

## **Studies of Accident Costs and Safety Investment in Construction: The Hong Kong Experience**

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### **Abstract**

Owing to the commencement of the Ten Mega Infrastructure Projects, the construction industry in Hong Kong is now enjoying the "Golden Ten Years". A significant growth in the construction industry implies a large amount of construction workers are working at construction sites and subsequently, safety issues in construction become a prime concern. In recent years, the promulgation of stringent safety requirements and regulations by the relevant government departments has driven contractors to provide more resources in safety management. As a result, the accident rate in the construction industry reached the lowest record of 49.7 per 1,000 workers in 2011. Through an investigation of previous research findings and relevant government's official publications, this paper is going to explore the relationships between safety investment and costs due to construction accidents, Gross Domestic Product (GDP) and insurance claims within the Hong Kong construction industry.

### **Keywords**

Construction accidents, safety investment, Insurance claims, Gross Domestic Product (GDP), Hong Kong

## **1) Introduction**

The Hong Kong construction market has been booming due to the commencement of a vast number of infrastructure projects in 2011. Both of the Policy Address in 2011-2012 and 2012-2013 announced the long-term development strategy of the whole territory by investing nearly HK\$100 billion per year in infrastructure and housing projects. The Hong Kong construction market is now enjoying the "Golden Ten Years".

The government has allocated a lot of resources in the construction market already, therefore a high construction accident rate would provoke public concerns. In 2011, the number of fatalities in the construction industry reached nearly a peak in the recent decade (Table 1) although the government has introduced a lot of safety initiatives to raise workers' safety awareness and promote safety culture and quality of works in the construction industry, such as Pay for Safety Scheme (PFSS) and Site Supervision Plan (SSP).

### **1.1) Construction accidents in Hong Kong**

Researchers concern construction accidents and safety management in Hong Kong (Rowlinson, 2003, Poon et. al., 2008 and Choudhry et al., 2009) and impact of economic issue of construction industry (Yiu et. al., 2004, Wong et. al., 2008, Tse and Sivaguru IV, 1997). This paper will cover the relationships between safety investment and costs due to construction accident, GDP and insurance claims within the Hong Kong construction industry.

### **1.2) Construction market in the territory**

The construction stage mainly consists of two categories of works: buildings and infrastructure. Apart from the infrastructure projects, residential buildings have been a major growth of kinetic energy in the construction market. As stated in the 2011-2012 Policy Address, the HKSAR Government is planning to build 40,000 flats (private and public) per year in order to stabilize the supply of residential properties. Hence, the construction market in Hong Kong is becoming fierce in competition. The GDP input by the construction industry will reach a high value in the coming year.

According to the Census and Statistics Department of Hong Kong, the percentage of contribution of the construction industry to the Hong Kong GDP from 2000 to 2011

ranges from around 2.6% to 4.9% and the construction industry input 39 to 65 billion Hong Kong dollars within the same period. The investment in the construction industry has risen from the trough since 2005 and it is expected that the investment in the construction industry will soar in near future.

GDP is a common concept and it is defined as a measure regarding the total value of production of all residents of a country or territory in a specified period before deducting allowance for consumption of fixed capital. It is a common practice to use annual series of current price GDP by economic activities to analyse the economic structure of a district.

### **1.3) Accident rates in Hong Kong**

Hong Kong is a small city which is only about 1,100 km<sup>2</sup> in territory, but houses a population of more than 7 million. Construction experts and stakeholders enjoy the fruitful booming of the market. Construction activities thrive on the growth of the distinct economic; in contrast, the rising accident number raises public concerns from different groups in the society.

Based on the statistical data of the Labour department of Hong Kong shown in Table 1, both the number of accidents and the accident rate per 1,000 workers in the construction industry have exhibited a general declining trend over the decade of 2002-2011. It is difficult to judge whether 3,000 accidents in a year is high but the accident rate per 1,000 workers could be an indication. The accident rate per 1,000 workers is going down in the decade but the fatality rate shows a sudden rise in 2011 and 2012. People may worry about whether the continuation of the ten major infrastructure projects will push up the accident number/ rate or fatality number/ rate in the near future.

The HKSAR Government has devoted concerted efforts in enhancing safety awareness of workers and promoting safety culture and quality of works in the construction industry such as the implementation of the Pay for Safety Scheme and the Site Supervision Plan. The current high number of construction accidents and the accident rate are not acceptable in the society.

