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OVERVIEW OF ADOPTED NATIONALLY DETERMINED PARAMETERS FOR EUROCODE 8

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ABSTRACT

The EN Eurocodes are a series of 10 European Standards, EN 1990 - EN 1999, providing a common approach to the design of buildings and other civil engineering works and construction products. The implementation of the Eurocodes in the EU and EFTA Member States comprises the publication of National Standards that transpose the EN Eurocodes to the country National Standards. They include National Annexes (NAs) containing the country choice of the Nationally Determined Parameters (NDPs) and reference to non-contradictory complementary information. The NDPs are those parameters that were left open in Eurocodes for national choice, to be used for the design of buildings and civil engineering works, in order to take into account country specific geographical, geological or climatic conditions, as well as specific levels of protection.

Since March 2005, the Joint Research Centre provides scientific and technical support to DG Enterprise and Industry in the frame of Administrative Arrangements on the Eurocodes, developing and maintaining a Database with the Nationally Determined Parameters (NDPs Database). The NDPs Database acts as a platform for notification to the European Commission by the Member States on the adopted values of the NDPs and constitutes the basis for the analysis of the NDPs, contributing to the definition of strategies tending to achieve further harmonization of the Eurocodes.

This paper presents an overview of the already uploaded NDPs in the Database, mainly for Eurocode 8 (EN 1998), and the results of a preliminary statistical analysis of the uploaded NDPs and their divergences from the recommended values (RVs) supplied by the Eurocodes. The analysis should be considered as preliminary, since the available data represents approximately 30% out of all expected NDPs for Eurocode 8 and cannot be treated as final. Nevertheless, few divergences were found in the uploaded parameters, indicating a tendency of acceptance of the recommended values, thus facilitating the process to the harmonization of the national choices and to the reduction of the number of the NDPs in the next generation of Eurocodes.

INTRODUCTION

The European Committee of Standardization (CEN) produced the EN Eurocodes that are a set of 10 European Standards, EN 1990 – EN 1999, providing common technical rules for the design of buildings and other civil engineering works and construction products. The EN Eurocodes are expected to contribute to the establishment and functioning of the internal market for construction products and engineering services by eliminating the disparities that hinder their free circulation

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within the European Economic Area. Further, they are meant to lead to more uniform levels of safety in construction in Europe. The Eurocodes are the product of a long procedure of bringing together and harmonizing the different design traditions in the Member States, but at the same time the Member States keep exclusive competence and responsibility for the levels of safety of works, since the Eurocodes are flexible enough to account for differences in national applications. In fact, the Eurocodes include Nationally Determined Parameters (NDPs), which are those parameters that were left open in the Eurocodes for national choice, to be used for design of buildings and civil engineering works, in order to take into account country differences in geographical, geological or climatic conditions, different design cultures and procedures for structural analysis, as well as different requirements for safety levels in the Member States (JRC, 2014).

The set of the NDPs comprises: (i) values and/or classes where alternatives are given in the Eurocodes, (ii) values to be used where a symbol only is given in the Eurocodes, (iii) country specific data (geographical, climatic, etc.), e.g. seismic zone maps, and (iv) the procedure to be used where alternative procedures are given in the Eurocodes.

Since March 2005, the Joint Research Centre provides scientific and technical support to DG Enterprise and Industry in the frame of Administrative Arrangements on the Eurocodes. The mission entrusted to the Joint Research Centre includes support to the national implementation and harmonization of the Eurocodes, training, international promotion and further development of the Eurocodes.

In this framework, and in view of achieving the concerned parts of the European Commission Recommendation of 11 of December, 2003 (2003/887/EC, 2003) *on the implementation and use of Eurocodes for construction works and structural construction products*, the JRC presently provides development and maintenance of a Website on the Eurocodes and of a Database with the Nationally Determined Parameters (NDPs Database) adopted in the countries of EU and EFTA applying the EN Eurocodes. The NDPs Database acts as a platform of notification to the European Commission by the Member States on the adopted values of the NDPs (Pinto et al., 2011) and constitutes the basis for the analysis of the NDPs, contributing to the definition of strategies tending to achieve further harmonization of the Eurocodes.

Actually, in 2010 and 2012, respectively, the European Commission (EC), Enterprise and Industry Directorate-General, issued to CEN the mandates M/466 EN and M/515 EN, concerning the process of further evolution of the Structural Eurocodes, leading to the publication of the second generation of EN Eurocodes. Among the guiding principles of the projects to be developed, further harmonisation of the Eurocodes is aimed at through minimizing the number of the NDPs. The assessment of the variations of the NDPs adopted in the first generation of the Eurocodes and of the potential to significantly reduce their number, shall be done in close collaboration with the JRC and will be based on the NDPs as defined on national level and uploaded in the NDPs Database.

BRIEF OUTLINE OF EUROCODES AND NDPs

The EN Eurocodes apply to structural design of buildings and other civil engineering works including geotechnical aspects, structural fire design, situations including earthquakes, execution and temporary structures. For design of special construction works (e.g. nuclear installations, dams, etc.) other provisions than those in the EN Eurocodes might be necessary The EN Eurocodes cover the basis of structural design (EN 1990), actions on structures (EN 1991), the design of concrete (EN 1992), steel (EN 1993), composite steel and concrete (EN 1994), timber (EN 1995), masonry (EN 1996) and aluminium (EN 1999) structures, together with geotechnical design (EN 1997) and design, assessment and retrofitting of structures for earthquake resistance (EN 1998) (see Figure 1) (JRC, 2004).

