

WalDeCoViet - International scientific cooperation between Republic of Vietnam and Wallonia Brussels International (Belgium)

Report on current situation of Construction and Demolition Wastes in Vietnam

Université de Liège

Hanoï University of Civil Engineering

Foreword

This document has been produced in the framework of the project WalDeCoViet between Université de Liège (ULiège) and Hanoï University of Civil Engineering (HUCE) on the topic « *Matériaux recyclés de haute qualité : mise en place d'une filière de valorisation de déchets de construction et de démolition au Vietnam*» with the financial support of Wallonia-Brussels International and the Governement of the Republic of Vietnam.

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With rapid urbanization and economic growth on all fronts, more and more infrastructure and buildings are being developed across Vietnam, particularly in major cities such as Hanoi, Haiphong, and Ho Chi Minh City. All these activities, new construction, renovation, and demolition of buildings and structures, generate huge amounts of wastes, called Construction and Demolition Waste (C&DW). According to the State of the Environment report of 2011 on solid waste management issued by Ministry of Natural Resources and Environment, the total municipal solid waste generation was about 60 thousand tons/day on average, of which the C&DW waste accounts for 10–12% of total solid waste. In order to maximize the potential positive impacts but at the same time to minimize the negative effects of modernization and industrialization in Vietnam, it is necessary to take immediate measures to protect the environment. This report describes the current condition of C&DW management in Vietnam.

The end solution intended will be to propose suitable C&DW management and recycling strategies that suit these conditions with proven benefits for all stakeholders.

1. International and European situation of C&DW production and management

The construction industry accounts for one third (37.5 %) of all the generated wastes and consists of one of the heaviest and most voluminous waste stream in the EU [1]. Construction and demolition wastes (C&DW) represent an amount of about 850 Mt generated every year by the EU-28 or 1.7 tons produced per year and per EU inhabitant. In the other side the annual European demand in aggregates amounted to 2,99 Mt in 2021: the European demand represents about 10% of the global demand in aggregates [2].

Aggregate and sand materials are in high demand globally for construction purposes, with an annual growth rate of around 5% while the availability of sand is decreasing. A clear increase in sand demands over the previous and coming years is observed (https://iveybusinessreview.ca/6580/lafargeholcim-the-plastic-solution-to-the-global-sand-wars/graphic-2-world-sand-demand). The United States and China show overall the highest yearly demand of sand.

Figure 1 provides a synopsis of the 2021 national production tonnages categorized by country and aggregate type. Germany emerged as the leading producer, surpassing 500 million tons, followed by Russia, Turkey, France, the UK, and Poland. In contrast, smaller nations such as Malta, Montenegro, Iceland, Luxembourg, and Cyprus exhibited production levels below 5 million tons. National tonnages depend not only on economic strength, but also on geological availability of and access to deposits, national ambient climate, ruggedness of the terrain and local building traditions.

