STATE OF EUROCODE 8 IMPLEMENTATION IN THE EUROPEAN UNION

Adamantia ATHANASOPOULOU1, Silvia DIMOVA2, Manfred FUCHS3, Maria Luísa SOUSA4, Artur PINTO5, Borislava NIKOLOVA6, Sonia IANNACCONE7

ABSTRACT

The implementation of the Eurocodes in EU Member States, including the preparation and publication of national Parts, the adoption of the national provisions and the withdrawal of the conflicting national standards was expected to be fully completed in 2012. The paper presents the results of the enquiry on the state of implementation of Eurocode 8 in the EU Member States and Norway, which was performed by the European Commission in 2014-2015. The results of the analysis have shown that the implementation of Eurocode 8 is mainly affected by two facts: (i) the existing approach in the national implementation of the Eurocodes, either as voluntary National Standards or via a Regulatory Framework; (ii) the seismicity of the country and the necessity for publication of the National Annex on Eurocode 8. The preliminary results on the acceptance of the recommended values of the Nationally Determined Parameters (NDPs) show that in almost three out of four cases the recommended values were accepted for the EN 1998 Parts thus allowing further harmonisation of the national implementation of Eurocode 8 and reduction of the number of NDPs.

Keywords: Eurocodes; standards; implementation; harmonisation; NDPs

1. INTRODUCTION

In line with the Europe 2020 strategy for smart, sustainable and inclusive growth (COM (2010) 2020), standardisation plays an important part in supporting the industrial policy for the globalization era. The publication of the Eurocodes by the European Committee for Standardisation (CEN) in May 2007 marked a major milestone in the European standardisation for the construction sector, since the Eurocodes introduced common technical rules for the structural design of buildings and other construction works. The on-going implementation of Eurocodes in the European Union enhances the functioning of the Internal Market for construction products and services by removing obstacles arising from different national practices. The improvement of the competition in EU markets through the adoption of the Eurocodes is recognised in the "Strategy for the sustainable competitiveness of the construction sector and its enterprises" (COM, 2012). The Eurocodes are distinguished as a tool for accelerating the

1 Project Officer, European Commission, Joint Research Centre (JRC), Directorate for Space, Security and Migration, Ispra, Italy, adamantia.athanasopoulou@ec.europa.eu
2 Project Leader, European Commission, Joint Research Centre (JRC), Directorate for Space, Security and Migration, Ispra, Italy, silvia.dimova@ec.europa.eu
3 Policy Officer, European Commission, DG Internal Market, Industry, Entrepreneurship and SMEs (GROW), Directorate for Industrial Transformation and Advanced Value Chains, Brussels, Belgium, manfred.fuchs@ec.europa.eu
4 Project Officer, European Commission, Joint Research Centre (JRC), Directorate for Space, Security and Migration, Ispra, Italy, luisa.sousa@ec.europa.eu
5 Head of Unit, European Commission, Joint Research Centre (JRC), Directorate for Space, Security and Migration, Ispra, Italy, artur.pinto@ec.europa.eu
6 Associated Professor, University of Architecture, Civil Engineering and Geodesy, Sofia, Bulgaria, nikolova_borislava@abv.bg
7 IT Consultant, GFT Italia S.r.l., Milano, Italy, sonia.iannaccone@ext.ec.europa.eu
process of convergence of different national and regional regulatory approaches and for fostering the
global competitiveness of the European construction enterprises.
The Joint Research Centre of the European Commission (JRC) provides scientific contribution to the
Eurocodes since 1992. Further, since March 2005 the JRC provides scientific and technical support to
DG Internal Market, Industry, Entrepreneurship, and SMEs (DG GROW) in the frame of
Administrative Arrangements on the Eurocodes. The mission initially devoted to the JRC included
support to the national implementation and harmonisation of the Eurocodes, support to training,
international promotion and further development of the Eurocodes. Since 2015, the scope of the JRC
contribution has been extended to support European policies and standards for sustainable
construction.
The next goal of the European Commission is to keep the Eurocodes as the most advanced state of the
art codes for structural design in the world. A project aiming to develop the second generation of the
Eurocodes is currently underway and it is expected to be completed by 2020 (M/515 EN (2012)).
In the frame of the above activities, this paper presents the results of the enquiry on the
implementation of the Eurocodes, with focus on Eurocode 8 (i.e. EN 1998), in the EU Member States
and Norway, which was performed by DG GROW and JRC of the European Commission in 2014-
2015. Further, in line with JRC’s activities in support harmonisation and further development of the
Eurocodes, updated data from the Nationally Determined Parameters (NDPs) Database, managed by
JRC, are presented and discussed. Thus, the state of uploading for the NDPs in the Eurocode 8 Parts
can be assessed in relation with the results of the enquiry in order for the reader to obtain a detailed
view of the present status.

