

AsiaConstruct2016

Country Report - Hong Kong

Prepared by

AsiaConstruct Team

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About the Research Centre for Construction and Real Estate Economics (RCCREE):

The RCCREE is the Hong Kong Polytechnic University's Research Centre for solution oriented research and consultancy in construction and real estate economics. It undertakes internationally relevant multi-disciplinary research that supports the advancement of the construction and real estate industries in the following areas: Economic Policy and Institutional Analysis, Real Estate Economics, Construction Economics, Housing, Human Behaviour in Economic Decision Making, and Value Management and Facilities Performance. For further information, please contact Professor Francis K.W. Wong, Director of RCCREE (bskwwong@polyu.edu.hk) or Professor Eddie C.M. Hui, Deputy Director (bscmhui@polyu.edu.hk).

I. Executive summary

The first quarter of 2016 saw the Hong Kong economy further slowing down, which only grew 0.8% in real terms over the preceding year, in contrast with 1.9% in the fourth quarter of 2015. Although private sector building works expanded solidly, public infrastructure works began to decelerate from the peak, mainly due to heated debate during funding application in the Legislative Council. Meanwhile, the construction sector registered a modest growth at 2% for 2015 as a whole, although it declined by 2.3% in the fourth quarter. The building and construction expenditure registered a modest decline in the first quarter of 2016.

The overall labour market generally stayed stable in the first quarter of 2016, reflecting the solid labour demand. The unemployment rate edged up to 3.4% from 3.3% in 2015. The total employment registered a modest growth of 0.3% and achieved 3,811,800. Wages and earnings sustained a moderate increase.

II. Macro-Economic Review and Outlook

1. Overview

In the first quarter of 2016, the economic growth of Hong Kong further slowed down with a year-on-year growth of 0.8% in real terms, in contrast with 1.9% in the fourth quarter of 2015. The seasonally adjusted GDP fell by 0.4% from the preceding quarter. On the other hand, the value of total exports of goods has been decreasing steadily since 2015. It fell by 3.6% in the first quarter of 2016 from a year earlier, and by 3.9% from the preceding quarter. The exports of services went down by 4.9% in real terms from a year earlier, and declined by 1.8% in real terms over the preceding quarter. The weakness of export performance was caused by the sluggish global demand.

Net output of the services sector grew moderately by 1.9% in real terms in 2015, down from the 2.4% growth in 2014, reflecting the slowdown in economic growth and the uncertain external economic environment. Among the major services sectors, import/export, wholesale and retail trades, and accommodation and food services declined slightly from one year earlier. Net output of financing and insurance grew solidly by 6.3% in 2015, followed by information and communications with a growth rate of 4%. Other service sectors such as transportation and storage, professional and business, retail, etc. expanded further. The net output of real estate activity decreased by 1.8% in the fourth quarter of 2015. However, it expanded modestly in 2015 as a whole.

Regarding the secondary sector, net output of the manufacturing sector declined for the second consecutive year. Meanwhile, the construction sector registered a modest growth at 2% in 2015 as a whole, although it declined by 2.3% in the fourth quarter. The building and construction expenditure registered a modest decline both in the fourth quarter of 2015 and in the first quarter of 2016. Although private sector building works expanded

solidly, public infrastructure works began to decelerate from the peak in 2015 mainly because of filibustering in the Legislative Council, according to the Under Secretary for Financial Services and the Treasury, in the Legislative Council meeting held on May 18, 2016 (Government of HKSAR, 2016).

In the first quarter of 2016, the labour market generally stayed stable. The seasonally adjusted unemployment rate edged up to 3.4%, which is similar to that of 2015. The total employment increased by 0.3% and reached 3,811,800. Nonetheless, employment of the consumption and tourism-related sectors, such as retail and accommodation, registered a modest decline amid the slowdown in inbound tourism and the slackened growth of local consumption. Wages and earnings sustained moderate growth (First Quarter Economic Report 2016, Government of the Hong Kong SAR).

2. Main Economic Indicator

Table 1: Main Socio-Economic Indicators

ECONOMIC INDICATOR						
	2010	2011	2012	2013	2014	2015
GDP & Components						
GDP in chained (2014) dollars (HK\$ million)	2,001,331	2,097,688	2,133,354	2,199,233	2,258,215	2,313,243
GDP at Current Market Price (HK\$ million)	1,741,564	1,896,695	2,040,104	2,125,353	2,258,215	2,397,124
Real GDP Growth (%)	6.8	4.8	1.7	3.1	2.7	2.4
<i>Agriculture, fishing, mining and quarrying sector</i>	3.9	0.8	-3.3	4.9	-6.0	-2.2
<i>Manufacturing Sector</i>	3.3	0.7	-0.8	0.1	-0.4	-1.5
<i>Electricity, gas, water supply, & waste management sector</i>	-0.2	0.6	1.4	-2.9	0.8	0.3

<i>Services Sector</i>	6.9	5.2	1.8	2.7	2.4	1.9
<i>Construction Sector</i>	15.6	18.3	8.3	4.2	13.0	2.0
Demographic and Inflation Indicators						
Population	7,097,600	7,103,700	7,177,900	7,221,800	7,266,500	7,324,300
Population Growth Rate (%)	0.9	0.7	0.9	0.6	0.6	0.8
Total Labor Force	3,650,400	3,734,900	3,794,900	3,858,800	3,904,400	3,925,500
Labor Force Growth rate (%)	-0.5	2.3	1.7	1.9	1.2	0.5
Unemployment Rate (%)	4.3	3.4	3.3	3.4	3.3	3.3
Inflation Rate (%)	2.9	5.7	3.7	4.3	3.5	2.5
Financial Indicators						
Interbank interest rate per annum at year end (%)	0.80	0.75	0.95	0.87	0.84	0.85
Short term interest rate* (%)	0.62	0.06	0.08	0.11	0.04	2.05
Long term interest rate** (%)	2.29	2.27	0.96	2.31	0.04	1.66
Exchange Rate against US\$	7.77	7.78	7.76	7.75	7.76	7.75

* yield of 91-day Exchange Fund Bills (mid-year)

** yield of 10-year Exchange Fund Notes (mid-year)

Sources: GDP, Demographic and Financial Indicators: Government of the HKSAR web page at <http://www.censtatd.gov.hk/hkstat/sub/bbs.jsp>; Short and long term interest rates: *Monthly Statistical Bulletin*, Hong Kong Monetary Authority, various issues.

III. Overview of the construction industry

1. Construction investment

As shown in the Table 2, construction works can generally be divided into two categories, “buildings” and “structures & facilities”. The overall expenditure of construction activities carried out by main contractors in Hong Kong registered a consecutively solid growth. The overall construction sector produced HK\$145 billion value of work in 2015, with a steady increase of about 18% over the preceding year. The public construction sector posted a continually solid growth (Table 2 & Table 3), though as before mentioned there has been a decline since the peak at 2015 due to alleged filibustering in the Legislative Council.

Table 2: Gross Value of Construction Contracts/ Expenditure

Type of Contract / Expenditure (HK\$ million)	2010	2011	2012	2013	2014	2015
Buildings	40,839	47,097	60,954	59,400	68,206	89,632
Residential	22,588	26,083	37,501	38,186	45,488	57,618
Commercial	7,979	7,648	7,564	7,659	8,223	13,116
Industrial & Storage	993	1,552	2,054	3,127	3,282	4,906
Services	9,279	11,815	13,835	10,428	11,213	13,991
Structures & facilities	20,683	30,254	43,067	52,367	54,571	55,391
Transport	10,852	19,551	30,465	41,540	44,606	48,262
Other utilities & plant	2,658	2,511	4,181	3,397	2,572	2,073
Environment	5,758	7,198	7,892	7,030	6,710	4,187
Sports & recreation	1,415	994	528	400	683	870
Overall total	61,522	77,351	104,021	111,767	122,777	145,023

Source: Report on the Quarterly Survey of Construction Output, The Census and Statistics Department, Hong Kong SAR, various issues

Table 3: Forecast of Public Construction Works

Respective Departments	Title of Contract	Scheduled Project Start	Scheduled Project Completion	Estimate of Cost (HKD)
Architectural Services Department (ASD)	Provision of Columbarium and Garden of Remembrance at Tsang Tsui, Tuen Mun	2016-17	2019-20	>=\$500M
	Provision of Columbarium at Wo Hop Shek Cemetery - Phase I	2016-17	2019-20	>=\$500M
	Sports Centre, Community Hall and Football Pitches in Area 1, Tai Po	2016-17	2020-21	>=\$500M
	Sports Centre, 5-a-side soccer pitch and public library facilities at Northwest Kowloon Reclamation Site 6, Sham Shui Po	2016-17	2019-20	>=\$500M
	Redevelopment of ex-Housing Staff Quarters in Tin Wan, Aberdeen	2016-17	2019-20	\$200M - \$300M
	Construction of rank and file quarters for Fire Services Department at Area 106, Pak Shing Kok, Tseung Kwan O	2017-18	2020-21	>=\$500M
	Signature Project Scheme (Wanchai District) - Construction of Moreton Terrace Activities Centre	2016-17	2018-19	\$100M - \$200M
	Junior Police Officers Married Quarters at Fan Garden	2017-18	2020-21	>=\$500M

Respective Departments	Title of Contract	Scheduled Project Start	Scheduled Project Completion	Estimate of Cost (HKD)
	Redevelopment of Queen Mary Hospital, Phase 1 - Main Works	2017-18	2023-24	>=\$500M
	Redevelopment of Kwai Chung Hospital (Phase 1)	2016-17	2018-19	>=\$500M
	A school for social development for boys in Area 2B, Tuen Mun	2016-17	2018-19	\$300M - \$400M
	A special school for students with mild, moderate and severe intellectual disabilities in Area 108, Tung Chung	2016-17	2019-20	\$200M - \$300M
	Renovation works for the West Wing of the former Central Government Offices for office use by the Department of Justice and law-related organisations	2016-17	2018-19	>=\$500M
	Inland Revenue Tower in Kai Tak Development Area	2017-18	2021-22	>=\$500M
	Conversion of the former French Mission Building for accommodation use by law-related organisation(s) and related purposes	2017-18	2019-20	\$100M - \$200M

