Disaster Recovery and Build Back Better
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Lecture - 24
Lessons from Peru

Welcome to the course disaster recovery and build back better. My name is Ram Sateesh. I am an assistant professor from Department of Architecture and Planning, IIT Roorkee. Today, we are going to take some lessons from a very different geography of the world from the South American side the Peru. So, this I call it as lessons from Peru.

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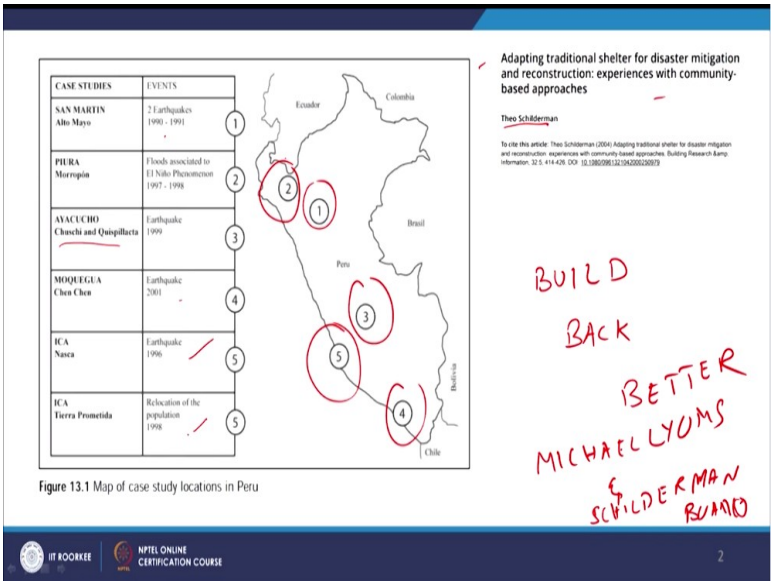

And, I am going to discuss about information gathered from various resources; one is, the earlier discussed version of build back better by Michael Leone and Theo Schilderman and as well as with Camillo Boano. So, the earlier version with that was a chapter on long-term impacts from the short-term recovery. So, this is here, what they did was they tried to compile a variety of cases in that particular geographical region.

And they have looked at how people have adapted to it, how people have responded to it in different context. So, there is also some other information we can see from adapting traditional shelter for disaster mitigation and reconstruction, experiences with community-based approaches. In all the discussions, they highlights on different modes of participation and different context and different responses to it.

So, this is Michael Leone and Schilderman and Boano; Camillo Boano, so what they did was they have taken about 6 study areas, which are affected by different earthquakes in different timings and different parts of Peru. Number 1 which we are talking about San Martin area, Alto Mayo which has been affected by 1990 and 1991 earthquakes. Number 2 which is of Piura Morropón region; in Piura region in Morropón which has been associated with the floods and it is not just only a one event oriented.

But it is also the El Nino phenomenon where a longer term impact has also like drought and other things have also been seen here. Ayacucho earthquake which is in 1999 which has affected the Chuschi and Quispillacta. Then, you have the Moquegua earthquake in 2001, down south and whereas, this is about the Ica area, which is 1996 earthquake and as well as in Ica Tierra Prometida, which is the relocation.

So, now in these, we have the relocation context as well. So, let us go case by case and briefly discuss about what they have worked on. So, I'll discuss about the technological aspects in the first case and then in because many of the things are common in all the cases but there is a slight variance in different cases especially with the adobe type of construction, so I will just briefly go through each and every case.

And finally, I will summarize it, see what are the various generic aspects of it and the specific aspects to it.

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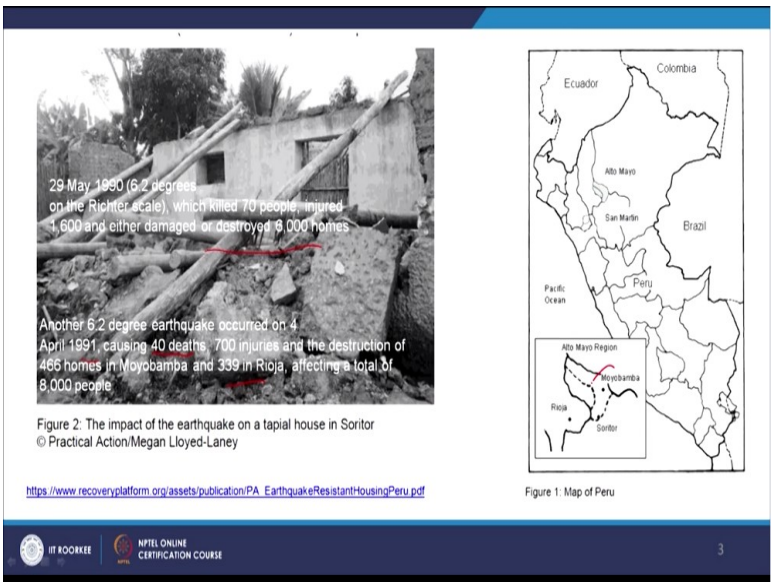