2. STEPS FOR THE EUROCODES IMPLEMENTATION IN THE CEN MEMBER COUNTRIES

The Members of CEN are the National Standardisation Bodies of 34 European countries – including
all 28 member states of the European Union (EU), three EFTA Member States (Iceland, Norway, and
Switzerland) and other European countries (the former Yugoslav Republic of Macedonia, Serbia and
Turkey). The European Standards (ENs) published by CEN are developed by experts, established by
consensus and adopted by the Members of CEN. The CEN/CENELEC Internal Regulations (Part
2:2015) specify two concrete steps to be performed by the CEN National Members in implementation
of ENs at national level by giving them the status of National Standards, namely:
   i. either publication of an identical text or endorsement in 6 months after the date of availability;
   ii. withdrawal of any National Standards conflicting with the EN in 6 months after the date of
availability.

The Eurocodes Implementation Plan as was designed by the National Authorities of the EU and EFTA
Member States, in liaison with NSBs and other relevant parties can be summarised as follows:
   i. translation of the Eurocode Part in authorised national languages;
   ii. setting the Nationally Determined Parameters (NDPs) to be applied on their territory;
   iii. publication of the National Standard transposing the EN Eurocode Part and the National
Annex (NA), containing among other, the national choices on the NDPs, and notify the European
Commission;
   iv. adaptation, as far as necessary, of the National Provisions so that the EN Eurocode Part can be
used on their territory, as a means to prove compliance of construction works with the national
requirements for "mechanical resistance and stability" and "resistance to fire" as a basis for
specifying contracts for the execution of public construction works and related engineering services;
   v. promotion and training on the Eurocodes.

3. THE ENQUIRY ON THE EUROCODES IMPLEMENTATION

The enquiry on the Eurocodes conducted by the European Commission was part of the activities
envisioned in the Action Plan of the "Strategy for the sustainable competitiveness of the construction
sector and its enterprises". It primarily aimed to establish the state of implementation of the
Eurocodes in the EU Member States in their specific regulatory and standardisation environment and
in parallel determine the place of the Eurocodes in Public Procurement. Further, the data collected
through the survey was envisaged to detect potential barriers, which restrict or impede the implementation of the Eurocodes and gather comments regarding experience accumulated in the implementation of the Eurocodes, problems encountered and solutions found.

The enquiry consisted of two separate Parts, each addressed to the National Authorities and the National Standardisation Bodies (NSBs) of the EU Member States and Norway. It was launched in the beginning of 2014 and data were received up to the first half of 2015. The questions included in the enquiry are listed in Table 1 found in Appendix A of this paper. All questions referred to each Eurocode Part, with EN 1990-A1 (Annex 2) considered as a separate Part, so the total number of the Eurocodes Parts taken into consideration was 59. For the case of Eurocode 8, denoted by EN 1998: “Design of structures for earthquake resistance”, the questions referred to all six Parts of the EN standard.

In the following section, an analysis of selected results, with particular focus on Eurocode 8, are presented and discussed. For detailed data analysis concerning all Eurocode Parts and commentary for each country based on the responses collected through the survey, the reader can refer to Dimova et al. (2015). It should be noted that the results discussed herein reflect the situation as reported by the countries in 2014-2015, while changes should be expected when compared with the present situation. However, the data provide important conclusions with regard to the general trends observed up to 2015 and can serve the European Commission and the EU Member States when planning activities in support of the second generation of the Eurocodes.