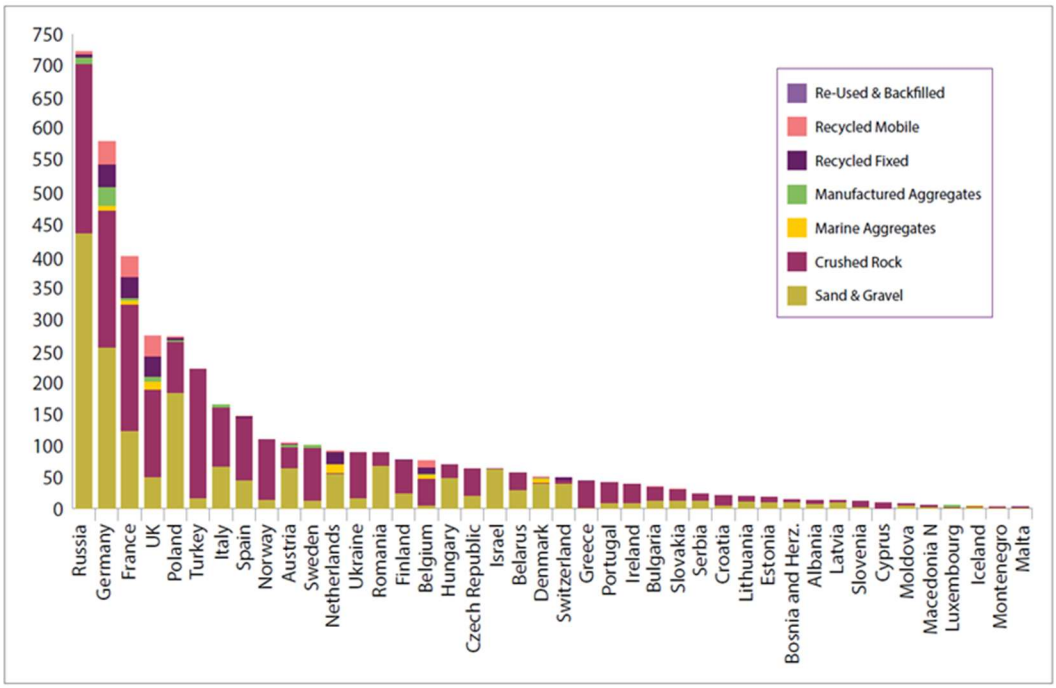

Figure 1: 2019 aggregates production in Europe [2]

The composition of aggregate types in the EU27+UK+EFTA countries in 2019 revealed that crushed stone accounted for 46.9% of all production, while sand and gravel constituted 39.7%. Aggregate production from recycled and reused materials contributed 9.3%, with marine and manufactured aggregates comprising the remaining 4% (Figure 2).

Figure 2: Aggregate type percentages

The market of recycled sands and aggregates (RS&A) needs to be healthful at country scale to foster Member States to reach the target defined in the Waste Framework Directive (2008/98/EC). The most cited drivers that can boost C&DW recycling are: Green Public Procurement, taxation on C&DW landfilling, taxation on natural sands and aggregates, availability and cost of natural sands and aggregates, quality certification of RS&A, better public perception and increased consumer acceptance and low distance with C&DW recycling plants (e.g. [3]).

However, while recycling of coarse aggregates is now well developed [4, 5, 6], finer fractions do not still offer ways for valorization: they are actually stored or landfilled.

Several research and master projects show there is an opportunity in substituting natural sands and fillers with recycled fine aggregates (RFA) or brick fines [7] for the development of existing or new applications in mortar and concrete technology.

2. Production and management of C&DW in Wallonia

In Wallonia, between 16 and 18 million tons of C&DW are generated each year (Table 1). These C&DW consist of four categories of waste:

- inert materials such as concrete, bricks, ceramics, and tiles (cf. Figure 3 depicting the composition of inert C&DW in Wallonia in 2010 (Plan wallon des Déchets Horizon 2010)). The inert part represents between 5 and 7 millions tons and is the category of interest in the project as their proper management and recycling can greatly limit the amount of C&DW and produce secondary resources;
- non-hazardous waste like paper, wood, plastics, and metals;
- hazardous waste including solvents and asbestos;
- excavated soil.

Table 1: Estimation of C&DW produced in Wallonia (data for 2013, Plan wallon des déchets-ressources, 2018).

Types	Tonnages (millions de tonnes)
Déchets inertes (béton, briques, tuiles, carrelages, mortier, ciment, verre plat…)	Entre 5 143 et 6 972
Déchets non dangereux (papiers, cartons, plastiques, métaux, EPS, bois…)	0,8
Déchets dangereux (amianterésidus et emballages de peinture, solvant)	Pour mémoire
Terres excavées	10
TOTAL	entre 15,9 et 17,8

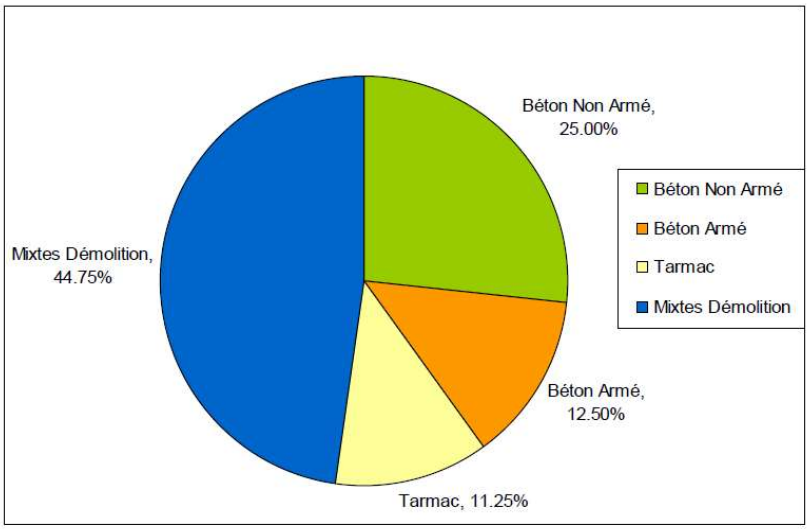

Figure 3. Composition of inert C&DW from Wallonia (Plan wallon des Déchets Horizon 2010).

