Photogeology in Terrain Evaluation (Part – 1)
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Lecture – 04
Aerial Photography

So, this is another topic, which is the most important one for us in terms of the photo geology course. So, we will talk in this lecture regarding, different type of photographs taken at any aerial platform, either by satellite or your aircraft or either you are using helicopter or anything.

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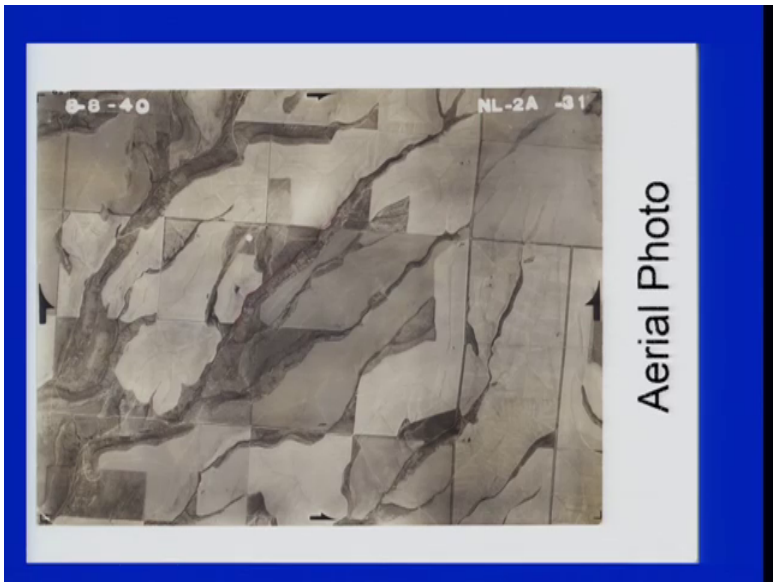

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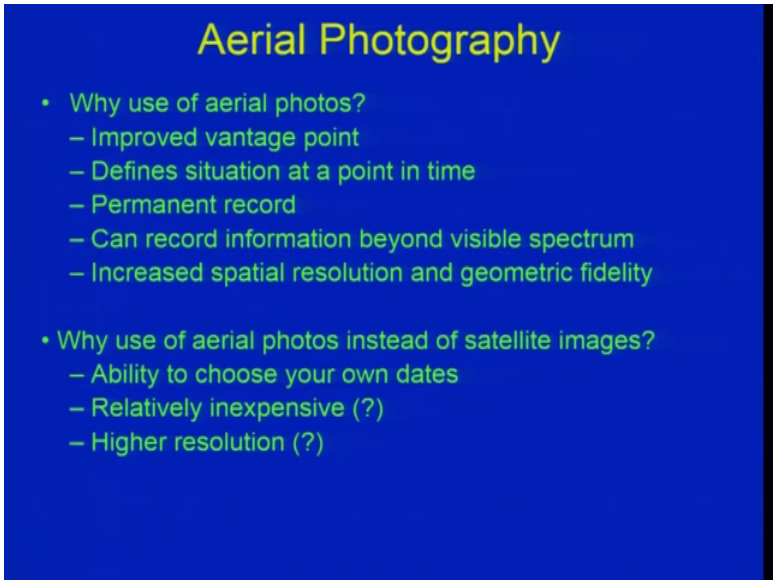

So, basically the aerial photography, if you look at why we use the aerial photographs because, it improve the vantage point, defines situation at a point in time, it will give a permanent record, can record information beyond visible spectrum, increase spatial resolution and geometric fidelity. Why use of aerial photographs instead of satellite images? Here you have an ability to choose your own dates, when you want to fly otherwise, in terms of if you are taking the satellite data, whenever the satellite will move over that area, only that data you will be able to collect.

But here, you can decide your own time and date, when you want to fly? And where you want to fly exactly? So, this is an important part and why we use aerial photos, more and why it is useful as compared to the satellite data? Relative inexpensive because, for launching a mission where you collect the data by satellite sensors, it will have a lot of expense but here if you are having a very good camera, you can get into the flight and take the photograph, either you use helicopter or maybe and another like, now a days we are using unmanned aerial vehicles again.

So, you can use UV's also and try to collect the data, whenever you want and variable you want actually depending on the conditions and it comparatively, you will have higher resolution, what we are looking at in the satellite imageries. So, these are the few things where they aerial photographs are important and more useful, as compared to the satellite images ways.

