① YAZD BUILDERS TRAINING WORKSHOP.

The ~~architects~~ local arch's + builders as in small cities are basically responsible for private + public buildings - These people are very useful because of their own experience of local builders + methods of bldg + have very good ideas.

Workshop for to worked between Bahman - Esfand 1355., organised by SIOP. The participants were the builders + labourers of the building industry of the villages in Bakhsh Lunestan + 2 Yazdi ~~builders~~ master masons. + D.W.

Basically used each others experience to make better use of local building materials and skills.

AIMS.

2 main aims of workshop - 1. Development of indigenous building methods based on experience of/knowledge of participants.

~~The group~~ 2. To enable local people to meet the building needs of the region without relying on city based contractors + imported materials.

The training was through Discussion, experimentation, practical demonstration. In detail to follow explained about different kinds of earth, foundations, walls, roofs. Each of the participants would talk about their own experience for each of the stages, and the best solutions would be agreed upon. Each building solution would be experimented

on in the yard and practical experiments done on wood, stone + mud brick. From the experiments done on different kinds of earth which would be easy for builders + owner builders to understand. In respect to the different kinds of local earth, to increase the mud walls load bearing capacity and reduce deterioration from wind and rain, stabilisers were found. The best kind of ranet and domes were chosen and the builders were taught how to build them. An important section of the training was training the local builders to use the local materials in order to protect the traditional buildings from earthquakes. The invited builders from yazd gave a lenstory talk about the historical buildings of the area. In the afternoons there were classes for the illiterate local architect builders. The workshop demonstrated the basic importance of literacy by relating it to their work. By gearing a literacy program directly to the - - - - becoming literate.

In general the aim of the workshop was to produce a way of methodology of training the builders with them minimal knowledge education so that it would be easy for them to use their local ways of building. This methodology, based on problem-solving (identification) within the workshop.

MASHKOUTCH

3. By that time there were many local architects and builders who could take responsibility for the plans, and these people started teaching new trainees and using the same methodology of the workshop.

F-2

In the first session meeting we (everyone) discussed the aim of the workshop and what they would do at the end. In this meeting it was agreed that the local ways of building was the main structure of the program. Besides the ways of local building being the structure, it we aimed then discuss the role of building in development, especially in Rural Dev, in respect to economic, social, environmental considerations. To be able to solve or improve/ (overcome the problems) the local ways with the use of local materials (resources). It was agreed that the design of the buildings; drawings, working drawings, management of building would be done by the local builders and even calculation of estimation for materials and ordering, and the different stages of building from foundation to roof would be discussed, experimented and practiced in the workshop. And it was explained that by visiting and observing the buildings in Gaza which were built with developed local technologies, exchange of local technology skills from one area to the other would be possible

(c) One of the basic communcats that the builders may was that by seeing the different complicated buildings they could understand the skills, but then the skills should be experimented on, and that the ways of building would much depend on thier economic status, and therefore when they are in much better economic situation they would for example change the walls of their houses from chineh to mudbrick and with a better financial sitcation it would be changed to fired bricks. we agreed that it is true that it depends upon their financial situation, but by observing examples of developed local skills discussions would be held with a much wider view of their experience would richer. Observation and experimentation compliment each other. So it was agreed that ½ of the time of the workshop would be spent on training observation and the other half to experimentation.

Although it is true that economical status is one of the basic factors in the way of improving housing and with the improvement of the economic status housing will be improved, but one should bear in mind that with improving the skills of the people, the quality of building and housing could be improved too. One could give the best efficiency to the locally available cheap materials by researching about them and improving them. for example mud brick in Yazd is is of very good quality, and the people of Luristan can use the yazdi ways of making mud bricks. In addition the new methods for the improvement of the material and the skills can be taught in this workshop and be experimented on so that

The best results are would be used by the villagers. (5)
About the way that the workshop works, it would
~~going to be the same relation as teacher/student,~~ it is not
~~but would be more to observation and practical~~
activities it would not be anything similar to the wa
that school classes are, which is basically a
~~relationship between the~~ teacher and students
relationship and the lessons are be purely
observation and practice, but these ~~also~~ meetings
will be discussions where everybody will be
using eachothers information and experiences
and the problems will be discussed in groups.
and therefore solutions which everybody agrees
on are necessary, so that everyone can use
eachothers knowledge in the best way. (for someone who is experienced and has 4 yrs exp.)
In this case one must be very patient
and be able to listen to those with minimal
experience as they might have precious comments
to make.

3 & 1 This patience must be kept all the way through
the practical + observation activities and the
more specialised jobs of builders and labourers, eg mixing
mortar, brick carrying will be done by everyone.
~~Otherwise~~ ~~for most~~ we have to be ready with
an open mind to be trained, and not think
that we are an expert in a field and we do not
need to learn about it. We should not be annoyed
from each others criticism and start defending
ourselves - one has to think about it and see
whether the criticism is right or wrong. We
should not be proud of ourselves and of
everyone uses eachothers knowledge, obviously
one will learn more. Most of you are from
a rural area/where you know about its particular,
and would like to develop this area.

The aims of the workshop are basically developing architectural skills to satisfy the needs of the villages and small towns like Alashtar. The workshop's activities are centralised on the necessary skills for the villagers and they would be less used in larger cities. The precise workable program and its timing is based on the needs and the intelligence of the people taking part in the workshop; but there will be a scheduled program which will be distributed to the participants.
At the end of the meeting the builders suggested that in their spare time literacy classes are formed so that those who have been in such classes could teach the others to read and write. This suggestion was praised by the other members of the workshop and it was agreed that the literacy classes would be in relation with ~~the~~ architectural and drawing.

Meeting 2. Discussion on endogenous development.
~~At~~ this meeting ~~it was tried to~~ attempted to present and discuss problems and solutions of development ~~on the basis of~~ ~~depending on the area~~ on the basis of the potentials of the region. ~~were presented and discussed.~~
Therefore questions about the potentials and the problems of the area were put forward and the builders answered these questions.
Q. (1). ~~is~~ think about your area and explain the negative and positive points about it.
A. Lots of water resources; fertile land; productive agriculture; animal husbandry; (rough grazing for sheep/goats in summer); lime; clay; timber beams historical remains; (after a little bit of help about the social relationships, answers continued) close relationship between neighbours and relations etc

1. (fellow workers) and serious friends:
Social cooperation

Q.2 Explain the negative points and problems of your area.

A. Shortage of bread + meat; unpurified water; ~~shoot~~ shortage of public transport; no bus terminals; high prices (in general); absence of factories and shortage of workplaces; school; being afraid of opening individual business; agricultural deteriorating (absence of factories in relation to agriculture); dry farming; the landlords and Khans would not let the farmers take part in agriculture.

Then the answers were mixed and this is what the result came to:-

Positive points.
1. Natural resources
2. Possible agriculture and animal husbandry.
3. Close relationships and social cooperation.

Negative points.
1. Shortage of food and agricultural products.
2. Shortage of employment
3. Shortage of productive workshops
4. Shortage of services and building labourers
5. Shortage of administrative organisations offices
6.

SOLUTIONS.
Q. We can see that there are some possibilities, but at the same time there are shortages. What can we do to use the possibilities to overcome the shortages.

8. By builders
A. ~~There are~~ natural resources exist; ~~to~~ to build kilns for bricks and lime and chalk; ~~stone~~ to build stone masons workshops and also stone quarrying; and to make the transportation of it easier.
To use the ~~wood from~~ resources of wood from the forests and ~~forestry~~ for and reafforestation.
To collect the water from the mountains for agriculture should be done by dambuilding and pipe laying.
Piped water to villages.