In 1990, in 29th May, Alto Mayo, which is this region we are talking at 6.2 Richter scale and it has killed about 70 people and injured 1600 and almost 6,000 homes either damaged or destroyed. Later within one year in 1991, again another 6.2 Richter scale have occurred and this is when 40 deaths and 700 injuries and the destruction of 466 homes in Moyobamba and 339 in Rioja affecting so this is all, the Moyobamba and Rioja and Soritor.

So, this is the Alto Mayo region and this has been carried out with the practical action group. A practical action group they does mostly on the recovery process, mainly in the long-term reconstruction rather than the short-term relief. So, how did they account the beneficiaries obviously based on various surveys, various on the feedback from the local residents and the leaders? So, they have actually calculated the whole expenditure of it and as well as what kind of requirement and needs assessment has been done.

And then they identified, yes these are the potential beneficiaries. So, at this point of time, when it comes from the architectural aspect of it, so, with all the consultation process with the local leaders and various stakeholders within that region, so they have decided to discard the use of rammed earth and adobe.

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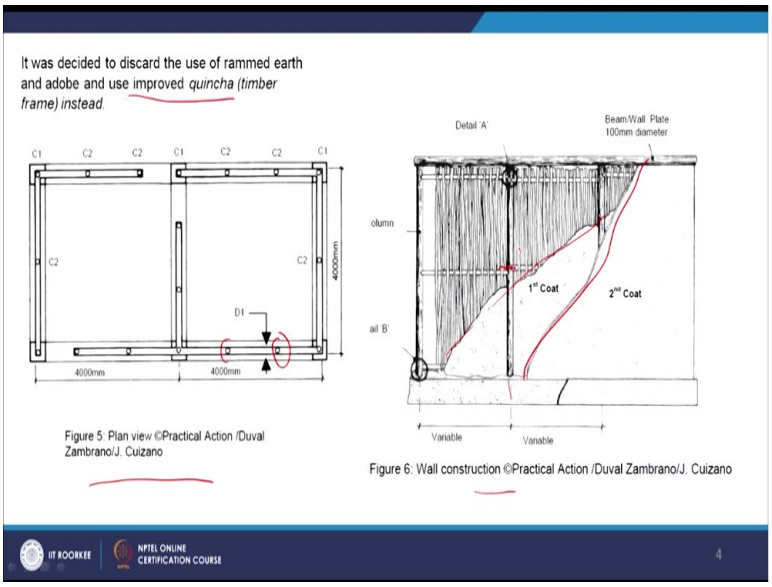

And they want to promote the quincha timber-frame instead to be as a better earthquake-resistant material. So, what you can see is from the practical action groups, the model they developed the plan with the timber posts in between and they have this is called quincha construction. So, what you can see here is it is a kind of timber studs embedded in the either in the concrete bedding or little deeper into the foundation.

So, then this whole wall like we know the rattle and daub sort of thing, so we have this bamboo screen, which has been weaven and then the first coat of slender has made and then the second coat of slender is made later on the bamboo screen. So, in that way, it has an intermediate vertical studs and which also having a horizontal stud because you can see to nail it on to other two studs and this is a whole very indigenous technique, they have slightly upgraded this part.

And in the first coat, what they did was in the render they first allowed it to dry and then cracks have appeared on it. So, when the cracks have appeared obviously they are made of a second coat that is where it can fix the second coat because it gives a texture for it.

