CONSTRUCTION INDUSTRY COUNCIL
建 造 業 議 會

Report of CIC Manpower Forecasting Model 2014 (Workers)

(Amended)

Sep 2014

Disclaimer

Whilst reasonable efforts have been made to ensure the accuracy of the information contained in this publication, the CIC nevertheless would encourage readers to seek appropriate independent advice from their professional advisers where possible and readers should not treat or rely on this publication as a substitute for such professional advice for taking any relevant actions.
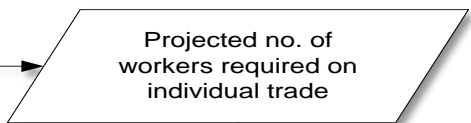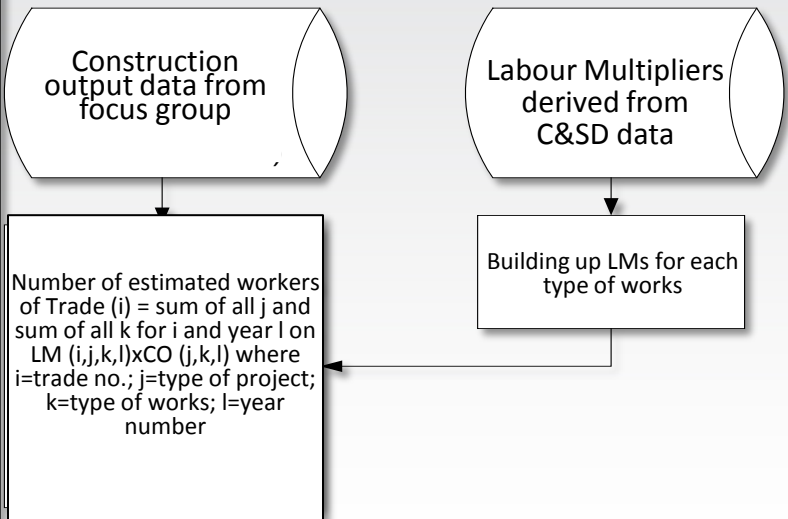
Preamble

- The study was carefully conducted but inevitably based on a web of assumptions and incomplete basic data, such as lack of data of RMAA works and primary data of private projects.

- Therefore, the figures of the report are only ballpark figures and provide an indication of general trends of manpower situation. Further development of the forecast model is necessary to enhance its accuracy.

- The figures must not be taken at face value and must be considered with all assumptions taken, the inherent limitations and the need for enhancements.

- The projections in this report are based on the forecast construction expenditure data from the Focus Group on Projected Construction Expenditure (Focus Group) of CIC latest update in 2014.

Objectives
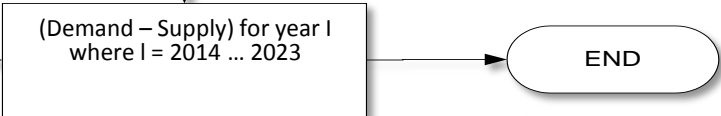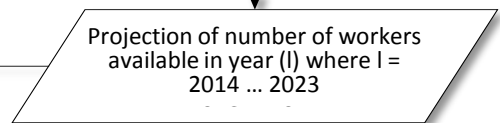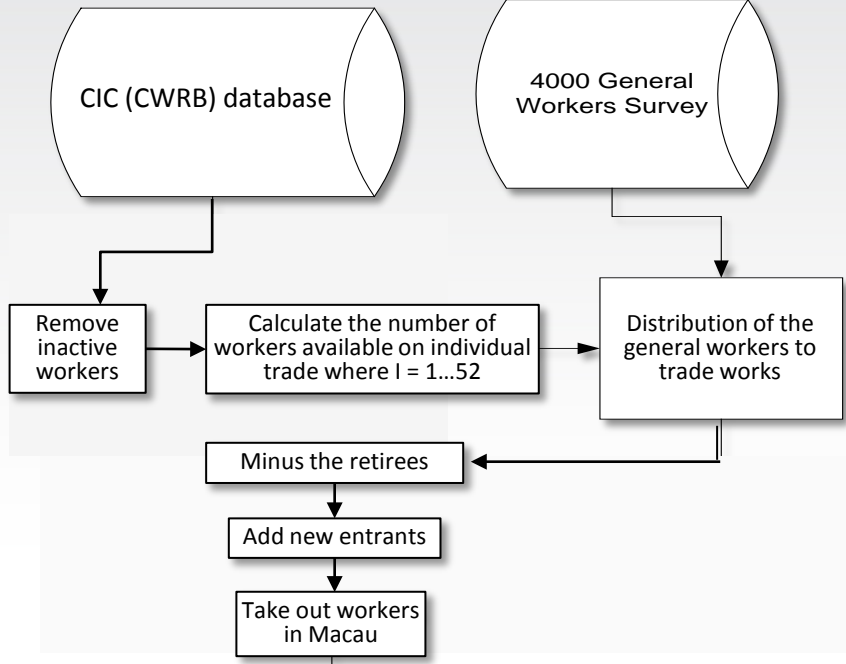
- The Construction Industry Council Manpower Forecasting (CICMF) model 2nd Update – Workers, focus on updating the manpower requirement according to Projected Construction Expenditure (Focus Group September 2014 update) and new assumptions.

