參考資料
2015 年 12 月 1 日

立法會小組委員會
跟進香港國際機場三跑道系統相關事宜

於 2015 年 11 月 3 日會議上提出的事宜

引言

於 2015 年 11 月 3 日的會議上，委員討論了立法會 CB(4)143/15-16(01)號文件，並就三跑道系統項目提供了寶貴意見。討論期間委員提出若干事宜，而香港機場管理局（「機管局」）及政府承諾提供所要求的資料。本文件載有委員所要求的資料。

跟進於 2015 年 11 月 3 日會議上提出的事宜

A. 預期三跑道系統整體經濟效益的細目分類

2. 委員注意到，在 2012 年至 2061 年的 50 年間，預期三跑道系統的整體經濟效益將約為 10,460 億元（按 2012 年價格計算）。有委員問及如何計算預期整體經濟效益的詳情，包括就得出有關預測所作的假設。

3. 誠如在會上所闡釋，機管局就編製《香港國際機場 2030 規劃大綱》（《2030 規劃大綱》）委託獨立顧問 Enright, Scott & Associates（「ESA」），於 2011 年進行一項經濟影響研究（「研究」），以評估擴建香港國際機場對香港經濟可帶來的影響。於 2015 年年初，ESA 根據最新的經濟數據、交通需求及成本，更新了三跑道系統的經濟影響研究。

4. 一般而言，投資對經濟的影響可以從直接、間接及連帶貢獻三方面來衡量，通常以其「增加價值額」[1]，以及某一年對本地生產總值的百分比貢獻來表示。這評估方法為航空業普遍所採用[2].

[1]「增加價值額」是指總產值減去中間投產消耗（在生產過程中所消耗的貨品及服務的價值）。

[2] 國際民用航空組織於 2005 年發表《Economic Contribution of Civil Aviation》報告，評估民用航空對全球經濟的貢獻，並藉此為多國提供評估方法（ICAO Circular 292-AT/124）。建議的核心方法一般包括直接、間接及連帶影響；而「經擴大」的方法則包括一般對旅遊業及

5. 預測香港國際機場的經濟影響 –

(a) ESA 首先評估香港航空業所帶來的「直接」增加價值額及就業機會，包括直接參與機場營運的機構（例如航空公司、航空貨運站營運商、航膳營運商、飛機維修及其他服務營運商、以及機管局等），以及在機場營運非航空業務的機構（包括零售業、餐飲業、酒店及會議展覽活動等行業的營運商）。

(b) ESA 繼而評估香港航空業供應商所帶來的「間接」增加價值額及就業機會，這些供應商為香港航空業的直接營運及機場的非航空業務提供商品及服務，當中包括例如公用事業供應商、燃料供應商、建築及清潔公司、食物及零售商品供應商等。

(c) 最後，ESA 評估直接及間接僱員在本地購物消費所帶來的「連帶」增加價值額及就業機會，例如航空公司僱員、公用事業供應商僱員、機管局僱員等人士的消費。

(d) 以上述對 2012 年的直接、間接及連帶經濟貢獻評估，ESA 為雙跑道系統及三跑道系統所帶來的經濟效益作出直至 2061 年的預測[3]。此外，我們亦採用 4%折現率[4]，折現計算預測經濟貢獻（以 2012 年價格計），以估算雙跑道系統及三跑道系統的經濟淨現值。

6. 2015 年經濟影響分析結果概要如下。

貿易的催化影響。

[3] 50 年預測期為一般評估基建投資的時間。就香港國際機場而言，假設基建使用年期為 50 年。

[4] 評估政府投資項目的折現率，旨在反映社會期望對進行項目產生的資源/成本經濟效益的跨期抵換(inter-temporal trade-off)。香港政府項目的經濟效益評估，按政府以實際條款假設的折現率 4%作經濟成本效益分析，而現有的經濟影響研究亦以此折現率計算。過往香港進行多個大型項目（例如香港迪士尼樂園、廣深港高速鐵路（香港段））的折現率亦為 4%。值得注意的是，英國政府財政部評估政府項目時，按實際折現率 3.5%對項目首 30 年進行評估，而歐洲委員會建議按折現率 3% 或 5%（折現率取決於經濟體的狀況而定）評估大型項目。

	2012 年（實際）	2030 年	
		雙跑道系統	三跑道系統
經濟貢獻（直接＋間接＋連帶）	940 億港元	1,330 億港元	1,840 億港元
佔本地生產總值百分比	4.6%	3.6%	4.9%
直接職位	63 000 個	89 000 個	123 000 個
間接+連帶職位	85 000 個	119 000 個	165 000 個
		2012 年至 2061 年	
經濟淨現值	-	5,910 億港元	10,460 億港元

註：經濟貢獻按 2012 年價格計算
資料來源：Enright, Scott & Associates Ltd（2015 年）

7. 有關經濟影響研究採納方法的詳細說明載於 2011 年報告及 2015 年報告的第三章及附錄 A，並可於機管局網站查閱，網址分別為：http://info.threerunwaysystem.com/pdf/en/ESA.pdf 及 http://info.threerunwaysystem.com/pdf/en/economic_impact_study_of_the_three_runway_system.pdf。**附件 A**（此附件沒有中文翻譯）亦附上 2015 年報告的有關章節。

B. 預期待三跑道系統投入運作後香港國際機場的航空交通量增長

8. 香港國際機場的年度航空交通需求預期到 2030 年客運量將達 1.023 億人次，而貨運量將達 890 萬公噸。就此，有委員要求機管局提交如何計算這預測的資料。

9. 於 2008 年，機管局就準備編製《2030 規劃大綱》委託 IATA Consulting[5]編製一系列直至 2030 年航空交通的初步預測。鑑於當時經濟前景存在多項不明朗因素，故此有關預測傾向較保守。於 2012 年，IATA Consulting 考慮到最新的實際航空交通數字、容量限制和短期前景後，修訂有關航空交通預測，以反映市況。

10. 為預測未來 20 年期的長期航空交通所採納的模型，是一個以本地生產總值迴歸為本的計量經濟模型。過往的數據證實，香港的客運量與香港本地生產總值息息相關，而貨運量亦與全球本地生產總值有不可分割的關係。即使基線預測由本地生產總值帶動，但 IATA Consulting 亦考

[5] IATA Consulting 隸屬國際航空運輸協會(International Air Transport Association) 的一家著名商務部門，專門為航空客戶提供航空交通預測。

慮了多個透過進行相關研究、訂立基準及訪問後而定的調整因素[6]，包括跑道容量限制。這種預測方法經證實有效，並遵照為機場預測的最佳慣例。綜觀全球各地多個機場與機構（如國際民用航空組織（「國際民航組織」）、國際機場協會、波音及空中巴士）亦使用類似的方法 。

11. 在考慮多個相關的調整因素後，預測香港國際機場的客、貨運量將分別按複合年增長率 3.4%及 4.5%增長，即由 2012 年到 2030 年，客運量將由 5 650 萬人次增加至 1.023 億人次；而貨運量將由 400 萬公噸上升至 890 萬公噸。

C. 第三條跑道於 2020 年投入運作及三跑道系統於 2024 年全面實行前有助提升香港國際機場容量的措施

12. 委員知悉香港國際機場將於 2016/2017 年達到其設計容量。在三跑道系統投入服務前，機管局已委聘獨立顧問，研究在過渡期間，如何提升現有雙跑道系統的容量。委員問及有關研究的資料。

13. 機管局已委聘顧問，研究如何增加香港國際機場在三跑道系統落成前的跑道容量。研究的主要工作，會重新評估就早前的《香港國際機場空域及跑道容量研究》[77] 所採用的假設，並根據最新運作數據，以及起降運作的關鍵績效衡量指標，作出調整。該研究將會檢討航空交通運作多個範疇，包括空域設計及管理、飛機起降管制、跑道運作模式、地面管制及飛行區基礎設施等。此外，研究亦包括增加公布的夜間（即晚上 10 時至翌日上午 7 時）可處理航班數量的可行性，以及就提升現時機場容量的相關噪音管理措施。該研究會涵蓋現有雙跑道系統和雙跑道系統過渡期間（即當新跑道與現有南跑道同時運作，而現有北跑道暫時關閉）的兩個方案。機管局將會適時向立法會簡介提升雙跑道系統容量的研究結果。

D. 擬議的噪音收費計劃

14. 委員知悉機管局正考慮提出噪音收費建議，並要求獲取進一步資料。

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6 調整因素為市場環境、航空公司及機場策略，以及在具競爭力環境中的預期發展等出現突變。

7 《香港國際機場空域及跑道容量研究》由機管局委託國家航空交通服務 (National Air Traffic Services) 於 2008 年進行。

15. 政府與機管局明白到夜間的飛機起降可能會對本地社區造成影響。因此，機管局現正進行研究，以制定噪音收費計劃，作為一項鼓勵航空公司採用較寧靜的飛機機種的措施。該研究仍在進行中。在制定噪音收費計劃過程中，機管局參考了以下各項：

(a) 國際民航組織原則；
(b) 國際慣例；及
(c) 香港國際機場的情況。

16. 按照國際民航組織原則，噪音相關收費應－

(a) 只在受飛機噪音問題影響的機場徵收；
(b) 為收回不多於就緩解或預防噪音問題而產生的成本（即「不涉及額外開支」）而設；
(c) 與着陸費相關；
(d) 不含歧視成分；及
(e) 制訂的收費水平不得過高。

17. 實際上，世界各地不同機場採取的噪音相關收費計劃形式各有不同。徵收噪音相關收費的主要目的是收回緩解措施成本，及／或提供資助以鼓勵航空公司轉用較寧靜的飛機。但因應各個機場的當地環境及噪音管制規定，收費形式可能大有差別。部分海外機場實施的噪音相關收費例子載列於**附件 B**。

18. 原則上，機管局認為噪音相關收費應－

(a) 針對對公眾造成最大噪音滋擾的航班，即於晚上 11 時至翌日上午 7 時時段內進行起飛和降落的航班（按民航處飛機噪音監察站所錄得的噪音數據作準測）；
(b) 不涉及額外開支；及
(c) 收費設訂於合理水平，以收回機管局就緩解噪音問題而產生的成本。

19. 機管局將會適時向立法會簡介擬議的噪音收費。

E. 機場建設費

20. 委員普遍支持機場建設費按不同收費水平徵費的機制，並認為目前建議的收費水平合理，其中一位委員要求機管局提供資料，若對短途

經濟客位及長途特選客位旅客的收費分別設訂為 50 元及最多 500 元，估計須徵收機場建設費的年期。

21. 根據立法會 CB(4)143/15-16(01)號文件所載，在不會對機管局信貸評級及借貸能力構成重大不利影響下，於制定經修訂的機場建設費收費機制時，機管局鑑於其信貸評級優良（即 AAA 級），已評估進一步擴大借貸規模的可行性。經修訂的機場建設費收費機制設不同收費水平，是盡量擴大機管局從市場上取得的借貸額度而得出。

22. 機管局於會上已向委員講解只有約 2%的旅客屬長途特選（頭等及商務客位）類別，而整體約 70%的旅客（即短途以香港為出發地/目的地及轉機過境的經濟客位離港旅客） 將繳付 90 元或以下的機場建設費。

23. 應該委員的要求，機管局進行了一個桌面分析，分析對短途經濟客位及長途特選客位旅客分別徵收 50 元及最多 500 元機場建設費可能帶來的影響。假設向短途經濟客位旅客徵收機場建設費的上限訂於 50 元，並假設旅客的旅遊模式有若干改變，而機管局的整體借貸水平可以維持現時水平，則對長途特選客位旅客徵收的機場建設費將要調高至 2,000 元的一個極不合理地高的水平。這樣高收費水平遠超國際慣例，令少數乘客（約總客運量的 2%）承受不合比例的負擔，從而令整個財務項目承受不必要的風險。

24. 假設同時向長途特選客位旅客徵收機場建設費的上限訂於 500 元，所收取的機場建設費收入將低於機管局目前財務安排建議下的收入目標，從而迫使機管局在三跑道系統施工期間須予籌集的資金，遠超出其實際借貸上限。因此，延長機場建設費徵收期並不能滿足興建三跑道系統整體的現金流需要。

F. 環境影響評估（「環評」）的持分者參與活動

25. 委員知悉機管局在 2012 年至 2014 年進行環評期間舉辦了約 700 項持分者參與活動，並要求機管局就持分者參與提供有關資料。

26. 主要持份者團體[8]的細目分類列於下表。

[8] 有關的資料細目分類資料已涵蓋了進行的持分者參與活動數目眾多及私隱考慮。

持份者類別	舉辦的持分者參與活動數目
1. 大學、中小學、教育界	261
2. 政黨、區議會及居民團體	163
3. 專業團體、工商組織及業務夥伴	95
4. 媒體	71
5. 環保團體	34
6. 學術界、智囊組織及意見領袖	33
7. 漁民團體	17
8. 諮詢團體	15
9. 技術研討小組	12
10.公眾人士	7
合計	**708**

