AsiaConstruct18
Country Report - Hong Kong

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The RCCREE is the Hong Kong Polytechnic University 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).

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1. EXECUTIVE SUMMARY

In the second quarter of 2012, Hong Kong economy expanded rather slowly by only 1.1% over a year earlier, after the 0.7% growth in the first quarter. The GDP by construction activity however picked up during the quarter, as public sector infrastructure works grew further. As such, overall building and construction expenditure expanded notably further by 12.4% in real terms in the second quarter. Works on the ten major infrastructure projects announced in 2007 are gathering momentum, and getting into full swing as scheduled, thus boosting Hong Kong's construction market.

Consequently, there is a general shortage of manpower from site workers up to technologists and professionals levels. The seasonally adjusted unemployment rate was 3.2% in the second quarter. There was an increase of 21,700 in total employment from the first to the second quarter of 2012. There was thus a notable growth in wages and earnings arising from a tight labour market and the implementation of statutory minimum wage (SMW) since May 2011 (*Half Yearly Economic Report 2012*).

2. MACROECONOMIC REVIEW & OUTLOOK

2.1 Overview of the National Economy

The economy growth of Hong Kong is slowing down since the beginning of 2012. Among the major services sectors, the slowdown is the most notable in communications, food services, information, accommodation and import/export trade. The output of the manufacturing sector further contracted by 1.6%. In the meantime, there was a moderate rebound of real estate activities after four successive quarters of year-on-year declines. The output of the construction sector also grew by 11.6% on year-to-year basis in the first quarter of 2012, resulting from the revival in private sector and from the intensive public sector infrastructure works (*Half Yearly Economic Report 2012*).

In the first quarter of 2012, the conditions of labour market continued to stay buoyant. The total employment figure reached record high as job opportunities creation continued across many sectors. The seasonally adjusted unemployment rate stayed relatively low at 3.4%. Labour salaries and wages were notably higher than in previous years.

2.2 Main economic indicator

Table 1: Main economic indicator

ECONOMIC INDICATOR					
	2008	2009	2010	2011	2012 Q2
GDP & Components					
GDP in chained (2009) dollars (HK$ million)	1,666,629	1,622,516	1,736,773	1,823,129	885,302
GDP at Current Market Price (HK$ million)	1,678,500	1,622,516	1,741,564	1,896,695	934,219
GDP Growth (%)	3.8	-3.2	7.3	8.7	NA
GDP Growth (%) for agriculture, forestry & fishery sector	-17.0	-4.6	3.9	-7.6	NA
GDP Growth (%) for Manufacturing Sector	-6.6	-8.3	3.5	0.7	NA
GDP Growth (%) for Services Sector	2.5	-1.6	7.0	4.8	NA
GDP Growth (%) for Mining Sector	NA	NA	NA	NA	NA
GDP Growth (%) for Construction Sector	8.8	-7.6	15.4	7.5	NA
Demographic Indicators					
Population Number	7,008,900	7,026,400	7,097,600	7,103,700	7,136,300
Population Growth Rate (%)	0.8	0.5	0.9	0.7	0.5
Labor Force(number)	3,668,000	3,669,900	3,650,400	3,734,900	3,796,900
Labor Force Growth rate (%)	1	0.05	-0.5	2.3	1.7
Unemployment Rate	3.5	3.9	3.9	3.3	3.2
Inflation Rate	2.1	1.3	2.9	5.7	1.6
Financial Indicator					
Interbank interest rate per annum at year end	1.93	0.43	0.80	0.75	0.85
Short term interest rate* (%)	1.13	0.03	0.62	0.06	0.08
Long term interest rate** (%)	3.47	2.64	2.29	2.27	0.96
Average Change against USD$	7.78	7.75	7.77	7.78	7.76

NA : data not available
* 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/hong_kong_statistics
Short and long term interest rates: *Monthly Statistical Bulletin*, Hong Kong Monetary Authority, various issues.

3. OVERVIEW OF CONSTRUCTION INDUSTRY

3.1 Cost Value of Construction Contract/ Expenditure

Table 2: Cost Value of Construction Contract/ Expenditure

Type of Contract / Expenditure (HK$ million)	2008	2009	2010	2011	2012 Q1
Buildings	37,900	39,742	40,839	47,447	14,136
Residential	20,613	22,804	22,588	26,231	8,599
Commercial	9,954	7,368	7,979	7,656	1,634
Industrial and Storage	797	359	993	1,514	305
Services	6,537	9,211	9,279	12,046	3,598
Structures & facilities	10,934	12,516	20,683	30,254	9,535
Transport	5,178	3,595	10,852	19,551	6,110
Other utilities & plant	2,088	2,606	2,658	2,511	953
Environment	2,502	4,461	5,758	7,198	2,310
Sports & recreation	1,167	1,794	1,415	994	162
Overall total	48,834	52,258	61,522	77,211	23,670

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

As shown in the table above, construction works can generally be divided into two categories, buildings and structures & facilities. The overall contract value of construction activities carried out by main contractors in Hong Kong has been rising since 2008. In particular, driven by a strong growth of the public construction sector, the overall construction sector produced HK$77 billion value of work in 2011, with a significant increase of about 25% over the previous year.

