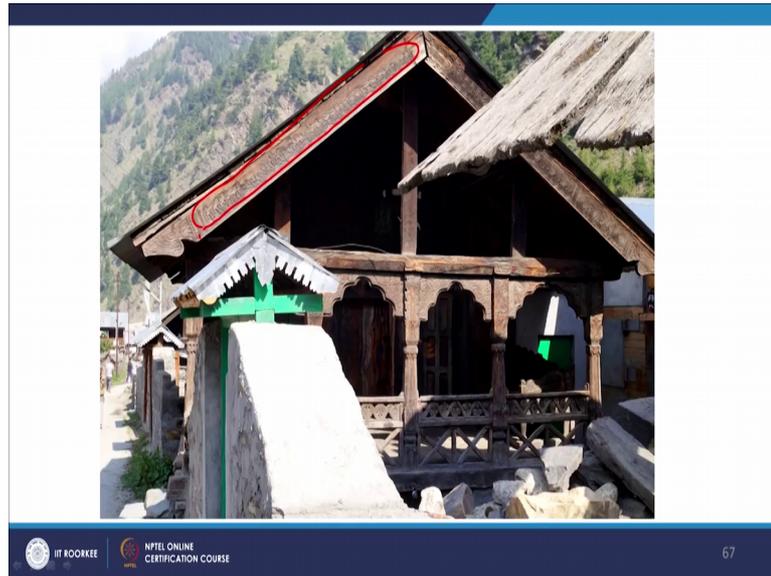
(Refer Slide Time: 21:50)



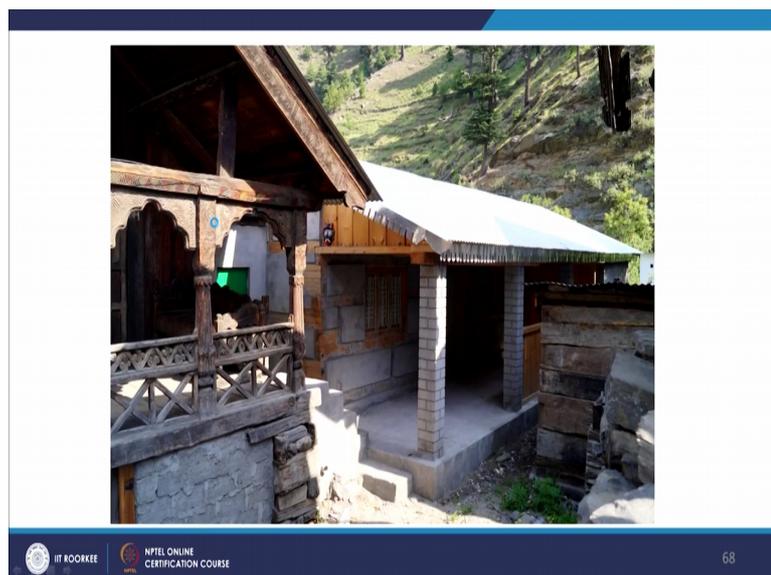
So, everything is made of timber. It was all because, earlier they used to get the access to the deodar wood. So, what; because in the higher altitudes, accessibility to deodar is also one important prominent aspect.

And those days, the skilled labor also talked about, they looked at the kind of decorative aspect of it, they looked at the construction technology and because would in wooden houses, what happen in these cold climates? It makes you warm in the winter and it makes you cool in the summer. So, you can see the kind of intricate work which the artisans have made of that times and unfortunately, what we see here is many of these houses are still vacant. Because, of some of them have migrated and some of them are on a seasonal basis. So, you can see the kind of the whole intricate work.

