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(De)construct for Circular Economy
(Des)construir para a Economia Circular

WP 1 – Baseline situation analysis and follow-up

Activity 1.5 – Estimate of CDW illegal dumping

Final report

1st Period

26th March 2021

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Promotor:



Parceiros:



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1. Introduction

The main objective of the **(De)construct for Circular Economy [in Portuguese: (Des)construir para a Economia Circular]** project is to promote a regional strategy for the reuse of building products and components as well as the recycling of construction and demolition waste (CDW), thus reducing the environmental impact of the construction sector and promoting its circularity.

This report aims to assess the CDW illegal dumping in *Baixo Alentejo* region, in Portugal (but also in *Timisoara* municipality, in Romania). This is an important challenge to Portuguese municipalities since they must deal with this reality in their territories, in terms of environmental and landscaping impacts, but also due to the knowledge gap about the costs that they have or may have in order to support the CDW illegal dumping removal, namely with their own human resources and equipment. This is particularly relevant when the waste management facilities are scarce or the transport costs are not competitive or affordable because of the distances involved (FCT NOVA & 3Drivers, 2020; Ramos & Martinho, 2017; Deloitte *et al.*, 2015; Martinho *et al.*, 2013), as it is the case of *Baixo Alentejo* region.

Taking this in consideration, Work Package (WP) 1 – Baseline situation analysis and follow-up – led by IP Portalegre, includes two specific activities related to the CDW illegal dumping monitoring in *Baixo Alentejo* region, being FCT NOVA (Nova School of Science and Technology from NOVA University) in charge of its implementation, namely in what regards the development of a specific methodology for CDW illegal dumping estimation (activity 1.4; concluded) and CDW illegal dumping assessment, to be performed during the project (activity 1.5). This report aims to address the results obtained in activity 1.5 first monitoring period, according to the mentioned methodological report, and due to that the report is structured in the following chapters:

- Introduction (current chapter);
- Main considerations (chapter 2);
- Results (chapter 3);
- Conclusions (chapter 4);
- References.

Although it was planned to implement the CDW illegal dumping monitoring only in *Baixo Alentejo* region (Portugal), partner CNPCD (Romania) proposed to join this activity, monitoring CDW illegal dumping in *Timisoara* municipality. In this case, a cooperatively analysis will be made in this report, although differentiating the results from *Baixo Alentejo* region from the results regarding *Timisoara* municipality.

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2. Main considerations

This chapter presents the main considerations for CDW illegal dumping assessment in the municipalities of *Baixo Alentejo* region, in Portugal, as well as in *Timisoara* municipality, in Romania, bearing in mind the following topics:

- Methodological report (regarding activity A1.4, concluded);
- First monitoring period (March 2021);
- Main monitoring criteria;
- Complementary data.

2.1. Methodological report

Within WP 1 (baseline situation analysis and follow-up), specifically regarding activity 1.4, FCT NOVA delivered a CDW illegal dumping estimate methodology report (FCT NOVA, 2021a), with the main objective of presenting the methodological approach to be followed during the CDW illegal dumping assessment (activity 1.5). This report was structured on the enumerated main chapters, each one of them establishing the following:

- Monitoring work criteria: specifying details about the territory to be evaluated, the monitoring periodicity, and information about data collection and complementary data necessary to calculate the performance and the monitoring indicators along the activity;
- Monitoring related data: detailing information about how to evaluate the municipal costs with CDW removal from dumpsites, as well as determining the performance and monitoring indicators to be assessed;
- Municipalities involvement and responsibilities: defining the way that municipalities will be involved with FCT NOVA (*Baixo Alentejo* region) and CNPCD (Romania) along the monitoring work;
- Schedule and deliverables: establishing three periods for the reporting data (March and September 2021, and April 2022; the current report refers to the first mentioned period).

2.2. First monitoring period

This report refers to the first monitoring period about CDW illegal dumping assessment in the *Baixo Alentejo* region, in Portugal (March 2021), as well as in *Timisoara* municipality, in Romania (February and March 2021).

In this first period, it was established together with *Baixo Alentejo* municipalities, in Portugal, that the focus will be in testing the methodological approach proposed by FCT NOVA. This is due because it is the first period for each municipality to perform this type of monitoring work, but also because of the covid-19 situation, where it was not possible to FCT NOVA to join the operational representatives of the (De)construct project in each municipality, helping them, in a face-to-face approach, to overcome the difficulties regarding the tasks implementation and harmonizing the criteria among all the municipalities. Nevertheless, detailed instructions about the monitoring work were given to municipalities in specific meetings with the *Baixo Alentejo* municipalities (held between 22-24th February, 2021), with two/three municipalities at each time. These

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meetings were conducted with 12 *Baixo Alentejo* municipalities (it was not possible to Beja municipality to attend).

