Solid waste management project in the building industry: analysing existing proposals

Fábio Martins Brum* and
Maria Aparecida Steinherz Hippert

Federal University of Juiz de Fora,
4a. Plataforma, Campus Universitário,
CEP 36036-900, Juiz de Fora, Minas Gerais, Brazil
E-mail: fabiombrum@yahoo.com.br
E-mail: aparecida.hippert@ufjf.edu.br
*Corresponding author

Abstract: Construction waste (CW) has become a world concern resulting in different problems associated with its massive production and inappropriate disposal. As a result, there are negative impacts on environmental and social issues in urban areas. Therefore it is of utmost importance that firms develop building industry solid waste management projects on their building sites in order to combat this negative influence. The aim of this study is to identify, through a review of the literature, the main measures Brazilian firms should take on site in order to properly handle and dispose all wastes produced, in accordance with the laws and regulations in force. The results obtained enable us to establish basic guidelines to indicate what measures firms should develop on their building sites in order to more efficiently manage the construction waste produced.

Keywords: construction waste; waste management project; environmental sustainability; building site.

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Biographical notes: Fábio Martins Brum graduated in Civil Engineering from the Federal University of Juiz de Fora (UFJF) in 2005 and received his post-graduation degree in Business Management from the Federal University of Rio de Janeiro in 2008. He worked as a Temporary Professor for the Department of Structures at the Federal University of Juiz de Fora from 2006 to 2008, and is currently developing his UFJF Master's degree dissertation on constructed environment. He also works as a Civil Engineer in the Sub-Department of Infrastructures at the Federal University of Juiz de Fora, where he develops projects, manages building sites and is part of the building maintenance team for the university campus.

Maria Aparecida Steinherz Hippert graduated in Civil Engineering from the Federal University of Juiz de Fora (UFJF) in 1983, received her Master's degree in Civil Engineering from Universidade Federal Fluminense in 1998, and a Doctoral degree in Production Engineering from the Federal University of Rio de Janeiro in 2005. She is currently an Adjunct Professor in the Department of Construction and on the Post-Graduation Program in

Constructed Environment at the Federal University of Juiz de Fora. Her main research interests include management of building projects with emphasis on quality and sustainability.

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1 Introduction

Construction waste is currently a worldwide concern. There are several problems resulting from its massive production which eventually have a negative impact on urban areas. This topic has become the object of observation and study; several investigations have been carried out in different parts of the world, giving data on the volume produced and its final disposal.

China, for example, according to Dong et al. (2001 cited at Yunpeng, 2011), produces approximately 29% of all urban solid waste in the world annually, of which 40% comes from construction-related activities. The USA, according to Schneider (2004 cited at Karpinski et al., 2008), produce approximately 136,000,000,000 kg/year of construction and demolition waste (CDW). The US have 3,500 recycling units which are able to process only 25% of the total volume produced. England and Wales (Bell, 1997 cited at Lawson et al., 2001) produce 53,500,000,000 kg/year of construction waste. This is also a reality found in Brazil, where according to Pinto (1999), construction waste amounts to 54–70% of the urban solid waste production, according to a study conducted in six medium- to large-sized Brazilian cities in the states of Sao Paulo and Bahia.

As a result, the large amount of waste produced causes increased wastage of materials (Oliveira and Mendes, 2008), besides impacting the environment negatively, since construction materials are mostly obtained from natural resources or quarried (Karpinski et al., 2008).

In addition to the production of waste, its inappropriate disposal is also of great concern. This also contributes negatively to the environment and causes disastrous impacts on society. According to Mendes (2004 cited at Oliveira and Mendes, 2008), waste that is disposed of clandestinely in vacant lots, on river banks and at the roadside on the outskirts of urban areas results in soil contamination, proliferation of insects and disease vectors, thereby exacerbating problems related to public health.

