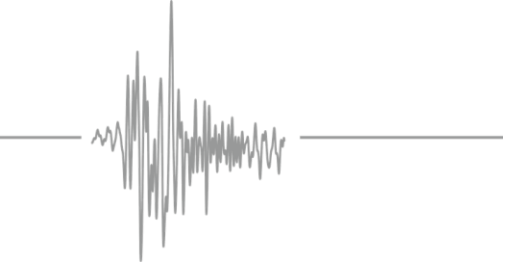
EN 1998-1:2004: BUILDINGS - Parameters Where National Choice is Allowed, National Annex

Section									
SEISMIC INPUT			STRUCTURAL CAPACITY (RESISTANCE)						
1	2	3	4	5	6	7	8	9	10
1.1.2 (7)	**2.1 (1)P**	3.1.1 (4) 3.1.2 (1)			6.1.2 (1) 6.1.3 (1)	7.1.2 (1) 7.1.3 (1) 7.1.3 (3) 7.1.3 (4)			
	FUNDAMENTAL REQUIREMENTS	**3.2.1 (1)** **3.2.1 (2)** **3.2.1 (3)** ***3.2.1 (4)*** ***3.2.1 (5)*** 3.2.2.1 (4), 3.2.2.2 (2)P 3.2.2.3 (1)P 3.2.2.5 (4)P	4.2.3.2 (8) 4.2.4 (2)P 4.2.5 (5)P	5.2.1 (5) 5.2.2.2 (10) 5.2.4 (1) 5.2.4 (3)	6.2 (3) 6.2 (7)			9.2.1 (1) 9.2.2 (1) 9.2.3 (1) 9.2.4 (1)	
	P_{DLR} = 10% T_{DLR} = 95 years		4.3.3.1 (4) 4.3.3.1 (8)				8.3 (1)	9.3 (2) **9.3 (3)** 9.3 (4) (Table 9.1)	10.3 (2)P
	P_{NCR} = 10% T_{NCR} = 475 years		4.4.2.5 (2) 4.4.3.2 (2)	5.4.3.5.2 (1)					
					6.5.5 (7)			9.5.1 (5) 9.6 (3)	
					6.7.4 (2)	7.7.2 (4)		9.7.2 (1) 9.7.2 (2)b 9.7.2 (2)c 9.7.2 (5)	
				5.8.2 (3) 5.8.2 (4) 5.8.2 (5)					
				5.11.1.3.2 (3) 5.11.1.4 (1) 5.11.1.5 (2) 5.11.3.4 (7)e					

Reference return period T_{DLR} of for the damage limitation requirement. (or, reference probability of exceedance in 10 years, P_{DLR}).

Reference return period T_{NCR} for the no-collapse requirement (or, reference probability of exceedance in 50 years, P_{NCR}).

3.2.1(1, 2, 3) Seismic zone maps and reference ground accelerations therein.
3.2.1(4) Governing parameter (identification and value) for low seismicity threshold.
3.2.1(5) Governing parameter (identification and value) for very low seismicity threshold.



EN 1998-1:2004: BUILDINGS - Parameters Where National Choice is Allowed, National Annex

Section									
SEISMIC INPUT			STRUCTURAL CAPACITY (RESISTANCE)						
1	2	3	4	5	6	7	8	9	10
1.1.2 (7)	**2.1 (1)P**	3.1.1 (4) 3.1.2 (1)			6.1.2 (1) 6.1.3 (1)	7.1.2 (1) 7.1.3 (1) 7.1.3 (3) 7.1.3 (4)			
	FUNDAMENTAL REQUIREMENTS	**3.2.1 (1)** **3.2.1 (2)** **3.2.1 (3)** ***3.2.1 (4)*** ***3.2.1 (5)*** 3.2.2.1 (4), 3.2.2.2 (2)P 3.2.2.3 (1)P 3.2.2.5 (4)P	4.2.3.2 (8) 4.2.4 (2)P 4.2.5 (5)P	5.2.1 (5) 5.2.2.2 (10) 5.2.4 (1) 5.2.4 (3)	6.2 (3) 6.2 (7)			9.2.1 (1) 9.2.2 (1) 9.2.3 (1) 9.2.4 (1)	
	P_{DLR} = 10% T_{DLR} = 95 years		4.3.3.1 (4) 4.3.3.1 (8)				8.3 (1)	9.3 (2) **9.3 (3)** 9.3 (4) (Table 9.1)	10.3 (2)P
	P_{NCR} = 10% T_{NCR} = 475 years		4.4.2.5 (2) 4.4.3.2 (2)	5.4.3.5.2 (1)					
					6.5.5 (7)			9.5.1 (5) 9.6 (3)	
					6.7.4 (2)	7.7.2 (4)		9.7.2 (1) 9.7.2 (2)b 9.7.2 (2)c 9.7.2 (5)	
				5.8.2 (3) 5.8.2 (4) 5.8.2 (5)					
				5.11.1.3.2 (3) 5.11.1.4 (1) 5.11.1.5 (2) 5.11.3.4 (7)e					

