For Information

**Legislative Council Subcommittee
to Follow Up Issues Relating to the
Three-runway System at the Hong Kong International Airport**

Issues Raised at the meeting on 1 December 2015

Introduction

In discussing LC Paper No. CB(4)275/15-16(01) at the meeting on 1 December 2015, the Airport Authority Hong Kong ("AAHK") undertook to provide the following additional information as per Members' request :

(a) projected numbers of passengers that would use the Hong Kong International Airport ("HKIA") each year from 2016 up to 2030;

(b) measures to ensure that the three-runway system ("3RS") project could be completed within budget and on time;

(c) explanations for the reasons for the differences between the estimated total project cost based on the preliminary design undertaken as part of Hong Kong International Airport ("HKIA") Master Plan 2030 Study ("MP2030") and the 3RS scheme design;

(d) technical feasibility study report on the 3RS regarding the Third Runway Concourse ("TRC") scheme design; and

(e) the results of the first trial on the Deep Cement Mixing ("DCM") method and the associated monitoring and testing.

Projection of HKIA's Annual Passenger Throughput up to 2030

2. As set out in paragraph 9 of LC Paper No. CB(4)273/15-16(01), AAHK commissioned IATA Consulting[1] to produce a set of updated traffic forecast based on latest actual traffic figures, the capacity

[1] IATA Consulting, the commercial arm of International Air Transport Association ("IATA"), is a highly regarded organisation in providing traffic forecast for aviation clients.

constraint and short-term outlook to reflect market conditions. This set of traffic forecast was adopted in AAHK's updated Economic Impact Study, which is available on AAHK's website at http://info.threerunwaysystem.com/pdf/en/economic_impact_study_of_the_three_runway_system.pdf. Projection of HKIA's annual passenger throughput up to 2030 is at **Annex A**.

Measures to ensure that the 3RS project could be completed within budget and on time

3. As set out in LC Paper No. CB(4)275/15-16(01), AAHK will endeavour to deliver the 3RS project within time and budget. For details of the robust systems and stringent measures that AAHK will adopt for project management and cost control, please refer to the relevant paragraphs as extracted in **Annex B**.

MP2030 and 3RS Scheme Design Cost Comparison

4. The estimated total project cost under the MP2030 Study was $136.2 billion (money-of-the-day ("MOD") prices) while that under the 3RS Scheme Design is $141.5 billion (MOD prices). It should be noted that the estimated project cost in the MP2030 Study was only a preliminary estimate. As the design of the 3RS project progressed since MP2030, the cost estimate has been refined, primarily in the light of the revised design (e.g. inclusion of more green features where possible) and updated inflation adjustment factors. An explanation on the major cost differences is summarized in **Annex C**.

Third Runway Concourse Scheme Design

5. During the 3RS Scheme Design stage, the arrangement of the TRC was further refined. It was affirmed that a single concourse (or commonly referred to as the "single Y" concourse) offers benefits in terms of more efficient airfield operations, terminal operations, cost effectiveness and a better level of passenger experience and commercial/retail opportunities. This single concourse of 283,000 m^2 construction floor area is larger than the MP2030 "double Y" concourse of 263,000 m^2. The single Y concourse will be able to cater for an additional 30 million passengers per annum as proposed in MP2030. It also provides flexibility to allow for future expansion where necessary in light of the future traffic demand. The TRC scheme design was therefore proceeded on the basis of a single Y concept (see the "Third Runway Concourse Scheme Design Report" attached). The soft copy of the "Third Runway Concourse

Scheme Design Report"[2] has been provided to the Legislative Council ("LegCo") separately.

First Trial on Deep Cement Mixing Method

6. With the presence of contaminated mud pits ("CMPs") underneath the 3RS reclamation footprint, extensive research and investigation were conducted to study feasible ground improvement method to ensure the impact to marine ecology is acceptable. DCM was then concluded as the most appropriate method to treat the CMP areas. Although this technique has not been used in Hong Kong before, it has been widely used internationally, in particular in Japan and South Korea (e.g. Osaka Kansai Airport and part of the runway in Tokyo Haneda Airport in Japan, Busan New Port and Incheon Asia Games 2014 Wangsan Yacht Marina Project in South Korea). AAHK has arranged a series of DCM trials to provide confidence in the constructability and the environmental acceptability of such method in Hong Kong.

7. The first trial on DCM method was undertaken by AAHK in February 2012 which focused on both the environmental and engineering feasibility of the method. The relevant reports have been provided to the LegCo separately and the results are summarized below.