In this context, it is essential for the Building Industry to seek best practices regarding construction waste to help reduce its negative impact. For Kulatunga (2006), managing construction waste has become an important area to improve the performance of the industry, with an emphasis on aspects related to quality, economy and sustainability. Investment in waste management on building sites is an efficient way to achieve excellent levels of performance in this field, since building sites are the main places responsible for waste production. Correct handling of waste combined with a suitable destination comprise a set of actions which, when widely implemented by firms in the industry, minimise environmental impacts and help to avoid the need for emergency solutions (Lordêlo et al., 2006).

In the specific case of waste management on building sites, the attitudes that can be developed in order to optimise handling and environmental destination are commonly referred to as Building Industry Waste Management Projects.

Starting from these considerations, this paper was based on a review of the literature and examines recommendations made by some Brazilian authors for the development and implementation of Building Industry Waste Management Projects. Its aim is to identify the main actions that Brazilian companies should carry out on their building sites in order to achieve appropriate environmental handling and proper waste disposal in accordance with the Brazilian legislation and norms currently in force.

2 Methodology

The analysis of publications about Building Industry Waste Management Projects consisted of research in academic papers, journals, websites, booklets, and guides with the following characteristics:

- Brazilian publications, since cultural differences among the various regions of the world could result in actions that would not be viable for the conditions of the workforce, technology and materials used on building sites in Brazil.
- Information regarding activities that can be developed within the building site only. Activities developed in the firm and/or after waste removal from the site will not be considered here.
- Content in compliance with the current Brazilian legislation and norms.

Based on these criteria five publications were selected for analysis. We analysed the stages and activities included in each reference and identified differences and similarities between proposals regarding their applicability to building sites.

The results were displayed in a chart showing the stages, activities and actions to be carried out by firms on their building sites in order to manage construction waste more efficiently.

3 Construction waste in Brazil

In Brazil, concerns over construction waste began in the 80's. One of the first studies was conducted by Tarcísio de Paula Pinto in 1986 reporting the use of recycled aggregates in mortars. However, it achieved greater prominence during the 90's, when other authors also linked waste to other areas, such as reusing waste in concrete, paving and even the emergence of the first recycling plants (Miranda et al., 2009.)

Several studies and investigations have been carried out in this country since then. One survey conducted in 350 Brazilian cities deserves special attention. It calculated the amount of construction waste collected by public garbage collection utilities for each region in Brazil (Table 1). The country collected a total of 99,354,000 kg/day of waste in 2010 through its public utility service, which amounts to approximately 31 billion kilograms of CDW per year (Abrelpe, 2010).

Brazil also has some public policies that encourage builders to seek best practices regarding treatment of all waste produced on building sites. According to Lordêlo et al.

(2006), the main action put into practice in legal terms was the publication of CONAMA (National Environmental Council) Resolution 307. This Resolution came into effect on 5 July 2002, and establishes directives and criteria for the management of construction waste and regulates actions that are needed to minimise waste-related environmental impacts. The Resolution adds that the primary objective is not to produce waste, and when this is not possible, to reduce, reuse and recycle waste so that it is appropriately disposed of (CONAMA, 2002).

One of the instruments provided for in Resolution 307 to implement waste management is the Integrated Building Industry Waste Management Plan. It defines responsibilities for both cities and businesses that produce large volumes of waste. Cities are responsible for developing City Waste Management Programs for the Building Industry by issuing directives for small producers in compliance with the technical criteria for the local urban cleaning system. Companies are responsible for developing and implementing Construction Waste Management Projects to establish the necessary procedures for proper handling and disposal of environmental waste (CONAMA, 2002).

