

Construction waste management in the Greater Bay Area: Prospects and challenges for construction managers

Dr Wilson Lu

Associate Professor, Department of Real Estate and Construction; Associate Dean (Research), Faculty of Architecture, The University of Hong Kong, Pokfulam, Hong Kong.

Email: wilsonlu@hku.hk

The unprecedented “Greater Bay Area” development

The Outline Development Plan for the Guangdong-Hong Kong-Macao Greater Bay Area (hereafter the GBA) was promulgated on 18 February 2019, signifying a new milestone in its development. The GBA comprises the two Special Administrative Regions of Hong Kong and Macao, and the nine municipalities of Guangzhou, Shenzhen, Zhuhai, Foshan, Huizhou, Dongguan, Zhongshan, Jiangmen and Zhaoqing in Guangdong Province. The 11 economies included in the GBA were worth US\$1.58 trillion in 2017, covering a total area of 56,000km² and a total population around 70 million by the end of 2017. The Outline Development Plan is an important outline document guiding the current and future cooperation and development of the GBA, which plays a significant role in the overall development of the country. The unprecedented plan of the GBA injects excitement to almost everyone involved, including us, construction stakeholders.

We have a good reason to feel excited. Construction plays a pivotal role in GBA strategic development. As shown in Fig. 1, construction consistently contributes around 3-5% to the Gross Domestic Production (GDP) of the 11 regions in the GBA. In 2016, the gross output value of construction reached HKD236.5 billion, MOP19.2 billion, CNY283.3 billion and CNY239.2 billion in Hong Kong, Macao, Guangzhou and Shenzhen, respectively. A huge amount of construction activity is being undertaken to support GBA growth, including housing, building, and infrastructure projects to provide shelters, accommodate our socio-economic activity, and promote connectivity. According to Hong Kong Construction Industry Council, construction expenditure will continuously grow over the next five years, maintaining a high level of HK\$180-200 billion per annum in Hong Kong. A similar tendency can be seen in other GBA regions in Guangdong Province. For example, the Guangdong 13th Five-Year Development Plan highlighted that provincial gross output value of the construction sector could reach CNY1.5 trillion with a yearly growth rate of 12% by 2020. Construction is set to continuously burgeon in the GBA.



Fig. 1 The construction GOV and its contribution to the GDP of the 11 regions in the GBA (Data Source: 11 regions' *Statistical Yearbooks* in 2016)

Looming construction waste crisis

Notwithstanding its significance, construction also generates a lot of by-products, one of which is the vast amount of construction waste material (CWM). CWM, or construction and demolition (C&D) waste material, is any substance, matter or thing generated as a result of construction work such as site clearance, excavation, construction, refurbishment, renovation, demolition and road works, and abandoned. In Hong Kong, CWM is divided into two generic portions: inert and non-inert. Inert CWM includes debris, rubble, earth, bitumen and concrete, while non-inert CWM mainly comprises bamboo, plastics, glass, wood, paper, vegetation and other organic materials. The non-inert part, owing to its non-combustible nature, is not suitable for incineration, land reclamation, or other reuse or recycling and must be disposed of at landfills. A similar taxonomy is applicable throughout the GBA, as construction waste management systems in the region were developed with reference to the Hong Kong experience.

Fig. 2 illustrates the CWM generation in Hong Kong over the past decade. Generally speaking, CWM generation is closely associated with construction output: the more built, the more CWM produced. Construction contributes around 5% of the GDP, but it consistently contributes around 25-30% of the solid waste landfilled in the precious, rapidly diminishing landfills in Hong Kong. In contrast, the amount of inert CWM is around 15 times that of non-inert CWM. Finding sufficient public fill space to contain the inert waste or properly channel to "digest" it is extremely burdensome. Other regions in the GBA more or less witness the similar situations. CWM is looming as a crisis in the GBA. While we make significant contribution to the GBA, the world is now interested in "green GDP". The CWM produced by the construction industry must be properly handled. Without a strategy to proactively deal with the construction waste, it is no exaggeration to say that the GBA development would be derailed.

