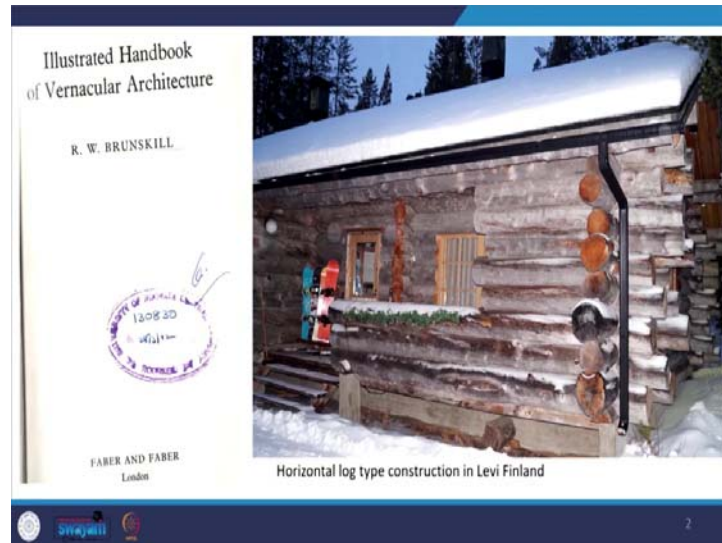


**International Studies in Vernacular Architecture**  
**Professor Ram Sateesh Pasupuleti**  
**Department of Architecture and Planning**  
**Indian Institute of Technology Roorkee**  
**Lecture 09**  
**Timber as Vernacular Resource Material**

(Refer Slide Time: 00:35)



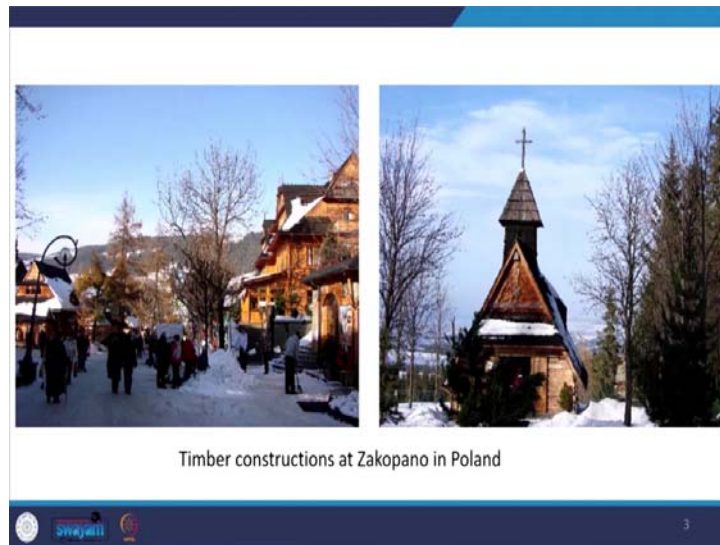
Welcome to the course International Studies in Vernacular Architecture. Today, we are going to talk about timber as vernacular building material. So much of the literature has been addressed in Brunskill work about types of timber houses, the crack frames, and how they are constructed, the construction techniques. So, I am going to give you an overview of these timber construction techniques, which we can commonly found in Europe, England, and many other parts of American continents.

So, after this, we will going to have some small introduction with the Indian context, especially in the hill States of Uttarakhand how the timber houses are even till today they are existed and how they are maintained. And we are also going to discuss about how the tradition versus modernity are negotiating with each other in the current context with the help of 2 cases with Alto Mayo case in Peru and as well as Uttarakhand case in India.

So, when we talk about the timber frame buildings or the wooden houses wooden architecture we call, so, some of the common types especially in the colder parts of European continent, whether in Sweden, Norway or Finland, like for example, this house is from Levy, Finland is a cottage and levy where the ski resorts are there and even till today, many of them still live in these timber houses, log houses.

And the simple technique is they have these horizontal logs, which actually interlock at these junctions and that actually formulates as a dwelling unit. So, very simple technique of making a wooden house and the advantage of this wooden house is it can keep you warm inside during the cold conditions and during the summer times can give you some cold conditions inside.

(Refer Slide Time: 02:32)

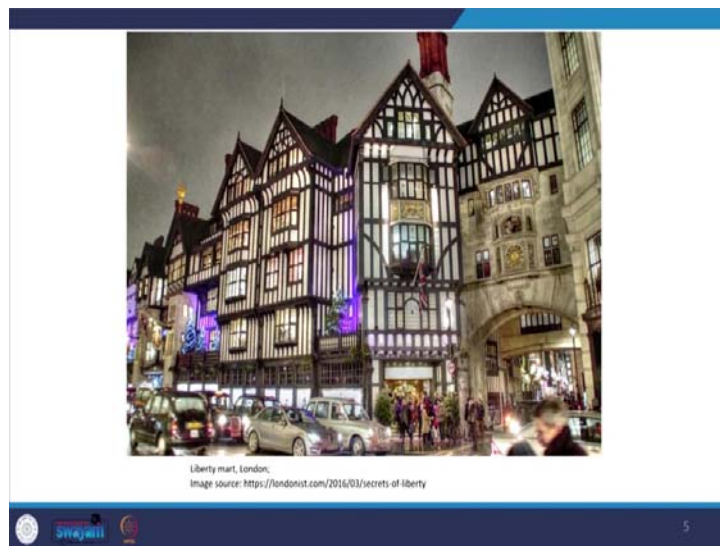


So, similarly, you can find many such places where the whole villages are completely built with wooden architecture like once I was doing some work in Zakopano in Poland and could see the whole village is completely whether it is a monastery, whether it is a church or any other things everything is built with completely with wood.

Because of the harsh climatic conditions, they have adopted the local materials and the kind of techniques they have adopted, it is not only the log house what we can find in the northern part of Scandinavian countries, but here we can find the wood cladding and we also find the timber frame buildings as well.

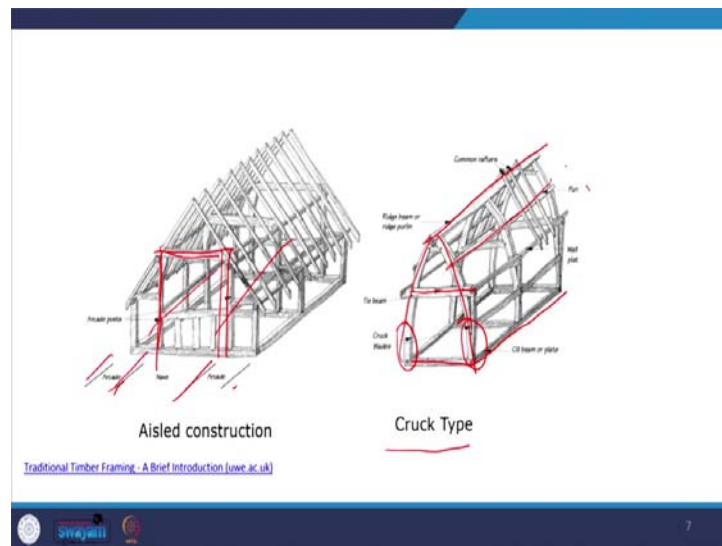
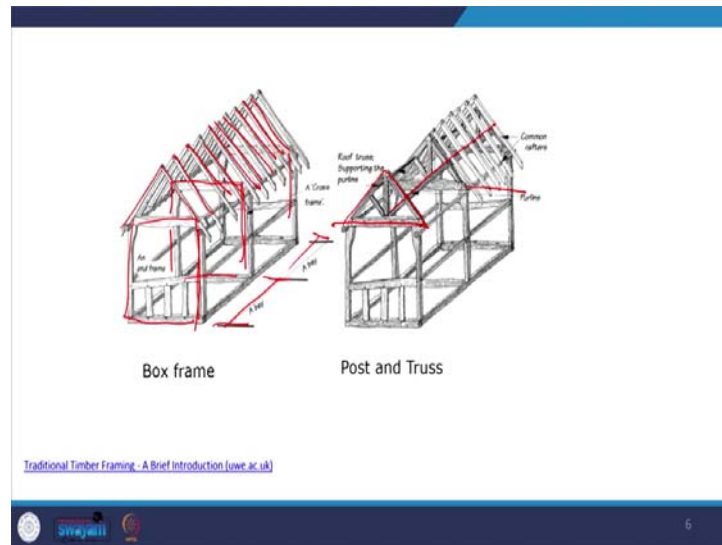
So, in many of these traditional houses, we can also find how these frame construction mix with the earthen material as well, so, how the traditional houses demonstrate the combination of materials both timber and the low materials in the construction.