Table 1 Amount of CW collected by region in Brazil

Region	*2009*	*2010*		
	CDW collected (tons/day)/rate (kg/inhab/day)	*City population (inhab)*	*CDW collected (kg/day)*	*Rate (kg/inhab/day)*
North	3,405/0.297	11,663,184	3,514,000	0.301
Northeast	15,663/0.412	38,816,895	17,995,000	0.464
Central-West	10,997/0.918	12,479,872	11,525,000	0.923
Southeast	46,990/0.632	74,661,877	51,582,000	0.691
South	14,389/0.630	23,257,880	14,738,000	0.634
Brazil	91,144/0.576	160,879.708	99,354,000	0.618

To assist in the treatment and disposal of construction waste, CONAMA Resolution 307 proposes a classification which is divided into four categories:

- Class A: reusable or recyclable waste, such as concrete, mortar, bricks, blocks, plates, and tiles, including soil from land levelling
- Class B: recyclable waste such as plastic, paper, cardboard, glass, metal and wood
- Class C: waste that does not yet have any economically feasible technology or application to enable its recycling or recovery, such as plaster products
- Class D: hazardous waste such as paints, solvents and oils.

Another regulatory action in Brazil involves technical norms that give guidance in the search for viable solutions in the context of construction waste. They refer to directives for the development of projects for transhipment, screening, landfill and recycling areas as well as characteristics for recycled aggregates that can be employed in the construction of floors and production of non-structural concrete (Table 2).

In addition to these, there are standards not directly related to CW issues, but which can contribute to its management. This is the case of norms NBR 10004:2004 (Solid

Waste – Classification) and NBR 10007:2004 (solid waste sampling), since construction waste is also solid waste produced in an urban setting.

NBR 10004:2004 also proposes a solid waste classification, divided into two classes. The first of these, Class I, comprises waste considered hazardous, and the second, Class II, refers to non-hazardous waste and is further divided into two subclasses – inert or non-inert – depending on their characteristics of biodegradability, combustibility or solubility in water (NBR 10004:2004).

Table 2 Brazilian technical norms for construction waste

Standards	*Year*	*Information*
NBR 15112: *Resíduos da Construção Civil e Resíduos Volumosos – Area de Transbordo e Triagem – Diretrizes para projeto, implantação e operação* (*Construction Waste and Bulk Waste – Transhipment and Screening Area – Project, Implementation and Operation Directives*).	2004	Waste transhipment and screening procedures for different waste classes, including environmental control and protection.
NBR 15113: *Resíduos Sólidos da Construção Civil e Resíduos Inertes – Aterros – Diretrizes Para Projeto, Implantação e Operação* (Solid Construction Waste and Inert Waste – Landfill Areas – Project, Implementation and Operation Directives).	2004	Site preparation procedures to receive Class A waste, including water and environmental protection, providing guidance on control and monitoring plans.
NBR 15114: *Resíduos Sólidos da Construção Civil – Áreas De Reciclagem – Diretrizes Para Projeto, Implantação e Operação* (Solid Construction Waste – Recycling Areas – Project, Implementation and Operation Guidelines).	2004	Area isolation procedures and Class A waste collection, screening and processing procedures.
NBR 15115: *Agregados Reciclados de Resíduos Sólidos da Construção Civil – Execução de Camadas de Pavimentação – Procedimentos* (*Recycled Aggregates from Solid Construction Waste – Use in Paving Layers – Procedures*).	2004	Characteristics of aggregates and conditions for use and control in the strengthening of sub-grade, sub-base, base, and primary coatings.
NBR 15116: *Agregados Reciclados de Resíduos Sólidos da Construção Civil – Utilização em Pavimentação E Preparo de Concreto Sem Função Estrutural – Requisitos* (*Recycled Aggregates from Solid Construction Waste – Use in Paving and Non-Structural Concrete – Requirements*).	2004	Characteristics of aggregates and conditions for production and use of aggregates in paving and non-structural concrete.

4 Solid waste management project in the building industry

Solid waste management project in the building industry (SWMPBI) consists of activities that should be developed within building sites and are directly associated with the production and handling of waste, and its creation and implementation are the responsibility of the great producers of waste. The project must be submitted together with the construction project to the relevant local government agency for analysis and approval (CONAMA, 2002), legalising the project for construction.