CICMF Model

Demand | **Supply**

Construction output data from focus group

Labour Multipliers derived from C&SD data

CIC (CWRB) database

4000 General Workers Survey

Building up LMs for each type of works

Number of estimated workers of Trade (i) = sum of all j and sum of all k for i and year l on $LM(i,j,k,l) \times CO(j,k,l)$ where i=trade no.; j=type of project; k=type of works; l=year number

Remove inactive workers

Calculate the number of workers available on individual trade where I = 1…52

Distribution of the general workers to trade works

Minus the retirees

Add new entrants

Take out workers in Macau

Projected no. of workers required on individual trade

Projection of number of workers available in year (l) where l = 2014 … 2023

(Demand – Supply) for year l where l = 2014 … 2023

END

Trade Classification List of Workers in Model

Trade No.	Trade Name (English)	工種名稱（中文）
1	Bar Bender & Fixer [or Steelbender]	鋼筋屈紮工
2	Concretor	混凝土工
3	Drainlayer	地渠工
4	Plumber	水喉工
5	Leveler	平水工
6	Scaffolder	棚架工
7	Carpenter	木模板工
8	Joiner	細木工
9	Plant & Equipment Operator (Load Shifting) [or Plant Operator (exc. driver, bulldozer driver, etc.)]	機械設備操作工（負荷轉移）[或機器設備操作工（挖掘機駕駛員、推土機駕駛員等）]
10	Truck Driver	貨車駕駛員
11	Rock-Breaking Driller [or Pneumatic Driller]	鑽破工

Trade Classification List of Workers in Model

Trade No.	Trade Name (English)	工種名稱（中文）
12	General Welder	普通焊接工
13	Metal Worker	金屬工
14	Glazier	玻璃工
15	Painter & Decorator	髹漆及裝飾工
16	Plasterer Terrazzo & Granolithic Worker	批盪工
17	Bricklayer	砌磚工
18	Marble Worker	雲石工
19	Mason (incl. rubble mason, splitting mason and ashlar mason)	砌石工
20	Structural Steel Welder	結構鋼材焊接工
21	Structural Steel Erector	結構鋼架工
22	Rigger / Metal Formwork Erector	索具工（叻㗎）／金屬模板裝嵌工

Trade Classification List of Workers in Model

Trade No.	Trade Name (English)	工種名稱（中文）
23	Asphalter (Road Construction)	瀝青工（道路建造）
24	Construction Plant Mechanic [or Fitter]	建造機械技工
25	Diver	潛水員
26	Electrical Fitter (incl. Electrician)	電氣裝配工
27	Mechanical Fitter	機械打磨裝配工
28	Refrigeration / AC / Ventilation Mechanic	空調製冷設備技工
29	Fire Service Mechanic	消防設備技工
30	Lift and Escalator Mechanic	自動梯技工／升降機技工
31	Building Services Maintenance Mechanic	樓宇工程設備維修技工
32	Cable Jointer (Power)	強電流電纜接駁技工
33	Asphalter (Waterproof)	瀝青工（防水）

Trade Classification List of Workers in Model

Trade No.	Trade Name (English)	工種名稱（中文）
34	Tiler	鋪瓦工
35	Roofer	屋面工
36	Waterproofer	防水工
37	Material Lab Labour	物料實驗室技工
38	Gas Piper	氣體裝置技工
39	Drywall	清水牆工
40	False Ceiling Worker	假天花工
41	Landscape Worker	園藝工
42	Track worker	鋪軌工
43	Piling Worker	打樁工
44	Pipelayer	敷喉管工

