LC Paper No. CB(4)275/15-16(01)

For discussion
on 1 December 2015

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

Project Scope and Cost

Introduction

Members are invited to note and give views on the paper at **Annex** prepared by the Airport Authority Hong Kong (AAHK) which aims to provide a brief account of the scope and cost of the Three-runway System (3RS) project. Members are also invited to note the employment of consultants by the Transport and Housing Bureau (THB) to assist in monitoring and verification of the works of AAHK during the detailed design and construction stages of the 3RS project.

Current Situation

2. With the affirmation of the Executive Council of the need for the 3RS project given on 17 March 2015, AAHK, as the project proponent, is actively taking forward the implementation of the project. In particular, AAHK has commenced the detailed design of the new reclamation (about 650 hectares) to the north of the existing airport and the modification/expansion works to Terminal 2. The designs of other components of the 3RS project will also commence progressively starting from end 2015/early 2016. These components include, for example, the Third Runway Concourse and apron, runways and airfield facilities, Automated People Mover System, Baggage Handling System, associated infrastructure and support facilities, etc. Preparation of tender documents by AAHK for various works contracts is under way.

Monitoring and Verification

3. While AAHK is responsible for the implementation of the 3RS project, the Government has a key and clear stake in ensuring the smooth and proper implementation of the 3RS project, which is crucial to maintaining the status and competitiveness of the Hong Kong International Airport (HKIA) as a global and regional aviation hub, as well as the long-term economic and sustainable development of Hong Kong. The public also expect the Government to closely monitor and scrutinise AAHK's implementation of the project in view of its unprecedented scale, cost and complexity.

4. On a day-to-day basis, the Airport Expansion Project Coordination Office (AEPCO) within THB is responsible for closely monitoring and scrutinising the works of AAHK in the project delivery process. In particular, it will monitor and assist AAHK in undertaking statutory procedures in connection with the gazettals under the Foreshore & Seabed (Reclamations) Ordinance (Cap. 127) and the Town Planning Ordinance (Cap. 131), formulating detailed implementation plans with associated details to fulfil the commitments made in the 3RS Environmental Impact Assessment report and the conditions on the Environmental Permit granted by the Director of Environmental Protection, and fine-tuning and implementation of financial arrangement proposal for the 3RS project. On engineering aspect, as can be seen from AAHK's paper at **Annex**, the design and construction of the 3RS involve highly specialised and advanced construction techniques with complex contract interface between different works packages. Each work package has to be planned, designed and constructed with due regard to other works packages. Furthermore, all construction works have to be carried out at or in the vicinity of HKIA, which is one of the world's busiest airports operating round the clock. AEPCO requires the support of independent expert consultants to monitor the work of AAHK in this respect. The briefs of the consultants, in the main will be as follows –

(a) aiming to assist in satisfactory delivery of the 3RS project having regard to cost-effectiveness, fit-for-purpose and value-for-money;

(b) independent review of the design works by AAHK to ensure full compliance with relevant statutory requirements and technical standards;

(c) provision of expert advice on tender documentation and contract procurement strategy, with particular focus on claims avoidance and mechanism for dispute resolution; and

(d) keeping under close review the overall construction process with particular emphasis on cost control, progress monitoring, works quality and contract interfacing arrangements.

5. It is our plan to commission two consultancies to conduct the above tasks. The first consultancy is expected to commence in 2016 to provide support during the detailed design stage of the 3RS project, and the second consultancy is to cover the construction stage of the project which is estimated to take around 8 years. The packaging and timing of the second consultancy will be kept under review to tie in with AAHK's programme for the construction work.

Advice Sought

6. Members are invited to –

(i) note and give views on the paper at **Annex**; and

(ii) note the proposed employment of consultants at an estimated cost of $184.4 million for the provision of monitoring and verification services during the detailed design stage ($90.7 million) and the construction stage ($93.7 million) of the 3RS project.

7. We will include the provision in the estimates of the relevant years. Subject to funding, we plan to commence the detailed design consultancy services in 2016 to tie in with the work schedule of AAHK in the delivery of the 3RS project.

Transport and Housing Bureau
25 November 2015

<u>**Annex**</u>

For Discussion
On 1 December 2015

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

Three-Runway System Project at the Hong Kong International Airport:
Project Scope and Cost

Introduction

This paper sets out :

(a) the scope and cost of the three-runway system ("3RS") project, including 3RS reclamation design; and

(b) the cost control for the 3RS project.

Background

2. At the meeting on 3 November 2015, Members were given an overview of the 3RS project, covering, inter alia, the project scope and cost as well as the latest progress (LC Paper No. CB(4)143/15-16(01)). Members asked for a further discussion of the project scope and cost.

3. The 3RS is the single largest development planned for the airport since its opening in 1998. The scale of the works is similar to the construction of the existing airport at Chek Lap Kok, except that the site is now within the operational environment of one of the world's busiest airports. The scope of works and design details of the 3RS are being fine-tuned at the detailed design stage to ensure the final project design takes due consideration for economy, as well as safety and operational efficiency.

Scope of the 3RS Project

4. On the basis of the scope as set out in Airport Authority Hong Kong's ("AAHK") Master Plan 2030, the 3RS is planned to cater for an additional 30 million passengers per annum ("mppa"). Together with the

capacity of the existing Hong Kong International Airport ("HKIA"), the completed 3RS would have the capacity of handling around 100 mppa by the year 2030, with the potential for expanding further, if and when necessary. The major components of the project include:

(a) formation of approximately 650 hectares ("ha") of land north of the existing airport island by reclamation;

(b) construction of the Third Runway, taxiways and apron;

(c) construction of the Third Runway Concourse ("TRC") with 57 parking positions upon 3RS commissioning;

(d) modification/expansion of the existing Terminal 2 ("T2") and construction of associated road network;

(e) provision of a new Automated People Mover ("APM") System and an integrated maintenance depot;

(f) provision of a new high-speed Baggage Handling System ("BHS") serving TRC and T2; and

(g) construction of airport support infrastructure, utilities and facilities.