G. 司法覆核

27. 二零一五年二月，收到兩宗司法覆核申請，要求覆核環境保護署署長的決定，通過三跑道系統計劃的環境影響評估報告(下稱“環評”)及向機管局發出相關環境許可證以推展三跑道系統計劃。 機管局是上述司法覆核個案有利害關係的一方。二零一五年六月中，再有人提出三宗司法覆核申請，挑戰行政長官會同行政會議“批准”三跑道系統計劃及相關財務安排計劃的決定。其中兩宗司法覆核個案，申請人同時挑戰機管局擴建香港國際機場成爲三跑道系統的“決定”。首兩宗有關環評的司法覆核個案將於二零一六年七月初展開聆訊。至於另外三宗司法覆核個案，法院將於二零一六年三月審議是否批准有關申請。於上述三宗司法覆核個案，機管局是其中一宗個案的有利害關係的一方及作爲另外兩宗個案的答辯人。第六宗司法覆核個案，於二零一五年九月九日提出。申請人認為城市規劃委員會就相關的分區計劃大綱草圖所進行的提出申述和意見程序並不公平，因而提出反對。

28. 機管局會繼續在法律上容許的情況下推展三跑道系統項目的工作。

H. 香港民航處發出的新聞稿

29. 香港民航處就珠三角空域事宜發出的新聞稿載於附件 C。

I. 有關港珠澳大橋項目的海上工程意外資料

30. 路政署所提供的資料載於附件 D。

J. 其他資料

31. 機管局的工作保持高度透明，大部分三跑道系統相關資料已上載至其網站。供公眾查閱的資料清單詳列於**附件 E**，方便委員參考。

徵詢意見

32. 請各委員參閱本文件內容。其他於 2015 年 11 月 3 日的會議上提出的事宜，將於適當情況下在日後的會議跟進。

香港機場管理局
2015 年 11 月

3. Methodology note

This Study uses variations of traditional economic impact techniques that are tailored to the particular situation of Hong Kong. Economic impact analysis attempts to quantify the impact that an investment, event, or decision can have on a given economy. It is frequently used in order to determine whether capital investments should be made. Below is a general description of the economic impact methodology. A detailed description including data sources for individual items is provided in Appendix A. Some caveats associated with economic impact analyses can be found in Appendix C.

3.1. General economic impact methodology[12]

Economic impacts are measured in terms of direct impact, indirect impact, induced impact, and catalytic impact. Each level of impact attempts to quantify in a different way the benefits that are likely to accrue to a specific economy as a consequence of capital investment. The impact from a capital investment that requires construction will flow in two stages. During the first stage, impacts arise from the construction activity itself. During the second stage, impacts are derived from the on-going operation of the facility or asset that has been built.

3.1.1. Direct impact estimates

All economic impact methodologies start with projections of the direct economic impacts of a given investment, usually in terms of output, employment, and / or value added. These projections come from estimates of throughput, capital costs, and other features associated with the investments in question. The methodologies then differ in terms of how they develop indirect, induced, and catalytic economic impact projections.

3.1.2. Indirect and induced impacts

In order to develop indirect and induced economic impact projections, most economic impact studies involving airports worldwide use what is called the "Input-Output Approach." In this approach, regional input-output models are used to generate multipliers for each industry affected by the airport that show the ripple effect of an expansion or contraction of each industry on the entire economy. The direct impact for a new investment in terms of numbers employed (or number of jobs or employees), output, and value added is then projected. The appropriate multipliers are then applied to these projections to generate projections of the indirect and induced effects.

While this approach has great appeal, in part due to its simplicity, it has a number of shortcomings. The first is that the multipliers generated through the analysis of the input-output tables are most valid for marginal changes in the direct impact projections, as they do not take into account the potential for shortages to develop in some inputs or for the potential that a large investment could bid up salaries and input costs in the local models generally do not take potentially diminishing returns into account.[13] A second shortcoming

[12] We note that there is no single universally accepted methodology for carrying out airport or aviation -related economic impact analyses. The process identified in this section and in Appendix A was developed from best practice guidelines provided by the Airport Authority of Hong Kong and tailored to the Hong Kong context by ESA.

[13] Economists would generally refer to the basic shortcoming as failure to account for general equilibrium effects.

is that this method requires the existence of relatively detailed up-to-date input-output tables, which are not available for many economies.

A second approach to generating indirect and induced economic impact projections uses closed multi-sectorial macroeconomic models to generate economic impacts. Such models not only have input-output relations embedded within them, but also take into account the effect of increases in demand in one sector on wages and costs across the economy. Projections of the direct economic impacts are generated and then entered into the models, which then produce estimates of the indirect and induced impacts of an investment over the specified range, rather than just linear multipliers that may be valid over a relatively small range of input values or for a relatively short period of time. The advantage of this approach is that it overcomes some of the shortcomings of the multiplier approach. The disadvantages are that this approach has substantial data requirements as well as requiring the construction (or existence) of a suitable macro-model for the economy in question. It is therefore more costly and in many cases not feasible to implement.

Unfortunately, in some locations, there are no widely accepted, detailed input-output tables or suitable detailed macroeconomic models available for the economy. This makes it impossible to generate a complete set of multipliers or carry out macroeconomic model analysis in the same way as is possible in many other places in the world. The result is that economic impact analysis in such economies is often carried out by adopting “rule of thumb” multipliers derived from those used in similar settings elsewhere, or based on the judgment of the researcher to generate indirect and induced impacts from the direct impact figures. The problem with this latter method, of course, is that the multipliers generated may have little to do with the target location, and its economy. Thus it is important to choose economies as close in structure to the target economy’s as is possible if this method is used, and to liaise with government economists who have worked on related issues to ensure that the multipliers used seem reasonable for the local context.

3.1.3. Catalytic impacts

The direct, indirect, and induced benefits of an airport are related to the total revenues, value added, and employment of the aviation-related businesses and additional lines of business at the airport (direct), their expenditures on outputs from other industries (indirect), and the portion recycled by the spending of employees of the direct and indirect lines of business (induced). Catalytic benefits involve spillovers and other benefits that cannot be captured by tracing the flows of cash from aviation and airport-related businesses. The presence of an airport will have ripple effects throughout an economy. In particular, it will influence inward investment, business development, trade, and tourism activity.

While some of the catalytic effects are recognisable and quantifiable (the impact on tourism and trade, for example), others (such as the impact on inward investment, business development, and productivity throughout the economy) usually are not. For the latter group of effects, it can be extremely difficult to separate out the impact of an airport from other influences on the development of an economy.

These effects are sometimes projected through the use of large-scale surveys of businesses on the impact of an airport on their own businesses. Business survey results tend to address whether survey respondents believe the airport is important to their

business, but these results can be difficult to link directly to economic activity. The difficulties associated with business surveys involve the time and expense of generating usable datasets and the challenge of relating the results to economic impacts.

A second approach is through detailed econometric investigations of relationships between air travel and investment, productivity, and other variables. The econometric investigations, where they can be done, tend to use cross-section comparison of multiple regions with airports, estimating the catalytic impacts of air travel across cities rather than within a single city. The difficulties with econometric investigations involve the requirements for detailed datasets across multiple, otherwise similar, cities, and the time necessary to build the relevant models.

A third approach is a more eclectic one that takes several pieces of information into account and tries to weave a picture that allows rudimentary estimates of catalytic impact. This would include information from existing business surveys as to the importance of air transportation to their businesses, growth rates of key sectors that rely upon aviation services, comparisons of growth in aviation services to key economic variables (GDP, trade, and employment, for example), and results from other locations combined with judgments as to the portion of the results that can be attributed to aviation services.

We note that catalytic effects also have their direct, indirect, and induced components. For example, many economic impact studies of aviation include the impact of the spending on retail, hotel, food and beverage, and transportation of foreign visitors outside the airport that is catalysed or facilitated by air travel on output, value added, and employment (direct catalytic effects); the impact of the spending of industries upstream of retail, hotel, etc. (indirect catalytic effects); and the impact of the spending of employees of the indirect and direct tourism-related industries (induced catalytic effects). For other catalytic effects, some studies only take the direct catalytic impact into account in an effort to be conservative.

3.2. Methodology for the present Study

The methodology of the present Study followed the general economic impact methodology described above. The specifics involved the use of specific data sources for the present direct impacts, the use of specific projections and forecasts to estimate the future direct impacts, the use of Hong Kong-specific multipliers to project indirect and induced impacts, the use of Hong Kong-specific information to generate quantifiable catalytic impacts, and the compilation of suggestive Hong Kong-specific information with a bearing on non-quantifiable catalytic impacts. The details of the methodology may be found in the Appendices to this document.

In the present Study, direct revenues, value added, and employment figures for aviation-related businesses in Hong Kong were obtained from data supplied by the AA and the Hong Kong Census and Statistics Department (HKCSD). Direct revenue and employment data for construction in each scenario and the operational non-aviation businesses at HKIA were obtained from the AA. Value added estimates were generated by applying the ratio of value added to revenue from HKCSD data for the relevant lines of business. Indirect and induced multipliers were calculated from a combination of ratios derived from data available from HKCSD and economic multipliers provided by the Economic Analysis and Business Facilitations Unit, Hong Kong Financial Secretary's Office (FSO), as broad working assumptions for use in the Economic Impact Study.

While most studies of catalytic tourism impacts of aviation only take spending entering an economy due to inbound tourism into account, an increasing number also take potentially lost spending by outbound travellers into account. This Study generated economic impact estimates incorporating inbound tourism only (analogous to most studies) and incorporating the effects of both inbound and outbound tourism for sake of completeness. Direct inbound and outbound tourism revenues related to air travel were estimated from data published by the Hong Kong Tourism Board, the World Tourism Organisation, and HKCSD. Direct value added and employment estimates were generated by applying the ratio of value added and employment to revenue for the relevant industries from HKCSD data. Indirect and induced impacts of tourism were estimated by using multipliers and Hong Kong economic ratios in a similar fashion to that described above for aviation-related businesses in Hong Kong and non-aviation businesses at HKIA.

The catalytic impact of aviation-facilitated trade on Hong Kong's economy was estimated by first setting direct revenue equal to the total value of Hong Kong's trade by air, as calculated from HKCSD data. Direct value added and employment estimates were generated by applying the ratios of value added and employment to revenue from HKCSD data multiplied by the conventional trade ratio. Indirect and induced impacts of aviation-facilitated trade were estimated by using multipliers and Hong Kong economic ratios in a similar fashion to that described above.

In order to generate future economic impact projections, it was necessary to obtain passenger and cargo traffic forecasts and to generate scale factors that could be used to project the various lines of business and their impacts into the future. Future projections for passenger and cargo traffic were generated by the AA's Consultants. Scale factors were generated by linking the aviation-related businesses in Hong Kong, the non-aviation businesses at HKIA, the catalytic tourism impacts, and the catalytic trade impacts to passenger, cargo, and work load unit (WLU defined as one WLU = one passenger or 100 kilograms of cargo) throughput in the most recent year for which data was available.

The economic cost-benefits (net benefits) of each scenario were analysed by taking the "Economic Net Present Value" (ENPV) and Economic IRR (EIRR) of the projected net benefits of each scenario (equal to the net value added generated by each scenario minus the costs of operations). The net benefits were estimated using projections in 2012 dollars. For the ENPV an economic discount rate of 4 percent was provided by the Economic Analysis and Business Facilitations Unit, Hong Kong Financial Secretary's Office (FSO) for use in this study.

In addition, IRR (EIRR) assumes that all the benefits from the project under review are re-invested at the internally generated rate of return, yielding further returns at this same rate in the following period(s). However, if the magnitude of the returns exceeds the amount that can be re-invested in the project and the IRR is high by comparison to rates of return available in the market, then the assumption that all the returns can be re-invested at the same rate as the IRR is false and the estimated IRR may not be a good measure for project evaluation. In any case, if the IRR (EIRR) and the NPV (ENPV) give different answers in the evaluation of mutually exclusive projects, the correct answer is by NPV (ENPV).

As indicated, a more complete explanation of the methodology is in the Appendices to this document.

Appendix A. Methodologies and data sources

This Section describes the details of how the economic impact analysis is implemented in the present Study. First, it describes the methods behind the estimation of the current economic impact of HKIA and related businesses on Hong Kong's economy. Second, it describes how future economic impacts and the specific case for the Investment Scenario are addressed. Third, it describes the methods used to carry out the net economic-cost benefit analysis.