Each of the codes (except EN 1990) is divided into a number of Parts covering specific aspects of the subject. In total there are 58 EN Eurocode parts distributed in the ten Eurocodes (EN 1990 – 1999). All of the EN Eurocodes relating to materials (EN 1991 to EN 1996 and EN 1999) have a Part 1-1 which covers the design of buildings and other civil engineering structures and a Part 1-2 for fire design. The codes for concrete, steel, composite steel and concrete, and timber structures and

earthquake resistance have a Part 2 covering the design of bridges. These Parts 2 should be used in combination with the appropriate general Parts (Parts 1) (JRC, 2004).

EN Eurocodes	
EN 1990	Eurocode: Basis of structural design
EN 1991	Eurocode 1: Actions on structures
EN 1992	Eurocode 2: Design of concrete structures
EN 1993	Eurocode 3: Design of steel structures
EN 1994	Eurocode 4: Design of composite steel and concrete structures
EN 1995	Eurocode 5: Design of timber structures
EN 1996	Eurocode 6: Design of masonry structures
EN 1997	Eurocode 7: Geotechnical design
EN 1998	Eurocode 8: Design of structures for earthquake resistance
EN 1999	Eurocode 9: Design of aluminium structures

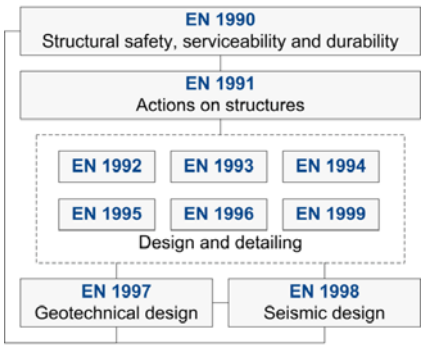


Figure 1. EN Eurocodes and links between the Eurocodes (JRC, 2014)

In all 58 parts of the Eurocodes there are 1,506 Nationally Determined Parameters (NDPs). In a number of cases, a NDP cannot be represented by a single numerical value. In fact, many NDPs take the form of tables, graphs, acceptance of the recommended procedure, choice of calculation approach among given alternatives, introduction of a new procedure, etc. The description of the different types of NDPs may be found in Table 1, where the NDPs relevant to Eurocode 8 are presented.

Figure 2 shows the distribution of NDPs per Eurocode, according to their types.

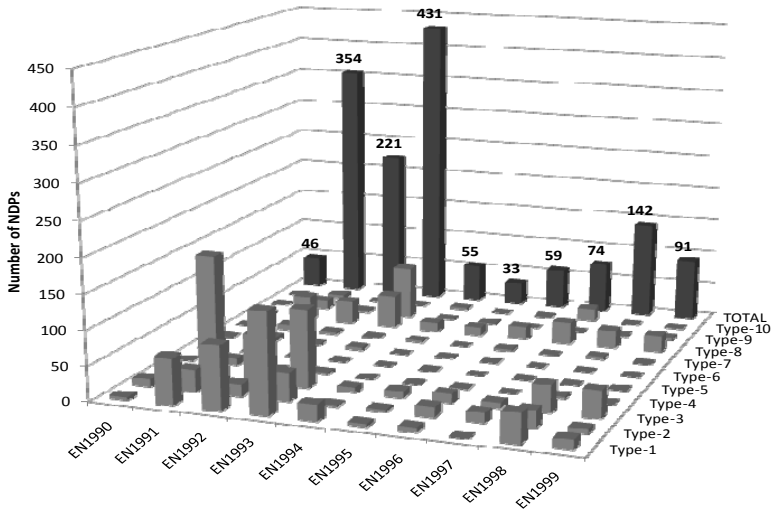


Figure 2. Distribution of NDPs in Eurocodes according to their type (Pinto et al., 2011)

Among the material Eurocodes, EN 1992, *Design of concrete structures* and EN 1993, *Design of steel structures* include the highest amount of NDPs. EN 1991, *Actions on structures* contains a big number of NDPs, most of them arising from different geographical, geological and climatic conditions. Only 563 NDPs in Eurocodes (37.5% of all NDPs) have numerical values and the most frequent type is 3 (see the description of this parameter in Table 1). The majority of the NDPs relates to choice of calculation approach, country specific data (geographical, climatic, etc.) diagrams, reference to non-contradictory complementary information, decisions on the application of informative annexes and provision of further more detailed information (Mehr et al., 2007).

PROGRESS OF UPLOADING NDPs

By the end of February 2014, in a universe of thirty one countries (twenty eight EU Member States plus three EFTA Member States), twenty five were uploading NDPs in the Database, five of

them were registered but not uploading yet, and one was not registered. The access to the Database is restricted to the interested Commission Services, CEN TC250 Coordination Group and its 10 Sub-Committees, the interested National Authorities and the National Standardization Bodies of the EU and EFTA Member States.

Information on the availability of data has been processed to estimate the progress of the upload of NDPs by the various countries of the different Eurocodes and their parts.

Figure 3 presents the progress of uploading NDPs in the Database since 2009, disaggregated by Eurocode, and Figure 4 presents the percentage of uploaded NDPs by Eurocode Part, together with the number of countries that are uploading.