The Decree of the Walloon Government of 18 March 2004 gives criteria for the admission of wastes in landfills. According to this decree, landfilling of inert C&DW has been forbidden since the 1st January 2006. As a result, recycling of C&DW has become an obligation. Excavated soils are not covered by this decree.

Belgium is recognized as one of the leading European countries in recycling inert construction and demolition waste, achieving a recycling rate of over 90% [8]. In 2019, the total production of aggregates in Belgium was estimated to be 75 million tons, including 22 million tons of recycled aggregates, accounting for nearly 30%. This positions Belgium as the top performer in terms of relative production of recycled aggregates, surpassing the United Kingdom (27%) and the Netherlands (25%) (UEPG, 2021).

In 2018, Wallonia had 258 authorized centers for sorting and recycling inert C&DW. Most of these centers are located north of the Sambre and Meuse Valley, particularly

in the Liège and Charleroi regions (Figure 4). The annual production of recycled aggregates in Wallonia is estimated at 4 million tons.

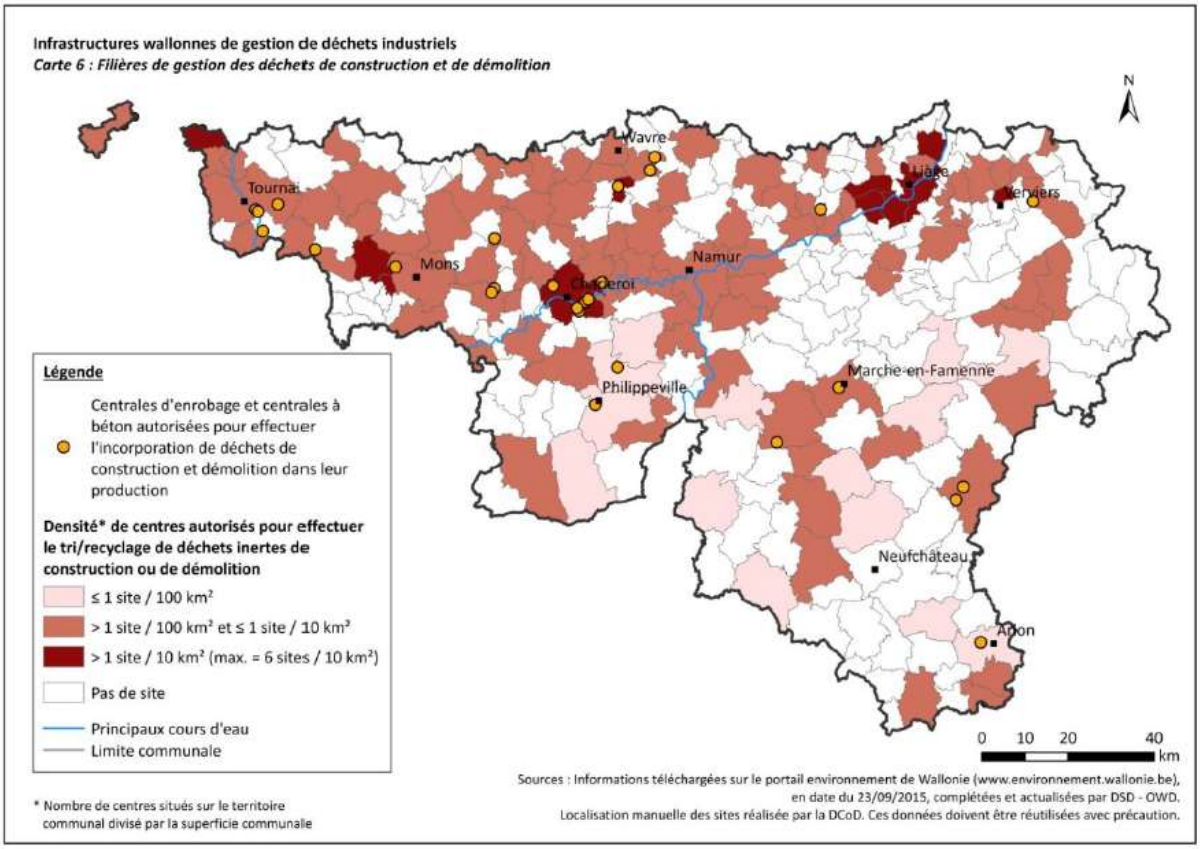

Figure 4: Geographic repartition of the Walloon C&DW treatment centers [9]

Furthermore, Wallonia is home to a federation of recycled aggregate producers called FEREDECO ("Professional Federation of Construction Waste Recyclers and Recycled Aggregate Producers in Wallonia"), which plays a crucial role in promoting the use of recycled products to the Wallonian public authorities [10]. This federation comprises 42 members representing 51 recycling centers spread across the entire region (Figure 5). These centers are responsible for the storage, sorting, and crushing of inert C&DW, producing a wide range of recycled aggregates in accordance with the NBN EN 13242 standard and regional recommendations [10]. In 2017, the production of FEREDECO members amounted to approximately 2 million tons.