(Refer Slide Time: 03:33)



For example, in the Stratford upon Avon, we can see that it is having a combination of both the timber as a structural elements or it is actually filled with these low materials. Very much in the heart of London, you can see the Liberty mart in London, that also you can see a similar model of the combination of wooden and the other composite low materials.

(Refer Slide Time: 04:03)



When we talk about the types of built forms, especially used in timber frame constructions are one is box frame, there are actually 4 types, one is box frame, in the box frame, what you can actually see is you have they are divided into different base, and you can see that there is this cross frames, so you have these segments which actually divides the whole building into different base and over that you are going to get a roof elements.

But here you do not find something which is connecting all the purlins which is connecting these roof it is like basically acts like a cover or lid on a vessel so that is how it is framed. Whereas the second model where we can see is a post on the truss. So here we can see the kind of truss which is a unified factor in this and we can see there are common rafters.

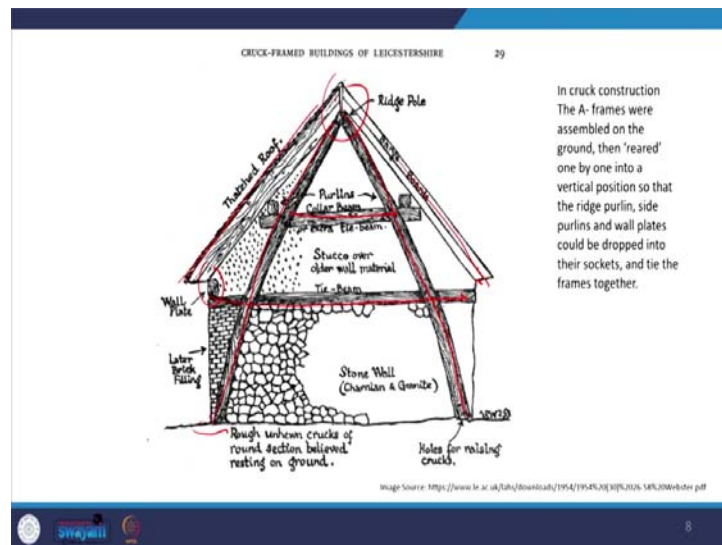
And these purlins which are actually connecting these trusses together, the purlins, which makes an important role because that is where all the trusses are connected together. The third model is L construction here we can see that especially this is very prominent in when we are doing construction of churches, or any religious or any other forts or any other public buildings.

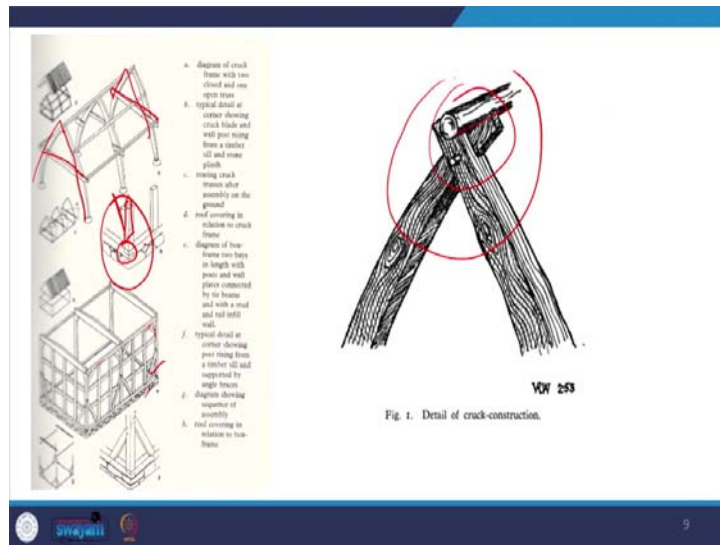
So, where we can see that there is a nail which is created with the 2 arcades along and these are referred as a kind of arcade post, and which actually make these aisled and over that the roof is made. So the most important form is the Cruck type construction. Here, they will actually collect the inclined timbers and they try to make a kind of A frame, and they try to assemble it and they join it with these ridge beam or the ridge perlin.

So here, this is the tie beam. And these are the Cruck blades here because from the bottom we have, let us say we call the sill beam or a soul plate. And we can sell I am going to show you the joinery of this.

And so, that is how this these incline member is joined here with his cruck blades. And again these purlins are there as we found in the post and truss model, this purlins actually bind all these systems.

(Refer Slide Time: 06:33)





So the more detailed version of this cruck frame buildings, one of the example in Lester's we can find that, see the timber frame the incline members are actually formulated as A frame and they are assembled at the ground and read one by one into your vertical position. So that the ridge purlin and the side purlins on the wall plates could be dropped onto the sockets and tie the frames together.

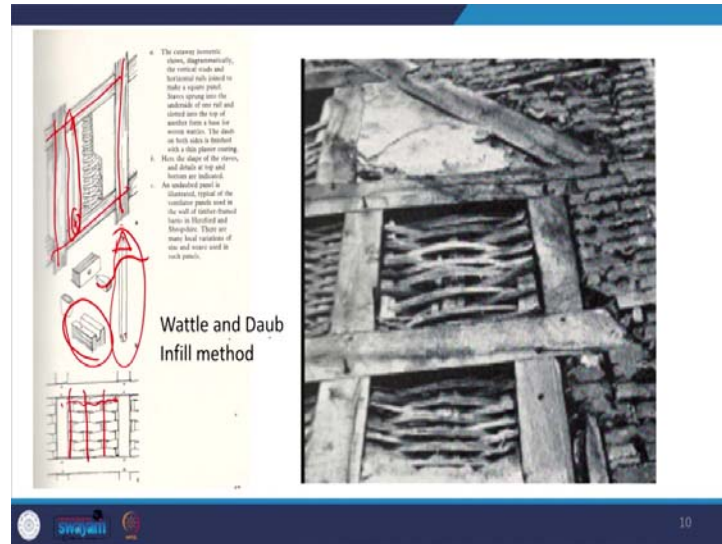
So, here we can see these wall plates and then we have these based on ridge pole you can have these kind of roof structures and the tie beam which connects the whole structure and the color beam at the top which creates a kind of attic space and then the infill material could be a stone wall and you can have the brick filling you can have the stucco over older wall materials.

So like that a variety of materials could be composed within these compartments. So, on the top, what we can see is a kind of lap joint come like this, and the ridge purlin passes through that and that is how the joint is made. So, when you actually see that, we can see that in this particular diagram, there are 2 closed and one open truss.

That is the kind of model and here you can see the joinery of at the sole plate or the sill beam, where you can see a lap joint and this is where the inclined member starts and this is where the vertical member is. And whereas, you can see the frame of these 2 bays in length with posts and wall plates connected by the tie beams with a start and drail infill wall. So here, this is where the infill material will be placed upon.

So again, similarly, we can see the corner post rising from the timber still supported by so these are supported by the angular braces. So that is basically about the kind of structural form, but let us come to the construction elements how we use for the filling material.

