Impact of green public procurement on the market of recycled concrete

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Abstract

According to the European Commission website, construction and demolition waste (CDW - consisting of materials such as concrete, bricks, gypsum, wood, glass, metals, asbestos, excavated soil…) accounts for approximately 25% - 30% of all waste generated in the EU. To move towards a recycling society, various policies have been launched by European governments. France adopted the framework provided by Directive 2008/98/EC on waste to promote the circular economy. The aim is to achieve a 70% (by weight) recycling target by 2020 for non-hazardous CDW while the valorisation percentage (reuse and recycling) is still around 60%. However, CDW are mainly used for backfilling operations and recycled as aggregates constituents of roads. This strategy is usually considered as a down-cycling option. High quality recycling is not developed because of the low demand for recycled aggregates as constituents of structural concrete for buildings. Therefore, there is a need to find drivers to spur the demand for recycled aggregates offering a higher added-value. The development of green building assessment system such as LEED, BREEAM or HQE, public procurement which represents a key source of demand for firms in sectors such as construction, and landfill taxation are studied in the framework of the French national project RECYBETON and are considered as potential drivers. This research paper focuses on one driver: the development of public procurement requiring a percentage of recycled aggregates in their call for tenders when transport distances do not exceed 25km. It examines how the incorporation of recycled aggregates in public procurement could impact the demand for recycled aggregates in concrete construction. The enforcement of the public policy aimed at spurring the use of recycled aggregates in concrete construction is also discussed.

Keywords: recycled aggregates, concrete, waste, public procurement, green building.

Introduction

According to the European Commission website, construction and demolition inert waste (CDW - consisting of materials such as concrete, bricks, gypsum, wood, glass, metals, asbestos, excavated soil…) accounts for approximately 25% - 30% of all waste generated in the EU. In 2012, CDW accounted for 72% of all waste generated in France (247 million tonnes over 345 – ADEME, 2015).

To move towards a recycling society, various policies have been launched by European governments. France adopted the framework provided by Directive 2008/98/EC on waste to promote the circular economy. The aim is to achieve a 70% (by weight) recycling target by 2020 for non-hazardous CDW while the valorisation percentage (reuse and recycling) is still around 60%. To deal with the environmental challenge, the Energy Transition for Green Growth law was enacted in August 2015. It aims at renovating buildings to save energy, developing green transport to improve air quality, developing renewables to create a balanced energy mix, tackling waste and promoting the circular economy. Among the initiatives, one concerns the aggregates used in road works. By 2020, 60% of these aggregates will have to come from the recycled stream. However, this policy raises two issues:
1. Recycling CDW as aggregates constituents of roads is usually considered as a down-cycling option (Hiete, 2013);
2. High quality recycling is not developed because of the low demand for recycled aggregates as constituents of structural concrete for buildings. The law which became stringent for road construction does not require a share of recycled aggregates in concrete.

Several drivers have been presented to spur the demand for recycled aggregates offering a higher added-value: Green Public Procurement, sustainable building rating systems requiring a share of recycled materials, taxation on natural aggregates, landfill taxation, quality certification of recycled aggregates from CDW, development of guidelines to increase the user confidence in the utilisation of recycled aggregates (Hiete, 2013; Garbarino and Blengini, 2013). This research paper will focus one of these drivers: the development of Green Public Procurement. It will examine how the incorporation of recycled aggregates in public procurement could impact the demand for recycled aggregates in concrete construction. The enforcement of the public policy aimed at spurring the use of recycled aggregates in concrete construction will also be discussed.

Impact of the integration of recycled concrete in public procurement

A large part of the demand in construction is stimulated by public procurement. In 2013, in France, the value of procurement published in TED (Tenders Electronic Daily) and concerning works, goods and services was €72 billion (OEAP, 2015). Public works accounted for €22 billion.

The use of virgin aggregates is dominant in the French construction as in any other country. In 2015, 80% of this production of aggregates (260 million tonnes - table 1) benefited to civil engineering and road construction. About 80 and 25 million tonnes of CDW were respectively re-used and recycled but almost exclusively for public works (Collonge, 2017).

Table 1. Uses of natural aggregates

<table>
<thead>
<tr>
<th>Destination</th>
<th>Public works</th>
<th>Building</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of use</td>
<td>Million tonnes and %</td>
<td></td>
</tr>
<tr>
<td>Road and rail works</td>
<td>188 (57%)</td>
<td>0</td>
</tr>
<tr>
<td>Surfacing</td>
<td>30 (9%)</td>
<td>0</td>
</tr>
<tr>
<td>Ballast</td>
<td>4 (1%)</td>
<td></td>
</tr>
<tr>
<td>Ready-mix concrete</td>
<td>20.1 (6%)</td>
<td>46.9 (14%)</td>
</tr>
<tr>
<td>Construction concrete and concrete products</td>
<td>17.9 (6%)</td>
<td>23.1 (7%)</td>
</tr>
<tr>
<td>Total</td>
<td>260 (79%)</td>
<td>70 (21%)</td>
</tr>
</tbody>
</table>

Source: UNPG, 2016

In 2007 public procurement represented approximately 23% of the turnover of building companies. Thus, it was assumed that approximately 16 million tonnes of natural aggregates were incorporated in public buildings. These data were used to examine how the

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1 I wish to thank the national project RECYBETON and DRI that sponsored part of the research. I would like also to express all my deep gratitude to the participants of the project who sent me valuable comments on an earlier draft of the paper. However, the views expressed in this paper are mine alone and should not be attributed to RECYBETON partners and the institute with which I am affiliated
2 The development of green building assessment system requiring a share of recycled aggregates in concrete, landfill taxation were also examined in the framework of the French national project RECYBETON.
3 This value does not integrate procurement expenditures linked to concessions and large public companies. By adding these elements, the government procurement markets account for 10% of GDP (Saussier and Tirole, 2015).
incorporation of recycled aggregates in public procurement could impact the demand for recycled aggregates in concrete construction.