3.2 Construction Demand forecast for 2012-2013

Table 3: Forecast of Construction Works

Respective Departments	Title of Contract	Scheduled Project Start	Scheduled Project Completion	Estimate of Cost (HKD)
Architectural Services Department (ASD)	Expansion of Tseung Kwan O Hospital	2008-09	2013-14	>=$500M
	Cruise Terminal Building and ancillary facilities for the Kai Tak Cruise Terminal Development	2010-11	2013-14	$4899M
	Construction of a secondary boundary fence and new sections of primary boundary fence and boundary patrol road - phase 2	2011-12	2015-16	$128.3M
	Re-provisioning of Wo Hop Shek Crematorium	2009-10	2012-13	$530M
	Conversion of aqua privies into flushing toilets - phase 7	2010-11	2013-14	$300M - $400M
	Construction of a secondary boundary fence and new sections of primary boundary fence and boundary patrol road - phase 1	2009-10	2012-13	$179M
	Reprovisioning of Cape Collinson Crematorium	2010-11	2014-15	$659M
	Provision of Columbarium and Garden of Remembrance at Kiu Tau Road, Wo Hop Shek	2009-10	2012-13	$428M
	West Kowloon Law Courts Building	2012-13	2015-16	$2168M
	Public Library and Indoor Recreation Centre in Area 3, Yuen Long	2010-11	2013-14	$95M
	District Open Space, Sports Centre and Library in Area 74, Tseung Kwan O	2011-12	2014-15	$591M
	Redevelopment of Kwun Tong Swimming Pool Complex and Kwun Tong Recreation Ground	2009-10	2014-15	$988M
	Town Park, Indoor Velodrome-cum-Sports Centre in Area 45, Tseung Kwan O	2009-10	2013-14	$1003M
	Re-provisioning of Pak Tin Public Library	2008-09	2012-13	<$50M
	Construction of an Annex Building for Ko Shan Theatre	2010-11	2013-14	$547M
	Redevelopment of departmental quarters for Customs and Excise Department at Tsing Chau Street and Lee Kung Street, Hung Hom	2009-10	2012-13	$236M
	North Lantau Hospital, Phase 1	2009-10	2012-13	$1700M
	Redevelopment of Tai Lam Centre for Women	2012-13	2016-17	$823M
	Special School in Area 16, Tuen Mun for the Physically Disabled Children	2010-11	2012-13	$221M
	Construction of Trade and Industry Tower in Kai Tak Development Area	2011-12	2014-15	$2039M
	Development of Aberdeen Fire Station-cum-ambulance Depot	2010-11	2013-14	$145M

Respective Departments	Title of Contract	Scheduled Project Start	Scheduled Project Completion	Estimate of Cost (HKD)
	Construction of Fire Station-cum-Ambulance Facility at Cheung Yip Street, Kowloon Bay	2011-12	2013-14	$158M
	Redevelopment of Fire Services Training School	2012-13	2015-16	$2818M
	Joint-user Complex at Bailey Street, To Kwa Wan Reclamation	2010-11	2012-13	$394M
	Fitting-out works for Government facilities at new air cargo terminal	2011-12	2012-13	$100M - $200M
	Construction of a station for the New Terminal Doppler Weather Radar	2012-13	2014-15	$113M
	Joint-user Complex in Area 44, Fanling	2011-12	2013-14	$146M
	Community Hall at the housing site in Area 18, Tuen Mun	2010-11	2013-14	$50M - $100M
	Redevelopment of Victoria Park Swimming Pool Complex	2009-10	2014-15	$929M
	Primary school at the junction of Victoria Road and Pokfulam Road, Pok Fu Lam	2009-10	2012-13	$185M
	Transformation of the Former Police Married Quarters on Hollywood Road into a Creative Industries Landmark	2011-12	2013-14	$354M
	Local open space at Chung Yee Street, Kowloon City	2012-13	2013-14	2013-14
	Tuen Mun River Beautification - Tin Hau Temple Plaza	2011-12	2011-12	$80M
	Construction of an ambulance depot at Choi Shun Street, Sheung Shui	2012-13	2014-15	$100M - $200M
	Sports centre, community hall and public library in Area 14B, Sha Tin	2012-13	2012-13	>=$500M
	Redevelopment of disciplined services quarters in Fu Tei, Tuen Mun	2012-13	2014-15	$400M - $500M
	Printing Workshop, Government Logistics Department	2013-14	2015-16	$200M - $300M
	New Broadcasting House Radio Television Hong Kong	2013-14	2017-18	>=$500M
Civil Engineering and Development Department (CEDD)	Formation, roads and drains in Area 54, Tuen Mun – phase 2 stage 1 works	16 September 2011	Early 2015	$291 M
	Disposal of Contaminated Sediment- dredging , management and capping of sediment disposal facility at Sha Chau.	8 July 2009	29 June 2013	$231.0 M

Respective Departments	Title of Contract	Scheduled Project Start	Scheduled Project Completion	Estimate of Cost (HKD)
	Planning and engineering study on development of Lok Ma Chau Loop : consultants' fees and site investigation	1 June 2009	2012/13	$33.7M
	Review studies on North East New Territories new development areas : consultants' fees and site investigation	June 2008	2013	$54.2M
	Cycle Tracks Connecting North West New Territories with North East New Territories – Sheung Shui to Ma On Shan section	25 May 2010	early 2013	$230M
	Cycle tracks and associated facilities along seafront at Town Centre South, Tseung Kwan O	11 July 2011	Mid 2013	$92.30M
	Wan Chai development phase II, engineering works	28 January 2010	Q3 2016	HK$3,359 M
Drainage Services Department (DSD)	Yuen Long and Kam Tin Sewerage Stage 3	6 September 2012	2016	about $213 M
	Condition Survey for Underground Sewers and Drains – Investigation	25 July 2012	end 2017	about $14 M
	North District sewerage, stage 2 part 2A - Pak Hok Lam trunk sewer and Sha Tau Kok village sewerage	28 June 2012	Mid 2016	Approx. $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	26 June 2012	Mid-2016	about $317M
	Sewerage in Ping Kong, Fu Tei Pai and Tai Wo	21 November 2011	end 2014	about $226 M
	Lam Tsuen Valley sewerage, stage 1	31 October 2011	end 2015	about $270M
	Reconstruction and Rehabilitation of Kai Tak Nullah from Po Kong Village Road to Tung Kwong Road - Remaining Works	31 October 2011	mid 2017	about $1,600 M
	Trunk Sewerage at Lau Fau Shan	14 October 2011	end 2015	about $196 M
	Drainage Improvement Works in Pok Fu Lam Road, Mount Butler and Happy Valley	Oct 2011	Early 2013	NA
	Drainage improvement works in Shuen Wan, Tai Po	26 February 2010	2014	about $252M
	Tai Po Sewage Treatment Works, Stage 5 Phase 2B	29 January 2010	September 2013	about $660M

