Lecture – 14

Earlier we have finish this flexible walls; that means, sheet pile seat sheet pile answer seat pile walls with fixed as well as rotation by means of failure.

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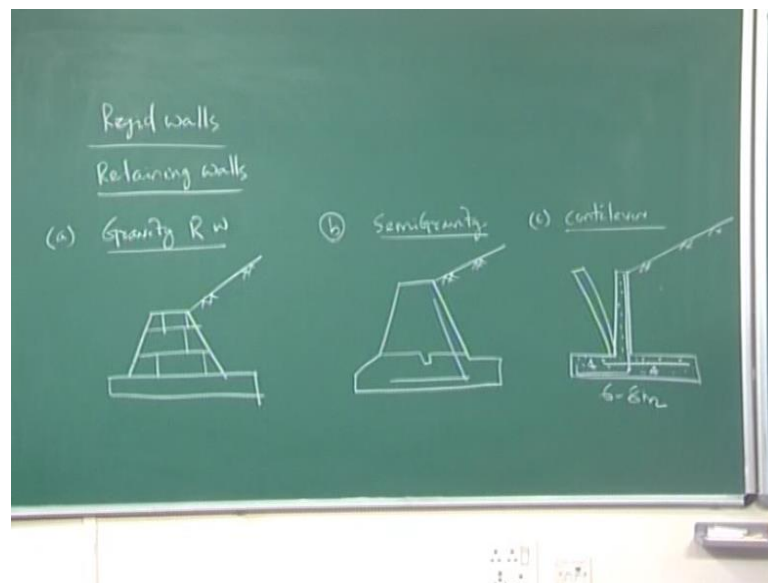
Now, there will be another part that is called rigid walls or we can say that these rigid walls are retaining walls flexible walls earlier, it is a sheet pile wall or Angkor sheet pile wall now, civil early rigid walls application of soil mechanics this is retaining walls. If I classify the retaining walls there are three types of rigid retaining walls. One is your gravity retaining wall, second is semi gravity, third is your cantilever third is your cantilever forth is counterfort retaining walls there are four classifications, it is not three there are four classifications the semi gravity, and gravity retaining wall. Now, you take it as a one. So, retaining walls as been classified into four types gravity retaining wall Semi gravity retaining walls cantilever, and counterfort c o u n t e r counterfort f o r t counterfort retaining wall. If I start with this gravity retaining wall look at this picture it stability analysis gravity retaining wall means retaining wall means, it will retaining soil marks at the one side, it will retain soil at the one side. So, that it constructions of road, and any man made such a can be made. So, what do you mean by gravity retaining wall.

In case of gravity retaining wall the stability analysis the stability of the wall has been it will come from gravity action come from gravity action civil early for semi gravity retaining walls in case of semi gravity retaining walls. So, what will happen gravity retaining wall generally.

If you look at here gravity retaining wall the analysis the stability the stability or the design the stability has been consider based on this gravity by its own weight the stability. So, generally its height or very small. Say have to five meter or three to five meter height has been allowed this gravity retaining wall to increase slightly better height semi gravity retaining wall; that means, this gravity retaining wall some part of this stability some part of this like reinforce reinforcement has been provided that is why it is semi gravity retaining wall. Now, the measure retaining walls or cantilever as well as counterfort retaining walls. If we look at this cantilever retaining walls, cantilever retaining walls it has been made by means of for complete walls, it will look at here this is walls r c c cement motor, and rod.