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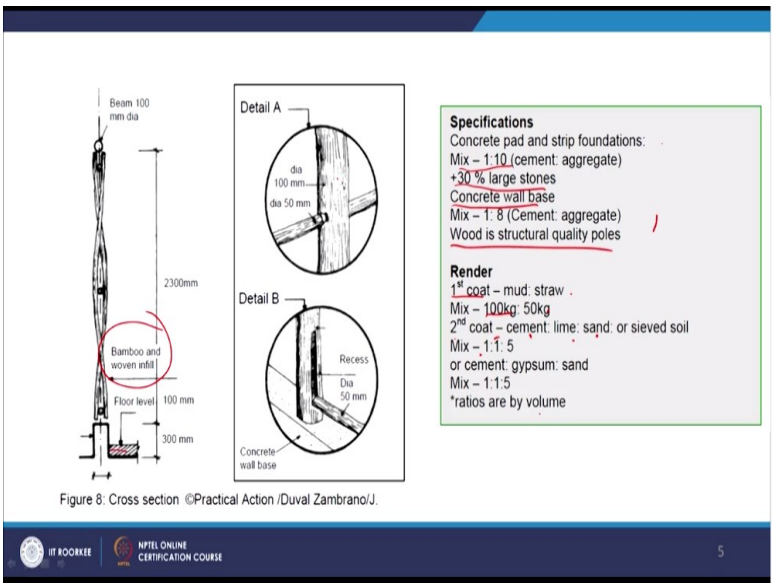

Figure 8: Cross section ©Practical Action /Duval Zambrano/J.

So, if you look at the cross-section of the woven timber, so this is how it looks where you have the floor level and about 300 mm height and then this woven timber is fixed upon it. So, this is about 2.3 meters, this is called we call it the woven infill and if you look at the detail A this junction and this junction, so these are the 2 junctions. So, now you have the 100 mm diameter and it has embedded the horizontal stud is embedded within it.

And there is also in the bottom, it have a recess so it goes into the wall base and as well as 50 mm diameter, so it fix the horizontal stud as well. So, this is a kind of detail it has been implemented. Then, the technical group also have suggested various specifications that concrete pad and strip foundations which should have a mix of 1:10 cement+aggregate+30%

of large stones and concrete wall base where it have mix of 1:8 cement and aggregate and wood is structural quality poles.

So, in render again they have mixed about first coat mud is to straw with 100 kg and 50 kg and second coat cement is to lime, sand or sieved soil as per the standards. So, this is where 1:1:5 or cement is to gypsum sand. So, this is again they are all about by volume.

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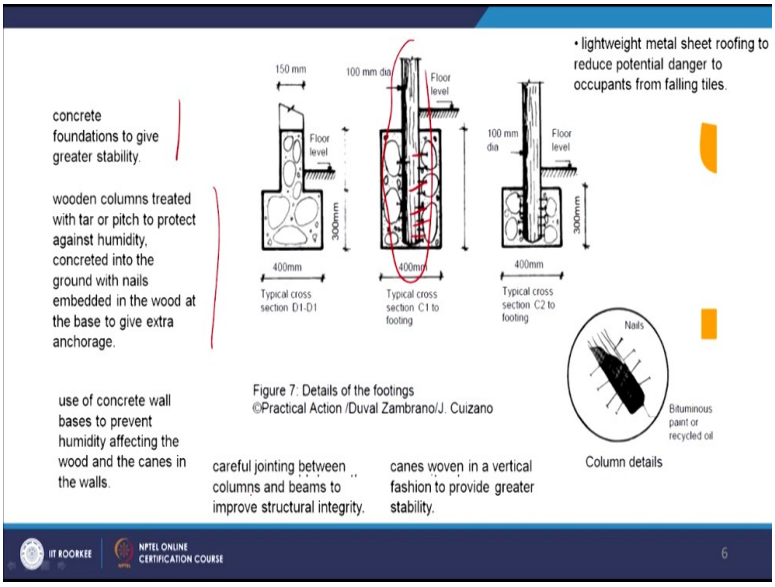

Figure 7: Details of the footings
©Practical Action /Duval Zambrano/J. Cuizano

And what are the benefits of this quince constructions; one is they have upgraded this type of construction also embedded the concrete aspect and the concrete foundations. They provided the concrete foundations, so which can give more stability, greater stability towards the earthquake. Then, the wooden columns treated with tar or pitch to protect against humidity concreted into the ground with nails.

So, this is what you can see here and these nails have been embedded into this, at the base to give extra anchorage and use of concrete wall basis to prevent humidity affecting the wood and the canes in the walls and similarly, careful jointing between the columns and beams to improve structural integrity.