Improvement of agriculture and animal husbandry in order to make it easier for the ~~shep~~ animal husband ~~to~~ in order not to sell their animals.
There is a shortage of shepherds and the fee for the shepherds are so high that it wouldnt be economical to hire them. The landlords do not give the farmers land to work on. and the landlords themselves plough the land.
Land has to ~~be~~ given to the farmers in order to be used for gardening (market gardening), ~~to~~ Wet farming ~~and~~ economical agriculture. to impiore. ~~The~~
The shortage of agricultural equipment, eg tractors, should be solved. Agricultural training and the knowledge of cultivation of various new products is necessary and should be taught to the villagers. (In this area some of the landlords would not permit plantation and only annual products like wheat were current.)

Productive workshops

1. It was suggested that with the help of the gov't and the local people producing units eg. chicken farming, animal husbandry, blanket weaving, cloth weaving, carpet weaving, leather making, ~~timber working~~ sawmills and carpentry, metal working; could be set up.

Employment.
These workshops with the agricultural units would solve the problem of employment and with more possibilities of employment the economic, financial situation, of the villagers would rise.

Services and infrastructure.
To make these plans and programs work there is a need for a ~~network~~ service and infrastructural network. eg. roads, water supply, electricity, schools, clinics etc.
Stimulation of agriculture and productive workshops and service and infrastructural networks ~~with improve~~ are in very close relation to eachother and will improve the area. eg. by building roads products will be transported to the market easier and another example, training will raise the financial situation and will help the work force, therefore development of the area has to be done together.

Administrative organisation

In order to harmonize these plans there is a need for an organisation and decision making and an implementation team.

People's trust for the administrative organisations who are the representatives of the people with the government, should be taken into consideration.

—

- As it was mentioned before all the development units are connected. ~~also~~ we will now talk about the building units (services and infrastructure) so that we can see how this section can help the development of the village.

Q. How did they build public buildings like the hamaam in the village in the past.

A. The elders of the village would gather in the mosque and they would discuss the problem and they would present it to the people. People would help as much as they could afford and they would even help in the process of building the hamaam. The first group of the student corps would gather the people of the village and they would ask for their help in the process of building a school. Obviously the government would decide about the ~~go~~ student corps + they in turn would make the people pay or work. Another way of building the public facilities in the villages would be through the direct act of the govt. Gov't organisations would chose the necessary needs of the people and they would agree on the budget which would usually end up being the same sort of plans for everywhere. Technical Offices of the Ostan will be responsible for the plans, calling for tenders, and well known Contractors will ~~take part~~ submit for the job, and

the winner will get the job. in limited cases the private sector ~~co~~, considering the beneficial points in public buildings, will do the job.

Taking into consideration these four methods of building the public buildings will enlighten the best way of doing it.

1. Direct help of the people, with their own financial contribution, will give the maximum ~~share of~~ and contri participation. ~~in~~ This contribution will enable a complete harmony for the needs of the people and it will make the people care for what they have done so they will keep it in good condition. But because of the low income in the villages this method will not satisfy the all the needs of the people, and besides, the wealth of the country should be distributed so that the buildings of public buildings are done under the financial responsibility of the government.

2. The cooperation of the Gov't and the village

In this method if there is a minimal financial contribution from the Gov't the problem of the shortage of contribution from the village will be solved. But because most of the plans which have been laid out by the government have been chosen and planned in advance, ~~it~~ the choice is not made by the people of the village, and so it will not be as fruitful as it would have been through the contribution/cooperation of the public and the + positive points mentioned in ① will

12. be minimised.

3. Construction of the public buildings by the Gov't will make a closer relationship between the villagers, the city and the central gov't. The types of the plans which have been introduced and the techniques and the materials used have often clashed with the social economic and environmental condition/situation of the village, and the local people have not been able to continue to build or to restore the existing building. The contractors and materials merchants of these buildings are usually located in cities. In this case a high percentage of the building budget goes out of the village and is returned to the city. Its only the building which is left in the village which in most cases does not satisfy the needs of the society.

4. Although the group believes that under the present circumstances financial contribution of the private sector in the village would increase the villagers economy, one must take into consideration that these private financial contributions have a basic personal beneficial aim and they rarely satisfy the needs of the village. Therefore one could conclude that the ~~method of~~ ideal method of presenting services and infrastructural organisation and public building to the village is arranged by the participation of the people and the help of the gov't

13.

In this case the people of the village will be in the sitvation right from the start which is descision making about the public buildings that are needed until the end which is the building and the using of the public buildings, And they will try to harmonise it with their needs. In this method the role of the gov't is to provide finances and expertise that the village does not have.

۶ الف Drawing
نقشه کشی

یادداشت

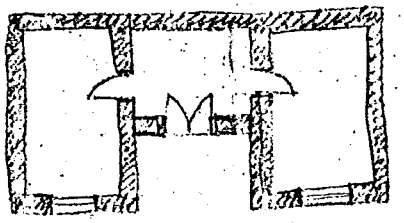
مؤسسه پژوهشهای دهقانی و روستایی ایران

ground plan
نقشه کف
plan ① پلان
(برش افقی)
horizontal sect.

③ مقطع (برش عمودی) section
vertical sect.

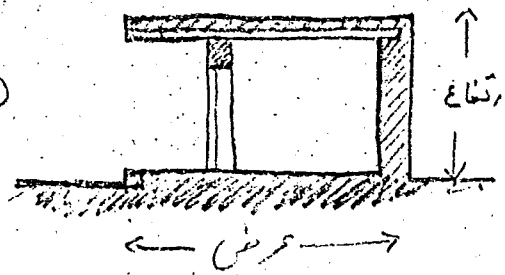
ارتفاع (criteria) height
عرض width
طول length

① پلان - نقشه کف
برش افقی



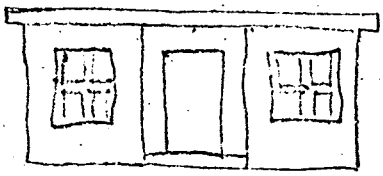
عرض width
طول length

② مقطع
برش عمودی



ارتفاع
عرض

④ نما
(دید خارجی)



ارتفاع
طول

15. Drawing

The purpose of drawing the plans of a building is to be able to bring all the details of the building on paper. The position of details like the interior or exterior walls doors windows, floor and roofs can be drawn in 3 ways on paper. These are ground plan, vertical sections and elevations.

1. Plan. If one makes a model of the building + then cut ~~through the horizontal plane~~ building in ½ horizontally. The upper part which has the roof + the walls of the bldg + to put aside these + if we look at the lower part vertically one can see the ground plan of the building. One can see the width + lengths of the rooms + walls + the bldg + the position of doors + windows on ground floor. The height of none of ~~these~~ the mentioned parts will be known from the plan. One important thing must be noted and that is the lines which have been cut through must be shown with a thicker line, + the lines which are in elevation must be thin. Cutting through the windows one must show the walls which are under the windows with thin lines but cutting through the doors where there are no walls underneath obviously no lines will be shown. The only thing which will be shown for the door is the position of opening. There are different kinds of plan which one has to draw for a building + they are: foundation plan, ground plan, beam plan.

2. Section.

If we cut through the same model vertically and look at it and both halfs from the front we will see the vertical section; a section will show the height of the building, the rooms, exterior + interior walls + the height of the doors + windows. To show all the details of a building usually 2 sections are drawn, accross + longitudinally.

16.3. Elevation.

An elevation of a building shows the exterior facade. In an elevation drawing the picture which one will see is what a person is standing exactly in front of the building so one must draw an elevation for each side of the building. (16)

4. SCALE.

Because we cant draw the building to its original size on paper, we must miniaturise all the parts of the building to the same scale so that a smaller image of the building can be drawn exactly.