Trade Classification List of Workers in Model

Trade No.	Trade Name (English)	工種名稱（中文）
45	Shotfirer	爆石工
46	Tunnel Worker	隧道工
47	Marine Craft Crew	海面建造機械操作工
48	Diver's Linesman	潛水架線工
49	Miner	礦工
50	Shotcretor (Nozzleman)	噴射混凝土工
51	Stevedore	搬運工人
52	General Worker	普通工人

The Construction Output Covered by Focus Group in Demand Model

Demand Model

- Private Works
  - Residential
  - Commercial
- Public Works
  - Government Departments
    - Highways Works
    - Housing Works
    - Drainage Works
    - Civil Works
    - Water Supplies Works
    - Hospital Works
    - Gov't Building Works
  - MTRC
    - System-wide E&M Installation
    - Building Services Installation
    - MTRC Depot
    - Buildings and Tunnels
    - MTRC Stations, Ancillary
  - Others
- RMAA Works
  - Private
  - Public
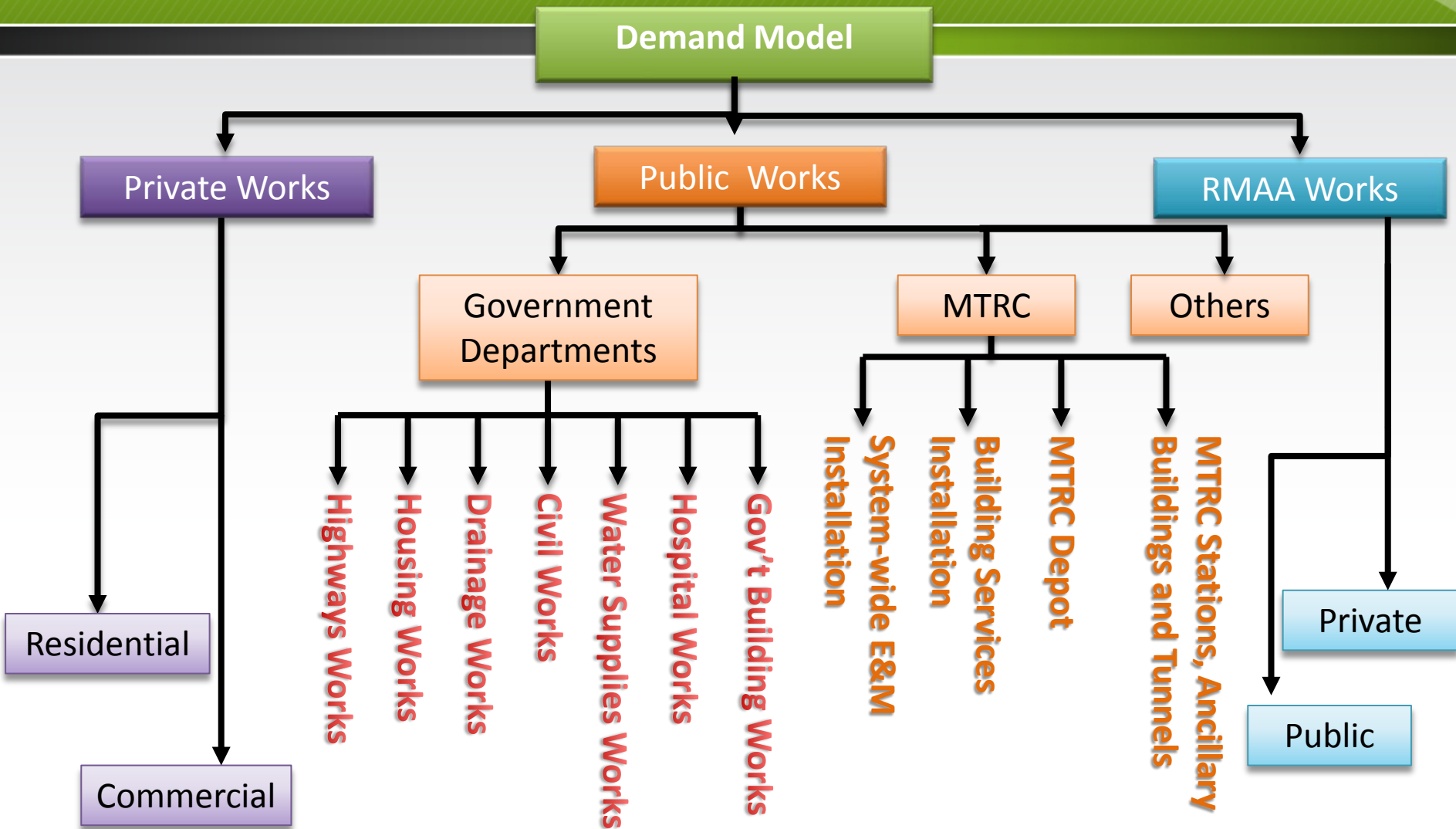
Assumptions in Demand Model Adopted since the 1st Update