Respective Departments	Title of Contract	Scheduled Project Start	Scheduled Project Completion	Estimate of Cost (HKD)
	Sewerage in western Tuen Mun	15 December 2009	end 2015	about $1,300 M
	Yuen Long South sewerage and expansion of Ha Tsuen sewage pumping station	24 September 2009	early 2013	about $550 M
	Village Sewerage at Wang Chau of Yuen Long	31 July 2009	mid 2013	about $219M

Sources: web-sites of Development Bureau available at http://www.devb.gov.hk/en/home/index.html

3.3 Construction Companies

Table 4: Number of contractors and the breakdown by size

	No. of registered contractors (2012)			
Buildings Department (Registered General Building Contractors)	647			
Development Bureau (List of Approved Contractors for Public Works)	Group A	Group B	Group C	Total
	46	45	56	147
Housing Authority (Counterparty Lists)	NW1	NW2	Total	
	21	22	43	

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

3.4 Construction Manpower

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

Job Levels	May 2010
Professional/Technologist	20361
Technician	32990
Skilled & Semi-Skilled worker	49559
General Worker	22754
Total	125664

Source: *Manpower Survey Reports on the Building and Civil Engineering Industry*, Building and Civil Engineering Industry Training Board, Vocational Training Council, bi-annual issue of 2007.

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

Main industry group	2008	2009	2010
Construction of buildings	10663	13309	18529
Civil engineering	21354	24117	24420
Demolition and site preparation	5804	5259	6233
Building services installation and maintenance activities	56107	47839	52664
Building finishing and other specialized construction activities	42062	44731	45112
All construction activities	135990	135254	146958

Source: *Report on Annual Survey of Building, Construction and Real Estate Sectors*, The Census and Statistics Department, Hong Kong Special Administrative Region, various issues.

3.5 Productivity

Table 7: Value added per employee

Year	Value added per employee (HK$million)
2007	0.148
2008	0.180
2009	0.187
2010	0.207

Source:
Value added by Construction activity:
2011 Gross Domestic Product, The Census and Statistics Department, Hong Kong Special Administrative Region
Employed Persons by Industry (Construction).
Hong Kong Annual Digest of Statistics 2011, The Census and Statistics Department, Hong Kong Special Administrative Region.

Table 8: Physical Measurement of Construction Production

End use of building (Unit: 000sq.m.*)	2007	2008	2009	2010
Private residential premises+	5860 (-3.4%)	5265 (-10.2%)	3894 (-26.0%)	3665 (-5.9%)
Office buildings	1030 (9%)	77.4 (-24.9%)	262 (-66.1%)	389 (48.5%)
Hotels and boarding houses	274 (-53.3%)	292 (6.6%)	301 (3.1%)	162 (-46.2%)
Multi-purpose commercial premises	1156 (29.9%)	16.33 (41.3%)	1442 (-11.7%)	987 (-31.6%)
Flatted factory blocks and warehouses	210 (56.7%)	246 (17.1%)	131 (-46.7%)	125 (-4.6%)
Total	8529 (-1.1%)	8210 (-3.7%)	6030 (-26.6%)	5328 (-11.6%)

* Area (sq. m) refers to gross floor area of buildings when completed.
+ Includes buildings purely for residential purpose and combined residential and non-residential buildings.
Source: *Report on Annual Survey of Building, Construction and Real Estate Sectors*, The Census and Statistics Department, Hong Kong Special Administrative Region, various issues.

3.6 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
2012	1414	NA	NA	NA
2011	1273	1320	1369	1408
2010	1134	1161	1249	1266
2009	1074	983	1111	1107
2008	1118	1305	1401	1262

Source: Building Works Tender Price Index (BWTPI) compiled by the Architectural Services Department available at http://archsd.gov.hk/archsd_home01.asp?Path_Lev1=5&Status=bwtpi

Table 10: Major construction material average price

		2008	2009	2010	2011	2012 May
Aggregates (HK$ per tonne)		45	47	50	63	61
Bitumen (HK$ per tonne)		6940	7240	7570	8483	9330
Concrete blocks, 100mm thick ($ per square metre)		60	59	62	68	70
Diesel fuel	For industrial use (light) ($ per 200-litre drum)	2389	2082	2440	1971	2047
	For road use (HK$ per 100 litre)	1171	916	1029	988	1018
Glass - Clear sheet glass, 5mm thick (HK$ per square metre)		93	115	136	144	147
Glazed ceramic wall tiles	White tiles, 108mm*108mm ($ per 100 pieces)	110	110	155	202	205
	Colour tiles, 200mm*200mm ($ per 100 pieces)	260	270	270	334	374
Hardwood	Sawn hardwood, 50*75 mm column ($ per cubic metre)	3628	3731	3992	5470	5499
Homogeneous floor tiles	Non-slip tile, 200mm*200mm ($ per square metre)	148	145	146	150	154
Galvanised mild steel	Steel plates (HK$ per tonne)	11387	7580	8303	9180	9261
	Steel angles (HK$ per tonne)	15755	11118	12099	12234	12024