(Refer Slide Time: 22:46)



(Refer Slide Time: 22:47)



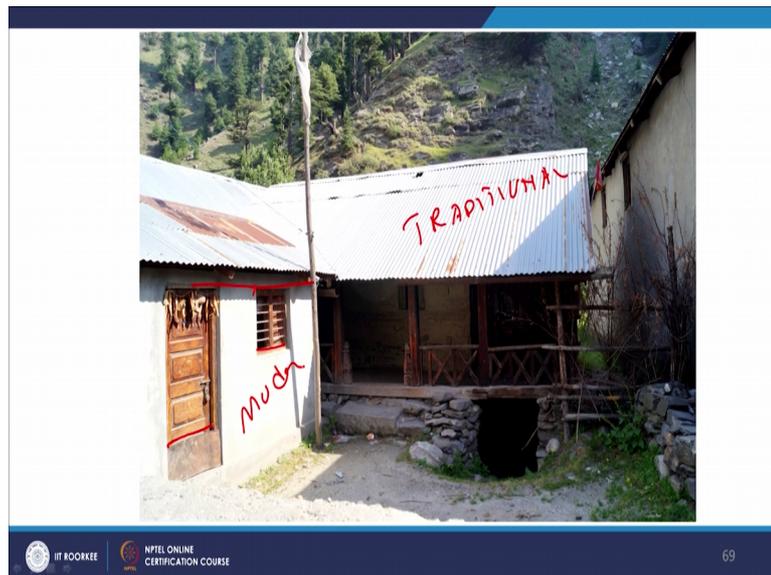
Now, what is happening to these kind of settlement? Because, this is a kind of transit, it has become a kind of transit settlement. Because, 6 months they live down hills and 6 months' 6 to 4 months they may not live here because of the harsh winters and because of lack of proper maintenance or any other things. So many of the villages around this region, they do not live here.

So, they go to either Uttarkashi area or Dudha and they settle there. So, in the in the summer time, they do they put the cattles and only 1 or 2 people live there just to take care of the village. Otherwise, most of the people migrate to the downside.

Now, one of the classic examples what you can see here is, because now, earlier the timber was accessible and it is available. It was available and it is accessible to the local communities. But now, because of some certain flood, forest regulatory acts 1 family can get only 1 tree. So, because of that limitation, so, they had a difficulty in constructing the same way which they had.

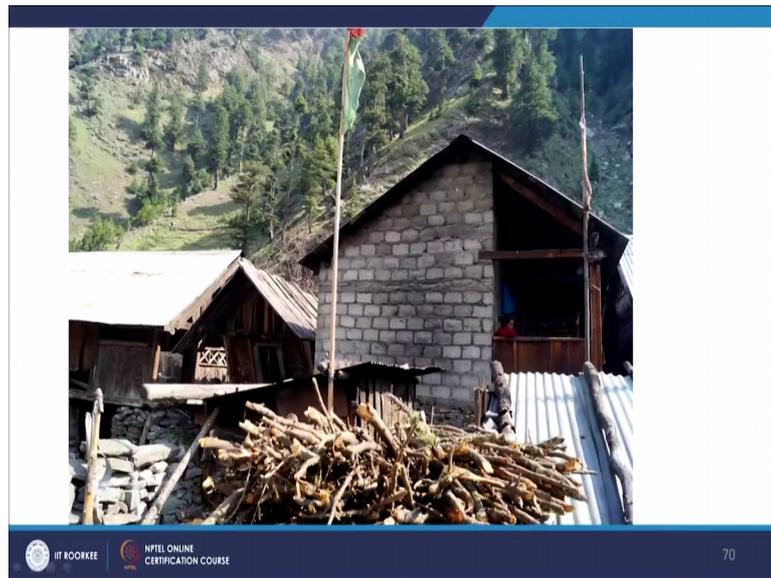
So, gradually, what they have adopted is kind of concrete blocks or the brick and concrete work or the AC blocks. So, in that way, what you can see is a part of the timber and as well as part of the foreign, I mean the usual materials which we use in the urban context.