The economic impact of HKIA is estimated for year 2012 to correspond with the AAHK study brief and currently available economic data. For future economic impact projections, year 2012 is used as the base year from which projections are scaled. Note Hong Kong statistical data for year 2012 now follows *Hong Kong Standard Industrial Classification (HSIC) Version 2.0*, and the data used is coded to this revised standard. All data inputs are updated to that available in May 2014. For the year 2012 and onwards all dollar values are quoted in 2012 dollars.

A.1. Present HKIA economic impact

The present economic impact consisted of five major components. First, the direct, indirect, and induced impacts of aviation-related industries in Hong Kong are estimated. Second, estimates are made of the direct, indirect, and induced impacts of other businesses at HKIA (on Chek Lap Kok, the airport island). Third, estimates are made for the impact of aviation- facilitated tourism, both for inbound tourism and net tourism. Fourth, estimates are developed for the impact of trade facilitated by HKIA. Fifth, areas of additional, but non-quantifiable impacts are identified and rough indicators of their importance to the Hong Kong economy are described where possible.

A.1.1. Aviation businesses in Hong Kong and non-aviation businesses at HKIA direct impacts

A.1.1.1. Aviation-related businesses in Hong Kong

Direct impacts from aviation-related businesses in Hong Kong result from the revenues, value added, and employment in aviation-related sectors in Hong Kong. The core assumption made is that these businesses would not exist without the presence of the Hong Kong International Airport (HKIA). The direct aviation-related businesses identified for the present Study correspond with the Hong Kong Census and Statistics Department (HKCSD) category "Air Transport and Incidental Services." This category includes Hong Kong-based airlines and helicopter companies, the local representative offices of overseas airline companies, air cargo forwarding services, and supporting services to air transport (including HKIA). The revenue, value added, and employment figures for this category will be taken directly from HKCSD data. [52] It should be noted that a significant portion of the activities of the aviation-related businesses take place outside of HKIA itself.

[52] Hong Kong Census and Statistics Department, direct communication.

As Exhibit A1.1 shows, the years 2008 and 2009 were atypical for Hong Kong's air transport sector when compared to the years immediately preceding. In 2008, revenue rose substantially, but value added fell, due in part to high fuel prices. In 2009, in the midst of a global economic slowdown, revenue and value added fell to approximately 2005 levels. A spike in fuel prices is again observed for 2011 and 2012, this time however revenues increased with fuel prices giving similar ratios of value added to revenue and employment to revenue as those observed pre 2008.

Exhibit A1.1. Air Transport and Incidental Services Statistics in Hong Kong

Air Transport	**2005**	**2006**	**2007**	**2008**	**2009**	**2011**	**2012**
Revenue (HK$mn)	177,985	189,351	206,055	223,835	173,085	225,207	222,209
Value added (HK$mn)	39,410	38,360	41,868	27,116	38,182	48,532	49,028
Number of employees (persons)	47,233	49,912	54,742	56,988	56,115	55.696	56,694
Compensation of employees (HK$mn)	16,582	17,699	19,331	20,353	20,382	24,156	25,655
Fuels (HK$mn)	18,223	22,953	24,829	47,018	17,438	42,771	43,706
Crude Oil (US$ average per barrel)	50.0	58.3	64.2	91.5	53.5	87.0	86.5
Proportion of Revenue							
Value added	22%	20%	20%	12%	22%	22%	22%
Compensation of employees	9%	9%	9%	9%	12%	11%	12%
Fuels	10%	12%	12%	21%	10%	19%	20%

Note: Industry code 7170, 7171, 7172, and 7182 (for HSIC v1.1) in year 2000 to year 2008, and industry code 5101, 5102, 5109, 5223, and 522901 (for HSIC v2.0) in year 2009

Source: Direct communication with HKCSD,http://www.inflationdata.com.

A.1.1.2. Non-aviation businesses at HKIA

In addition to aviation-related businesses, there are a number of other businesses at HKIA and on Chek Lap Kok. These include retail, food and beverage, and hotels at the airport itself, as well as the exhibition and convention businesses at AsiaWorld-Expo. In order to estimate the direct impact of the retail and food and beverage businesses, data on the revenues and employment of the relevant businesses at HKIA is obtained from the AA. These figures are adjusted by removing estimates of the spending of Hong Kong residents (assumed to match the share of Hong Kong residents in passengers served by HKIA). The reason is that it can be argued that in the absence of HKIA, retail and food and beverage spending by Hong Kong residents at HKIA would go to retail and food and beverage outlets elsewhere in Hong Kong and therefore HKIA is not responsible for new spending accruing to Hong Kong by these passengers. To the extent that a full 100 percent of this expenditure would not actually occur in the absence of HKIA, the estimate will be conservative. Direct value added and employment for these sectors is estimated by applying the value added to revenue and employment to revenue ratios for these sectors reported by HKCSD [53] to the adjusted revenues at HKIA.

For hotels on the airport island, including the five-star Regal Airport Hotel and the five-star SkyCity Marriot Hotel, expected hotel revenue is calculated by multiplying the average occupancy rate for five-star hotels in Hong Kong by the five-star hotel average

[53] Hong Kong Census and Statistics Department, Website Table 90: Selected Statistics for All Establishments in the Industry Sections of Import/Export, Wholesale and Retail Trades, and Accommodation and Food Services.

annual revenue per room[54] and by the number of rooms in each hotel.[55] Value added and employment is estimated by applying to the estimated revenues the value added to revenue and employment to revenue ratios reported for the hotel industry by HKCSD.[56]

Revenues for the exhibition and convention business is taken to equal the industry organizer expenditure at AWE.[57] Expenditures by exhibitor and delegate staff attending the events is not estimated as we assume that these will be picked up in the hotel, retail, and food and beverage figures for HKIA as well as in the general catalytic tourism impacts described below. As HKCSD does not provide a specific category analogous to the exhibition and convention industry, value added and employment are estimated by using the ratios of value added to revenue and employment to revenue for HKCSD's "Administrative and support service activities" category.[58]

A.1.2. Catalytic "direct" impacts

Although the economic impacts of aviation-facilitated tourism and trade are properly termed "catalytic" impacts, these impacts also have their direct, indirect, and induced components.

A.1.2.1. Aviation-facilitated tourism impacts

Tourism can be classified into two categories, the export of tourism services (resulting from the spending of inbound visitors to Hong Kong), and the import of tourism services (resulting from the spending of outbound Hong Kong residents abroad). Tourism exports result in a revenue, value added, and employment gain to the Hong Kong economy, while imports result in a revenue, value added, and employment loss to the Hong Kong economy.

Many studies of the economic impact of airports focus on benefits to the local economy derived from the spending of inbound tourism facilitated by the airport (tourism exports) without reference to the impacts of spending that might be lost due to outbound tourism by local residents (tourism imports).[59] However, an increasing number of studies suggest that the proper measure of the economic impact of aviation-facilitated tourism should take into account outbound tourism (tourism imports) as well. The idea is that just as the presence of an airport facilitates inbound tourism and allows a location to receive the spending of inbound tourists, the airport also facilitates outbound tourism and spending by local residents in other locations. To the

[54] Hong Kong Hotels Association and Hong Kong Tourism Board, *Summary of the Hong Kong Hotel Industry Review,* 2012.
[55] Regal Airport Website and Airport Authority of Hong Kong,
[56] Hong Kong Census and Statistics Department, Website Table 90*, Selected Statistics for All Establishments in the Industry Sections of Import/Export, Wholesale and Retail Trades, and Accommodation and Food Services.*
[57] Exhibition and convention industry sources.
[58] Hong Kong Census and Statistics Department, Website Table 91: *Selected Statistics for All Establishments in the Information and Communications, Financing and Insurance, Professional and Business Services Sections*.
[59] Air Traffic Action Group, *The Economic and Social Benefits of Air Transport*, 2008, focuses on the benefits of aviation to the tourism sector globally. URS, *The Economic Impact of Growth at Sydney Airport*, 2008, notes the gains to Sydney's economy from tourists and tourist-related industries, but does not discuss the impact of outbound tourism. Campbell-Hill Aviation Group, *City of Houston Department of Aviation: 2030 Economic Impact Study*, 2004, estimated the economic impact of arriving visitors to Houston, but not the impact of outgoing visitors. Connecticut Center for Economic Analysis, University of Connecticut, *Bradley International Airport Improvements: An Economic Impact Analysis*, 2001, similarly focused on the spending from additional visitors to Connecticut, but did not account for additional spending by Connecticut residents outside the state that might result from airport improvements.

extent that this outbound tourist spending would otherwise be spent locally, there is less local spending and a loss to the local economy. Several studies suggest that the spending of outbound tourists as well as inbound tourists be taken into account by determining the impact of spending by inbound tourists arriving by air and the impact of lost local spending due to outbound tourists departing by air and then subtracting the latter from the former.[60] The result in some cases will be a negative net tourism impact.

Some analysts argue that the facilitation of outbound tourism actually creates a substantial benefit for the local economy in terms of the ability of its residents to travel to other locations and the ability of its businesses to interact with the rest of the world and therefore any loss of spending in the local economy should not be emphasised.[61] They claim that for locations with a negative tourism balance, this could lead to conclusions that air travel should be restricted rather than expanded. Other analysts argue that the gains and losses are gains and losses and should be reported as such without prejudice and that tourism gains claimed by studies that do not include the net benefit calculation overstate the potential gains from expanded aviation services.[62] In terms of GDP impact, it is increasingly common to factor both impacts in. Ignoring the outbound tourism is equivalent to assuming that the gains to the local economy in terms of consumer welfare and other potential positive business effects exactly offset the impact of lost spending in the local economy by outbound tourists.

We provide an estimate of both the inbound tourism (exports) economic impacts and the net tourism (exports minus imports) economic impacts.

A.1.2.1.1. Direct tourism export impacts

No single data source is available for revenue, value added, or employment generated by visitors that arrive in Hong Kong by air. Tourism revenue attributable to air transport is, therefore, calculated by taking the number of tourist arrivals by air from each major region, multiplying by the average spend in Hong Kong of tourists from each region, and summing the results.[63] Tourism revenue is further broken down into retail, food and beverage, hotel, and other expenditure based on the average spending breakdown for visitors from each region.[64] Value added and employment attributable to air visitors is estimated by taking the resulting revenue figures by industry and applying the value added to revenue and employment to revenue ratios from HKCSD and the Hong Kong Tourism Board for the relevant industries.[65]

[60] Reports that acknowledge a need to net tourism imports and exports in economic impact analyses include York Aviation, *The Economic and Social Impacts of Airports*, 2005; Oxford Economic Forecasting, *The Economic Contribution of the Aviation Industry in the UK*, 2006; Oxford Economic Forecasting, *The Economic Catalytic Effects of Air Transport in Europe*, 2002; CE Delft, *The economics of Heathrow expansion*, 2008; GLA, *Heathrow Economics Study*, 2006.

[61] See, for example, York Aviation, *The Economic and Social Impacts of Airports*, 2005; Oxford Economic Forecasting, *The Economic Contribution of the Aviation Industry in the UK*, 2006.

[62] See, for example, CE Delft, *The Economics of Heathrow Expansion*, 2008; GLA, *Heathrow Economics Study*, 2006.

[63] Hong Kong Tourism Board, *A Statistical Review of Hong Kong Tourism*, 2012.

[64] Hong Kong Tourism Board, *A Statistical Review of Hong Kong Tourism*, 2012.

[65] Hong Kong Census and Statistics Department, Website Table 90: *Selected Statistics for All Establishments in the Industry Sections of Import/Export, Wholesale and Retail Trades, and Accommodation and Food Services, and Hong Kong Tourism Board, A Statistical Review of Hong Kong Tourism, 2012.*

A.1.2.1.2. Direct tourism import impacts and net tourism impacts

Estimates of Hong Kong's total number of outbound visitors and their total spending are available from the World Tourism Organisation[66] and HKCSD.[67] No data is directly available on the import of tourism services by air (resulting from the spending of Hong Kong residents travelling abroad by air). However, this can be estimated from the breakdown of outbound spending by destination provided by HKCSD. As all destinations, with the exception of the Chinese Mainland and Macau, are too distant for the vast majority of Hong Kong travellers to make the journey except by air, we have assumed that all these journeys are by air. In the case of outbound visitors to Mainland China, this cannot be assumed due to the land border. However, HKCSD[68] produced a special report on Hong Kong residents' visits to Mainland China which gives the total number of passengers and the percentage of passengers by air and their per capita spending in 2012, from which tourism imports by air from Mainland China can be calculated.