Reference return period T_{DLR} of for the damage limitation requirement. (or, reference probability of exceedance in 10 years, P_{DLR}).

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3.2.1(1, 2, 3) Seismic zone maps and reference ground accelerations therein.
3.2.1(4) Governing parameter (identification and value) for low seismicity threshold.
3.2.1(5) Governing parameter (identification and value) for very low seismicity threshold.

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3.2.2.3 **Near source effects** (*Definition of active fault*)

(1)P ***Site-specific spectra*** considering near source effects shall be used, when **the site is located within 10 km horizontally of a known active seismotectonic fault** that may produce an event of Moment Magnitude (Mw) higher than 6.5.

EARTHQUAKE-RESISTANT DESIGN: EMBEDDED CONCEPT

Engineers do not attempt to make earthquake proof buildings that will not get damaged even during the rare but strong earthquake; such buildings will be too robust and also too expensive.

Instead, the engineering intention is to make buildings earthquake-resistant to withstand the largest earthquake of a certain probability that is likely to occur at their location; such buildings resist the effects of ground shaking, although they may get damaged severely but would not collapse during the strong earthquake.

Safety of people and contents is assured in earthquake-resistant buildings, and thereby a disaster is avoided. Thus the LIFE SAFETY is a major objective of seismic design codes throughout the world.

A properly earthquake-resistant designed structure does not necessarily have to be extremely strong or expensive. It has to be properly designed to withstand the seismic effects while sustaining an ACCEPTABLE LEVEL of damage.

GENERAL GOALS IN SEISMIC-RESISTANT DESIGN AND CONSTRUCTION

The philosophy of earthquake design for structures other than essential facilities has been well established and formulated as follows:

- To prevent non-structural damage in frequent minor ground shaking
- To prevent structural damage and minimize non-structural damage in occasional moderate ground shaking (**DLC**)
- To avoid collapse or serious damage in rare major ground shaking (LIFE SAFETY PRINCIPLE, **CLR**).

This philosophy is in complete accord with the concept of comprehensive design. However, current design methodologies *frequently* fall short of realizing the objectives of this general philosophy.

The implementation of this philosophy presents serious problems particularly in quantifying the different types of damage (structural and non-structural) and what constitutes frequent minor, occasional moderate, and rare major earthquake ground shaking.

RISK CATEGORIES/ 1

- Perceived risk;
- Acceptable risk;
- Calculated or estimated risk; and,
- Real risk.