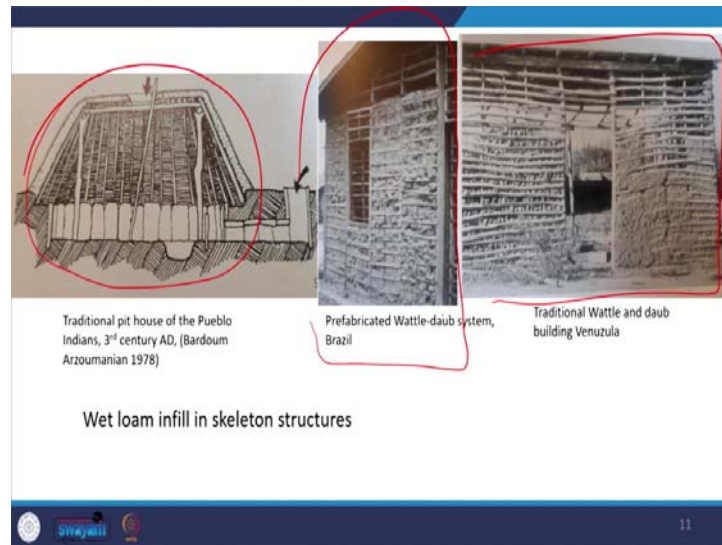
(Refer Slide Time: 08:32)



So, one of the prominent technique is wattle and daub technique. So, here if you can notice like these are the staves I think, if these wooden locks are actually making these compartments and the horizontal rails and the vertical Studs they actually make a square panels, and within that, you have these staves, which are actually pushed into these upper side on the lower side of it.

So, in that way, they actually formulate a grid within this box, and then the wattle is woven in alternate directions, like we have this in one on to this side and the other on this side. So, in that way a pattern is also created, and in the bottom of the staves, this is how the detail is all about how the stave is going to sit on it and in the top, it is having a groove about and it will be fixed on trails. So, once this is done, then the infill material whether it is a thin plaster coating will be filled from both sides.

(Refer Slide Time: 09:33)

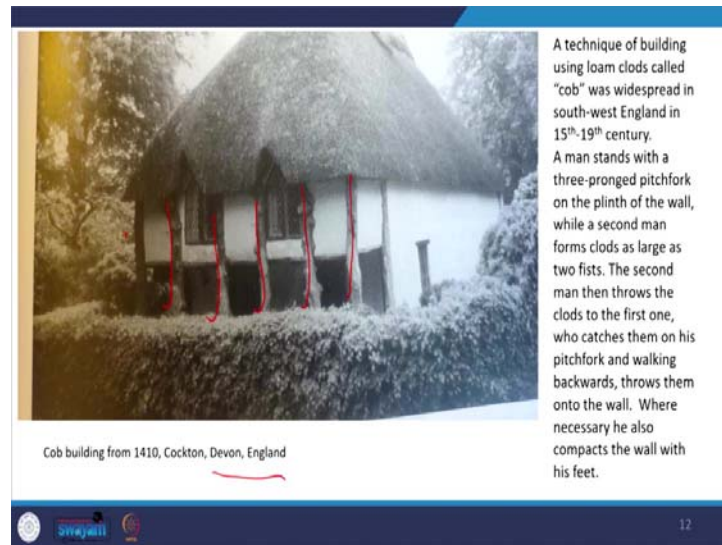


So this wattle and daub construction is not very recent even we can find in the Pueblo Indians houses traditional pit houses were dates back to the third century AD and we can see that this whole roof structure is completely made with a wet loam infill in the skeleton structures. And there are also many advancements which we can find the people have adopted the prefabricated Wattle-daub system in Brazil.

And also we can see the Wattle and daub buildings in the Venezuelan country. So, here again they see that, they actually do some infill material within this frame and then they plaster with this wet loam plasters depending on the soil conditions depending on the loam conditions where it is available, what kind of binding elements it has, whether it is in soil content, silt content, clay content, so, all these things they will look into it and then if there is any stabilizers that they may have to add and then they try to apply it onto the surfaces.



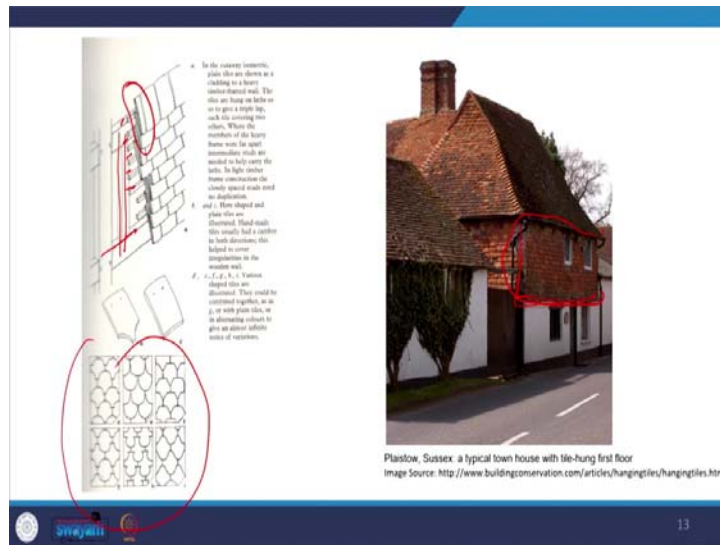
(Refer Slide Time: 10:36)



So, on a similar note, there is another model which we should also discuss is the Cob buildings, so, where this is frequently observed in the Devonshire England and which is become wide spread in around 15th to 19th century in the Devonshire in England. And this is where you can see the tree trunks actually formulated these panels, the kind of spaces for the windows on the infill material.

And then here what they do is they actually a man stands with a 3 pronged pitchfork on the plinth of the wall. And whereas the second man forms the clods, which is basically the balls and as large as 2 fists, and the second man then throws to the clods to the first one, and he catches that into the pitchfork and walking backwards throws from onto the wall. So, he also compacts the wall with his feet wherever it is needed.

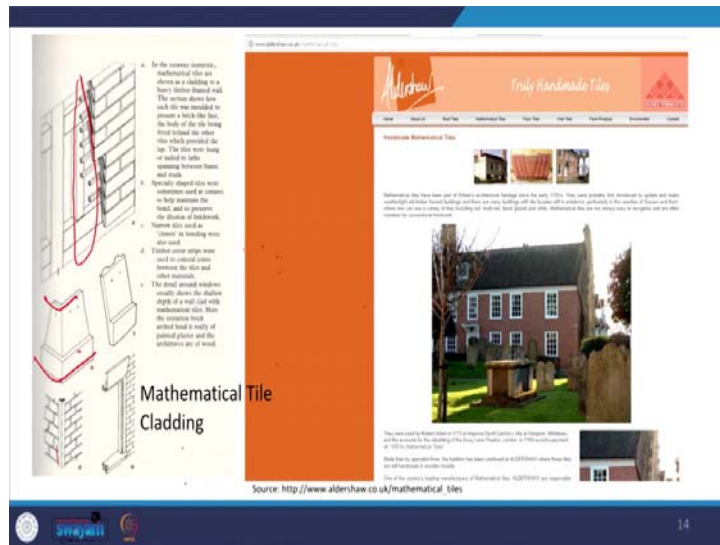
(Refer Slide Time: 11:21)



So, when we talk about the external facade elements here, we can actually notice that within that once the timber starts have formulated as a frame, then people also do with the tiling as a cladding material. So, here we can see that how the tiles are fixed once the start frame is fixed, then you can see the battens over there maybe they may range up to 45 mm to 50 mm or and then they have these regular intervals and then there is a triple layered here you can see that their triple layered mathematical cladding process.

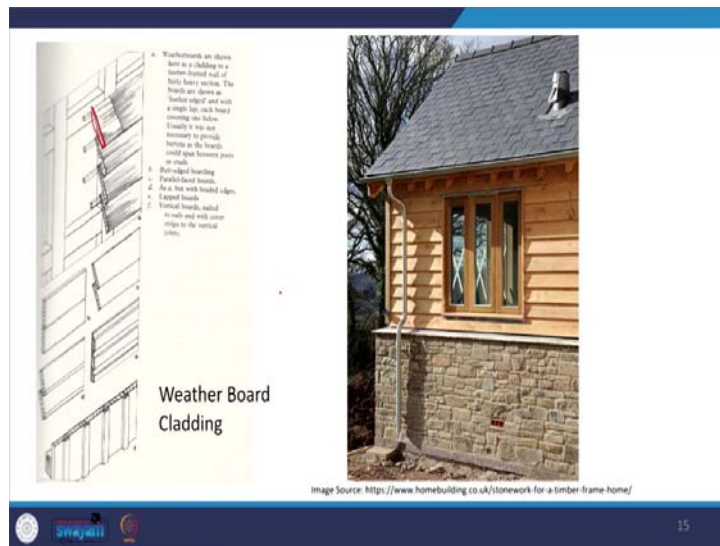
So, different varieties and different formats could be developed within that and there are different shapes of tiles which comes in the market and how they can use this as a cladding materials. And in the present building industry, what we can actually see is, now that the cladding material has been advanced and it has been produced as a mathematical tiles.