4. STATE OF IMPLEMENTATION OF EN 1998 IN THE EUROPEAN UNION

4.1 Publication of National Standards on EN 1998 Parts

As noted in the introduction, the publication of National Standards is a necessary step to be performed by CEN National Members when implementing ENs at national level. Figure 1(a) shows the number of published National Standards on the Eurocodes Parts as percentage of all 59 Parts considered in the enquiry. All EU Member States and Norway have published all Eurocodes Parts with the exception of Germany and Luxembourg, which did not publish EN 1990-A1 (Annex 2) and Spain, which published 75% of the Eurocodes Parts. In fact, the rate of accepted Eurocodes Parts as National Standards by Spain is 83%, because the standards of the EN 1999 series have been ratified.

![Figure 1](image.png)

Figure 1. Publication of National Standards: (a) on the Eurocodes in percentage of all Parts; (b) on Eurocode 8 Parts in percentage of its six Parts.

For EN 1998 Parts (see Figure 1(b)), all EU Member States and Norway published all six Parts, except for Spain that had not publish EN 1998 Parts 4 and 6 by 2015. Thus, in general, the state of publication of National Standards on EN 1998 is similar to the overall situation when considering all Eurocode Parts as all countries considered in the enquiry (except for Spain) have adopted Eurocode 8
as a national standard and have made it available for use in their country.
The Eurocodes Parts were published by CEN in three languages: English, French and German. The rate of the Eurocodes Parts available in national language as percentage of the published Parts is shown in Figure 2(a). All Eurocodes published Parts were translated in the national language in Austria, Bulgaria, the Czech Republic, Greece, Lithuania, and Romania. Cyprus has used the Greek translation for all Parts and Spain has translated all 44 published Parts. More than 75% of the Eurocodes Parts were translated in Croatia, Estonia, Finland, Latvia, Poland, Slovakia and Sweden. In Luxembourg, Luxembourgish is one of the three official languages there (together with French and German), thus explaining the lack of translation. English is an official language in Malta and Ireland thus justifying the very low rate or lack of translation. Thus, in 70% of countries more than 75% of the published Eurocodes Parts are available in the national language or into one of the official national languages.

Figure 2. Availability of (a) all Eurocodes Parts; (b) Eurocode 8 Parts, in the national language as percentage of the respective published Parts.

In parallel, the rate of EN 1998 Parts available in national language as percentage of the published Parts is shown in Figure 2(b). Significant differences in the rate of EN 1998 Parts translated in the national language compared to the situation for all Eurocodes Parts are observed for several countries, namely: Denmark, Estonia, Finland, Netherlands, Poland and Sweden that have not published any EN 1998 part in the national language and Latvia that has published only EN 1998 Part 2. Smaller difference comparing the overall situation with EN 1998 is observed in Croatia, Norway and Slovakia. In fact, all EN 1998 Parts are available in the national language in Croatia (compared to 92% when considering all 59 Eurocode Parts). EN 1998 Parts 1, 2, 3 and 5 are available in Italian (i.e. 67% of the published EN 1998 Parts) whereas 50% of the published EN 1998 Parts (Parts 1, 3 and 5) are available in the national language in Hungary. In Portugal, despite an overall low rate of translation, EN 1998 Parts 1 and 5 were already available in Portuguese at the time the enquiry was conducted. EN 1998 Part 1 “General rules, seismic actions and rules for buildings” is the most translated Eurocode 8 part; it is available in one of the official national languages in 19 of the considered countries and there is no translation in seven countries (Denmark, Estonia, Finland, Latvia, Netherlands, Poland, Sweden). The least translated EN 1998 Parts are Part 4 “Silos, tanks and pipelines” and Part 6 “Towers, masts and chimneys”.