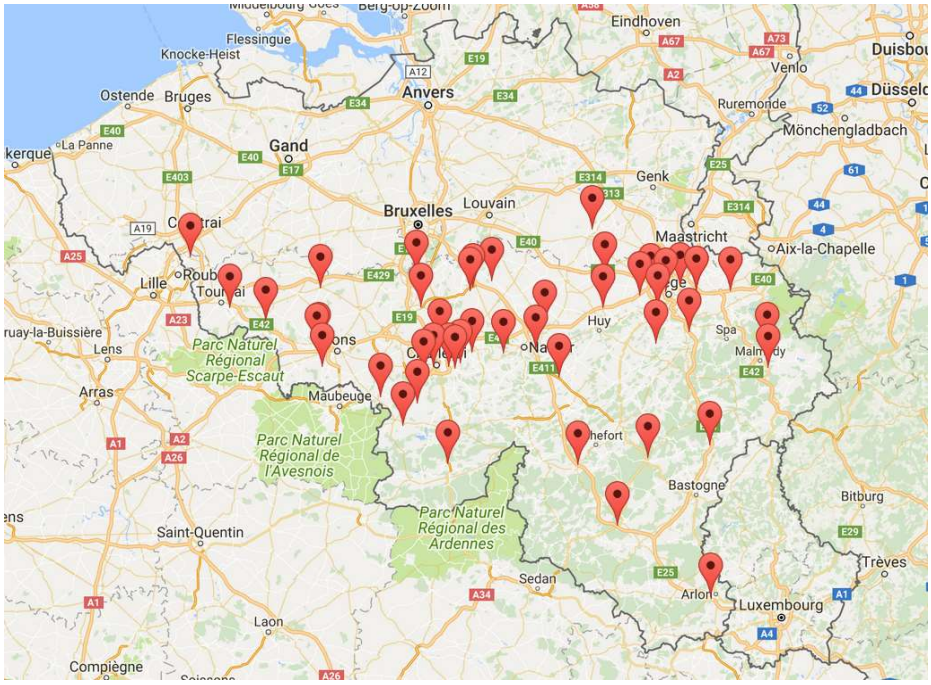

Figure 5: Geographic repartition of the FEREDECO members (http://www.feredeco.be/).

3. Production and management of C&DW in Vietnam

3.1. Overview on production of C&DW in Vietnam

Vietnam has strong economic growth and rapid urbanization, particularly in large cities. The average annual economic growth rate is 6.0% in 2015-2020, and the urbanization rate increased rapidly from 35.7% in 2015 to 39.3% in 2020 and is expected to reach around 45% in 2025.

Given the remarkable growth of the construction industry, construction and demolition waste C&DW has become a major issue that Vietnam must now confront more seriously, especially in large cities in Vietnam such as Hanoi, Hai Phong, Da Nang, and Ho Chi Minh City. The daily waste generation in Vietnam has reached approximately 6000 tons, in which the CDW accounts for 10–12% of total solid waste according to the Ministry of Natural Resources and Environment. In Hanoi, it was reported that the daily CDW generation was projected to increase from 1500 in 2011

to 4000 tons in 2020, and the annual increment in the generation of building demolition waste was estimated to be 4–5% from 2016 to 2020. The construction industry, on the other hand, is one of major sectors of hazardous waste production in Vietnam.