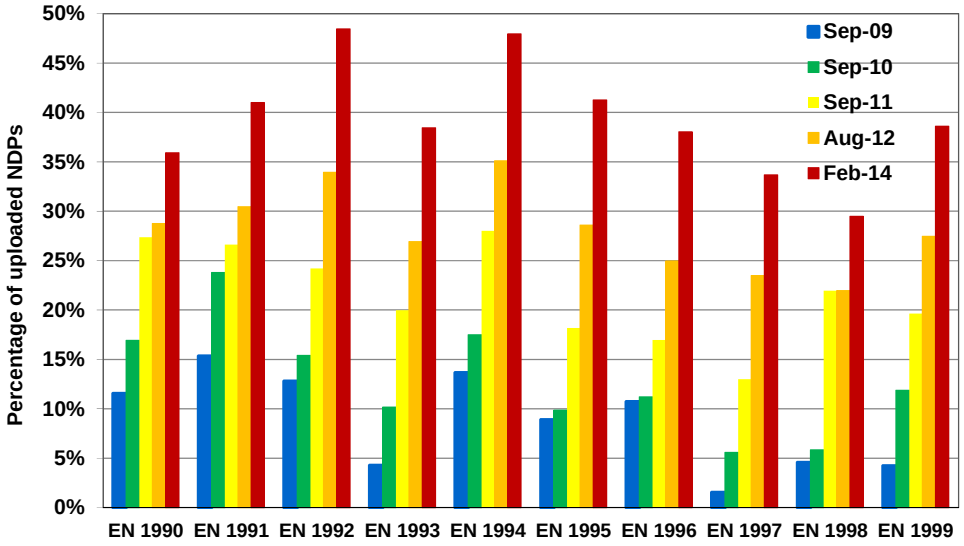


Figure 3. Progress of uploading NDPs by Eurocode

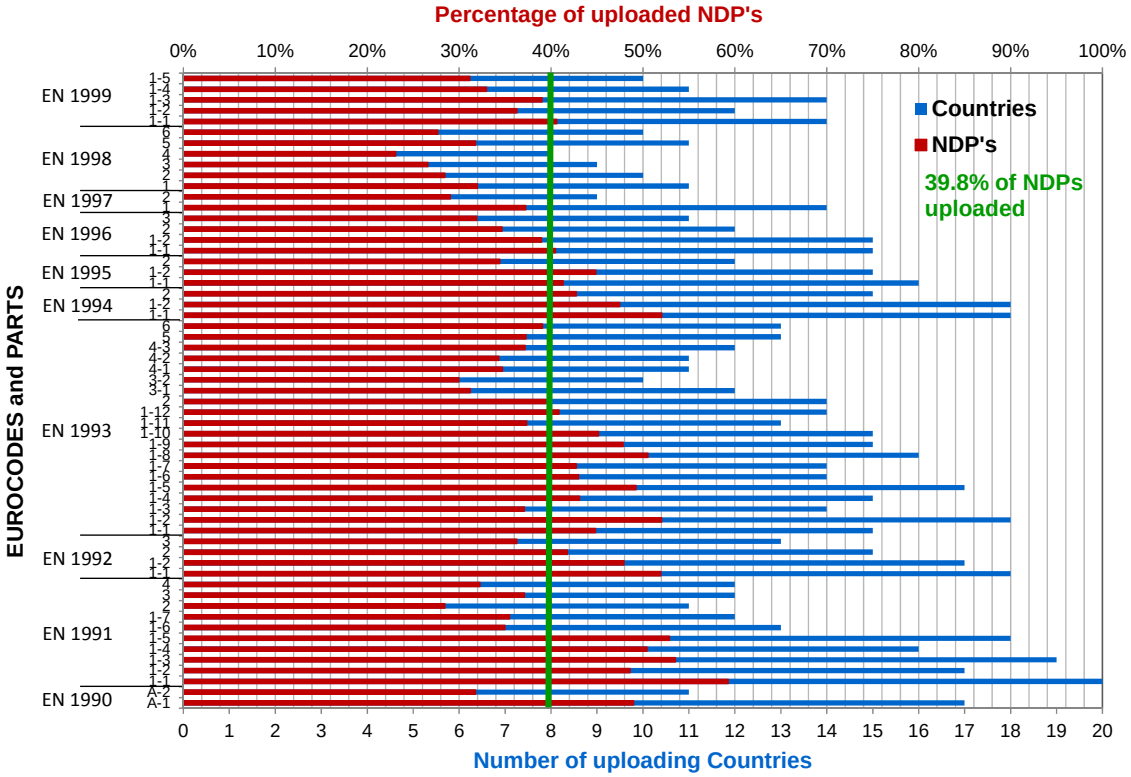


Figure 4. Percentage of uploaded NDPs by Eurocode part and number of uploading countries

Figure 3 shows that during the past year and a half, the rate of uploading increased considerably. Respecting Eurocode 8, the most fruitful year for uploading was 2011.

By the end of February 2014, the Database accommodated a total of 18,218 NDPs for all Eurocodes, approximately 40% out of all expected data.

The most populated Eurocodes in terms of data are EN 1992, with 48.4% of expected NDPs uploaded, and EN 1994 with 48.0%. Two more Eurocodes, EN 1991 and EN 1995, have exceeded the threshold of 40% of expected NDPs uploaded. EN 1998 is noted for being the least populated Eurocode with 29.5% of the expected data, resulting from the uploading of 1,297 NDPs. The Part 4 of Eurocode 8, *Silos, tanks and pipelines*, is the least populated part of all Eurocodes, with 23.1% of expected NDPs uploaded.

The relatively low rate of uploading of the NDPs and NAs on EN 1998 might be explained either by the fact that not all the EU and EFTA Member States adopted this Eurocode, because of the insignificant seismicity on their territories, or by the time span needed to prepare the seismic hazard maps to be included in the NAs.