In addition to informing the relevant agencies of how the waste will be handled during the development, the project also guides the technical staff to meet and implement

the provisions as provided in CONAMA Resolution 307/02. Its aim is to characterise the waste produced, estimate the amount produced, propose measures to reduce its production and establish procedures for proper treatment of the waste (Novaes and Mourão, 2008).

According to Article 9 of CONAMA Resolution 307, the SWMPBI should include five different activities: characterisation, screening, transport, packing and waste disposal (CONAMA, 2002).

Table 3 Publications about construction site waste management

Title	*Participating institutions*	*Region*	*Author*
Cartilha de Gerenciamento de Resíduos Sólidos para a Construção Civil (*Booklet on Solid Waste Management for the Building Industry*)	SINDUSCON-MG, Belo Horizonte City Government, SENAI-MG, private companies and autonomous workers	Minas Gerais	Cunha (2005)
Gestão Ambiental de Resíduos da Construção Civil – A Experiência do Sinduscon-SP (*Environmental Management of Waste in the Building Industry – The Sinduscon-SP Experience*)	SINDUSCON-SP, Obra Limpa (clean site) and information and techniques for the building industry	Sao Paulo	Pinto (2005)
Gestão de Resíduos na Construção Civil (*Waste Management in the Building Industry*)	SENAI-SE, SENAI-DN, SEBRAE-SE, COMPETIR and SINDUSCON-SE	Sergipe	Barreto (2005)
Manual de Gestão Ambiental de Resíduos Sólidos na Construção Civil (*Manual of Environmental Management of Solid Waste in the Building Industry*)	Coopercon-CE, SENAI-CE and FIEC-CE	Ceará	Novaes and Mourão (2008)
Guia para Elaboração de Projeto de Gerenciamento de Resíduos da Construção Civil (*Guide for the Creation of Waste Management Projects in the Building Industry*)	CREA-PR	Paraná	Lima and Lima (2009)

Using this project on the construction site brings positive consequences for firms. Pinto (2005) in a study with eleven construction companies in the metropolitan region of Sao Paulo concludes that the main positive aspects perceived as a result of the implementation of a waste management program are:

- reduced costs of collection
- reduced wastage (less production of waste)
- reuse of waste within the building site
- clean and tidy building sites
- reduced risk of accidents at work.

Several publications can be currently found in Brazil to assist firms in preparing their SWMPBI. Authors in different regions of the country present the content in the form of manuals, professional guides or booklets developed in partnership with several

institutions such as SINDUSCON, SEBRAE, SENAE, CREA, town or city councils, private companies, among others (Table 3).

These works propose models, methodologies and even step-by-step guides to be followed by firms in the phases of preparation and implementation of a SWMPBI. As well as providing guidance for the development of the five stages as outlined by the CONAMA Resolution, these works present other information that help make the project more complete. These include data on waste production in the region where the work was published, information on production indicators and the composition of construction waste, presentation of regulations in force within the country (Federal and Municipal Laws, Technical Norms and CONAMA Resolution 307) and results from studies of program implementation for construction waste management in building firms.

As for the SWMPBI, works under review have a structure organised into a sequence of activities to be followed by firms during the development of the project on the building site. However, this sequence is not standardised as can be seen in items 4.1 to 4.5.

4.1 Booklet on Solid Waste Management for the Building Industry (Cartilha de Gerenciamento de Resíduos Sólidos para a Construção Civil)

This booklet proposed by Cunha (2005) presents a basic guide for the development of a SWMPBI containing five different steps that can be taken by companies for the development of a project: general information, demolition, SWMPBI elements, environmental education and communication, and the SWMPBI implementation schedule.