Example. one cannot draw a ten metre long wall on a ten metre piece of paper but we can draw the ten metres on a A4 / metre paper. In this case the scale of that drawing will be 1:10. meaning, 1 metre for every 10 m. The 1:10 scale would be shown at the bottom of the drawing; or one could draw the one metre as ten centimetres on paper. + in this case the scale would be 1:100. It is essential to know that one shouldnt measure the drawings with a ruler / scale in the workshop but the dimensions must be on the drawings.

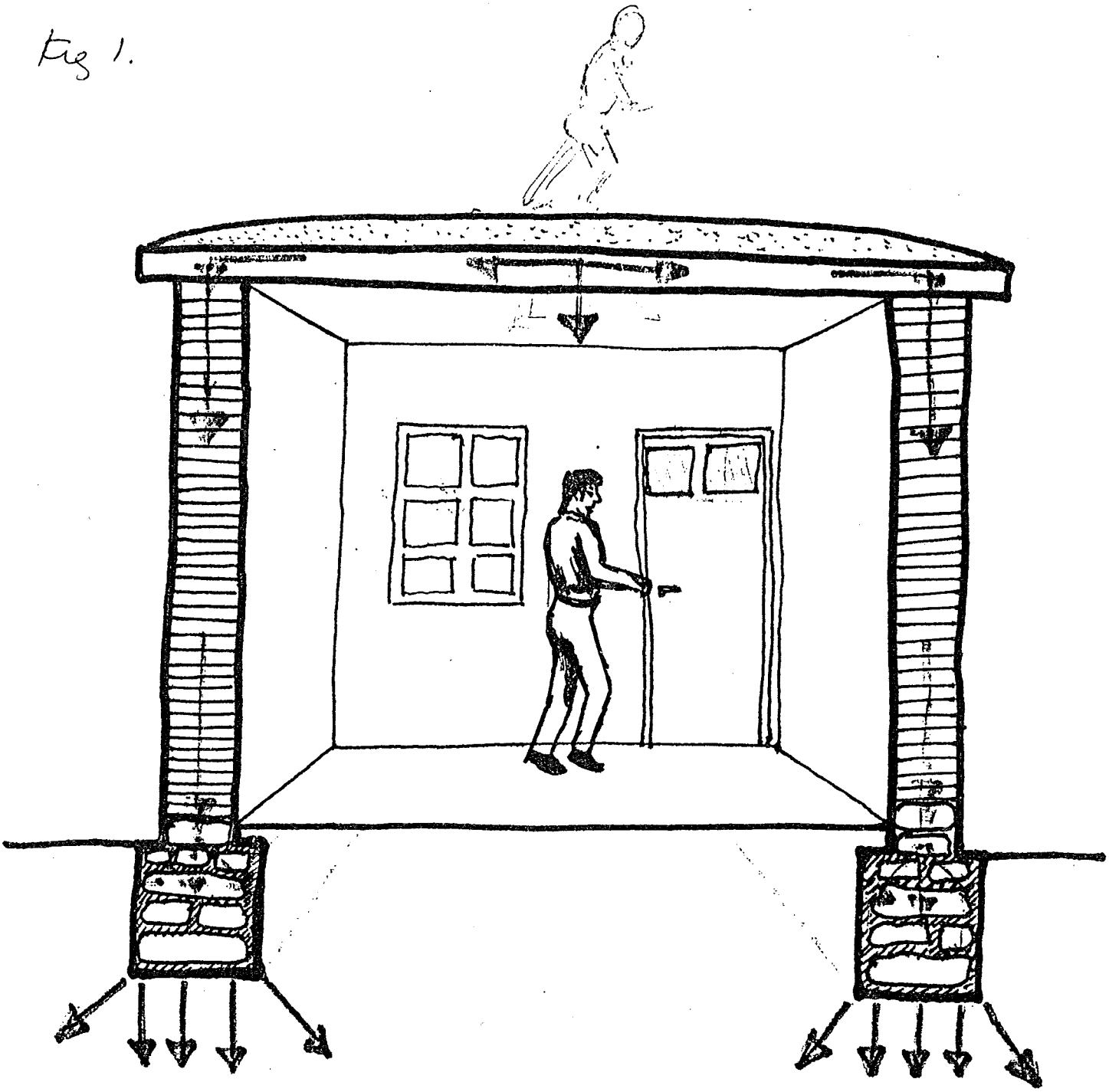
- Four

حمل فشارها در ساختمان

(۱۹)

in the building loads/pressu beams

fig 1.



18. FOUNDATIONS.

Q. How do yr make the foundation of yourown bldg.

A. I dig 75cms, mix straw mud, I allowed it stand overnight, when ready fill the hole with straw mud + its even better than lime.

VS. We have to dig until we reach a firm base, some places its 2 m + some places ½, it depends on the kind of soil. The earth that we have dug, of its good earth, will mix with lime + we will mix well, because if it is not mixed it wnt be firm.

1. function of foundation

The foundation of a building transfers the load of the building and the weight of the building or the pressures which are on the building to the ground. In fig 1. we can see that the weight of the building + the loads which are on the building like people, snow etc. will be transfered through the beams on the roof to the load bearing walls (or columns) The walls themselves have a certain weight, this weight will be added to the load of the roof and is transfered to the foundation. Therefore the load of the building will be all located on the foundation + thus the foundation it will be distributed to the ground. The foundation is called known as a firm and level base for the building which will keep the building from changing its shape or buckling from the pressures which are on the building.

So Therefore, ~~and~~ the width of the foundation must be more than the width of the walls in it in order to distribute the load of the building

19 area a longer area. The foundation deep level is very important because the pressure is distributed vertically on the foundation and ground. so that foundation doesnt buckle or crumble under the pressures on it. In case of penetration of water in the foundation of the building it shouldnt become unstable and it shouldnt move.

Digging foundation - one should dig until one reaches a firm base + if one cant reach a firm base we must build a foundation so that because of the movement of the ground + its being unstable the foundation doesnt crack or subside. The foundation shouldnt move or slide because of it not being level. (Eg. foundations which are built in sloped sites + mountainous area). shouldnt crack because of the roots of house nearby trees. The roots of the trees more in the ground and they absorb water, + therefore the immediate ground around it will become unstable. Therefore the roots of trees around the foundation are harmful to the foundation + one has to get rid of them before filling the foundation. The building should be approximately as far from the tree as the spread of its branches so that the roots cant harm the foundation.. The depth of the foundation should be able to bear the load of the building, foundations mostly settle after bearing the loads of the building. If this settling comes to an end after a certain amount of time no problems will occur but it it continues it will become dangerous and one has to find a way to prevent it.

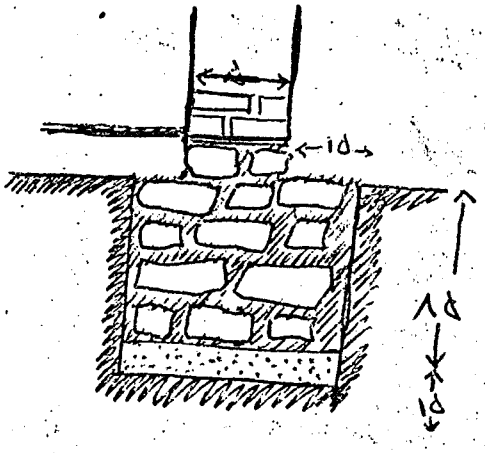
20. Therefore foundation is one of the most important parts of the building + in bldg it one has to be most careful + precise. But we can see that almost everybody doesnt take much care in building the foundation especially in rural buildings they either dont build a foundation at all or if they do they are very basic or shallow.