Overall, in approximately 60% of the countries more than 75% of the published EN 1998 Parts are available in one of the official national languages supporting that there are no language-related barriers to the implementation of Eurocode 8. It is clear that in several northern European countries, the translation of EN 1998 Parts is low; however, in these countries there is no necessity for seismic design and the translation of the EN 1998 Parts is not a priority. Thus, it can be concluded that rate of EN 1998 Parts translation is well progressing in the southern European countries where seismic design is necessary.
As it was mentioned in the previous section, the publication of the National Standard transposing the EN Eurocode, should be followed by the publication of the related National Annex. The publication of National Annexes in percentage of the 59 Parts can be observed in the Figure 3(a). Responses to the inquiry to all Eurocodes Parts (see Figure 3(a)) showed that 80% of the countries published National Annexes to more than 75% of the Eurocodes Parts, as follows:

i. Belgium, Cyprus, Czech Republic, Greece, Italy, Norway, Romania, and Slovakia published National Annexes to all Eurocodes Parts;

ii. Austria, Bulgaria, Croatia, Germany, Lithuania, Luxemburg, Estonia, Poland and Slovenia published National Annexes to or more than 90% of the Eurocodes Parts;

iii. Finland, France, the United Kingdom, Ireland, Latvia, the Netherlands and Sweden published National Annexes to more than 75% of the Eurocodes Parts.

With respect to EN 1998 Parts, as it is shown in Figure 3(b), differences in the rate of publication of National Annex were observed in several countries compared to the situation when considering all Parts. Denmark, Spain, Estonia, Finland, Ireland, Malta, Netherlands, Poland and Sweden have not published any National Annex for the EN 1998 Parts whereas Latvia has published a National Annex only to Part 2 of EN 1998 (bridge design).

Contrary to the situation when considering all 59 Parts, France, Croatia, Lithuania and Luxembourg have published National Annexes for all EN 1998 Parts. Germany had published National Annexes for EN Parts 1, 2 and 5 by 2015 and Hungary for EN Parts 1, 3 and 5.

It can be observed that for the southern European countries the publication of National Annexes to EN 1998 was progressing well at the time of the survey with the exception of Malta, Portugal and Spain. Portugal had published National Annexes only to Parts 1 and 5; these same Parts are also available in Portuguese.

Similar to the observation made concerning the EN 1998 Parts that are available in one of the countries’ national language, there is a National Annex on Part 1 in the majority of the countries (19 of the considered countries). The United Kingdom was the country to first publish National Annexes in EN 1998 Parts 1 and 5 in 2004, followed by publication on the National Annexes for Parts 2 and 6 in 2005. Most of the countries considered have published the National Annexes to each EN 1998 Part at different years with the exception of Greece, Croatia, Lithuania and Luxembourg that published all annexes for EN 1998 in the period 2010-2011; Italy has published all National Annexes to EN 1998 Parts in 2013.

Overall, the rate of publication of National Annexes on EN 1998 is lower than the rate of publication of National Annexes on all Eurocodes Parts. However, the publication of National Annexes for EN
1998 is mainly linked to the necessity of seismic design in each country, as it is evident that the publication rate is significantly lower in the northern countries where seismicity is low. By 2015, the amount of the published National Annexes had reached 83% of the total. Figure 4 presents the state of publication of the National Annexes by Eurocode as percentage of the total expected (i.e., the number of the Eurocodes Parts to a given Eurocode multiplied by the number of the countries in the analysis). The highest percentage of National Annexes was published to EN 1994, which covers an area where National Standards did not exist before in many countries. It is noted that EN 1998 exhibits the lowest rate of publication of National Annexes (60%) due to the seismicity conditions in many of the analysed countries, which do not require seismic design and thus publication of a National Annex is not a priority or necessity.

Figure 4. Publication of the National Annexes by Eurocode as percentage of the expected total (2015)

4.3 Use of National Standards in parallel with EN 1998

When the CEN National Members are implementing an EN standard, they should withdraw the National Standards conflicting with it. Figure 5(a) shows the rate of use of National Standards in parallel with the Eurocodes Parts, expressed in percentage of the published Parts. As seen from Figure 5(a), in 80% of the countries included in the analysis, there are no National Standards used in parallel with the Eurocodes Parts.

Regarding EN 1998 Parts, no related National Standards are used in parallel in any of the considered countries with the exception of Bulgaria. In Bulgaria, it is allowed to use either the Eurocodes or the existing National Regulations for designing new construction works of third, fourth and fifth category (e.g., family houses) not assigned under Public Procurement, without combining the methods of calculation. It should be also noted that in Latvia, a regulation enforcing the EN 1998 Parts was expected in 2015.