Summary of the Engineering Test Results for the DCM Trial

8. After completion of the installation of DCM clusters, they were cored to collect samples for compressive strength tests. The test results showed that DCM could improve the stiffness and strength of the contaminated mud within the CMPs and was technically feasible for the production of DCM-stabilised foundation soils for the support of future reclamations and seawalls.

Summary of Environmental Monitoring Test Results for the DCM Trial

9. Based on the water quality monitoring results, the DCM installation works did not result in any deterioration in the marine water quality. No leakage of contaminants was identified and no leakage of cement slurry was detected throughout the entire DCM trial. As regards the elevated turbidity/suspended solid levels detected during post-installation periods, it was confirmed that these were due to the demobilisation process of the DCM barge and tugboats at the end of each

[2] The report (as well as those reports mentioned in paragraph 11) is for Legislative Council ("LegCo") Members' reference only.

runway closure period. This has been dealt with and overcome in the second DCM trial by allowing the DCM barge to operate at the trial site 24 hours continuously.

10. Based on the underwater noise monitoring results, the noise induced by the DCM trial was at very low frequencies which are outside the frequency range of noise that would be sensitive to the marine mammals such as cetaceans, dolphins and finless porpoises.

11. The test results of the first DCM trial works were submitted to the Environmental Protection Department in September 2012. Relevant results were also included and considered in the 3RS Environmental Impact Assessment Report, which was subsequently approved by the Director of Environment Protection in November 2014. The soft copies of the "DCM Trial Works Engineering Report" and "DCM Trial Works Environmental Monitoring Report (with appendixes)"[3] have been provided to LegCo separately.

Airport Authority Hong Kong
December 2015

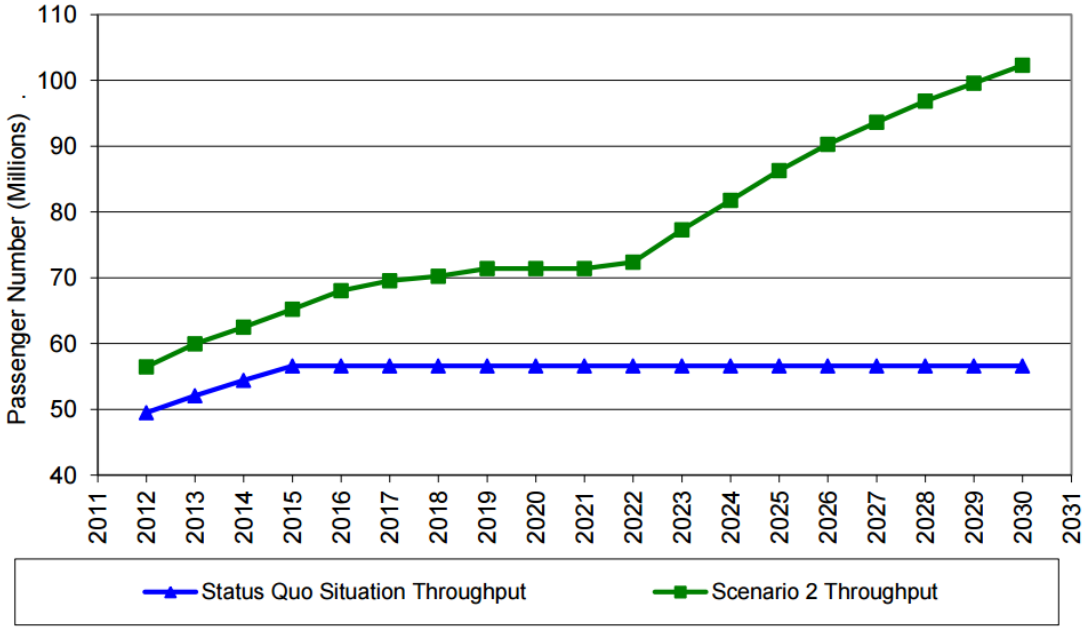
[3] As mentioned in footnote 2, the reports are for LegCo Members' reference only.

Annex A

Projection of HKIA's Annual Passenger Throughput up to 2030

(extracted from AAHK's updated Economic Impact Study)

Exhibit 4.18. Scenario 2 Passenger Throughput



Passengers (millions)	2015	2020	2025	2030
Status Quo Situation Throughput	57	57	57	57
Scenario 2 Throughput	65	71	86	102

Note: According to Enright, Scott & Associates Limited's ("ESA's") definition, Scenario 2 refers to the 3RS project.