Respective Departments	Title of Contract	Scheduled Project Start	Scheduled Project Completion	Estimate of Cost (HKD)
	Reprovisioning of Shanghai Street refuse collection point and street sleepers' services units to the site at Hau Cheung Street, Yau Ma Tei for the phase II development of the Yau Ma Tei Theatre project	2016-17	2019-20	\$200M - \$300M
	Re-provisioning of Transport Department's Vehicle Examination Centres at Tsing Yi	2016-17	2021-22	>=\$500M
	Kowloon East Regional Headquarters and Operational Base cum Ngau Tau Kok Divisional Police Station	2016-17	2021-22	>=\$500M
	A 30-classroom secondary school at Site 1A-2, Kai Tak Development	2016-17	2019-20	\$400M - \$500M
	Sports centre at Choi Wing Road, Kwun Tong	2016-17	2020-21	>=\$500M
	A 30-classroom primary school at Site KT2b, Development at Anderson Road, Kwun Tong	2016-17	2018-19	\$300M - \$400M
	Converting Tsun Yip Street Playground as Kwun Tong Industrial Culture Park	2016-17	2018-19	\$100M - \$200M

Respective Departments	Title of Contract	Scheduled Project Start	Scheduled Project Completion	Estimate of Cost (HKD)
	Reprovisioning of Shing Yip Street Rest Garden as Tsui Ping River Garden	2016-17	2018-19	\$100M - \$200M
	Signature Project Scheme (Kwun Tong District) - Construction of Music Fountains at Kwun Tong Promenade	2016-17	2018-19	<\$100M
	Signature Project Scheme (Kwun Tong District) - Construction of Lift Tower at Shung Yan Street in Kwun Tong	2016-17	2018-19	<\$100M
	Signature Project Scheme (Tsuen Wan District) - Redevelopment of the Sai Lau Kok Garden	2016-17	2018-19	<\$100M
	Signature Project Scheme (Kowloon City District) - Revitalisation of the Rear Portion of the Cattle Depot	2016-17	2018-19	<\$100M
	Signature Project Scheme (Eastern District) - Eastern District Cultural Square	2016-17	2017-18	<\$100M
	The demolition of existing structures in sites A and B1 of the Sung Wong Toi Vehicle Repair and Maintenance Workshop	2016-17	2019-20	<\$100M

Respective Departments	Title of Contract	Scheduled Project Start	Scheduled Project Completion	Estimate of Cost (HKD)
	The demolition of existing superstructures at Carolina Hill Road site, Causeway Bay	2017-18	2018-19	\$100M - \$200M
Civil Engineering and Development Department (CEDD)	Wan Chai development phase II, engineering works	Jan 2013	Q3 2017	\$3.35B
	Kai Tak development – Stage 3A & Stage 4 infrastructure works at north apron area of Kai Tak Airport	Jul 2013	Mid 2017	\$918M
	Infrastructure works for housing sites adjacent to Lung Ping Road at Tai Wo Ping, Shek Kip Mei	Jul 2013	End 2016	\$576M
	Kai Tak development – infrastructure works for developments at the southern part of the former runway	Nov 2015	Between end 2017 and 2019	\$2.18B
	Formation, Roads and Drains in Area 54, Tuen Mun	Nov 2015	2019	\$428M
	Dredging, Management and Capping of Contaminated Sediment Disposal Facility to the South of The Brothers	Sep 2012	Feb 2017	\$215M
	Liantang/Heung Yuen Wai Boundary Control Point and associated works - site formation and infrastructure works	Dec 2013	Mid to end 2018	\$10.31B

Respective Departments	Title of Contract	Scheduled Project Start	Scheduled Project Completion	Estimate of Cost (HKD)
	Disposal of Contaminated Sediment-dredging, management and capping of sediment disposal facility at Sha Chau	Sep 2012	Feb 2017	\$215M
	Roads and Drains in Area 16 and Area 58D, Sha Tin	Mar 2016	End 2018	\$93M
	Ma On Shan Development – Roads, Drainage and Sewerage Works at Whitehead and Lok Wo Sha, Phase 2	Jul 2015	Early 2018	\$155M
	Greening master plans for the New Territories Southeast and Northwest – priority greening works	Dec 2014	Mid 2017	\$88M
Drainage Services Department (DSD)	Yuen Long Effluent Polishing Plant – Investigation, Design and Construction	9 May 2016	Nov 2028	About \$61.8M
	Upgrading of San Wai sewage treatment works – phase 1	May 2016	March 2021	\$2,572.3 M
	Shek Wu Hui sewage treatment works – further expansion phase 1A – advance works, consultants fees and investigation	1 May 2015	End 2026	About 503M

Respective Departments	Title of Contract	Scheduled Project Start	Scheduled Project Completion	Estimate of Cost (HKD)
	Feasibility Study on Relocation of Sham Tseng Sewage Treatment Works to Caverns	Aug 2014	March 2017	About \$39M
	Relocation of Sha Tin Sewage Treatment Works to Caverns – Consultants’ Fee and Investigation	Sep 2014	2022	\$637.7M
	Feasibility Study on Relocation of Sai Kung Sewage Treatment Works to Caverns	Aug 2014	Aug 2016	About \$40M
	Reconstruction and Rehabilitation of Kai Tak Nullah from Tung Kwong Road to Prince Edward Road East - main works	Dec 2013	End 2017	About \$1,200M
	Sewerage in Nam Wa Po and Wai Tau Tsuen	Jul 2013	Sep 2017	About \$319.1M
	Tolo Harbour Sewerage of Unsewered Areas, Stage 2 Phase 1	Jul 2013	Sep 2017	About \$364.7M
	Sewerage at Clear Water Bay Road, Pik Shui Sun Tsuen and West of Sai Kung Town	Jan 2013	Jan 2017	\$359M

Respective Departments	Title of Contract	Scheduled Project Start	Scheduled Project Completion	Estimate of Cost (HKD)
	Sewers at Kam Tin, Tan Kwai Tsuen and Tong Yan San Tsuen, Storm Drains at Fanling and Covers to Tanks at Siu Ho Wan Sewage Treatment Works	Dec 2012	Jul 2016	About \$66M
	Lam Tsuen Valley Sewerage, Stage 2	Oct 2012	End 2016	About \$590M
	Yuen Long and Kam Tin Sewerage Stage 3 Package 2	Sep 2012	2016	About \$213M
	Condition Survey for Underground Sewers and Drains – Investigation	Jul 2012	End 2017	N/A
	Upgrading of Mui Wo Sewage Treatment Works and Sewerage at Mui Wo Town Centre and Wang Tong	Jul 2012	Sep 2017	About \$767M
	North District Sewerage, Stage 2 Part 2A - Pak Hok Lam Trunk Sewer and Sha Tau Kok Village Sewerage	Jun 2012	Mid 2017	About \$272M
	Village Sewerage in Kau Lung Hang San Wai, Kau Lung Hang Lo Wai and Tai Hang, and Southern Trunk Sewer Between Wai Tau Tsuen and Nam Wa Po	Jun 2012	Mid 2016	About \$317M
	Sewerage in Ping Kong, Fu Tei Pai and Tai Wo	Nov 2011	Sep 2016	About \$226M

Respective Departments	Title of Contract	Scheduled Project Start	Scheduled Project Completion	Estimate of Cost (HKD)
	Lam Tsuen Valley Sewerage, Stage 1	Oct 2011	Mid 2016	About \$270M
	Reconstruction and Rehabilitation of Kai Tak Nullah from Po Kong Village Road to Tung Kwong Road - Remaining Works	Oct 2011	End 2017	About \$1,600M
	Trunk Sewerage at Lau Fau Shan	Oct 2011	Apr 2016	About \$196M
	Happy Valley Underground Stormwater Storage Scheme	Sep 2011	Feb 2018	\$1,066M
	Rehabilitation and Construction of Trunk Sewers Underneath Shing Mun River Channel (SMRC)	Feb 2011	Mid 2016	About \$140M
	Harbour Area Treatment Scheme, Stage 2A – Planning and Design of The Upgrading Works of Stonecutters Island Sewage Treatment Works and the Preliminary Treatment Works	Aug 2007	Jun 2016	\$105.6M
	Outlying Islands Sewerage Stage 2 – Lamma Village Sewerage Phase 2 Package 1	End 2013	Mid 2018	About \$340M

Sources: Web-sites of Public Works Project Information in Development Bureau, Retrieved from http://sc1.devb.gov.hk/TuniS/www.devb.gov.hk/tc/links/public_works_project_information/index.html on July 7, 2016.

2. Construction companies

Table 4: Number of contractors and the breakdown by size

	No. of registered contractors (by July 2016)			
Buildings Department (Registered General Building Contractors)	1144			
Development Bureau (List of Approved Contractors for Public Works)	Group A	Group B	Group C	Total
	100	137	112	349
Housing Authority (Counterparty Lists)	NW1		NW2	Total
	18		23	41

Notes: 'A' denotes Group A for contracts of value up to \$30 million; 'B' denotes Group B for contracts of value up to \$75 million; 'C' denotes Group C for contracts of any values exceeding \$75 million. Group NW1 - Contractors are eligible to tender for new works contracts with a value of up to \$270M. Group NW2 - Contractors are eligible to tender for new works contracts of unlimited value.

Sources:

List of Registered General Building Contractors of Buildings Department available at http://www.bd.gov.hk/english/inform/e_gbc_1.html; List of Approved Contractors for Public Works available at <http://www.devb.gov.hk/Contractor.aspx?section=80&lang=1>. Housing Authority Counterparty List available at http://comis.housingauthority.gov.hk/ha/eng/ctp_list.jsp?LIST_CD=BLG.

3. Employees and Construction Labor

Table 5: Number of workers employed in principal jobs of construction, building and civil engineering and related disciplines

Job Levels	March 2015
Professional/Technologist	22,924
Technician	36,414
Skilled & Semi-Skilled worker	75,755
General Worker	36,800
Total	171,893

Sources: 2015 *Manpower Survey Reports on the Building and Civil Engineering Industry*, Building and Civil Engineering Industry Training Board, Vocational Training Council.