So, in these case these how it retaining the soil mass by means of cantilever action by means of cantilever action it retaining the soil marks back side of this retaining wall, and generally we can to go up to height go up to height say six to eight meter go up to height a six to eight meter so; that means, it we look at here gravity retaining wall it is three to four meter or may semi gravity three to five meter cantilever retaining walls are very rigid, and it has been constructed by means of r c c rent concrete retaining wall, and one side to retaining by means of soil mark, and generally height preferred six to eight or may be six to ten meters up to that up to that, you can go up to this kind of retaining wall you can used cantilever type of retaining wall. So, you can soil a retain the soil marks up to ten meter why it is say this cantilever, because this soil marks retain it will acted as a cantilever action by means of cantilever action soil marks will be retain.
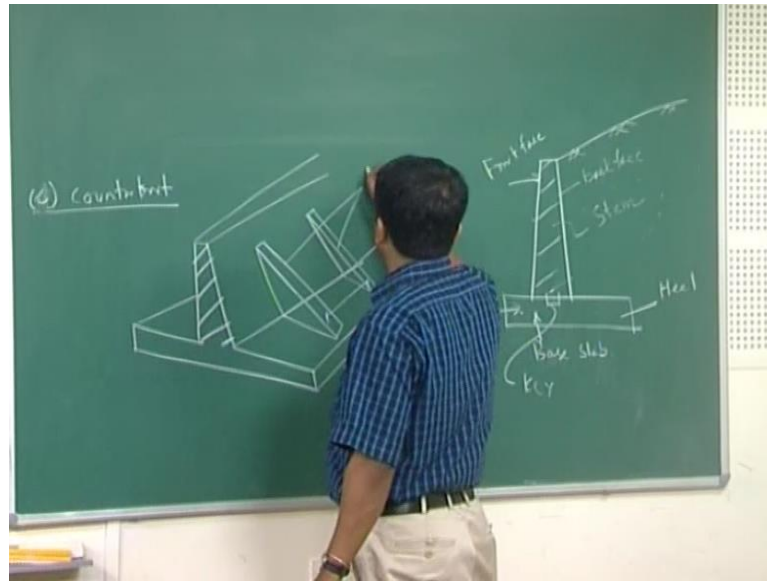
Now, last one is your counterfort retaining wall look at this why is called counterfort retaining wall? What is the meaning behind, it is called counterfort retaining wall. If they look at the four gravity semi this height is very small zero to say three to five meter gravity semi gravity cantilever is six to eight meter it is not necessarily always that you will retain the soil marks up to this side it may possible that you can go beyond ten meter height beyond ten meter height may be ten to twenty meter or ten to thirty meter you want to retain this soil marks. So, that in the you can retain the soil marks one side to…

So, that you can half your construction of road or other man made structure. So, in these case. If you go beyond ten meter height what will you happen? This will fail by means of bending this will fail by means of bending this hall part cantilever action will fail by means of bending. So, it will bend by means of bending means of bending to make it stubble one side of the wall one side of the wall counterfort; these are called of counterfort has been provided inter wall counterfort has been provided inter wall regular x x x. So, that once it has been attached. So, you will go increase the high retaining wall is not going to fail by means of your bending or other parts. So, these are the whole part of the retaining wall gravity semi gravity cantilever, and counterfort walls now, we this let me start with these.

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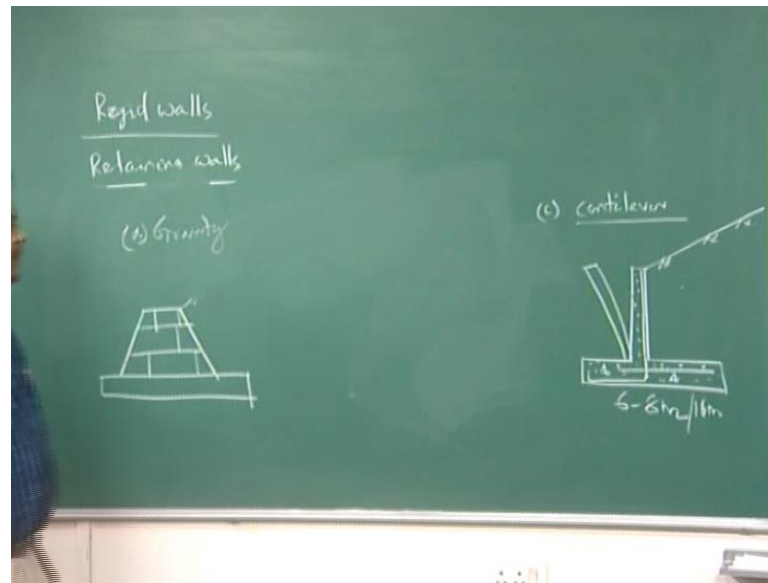
 Let me make it into three parts let me make it into three parts; one is your simple. Let us say one is you gravity inside that gravity, and semi gravity coming into picture second part is cantilever third part is your let us say counterfort retaining walls. Now, what are the common proportion, if we look at here, if we look at here particularly b, and c b, and c if I draw this is my wall, and these part it is going to retain the soil marks. So, this is your front face, this side is your back face, and this is called this enter part this called of this it is called stem, and this is called toe, and this is called heel this is called base slab if a provided key. So, this is called key just to all this thing, if this is a cantilever retaining wall. So, generally the part why are the retaining this soil mark wall this is called back face if the soil mark has to retain this side. So, this side will be called as a back face. So, as the soil mark retain in this side.