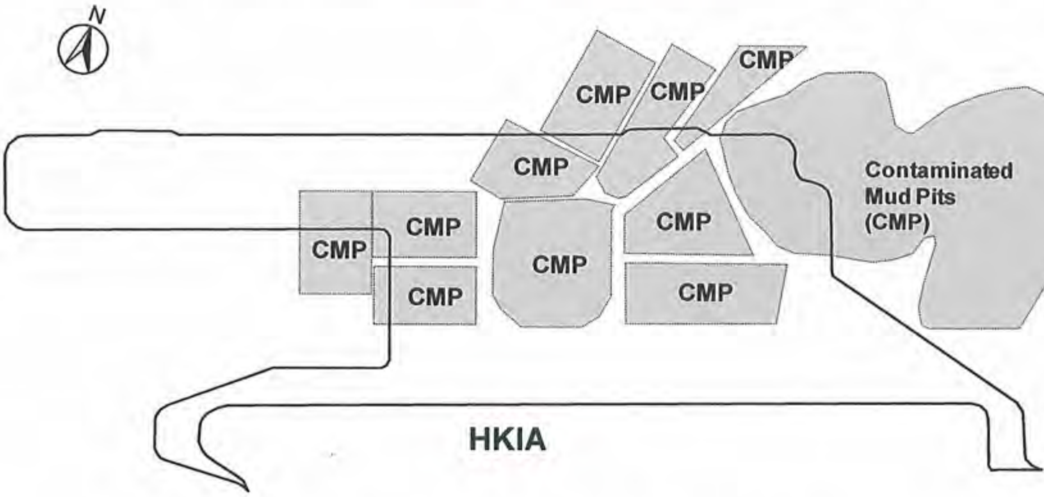
5. The layout plan for the 3RS project at **Appendix A** and details of the major works items are elaborated in the following paragraphs.

(a) Formation of Land by Reclamation

6. The 3RS project requires reclamation to create a platform of around 650 ha north of the existing airport to accommodate the new runway, all associated taxiways, a passenger concourse, aprons and other airport infrastructure.

7. In order to fully understand the existing ground conditions of the reclamation area, a comprehensive ground investigation study has been conducted (with over 650 ground investigation points). The study reveals that the general ground condition comprises a thick layer of soft marine mud of varying thickness (averaging 15m), underlain by a layer of stiffer alluvium of 15 to 20m. About 40% of the reclamation area is underlain by disused Contaminated Mud Pits ("CMPs") within the layer of the marine mud, as shown in **Figure 1** below. The contaminated mud is generally highly disturbed and is softer than the surrounding mud.

Figure 1 : Contaminated Mud Pits within the Reclamation Footprint



8. The reclamation works comprises three main components : ground improvement, seawall formation and land formation. In view of the ground conditions and environmental considerations, a combination of meticulous techniques and procedures, which will comply with both the geotechnical as well as environmental requirements, will be adopted to strengthen the soft marine mud which will be left in place but, at the same time, strong enough to ensure the formation of a stable platform.

Ground Improvement

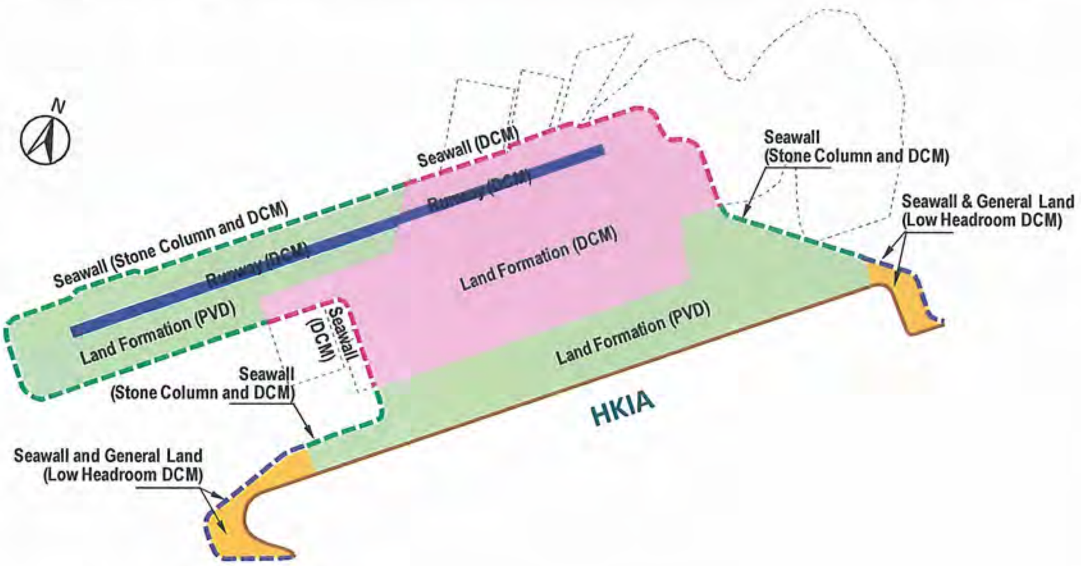
9. In simple terms, land will be formed above the CMP areas and non-CMP areas. Having considered the possible impacts on the environment, a combination of non-dredged reclamation methods will be used. In the CMP areas, the use of Deep Cement Mixing ("DCM") will be adopted. DCM involves the solidification of the marine mud by mixing it with cement, giving rise to clusters of improved ground in the form of closely spaced columns that are able to support the reclamation above. The merit of DCM is to contain contaminates from escaping in any water squeezed out. Whilst this technique has been widely used in Asia (principally Japan and Korea)[1] and Europe and America, to provide confidence in the constructability and the environmental acceptability of the method in Hong Kong, a series of trials has been conducted. The trials and the associated monitoring and testing have all been proven successful.