In *Timisoara*, Romania, three meetings took place in order to discuss the CDW illegal dumping aspects:

- Meeting on 13th February 2021, with Public Administration Sanitation Office, to present the project, the CDW illegal dumping monitoring criteria and also to ask for their support; during the meeting were discussed aspects related to the management of the CDW illegal dumping, responsibilities of the Office, CDW dumpsite's locations, and data related to CDW illegally dumped, in 2020;
- Meeting on 15th February 2021, with CDW subcontractor Transclean, responsible for collecting the CDW illegally dumped; the discussion referred to their procedures, how CDW is collected, quantities and costs; this subcontractor joined the staff during the visit to the CDW illegal dumpsites;
- Meeting on 1st February 2021, with the sanitation company Retim, responsible for the management of the CDW collection centers and for the cleaning up of the illegal CDW dumpsites.

2.3. Monitoring criteria

In what regards the **CDW dumpsites identification and evaluation**, the following instructions were established by FCT NOVA and communicated and discussed with the municipalities involved:

- Identification and registration of all the known CDW dumpsites, although in this first monitoring period it was established to perform the monitoring work only for the principal CDW dumpsites known in the municipalities (*i.e.*, in terms of CDW quantities and/or recurrence for CDW illegal dumping).

After sending, for the first time, the data to FCT NOVA, a first feedback was given to each *Baixo Alentejo* municipal project representative, asking for extra information, sometimes correcting some data filled (*e.g.*, cross analysis of pictures and estimated CDW quantities, use of the European List of Waste (ELW)¹ codes, use of materials density, dumpsites and pictures codification, among others) and trying as well to harmonize criteria among all the municipalities involved.
- If a site is constituted by more than one CDW dumpsite (*e.g.*, part of a street with three dumpsites next to each other), it must be registered as one dumpsite;
- If a dumpsite has more than one type of CDW, each type must be identified (using the ELW codes) and quantified independently;
- Each CDW dumpsite must have at least one photograph associated in each monitoring period, representing the reality of the dumpsite, for future analysis.

In relation to the monitoring work **periodicity**, the methodological report established the following main criteria:

- Each dumpsite must be visited on a monthly basis, from March 2021 until, at least, April 2022;

¹ *European List of Waste (ELW): Commission Decision 2014/955/EU, of 18 December, amending Decision 2000/532/EC on the list of waste, pursuant to Directive 2008/98/EC of the European Parliament and of the Council.*

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- Each municipality must register, on a monthly basis, the amount of CDW illegally disposed in their territory, specifying the sites where it happens;
- Even if the CDW illegal dumping has been removed, the site must be visited in the next monitoring periods;
- New sites must be registered and must be visited in a monthly basis after the first registration.

Regarding **data reporting**, a *Microsoft Excel* format file was created, trying to address the methodological approach established in the report mentioned in the subchapter 2.1, specifically in its Annex II (FCT NOVA, 2021a), namely:

- Site identification and complementary information (*i.e.*, spatial coordinates, parish name, street name, type of site ownership, and notes);
- Date of the visit;
- Types of CDW (according to the ELW or, if not possible, with an exact description);
- CDW quantification (if estimated, indicating the volume and transforming it in weight, through the density of materials selected; if real, directly registering the data in weight reported by the waste management operator).

The CDW illegal dumping must be estimated, in a monthly basis, in volume (m³), using, for reference, 1 m³ big-bag, or a 6 or 8 m³ trapezoidal metallic container for CDW collection and storage; the registers must be carried out, discriminating the quantities by ELW code or by type of CDW (description);

Also, to convert the estimated quantities (in volume) into weight (ton), the density of the different types of CDW should be used, per ELW code, as demonstrated in the indicative list presented in the methodological report (FCT NOVA, 2021a).

- CDW removal actions from dumpsites (indicating if “yes” or “no” and, if “yes”, indicating the action date, the final destination for CDW – *e.g.*, waste management operator, quarry –, and the respective cost);
- Photographs and photographs ID registration (creating a picture code for each CDW dumpsite and corresponding visit date);
- Notes (if necessary, adding extra information about the dumpsites and/or the monitoring work).

2.4. Complementary data

For a more complete CDW illegal dumping assessment it will be important to collect complementary data, although this information will be more relevant regarding the reporting periods of September 2021 and April 2022, after CDW illegal dumping monitoring work has been established, with some months ahead, so it can be possible to calculate other monitoring indicators. This complementary data will be collected in other WP 1 tasks or, if it is not possible to obtain it in time, during the implementation of the activity 1.5 itself, including:

- Data about CDW illegal dumping in the last years, to attempt to evaluate the baseline situation before the implementation of the project and the activity 1.5 itself;

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- Data about CDW generation and treatment (in general), to attempt to assess the effect of implementing the project on the CDW management, and specifically of the participatory actions dedicated to *Baixo Alentejo* municipalities and small construction companies (within WP 7 – Information, awareness and training; see FCT NOVA, 2021b), evaluating the effect and evolution of the CDW illegal dumping in the region;
- CDW management costs, to attempt to measure and raise awareness about the effects of CDW management costs *versus* the costs resulting from the removal of CDW illegal dumping with the municipality own resources (*i.e.*, human resources and equipment);
- CDW information and awareness campaigns, to attempt to assess the effect of information and awareness campaigns, especially regarding the CDW management by small construction companies;
- Construction sector dynamic, to attempt to calculate specific performance and monitoring indicators.

Some municipalities already started to collect this type of data, for instance regarding the unitary reference costs or the construction sector dynamics, but not in a consist way in terms of the performance indicators evaluation. This evaluation will be made in the second and third reporting periods (September 2021 and April 2022, respectively).