Labour Multipliers (LMs)

- LMs of public works updated from 150 government projects & Civil Engineering Works Index and Building Works Tender Price Index

- New type of LMs for hospitals new works are added to the LMs data bank.

Assumptions in Demand Model Adopted since the 1st Update

Labour Multipliers (LMs)

- For the private new works, while the new data is still being collected, the following information has been adopted to adjust the original LMs:

  1) Original LMs with price level adjustment by the RLB Tender Price Index to 2013 Q3

  2) Data of C&SD
     a) No. of manual workers on private new works sites
     b) Construction Output on the private new works

  3) data from developers

- For the private RMAA works, a combination of LMs are used to generate a set of more accurate and reliable private LMs :

  1) public maintenance works;

  2) renovation works of Airport Authority; and

  3) RMAA projects of private stakeholders

Assumptions in Demand Model Adopted since the 1st Update

Labour Multipliers (LMs)

- Manpower data provided by MTRC are on-going contracts. Linear fraction of expenditure spent during the time span of contracts are used to calculate LMs.

Expenditure spend on Schedule

- Construction Expenditure released in September 2014 by the Focus Group of CIC will be spent on schedule.

Linear Transformation of the man-year

- Number of man-days is transformed to number of man-years.

Enhancement on model (2nd Update) - Construction Workers

- Demand
  - Used the construction output data from the Focus Group on Projected Construction Expenditure (Focus Group) released in August 2014
    - Note: The proportions within each type of works maintained as in the 1st update
  - Used a new set of New Work: RMAA ratios obtained from:
    1. phone survey jointly conducted by CIC and Hong Kong Construction Industry Employees General Union (HKCIEGU);
    2. interview workers at the Workers Registration Offices

Details of Survey Conducted by CIC at the Workers Registration Offices (WRO)

- Aim: to identify the ratio of workers under different trades at WRO performing new works vs RMAA works

- No. of samples taken: 423

- Period of samples taken: March to mid of April 2014

Details of Survey Conducted by CIC and HKCIEGU

- Aim: to identify the ratio of workers under different trades in the workers union performing new works vs RMAA works

- Period: March to April 2014

- No. of samples taken: 1,220

Enhancement on Model (2nd Update) % of RMAA Works

- After consolidating the results from surveys with HKCIEGU and at Workers Registration Office of CIC:

No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Trade Name	Bar Bender & Fixer	Concretor	Drainlayer	Plumber	Leveler	Scaffolder	Carpenter	Joiner	Plant & Equipment Operator (Load Shifting) [or Plant Operator (exc. driver, bulldozer driver, etc.)]	Truck Driver	Rock-Breaking Driller	General Welder	Metal Worker	Glazier	Painter & Decorator	Plasterer Terrazzo & Granolithic Worker	Bricklayer	Marble Worker
Adopt RMAA % used in 1st Update					✓			✓	✓	✓	✓						✓	✓
Result of HKCIEGU & CWROSurvey					▓			▓	▓	▓	▓						▓	▓
New RMAA ratio adopted in 2nd update	✓	✓	✓	✓		✓	✓					✓	✓	✓	✓	✓		

🟧 Small Sample Size - Not considered   🔲 No data - Not considered

Enhancement on Model (2nd Update) % of RMAA Works

- After consolidating the results from surveys with HKCIEGU and at Workers Registration Office of CIC:

No.	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Trade Name	Mason	Structural Steel Welder	Structural Steel Erector	Rigger/Metal Formwork Erector	Asphalter (Road Construction)	Construction Plant Mechanic [or Fitter]	Diver	Electrical Fitter (incl. Electrician)	Mechanical Fitter	Refrigeration/AC/Ventilation Mechanic	Fire Service Mechanic	Lift and Escalator Mechanic	Building Services Maintenance Mechanic	Cable Jointer (Power)	Asphalter (Waterproof)	Tiler	Roofer	Waterproofer
Adopt RMAA % used in 1st Update	✓	✓	✓		✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓
Result of HKCIEGU & CWROSurvey	(grey)	(orange)	(orange)		(orange)	(orange)	(orange)		(orange)		(orange)	(orange)	(grey)	(grey)	(orange)	(grey)	(grey)	(grey)
New RMAA ratio adopted in 2nd update				✓				✓		✓								

Legend: (orange) Small Sample Size - Not considered   (grey) No data - Not considered

% of RMAA Works

- After consolidating the results from surveys with HKCIEGU and at Workers Registration Office of CIC:

No.	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Trade Name	Material Lab Labour	Gas Piper	Drywall	False Ceiling Worker	Landscape Worker	track worker	Piling Worker	Pipelayer	Shotfirer	Tunnel Worker	Marine Craft Crew	Diver's Linesman	Miner	Shotcretor (Nozzleman)	stevedore	General Worker
Adopt RMAA % used in 1st Update	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Result of HKCIEGU & CWROSurvey	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■
New RMAA ratio adopted in 2nd update				✓												*

■ Small Sample Size - Not considered
■ No data - Not considered

* Considered the RMAA ratio of general workers by referencing to survey conducted by CIC (CWRB) from Dec 2013 to April 2014 released in May 2014.

Assumptions in Supply Model Adopted since the 1st Update

Base on CIC (CWRB) database for labour force of construction workers

(deduct inactive workers and distribute registered general workers possessing skills to individual trades)

Assume retirement rates from age 61-70 (sun-shine trades assumed to have higher retirement proportions in relatively younger ages compared with other trades)

Build-up database based on age profile

(verified with the age distribution with GHS from C&SD)

Project new entrants and workers exited to work in Macau

Project total number of construction workers available from year 2014 to 2023

Assumptions in Supply Model Adopted since the 1ˢᵗ Update

- Phone survey for registered general workers can properly approximate the real situation of registered general workers doing trades work on sites.

- The retirement process mainly starts after age 60 with increasing possibilities as the age increased to 70.

- The model result is verified by the CIC (CWRB)'s age profile and GHS age profile.

- New entrants mainly come from trainees of the Construction Industry Council (CIC) with wastage included.

- The number of employed workers exited to work in Macau has been considered taking into account the past trend.

Considerations of the Model (2nd Update) - Construction Workers

- Supply
  - ➢ Extract data from the database of Construction Worker Registration Board (CWRB) up to December 2013
  - ➢ Took into account unemployed workers and productivity of underemployed workers
  - ➢ Took in account the estimation of productivity and retention rates of new entrants
  - ➢ Added the assumptions on in-services skilled workers required to nurture the new entrants
  - ➢ Took into account the potential workforce to be better utilized
  - ➢ Training places updated according to the forecast in early 2014

Enhancement on Model (2nd Update) - Construction Workers

- Productivity of New Entrants
  - ➤ Based on the result of the proficiency tests to CIC graduates carried out in late 2013 to early 2014 on five trades as follows:

Bar Bender & Fixer	Plumber	Carpenter	Painter & Decorator	Bricklayer
~ 63.2% (Average)				

  - ➤ All trades: average figures of the tested trades are assumed in the first year of graduation
  - ➤ Assumed 81.2% in the second year and full productivity afterwards
- Discounted productivity of skilled workers as trainers required in nurturing new entrants in first and second years : 25% of new entrants

Enhancement on Model (2nd Update) - Construction Workers

- Retention of New Entrants

  ➢ Based on the % of CIC graduates who are still working in the construction industry 12 months after graduation

  ➢ 65% of retention rate is adopted (according to the employment situation of 2012 graduates)

Enhancement on Model (2nd Update) - Construction Workers

- Comparison between Demand and Supply for overall figures (Demand minus Supply)