(20)

Before digging the foundation the site should be studied and the necessary info. should be gathered and this study consists of two parts. 1 Observation: and discussion with the local people in order to know how they used the land before, Existance of holes which have been filled by rubbish, if the site being flooded etc.

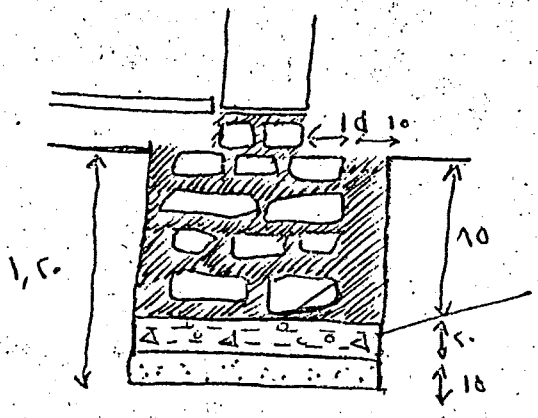
2. Physical investigation which consist of digging experimental ditches (1 ditch for every 300 m² of being 2 metres deep) + experimenting the earth of the ditch in order to find the chemicals which exist in the earth. (in the next section a simple way of experimenting will be explained) By digging the ditches one can find the water table, fineness of the earth, the presence of stone and waste (vegetable or other) Basically stony ground and gravelly grounds can bear a lot of pressure + they are called as firm + stable ground. Clay Ground which has a lot of clay are unstable • Clay changes its volume through the penetration of water + when it dries it cracks.. We will now see the ways of buildg foundations which will satisfy the needs of rural buildgs. F2

در اینجا به نحوه ساختن پی‌هائی که مصالح ساختمانی مورد استفاده آنها سنگ و آجر و بتن آرمه و ساختمان دست‌ساز میباشد میپردازیم.



پی شماره ۱ (تصویر) برای زمینهای (مستحکم) پایدار

foundation 1. Firm + stable ground.

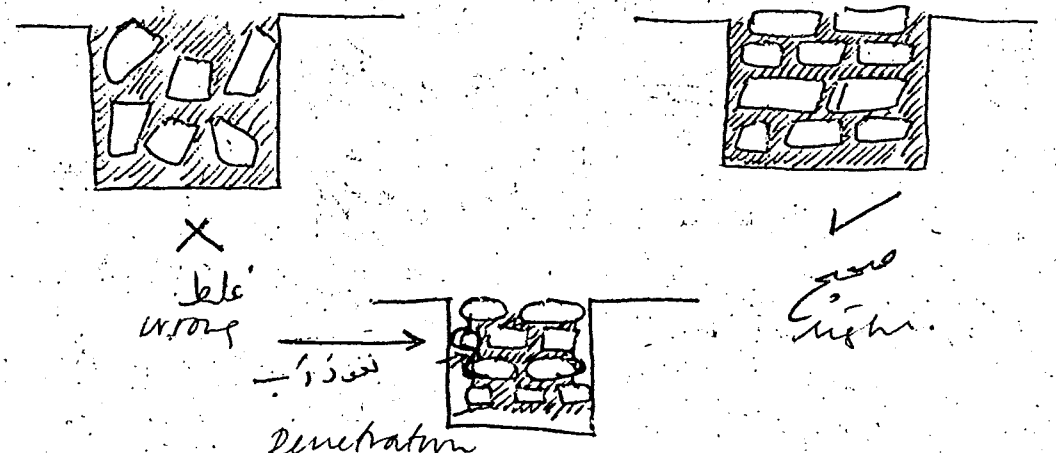


پی شماره ۲ - زمینهای سست

F2

ناپایدار، unstable.

بتن آرمه
R.C.



F2

22. Soil testing.

The basic mixture of the soil in a village can be tested with various simple methods.

(A). Testing the soil by observation, feeling / touching & breaking the soil in the hand etc.

1. Agricultural soil because of the roots & its darker colour can be noticed with ~~the method of~~ this method

2. Feeling & touching the soil & putting a very small amount between the teeth wish show the amount of sand in it.

3. With pressing the soil in your hands & if it stays like a little ball in your hand the amount of clay is more than the sand. & if you cut the ball with a knife you can see the clay if a shiny area remains on the surface of the cut.

(B) Testing the soil by sedimentation.

Take a certain amount of earth & crumple it until you get rid of the lumps, & pour it into a cylindrical shaped bottle or jar & fill with water. Stir & shake it well until the soil is mixed with the water thoroughly & then let you leave the bottle on a steady surface without moving it for one night in order to allow the soil to settle. Sand and gravel which are heavier will settle sooner than clay and silt which are lighter & therefore sand and gravel will be stored on the lower part of the jar and clay & silt will settle on top of them. Then one can measure the amount of sand gravel clay & silt with a ruler & calculate the volume of each one.

23. The materials which are usually in reach of the villages for building foundations for rural buildings are ① Soil, ② lime, ③ Stone, & Gravel. ④ (Shefte Ahak)

Method Making Shefte Ahak.

In the process of making shefte Ahak which is the mortar for the foundation basic mistakes occur which will make the foundation unstable or sometimes will collapse. One of the common mistakes is mixing the day ~~ahak shefte~~ ~~time~~ unslaked lime or any lime with soil which makes the foundation after building it crack because the lime will be in contact with humidity / ground water. In the process of making shefte ahak one must first pour water on the lime so that the lime 'explodes' so that the lumps will either dissolve or they can be separated from the foundation lime. The time needed for the slaking of the lime depends on the kind of the lime but basically it must be done (slaked) the night before, & the day after must be mixed with the soil. One must bear in mind that the time lumps unexploded are not mixed with the foundation. & other particles like rubbish, plants, cloth plastics etc, existing in the soil or in the foundation soil, are removed. The soil lumps should be crumpled or dissolved in water & then mixed with slaked lime.

Stone laying in the foundation

In some rural areas the foundation of a building is filled only with shefte ahak. as one of the trainees commented in some areas Grawund is used in filling the foundation

28. The correct method of building foundation is using stone with sheffe ahale mortar. Just throwing stones in without pattern which is what is usually done is not correct. The stones which are poured in foundation like this will not be bonded and therefore under pressure of the load of the bldg the foundation will settle. The stone foundations must be bonded like the bonding on a wall. The sheffe ahale mortar must fill the spaces between the stone + the exterior surface of the ditch. in order not to have empty spaces in the foundation which will stop the penetration of water from the exterior surface of the foundation to the interior spaces between the stones + sheffe.

The role of sand.

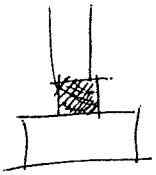
In earthquake zones (most parts of Iran) it is better to pour sand under neath the foundation to a depth of approx 15cm. The purpose of this layer of sand is to stop the settling of the foundation when there is a large amount is to neutralise the large amount of movement which occurs when there is an earthquake, and the settling of the foundation from ground water penetration. When the movements in the ground occur the sand leaves the foundation in a free position to have the same movements all across as the ground do - what the sand really does is that it works like a spring in a car which neutralises the strong movements.

25. Limited usage of concrete.

In foundations which are built in unstable areas / ground one can use a layer of 20 cm thick ~~concrete~~ concrete reinforced with 12 ~~mm~~ mm steel rod. [In buildings with 1-2 storey height) on top of the sand layer. (Fig) The purpose of this concrete layer is to stabilise the stones underneath the foundation and it will make the foundation settle evenly + it will resist the movement of earth.

Setting out of walls.