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3. Results

In this chapter the results of the CDW illegal dumping assessment in *Baixo Alentejo* municipalities (Portugal), as well as in *Timisoara* municipality (Romania) will be presented in three subchapters: i) implementation of the monitoring work (subchapter 3.1); ii) monitored CDW dumpsites (subchapter 3.2); and iii) CDW estimated and its physical composition (subchapter 3.3).

3.1. Implementation of the monitoring work

Before the beginning of the CDW illegal dumping monitoring work, specific meetings were held with the municipalities of *Baixo Alentejo* region, in Portugal, to present the monitoring criteria for the activity 1.5, and to clarify the remaining doubts of the representatives in the municipalities for the (De)construct project.

After that, and during the monitoring work itself (first half of March, 2021), some constraints did not allow all *Baixo Alentejo* municipalities to perform the monitoring work in the same way. So, in some few cases, it was not possible to estimate, in this first monitoring period, the CDW present in the dumpsites (by ELW code), but only to identify the dumpsites themselves and the type of site. This missing data will be collected soon, and the results will be presented in the next reporting period. An information summary about the first monitoring period is presented in Table 1.

Taking into account the monitoring work developed by *Baixo Alentejo* municipalities (Portugal), the following situations have to be considered:

- It was not possible to *Beja* municipality to attend the first meeting. This meeting aimed at explaining the monitoring work and to clarify some doubts, although further contacts were established by CIMBAL and FCT NOVA with the municipal representative for the project in order to explain the work to be performed by the municipality in this first monitoring period; nevertheless, until now it was not possible to obtain any data;
- All the remaining municipalities performed the identification of the CDW dumpsites, as well as the identification of the type of site (ownership) where the dumpsites are located;
- The majority of the municipalities (except *Alvito*, *Barrancos* and *Cuba* municipalities) performed the estimation of the CDW in the dumpsites: *Alvito* municipality identified a dumpsite where it is frequent to see CDW illegally dumped, but at the moment the dumpsite was clean; *Barrancos* and *Cuba* municipalities, although identified the dumpsites, did not perform the CDW estimation;
- *Mértola* and *Ferreira do Alentejo* municipalities declared considerable amounts of CDW in specific dumpsites; these situations have been discussed with the municipal representatives and seems to be correct; nevertheless, a closer work will be performed in the next months, to clarify some doubts, namely with *Mértola* municipality, due to the fact that at the moment the larger dumpsite is covered with grass;
- *Ferreira do Alentejo* municipality had some problems identifying the CDW types in a few sites (private ownership, with fence), so it will be tried again later;
- *Vidigueira* municipality identified more dumpsites (13) then the places where the CDW estimation have been done (3); this monitoring work will be completed soon;

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- *Moura* municipality executed the estimation directly into weigh, but have received FCT NOVA instruction to perform it into volume, so the criteria are the same for all the municipalities.

In *Timisoara* municipality (Romania), a meeting was held on the 13th February 2021 with the Sanitation Office municipal representatives and CNPCD employees, to present the project, the monitoring criteria for the activity 1.5 and to discuss the issue related to CDW illegal dumping. The CDW dumpsites have been identified previously the visits. It has been decided to perform the first visits to the sites together with the CDW subcontractor Transclean, so the representative of Transclean joined the staff during the first visit, which took place on the 15th of February.

Table 1. Information about the first monitoring period.

Country, Region	Municipality	Attendance at the initial meeting about Activity A1.5	CDW dumpsites data		CDW estimate, by ELW code
			Identification	Type of site ownership	
Portugal, <i>Baixo Alentejo</i>	<i>Aljustrel</i>	●	●	●	●
	<i>Almodôvar</i>	●	●	●	●
	<i>Alvito</i>	●	●	●	*
	<i>Barrancos</i>	●	●	●	-
	<i>Beja</i>	-	*	*	*
	<i>Castro Verde</i>	●	●	●	●
	<i>Cuba</i>	●	●	●	-
	<i>Ferreira do Alentejo</i>	●	●	●	●
	<i>Mértola</i>	●	●	●	●
	<i>Moura</i>	●	●	●	●
	<i>Ourique</i>	●	●	●	●
	<i>Serpa</i>	●	●	●	●
<i>Vidigueira</i>	●	●	●	●	
Romania, <i>Banat</i>	<i>Timisoara</i>	●	●	●	●

Legend: ● (performed); - (not performed or in need of adjustments); * (waiting for data)

In all the identified cases, individualized instructions were given to the municipal representatives for the project, to allow the CDW correct estimation in April, the next monitoring period. Moreover, all the municipalities will receive general instruction (though *e-mail*) and individualized instructions (though notes in the corresponding *Excel* file and through phone calls, when necessary), so the monitoring work can be harmonized in the *Baixo Alentejo* region. The individualized instructions are mainly related, for example, to CDW estimation (*i.e.*, comparing the photographs with the data collected in the *Excel* file) or CDW physical composition in each dumpsite (*i.e.*, sometimes it is difficult to estimate because there is grass covering the CDW, or because the dumpsite it is composed by different CDW types).