(Refer Slide Time: 24:07)



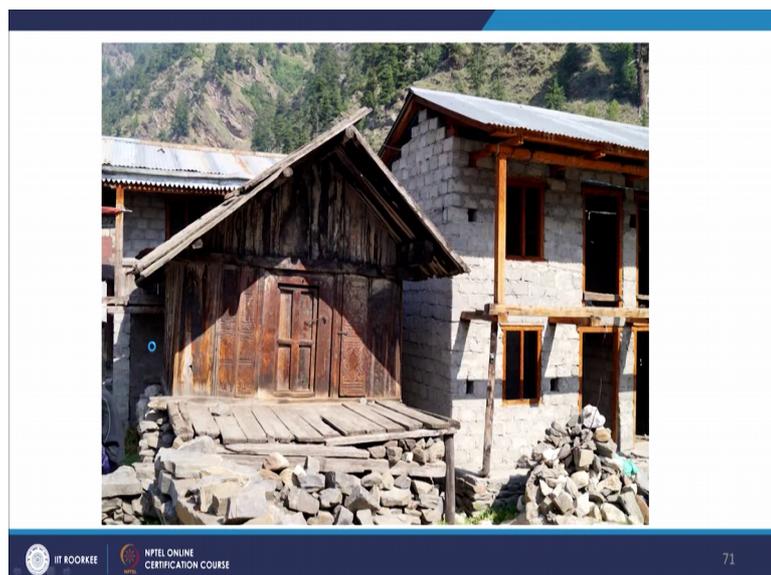
So, you can see the brick and concrete buildings and at this sense. So, how this one house has been modified on one side, you have the traditional and you have the modern. But, what fun you can notice is, if you look at the way they are look, they are looking at, the sill heights, the window heights, the roof heights, they try, they have a sensitivity of how to match even the size and the plan of the rooms according to their context.

(Refer Slide Time: 24:44)



So, similarly, here the blocks which they have used and the front facade because, most of the time this particular place is used mostly for the livelihood activity. Because, the yarn and they do any kind of domestic works, the women will be weaving sweaters you know so, the lot of work which is happening in this area. So, even still you can see and some of these timber houses are rested many earthquakes.

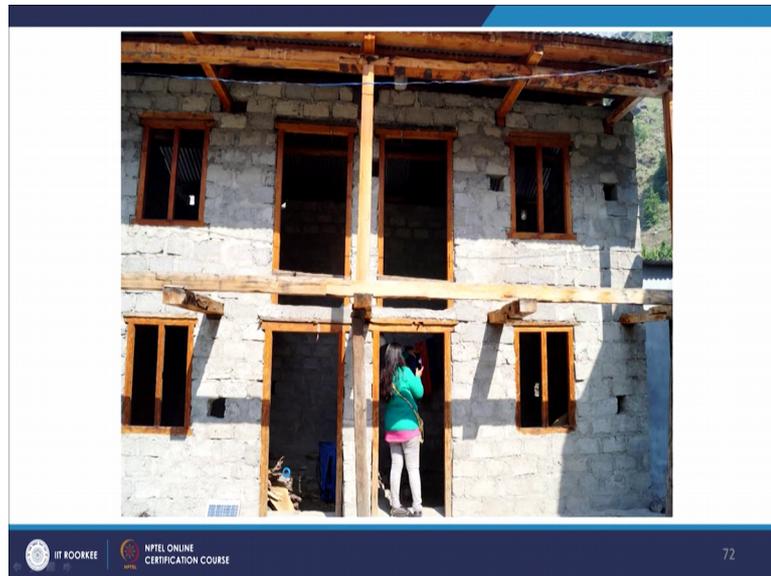
(Refer Slide Time: 25:07)



So, this is again, this is one of the typical form of a kind of granaries in Uttarakhand, in the hill region. This is some Uttarakhand granaries. So, what they do is, because they

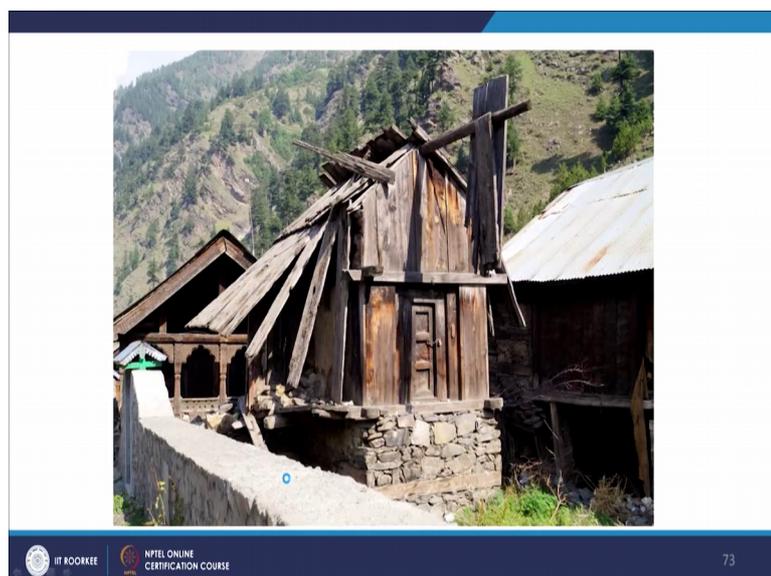
have to store the grains for the rest of the year for 6 to 4 months, so, what they do is, they once you go in, it is a very small openings. Once you go inside, they have under a little down into it, they have a room sort of thing and then they store all the grains.