[1] Examples of DCM used in other major airport developments include the Osaka Kansai Airport and the Tokyo Haneda Airport.

10. For the formation of land in the remaining non-CMP area, the traditional method of drained reclamation will be adopted by installing closely spaced Perforated Vertical Drains ("PVD") within the thick marine mud layer to allow the water within the mud to escape during the filling operation, thereby accelerating consolidation of the marine mud. In addition, the land will be filled to several metres above the future formation level to provide a temporary additional load (called "surcharge") to speed up the consolidation process. Upon the removal of the surcharge, the excessive settlement would have been removed and ready for the subsequent infrastructure and superstructure construction.

11. A simplified layout of the different ground improvement methods to be adopted, with their relative locations and areas within the land formation footprint, is illustrated in **Figure 2** below.

Figure 2 : Layout of Ground Improvement Methods to be Adopted



Seawall Formation

12. The reclamation area will be bounded by approximately 13.4 km of seawall. The seawall principally consists of a conventional sloping rubble mound seawall for protecting the fill materials in the reclamation. The seawall has been designed to withstand the action of currents and waves under operating and predicted extreme conditions (including typhoons) derived from the hydrodynamic modelling and studies. A 10% increase in the predicted future typhoon intensity was adopted in the model and the crest levels of the seawalls will also be raised to cater for effects based on the suggestion in the

Intergovernmental Panel on Climate Change[2] (IPCC 2014).

13. Ground improvement techniques will be adopted below the seawalls, including DCM wall panels, to provide lateral resistance under the seawall in the CMP. Outside the CMP, the marine mud will be improved by stone columns (another common type of ground improvement technique used in soft ground), together with DCM wall panels introduced to counter lateral loads.

Land Formation

14. In summary, the land to be formed will be placed in layers. Initially, a 2m thick sand blanket will be placed over the seabed to avoid disturbance of the soft marine mud; then to be followed by the main body of the reclamation, predominately using sand placed to slightly above water level (approximately +2.5mPD). After this, the fill will be placed by land-based plant using different types of fill materials including sand and public fill. The final formation level of the general platform will be similar to that of the existing airport (+6.5mPD). The whole land formation process will be completed in phases, with an average completion time of four years.

15. To form the reclamation, it is estimated that about 100 Mm^3 of sand fill; about 5 Mm^3 of rock fill and rock armour (for the formation of seawall); and up to 28 $Mm^3$of public fill will be required. Marine sand will be sourced from the Mainland. Based on the advice from the Civil Engineering and Development Department, public fill would be available from their fill banks and other concurrent infrastructure projects. Potential sources of rock fill and rock armour are nearby quarries in the southern part of Mainland China. In case of any shortfall, the use of precast units would be considered. Rock armour removed from the existing Airport Island north seawall will also be reused where possible. With the adoption of all these techniques, the land formed will be structurally strong while fulfilling the relevant environmental considerations.

Management of Marine Construction Activities

16. In discussing LC Paper No. CB(4)143/15-16(01) at the meeting on 3 November 2015, a member requested AAHK to provide information on the measures to be adopted to safeguard the safety of fishermen and others at sea in

[2] The Intergovernmental Panel on Climate Change, established by the United Nations Environment Programme and the World Meteorological Organization in 1988, is the leading international body for the assessment of climate change. It provides the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socio-economic impacts.

the course of carrying out the reclamation works for the 3RS project. In this regard, members may wish to note that during the conceptualization of reclamation design, special considerations have been given to ensure proper management of marine construction activities. In addition to liaising closely with the Marine Department, a Marine Traffic Control Centre will be set up as part of the reclamation works contract to manage and coordinate the movement of working vessels in relation to the 3RS works so that the impact of working vessels on regular marine activities, including those of fishing vessels, are practically minimized. Furthermore, the reclamation works areas will be clearly delineated and patrolled to prevent unintentional entry of unauthorized vessels that may pose danger to themselves as well as to other working vessels.

(b) Construction of the Third Runway, Taxiways and Apron

17. The design of the airfield is guided primarily by two principles :

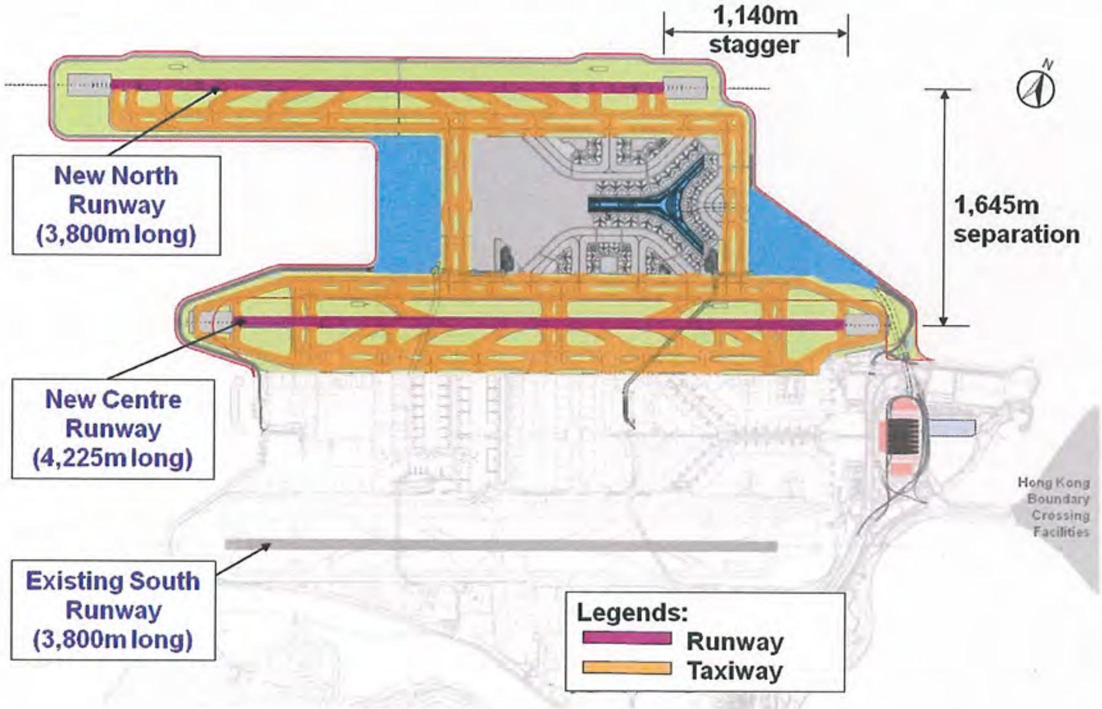
(a) the standards set out by the International Civil Aviation Organisation[3] ("ICAO"), and standards and practices required by the Civil Aviation Department; and
(b) the need to accommodate the full range of aircraft up to the largest passenger aircraft i.e. the Airbus A380 (Code F).