(Refer Slide Time: 12:20)



So, these tiles are nothing but there are initially introduced around 17th century and they are weather tight old, timber framed buildings and what they do is they actually use the same principle of having the battens on the external facade and with different shapes, for example, this is a corner tile, so, that you do not see the joinery of the struts also. So, in that way, you can actually prepare in the way you want for the building requirement.

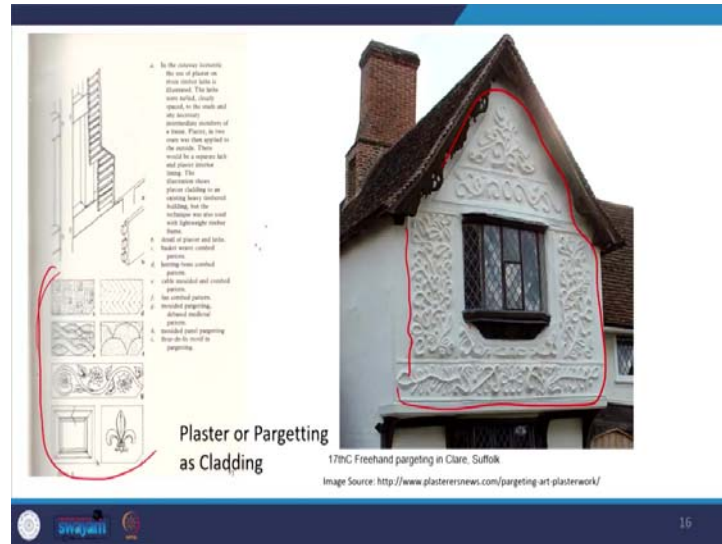
(Refer Slide Time: 12:53)



And similarly, we use weather boards and this is also in the similar technique like here, we have these battens and they overlap to one another. And generally the way it has to be fixed onto this site, because the rain water when it falls, it has to dry from top to down, it will never go in to be like this because of the rain water go inside. So there is a method of how you

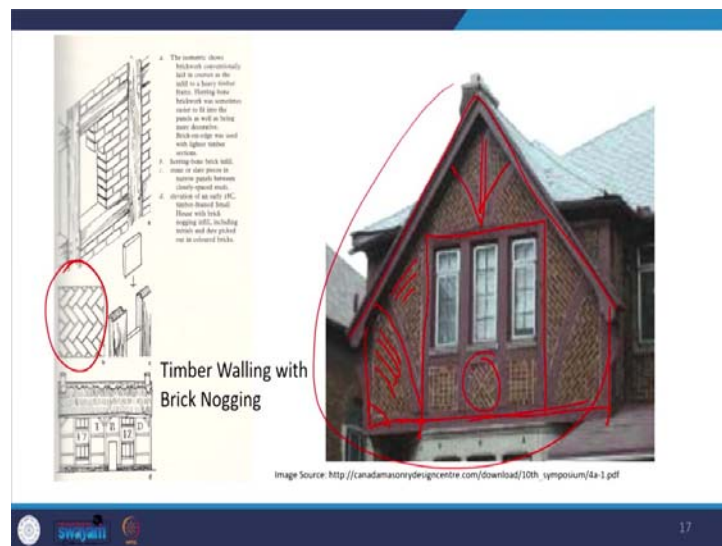
apply these weatherboard cladding. And nowadays, of course, they are also using certain ACP panels or the aluminum panels also in the cladding material.

(Refer Slide Time: 13:25)



And when it comes to the traditional representations, especially in Suffolk area, we can actually find this pargetting techniques which they have actually used these plasters and they actually do these decorative elements, so, they actually make these facades interesting with these pargetting techniques. So, here what they do is they have different formats with inter woven things and concentric patterns and zigzag patterns. So, in that way, this is a kind of decorative element even till today they are using it.

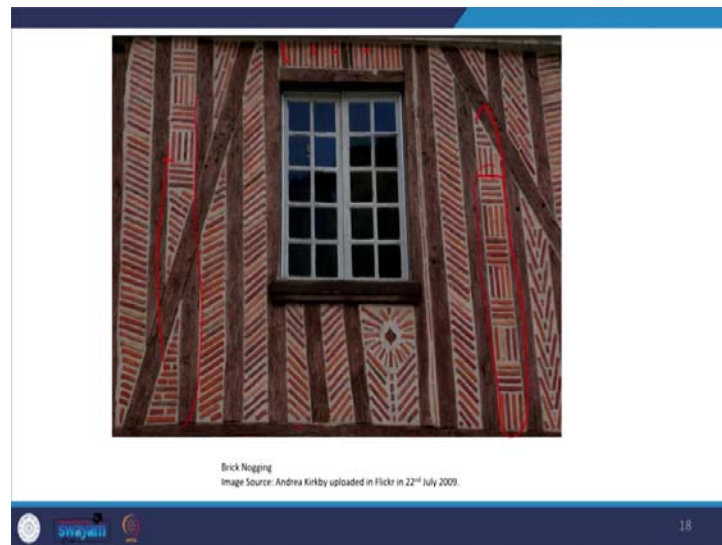
(Refer Slide Time: 13:55)



And we talk about the timber walling with the brick noggin technique. So, as I said, once the frame is done and the struts and their sill plates and the roof plates once the frame is done. So, basically the infill material we have talked about battle and dark technique we have talked about, cladding techniques and the brick noggin technique is also an important factor. So you can arrange these bricks in different directions in a zigzag pattern here.

Or you can see that they can also in the same house you can see they are arranged in different patterns here you can see a zigzag pattern and here they are arranged in a inclined pattern in one direction and inclined pattern in another direction. So in that way a patterns could be created with this process. So the detail of it if you look at it, so this is how the detail could be worked out.

(Refer Slide Time: 14:51)



And to be having more clear understanding of so you can see that brick has been nog within these spaces and that is how the patterns are created. And they are actually followed a particular typical element, in both the cases, if you will see like, there are following some similar patterns on either side of it.

So that is a kind of background on how the timber building the wooden architecture was there and how different types of buildings do exist and how different patterns of the construction elements do exist. But now we are going to talk about how these traditional elements, how they actually respond within this modern set up, modernities.

(Refer Slide Time: 15:27)

## TRADITIONS Vs MODERNITIES

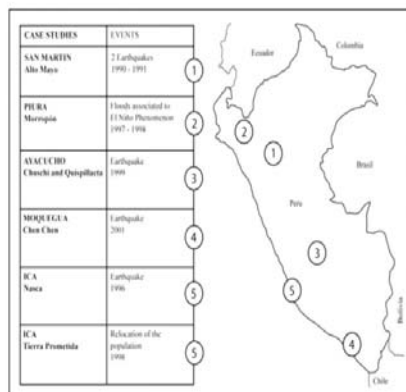


Figure 13.1 Map of case study locations in Peru

Adapting traditional shelter for disaster mitigation and reconstruction: experiences with community-based approaches

Thao Schilderman

To cite this article: Thao Schilderman (2016) Adapting traditional shelter for disaster mitigation and reconstruction: experiences with community-based approaches. Building Research & Information, 44(1), 44-49. DOI: 10.1080/09513252.2015.1028287

It was decided to discard the use of rammed earth and adobe and use improved quinchá (timber frame) instead.