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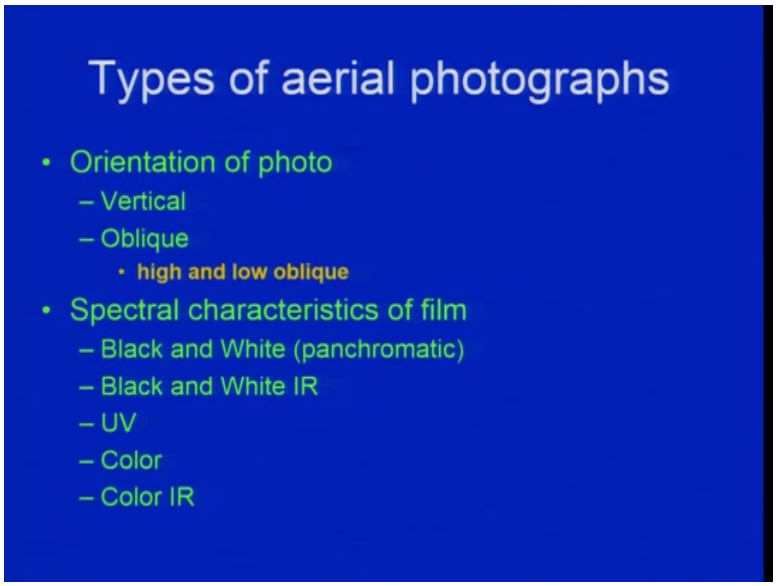

So, type of aerial photographs, we will discuss of course, in detail when we are talking about the type of photographs, but in general we have the, depends on the orientation of the photos, that is the orientation of the sensor of the camera by which you have collected the data. So, either it is exactly vertical, or it is oblique an oblique also high oblique or lower oblique. So, you can have different type of photographs, spectral characteristics of the film even have panchromatic black and white infrared, ultraviolet color or color infrared. So, you have again the range of spectral characteristics of the different films, which are available which you can use depending on your requirements.

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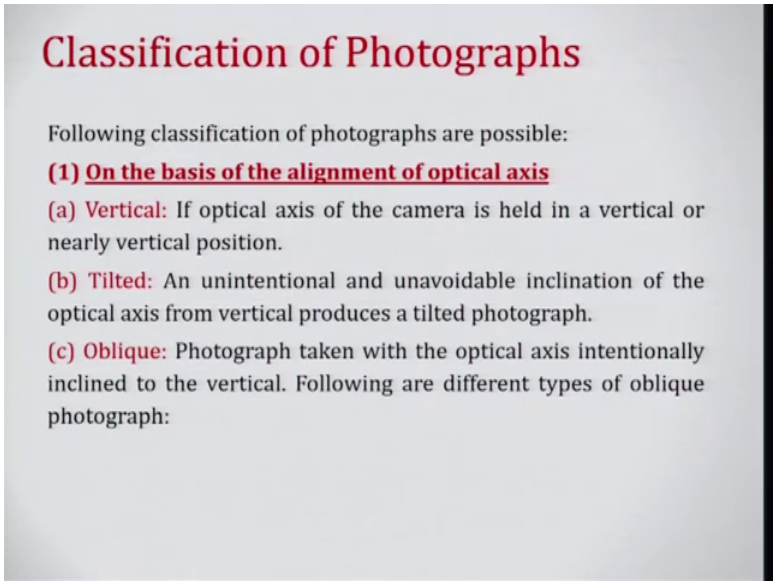

So, classification of photos, aerial photographs following classification of photographs are possible, one is on the basis of the alignment of the optical axis. Now, this optical axis we are talking in terms of taking into consideration the camera lens. So, vertical if optical axis of the camera is held, in a vertical or nearly vertical position; with respect to ground tilted an unintentional or unavoidable tilt, or inclination of the optical axis, from vertical produces slight tilt in the photographs.

So, you may have come across many such photographs which are slightly dateless, and they are not exactly vertical. Oblique photographs taken with an optical axis, intentionally inclined to the vertical.