So, that is why this side has been called back face, and this side is called front face. So, this enter part were this cantilever action has been taken into consideration or may be this stability as come from the cantilever action this is called stem, and this is called base or base slab this base slab one part where is the front face this is called toe, and back face it is called heel it is same it is same incase of counterfort retaining wall; however, this is called these two are called counter forts counter forts. Now, what are the common proportion? If I take this kind of cantilever wall this kind of cantilever wall what is the common proportion means common dimension these not necessarily that the dimension is to be provided, and making it of one bigger way.

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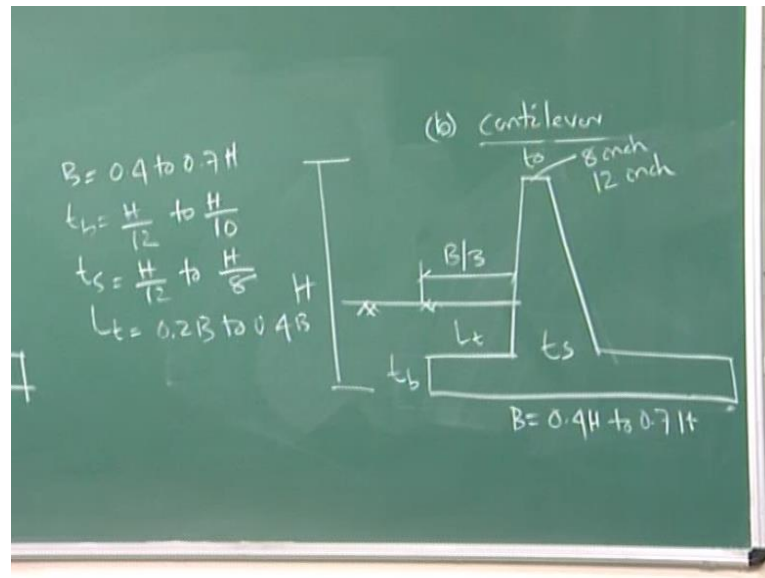
If this is my cantilever retaining wall what weight, it is not necessarily in case of cantilever retaining wall this would be cantilever cantilever, it may here to here, what is would minimum proportion it is eight inch. So, preferably twelve inch So, these would be this distance should be b by three, and this would be your zero point four zero point four h to zero point seven h, and this is your h this is your complete high h, and this parts your b now, if I put it this is my t zero, and and this is my t s, and this is your t b, and this is your l t, then if I am writing that value of b base slab of warring form zero point four to zero point seven h, then t v s equal to h by twelve to h by ten, and t s is equal to h by twelve two h by eight, and lt is equal to zero point b to zero point four b this is common proportion of the dimensioning. This all your common proportion of the dimension means that not necessarily it not necessary that dimension should be within that the region, but about the period of time about the practice the dimension has been derived from the practice of the from the practical point able, it may be either side, it may be within that range, it may go beyond that range, but this is a tentative idea what should be a dimension of your retaining wall.

Thank you for retaining wall what should be what should be a high height other say it is varying from Eight to ten meter zero to ten meter, and other proportion has given. Now, come back to outer floor retaining walls, because before you are going for a design, and stability analysis these dimensions has to be specified you to start from where will start the design you should start with suppose if you assume evaluates is t b, and t e is the at

the end if design is satisfied the dimension are if your design is not satisfied, then you have to change your dimension that put all the sole, and beginning where you have to start these are all called you can say that these are called ten thirty dimension these are all called ten thirty dimension it started with these. If it is satisfied, if you are design criteria as well as stability analysis that is fine; that is the dimension now for counterfort retaining wall.

