And also, you know, don't have too many offsets you know here, this is like too many, so symmetrical but still it's too many offsets in it but then either try to make more of a defined shape because that is where you can even have a diagonal bracings, you can have some kind of support system so, it will; it is at least bound to a; this plan should be square or rectangular, if it is rectangular then you need to have a kind of intermediate support systems into it.

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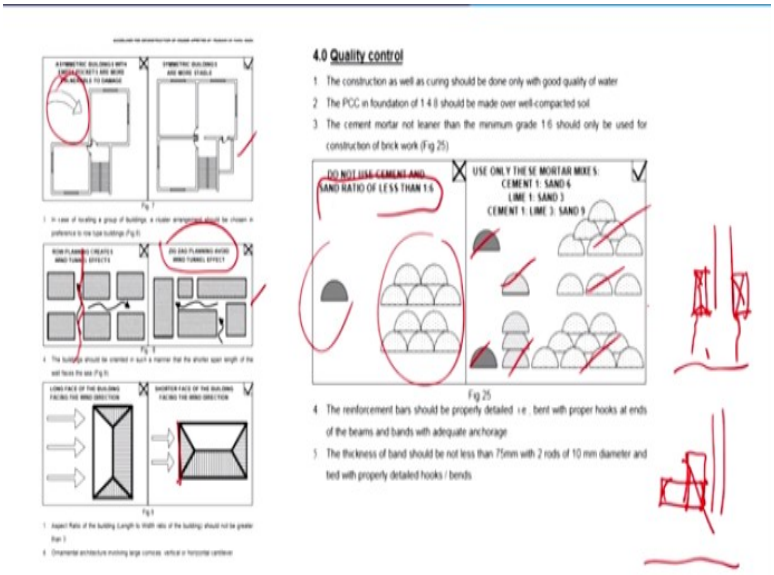

Now, asymmetric buildings with empty pockets are more vulnerable to damage because don't leave these empty pockets, we tried to fill that and that is where these are more stable you know, the symmetric buildings are more stable and also when we say about the row house planning; the row house planning also creates wind tunnel effects because the moment your house is one step to another, next to the shore and then it channels the wind and that is where it can damage the edges of the walls or the corners.

So, that is where you can even you know, now even the zigzag planning avoid wind tunnel effect right, so how actually, you can actually see about, how you can actually, give a little bit of vastness and then reduce it so, the zigzag pattern as well can have some control, it depends on how you are actually orienting it and similarly, the long phase of the building facing the wind direction.

In fact, if you ever visit in the coastal villages of Tamil Nadu and the coastal areas; most of the times your short phase is of the building is facing the wind direction and whereas, in

horizontal phase because that is where they have less number of openings and either that, if they are facing that side and they will have less number of openings and otherwise, if they mostly they orient so, the whole building pattern is like you have the seashore and you have these.

So, the building's; the shorter side will face the seaside, so that is how they are oriented and similarly, in terms of the; this particular manuals also talk about the quality control. In terms of quality control, it is also talks about the material, what are the ratios we have to include. So, when we say about do not use cement and sand to be less than 1.6 okay, 1:6, so for 1 cement and 6 part of the sand.

So, you should not make use of the combination of this mortar not less than 1:6, either it is recommended to use 1 sand, 1 cement and 6 sand or 1 lime with 3 sand or 1 cement, 3 lime and 9 sand, so this is a kind of mortar mixes which normally guidelines do recommend and at the end of the day, all these are coming from the proper IS code but these are only a thumb rules.

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And many of these manuals, when they are published in English, it becomes very hard how a local mason can understand it, so that is where a recent efforts have been done by architect Benny Kuriakose after the recent Kerala floods. So, what he did was he developed a manual for retrofitting and flood resilient design for flood-affected areas in Kerala. So, the Malayalam version is already printed and the English version is on the process.