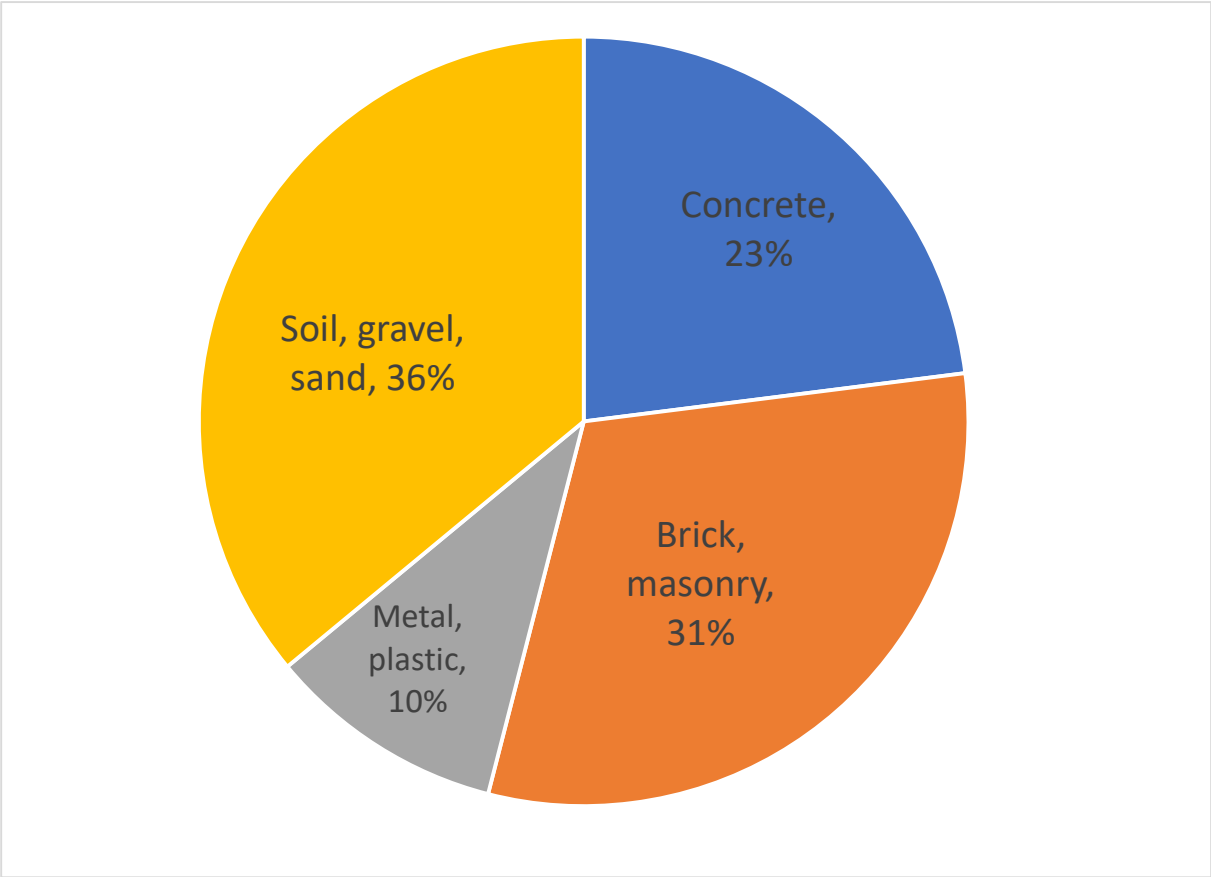

Figure 6: Typical components of construction waste in Vietnam

3.2. Management of C&DW in Vietnam

Currently, the generated C&DW is not fully recycled in Vietnam, and a major disposal method of generated C&DW is dumping at designated sites. The main treatment of generated C&DW is landfill (85-90%), and the reuse and recycling rate has been reported to be around 10% and only 1-2%, respectively. But, the collected C&DW is landfilled without any treatment or recycling (hereafter, the C&DW dumping sites are called 'C&DW landfills'). In Hanoi, for example, approximately 40–50% of C&DW generated daily is estimated to be brought to C&DW landfills. In addition, illegal dumping of C&DW is found frequently at roadsides and drainage canals in both urban

and rural areas of the city, creating risks to human health and the environment, including soil and groundwater contamination, air pollution, transportation obstacles (traffic accidents), degradation of the urban landscape, and economic loss.

Figure 7: Construction waste and its dumping on the street cause unsightly environmental damage.

Figure 8: Solid waste gathered at Nguyen Khe dumps in Dong Anh District

3.3. Policies of management of C&DW *in Vietnam*

To implement better and sound C&DW management, various policies and regulations that promote reuse and recycling of C&DW were implemented in Vietnam.

3.3.1. Major legal documents

Circular No. 08/2017/TT-BXD stipulates management of C&DW, which is pursuant to Decree No. 38/2015/ND-CP that regulates management of waste and scrap under the Law on environmental protection (No. 55/2014/QH13).

