Structural Health Monitoring (SHM)
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Lecture - 03
Necessity of Structural Health Monitoring - Part 1

Friends, welcome to the second lecture in module 1, on the course Structural Health Monitoring.

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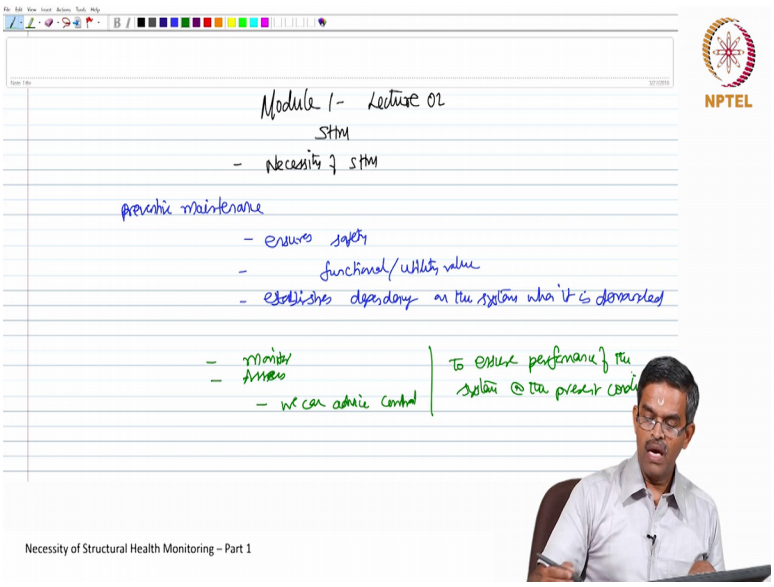

In this lecture we will talk about necessity of SHM. In the last lecture we understand that, preventive maintenance plays a very important role by ensuring safety functional or utility value, and establishes dependency on the system when it is demanded. To do this we already said, we need to monitor, then assess, if require we can advise control.

So, the overall objective is to ensure satisfactory performance of the system at the present condition.

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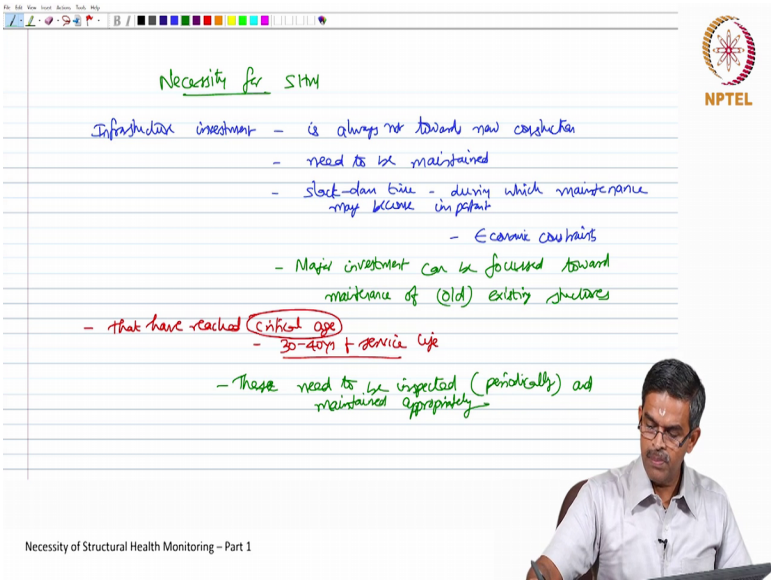

Having said this, let us ask a question, what is the necessity for structural health monitoring. There are many reasons why one should do or practice structural health monitoring. We all agree that infrastructure investment is always not towards new construction. One has to agree that whatever you construct new, they also need to be maintained.

There can be a slack downtime in infrastructure growth, during which investment towards maintenance may become important. This may be due to some economic constraints, but it will assume it is importance during a slack downtime. During that period, major investment can be towards maintenance of old existing structures.