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Regarding *Timisoara* municipality (Romania), instructions were given to the municipal representatives and CNPCD assistant manager to allow the CDW correct estimation. General instructions were given face-to-face so the monitoring work can be harmonized in *Timisoara* region. The instructions were related to CDW estimation: physical composition in each CDW dumpsite, type of waste, density, level of danger, among others.

Taking these considerations into account, this first monitoring period was very important for the validation of the methodological approach, but it must be considered that the results may need to be completed or readjusted in the second month of the monitoring work (April), as well as in the following months.

It should be also noted that it is not possible to differentiate whether the CDW dumpsites that occur in a given territory come from that same territory or from neighbouring areas. Likewise, a given territory can contribute to CDW dumpsites in its adjacent areas. These statements are valid both for the monitoring work about dumpsites identification (subchapter 3.2), and for the CDW estimated in each one of them (subchapter 3.3).

In a complementary way, Annex I present photographs of the monitoring work, bearing in mind that is not the objective to represent the reality of each municipality, but to characterize different realities of the CDW dumpsites.

3.2. Monitored construction and demolition waste dumpsites

Table 2 shows the number of CDW dumpsites monitored by each municipality. In absolute terms, *Ferreira do Alentejo* municipality identified more CDW dumpsites (22) and *Alvito* municipality identified less (1). But if the analysis takes into account an indicator by municipal area (*per 100 Km²*), then *Cuba*, *Vidigueira* and *Ferreira do Alentejo* municipalities covered their territory in a more homogeneous way, and *Mértola*, *Alvito* and *Serpa* municipalities present a less consistent approach. For the *Baixo Alentejo* region (Portugal), 109 dumpsites were registered in this first monitoring period, corresponding to 1,3 dumpsites *per 100 km²*.

In respect to *Timisoara* municipality (Romania), Table 2 shows the number of CDW dumpsites monitored. The activity started in February, when 10 illegal CDW dumpsites were visited, corresponding to an area of 130 km². The second visit was performed on the 19th of March, in the presence of a legal representative of the Sanitation Office and the data was refined. All the data reported is according with the status recorded in March.

Table 2. Monitored construction and demolition waste dumpsites.

Country, Region	Municipality	Area (km ²)	CDW dumpsites	
			nº	Indicator (nº/100 km ²)
Portugal, Baixo Alentejo	<i>Mértola</i>	1 293	4	0,3
	<i>Beja</i>	1 146	-	-
	<i>Serpa</i>	1 106	4	0,4
	<i>Moura</i>	958	12	1,3
	<i>Almodôvar</i>	778	6	0,8
	<i>Ourique</i>	663	16	2,4

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Country, Region	Municipality	Area (km ²)	CDW dumpsites	
			n ^o	Indicator (n ^o /100 km ²)
Portugal, <i>Baixo Alentejo</i>	<i>Ferreira do Alentejo</i>	648	22	3,4
	<i>Castro Verde</i>	569	4	0,7
	<i>Aljustrel</i>	458	12	2,6
	<i>Vidigueira</i>	317	13	4,1
	<i>Alvito</i>	265	1	0,4
	<i>Cuba</i>	172	12	7,0
	<i>Barrancos</i>	168	3	1,8
	<i>Baixo Alentejo</i>	8 543	109	1,3
Romania, <i>Banat</i>	<i>Timisoara</i>	130	10	7,7

Source (*Baixo Alentejo* municipalities areas): INE (*Instituto Nacional de Estatística – Statistics Portugal*, 2019)

Other import analysis refers to the site ownership type where the CDW dumpsites occurs: public or private. The distribution in each municipality (in number and in percentage) is presented in Table 3, showing that the majority of the CDW dumpsites occurs in public sites, with exceptions for *Almodôvar*, *Ferreira do Alentejo*, *Mértola* and *Castro Verde* municipalities. For the *Baixo Alentejo* region (Portugal), the tendency remains true, with 67% of the CDW dumpsites occurring in public sites.

For *Timisoara* (Romania), eight of the monitored CDW dumpsites are public and just two of them are private properties.

Table 3. Type of site ownership where the construction and demolition waste dumpsites occur.

Country, Region	Municipality	CDW dumpsites, by type of site ownership					
		n ^o			%		
		Public	Private	Total	Public	Private	Total
Portugal, <i>Baixo Alentejo</i>	<i>Aljustrel</i>	12		12	100	0	100
	<i>Almodôvar</i>	2	4	6	33	67	100
	<i>Alvito</i>	1		1	100	0	100
	<i>Barrancos</i>	3		3	100	0	100
	<i>Beja</i>	-	-	-	-	-	-
	<i>Castro Verde</i>	2	2	4	50	50	100
	<i>Cuba</i>	11	1	12	92	8	100
	<i>Ferreira do Alentejo</i>	6	16	22	27	73	100
	<i>Mértola</i>	1	3	4	25	75	100
	<i>Moura</i>	10	2	12	83	17	100

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Country, Region	Municipality	CDW dumpsites, by type of site ownership					
		nº			%		
		Public	Private	Total	Public	Private	Total
	<i>Ourique</i>	10	6	16	63	38	100
	<i>Serpa</i>	3	1	4	75	25	100
	<i>Vidigueira</i>	12	1	13	92	8	100
	Total	73	36	109	67	33	100
Romania, <i>Banat</i>	<i>Timisoara</i>	8	2	10	80	20	100