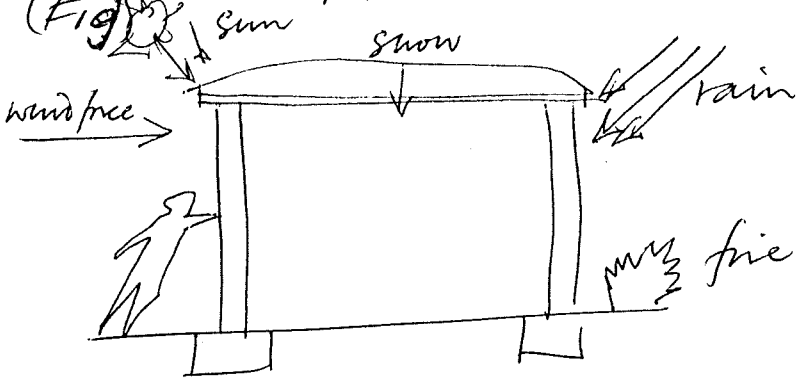
After building the foundation the way that the walls are supposed to be located on it has to be clear. The wall has to ~~be~~ sit in the middle of the width of the foundation so that equal pressure will be distributed to the exterior and interior surface of the foundation. If one is using mud brick, cement or brick walls it is better to use stone for the walls in order for the wall not to have direct contact with rainwater snow + ice on the ground



In earthquake zones this wall ~~string~~ base can be done by reinforced concrete with 12 mm rods. This layer of reinforced concrete will halter the building ~~with~~ like tie beams around the building and it will make the building more evenly with the strong movement of the earth. On top of the ~~se~~ base of the wall, a layer of cc cement and then a layer of bitumen + hessian, in order to stop water penetration to the upper parts of the walls. On top of the gir gouni a layer of cement is layed and then the wall starts.

26. Where the layer of gir gouni is layed is very important and one must pay attention to it.

(Fig) other pos.



WALLS.

Purpose of the wall

Q. ~~Why~~ Why do we build a wall? + what do we expect from a wall?

A: ①. A wall has to be able to bear the weight of the roof, snow + its own load.

② To be a shelter from, rain, wind, snow, ice, sun, + other climatic effects.

③ A security for the members of the family + their belongings against theft + wild animals.

④ Make a boundary for the family.

⑤ Keep the noise out.

⑥ To have stability against earthquake, flooding + other accidents

⑦ In case of fire being able to stop spreading like fire to the other interior spaces of the house.

Explaining the some of the uses of walls.

1. Strength + stability of walls. As we mentioned before the walls bear the loads of ceiling + their own weight. + they transfer it to the foundation + therefore they have to be strong enough to bear other loads like snow, humans, or any other things which are on the roofs.

27. Other than the vertical forces walls should be strong enough against horizontal forces like wind (21) pressure, or forces excerted ~~by~~ in ~~case~~ an earthquake situation. In this case the strength of the mortar of the walls are very important and therefore if the mortar is not strong enough the walls cannot bear the horizontal forces. Another factor which is very important for the walls in order to bear the horizontal forces is for the walls to be vertical. Walls in their lifetime ~~as~~ should be stable against any kind of deterioration and keep their stability.

2. The climatic function of a wall.

Walls should be built ~~in a way~~ considering the climate in a way so that they will act as a filter so that unwanted climatic factors dont get in, and to use the wanted climatic factors as much as possible. For example if we will take sun and wind into consideration: In winter one must use the sunshine as much as possible for heating the interior spaces but in summer one must minimise the penetration of sunshine into the interior spaces in order to keep them cool. Wind in summer can be used to cool the buildings but in winter one must keep it from getting in. Even in the summer one must protect the building from dust laden winds and only to let in cool clean air. Therefore the building should be built and organised in such a way that one can use the maximum wanted climatic factors in order to create a comfortable space for the people who live there. Because the usage of climate has a close relation to the material

28. of which the buildings is built with and the section where we explain the climatic image of the wall everything will be explained in detail.

Different kinds of walls.

Basically there are two types of walls...
1. walls which bear the loads of the beams of the roof
2. walls which bear the load of themselves only + not the load of the roof.

The amount of pressure which each of these types can bear is different, e.g. the non load bearing wall ② can be constructed thinner and with less stability than the loadbearing wall ①. Other than these two basic types which are based on the loads they carry there are two other kinds of walls which are distinguished by the way they are built. ①. Walls made out of a homogenous material - church, concrete, plastics (G.R.P etc) + chalk walls - ② Walls made out of small units - like mudbrick, fired brick, or stone, cone blocks.

Chinch walls

Q. Could someone who has the experience of building a chinch wall explain the process.

A. It must be good earth, it has to be cleaned and the stone + rubbish must be removed. + then straw must be added. (It will be continued in the text) Chinch is one of the oldest types of building walls Earth which is the basic material for this kind of wall has always been available and in reach of everyone. If a chinch wall is constructed correctly it can be a very strong and unexpensive.

¾29 Mixtures of earth for building cmineh.

① Rubbish - stone - bones - plastics + cloth are to be removed from the earth to be used.

② Aqueultual earth which has a dark colour and has roots occupies ½ m ~~above~~ below the surface which is not good for any kind of construction ~~that~~ which mends cmineh walls. The earth which is under this is a mixture of clay sand and gravel. The ideal ratio for building a chineh wall is 1:1 to 1:3 of clay/sand - (50-75% sand)

This percentage of sand will stop the clay from cracking + will increase the strength of the wall against rain. Clay needs a lot of straw in order to be resistant to cracking but a good mixture of clay + sand does not need a lot of straw. ~~The greater the amount of straw~~

Using a lot of straw will increase the wreakness of the wall because insects (termites) will eat the straw.

The slope of a chineh wall shows the increase of pressure in the lower part of the wall. Therefore to increase the walls stability against pressure the lower part of the wall has to be thicker than the upper part. To solve this problem + economise ~~on the amount~~ in the use of the material wooden moulds can be used for the construction of a chineh wall. The wod wooden moulds will compress the earth which will make the wall straight + stable. Rammed Earth construction. (Khent Zani.)

Nasim 10. ~~was~~ has pics.

30. Q. How was is mud brick made?
A. by Mashallah. Mud is mixed with water the night before + it is soaked until the morning. In the morning the ~~earth~~ mud must be thoroughly mixed in the pit + moved from the pit to the brick field [on the way it is shaken for 4 times (?)). In Yazd they usually dont mix the mud brick earth with straw and that is because the earth is suitable for making mud bricks. Earth is poured ~~onto~~ under the mud brick moulds [dry earth] so that the mud bricks dont stick to the ground. There is usually a bucket of water near the person who is making the mud brick and they splash water in the mould in order for the mud not to get stuck to the mould. Then the moued is filled and the mud is pressed down + the top cut off smooth + then the mould is removed. The mud brick which has been made in the morning if it is exposed to sunshine is collected in the afternoon and stood on end until it's dried. The amount of time that it takes to dry depends on the weather. In warm weather it takes 1 day to dry - in very hot weather there is a danger of cracking. In order to protect it from cracking fine earth is poured on top of it to protect it from direct sunshine.

*

Important points in making mud bricks -

1. Agricultural earth on the surface of the ground has plant roots + it's not good for making mud bricks.
2. There mustnt be rubbish + stones in the earth which m.b are made of.

③. Earth must be very well soaked so that the lumps of earth are completely dissolved (the earth must be ~~so~~ soaked the night before)

④ Clay will crack after drying, therefore mud brick earth must at least have min. 30% sand (the amount of sand can be measured by the experiments which were explained before) Mud brick earth must be have very fine sand and it must be up to 50% of the earth which is used,.

Sand will increase the strength of mud brick against water and it will stop it from cracking.