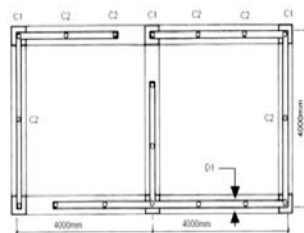


Figure 5: Plan view ©Practical Action /Duval Zambrano/J. Cuizano

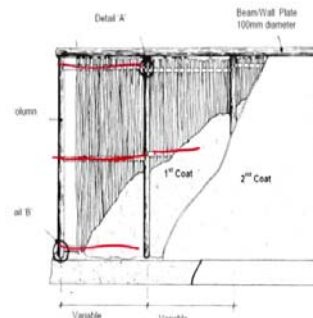


Figure 6: Wall construction ©Practical Action /Duval Zambrano/J. Cuizano

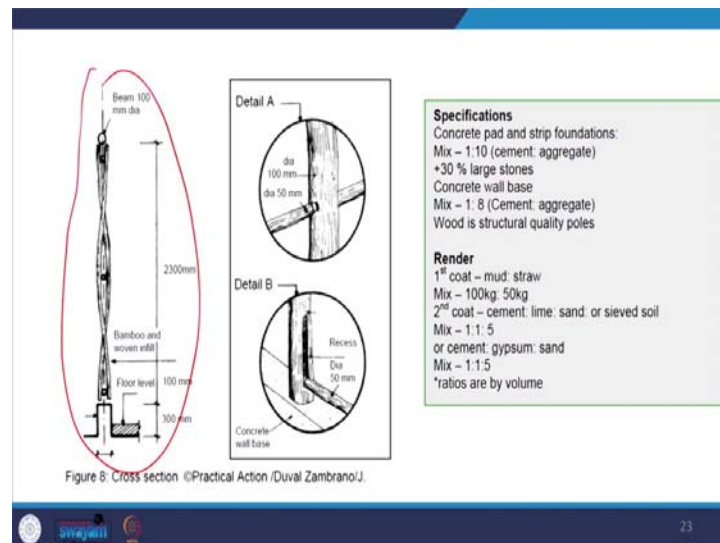
So I am going to talk about 2 different contexts. One is in the Peru context, and the other one is in the Uttarakhand context. So in the work of Theo Schilderman work, where he talks about adapting traditional shelter for Disaster Mitigation and reconstruction, and his experiences with a community based approaches. So basically, he talks about different cases.

And I am going to talk about one particular case here, and especially with this Alto Mayo region were in from 1990 and 1991, the series of earthquakes, which has impacted these areas, and many injuries, and many deaths have been reported, and many people lost their houses about 6000 homes were destroyed or damaged.

So, what they did was because the existing Adobe construction techniques, so, they tried to discard that process, because of the earthquake conditions. And now, they want to improve kind of structural reinforcement, and they have adopted the local quincha techniques, the timber frame. And so, what they did was the technique is very simple form, and you have this wall, and this quincha is basically the, the battle or the beam, which is woven into that.

So, in the previous discussion, we thought of the staves on coming onto the vertical, but here, it is also coming in the horizontal level, and these staves are interwoven at these 3 directions. And then for instance, if you can see these, when the 2 panels are joining, you can see that, they are just slightly overlapping above one above the other, so that we can nail to each other for the nailing purposes also, and then the 2 layers of code will be applied.

(Refer Slide Time: 17:13)

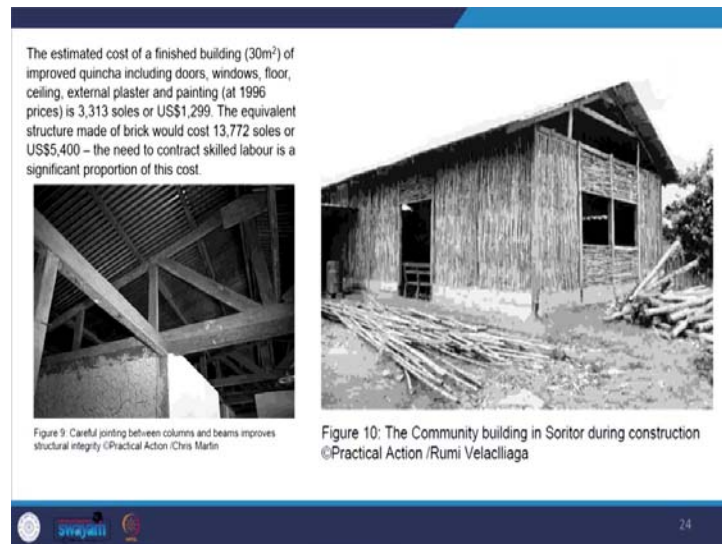


And here you can see this is the sections of these bamboo and woven fill process you have the floor level and this is how the bamboos are intertwined like this. And so, for instance, we

have the concrete pad and the strip foundations the mix is about 1:10 + 30 % of the large stones in the concrete in the foundation process, and whereas, the wall base it is about 1:8, and wood is actually composed with the structural quality poles.

So, in terms of the render, render, there are 2 coats, the first coat is run with the mud and straw and the second coat with the cement lime and the sand. So, in the ratio of 1:1:5. So, when they actually adopted this particular improvised quincha technique, and they constructed these houses in 1996, it was costing about 1300 US dollars.

(Refer Slide Time: 18:09)



And whereas similar equivalent structure made out of brick was costing about 5400 US dollars. So, that is how this has proved efficient, cost efficient. And it is also able to prove because of its lightweight in nature. So it has been proved a successful model. So, in fact what kind of impact that this project has brought. Of course, I am not going to talk to you about the whole project management and other things, but I am just going to talk about the final outcome of it.



(Refer Slide Time: 18:39)



**Project impact**  
The direct intervention in reconstruction activities by Practical Action and C aritas ceased in March 1994 and had, by that time, resulted in 558 improved quicha houses being built in the Alto Mayo province. There are also many thousands of improved quicha houses which have been built by men and women, independently of the project. The 1993 national census estimated that quicha formed just 7% of the national housing stock but within the project area this figure rose to nearly 30%.

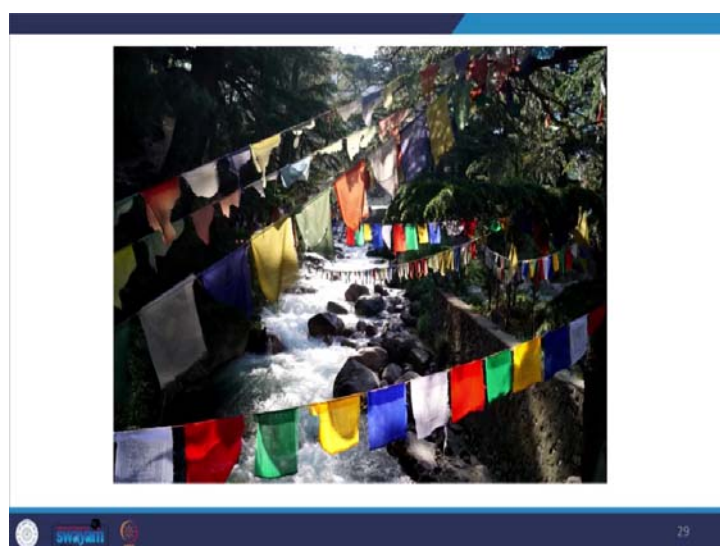
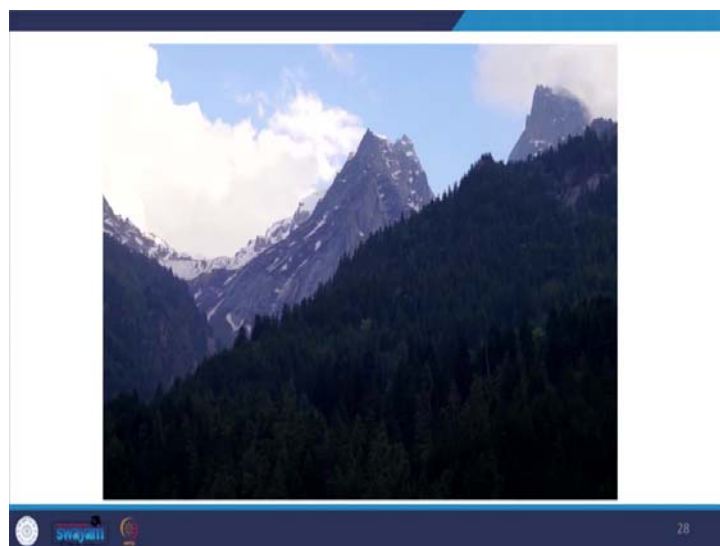
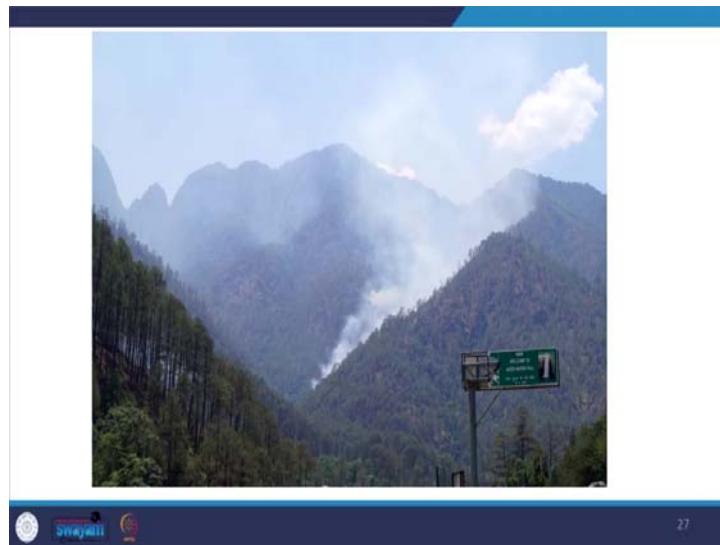
Figure 11: Improved quicha building in Jepelacio  Practical Action /Lucky Lowe