3.3. CDW estimated and its physical composition

Considering the CDW estimated by the municipalities, it is important to define some criteria used in data treatment to justify the presentation of the results, namely:

- It was only considered the CDW classified in the chapter 17 of the ELW (CDW); nevertheless, other CDW (*i.e.*, waste resulting from the construction sector) is being registered, as for example packaging containing residues of or contaminated by hazardous substances, like paint cans (ELW 15 01 10*), although in small quantities;
- Soils and stones (ELW 17 05 04) are not considered CDW, according to the waste regulatory framework, because the main purpose is to reuse it, but it will be included in the analysis because it is often a problem for municipalities regarding the soils resulting from excavation construction works.

In this context, each municipality tried to develop, in the first half of March 2021, a monitoring work according to the established criteria. The results are presented, for each municipality, in Table 4. The quantities were estimated in volume and then transformed into weight through the materials density (see the methodological report for more details; FCT NOVA, 2021a). The results are presented by ELW codes and the values registered in precision of units because it is an estimation.

Annex I present photographs of the monitoring work executed by the municipalities, bearing in mind that is not an objective to represent the reality of each municipality, but to characterize different realities of the CDW dumpsites.

Table 4. Construction and demolition waste estimated, by municipality.

Municipality	EWL code		CDW estimated	
			Volume (m ³)	Weight (ton)
<i>Aljustrel</i>	17 01 07	Mixtures of concrete, bricks, tiles and ceramics	39	69
	17 09 04	Mixed CDW	3	5
	17 01 03	Tiles and ceramics	1	1

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Municipality	EWL code		CDW estimated	
			Volume (m ³)	Weight (ton)
	17 02 03	Plastic	< 0,5	< 0,5
	17 08 02	Gypsum-based construction materials	< 0,5	< 0,5
	17 02 01	Wood	< 0,5	< 0,5
	Total		43	75
<i>Almodôvar</i>	17 01 07	Mixtures of concrete, bricks, tiles and ceramics	15	27
	17 03 02	Bituminous mixtures	4	10
	17 01 03	Tiles and ceramics	2	3
	Total		21	40
<i>Castro Verde</i>	17 05 04	<i>Soils and stones</i>	12	23
	17 09 04	Mixed CDW	11	17
	17 01 03	Tiles and ceramics	9	12
	17 01 07	Mixtures of concrete, bricks, tiles and ceramics	4	7
	17 03 02	Bituminous mixtures	2	4
	17 06 05*	CDW containing asbestos	1	1
Total		38	63	
<i>Ferreira do Alentejo</i>	17 01 07	Mixtures of concrete, bricks, tiles and ceramics	338	608
	17 03 02	Bituminous mixtures	258	644
	17 05 04	<i>Soils and stones</i>	135	270
	17 01 01	Concrete	75	150
	N.D.		23	N.D.
	Total		829	1 672
<i>Mértola</i>	17 01 07	Mixtures of concrete, bricks, tiles and ceramics	6 444	11 600
	Total		6 444	11 600
<i>Moura</i>	17 01 07	Mixtures of concrete, bricks, tiles and ceramics	N.D.	74
	17 02 01	Wood	N.D.	10
	17 05 04	<i>Soils and stones</i>	N.D.	9
	17 01 03	Tiles and ceramics	N.D.	2
	17 09 04	Mixed CDW	N.D.	1
	17 01 01	Concrete	N.D.	1
	Total		N.D.	97
<i>Ourique</i>	17 09 04	Mixed CDW	33	52
	17 01 07	Mixtures of concrete, bricks, tiles and ceramics	9	16
	17 01 01	Concrete	3	6
	Total		45	74

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Municipality	EWL code		CDW estimated	
			Volume (m ³)	Weight (ton)
Serpa	17 01 07	Mixtures of concrete, bricks, tiles and ceramics	14	25
	17 09 04	Mixed CDW	9	14
	Total		23	39
Vidigueira	17 09 04	Mixed CDW	6	9
	17 01 02	Bricks	6	8
	17 03 02	Bituminous mixtures	2	5
	17 01 07	Mixtures of concrete, bricks, tiles and ceramics	1	1
	Total		15	23
Portugal (Baixo Alentejo region municipalities)			7 458	13 683

Timisoara	17 01 01	Concrete	100	200
	17 01 07	Mixtures of concrete, bricks, tiles and ceramics	6 620	12 096
	17 02 03	Plastic	< 0,5	< 0,5
Romania (Timisoara municipality)			6 720	12 296

N.D. – no data

For *Baixo Alentejo* region, in Portugal, the results showed that the mixtures of concrete, bricks, tiles and ceramics (ELW 17 01 07) are the more relevant CDW type for most of the municipalities (*Aljustrel, Almodôvar, Ferreira do Alentejo, Mértola* and *Moura* municipalities). It also appears CDW mixtures – ELW 19 04 (*Ourique* and *Vidigueira* municipalities) –, and soils and stones – ELW 17 05 04 (*Castro Verde* municipality). The tendency is shown in Table 5 for the whole *Baixo Alentejo* region (Portugal), representing ELW 17 01 07 around 90% of the total.