5. If the amount of sand in the earth is not enough + (tables) straw must be mixed in order to protect the mud brick from cracking. Earth which has less than 40% sand

⑥ of its own volume has to be mixed with 10 kilos of straw for every 1000 mud bricks.

⑥. The mud for mud brick must be thoroughly mixed + turned over until it is ready for use.

⑦. The minimum time ~~to~~ for mud brick to be dried is 2 days.
The mud bricks which have a large mixture of clay must be dried in shade gradually in order for them not to crack.

Mud brick walls are very good insulators against heat + cold - (very low conductivity factor) which is even lower than fired brick walls.
It takes a very long time for a mud brick wall

32. exposed to direct sunshine to absorb heat + it will not conduct the heat to the interior spaces of the rooms easily, therefore the rooms will be cool during the daytime. By evening the wall is completely warm and it will conduct its heat to the rooms therefore the rooms will be warm at night. by morning the wall has lost all its heat + the procedure repeats.

- Performance of a wall against rain, heat.

Walls which are made out of mudbricks, cement + even (some) bricks are not waterproof and rain water can penetrate and can be absorbed into the walls. Therefore to prevent the penetration of rain water into the rooms the thickness of the exterior walls of a building must not allow the penetration of water to the interior surface of the wall. The interior surface must stay dry so that after the rain has stopped the amount of water that has been absorbed by the wall can be evaporated in order for the wall to be dry again. A mud brick wall which is exposed to direct rain can gradually be washed away which will reduce its life.

Protecting mud brick walls against rain water.

1. On walls with no roof, there should be a waterproof overhang of 50 cms.
2. ~~On~~ mud brick walls are ~~at~~ covered with straw/mud at least every 3 years to protect the mud bricks from being washed by rain.
3. In some rural areas [some areas of Lucotan]

33. a layer of brick is built on the exterior surface of the mud brick wall.

4. Other coatings than straw mud (which still very protective against rain anyway) can be used. These coatings or plasters can be specified in 3 types.
Lime coatings
Cement coatings
Bitumen coatings.

i- Brick coating or a layer of brick on the exterior surface of mud brick walls.
This type of wall which on one hand increases the strength of the mud bricks against rainwater gives a brick facade to the building: on the other hand it has its problems. Using both mud bricks and fired bricks together will create problems like the use of mortar, eg. mud bricks can be laid with mud mortars but this mortar is not suitable for bricks. The part of the wall which is made out of mud bricks will naturally settle after a while but the brick doesn't. This makes the wall uneven if the mud brick and the bricks are laid separately meaning to erect one wall first and then tie the other one to it, will create the problem of bonding of the walls. and they will not be strong enough against earthquakes or the settling of the building, and therefore the mud brick surface and the brick surface will come apart, and because none of them on their own have the strength to bear the loads the building will collapse. therefore the kind of mortar + the correct method of bonding in this type

34. of wall is very important. There were experiments done in the workshop which the conclusion was that it is basically dangerous to build such walls in earthquake zones.

—

Lime coatings (for mud brick walls)

Different kinds of lime coatings were experimented on in the workshop and they are ①. A ratio of 2:1 sand/lime. a wooden trowel is used to spread the coating on a straw/mud wall which was been soaked with water ~~the night bef~~ in advance.

②. A ratio of 3:1 sand/earth with 10% of the volume being lime is mixed and mud brick wall is coated.

③. A ratio of 2:3. brickdust/lime.

After experiments like exposing ~~those~~ coatings to rainwater, those coatings of nos. 1, 3 showed the maximum strength. (table)

One must bear in mind that the kind of earth sand and lime differs from place to place + before using the coatings on a building they must be experimented on.

CEMENT COATINGS.

Cement cannot be used as a coating for mud & walls or + chinch walls as simply as it sounds because cement and earth wont stick together very well, but if ~~a coating made out of a mixture of earth and sand~~ the wall is coated with a mixture of earth and sand first ~~and~~, then a diluted coat of cement can be spread on top. This coat can be 2 or 3 very thin layers.

35. Different mixtures of cement coatings.

① 1 cement mixed with 12 fine sand.

② 1 cement 1 lime 9 sand

③ ~~1 cement mixed with earth~~. Earth./cement.

Bitumen coatings

By with mixing a little amount of liquid bitumen with earth a coating will be prepared which will protect mud brick walls and burnt walls. against rainwater. Bitumen cannot be mixed with earth easily and in order to overcome that problem soap can be used. The soap can be mixed with the liquid bitumen + then mixed with earth. The ratio of bitumen to earth will differ ~~with~~ from 1:10 to 1:16. and it depends on the kind of earth. Clay needs more bitumen than sandy earth. This coating has to be done in 2 thin layers on the walls.

Coatings

Its important to clean the walls before ~~for~~ coating. Any kind of soft objects must be removed from the surface of the wall in order for the coat to stick well to the wall the wall must have a non homogenous surface. Before coating the wall must be wet.

Tables of experiments on the coatings.

5 mins against rain	direct after one day	2 min against rainwater.	Impact test.	Scratching surface	Kind of coating
resistant	resistant	resistant	dents + cracks	very strong + firm + hard.	2 sand / 1 lime
weak	weak cracked	weak	dents + weak cracks	medium	2 sand 1 earth 10% lime
resistant	resistant	resistant. but softening	shallow dent	hard ~~strong~~	buck dust + lime
resistant	resistant	resistant but soft	shallow dent	medium hard.	bitumen + naft. 5%
resistant	resistant	resistant	very shallow dent.	hard.	bitumen + naft 10%

STONE WALLS.

Talk about your expriences in Stone laying. Good nice quarry. stones must be used They must be lime stones. The mortar used for a stone wall must be ~~very~~ strong and it must have cement in it: 6 Sand and one Cement. The thickness of a stone wall can not be any less than 50 cm. ~~The stones must be bonded, not more than 4 layers can be layed in a day. Because they must be~~ Because time must be allowed for the wall to ~~dray~~ dry not more than 4 layers can be ~~laied~~ layed in a day.

~~Two~~ Essential points in Building ~~a~~ stone walls.

1) Min. thickness of the wall must be 50 cm.

2) The Stones must be wet before using in order ~~to~~ for the dust to be removed.

3) (In ~~every~~ each layer a stone ~~a~~ which is the same lenght as 3/4 as the thickness of the wall must be layed in every 1.5 m)

3). A ~~stone~~ which is (3/4 of the thickness of the wall) long must be layed in every 1.5 m in every layer.

4) In all Corners, and all around the doors and the large windows larger stones must be layed the Size of the stones must be 3/4 of the thickness of the walls.

5) MORTAR: 1 cement, 6 Sand or 1 cement, 2 lime, and 9 Sand.

FLAT TIMBER ROOFS.

Master Builder Reza From the plains of Yazd.
The [Sefidar) (Tabrizi) white poplar is the
~~The necessary~~ necessary amount of poplar is sawn (4m). 2 frames (plates) are placed on ~~the~~ two opposing ~~corners of the walls~~ (under the Timber beams).

Then the Beams are placed on the frames. 60 Cm apart. A ~~Board~~ timber board with a thickness of 3 Cm (poplar) and 60 Cm long is nailed to the timber beams.
They used to ~~put~~ pour mud on top of the board in the old ~~en~~ days, the mud being clinch mud. or they would fill the cracks on the board with saw dust. They use plastic sheets to cover the boards now a days. Straw-mud is mixed with salt and it is spread on top of the roof to a thickness of 10 Cm. Mud ~~with~~ which contents sand is usually better. The reason for adding the salt is to stop the roof from leaking. Sometimes the Roof Beams are placed ~~with~~ on a slant. ~~Then~~
The mud gets (compacted) pounded on the roof, after two to three days it dries. It's again covered with a mixture of Straw-mud and salt. ~~Then~~ ~~took~~ ~~this~~
The straw-mud is harrowed, the Trowel shouldn't stick to the straw-mud. ↖ smoothed.
Poplar trees ~~are~~ ~~as~~ ~~usu~~ which are usually used in this kind of Construction take 7 to 10 years to mature. (Depending on type of the earth and the amount of water).