  ➢ The average of upper bound and lower bound for demand is used in comparison

Construction Expenditure Forecast ($Billion)
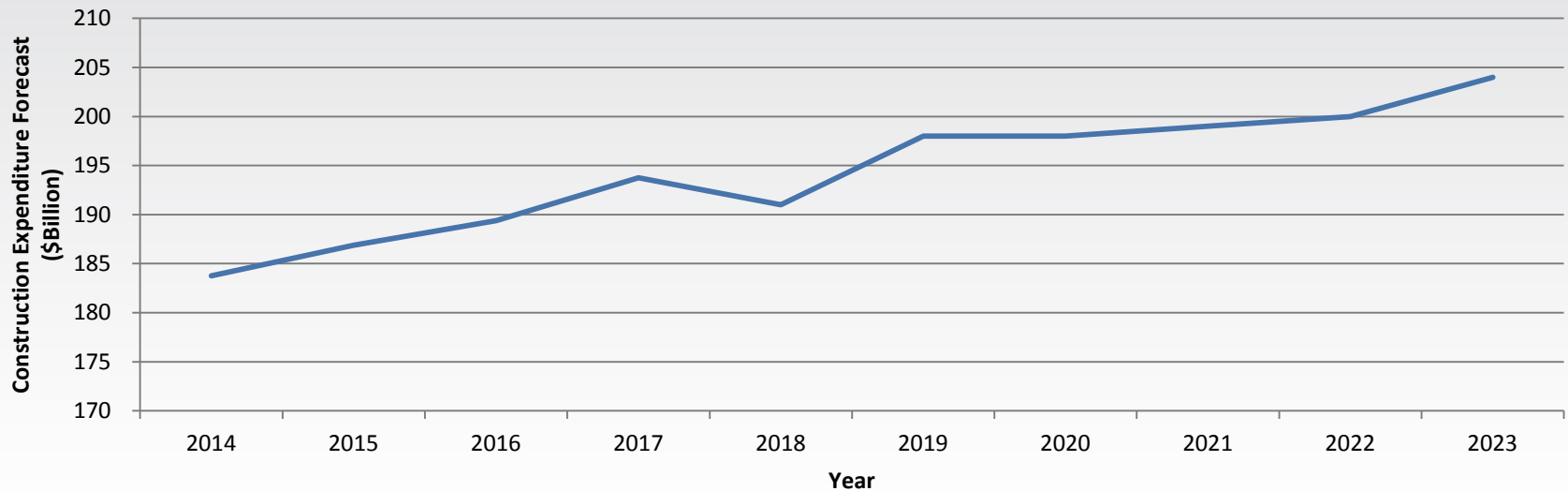
Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Construction Expenditure Forecast ($Billion)	184	187	189	194	191	198	198	199	200	204

Note: Average of upper and lower bounds of expenditure forecast from 2014 to 2023

