Noise Management & Its Control
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Lecture – 64
Acoustic Barriers – II

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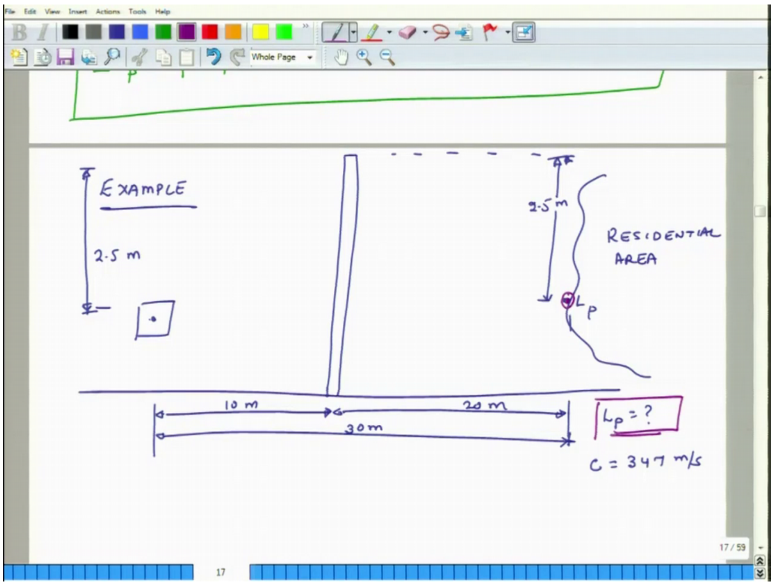

Hello, welcome to noise control and its management. Today is the second last day of this week, which is the eleventh week of this course. Yesterday, we had discussed how to design a barrier which is located outside to control noise. And what we plan to do today is illustrate that particular example further through an example, and here is the example. So, let us say that there is a machine, a transformer and it is generating a lot of sound very noisy transformer, and it is sitting on ground, and then there is this residential area. And let us say this is the point where we are monitoring the noise.

So, what we are interested in finding out is the value of L P at this location, and the directivity of this barrier is Q is equal to 1 of this transformer. So, what we want to do is, so we measure the value of L P and we find that it is too high. So, we want to create a barrier actually I will relocate this point may be a little on the lower side, so this is L P and the overall distance is 30 meters. The distance between the barrier and the transformer is 10 meters, and the distance between the barrier and the location where we are measuring sound is 20 meters.

The other thing is that this height, so actually I will again relocate the transformer it is also at some height, so let us say this height is 2.5 meters and the same thing is, so this is the height the distance between the tip of the barrier and the machine, which is the transformer that is 2.5. And the same thing is here also, so this is 2.5 meters and I am sorry for all the miss. So, this is L P and this distance is 2.5 meters. A velocity of sounds let us assume that its 347 meters per second. So, the question is what is the value of L P, what is the value of L P with and without barrier? And what we are given is for different frequencies, we know the sound power level of this machine.

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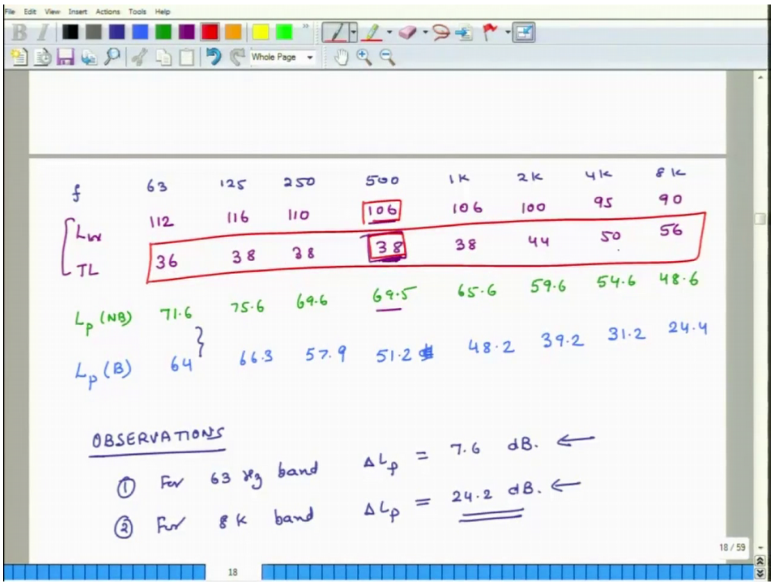