However, this very positive result regarding EN 1998 shall be considered having in mind the regulatory environment in some EU Member States, where the rules for structural design are enforced by legislative acts, hereinafter referred to as National Regulations. In the different regulatory environments, the National Regulations either refer to standards thus making the compliance with them compulsory, or introduce directly a set of design rules. In the latter case, no National Standards exist, and hence – there is no need to withdraw conflicting standards. As example of countries, where there are no conflicting standards, but the existing National Regulations introduce directly design rules which do not fully reflect the entire set of the Eurocodes provisions, one can mention Italy, Portugal, Romania, and Spain.

There are also countries, where the National Regulations allow the parallel use of the Eurocodes and other standards or Regulations. For example, in Greece, the owner/authority has to choose the framework of regulatory documents for structural design: either, the pre-existing regulatory documents, or, the Eurocodes together with their National Annexes. Also, in Lithuania and
Luxembourg there are National Regulations on structural design, which may be used in parallel with the Eurocodes. In Poland, the national equivalents of the Eurocodes have status of withdrawn standards. However, other National Standards are used in parallel with 70% of the Eurocodes Parts, posing similar or additional requirements.

Figure 5. (a) Rate of use of National Standards in parallel with the Eurocodes Parts; (b) Rate of use of National Standards for EN 1998 Parts (rates expressed in percentage of the respective published Parts)

4.4 Amendment of National Regulations to allow the use of the EN 1998 Parts

In Figure 6(a) it is depicted the percentage of all Eurocodes Parts for which an amendment for the National Regulation was necessary in order to allow use of the Eurocodes. No amendment was needed by 40% of the countries with respect to all Eurocode Parts.

When considering these answers, it should be noted that:

i. In Greece, a Ministerial Decision had been drafted at the time of the enquiry, rendering the use of existing national regulatory documents non-mandatory and allowing the use of Eurocodes as an alternative option, which is the common practice in the case of Public Procurements.

ii. In Bulgaria, Ordinance № RD-02-20-19 defines the conditions and procedure for the structural design by the Eurocodes. As this was a new Ordinance at the time of the enquiry, the Bulgarian reply did not consider that act as amendment of the relevant National Regulations.

Figure 6. (a) Percentage of all Eurocodes Parts for which amendment of National Regulations was/will be necessary; (b) Percentage of EN 1998 Parts for which amendment of National Regulations was/will be necessary
Concerning EN 1998 Parts (Figure 6(b)), the situation is different, as no amendment was needed by 65% of the countries (Austria, Belgium, Bulgaria, the Czech Republic, Germany, Denmark, Spain, Estonia, Finland, the United Kingdom, Greece, Hungary, Ireland, Luxembourg, Netherlands, Norway, Malta, Poland, Slovakia and Sweden). Contrary, amendment was necessary for all EN 1998 Parts in the case of seven countries among which some southern countries, namely Cyprus, France, Croatia, Italy, Lithuania, Latvia and Slovenia. In particular, in Italy and Slovenia, the national regulation where amended in 2008 and 2011, respectively, allowing the use of all EN 1998 Parts. For France national regulation was amended in 2010 for allowing use of EN 1998 Parts 1 and 3-6 whereas a year later for allowing use of Part 2. For the case of Bulgaria and Cyprus, amendment in the national regulation allowing the use of EN 1998 (all Parts) was done in 2012 where as for Croatia and Lithuania in 2013.

4.5 Obligatory use of EN 1998 Parts

Voluntary application of standards is one of the founding principles of the European standardisation system. It is important to note that the use of standards is voluntary, and so there is no legal obligation to apply them. However, the National legislative provisions may refer to standards, thus making compulsory the compliance with such standards. Figure 7(a) shows the Eurocodes Parts that are obligatory for use in each country as percentage of all Parts. Approximately half of the analysed countries declared that none of the Eurocodes Parts is obligatory. However, when considering this data, it should be noted that:

i. Though being non-compulsory, the Eurocodes are in practice the only mean for structural design in Austria, Croatia, Estonia, Finland, Hungary, Norway, Poland, Slovakia, and the United Kingdom.

ii. The rate of publication of National Annexes in Malta and Spain is in a stage when no design with the Eurocodes can be performed.