1 General information: Refers to all the information drawn up that characterises the firm and the construction. The company data involves the identification of the building firm, the team responsible for developing the SWMPBI and the technical staff responsible for the construction. The characterisation of the construction involves its location, with full address, identification of the building system, presentation of the architectural plan showing the location of the building and the site, a record of the total number of workers, including outsourced contractors, and presentation of the project schedule.

2 Demolition: Presentation of the demolition permit, provided this service is part of the scope of the work.

3 SWMPBI elements: Covers seven different activities to be carried out by the site team:

- waste characterisation – classification of waste types according to the classification in CONAMA Resolution 307 (Classes A, B, C and D, plus Class E for domestic type waste), estimated average weekly production by waste type (volume or weight), and description of the procedures adopted for quantification of the waste produced
- waste minimisation – procedures used on site in order to minimise waste production
- waste segregation – procedures used on site in order to segregate waste at its place of production

- Packing/storing – procedures used on site in order to pack waste so as to guarantee its integrity, as well as to identify places on site intended for storage of each type of waste, and inform what system is adopted for storage, identifying the characteristics of the storage places or equipment
- transport – identification of the firms responsible for construction waste collection and transport, including the types of vehicles and equipment used, and the collection times and itinerary.
- waste transhipment – mapped location of city transhipment units
- waste disposal – identification of all the disposal units, which are regulated by the authorities according to the type of waste to be disposed of, identifying who is responsible for its disposal (the producers themselves, a contracted firm or the local authorities).

4 Environmental education and communication plan: Mobilisation, awareness and environmental education actions for workers in order to achieve goals of minimisation, reuse and waste segregation at origin, as well as to provide the correct packing and transport.

5 SWMPBI implementation schedule for the duration of the construction.

4.2 Environmental Management of Waste in the Building Industry – The Sinduscon-SP Experience (Gestão Ambiental de Resíduos da Construção Civil – A Experiência do SINDUSCON de São Paulo)

Pinto (2005) does not present a step-by-step guide to be followed by building firms, but emphasises that the SWMPBI must explicitly focus attention on the characterisation, screening (or segregation), packing, transport and waste disposal activities, as presented by Cunha (2005). In addition to these activities, packing, transport and disposal are also emphasised.

Packing should be performed in two stages. Initial Packing comes first, in which waste is stored as close as possible to its place of production, consistent with its volume and preserving good organisation of space throughout the construction period. Later, final packing is carried out, when waste is stored in appropriate containers to be removed from the site.

The transport activity is also divided into internal and external transport. Internal transport may occur horizontally (carts, wheelbarrows, manual transport) or vertically (cargo lift, crane or debris chute). A team of workers is also necessary for transporting waste along the floors of a building so as to adjust the task routine to the availability of vertical transport equipment. As for external transportation, a building company must consider certain factors in choosing a waste collection company, such as compatibility with the final form of waste packing, minimising collection and removal cost, the possibility of waste treatment and suitability of waste removal equipment as provided for in the legislation (Pinto, 2005).

Finally, for waste disposal, Pinto (2005) suggests combining environmental commitment with cost-effectiveness, and analysing certain factors to help find the best solution for waste disposal. Such factors include evaluating the possibility of reusing and recycling waste on site, the proximity of disposal sites to minimise transport costs, and

checking the existence of specialised areas to receive small volumes of problem waste, making its disposal more efficient.

In addition to this information, the author makes some recommendations to assist in the development of a SWMPBI:

- reuse and recycling: consider the potential reuse of materials, or the economic feasibility of recycling waste on site, thereby avoiding the additional costs of purchasing new materials and their removal from site
- organisation of the building site: the site should be well-organised, carefully planning the storage spaces for stocking new materials to be used in the construction as well as the waste packing areas
- training of the team: building site workers should be given guidance as to the tidying, sorting and disposal of waste
- SWMPBI monitoring: checking whether the activities included in the project are being performed correctly, by using a standard checklist and producing regular reports during the construction period.