Cost and benefit analysis usually considers that the economic feasibility of the recycling process strongly depends on transport conditions. When recycled aggregates have to be transported over longer distances than natural aggregates, then recycling may not be the best option: Firstly, transportation costs jeopardize the economic feasibility of the aggregates recycling process. Secondly, CO\textsubscript{2} emissions from recycled aggregates transportation could aggravate the environmental impact of this option. Thus, it is necessary to take into account distances between the worksite and the location of the plant in charge of recycling aggregates. For the analysis, it was assumed that recycled aggregates can be used when they are situated within a radius of 25km around the construction site.

CDW management plants which are in charge of separating mixed waste fractions and crushing and grinding secondary raw material, are not evenly distributed on the French territory (Mongeard and Dross, 2016). They are usually located around main urban areas where deconstruction generates important quantity of CDW. Conversely, the relative pressure on resource availability is stronger around these areas and the availability of natural aggregates frequently requires long transport distances which render them relatively less competitive than secondary sources.

In France, public procurement concerns four types of actors: 1/ social housing companies; 2/ public companies; 3/ local authorities; 4/ State administrations. 67% of multi-family dwellings which are dominant in the social rented sector, are located either in Paris and its suburbs or in cities with more than 100,000 inhabitants (INSEE, 2016). To take account the distance constraint, it was assumed that between 8 and 16% of the construction projects (i.e. roughly a quarter and half of the dwellings located away from urban areas) launched by housing companies do not have any recycling plant within a radius of 25km around the construction site. Similar hypothesis was retained for new construction concerning public companies and local authorities. Conversely, State administrations are usually concentrated around densely populated urban areas. Thus, it was assumed that all projects developed by State administration could benefit from recycled aggregates.

Based on these assumptions, table 2 assess the impact of public procurement requiring respectively 10, 20 and 30% of recycled aggregates in concrete construction. It is assumed that 1m\textsuperscript{3} of concrete is made of cement (280 kg), coarse aggregates such as stone and gravel (1200kg), fine aggregates such as sand (800 kg) and total water (180 litres). According to French standards, recycled structural concrete can contain up to 30% of recycled coarse aggregates in the most favourable environment (depending on the exposure classes). Conversely most of the fine aggregates have to be natural.

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Estimated volume of aggregates in public buildings (Mt)</th>
<th>Estimated volume of aggregates in public buildings (with a distance constraint)</th>
<th>Estimated volume of recycled aggregates with different constraints for public procurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social landlords</td>
<td>4.9</td>
<td>4.12</td>
<td>4.51</td>
</tr>
<tr>
<td>Public companies</td>
<td>1.4</td>
<td>1.18</td>
<td>1.29</td>
</tr>
<tr>
<td>Local authorities</td>
<td>7</td>
<td>5.88</td>
<td>6.44</td>
</tr>
<tr>
<td>State administrations</td>
<td>2.8</td>
<td>2.8</td>
<td>2.8</td>
</tr>
<tr>
<td>Total</td>
<td>16.1</td>
<td>13.98</td>
<td>15.04</td>
</tr>
</tbody>
</table>

\textsuperscript{*}0.25 = 4.12 x 0.1 x (1200/2000)
Table 2 shows that requiring 10% of recycling aggregates in public procurement for buildings would have a limited impact on the market. However, it would play a major role to launch the market for recycled concrete and to send a credible signal to the market.

It is recognized that recycling plants have no incentive to invest in crushing equipment and to develop recycled aggregates for concrete constructions since the demand of road works is large enough. By creating a critical mass of demand for recycled aggregates for concrete construction, this policy would incite recycling plants to invest in crushing and screening equipment and to propose recycled aggregates that can be used in structural concrete.

**Discussion on the enforcement of the public policy**

The enforcement of the public policy raises several questions: What would be the optimal rate of recycled aggregates in public procurement? How would demolition companies react to this measure? How the equilibrium between road and building projects could be modified? In the short run, limiting the level of recycled coarse aggregates in concrete construction to 10% would probably reinforce the effectiveness of the public policy.

Firstly, at this level, it would be easy to overcome culture resistances and to improve the clients’ confidence in the use of recycled aggregates in structural applications. Secondly such a rate would be accepted for most environments and intermediate storage of recycled coarse aggregates would not be necessary. Thus, additional costs would be limited.

Thirdly the Energy Transition for Green Growth law which was enacted in 2015 put a strong pressure on road construction by requiring 60% of recycled aggregates used in road works by 2020. Thus, the high demand for recycled aggregates in road construction will attract most of the CDW streams. At the level of 10%, the competition will be limited.

The creation of a critical mass of demand for high quality recycled concrete could also incent demolition companies to invest in mechanical equipment for an effective sorting out of CDW. Another option would be to implement this policy at the regional level. This would be consistent with the Law enacted in August 2015, which transferred CDW management to regional authorities. Moreover, it has been proven that CDW management is a local issue.

Profit margin, market price for recycled aggregates, production costs of natural and recycled aggregates, logistics costs to the market differ from one region to another (WBCSD, 2009). Such a policy would be very relevant around main urban areas where deconstruction generates important quantity of CDW and the availability of natural aggregates requires long transport distances.

**References**

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