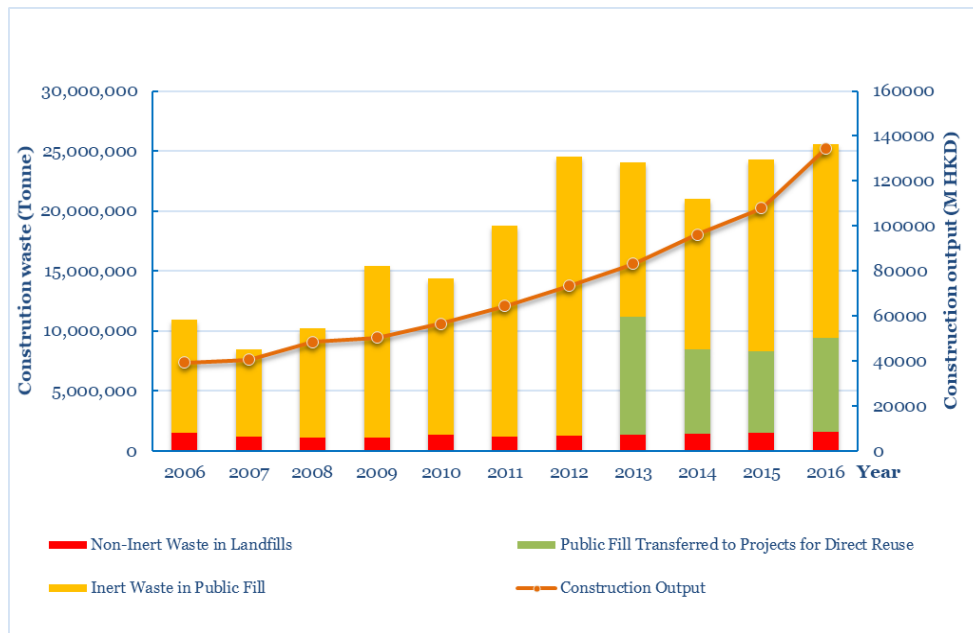


Fig. 3 CWM generation and construction output in Hong Kong (Data Source: EPD, 2017)

With the promulgation of the Outline Development Plan, in particular its strategies of “expediting infrastructural connectivity”, “taking forward ecological conservation”, and “jointly developing GBA cooperation platforms”, the GBA will provide enormous prospects to deal with the waste crisis and making construction a true supporter to the sustainable development of the GBA. Meanwhile, construction managers are facing enormous challenges ahead.

Prospects

Waste is just the misplaced resources. The large amount of inert CWM can actually be reduced, reused, or recycled (a.k.a 3R). It can be used for different purposes, such as recovery and recycling into aggregates for concrete, site formation, and land reclamation. It has been widely reported that the concrete aggregates in the GBA are quite short of supply, while on the other hand, the inert CWM contains a certain portion of materials that can be recycled as concrete aggregates. Sharing CWM for site formation and land reclamation is taking place in each individual economy but not the GBA as a whole. It is expected that the development of the GBA will bring the following prospects.

1. More buffer to reuse or recycle CWM

A CWM sharing economy can exist: a region possessing spare capacity can receive CWM from another for proper compensation; a region could use inert CWM from another. Shenzhen, for example, disposed around 20% of its CWM to nearby cities in 2015. This does not necessarily entail predatory dumping by an economically developed region in one less developed. However, current *de facto* CWM sharing in the GBA is too modest owing to various technical, economic, attitudinal, and institutional barriers. Sharing CWM amongst different construction sites, e.g., for site formation, for backfill, is highly desired. But owing to construction activities are running very fast in Hong Kong and GBA, to find a matching site is not always easy. The key to successful sharing is to explore options in all GBA regions, through

which, a bigger buffer to deal with CWM will be available for achieving the great construction plan of GBA. It is expected that by looking at the whole GBA it is possible to easier for find the matching projects than now.