Runway and Taxiways

18. Construction of the new runway and taxiways will commence after completion of the land formation. The configuration of the runway and taxiways in the 3RS is illustrated in **Figure 3** below.

[3] ICAO works with the Member States of the Convention on International Civil Aviation (Chicago Convention).and industry groups to reach consensus on international civil aviation Standards and Recommended Practices (SARPs) and policies in support of a safe, efficient, secure, economically sustainable and environmentally responsible civil aviation sector.

Figure 3 : Three-Runway System Configuration



19. A 3,800-metre-long and 60-metre wide[4] new runway, parallel to the existing two runways and to the north of the existing airport platform, will be built. Upon completion, the third runway will become the North Runway.

20. The third runway will be staggered 1,140m to the west of the existing North Runway. Technical studies had been conducted and the findings confirmed that to comply fully with the safety and air traffic control requirements, the alignment of the third runway will need to be staggered within the range of 700m and 1,400m to the west of the existing North Runway. After careful assessment, the 1,140m stagger has been confirmed to be the most optimum alignment that will not affect the busy Urmston Road channel to the east and leave a reasonably wide and adequate air-draft navigational channel to the west of the third runway. Such an alignment will also, on balance, achieve the highest efficiency in apron operation and minimize the reclamation overlap with the CMPs. In short, careful consideration has been given to establish the 1,140m stagger to optimize the performance of the 3RS in relation to the existing airport and surrounding topography.

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4 The configuration is the same as those of the existing two runways whereby all types of aircraft, including Airbus A380, can be accommodated.

21. Following the completion of the third runway, the existing North Runway will be closed for about two years to be modified into the Centre Runway. It will be extended, from its current length of 3,800 metres, by 425m to accommodate a Wrap-Around-Taxiway on either ends to avoid aircraft landing on the new North Runway having to taxi across the new Centre Runway to reach the Terminal 1 ("T1") Aircraft Parking Apron. During the modification works, planes will take off and land from the Third Runway and the existing South Runway.

22. Two parallel taxiways and four crossfield taxiways are provided to the south of the new North Runway and, similarly, two new parallel taxiways are also provided to the north of the new Centre Runway.

<u>Aircraft Parking Apron</u>

23. The following design considerations have been taken into account in the planning of the apron layout and aircraft parking positions:

(a) airline terminal and concourse occupancy to minimize long transfer distances between airlines of the same alliance;
(b) minimization of taxiway routing of aircraft between TRC apron and runways;
(c) maximization of the number of contact parking positions served by Aircraft Loading Bridges ("ALB"); and
(d) provision of apron road network to facilitate efficient ground service operations.

Figure 4 shows the indicative apron configuration.

<u>Figure 4 : Indicative Apron Configuration</u>

24. Based on the traffic forecast of IATA Consulting[5] and the airlines allocation strategies, it is forecast that the TRC apron will require 57 parking positions, of which 34 will be contact positions with direct ALB connection to the concourse and 23 will be remote parking positions to meet the aircraft stand demand and the passenger handling capacity of 30 mppa.

(c) Construction of TRC

25. The concourse is the place where passengers will either congregate before boarding their departure flight, or first alight from aircraft as an arriving passenger. The prime consideration in the design of the TRC therefore is passenger experience. In terms of space provision, the TRC will have a floor area of about 280,000 square metres. The general layout will be largely on a par with that of T1 and the level of service standard of the TRC will also be on a par with most of the other international airports. Passengers will be provided with a good level of services, in terms of space allowance at critical areas such as transfer area, waiting / circulation area, security screening area, holding area and boarding gate loading area. All in all, passengers will enjoy an efficient, comfortable and pleasant environment at the TRC.

26. Similar to T1, the TRC will be a single concourse that allows passengers to access all gates by walking. Departing passengers enter the Departure Level at a single point set on the TRC, thus avoiding the duality of the north and south access points of T1, offering substantial improvement in the clarity of way finding. It also offers a piazza-like commercial hub which optimises exposure to retail facilities and direct sightlines to departure gates. A widened central concourse incorporating outdoor courtyards offers passenger access to and views of natural landscaped spaces while two sunken gardens will be built to enhance the experience of arriving passengers. The roof will adopt a single flowing form which is designed to express spatial continuity and enhance intuitive passenger orientation in the same way as in T1. **Figures 5 to 7** show the TRC artist impression; the piazza-like commercial hub; and the view of landscape courtyard at departure level respectively.