As depicted in Figure 5, by April 2014, the post-processing of NDPs with recommended value given, *i.e.* NDPs of type 1.1, 2.1, 2.2, 3.1, 3.3, 3.7, 3.8 and 6 (see the description in Table 1), shows that:

i. the mean percentage of acceptance of the recommended values of NDPs is 79.5%, representing a total of 8,690 in 10,932 NDPs;

ii. the Eurocodes with higher than the mean percentage of acceptance of the recommended values are EN 1994 (92%), EN 1993 (89%), and EN 1992 (84%). These results indicate that one can expect good harmonization in the National adoption of the most wide-used “material Eurocodes” EN 1992 and EN 1993.

iii. The Eurocode with the lowest percentage of acceptance of the recommended values is EN 1990 with 53% of acceptance.

iv. EN 1998 presents an acceptance percentage of 78.9%, slightly below the average acceptance.

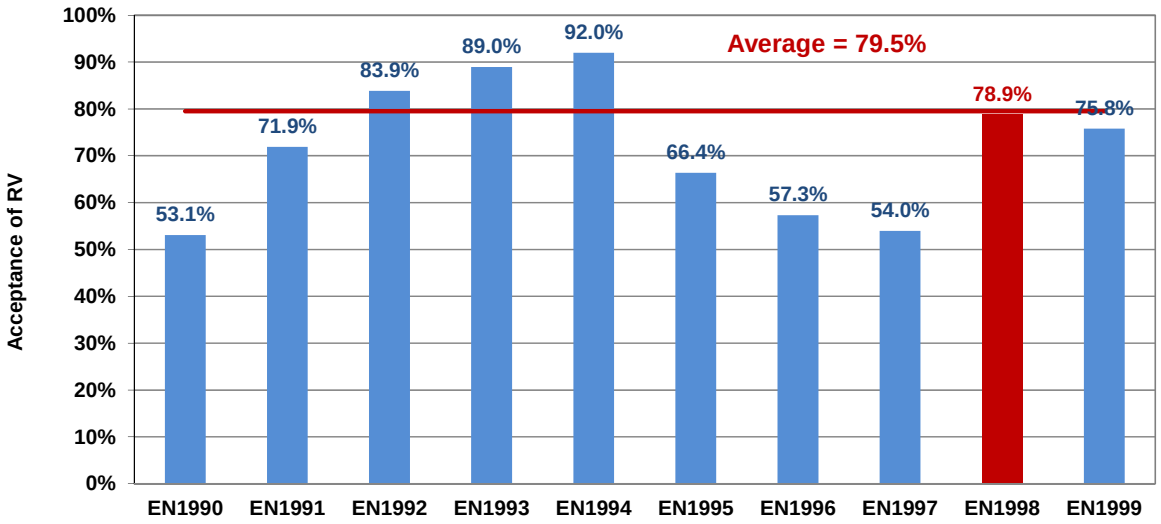


Figure 5. Percentage of acceptance of the recommended values

PRELIMINARLY ANALYSIS OF NDPs FOR EUROCODE 8

The Eurocode 8, *Design of structures for earthquake resistance*, is composed of six parts covering the topics of:

1. General rules, seismic actions and rules for buildings;
2. Bridges;

3. Assessment and retrofitting of buildings;
4. Silos, tanks and pipelines;
5. Foundations, retaining structures and geotechnical aspects;
6. Towers, mast and chimneys.

Within all its six parts, Eurocode 8 contains a total of 142 Nationally Determined Parameters. Table 1 describes the type of NDPs existing in the Database and shows the number of NDPs in each part of Eurocode 8. Most NDPs in Eurocode 8 are type 1.1 (28%), which are *Predetermined Parameters (with RV*), followed by type 8 (18%), type 3.1 (17%) and type 2.2 (16%) *i.e. Decisions on the application of informative Annexes*, *Acceptance of recommended procedures / approaches or introduction of new ones* and *Flexible Tables (rows and columns can be changed)*, respectively. Part 1 of Eurocode 8 comprises 43% of the total NDPs and Part 2 comprises 27%, whereas the remaining parts contain 30% of the total NDPs.

Table 1. NDPs type and descriptions; number of NDPs per part of Eurocode 8

NDP type & description		Part 1	Part 2	Part 3	Part 4	Part 5	Part 6	TOTAL
1.1	Predetermined Parameters (with RV)	19	8	4	5	3	1	**40**
1.2	Predetermined Parameters (without RV)	1						**1**
1.3	No Predetermined Parameters			1				**1**
2.1	Fixed Tables (only cell values can be changed)	2	1					**3**
2.2	Flexible Tables (rows and columns can be changed)	10	5	1	4		2	**22**
3.1	Acceptance of recommended procedures / approaches or introduction of new ones	10	11				3	**24**
3.2	Country procedures / approaches	5	2		1			**8**
3.3	Alternative choice from given options (with RV)							
3.4	Alternative choice from given options (without RV)	1	1					**2**
3.5	Choice from given options (without RV)			1				**1**
3.6	Choice from given options (without RV) or introduction of new procedures / approaches							
3.7	Acceptance of recommended procedures / approaches in fixed tabular form or introduction of new ones	1						**1**
3.8	Acceptance of recommended procedures / approaches in flexible tabular form or introduction of new ones	2	1	1				**4**
4	Country specific data	4						**4**
5	National charts or tables							
6	Diagrams							
7	References to non-contradictory complementary information	3		1				**4**
8	Decisions on the application of informative Annexes	2	9	3	2	4	6	**26**
9	Provision of further, more detailed information	1						**1**
10.1	Reference to information which is included in an informative annex							
10.2	Reference to information which is included in other parts of the EN text							
TOTAL		**61**	**38**	**12**	**12**	**7**	**12**	**142**

The total number of uploaded NDPs with recommended value and the number of accepted recommended values for each country, in Eurocode 8, is presented in Figure 6, confirming the mean acceptance rate of 78.9% for this Eurocode (*i.e.* a total of 701 in 889 NDPs). This figure shows that 13 countries, out of 31 expected countries, have uploaded NDPs for Eurocode 8 in the Database.