For *Timisoara* municipality, in Romania, the results show that mixtures of concrete, bricks, tiles and ceramics (ELW 17 01 07) are the prevalent CDW type (97%), followed by 3% of concrete (ELW 17 01 01) (see Table 4).

Table 5. Construction and demolition waste estimated at *Baixo Alentejo* region.

EWL code		CDW estimated			
		Volume		Weight	
		m ³	%	ton	%
17 01 07	Mixtures of concrete, bricks, tiles and ceramics	6 864	92	12 429	91
17 03 02	Bituminous mixtures	265	4	663	5
17 05 04	Soil and stones	147	2	302	2
17 01 01	Concrete	78	< 0,5	157	1
17 09 04	Mixed CDW	62	< 0,5	96	< 0,5
17 01 03	Tiles and ceramics	12	< 0,5	18	< 0,5

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EWL code		CDW estimated			
		Volume		Weight	
		m ³	%	ton	%
17 02 01	Wood	< 0,5	< 0,5	10	< 0,5
17 01 02	Bricks	6	< 0,5	7	< 0,5
17 06 05*	CDW containing asbestos	< 0,5	< 0,5	< 0,5	< 0,5
17 08 02	Gypsum-based construction materials	< 0,5	< 0,5	< 0,5	< 0,5
17 02 03	Plastic	< 0,5	< 0,5	< 0,5	< 0,5
N.D.	(Ferreira do Alentejo municipality, ongoing)	23	< 0,5	-	-
Portugal (Baixo Alentejo region municipalities)		7 458	100	13 683	100

N.D. – no data

For the calculation of a performance indicator for Baixo Alentejo region (Portugal), CDW was estimated by ELW subchapter and considering the territory total area. In this context, CDW illegally dumped from the ELW subchapter 17 01 (concrete, bricks, tiles and ceramics, considering no hazardous CDW) represents 81 m³ per 100 km², corresponding to 148 ton per km² (Table 6).

In respect to *Timisoara* municipality (Romania), and considering the total area of the territory of 130 km², the CDW illegally dumped shows a total of 5 169 m³ per 100 km², corresponding to 9 459 ton per km²

Table 6. Indicators for construction and demolition waste estimated.

Group / subchapter (and corresponding ELW codes)		Volume		Weight	
		m ³	Indicator (m ³ /100 km ²)	ton	Indicator (ton/100 km ²)
17 01 - concrete, bricks, tiles and ceramics	17 01 01, 17 01 02, 17 01 03, 17 01 07	6 960	81	12 612	148
17 03 - bituminous mixtures, coal tar and tarred products	17 03 02	265	3	663	8
17 05 - soil (including excavated soil from contaminated sites), stones and dredging spoil	17 05 04	147	2	302	3
17 09 - other CDW	17 09 04	62	< 0,5	96	< 0,5
Other	17 02 01, 17 02 03, 17 08 02, N.D.	24	< 0,5	10	< 0,5
Hazardous CDW	17 06 05*	1	< 0,5	1	< 0,5
Portugal (Baixo Alentejo region municipalities)		7 458	87	13 683	160
17 01 - concrete, bricks, tiles and ceramics	17 01 01, 17 01 07	6 720	5 169	12 296	9 459
Romania (Timisoara municipality)		6 720	5 169	12 296	9 459

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Legend: 17 01 01 (concrete); 17 01 02 (bricks), 17 01 03 (tiles and ceramics), 17 01 07 (mixtures of concrete, bricks, tiles and ceramics), 17 02 01 (wood), 17 02 03 (plastic), 17 03 02 (bituminous mixtures), 17 05 04 (soil and stones), 17 06 05* (CDW containing asbestos), 17 08 02 (gypsum-based construction materials), 17 09 04 (mixed CDW); N.D. – no data

An analysis considering the potential recovery for materials existing in the CDW dumpsites in *Baixo Alentejo* region (Portugal) shows, though Table 7, that the major part may be sent for recycling, representing around 97% of the total, in weight.

For *Timisoara* municipality (Romania), CDW remain at dumpsites for a long time, and when removed they are transported to landfill because no CDW recycling facilities exists. Nevertheless, it is possible to evaluate the potential for the CDW illegally dumped recyclability (and landfilled), being the results presented in Table 7.

Table 7. Potential recovery for construction and demolition waste estimated.