4.3 Waste Management in the Building Industry (Gestão de Resíduos na Construção Civil)

Barreto (2005) presents the SWMPBI as a set of activities, which comprise characterisation, screening (or segregation), packing, transport and waste disposal.

The packing activity should be carried out in such a way as to avoid contamination of waste, particularly Class A waste, since this has a greater potential for recycling. For disposal, Class B waste can be sold or donated to recycling agents, especially garbage pickers or cooperatives.

The study also presents some directives on how to create a SWMPBI. Content is exhibited only by topic with no further explanatory comments on the issues addressed. According to Barreto (2005), the project should include waste reduction, reuse and recycling plans, one stage of preparation for the building site and one for the workforce, who should be sensitised, have their awareness raised, and be monitored and assessed.

4.4 Manual of Environmental Management of Solid Waste in the Building Industry (Manual de Gestão Ambiental de Resíduos Sólidos na Construção Civil)

Novaes and Mourão (2008) present a manual with a basic project elaboration guide similar to the first and third stages proposed by Cunha (2005) and presented in Section 4.1. When identifying the company and the project, the authors point out that the building firm should be identified, as well as the technicians responsible for the construction, the technicians responsible for the program and the characterisation of the project (construction and demolition). The activities to be developed on site should include waste characterisation with quantitative estimates, and the development of a waste minimisation, segregation, packing, transport and disposal policy.

The manual then goes on to provide step-by-step activities related to the SWMPBI, divided into four stages: design, training, action and assessment.

1 Design: Consists of developing a SWMPBI by a technician responsible for the project and the building company. It defines the types and amount of waste produced and ways to reduce, pack, collect, transport and dispose of it.

2 Training: Should be given by a team made up of the construction manager, safety at work technician, foreman and production supervisors, in order to inform the jobsite workers team of the environmental impacts related to construction waste, present the SWMPBI, set up the new physical arrangement for the building site, show the benefits gained by using the project, and acquire and distribute the collection and signalling devices on site.

3 Action: Carrying out the activities of waste segregation, waste collection at the place of production, initial packing, internal transport on site, final packing, final transport and disposal.

4 Assessment: Must accompany total produced in order to close the balance of waste at the end of construction. It should also include a report containing information on expected quantities and quantities produced, including information on the firm responsible for transport and the location of the final disposal.

4.5 Guide for the Creation of Waste Management Projects in the Building Industry (Guia para Elaboração de Projeto de Gerenciamento de Resíduos da Construção Civil)

Lima and Lima (2009) present a basic SWMPBI preparation guide very similar to the one presented by Cunha (2005). The following stages are considered: general information, SWMPBI elements, environmental education and communication, and the SWMPBI Implementation schedule.

The demolition stage does not appear explicitly and is included in general information. Transport is divided into internal and external transport. For internal transport, waste should be moved to the packing area, which is generally performed by winches, cranes, cargo lifts or wheelbarrows. In addition to the information already given in Cunha (2005), External Transport, on the other hand, must be performed by licensed companies, which generally use trucks with multi-crane equipment or dump trucks which should be covered with tarpaulins to avoid spilling material on public roads. Transport should be controlled by means of a record card known as waste transport control, containing producer information, amount and type of waste, carrier information and final destination for the waste. This control is important for the systematisation of the information on the production of waste on site.

Besides these considerations, the guide features the addition of one more stage to be included in the SWMPBI – reuse and recycling. This stage should describe all procedures to be followed to go ahead with the reuse and recycling of waste produced on site.

The guide also provides recommendations to include an initial planning stage, where the construction projects of a building should be assessed in order to find ways to minimise waste production. At this point, it is important that the architectural project design takes into account the building system to be adopted, types of materials to be used, modulations, and integration with complementary projects. Budgeting must also be well done to avoid losses from purchase of excess material (Lima and Lima 2009).