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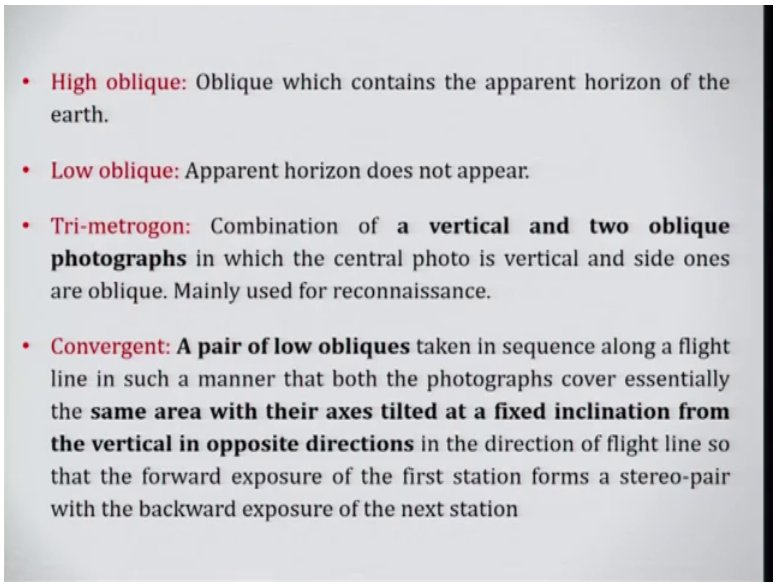

Following are different types of oblique photographs, if you take you have high oblique, which contains an apparent horizon of the earth, then you have low oblique apparent horizon does not appear. So, horizons you are looking at so, if you are having a land and then you are coming into looking at the contact of the sky, and all that. So, that is what we are calling the horizon so, high oblique and low oblique. So, in low oblique apparent horizon you will not be able to see, but in high oblique you will be able to see the horizon.

And other one is tri metrogon, there is a combination of vertical and oblique photograph, in which the central photo is vertical and the side ones are oblique. So, if you have this combination, then you will say that this is, tri metrogon type of photograph. So, where

you have the combination of vertical and 2 oblique photographs on the side. Convergent is a pair of low oblique photographs, taken in sequence along a line of flight, in such a manner that both the photographs cover essentially, the same area with their axes tilted, at the fixed inclination from the vertical in position of in that direction. So, these are the type of photographs. So, if you look at this one, the sketches which explain to some extent that how the vertical will be?

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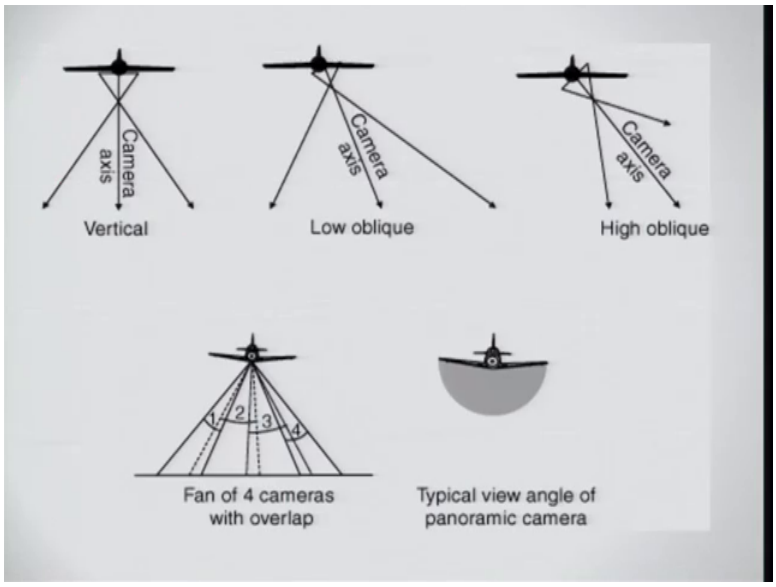

So, you are having with respect to your optical here, you have the completely vertical photographs you are taking here. So, it vertical with respect to your round here whereas, here slightly oblique. So, this camera is oblique to the ground here, highly oblique mortal and this which you see, is your plane of the lens and you have in combination of overlapping. If you are looking at the panorama then, you will have the complete photograph covering in wider area, but again you may have at the center this is a combination of all center may be vertical, but the sides will be an oblique one.

