Structural Reliability
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Lecture –246
Target Reliabilities (Part - 09)

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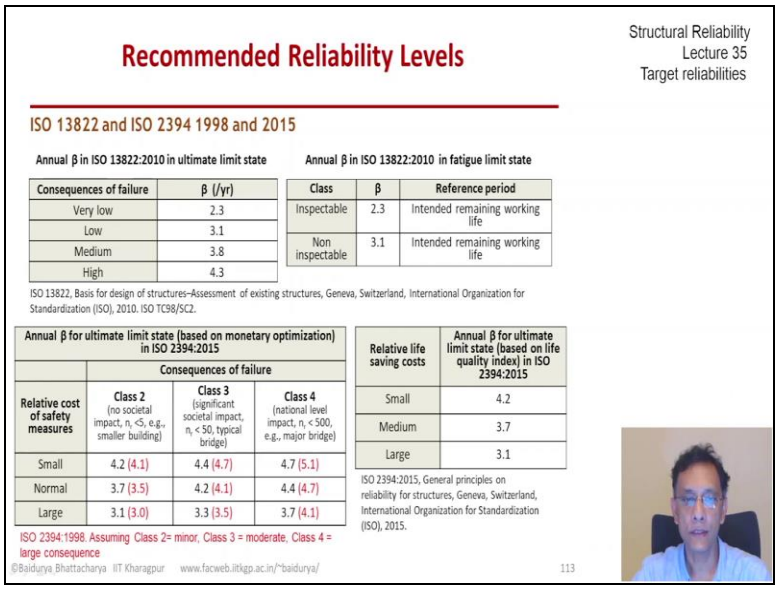

Next we will look at three ISO documents the 13822 of 2010 for existing structures and 2394 the general principles on reliability the 1998 revision and 2015 which is the latest. So, let us take a look at the annual target beta values in 3822 in ultimate limit state as you see on the screen and compared to that we can look at the fatigue limit state which is on the right side of your screen. Now it is it is interesting to see that we still have a consequence of failure here we have four levels very low and then low medium high as we had before.

And it is interesting to see that for an existing structure at it at least according to ISO the consequence of fatigue failure is either very low or low that is if we match the two permissible beta values. Now moving on to the 2394 documents let us see the latest revision first. So, what we have here is an example of annual permissible beta values in ultimate limit state now with three different levels of cost to save lives.

So, we have small medium or large life-saving cost relative and then corresponding to these three we have 4.2, 3.7 and 3.1 it is interesting to note that with increasing relative life-saving costs the annual permitted beta values keep decreasing. Now one could also look at the annual beta values the target beta values based on monetary optimization and that's the other table provided in ISO 2394 of 2015 and here we see as before we have seen consequences of failure different levels and different costs of safety measures.

So, we have seen this for example we remember that when it is large the last row on the left bottom table is basically for a structure that is in service or that is that has a high rate of obsolescence and so on. So, now we would like to compare the columns of the values obtained from life-saving cost versus the consequence of failure in terms of monetary optimization and we clearly see that class 2 which has no societal impact and the number of lives at risk nr is fewer than 5.

So, there we clearly see that it matches the beta values given for the from the life-saving cost considerations. So, presumably these two this class 2 corresponds to the consequence of an individual's life. Now if we look, now we if we want to compare between different codes let us take a look at 2394 of 2015 versus 1998 which we have seen before we see that the target beta values are more or less the same.

But there is a clear downgrading of the target beta values between 1998 and 2015 which is clear in the higher consequence classes. So, in class 3 and class 4 clearly we see 4.7 going down to 4.4 5.1 going down to 4.7 and all the way 4.1 going down to 3.7. So, we see a certain amount of revision going on there. Now let us look at let us let us compare ISO 2394 with 1322 and there we see certain interesting features is if we look at the large consequence of the if we look at the large relative cost of safety measure in the three consequence classes.

And presumably if low medium and high consequence corresponds to classes 2, 3 and 4 then we should be able to compare the large relative cost of safety measure with the ultimate limit state of existing structures we see that in the low case the two numbers match exactly 3.1 with 3.1. However with the medium and high consequence of failure or classes 3 and 4 we see that the

monetary optimization based technique gives lower target reliability.

And that could presumably be a difference between existing buildings versus new construction although one could argue that if the consequences of failure are the same then the target reliability also should be the same which is actually a comforting principle that has guided the development of these codes over 2 or 3 decades. Finally we will look at the AAC 7 standard which is the latest in this sequence of reliability based codes and that is we will look at the 2016 revision.