5 Results

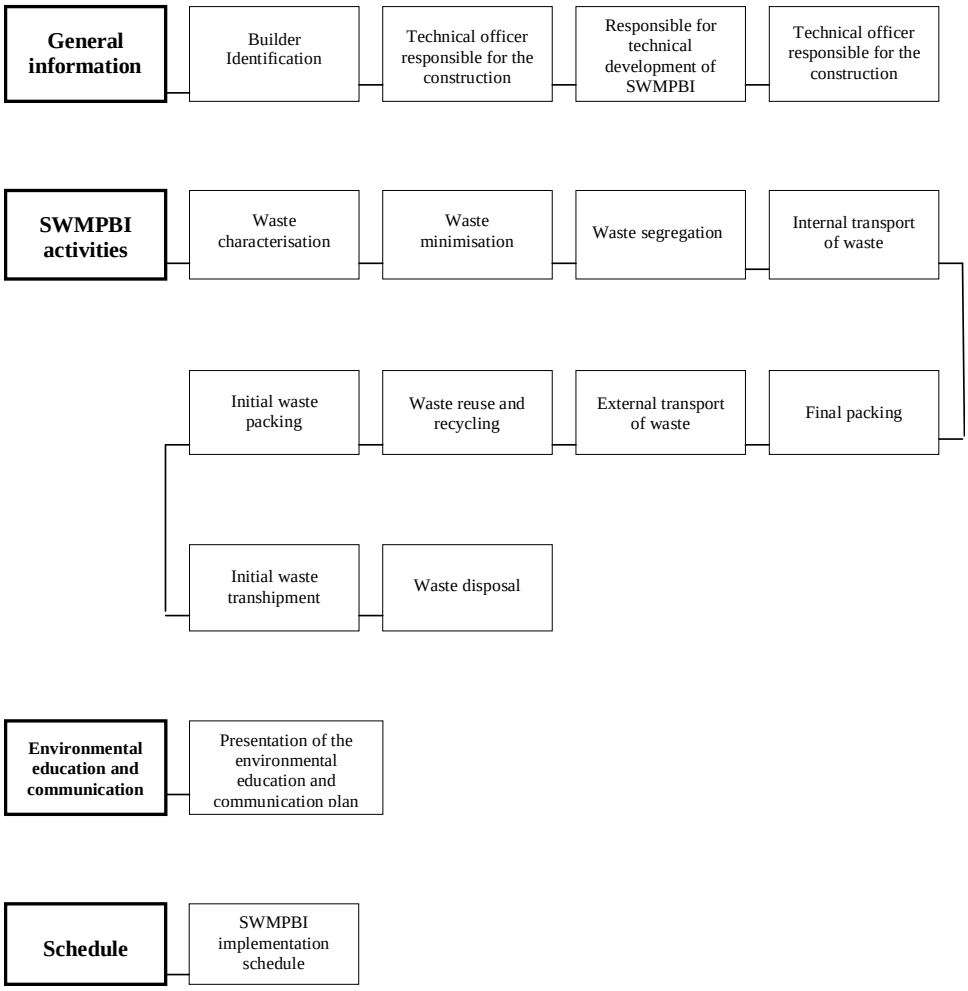
There is no set standard for the SWMPBI structure in the works we analysed. They all follow the minimum recommendations in CONAMA Resolution 307, including characterisation, screening, transport, packing and disposal activities. However, some studies go further, and recommend other activities that make the project more complete: minimisation, transhipment, reuse and recycling of waste.