Potential for treatment (by type of treatment), by ELW code			CDW estimated	
			ton	%
Reuse		17 05 04	302	2
Recovery	Recycle (R5)	17 01 01 17 01 02 17 01 03 17 01 07 17 03 02	13 274	97
	Recycling (R5), but with pre-treatment	17 09 04	96	< 0,5
Other (to evaluate)		17 02 01 17 02 03 17 08 02 N.D.	10	< 0,5
Disposal	Landfilling (D1)	17 06 05*	1	< 0,5
Portugal (<i>Baixo Alentejo</i> region municipalities)			13 683	100
Recovery	Recycle (R5)	17 01 01	12 296	100
		17 01 07		
Romania (<i>Timisoara</i> municipality)			12 296	100

Legend: 17 01 01 (concrete); 17 01 02 (bricks), 17 01 03 (tiles and ceramics), 17 01 07 (mixtures of concrete, bricks, tiles and ceramics), 17 02 01 (wood), 17 02 03 (plastic), 17 03 02 (bituminous mixtures), 17 05 04 (soil and stones), 17 06 05* (CDW containing asbestos), 17 08 02 (gypsum-based construction materials), 17 09 04 (mixed CDW); R5 - Recycling/reclamation of other inorganic materials; N.D. – no data

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4. Conclusions

4.1. Synthesis

The main objective of this first monitoring period was defined as a test for the CDW illegal dumping monitoring criteria, by each municipality itself, although after meetings, and other contacts, where the instructions, the responsibilities between FCT NOVA (Portugal) and CNPCD (Romania) and the municipalities, as well as the remaining doubts were clarified. It is expected that the parameters monitored will improve their consistency during the next periods, according to the training and the general and individualized (*i.e.*, municipal level) explanations that will be provided monthly.

In this context, the following results for the first monitoring period (March 2021) must be highlighted for the *Baixo Alentejo* region (Portugal):

- 109 CDW dumpsites were registered by 12 of the 13 municipalities of the region (1,3 dumpsites *per* 100 km²), where 67% of them are located at public sites, while the other 33% corresponds to private sites;
- A total of 7 458 m³ of CDW was estimated (corresponding to 13 683 ton); from this total, around 91%, in weight, corresponds to mixtures of concrete, bricks, tiles and ceramics (ELW 17 01 07); it must be taken into account that there are some dumpsites that need further monitoring attention, namely in *Mértola* and *Ferreira do Alentejo* municipalities, because of the quantities involved, but also because the CDW was covered, in some parts, by grass;
- Considering the CDW estimated, by subchapter of the ELW, 81 m³ of concrete, bricks, tiles and ceramics (ELW subchapter 17 01, without hazardous CDW) exist in each 100 km² of *Baixo Alentejo* region (corresponding to 148 ton *per* km²);
- Having in mind the potential for recovery, around 97% of the dumpsites estimated CDW can be recycled (R5 recovery operation).

In *Timisoara* municipality, in Romania, the monitoring activities started in February, with eight CDW dumpsites monitored, and continued in March with two more CDW dumpsites added. The first monitoring period refers to the data status from March 2021:

- The CDW is concentrated in 10 illegal dumpsites at the city's limit (7,7 dumpsites *per* 100 km²), where 80% of them are located at public sites, while the other 20% corresponds to private sites;
- A total of 6 720 m³ of CDW was estimated (corresponding to 12 296 ton); from this total, around 97%, in weight, is represented by mixtures of concrete, bricks, tiles and ceramics (ELW 17 01 07), and 3% by concrete (ELW 17 01 01);
- Considering the estimated CDW by category of the ELW, 5 169 m³ of concrete, bricks, tiles and ceramics (ELW subchapter 17 01, without hazardous CDW) exist in 100 km² (corresponding to 9 459 ton *per* 100 km²).

4.2. Limitations

In *Baixo Alentejo* region (Portugal), the covid-19 pandemic situation limited the planned monitoring work to be executed by FCT NOVA together with the municipalities, in this first monitoring period, that was planned

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to be executed in a face-to-face approach, to help the instructions' implementation, as well as to clarify doubts and harmonize criteria in the region.

4.3. Next steps

For next steps, it is important to complete the monitoring work, together with the municipalities (*Baixo Alentejo* municipalities, in Portugal, and *Timisoara* municipality, in Romania), trying to improve and harmonizing the criteria among them. In this context, it is important to ensure, for the next monitoring periods, the following:

- The effort to cover all the CDW dumpsites in the municipalities, coordinating synergies with the services from other waste types collection services (*i.e.*, municipal waste, bulky waste), the construction works supervision personnel, parish representatives, among others;
- To verify the CDW reported in this first period, and ensure that all the types of waste present in each dumpsite is being registered independently, avoiding, when possible, the classification in mixtures, as for example ELW 17 01 07 (concrete, bricks, tiles and ceramics) or ELW 17 09 04 (CDW mixtures), although these mixtures are a reality in most cases;
- To attend and reinforce, monthly, the monitoring work, repeating the visits and the photograph reporting for all the CDW dumpsites previously identified;
- To present the results evolution to the municipalities, so it can be easier to them to engage with the projects and the activity itself.

Specifically, in *Baixo Alentejo* region, in Portugal, FCT NOVA will try to verify the largest amounts of CDW registered at few CDW dumpsites, specifically in *Mértola* and *Ferreira do Alentejo* municipalities, since they vary a lot from the other dumpsites' registrations and have mentioned difficulties regarding the grass covering specific dumpsites.