	Steel flats (HK$ per tonne)	11500	8947	9714	10023	10214
Metal formwork	Steel plate, 4mm thick (HK$ per tonne)	8258	5280	5857	6542	6356
Mosaic tiles	Unglazed tiles, 18mm*18mm ($ per square metre)	59	53	70	81	91
	Glass tiles, 25mm*25mm ($ per square metre)	31	31	31	35	42
	Glazed tiles, 45mm*45mm ($ per square metre)	79	85	89	109	114
Paint	Emulsion paint (HK$ per litre)	39	37	39	45	47
	Acrylic paint (HK$ per litre)	38	38	41	48	49
Portland cement (ordinary) (HK$ per tonne)		538	592	621	677	685
Sand (HK$ per tonne)		83	75	72	101	115
Steel reinforcement	Mild steel round bars, 6mm to 20mm ($ per tonne)	9602	5687	6408	6747	6557
	High tensile steel bars, 10mm to 40mm ($ per tonne)	9742	4581	6003	6288	6174
Timber formwork	Plywood, formwork, 19mm thick ($ per square metre)	67	63	66	71	73
	Sawn hardwood, 25mm thick plank ($ per cubic metre)	2960	3068	3072	3355	3572
uPVC lined GMS pipes	20mm diameter pipes, 5.5 long ($ per number)	NA	NA	NA	NA	NA
uPVC pipes	32mm diameter pipes, 4m long (HK$ per number)	42	45	47	51	56

Note : Prices are based on June data from 2008 to 2011 and in Hong Kong dollars.
Source: *Average Wholesale Prices of Selected Building Materials*, Census and Statistics Department, Hong Kong Special Administrative Region, various issues.

Table 11: Construction Industry Salaries and Wages – Technicians and Unskilled Workers

	Unskilled Workers Daily Wage (HK$)
2007 Dec	566
2008 Dec	582
2009 Dec	576
2010 Dec	599
2011 Dec	616

Sources: *Average Daily Wages of Workers Engaged in Public Sector Construction Projects*, Census and Statistics Department, Hong Kong Special Administrative Region, 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$)	2007 June	2008 June	2009 June	2010 June	2011 June
Accountant	30200	31900	32800	34400	32900
Administrative Officer / Executive Officer	NA	19300	16900	18400	NA
Architect	49400	47700	52700	50900	55800
Administration Manager/ Company Secretary/ Office Manager	NA	42500	NA	NA	NA
Building Services Engineer	30000	31800	31700	29400	31200
Civil Engineer	32900	34700	NA	NA	NA
Electrical Engineer	37600	28000	NA	NA	NA
Financial Manager/ Accounting Manager	47000	54600	NA	NA	NA
I.T./ Computer Manager	37200	38100	NA	NA	NA
Mechanical Engineer	37900	30100	28700	31500	28100
Personnel Manager/ Human Resources Manager/ Staff Relations Manager	46100	27700	35200	32000	37800
Project Manager	48300	54600	41800	55100	55200
Quantity Surveyor	28900	23500	NA	NA	NA
Safety Officer	29200	29900	29300	30700	33200
Structural Engineer	25000	29900	27700	33400	34100

NA : data not available
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 Special Administrative Region.

Professionals in some disciplines had a substance increase in their wages, such as architects, human resources managers and safety officers. On the other hand, the wages of some other professionals, for example, accountants and mechanical engineers, decreased by 5-10%.

Table 13: Construction Industry Salaries and Wages –Skilled Workers (in HK$)

	2007 Dec	2008 Dec	2009 Dec	2010 Dec	2011 Dec
Concretor	915	957	952	926	1073
Bricklayer	853	805	896	861	853
Drainlayer	786	858	874	876	970
Mason	838	736	811	818	853
Bar bender and fixer	1071	1081	1124	1167	1249
Metal worker	786	793	803	829	835
General welder	766	787	807	843	894
Structural steel erector	891	881	922	1017	1181
Structural steel welder	920	915	747	952	1005
Rigger/metal formwork erector	820	798	813	831	949
Carpenter (formwork)	951	994	1014	997	1091
Joiner	879	858	851	916	899
Plumber	782	826	846	886	894
Construction plant mechanic	706	747	761	797	899
Plant & equipment operator (load shifting)	753	752	739	746	802
Truck driver	587	586	595	611	654
Rock-breaking driller	790	780	780	784	840
Asphalter (road construction)	713	677	683	705	747
Bamboo scaffolder	1036	998	1060	1072	1129
Diver	1663	1665	1721	1766	1761
Plasterer	817	847	860	891	940
Glazier	799	756	849	908	897
Painter and decorator	742	752	785	813	781
Leveller	697	719	715	762	839
Marble worker	975	627	932	779	898
Electrical fitter (incl. electrician)	680	680	711	697	723
Mechanical fitter	686	691	636	623	622
Refrigeration/AC/ventilation mechanic	581	534	621	660	610
Fire services mechanic	690	686	714	755	667
Lift and escalator mechanic	623	812	682	696	645
Building services maintenance mechanic	511	744	685	628	655
Power cable jointer	600	479	404	751	853

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

The table above summarizes the wages of 32 categories of skilled workers. The average daily salaries and wages of skilled workers increased in 2011. It would be expected that the demand for workers and their wages will further increase following the commencements of more construction projects.