According to the Decision No. 491/QD-TTg (2018) pursuant to the Law on environmental protection (No. 55/2014/QH13) and the construction law (No. 50/2014/QH13), 90% of C&DW discarded from urban areas should be collected and treated by 2025 with meeting environmental protection requirements and 60% of it should be also reused or recycled by 2025.

In addition, proper collection and transportation of C&DW is required by Decree No. 12/2009/ND-CP under the Construction law (No. 50/2014/QH13). Relationships

among the above major legal documents of C&DW and their related descriptions are shown in the following figure and table, respectively.

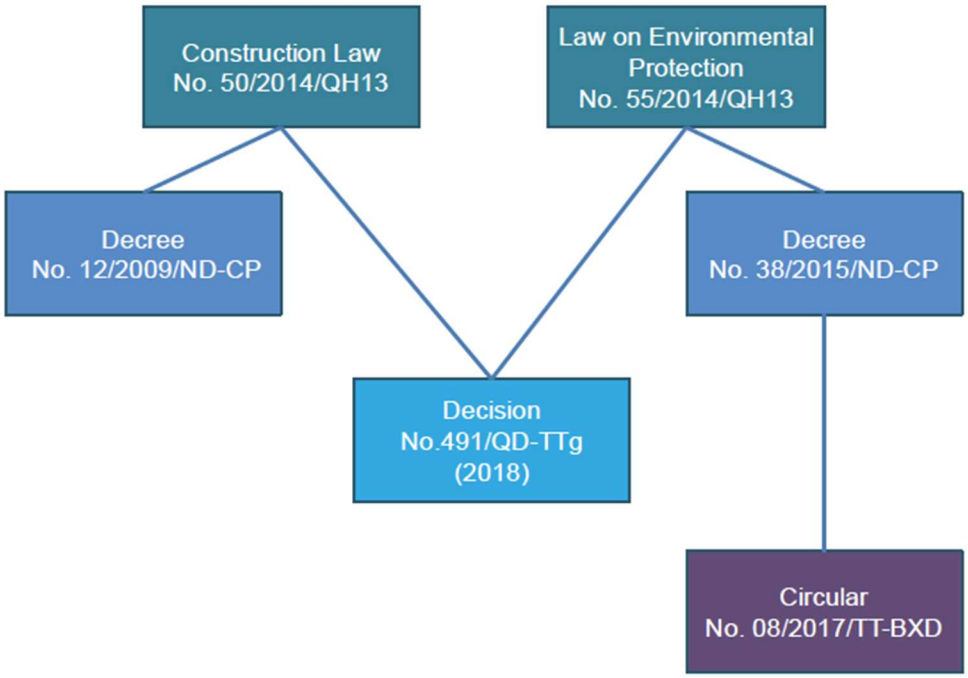

Figure 9: Relationships among major legal documents on C&DW in Vietnam

Table 2: Related descriptions in the major legal documents on C&DW

Code	Title of the legal document	Related major
Law No. 50/2014/QH13	Construction law	● Clause 7, Article 4: Basic principles of construction investment activities ● Clause 3, Article 109: Requirements on construction sites ● Clause 1 and 2, Article 116: Environmental protection in construction
Law No. 33/2014/QH13	Law on environmental protection	● Clause 3, Article 73: Environmental protection in construction works
Decree No. 12/2009/ND-CP	Management of investment projects on the construction works	● Clause 1 and 2, Article 31: Management of the construction environment
Decree No. 38/205/ND-CP	On waste and scrap management	● Clause 1 to 4, Article 50: Management of solid waste from construction activities
Decision No. 491/QD-TTg (2018)	Approving adjustment to national strategy for general management of solid waste to 2025 with vision towards 2050	● Item 3-b), Article 1: Particular objectives to bereached by 2025 ● Item 4-d), Article 1: Basic missions with regard to other particular solid waste
Circular No.08/2017/TT-BXD	Construction solid waste management	● All

The amended ‘National Strategy for Integrated Solid Waste Management to 2025’ with a vision towards 2050 set a target of 90% for C&DW collection and 60% for reuse or recycling of CDW. Circular No. 8/2017/TT-BX-D on Construction Solid Waste Management formulated legal procedures such as separation, storage, transportation, reuse, recycling, and disposal of C&DW, responsibilities of stakeholders, reporting forms, and a database of CDW management of responsible agencies. To develop proper C&DW management and promote reuse and recycling of CDW in Vietnam, further challenges and opportunities are highly expected.

3.3.2. Management of CDW stipulated by Circular No. 08/2017/TT-BXD

a) Focal points of the circular

Circular No. 08/2017/TT- BXD is the first legal document that stipulates detailed C&DW management in Vietnam. This circular was developed with the following focal points toward stepwise improvement of C&DW management.