Table 6: Number of persons directly engaged in the building and civil engineering establishments

Main industry group	2012	2013	2014
Construction of buildings	24,025	22,442	25,921
Civil engineering	20,732	23,717	24,195
Demolition and site preparation	7,673	8,206	8,474
Building services installation and maintenance activities	73,828	73,165	66,592
Building finishing and other specialized construction activities	58,305	58,243	64,272
All construction activities	184,563	185,773	189,454

Source: *Key Statistics on Business Performance and Operating Characteristics of the Building, Construction and Real Estate Sectors*, The Census and Statistics Department, Hong Kong SAR, various issues.

4. Productivity

Table 7: Value added per employee

Year	Value added per employee (HK\$million)
2010	0.23
2011	0.27
2012	0.28
2013	0.28
2014	0.31
2015	0.30

Source: Value added by Construction activity: *Chain volume measures of Gross Domestic Product (GDP) by economic activity - in chained (2014) dollars*, The Census and Statistics Department, Hong Kong SAR; Employed Persons by Industry (Construction): *Hong Kong Annual Digest of Statistics*, The Census and Statistics Department, Hong Kong SAR.

Table 8: Physical Measurement of Construction Production

End use of building (Unit: Thousand sq.m.*)	2010	2011	2012	2013	2014
Private residential premises+	3665 (-5.9%)	5839 (59.3%)	5282 (-9.5%)	5235 (-0.9%)	5957 (+13.8%)
Office buildings	389 (48.5%)	172 (-55.7%)	471 (173.8%)	486 (+3.1%)	526 (+8.3%)
Hotels and boarding houses	162 (-46.2%)	401 (147%)	322 (-19.7%)	247 (-23.3%)	310 (+25.4%)
Multi-purpose commercial premises	987 (-31.6%)	455 (53.9%)	494 (8.6%)	711 (+44%)	793 (+11.6%)
Flatted factory blocks and warehouses	125 (-4.6%)	362 (189.3%)	486 (34.3%)	327 (-32.7%)	288 (-11.9%)
Total	5328 (-11.6%)	7229 (35.7%)	7055 (-2.4%)	7006 (-0.7%)	7875 (+12.4%)

* Area refers to gross floor area of buildings when completed; + Includes buildings purely for residential purpose and combined residential and non-residential buildings.

Source: Key Statistics on Business Performance and Operating Characteristics of the Building, Construction and Real Estate Sectors, The Census and Statistics Department, Hong Kong SAR.

5. Construction Cost

Table 9: Building Works Tender Price Index (BWTPI)

Year	Building Works Tender Price Index (BWTPI)			
	Qtr 1	Qtr 2	Qtr 3	Qtr 4
2015	1732	1761	1777	1775
2014	1621	1648	1679	1703
2013	1516	1532	1559	1590
2012	1414	1438	1467	1496
2011	1273	1320	1369	1408
2010	1134	1161	1249	1266

Note: The value in the first quarter of 1970 is taken to be the base index value of 100, and subsequent values are expressed in index form based on the first quarter 1970 value.

Source: Building Works Tender Price Index compiled by the Architectural Services Department available at <http://www.archsd.gov.hk/en/reports/building-works-tender-price-index.aspx>

Table 10: Major construction material average prices (in HK\$)

		2011	2012	2013	2014	2015
Aggregates (HK\$ per tonne)		63	59	60	76	75
Bitumen (HK\$ per tonne)		8,483	9,230	8,803	7,150	8,250
Concrete blocks, 100mm thick (\$ per square metre)		68	70	72	76	77
Diesel fuel	For industrial use (light) (\$ per 200-litre drum)	1,971	1,970	2,075	1,843	1,957
	For road use (HK\$ per 100 litre)	988	957	1,030	840	941
Glass - Clear sheet glass, 5mm thick (HK\$ per square metre)		144	149	151	157	157
Glazed ceramic wall tiles	White tiles, 108mmx108mm (\$ per 100 pieces)	202	204	233	233	233
	Colour tiles, 200mmx200mm (\$ per 100 pieces)	334	374	398	443	401
Hardwood	Sawn hardwood, 50x75 mm column (\$ per cubic metre)	5,470	5,511	5,502	5,707	5,707
Homogeneous floor tiles	Non-slip tile, 200mmx200mm (\$ per square metre)	150	154	158	160	160
Galvanised mild steel	Steel plates (HK\$ per tonne)	9,180	9,033	8,773	8,578	9,577
	Steel angles (HK\$ per tonne)	12,234	11,980	11,823	11,469	11,967
	Steel flats (HK\$ per tonne)	10,023	10,214	10,076	9,926	10,319
Metal formwork	Steel plate, 4mm thick (HK\$ per tonne)	6,542	6,322	5,848	4,615	5,683
Mosaic tiles	Unglazed tiles, 18mmx18mm (\$ per square metre)	81	91	104	119	119

		2011	2012	2013	2014	2015
	Glass tiles, 25mmx25mm (\$ per square metre)	35	42	50	50	50
	Glazed tiles, 45mmx45mm (\$ per square metre)	109	114	122	134	132
Paint	Emulsion paint (HK\$ per litre)	45	48	52	53	52
	Acrylic paint (HK\$ per litre)	48	48	49	51	49
Portland cement (ordinary) (HK\$ per tonne)		677	684	700	738	729
Sand (HK\$ per tonne)		101	117	122	189	119
Steel reinforcement	Mild steel round bars, 6mm to 20mm (\$ per tonne)	6,747	6,443	5,870	5,037	5,470
	High tensile steel bars, 10mm to 40mm (\$ per tonne)	6,288	5,865	5,099	3,242	4,349
Timber formwork	Plywood, formwork, 19mm thick (\$ per square metre)	71	71	74	75	75
	Sawn hardwood, 25mm thick plank (\$ per cubic metre)	3,355	3,572	3,814	4,026	3,814
uPVC pipes	32mm diameter pipes, 4m long (HK\$ per number)	51	56	57	52	55

Source: Average Wholesale Prices of Selected Building Materials, Census and Statistics Department, Hong Kong SAR, various issues.

Table 11: Construction Industry Salaries and Wages –Unskilled Workers

	Unskilled Workers Daily Wage (HK\$)
2011 Dec	616
2012 Dec	679
2013 Dec	743
2014 Dec	856
2015 Dec	916
2016 Apr	926

Source: *Average Daily Wages of Workers Engaged in Public Sector Construction Projects*, Census and Statistics Department, Hong Kong SAR, various issues.

Table 12: Construction Industry Salaries and Wages – Construction Professionals

Professionals in Building and construction and related trades (Unit: Median monthly salary in HK\$)	2011 June	2012 June	2013 June	2014 June	2015 June
Accountant	32,900	35,000	34,900	34,300	34,300
Architect	55,800	58,700	N/A	N/A	N/A
Building Services Engineer	31,200	32,500	35,600	36,100	37,200
Mechanical Engineer	28,100	28,100	29,900	32,700	33,900
Personnel Manager/ Human Resources Manager/ Staff Relations Manager	37,800	41,200	45,200	48,300	50,400
Project Manager	55,200	60,400	64,100	65,800	64,900
Safety Officer	33,200	34,300	38,200	41,200	42,900
Structural Engineer	34,100	35,000	39,600	42,200	44,500

Source: *Report of Salaries and Employee Benefits Statistics, Managerial and Professional Employees (Excluding Top Management)*, Wages and Labour Costs Statistics Section, Census and Statistics Department, Hong Kong SAR.

Professionals in most of the disciplines had a modest increase in their wages, such as building services engineers, mechanical engineers, human resources managers, safety officers, and structural engineers (Table 12). However, the wages of project managers decreased slightly.

Table 13: Construction Industry Daily Wages –Skilled Workers (in HK\$)

	2011 Dec	2012 Dec	2013 Aug	2014 Dec	2015 Dec	2016 Apr
Concretor	1,073	1,252	1,414	1,895	1,895	1,939
Bricklayer	853	936	943	1,189	1,212	1,188
Drainlayer	970	1,125	1,164	1,420	1,502	1,615
Mason	853	1,113	1,223	1,229	1,082	1,025
Bar bender and fixer	1,249	1,401	1,553	1,882	1,899	2,021
Metal worker	835	900	955	1,104	1,159	1,153
General welder	894	1,013	1,144	1,320	1,324	1,330
Structural steel erector	1,181	1,062	1,585	1,450	1,470	1,050
Structural steel welder	1,005	1,116	1,539	1,457	1,472	1,553
Rigger/metal formwork erector	949	1,032	1,352	1,488	1,628	1,625
Carpenter (formwork)	1,091	1,345	1,491	1,877	1,838	2,017
Joiner	899	942	914	1,048	1,184	1,211
Plumber	894	953	934	1,130	1,259	1,283
Construction plant mechanic	899	978	1,046	1,179	1,219	1,216
Plant & equipment operator (load shifting)	802	860	923	1,045	1,129	1,172
Truck driver	654	708	741	789	828	830
Rock-breaking driller	840	1,065	1,077	1,595	1,380	1,457
Asphalter (road construction)	747	772	750	884	893	979
Bamboo scaffolder	1,129	1,243	1,276	1,639	1,706	1,719

	2011 Dec	2012 Dec	2013 Aug	2014 Dec	2015 Dec	2016 Apr
Diver	1,761	1,959	2,030	2,243	2,172	2,189
Plasterer	940	1,029	1,058	1,256	1,344	1,366
Glazier	897	929	1,099	1,247	1,258	1,265
Painter and decorator	781	846	879	982	1,122	1,135
Leveller	839	991	1,095	1,376	1,342	1,420
Marble worker	898	1,042	903	1,153	1,200	1,232
Electrical fitter (incl. electrician)	723	781	810	928	1,033	1,068
Mechanical fitter	622	705	734	817	798	828
Refrigeration/AC/ventilation mechanic	610	686	657	753	821	824
Fire services mechanic	667	757	850	989	1,042	983
Lift and escalator mechanic	645	606	650	720	749	791
Building services maintenance mechanic	655	718	765	710	742	748
Power cable jointer	853	1,230	1,267	1,010	1,200	932

Source: Average Daily Wages of Workers Engaged in Public Sector Construction Projects, Census and Statistics Department, Hong Kong Special Administrative Region, various issues.