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
No of accidents	6239	4367	3833	3548	3400	3042	3033	2755	2884	3112	3160
No. of fatalities	24	25	17	25	16	19	20	19	9	23	24
Employment size	73223	64112	63520	59266	52865	50185	49422	50501	55341	62635	71295

Accident rate/ 1,000 workers	85.2	68.1	60.3	59.9	64.3	60.6	61.4	54.6	52.1	49.7	44.3
Fatality rate/ 1,000 workers	0.328	0.39	0.268	0.422	0.303	0.379	0.405	0.376	0.163	0.367	0.337

Table 1: Overview of the construction accidents and accident rates in Hong Kong  
 (Source: Labor Department, HKSAR 2013)

#### 1.4) Accident costs in Hong Kong

Accidents in the construction industry undoubtedly have significant time and cost implications. Several researchers discussed direct, indirect and social cost implications due to accidents. (Hinze and Appelgate, 1991, Tang et. al., 2004 & 2007, Ahmed et. al., 2006, Abid et al., 2009)

Direct and indirect costs are easy to be understood; accidents bring cost implication, such as time delay, material and equipment loss. On the other hand, social cost is about the suffering in the society. Social cost (Tang et al., 2004 & 2007, Abid et al., 2009) may be briefly interpreted as police and rescue force going to the disaster area to save lives; labour officers going to the area concerned to investigate the accident; social welfare officers helping the victims and their families; legal aid officers and court solicitors acting as consultants to provide legal advice.

It is difficult to find out the real data of the cost incurred due to accidents. This is no authorized statistics about the cost in Hong Kong. It is believed that the cost involves a lot of financial and social issues which are difficult to be measured. Previous researchers found that the overall yearly social costs are about 150 – 790 million Hong Kong dollars (Tang et al., 2004 & 2007, Nadeem et al., 2009).

Accidents are unpredictable and unexpectable. There is no trend about the expenses per year. It is feasible to average the previous data for a datum; but it can be treated as a reference only.

#### 2) Safety Investment in Hong Kong

Safety investment includes employment of staff such as safety managers and safety officers, safety training and safety equipment with its associated operation costs. Similar to the situation of costs due to construction accidents, safety investment is difficult to be measured. It may involve business strategies that companies would not usually disclose.

Previous researchers estimated the overall yearly social safety investments range from around 840 - 1160 million Hong Kong dollars, based on the data collected between 1999 – 2005 (Tang et al., 2004 & 2007).

### **3) Construction Industry as a major economic activity of Gross Domestic Product (GDP)**

Total GDP of economic activities and the percentage of these activities contributed to GDP are shown in Table 3 at current prices. There are previous studies which discussed the impact of GDP on the construction industry. Tse and Sivaguru IV (1997) used the granger causal method and unit root analysis to test the lead-lag relationship between GDP and construction flow in Hong Kong, and they found that there was inter-temporal diversion of the GDP and the construction flow. Variations in the construction market are not more volatile than the economic change. Yiu et. al. (2004) further applied the granger causality method to analyse the relationship between the growth rate of the construction industry and GDP. They advocated that the growth of GDP led the construction output from 1984 to 2002.

Wong et al. (2008) discussed the relationship between gross values of construction work (GVCW) and gross domestic product (GDP) time series in Hong Kong.

The authors further remarked that the construction industry is going to become a major sector in the GDP combination of the Hong Kong market.

### **4) Insurance claims due to construction accidents**

The construction industry has been booming recently in Hong Kong and it has evolved to be an important sector, at least in the coming foreseeable "golden ten years". However, safety issues are receiving grave concerns. In 2011, there were over 146,000 employees working in construction related jobs including new construction contractors, decoration/ repair/ maintenance contractors, special trade contractors/ architects/ engineers/ surveying services, major estate developers, tertiary institutions/ utilities and government departments (Vocational Training Council, 2011). According to Table 2, it appears significantly that people in Hong Kong are not happy in general with the sustained high accident rates in construction.

The high accident rate gives rise to another issue on insurance claims. From Table 2, gross premium, insurance value, gross claims paid and gross outstanding claim in the

construction industry reach high values. It is expected that the insurance claims in the construction industry are keeping at high values due to the booming of the construction industry in Hong Kong.

<b>Year</b>	<b>Gross Premium in construction industry, (Annual wage + contract value) HK\$ million</b>	<b>Insurance Value of Construction industry, (Annual wage + contract value) HK\$ million</b>	<b>Gross Claims Paid (Construction industry), HK\$ million</b>	<b>Gross outstanding claims provision as at end of period, HK\$ million</b>
2004	1356	84257.15	15.666	13.810
2005	781.83	69999.19	30.902	18.354
2006	894.76	74203.86	45.256	24.623
2007	829.1	75416.41	109.221	54.775
2008	847.58	85074.93	143.481	170.72
2009	1745.48	137552.83	148.383	276.817
2010	1308.4	127898.21	110.47	363.936
2011	1260.13	111558.94	25.221	267.624

Table 2: Insurance premiums and values in Hong Kong  
 (Source: Office of the Commissioner of Insurance, Hong Kong)

Tang et al. (2003) indicated that insurance claims are classified as non-material cost, which is a part of social cost. They suggested that insurance premiums are related to the pain and suffering costs. Saram and Tang (2005) investigated the impact of pain and suffering costs due to court judgment. They estimated non-material cost due to court judgment to be 30% of material cost. However, insurance claims paid are not separated into non-material cost paid and material cost paid, and thus it is difficult to explore the relationship between material cost and non-material cost in such cases. Contractors insured their projects according to the current Hong Kong legislation is an example of a safety investment.