(Refer Slide Time: 25:33)



So, you can see how the modern developments are happening and in the similar way.

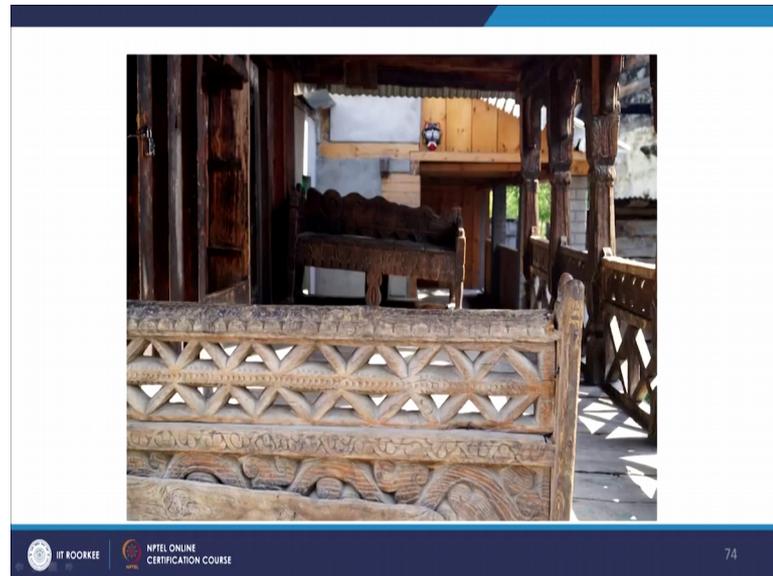
(Refer Slide Time: 25:38)



Now, this is one classic example. Here, this particular houses the you can find many of these houses here and there. Because, they are gradually getting abandoned because some of the families have migrated down and who owns it and what to do with it, no one

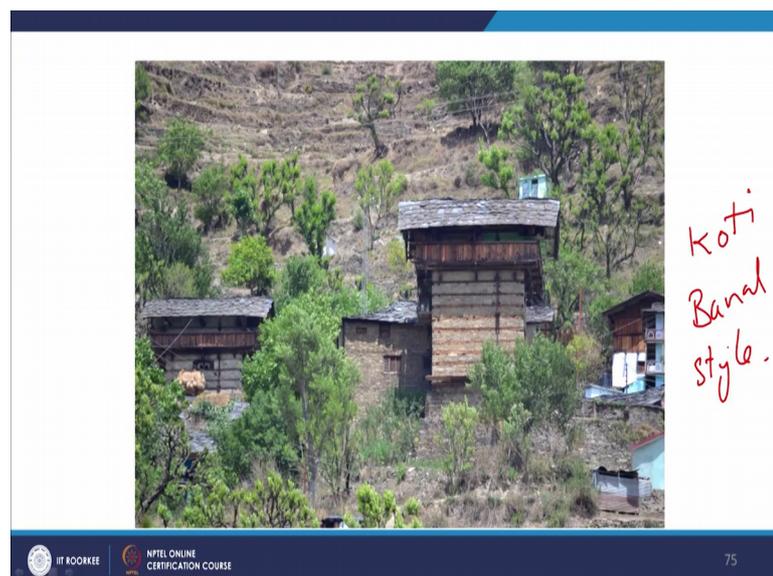
knows. So, everywhere in Uttarakhand, when you travel, you can see all these traditional houses which of done with the rich timber buildings or unmaintained and no one is having an idea how we can retrofit this, how we can requalify this for new uses.