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That is where you see in the next slide, you can see that here that the joining of the beams and the columns, how carefully they have them because that is where, it is going to tie the whole building and it is going to make sure that the whole structure acts in a better way in terms of the earthquake, when earthquake happens and because when the canes are woven in a fashion it will also not only the aesthetic character of it but it also gives a kind of structural stability.

And in terms of roof, there has been a lightweight probably galvanized metal sheets roofing to reduce potential danger to occupants from falling roof tiles or the adobe roofs. So, when the building shakes obviously, the stones used to fell down on the people, so that is where they thought of going for lightweight materials. So, what you can see is a community building in Soritor area.

So, what they did was they try to upgrade this technology. First, they did was, they tried to construct the public buildings like schools or the community buildings so that people get some awareness of this technology and they could also train the local people, they could also train, give some training sessions or the masonry training sessions to the local people so that it can be spread out to the other places as well.

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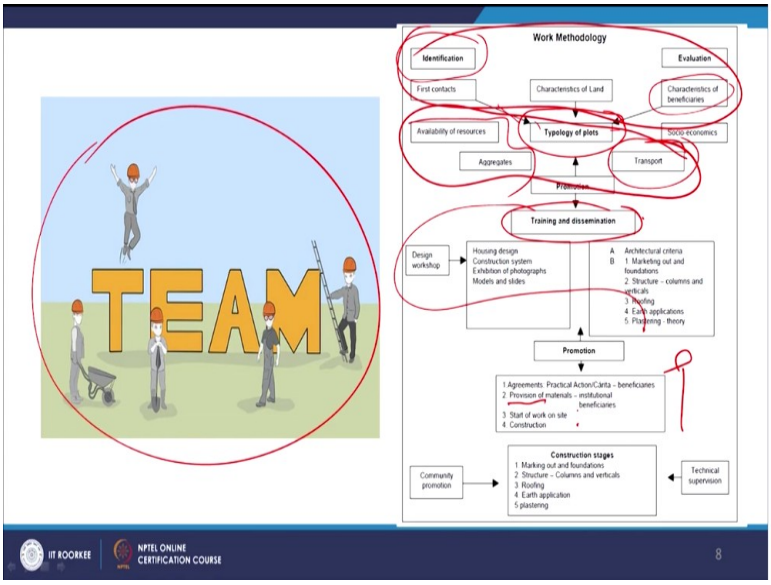

So, the way they have developed is basically, there is 20 to 40 people in a team and then they start working on, they have been got training and they have been implementing in different sites. So, this is how the methodology has been done, you have the identification of the beneficiaries and the first contacts, then you have these, what is characteristics of the beneficiaries, you know how do one figure out these beneficiaries.

This is where the socio-economics also play into the role and the damage statistics also play into the role and this is where the typology of plots and now who will supply the material resources, you know that is where they have to negotiate with how communities can also provide some resources to it. The main issue is the transport, you know like in certain places bamboo is not locally available.

And they have to transport raw materials from different places, and that is where some NGOs also are provided some kind of technical means and this is where the training and so first of all procurement happens at this stage and identification happens at this stage and the training and dissemination and that is where they talk about the implementation process.

And this is where they talk about the promotions you know, agreements with various NGOs and beneficiaries and as well as the provision of materials as well as how they have to really implement at different stages and technical supervision, how it has to conduct at different stages. So, this is how the working methodology has been developed. Now, what kind of impact?

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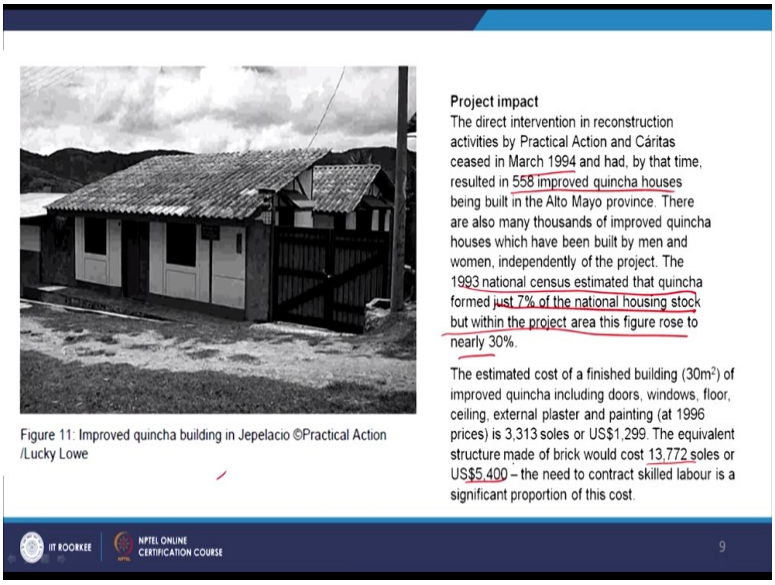