Table 13 summarizes the wages of 32 categories of skilled workers. The trend of the average daily wages of skilled workers is upward from 2011 to April 2016. However, the daily wages of several categories registered a mild decline, such as bricklayers, structural steel erectors, and power cable jointers.

6. Import and Export of Construction Services

Table 14: Import and Export of Construction and Consultancy Services (in HK\$million)

Year	2010	2011	2012	2013	2014
Imports					
Value of construction services	413	609	2,500	2,710	2,690
Value of consultancy services	1,971	2,483	2,544	2,593	2,837
Exports					
Value of construction services	1,123	1,111	2,564	3,043	2,818
Value of consultancy services	3,745	3,731	3,946	3,815	4,107

Notes:

"Construction services" include: General construction work (including new work, additions and alterations, repair and maintenance) and installation work at sites, buildings and structures that usually last for less than one year.

"Consultancy services - Architectural, engineering and other technical services" include: Advisory architectural services; architectural design services; contract administration services; advisory and consultative engineering services; engineering design services for construction projects or industrial processes; and urban planning and landscape architectural services.

Source: *Hong Kong Trade in Services Statistics*, the Census and Statistics Department, Hong Kong SAR.

A decline was registered in both import and export of construction services in 2014. The value of import decreased from HK\$2,710 million to HK\$2,690 million in 2014. The net export value of construction services decreased from HK\$333 million in 2013 to HK\$128 million in 2014 (Table 15). The import of architectural, engineering and other technical services have increased since 2010, while the export decreased from HK\$4,107 million in 2013 to HK\$3,731 million in 2014. The net export value of architectural, engineering and other technical services declined from HK\$1,514 million in 2013 to HK\$894 million in 2014. In addition, the majority of the export and import of both construction and consultancy services are carried out within the Asian region. However, exports to the Asian markets were also mostly subdued in 2014.

Table 15: Annual Import/Export of Construction and Consultancy Services

Major service group/Region	Year	Export of services	Import of services	Net export of services
		HK\$million	HK\$million	HK\$million
<i>Construction services</i>	2010	1,123	413	710
	2011	1,111	609	502
	2012	2,564	2,500	64
	2013	3,043	2,710	333
	2014	2,818	2,690	128
Asia	2010	1,120	357	763
	2011	1,066	609	457
	2012	2,564	2,500	64
	2013	3,043	2,710	333
	2014	2,818	2,690	128
Australasia and Oceania	2010	<0.5	49	-49
	2011	<0.5	<0.5	<0.5
	2012	N/A	N/A	N/A
	2013	N/A	N/A	N/A
	2014	N/A	N/A	N/A
Central and South America	2010	<0.5	<0.5	<0.5
	2011	<0.5	<0.5	<0.5
	2012	N/A	N/A	N/A
	2013	N/A	N/A	N/A
	2014	N/A	N/A	N/A
North America	2010	<0.5	<0.5	<0.5
	2011	45	<0.5	45
	2012	N/A	N/A	N/A
	2013	N/A	N/A	N/A
	2014	N/A	N/A	N/A
Western Europe	2010	<0.5	7	-7
	2011	<0.5	<0.5	<0.5
	2012	N/A	N/A	N/A
	2013	N/A	N/A	N/A
	2014	N/A	N/A	N/A

<i>Architectural, engineering and other technical services</i>	2010	2,233	517	1,716
	2011	3,946	2,483	1,463
	2012	3,815	2,544	1,271
	2013	4,107	2,593	1,514
	2014	3,731	2,837	894
Asia	2010	1,772	425	1,347
	2011	N/A	N/A	N/A
	2012	N/A	N/A	N/A
	2013	N/A	N/A	N/A
	2014	N/A	N/A	N/A
Australasia and Oceania	2010	38	20	18
	2011	N/A	N/A	N/A
	2012	N/A	N/A	N/A
	2013	N/A	N/A	N/A
	2014	N/A	N/A	N/A
Central and South America	2010	**	**	**
	2011	N/A	N/A	N/A
	2012	N/A	N/A	N/A
	2013	N/A	N/A	N/A
	2014	N/A	N/A	N/A
North America	2010	166	16	150
	2011	N/A	N/A	N/A
	2012	N/A	N/A	N/A
	2013	N/A	N/A	N/A
	2014	N/A	N/A	N/A
Western Europe	2010	187	**	**
	2011	N/A	N/A	N/A
	2012	N/A	N/A	N/A
	2013	N/A	N/A	N/A
	2014	N/A	N/A	N/A

** Data suppressed for confidentiality reason

Source: *Hong Kong Trade in Services Statistics*, The Census and Statistics Department, Hong Kong Special Administrative Region.

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About the Research Centre for Construction and Real Estate Economics (RCCREE):

The RCCREE is the Hong Kong Polytechnic University's Research Centre for solution oriented research and consultancy in construction and real estate economics. It undertakes internationally relevant multi-disciplinary research that supports the advancement of the construction and real estate industries in the following areas: Economic Policy and Institutional Analysis, Real Estate Economics, Construction Economics, Housing, Human Behaviour in Economic Decision Making, and Value Management and Facilities Performance. For further information, please contact Professor Francis K.W. Wong, Director of RCCREE (bskwwong@polyu.edu.hk) or Professor Eddie C.M. Hui, Deputy Director (bscmhui@polyu.edu.hk).

Sustainable Construction Policy and Market in Hong Kong

1. Executive Summary

Construction industry not only plays an important role in economic development, but also imposes significant impacts on the environment. Construction activities may bring about various adverse effects on the environment, such as pollution (e.g., air, noise, fresh water, sea water, and land), waste generation, and over-consumption of natural resources (Shen et al., 2007). Sustainable development of the construction industry is vital in reducing the negative externalities of construction, thus bringing long-term benefits to human well-being.

“Sustainable development” was defined by the United Nations World Commission on Environment and Development (WCED) as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987). It is composed of three essential dimensions, i.e., economic sustainability, social sustainability, and environmental sustainability.

From the above three perspectives, we shall examine the main issues and constraints of the construction industry in Hong Kong, the efforts made to overcome these constraints, and put forward suggestions on future development for construction sustainability in the remaining sections.

2. Main Issues with the Construction Industry and Market in Hong Kong

2.1 Overview of the construction market

The construction industry is known worldwide as a cyclical and labour-intensive industry. Hong Kong has gone through different stages of construction cycles. The volume of construction works (including GVCW¹, buildings, structures, and facilities) fluctuated during the period from 1983 to 2013 (Chiang et al., 2015). The volume of GVCW increased from mid-1980s, peaked in 1997, and began to decrease after that due to the Asian economic turmoil. Since the commencement of a large volume of infrastructures and facilities construction (e.g., the five railway-expansion projects²), the volume picked up again in 2010, and increased rapidly since then. Although it has not yet exceeded the peak in 1997, the volume is almost equal to that of 1995 (see Fig. 1).

In nominal terms, the construction values by main contractors and sub-contractors have increased respectively from HKD90.2 and HKD55.7 billion in 2006, to HKD223.9 and HKD175.4 billion in 2015 (The Census and Statistics Department of Hong Kong, 2016). In addition, the total construction expenditure by public and private sectors was forecasted to reach HKD280 billion in 2024/25 at constant 2015 prices from HKD215.4 billion in 2014/15 by the Hong Kong Construction Industry Council (2016).

¹ GVCW refers to gross value of construction works.

² The five railway-expansion projects include West Island Line, South Island Line (East), Kwun Tong Line Extension, Guangzhou-Shenzhen-Hong Kong Express Rail Link, and Sha Tin to Central Link, which are constructed to extend the reach of Hong Kong's railway network by 25%.

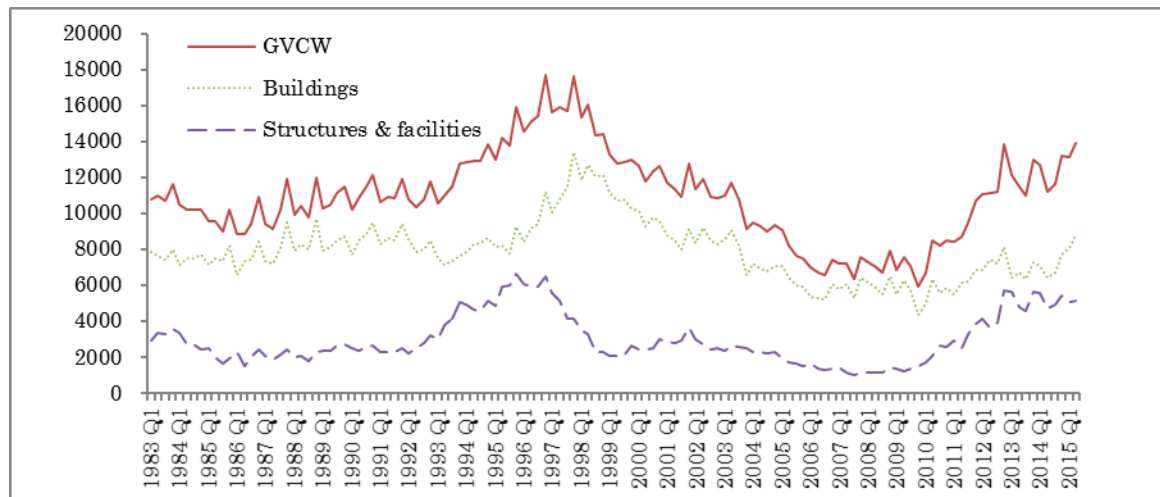


Fig. 1. Hong Kong GVCW, buildings, structures, and facilities construction values
(at constant 1990 prices; unit: HK\$ million)

Source: Census and Statistics Department, Hong Kong SAR.

2.2 Manpower

(1) Labour shortage

Due to the increasing amount of construction works in Hong Kong as indicated above, construction workers are highly demanded mainly in the areas of infrastructure works, building works, and renovation, maintenance, alteration and addition (RMAA) works. However, it is difficult to recruit enough young labour to engage in the construction works these years. The number of vacancies of manual workers at construction sites has been increasing since 2010 and peaked in 2014, especially in the public sector (see Fig. 2).

