

**Structural Reliability**  
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**Lecture –06**  
**Introduction (Part - 06)**

Needless to say these examples we just discussed do not imply that structures are weak or structural failures are common. It is more like you truly notice something you had taken for granted only when it is absent. Rather I wanted to show that various disciplines must interact and come together for the successful performance of a system and the structural aspect is an integral part.

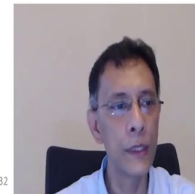
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### Managing uncertainties

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Structural Reliability  
Introduction

- Modern engineering systems are becoming more complex
  - Some uncertainties are irreducible
  - Greater interaction between structural non-structural and human elements
  - Shorter development cycle
  - Layered distribution of responsibility among owners, builders, operators and stakeholders



So the clear message is that systems are becoming more complex more interdependent. It is not possible to have perfect knowledge about the system now or into the future. And structures are not passive systems there is an increasing possibility that what the operator or the user does will have a bearing on structural integrity. Also the base of innovation has quickened that sometimes there is not enough time to learn from failures.

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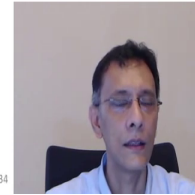
## Managing uncertainties

**Code of Hammurabi (Babylon, 1772 BC):**  
Building construction - 6 clauses, 193 words to define payment and liability  
*Clause 229. If a builder build a house for some one, and does not construct it properly, and the house which he built fall in and kill its owner, then that builder shall be put to death*



**Indian Civil Nuclear Liability Act (2010)**

- 14000 words, 49 major clauses
- Grades of damage (7 types)
- Determination of responsible party
- Liability is "no fault" type
  - Limited to Rs 15 Bn
  - Depends on size and cause of event
  - Arbitration by Claims Commissioner
- Penalty for non-compliance or obstruction
  - Fine
  - Imprisonment (up to 5 yrs)



And this last point on the distribution of responsibility it becomes clear when we compare with simpler times. We can only presume that these 6 clauses worked for the most part four million year ago but not only has human civilization become less violent our laws and social structure implicitly acknowledge the complexities including those involving engineering infrastructure systems that have a bearing on the health and happiness of a large number of people.

And comparison becomes clear when you put these two sets of national laws side by side separated by a span of 4000 years.