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

Figure 5 : TRC Artist Impression

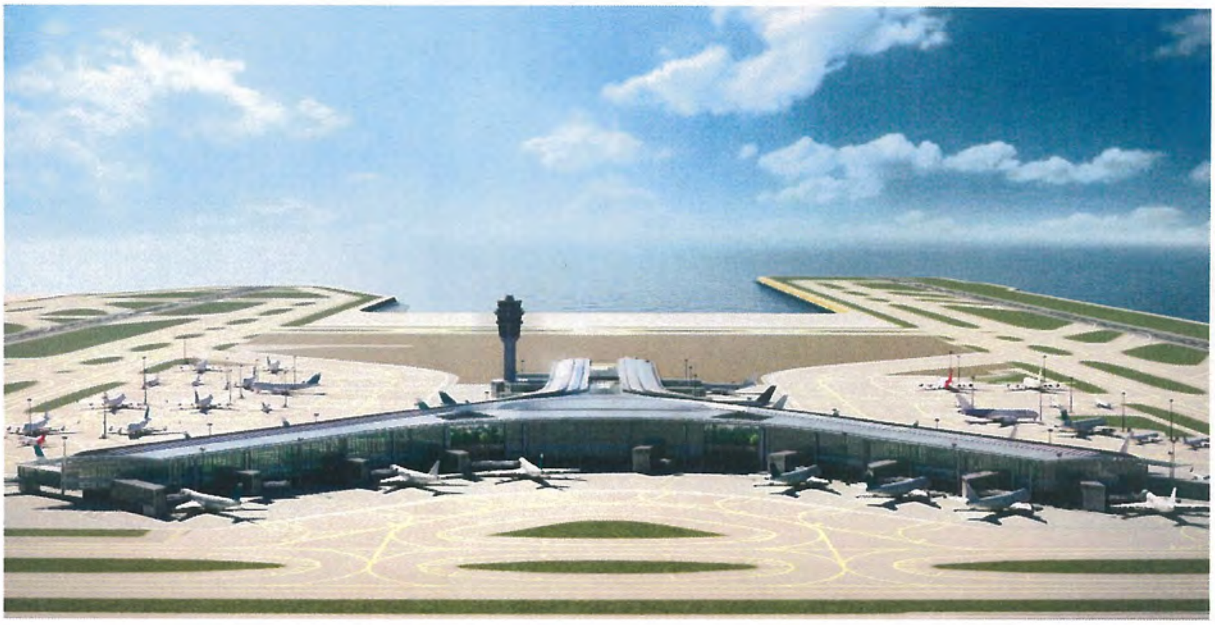

Figure 6 : View of Piazza-like Commercial Hub

Figure 7 : View of Landscape Courtyard at Departure Level

(d) Modification/Expansion of T2

27. With the expansion of the HKIA into a 3RS, T2 will be expanded to provide full-fledged terminal services, serving departure, arrival and transfer operations. The need to modify and expand T2 has been examined in great detail and is considered absolutely necessary for the overall operational efficiency of the 3RS. Careful consideration has been given to retaining the existing structures and facilities. According to the latest design, the entire T2 foundation, substructures, and coach hall at Level 3, together with most of the building services facilities and airport system works, such as generators and transformers, chillers, lifts etc, will be retained. Other floor levels will also be retained as far as possible but with modifications necessary to suit the expanded T2 layout. Materials demolished from the T2 would be reused or recycled in the 3RS project wherever possible.

28. The design of the modified/expanded T2 will provide an airport terminal that facilitates a simple, direct and efficient flow for passengers and baggage handling. A "T1 Mirror" design concept will be adopted to provide a reflection of the world class standard and efficiency of T1. The Check-in Hall at Departure Level comprises check-in islands with a central Departure Portal above the new T2 Baggage Reclaim and Meeters and Greeters Arrival Level. Furthermore, the North and South Annex Buildings will be constructed on both sides of T2 to house several key land transportation and building facilities including coach staging area, arrival pick up, loading / unloading bays, limousine lounge and staging area and public car parking. An APM Interchange Station ("AIS") will be provided at the basement of T2 to serve as the central transfer between T1, T2, TRC and SkyPier. In short, the design of T2 will allow for maximum flexibility in terms of internal space utilization and possible future changes in the functional requirements and expansion. Construction works will be implemented in phases to minimize disruption of existing airport operations.

(e) Provision of a new APM System

29. The 3RS APM system consists of a new underground APM line of 2.6 km long, connecting the AIS and TRC. It will be a three-guideway (track) system with a single pinched loop[6], catering for four x 6-car trains at 2.5 minutes headway, with a maximum train speed at about 80 km per hour. The travelling time from T2 to the TRC will be about 2.7 minutes. Up to 10,800 passengers can be transported per hour.