Figure 11: Improved quincha building in Jepelacio ©Practical Action /Lucky Lowe

See, this is one of the, this building what you are seeing is an improved quincha building in Jepelacio and here what is the impact, by from 1991 we move on to 3 to 4 years down the line in 1994, it has about 558 improved quincha houses within that Alto Mayo province and there are also, by taking the inspiration there are many have been built in that particular province independently by both men and women.

And in fact, in 1993, the national census estimated that the quincha formed just 7% of the national housing stock but within the project area, this figure rose to nearly 30%. So, that kind of inspiration it has motivated them and about 1300 US dollars it used to take construct a 30 square meter house and if it was taken by a brick or concrete house, it would have taken more than nearly, thrice the amount which is about 5400 dollars because which needs a skilled labour, skilled contract.

But here, the benefits for these particular community was because the skilled labour was also easily available in that region number one and the material resources many of the resources bamboo and all, they are also available in that region. So, the timber was available, the resources was available, the skill was available. So, in that way, it has come, the cost has come down and people were able to participate in much progressive way.

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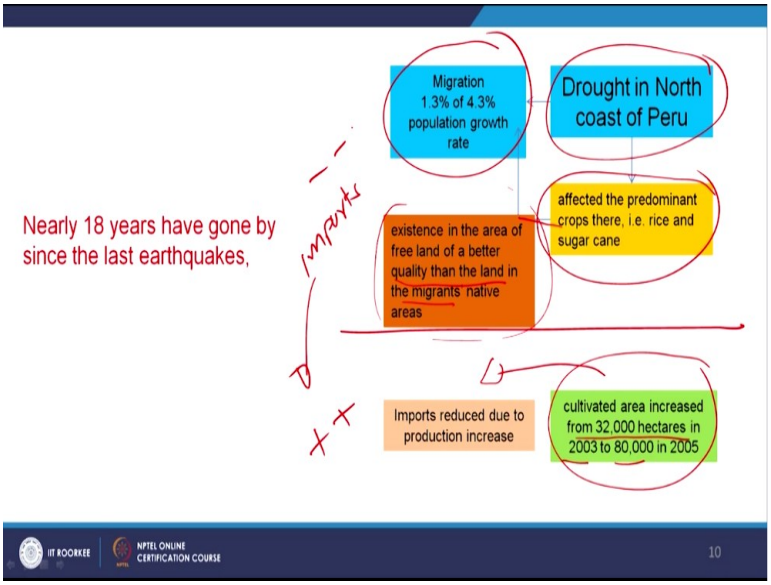

So, the same caves 18 years after, you know, when the authors have investigated, so what changes they have looked at? Now, one is gradually, the drought in North coast of Peru have been consistently occurring and that has caused the affecting the predominant crops like rice and sugar canes which needs more water and also there is, also impact on the water resources and that is where that is one aspect people tend to migrate to other places.

And here, again in this particular Alto Mayo region, there is an existence in the area of free land of a better quality than the land in the migrant's native area. So, in the North coast area so they are getting you know instead of 0.5-hectare land, they are having about 2 to 3 hectares land of it. So, that is how people tend to migrate and about 1994 when we see the migration, out of 4.3% of population growth, 1.3% have contributed for the migrant population.

And considering this conditions, the government has motivated to and encouraged to enhance the production of the feasible cultivated areas. So, that is where they have also promoted certain schemes and they also developed and encouraged the people to work on the possible cultivated areas. So, that is worth from 32,000 hectares in 2003 has become 80,000 hectares in 2005, so it has more than double.

And that has actually, the production has increased and obviously, the productions and the imports from other places has been decreased. So, this is one of the important considerations because and people are getting a better economic status. So, they are able to, now in the