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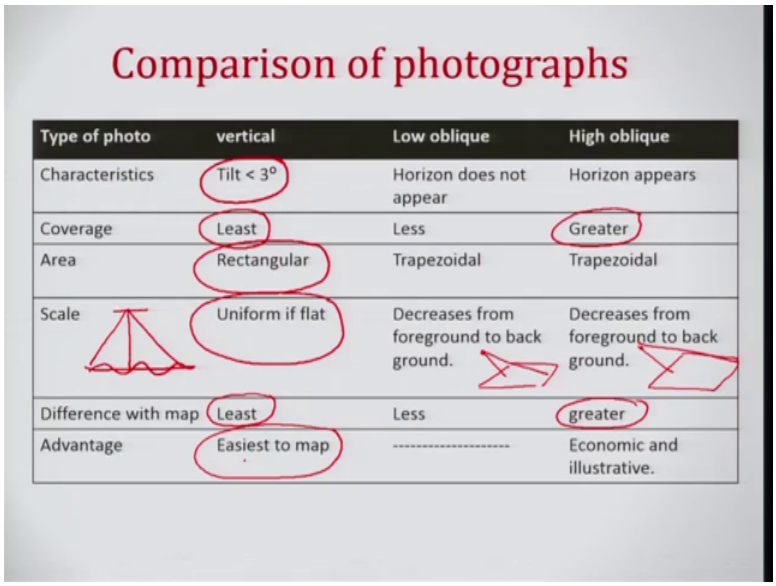

So, if you look at the comparison in terms of the vertical photograph, low oblique high angle or high oblique photographs and their importance in terms of the coverage of area, scale and all that, this is the important table which you can remember.

So, for vertical the tilt will be around less than 3 degrees, and these are typical characteristics of that, as in case of the low oblique horizon does not appear in case of the high oblique horizon appears here, and the in terms of the coverage he will have the least coverage, because you are not viewing oblique. So, you will have least cover in terms of the vertical photograph, even has comparatively less in terms of low oblique, but you will have a very large area covering, when you are looking at or taking the high oblique aerial photographs.

Area covered will be mostly rectangular, trapezoidal in case of the low angle and trapezoidal also in case of the high angle, scale will be almost uniform if the terrain is flat. Otherwise the scale will change, because if you are taking for example, from this point here and you have to take the photograph the terrain is undulating and the height of the scale is different at the front point, but it can average it out if you are having a flat terrain, then the photograph will have very uniform scale, in case of low angle or low oblique photographs, it decreases from the foreground to the background.

So, if you if you are having in camera here, and if you are looking at for example, this area here, then you have an different here scale, because if you are viewing this one it

will be different. So, in foreground decreases, the scale decreases from the foreground to background. Similarly, in the case of decreases from the foreground to background, difference with maps will be least, because maps usually have a very uniform scale.

So, it will have a less least difference with the available maps, this will have less but this will have greater, because in if you are viewing from here, then you are having high oblique. So, you will have greater variation in terms of the scale, as compared to the maps which are available, the advantage because it is vertical most of the information you will be able to mark accurately. So, easiest to map whereas, in terms of the low it is again, not very easy and this one, that is an high angle oblique, it is good in terms of the economic and the illustration, because he will be able to cover greater radius coverage is very large here, but here if the coverage will be comparatively less.

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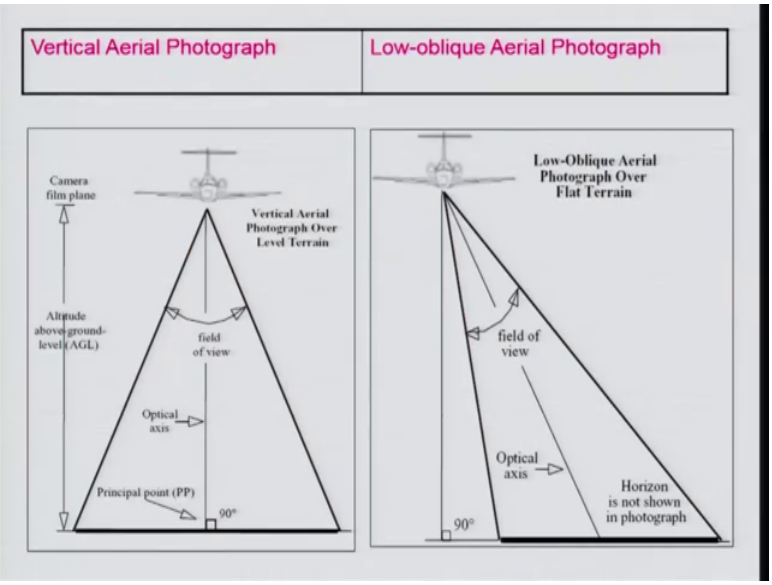