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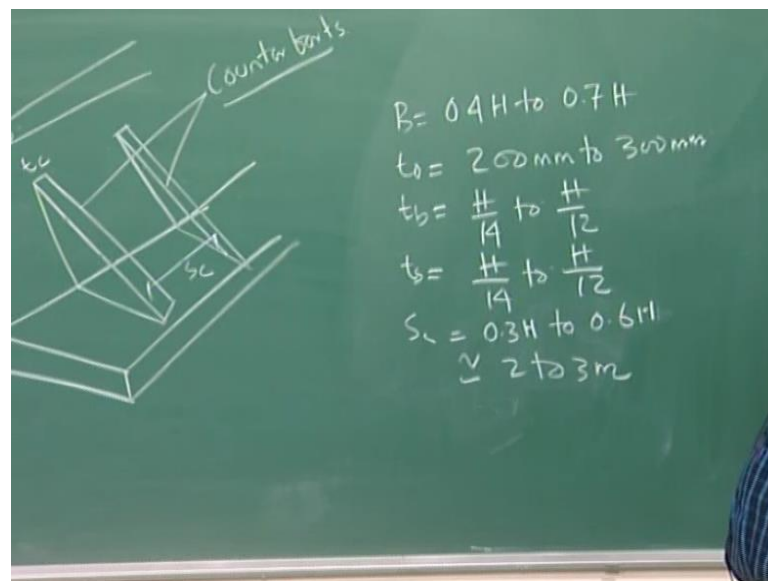
If I write it, if I write is this is my this is hide this is three zero this is t s this is t b this is you b this is a c, this is dc c terms means counterfort; these are all counterfort, and if I write this ten thirty dimension b easy equal to zero point h to zero point seven h, and t zero easy equal to two hundred m m to three hundred mm, and t b easy equal to h by fourteen to h by twelve, and t s easy equal to h by fourteen to h by twelve, and sc easy equal to zero point three h to zero point six h or sc taken us generally two two three meter these are these kind of Indian conditions means some of the values are certainties based on the design earlier design on the based on the applied in the field. These are all the ten thirty dimension of cantilever, and counterfort retaining walls, then if you come back to gravity retaining wall if you come back to gravity retaining wall.

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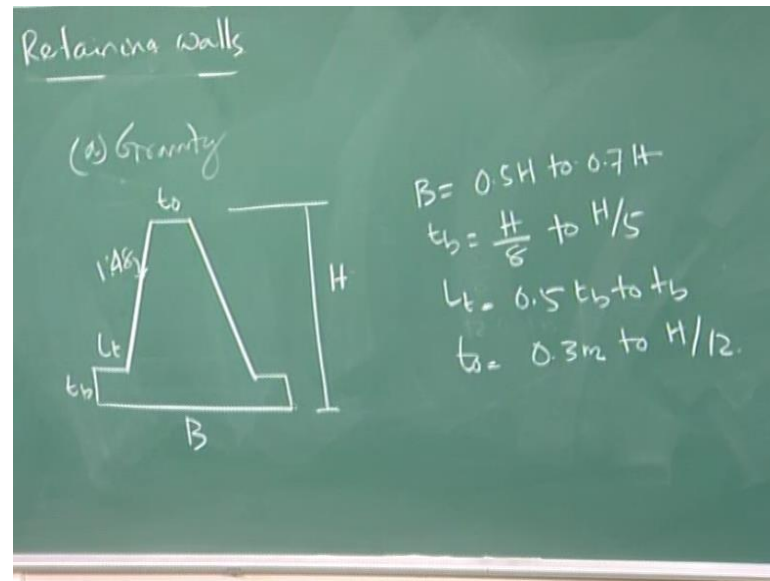
So, base easy equal to gravity retaining wall zero point five base to zero point seven h, and tb easy equal to h by eight to h by five t easy equal to zero point five t b to t b, and t zero easy equal to zero point two meter to h by twelve, and minimum back it should one is to forty eight this angle these are all certainty dimension I want give it that. So, you can while starting this kind of this starting this analysis, and stability.