Overall Manpower Requirement in the Construction Industry
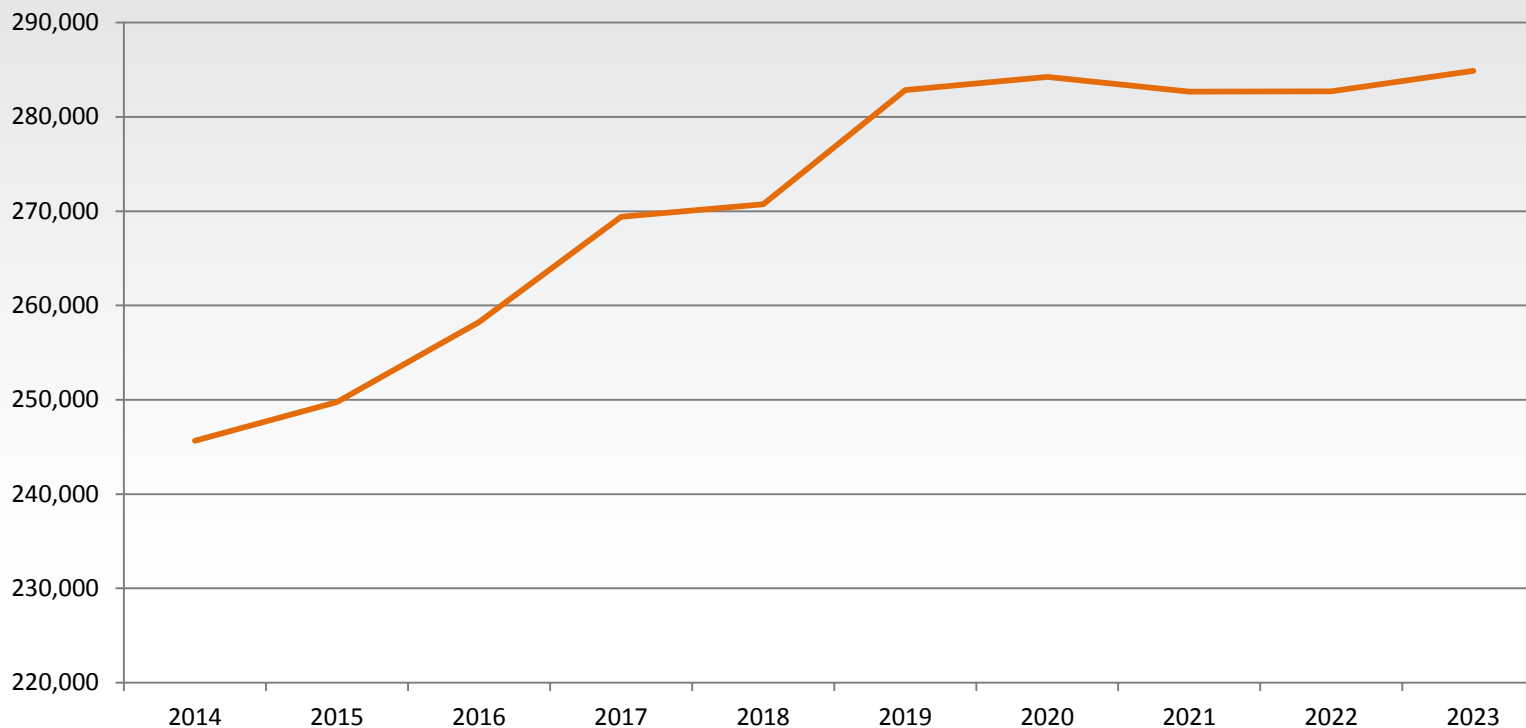
Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Overall manpower requirement in the construction industry	246,000	250,000	258,000	269,000	271,000	283,000	284,000	283,000	283,000	285,000

Critical Trades

- Critical trades are those which have been forecasted with possible demand figures are larger than the supply figures within the period from year 2014 to 2023.

- Trades shown on the list are presented with relatively higher confidence on the reliability of the forecasted figures.

- Trades do not appear on the list do not necessarily represent their supply fulfill the forecasted demand.

Trend of Skill Trades with Demand > Supply (With Training Output Considered)

No.	Trade Classification	Year									
		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1	Bar Bender & Fixer [or Steelbender] ✳										
2	Concretor ✳										
3	Drainlayer										
5	Leveler ✳										
6	Scaffolder ✳										
7	Carpenter ✳										
9	Plant & Equipment Operator (Load Shifting [or Plant Operator (exc. Driver, bulldozer driver, etc.)]										
13	Metal Worker ✳										

250   500   1000   1500   2000

✳ Exist (partially exist) in the list of shortage trades provided by Task Force on Short-term Labour Supply in February 2014

Trend of Skill Trades with Demand > Supply (With Training Output Considered)

No.	Trade Classification	Year									
		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
16	Plasterer Terrazzo & Granolithic Worker *										
20	Structural Steel Welder *										
21	Structural Steel Erector *										
22	Rigger/Metal Formwork Erector *										
27	Mechanical Fitter										
28	Refrigeration/AC/Ventilation Mechanic *										
45	Shotfirer *										
46	Tunnel Worker *										

Legend: 250 | 500 | 1000 | 1500 | 2000

* Exist (partially exist) in the list of shortage trades provided by Task Force on Short-term Labour Supply in February 2014

Result of CICMF Model

- The overall requirement of skilled workers is in an upward trend from 2014 to 2023.

- Forecasted Manpower demand higher than supply for certain trades continuously exists provided no significant change on the current situation.

- Aging, job mismatch, limitations in training, increasing manpower demand etc, are all possible factors causing the critical manpower situation in the coming years.