3.7 Import & Export of Construction Work and Consultancy Services

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

Year	2007	2008	2009	2010	2011
Imports					
Value of Construction services by foreign contractor	2303	1,283	923	413	NA
Value of consultancy services by foreign consultant	474	800	400	417	NA
Exports					
Value of construction services by local contractor in foreign country	2699	1,580	1079	1,123	NA
Value of consultancy services by local consultants in foreign country	1933	3,193	2,134	2,233	NA

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

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 lasts 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.

The table above indicates that there is a decreasing trend of export of construction services. The value decreased from HK$2,699 million in 2007 to HK$1,123 million in 2010. However, the export of architectural, engineering and other technical services increased from 2007. There is more overseas demand of local professional than construction services. Major demands have come from China Mainland, Dubai, India and other South East Asian countries.

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
Construction services	**2007**	**2699**	**2303**	**396**
	2008	**1580**	**1283**	**297**
	2009	**1079**	**923**	**156**
	2010	**1123**	**413**	**710**
Asia	2007	2651	**	**
	2008	1496	1212	284
	2009	1040	751	289
	2010	**	357	**
Australasia and Oceania	2007	<0.5	<0.5	<0.5
	2008	<0.5	**	**
	2009	**	**	**
	2010	<0.5	**	**
Central and South America	2007	<0.5	<0.5	<0.5
	2008	<0.5	<0.5	<0.5
	2009	<0.5	<0.5	<0.5
	2010	<0.5	<0.5	<0.5
North America	2007	**	**	**
	2008	**	<0.5	**
	2009	<0.5	<0.5	<0.5
	2010	<0.5	<0.5	<0.5
Western Europe	2007	**	<0.5	**
	2008	**	**	**
	2009	<0.5	**	**
	2010	<0.5	**	**
Architectural, engineering and other technical services	**2007**	**1933**	**474**	**1459**
	2008	**3193**	**800**	**2393**
	2009	**2134**	**440**	**1694**
	2010	**2233**	**517**	**1716**
Asia	2007	1466	310	1136
	2008	2364	548	1816
	2009	1619	302	1317
	2010	1772	425	1347
Australasia and Oceania	2007	16	**	**
	2008	45	28	17
	2009	21	13	8
	2010	38	20	18
Central and South America	2007	<0.5	<0.5	<0.5
	2008	**	<0.5	**
	2009	<0.5	<0.5	<0.5
	2010	**	**	**
North America	2007	166	99	67
	2008	205	15	190
	2009	198	69	129
	2010	166	16	150
Western Europe	2007	26	50	-24
	2008	297	189	108
	2009	181	44	137
	2010	187	**	**

** Data suppressed for confidentiality reason
Sources: *Report on Hong Kong Trade in Services Statistics for 2010 and 2007*, The Census and Statistics Department, Hong Kong Special Administrative Region.

The majority of the export and import of both construction and consultancy services are carried out within the Asian region. The Chinese Mainland market has taken the highest proportion. The export of major consultancy services includes engineering consulting, contracting and project management. In 2010, consultants have also generated HK$391million from countries outside Asia, including Australasia and Oceania, North America and Western Europe. On the contrary, the export of construction services to regions outside Asia has been negligible in the last few years.

AsiaConstruct18

Theme Paper - Hong Kong

Sustainable Building Practices during Construction

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

The RCCREE is the Hong Kong Polytechnic University 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).

Executive Summary

Building and construction work together is the largest user of global resources and emits the most greenhouse gas. In OECD countries, the built environment uses approximately 30% of all raw materials, generates 30% to 40% of all solid wastes, emits 30% to 40% of all greenhouse gas, and uses 25% to 40% of total energy (OECD, 2003). Therefore, the construction industry has strong global incentive to help protect the environment and improve living conditions and well-being.

This paper will focus on sustainable practices during the construction stage in Hong Kong, and share with AsiaConstruct member countries our experience in green technologies, methods, and best practices that builders use to reuse and recycle, save energy, and reduce water in construction sites. The objective of this paper is to provide some insights into the future of developing sustainable building practices and encouraging a wider application of different green technologies and materials in construction projects.

1. Introduction

Construction activities contribute to the adverse impact on the environment via the creation of waste, air pollution, resource depletion, and energy consumption (Ngowi 2001). Energy saving in the operation of buildings and construction work is a critical issue in the construction industry. Issues related to green building have elicited the attention of scholars and professionals in building across the world (Rees, 1999; Ding, 2007). Sustainable building practices such as selection of green materials, designing for recycling, and green technologies are strategic methods in minimizing the detrimental effects of construction work on the natural environment.

2. Green initiatives in the building sector by Hong Kong Government

In order to avoid the significant impact of construction activities on the environment, different restrictions and regulations have been formulated and implemented by the Hong Kong government, as detailed below in chronological order.

2.1 Hong Kong Energy Efficiency Registration Scheme for Buildings (1998)

The registration scheme was launched by Electrical and Mechanical Services Department (EMSD) in 1998. The Building Energy Codes (BECs) are a set of five Codes of Practice. It includes lighting, air-conditioning, lift and escalator installation, and electrical installation.

They are performance-based building energy Codes that stipulate the minimum energy performance standard of these installations.

2.2 Sustainable Development Fund (2003)

The Sustainable Development Fund was established by the HKSAR government. A sum of HK$ 100M was provided as a central financial source of support initiatives, which helped develop public awareness on sustainable development. It also aims to encourage sustainable practices in Hong Kong. A sum of HK$ 10M has been earmarked for disbursement every year (Sustainable Development Fund, 2010).