There are few things which are important, which we also discuss in the previous one, that if you are having vertical photograph over the level terrain, then this point that is the lens or the information collected by the camera will be almost 90 degrees here, and that is what we also come call as an principal point. So, the optical axis will be almost vertical with respect to your ground whereas, in case of the low oblique aerial photographs, over the flat terrain the axis will be inclined, unless we will b talking about that, if we are having the vertical photographs the tilt could be less than 3 degrees again.

So, this is permissible whereas, in this case the horizon appears. So, in this case or sorry horizon will not appear in this case, that is low angle, but is in the high angle it will be seen.

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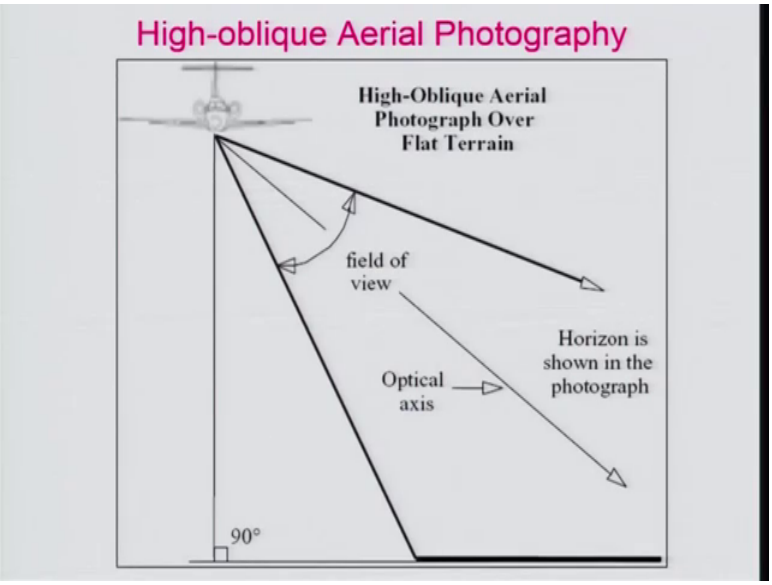

So, this is what we see the high angle where you will be able to see horizon. So, I will show couple of ground the photographs, which have been collected or taken by the from the aircraft which will clear your understanding of, the high oblique low oblique and vertically.

Now, this is we did some survey in kutch, after 2001 bhuj earthquake, where we used the small aircraft to map the area, now the reason was that we were not having very high-resolution satellite data, for this region and we wanted to map the surface deformation which was been caused by 2001 bhuj earthquake, it was large very damaging earthquake which occurred. So, we decided that let us fly and try to look at, and understand the pattern of damage, in the area in kutch district, as well as the surface deformation caused by 2001 bhuj earthquake.

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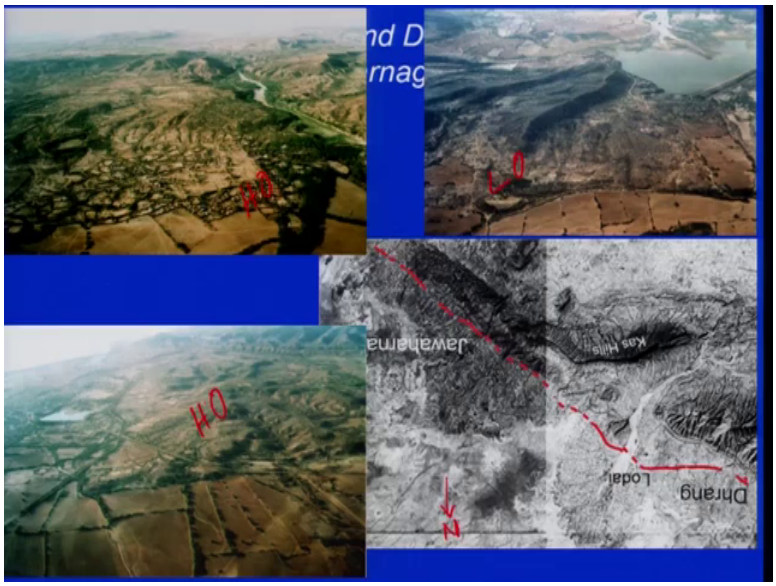