Figure 7. (a) Rate of obligatory Eurocodes Parts as percentage of all Parts; (a) Rate of obligatory EN 1998 Parts as percentage of its Parts

Figure 7(b) presents the situation in particular for Eurocode 8 Parts. It is noted that all EN 1998 Parts are obligatory for use in Bulgaria, Cyprus and the Czech Republic, similar to the status for all Eurocode Parts. In Slovenia, all EN 1998 Parts are obligatory to use, similarly to the situation for EN 1990, EN 1991 and EN 1992 where as the other Eurocodes are not obligatory. In France, EN 1998 Parts 1, 3 and 5 are obligatory and the situation in Portugal is the same with the addition of Part 2. The results above show clearly two main approaches in the national implementation of the Eurocodes: (i) either as voluntary National Standards or (ii) via a Regulatory Framework, which encompasses different amount of Parts in the different countries. Additionally, for the case of EN 1998, the aspect of the country seismicity also affects the obligatory use of the respective Parts as some southern countries (Bulgaria, Cyprus, France and Slovenia) have rendered the use of Eurocode 8 obligatory.
4.6 Restrictions to the use of EN 1998 Parts

The replies to the question on the existing restrictions to the use of all Eurocode Parts (e.g. additional requirements, calculations, certificates, etc.), are summarized in Figure 8(a). As seen from Figure 8(a), more than 80% of the countries noted that there are no restrictions to the use of the Eurocodes. Countries that report restrictions for all published Eurocode Parts are Austria and Italy, while Romania, Germany and Ireland reported restrictions for 27%, 17% and 10%, respectively of all Parts. Contrary, for the case of EN 1998 Parts shown in Figure 8(b), there no restrictions in Germany and Ireland. In Romania, there are restrictions for the use of Parts 1 and 3. For the case of Austria and Italy, the situation on the restrictions on EN 1998 Parts is the same as the overall situation.

Formulation of Public Procurement technical specifications by reference of National Standards transposing EN standards, improves functioning of the EU Internal Market. Figure 9(a) represents the rate of the Eurocodes Parts under a Regulatory Framework enforcing their use in Public Procurement.

![Figure 8. (a) Rate of restricted Eurocodes Parts as percentage of all Parts; (b) Rate of restricted EN 1998 Parts as percentage of its Parts](image)

![Figure 9. Rate of (a) all Eurocodes Parts or (b) EN 1998 Parts under a Regulatory Framework enforcing their use in Public Procurement](image)

The results show that in 40% of the analysed countries there is such Framework. All Eurocodes Parts are encompassed in a Regulatory Framework in eight countries: Austria, Bulgaria, Cyprus, the Czech Republic, Ireland, Lithuania, Poland, and Slovenia. In the Netherlands and Denmark, the Regulations,
which made the Eurocodes Parts obligatory, enforced also their use in Public Procurement: 52 Parts in the Netherlands and 41 Parts in Denmark. In addition, five countries consider the Eurocodes as well-placed in the Public Procurement without having a particular Regulatory Framework, namely Belgium, Croatia, Finland, Greece and Norway. Taking the above comments into account, it can be concluded that 60% of the analysed countries reported a good place of the Eurocodes in their Public Procurement.

Some differences were observed in the situation in particular for EN1998 as presented in Figure 9(b). Denmark, Netherlands and Sweden report that no EN 1998 Part is under a Regulatory Framework enforcing their use in Public Procurement. However, it is reminded that these countries have not published National Annexes on the EN 1998 Parts. For the case of the southern European countries where there is necessity for seismic design, it is in Bulgaria, Cyprus and Portugal that there is a Regulatory Framework enforcing the use of Eurocode Parts in Public Procurement.

6. HARMONISATION AND FURTHER DEVELOPMENT OF THE EUROCODES

The JRC has developed and is maintaining a Database with the values of the Nationally Determined Parameters (NDPs) adopted in the EU and EFTA countries that are applying the EN Eurocodes. The NDPs Database has restricted access, acts as a platform of notification by the MS to the European Commission on the adopted values of the NDPs and constitutes the basis for the analysis of the NDPs, contributing to the definition of strategies supporting further harmonisation of the Eurocodes.