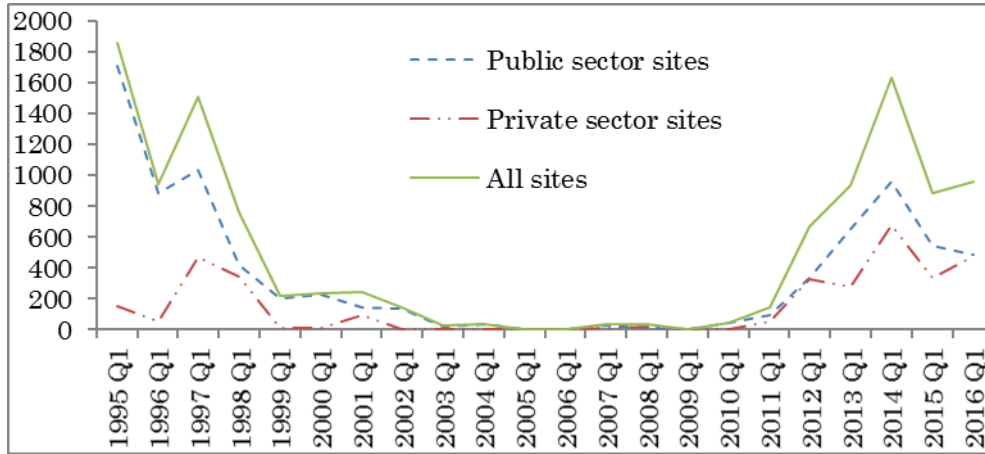


Fig. 2. Quarterly vacancies of manual workers at construction sites in Hong Kong

Source: Quarterly Report of Employment and Vacancies at Construction Sites,
<http://www.censtatd.gov.hk/hkstat/sub/sp452.jsp?productCode=B1050004>

According to our survey³ in 2014 - 2015, one vital reason for the recruitment difficulty is that the construction industry in Hong Kong has gone through a low ebb for more than ten years from 1997 to 2010. Many construction workers had gone to other industries. Another reason is the poor image of the construction industry in terms of safety, working environment, welfare and career development. Young people are reluctant to join this industry.

(2) Ageing labour

There were 378,840 registered construction workers in Hong Kong by 31 March 2016. Among them, 67.22% were above 40 years old (see Table 1). The proportion of construction workers aged 55 to 59 was the largest among the ten age groups (see Fig. 3).

³ This survey is part of the consultancy project (i.e., “Research on the Feasibility and Implementation Strategy for “No-Saturday-Site-Work” in the Hong Kong Construction Industry”) that we conducted for the Hong Kong Construction Industry Council in 2014-2015.

The problem of ageing labour is most serious among skilled workers.

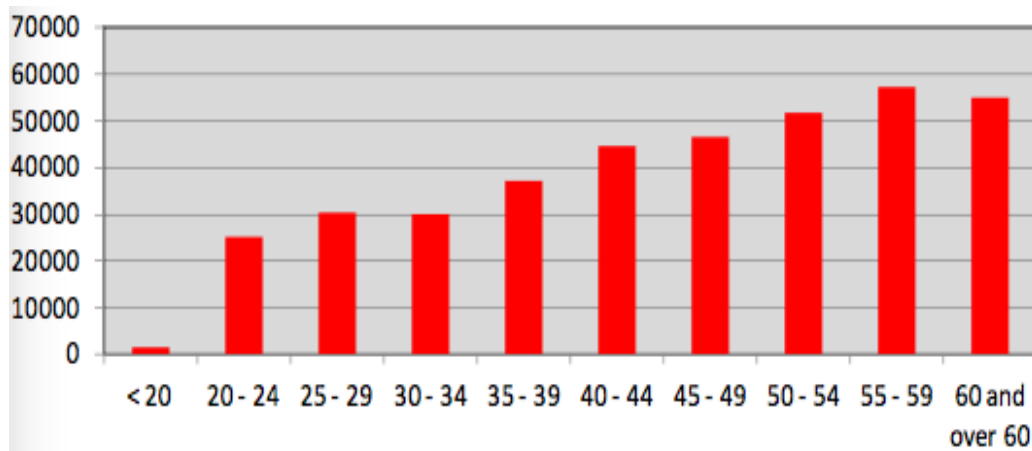


Fig. 3. Age distribution of the registered construction workers (by 31 March 2016)

Source: http://cwr.hkcic.org/download/Chi_Age_Distribution_by%20alphabetical%20order.pdf

Table 1. Age distribution of the registered construction workers (by 31 March 2016)

Age	Registered general workers	Registered semi-skillful workers	Registered skillful workers	Total
Below 20	0.36%	0.00%	0.05%	0.40%
20-24	5.74%	0.75%	0.15%	6.64%
25-29	6.38%	0.98%	0.66%	8.03%
30-34	5.17%	0.85%	1.92%	7.95%
35-39	5.67%	0.69%	3.40%	9.77%
40-44	6.94%	0.66%	4.13%	11.74%
45-49	7.33%	0.59%	4.32%	12.26%
50-54	7.52%	0.56%	5.53%	13.62%
55-59	7.43%	0.60%	7.05%	15.11%
60 or above	7.65%	0.55%	6.28%	14.49%
Total	60.17%	6.28%	33.45%	100.00%

Source: Calculated from the statistics provided by Hong Kong Construction Industry Council at

http://cwr.hkcic.org/download/Chi_Age_Distribution_by%20alphabetical%20order.pdf.

(3) High accident and fatalities rate

The image of the construction industry is poor especially because of its dismal safety record and harsh working environment. Site safety, or the lack of it, has been a main

reason for the Generation Y not joining the industry, contributing further to labour shortage. The construction industry recorded the highest number of fatalities and accident rate among all industry sectors in Hong Kong. It recorded 3,723 industrial accidents in 2015, 7.4% higher than 3,467 in 2014. Among all the 11,497 industrial accidents and 24 fatalities in Hong Kong in 2015, there were as high as 32% industrial accidents and 79% fatalities happening in the construction industry (Labour Department, 2016). Although the accident rate per 1,000 workers began to decrease in 2008, the absolute rate is still high. It increased slightly from 40.8% in 2013 to 41.9% in 2014 (see Fig. 4). The fatality rate also has a decreasing trend since 2011 (see Fig. 5).

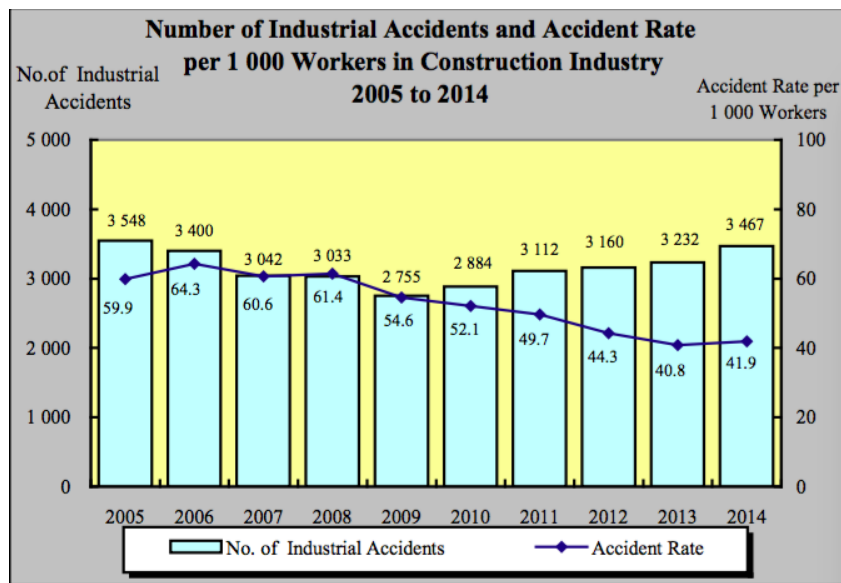


Fig. 4. Industrial accidents in Hong Kong construction industry (2005-2014)

Source: <http://www.labour.gov.hk/eng/osh/pdf/Bulletin2014.pdf>

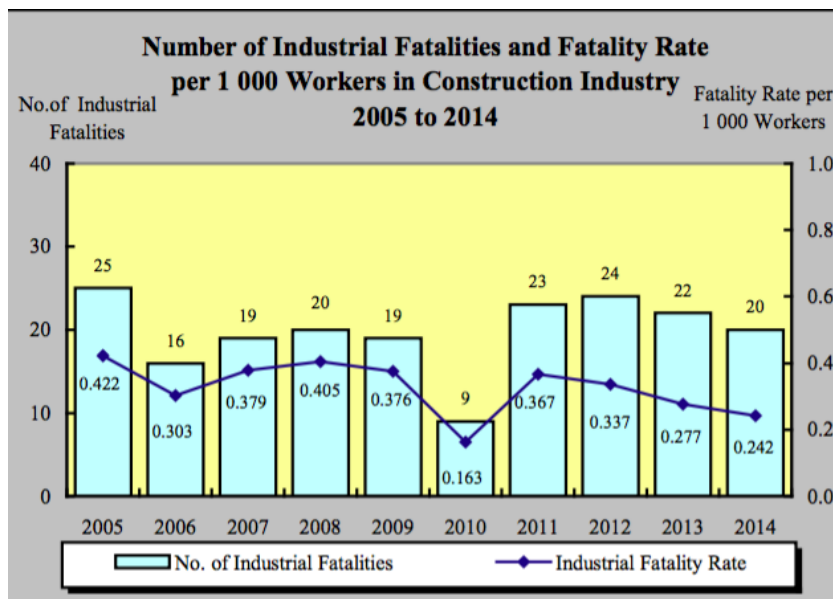


Fig. 5. Fatal accidents in Hong Kong construction industry (2005-2014)

Source: <http://www.labour.gov.hk/eng/osh/pdf/Bulletin2014.pdf>

2.3 Technology

The conventional in-situ construction methods are not only labour intensive, but also generate large quantities of construction wastes (Jaillon & Poon, 2010). Although prefabrication has been implemented in Hong Kong since the 1980s, this technique has been largely applied to public housing projects. The private sector still relies to a large extent on traditional construction methods, although the situation has improved a lot since the implementation of the Joint Practices Notes No.1 and Joint Practices Notes No.2 respectively in 2001 and 2002, which gives incentives to developers adopting prefabricated technology. They would be given more floor areas to build if they use prefabricated components and provide “environmental balconies” in the flats.