(Refer Slide Time: 26:16)



So, similarly you can see the kind of work the craftsmanship, how they have detailed it out and very with a simple understanding what they need.

(Refer Slide Time: 26:27)

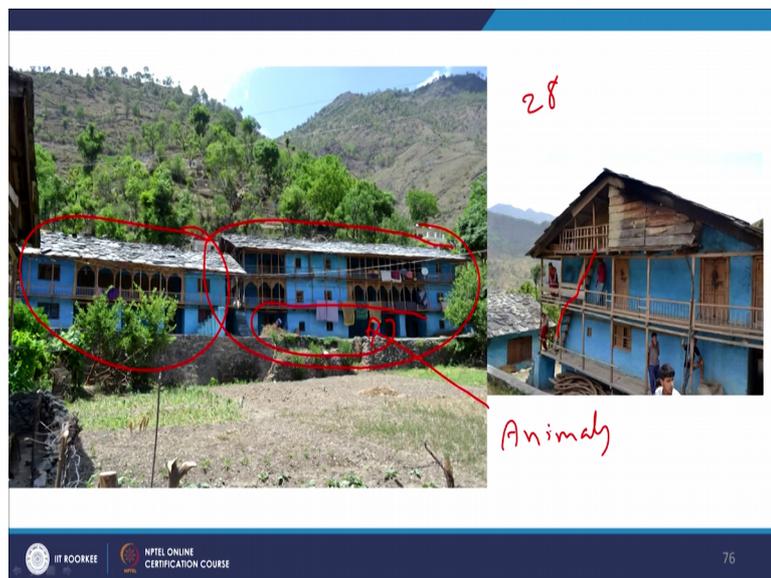


And that is near Harsil and further down, you can also find in places of a Koti banal of even a 7 to 8 storeyed buildings of a multistoreyed buildings built with stone and timber

which is using the Kathakoni styles. And so, you can see the bands of alternate bands of timber stone, timber stone. And sometimes, you can even find 7 to 8 Storeys of building a group of houses (Refer Time: 26:52). This is what they refer as kind of Koti banal style.

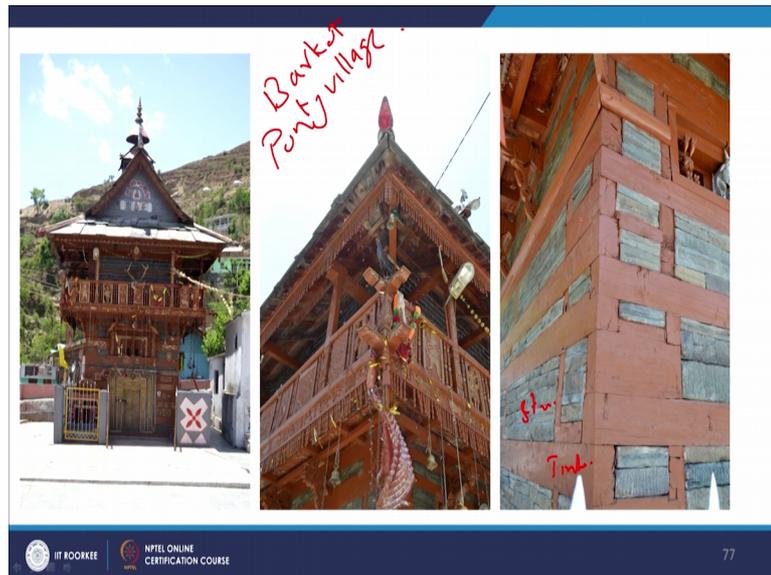
So, you will find a village of, because at hilly area, you will find that series of houses in that same fashion you can see here. And in fact, you will be surprised to see how many rooms inside other I have seen. At least I have visited about 28 rooms in one building, small small rooms and they have multiple aspects. Sometimes, it is one big family who will be living and how their function itself is a very interesting to understand how they use this spaces in what period of the year and what gender use the space.