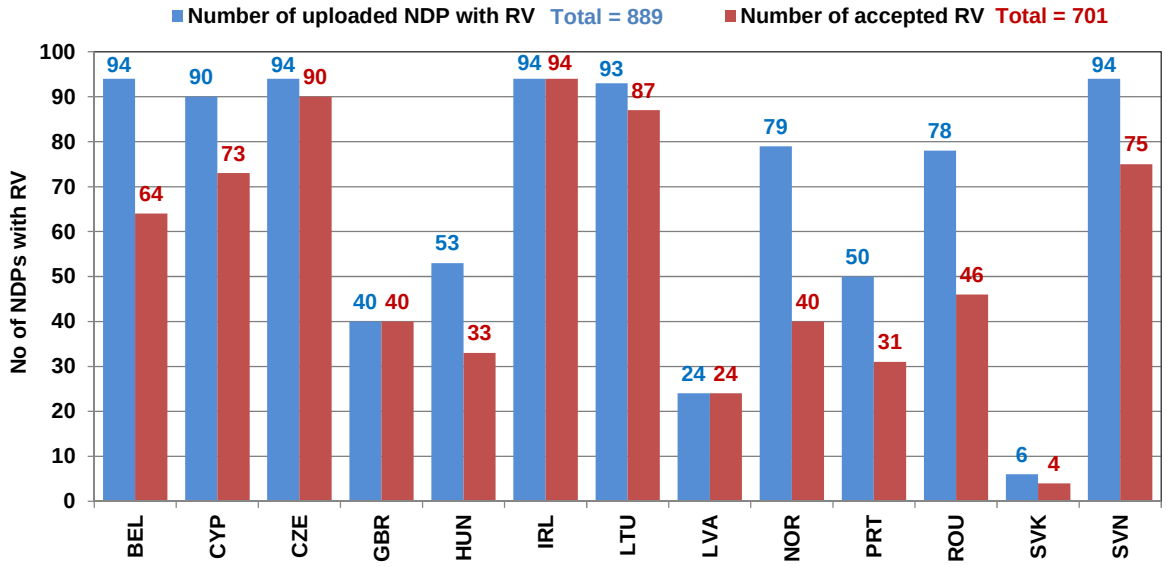


Figure 6. Number of uploaded NDPs with RV and of accepted RV in Eurocode 8

Figure 7 illustrates a query implemented in the NDPs Database reporting the statistics on the acceptance of the recommended values (RV) for the NDPs of type 1.1 and 1.2 (predetermined Parameters with or without RV) that may be automatically generated by authorized users. The analysed NDPs belong to Part 1 of Eurocode 8. The NDPs that were not uploaded in the Database in the required format were discarded in the statistical analysis.

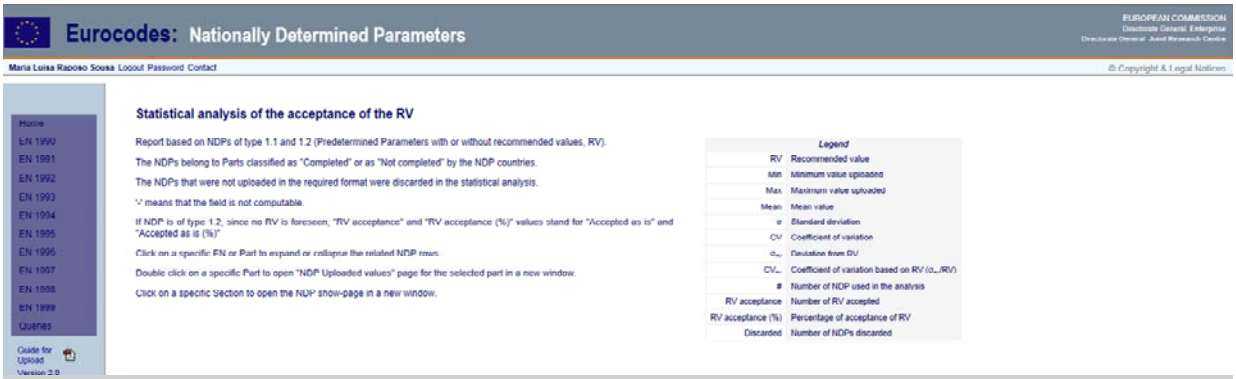
This query shows for each parameter: (i) its recommended value (for NDP type 1.1), (ii) the minimum value, the maximum value, the sample mean, the sample standard deviation and the coefficient of variation of the NDPs uploaded by countries, (iii) the sample deviation from the recommended value (σ_{RV}) and the coefficient of variation based on the recommended value ($CV_{RV} = \sigma_{RV} / RV$), (iv) the number of NDPs values used in the analysis, the number of recommended values that were accepted by countries, the percentage of acceptance of recommended values and the number of NDPs values that were discarded in the analysis, since they were not in the required format for uploading.

Notice that in the specific case of a type 1.2 parameter, the recommended value is not available. However, for type 1.2 parameters “Accept as is” option is enabled in the NDPs Database, and this choice indicates that the EN text is accepted as it is, *i.e.* the country does not propose a value. In the statistical report shown in Figure 7 the fields “RV acceptance” and “RV acceptance (%)” were evaluated for parameters type 1.2, similarly to what was done with parameters type 1.1, *i.e.* by the choice of “Accept as is” option. Naturally, the deviation from the recommended value (σ_{RV}) and the coefficient of variation based on the recommended value (CV_{RV}) were not evaluated (“ – “) for parameters type 1.2. However, Eurocode 8 just contains one NDP of type 1.2.