So, the sound power level of this machine which is given for different frequencies 63, 125, 250, 500, 1000, 2000, 4000 and 8000. And the value of L P no sound power level L W for the transformer it is given. So, this is all given data 112 decibels, 116, 110, 106, 106, 100, 95, 90. Also given is the transmission loss because of the barrier, so this is 36, 38 decibels, 38, 38, 38, 44, 50, 56 decibels. So, these are the data which are given. So, with this data and also this geometry we have to figure out what is the sound pressure level at this location, if there is no barrier; and what is the sound pressure level at this location if there is barrier.

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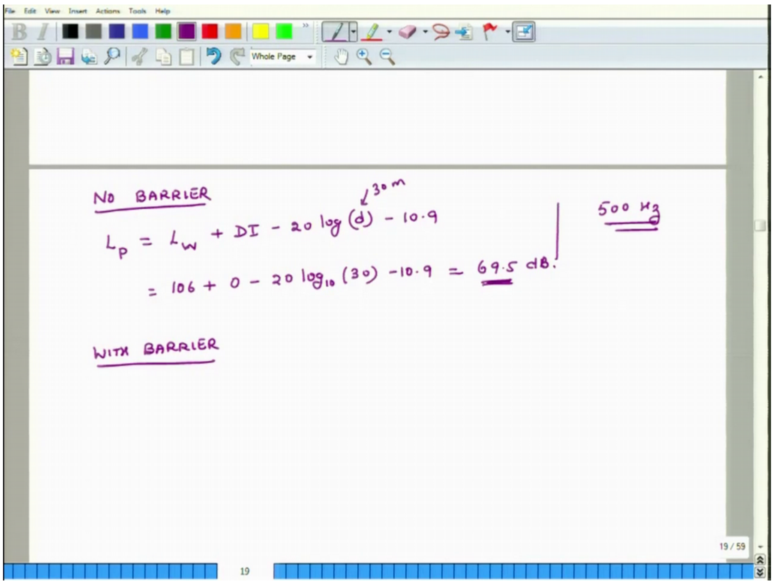

So, first we will do the case of no barrier. Now, this is a problem where the source of the noise is outside. So, if the source of the noise is outside and there are no reflecting surfaces then we have explained earlier and we have discussed this that some pressure level can be calculated through this relation. So, lower level plus directivity index minus 20 log of d 10.9. And what is d, d is 30 meters. What is directivity of this? So, Q is equal to 1. So, directivity index is 10 log of that thing, so that 0. So, so we will first calculate it at 500 hertz band, we will calculate it for 500 hertz band.

So, we look at these data for the 500 hertz band this machine or this transformer emits 106 decibels of power. So, we have to do similar calculations for all the bands, but anyway for the 500 hertz band L W is 106 plus directivity index. So, directivity is factor is 1. So, directivity index gives us is 0 minus 20 log of 10 of 30 meters minus 10.9. So, this works to be 69.5 decibels. Now, this sound pressure level is only for 500 hertz band; likewise we have to compute the sound pressure level at for all the bands. So, this is when there is no barrier. So, actually I am just going to directly write down the results for no barrier. So, L P no barrier is NB. So, this is equal to 71.6, 75.6, 69.6, 69.5, and this is 69.6, 65.6, 59.6, 54.6, and 48.6. So, when there is no barrier then these are the sound pressure levels associated with different frequency bands and through this we can actually also calculate the overall sound pressure level.

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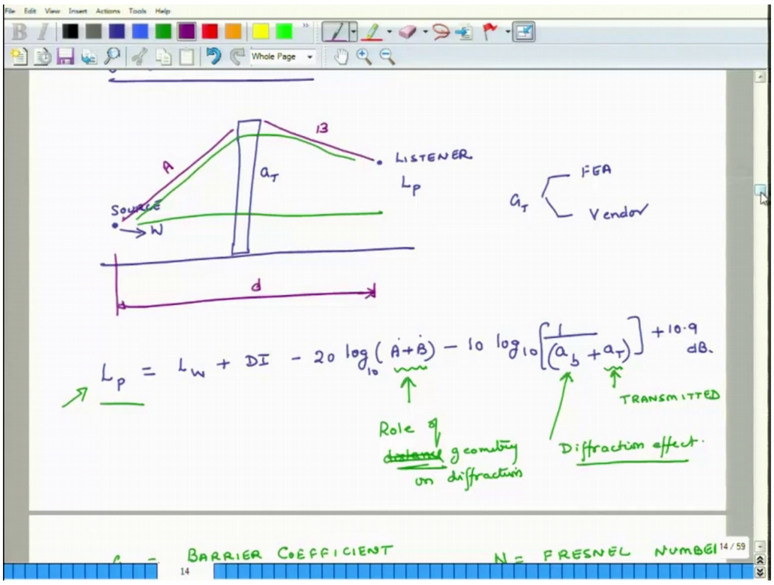