Updated Manpower Situation as at May 2014

(a) No. of registered workers in CIC (CWRB)	~ 330,000
(b) No. of registered workers who have left the construction industry *(Estimation based on survey result from CIC(CWRB))*	~ 70,000
(c) Estimated no. of unemployed workers *(With reference to data source: C&SD Mar to May 2014 – Number of unemployed persons for construction industry)*	~ 15,000
(d) Estimated no. of in-service workers = (a) – (b) – (c) * The estimated in-service workers has included above 12,000 in-service registered truck drivers. Data can be referred to Workers Registration Data Analysis of CIC (CWRB).	above 240,000*
(e) Discount of productivity for underemployed workers *(With reference to data sources: (1) CWRB - No. of registered workers in CIC who have not left the construction industry and (2) C&SD Mar to May 2014 – underemployment rate for construction industry)*	~ 9,000

Updated Manpower Situation as at May 2014

(f) Estimated no. of workers in Macau *(Based on statistic in the past)*	∼ 5,000
(g) Estimated no. of registered workers performing non-construction works on site *(Estimation based on survey result from CIC(CWRB))*	∼ 4,000
(h) Discount manpower related to productivity and nurturing of new entrants *(Assumption: the discount value is the interpolation ratio times the assumed value of the whole year)*	∼ 2,000
(i) Estimated no. of active workers under CIC (CWRB) registration (Registered workers)	(i) = (a) - (b) - (c) - (e) - (f) - (g) - (h) ∼ 225,000
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Range of Additional Manpower Required

- Sensitivity analysis on projection of additional manpower requirement by changing the following three variables in the supply model:

	1) Retention Rate of New Entrant	2) Productivity of in-service skilled workers affected in nurturing new entrants	3) Deviation from original assumption on number of workers in Macau*
Best Estimate	65%	25%	0%
Lower Bound	70%	20%	-1%
Upper Bound	60%	30%	+1%

*The number of workers in Macau is relatively sensitive and a small percentage change will cause a substantial change in the projection of additional manpower requirement.

Additional Manpower Requirements in Coming Years

Year end	2014	2015	2016	2017	2018
Additional workers required * (approx.)	>25,000 to ~30,000	>30,000 to 35,000	>30,000 to ~35,000	>35,000 to ~40,000	>30,000 to 40,000
Additional skilled workers required * (approx.)	>10,000 to 15,000	~15,000 to 20,000	>15,000 to 20,000	>15,000 to ~20,000	>15,000 to ~20,000

*Figures are in absolute at the end of corresponding years and are non-cumulative.

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Further Exploration on the Additional Skilled Workers in Coming Years

Rough estimation on the additional skilled workers required (approx.) after considering the following assumptions:

(a) Better utilization of potential workforce including unemployed workers, underemployed workers and those who have left the industry (industry leavers).

Year end	2014	2015	2016	2017	2018
Additional skilled workers required* (approx.)	Below about 10,000	About 10,000 to 15,000	About 10,000 to 15,000	About 10,000 to 15,000	About 10,000 to 15,000
Additional skilled workers required* (approx.) **As in the 1st Update**	Below about 10,000	Close to 10,000 to above 10,000	Close to 10,000 to above 10,000	Below about 10,000	N/A

*Figures are in absolute at the end of corresponding years and are non-cumulative.

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Comparison on the additional skilled workers required between 1st & 2nd update

- Both the trend of the additional skilled workers required and the time span of it go up in the 2nd update as compared to the 1st one

- This could be caused by the new initiatives mentioned in the 2014 Policy Address and its accumulation effect

Concluding Remarks

- CICMF model shows the trend of manpower requirement.

- The construction output data adopted in this update covers forecast construction works in both public and private sectors, which are affected by many factors.

- The manpower requirements are in man-year and should be carefully handled when used to compare directly with the actual number of workers.

- Supply model has gone through the redistribution process of registered general workers to skill works (accuracy depends on the information provided by respondents of the telephone survey).

- The model is based on a set of assumptions and limitations and there exists a number of unknowns in the industry affecting the accuracy of the forecast. It will be updated and enhanced constantly aiming to reflect the current situation of the industry.

Ways Forward

- To enrich and constantly update both the construction data for LMs from public and private sectors

- To enrich data on RMAA works to reduce the distorting effect due to insufficient samples

- To monitor closely on any changes in output of any construction projects requiring particular high demand of specific trades.

- To consider threshold for the demand on some specific trades in which their demand fluctuate in a comparatively wider range as reaction to certain types of projects.

Future Enhancement

- Taking into account CIC (CWRB)'s data analysis result in the study of the model
- Further investigation on the problematic trades

Enquiries

Enquiry on this report maybe made to the CIC Secretariat at:

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Thank you