The above phenomenon can be largely attributed to the subcontracting system that has long been adopted in Hong Kong due to the cyclical and highly competitive nature of the construction industry. Contractors tend to outsource projects to various sub-contractors of different trades. There are multi-layers of sub-contractors to undertake the cyclical

construction works. Both main contractors and sub-contractors place much emphasis on supply chain management, and have insufficient motivation to improve the production process by adopting innovative technologies such as prefabrication and mechanisation.

2.4 Space

Hong Kong is a compact city with a dense and high-rise urban environment (Jaillon, Poon & Chiang, 2009). The total area is 2,754 km² (including the sea area). It is the fourth most densely populated sovereign territory in the world. Almost the whole area is composed of hills and mountains, with around 84% steep slopes. The developed territory is less than 25% of the total area. About 40% of the remaining land is reserved as country parks and nature reserves (Hong Kong Government, 2016).

Industrialisation needs economy of scale to bring construction costs down. Cost reduction is achieved by large-scale production of elements (Jaillon & Poon, 2010). However, due to limited space found on a typical site in especially the private sector in Hong Kong, there is a constraint to large-scale industrialisation. For most of the private property development, there does not seem to be enough space for producing prefabricated components and elements, implementing volumetric prefabrication, transportation, site access, and onsite storage area.

2.5 Environment

The construction industry plays a significant role in sustainable development (United Nations Environment Programme, 2001). Buildings account for nearly half of the total primary energy use in Hong Kong (Chen et al., 2001). Moreover, the construction industry is a large contributor to waste generation (Tam et al., 2007).

Construction wastes consist of surplus materials arising from site clearance, excavation,

construction, refurbishment, renovation, demolition and road works. They can be divided into two broad categories, i.e., inert wastes and non-inert wastes. Inert wastes (also known as public fill) include debris, rubble, earth and concrete. They are suitable for land reclamation and site formation. In contrast, non-inert wastes, which include bamboo, timber, vegetation, packaging waste and other organic materials, will go to landfills (Environmental Protection Department, 2016).

In Hong Kong, over 90% of construction wastes are inert. As to non-inert wastes, the mixed construction wastes accounted for 25% of the total waste disposed at the three existing landfills in 2013 and 27% in 2014 (Environmental Protection Department, 2016). Fig. 6 and Fig. 7 show that the trend of construction waste generation is generally and expectedly consistent with that of the construction cycle. Since the pick-up of construction activities in 2010/11, the generation of overall construction waste has followed an increasing trend. The proportion of construction wastes that is disposed at landfills has stayed at a single digital level since 2009. The majority of the remaining construction wastes were treated as public fill. The others were reused direct in projects.

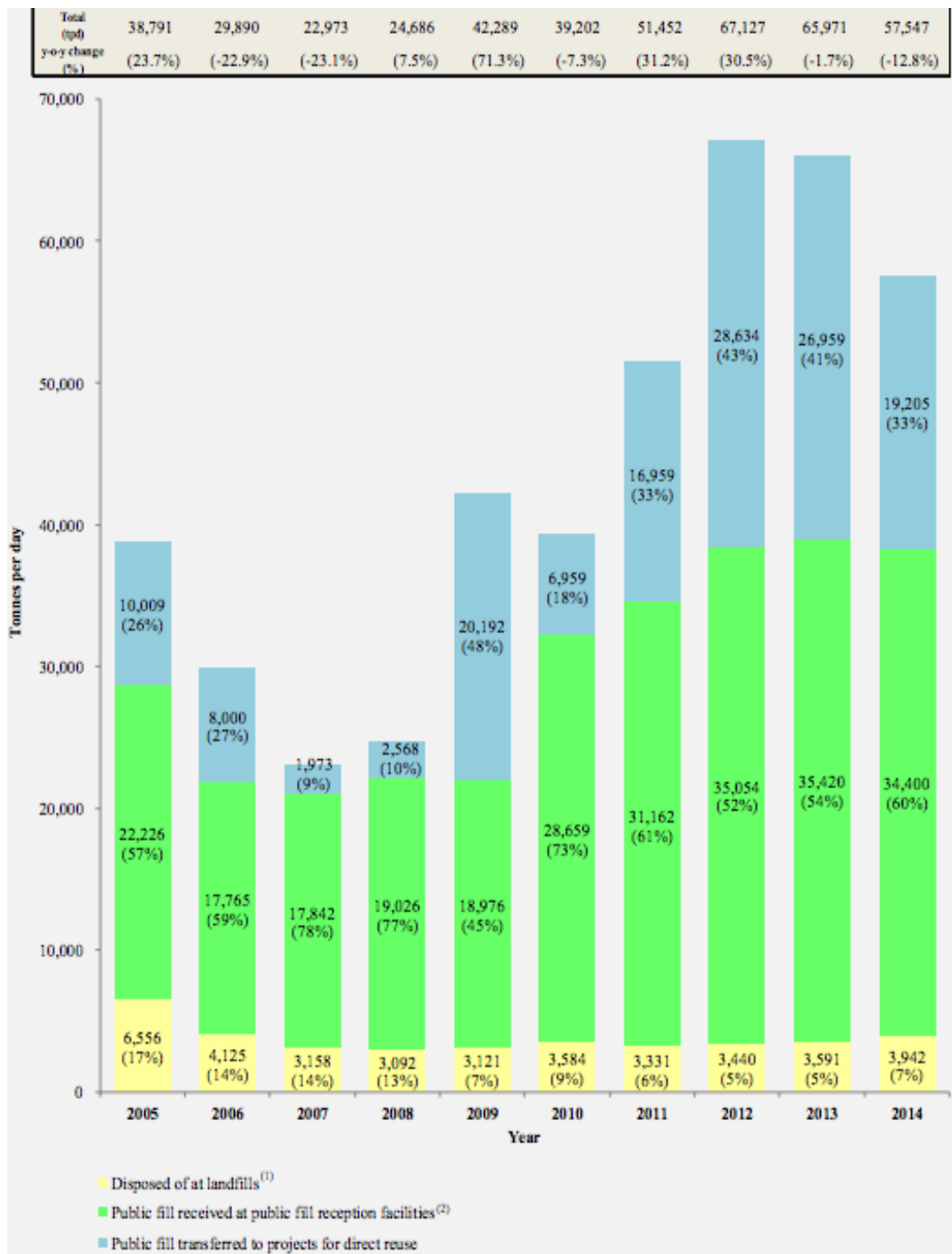


Fig. 6. Daily disposal and reuse of overall construction waste (2005 - 2014) (Unit: tonnes)

Source: Waste statistics for 2014, <https://www.wastereduction.gov.hk/sites/default/files/msw2014.pdf>.

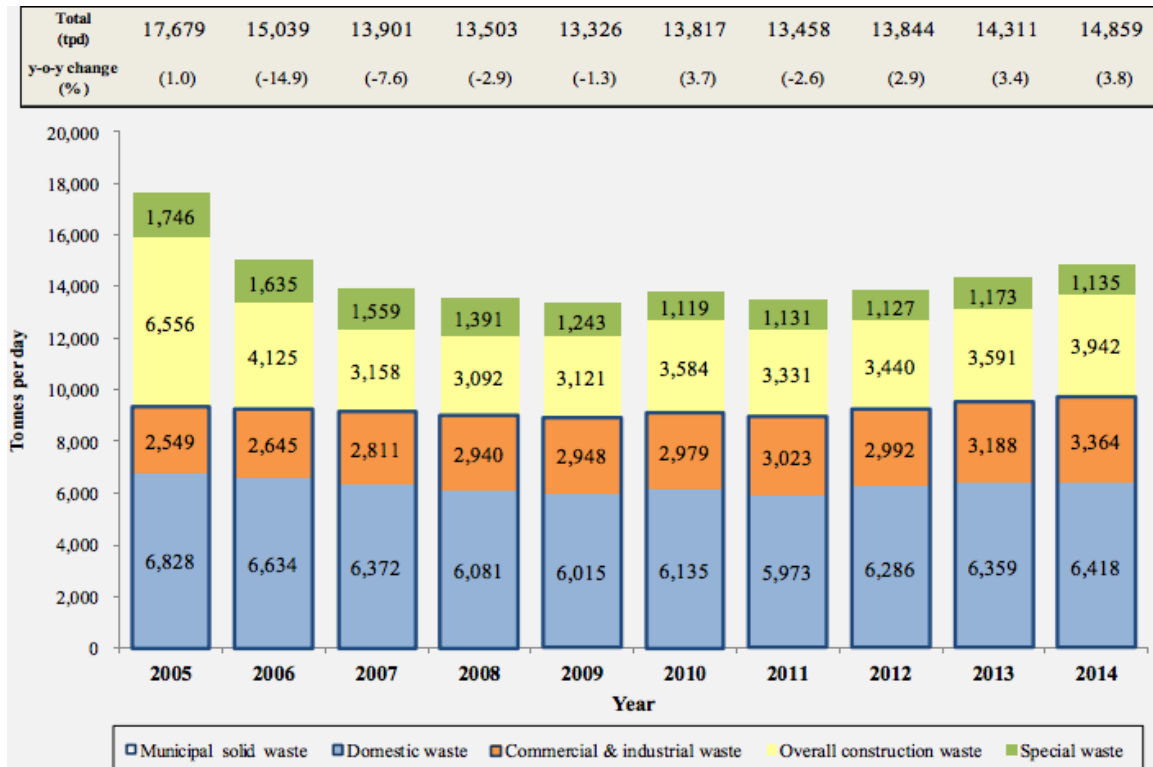


Fig. 7. Daily disposal of solid waste at landfills in Hong Kong (2005-2014) (Unit: tonnes)

Source: Waste statistics for 2014, <https://www.wastereduction.gov.hk/sites/default/files/msw2014.pdf>.