So, now we do the case when there is barrier with barrier. So, for the barrier, what do we have to do we have to use this relation right, you have to use this particular relation. So, we have to compute A, we have to compute d, we have to compute AB and we have to compute a t. With all these data then we can plug it in this relation and calculate the value of sound pressure level, and we have to do it for all the frequency bands, so that is what we will do.

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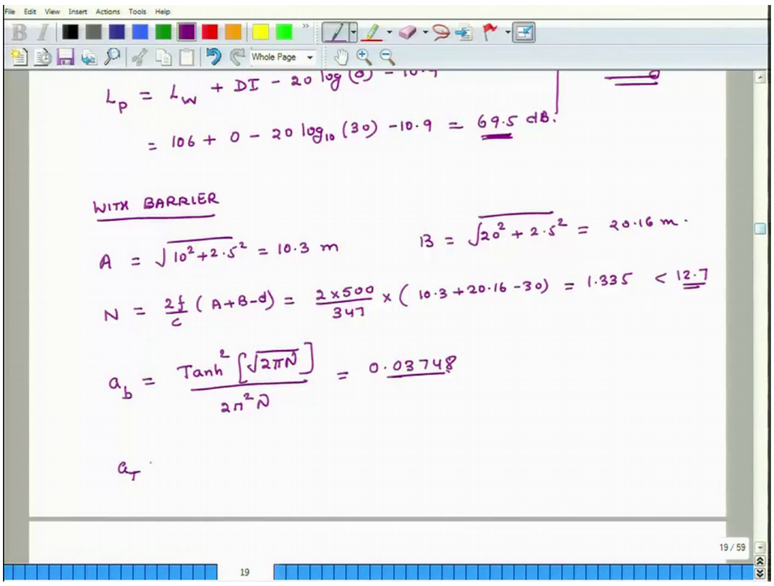

So, what is A? A is the distance between the source and the tip of the barrier. So, that is equal to 10 square plus 2.5 square the whole thing square root. So, this is equal to 10 square plus 2.5 square and that works out to be 10.3 meters. Similarly, B equals 20 square plus 2.5 square and this is equal to 21.6 meters. Now, we compute N because to compute AB which is the barrier coefficient, we have to know the value of N which is Fresnels number, so that equals 2 over lambda or in terms of frequency we can say twice of frequency divided by c times A plus B minus d. And what is that, so we are doing this at 500 hertz. So, 2 times 500 divided by speed of sound in this case is specified as 347 times 10.3 plus 20.16 minus 30, and this comes out as 1.335. So, fresnels number in this case is less than 12.7. So, we use the first relation. So, a b equals tan hyperbolic square of 2 pi N divided by 2 pi square N and this value comes to be 0.03748. And a T, so all these calculations are done for 500 hertz band. So, a T what is the transmission loss associated with this thing 60 no 38 decibels.

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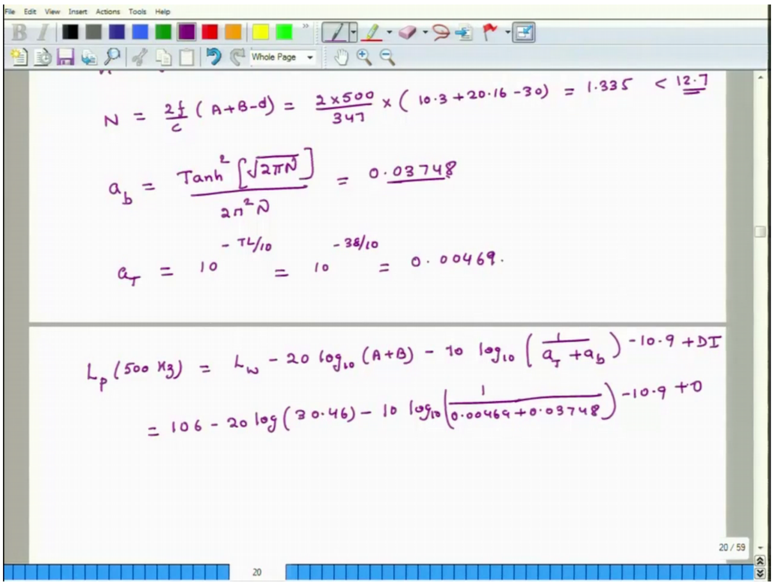