From this figure, we subtract the estimated hotel expenditures of Hong Kong outbound travellers by air. The logic is that the assumption that 100 percent of what a Hong Kong outbound traveller by air spends abroad would be spent in Hong Kong if they did not travel is extreme and since they would not have to spend on hotel should they remain in Hong Kong this can be deducted to provide a reasonable approximation.

To estimate the direct value added and employment impact of outbound tourism spending, we take the adjusted outbound spending and assume that if the Hong Kong traveller had remained at home they would have spent the remaining amount in roughly the same pattern as the typical foreign visitor to Hong Kong except for hotels (i.e. on retail, food and beverage, and related items). The relevant revenue estimates were used to generate value added and employment estimates by reference to the revenue to value added and revenue to employment ratios in the relevant categories derived from HKCSD data.

The net tourism impacts on Hong Kong's economy are estimated by subtracting the tourism import impact estimates from the tourism export impact estimates.

A.1.2.2. Aviation-facilitated trade

The starting point for the estimate of the direct economic impact of aviation-facilitated trade is to sum up the value of domestic exports, retained imports, and re-exports that arrived or departed by air in order to generate a total trade value (direct revenue) by air for Hong Kong. This revenue figure is then multiplied by the value added to revenue ratio for the "Import- Export Trading" industry and the conventional trade ratio (excluding offshore trade) to generate a value added to Hong Kong's economy through trade by air. Employment is estimated by applying the employment ratio for the "Import-Export Trading" industry to the value added figure.

Note that there is no "net trade" analysis as the bulk of Hong Kong's imports come by sea or by land and it is not plausible to suggest that in the absence of air cargo

[66] http://stat.wto.org/StatisticalProgram/WSDBStatProgramHome.aspx?Language=E
[67] Hong Kong Census and Statistics Department, *Report on Hong Kong Trade in Services Statistics*, 2012.
[68] Socio-economic Characteristics and Consumption Expenditure of Hong Kong Residents Making Personal Travel to the Mainland of China, 2012

facilitated by HKIA that there would be more manufacturing in Hong Kong. Thus there is no analogous potential loss associated with inbound air cargo as there may be with spending by Hong Kong residents travelling abroad, some of which at least could be plausibly assumed would be spent in Hong Kong if they did not travel.

A.1.3. Indirect and induced impacts

Indirect impacts reflect the result of the purchases of the direct businesses. Induced impacts reflect the result of the spending of employees in the direct and indirect businesses in the wider economy. Indirect and induced multipliers were calculated from a combination of ratios derived from data available from HKCSD and economic multipliers (see Exhibits A1.2) for year 2011 (used for 2012 and subsequent years in the economic model). The multipliers relating Direct plus Indirect Value Added to business receipts are provided by the Economic Analysis and Business Facilitation Unit (EABFU), Hong Kong Financial Secretary's Office, as broad working assumptions. These are produced based on the observed linkages between sectors and the resultant pattern of intermediate consumption, import leakages of the various economic activities, gross margin of external trade, and the ratios of value added to gross-output and business receipts for the affected sectors in recent years. Since tourism- related industries dominate the non-aviation businesses at HKIA, the tourism multipliers are used for the larger category. In addition, EABFU provided multipliers for the link between consumer spending and value added in the Hong Kong economy. We take these latter values as the Induced Value Added to Revenue Multiplier, as induced spending is consumer spending by employees in direct and indirect industries.

Exhibit A1.2. Economic Multipliers 2011

Industry	Multiplier
Direct Revenue to Direct + Indirect Value Added Multiplier	
Air Transport	0.317
Tourism	0.501
Trade (re-exports)	0.134
Trade (retained imports)	0.090
Induced Revenue to Induced Value Added to Multiplier	0.547

Note: The direct and indirect value added multipliers for re-exports and retained imports have both excluded air transport related value added.

Source: Economic Analysis and Business Facilitation Unit, Hong Kong Financial Secretary's Office; Enright, Scott & Associates, Ltd.

For aviation-related businesses in Hong Kong, non-aviation businesses at HKIA, tourism- related businesses, and trade, the Indirect Value Added is estimated by first multiplying Direct Revenue by the relevant Direct + Indirect Value Added Multiplier and then subtracting the Direct Value Added obtained through methods described above.

Indirect Value Added = (Direct Revenue x Direct Plus Indirect Value Added to Revenue Multiplier) – Direct Value Added

For aviation-related businesses in Hong Kong, non-aviation businesses at HKIA, and tourism-related businesses, Indirect Revenue is estimated by subtracting

Direct Value Added from Direct Revenue. This is the same as assuming that import leakage in these businesses is balanced by the contribution of all of the local supply industries upstream of the focal industry. As there is no information available that allows either the import leakage or the contribution of the upstream local supply industries, this remains as an assumption. Since no other estimation depended on Indirect Revenues, and in the absence of a Hong Kong-specific multiplier for Direct to Indirect Revenue, this approximation is taken as the best available.

$$\text{Indirect Revenue} = \text{Direct Revenue} - \text{Direct Value Added}$$

In the case of trade, since the extremely high import leakage makes Direct Revenue – Direct Value Added a poor proxy for Indirect Revenue, an estimate is obtained by multiplying Indirect Trade Value Added by the economy wide ratio of Revenue to Value Added.

$$\text{Indirect Trade Revenue} = \text{Indirect Trade Value Added} \times (\text{Revenue/ Value Added})_{\text{Hong Kong}}$$

For all industries, Indirect Employment is estimated by multiplying Indirect Value Added by the economy-wide ratio of Employment to Value Added. The economy-wide ratio is used because it is not possible to reverse engineer all of the upstream industries that are involved from the multiplier.

$$\text{Indirect Employment} = \text{Indirect Value Added} \times (\text{Employment/ Value Added})_{\text{Hong Kong}}$$

Induced Revenue refers to the revenue generated by the purchases of people employed in the direct and indirect industries and is calculated from the following formula:

$$\text{Induced Revenue} = [(\text{Direct VA})_{\text{Industry}} \times (\text{Comp/ VA})_{\text{Industry}} \times (1 - \text{HK SR})] + [(\text{Indirect VA})_{\text{Industry}} \times (\text{Comp/ VA})_{\text{Economy}} \times (1 - \text{HK SR})]$$

Where $(\text{Direct VA})_{\text{Industry}}$ is the direct value added for the industry, $(\text{Comp/ VA})_{\text{Industry}}$ the compensation portion of value added in the industry, HK SR the Hong Kong economy-wide savings rate, $(\text{Indirect VA})_{\text{Industry}}$ the industry's indirect value added, and $(\text{Comp/ VA})_{\text{Economy}}$ the compensation portion of value added in the Hong Kong economy. (1-HK SR) or one minus the savings rate, is the portion of income that is spent by consumers in Hong Kong.

Induced Value Added is estimated by multiplying Induced Revenue by the Induced Value Added to Revenue Multiplier. Induced Employment is estimated by multiplying Induced Revenue by the ratio of retail trade Employment to Revenue for Hong Kong. The assumption here is that most induced spending will be on retail goods.

$$\text{Induced Value Added} = \text{Induced Revenue} \times \text{Induced Value Added to Revenue Multiplier}$$

$$\text{Induced Employment} = \text{Induced Value Added} \times (\text{Employment/Value Added})_{\text{Retail, Hong Kong}}$$

The methodology for calculating direct, indirect, and induced impacts is summarised in Exhibit A1.3

Exhibit A1.3. Economic Impact Method Summary

	Revenue	Value Added	Employment
Direct	**DREV from HKCSD data or AA**	**DVA from HKCSD or relevant VA/REV ratio from HKCSD**	**DEMP from HKCSD or relevant EMP/REV ratio from HKCSD**
Indirect	**INDIREV = DREV-DVA, except for trade INDIREV = INDIVA x EREV/EVA**	**INDIVA= DREV x MULTIPLER$_1$ – DVA**	**INDIEMP = INDIVA x EEMP/EVA**
Induced	**INDUREV = DVA x (DCOMP/DVA) x (1-HKSR) + INDIVA x (ECOMP/EVA) x (1-HKSR)**	**INDUVA = INDUREV x MULTIPLIER$_2$**	**INDUEMP = INDUVA x Retail EMP /Retail VA**

D = Direct, INDI = Indirect, INDU = Induced
REV = Revenue, VA = Value Added, EMP = Employment
E = Economy wide, COMP = Compensation
MULTIPLIER$_1$ = Direct + Indirect Value Added Multiplier for relevant industry
MULTIPLIER$_2$ = INDUREV to INDUVA Multiplier
HKSR = Hong Kong Savings Rate

A.2. Economic impact of capital investment

The expenditure on infrastructure construction and subsequent expenditure on infrastructure maintenance under the investment scenarios will generate direct, indirect, and induced economic impacts.

In order to calculate the direct construction impacts, data on the forecast material, labour and plant costs, together with the number of persons to be employed were obtained from the AA, in addition to details of the planned construction phases. A portion of the cost data provided was in nominal "Money of the Day" dollars (MOD), as all dollar values used in the economic model are in real 2012 dollars, each annual nominal cost figure was discounted back to its equivalent value in 2012 dollars using the following formula:

$$\text{Real}_{(2012\ \$)}\ \text{Cost}_{(\text{Year Y})} = \text{Nominal Cost}_{(\text{Year Y})} \times \text{Real}_{(2012\ \$)}\ \text{GDP}_{(\text{Year Y})} / \text{Nominal GDP}_{(\text{Year Y})}$$ [69]

The AA provided construction costs for the third runway as a single lump sum figure in 2012 dollars. As construction was planned to cover 8 years, without further information on cost allocation, a simple division of expenditure by 8 gave the average annual expenditure. The real 2012 annual expenditures were first inflated by the MOD inflation rate then deflated by the GDP deflator to give a 2012 dollar value that correctly accounts for the higher MOD inflation rate over the projected economy wide inflation rate. ESA was subsequently provided with an MOD total third runway construction cost, which closely matched that derived from a roughly even 8 year split.

$$\text{Nominal Cost}_{(\text{Year Y})} = \text{Cost in 2012 HK\$}_{(\text{Year Y})} \times (1+ \text{Gr}_{(\text{Year Y})}) \times (1+ \text{Gr}_{(\text{Year Y - 1})}) \times \ldots\ldots\ldots (1+ \text{Gr}_{(\text{Year 2013})})$$

Gr = Annual Nominal MOD inflation rate, as provided by HKAA

$$\text{Cost in 2012 HK\$}_{(\text{Year Y})} = \text{Nominal Cost}_{(\text{Year Y})} \times \text{GDP in 2012 HK\$}_{(\text{Year Y})} / \text{Nominal GDP}_{(\text{Year Y})}$$

Direct Revenue to the construction companies is equal to the projected total sum of material, plant, and labour costs for the project. Direct Value Added is calculated as projected labour costs minus projected labour import leakages plus the projected profit margin for the construction companies. Labour leakages were estimated with reference to figures for the construction of Chek Lap Kok airport which indicate that labour import percentages ran as high as 20 percent,[70] and in consultation with the AA. Given that the project continues over a longer period and is smaller than the initial construction of Chek Lap Kok, and there are likely to be fewer major projects going on in Hong Kong at the same time than was the case then, it seems likely that there will be less competition for labour than there was when Chek Lap Kok was built, and that the need

[69] Real and Nominal GDP forecasts came from IHS Forecasts, November 2014
[70] Legislative Council Brief, Special Importation of Labour Scheme for the New Airport and Related Projects, Education and Manpower Branch, 1993

for imported labour will be mainly limited to specialists in the technical and management aspects of airport runway construction. On this basis, an estimate of 5 percent labour leakage is considered reasonable and is assumed in the present case. The projected profit margin for construction companies is 6.2 percent. This was taken as the ratio of gross surplus to total revenue for the Hong Kong construction industry in 2012.

Direct Employment, measured in "person-years," was calculated using estimates of the average "person-days" to be worked on each of the various activities involved in the construction of each scenario. The AA provided the estimated average person-day construction works schedule. The impact on Direct Employment was adjusted to take into account estimated import leakages for labour which again were assumed to be 5 percent.

Indirect revenue was estimated by taking projected costs for material and plant and adjusting them by subtracting import leakages. Import leakages for materials were assumed to be 80 percent on the basis that the majority of goods that are imported into Hong Kong arrive in a finished, or close to finished, state. Plant import leakages were assumed to be 50 percent. Although all, or nearly all, of the plant is likely to be imported, the total cost of plant includes items such as setup, on-going maintenance work, and the management of leases relating to plant, and these items are estimated to reduce overall leakage to 50 percent.