2. Land reclamation in Hong Kong

From a technical point of view, land reclamation is a big consumer of CWM that should be closely monitored. In the Netherlands, Japan and Singapore, CWM is one of the most popular materials for land reclamation. Rocks and aggregates recycled from CWM are used for land reclamation in the US and Taiwan. In Hong Kong, “up to end 2014, we have delivered some 73.6 million tonnes (“Mt”) of surplus public fill to Taishan enabling the creation of new land of some 570 hectares there”. So, according to the experiences around the world, CWM, properly processed, can be used for land reclamation.

Following the Lantau Tomorrow Vision (“明日大嶼”) plan, our Chief Executive Ms. Carrie Lam in her 2018 policy address included the creation of a third core business district by constructing artificial islands with a total area of about 1,700 hectares through massive land reclamation. Recently,

the Government Development Bureau started to unfold the plan of reclamation of 1,000 hectares of land in the waters off Lantau Island. This has triggered another round of debate that the author does not want to be involved in. However, when it is decided to go for it, we construction industry should argue for using the CWM as the filling materials. That will allow a “win-win” situation. The ambitious land reclamation plan will require huge amount of filling materials, which will push up the marine sand or artificial sand. The suppliers in Mainland and around the Southeast Asian are longing for the huge profit. Using marine sand or artificial sand will cause something I call “double environmental jeopardy” – it will jeopardize the environment of both the original supplying places and the reclaimed areas. Using CWM can ease the burden of landfill or public fill, it will low the land reclamation cost as well.



3. Opportunity to level up construction waste management

Currently, construction waste management in the GBA, even in Hong Kong, is in a low level. A recycling industry is yet to be established. Irresponsible conducts such as illegal dumping, or improper processing are reported every now and then. It is expected that the GBA will provide an opportunity to better manage CWM, to make construction really sustainable to the overall GBA development. Although not perfect, Hong Kong can act as an exemplar to help other regions in the GBA to level up their CWM management system. For example,

construction waste does not need to be disposed of completely, when properly managed, CWM can be transformed into useful materials for building and construction activities. Sharing construction waste across the cities in GBA regions presents a win-win situation for both the giving and receiving parties. It is also considered to be a more environmentally-friendly option since resources need not be spent on purchasing virgin materials.

Challenges

However, there are also various challenges to be tamed before the above opportunities can be harnessed.

1. Misperception of construction waste materials

Construction waste material, perhaps with a “waste” in it, has been much stigmatized. The general public automatically believes that they should be eliminated or disposed far away. Transportation of CWM across borders is thus heavily regulated. Owing to this attitudinal barrier, CWM trading is *de facto* a black market. It is not transparently pursued by the related industries and government authorities in the GBA. Actually, as mentioned above, CWM are the recourses being put in the wrong place. CWM is generally classified into two categories: inert and non-inert. The former refers to material which have minimal or no chemical or biological activity such as debris, rubbles, earth, bitumen, and concrete. They can be recycled into bricks, blocks or aggregates for concrete production, site formation, and land reclamation etc. In Hong Kong, over 90% of construction waste is inert that can be reused or recycled. Most CWM can be transformed into renewable resources for building and construction activities to reduce using natural virgin materials and minimize the waste going to landfill.

2. Different technical standards and unclear specifications

Actually, the general public’s misperception of CWM should not be blamed. The misperception is due in large part to the unclear specifications on tradable/sharable materials. Lacking specifications, quality supplies of CWM cannot be guaranteed. This may foster asymmetric information between the buyer and seller regarding quality, i.e. the ‘lemons problem’, undermining the stakeholder trust that underpins transactions in a sharing economy. Another barrier is the different technical standards governing CWM management, in particular 3R. It needs to analyze the engineering and environmental properties of CWM and clarify the specifications of sharable/tradable CWM. It is important to achieve a consensus among all regions in the GBA on these CWM standards

3. Poor information

Poor information may relate to products/services to be shared. Lack of clear specifications of the sharable/tradable CWM is a major cause of poor information. It is also seen in the costs (e.g. processing, operation, transportation, environment, and opportunity costs) and benefits (e.g. direct or indirect benefits) of CWM sharing. Poor information is particularly a problem when it relates to demand and supply of CWM. Regions including Hong Kong, Shenzhen and Guangzhou have established online platforms, similar to Uber and Airbnb, to help publicize CWM demand and supply information and enable matching. The Hong Kong CIC broadcasts this information via WhatsApp, hoping to encourage more active project-to-project sharing.