So, with that we will compute a T. So, this is equal to 10 to the power of minus transmission loss divided by 10, and this is equal to 10 minus 38 by 10, and this is equal to 0.00469. So, now we have done all the we have calculated all the parameters. So, L P and this is again at 500 hertz with the barrier in place is equal to L W minus 20 log of 10 of A plus B minus 10 log of 10 by a T plus a b minus 10.9 and of course, plus directivity index. So, this is equal to 106 minus 20 log of 30.46 minus 10 log of 10 1 over 0.00469 plus 0.03748 minus 10.9. And what is directivity index 0.

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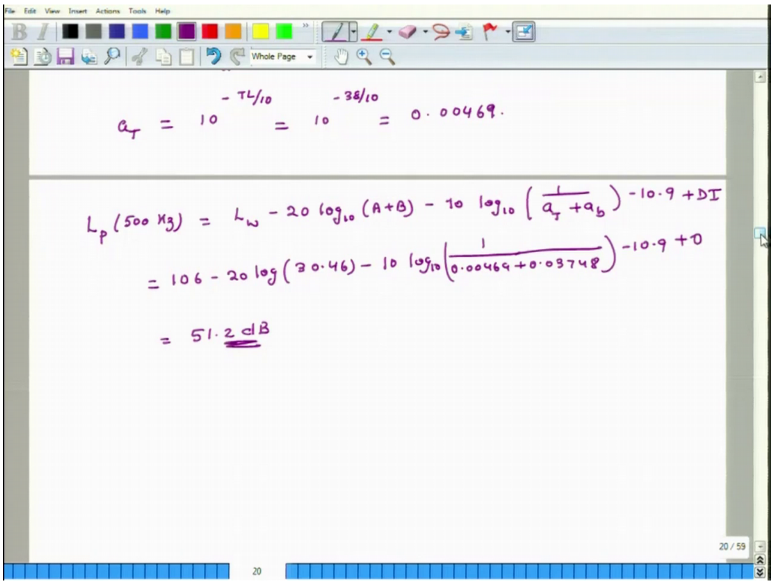

So, this is equal to 51.2 decibels, 51.2 decibels. So, we will complete that table. So, L P with barrier is how much at 500 hertz is 51.2 decibels. And for other frequency bands I will also give the results and then we will make couple of observation. So, this is 64, 66.3, 57.9, 48.2, 39.2, 31.2, 24.4. Now, we will make some observations. So, let us look at the data without at 63 hertz for the 63 hertz band what is the difference 71 minus 64. So, at for 63 hertz band, actually this should be for 63 hertz band, change in L P is how much is 7.6 decibels; for 8 k band change in sound pressure level is how much 48 minus 24 - 24.4 decibels. So, significantly large difference you know noise reduction at 8000 hertz; and at 63 hertz, it is gone down not only by 7.6 decibels.

So, once again as we had discussed earlier the barriers become very efficient especially at high frequencies at low frequencies they are not all that efficient. So, this is important to understand that at high frequencies they are very efficient. The other thing you should note is that at high frequencies, a lot of these panels whether they are used in barriers or whatever, their transmission loss at high frequencies is very high. And low frequencies it 36 decibels it is still good, but at high frequency it is very large 56 decibels, I mean if you design it correctly, it can be even higher you can go up to 60, 70 decibels. So, the important thing to note is that barriers in general are very efficient to reduce noise at high frequencies, but at low frequencies we will still have good amount of sound passing through. So, that concludes our discussion barriers which are located on the inside;

starting tomorrow we will discuss barriers which are located inside what we discussed today and yesterday was outside barriers.

So, thank you very much, and we will meet you once again tomorrow, bye.