In all Eurocodes Parts, there are 1,507 Nationally Determined Parameters (NDPs). Within all its six Parts, Eurocode 8 contains 142 NDPs. In a number of cases, an NDP cannot be represented by a single numerical value and takes the form of tables, graphs, acceptance of the recommended procedure, choice of calculation approach among given alternatives, introduction of a new procedure, etc. Further details on the NDPs database and an analysis on the Eurocode 8 NDPs parameters adopted by the EU countries is available by Sousa et. al (2014).

By November 2017, 66.5% of all NDPs (with and without recommended value) were uploaded in the database; for EN 1998, 67% of NDPs were available in the database. Figure 10 presents the results of the preliminary analysis on the uploaded NDPs with recommended value per Eurocode. It is noted that the presented analysis should be considered as preliminary, since the available data for post processing represents approximately 61% out of all expected NDPs that have recommended values, and cannot be considered as final.

![Figure 10. Acceptance (in %) of the NDPs recommended value for each Eurocode (November 2017)](image)

It was found that the mean acceptance rate of the recommended values for all NDPs (thus in all Eurocode Parts) is 74.3%, meaning that in almost three out of four cases the recommended values were accepted. The Eurocodes with higher than the mean percentage of acceptance of the
recommended values are EN 1993 with 83.5% of acceptance, EN 1994 with 81.0%, EN 1992 with 77.8% and EN 1999 with 77.6%. These results indicate that one can expect good harmonisation in the national adoption of the most widely-used “material Eurocodes” EN 1992 and EN 1993. The Eurocode with the lowest percentage of acceptance of the recommended values is EN 1997 with 50.2% of acceptance, followed by EN 1990 with 51.1% of acceptance;

For the case of EN 1998, the acceptance rate of recommended values is slightly lower than the average when considering all Eurocode Parts and equal to 72.9%. Thus, in almost three out of four cases the recommended values were accepted for Eurocode 8. The divergence of the accepted NDPs for EN 1998 is caused mainly due to differences in the local seismic conditions but also by different approaches and technical considerations existing in the countries. Thus, the current state of acceptance for EN 1998 NDPS reveals that there is room for further harmonisation of the national implementation of Eurocode 8 and reduction of the number of NDPs.

7. CONCLUSIONS

As stated in the JRC Report by Dimova et al. (2015), the Eurocodes are already accepted as National Standards in Europe. All EU Member States and Norway published all Eurocode Parts as National Standards, with the exception of Germany, Luxembourg and Spain. In three out of four countries, more than 70% of the published Eurocodes Parts are available in the National Language or in one of the official National Languages. Further, by 2015, the publication of National Annexes was in good progress and supporting the enforcement of using the Eurocodes as 90% of the considered in the analysis countries published National Annexes to more than 70% of all Eurocodes Parts.

No National Standards are used in parallel with the Eurocodes Parts in 80% of the countries included in the analysis. However, the CEN requirement for withdrawal of conflicting standards is not enough to ensure the enforcement of the use of the Eurocodes in countries where the National Regulations introduce directly design rules. There is need of a Commission Recommendation on the regulatory environment for use of the Eurocodes; this observation can be taken also in consideration with the expected publication of the second generation of the Eurocodes in 2020 (Dimova et al., 2015).

The results of the analysis presented in this paper, have shown that the implementation status of Eurocode 8 in the EU is in good accordance with the situation when considering all Eurocode Parts. Overall, the implementation of Eurocode 8 is mainly affected by two facts: (i) the existing approach in the national implementation of the Eurocodes either as a voluntary National Standards or via a Regulatory Framework; (ii) the seismicity of the country that affects the publication of the National Annexes on Eurocode 8 and its obligatory use. In particular, it was found that:

- All EU Member States and Norway published all six Parts of EN 1998, except for Spain that had not publish EN 1998 Parts 4 and 6 by 2015.
- In 60% of countries considered in the analysis, more than 75% of the published EN 1998 Parts are available in one of the official national languages supporting that there are no language-related barriers to the implementation of Eurocode 8. The translation of EN 1998 Parts is mainly low in the northern European countries where the translation of these Parts is not a priority due to the low seismicity.
- The publication rate of National Annexes on EN 1998 is lower than the overall for all Eurocode Parts. A National Annex on EN 1998 Part 1 has been published in the majority of the countries (19 of the considered countries). In the southern European countries, the publication of National Annexes to EN 1998 was progressing well at the time of the survey (2014-2015) with the exception of Malta, Portugal and Spain.
- No amendment in the National Regulation for using EN 1998 Parts was needed by 65% of the countries.
- All EN 1998 Parts are obligatory for use in Bulgaria, Cyprus, Slovenia and the Czech Republic. Three EN 1998 Parts are obligatory in France (Parts 1, 3 and 5) and four Parts in Portugal (Parts 1, 2, 3 and 5). Restrictions for the use of EN 1998 exist in Romania, Austria and Italy.

The preliminary results on the acceptance of the recommended values of the NDPs show that in almost three out of four cases the recommended values were accepted for the EN 1998 Parts. Despite existing differences in the local seismic conditions, the approaches and technical considerations in the countries, it was found that the acceptance rate for EN 1998 NDPs is high and almost equal to the
average acceptance rate when considering all NDPs. However, there is room for further harmonisation of the national implementation of Eurocode 8 and reduction of the number of NDPs, as regards the approaches and technical considerations.

8. ACKNOWLEDGMENTS

The contribution of the representatives of the National Authorities and National Standardisation Bodies of all EU Member States, Norway and Turkey, who provided information on the implementation of the Eurocodes is gratefully acknowledged.

9. REFERENCES

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M/515 EN, 2012 “Mandate for Amending Existing Eurocodes and Extending the Scope of Structural Eurocodes”
DG Enterprise and Industry, European Commission, Brussels, 12 December 2012

APPENDIX A – ENQUIRY ON THE EUROCODES IMPLEMENTATION STATE

Table 1. List of questions included in the enquiry on the Eurocodes

<table>
<thead>
<tr>
<th>Part 1 (questions addressed to National Authorities)</th>
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<tbody>
<tr>
<td>1. This EN Part was or will be implemented in your country? (Yes/No)</td>
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<tr>
<td>2. Amendment of relevant national regulations to allow the use of the Eurocodes: Was it/is it necessary for the implementation of the EN part? (Yes/No). If yes, date (or envisaged date) of such amendment?</td>
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<td>3. Is the use of the Eurocodes obligatory in your country?</td>
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<td>4. Is the use of this EN Part obligatory in your country? (Yes/No) If yes, please provide title/reference of/to the regulation/</td>
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<tr>
<td>5. Is the use of the Eurocodes restricted (e.g. additional requirements, calculations, certificates, etc.)?</td>
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<td>6. Is the use of this EN Part restricted? (Yes/No) If yes, which restrictions apply?</td>
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<td>7. Is there a Regulatory Framework in your country enforcing the use of the Eurocodes in Public Procurement?</td>
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<tr>
<td>8. Framework for use of this EN Part in Public Procurement (Yes/No). If yes, please provide title/reference of/to the regulation</td>
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<td>9. Comments (experience, problems encountered, solutions found)</td>
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<th>Part 2 (questions addressed to National Standardisation Bodies)</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1. This EN Part was or will be implemented in your country? (Yes/No)</td>
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<td>2. Date of publication of the EN Part as National Standard</td>
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<td>3. The EN Part was completely translated in National language? (Yes/No)</td>
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<td>4. National Annexes: (i) Date of publication; (ii) Available in English? (Yes/No)</td>
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<tr>
<td>5. Is the use of the Eurocodes restricted (e.g. additional requirements, calculations, certificates, etc.)? i. Is the use of this EN Part restricted? (Yes/No). ii. If yes, which restrictions apply?</td>
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<tr>
<td>6. Are there National Standards on structural design used in parallel with the Eurocodes? i. National Standards used in parallel with this EN part? (Yes/No). ii. If yes, please provide reference. iii. If yes, what is their correspondence to this EN part?</td>
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<td>7. Comments (experience, problems encountered, solutions found)</td>
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