But still, I could show you some images of what his work and it was very diagrammatic and really illustrative work. He looks into the before coming into the solutions, he actually explains the situation of how the causes you know, this is a very important aspect of developing any guidance, so one has to understand the consequences of these disasters and especially, what are the causes; root causes for it.

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And whether it is the form of orientation, whether it is the type of construction, whether it is a citing out you know, so this all for instance, here, you have these normal setup where you have the river level and all of them have built on the top, on the mountains and then the average flood level in case, it might have reached here but then because, after the construction of dams, people started construction near the riverbeds, they change.

Because they know, that the water is not coming very frequently, that is how they started coming down and they even started you know, constructing the houses near the riverbeds, so that is where you can see that in 2018, the Kerala flood have almost submerged 3/4th of the houses even on the top but even after the flood process still certain because you see that when this kind of images have formed, even after the this low-lying areas are still leftover with the water and that is what creating some endemic and epidemic diseases which are spreading.

And that is even much bigger disaster okay, so it takes so much time and also there are the water has stayed back even after you know because even after the flood and even after the rescue process still in being the same story in Kashmir, the water has stayed back and because the main issue is lack of proper drainage systems, the Chennai floods it is the same

because that is where the planning situation, the service infrastructure orientation has to be addressed.

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Then, when the water keeps coming into these areas obviously, there is also an aspect of; there is a difference in water levels for instance, the amount of water it enters and the amount of water outside, this is almost 8 cars, you know the load which is coming of the 8 cars worth of load which is pushing this wall and this difference in water level you know creates the pressure on the wall you know, this difference is creating the pressure.

And that is how there is a major scope that this wall might collapse right because there is two forces; one is a smaller force, one is a bigger force and it is pushing, it's almost about 8 cars and then obviously, that balance is missing and even the water so, it takes out the topsoils, the moment the topsoils are going out because the foundation we are talking about maybe a 1000 mm.

And obviously, this can loosen and this can change the soil conditions and movement beneath, so in that way, there is a possibility that these houses may collapse, so that is what we have seen in those videos.

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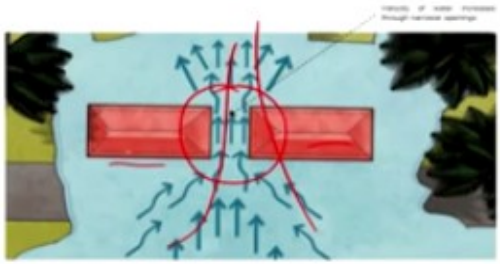

2.2.2 Velocity of Floodwater

When a certain volume of water moves through narrower areas, the velocity of water flow increases intensifying the damage further

Also, the velocity of the flood water because the moment you are keeping the same thing what the other manual of the tsunami is talking, the moment you are making these row houses like this that is where this is going to create the pressure you know, intensify because that is where the it's a kind of bottleneck process so, the water and then it affects this whole damaged process both the walls and also it can affect the foundations.

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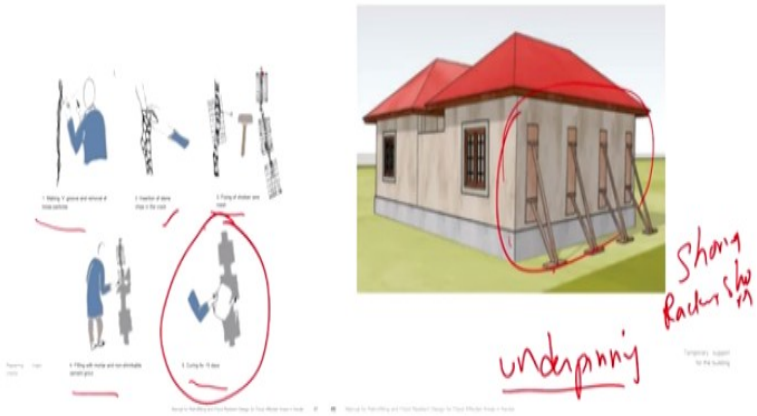

So, these are a few glimpses of the reasons but there are many other which he have explained in this manual and in fact, how to retrofit these things because there are some solutions not only the causes for these aspects but you also have to talk about the solutions so, for instance when we say about solutions, how to retrofit it, what are the techniques one can use.