25

And in the 1994 it has only 558 improvised Quicha houses built in Alto Mayo province, but and it only formed in 1993, it only has 7 percent of the national housing stock and but when this project area within this project area, it has rose to nearly 30 percent. So, people have understood the essence of this improvised techniques and they gradually adopted these techniques in their places.

So, in that way, there is some improvisation process absorbed in it. So, that is one cases where traditions has been improvised and people have accepted and it has been scaled up further independently also. In the Indian context, I am going to discuss you about some of the timber buildings would an architecture in Uttarakhand,

(Refer Slide Time: 19:23)

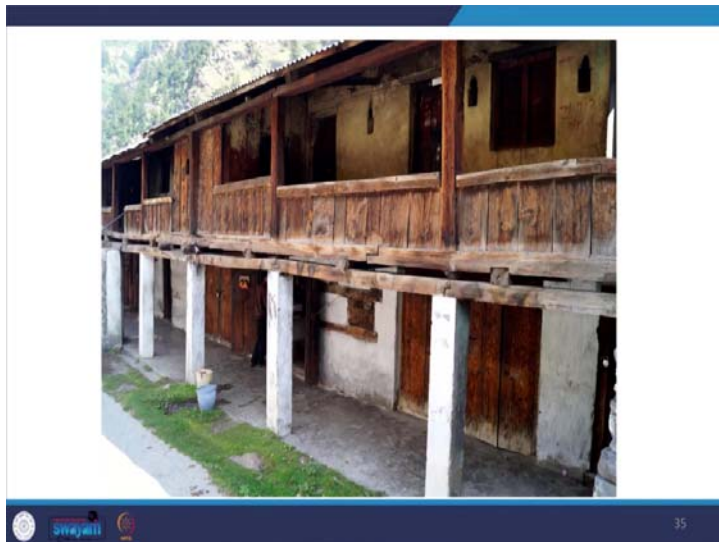
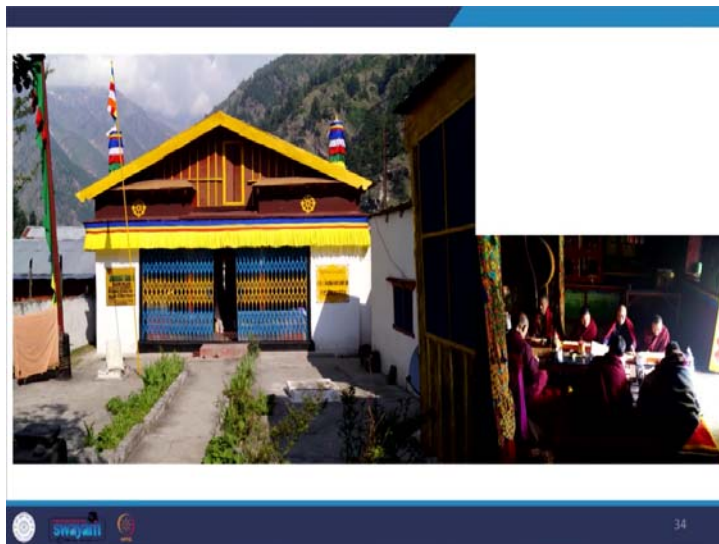




And especially these are some of the places in Gangotri and Yamunotri region where we were doing some studies earlier. And there are many communities, Rajput communities Bhotiya, who lives over there and they have been surviving in these harsh conditions. So, this is one of the village of Bagori near Harsil.

And we can see this Kath-khuni style of architecture where you have these horizontal bands of wooden members and then the stone walls with an alternate layers. So their best proven as a kind of traditional earthquake format because, the alternate led these wooden bands act as like a sill band and the lintel band, what we use in our regular constructions. So they are been proven very efficient.

(Refer Slide Time: 20:13)

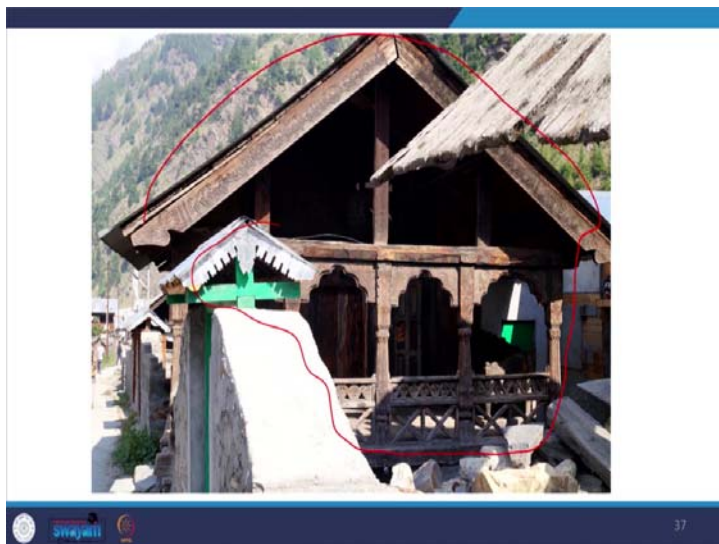




And you can see that there is very linear Village and this is a kind of traditional character of this village that have the Buddhist monks the temple and their whole dwellings are made with of course, usage of the pillars as well as the top floors and the railings, and the roofs are made completely with the floors are made with the wooden elements.

And the even many of the houses are completely made with the wooden elements. So, these were these people used to live before in a long valley and after the war, they moved here and then they settled here, and during that time, they constructed using these timber houses.

(Refer Slide Time: 20:52)

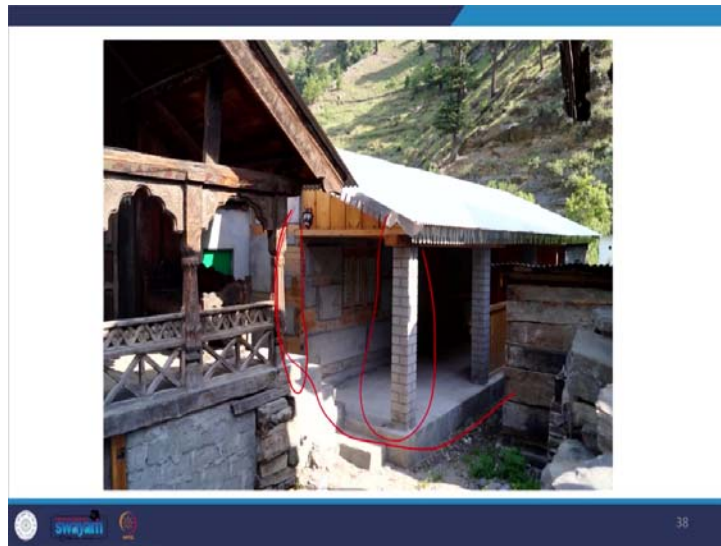


But if you look at it, the kinds of artisans the kinds of craftsmanship, they invested, that is very interesting. And today, unfortunately, you do not find such craftsman who can do this

kind of meticulous work. So, there are some linguistics associated to it, there are some signs and symbols associated their house friends and then belonging.