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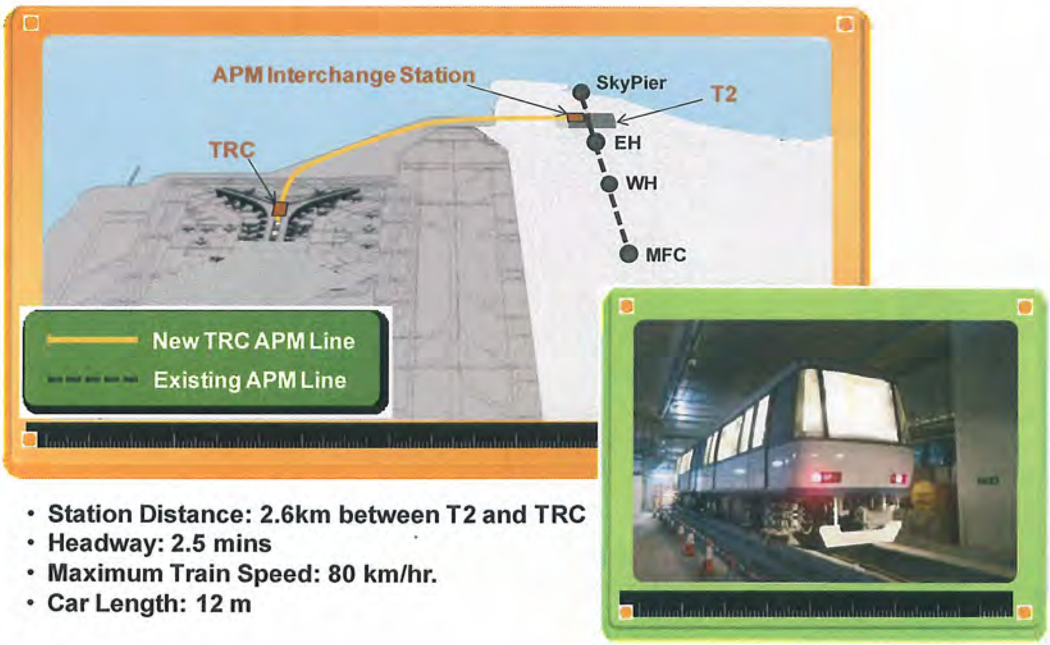
[6] A pinched loop consists of a dual guideway configuration whereby trains travel in a loop by reversing direction and changing lanes at the end stations.

30. In view of the relatively long distance between T2 and the TRC which is beyond walking distance, a high level of operational redundancy is required for the APM system. In the event of failure of either one of the normal tracks, the backup track (hence a three guideway system) can substitute the failed track and maintain the pinched loop operation, thus providing a high level of operational redundancy. Furthermore, the APM system is designed with the provision of dual feed power supply system, redundant signalling system and redundant communications system to ensure 100% overall system redundancy.

31. In anticipation of further passenger demand, a fourth APM tunnel will be built but without fit-out to provide for possible expansion of the APM system to a four-guideway double pinched loop operation. This is prudent planning as it is highly difficult, if not impossible, to carry out the necessary tunnelling work after completion of the APM system. **Figure 8** shows the layout for the 3RS APM System.

<u>Figure 8 : 3RS APM System Layout</u>

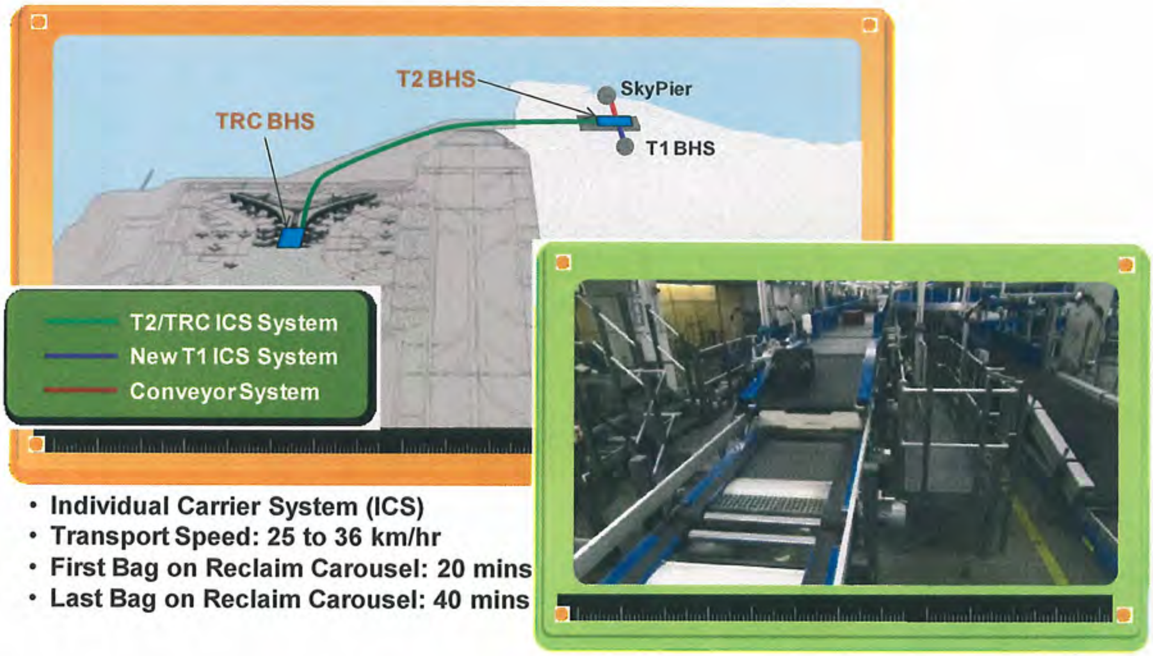


32. In addition, a new underground APM depot, situated adjacent to the AIS, will be constructed to serve both the planned TRC and existing APM fleets. The primary functions of the depot include the support of vehicle maintenance, vehicle stabling, and APM operation with the central control facility for all existing and new APM lines.

(f) BHS

33. Currently, baggage to and from the T1 baggage hall is transported by a manual "tug-and-dolly" system. Given the long distance between the TRC and the baggage hall at the expanded T2, a high speed and fully automated BHS will be built to ensure a high level of baggage delivery service. The BHS will connect the TRC with T2 and provide baggage security screening and early bag store facilities. A high speed Individual Carrier System ("ICS") is adopted for the TRC BHS design. This ICS is capable of working up to 10 m/sec in BHS tunnel section, as compared to the speed of the existing conveyor based T1 BHS system at 2 m/sec. This will ensure the first arrival bag is delivered within 20 minutes.