In this sample, the maximum number of uploading countries, by NDP, is eleven and the minimum is seven.

Figure 8 presents a histogram of the number of countries that did not accept the recommended value of NDPs in the Eurocode 8. The NDPs of type 1.1 were considered in this analysis. Notice that some NDPs of type 1.1 correspond to a set of values, so the cumulative frequency sums 57 occurrences, not matching the total number of NDPs (40) shown in Table 1. Figure 8 shows that most RVs have been accepted by uploading countries (≅ 60% of NDPs values uploaded). In almost 40% of the NDPs values only one country did not accept the RVs. The maximum number of countries that did not accept a given RV is three, happening once for the NDP of the Section 7.6.2, Clause 5, of part 2 of Eurocode 8, which refers to the *value of γ_m for elastomeric bearings in the seismic design situation*.

The recommended value is 1.15 and three out of nine countries decided to upload a NDP value equal to 1.0.



EN	Part	Section	Clause	Type	Parameter	RV	Min	Max	Mean	σ	CV	σ_{RV}	CV_{RV}	#	RV acceptance	RV acceptance %	Discarded
1998	1	2.1	1 NOTE 1	1.1	The value of T_{ICR} (years)		475	100	475	433.33	125	0.29	132.58	0.28	9	8	88.89	1
					The value of P_{ICR} (%)		10	10	39	13.22	9.67	0.73	10.25	1.03	9	8	88.89	1
		2.1	1 NOTE 3	1.1	The value of T_{DLR} (years)		95	30	95	87.78	21.67	0.25	22.98	0.24	9	8	88.89	1
					The value of P_{DLR} (%)		10	10	28	12	6	0.5	6.36	0.64	9	8	88.89	1
		3.2.2.5	4	1.1	The value of lower bound factor, β		0.2	0.2	0.2	0.2	0	0	0	0	11	11	100	0
		4.3.3.1	8	1.2	Threshold value of importance factor, γ_I, relating to the permitted use of analysis with two planar models			1	1.2	1.03	0.08	0.07	-	-	9	-	-	0
		5.8.2	4	1.1	The values of t_{min} (m)		0.2	0.12	0.2	0.19	0.02	0.13	0.03	0.13	11	10	90.91	0
					The values of $\rho_{t,min}$ (%)		0.2	0.2	0.25	0.2	0.02	0.07	0.02	0.08	11	10	90.91	0
		5.8.2	5	1.1	The value $\rho_{s,min}$ (%)		0.4	0.4	0.4	0.4	0	0	0	0	10	10	100	0
		5.11.1.5	2	1.1	The value of A_s (%)		30	0	30	26.25	10.61	0.4	11.34	0.38	8	7	87.5	2
		5.11.3.4	7 e	1.1	The value of $\rho_{s,min}$ (%)		1	1	1	1	0	0	0	0	11	11	100	0
		6.1.2	1 NOTE 1	1.1	Upper limit of q for low-dissipative structural behaviour concept within the range of Table 6.1may		1.5	1.5	1.5	1.5	0	0	0	0	10	10	100	0
		6.2	3 NOTE 2	1.1	The value the overstrength factor used in design, γ_{ov}		1.25	1.25	1.25	1.25	0	0	0	0	11	11	100	0
		6.7.4	2 NOTE 2	1.1	The value of γ_{ra}		0.3	0	0.3	0.27	0.09	0.35	0.1	0.33	10	9	90	0
		7.1.2	1 NOTE 1	1.1	Upper limit of q for low-dissipative structural behaviour concept		1.5	1.5	1.5	1.5	0	0	0	0	10	10	100	0
		7.1.3	4	1.1	The value the overstrength factor used in design, γ_{ov}		1.25	1.25	1.25	1.25	0	0	0	0	10	10	100	0
		7.7.2	4	1.1	The value of the reduction factor, r		0.5	0.5	0.5	0.5	0	0	0	0	9	9	100	1
		9.2.2	1	1.1	The value of $f_{k,min}$ (N/mm²)		5	5	5	5	0	0	0	0	5	5	100	5
					The value of $f_{k,min}$ (N/mm²) (for low seismicity)		5	5	5	5	0	0	0	0	5	5	100	5
					The value of $f_{bt,min}$ (N/mm²)		2	2	2	2	0	0	0	0	7	7	100	3
					The value of $f_{bt,min}$ (N/mm²) (for low seismicity)		2	2	2	2	0	0	0	0	5	5	100	5
		9.2.3	1	1.1	The value of $f_{m,min}$ for reinforced masonry (N/mm²)		10	8	10	9.78	0.67	0.07	0.71	0.07	9	8	88.89	1
					The value of $f_{m,min}$ for unreinforced or confined masonry (N/mm²)		5	1	5	4.56	1.33	0.29	1.41	0.28	9	8	88.89	1
		9.7.2	2 b	1.1	The value of λ_{min}		0.25	0.25	0.25	0.25	0	0	0	0	10	10	100	1
		9.7.2	2 c	1.1	The value of ρ_{min} (%)		15	15	15	15	0	0	0	0	11	11	100	0
		9.7.2	5	1.1	The values of $\Delta_{x,min}$ (%)		20	20	20	20	0	0	0	0	11	11	100	0
					The values of $\Delta_{y,min}$ (%)		20	20	20	20	0	0	0	0	11	11	100	0
		10.3	2	1.1	The value of γ_c		1.2	1.2	1.2	1.2	0	0	0	0	10	10	100	0