Indirect Value Added was estimated by multiplying Indirect Revenue by the economy wide ratio of Value Added to Revenue. This ratio was calculated from HKCSD data.

Indirect Employment was estimated by multiplying Indirect Value Added by the economy wide ratio of Employment to Value Added. This ratio was calculated from HKCSD data.

Induced Revenue, Value Added, and Employment were calculated following the same method as used in estimating the economic impact from operations of HKIA. Accordingly, Induced Revenue was calculated from the following formula:

$$\text{Induced Revenue} = [(\text{Direct VA})_{\text{Industry}} \times (\text{Comp/ VA})_{\text{Industry}} \times (1 - \text{HK SR})] + [(\text{Indirect VA})_{\text{Industry}} \times (\text{Comp/ VA})_{\text{Economy}} \times (1- \text{HK SR})]$$

Where $[(\text{Direct VA})_{\text{Industry}}$ is the Direct Value Added for the industry, $(\text{Comp/ VA})_{\text{Industry}}$ is the compensation portion of Value Added in the industry, HK SR is the economy-wide Hong Kong savings rate, $(\text{Indirect VA})_{\text{Industry}}$ is the industry's Indirect Value Added, and $(\text{Comp/ VA})_{\text{Economy}}$ is the compensation portion of Value Added in the Hong Kong economy.

Induced Value Added is estimated using the multiplier on private consumption expenditure provided by the Economic Analysis and Business Facilitation Unit, Hong Kong Financial Secretary's Office for the value added to consumer spending ratio for Hong Kong. Induced Employment was estimated by multiplying estimated Induced Value Added by the ratio of retail trade Employment to Value Added calculated from HKCSD data. Implicit in this is the assumption that employment in the retail sector per dollar of value added is broadly comparable to employment in the other spending

categories per dollar of value added.

AA provided estimated maintenance expenditure for each scenario from years 2012 to 2046. Maintenance expenditure will have a different mix to construction with lower expenditure on plant and material but higher expenditure on labour. No data is available on this expenditure mix and so we have assumed the same mix as used for construction.

A.3. Future projections

The economic impact analysis for the present provides a basis for estimates of future economic impacts. However, a number of additional assumptions and methods are necessary to project these impacts. We separate these into assumptions and methods that affect base economic impact projections and those specific to the projection of the economic impact of each scenario at HKIA.

A.3.1. Base projections

To generate future economic impact projections, it was necessary to obtain throughput or traffic forecasts for HKIA, and to generate scale factors that link future economic impact to the number of passengers and the amount of cargo handled by HKIA. The traffic projections were generated by AA's Consultants for the Status Quo Situation, Scenario 1, and Scenario 2. These projections indicated that Hong Kong residents would be served even if capacity were constrained at HKIA, with transit passenger then foreign visitor traffic bearing the brunt of the capacity limitations. Thus we project all Hong Kong resident demand is served through 2030 and that the ratio of Hong Kong resident to foreign visitor to transit and transfer passengers remains constant thereafter.

Scale factors for each major line of business were generated based on year 2012 data, and the relevant passenger and cargo throughput information. For businesses that are likely to scale with passenger numbers (retail, and food and beverage, for example), the most recent revenue per passenger was calculated and applied to projected passenger numbers. For businesses most likely to scale with cargo (cargo related services, for example), revenue per tonne of cargo throughput was calculated for the most recent year for which data was available and then applied to the projected cargo throughput numbers. For businesses where it was not possible to separate passengers and cargo (for example, the HKCSD "Air Transport and Incidental Services" category), the future projections were scaled by work load unit (WLU) as defined in Exhibit A3.1.

Exhibit A3.1 identifies each of the major line items in the analysis and whether the future projections are based on projected passenger numbers, cargo throughput, or workload unit.

Exhibit A3.1. Economic Model Industry Line Items Scale Factors

Industry	Scale Factor
Aviation-related Business in Hong Kong	
Air Transport and Incidental Services - (i) Air Transport & Cargo	Work Load Unit (WLU)
Non-aviation Business at the HKIA	
Total Retail, Food, and Beverage	Visitors arriving by air and Transit passengers
Hotel	Fixed at 2012 occupancy rate
Exhibitions and Conventions	Cargo weight
Tourism	
Tourism Exports	Visitors arriving by air
Tourism Imports	Hong Kong residents departing by air
Trade	
Hong Kong Trade Services	Cargo weight

Note: One WLU equals one passenger or 100 kg of cargo

Source: Enright, Scott & Associates, Ltd. research.

A.3.2. The economic impact of Scenario 1 and Scenario 2 at HKIA

The initial estimates of the economic impact of the investment programs associated with Scenario 1 and Scenario 2 at HKIA on Hong Kong's economy were generated by taking the economic contribution of HKIA projected in Scenario 1 or Scenario 2 and subtracting from this the economic contribution of HKIA projected in the Status Quo Situation with the net difference being the economic impact of Scenario 1 or Scenario 2. We have performed this calculation and the results are described in this Report as a separate analysis for construction and maintenance and airport operations.

A.4. Economic cost benefit analysis

Beyond estimating and projecting the net economic impacts of each investment scenario in nominal dollars, it is useful to assess the size of the economic return on investment to Hong Kong from each investment scenario in turn.

This can be expressed in the form of an Economic Internal Rate of Return (EIRR) and also as an Economic Net Present Value (ENPV). The EIRR and ENPV calculations are similar to the more commonly performed Internal Rate of Return (IRR) and Net Present Value (NPV) calculations, the main difference being that the "returns" or "inflows" used in doing an EIRR / ENPV are typically larger than the projected cash inflows that are used in doing a traditional IRR / NPV analysis because they may include broader economic benefits such as indirect impacts stemming from the suppliers providing goods and services to the direct activities in the project, and induced impacts from the spending of income generated by the direct and indirect activities. The capital costs or "outlay" expenditures are the same as those that would be used in a regular IRR / NPV calculation and represent the actual cost

of the project.

For the present project, the ENPVs were calculated assuming a discount rate of 4 percent provided by the Economic Analysis and Business Facilitation Unit of the Hong Kong Financial Secretary's Office, understood to be the rate that is commonly taken as the imputed discount rate used for capital budgeting purposes for projects that are government funded in Hong Kong.

The AA have provided cash flow estimates for construction and maintenance out to the first quarter of 2047. As some of the cash flow components were in financial year periods (April to March) these were converted to calendar year periods (January to December). By 2024 all expenditures are projected to be maintenance expenditure at the airport, we have assumed that maintenance expenditure for 2047 to 2061 remain at the 2046 levels.

For the various scenarios and cases investigated, we report the EIRRs and ENPVs for the direct benefits, direct plus indirect benefits, and direct plus indirect plus induced benefits. We also report results that include only the direct catalytic benefits, as well as the direct plus indirect plus induced catalytic benefits.

For each of the cases estimated, a 50 year period from 2012 to 2061 was taken as the relevant project timeline for the purpose of estimating EIRR and ENPV. The 50 year period was taken with reference to the time periods used in estimating the economic benefits of other major infrastructure projects, such as the Hong Kong-Shenzhen Western Express Line (WEL), which use 50 years as the projected period of time over which economic benefits may reasonably be estimated. The analysis assumes a zero terminal value for the investments of both Scenario 1 and Scenario 2. This is likely to be conservative.

For each of the cases estimated, the projected costs of each scenario were taken as being equal to the construction and maintenance costs from 2012 to 2046 as described in Section A.2. The annual cost flows for each scenario up to 2046 are given in Exhibits A4.1 and A4.2.

The projected economic benefits of airport expansion were taken as being equal to the incremental value added for each scenario. This was calculated by subtracting the projected value added for the Status Quo Situation from the projected value added in the Scenario 1 or Scenario 2. For each scenario, after 2030 the annual value added from operations in each year is assumed to remain constant at the 2030 level. The annual value added flows for each scenario up to 2046 are given in Exhibits A4.1 and A4.2.

The projected economic cost was subtracted from the projected economic benefit in each year to determine a net economic benefit for each year which was then discounted to present value terms using the 4 percent discount rate giving the estimated ENPV for each scenario. The discount rate that would give an estimated ENPV for each scenario that is equal to zero was then calculated for each of the estimated cases, this rate being the estimated EIRR for each scenario.

The EIRR and ENPV values can be found in Exhibit A4.3. In each case, the first three rows of results only take into account aviation-related businesses in Hong Kong and non-aviation businesses at HKIA, the fourth row includes the direct impact of aviation-facilitated tourism and trade, and the fifth includes the direct, indirect, and

induced impacts of aviation- facilitated tourism and trade. Note that only results for the “Net Tourism” cases are shown.

We note that the high EIRRs are due in part to the fact that significant leverage can be achieved with the existing asset and benefits can be readily realized from the second year of investment. In addition, IRR (EIRR) assumes that all the benefits from the project under review are re-invested at the internally generated rate of return, yielding further returns at this same rate in the following period(s). However, if the magnitude of the returns exceeds the amount that can be re-invested in the project and the IRR is high by comparison to rates of return available in the market, then the assumption that all the returns can be re-invested at the same rate as the IRR is false and the estimated IRR may not be a good measure for project evaluation. In any case, if the IRR (EIRR) and the NPV (ENPV) give different answers in the evaluation of mutually exclusive projects, the correct answer is by NPV (ENPV).

We note that for the EIRR calculation we assumed that all capital expenditures (cash outflows) occurred at the beginning of a year and all benefits were obtained at the end of a year. If we assumed both expenditures and benefits were made evenly through the year, then the net of expenditure and benefits was positive, even in the first year, yielding infinite EIRR estimates. The time shift will yield conservative EIRR estimates.

Exhibit A4.1. Costs and Economic Benefits Cash Flows for Scenario 1, HK$ mn

Year	Costs	Direct		Direct + Indirect		Direct + Indirect + Induced		Direct + Indirect + Induced + Catalytic Direct Only		Direct + Indirect + Induced + Total Catalytic	
		VA	Net	VA	Net	VA	Net	VA	Net	VA	Net
2012	(2,288)	5,726	3,43	8,511	6,223	10,284	7,995	18,507	16,219	31,087	28,799
2013	(3,864)	5,502	1,63	8,226	4,362	9,937	6,073	15,747	11,883	23,318	19,454
2014	(3,712)	5,639	1,92	8,430	4,718	10,184	6,472	16,137	12,424	23,898	20,186
2015	(2,352)	6,768	4,41	10,076	7,724	12,174	9,822	21,174	18,822	34,525	32,173
2016	(3,514)	10,080	6,56	14,952	11,438	18,066	14,552	34,002	30,488	59,338	55,824
2017	(5,245)	12,140	6,89	17,974	12,729	21,719	16,474	42,389	37,144	76,099	70,854
2018	(3,698)	12,995	9,29	19,232	15,534	23,239	19,541	45,698	42,000	82,547	78,849
2019	(1,674)	14,633	12,959	21,635	19,961	26,143	24,469	52,438	50,765	96,028	94,354
2020	(1,003)	15,402	14,399	22,765	21,762	27,509	26,506	55,480	54,477	102,032	101,029
2021	(742)	16,840	16,098	24,868	24,126	30,051	29,309	61,648	60,906	114,705	113,962
2022	(515)	17,483	16,968	25,823	25,308	31,205	30,690	63,761	63,245	118,317	117,801
2023	(284)	17,922	17,638	26,478	26,194	31,996	31,712	65,017	64,733	120,248	119,964
2024	(132)	18,417	18,285	27,210	27,078	32,880	32,748	66,806	66,674	123,552	123,420
2025	(207)	18,832	18,625	27,821	27,614	33,619	33,412	68,370	68,163	126,523	126,316
2026	(288)	19,027	18,739	28,121	27,833	33,981	33,694	68,498	68,210	126,041	125,753
2027	(314)	19,529	19,216	28,862	28,549	34,877	34,563	70,375	70,061	129,618	129,304
2028	(314)	19,871	19,557	29,377	29,063	35,498	35,184	71,174	70,860	130,539	130,225
2029	(295)	20,411	20,116	30,164	29,869	36,450	36,155	73,581	73,285	135,623	135,327
2030	(291)	20,794	20,503	30,734	30,443	37,138	36,847	74,788	74,497	137,621	137,329
2031	(321)	20,794	20,474	30,734	30,413	37,138	36,818	74,788	74,467	137,621	137,300
2032	(547)	20,794	20,247	30,734	30,187	37,138	36,592	74,788	74,241	137,621	137,074
2033	(800)	20,794	19,995	30,734	29,934	37,138	36,339	74,788	73,988	137,621	136,821
2034	(1,008)	20,794	19,786	30,734	29,726	37,138	36,131	74,788	73,780	137,621	136,613
2035	(1,191)	20,794	19,603	30,734	29,543	37,138	35,947	74,788	73,597	137,621	136,430
2036	(1,252)	20,794	19,542	30,734	29,482	37,138	35,886	74,788	73,536	137,621	136,369
2037	(1,172)	20,794	19,622	30,734	29,562	37,138	35,966	74,788	73,616	137,621	136,448
2038	(1,089)	20,794	19,705	30,734	29,645	37,138	36,049	74,788	73,699	137,621	136,531
2039	(1,001)	20,794	19,793	30,734	29,732	37,138	36,137	74,788	73,786	137,621	136,619
2040	(956)	20,794	19,838	30,734	29,778	37,138	36,182	74,788	73,832	137,621	136,665
2041	(1,030)	20,794	19,764	30,734	29,703	37,138	36,108	74,788	73,758	137,621	136,590
2042	(1,216)	20,794	19,578	30,734	29,517	37,138	35,922	74,788	73,571	137,621	136,404
2043	(1,450)	20,794	19,345	30,734	29,284	37,138	35,689	74,788	73,338	137,621	136,171
2044	(1,675)	20,794	19,119	30,734	29,059	37,138	35,463	74,788	73,113	137,621	135,945
2045	(1,893)	20,794	18,901	30,734	28,841	37,138	35,246	74,788	72,895	137,621	135,728
2046	(1,993)	20,794	18,801	30,734	28,741	37,138	35,146	74,788	72,795	137,621	135,628
2047-2061	(1,993)	20,794	18,801	30,734	28,741	37,138	35,146	74,788	72,795	137,621	135,628

Note: VA = value added, Net = VA – Costs. Dollar values are in 2012 dollars.