But many of these people they have to live 4 months during the harsh winter times in the downhill areas, maybe in Duda area, and then they mostly come in the summer times and live here. So, in this process, nowadays, only the ancestors, their elderly people are living ended up living here. And sum many of them they try to migrate to nearby towns.

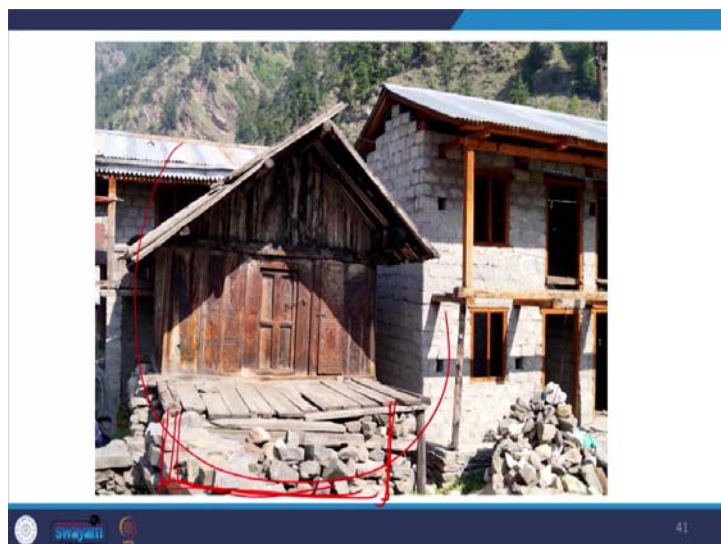
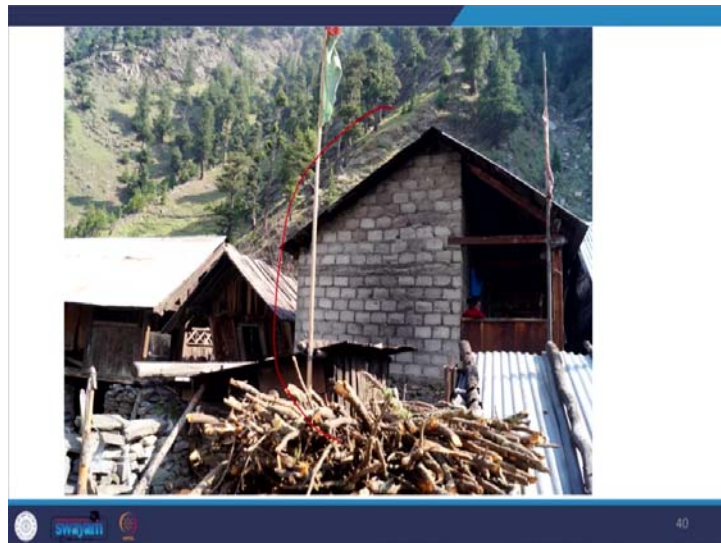
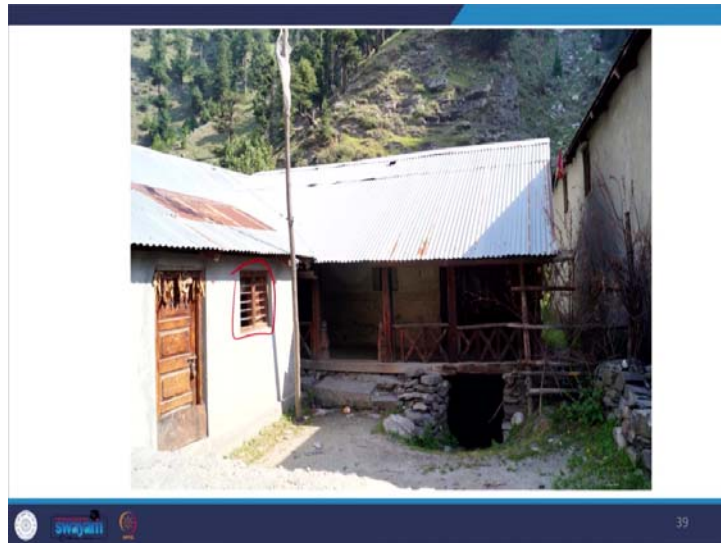
(Refer Slide Time: 21:36)



And some of the houses are abandoned in nature. And some of these, you can see that they are actually modifying some of their techniques, you can see that they are adopting a similar outcomes, but the problem now they are facing is they cannot access the timber because with the forest Regulation Act, now, each family they are only permitting probably one tree, but to make one house, they may need completely about 9 - 10 trees.

So, but today, it is not possible it is it is almost a dream for them to have a wooden house. So still, they are able to come up with kind of negotiation with the traditional qualities and what they are able to get in the local market, they are going to get these AAC blocks or the concrete blocks and they are going to blend with these cultures.

(Refer Slide Time: 22:24)

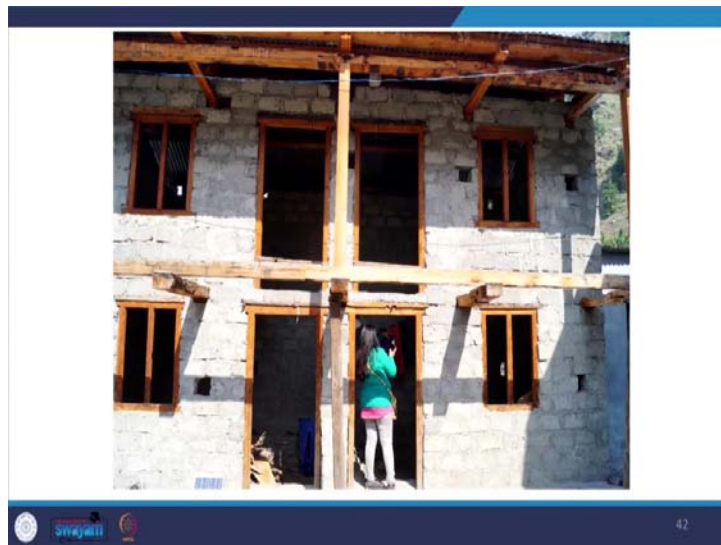


So, here even the heights that the window opening sizes which they had. So, though it is the modern craftsman, the modern elements, which we are bringing out, but somehow they are trying to negotiate with what they have and what they are trying to adapt with it. So, of course, these are all the examples which communicate different meanings, how the new materials are bringing a different because obviously.

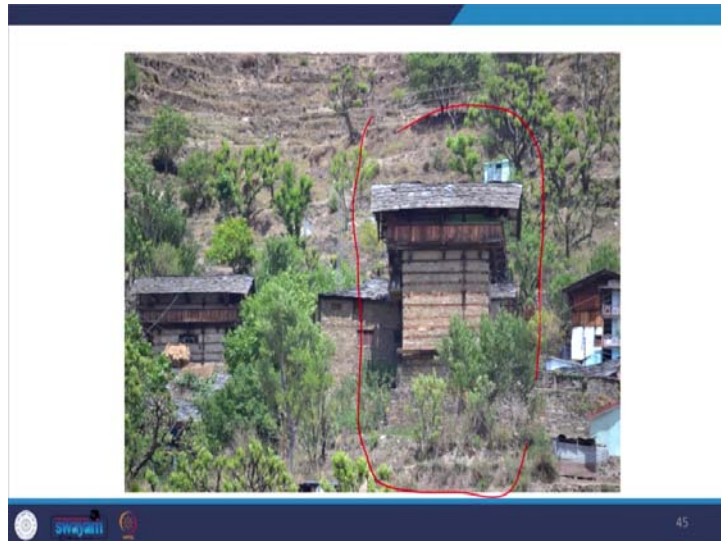
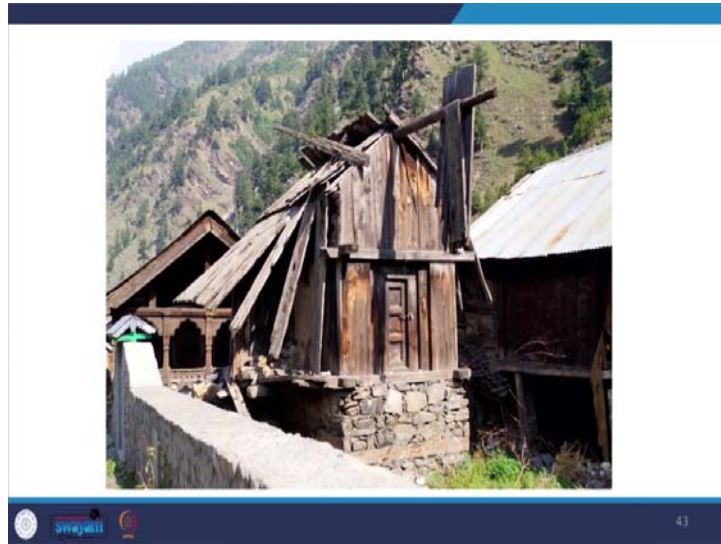
They feel that these are not very good for their climatic conditions and similarly their storage of the grains and also all these this is a storage for the grains because 4 months 5 months, what they do is they actually store all these grains for the next whole winter time and then so that they can survive on it.

