

**Structural Reliability**  
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**Lecture –244**  
**Target Reliabilities (Part - 07)**

The next example we look at is from the end of that decade the draft mob classification guide brought out by the American Bureau of Shipping. The mobile offshore base was a novel concept it was a floating naval base and as a structural system it had no precedence. So, calibration was simply not possible.


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### Recommended Reliability Levels

**ABS - MOB**

Class Of Limit State	Consequence	Scale of Participating Structure	Maximum Permissible Life-time $P_f$
Serviceability/ Operability	minor	Structural element or assembly	$10^1 q^*$
	moderate	Structural sub-system or one module or fully connected MOB	$\min(10^1 q^*, 1-A_1)$
Fatigue	minor	Structural element/ assembly (redundant & accessible)	$10^2 q^*$
	moderate	Structural element/ assembly (redundant but inaccessible)	$10^1 q^*$
	serious	Structural element/assembly (non-redundant)	$10^1 q^*$
	serious	Inter-module connector (redundant design)	$\min(10^1 q^*, 1-A_2)$
	critical	Structural element/assembly (non-redundant) or sub-system	$10^1 q^*$
	critical	Inter-module connector (non-redundant design)	$\min(10^1 q^*, 1-A_2)$
Strength	moderate	Structural element (redundant)	$10^1 q^*$
	serious	Structural element/ assembly (redundant)	$10^1 q^*$
	serious	Inter-module connector (redundant design)	$\min(10^1 q^*, 1-A_2)$
	critical	Structural element/ assembly (non-redundant) or sub-system	$10^1 q^*$
	critical	Inter-module connector (non-redundant design)	$\min(10^1 q^*, 1-A_2)$
Global Failure			
(i) Progressive Collapse	catastrophic: loss of one module	One module	$10^1 q^*$
	catastrophic: loss of all modules	Fully connected MOB / all modules	$q^*$
(ii) Damaged Condition	catastrophic: loss of one module after loss of one subsystem	One module after loss of one subsystem	$10^1 q^*$ (conditional)

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$q^*$  = life-time target failure probability of entire MOB, assumed less than  $10^{-5}$   
 $A_1$  = minimum permissible availability of one module,  $A_2$  = minimum permissible availability of connector.

American Bureau of Shipping. Draft mobile offshore base classification guide. Houston, TX, 1999. 110

So this is the structure of the various target reliabilities that was proposed. So, we see that several classes of limit states were considered about five of them serviceability or operability and then fatigue strength and then two global failures one of progressive collapse in the other of damaged condition. Now with each of these was matched a set of consequences that you see in the next column. So, we see about five consequences minor moderate serious critical and catastrophic.

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**Recommended Reliability Levels**

ABS - MOB

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Target reliabilities

Class Of Limit State	Consequence	Scale of Participating Structure	Maximum Permissible Lifetime P <sub>f</sub>			
Serviceability/ Operability	minor	Structural element or assembly	$10^{-5} q^*$			
	moderate	Structural sub-system or one module or fully connected MOB	$\min(10^{-4} q^*, 1-A_i)$			
	minor	Structural element/ assembly (redundant & accessible)	$10^{-5} q^*$			
Fatigue	<b>Definition</b>					
		Inconvenience or discomfort	Interference with operations	Suspension of operations, loss of property or assets, threat to structural integrity	Loss of lives or mission, pollution, compromise of structural integrity	Total loss of structure
	<b>Level of consequence</b>					
	Minor	←→				
	Moderate	←→→				
Strength	Serious	←→→→				
	Critical	←→→→→				
Global Failure	Catastrophic	←→→→→→				
(i) Progress Collapse						
(ii) Damaged Condition	catastrophic: loss of one module	all modules	One module after loss of one subsystem			$10^{-5} q^*$ (conditional)

American Bureau of Shipping. Draft mobile offshore base classification guide. Houston, TX, 1999. 110



So, these were defined in terms of the losses or obsession of service. So, the first two the minor and moderate are mostly of a serviceability type. So, inconvenience and interference with operations and then we have the more serious safety class one type situations which is serious and critical which is a loss of property threat to structural integrity and then pollution and in fact compromise of structural integrity and then the total loss of structure is the catastrophic level of consequence.

So, just like DNV had this guide also considered the effects or lack of redundancy? So, you see several redundant or non-redundant whether accessible or not those things were also considered and with all of those the maximum permissible lifetime failure probabilities were defined the it is interesting to note that the system target reliability over the entire life was given in terms of one parameter  $q^*$ ,  $q^*$  was the maximum allowable failure probability and that had to be  $10^{-5}$  or less.

So, and based on that; all the other reliabilities or other permissible failure probabilities were derived. So in some sense these reliabilities were a little more stringent than that proposed by CSA and DNV and presumably because this was not only a novel structure but had other consequences of failure beyond loss of life beyond pollution and had military implications.