Source: AAHK; IATA Consulting; "An Update of Airport Master Plan 2030 Economic Impact Study for The Hong Kong International Airport", ESA (2015)

Annex B

Extract of paper for the Subcommittee to Follow Up Issues Relating to the Three-runway System at the Hong Kong International Airport on "Project Scope and Cost"

Project Management and Cost Control

45. Operating along prudent commercial principles and having committed to self-financing the 3RS Project, AAHK will do its best to deliver the project within time and budget. Cost control is vitally important with the objectives of delivering the project within budget, achieving value for money, securing early certainty of the out-turn cost and obtaining competitive prices through healthy competition.

46. Project cost control is not an isolated project management issue but will be integrated with other key planning, design, procurement and construction management activities of the project. Accordingly, in achieving the cost control objectives, it will be imperative to have effective organisation/leadership, robust planning and strong project control and execution, each of these aspects is described in the ensuing paragraphs.

(a) Organisation/Leadership

47. Airport construction is highly specialised and requires in-depth design and construction knowledge of the full range of airport infrastructure works; specialised systems; their relationship with the existing airport facilities; and an appreciation of the logistic and construction constraints imposed by the existing airport operations. The Third Runway Division ("TRD") within AAHK, which is responsible for managing the 3RS Project, has over 20 years of experience in project management construction at HKIA since the commencement of the original airport construction in the early 1990s. The TRD, comprising a compact structure of key in-house professionals, will expand its in-house project management team to cope with the challenging tasks ahead. External augmentation will be engaged to provide additional professionals, specialists and experts required for the 3RS Project as and when necessary.

48. The proposed project management approach is based on that used in the implementation of the original airport expansion, but adapted to take on lessons learnt from subsequent works at the airport, together with

other major projects in Hong Kong and international benchmarks. The organisation comprises a Project Management Office ("PMO") that provides a centralised functional leadership role and the Project Delivery Team ("PDT") which focuses on managing the construction delivery.

49. The central PMO will set a clear governance structure and provide embedded resources through a matrix organisation into the PDT to ensure accountability for the overall project programme and budget with a "single-source of truth" and prevents project management "optimism bias" from the PDT. The key roles of PMO are as follows:

a. **Programme Control** – The central PMO develops the integrated master programme, sets the programme management strategy and maintains a fully integrated suite of updated programmes.
b. **Risk management** – This is a key discipline within the central programme office that drives risk management capability across the sub-projects. It regularly performs schedule analysis, risk analysis, "what-if" scenarios and contingency planning.
c. **Cost Control** – The PMO establishes the full suite of cost, programme, risk, change and reporting tools and require these to be utilised by all sub-projects and interfaced to contractors' performance data.
d. **Coordination and Reporting** – The central PMO establishes a clear set of performance measures, baselines to report performance against and quantitative reporting to show performance, trends and forecasts.
e. **Peer Review** – The PMO provides the capability to establish a small team of highly experienced, independent design, construction, programme and project management professionals that are able to provide a peer review/assurance function at key project milestones and gateways.

(b) Planning

50. Robust project planning provides a sound basis for effective cost control which must be integrated with programme and risk management.

51. AAHK has completed comprehensive **Scheme Designs** with extensive site investigations to establish the basis for the project budget estimate. These scheme designs were prepared by experienced local and

international design and specialist system consultants, providing a robust basis for establishing the project definition and scope agreed with the internal "clients" including operations, maintenance, commercial, etc.

52. An independent consultant was appointed to further develop a detailed **Project Master Programme**, **Project Procurement Strategy and Project Risk Management Plan** with a view to providing a robust basis for taking the project forward with programme and cost certainty.

(c) Controlling

53. A high performance project team that executes effective cost control requires strong leadership, both at the board, management and working levels. One crucial aspect of project management is the capacity to make sound and timely decisions throughout the project cycle, with appropriate levels of delegated authority.

54. While the PMO is responsible for making decisions at working levels, it is supported and overseen by the AAHK Board and its committees. To give due attention to the 3RS Project, special committees have been set up, including a Steering Committee chaired by the AAHK Chairman; and the 3RS Coordination Committee led by CEO/AAHK, supported by other AAHK executive directors. This organisational setup facilitates development of close working relationship between the AAHK senior management and the PMO and enables regular consultation with and direction from the AAHK Board and its committees on key issues. Regular progress and budget updates are given to the AAHK Board with a high level of transparency.

(d) Execution

55. AAHK has an established cost control system to manage its capital works project, comprising the following key tasks.

56. **Establishment of Project Budget**: The project budget estimate has been established based on comprehensive scheme designs through a robust process, providing a high level of confidence in the sufficiency and accuracy of the estimated project out-turn cost.