2.3 Incorporation of elements about environmental concerns in Tender Evaluation of Work Contracts (2004)

According to ETWB (2004), for tenders submitted with the two-envelope approach, the technical proposal of the tender may include the use of environmentally friendly products and processes. Moreover, the reports on contractor performance consider the outcomes of implementation of their waste management plans and the environmental friendliness in their contractors' designs.

2.4 Pay for Safety and Environment Scheme (2005)

The HKSAR government unified the standard and payment methods on specific environmental nuisance abatement measures and incorporated the payable items on environmental management into the Pay for Safety and Environmental Scheme (PFSES) (ETWB, 2005a). Contractors have priced unreasonably low rates for payable items for environmental management due to keen competition. Thus, these items are now pre-priced in the bills of quantities/schedules of rates in public works contracts. Designated deductions of payments will be made to the contractor if the specified actions are not taken (Lam et al., 2011).

2.5 Construction Waste Disposal Charging Scheme (2005)

Based on the "polluter pays principle," the Construction Waste Disposal Charging Scheme was implemented by the HKSAR Government in December 2005 (Environmental Protection Department, 2011). This scheme aims to charge against violating contractors who dump their construction waste into public landfills, encouraging contractors to recycle and reuse construction and demolition waste instead. An economic disincentive is introduced under this scheme to encourage contractors to reduce, sort, recycle, and reuse construction waste (Legislative Council, 2007).

2.6 Adoption of Renewable Energy Technologies and Energy Efficient Features in Government Projects and Installations (2005)

Another technical circular was issued by the ETWB in 2005 to promote the application of renewable energy technologies and energy efficient features in government projects (ETWB, 2005b). The same circular should be issued so that related departments can strive to identify opportunities to promote existing government buildings or installations to incorporate renewable energy technologies and energy efficient features such as photovoltaic panels and solar water heating systems.

2.7 Building Energy Efficiency Funding Schemes (2009)

In response to the 2008–2009 Policy Address, the Building Energy Efficiency Funding Scheme was set up to subsidize building owners to conduct energy-cum-carbon audit (ECA) and energy efficiency projects (EEP).

The purpose of EPP is to provide incentives to building owners to conduct additional improvement or alteration work to improve the energy efficiency performance of building services installation. The reimbursement for the energy efficiency projects is limited to 50% of the approved total actual expenditure and maximized at HK$ 500,000 per building per application (ECF, 2011). A total of 672 applications were approved up to 30 September 2011.

2.8 Green Government Buildings (2009)

In addition to the issuance of the Technical Circular (Works) 16/2005, the HKSAR Government issued another technical circular, “Green Government Buildings”, in April 2009 to establish a comprehensive target-based green performance framework for existing and new government buildings in view of promoting green buildings in Hong Kong. The targets set in the framework apply to new government buildings and existing government buildings. The framework covers seven areas: 1) Green Building Ratings, 2) Energy Efficiency, 3) Greenhouse Gas Reduction, 4) Renewable Energy, 5) Waste Reduction and Management, 6) Water Management, and 7) Indoor Air Quality. The additional cost involved in items 4 to 7 would be capped at 2% of the total project cost (Development Bureau, 2009).

2.9 Encouraging the Use of Recycled and other Green Materials in Public Works Projects (2011)

A technical circular was issued to establish a framework for the procurement of recycled materials and other green materials to promote their applications in public work projects (Development Bureau, 2011). A three-tier framework for trial use, early phase of implementation, and full implementation of priority use is presented in this document. At the first tier, the technical performance of the new recycled materials (or green material) should be proven satisfactory in the trial run in terms of strength, durability, environmental

performance, and the like. At the second tier, if at least two suppliers can be identified, recommendations will be made to work departments for early phase of implementation. At the third tier, if suppliers are identified and the technical performance is reconfirmed, recommendations will then be made to work departments for full implementation of priority use (Development Bureau, 2011).

3. Sustainable Building Practices

The literature reveals various green approaches, technologies, and materials to reduce environmental impact of construction activities. The details of these sustainable building practices will be discussed in this section.

3.1 Green Technologies

Table 1 Application of different green technologies

Green Technologies	Applications	Sustainability
Two level lighting control system	Public area (lobby, corridor and staircase)	Reduce energy consumption
Photocell Sensor Control for Lights in Public Areas	Areas near the windows in public areas	Reduce energy consumption
Electronic Ballast to replace Electromagnetic Ballast	Equipped with fluorescent type lighting fittings	Save about 15% of electrical energy
T5 Fluorescent Tube and LED Lighting Systems	General illumination at housing estates	Reduce energy consumption
Variable speed drive control for the fresh water booster pumping system	Residential housing	Extend the life span of the pumping equipment, achieve higher energy efficiency and occupy lesser plant room space.
Hybrid ventilation system	New shopping centres	Reduce energy consumption and carbon emissions from the air-conditioning system

Two-level lighting control system

In response to the requirements specified in the “Barrier Free Access 2008”, a design manual promulgated by the Building Department, the illumination standard of public areas has been

significantly increased to cater to persons with special needs, such as those who have impaired vision. To achieve the new illumination standard for domestic blocks without undue increase on energy consumption, a new two-level lighting control system has been adopted in the new design for public rental housing estates since December 2008. This system enables users to raise the lighting level when necessary. The standby sets of lighting system at different areas can be elevated to 85 lux when switched or triggered on. When occupancy is no longer detected, the lighting system returns to the low stand-by level (ITC, 2011).