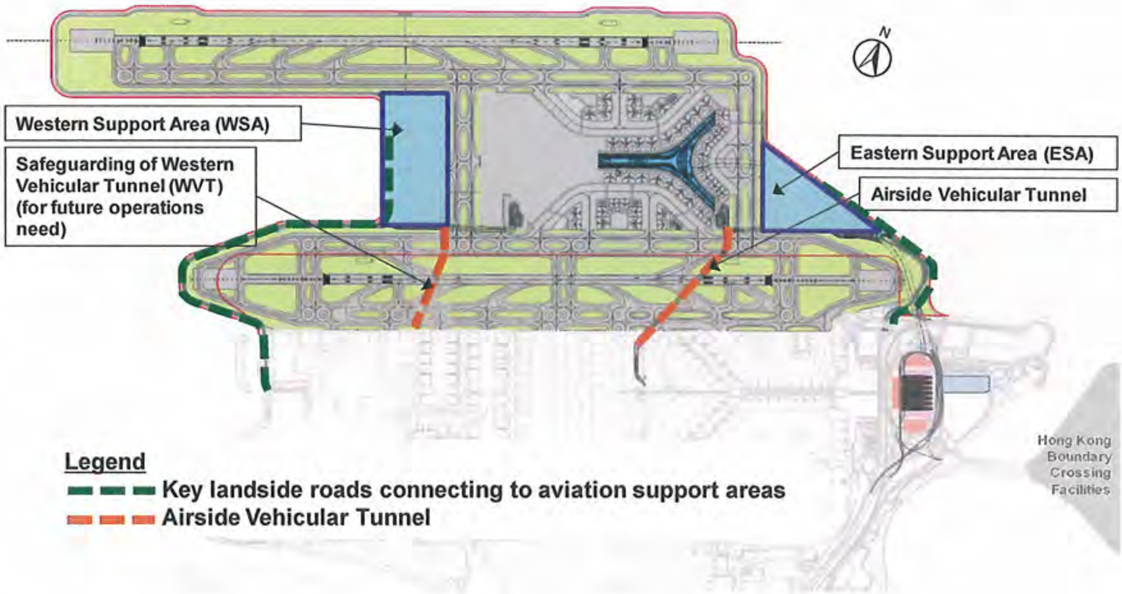
<u>Figure 9 : Airport-Wide Baggage Handling Strategy</u>



(g) Construction of Airport Support Infrastructure, Utilities and Facilities

34. Apart from the major works components for the 3RS project described above, other ancillary facilities are necessary to support the daily operations of the future 3RS. These ancillary facilities are planned to be located in the Eastern Support Area ("ESA") and Western Support Area ("WSA"), the locations of which are shown in **Figure 10** below.

Figure 10 : New Airside Vehicular Tunnel and Landside Road Connection



35. The ESA to the east of TRC will mainly accommodate the ground service equipment ("GSE"), flight catering facilities, Government facilities e.g. fire station and police station as well as utilities. It will also accommodate the underground APM and BHS facilities, and their associated above-ground facilities.

36. The WSA to the west of TRC will mainly accommodate aviation-related maintenance and servicing facilities to support the operational needs of 3RS. These mainly include aircraft maintenance facilities (i.e. maintenance hangars and aprons, engine run-up facilities, and aircraft recovery equipment facilities), GSE and other supporting facilities, air cargo staging area, Government facilities as well as utilities.

37. Among the various facilities in the support areas, there will be a total of three fire stations – two in the ESA (one airside and one landside) and one airside station in the WSA. The provision of fire stations at the airside is particularly critical to ensuring fire safety requirements stipulated by the ICAO.

38. The 3RS development will also require the extension and improvement of some existing landside roads on the airport island, and the provision of a new airside vehicular tunnel connecting the existing facilities to the future development areas to ensure operational continuity.

39. The airside vehicular tunnel will provide connectivity for GSE and cargo movements across the new Centre Runway. Journey time analysis has

shown that the provision of airfield new airside vehicular tunnel considerably shortens connection time and distance in comparison to at-grade routes around the new Centre Runway. This will also reduce emissions and fuel consumption of the cargo and GSE operators. An empty Western Vehicular Tunnel box structure underneath the new Centre Runway will also be constructed 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.

40. Extension of existing utility services will be provided to support future 3RS operations, which include aviation fuel supply system, power supply system, potable water and fire fighting system, seawater supply system, stormwater drainage and oil separation system, sewerage system and the associated airport systems.

Green and Sustainable Design Features

41. The 3RS scheme design embodies an extensive range of sustainability, constructability and environmental initiatives that will take full advantage of contemporary technologies. At the detailed design stage, further flexibility to accommodate the rapid airport industry development environment will also be explored. In the light of AAHK's commitment in making HKIA the world's greenest airport and the recommendation from the Advisory Council on the Environment, the 3RS project is targeted for the BEAM Plus Platinum certification[7] where practicable.

Project Cost Estimate

42. The scale of the 3RS project is almost as big as building a new airport next to the existing one. The total estimated construction cost is HK$141.5 billion in money-of- the-day ("MOD") prices with breakdown at **Appendix B**.

43. 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 March 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. The estimate has also taken into account the assumption that the construction works for the 3RS will start in 2016 and last for 8 years.

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7 BEAM Plus is a comprehensive environmental assessment scheme for buildings recognized by the Hong Kong Green Building Council Limited ("HKGBC").

44. The project estimate was developed in conjunction with scheme design consultants and a professional independent quantity surveying ("QS") consultant and was reviewed by AAHK's management team. In coming up the estimated cost, reference has been made to the appropriate market rates; supported by benchmarking and AAHK's historical cost data for similar construction works. The whole process of cost estimation was highly vigorous which enables a high degree of confidence in the sufficiency and accuracy of the estimate.

Project Management/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 specialized 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 centralized 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 organization 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 utilized 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 organizational 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.