The minimum diameter of a timber beam which is used for roofs of ~~habitant spaces~~ rural habitant spaces must be 12 Cm. The trees must be sawn in Autumn, because that is when they are in their heaviest and strongest phase. In some areas like "Lorestan" occasionaly the trees are sawn in

spring. It is said that spring timber is usually the whitest wood, But they are weaker than the ones fell in autumn. The best months for saving down trees are November (Azar), December (Day) and Jan, Feb. (Bahman).

"The timber" We either buy the timber or cut down trees, and then we start building.

or fell trees, and then we start building.

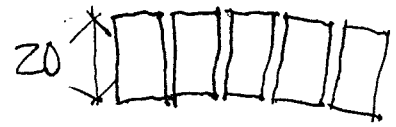
When the building reaches the roof the timber is ready to be used. (Approximately 2 weeks after cutting the beams they are left on the ground for sometimes they are leaned against the wall. In every metre there are 3 beams placed. In the old days branches of the willow or bark were placed on the beams. A special kind of straw is called 'Boosh' in Luri [same as Sarakhi's in caspian = fern/bracken (J.N)?] is placed on top of the beams which would protect the roof from penetration of water. Nowadays boards are nailed to the beams. The boards being 1cm thick + 1m long and then cardboard or plastic sheets are placed on top of it and then covered with a layer of hard mud and finally a layer of dry earth is poured on top, and then a stone roller [galtak] is used to compact the earth. Then the roof is covered with straw mud which is usually mixed with salt. Sometimes sand is added too. The salt stops the roof from freezing. In Luristan the beams of the roofs are directly put on the walls. All this was said by a Luri builder

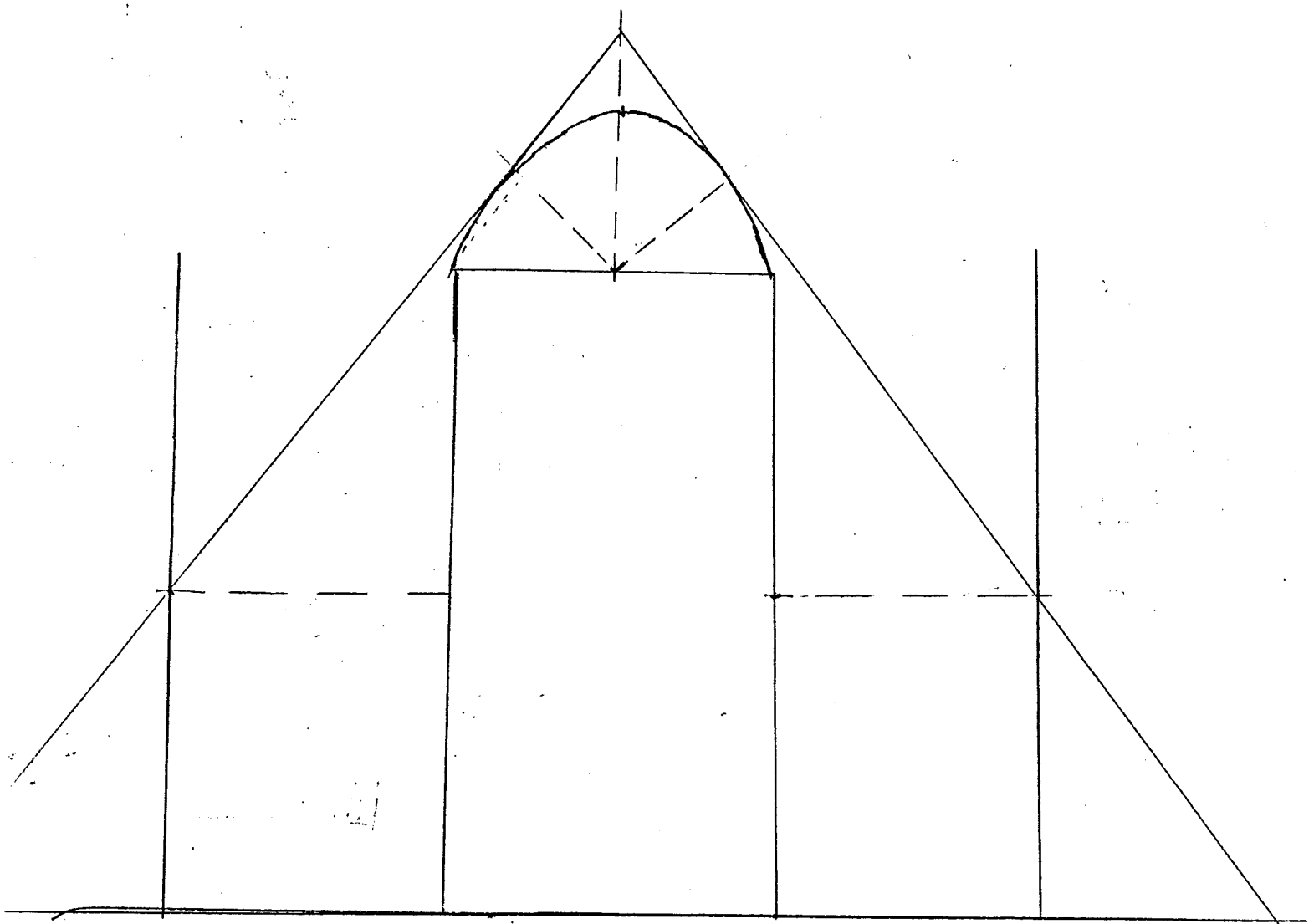
Ustad Mamallah. Arches.
? talks about arches [Rumi]

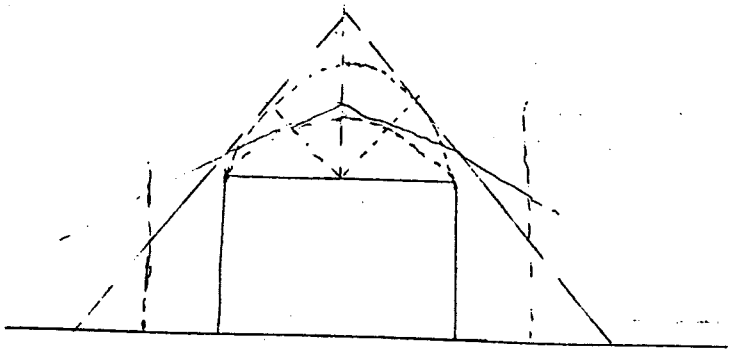
There are four kinds of arches.

1. 1 metre span - ½ m rise.
2. 1 metre span 25 cm rise.
3. 1 metre span 50 cm rise but the arch is pointed. Shaq e Bozi
4. 1 metre span 10 cm rise.
5. Engineering arch 5 cm rise / m, + the 5 cm rise is from underneath. On top it is level. F

The 10 cm arch and the engineering arch must a least have 20 cm thickness, meaning the ~~brick~~ bricks are laid vertically. The higher the rise the stronger the arch, meaning it can bear more pressure. Of course the rises must be correct. or regular in form + repetitive form.