For the next reporting periods (September 2021 and April 2022), it will also be important to perform the following tasks:

- A cross-analysis between the CDW illegal dumpsites and the CDW treatment facilities locations, as well as the solutions provided by the municipalities, evaluating the distances but also other factors that might be influencing the CDW illegal dumping;
- Until the next reporting periods, it is expected to have data resulting from activities 1.1 (data collection about CDW generation and recovery) and 1.3 (analysis of the regional construction sector dynamics), as well as from complementary data regarding the costs estimate for CDW management resulting from illegal dumping, to calculate specific monitoring indicators and, for instance, direct municipal costs related to CDW illegal dumping, as referred in the methodological report (activity1.4; see FCT NOVA, 2021a);
- If the monitoring results show a stabilization in a short term, it may be possible during the project to test with the municipalities different approaches to CDW waste management, trying to reduce the occurrence of CDW illegal dumpsites.

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References

- Deloitte, BRE, ICEDD, RPS, VTT, FCT NOVA (2015). *Construction and demolition waste in Portugal. Resource-efficient use of mixed wastes. Improving management of construction and demolition waste*. Tender ENV.A.2/ETU/2014/0049. Environment Directorate General of the European Commission. Consortium led by Deloitte, with the participation of BRE, ICEDD, RPS, VTT, FCT NOVA (Nova School of Science and Technology, Laboratory waste@NOVA, from MARE - Marine and Environmental Sciences Centre).
- FCT NOVA (2021a). *Construction and demolition waste estimate methodology report*. WP 1 - Baseline situation analysis and follow-up. (De)construct for Circular Economy [in Portuguese: (Des)construir para a Economia Circular] project. EEA Grants Portugal. Promoted by Comunidade Intermunicipal do *Baixo Alentejo*. Partners: LNEG – National Laboratory of Energy and Geology (Portugal); Nova School of Science and Technology – CT NOVA (Portugal); Polytechnic Institute of Portalegre (Portugal); Smart Waste Portugal Association (Portugal); RDF Construções (Portugal); Cercibeja (Portugal); International Development Norway AS (Norway); CNPCD – National Centre for Sustainable Production and Consumption (Romania); ENVIROS s.r.o. (Czech Republic).
- FCT NOVA (2021b). *Stakeholders' consultation methodology report*. WP 7 – Information, awareness and training. (De)construct for Circular Economy [in Portuguese: (Des)construir para a Economia Circular] project. EEA Grants Portugal. Promoted by Comunidade Intermunicipal do *Baixo Alentejo*. Partners: LNEG – National Laboratory of Energy and Geology (Portugal); Nova School of Science and Technology – CT NOVA (Portugal); Polytechnic Institute of Portalegre (Portugal); Smart Waste Portugal Association (Portugal); RDF Construções (Portugal); Cercibeja (Portugal); International Development Norway AS (Norway); CNPCD – National Centre for Sustainable Production and Consumption (Romania); ENVIROS s.r.o. (Czech Republic).
- FCT NOVA & 3Drivers (2020). *Demonstrator projects for construction and demolition waste (CDW) in Porto Metropolitan Area (PMA), within the Plan of action for the sustainable management of CDW in PMA* (in portuguese: *Projetos demonstradores para os resíduos de construção e demolição (RCD) na Área Metropolitana do Porto (AMP)*), no âmbito do Plano de Ação para a Gestão Sustentável dos RCD na AMP). Project component led by FCT NOVA (Nova School of Science and Technology, Laboratory waste@NOVA, from MARE - Marine and Environmental Sciences Centre), in consortium with 3Drivers. Developed for PMA (with the collaboration of Lipor and Smart Waste Portugal Association). Lisbon. Available at: http://portal.amp.pt/media/documents/2020/09/21/5_PD_GuiasPD_jun2020.pdf
- INE (2019). *Territorial data for Baixo Alentejo region (municipalities)*, in Portugal. Statistics Portugal. Consulted in March 2021. Available at: <https://www.ine.pt>
- Martinho, G.; Ramos, M.; Pires, A.; Santos, P.; Gomes, A.; Moura, E. (2013). *Study for the sustainable management of construction and demolition waste in the North Interior Region of Portugal*. (in portuguese: *Estudo para a Conceção Sustentável de Modelo de Gestão de Resíduos de Construção e Demolição na Região Norte Interior*). Project funded and developed for North Regional Coordination and Development Commission. FCT NOVA (Nova School of Science and Technology, Laboratory waste@NOVA, from MARE - Marine and Environmental Sciences Centre). Monte de Caparica. Available at: <https://www.ccdr-n.pt/noticia/servicos/estudo-da-ccdr-n-propoe-reciclagem-dos-residuos-de-construcao-e-demolicao-159>
- Ramos, M. & Martinho, G. (2017). *Study about the practices adopted in the construction and demolition waste management and the use of recycled materials by Portuguese construction companies* (in portuguese: *Estudo sobre as práticas adotadas na gestão dos RCD e a utilização de materiais reciclados pelas empresas de construção portuguesas*). FCT NOVA (Nova School of Science and Technology, Laboratory waste@NOVA, from MARE - Marine and Environmental Sciences Centre). Monte de Caparica.

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ANNEX I – Photographs of the first monitoring period

The photographs presented in this Annex do not have the objective to represent all the CDW dumpsites monitored, although each municipality must register it, in monthly basis. In this context, this Annex is not organized by municipality, nor by dumpsite (only by country), but in a way to present different realities for CDW illegal dumping.

Baixo Alentejo region (Portugal)



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Timisoara municipality (Romania)



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