(Refer Slide Time: 27:37)



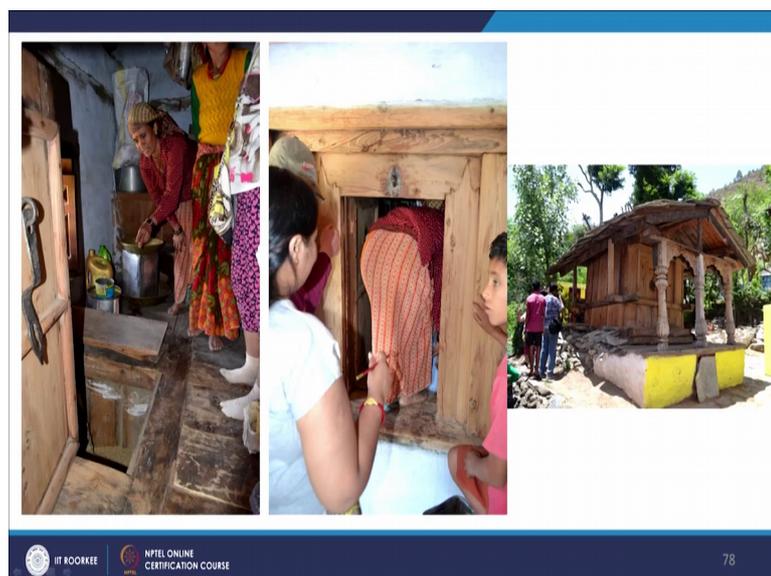
Like one good example, this is about this one longhouse you see about more than 28 rooms within it. So, here on this is a side section of it. It is not like there is a vertical transition and then in the bottom part, they have for animals. So, what you can they have the cattle, they have the grass. So, that makes them also warm, you know having the animals in ground floor areas.

(Refer Slide Time: 28:08)



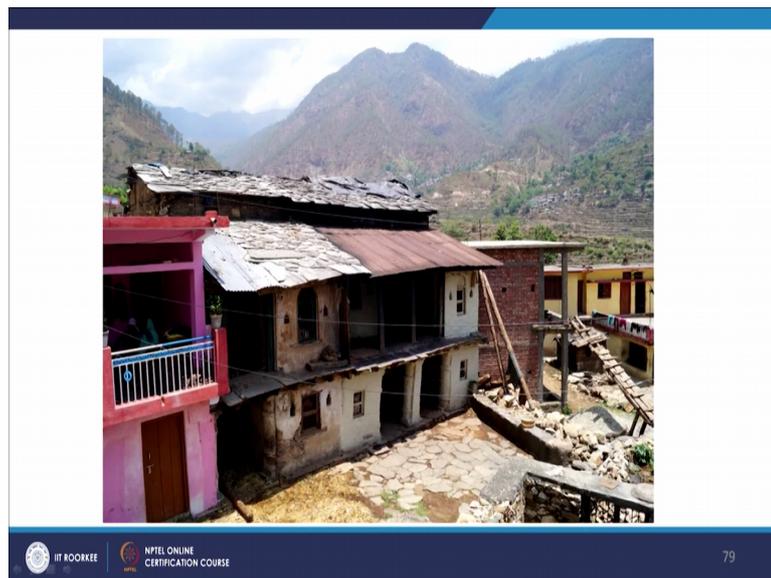
And similarly, the religious aspects of it, any temples you will find a typical temples of this Barkot region, this is near it is near Barkot, it is called Pundi village. So, here the Bhadrakali temple is you can see the kind of technology they have used in the joints. This is the timber and the stone bands and how it is overlaid one other and the whole temple structure and this is the very common style which you will find in this region and which might have survived many earthquakes. And till now, these are the symbolic aspects of that particular communities.