Source: Enright, Scott & Associates, Ltd. analysis.

Exhibit A4.2. Costs and Economic Benefits Cash Flows for Scenario 2, HK$ mn

Year	Costs	Direct		Direct + Indirect		Direct + Indirect + Induced		Direct + Indirect + Induced + Catalytic Direct Only		Direct + Indirect + Induced + Total Catalytic	
		VA	Net	VA	Net	VA	Net	VA	Net	VA	Net
2012	(2,288)	5,726	3,437	8,511	6,223	10,284	7,995	18,507	16,219	31,087	28,799
2013	(3,864)	5,502	1,638	8,226	4,362	9,937	6,073	15,747	11,883	23,318	19,454
2014	(3,805)	5,639	1,834	8,430	4,625	10,184	6,379	16,137	12,331	23,898	20,093
2015	(3,318)	6,768	3,450	10,076	6,758	12,174	8,856	21,174	17,856	34,525	31,207
2016	(19,145)	10,080	(9,065)	14,952	(4,193)	18,066	(1,079)	34,002	14,857	59,338	40,193
2017	(20,708)	12,140	(8,567)	17,974	(2,733)	21,719	1,011	42,389	21,681	76,099	55,392
2018	(18,606)	12,995	(5,611)	19,232	627	23,239	4,634	45,698	27,092	82,547	63,941
2019	(16,705)	14,633	(2,072)	21,635	4,930	26,143	9,438	52,438	35,734	96,028	79,323
2020	(16,369)	15,702	(666)	23,173	6,804	28,003	11,634	58,128	41,759	109,033	92,664
2021	(16,493)	16,430	(63)	24,220	7,727	29,269	12,776	62,026	45,533	117,923	101,430
2022	(16,651)	17,130	480	25,264	8,614	30,531	13,880	64,131	47,480	121,230	104,579
2023	(16,758)	22,332	5,573	32,941	16,183	39,808	23,049	83,313	66,555	157,184	140,426
2024	(132)	27,020	26,889	39,864	39,732	48,173	48,041	100,530	100,398	189,310	189,178
2025	(207)	31,633	31,426	46,678	46,471	56,408	56,201	117,280	117,073	220,306	220,099
2026	(288)	35,708	35,421	52,698	52,411	63,683	63,395	132,024	131,736	247,630	247,342
2027	(314)	39,395	39,081	58,134	57,821	70,252	69,938	145,824	145,511	273,804	273,491
2028	(323)	42,950	42,627	63,375	63,052	76,585	76,262	159,185	158,862	299,225	298,902
2029	(327)	46,211	45,884	68,173	67,846	82,383	82,056	171,836	171,509	323,806	323,479
2030	(352)	49,444	49,091	72,932	72,579	88,134	87,782	184,312	183,960	347,924	347,571
2031	(428)	49,444	49,016	72,932	72,504	88,134	87,706	184,312	183,884	347,924	347,496
2032	(678)	49,444	48,766	72,932	72,254	88,134	87,457	184,312	183,634	347,924	347,246
2033	(970)	49,444	48,473	72,932	71,961	88,134	87,164	184,312	183,342	347,924	346,954
2034	(1,204)	49,444	48,240	72,932	71,728	88,134	86,931	184,312	183,108	347,924	346,720
2035	(1,434)	49,444	48,009	72,932	71,497	88,134	86,700	184,312	182,878	347,924	346,490
2036	(1,597)	49,444	47,847	72,932	71,335	88,134	86,538	184,312	182,715	347,924	346,327
2037	(1,769)	49,444	47,675	72,932	71,163	88,134	86,366	184,312	182,543	347,924	346,155
2038	(1,942)	49,444	47,502	72,932	70,990	88,134	86,192	184,312	182,370	347,924	345,982
2039	(2,092)	49,444	47,352	72,932	70,840	88,134	86,043	184,312	182,220	347,924	345,832
2040	(2,754)	49,444	46,689	72,932	70,178	88,134	85,380	184,312	181,558	347,924	345,170
2041	(3,397)	49,444	46,046	72,932	69,534	88,134	84,737	184,312	180,915	347,924	344,527
2042	(3,796)	49,444	45,648	72,932	69,136	88,134	84,338	184,312	180,516	347,924	344,128
2043	(3,956)	49,444	45,488	72,932	68,976	88,134	84,179	184,312	180,356	347,924	343,968
2044	(3,935)	49,444	45,509	72,932	68,997	88,134	84,200	184,312	180,377	347,924	343,989
2045	(3,836)	49,444	45,608	72,932	69,096	88,134	84,298	184,312	180,476	347,924	344,088
2046	(3,764)	49,444	45,679	72,932	69,167	88,134	84,370	184,312	180,548	347,924	344,159
2047-2061	(3,764)	49,444	45,679	72,932	69,167	88,134	84,370	184,312	180,548	347,924	344,159

Note: VA = value added, Net = VA – Costs. Dollar values are in 2012 dollars.

Source: Enright, Scott & Associates, Ltd. analysis.

Exhibit A4.3. Economic Internal Rate of Return and Economic Net Present Value for a 50 Year Return, Scenario 1 and 2

Impact	EIRR (percent)	ENPV (HK$ mn)
Scenario 1		
Direct	106%	314,739
Direct + Indirect	211%	482,969
Direct + Indirect + Induced	285%	591,214
Direct + Indirect + Induced + Catalytic Direct Only	626%	1,213,343
Direct + Indirect + Induced + Catalytic Total	1,164%	2,243,271
Scenario 2		
Direct	27%	525,722
Direct + Indirect	179%	841,521
Direct + Indirect + Induced	269%	1,045,637
Direct + Indirect + Induced + Catalytic Direct Only	623%	2,309,927
Direct + Indirect + Induced + Catalytic Total	1,163%	4,447,187

Note: The "Direct," "Direct + Indirect," and "Direct + Indirect + Induced" lines include only aviation-related businesses in Hong Kong and non-aviation businesses at HKIA. The "Direct + Indirect + Induced + Catalytic Direct Only" line adds in the direct benefits of aviation-facilitated tourism and trade. The "Direct + Indirect + Induced + Catalytic Total" line adds in the direct, indirect, and induced benefits of aviation-facilitated tourism and trade. All dollar values are in 2012 dollars.

Source: Enright, Scott & Associates, Ltd. analysis.

On economic grounds, the results suggest that Scenario 2 would be far more beneficial to Hong Kong than Scenario 1.

A.5. Cost of delay

The present report has assumed that there will be no delay in the start to construction and the final opening date for the third runway under Scenario 2. To estimate the cost of delaying the opening of a third runway, ESA calculated the ENPV for Scenario 2 assuming that the costs and benefits of the third runway construction would be delayed by one year, two years, three years, four years, and five years. To provide an "apples to apples" comparison, ESA allowed for an extension of the cash flows beyond 2061 for each year of delay. The cost of delay was then estimated by taking the difference between the ENPV in the no delay case and that for the delay cases. The results of this analysis are reported in Appendix G.

附件 B

海外機場徵收噪音相關收費的例子

1. 大部分徵收噪音相關收費的機場不會將噪音收費與着陸費掛鈎。部分機場按照飛機重量及噪音水平等因素，採用獨立的公式計算（如位於法蘭克福、慕尼黑及台北的機場），另一些機場則參照着陸費訂立噪音收費水平（如首爾金浦機場、巴黎戴高樂機場及東京成田機場），亦有某些機場會採用混合公式計算（如阿姆斯特丹史基浦機場[9]及倫敦希斯路機場[10]）。

2. 大部分機場只向着陸的航班徵收噪音費用（如位於慕尼黑、蘇黎世及首爾金浦的機場），而另有一些機場對所有起飛及降落的航班均徵收噪音費用（如位於法蘭克福、杜塞爾多夫及布達佩斯的機場）。

3. 多個機場利用設於機場四周的噪音測量儀器，以釐定噪音收費的類別（如位於慕尼黑、蘇黎世及杜塞爾多夫的機場），而有另一些機場則按照國際民航組織飛機噪音標準合格證明書[11]向航空公司收取費用（如位於阿姆斯特丹、巴黎、東京（成田）及法蘭克福的機場）。

4. 一般而言，機場實施的噪音收費水平佔其總航空收費[12]約 2 至 3%。所徵收的噪音收費視乎機場當地環境及飛機機種而定，製造最多及最少噪音的飛機被收取的收費可能有較大差別（從一至兩倍至超過 60 倍不等）。部分機場更於晚間收取較日間高的噪音收費。

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[9] 阿姆斯特丹機場的着陸及起飛費用按照飛機噪音類別而有所差異。阿姆斯特丹政府亦特意按照獨立公式，徵收噪音/隔音稅，為房屋及其他易受噪音影響建築物進行隔音工程提供資金（資料來源：「史基浦機場收費及細則」(Schiphol Airport Charges and Conditions) 2015 年 4 月 1 日）。

[10] 倫敦希斯路機場除按照國際民航組織原則實施噪音收費計劃，亦可在按照有關原則制定的噪音收費機制外，根據英國政府（運輸部）直接訂立的指引，向超出噪音限制的飛機作出懲罰。（資料來源：2013 年 3 月英國運輸大臣提交國會的「航空政策框架」）

[11] 國際民航組織飛機噪音標準合格證明書將飛機按照《國際民用航空公約》不同章節劃分為多個大類，統稱「『章』標準（chapter standards）」（如《第三章》飛機被視為較《第四章》飛機的「噪音水平較高」）。國際機場協會監管委員會於 2002 年 10 月建議使用國際機場協會飛機噪音評級指標(ANRI)（於 2010 年修訂），有關指標將國際民航組織「『章』標準」內飛機噪音類別細分，在國際民航組織附件 16 （ICAO Annex 16 certification）證明書的基礎上，為機場提供更精細的飛機噪音評級工具。

[12] 根據 LeighFisher 在二零一三年發表的《航空收費基準研究》（Aeronautical Charges Benchmarking Study）。

附件 C

香港民航處 2004-2015 年就珠三角空域事宜發出的新聞稿

展示編號	日期	標題
C1	2004 年 2 月 20 日	高層會議召開商談優化珠江三角洲航空交通管理
C2	2011 年 8 月 12 日	進出珠三角空域新增空管移交點（附圖）
C3	2011 年 9 月 1 日	珠三角地區空管規劃與實施專題工作組會議
C4	2012 年 6 月 18 日	珠三角地區空管規劃與實施專題工作組會議（附圖）
C5	2015 年 3 月 10 日	民航處就傳媒報道有關珠三角空域事宜的聲明
C6	2015 年 4 月 2 日	香港國際機場雙跑道運作的局限和空域問題 (民航處處長羅崇文 撰文)
C7	2015 年 10 月 20 日	香港民航處與國家民航局就新增往來華東地區航道達成協議

C1. 高層會議召開商談優化珠江三角洲航空交通管理

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民航處處長林光宇將與內地和澳門民航當局高層官員舉行會議，制定珠江三角洲地區未來航空交通管理規劃的藍圖。