Now, this is the satellite photo, corona satellite photo I have put upside down just to compare with the aerial photographs which we took. So, where these are the location may be you will be able to read out, this is jawaharnagar and this is known as lodai, and dhrang and we may talk or most likely, if we are having in this part or may be in the part 2 about the mapping of active faults and all that, but this is the what we call the fault line and based on our studies, we suggest that this fault line is an active and having incapability of producing large magnitude earthquakes in near future.

But, the question was whether this fault line was responsible for producing 2001 bhuj earthquake or not, we wanted to map that actually. So, what we did we. So, it is so, in photograph if you look at this side is north, this is your north and this we are moving towards south again. So, this is the south or southeast. So, this an you can easily make out now, which type of photograph we are looking at, we are unable to see the horizon.

So, this photograph which was collected by our normal SLR camera, this low oblique aerial photograph, where you are unable to see the horizon and this portion which you see here, on the aerial photograph you can see this portion here, on the satellite photo this 2 lines here, if you look at these are the 2 lines which are been seen here this is the ridge lines here. So, this you can compare. So, we flew like this, in this direction viewing the terrain over like this.

So, this post and low oblique aerial photo another one, now here this is slightly high angle or high oblique aerial for their, because you are able to see the horizon here. So, you can see the horizon. So, this is the 2 different photographs, which have been taken along the flight, now this portion is over here and this is from jawaharnagar, again we are able to see the horizon. So, this is jawaharnagar area, which we have taken the photograph here, we are able to see the horizon on the top. So, this is your high oblique photograph, this is your low oblique photograph this is also high oblique photograph.

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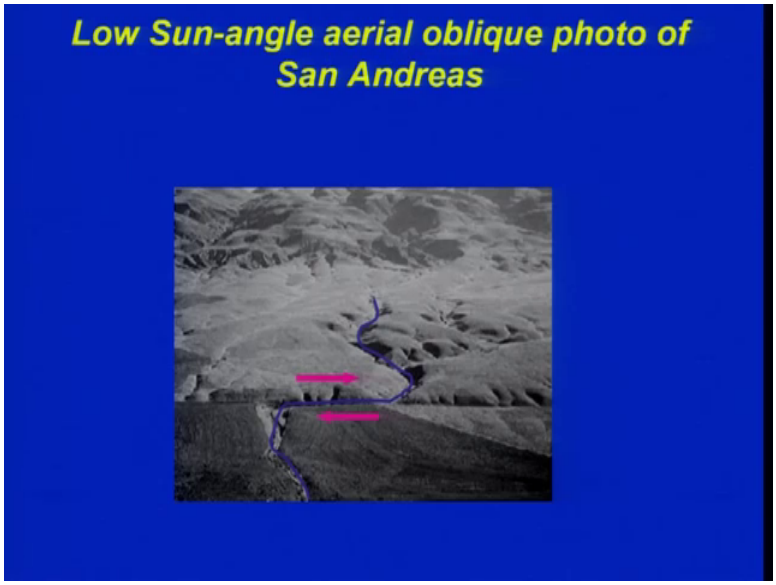

Now, low sun angle aerial oblique photograph, this is from san andreas fall again we are unable to see the horizon, but this we are been taken to map the san andreas fall system, here where you can see the drainage and this is the fault which crosses in the aerial.