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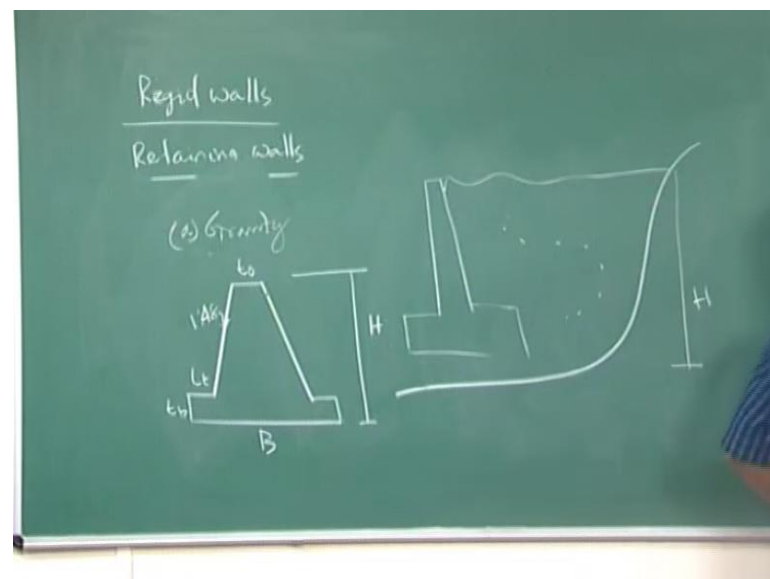
Then you can start with stress, because if you look at here this is a low line area of here actually this is a low line area here here actually, there is already existed this village, and

others during this is there is a plot. So, what happens? If want to flag some or else, and make a structure here at the top. So, that how how you suppose to do; that means, you one to construct here you want to construct a retaining walls some or else here. So, that it will retaining soil marks of these. So, that road at the surface it can be past from at the surface the movement you start only these height is given you height is how much height you going to elevate or may be construction height or may be may be height of retaining wall; that means, certainty given race the what you debt of foundation What is these how you are going to start race everything you have to start from your start once you start from in this scratch, then step by step go. If it is not satisfied you stability analysis, then return back change the dimension, then proceed further that why tentative dimension are require.

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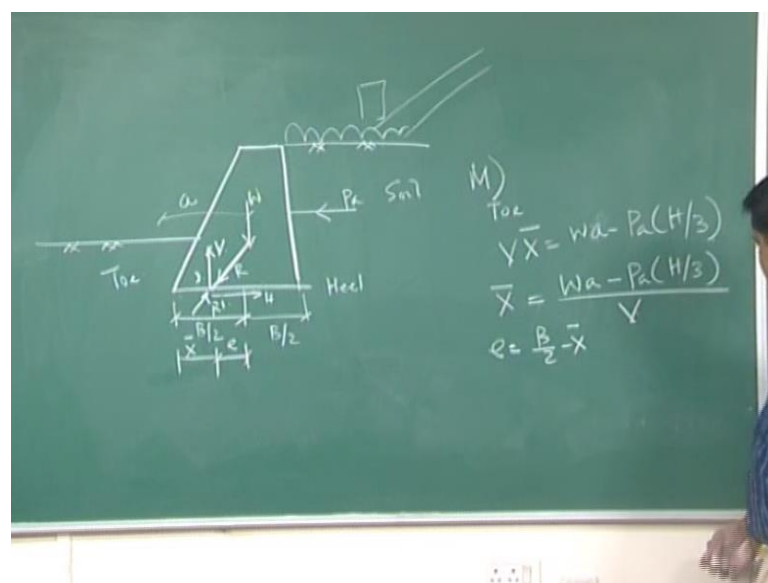
Now, will start the stability analysis look at the stability analysis of basic principle of retaining wall if I consider retaining wall with smooth back face, and no such are very simple way retaining wall I have taken smooth back feel with no searcher this is the retaining wall, and this side it is going to retain this soil mark. So, what are the posses suppose to come the come is yourself quiet of retaining wall, then is your, because of soil come into picture they p c g or toe, and this is you heel now, it these if this is my b by to this is my b by to. So, this is the w form height w to these distance let us say a I have a consider a very simple retaining wall with these simple retaining wall there is no searcher search as means there is no load. So, above this retaining wall, and wall face is

very smooth if this is my retaining wall past I identify for stability analysis what are the come into picture if look at the process one is self quite other is are soil. So, if take into picture, and consider this regent, and like these, and this is my this is the regent.