RISK CATEGORIES/ 2

Perceived risk: **"the risk as understood by those [population] at risk"**

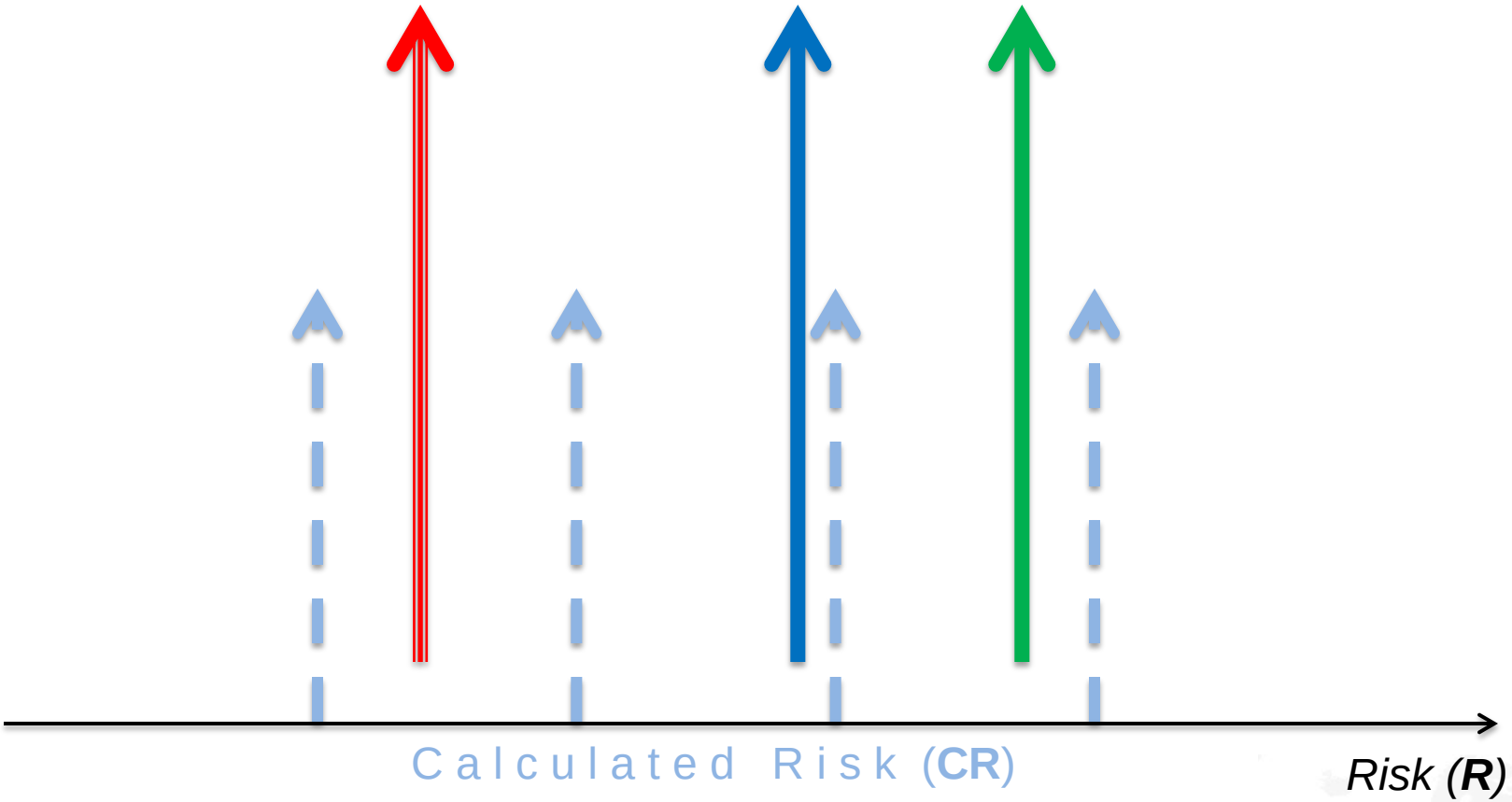
Acceptable risk: **"a risk level chosen as a limiting requirement by those setting standards and making decisions for the society"**

Calculated or estimated risk: **"the figure computed by designers and planners for the risk of failure of something to be built"**