Table 4 Comparative chart

Phases	*Stages in a construction waste management project*	*a*	*b*	*c*	*d*	*e*
General information	Builder identification	x			x	x
	Technical officer responsible for the construction	x			x	x
	Responsible for technical development of SWMPBI	x			x	x
	Technical team responsible for the SWMPBI	x				x
	Project characterisation	x			x	x
SWMPBI activities	Waste characterisation	x	x	x	x	x
	Waste segregation	x	x	x	x	x
	Waste packaging	x	x	x	x	x
	Waste transport	x	x	x	x	x
	Waste disposal		x	x	x	x
	Waste minimisation	x		x	x	x
	Waste reuse		x	x		x
	Waste recycling		x	x		x
	Waste transhipment	x				x
Demolition	Demolition license	x				x
Environmental education and communication	Presentation of the environmental education and communication plan	x				x
Schedule	SWMPBI implementation schedule	x				x

Notes: a *Cartilha de Gerenciamento de Resíduos Sólidos para a Construção Civil* (*Booklet on Solid Waste Management for the Building Industry*) (Cunha, 2005)
b *Gestão Ambiental de Resíduos da Construção Civil – A Experiência do Sinduscon-SP* (*Environmental Management of Waste in the Building Industry – The Sinduscon-SP Experience*) (Pinto, 2005)
c *Gestão de Resíduos na Construção Civil* (*Waste Management in the Building Industry*) (Barreto, 2005)
d *Manual de Gestão Ambiental de Resíduos Sólidos na Construção Civil* (*Manual of Environmental Management of Solid Waste in the Building Industry*) (Novaes e Mourão, 2008)
e *Guia para Elaboração de Projeto de Gerenciamento de Resíduos da Construção Civil* (*Guide for the Creation of Waste Management Projects in the Building Industry*) (Lima e Lima, 2009)

Figure 1 Stages in a construction waste management project



There are also guidelines to support the development of a SWMPBI, such as concern with site organisation, providing site team training, monitoring the actions included in the SWMPBI, and implementing an initial planning stage, analysing the project designs and the construction processes adopted.

Another noteworthy factor is that, of all the studies reviewed, the most complete regarding all the information to be included in a SWMPBI was the guide developed by Lima and Lima (2009), as shown in Table 4.

The methodology described in the Manual de Gestão Ambiental de Resíduos Sólidos na Construção Civil (Manual of Environmental Management of Solid Waste in the Building Industry) (Novaes and Mourão, 2008), as well as in the Guia para Elaboração de Projeto de Gerenciamento de Resíduos da Construção Civil (Guide for the Creation of Waste Management Projects in the Building Industry) (Lima and Lima, 2009), contain similarities with the basic guide suggested by Cunha (2005) in Cartilha de Gerenciamento de Resíduos Sólidos para a Construção Civil (Booklet on Solid Waste Management for

the Building Industry). However, the first two give additional information to assist in the preparation of a SWMPBI.

As a result of the analysis of these five studies, the main actions that Brazilian companies should take on their building sites in order to achieve appropriate environmental management and waste disposal are shown in the model presented in Figure 1.

6 Conclusions

Massive production of waste on building sites and its improper disposal are the main causes contributing to negative impacts on the environment, society and urban areas. It is extremely important that building firms reappraise their construction and management processes as regards the waste they produce during their construction activities.

Since CONAMA Resolution 307 came into force, Brazil has made significant progress in this direction, gradually increasing the number of regions that adopt waste management practices in order to regulate the situation in the Building Industry.

Moreover, there are several publications produced in different regions of Brazil, which present methodologies that should be incorporated by building companies attempting to develop a Waste Management Project in the Building Industry.

Thus, the creation of such projects by building companies contributes to the reduction of waste and to its proper disposal, and promotes the minimisation of environmental and social impacts in urban areas. It is also an essential tool to achieve optimal performance on building sites by improving their organisation and reducing costs.

Project activities involving waste characterisation, minimisation, segregation, transport, packing, reuse and recycling define actions that are necessary for proper construction waste management, resulting in greater organisation on site and combating massive waste production. Waste transhipment and disposal complete the set of activities that ensure proper environmental waste disposal.

In addition to these, there are other actions that can be carried by building companies in order to help develop a SWMPBI on the building site, such as planning site organisation, providing workforce training, checking actions included in the SWMPBI by monitoring and analysing development projects in order to reduce waste production as much as possible. Many of these actions are carried out as part of the construction quality management.

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