And coming here acted here, and this is the some of the vertical, and horizontal process, and it will act at a distance regent force will act at a distance e from the centre of the wall. Now, let us start with this by taking movement of toe this is the toe taking movement of the toe. So, it will be b into x y this is e. So, this will be x y be into x y easy equal to w into x w into x mynas w into a mynas b a into h by three. So, from they are we can find out distance x y or regent, and force acted, past you have to identify your distance a x why are you agent, and force suppose to is a, if I take the movement on this point; that means, lot of things will go. So, only the distance x will come out. So, it will be w into a mynas p a into h y three by b b. So, is your summation of all practical process h is you summation of lateral process of p a is coming. So, b is nothing but w b is nothing,,, but w. So, now, eccentricity you can find it out eccentricity easy equal to b by two mynas x b by two mynas x. So, these are the two parameters you need to find it out why is you exactly past you identify one if retaining wall what are the process going to a g one case you process is common process is this is self quiet.

Then there is a, then it may possible that if there is row there might be searchers there might be searchers may be some building may be some are else railway track is going on. So, all the process will be taken into consideration once you take into consideration of all process after knowing all process, then find it out go head this going to I do not know I just put it result force it may hug here, here, here, here anywhere else. So, I take it result force at a distance of x bar form this to. So, I have taken this there are taken two parameters you have to find it out distance x as well as e; that means, if you take movement of toe the distance x to come out, then eccentricity e as to also come out once you get both the parameter they check one by one you check first case is your stability analysis first case is your no sliding.
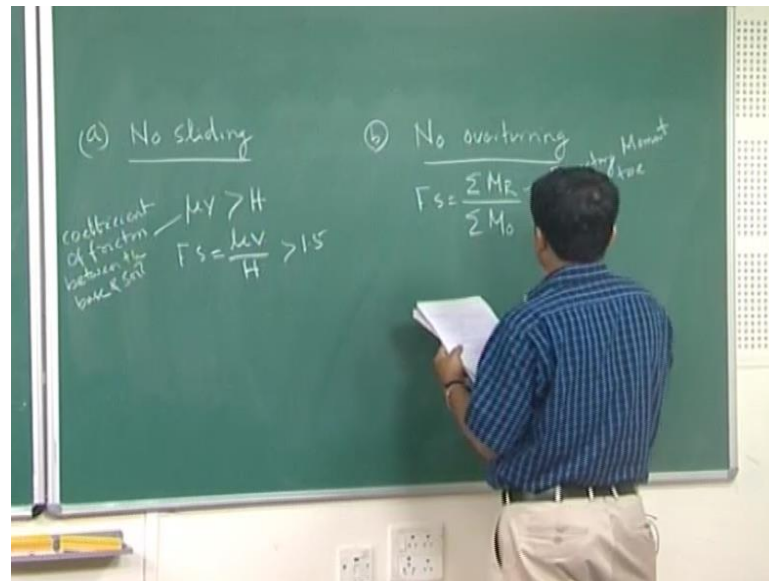
What you mean by no sliding; that means, if this is the wall, and this is the soil it may possible that retaining wall will slide this entire retaining wall will go as a rigid body it will slide what to check that no sliding. So that means, your may be should be greater than h what is my be course may be my be this direction should be greater than you r h resisting fictional greater than h from they are you can find factor sector factor sector easy equal to may be by h my easy equal to my easy equal to coefficient of friction coefficient of friction between the base, and soil. So, factor sector easy equal to new be y h. So, then a minimum factor sector it should be should be minimum it should be greater than one point five if these factor sector is greater than equal to one point five, then the wall is safe wall is safe against sliding safe against means the wall is not going to slide; that means, entire wall, because of the up side it is not going to move, then next part is your no overturning

What you mean by no overturning; that means, if pressure is more lateral pressure is coming it may possible that it may possible that the wall may overturning at the toe, because of pressure. So, there is change wall wall me overturning you stopped; that means, you find it out factor of sector which is easy equal to movement of resistance by movement of overturning. So, m r is your resisting movement. So, m r g resisting movement about toe m o is your overturning movement overturning movement about toe.

So that means, should be greater than equal to one point five to two times, it should be greater than equal to one point five to to types. Now, if we look at here other factor sector other sliding I discuss in the next class, but if we look at here movement of registering movement about toe, which is registering movement which is overturning movement. If we look at this there are two process one is yourself quiet other is which is your overturning, and which is your registering by means of self quite it will act as a registering by means it will act as a overturning it will act as a overturning. So, factor sector easy equal to movement of registering by movement overturning. So, these factor sector it, it is greater than one point five to two, then there will not be any overturning stop it another parameters will discuss next class.