- to collect and integrate planning data and reporting result data on C&DW management in Vietnam with forms, (examples of data: amount and capacity of collection and transportation and treatment, including recycling/ reuse)
- to promote reuse and recycling of C&DW in addition to proper collection, transportation and treatment by publishing lists of construction sites and lists of SWM service providers
- to clarify responsibility of generators of C&DW, investors of construction works and SWM service providers in addition to authorities or competent agencies.

b) Structures of the circular

The Circular No. 08/2017/TT- BXD in the above major legal documents mainly stipulates:

- Regulation on C&DW management

- Database of C&DW
- Separation at sources
- Storage, collection, transportation
- Reuse, recycling and treatment
- Responsibilities of stakeholders in C&DW

Among those contents, the roles of waste generators are very important for managing CDWs. According to the circular, waste generators are different depending on the types of constructions.

c) Planning system of C&DW management

The planning system of C&DW is shown in the following figure.

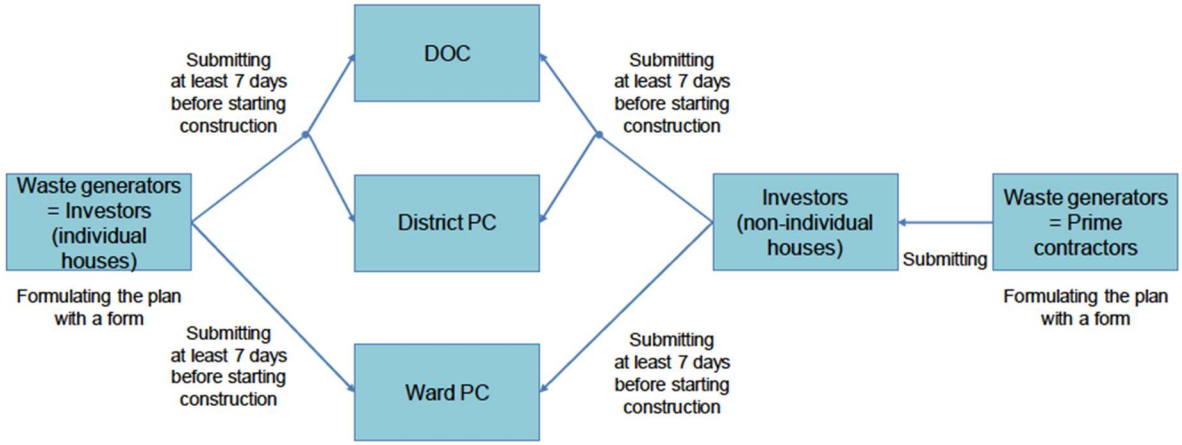

Figure 10: Formulation and submission of CDW management plan

- Investors of construction works (including demolition works) are required to submit a C&DW management plan following a form of Circular No. 08/2017/TT-BXD to Ward PC and an authority to grant construction permit (DOC or District PC) at least 7 days before starting construction.
- Responsibilities of investors between housing construction works and construction works other than housing construction works are different.

- Investors need to not only formulate C&DW management plan as a waste generator bust also submit the plan to Ward PC and DOC or District PC. In many cases of housing construction works, the plan is to be submitted to District PC more than DOC.

If there is a prime contractor authorized by an investor under a contract, the prime contractor needs to formulate the plan as a waste generator and submit the plan to the investor. The investor needs to approve and send the plan to a Ward PC and DOC or District PC.

- CSW management planning data is not integrated at a provincial level because it is not necessarily for DOC (competent agency under provinces) to collect information on C&DW management plans submitted to District PC and Ward PC under Circular No. 08/2017/TT-BXD.

4. Challenges and opportunities for C&DW recycling in Vietnam

4.1. National Strategies for Promoting Sound C&DW Management and Recycling

In the past two decades, the Vietnamese Government has put in place a sound legal framework for environmental protection that addresses guidelines for the management and disposal of all waste streams [11]. This framework is supported by many national strategies and directives that apply to solid waste management. In the National Strategy for solid waste management [N], it is expected that by 2050, all kinds of solid waste will be collected, reused, recycled and comprehensively treated by advanced, environmentally-friendly technologies, suitable to each locality, thereby limiting the amount of solid waste that needs to be landfilled (Table 2).