珠江三角洲是全球最繁忙的空域之一，為繼續確保航空交通管理安全和有效率，林光宇將率領一個由航空交通管制（空管）和工程專業人員組成的代表團，於星期三（二月二十五日）參與在大連舉行的第一次內地、香港和澳門三方空中交通管理規劃和實施工作組會議。

一連兩日的會議將由中國民航總局空中交通管理局局長蘇蘭根主持，該局其他多名領導亦會從北京往大連出席會議。

會議議題包括討論編寫珠江三角洲地區空管規劃和實施方案的工作計劃；進一步提升珠江三角洲地區空管運作效率的方案；以及由中國民航總局介紹廣州新白雲國際機場的飛行程序。該個位於花都的新機場將於二○○四年年中啟用。

林光宇說：「我很高興能夠參加這次會議，與內地和澳門的空管專家共同努力，為珠江三角洲奠定一套長遠的綜合航空交通管理計劃。珠江三角洲位於亞太區的重要地理位置，區內航空交通量正迅速增長。」

他指出，儘管受九一一和非典型肺炎事件影響，珠江三角洲地區內的整體航空交通量仍能穩步增加。

他續說：「珠江三角洲地區的航空市場有強勁的增長潛力。我期望透過與內地和澳門民航當局共同努力，優化區內的空域使用及空中交通管理，更好地促進珠江三角洲的空運事業，並使能健康地持續發展。」

林光宇在返回香港前亦會前往廣州，到訪中國民航總局中南管理局，並與該局局長王繼武及其他領導會面。

完

二○○四年二月二十二日

C2. 進出珠三角空域新增空管移交點（附圖）

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經國家民航局、香港民航處及澳門民航局三方共同努力，從今年九月二十二日開始，在香港與廣州兩個飛行情報區之間，將增設一個空管移交點「LANDA」，供飛越香港空域而降落深圳的航班使用，珠三角航空交通管理的持續優化計劃又再邁進一步。

通過三方合作平台，民航處會一如既往與國家民航局和澳門民航局制訂改善措施，逐步落實優化珠三角地區外圍航路結構，積極推進該地區空管合作交流，以便優化航道及飛行程序設計，從而進一步提高珠三角地區空域使用效率，以配合未來珠三角區內航空交通量持續快速增長。

目前經香港到深圳的航班必須穿越香港飛行情報區內最繁忙的香港機場進近空域，新移交點及相關新航道遠離上述繁忙空域，大大減低航班處理的複雜性，從而令香港空管效率得以提升。

新移交點啟用後，由香港進出珠三角空域的空管移交點數量，會由現時兩入（香港往內地）一出（內地往香港）增至三入一出（請參考附圖），有助紓緩現有空管移交點的流量壓力，同時可騰出現有移交點約 18%的容量，供離港前往內地的航班使用，有利中港航空交通量的持續增長。

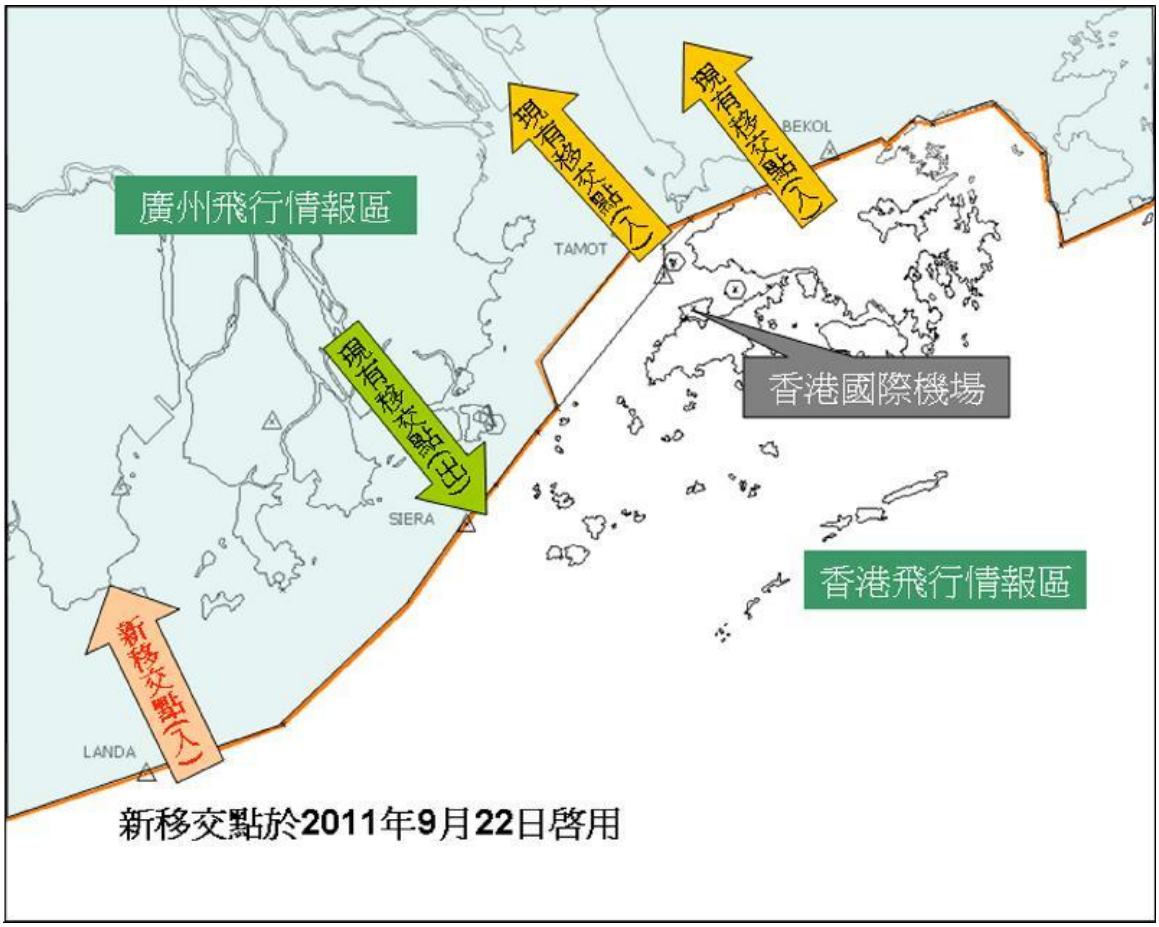
國家民航局、香港民航處及澳門民航局三方將繼續研究和落實其他優化珠三角地區空域設計和管理的措施。

此外，由本年七月一日起，使用 M750/B576 航路從香港飛越台北飛行情報區往南韓的航班流量間隔，已由原來的十分鐘縮短至五分鐘，令該航路的容量倍增。

民航處會繼續致力提升香港飛行情報區內其他航道容量及空域管理效率，一如既往為旅客提供安全及有效率的服務。

完

２０１１年8月１２日（星期五）


廣州飛行情報區
TAMOT
BEKOL
SIERA
LANDA
香港國際機場
香港飛行情報區
新移交點(入)
新移交點(出)
新移交點(入)
新移交點(入)
新移交點於2011年9月22日啓用

C3. 珠三角地區空管規劃與實施專題工作組會議

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由國家民航局、香港民航處及澳門民航局三方共同組成的珠江三角洲地區空中交通管理規劃與實施專題工作組，於八月三十一日在珠海舉行了最新一輪會議，繼續就珠三角空管程序與空域結構商討優化措施。

專題工作組會議總結了近年三方協同工作的成果，已經落實的多項空域優化措施包括：新增珠三角外圍航道；調整珠海終端區的邊界；及從今年九月二十二日開始，在香港與廣州兩個飛行情報區之間，增設一個空管移交點及相關航道，進一步優化珠三角航空交通的管理。

會議審議了下一階段的工作計劃。為改善區內的空域規劃和航空交通管理，三方同意繼續按「統一規劃、統一標準、統一程序」的原則，充分考慮珠三角地區的實際運行情況，進一步細化完善廣州和南珠三角終端區規劃方案，加快推進相關軟硬件設備的建設，加強三方運行層面協調，持續優化解決實際運行需要。三方亦同意專題研究論證在南珠三角終端區運行上使用統一標準的可行性和實施安排，從而進一步提升珠三角地區空域使用效率，以配合未來區內航空交通量的持續增長。

國家民航局、香港民航處及澳門民航局三方會繼續共同研究和落實其他優化珠三角地區空域設計和管理的措施，有關空域改善措施可充分照顧珠三角區內機場的未來發展，包括假如香港機場興建第三條跑道後的運作模式，即每小時 102 架次運作，預計每年約 62 萬架次的最高起降量。

完

２０１１年9月1日（星期四）

C4. 珠三角地區空管規劃與實施專題工作組會議（附圖）

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由國家民航局、香港民航處及澳門民航局三方組成的珠江三角洲地區空中交通管理規劃與實施專題工作組，今日（六月十八日）在澳門舉行最新一輪會議，商討如何進一步優化珠三角空管程序與空域結構的措施，以應付未來珠三角地區航空交通量的需求，及提升該地區空域使用效率。

專題工作組會議同意按照早前訂立的中長期工作目標和計劃，繼續優化區內空域設計，包括飛行程序及航道，以及設置相關的軟硬件設備，如訊息交換平台等，以進一步加強三方的溝通和協調，完善珠三角空域的使用和航空交通管理。專題工作組亦同意按計劃推動取消珠三角地區空域限制，並逐步建立包括香港、澳門、深圳及珠海各機場在內的南珠三角終端區，從而提升區域航空運輸能力，及達致如期於二〇二〇年實踐「統一規劃、統一標準、統一程序」的最終目標。

民航處於會上亦向國家民航局及澳門民航局介紹了《香港國際機場 2030 規劃大綱》。與會各方對香港國際機場以「三跑道系統」作為未來發展方向，及民航處以這個方案作空域管理規劃用途，均表示支持。會上三方承諾繼續共同落實優化珠三角地區空域設計和管理的措施，以充分照顧珠三角區內各機場的未來發展，包括香港國際機場興建第三條跑道後的運作模式，即每小時最高 102 架次航班升降的運作，及每年約 62 萬架次的起降量。

完

２０１２年6月１８日（星期一）

（左起）國家民航局空管局局長王利亞、澳門民航局局長陳穎雄、國家民航局空管辦主任蘇蘭根、香港民航處處長羅崇文和國家民航局中南空管局局長陳松林於今日（六月十八日）在澳門舉行的珠江三角洲地區空中交通管理規劃與實施專題工作組會議上，商討如何進一步推動優化珠三角空管程序與空域結構的措施。

C5. 民航處就傳媒報道有關珠三角空域事宜的聲明

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就傳媒有關珠三角空域事宜的報道，民航處發言人今日（三月十日）作以下聲明：

為配合珠三角區內航運業高速發展及五大機場（香港、深圳、澳門、珠海及廣州）日後擴建需要，香港民航處與內地民用航空局和澳門民航局三方於二〇〇四年成立了「珠三角地區空中交通管理規劃與實施專題工作組」（三方專題工作組），目的是致力提升珠三角地區空域的整體航班處理能力。於二〇〇四至二〇〇七年期間，三方專題工作組召開了十次會議，通過快速模擬的嚴謹驗證，及本著「統一規劃、統一標準、統一程序」的基本原則，於二〇〇七年共同制訂了《珠江三角洲地區空中交通管理規劃與實施方案 (2.0 版本) 》(《方案》)。該《方案》明確規劃在二〇二〇年前的短、中及長期優化目標和措施，亦已周詳考慮區內各機場日後新建跑道、航道及空域設計，包括香港國際機場三跑道發展和周邊主要機場擬定的發展計劃的兼容性，三方並同意透過空域共享、統一度量衡等互惠互利的方式，盡用珠三角空域資源。《方案》中的改善措施包括新增珠三角外圍航道、增設空管移交點及調整珠海空域結構等，已得到落實。《方案》旨在提升珠三角地區空域的整體航班處理能力，在空域共享的大前提下，雙方（內地及香港）都會利用對方小部分的空域。為了更有效進行空管，雙方會使用不同的高度層，有關空域的擁有權仍屬於原有空管單位，因此並不存在香港擴展空域至廣州或管理國家軍機的問題。目前民航處的重點工作是繼續與內地民用航空局及澳門民航局透過三方專題工作組這平台，按部就班地推展《方案》內的工作項目，以配合香港國際機場三跑道系統的發展。