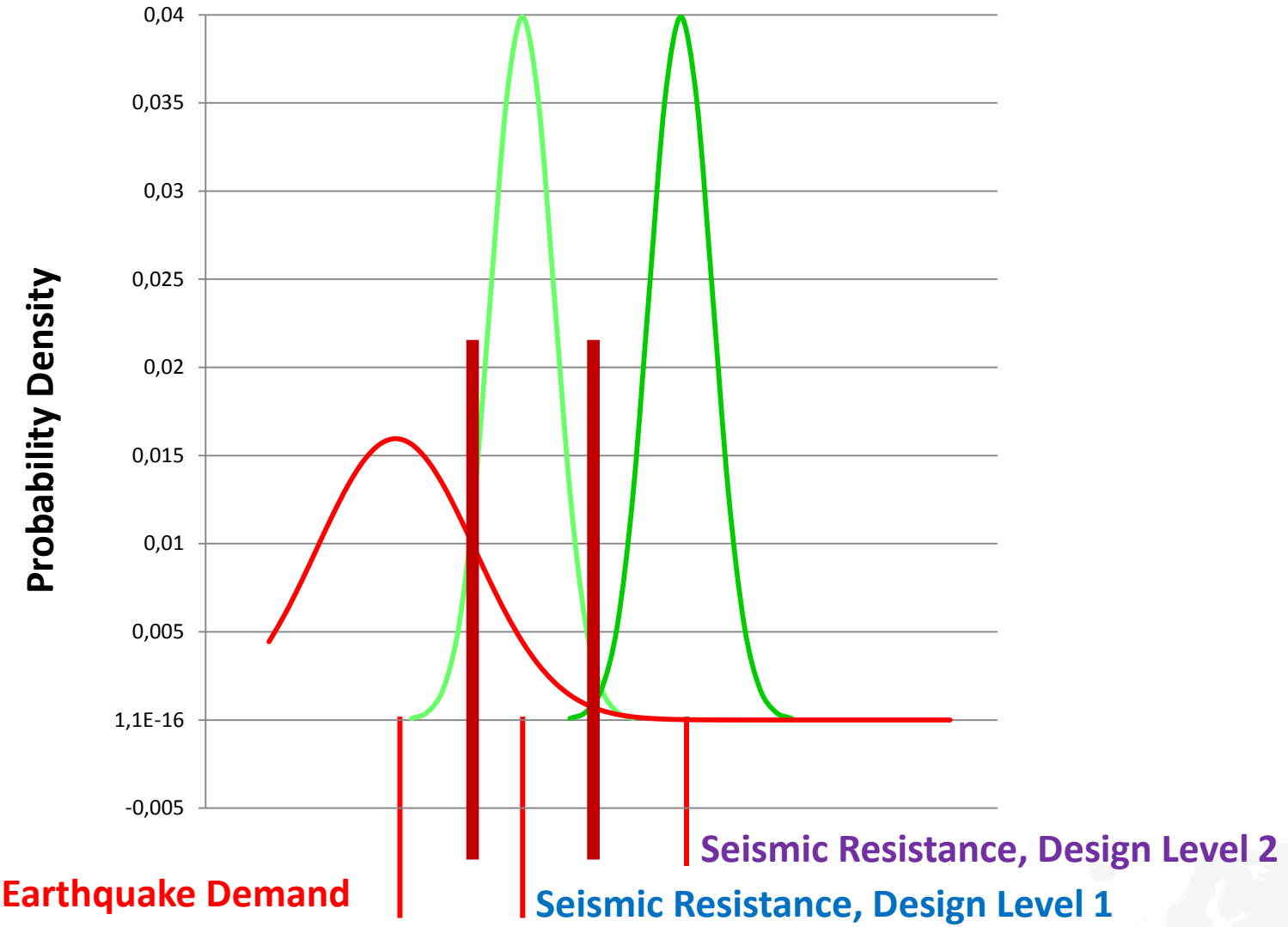
Real risk: **"the true risk which could only be known if the access could be made to all that could be known about the situation"**

(SEISMIC) RISK PREVENTION, CONCEPT (Ex YU)