However, the effectiveness of these platforms is questionable. Instead, there needs to be a GBA-level information sharing platform to strategically coordinate the demand and supply.

4. Silo thinking

The problem of silo thinking here refers to the various jurisdictions in the GBA may solely focus on their own interests and thus pursue predatory dumping to other regions without treating the GBA as a whole. The silo thinking may originate from the unparallel economic positions, traditional technical advantages, different environmental protection standard, or even the long persistent or emerging arrogance. This silo think is envisaged as the biggest barrier for sharing/trading CWM in the GBA in the future.

Countermeasures

In view of the prospects and challenges to deal with the CWM crisis in the GBA, Dr Lu, teamed up with professors and experts in Hong Kong, Shenzhen, and Guangzhou to apply for a research project from the Hong Kong Government Policy Innovation and Co-ordination Office and secured a Strategic Public Policy Research project. The primary aim of the project is to examine policy options that can boost better CWM sharing/trading in the GBA. Their major proposition is to set up a Waste Trade Organisation (WTO) across different jurisdictions in the GBA (see Fig. 4 for a press conference photo). Their specific measures include the follows.



Fig. 4. Press conference by Dr Lu and his team

(from left to right: Prof. C.S. Poon, Chair professor, Dept. of Civil and Environment Engineering, The Hong Kong Polytechnic University; Prof. K.W. Chau, Head, Dept. of Real Estate and Construction, The University of Hong Kong; Dr Wilson Lu, Associate Professor, Dept. of Real Estate and Construction, The University of Hong Kong; Prof. Jiayuan Wang, Dean, Faculty of Civil Engineering, Shenzhen University)

1. A “Green label” system

A “Green label” is a certification for CWM that reach certain standards and can be shared/traded. Different ‘green labels’ can be recommended to qualify CWM as a sharable/tradable ‘regular product’ rather than waste likely to pollute the environment. Different labels represents different types of CWM for diffent usage. Proper quality assurance can also help convince authorities and the general public to obtain ethical clearance for sharing/trading CWM. The green labels will alleviate information asymmetries for the CWM information-sharing platforms, foster trust between demanders and suppliers, and lower the transaction cost to make CWM sharing economically viable.

2. An informaton platform

An online CWM information-sharing platforms similar to the Uber and Airbnb models have been separately developed in Hong Kong, Shenzhen and Guangzhou. For example, a ‘Construction Debris Bank’ has been established to store, distribute and share construction debris among eighty construction projects in Dapeng District of Shenzhen; the Hong Kong CIC broadcasts this information via WhatsApp, hoping to encourage more active project-to-project sharing. However, the effectiveness of these platforms is questionable. The key to successful sharing is to explore options in all GBA regions, creating a bigger buffer. However, no information sharing platform exists to allow coordination of CWM demand and supply. Therefore, a GBA-level information sharing platform will be recommended to allow CWM demand and supply potential to become a real exchange. The platform can help publicize CWM demand and supply information and enable matching to coordinate demand/supply of CWM among contractors.

3. Economic instructments

The governments can also undertake some economic instruments to boost the establishing and operation of the WTO. For example, providing subsidy for cross-regional waste sharing and trading, building a bonus system to encourage waste sharing and trading among the GBA, or increasing the cost of waste disposal and penalizing illegal dunping. Such economic instruments can help promote the waste sharing and trading among the GBA, reduce the disposal of CWM, reduce the demand of construction material, and thereafter, make GBA a more sustainable area for economic development.

All the measures introduced above can be cumulated in the WTO. This WTO, similar to the World Trade Organisation, can serve as a platform for negotiating trade agreements and a dispute resolution. This WTO can be an immediate working item after the top level GBA Leading Group is set up. Certainly, these are just some initatial measures. More works of CWM management desire us, construction managers, to take real, responsible action!

Acknowledgement

This research project is funded by the Strategic Public Policy Research Funding Scheme from the Policy Innovation and Co-ordination Office of the Government of the HKSAR (Project Number: S2018.A8.010.18S).