Photocell Sensor Control for Lights in Public Areas of Domestic Blocks

Photocell sensor controls for lights are installed in areas with natural light, such as areas near the windows in communal areas, to switch off certain lights to save energy when the illumination level is adequate. In the area of energy savings, the Hong Kong Housing Authority (HKHA) adopted the Code of Practice for energy efficiency of EMSD. Trial applications of Photocell sensor control system have been conducted at selected housing estates. In the case of Ching Yi Estate, a public housing estate comprising 4 multi-storey residential blocks housing altogether 2,000 residents in 800 households, electricity consumption in the public areas was reduced by 30.9% after setting up indoor lighting control devices in the corridors. With reference to the assessment results of pilot projects, wider application of such control system may be considered for adoption in other new estates (HKHA, 2012a).

Use of Electronic Ballast to replace Electromagnetic Ballast

Control gear is an essential element for the operation of fluorescent lamps, which is used to regulate the amount of electricity that flows to the lamp. The control gear used is known as ballast. Ballast can be divided into two major kinds: electronic ballast and magnetic ballast (EMSD, 2011a). Magnetic ballast has been developed and adopted for over two decades, whereas electronic ballast is a modern energy-saving option. For fluorescent-type lighting fittings, approximately 15% of electrical energy could be saved if electronic ballast is used instead of electromagnetic ballast. Thus, the HKHA has widely adopted the use of electronic ballast. At present, all new buildings being constructed are equipped with fluorescent-type lighting fittings driven by electronic ballasts.

Wider Use of T5 Fluorescent Tube and LED Lighting Systems

T5 fluorescent tubes of higher efficacy have been used for all exit and directional signs of public rental housing to replace the T8 counterparts. Coupled with the use of electronic ballast, the overall efficacy of the fixture can be raised by approximately 20% to 30% (Cheung and Fan, 2012). In one renovation project were the replacement of the existing 320 sets of T8 fluorescent luminaries in the office areas with T5 fluorescent luminaries, complete

with electronic ballasts. The average daily lighting energy consumption measured onsite before retrofit was 470 kWh, whereas the energy consumption measured after retrofit was 270 kWh. Thus, energy savings of 55,000 kWh per floor is anticipated annually (EMSD, 2011b).

Variable speed drive control for the fresh water booster pumping system

The HKHA has adopted variable speed drive controls for the fresh water booster pumping system in all new public rental housing estates (HKHA, 2012a). In a variable speed drive control system, the water pump output is adjusted and varied to meet the system requirements. The pump will deliver the exact amount of water that is required by the system. The system has been used together with smaller stainless steel pneumatic pressure vessels and stamped stainless steel multi-stage pumps to extend the life span of the pumping equipment, achieve higher energy efficiency, and occupy less plant room space.

Hybrid ventilation system

The hybrid ventilation system is a combination two-mode system. An energy efficient way to provide a comfortable indoor environment is to use both natural and mechanical forces at different periods of the day or season of the year. In order to maintain a satisfactory indoor environment, the hybrid ventilation systems can be controlled automatically and changed between natural and mechanical modes to minimize energy consumption (Heinonen and Kosonen, 2000). This system has been introduced at some new shopping centers. Combining the use of natural ventilation and mechanical air conditioning, as well as switching between two operation modes to suit user needs, the new system greatly reduces energy consumption and carbon emissions from the air-conditioning system.

3.2 Green Materials

Table 2 Application of different green materials

Green materials	Applications	Sustainability
Concrete paving with recycle glass	◆ Production of paving blocks	◆ Recycle waste glass
Air pollutant removal paving block	◆ Paving blocks	◆ Remove air pollutants such as nitrous oxides (NOx) by at least 20 %
Recycling and reuse of marine mud	◆ Paving tiles ◆ Backfill materials	◆ Reduce construction and demolition wastes
Recycled concrete and aggregates	◆ Pavement sub-base; ◆ Production of concrete ◆ Production of recycled concrete paving blocks ◆ Parapet wall and planters ◆ Partial replacement of virgin aggregates for concrete works in retaining walls, beams ground slabs and pile caps etc.	◆ Reduce the impact on the landscape due to the exploitation and quarrying of natural aggregates. ◆ Slow the consumption of natural resources used in concrete ◆ Reduce construction and demolition wastes
Recycled brick	◆ Reuse as bricks ◆ Recycle into new bricks ◆ Brick wall	◆ Reduce construction and demolition wastes ◆ Save energy to manufacture new bricks
Recycled boards and partition	◆ Partition walls for office and toilets use	◆ Reduce construction and demolition wastes
Recycled flooring	◆ Floors of residential and commercial buildings	◆ Reduce construction and demolition wastes
Energy efficient windows glazing	◆ Windows of residential and commercial buildings	◆ Reduce solar heat transfer and cooling load ◆ Reduce noise and internal condensation

Concrete paving with recycle glass (Eco-Glass-Block)

In 2004, the Environment Protection Department (EPD) funded research on developing local recycling outlets for waste glass by a local university. In the recycling process, the waste

glass such as glass containers were crushed into smaller particles to replace natural river sand for the production of paving blocks. Since 2004, two concrete paving blocks manufacturers have used recycled glass containers collected in Hong Kong. EPD (2012) reported that the Highways Department (HD) introduced new requirements in its road maintenance contracts in October 2010 to prioritize the use of concrete paving with recycled glass at paving areas. The Housing Department also started using such environmentally friendly concrete pavers in their projects in late 2010.