### **5) Relationship between Insurance claim and GDP in Hong Kong**

Insurance claims are becoming a huge issue in the construction industry nowadays. From Table 3, insurance claims in the construction industry have increased gradually to about 0.2% of total value in the construction industry. There is a prediction that the amount of insurance claims will become higher and higher if the construction industry keeps on growing in the coming year.

Year	2004	2005	2006	2007	2008	2009	2010
Construction Industry of GDP (HK\$ billion)	40.774	38.984	39.124	40.6111	48.357	50.146	56.277
Gross insurance claims paid in the construction industry (HK\$ million)	15.666	30.902	15.256	109.221	143.481	148.383	110.47
% of insurance claims in the construction industry against GDP	0.0384	0.0793	0.0389	0.268	0.296	0.295	0.196

Table 3: Relationship between the insurance claim and the construction industry GDP in Hong Kong

## 6) Concluding Remarks

The construction industry remains a high accident rate and number of fatalities among all the major industry sectors in Hong Kong. Accidents mean loss, whether from the point of view through direct loss, indirect loss or social loss. By conducting a desktop literature study of the insurance claims paid and GDP of the construction industry in the district, the insurance claims due to construction accidents may rise to an alerting level.

In view of court judgment, insurance claims and contractor compensations, accidents indeed exhaust monetary compensations. According to the analysis of available statistical data, an average insurance claim is about 0.2% of total GDP in Hong Kong and it consumes nearly HK\$ 100 million yearly on insurance claims.

The authors are going to further investigate the relationship between safety investment and accident (safety) cost in Hong Kong. By consolidating all the available latest statistical data, a comprehensive regression analysis and a benchmark model between safety investment, accident (safety) cost and social cost are expected to be generated for future use in Hong Kong.

## 7) References:

Ahmed S.M., Azhar S. and Forbes L.H. (2006) “Cost of injuries/illnesses and fatalities in construction and their impact on the construction economy”, *Proceedings of The CIB W99 International Conference on Global Unity for Safety and Health in Construction*, 28-30 June 2006, Beijing China pp. 363 – 371.

- Choundhry R.M., Fang D. and Lingard H. (2009) "Measuring safety climate of a construction company", *Journal of Construction Engineering and Management*, ASCE, Vol. 135, No. 9, pp. 890 – 899.
- Hinze J. and Appelgate L.L. (1991) "Costs of construction injuries", *Journal of Construction Engineering and Management*, ASCE, Vol. 117, No. 3, pp. 537 – 550.
- Nadeem A., Tang S.L. and Lee H.K. (2009) "Social costs of construction accidents and safety investments in Hong Kong", *Proceedings of the Fifth International Conference on Construction in the 21st Century (CITC-V)*, May 20-22, 2009 Istanbul, Turkey pp. 757 – 765.
- Poon S.W., Tang S.L. and Wong K.W. F (2008) "*Management and economics of construction safety in Hong Kong*", 2<sup>nd</sup> ed. Hong Kong University Press
- Rowlinson S. (2003) "*Hong Kong construction – safety management and the law*", Sweet & Maxwell Asia
- Saram D.D.D. and Tang S.L. (2005) "Pain and suffering costs of persons in construction accidents: Hong Kong", *Journal of Construction Management and Economics*, Vol. 123, No. 6, pp. 645-658.
- Tang S.L., Saram D.D.D., Wang Z.M. and Zhang T.Q. (2003) "Costs of construction accidents in social and humanity context", *Proceedings of The Ninth East Asia-Pacific Conference on Structural Engineering and Construction (EASEC-9)*, 16-18 December Bali, Indonesia, pp 70-75.
- Tang S.L., Ying K.C., Chan W.Y. and Chan Y.L. (2004) "Impact of social safety investment on social costs of construction accidents", *Construction Management and Economics*, Vol. 22, No.9, pp 937-946.
- Tang S.L., Chan S.K. Saram D.D.D. and Kwong L.H. (2007) "Costs of Construction Accidents in the Social and Humanity Context – A case study in Hong Kong", *The HKIE Transactions* Vol.14 No. 2, pp 35-42
- Tse Y.C.R. and Sivaguru IV G. (1997) "Causal relationship between construction flows and GDP: evidence from Hong Kong", *Construction Management and Economics*, Vol. 15, No.4, pp 371 -376.
- Vocational Training Council (2011) "*2011 Manpower survey report of building and civil engineering industry*"
- Wong M.W.J., Chiang Y.H. and Ng S.T. (2008) "Construction and economic development: the case of Hong Kong", *Construction Management and Economics*, Vol. 26, No. 8, pp 815 -826.
- Yiu C.Y., Lu X.H., Leung M.Y. and Jin W.X. (2004) "A longitudinal analysis on the relationship between construction output and GDP in Hong Kong", *Construction Management and Economics*, Vol. 22, No. 4, pp 339-345.