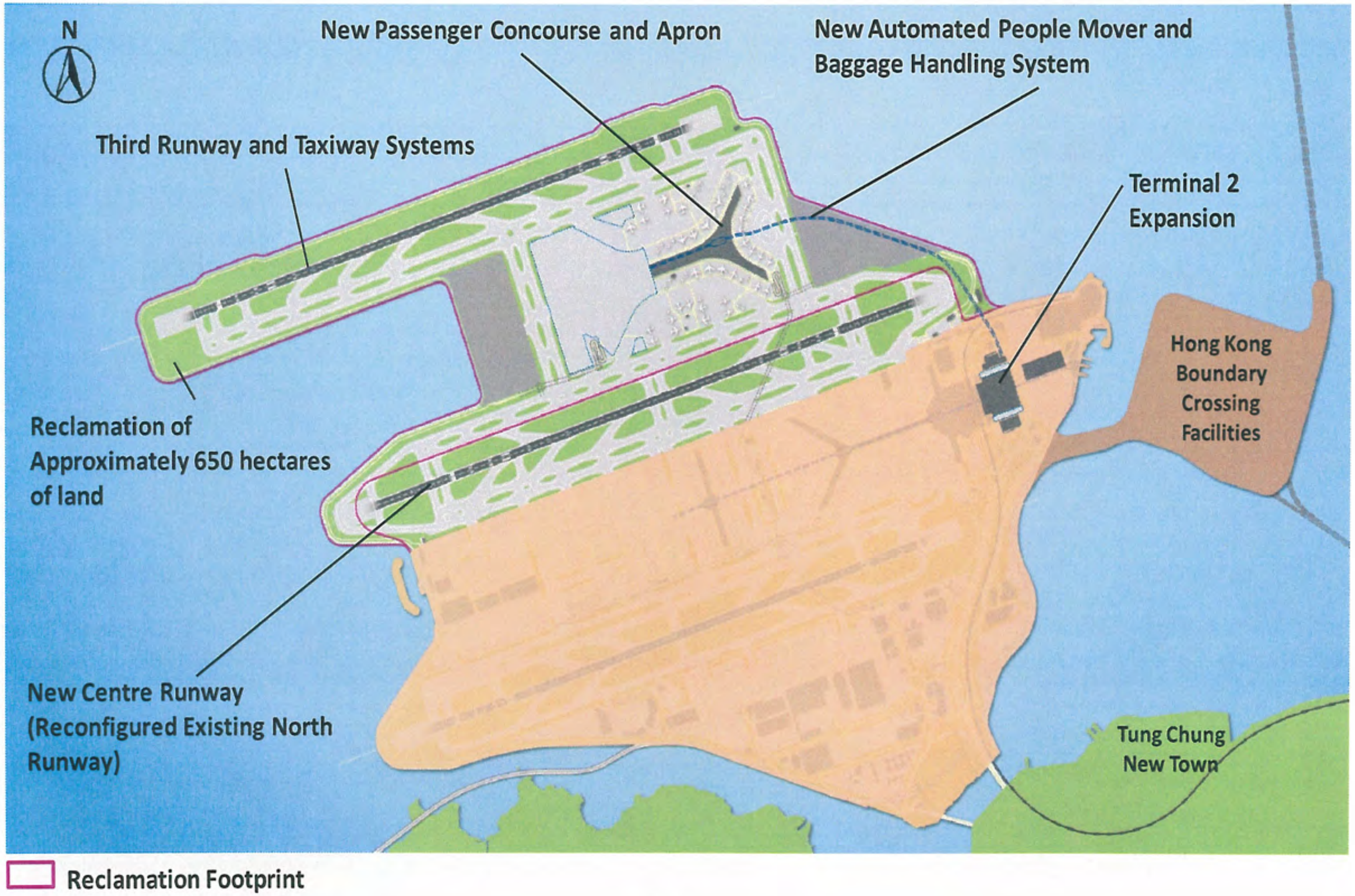
62. With the above robust systems and stringent measures in place, AAHK will be making its best endeavours for programme and budget control for the delivery of the 3RS project.

Advice Sought

63. Members are invited to note and comment on the issues covered in this paper.

Airport Authority Hong Kong
November 2015

Three-Runway System Project Layout Plan



Appendix B

Breakdown of the Total Estimated Construction Cost for the 3RS Project

	Scope of Works	4Q2010		MOD (Mar 2014)	
		Sub-total (HK$B)	**Total (HK$B)**	Sub-total (HK$B)	**Total (HK$B)**
1.	**Land Formation and Marine Works**		**36.8**		**56.2**
	- Ground Improvement	18.8		28.8	
	- Fill Management	17.0		25.9	
	- Utilities Diversion	1.0		1.5	
2.	**Airfield Facilities**		**6.5**		**11.5**
	- Runway, Taxiway & Taxilane	2.9		5.2	
	- Airfield Support Area	1.0		1.7	
	- Airside Road Network	2.6		4.6	
3.	**Apron Works**		**2.7**		**5.0**
4.	**Terminal 2 Modification/Expansion**		**9.5**		**16.5**
	- Foundation, Basement and Structure	3.3		5.7	
	- Architectural Works	2.4		4.2	
	- E&M and Airport Systems Works	3.8		6.6	
5.	**Third Runway Concourse**		**14.1**		**26.3**
	- Foundation, Structure and FLB & ALB	6.6		12.3	
	- Architectural Works	2.4		4.5	
	- E&M and Airport Systems Works	5.1		9.5	
6.	**APM System**		**6.1**		**10.9**
7.	**Baggage Handling Systems**		**4.5**		**7.8**
8.	**Airport Support Facilities and Utilities**		**4.3**		**7.3**
	TOTAL		**84.5**		**141.5**