Jaillon et al. (2009) found that prefabrication could reduce construction wastes to a large extent (at 52%) in Hong Kong. Tam et al. (2007) found that different sub-contracting arrangements could cause different levels of construction wastes. Private projects were found to generate a higher level of construction wastes due to the non-standardised building structures. To reduce wastes, they suggested promoting prefabrication, developing a cost-effective approach, integrating waste minimisation at the tender stage, providing waste reduction training, and integrating waste control as part of site management functions.

3. Efforts Made According to the Conditions of the Construction Industry

Sustainable construction was deemed to consist of four pillars, namely, social sustainability, economic sustainability, biophysical sustainability, and technical sustainability (Hill & Bowen, 1997). The social sustainability is based on equity and social justice, and calls for addressing poverty and inequity. The economic sustainability calls for financial affordability of intended beneficiaries, employment creation, and enhancing competitiveness in the market to advance sustainable policies and practices. Biophysical sustainability includes maximising resource reuse/recycling, renewable resources usage, minimising pollution, and reducing the use of water, land, materials and energy. To achieve technical sustainability is to construct durable, reliable, and functional structures, to pursue quality in creating built environment, to humanize larger buildings and to revitalise the existing urban infrastructure.

Accordingly, the efforts made to promote sustainable development of the construction industry in Hong Kong will be introduced in the following three dimensions, i.e., economic dimension, environmental dimension and social dimension.

3.1 Economic dimension

3.1.1 Technology with economic efficiency

Prefabrication was introduced to the private sector of Hong Kong only after 1998, although it has become mandatory in public housing projects since 1997. Between 1997-2001 and 2002-2006, there was a sharp increase in the number of private projects using prefabrication, mainly due to the introduction of Joint Practice Note No.1 (JPN1) and Joint Practice Note No. 2 (JPN2) in 2001 and 2002, which will be elaborated in the later section.

The adoption of prefabrication was proved to be able to improve quality control, foster higher productivity, save construction time, reduce construction waste, dust and noise on-site, improve site safety, and decrease the dependency on labour on-site (Jaillon & Poon, 2009). Construction time was reduced at the later stage of a project since less finishing works were required.

3.1.2 Infrastructure development

To facilitate continual economic growth and local employment, the Hong Kong government has been increasing its infrastructure investment over the past few years, e.g., the well-known ten mega-infrastructure projects (see Fig. 8). In recent years, public spending on infrastructure has been maintained at high levels. Of the HKD 370 billion on Capital Works Programme projects approved by the Legislative Council's Finance Committee in the past five years, about 60% is related to the ten mega infrastructure projects (Development Bureau, 2016).

Take the Hong Kong-Zhuhai-Macao Bridge (HZMB) for instance, it will significantly reduce the travelling cost and travelling time between Hong Kong and the Western Pearl River Delta (PRD) region. It will also facilitate the flow of goods and accelerate the economic integration of the PRD and the neighbouring provinces. The Hong Kong section of the Guangzhou-Shenzhen-Hong Kong Express Rail Link (XRL), being part of the 16,000 km national high-speed rail network, will foster closer economic ties between Hong Kong and the mainland. Other large-scale infrastructure projects are conducted to improve the local transportation system and provide a quality living space to citizens (HKTDC Research, 2016).

10 mega infrastructure projects

Project	Description	Estimated cost (US\$ mln)	Commencement	Target completion
1. South Island Line East	<ul style="list-style-type: none"> Linking Admiralty to the Southern District on Hong Kong Island 	1,590	2011	2016
2. The Shatin to Central Link (SCL)	<ul style="list-style-type: none"> Connecting the northeast New Territories and Hong Kong Island 	10,300	2012	2019-2021
3. The Tuen Mun Western Bypass and Tuen Mun Chek Lap Kok Link	<ul style="list-style-type: none"> Linking up Deep Bay in Shenzhen, the northwest New Territories and Hong Kong International Airport. 	6,030	2013	2016-2018
4. The Guangzhou-Shenzhen-Hong Kong Express Rail Link (Hong Kong Section)	<ul style="list-style-type: none"> Linking up the national rail network of the Chinese mainland Connecting West Kowloon to Shenzhen, Guangzhou 	8,050	2010	2017
5. Hong Kong-Zhuhai-Macau Bridge	<ul style="list-style-type: none"> 29.6 km-Bridge with 6 lanes Linking up Hong Kong, Zhuhai and Macau. 	2,740	2010	2016
6. Hong Kong-Shenzhen Airport Cooperation	<ul style="list-style-type: none"> A dedicated rail link between Shenzhen Airport and Hong Kong International Airport 	N.A.	N.A.	N.A.
7. Hong Kong-Shenzhen Joint Development of the Lok Ma Chau Loop	<ul style="list-style-type: none"> Lok Ma Chau Loop, an area near the Hong Kong-Shenzhen border Working with Shenzhen authorities to develop the area 	N.A.	N.A. (Environmental Impact Assessment Report completed in 2013)	N.A.
8. West Kowloon Cultural District (WKCD)	<ul style="list-style-type: none"> The flagship art and culture development in Hong Kong with aims to provide a platform to enhance arts education and cultural exchange and cooperation. 	Over 6,000	2013	2015 (first phase)
9. Kai Tak Development	<ul style="list-style-type: none"> An area consisting of former Hong Kong airport and its adjoining parts, To be developed into an area for commercial, residential, recreational, tourism and community uses together with supporting infrastructure 	Over 16,700	2009	2013 / 2016 / 2021 (In 3 phases)
10. New Development Areas (NDAs)	<ul style="list-style-type: none"> In the Northern New Territories Purposes of land use include housing, commercial, recreation and cultural facilities 	N.A.	N.A. (Environmental Impact Assessment Report approved in 2013)	2019 (first phase)

Source: various press and government sources

Fig. 8. Ten mega infrastructure projects in Hong Kong

Source: "Building and Construction Industry in Hong Kong" by HKTDC Research,

<http://hong-kong-economy-research.hktdc.com/business-news/article/Hong-Kong-Industry-Profiles/Building-and-Construction-Industry-in-Hong-Kong/hkip/en/1/1X000000/1X003UNV.htm>

3.1.3 Procurement System

New contractors and consultants are facilitated by the Development Bureau to undertake public projects without compromising quality. The aim is to ensure sufficient market participants (or market competitiveness) and encourage the adoption of new technologies and ideas. The Development Bureau also expressed its intention to split large public projects into smaller ones to facilitate more contractors' participation (2016).

3.1.4 Market extension

Since the signing of the “Mainland and Hong Kong Closer Economic Partnership Arrangement” in 2003, 51 market liberalisation measures have been implemented to facilitate stakeholders of the Hong Kong construction industry to practise and develop business in the Mainland. In the coming year, the Development Bureau will further liaise with the Ministry of Commerce to explore business opportunities besides the supervision contracts for two medium-sized foreign aid projects in Nepal and Cambodia in 2015 (Development Bureau, 2016).

3.2 Environmental dimension

Since large quantities of solid wastes are produced every year from construction activities in Hong Kong, more and more concerns have been raised on reducing construction wastes. The government is also taking action to handle the problem, such as increasing landfill charges to discourage creation of construction wastes, and introducing incentives to promote prefabrication to reduce onsite waste generation (Tam, Shen & Tam, 2007).

Regarding the series of policies, Lu and Tam (2013) established a comprehensive framework to illustrate the evolution of regulations, codes, and initiatives concerning construction waste management in Hong Kong (see Fig.9). They found that Hong Kong

has been actively trying new measures based on the principles of “reduce, reuse, recycle, and polluter pays”.

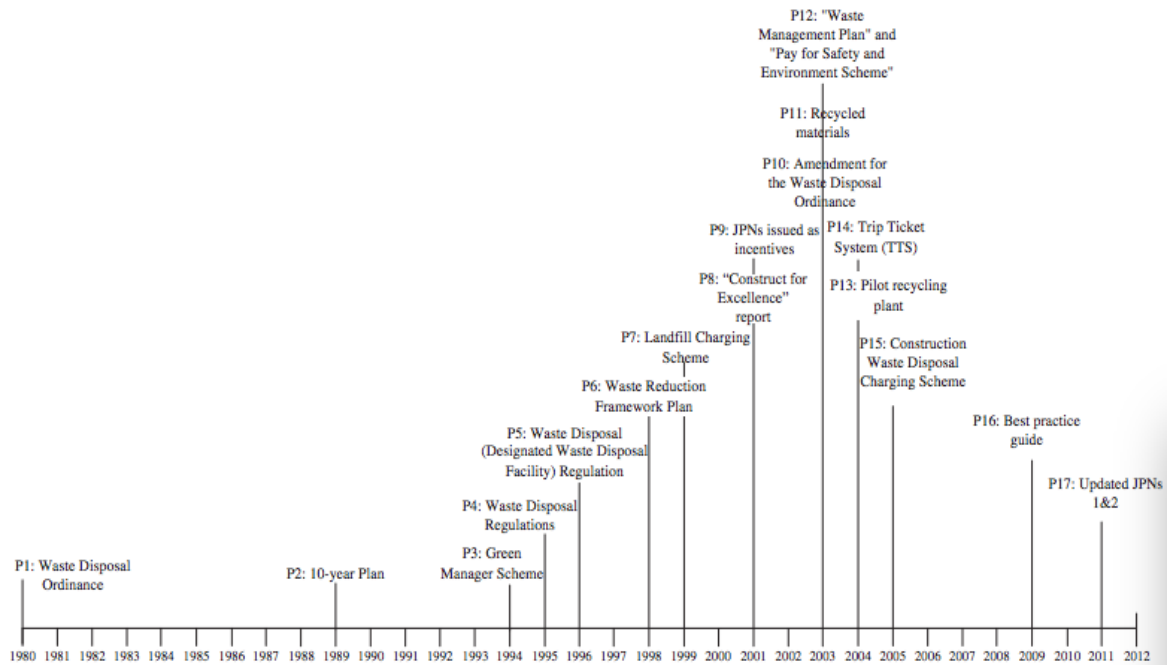


Fig. 9. Series of policies concerning construction waste management in Hong Kong

Source: “Construction waste management policies and their effectiveness in Hong Kong: A longitudinal review” by W. Lu & V.W. Tam, 2013, *Renewable and sustainable energy reviews*, 23, 214-223.