How do you identify the structures, which needs a critical maintenance? Structures that have reached critical age, maybe 30 to 40 years of service life ok, they come under the span of criticality. Of course, depends on material, depends of type of loading, depends on environmental conditions, depends also on degree of maintainability. There are many factors which dictates whether the structure will be of a critical age; however, in a general practice if the structure is about 30 to 40 years of it is served life, those structures come under the bracket of critical age.

These structures, need to be inspected, I should say periodically and maintain appropriately.

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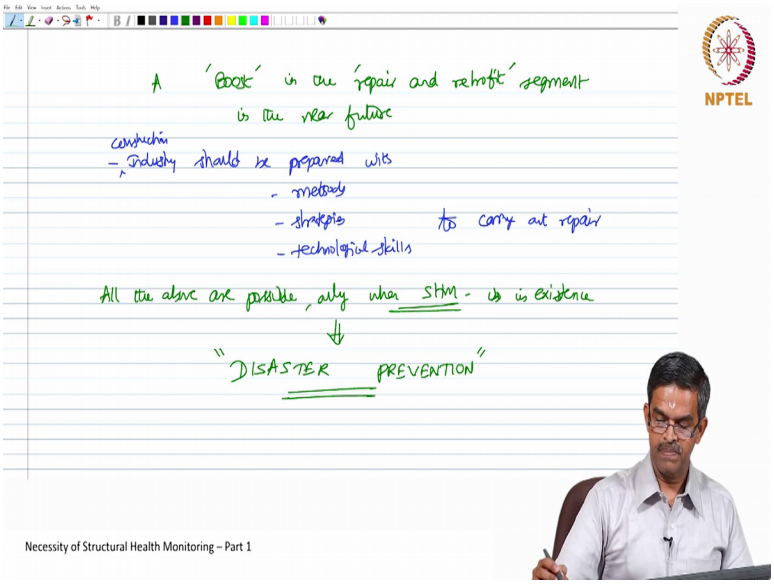

So, most importantly, there will be a boost in the repair and retrofit segment in the near future. If it is so then, industry should be prepared, which industry? Essentially, the construction industry should be prepared with methods, strategies and technological skills to carry out the repair. All the above are possible, only when structural health monitoring is in existence.

So, SHM is very necessary to prepare the technological manpower, to take care of immediately the repair and retrofit procedures for the structures which demand this kind of attention. So, structural health monitoring is actually a science, which deals with an art of preparedness, for carrying of repair and retrofit methodologies, for structures which deserve such kind of treatment.

On a healthy practice of SHM, the major and successful outcome as expected by Indian government as of now in the present scenario is disaster prevention. One can avoid, one can completely mitigate disasters caused by natural events if the structures are monitored on a continuous basis, and they are maintained to upkeep their functional value in the present scenario with respect to the present age and working conditions.

So, the main objective of SHM full fills necessitating a disaster prevention mechanism, which is initiated through structural health monitoring science.

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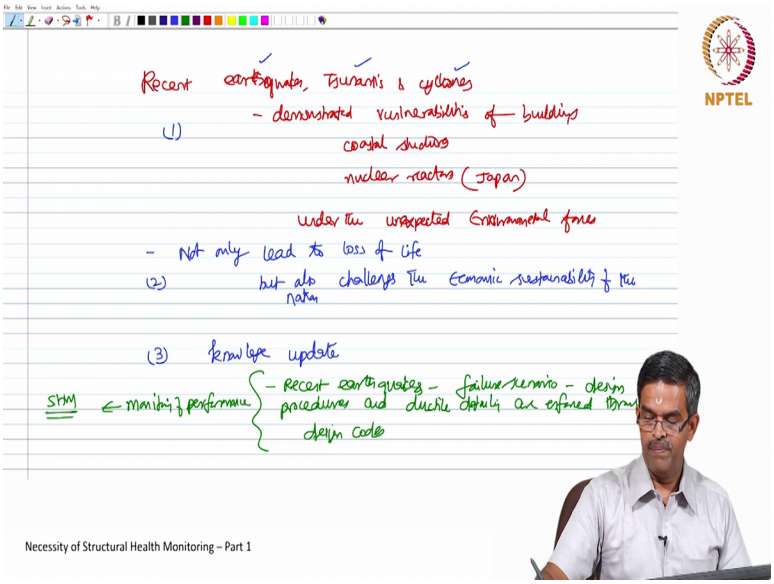