(Refer Slide Time: 28:49)



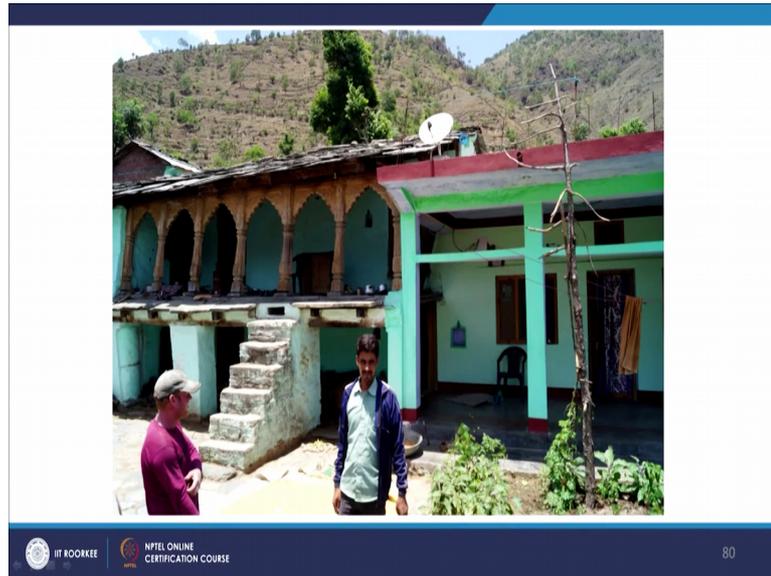
And again, the granaries which I told you this is some of the granaries. So, but inside the homes also, they have some of the granaries like for example, if you look at the scale, it is almost about 2 and half to 3 feet height. So, we can see a person is bending and going and once you go inside, you see the granary the storage area. So, you know completely coupled up with the wooden battens and it keeps the you know the necessary items in without spoiling them during winter or in a summer.

(Refer Slide Time: 29:19)



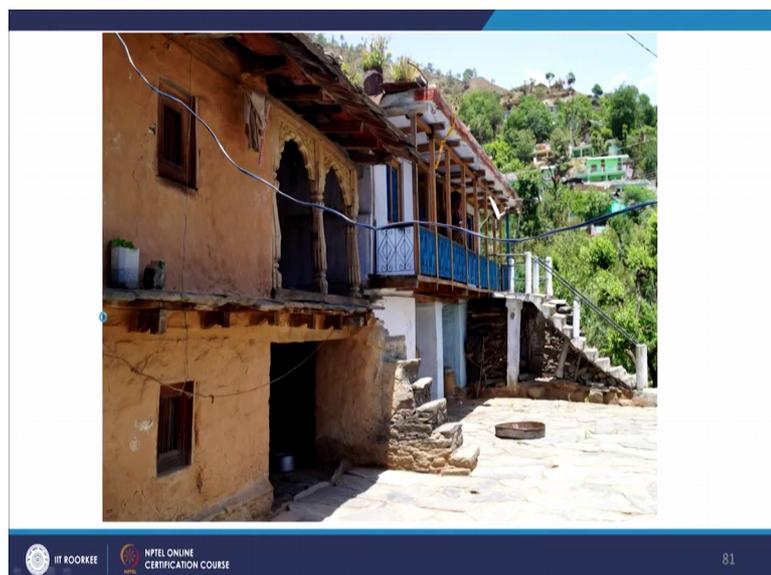
Now, after the earthquake and the floods, there are lot of recent modifications which are happening in this region. Especially, the new buildings were coming and the old buildings were abandoned. So, at the same time, on one side, they are abandoning this old buildings and but during the winter, I have seen people using the same buildings because, it makes them warm like a good example of this.

(Refer Slide Time: 29:44)



So, in earthquake, this particular facade has fallen like this and then they built another one. But, in this case, what they are doing is you can see they are cooking, they are using this space even now, right. So, in winter, they are even sleeping there. So, despite of having a modern interventions in their places, but still these old buildings. So, becomes that kind of double house concept.