57. **Design Phase Cost Control**: Continuous engineering analyses will be carried out during the detailed design stage to freeze the design scope and achieve cost-effectiveness and operational needs of the 3RS to ensure that the design will be fit-for-purpose and value-for-money,

avoiding extravagant or unnecessary design or architectural features. Regular cost checks on the detailed designs will be carried out by independent professional QS consultants to ensure that the project cost based on the final design will not exceed the project budget estimate established in the scheme design phase.

58. **Development of Procurement Strategy**: The Project Procurement Strategy, supported by global benchmarking and market sounding, will enhance competitiveness of tenders e.g. use of appropriate contract packaging strategies to promote competition and reduce interfaces.

59. **Commitment Control (Change Management)**: Each contract will be awarded with a contract budget which will become the basis of cost control for the works covered in the contract. In the event that adjustments to the contract sum are necessitated by genuine needs, a detailed assessment of the need, justification, cost and programme implications of the proposed change will be carried out to ensure vigorous cost control.

60. **Continuing Risk Management**: AAHK will carry out proactive risk management in accordance with the Project Risk Management Plan as described above to identify risks for early mitigation, thereby minimizing the probability of cost overrun.

61. **Project Cost Monitoring and Reporting**: Regular cost reports will be prepared by the PMO for submission to Senior Management and Board and its committees, detailing the project budget status.

62. With the above robust systems and stringent measures in place, AAHK will be making its best endeavours for programme and budget control for the delivery of the 3RS Project.

Annex C

3RS Project Cost Comparison
MP2030 vs Scheme Design

Scope of Works	**MP2030 Estimate**	**3RS Scheme Design**	**Major Reasons for the Cost Differences Between (a) and (b)**
	MOD* Total (HK$Bn) (a)	**MOD# Total (HK$Bn) (b)**	
1. Land Formation and Marine Works	53.4	56.2	Increased cost of reclamation.
2. Runway and Airfield Facilities	12.4	11.5	Savings arising from the change of the planned full provision of the western vehicular tunnel across the new Centre Runway to an empty tunnel box structure only. The tunnel is planned to meet future operation needs as construction of the tunnel box in future underneath an operating new Centre Runway is impractical, highly disruptive and unacceptable.
3. Apron Works	3.6	5.0	Expansion of utilities services and apron systems including green operations initiatives.
4. Terminal 2 Modification/ Expansion	15.3	16.5	• Increased bag hall size to accommodate a high speed and fully automated baggage handling system.

Scope of Works	**MP2030 Estimate**	**3RS Scheme Design**	**Major Reasons for the Cost Differences Between (a) and (b)**
	MOD* Total (HK$Bn) (a)	**MOD# Total (HK$Bn) (b)**	
			• Increased APM interchange station size to provide a high level of operational redundancy and safeguard for possible future expansion.
5. Third Runway Concourse	23.2	26.3	Increased construction floor area and size of fixed link bridges to accommodate larger aircraft.
6. Automated People Mover ("APM") System	7.4	10.9	Inclusion of an additional APM tunnel and associated auxiliary services to cater for possible future expansion in the light of anticipated further passenger demand. It will be highly difficult and expensive if further tunnelling works were to be constructed after completion of the APM system.
7. Baggage Handling Systems	7.4	7.8	Adoption of the latest technology using Individual Carrier System for the provision of a high service level of baggage delivery systems.
8. Airport Support Facilities and Utilities	7.7	7.3	Cost reduction due to design optimization for utilities services.

Scope of Works	**MP2030 Estimate**	**3RS Scheme Design**	**Major Reasons for the Cost Differences Between (a) and (b)**
	MOD* Total (HK$Bn) (a)	**MOD# Total (HK$Bn) (b)**	
9. Midfield and Freighter Apron Expansion	5.8	-	The Midfield development was examined as part of the MP2030 Study but was subsequently taken forward as a separate project which is financed entirely by AAHK's own resources to handle the anticipated increase in passenger volume under the existing two-runway system.
Total Project Cost :	**136.2**	**141.5**	

Note :

* For MP2030 Estimate, the MOD estimate was derived on the basis of the Government's price adjustment factors as set out in PWSCI (2010-11)11 issued in Oct 2010. The prices of public sector building and construction output were assumed to increase by 5% per annum in 2014 and 5.5% per annum from 2015 to 2020.

For 3RS Scheme Design, the MOD estimate is derived on the basis of the Government's price adjustment factors as set out in PWSCI (2013-14)15 issued in Mar 2014. The prices of public sector building and construction output were assumed to increase by 6% per annum from 2014 to 2018; 5% per annum from 2019 to 2021 and 4.5% per annum from 2022 to 2024.