Figure 7. Report on the statistical analysis of the acceptance of the recommended values available on the NDPs Database; Eurocode 8 - Part 1

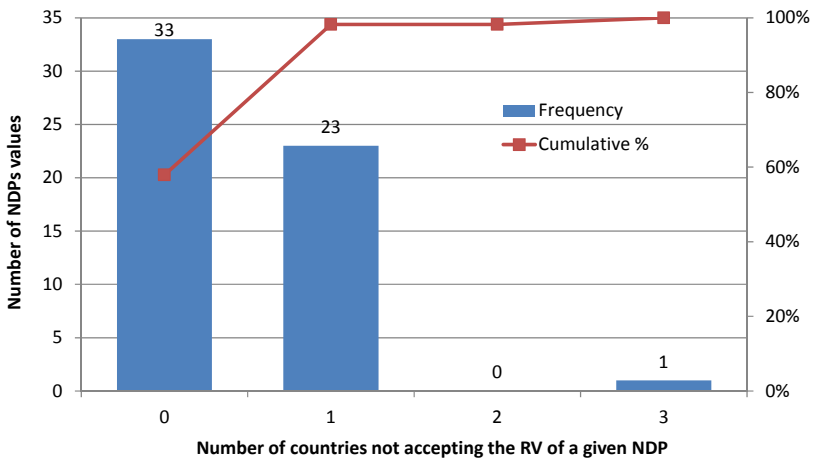


Figure 8. Histogram of the number of countries that did not accept the recommended values of a given NDP; NDPs of type 1.1 in Eurocode 8

Figure 9 presents the mean value of the NDPs of type 1.1 in Eurocode 8, normalized with respect to their recommended values, *i.e.*, $\overline{NDP / RV} = \overline{NDP} / RV$. The standard deviation of the variable *NDP*/*RV*, is summed, with positive or negative signs, to its mean value, being illustrated by the red points in Figure 9, *i.e.*, $\overline{NDP} / RV \pm \sigma_{NDP/RV}$. In the present case the deviations from the RV are either positive or negative, meaning that all countries deviate from the actual RV in the same direction, or in other words, the range of *NDP*/*RV* is either equal to the minimum or to the maximum value of *NDP*/*RV*, also shown in Figure 9. Nevertheless, for the analysed sample, representing 30% out of all expected NDPs, the possible range of deviation within minus or plus one standard deviation from the mean value of *NDP*/*RV* is illustrated.

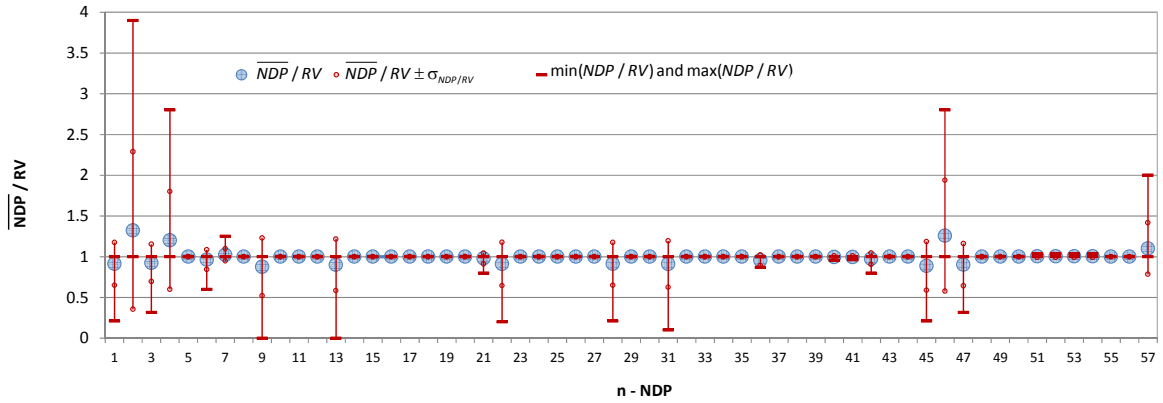


Figure 9. Mean value, standard deviation, maximum and minimum value of *NDP/RV*; type 1.1 NDPs of Eurocode 8

Figure 10 presents a histogram of the coefficient of variation based on the recommended value (CV_{RV}). Analysing this Figure one may conclude that most NDP values have a null deviation from the recommended value, confirming that almost 60% of recommended values were accepted by all uploading countries.

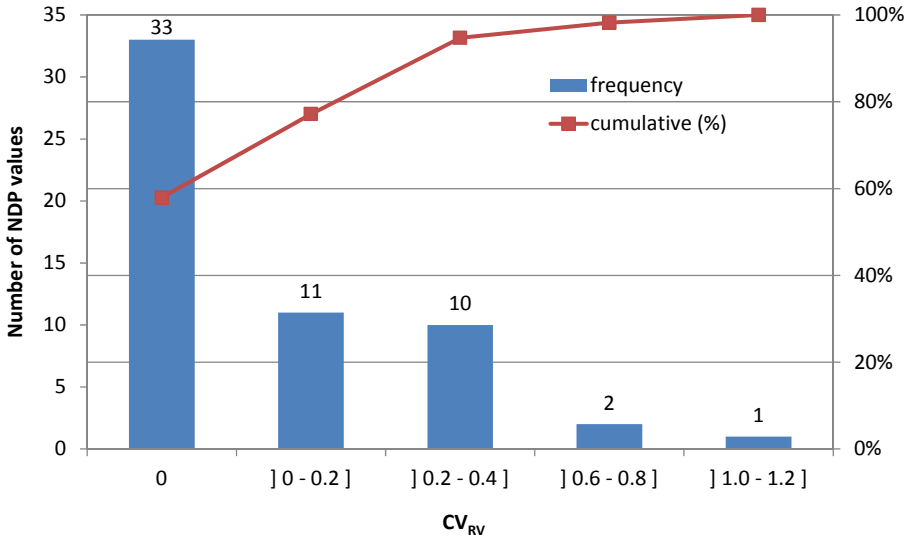


Figure 10. Histogram of the coefficient of variation based on the recommended value (CV_{RV}); type 1.1 NDPs of Eurocode 8

Figure 10 shows that there are three NDP values having a coefficient of variation based on the recommended value (CV_{RV}) greater than 0.4; by way of example, the reasons for these deviations were analysed. In Table 2 is shown a selection of Eurocode 8 NDPs values uploaded in the Database having a CV_{RV} greater than 0.4.