So, because they have a small under the I mean underground floors, so where they actually store all these food products, and now with the newer materials, because that is what locally available for them right now, because the cement concrete blocks can come by a truck and they can make it and even the local Masons who are settling in the nearby towns or nearby taluks, they can come and do these constructions.

(Refer Slide Time: 23:29)



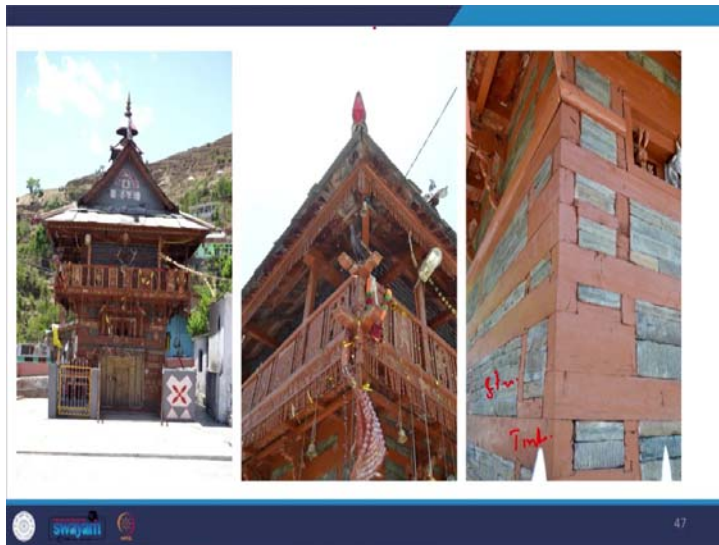
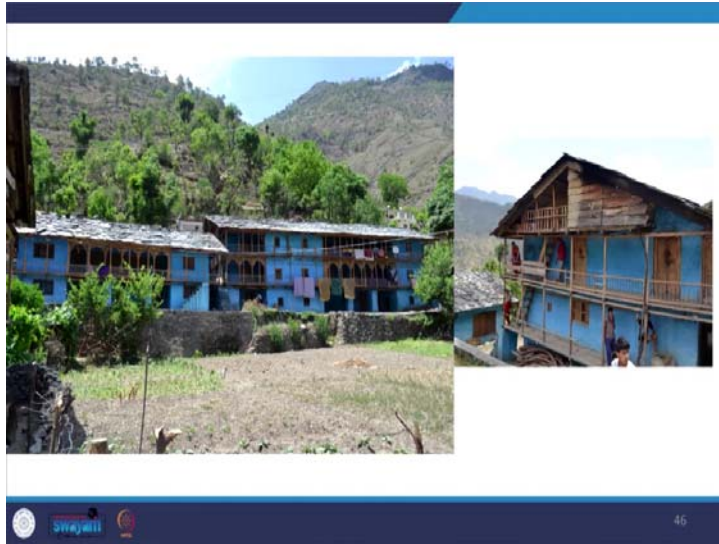




But unfortunately, they are not able to find any of these craftsmen who can actually do their traditional buildings. So, similarly, we can see that many buildings which are getting abandoned. So one of these families they do not know the left or they have migrated somewhere and their house was lying decayed for many years.

So, in that way, we can see many number of these houses in different villages. And also the famous Koti banal techniques, what we can see is the tower shaped structures and almost 20 - 25 rooms existed in these kinds of buildings. And these are very famous in this Koti banal area.

(Refer Slide Time: 24:11)

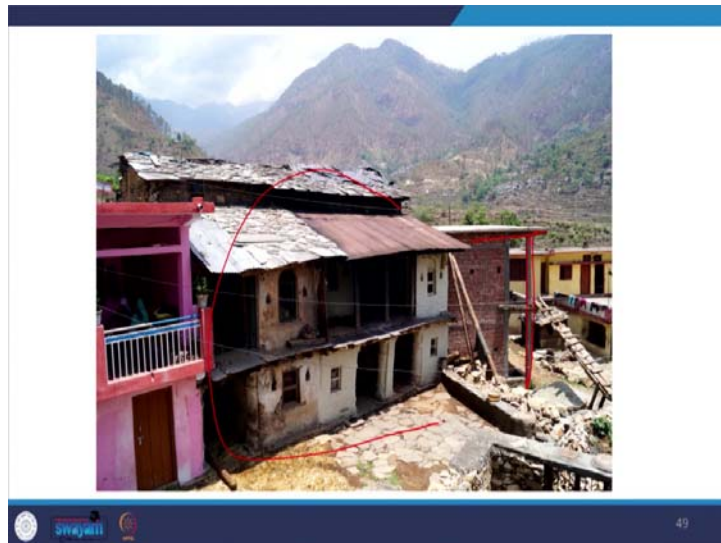


And so similarly, some of these houses are also completely made with a wooden and low material. And here, this is an example of where 28 rooms existed in this particular house, and people still maintain these houses, but the newer things which have come for them with like no gas cylinder, the cooking gas, they are actually able to get the new toilet systems, so all these things, there are some new adaptations we can observe in these processes.

And the temples, the traditional temples, which are finely carved and because that is the symbolic representation of the craftsmanship, how they showcase their belonging, and the kind of respect the kind of faith they have in these particular temples.

And this is one of the interior of these storage houses, where they are stored, so they go inside, and then it is almost half a meter, and then they go inside and then you can find actually all these wheat, barley or grain, the rice, everything is stored in that, so that they can use it for the rest of the period. So, these are some of the traditional techniques.

(Refer Slide Time: 25:23)





But today, what you see actually commonly in these villages is many of these traditional houses are getting abandoned and the newer constructions are coming into the picture, but one has to really understand, are they really not able to qualify for this? Or why are people, why are people able to go for the newer construction, this is something one really have to inquire and even after a disaster, one can see after the earthquake, though this house has got some minor repairs, and it is not safe to live here.

But you can see the inclined facade, and people they construct a new house next to it, but still, the elderly people they still live in this house and they cook there because they were they have their attachment in these particular houses. And they feel comfortable because of the cold climatic conditions. And what the kind of the comfort level they get in this particular houses. The similar model they have people have abandoned and they will start building a new house next to each other.

Now after the, this is somewhere near Yamnoti there is a village near Kharadi and where some of them were affected their hotels were affected their houses were affected. And now, in response to this, what they did was they got there, they have their own land and they constructed in a completely modern responses. So this is one thing, when we went there, we can see like the way the tiling is done, the floor tiles are there the ceramic tiles have been used. And then the way we observe in our plain lands, that is what the new grammar is associated in these hills.

But whereas for the animals, they started making some of these, they are using the timber and they are making these elements, they are like no for animals to stay, but the newer generation because they are now getting familiar with the architecture in the plains. So it is actually taken into the hills also now. So, apart from this, there are also some institutional efforts where how, how to actually transfer this knowledge like for this case of Pakistan.

(Refer Slide Time: 27:32)



The Dhajji Dewar technique, how the Pakistan government, NDMA Pakistan, they also promoted certain guidelines, where how can we incorporate these traditional techniques, and it is the kind of manual and how it can help the villagers or the artisans or the construct contractors who can actually carry on these traditional technologies. So, in the next class, we are going to discuss on similar issues about the advancements in the material applications. Thank you very much.#