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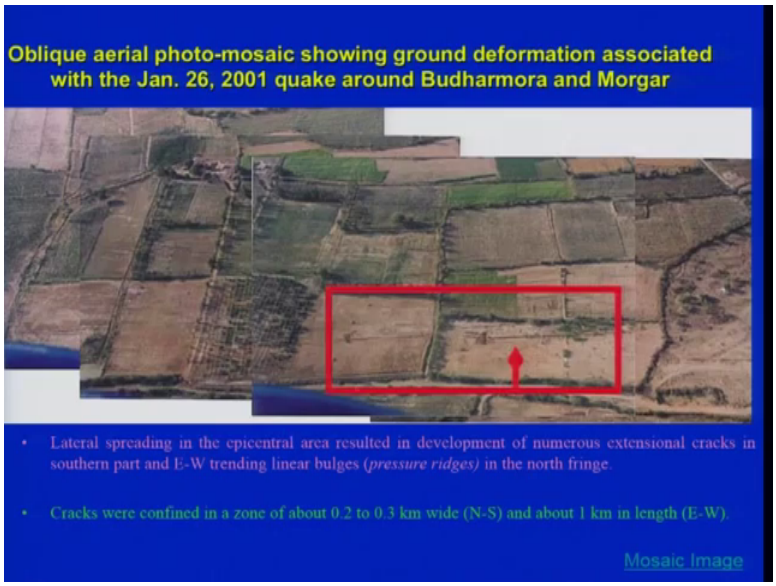

So, oblique aerial photos, photo mosaic showing ground deformation associated with 2001 earthquake in kutch. So, what we did was again, we are unable to see the horizon. So, this is a low oblique aerial photograph.

And since we took the photographs quickly, keeping in mind that we may use this for to view this area or the terrain in 3 dimension, that is how we can have the stereographic vision, because there is an overlap here, you see this part is having the overlap as well as it can help us in mosaicking, the complete terrain or the mosaicking the photographs to have an bird eye view of the terrain we are interested in.

So, what we did was this was as I told that the aerial photography, you can anytime and does it depending on what is the purpose? Or what you want to map? So, we flew we did not wait for the satellite information to come, or the satellite data we flew we collected the informant and then we did the ground truthing. So, that help us in reducing our time because, we knew that which area was showing extensive deformation. So, we went directly to that area and did our field mapping.

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So, the box which has been shown here, in the red I will show couple of round photographs now again. So, close up off not here, if you see this again and close up shot. So, what we did to do this is that, after we were able to identify from air that this area is showing extensive deformation or prominent deformation, we asked the pilot to reduce the height again and we flew at the lower elevation. So, this is again another advantage, if you are flying and taking the information or collecting the information by the aircraft.

So, we took very close photographs, we reduce the fly flying height similarly here this is the ground photograph of this deformation line, here another one, this one is the another deformation line which we identified from the aerial photograph, and did the field investigations. So, this reduced our time and we were able to pick up, the exact correct areas over the points which we are interested to map up.

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So, this is a aerial photo, this is the ground photograph of the same. So, this portion here we are able to see this one this land form. So, it is very useful in quick identification and conducting the field investigations.

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This is from andaman island and the type of photograph again you see here, that you are able to see the horizon, hence this is your high oblique aerial photograph.

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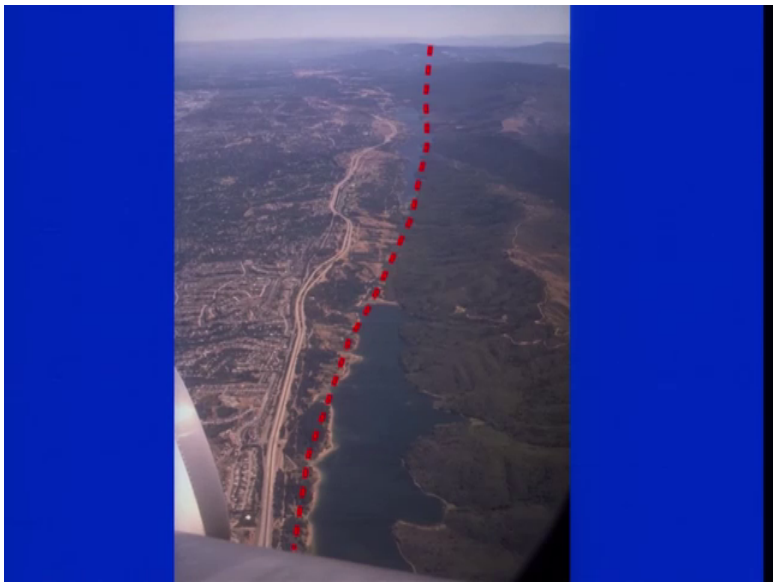

Another one from gain from the San Andreas Fault system, you are able to see the horizon here. So, this is your high oblique aerial photograph.