至於「基於性能導航」(Performance-based Navigation 或 PBN）程序的報道，有關的程序旨在提升航機導航的精確性及飛行程序效率，使空管運作更具彈性，但對於減低進場及離場航機間距或提升跑道容量沒有實質幫助。在這方面，民航處一直緊隨國際民航組織的指引，逐步落實 PBN 程序。事實上，香港國際機場已於二〇一三年一月全面實施了 PBN 進場及離場程序，現時大部分進出香港國際機場的航機亦已具備所需的性能導航能力。廣州及深圳機場亦有實施 PBN 程序。

完

２０１５年3月１０日（星期二）

C6. 香港國際機場雙跑道運作的局限和空域問題

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民航處處長羅崇文 撰文 二零一五年四月二日

近期有關香港國際機場「三跑道」系統規劃，坊間有質疑（一）目前「雙跑」系統下是否仍有擴充容量的空間（因而就無需建第三跑道）；及（二）空域問題能否解決。

現時雙跑道最高容量

過往曾有多項專家顧問研究，評估「雙跑」系統的容量。最近期的一次是於2008 年，機場管理局委託英國航空專家英國國家航空交通服務有限公司（NATS），按照最新的航空交通管制技術和國際標準，為香港國際機場進行「空域及跑道容量研究」。根據該研究，在完全符合國際民航組織的安全標準／規定的情況下，「雙跑」系統的實際最高容量為每小時 68 架次飛機升降量。

現時雙跑道最高容量可否再增加？

現時「雙跑」系統的容量主要受兩個因素限制：（一）因為航機在飛行時會產生螺旋形的不穩定氣流（稱為尾流湍流），因此航機與航機之間需要保持間距；（二）跑道附近地勢。國際民航組織對兩者都有嚴格的規定和標準。

尾流湍流

由於強烈的尾流湍流可引致尾隨航機失去平衡，影響飛行安全，所以國際民航組織規定航機之間在跑道升降時必須保持一定最少間距。航機重量越大，所產生的尾流湍流越強越大，所需的間距越多，跑道容量因此而受到限制。

地勢限制

1992 年臨時機管局的《新機場總綱計劃》（《總綱計劃》）報告提出，雙跑道在不同模式下運作，理論上可達至每小時 52 至 86 架次不等（見下圖表）；但報告總結也清楚指出，因受到周邊大嶼山的高山阻礙，要達到較高容量，並不可能符合國際民航組織有關飛行程序的標準，既不安全也不切實際。

起降模式	估計每小時的實際容量
(a) 單跑道系統	43 架次
(b) 採用分隔起降模式運作的雙跑道系統 (即一條跑道專供航機降落，另一條專供航機起飛)	52 架次
(c) 採用混合起降模式運作的雙跑道系統	
(i) 非獨立混合起降模式 – 航機在一條跑道上起飛或降落時，必須顧及另一架在平行跑道上正在起飛或降落的航機。可出現的模式如下:	
(a) 非獨立進場和起飛模式；	69 架次
(b) 獨立進場但非獨立起飛模式；及	71 架次
(c) 非獨立進場但獨立起飛模式。	79 架次
(ii) 獨立混合起降模式 – 一條跑道完全獨立運作，不會對平行跑道造成干擾。兩條跑道猶如兩個不同機場般運作	86 架次

民航處於 1994 年委聘的顧問亦指出，礙於鄰近高山限制，「雙跑」的最高升降容量只約為每小時 63 架次。正如上文提及，2008 年，英國 NATS 全面檢視香港國際機場的容量，確認經引進 40 多項優化措施及應用最新的空管技術，在完全符合國際民航組織的安全標準／規定的情況下，雙跑道系統最高容量可增至每小時 68 架次。

有意見認為，假如按照 1992 年臨時機管局《總綱計劃》的建議，削去位於大嶼山東北的大陰頂（高 610 呎）及花瓶頂（高 810 呎）兩個峰頂，便可以進一步增加「雙跑」系統的容量。然而《總綱計劃》的有關建議，實際上只是針對減低離港航機在引擎失去動力的情況下而採取緊急離場程式時的爬升率。若要達到《總綱計劃》所提及理論上的最高跑道容量，即每小時 86 架次，而又同時能符合國際民航組織的安全運作要求，便須要削除大嶼山大部分高山的峰頂，包括鳳凰山、大東山及其他高山。位於受影響範圍內的重要基建設施／地標（例如昂坪纜車、天壇大佛和寶蓮禪寺）將會因此受到影響，而且大部分受影響的地方均坐落於大嶼山郊野公園範圍之內。因此，所謂「削山」辦法並不實際，也不可行。

「空牆」問題

社會上有人關注所謂「空牆」的限制。其實這個用語並不準確，空域與空域之間實際上並不存在「牆壁」式的分隔。為確保位於毗連空域內的航機能同時安全有效地運作，航機須遵照指定高度及地理位置才可由一個空管單位移交至另一個空管單位，讓不同航機在毗連空域對飛時可維持不同高度飛行，

從而避免衝突。這項「空管移交點」安排，旨在保障飛行安全，亦是世界各地如倫敦、紐約等繁忙機場慣常採用的措施。

空域問題

由國家民航局、香港民航處與澳門民航局組成的三方工作組經三年時間、10多次不同層面的協調會議致達成共識，共同制訂的珠三角空管規劃與實施方案（2007 年方案）。機管局提出「三跑」系統可達至的最高容量（即每小時 102 架次），便是基於 2007 年方案。

2007 年方案

2007 年方案是有具體目標和內容的方案。按國家民航局 2007 年 2 月 15 日的新聞公布，該方案「立足於加強三方之間的協同管制運行，從終端區空域結構、管制運行標準、管制運行程序等三個方面，明確了珠三角地區空管分三個階段的發展規劃。三方技術人員利用先進的計算機仿真評估技術對規劃方案進行了分析研究後得出的結論是，該方案基本可以滿足 2020 年珠三角地區航空運輸發展的需求」。

2012 年 6 月 18 日的三方工作組會議上，與會各方對香港國際機場以「三跑」系統作未來發展方向，以及民航處以這個方案作空管規劃用途，均表示支持。

中央有關部委一向支持香港鞏固其國際航空樞紐的作用及發展「三跑」。我們深信內地與港、澳三方定必可以在 2007 年方案下，推展各項有利珠三角地區五大機場共同發展所需的各項優化和協調措施。

C7. 香港民航處與國家民航局就新增往來華東地區航道達成協議

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通過「珠三角地區空中交通管理規劃與實施工作組」的合作平台，香港民航處今日（十月二十日）與國家民航局空中交通管理局達成協議。從明年一月七日開始，在香港與廣州兩個飛行情報區之間，將增設往來華東地區航道及一個名為「LELIM」的空管移交點，供來往港澳及華東地區的航班使用。

目前包括從港澳起飛，以及東南亞以至澳洲、新西蘭起飛飛越香港飛行情報區來往華東地區的航班，均集中在單一航道進出內地空域。航班增加令現有航道不勝負荷，繁忙空域亦增加航班處理的複雜性。

新增往來華東地區航道乃《珠江三角洲地區空中交通管理規劃與實施方案（2.0 版本）》的其中一項重要優化項目。民航處就此與國家民航局一直保持密切溝通，並先後進行多次協調會議，商討相關的技術安排。在確保運行安全、有序及有效率的前提下，發揮往來華東地區航道最大功效。

新增航道及相關移交點啟用後，將會分流港、澳的航班以及飛越香港飛行情報區的航班，並紓緩現有航道的壓力，同時有望增加空域容量及流量，提升空管處理效率，有利中港航空交通量的持續增長。

民航處將一如以往積極推進珠三角地區空管合作交流，研究和落實其他優化區內空域設計和管理的措施，以配合未來航空交通量持續快速增長。

完

２０１５年１０月２０日（星期二）

附件 D

有關港珠澳大橋項目的海上工程意外資料

由 2012 年 1 月至 2015 年 6 月，港珠澳大橋本地相關工程項目（包括香港口岸、香港接線及屯門至赤鱲角連接路）共發生了 35 宗海上工業意外，涉及的受傷或死亡人數按意外類別分類如下：

意外類別	**2012**		**2013**		**2014**		**2015 年上半年**		**總數**	
	受傷人數	死亡人數	受傷人數	死亡人數	受傷人數	死亡人數	受傷人數	死亡人數	受傷人數	死亡人數
受困於物件之內或物件之間	0	0	2	0	0	0	1	0	3	0
提舉或搬運物件時受傷	0	0	1	0	2	0	0	0	3	0
滑倒、絆倒或在同一高度跌倒	1	0	7	0	7	0	0	0	15	0
人體從高處墮下	0	0	1	0	1	0	1	0	3	0
與固定或不動的物件碰撞	0	0	2	0	0	0	0	0	2	0
被移動物件或與移動物件碰撞	1	0	3	0	1	0	0	0	5	0
踏在物件上	0	0	0	0	0	0	0	0	0	0
遭移動或墮下的物件撞擊	0	0	0	0	0	0	0	0	0	0
遭移動中的車輛撞倒	0	0	0	0	0	0	0	0	0	0
遇溺	0	0	0	0	0	2	0	0	0	2
其他類別	0	0	0	0	2	0	0	0	2	0
總數	2	0	16	0	13	2	2	0	**33**	**2**

附件 E

Information on 3RS available to the public

資料	網址
A. 刊物	
《三跑道系統資料冊》	http://info.threerunwaysystem.com/pdf/tc/3rs_infokit.pdf
《三跑道系統的經濟影響研究》（2015 年更新）（只有英文版本）	http://info.threerunwaysystem.com/pdf/en/economic_impact_study_of_the_three_runway_system.pdf
《三跑道系統專訊》（第一至第六期）	http://www.threerunwaysystem.com/tc/Information/Publications.aspx
B. 環境影響評估及環境許可證	
環境許可證	http://www.epd.gov.hk/eia/chi/register/permit/latest/ep4892014.htm
擴建香港國際機場成為三跑道系統（根據《環境影響評估條例》第8(1)條所提交的進一步資料）	http://www.epd.gov.hk/eia/register/report/eiareport/eia_2232014/further_info/pdf/index.html (只有英文版本)
《環境影響評估報告》	http://www.epd.gov.hk/eia/register/report/eiareport/eia_2232014/html/index.htm
三跑道系統環境影響評估公眾論壇－簡報資料	http://info.threerunwaysystem.com/pdf/tc/public_forum_20140627.pdf
《研究概要》（環境影響評估）（只有英文版本）	http://www.epd.gov.hk/eia/register/study/latest/esb-250.pdf
關於工程項目簡介的進一步資料	http://www.epd.gov.hk/eia/chi/register/profile/latest/cesb250/further/further.pdf
工程項目簡介（只有英文版本）	http://www.epd.gov.hk/eia/chi/register/profile/latest/cesb250/cesb250.pdf

資料	網址
《碳排放研究》（只有英文版本）	http://info.threerunwaysystem.com/pdf/en/hkia_carbon_emissions_study_airport_emissions_management_report_executive_summary.pdf
C. 《香港國際機場 2030 規劃大綱》	
諮詢結果報告	http://info.threerunwaysystem.com/pdf/tc/consultation_results_report.pdf
《香港國際機場 2030 規劃大綱》	http://www.threerunwaysystem.com/tc/Information/Airport_master_plan_2030.aspx
《香港國際機場 2030 規劃大綱》（摘要）	http://info.threerunwaysystem.com/pdf/tc/mp2030_leaflet.pdf
《香港國際機場 2030 規劃大綱》（技術報告）	http://www.threerunwaysystem.com/tc/Information/Tech_report.aspx
顧問報告（只有英文版本）	http://www.threerunwaysystem.com/en/Information/Consultancy_reports.aspx
D. 有關三跑道系統的短片	
《香港國際機場 2030 規劃大綱》－持份者意見（24 條短片）	http://www.threerunwaysystem.com/tc/Information/Videos.aspx
《香港國際機場 2030 規劃大綱》影片系列（16 條短片）	http://www.threerunwaysystem.com/tc/Information/Videos.aspx
三跑道系統項目（20 條短片）	http://www.threerunwaysystem.com/tc/Information/Videos.aspx
E. 有關三跑道系統各個議題的文章	
機管局刊登的文章（23 篇）	http://www.threerunwaysystem.com/tc/Information/Articles.aspx

資料	網址
F. 其他	
三跑道系統專題網站	http://www.threerunwaysystem.com/tc/
環境監察數據及提交文件的專題網站	http://env.threerunwaysystem.com/tc/index.html
三跑道系統 Facebook 專頁	https://www.facebook.com/threerunwaysystem
G. 有關三跑道系統的新聞稿	
新聞稿（13 篇）	http://www.threerunwaysystem.com/tc/Information/Press_release.aspx