For example, in architecture we might have studied shoring and you might have studied about raking shores and you might have studied about underpinning so, these are various techniques which we learn from our architecture building construction subject but then this is one, where you really apply it because this is where, in order to protect this wall and during the restoration process, you need to apply these shores.

So, that you need to give a kind of temporary support until the restoration is done or retrofitting is done. Now, there are different ways of; he explains different scales of these cracks for instance, if it is a smaller crack what to do is; we making a V groove and removal of loose particles, then insertion of stone chips, so there is a Gelatin technique sort of thing, you keep the stone chips and then, then fixing a chicken wire mesh all along and then filling with the mortar and non-shrinkable cement grout.

So, in that way curing it for 15 days, the curing is most important part you know, everyone ignores this curing part, it is only not just only the plaster part of it so, these are some few techniques which he comes up with you know how to retrofit these things.

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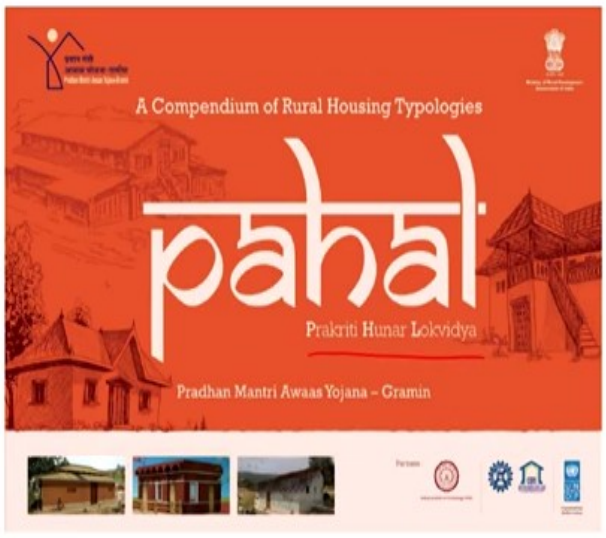

And then till now, we have spoken about we have discussed our discussion about the giving the manuals and guidance from a very disaster focus, whether it is an earthquake focus, whether it is a tsunami focused and it is a flood focused but in Benny Kuriakose, we have observed that these are being translated in the local language which and illustrated more in a diagrammatic manner explaining the cause and the reason for it and the impact of it.

So, there is a issue, there is a cause and there is an impact and as a result of this, how we can deal with this as a solution you know, what are the very different ways we can deal, so that is how these manuals have been framed but then when we talk about the manuals or the guidance yes, we do understand the show a broader picture of it but then, what about whether it is a State Government of Tamil Nadu whether it is engineering structures GSD, MA where is a Gujarat State Disaster Management Authority which have issued some manuals for retrofitting the buildings or reconstruction.

But the state; whole state is very diverse, it has its own regions, it has his own unique geological and geographical and topographical conditions, it has unique landscape; is a very diverse landscape, if you take Gujarat state, you have the desert part of it; you have the Banni grasslands part of it. Similarly, in Tamil Nadu you have the coastal Tamil Nadu; you have the Nilgiris, as a mountainous place.

So, one has to understand that each state is been sub-categorized by different cultural geographies, which is not only the geography but they also vary with the cultures, the moment culture comes into it, it can talk, it is reflected in the building practices whether it is a type of construction, whether it is an alignment of a house, whether it is the dwelling typology and their belief systems.

So, that is where and there has been an effort by the Ministry of Rural Development and Government of India where they have issued a compendium of rural housing typologies of 13 states, this is called Prakriti Hunar Lokvidya under the Pradhan Mantri Awas Yojana Gramin scheme, this has been compiled as a kind of compendium of different rural housing technologies.

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