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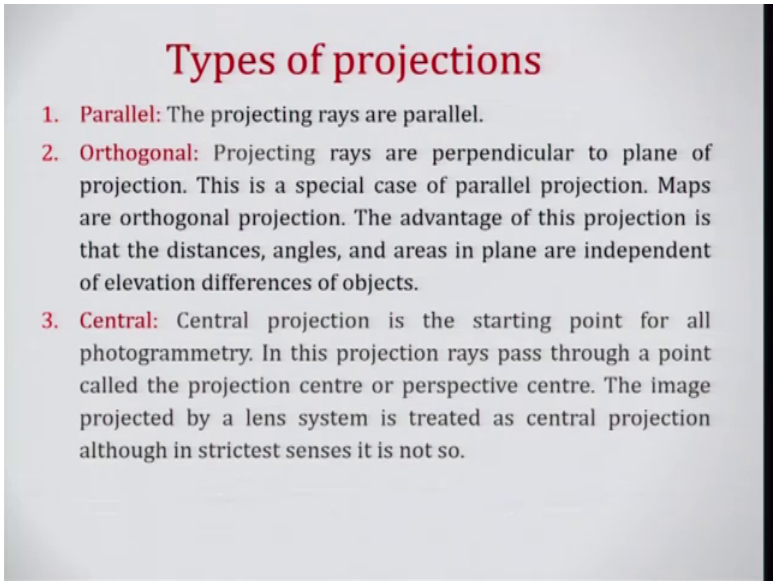

Now, type of projections if you look at, we have parallel the projecting rays are almost parallel here, orthogonal projecting rays are perpendicular to the plane of projection and this is a special case of parallel projection, maps are orthogonal projection the advantage of this projection is that the distance angle and area in plane are independent of elevation difference of the object.

This is almost you are taking an vertical photographs. So, these are termed as orthogonal projections and we are mostly interested in using ortho photographs. Then we have central projection is the starting point for all photogrammetry, in this projection rays passes through a point called the projection center or prospective center, the image projected by a lens system is treated as central projection although strictest sense it is not.

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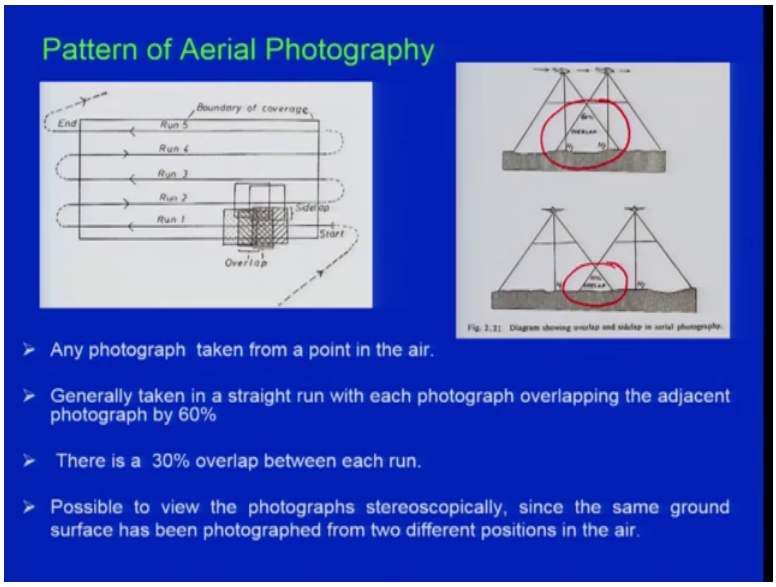

So pattern of aerial photographs or aerial photography is usually done, keeping in mind the overlap along the same line of flight and to the adjacent one, because this helps in having the ortho photographs or you can say the stereo photographs, ortho photographs when it is taken vertically then definitely it is there, but while the liner along the line of light. So, this shows the line of light, you will have you should have the overlap of 60 percent of the area, it is a photograph taken first and the second photograph which has been taken should have almost 60 percent of overlap along the direction of line of flight.

But sideways, overlap you may have around 30 percent. So, any photograph taken from a point in the air generally taken in the straight run, with each photograph overlapping the adjacent by 60 and there is a 30 percent overlap, between each run the sideways over that is along the sideways. So, possible to view the photographs stereographically, since the same ground surface has been photographed from 2 different points. So, this will help us

in generating the stereographic images. So, I will stop here, and we will continue in the next lecture.

Thank you.