Based on the Polluter Pays Principle, the “Landfill Charging Scheme” was implemented in 1999. Another example is the Trip Ticket System (TTS), which was implemented in 1999 and enhanced in 2004 to prevent illegal dumping. It can easily track and monitor the transportation routes and destinations of construction wastes generated by a particular construction project. In 2005, the Construction Waste Disposal Charging Scheme was launched to encourage producers to reduce, sort and recycle construction wastes.

Based on the “reduce, reuse and recycle” principles, in a report called “Construct for Excellence”, the Construction Industry Review Committee (2001) encouraged greener and more energy efficient designs in the construction industry, and proposed to use information technology, prefabrication, standardized and modular components in local construction more widely to increase construction quality and efficiency, and to minimise

waste generation. The committee also urged the industry to place emphasis on life-cycle benefits instead of short-term efficiency, and recommended a more extensive use of recycled materials. Meanwhile, Joint Practice Note No.1 (JPN1) and Joint Practice Note No. 2 (JPN2) were consequently published in 2001 and 2002. Under the schemes, site coverage and gross floor area (GFA) exemption are introduced as a financial incentive to promote buildings with green features such as prefabricated non-structural external walls.

In practice, the Architectural Services Department has embedded sustainable principles into the whole life cycle of the construction projects in Hong Kong, namely, from design stage, tender stage, construction stage, operation stage, up to post-operation stage. Design stage incorporates green procurement principles and specification of environment-friendly building materials. At the tender stage, contractors are encouraged to emphasise their long-term performance. The “Formula Approach” is adopted to decide the tender. It considers not only tender price but also tenderer’s past performance (including quality, programme, safety and environmental management). In addition, Public Private Partnership (PPP) is adopted as the procurement strategy where appropriate, which requires the private partner not only design and construct the project but also finance and operate it. The aim is to achieve a high standard of design and construction, to improve the operational efficiency, and to reduce the overall costs throughout the life cycle (Architectural Services Department, 2016).

At the construction stage, contractors are required to implement environmental management to minimise pollution. The policies of “pay for site cleanliness” and “pay for waste management” are being adopted. The environment management of contractors is regularly monitored on a quarterly basis, the result of which would be considered when assessing their bids in the future. Prefabrication and low-waste technologies are widely

encouraged. At the operation stage, energy efficient installations and environment-friendly materials are used to conserve energy, water and material resources. Adaptive reuse, alteration and addition methods are adopted at the post-operation stage to save construction time, cost, and to conserve the embodied energy (Architectural Services Department, 2016).

3.3 Social dimension

3.3.1 Construction safety

The Construction Industry Review Committee (2001) pointed out that site safety is a shared responsibility of regulators, employers and employees. Safety culture, safety promotion and training are needed to improve the safety performance in the construction industry.

The Hong Kong Government has introduced a series of safety initiatives in both the public and private sectors over the past decades to improve the safety record in the construction industry. The Works Bureau developed two schemes, i.e., “Pay for Safety Scheme” (PFSS) and “Independent Safety Audit Scheme” in 1996, to improve the safety performance in the construction industry (Chan, Chan & Choi, 2010). The principle of PFSS is that safety and health at work should begin with the one who pays. Under PFSS, contractors tendering for public works contracts should include safety-related tasks into the Bills of Quantities. The employers should pay the contractors for safety-related tasks after they successfully complete the tasks and have it certified for payment. The aim is to remove site safety items from the scope of competitive tendering by the client/consultant stipulating their values in the contract for payment if those works are carried out. The cost of such safety items is estimated to occupy between 0.5% and 2.0% of the total project sum. Currently, the PFSS is under the Pay for Safety and Environment Scheme (PFSES)

for public works contracts (Hong Kong Construction Industry Council, 2012).

According to the guideline provided by the HKCIC in 2012, the safety-related areas for public works contracts under the PFSS mainly include provision and updating of safety plan (one of the most vital elements), provision of registered safety officers, provision of safety training and workshop to workers, arrangement and attendance of site safety committee meetings, arrangement and attendance of weekly safety walks (most essential portion of the PFSS which contributes the major portion of payment under the PFSS), and other possible items subject to the characteristics of each project. The implementation of the PFSS proved to lead to a decrease in the accident rate of public projects in Hong Kong. The Government is planning to extend the existing PFSS or PFSES by including the Pay for Safety Performance Merit Scheme (PFSPMS).

Further, the Hong Kong Housing Authority (HKHA) began to implement the PFSS in all building contracts in 2000, and expanded the scheme to Integrated Pay for Safety, Environment and Hygiene (PSE&H) Scheme in 2003. The PSE&H Scheme was further applied to all other types of new works contracts in the same year (Hong Kong Construction Industry Council, 2012). To encourage the adoption of PFSS in the private sector, The Real Estate Developers Association of Hong Kong (REDA) and the Hong Kong Construction Association (HKCA) launched the “Safety Partnering Programme” (SPP) together in 2005. Joining the SPP is on a voluntary basis. The aim is to help the participating sites create and maintain a safe and healthy working environment. Four guidance documents were published by REDA and HKCA for the programme, namely, “Contractual Provisions for the Pay for Safety Scheme”, “Construction Site Safety Manual”, “Construction Site Safety Handbook”, and “A Practical Guide to Construction Site Safety Management”. In addition, a series of training modules are provided to the

participating ones as a supplement to the guidance documents.

3.3.2 Construction employment

To soothe the manpower shortage in the construction industry of Hong Kong, the Labour Department set up the Construction Industry Recruitment Centre (CIRC) at the Construction Industry Council (CIC) Training Centre in January 2016 to offer a one-stop job search and recruitment service. On the other hand, labour importation is permitted on an appropriate, limited and targeted basis in Hong Kong. The employment of local labour is prioritised. The importation of skilled workers will be taken into consideration only when employers genuinely have difficulties in recruiting local workers (Hong Kong's Information Services Department, 2016).

3.3.3 Labour welfare

The Standard Working Hours Committee (SWHC) was established in April 2013. Its recommendation includes writing working hours and overtime compensation arrangements into employment contracts in a mandatory manner, based on its first-stage consultation and survey in 2014. The SWHC is also exploring other measures to further protect grass-roots employees with lower income, lower skills and less bargaining power. It will soon launch the second-stage consultation on working hours policies (Hong Kong's Information Services Department, 2016).

Further, the Development Bureau proposed Security of Payment Legislation (SOPL) for the construction industry in June 2015. The aim is to encourage fair payment and rapid dispute resolution and increase cash flow. For government works, all construction contracts, consultancy appointments, supply contracts and sub-contracts will be covered regardless of value. Concerning the private sector, SOPL will only cover individuals,

businesses and Incorporated Owners when they procure new buildings at a cost over HKD 5 million or related consultancy services at a cost over HKD 0.5 million. Repair, maintenance and renovation in the private sector will not be covered (Development Bureau, 2015).

4. Future Development for Sustainable Construction Policy and Market

In Section 2, we have addressed the constraints of sustaining the construction industry in Hong Kong. The constraints involve issues related to manpower, technology, space and the impact on the environment. To overcome these constraints, suggestions on future development for sustainable construction policy and market are put forward as follows.

(1) Industrialisation

In the construction industry, there are five degrees of industrialisation, namely, prefabrication, mechanisation, automation, robotics and reproduction (Richard, 2005). Industrialisation will not only improve the productivity, quality, efficiency of the construction industry, but also reduce the construction costs and waste, and thus contribute to the sustainability agenda of Hong Kong. Further, industrialisation is an efficient way to balance the cyclical characteristics of the construction industry and to cope with the periodic labour shortage.

(2) Incentives to construction projects with green features

With the wide adoption of the trade-based sub-contracting system, contractors place much emphasis on supply chain management and the short-term benefits, to meet the tight deadlines and handle the intense competitiveness. Further efforts should be made to encourage green-featured construction in Hong Kong. More incentive measures (similar

to GFA exemption) as well as restrictive measures (similar to waste charges) should be put forward to encourage green-featured construction and minimize construction waste, by promulgating policies and legislation.

(3) Continue improving construction safety

The construction industry has recorded the highest number of fatalities and accident rate among all industry sectors in Hong Kong, partly due to the site-based ad-hoc nature of construction work. Another important reason is probably the multi-layer sub-contracting system, in particular, what the Construction Industry Review Committee (2001) called “the non-value-adding sub-contracting”. Safety culture and relevant initiatives should be further promoted to improve the working safety of construction workers, especially for the safety of those working for lower-tier sub-contractors.

(4) Further improving labour welfare

Due to the cyclical nature of the construction industry and the highly competitive tendering, contractors are often required to complete construction projects within a very tight schedule, especially during a construction boom. As a result, construction workers, especially those working for bottom-tier sub-contractors, usually work over long hours to meet the deadline.

For the sake of occupational health and to improve the work-life balance of construction workers, reasonable working hours should be specified in the contract. On the other hand, the payment (including the overtime compensation) of the construction workers should be further secured, especially for those with lower income, lower skills and less bargaining power.

(5) Extend external collaboration

Due to the mature economy in Hong Kong, there may not be too much expansion of the local construction market in the future. External collaboration should be further promoted to facilitate the exportation of local professional services.

5. Conclusion

This paper has examined the sustainable development of the construction industry in Hong Kong from three perspectives, i.e., economic sustainability, environmental sustainability, and social sustainability. Firstly, we have discussed the issues and constraints concerning the construction industry in Hong Kong, in terms of labour shortage, labour ageing, construction safety, contractors' reluctance to adopt new technologies, limited working space on sites, and large volume of waste generation.

Secondly, we have looked into the efforts made by the local government and non-government institutions to sustain the development of the construction industry, such as encouraging prefabrication, developing mega infrastructure projects, guaranteeing sufficient market competitiveness, facilitating the business extension of local stakeholders, encouraging construction waste management, improving construction safety and labour welfare, etc.

Finally, we have put forward suggestions for the sustainable development of the construction industry, e.g., facilitating the industrialisation, incorporating as much green features in construction projects as possible, further improving construction safety and labour welfare, and extending collaboration with the external market.

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