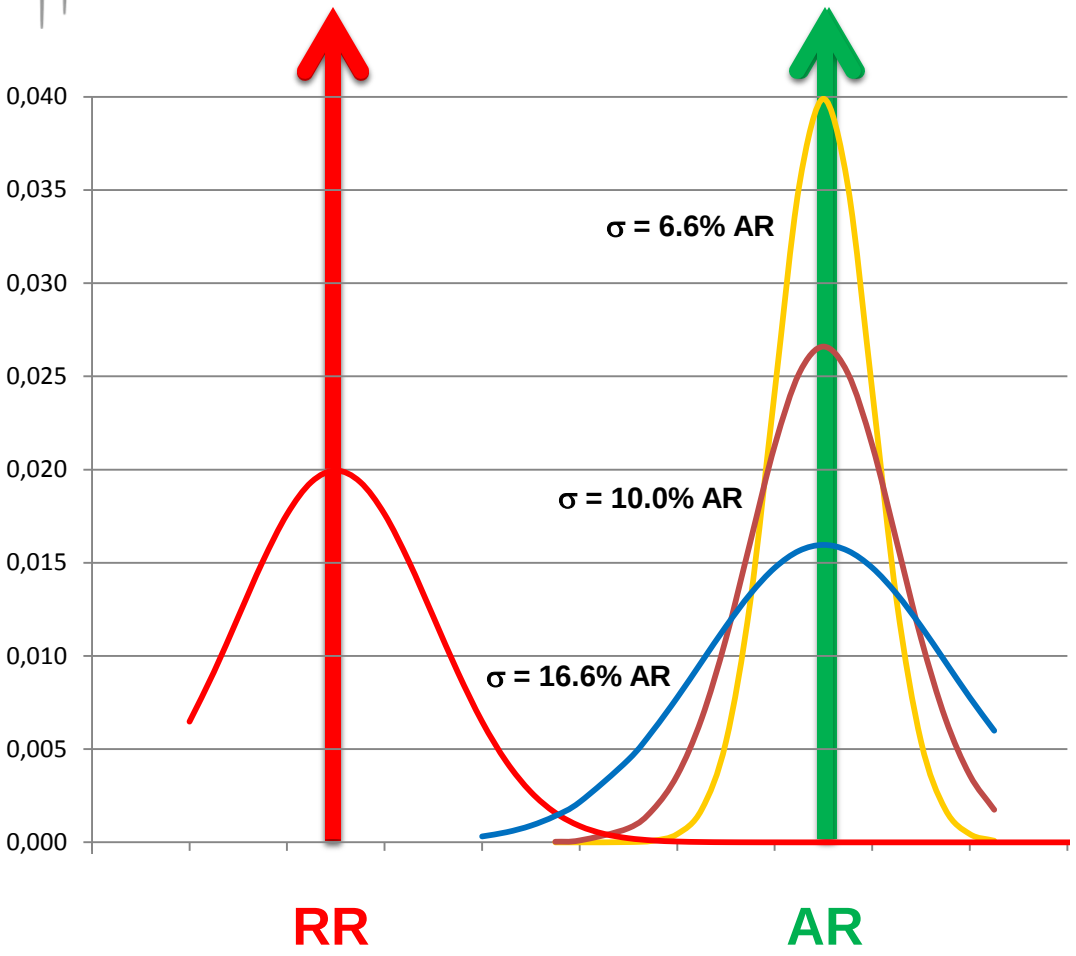
1948 – 1964 *No Code*
1964 – 1981 *PIOVS64*
1981 – Now *PIOVS81*