I can also add one more word saying that recent earthquakes, Tsunamis and cyclones have demonstrated the vulnerability of buildings, coastal structures, nuclear reactors. Especially, if we look at the devastation happen in Japan nuclear reactors were very badly affected under the unexpected environmental forces.

The issues is, these activities like earthquakes, Tsunamis, cyclones not only lead to loss of life, but also challenges the economic sustainability of the nation. So, the first necessity is preparedness for these natural calamities, the second necessity is this. The third is let us say knowledge update.

I will show this with an example, if you consider the recent earthquake; recent earthquakes have taught a very interesting lesson of failure scenario. So, that appropriate design procedures and ductile detailing are enforced through the design codes.

This is possible only, when there is a constant update about the laws of strength of structural systems under unexpected forces like earthquakes; which is nothing but a continuous monitoring of performance, which is actually a part of or a segment of SHM.

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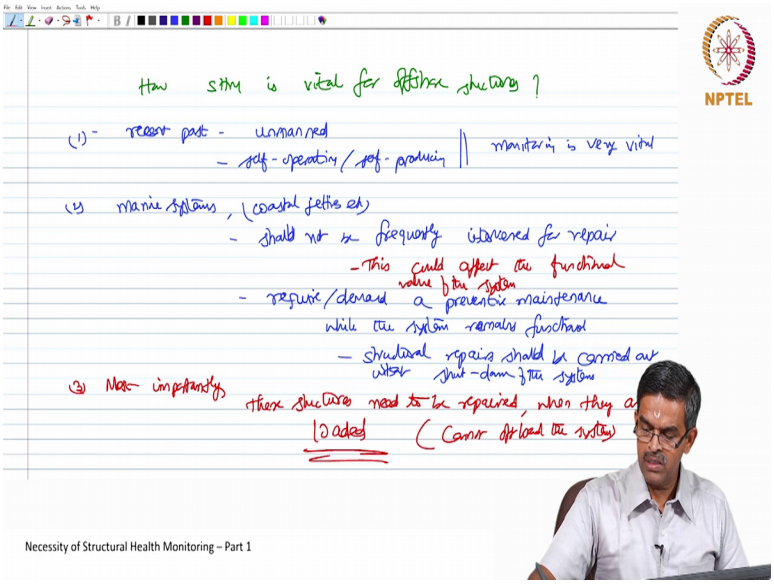

Let us try to ask a question, how structural health monitoring is vital for offshore structures? Friends, most of the offshore platforms in the recent past, are constructed to be unmanned. They are self-operating, and I should say self-producing. In such cases continuous monitoring is very vital.

Secondly marine structural systems like, coastal jetties etcetera should not be frequently intervened for repair. The reason is, this could affect the functional value of the system. So, frequent repair or frequent intervention for repair is not advised in the structures, therefore, these structures require or they demand a preventive maintenance while the system remains functional.

So, structural repairs should be carried out or need to be carried out, without shutdown of the system. Without causing shutdown of the system you need to carry out the repairs. Most importantly, these structures need to be repaired, when they are loaded. That is very, very important you cannot offload the system. Structural load cannot be decreased on a given system.

Even when they are loaded, you need to carry out the repair. To understand the response behaviour, under such loading conditions, it is important to have your continuous monitoring.