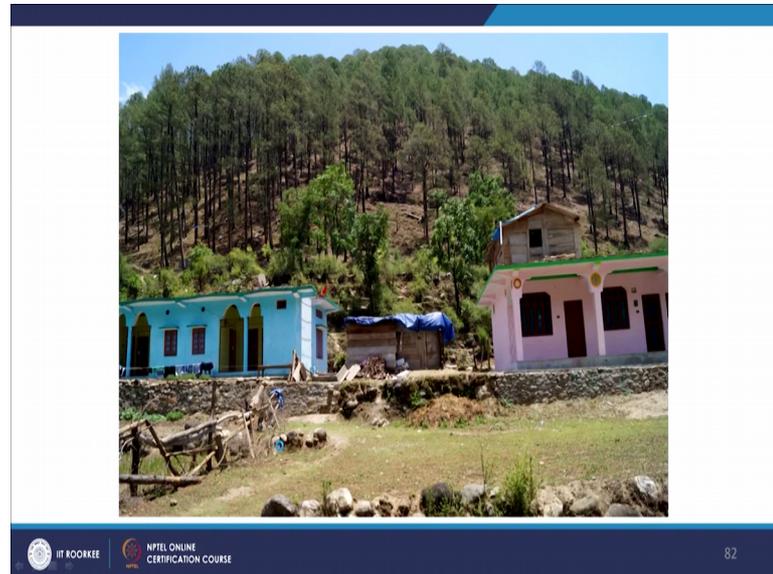
(Refer Slide Time: 30:15)



And similarly here so, still this particular sometimes the old people, they are using still using this places and the younger generation started using here because of certain

modernity and modern impressions which they are thinking of. But, ideally for a climatic reason, this is much more sensitive to the climate, but now, much more in advance.

(Refer Slide Time: 30:32)



So, we have still, we have seen an adaptation; one is an abandoned version of it and one is a seasonal version of it and the third one is side by side. You have a double house concept, you know you are using this and that. But, you see completely which is relevant of what they have lived. So, these are in somewhere near Karadi village in Yamunothri and you can see after the disaster, they migrated somewhere and they built completely new which has nothing to do with because, their style the living style also have gradually changing and they believe that this a kind of durable nature.

And, the problem of all these, why we are trying to ignore these traditional technologies? One legally, first of all, there is a legal restriction because, the moment the forest regulation acts have a control with your access, obviously, that is one limitation. The second limitation is availability of craftsmen who will do all the crafts. It is more expensive to build a timber home now rather than building a brick and concrete home is much more easier and much more least expensive. So, people are going for that.

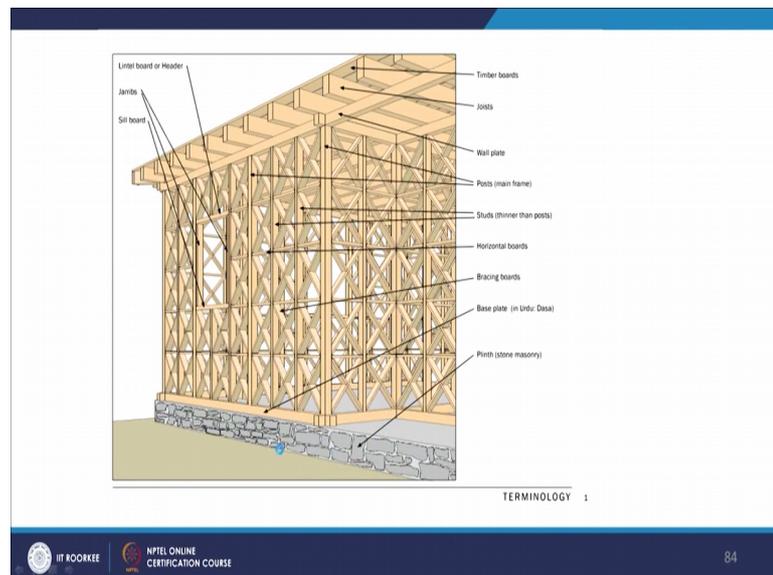
So, and the other thing is, any how are the building codes or any other codes the structural codes how are they categorizing these indigenous techniques. So, that is where I think the central building research institute in India, they also doing on validation of these traditional technologies especially, with the ministry of rural development.

(Refer Slide Time: 32:16)



So, in the same process, I can show you some good examples of especially the Dhajji constructions and where the Pakistan government is working on a guidebook for technicians and artisans how to do a Dhajji construction, what are the technicalities involved in it.

(Refer Slide Time: 32:29)



You know, how we can qualify these traditional technologies into the code process and how we can make it them eligible. So, then, that is one way only we can bring this traditions back into the modern times in the present context.

Thank you very much.