The first two cases correspond to NPDs of the Section 2.1 of part 1 of Eurocode 8, Clause 1, NOTE 1 and NOTE 3. The NDP of Clause 1 NOTE 1 refers to the *reference probability of*

exceedance in 50 years, P_{NCR}, *for the no-collapse requirement*, in which the recommended value is 10%. The NDP of Clause 1 NOTE 3 refers to the *reference probability of exceedance in 10 years*, P_{DLR}, *for the damage limitation requirement*, in which the recommended value is also 10%. In both cases, ten countries uploaded values for these NDPs and one of the values uploaded was discarded in the analysis, since it was not in the required format. The number of recommended values accepted by countries is eight, meaning that all uploading countries, except one, accepted the recommended values. Therefore, the different values correspond to the maximum values shown in Table 2, *i.e.*, P_{NCR} = 39% and P_{DLR} = 28%, for NOTE 1 and NOTE 3, respectively. The country reasons for not accepting the recommended values may be further investigated.

Table 2. NDPs in Eurocode 8 with a CV_{RV} greater than 0.4

Part	1	1	4
Section	2.1	2.1	2.1.3
Clause	1 NOTE 1	1 NOTE 3	5
Parameter	the value of P_{NCR} (%)	the value of P_{DLR} (%)	the value of P_{DLR} (%)
RV	10	10	10
Min	10	10	10
Max	39	28	28
Mean	13.2	12.0	12.6
σ	9.7	6.0	6.8
CV	0.7	0.5	0.5
σ_{RV}	10.3	6.4	7.4
CV_{RV}	1.0	0.6	0.7
#[1]	9	9	7
RV acceptance	8	8	6
RV acceptance (%)	88.9	88.9	85.7
Discarded	1	1	0

[1] Number of NDPs considered in the analysis

The third case corresponds to a NDP of the Section 2.1.3 of part 4 of Eurocode 8, Clause 5 that refers to the *reference probability of exceedance in 10 years*, P_{DLR}, *for the damage limitation state*, in which the recommended value is 10%. In this case, seven countries uploaded values for this NDP and no value was discarded in the analysis. The number of recommended values accepted by countries is six, meaning that all uploading countries, except one, accepted the recommended value. Therefore, the different value corresponds to the maximum value shown in Table 2, *i.e.*, P_{DLR} = 28%. The country reasons for not accepting the recommended values may be further investigated.

CONCLUSIONS

The European Commission Recommendation of 11 of December, 2003 (2003/887/EC, 2003) states that *"Member States should use the recommended values provided by the Eurocodes when nationally determined parameters have been identified in the Eurocodes. They should diverge from those recommended values only where geographical, geological or climatic conditions or specific levels of protection make that necessary."*

Member States are encouraged to harmonize their choices with the recommended values, (harmonization across national borders), but also the methodologies used for their assessment, as well as the design procedures used for different structures (harmonization across different materials), *e.g.* reinforced concrete, steel and composite structures, in order to contribute to the gradual alignment of

safety levels across Europe and to the free circulation of construction products and engineering services.

Nevertheless, Eurocode 8 contains NDPs that account for differences in geological conditions in national applications, for instance, the parameters that define the *horizontal and vertical elastic response spectra*, the *seismic zone maps* or the *reference ground accelerations* for *reference return periods of seismic action*.

This paper presented an overview of the data available in the NDPs Database of Eurocodes and the results of a preliminary statistical analysis for Eurocode 8. The data available in the Database for this Eurocode represent approximately 30% out of all expected NDPs. This ratio was calculated with the contributions from 13 countries out of 31 expected.

The presented analysis should be considered as preliminary, since the available data for post-processing represents approximately 30% out of all expected NDPs and cannot be treated as final. Nevertheless, the JRC efforts to populate the NDPs Database are bearing results, as shown in Figure 3 where the progress of uploading was reported.

The preliminary analysis showed that the mean acceptance rate of NDPs for Eurocode 8 is 78.9%, resulting from a total of 701 NPDs accepted in 889 NPDs uploaded, meaning that almost every four out of five recommended values were accepted.

The maximum number of uploading countries that didn't accept a given recommended value was three, happening for one specific NDP value. For all but one value of NDPs the recommended values were accepted, either by all countries, or by all but one country.

The causes of large divergences found in the coefficients of variation based on the recommended value (CV_{RV}) of three NDPs (type 1.1) were investigated, showing that were due to the non-acceptance of the recommended values by one Member State. Most NDPs values (around 80%) uploaded by the 13 countries shows non-significant deviations from recommended values ($CV_{RV} < 0.2$), indicating that the majority of countries tend to accept the recommended values, or values close to the recommended ones.

Future analysis of the causes of those divergences will contribute to a harmonization of the national choices and to reduction of the number of the NDPs in the next generation of Eurocodes with the aim of further harmonization.

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