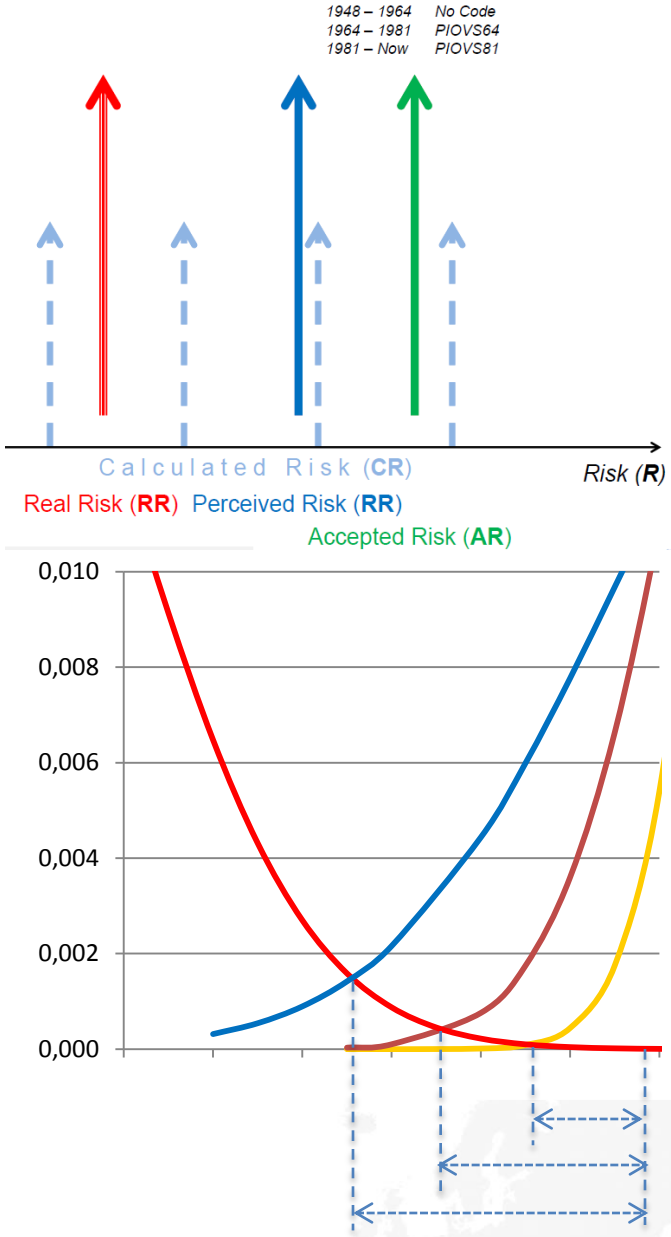


ACCEPTABLE RISK, CONCEPT



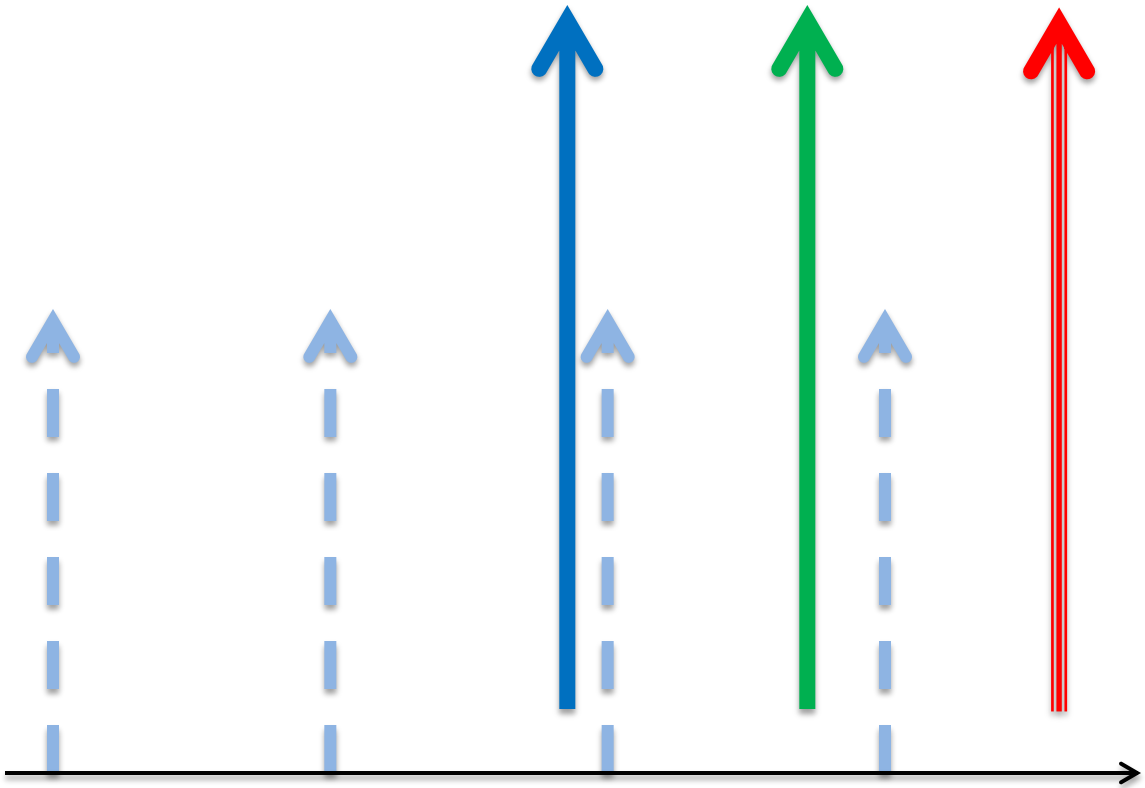
SEISMIC RISK - ROOT FACTORS/ 1





SEISMIC RISK - ROOT FACTORS/ 2

1948 – 1964 *No Code*
1964 – 1981 *PIOVS64*
1981 – Now *PIOVS81*



Calculated Risk (**CR**)

*Risk (**R**)*

Perceived Risk (**RR**)

Real Risk (**RR**)

Accepted Risk (**AR**)

LOW PERCEIVED RISK (16.04.2013)

Perceived Risk (**RR**)

1948 – 1964 *No Code*
1964 – 1981 *PIOVS64*
1981 – Now *PIOVS81*