Air pollutant removal paving block

The air pollutant removal paving blocks can effectively help improve the environment. They are also manufactured from environmentally friendly materials. The paving block is a thin surface layer made of cement, recycled aggregates, a small amount of titanium dioxide, and other industrial wastes, with a concrete base layer. When the surface layer of the block is irradiated by natural sunlight, active oxygen molecules will be created on the paving block surface. Thus, NOx in the air will be oxidized into nitrate. The nitric acid, as a resultant, will be washed away by rain. Approximately 20% of air pollutants such as nitrous oxides (NOx) can be removed (HKNG, 2011).

Recycling and reuse of marine mud

The construction site for the Kai Tak public rental housing development involved substantial amounts of marine mud excavation. Approximately 12,000 m^3 were excavated, which is equivalent to five standard Olympic-sized swimming pools. Traditionally, the excavated mud would be treated as waste and dumped in landfills or out at sea. However, an innovative and practical method was developed by the project team to help minimize construction costs as well as environmental impact. More than HK$ 8 million was eventually saved on waste disposal (HKIE, 2010).

The excavated marine mud mixed with cement and sand is processed at the treatment plant on-site. The green-treated marine mud was then backfilled and compacted in layers of approximately 300 mm for sufficient reinforcement to support the building foundation. This treatment of marine mud was turned into other products such as paving tiles and used at other construction sites of new public rental housing projects of HKHA in Tseung Kwan O (HKHA, 2012b).

Recycled concrete and aggregates

Many environmental, economical, and energy benefits can result from recycling and reusing concrete. The use of recycled concrete and aggregates can greatly reduce the natural disturbance on the landscape due to the exploitation and quarrying of natural aggregates,

preserve our landfill space, and regain the embodied energies. The demand for natural resources can also be reduced. In the disintegration process of the concrete matrix, recycled aggregates can be obtained. Moreover, constituents of the concrete matrix tend to return to their most stable form during the crushing process. This means that only strong particles can survive, whereas weaker particles will be reduced to more stable, yet smaller particles that can still be reused. Recycled aggregates have been commonly applied in construction work such as the replacement of virgin aggregates for concrete works in retaining walls, beams, and ground slabs, among others (EMSD, 2012).

Recycled brick

Bricks and masonry units are similar to concrete, involving extensive primary embodied energy. Considerable amounts of energy, natural resources, and valuable landfill space can be preserved by recycling and reusing these units. Several types of bricks are reusable. Reused brick can be collected from other construction sites and recycled, crushed, and manufactured into new bricks. Some by-products of recycling, such as fly-ash, can be integrated into mixtures of brick or masonry (EMSD, 2012). Crushed brick rumble can be utilized as an aggregate for lightweight concrete. Crushed masonry aggregate from different types of demolition waste can be used for the production of pavement bases and in the precast concrete industry. Moreover, they are applied as landscaping rocks in some regions in the US.

Recycled boards and partition

Previously used partitions and boards can be refurbished and reused to reduce the amount of new resources used. This process also minimizes diverting material from entering the waste stream, which ultimately enters landfills. Recycled boards can be applied as partition walls for office and restroom use. In the construction project of the Jockey Club Environmental Building, located in Kowloon Tong in the Kowloon Peninsula of Hong Kong, the amount of waste that could be generated was reduced with the application of recyclable hoarding instead of traditional plywood hoarding. When the building structure was finished and the boundary fence was erected, the entire recyclable hoarding can be removed and reused as internal permanent partitions inside the building. Recycled boards and partitions have been applied successfully in many places throughout the world. For example, gypsum boards with recycled content were adopted at the City of White Rock Operations Building in New York. The walls of Sonoma County Waste Management Agency in California were made of gypsum board with approximately 20% recycled gypsum (EMSD, 2012).

Recycled flooring

Many types of environmentally-friendly floor finishing materials are available in the market, including bamboo, concrete, wood, ceramic tile, and terrazzo. It is recommended to avoid

using the traditionally-used synthetic materials, because they contain chemicals that are harmful to our health, such as petroleum. Green carpet options comprise natural and inert fibers that are primarily made from sustainable materials that are biodegradable, recyclable, or renewable. Cork is another sustainable flooring choice. With proper care, cork is an economical, resilient, and durable floor finishing option. Linoleum that is made from renewable and natural materials is also a naturally durable flooring material that is simple to maintain and fix. Ceramic tile is entirely recyclable because it comes from natural sources. Asian bamboo strips laminated onto durable flooring boards are innovative technology from a renewable resource (EMSD, 2012).

Energy efficient window glazing

Window technology has undergone a significant revolution in the past few years. The application of energy-efficient window and glazing systems can significantly reduce building energy consumption. These energy-efficient windows feature improved frame, insulating gas in between glass panes, multiple glazing, and are specialized with transparent coatings. All these features minimize heat transfer; they are thus able to cut energy costs. Low-emissivity glass is coated with a special layer of metal, which is able to reflect much of the infrared portion of the solar spectrum while transmitting most of the visible spectrum. Thus, the amount of solar heat transmitted to the building can be reduced (EMSD, 2012). Double glazing windows comprise two glass panes that are separated by an air gap. Double glazing offers greater insulation from convective and conductive heat transfer when compared with single glazing. In addition to thermal advantages, double glazing can provide a notable reduction in internal condensation and outside noise. The thermal insulation performance of double glazing can be further enhanced by filling inert gas such as krypton or argon, instead of air, between the two glass panes.

4. Conclusions

The construction industry, as one of the major users of environmental resources, is consequently a major polluter of the natural environment. This paper has attempted to demonstrate how environmental impact could be reduced using sustainable building practices. A series of green technologies and sustainable building materials during construction stages of a building are introduced and recommended. If these approaches could be effectively applied in the construction process of all building, the adverse effects of construction activities on the environment would be largely reduced.

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