Table 2. National Strategy for management of solid waste up to the year 2025

Targets (%)	2020	2025

The ratio of cities that have solid waste recycling system (%)	70	100
Reduction of plastic bags compared to 2010 (%)	65	85
Recycled Urban house solid waste	90/85	100/90
Construction and Demolition Waste	80/50	90/60
Urban sludge	50/30	100/50
Non-hazardous Industrial solid waste	90/75	100/100
Hazardous Industrial solid waste	70/0	100/0

Together with national strategies, there have been relevant laws and policy documents such as decrees, circulars, joint circular and technical standards that have been issued (see list of official documents in appendix).

Along with the National Strategy for solid waste management [N], the Prime Minister-issued Decision No 609/QD-TTg approving the planning for treatment of solid wastes in the capital Hanoi to 2030, with a vision for 2050 [11], in which the city will be divided into three zones for solid waste collection and treatment [12].

Despite several national strategies and decisions, detailed technical instructions for promoting treatment and recycling of C&DW are not fully available in Vietnam. Besides, necessary standards and criteria for recycled materials from C&DW and guidelines on the use of recycling materials (e.g., roadbed materials, concrete aggregate) have not yet been fully regulated in Vietnam.

4.2. Challenges and Opportunities for Sound C&DW Management and Recycling

Right now, like other developing countries in Asia, Vietnam is facing a shortage of laws and enforcement in C&DW management, as mentioned above. The priority in current solid waste management is for organic waste management and hazardous waste management (health waste and hazardous industrial waste). C&DW, which is a non-hazardous solid waste, is considered mostly on the research scale, and no big investment has been made so far. At present, a priority policy or investment policy for

research, manufacture, and business investment in the recycling and management of C&DW has not been promulgated. The recycle policy is only mentioned for general solid waste management in National Strategy on Environmental Protection up to the year 2020 and Vision to 2030 as approved by Decision No.2149/QD-TTg in 2009 [N]. In this legal document, one of the big tasks is to increase the reuse and recycling of solid waste by increasing recycling of solid waste percentage, building and developing the waste market and economy, developing the recycling industry, promoting the purchase of recycled products, elaborating and applying incentive policies for recycling activities, and forming recycling funds. Furthermore, public awareness of and attitudes towards the waste generated from construction and demolition sites is limited. This must be changed, at first possibly in the industrial practice. It is required to sensitize not only engineers but all stakeholders, including regulatory authorities in the construction industry. This also requires a full understanding of the reuse potential of C&DW and existing practices in implementation and enforcement for achieving the objectives of the national strategy.

Japan International Cooperation Agency (JICA), as one of the leading donors, has carried out following projects on solid waste management:

- 2006-2009: 3R Initiative Project in Hanoi City.
- 2005-2013: Haiphong Environmental Improvement Project.
- 2014-2018: Project for Capacity Development on Integrated Management of Municipal Solid Waste.

Several projects have also been conducted in related Vietnamese Ministries. However, most of these projects on the recycling of C&DW were mainly on the research scale :

- 2010-2012 : Investment of C&DW recycle line to produce construction materials project by the Ministry of Construction.

- 2010–2014 : Treatment and recycling of solid waste in the construction of road infrastructure project by the Ministry of Transportation.
- 2008–2010 : Investigation of the management system of C&DW in urban areas by Vietnam Urban Environment and Industrial Zone Association.

In 2018, a new cooperative project between Vietnam and Japan called "*Establishment of Environmentally Sound Management of Construction and Demolition Waste and Its Wise Utilization for Environmental Pollution Control and for New Recycled Construction Materials in Vietnam*" was set up (the so-called JST-JICA SATREPS project) [29]. The project proposes promoting the recycling of C&DW in Vietnam in order to :

- establish guidelines necessary for environmentally sound C&DW management,
- develop quality standards for recycled materials produced from C&DW,
- develop new technologies utilizing recycled materials produced from C&DW,
- propose strategic business models designed to promote C&DW recycling in Vietnam and examine their effectiveness and feasibility through on-site pilot projects.

The final goal of this project is to contribute to the achievement of a C&DW recycling rate of 60%, which meets the Vietnam national strategy for management of solid waste up to the year 2025, through the application of developed technologies and business models.

5. Conclusions

It is obvious that C&DW management and recycling is one of the most critical engineering issues that requires immediate intervention in Vietnam. Though there have

been some initiatives in the past to address this issue, none has been successful, mainly due to the multiplicity of the problem. Therefore, a more holistic approach addressing all technical, social, institutional, and economic issues is vital to achieving a sustainable solution. Sharing experiences with Wallonia could be very fruitful for Vietnamese universities and authorities.

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