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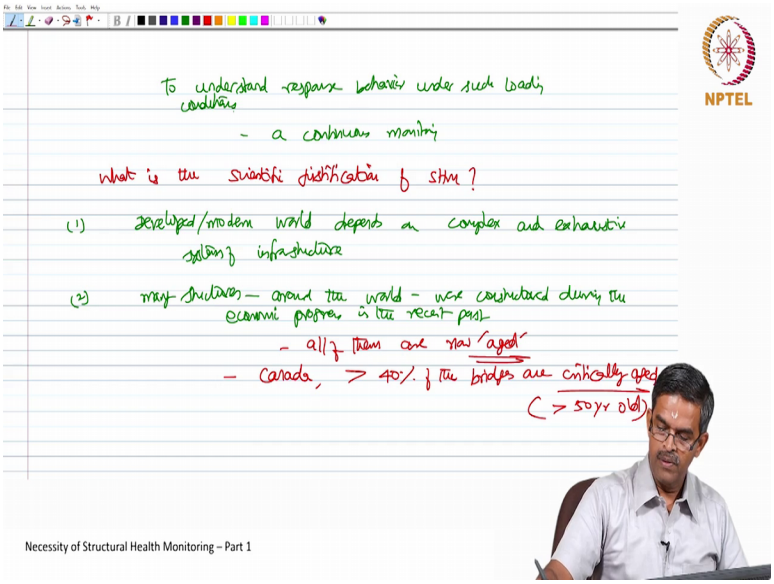

Let us ask a question, what is the scientific justification of structural health monitoring? There are many reasons, which lead towards scientific justification of the monitoring system let us see one by one. We all agree that the developed modern world depends on complex and exhaustive systems of infrastructure. Many structures around the world where constructed during the economic progress in the recent past. So, all these structures are now aged.

For example, statistics say that in countries like Canada more than, more than 40 percent of the bridges are critically aged, which are found to be more than let us say, 60 years or 50 years old.

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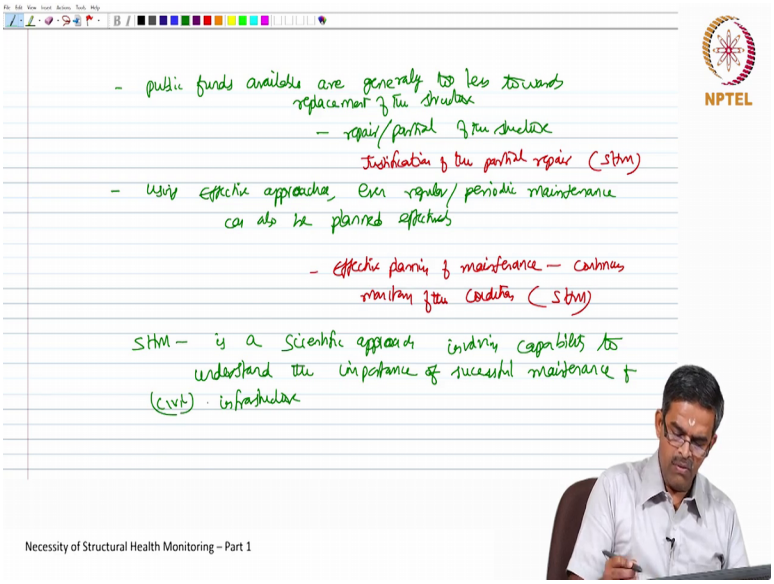

Therefore, most point, in general the public funds available are generally too less towards replacement of the structure. It can only enable repair that to partial repair of the structure. If that is the case, one should need to know the justification of the partial repair and that can be done only through SHM.

Next point would be, using effective approaches; your regular periodic maintenance can also be planned effectively. So, I mean to say that, effective planning of maintenance also require your continuous monitoring of the condition, which essentially arise from SHM.

Therefore, structural health monitoring is completely a scientific approach, involving to understand the importance of successful maintenance of infrastructure. I can always say at least civil infrastructure.