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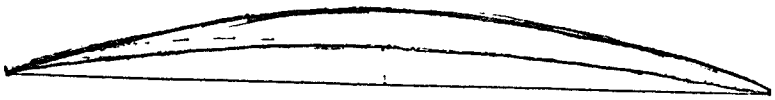
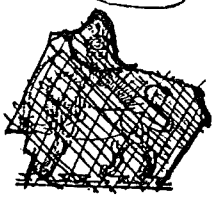
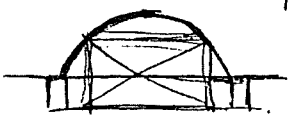




پاشالله در سه روی ۱ (قوس)

1 m / 50 cm.



Shaq Bozi

چهار نوع روی داریم.

۱- یک متر دهنه ½ متر دور ـ دور نخف.

۲- " " " ۲۵ سانت دور.

۳- یک متر دهنه ۵۰ سانت دور را سرد دز است پاشاخ بزی

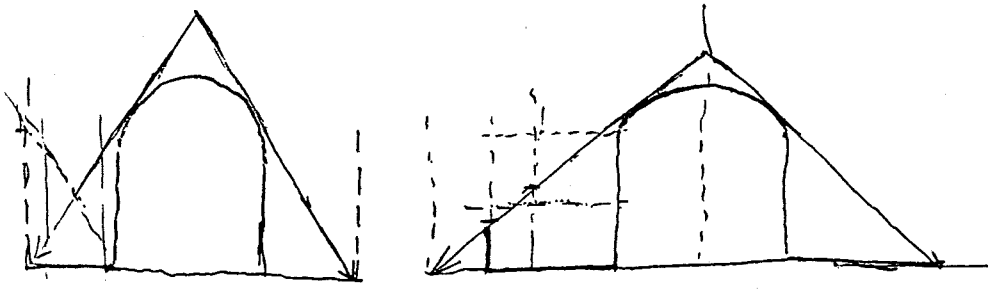
۴- دور یک متر دهنه ۱۰ سانت دور

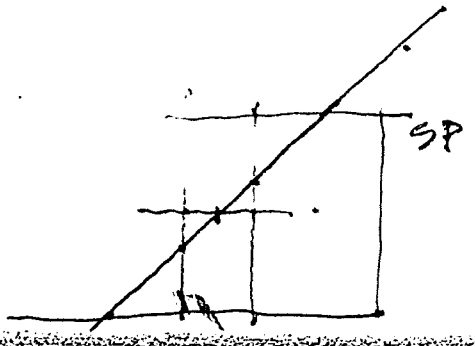
۵- روی مهندسی متری ۵ سانت دور: از زیر ۵ سانت دور دارد

از دور تراز بسته میشود.

روی ۱۰ سانتی مهندسی با یه حداقل ۲۰ سانت ضخامت داشته باشه یعنی اجرا است که داشته میشه

دور بیشتر شد، بیشتر تحمل میکنه. البته دورها باید طبق قاعده باشه





Timber Roofs. Tape 18

The beams which are used in Alashtar for roofing are Karen, sefidchub, bid (willow) or manbar & ~~[illegible]~~

It takes 7-8 years for the trees to mature. To build the trees are felled in autumn. Autumn wood is heavier and stronger but they also fell trees in Spring in Lurestan because the wood is paler.

The people who own and fell the trees do not agree on felling the trees in autumn. They usually wait until the beginning of november and the best months are december. jan. feb. After felling the trees they usually grow the trees 3 or 4 more times again.

Insert. Wrote by Lurbuilder. -

— ... ~~Lume mustu~~

using lime on roofs ~~is~~ lime mustut be used on roofs.

Placing beams on the ground: willow wood is used underground - willow is stronger than Tabrizi [black poplar]. Thinner wood (branches) are placed on top of the beams, perpendicular to the beams ##, ~~the~~ or spaces left for ~~changing the~~ underground. (underneath ? J.)
replacing the beams ~~on the ground~~

The distance between the beams and the roof doesn't change. But the underground thickness ... (!)
check.

Burning the heads of the beams which are placed in the walls was common. sometimes they use black oil.

Conclusions of the timber table

Characteristics of timber.

1. Considering the weight of timber it has a great capacity of bearing pressure, being both used as columns or beams, meaning it is strong in compression and tension (for example concrete is only good in compression but not in tension)

Trees usually absorb the water from the ground through the roots + the cells are full of water. When a tree is felled, because of direct sunshine and heat the water is evaporated and the wood gradually dries. This drying process is very important. When the wood is dri is being dried: 1. Its bearing of loads increases. 2. Its resistance to heat increases 3. Its resistance to ~~wat~~ insects and fungi increases. 4. Painting, nailing + glueing will become easier. 5. Easier to protect it with oil or black oil [it absorbs them better).

Therefore ~~water~~ moisture is a dangerous factor to wood.

Its resistance against fire is more than R.S.J.'s, I beams of the same size. Its true that wood burns, but steel doesn't but steel melts on high temperatures and it collapses under compression but wood has to burn completely before/ until it collapses. When wood ~~burns~~ is on fire the surface burns and it becomes black, the coal on the surface or around the wood stops the wood from burning inside + therefore the inside burns much later.

One of the biggest mistakes when using wood and protecting it is after the cutting which is never taken care of.

Timber talk

If wood is exposed to direct heat or sunshine in 20 days it will dry very quickly but the inside will remain wet. The surface will contract and crack and the cracks that we see in some beams is the result of this process. Therefore it is better if the wood is dried in the shade, gradually if the wood is left on the ground it will absorb moisture and it won't dry correctly. and it will be in danger of insects.

Protecting the wood from insects: ~~Timber which has been attacked by insects~~ The insects which attack timber will be killed ~~by~~ in temperatures 0 - 40°c. for preserving the wood the beams are placed on blocks raised from the ground. The beams are placed on the blocks ~~at~~ at a distance from each other The blocks must be covered so that ~~direct sun~~ they are not exposed to direct sun in order to protect them from cracking and insects which make the timber weak. Timber is a very good material if it is used correctly and if its available. The minimum time for drying is 3 weeks (summer) When the wood is moved from the drying place to the building site it must be left in the ground nor exposed to rain water. Before placing the beams the parts which are in direct contact to the wall and have a possibility of absorbing

moisture must be covered with black oil. [naft-e siah] (46)
& dried again.
Telegraph poles are of this kind and they are covered with naft-e siah - they are guaranteed for 60 years.
The timbers that are exposed to the outside or indoors again have to be covered in naft-e siah.
Timbers exposed to are in danger of catching on fire. In some places/areas timber is dried in kilns but in most dry areas in Iran the natural method of drying is sufficient. Timber should have less than 20% of its weight in moisture.

-Continue timber talk - preservation.

Preserving timber with black oil: Bulkus? (47)

Black oil must be completely absorbed into timber in order for the timber not to be able to absorb any other fluids. Timber must be in black oil for at least 10 mins. For greater absorption the black oil can be heated and then the timber can be put in the black oil until it cools.

After felling trees must be replanted in order to have timber again for the future. Its the opposite with steel beams which are to have taken thousands of years for the iron to be made and they can now be used in an excess amount. Sandy lands which are not usually suitable for other agricultural use can have trees planted in order to use the timber.

The method which is used in Luiston for putting the beams on mud brick/brick walls is to distribute the weight of the beam only on a small area, but the correct way is to spread this load as much as possible over the wall. If a roof plate is used meaning to lay one beam along the wall and the other beams on top of this plate. in this case the force will be equally distributed along the wall. Therefore the use of a plate is necessary. If the plate is made out of wood split in half then the force will be distributed on the wall much better, and there is less timber used. The flat surface of the plate must be laid on top of the wall and if the semi circular surface is fastened, it has greater efficiency. The timber beams must be nailed to the plates this will prevent the building from the dangers of earthquake and settling of the building, and it will also produce a stronger roof. The plates will be placed on every four walls, and then they are tied together and then the roof will be one whole peice